Appendix O

ENDANGERED SPECIES ACT CONSULTATION

Since publication of the Draft SEIS, President Trump signed Executive Order (EO) 14154 – *Unleashing American Energy* – which, among other things, required the Council on Environmental Quality (CEQ) to issue guidance on implementing the National Environmental Policy Act (NEPA) and propose rescinding its NEPA regulations at 40 CFR Part 1500 et seq. Subsequently, on February 25, 2025, CEQ published an Interim Final Rule (IFR) removing the CEQ NEPA implementing regulations, effective April 11, 2025 (90 Fed. Reg. 10610). In addition to EO 14154, on January 20, 2025, President Trump signed EO 14148 – *Initial Rescissions of Harmful Executive Orders and Actions*. Together, EO 14154 and EO 14148 revoked EO 13990 – *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis* (January 20, 2021) and EO 14008 – *Tackling the Climate Crisis at Home and Abroad* (January 27, 2021). Subsequently on January 29, 2025, Secretary Duffy signed a Memorandum for Secretarial Offices and Heads of Operating Administrations – "Implementation of Executive Orders Addressing Energy, Climate Change, Diversity, and Gender." EOs 14148 and 14154 also revoked EO 14096 – *Revitalizing Our Nation's Commitment to Environmental Justice for All* (April 21, 2023). Subsequently on January 21, 2025, President Trump signed EO 14173 – *Ending Illegal Discrimination and Restoring Merit-Based Opportunity*. This EO revoked EO 12898 – *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994). As a result of these actions, coupled with CEQ's rescission of its NEPA implementing regulations, all federal environmental justice and climate change requirements are revoked and no longer apply to the federal environmental review process and will not be considered in the federal decision.

Appendix O, Endangered Species Act Consultation, includes concepts that were appropriate for consideration at the time of its development. Any concepts that are inconsistent with current Federal requirements were included for historical record-keeping purposes only, were not considered in this Final SEIS, and will not be considered in the Amended Record of Decision.

UNITED STATES FISH AND WILDLIFE SERVICE (USFWS) LETTER OF CONCURRENCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon Fish and Wildlife Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266
Phone: (503) 231-6179 FAX: (503) 231-6195

File Number: 2024-I-0006
File Name: IBR_LOC5.doc
TS Number: 23-368
Ecosphere: 2024-0014982-S7

Thomas D. Goldstein
Interstate Bridge Replacement Program Oversight Manager
Federal Highway Administration
Oregon Division Office
530 Center Street NE, Suite 420
Salem, Oregon 97301

Subject: Informal Consultation for the Interstate Bridge Replacement Program

Dear Mr. Goldstein,

The Fish and Wildlife Service (Service) has reviewed your September 21, 2023, letter and biological assessment, both received in this office on September 26, 2023, requesting informal consultation for the Interstate Bridge Replacement Program (IBR; Project) that will replace the existing I-5 bridges over the Columbia River and North Portland Harbor bridge. The Project site is located along a 5-mile stretch of the Interstate 5 corridor in Portland, Oregon and Vancouver, Washington. The Federal Highway Administration and the Federal Transit Administration have determined that the Project is not likely to adversely affect, bull trout (*Salvelinus confluentus*), the streaked horned lark (*Eremophila alpestris strigata*), and designated critical habitat for bull trout. Our review and comments regarding these determinations are provided pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.).

Project Description and Background

The IBR Program was originally developed and evaluated as the Columbia River Crossing (CRC) project. The environmental review processes (including a National Environmental Policy Act Record of Decision and Endangered Species Act consultations for the CRC project were completed between 2005 and 2013, and the project was suspended in 2014. In 2019, a bi-state legislative committee requested that the Oregon Department of Transportation and the

Washington State Department of Transportation reinitiate the CRC project, and it was re-named the IBR Program.

The Project will replace the Interstate Bridge over the Columbia River and North Portland Harbor bridge with modern, seismically resilient, multimodal structures. Additional components of the Project include improved interchanges and roadways; light-rail transit extensions from north Portland to downtown Vancouver with associated improvements such as construction of new light-rail transit stations and park-and-ride facilities, existing maintenance facility expansion, and a new overnight facility for light-rail vehicles; and new shared-use paths to improve in bicycle and pedestrian access. The Project also includes substantial improvements to stormwater runoff capture and treatment. Construction is expected to take between 9 and 15 years and will require work within up to nine in-water work seasons. This schedule assumes that up to six in-water work seasons will be necessary to construct the replacement bridges, and up to three in-water work seasons will be necessary to complete the demolition of the existing bridges.

Bull Trout: Historically, bull trout were widely distributed throughout the Columbia River Basin. While historical cannery records suggest bull trout used to be present in the lower Columbia River, very few bull trout have been documented there in the past two decades. The closest extant population is in the Lewis River, which enters the Columbia River near Woodland, Washington, several miles downstream of the Project. The portion of the action area within the Columbia River is potentially suitable migratory habitat and designated as critical habitat. However, the likelihood of bull trout occurrence within the affected area is extremely low. Bull trout, if any, would be large, migratory fish (adult, sub-adult, or large juvenile fish).

Streaked Horned Larks: Streaked horned larks are present in the Columbia River throughout the year. Breeding and wintering streaked horned larks prefer habitats with substantial areas of bare ground and sparse, low-stature vegetation that are periodically disturbed, such as native prairies, coastal dunes, and shorelines. Streaked horned larks have not been documented within the action area but are known to occur within the vicinity. There is limited suitable habitat for streaked horned lark within the terrestrial portions of the action area, including the sandy shorelines on Hayden Island, in North Portland Harbor, and the Columbia River shoreline in Washington. These locations provide foraging habitat, but do not provide suitable nesting habitat. Habitat usage within the action area is expected to be limited to occasional opportunistic foraging, which could occur at any time during the year. There is no designated critical habitat for the streaked horned lark in the project area.

Concurrence

Potential effects from construction activities include temporary displacement from the Project area due to general construction activities, noise disturbance from pile driving, and temporary increases in turbidity during and immediately following in-water activities. Effects to listed species include localized disturbance to individuals that is short-term, localized, and temporary in nature. The Project incorporates conservation measures and extensive best management practices (BMPs) to minimize these potential effects to listed species. Examples of Project conservation actions include on-site riparian enhancements (plantings/invasive species management and terrestrial habitat creation/enhancements to mitigate for terrestrial habitat

impacts and a preliminary stormwater treatment design has been developed for the proposed action that identifies the likely size and location of water quality treatment BMPs. Given that few, if any, bull trout or streaked horned lark are likely to be present in the action area during Project implementation in any given year, the effects to individuals of these species are most likely insignificant. Additional discussion is provided below:

Bull Trout: Any bull trout in the vicinity of the project area could be exposed to elevated sound levels from in-water work and temporary increases in turbidity resulting in temporary displacement of individuals from the project area. The loudest source of underwater noise from the proposed action will come from the impact driving of steel pipe piles. Impact pile driving the largest diameter pile (48-inch) will create the highest noise levels: 214 dBPEAK, 201 dBRMS, and 184 dBSEL (sound exposure level) (measured at a distance of 33 feet or 10 meters from the pile). If individual bull trout are present, they would be of the adult and sub-adult life stage and capable of leaving the immediate work area to avoid injury from pile driving. The use of vibratory hammers and restricting the use of impact hammers to in-water work windows reduce potential effects to bull trout. In the unlikely event bull trout are present, individuals could be temporarily displaced from the general construction area, resulting in increased energetic costs and reduced foraging time. However, because habitat conditions and water quality in the project area have been degraded for many years, it is highly unlikely that individuals will be present during construction. As a result, the potential effects are unlikely to occur and are therefore discountable.

Further, the Project proposes BMPs that minimize and avoid potential adverse effects to water quality and listed salmonids under the jurisdiction of the National Marine Fisheries Service; these BMPs are expected to significantly limit the potential for adverse effects and protect large migratory bull trout. These BMPs, combined with the extremely low likelihood of bull trout presence in the Project-affected area, support your "not likely to adversely affect" determinations.

Based upon the information in your request for concurrence, other available information, our known records of bull trout, and our analysis of the Project, the Service concurs with your determination that the Project is not likely to adversely affect bull trout for the following reasons: 1) survey efforts over decades do not indicate persistent presence of bull trout in the lower Columbia River; 2) few, if any, bull trout would be present in the Project area, and those would be larger life stages (sub-adult and adult); and, 3) if present they would move out of the project area during construction or operation. As such, the effects of the Project on the bull trout are discountable.

Bull Trout Critical Habitat: The Project will have minor effects on food resources and water quality resources, which are two of the physical and biological features necessary for bull trout critical habitat. In addition, the Project will temporarily increase suspended sediments in and downstream of the project area and degrade overall water quality during construction. However, because these effects are temporary and minor relative to the scope of other available resources to bull trout in the area, the effects to designated bull trout critical habitat are likely to be insignificant.

Based upon the information in your request for concurrence, other available information, and our analysis of the Project, the Service concurs with your determination that the Project is not likely to adversely modify bull trout critical habitat for the following reasons: 1) the Primary Biological Factors of bull trout critical habitat have been previously degraded and are not functioning to support bull trout; 2) the Project will not further degrade or permanently impact or destroy the physical and biological features necessary for bull trout critical habitat; and 3) direct effects would likely be limited to temporary and localized disturbance of food resources and decreases to water quality. As a result, designated critical habitat for bull trout will not be destroyed or adversely modified.

Streaked Horned Larks: There could also be temporary impacts to streaked horned larks and suitable lark habitat in the action area. The Project will result in temporarily elevated terrestrial noise during construction and temporary and permanent ground disturbance. It is expected that impact driving of steel piles will create the loudest terrestrial noise source during construction at the action area. Peak terrestrial noise levels are estimated to be approximately 110 A-weighted decibels, measured at 50 feet. Ground disturbance includes disturbance from temporary construction activities, location of permanent infrastructure elements, and conservation activities. However, these effects are not anticipated to impact breeding pairs since there are no known breeding populations in the project vicinity. Foraging and non-breeding individuals dispersing to or wintering in the vicinity of the project area could be affected by the noise and presence of people, which could disturb individuals and cause them to flush, resulting in increased energetic costs and reduced foraging time. These effects would be difficult to detect or evaluate and are therefore insignificant, given that individuals arriving in the project area would be capable for sustained flight and could flee the area for the duration of the disturbance.

Based on the Project described in the biological assessment, other available information, and our known records of streaked horned larks in the action area, we concur with your determination that the Project is not likely to adversely affect the streaked horned lark for the following reasons: 1) the Project will not directly destroy suitable nesting habitat for streaked horned larks; 2) if individuals are present in the vicinity of construction activities, they may experience temporary auditory or visual disturbance, or may temporarily avoid the vicinity, but the potential for adverse effect would likely be limited to foraging streaked horned larks. Given the lack of documented sightings, few, if any, streaked horned larks are anticipated to be in the project area. The effects to streaked horned lark are therefore discountable.

Conservation Recommendations for Lamprey and Mussel Species

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by implementing conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or designated critical habitat, to assist in the implementation of recovery plans or to obtain information. We have provided the following assessment and recommendations for your consideration as part of the Project. At this time, we are commenting on freshwater aquatic species that use the river benthos for all or a substantial portion to complete their life cycle, which may be adversely affected by

in-water work within waterways in the western United States. The Service will focus on native lampreys and freshwater mussels for this review. These groups are ecologically significant to riverine systems and food webs, and both are Tribal Trust species culturally crucial to Native American Tribes in the Pacific Northwest.

In-water construction activities, such as those proposed for the Project, are invasive and highly disruptive to benthic organisms and the overall aquatic ecosystem. Western lampreys and western freshwater mussels may occur in the Project-affected area. Because of the potential for substantial impacts to benthic communities, the Project should conduct surveys to determine if lamprey and mussel species are present, employ best management guidelines to minimize impacts, and mitigate for unavoided impacts. For both lampreys and mussels, recommended steps are generally outlined below:

Determine Species Distribution: Use available online distribution maps to determine what lamprey and mussel species may be at the Project site. The online maps below are based on submitted observations; a lack of documented presence does not mean these species are not in the project area and site-specific surveys should be conducted.

> For Lampreys: see www.databasin.org to view available information on the current distribution of lampreys.
>
> For Freshwater Mussels: request the most up-to-date database from the Xerces Society at mussels@xerces.org.

Conduct Site-Specific Surveys: Conduct site-specific surveys for lampreys and mussels prior to in-water work activities. Both species groups are cryptic and require specific survey techniques. Site-specific surveys should occur at areas where sediments will be disturbed/removed and in areas to be dewatered.

For Lampreys: Within the area of impact, survey areas of fine sediment and sand deposits to document larval lamprey presence. For wadable streams, use backpack electrofishers (see Appendix B of Best Management Guidelines for Native Lampreys during In-water Work; Lamprey Technical Workgroup 2020). In deeper waters, use deep-water electrofishers if available. If unavailable, estimate the area of fine sediment and sand deposits. For more information on preferred habitats of lampreys, surveys, identification, and best management guidelines, see Best Management Guidelines for Native Lampreys during In-water Work; Lamprey Technical Workgroup 2021.

For Mussels: Survey areas of relatively stable sediments of all types where salinity is less than 2 ppt. Surveys are done by snorkeling, diving, or underwater video, depending on the depth. Surveys should occur during warmer times of the year or when conditions are suitable and well before the permitted action to allow for adequate planning. The number of mussels within the area of impact should be estimated. For more information on mussels, identification, salvage, and restoration see Xerces' 2019 publication on in-water work and freshwater mussels (Mussel-Friendly Restoration).

If site-specific surveys are not conducted, the Permittee should estimate the amount of suitable habitats (square meters) for each species, which can be used to determine appropriate mitigation. Without presence/absence surveys, the entire project area should be assumed to be suitable habitat.

Timing of In-water Work: We recognize there is little flexibility in the in-water work, given the complexity of the Project. There is no in-water work window protective of larval lamprey or mussel species in the river bottom year-round and salvage is recommended if these species are present.

Salvage of Lampreys and Mussels: If lamprey or mussels are found within the Project area that will be impacted, lamprey and mussels should be relocated if possible. Salvage of lamprey is difficult in deep waters and likely only possible in wadeable waters using backpack electrofisher to remove as many lamprey as possible and relocate in suitable habitats out of harm's way (see Best Management Guidelines for Native Lampreys during In-water Work; Lamprey Technical Workgroup 2020). Salvage and relocation of mussels can be done in shallow or deeper waters, and divers could be required; however, careful planning and selection of suitable mussel habitat for relocation is necessary (see Mussel-Friendly Restoration; Xerces 2019).

Mitigation in Lieu of Minimizing Impacts: We note there may not be an economical manner to survey, minimize, or avoid impacts on the benthic community from the Project. However, multiple in-water work actions occur throughout the lower Columbia River every year. While each action may not represent a large footprint relative to a specific basin, collectively and over time, these actions can represent substantial impacts to lamprey and other benthic invertebrates and their future recruitment. For lampreys, these impacts are most significant in areas used by spawning lampreys, or areas occupied with high densities of larval lamprey across multiple age classes. For mussels and other invertebrates, the impacts are most significant when individual species are highly abundant or of reproductive age. We recommend IBR include consideration for these species in their mitigation proposals to offset impacts to lampreys and mussels commensurate to Project impacts on these species.

Reporting: The Service is interested in obtaining data collected by the Project on lampreys and mussels as this will contribute to the available information and aid in our understanding of these species. Information on presence, distribution, relative abundance, habitat, salvage efforts, and success, or alternative offsets or mitigation should be documented and reported to the Service. Please include location, dates, biological information collected on lamprey and mussels, and any mitigation actions. Please send this documentation to the appropriate Service office for our records:

Email: fw1ofwo@fws.gov
USFWS
2600 SE 98th Ave, #100
Portland, OR 97266

Northwestern Pond Turtle

The Service recently proposed listing of the northwestern pond turtle (NWPT FED REG NOTICE) on October 3, 2023. While we have no data that confirm NWPT use habitats affected by the Project, there are documented occurrences of NWPT near the Columbia River in the Project vicinity. Most turtle sightings along the Lower Columbia River are of the more brightly colored (thus more easily seen) and more abundant western painted turtle. There are known observations of individuals and nests of western painted turtles along the mainstem Columbia and Hayden Island; as these turtles share some habitat requirements with NWPT, their presence lends support that NWPT may also be in the Project affected area.

We are not aware of any survey effort for turtles along the Columbia River mainstem, but that area contains suitable NWPT aquatic habitat for dispersal, foraging (most likely along the shallower/more productive shorelines where there is food and cover); basking (e.g., along shoreline where there is woody structure); nesting along shorelines; and possibly overwintering in complex substrate along shoreline. We recommend IBR conduct surveys in Project-affected areas prior to the beginning of construction. Interstate Bridge Replacement may also want to consider the benefits of conferencing under the Act on this species, which could ensure timely Act coverage should the NWPT be formally listed prior or during construction. For more information on northwestern pond turtle habitat, identification, and best management guidelines, please refer to the Oregon Department of Fish & Wildlife 2015 BMPs. For additional information about northwestern pond turtles, please refer to the Frequently Asked Questions portion of the October 3, 2023 Proposed Rule News Release, and the Western pond turtle Range-wide Management Strategy.

Conclusion

This concludes informal consultation pursuant to section 7(a) (2) of the Endangered Species Act. As provided in 50 C.F.R. 402.16, reinitiation of consultation is required and shall be requested by the Federal Highway Administration, Federal Transit Administration, or by the Fish and Wildlife Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) if information reveals that effects of the action may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (2) if the action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this letter of concurrence; or (3) if a new species is listed or critical habitat is designated that may be affected by this action.

Thank you for your coordination on this project and for your concern for the conservation of these species. If you have any further questions regarding this consultation, please contact Liliana Calderon of my staff at (970) 518-8518.

Sincerely,
JEFFREY DILLON
Digitally signed by JEFFREY DILLON
Date: 2023.12.11 15:26:54 -08'00'
Acting for Kessina Lee
State Supervisor

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) BIOLOGICAL OPINION

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

Refer to NMFS No:
WCRO-2023-02287

September 5, 2025

Thomas D. Goldstein, PE
IBR Program Oversight Manager
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Mark Assam
Environmental Policy and Programs
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Office Environmental Policy and Programs
915 2nd Avenue, Suite 3192
Seattle, WA 98174-1002

Re: Endangered Species Act Section 7(a)(2) Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Interstate Bridge Replacement Project (with an editorial revision)

Dear Mr. Goldstein and Mr. Assam,

Thank you for your September 18, 2023, letter requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the I-5 Interstate Bridge Replacement Project.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)] for this action. We have concluded that the action would adversely affect EFH designated under the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species Fishery Management Plans. EFH conservation recommendations are provided as part of the EFH consultation, which follows the Biological and Conference Opinion. As required by section 305(b)(4)(B) of the MSA, FHWA and FTA must provide a detailed response indicating whether the agency will implement the conservation recommendations, in writing to NMFS, within 30 days after receiving an EFH Conservation Recommendation.

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action, and the cumulative effects, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Upper Columbia River (UCR) spring-run Chinook salmon (*Oncorhynchus tshawytscha*), UCR steelhead (*O. mykiss*), Middle Columbia River steelhead, Snake River Basin steelhead, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon (*O. nerka*), Lower Columbia River (LCR) Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead, Columbia River chum salmon (*O. keta*), Upper Willamette River (UWR) Chinook salmon and steelhead, Southern distinct population segment (DPS) of eulachon (*Thaleichthys pacificus*), or the southern DPS green sturgeon (*Acipenser medirostris*). NMFS also determined the action will not destroy or adversely modify designated critical habitats for these species. In this biological opinion

(Opinion), we also determined that the proposed action is not likely to adversely affect Southern Resident killer whales (*Orcinus orca*). We provide the rationale for our conclusions in the attached Opinion. Because of the Proposed Threatened status of the Sunflower Sea Star, we are conferencing for that species in this Opinion. Sunflower Sea Star is at the lower end of the Action Area and will be adversely affected by stormwater discharge from the project. The enclosed Opinion is based on information provided in your biological assessment dated September 18, 2023, the Interstate Bridge Replacement (IBR) Team, and other sources of information cited in the Opinion.

As required by section 7 of the ESA, NMFS provided an incidental take statement (ITS) with the Opinion. The ITS includes reasonable and prudent measures (RPMs) that NMFS considers necessary or appropriate to minimize incidental take associated with the proposed action. The take statement sets forth terms and conditions, including reporting requirements that the FHWA and any person who performs the action must comply with to carry out the RPMs. Incidental take from the proposed action that meets these terms and conditions will be exempt from the ESA take prohibition.

Note that Biological Opinion supersedes the previous document issued on June 27th, 2025. This document corrects an error in the previous version regarding vibratory pile driving and the in-water work window.

Please contact NMFS West Coast Region Willamette Branch at 503-230-5400 if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kate Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Cindy Callahan – FHWA Senior Biologist
Mark Assam, AICP – FTA Environmental Protection Specialist
Bill Warncke – Deputy Environmental Manager IBR Program

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

The Interstate Bridge Replacement Project

NMFS Consultation Number: WCRO-2023-02287

Action Agency: Federal Highway Administration and the Federal Transportation Administration

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, *Oncorhynchus tshawytscha*	Threatened	Yes	No	Yes	N/A
Upper Columbia River spring-run Chinook salmon, *Oncorhynchus tshawytscha*	Endangered	Yes	No	Yes	No
Snake River spring/summer run Chinook salmon, *Oncorhynchus tshawytscha*	Threatened	Yes	No	Yes	No
Snake River fall-run Chinook salmon, *Oncorhynchus tshawytscha*	Threatened	Yes	No	Yes	No
Columbia River chum salmon, *Oncorhynchus keta*	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon, *Oncorhynchus kisutch*	Threatened	Yes	No	Yes	No
Snake River sockeye salmon, *Oncorhynchus nerka*	Endangered	Yes	No	Yes	No
Lower Columbia River steelhead, *Oncorhynchus mykiss*	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead, *Oncorhynchus mykiss*	Threatened	Yes	No	Yes	No

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?
Middle Columbia River steelhead, *Oncorhynchus mykiss*	Threatened	Yes	No	Yes	No
Upper Columbia River steelhead, *Oncorhynchus mykiss*	Threatened	Yes	No	Yes	No
Snake River Basin steelhead, *Oncorhynchus mykiss*	Threatened	Yes	No	Yes	No
Southern green sturgeon, *Acipenser medirostris*	Threatened	Yes	No	Yes	No
Eulachon, *Thaleichthys pacificus*	Threatened	Yes	No	Yes	No
Southern Resident Killer Whale, *Orcinus orca*	Endangered	No	No	Yes	No
Sunflower Sea Star, *Pycnopodia helianthoides*	Proposed Threatened	Yes	No	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:

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: September 5, 2025

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ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
BA	Biological assessment
BMP	Best management practice
BNSF	Burlington Northern Santa Fe Railway
BO	Biological opinion
C-TRAN	Clark County Public Transportation Benefit Area
CD	Collector-distributor
CESCL	Certified Erosion and Sediment Control Lead
CIA	Contributing Impervious Area
CR	Columbia River
CRC	Columbia River Crossing
CRD	Columbia River Datum
dB	Decibels
dBA	A-weighted decibels
dBPEAK	Peak decibels
dBRMS	re: 1 µPa Root mean square decibels referenced to 1 micropascal
dBRMS	Root mean square decibels
dBSEL	Decibels sound equivalent level
DEQ	(Oregon) Department of Environmental Quality
DPS	Distinct Population Segment
DSL	(Oregon) Department of State Lands
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESH	Essential Salmonid Habitat
ESU	Evolutionarily Significant Units
FAHP	Federal Aid Highway Program
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	Greenhouse gas
IBR	Interstate Bridge Replacement
IWWW	In-water work window
ISA	Impervious Surface Area
LCR	Lower Columbia River
LPA	Locally Preferred Alternative
LRT	Light-rail transit
LRV	Light-rail vehicle
MAX	Metropolitan Area Express
MCR	Middle Columbia River
Metro	Oregon Metro

mg/L	Milligrams per liter
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRI	Natural Resources Inventory
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHWM	Ordinary High Water Mark
PAH	Polycyclic aromatic hydrocarbons
PBF	Physical or biological features
PCB	Polychlorinated biphenyls
PCP	Pollution Control Plan
PMLS	Portland Metro Levee System
PRM	Permittee-responsible mitigation
PTS	Permanent Threshold Shift
RMS	Root Mean Square
ROD	Record of Decision
RUIP	Recovery Unit Implementation Plan
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SPCC	Spill Prevention, Control, and Countermeasures
SR	State Route
SR-FR	Snake River fall run
SR-SSR	Snake River spring/summer run
SRKW	Southern Resident (Distinct Population Segment) Killer Whale
SROTF	Southern Resident Orca Task Force
TMDL	Total Maximum Daily Load
TriMet	Tri-County Metropolitan Transportation District
TTS	Temporary Threshold Shift
UCR	Upper Columbia River
UCR-SR	Upper Columbia River spring run
USACE	United States Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
WDFW	Washington Department of Fish and Wildlife
WQPMP	Water Quality Protection and Monitoring Plan
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

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

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

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

1.2. Consultation History

The Interstate Bridge Replacement (IBR) Program is partnering with the Federal Highway Administration (FHWA), Federal Transit Authority (FTA), Oregon Department of Transportation (ODOT), and Washington State Department of Transportation (WSDOT) to replace the Interstate 5 Bridge over the Columbia River and the bridge over North Portland Harbor as part of the IBR Program. The project consists of constructing a replacement bridge over the Columbia River at approximately river mile (RM) 106.5. In addition, they will be replacing a bridge over the North Portland Harbor and adding five new crossings. The FHWA is providing some funding for the proposed project and is the lead Federal action agency for this project.

We held monthly early coordination meetings with the ODOT, the IBR consultant team, FHWA, FTA, and WSDOT beginning in April 2022, to discuss the ESA consultation and the Biological Assessment (BA) for this project. Early coordination discussions included an overview of the project, confirmation of species lists, and a discussion of impacts and preliminary effects determinations, Marine Mammal Protection Act (MMPA) coordination and the mitigation strategy.

In addition, there have been monthly Habitat Mitigation team meetings with a number of stakeholders including ODOT, WSDOT, The City of Portland, tribes, and the consultant team.

NMFS and FHWA reviewed and provided comments on three initial drafts of the biological assessment (draft BA) prepared for the project by WSP consultants (WSP 2023) as well as the final BA dated September 2023.

The IBR Project team and WSP refined some of the design and construction assumptions of the project between April 2022 and September 2023, in close coordination with ODOT, FHWA, FTA, and NMFS. Multiple coordination meetings and teleconferences were held to discuss technical design considerations including stormwater treatment, demolition, pile installation, and to refine the project schedule and in-water work window.

To establish an in-water work window (IWWW) for purposes of this proposed action, we used the same IWW period that was established during the Columbia River Crossing negotiations between 2005 and 2011 with representatives from ODOT, FHWA, NMFS, Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fish and Wildlife (WDFW). To establish appropriate assumptions regarding the IWWW timing restrictions for this proposed action, several meetings were coordinated between July and November 2022 with representatives from FHWA, FTA, NMFS, ODFW, WDFW, and interested tribes. The IWW period was established as September 15 through April 15 (212 days) for impact pile driving activities, with in-water debris removal with a bucket dredge restricted to November 1 through February 28/29 (120 days).

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

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (see 50 CFR 402.02). 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 FHWA and FTA are proposing to fund this project for the purpose of replacing the Interstate 5 Columbia River Bridge in Portland, Oregon.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would cause activities to occur that are not already part of the proposed action.

This section discusses the Proposed Action for the Interstate Bridge Replacement Program. The Proposed Action in the BA is lengthy and detailed, so this Proposed Action includes several areas where we incorporate by reference some description, figures, and tables from the BA. For the purposes of this consultation, the Modified Locally Preferred Alternative is the design that is expected to have the largest footprint with the largest amount of Contributing Impervious Area (CIA). The most likely design with the largest footprint is the single-level movable-span with two auxiliary lanes. If a different final preferred alternative is selected, we anticipate it will cause effects consistent with those considered in this Opinion but generally at reduced magnitudes

The proposed action includes Components of the Single-level Movable-Span with two Auxiliary Lanes:

- A new pair of bridges over the Columbia River one for northbound and one for southbound travel built west of the existing Interstate Bridge. The new bridges will include three through lanes, safety shoulders, and one auxiliary lane (a ramp-to-ramp connection on the highway). Both spans of the existing Interstate Bridge will be removed. These would be ingle-level bridges with movable spans over the primary navigation channel.
- A 1.9-mile light-rail transit (LRT) extension of the current Metropolitan Area Express (MAX) Yellow Line from the Expo Center Station in North Portland, where it currently ends, to a terminus near Evergreen Boulevard in Vancouver. Improvements include new stations at Hayden Island, downtown Vancouver (Waterfront Station), and near Evergreen Boulevard (Evergreen Station), as well as revisions to the existing Expo Center MAX Station.
- Associated LRT improvements, such as traction power substations, overhead catenary system, signal and communications support facilities, an overnight light-rail vehicle (LRV) facility at the Expo Center, 19 new LRVs, and an expanded maintenance facility at TriMet's Ruby Junction.
- Wider shoulders on I-5 from Victory/Interstate Boulevard to SR 500/39th Street to accommodate express bus-on-shoulder service in each direction.
- Improvements to seven I-5 interchanges and I-5 mainline improvements between Victory/Interstate Boulevard in Portland and SR 500/39th Street in Vancouver. Some adjacent local streets will be reconfigured to complement the new interchange designs, and improve local east-west connections.
- Six new adjacent bridges across North Portland Harbor: one on the east side of the existing I-5m North Portland Harbor bridge and five on the west side or overlapping with the existing bridge (which will be removed).
- A variety of improvements for people who walk, bicycle, and roll throughout the project site including a system of shared-use paths, bicycle lanes, sidewalks, enhanced wayfinding, and facility improvements to comply with the Americans with Disabilities Act. These are referred to in BA as "active transportation" improvements.
- Integration of local bus transit service, including bus rapid transit, in addition to the proposed new LRT service.
- Variable-rate tolling for motorists using the river crossing as a demand-management and financing tool.
- Stormwater management for all triggered contributing impervious area (CIA).

Figure 1-1. Overview of the Proposed Action

I-5 Mainline and 4 Geographic Sub-Areas (A through D)

In each subarea, proposed improvements to I-5, its interchanges, and the local roadways are described first, followed by transit and active transportation improvements. Design options are described under separate headings in the subareas in which they may be located. Figure 1-1 and 1-2 and the figures in each section show both the anticipated limit of ground disturbance, which includes disturbance from temporary construction activities and the location of permanent infrastructure elements.

In this Opinion, where specific quantities or impacts differ between the various design options, we analyzed the effects associated with the design option with the greatest impact, or the largest quantities. So, each Sub-Area will describe the different options.

Figure 1-2. Four Geographic Sub-Areas: A through D described in this Proposed Action

Interstate 5 Mainline Through the Project Area (all 4 Sub-Areas)

Currently, within the project site, I-5 has three 12-foot-wide through lanes in each direction and two 3-foot wide inside and outside shoulders. There are intermittent auxiliary lanes between the Victory Boulevard and Hayden Island interchanges in Oregon and between SR 14 and SR 500 in Washington.

The proposed action will include three 12-foot through lanes from Victory Boulevard to SR 500 and a 12-foot auxiliary lane from approximately the Marine Drive interchange to the Mill Plain interchange in each direction. Many of the existing auxiliary lanes on I-5 between the SR 14 and Main Street interchanges in Vancouver will remain, although they will be reconfigured. The existing auxiliary lanes between the Victory Boulevard and Hayden Island interchanges will be replaced with changes to on- and off-ramps and interchange reconfigurations. The modified locally preferred alternative (LPA) will also include wider shoulders (12-foot inside shoulders and 10- to 12-foot outside shoulders).

The two auxiliary lane design option will add a second 12-foot-wide auxiliary lane in each direction of I-5 to the single auxiliary lane proposed for the Modified LPA with the intent to

further optimize travel flow in the corridor. This second auxiliary lane will extend from approximately the Marine Drive interchange to the SR 500 interchange.

Portland Mainland and Hayden Island (Area A)

Victory Boulevard Interchange Area

The southern extent of the proposed action is two ramps associated with the Victory Boulevard interchange. The first ramp improvement will be the southbound I-5 off-ramp to N Victory Boulevard/N Denver Avenue; this off-ramp will be braided below (i.e., grade separated or pass below) Marine Drive to the I-5 southbound on-ramp (see the Marine Drive Interchange Area section below). The other ramp improvement will lengthen the merge distance for northbound traffic entering I-5 from N Victory Boulevard and from N Interstate Avenue.

Marine Drive Interchange Area

The next interchange north of the Victory Boulevard interchange is at Marine Drive. The new configuration will be a single-point urban interchange.

The Marine Drive to I-5 southbound on-ramp will be braided over I-5 southbound to the N Victory Boulevard/N Denver Avenue off-ramp (see the Victory Boulevard Interchange Area section above). NE Martin Luther King Jr. Boulevard will have a new direct connection to I-5 northbound.

North Portland Harbor Bridges

To the north of the Marine Drive Interchange is the Hayden Island interchange area. I-5 crosses over the North Portland Harbor when traveling between these two interchanges. The existing Interstate Bridge spanning North Portland Harbor will be replaced to improve seismic resiliency. Six new parallel bridges will be built across the waterway: one on the east side of the existing North Portland Harbor bridge and five on the west side or overlapping the location of the existing bridge, which will be removed. From west to east, these bridges will carry the LRT tracks, north and southbound offramps, north and southbound I-5, and an arterial bridge for local traffic between Portland and Hayden Island.

Each of the six replacement North Portland Harbor bridges will be supported on foundations constructed of 10-foot diameter drilled shafts. Concrete columns will rise from the drilled shafts and connect to the superstructures of the bridges.

Hayden Island Interchange Area

A half-diamond interchange will be built on Hayden Island with a northbound I-5 on-ramp from Jantzen Drive and a southbound I-5 off-ramp to Jantzen Drive.

Connections to Hayden Island for those movements will be via the local access bridge connecting North Portland and Hayden Island.

Transit and Active Transportation

A new light-rail alignment for northbound and southbound trains will be constructed within Area A to extend from the existing Expo Center MAX Station over North Portland Harbor to a new station at Hayden Island. An overnight LRV facility will be constructed on the southeast corner of the Expo Center property. Other platform modifications are also anticipated to transition to the extension alignment.

In the Victory Boulevard interchange area active transportation facilities will be provided along N Expo Road between N Victory Boulevard and the Expo Center. New shared-use path connections throughout the Marine Drive Interchange area will provide access between the Bridgeton neighborhood (on the east side of I-5), Hayden Island, and the Expo Center MAX Station.

The new arterial bridge over North Portland Harbor will include a shared-use path for pedestrians and bicyclists. On Hayden Island, pedestrian and bicycle facilities will be provided on Jantzen Avenue, N Hayden Island Drive, and N Tomahawk Island Drive. The shared-use path on the arterial bridge will continue along the arterial bridge to the south side of N Tomahawk Island Drive.

Columbia River Bridges (Area B)

Highways, Interchanges, and Local Roadways

The existing Interstate Bridge will be replaced by two new parallel bridges, located west of the Interstate Bridge. The existing bridges each have three lanes with no shoulders, where each of the two new bridges will be wide enough to accommodate three through lanes, two auxiliary lanes, and shoulders on both sides of the highway.

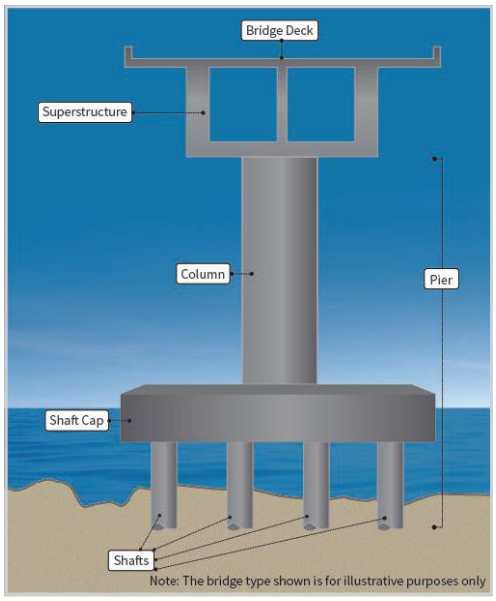

Figure 1-3. Columbia River Bridge Piers – Typical section

The existing Interstate Bridge has nine in-water pier sets, whereas the new Columbia River bridges will be built on six in-water pier sets (Figure 1-3), plus multiple piers on land. Each in-water pier set will be supported by a foundation of drilled shafts; each group of shafts would be tied together with a concrete shaft cap. Columns or pier walls will rise from the shaft caps and connect to the superstructures of the bridges.

Columbia River Bridge Design Option

The single-level movable-span option is the only bridge option that provides a vertical navigation clearance of at least 178 feet (in the movable-span open position) per the USCG Preliminary Navigation Clearance Determination (USCG 2022). To ensure the proposed action includes the full range of effects potentially caused by the action, NMFS is analyzing the single-level movable-span with two auxiliary lanes. All other options are anticipated to have lesser or equal effects.

Single-Level Movable-Span Bridge Configuration

The single-level movable-span bridges configuration would have two side-by-side, single-level steel girder bridges with movable lift spans between Piers 5 and 6. The movable-span configuration will be a vertical lift span with counterweights. The lift span towers will be approximately 243 feet high (the existing lift span tower is 247 feet high).

The single-level movable-span would provide 89 feet of vertical navigation clearance over the existing primary navigation channel when the movable lift spans are in the closed position. In the open position, the bridges would provide 178 feet of vertical navigation clearance over the proposed relocated primary navigation channel.

Similar to the fixed-span configurations, this configuration would provide 400 feet of horizontal navigation clearance at the primary navigation channel and two barge channels. I-5 highway, light-rail tracks, and the shared-use path will be on the same level across the two bridges instead of the double-deck configuration. A comparison of all three bridge design options is shown in Figure 1-4.

There would be the six in-water piers per bridge and two piers on land per bridge. For Piers 5 and 6, there would be 22 in-water drilled shafts per pier and the shaft caps would be 50 feet by 312 feet to accommodate the movable lift spans. For Piers 2, 3, 4, and 7, there would be 16 in-water drilled shafts per pier and the shaft caps would be the same as for the fixed-span options (50 feet by 230 feet). There would be a total of 108 in-water drilled shafts.

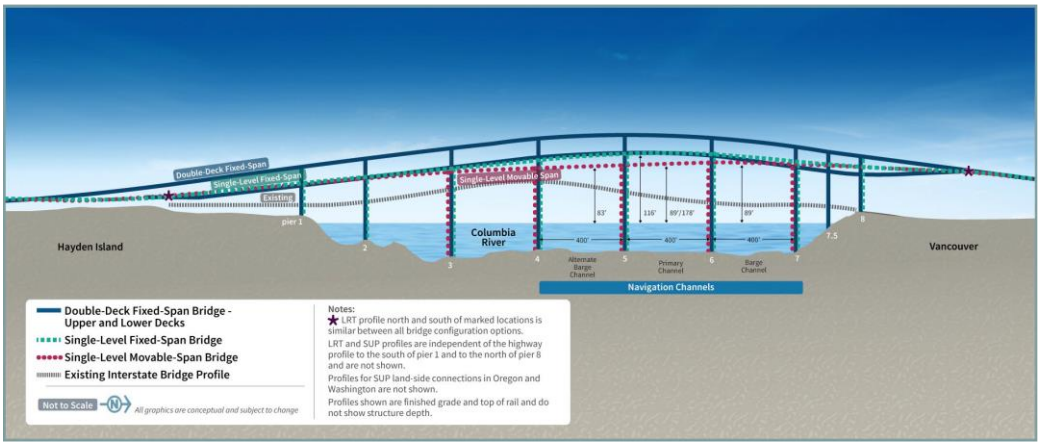

Figure 1-4. Comparison of the profile of the bridge design options. The single level moveable span bridge is red in this figure.

The configuration that has the largest footprint is the LPA with the single level movable span bridge with the 2 auxiliary lane. This is the configuration that will be used our analysis and has the following elements:

- Out to out width: 292 feet at the movable span and 252 feet at the fixed span.
- Deck widths: 113 feet at the southbound fixed span and 103 feet at the northbound fixed span.
- Approximate tower height: 243 feet.
- Span length between Piers 5 and 6 (from center of pier to center of pier): 450 feet.
- Number of in-water piers: Six pier sets per bridge.
- Number of drilled shafts: 108.
- Shaft cap dimensions: Piers 2, 3, 4, and 7: 50 feet by 230 feet
- Piers 5 and 6: 50 feet by 312 feet (one combined footing at each location to house tower/equipment for the lift span).

Downtown Vancouver (Area C)

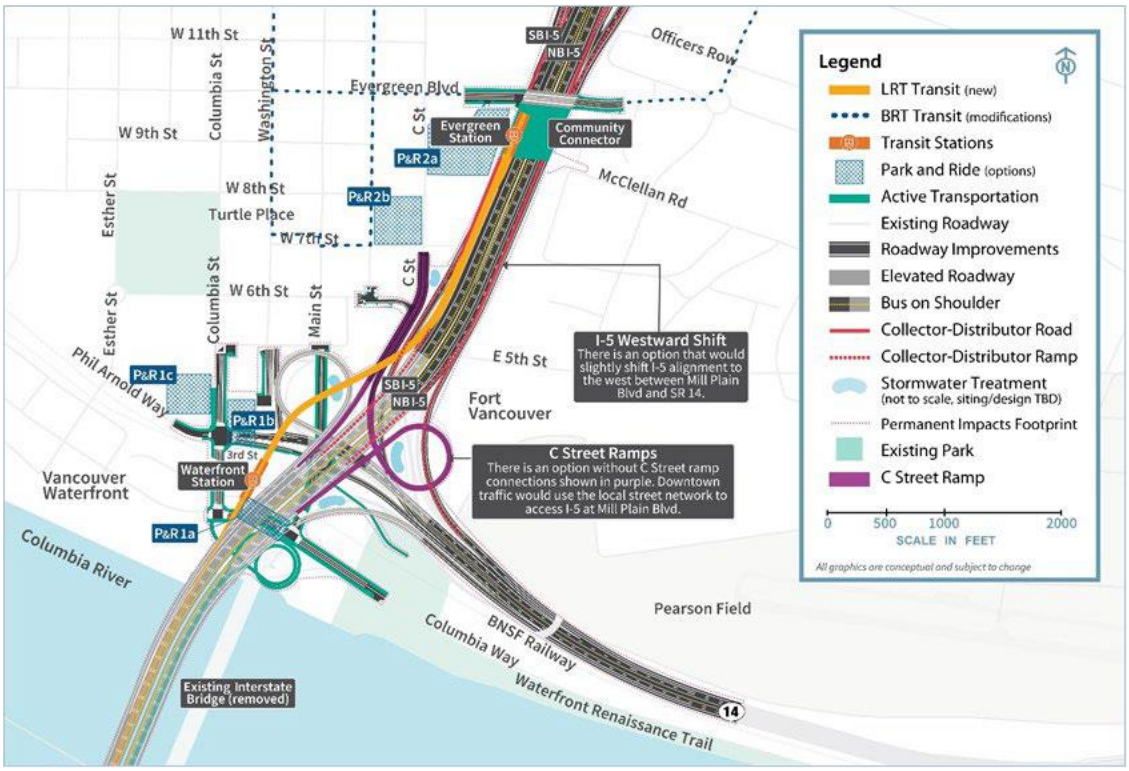

Figure 1-5. Downtown Vancouver, Area C

Highways, Interchanges, and Local Roadways

North of the Interstate Bridge in downtown Vancouver, improvements are proposed to the SR 14 interchange (Figure 1-5). The new Columbia River bridges will touch down just north of the SR 14 interchange. Direct connections between I-5 and SR 14 will be rebuilt.

Transit and Active Transportation

After crossing the Columbia River, the light-rail tracks will exit the highway bridge and be supported by their own bridge along the west side of the I-5 mainline. Up to two park and rides could be built in Vancouver along the light-rail alignment: one near the Waterfront Station and one near the Evergreen Station.

Within the downtown Vancouver area, the shared-use path on the eastern, northbound bridge will exit the bridge at the SR 14 interchange, loop down on the east side of I-5 via a vertical spiral path, and then cross back to the west side of I-5 to connect onto the Waterfront Renaissance Trail on Columbia Street and into Columbia Way.

Upper Vancouver Area D

Highways, Interchanges, and Local Roadways

Within the upper Vancouver area, the IBR Program proposes improvements to three interchanges; Mill Plain, Fourth Plain, and SR 500.

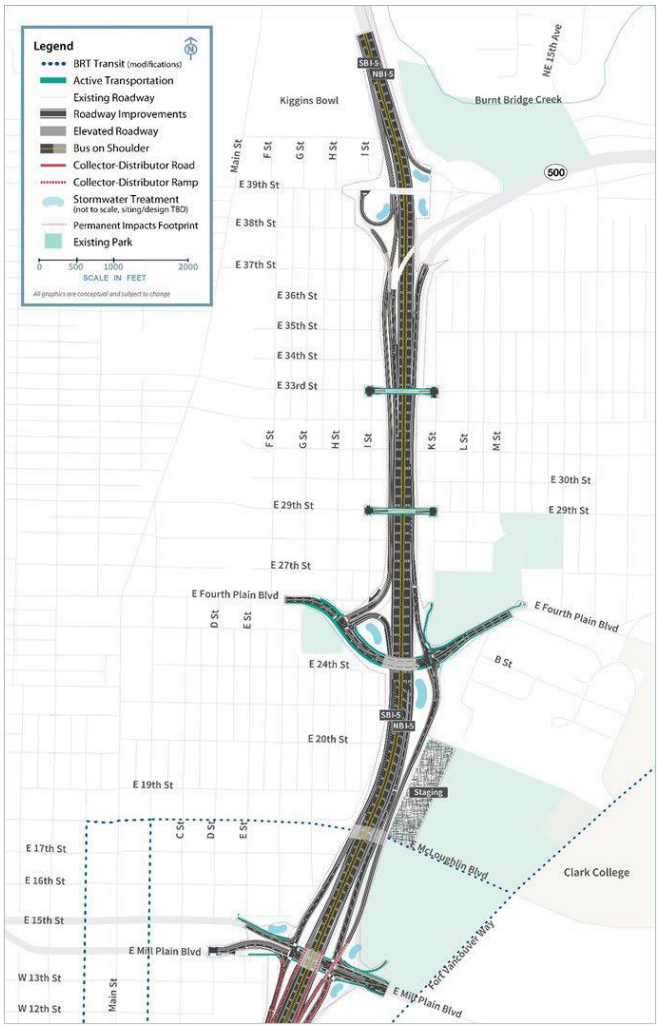

Figure 1-6. Upper Vancouver Area D

The Mill Plain Boulevard interchange is north of the SR 14 interchange (Figure 1-6). This interchange will be reconstructed as a tight-diamond configuration but will otherwise remain similar in function to the existing interchange. At the Fourth Plain Boulevard interchange, improvements will include reconstruction of the overpass of I-5 and the ramp terminal intersections. The northern terminus of the I-5 improvements will be in the SR 500 interchange area. The improvements will be minor and primarily connect the Modified LPA to existing ramps. Several active transportation improvements will be made in Area D consistent with City of Vancouver plans and policies.

Transit Support Facilities

Transit Support Facilities will be expanded at the TriMet Ruby Junction Maintenance Facility in Gresham, Oregon, the Expo Center overnight light-rail overnight vehicle facility will be expanded to accommodate the additional LRVs associated with the Modified LPA's LRT service (the Ruby Junction location relative to the project site is shown in Figure 3-21). Improvements will include additional storage for LRVs and maintenance materials and supplies, expanded LRV maintenance bays, expanded parking for additional personnel, and a third track at the northern entrance to Ruby Junction. An overnight facility for LRVs will be constructed on the southeast corner of the Expo Center property to reduce deadheading between Ruby Junction and the northern terminus of the MAX Yellow Line extension. Three bus bays will be added to the C-TRAN operations and maintenance facility. These new bus bays will provide maintenance capacity for the additional express bus service on I-5. Modifications to the facility will accommodate new vehicles as well as maintenance equipment.

Transit Operating Characteristics

Light-Rail Transit Operations

Nineteen new LRVs will be purchased to operate the extension of the MAX Yellow Line. These vehicles will be similar to those currently used for the TriMet MAX system. With the Modified LPA, LRT service in the new and existing portions of the Yellow Line in 2045 will operate with 5.4-minute average headways (defined as gaps between arriving transit vehicles) during the 2-hour morning peak period. Mid-day and evening headways will be 15 minutes, and late-night headways will be 30 minutes. Service will operate between the hours of approximately 5 a.m. (first southbound train leaving Evergreen Station) and 1 a.m. (last northbound train arriving at the station), which is consistent with current service on the Yellow Line. LRVs will be deadheaded at Evergreen Station before beginning service each day. A third track at this northern terminus will accommodate layovers.

Tolling

To help fund construction and future maintenance, and to encourage alternative mode choice for trips across the Columbia River, tolling is proposed for cars and trucks that cross the new bridges. Tolls would be collected using an all-electronic toll collection system using transponder tag readers and license plate cameras mounted to structures over the roadway.

Construction Timeline and Sequencing

The project will likely commence with the construction of the Columbia River and North Portland Harbor bridges, and these bridges are expected to require the longest timelines.

For purposes of this consultation, it has been preliminarily estimated that construction activities associated with the proposed action will commence in 2025. This schedule further assumes that the proposed action will take between 9 and 15 years to complete, and will require work within up to nine in-water work seasons. This schedule assumes that up to six in-water work seasons

will be necessary to construct the in-water components of the replacement bridges, and three in-water work seasons will be necessary to complete the demolition and removal of the in-water portions of the existing bridges. However, construction timing, sequencing, and duration will depend on a multitude of factors. Funding will be a large factor in determining the overall sequencing and construction duration. Design assumptions will also be refined as design progresses, which could result in changes to timing, sequencing, and duration. Contractor schedules, weather, materials, and equipment will also influence construction timing, sequencing, and duration during the construction phases of the project.

Project Elements and Timelines

Columbia River bridges- 4 to 7 years. Construction is likely to begin with the main river bridges. General sequence will include initial preparation and installation of foundation piles, shaft caps, pier columns, superstructure, and deck.
North Portland Harbor bridges- 4 to 10 years. Construction duration for North Portland Harbor Bridges is expected to be similar to the duration for Hayden Island Interchange construction. The existing North Portland Harbor bridge will be demolished in phases to accommodate traffic during construction of the new bridges.
Hayden Island interchange- 4 to 10 years. Interchange construction duration will not necessarily entail continuous active construction. Hayden Island work could be broken into several contracts, which could spread work over a longer duration.
Marine Drive interchange- 4 to 6 years. Construction will need to be coordinated with construction of the North Portland Harbor bridges.
SR 14 interchange- 4 to 6 years. Interchange will be partially constructed before any traffic could be transferred to the new Columbia River bridges.
Demolition of the existing Interstate Bridge-1.5 to 3 years. Demolition of the existing Interstate Bridge could begin only after traffic is rerouted to the new Columbia River bridges.
Three interchanges north of SR 14- 3 to 4 years for all three. Construction of these interchanges could be independent from each other and from construction of the Program components to the south. More aggressive and costly staging could shorten this timeframe.
Light-rail- 4 to 6 years. The light-rail crossing will be built with the Columbia River bridges. This phase includes all the infrastructure associated with LRT (e.g., overhead catenary system, tracks, stations, and park and rides).
Total construction timeline- 9 to 15 years. Funding, as well as contractor schedules, regulatory restrictions on in-water work and river navigation considerations, permits and approvals, weather, materials, and equipment, could all influence construction duration.

In-Water Work Window

The in-water work period was developed during the Columbia River Crossing Project development. Multiple agencies were involved including ODOT, FHWA, FTA, Washington Dept of Transportation (WSDOT), NMFS, Oregon Dept of Fish and Wildlife (ODFW), and Washington Dept of Fish and Wildlife (WDFW). Extensive modeling was done using a species exposure matrix to determine the time period necessary to minimize impacts to all Columbia River species, while focusing on the most sensitive. Species, run timing, and models were used to determine the most appropriate in-water work window to use to minimize impacts, and have a

reasonable time of construction. Without this analysis, using the normal in-water work window, the project would take decades to complete; affecting multiple life cycles of these sensitive species.

The USACE, NMFS, USFWS, ODFW, and WDFW all can recommend and/or require restrictions on the timing of in-water work during their regulatory review processes. The following agencies have published regulatory guidance regarding the preferred timing for in-water work to minimize impacts to aquatic species on the reach of the Columbia River at the project site:

- USACE: November 1–February 28 (USACE 2010)
- WDFW: July 16–February 28 (WDFW 2018)
- ODFW: November 1–February 28 (ODFW 2022)

For projects on the Columbia River where both ODFW and WDFW have review authority, a work window is typically negotiated among the agencies early in the permitting phase of the project.

Because of the amount of in-water work involved, and the logistical complexity of construction, adhering strictly to the published IWWW guidelines would more than double the anticipated construction timeline. This schedule was determined to be undesirable from both a cost standpoint and for the impacts to listed species associated with a longer construction duration requiring multiple seasons of in-water work.

The IWWW timing restrictions that are proposed for the project are the same as those proposed for the CRC project in 2011. Extensive agency, tribal, and interested party coordination was conducted between 2005 and 2011 to develop the IWWW timing restrictions that were ultimately proposed for the CRC project.

To establish appropriate assumptions regarding the IWWW timing restrictions for this proposed action, several meetings were coordinated between July and November 2022 with representatives from FHWA, FTA, NMFS, ODFW, WDFW, and interested tribes. The purposes of these meetings were to refine the assumptions around the in-water construction elements, construction schedule and in-water work timing, to establish an IWWW for purposes of the consultation, and to define which activities will be restricted to the IWWW.

Based on the outcome of the coordination and schedule refinement described above, the following IWWW restrictions have been established for purposes of this consultation.

- Impact pile driving will be confined to September 15 through April 15 of each year. This was confirmed as the most biologically defensible window for this proposed action, as it allows for an expedited construction schedule that minimizes the number of in-water work seasons, while still avoiding the peak run timing of each Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) of ESA-listed fish to the greatest extent practicable.

- In-water debris removal with a bucket dredge will be confined to November 1 and February 28 of each year. This is the standard published work window for this reach of the river, and will appropriately avoid impacts to each ESU/DPS of ESA-listed fish in the river. However, limited, diver-assisted removal of specific individual pieces of debris or large riprap necessary to place a drilled shaft may be conducted at any time of year.

The following in-water and over-water construction activities will not be restricted to an IWWW, and may be conducted year-round, provided they are conducted consistent with the best management practices (BMPs) described in Section 4 of this document and in compliance with all applicable permit conditions:

- Pile installation with a vibratory hammer.
- Pile removal with a vibratory hammer or by direct pulling.
- Sheet pile installation or removal with a vibratory hammer.
- Drilled shaft casing installation via vibratory hammer or oscillator.
- Wire saw/diamond wire cutting to demolish and remove existing piers.
- Operation of barges and other water-based construction vessels (small skiffs etc.), including movement, anchoring, and repositioning.
- Work conducted below the OHWM elevation but in isolated and/or dewatered conditions, or above the wetted channel. Such activities include, but are not limited to, fish salvage activities; work within drilled shaft casings (excavation, reinforcement, concrete placement); construction of formwork and concrete placement for cast-in place concrete work; and demolition work within cofferdams.
- Work conducted waterward of OHWM, but above the OHWM elevation (overwater work). Such activities include, but are not limited to, installation of superstructure elements of the bridge, cast-in-place concrete work, and overwater demolition activities.

The timing of in-water work will ultimately occur in compliance with the terms and conditions of the regulatory permits ultimately obtained for this proposed action.

Project Elements

There are a number of project elements that are explained in detail in the BA and we are incorporating those detailed project elements and assumptions of the BA by reference here (Section 3.4 pages 3-46 through 3-114). These project elements include details on:

- Mobilization and Site Preparation
- Construction Access, Staging, and Casting Yards
- Temporary Work Structures
- Temporary Work Platforms, Bridges, and Piers
- Suspended Shaft Cap Isolation System
- Sheet Pile Cofferdams
- Drilled Shaft Isolation Casings
- Barges and Barge Mooring Piles
- Other Temporary Piles
- Work Area Isolation and Fish Salvage

- Upland Ground Improvements
- Foundation Construction – Interstate Bridge
- Superstructure Construction
- Precast Concrete Work
- Cast-in Place Concrete Work
- Foundation Construction- North Portland Harbor
- Debris Removal
- Vibratory Pile Driving and Removal
- Impact Pile Driving
- Temporary Drilled Shaft Isolation Casings
- Permanent Drilled Shaft Casings
- Demolition of Existing Bridges- Interstate Bridges
- Demolition of Existing Bridge- North Portland Harbor
- Light-Rail Construction and Operation
- Construction Stormwater Management
- Post-Project Stormwater Management

Conceptual Construction Sequence and Timeline – Interstate Bridge

Depending upon which pier is being constructed, in-water and over-water construction will likely occur according to the following general sequence.

- Mobilization, staging, and installation of BMPs
- Install and dewater temporary cofferdam (Piers 2 and 7 only).
- Install temporary piles for barge mooring.
- Install temporary work bridges, platforms, and/or piers (including associated piles).
- Install drilled shafts for each pier
- Install shaft cap isolation system (Piers 3 through 6 only)
- Install shaft caps at the water level.
- Remove cofferdam (Piers 2 and 7 only), or shaft cap isolation system (Piers 3 through 6).
- Construct columns on the shaft caps.
- Construct bridge superstructure.
- Connect superstructure spans with mid-span closures.
- Remove all temporary work platforms, bridges, piers and associated piles.

One or more of the activities identified above may be occurring at more than one pier complex at a time, as the construction sequence progresses.

Conceptual Construction Sequence and Timeline- North Portland Harbor

At each pier, construction will likely occur according to the following general sequence.

- Mobilization, staging, and installation of BMPs.
- Conduct debris removal as necessary to install temporary piles, isolation casings, or drilled shafts.

- Install temporary piles for barge mooring.
- Install temporary work bridges and associated piles.
- Install and dewater temporary isolation casing.
- Install drilled shaft.
- Construct columns on the drilled shafts.
- Remove temporary isolation casing.
- Construct a cap or crossbeam on top of the columns at pier location.
- Erect bridge girders on the caps or crossbeams.
- Place the bridge deck on the girders.
- Remove all temporary work bridges, isolation casings, and barge mooring piles.

One or more of the activities identified above may be occurring at more than one pier at a time, as the construction sequence progresses.

Project-Related Mitigation/Conservation Activities

As described in the introduction, the IBR Program will be designed to avoid, minimize, and mitigate impacts to resources under NMFS jurisdiction. The FHWA and FTA assumes the proposed action will result in unavoidable impacts that will require compensatory mitigation under one or more regulatory frameworks. Compensatory mitigation plans are being prepared to provide compensation for any such unavoidable impacts to regulated resources (wetlands, waters, designated critical habitat) and to demonstrate that the proposed action will achieve "no net loss" of function of these resources.

Compensatory mitigation plans will be developed to satisfy the regulatory frameworks of the agencies with jurisdiction. These frameworks establish the following range of potential options for providing compensatory mitigation:

- Mitigation banks: A mitigation bank is a third-party sponsor that has constructed a mitigation site and gained approval to sell mitigation "credits." Permittees can purchase these credits to satisfy the compensatory mitigation requirements of their projects. There are several approved mitigation banks in Washington and Oregon that provide credits for specific types of impacts including wetlands, buffers, and fish and wildlife habitat credits. Each state has a different process for reviewing and approving banks. Mitigation ratios are established in the mitigation bank instrument, which is the regulatory document that guides the operation of the bank.
- Permittee-responsible mitigation (PRM): PRM consists of a stand-alone project or projects that are developed and implemented by the permittee. In this scenario, permittees (or their legal designees) retain full responsibility to implement, manage, and maintain the compensatory mitigation site until performance criteria have been satisfied. The Program may elect to contract with a third party to implement or manage a given PRM project. The Program may also elect to use advance mitigation credits from a PRM project (such as ODOT's proposed Columbia Bottomlands Advance Mitigation/Conservation Site).
- PRM may be conducted concurrently with a project/impact or may occur in advance of a project. Advance PRM is typically considered to provide relatively greater level

of function, given the additional time the site has to develop and the greater certainty of success.

- In-lieu fees and/or payment-in-lieu mitigation program: Both Oregon and Washington have programs in place to accept payments in lieu of mitigation under certain specific circumstances. The state then uses these payments to fund, design, and manage a variety of restoration and mitigation projects. These are typically seen as a last resort option, when there are no other options are available. In-lieu fees are not anticipated to be applicable to the IBR Program, as there are no in-lieu fee programs available in the Washington portion of the study area, and in-lieu fees would not satisfy the USACE's mitigation requirements.

It is anticipated that compensatory mitigation for impacts to aquatic and terrestrial habitats and species, and floodplains in Washington will be provided through the purchase of credits from the proposed Wapato Valley Mitigation and Conservation Bank. The bank is approximately 876 acres and is located in the Columbia River floodplain at the mouth of the Lewis River, approximately 19 river miles downstream of the Interstate Bridge. The bank is currently in the final stages of regulatory review and approval is anticipated to be approved for use in late 2025.

It is anticipated that compensatory mitigation for impacts to wetlands, aquatic and terrestrial habitats and species, and floodplains in Oregon will be provided partially through the purchase of advance mitigation credit at ODOT's proposed Columbia Bottomlands Advance Mitigation/Conservation Site, and partially through the purchase and protection under conservation easement of a site on West Hayden Island. The Columbia Bottomlands Advanced Mitigation/Conservation site is located in Scappoose Bay, a slough of Multnomah Channel, in Columbia County, Oregon. The site is located approximately 1 mile upstream of where the Multnomah Channel meets the Columbia River and approximately 20 river miles downstream of the Interstate Bridge. The site has been designed to provide advance mitigation credits for impacts to wetlands and aquatic and terrestrial habitats and species for future ODOT projects in the Lower Willamette 4th Field Hydrologic Unit Code. ODOT has applied for permits to complete the restoration and enhancement activities, and it is currently anticipated that construction on the site will commence in the summer of 2026.

The proposed site on West Hayden Island is approximately 65 acres in size and is located approximately 2.5 river miles downstream of the Interstate Bridge, on the south side of the island adjacent to North Portland Harbor. The site is currently owned by DSL, but ODOT has proposed to purchase this site and place it under a conservation easement. One or more compensatory mitigation projects may also be conducted on the site. The specific activities to be conducted at this site would be developed in coordination with the applicable regulatory agencies for each of the various permit applications.

In addition to the compensatory wetland and habitat mitigation described above, the IBR Program may need to excavate material from within the 100-year floodplain to address the compensatory excavation requirements of the City of Portland's recently updated floodplain ordinance. If such activity is required, it is anticipated that this material would be removed from upland portions of the 65-acre parcel on West Hayden Island described above, or from aquatic

areas adjacent to this parcel. If such excavation activities are conducted, excavated materials will be disposed of at a location approved to receive that type of material.

Compensatory mitigation activities at the West Hayden Island site may include in-water work including in-water work area isolation, fish salvage, and short-term construction-related effects. Efforts will be made to exclude fish from the work areas by guiding sediment curtains out from the bank and anchoring both ends of the curtain. This will not eliminate the need for electrofishing, but will minimize the need.

The following is a summary of potential mitigation and conservation actions (from Table 3-16 in the BA on page 3-127 and 3-128):

Benthic Habitat Impacts (Permanent and Temporary)
- Removal of derelict piles/structures/debris
- Aquatic habitat creation/enhancement addressing limiting factors
- Mitigation bank credits

Overwater Coverage (Permanent and Temporary)
- Removal of derelict piles/structures/debris
- Aquatic habitat creation/enhancement addressing limiting factors
- Mitigation bank credits

Fill within Floodplain/Functional Floodplain
- Excavation of material to satisfy regulatory requirements
- Mitigation bank credits

Terrestrial Habitat Impacts (Permanent and Temporary)
- On-site riparian enhancements (plantings/invasive species management)
- Terrestrial habitat creation/enhancements

Project Element/Impact Potential Mitigation/Conservation Actions
- Mitigation bank credits

Wetland and Buffer Impacts (Permanent and Temporary)
- Wetland creation, restoration, enhancement, or preservation
- Could be combined with habitat mitigation for additional benefit
- Mitigation bank credits

Stormwater from new/rebuilt impervious surfaces
- Substantial conservation benefit provided by proposed treatment

Species-specific Impacts
- Species-specific conservation considerations may be developed in coordination with interested parties and agencies

Construction of the types of PRM and conservation activities shown above have the potential to result in temporary disturbance of aquatic, riparian, wetland, and/or upland terrestrial habitats. These types of activities typically require vegetation clearing and/or ground disturbance, in-air construction noise associated with earthwork, and temporary effects to water quality during construction. Floodplain reconnection projects may require work below the OHWM of fish-bearing water bodies and could require work area isolation and fish salvage activities. These impacts will be avoided and minimized through implementation of appropriate construction

BMPs (developed during the permitting of the project and mitigation plan development), and function will be fully restored once construction activities are completed.

Compensatory mitigation plans will be fully developed during the permitting phase of the project. The mitigation project will likely be designed and permitted in multiple construction packages, and it is anticipated that separate compensatory mitigation plans will be developed to support the various permitting packages that will ultimately be developed for the project. Each plan will identify the amount, type, and specific locations of any proposed mitigation and conservation actions, specific impact avoidance and minimization measures to be implemented, as well as the goals, objectives, and performance standards for measuring success. Full implementation of the compensatory mitigation plans will be a condition of the applicable permits of the agencies with jurisdiction (i.e., USACE Section 10/404 permit, the Oregon Department of Environmental Quality [DEQ] and Ecology Section 401 certifications, the Oregon Department of State Lands [DSL] Removal-Fill permit, WDFW Hydraulic Project Approval, City of Vancouver Shorelines and Critical Areas permits, and City of Portland Environmental Review and Floodplain Development Permits), and the mitigation will comply fully with all applicable terms and conditions of these permits (including any applicable exemptions or variances). Compensatory mitigation plans will be provided to NOAA Fisheries for review, and NOAA Fisheries may provide feedback on the adequacy of the plans related to the impacts of the project.

The plans will identify the amount, type, and specific locations of any proposed mitigation and conservation actions, including floodplain mitigation specific impact avoidance and minimization measures to be implemented, as well as the goals, objectives, and performance standards for measuring success (Table 1-1). The mitigation associated with the Interstate Bridge Replacement Project will have elements and benefits consistent with those found in SLOPES V Restoration Programmatic Biological Opinion. These mitigation elements will take place in the three locations discussed above. We are completing our analysis without considering any beneficial impacts of the mitigation because the mitigation plans are not developed with sufficient specificity at this time.

Table 1-1. Habitat Impacts to be Addressed in the Mitigation Plans.

Impact Type	Col*/ NPH**	Addressed in future mitigation plans? (Y/N)	Impact Area	Exposure Time
Riparian Loss - Washington		Y	0.79 ac	Permanent
Riparian Loss - Oregon		Y	1.15 ac	Permanent
Benthic Loss – Shallow	Col	Y	10,587 ft^2	Permanent
Benthic Loss - Deep	Col	Not Applicable	-10,299 ft^2	Not Applicable
Benthic Loss – Shallow	NPH	Y	2,539 ft^2	Permanent
Benthic Loss – Deep	NPH	Not Applicable	0	Not Applicable
Overwater coverage – Shade/Pred - Deep	Col	Y	58,474 ft^2	Permanent
Overwater coverage – Shade/Pred - Shallow	Col	Y	10,244 ft^2	Permanent
Overwater coverage – Shade/Pred - Deep	NPH	Not Applicable	0	Not Applicable
Overwater coverage – Shade/Pred - Shallow	NPH	Not Applicable	0	Not Applicable

Impact Type	Col*/ NPH**	Addressed in future mitigation plans? (Y/N)	Impact Area	Exposure Time
Proposed structures – Shallow water habitat	Col	Y	10,587 ft^2	Permanent
Proposed structures – Deep water habitat	Col	Not Applicable	-10,299 ft^2	Not Applicable
Proposed structures – Shallow water habitat	NPH	Y	2,539 ft2	Permanent
Temp Overwater coverage	Col	To Be Determined	343,695 ft^2	1.5 years
Temp Overwater coverage	NPH	To Be Determined	336,900 ft^2	2.5 years
Temp Benthic Loss	Col	To Be Determined	72,471 ft^2	2-months to 1.5 years
Temp Benthic Loss	NPH	To Be Determined	17,445 ft^2	2-months to 2.5 years
*Columbia River (Col); **North Portland Harbor (NPH)				

Conservation measures will likely consist of additional measures incorporated to provide conservation uplift outside of the specific regulatory framework that is established for compensatory mitigation. Conservation actions may include project-specific performance commitments and/or design criteria that provide a conservation benefit (such as stormwater treatment), which on this project, as proposed will have a conservation benefit. Conservation actions may include opportunistic on- or off-site restoration or habitat enhancement activities (such as pile removals or plantings). They may also be provided through the purchase of additional bank credits, PRM mitigation, in-lieu fee payments, and/or project funding as deemed appropriate. Specific compensatory mitigation plans are still in development for this proposed action and specific mitigation and conservation actions are being established.

Fill within the Floodplain

The project will require both removal and placement of material below the 100-year floodplain elevation. The City of Portland recently updated their floodplain ordinance as part of their adoption of the City's Floodplain Resilience Plan (City of Portland 2023). The updates were intended in part to bring the City's code into compliance with the recommendations of the 2016 Federal Emergency Management Agency National Flood Insurance Program Biological Opinion that was issued by NOAA Fisheries in 2016. The City's floodplain ordinance includes requirements for compensatory excavation to offset impacts to habitat for ESA-listed species and flood storage, in addition to other measures designed to preserve the function and resiliency of floodplains. The City of Fairview and City of Vancouver also regulate cut and fill activities within the regulatory floodplain and require demonstration of no net-rise through their local environmental approval process and any associated variances to those processes. These regulatory frameworks also include provisions for exemptions from, and/or variances to, certain provisions of the ordinance under certain conditions.

Excavation of material from within the regulatory floodplain may be required to satisfy the applicable regulatory frameworks of the agencies with jurisdiction over floodplain fill, either through direct compliance with requirements or alternative methods that satisfy local permitting requirements. While specific areas of excavation have not yet been identified, the elements associated with these activities, would likely include measures such as removal of floodplain fill, creation of shallow water habitat, creation of off-channel refugia, and reconnecting access to off-

channel habitat, migration habitat, and high flow refugia. These types of measures are consistent with the types of restoration in the SLOPES V Restoration Opinion and any adverse effects on fish will be minor. Compensatory mitigation plans for floodplain fill will be provided to NOAA Fisheries for review. We apply the same assumptions, as above, regarding proposed mitigation.

The project will also require both removal and placement of material within the functional floodplain. Specific quantities of removal and fill have only been estimated at this time, and will depend substantially on final design and permitting details. Approximate quantities are provided in Table 3-5 and Table 3-6 in Section 3.4.6. of the BA (pages 3-76 through 3-85). The proposed action will install up to approximately 62,400 cubic yards of new material within the functional floodplain of the Columbia River and North Portland Harbor, and will remove approximately 13,250 cubic yards of existing material from within the functional floodplain. It is estimated, therefore, that the proposed action will result in a maximum net increase of approximately 55,000 cubic yards of material within the functional floodplain. Most of this volume would be associated with the shaft caps for the Columbia River bridge, which are approximately 20 feet thick, and most of which will be below the OHWM elevation, but not on the bottom of the river. Despite the potential net increase of fill within the regulatory and/or functional floodplains, the proposed action will provide compensatory mitigation that will demonstrate "no net loss" of floodplain function as described above. These compensatory mitigation plans will be provided to NOAA for review and feedback on the adequacy of the plan regarding impacts to floodplain function for ESA listed species and critical habitats.

Related Activities

The activities described in this section include activities caused by the proposed action, but that are not part of the proposed action. The activities are reasonably certain to occur, and would not occur "but for" the proposed action. These related activities include long-term maintenance and operation of the bridges, roadways, stormwater BMPs and other infrastructure associated with the proposed action, project-related mitigation and conservation activities, and other activities described below.

Maintenance Activities

ODOT, WSDOT, TriMet, C-TRAN, and the Cities of Vancouver and Portland may all have responsibility for maintaining elements of the bridge, the approaches, adjacent roadways, stormwater infrastructure, or other elements within their respective jurisdictions, unless interagency agreements between jurisdictions prevail.

Current maintenance activities that would occur include cleaning, replacing signs or other structures, and structural inspection/repairs. New maintenance activities are likely to include sweeping and snow plowing on the new bridge deck, and maintenance of stormwater BMPs.

Federal Levee Modifications

In addition to the bridge replacement, the proposed action includes some maintenance to the levee system. The Portland Metro Levee System (PMLS) is a system of federal flood control

levees located along the south bank of the Columbia River, from its confluence with the Sandy River to just upstream of its confluence with the Willamette River. The PMLS consists of four integrated and contiguous levee systems: Peninsula Drainage District No. 1, Peninsula Drainage District No. 2, Multnomah County Drainage District No. 1, and Sandy Drainage Improvement Company. The USACE and drainage districts are partner entities in the Levee Ready Columbia project, an ongoing project to modernize the PMLS, which includes raising the height of the levees in Peninsula Drainage District No. 1 and Peninsula Drainage District No. 2. All work associated with the levee modifications would occur in uplands. No work below the ordinary high-water mark is planned or anticipated associated with levee modifications.

Changes After the Final Biological Assessment

NOAA recognized during the development of the Opinion that additional information and clarification was needed regarding mitigation, work associated with levee modifications, and a more current assessment of the temporary work structures. FHWA responded to this request with the following:

- Mitigation actions would result in minor short-term adverse effects from near and in-water construction. All of the long-term effects would be beneficial. These effects are fully described in NMFS programmatic consultations on restoration activities including the SLOPES Restoration (NMFS 2013a), ARBO II (NMFS 2013b), and PROJECTS (NMFS 2013c) programmatic biological opinions.
- Fish salvage would not be needed for levee modifications and all work will be upland, and above the Ordinary High Water elevation,

Much of this section in the BA remains the same, however, the IBR team is proposing one change. A proposed update to Table 3-3 of the Biological Assessment is provided below. This change will increase the duration of the benthic and overwater shading effects associated these temporary structures, but would not affect any of the analysis or conclusions presented in the BA. It was determined that the 500-day duration for temporary work platforms/bridges/piers and associated piles that was presented in the BA, should be increased to 1,500 days to accommodate scenarios in which a contractor may elect to leave temporary work bridges in place over multiple seasons.

Modified LPA

With the Modified LPA, future active transportation trips across the new Columbia River bridges are estimated to range between 740 and 1,600 trips per day. The Modified LPA would offer improved conditions for active transportation, improving capacity, access, safety, and user experience for trips across the bridge. These improvements would combine with the transit improvements offered by the Modified LPA to further improve mobility. Trains and buses would accommodate bicycle trips and allow active transportation travelers to use the new stations to reach a wider array of destinations on both sides of the river, compared to the No-Build Alternative. Measures for evaluating the perceived stress active transportation travelers experience would also improve.

Areas in proximity to new LRT stations could experience new development and/or redevelopment. This development would facilitate growth and increased land use density, as encouraged by local and regional land use plans. As described in Section 3.4.4 in the draft FSEIS, the provision of high-capacity transit is expected to support development in already urbanized areas of Hayden Island and downtown Vancouver, while reducing the potential for urban sprawl. The growth that would occur in these areas is accounted for in current growth targets, which anticipate the extension of high-capacity transit service. Thus, the indirect effects of the Modified LPA would be consistent with local and regional planning.

Increased development in areas near the IBR Program stations is anticipated in the regional travel demand model, which includes changes to overall transit ridership beyond the study area. The mode of access to and from stations may shift as a result of increased development near the IBR Program stations. This may result in a greater percentage of active transportation or transit transfers and a lower percentage of automobile access as population and employment densities increase within station area walksheds and bikesheds. Increased active transportation trips to stations, particularly if higher-density residential and commercial development occurs in surrounding areas, may involve increased travel along streets that lack ADA accessibility or facilities to accommodate active transportation. However, increased development and transportation activity along these streets could encourage infrastructure improvements by local jurisdictions.

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 FHWA determined the proposed action is not likely to adversely affect SRKW or its critical habitat. Our concurrence for SRKW and determinations for SRKW and critical habitat is documented in the "Not Likely to Adversely Affect" Determinations section of this opinion (Section 2.16).

2.1. Analytical Approach

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

CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

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

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

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

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

2.2. Rangewide Status of the Species and Critical Habitat

In this opinion, we examine 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. We also examine the condition of critical habitat throughout the designated area, evaluate the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discuss the function of the PBFs that are essential for the conservation of the species. The Federal Register notices and notice dates for the species and critical habitat listings considered in this opinion are included in Table 2-1.

2.2.1 Status of Species

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

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

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

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

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

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

Our status of the species summaries for Lower Columbia River (LCR) Chinook salmon, Upper Columbia River spring run (UCR-SR) Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Snake River fall run (SR-FR) Chinook salmon, SR spring/summer-run Chinook salmon, Columbia River (CR) chum salmon, Snake River (SR) sockeye salmon, LCR coho salmon, LCR steelhead, UWR steelhead, Upper Columbia River (UCR) steelhead, Snake River Basin (SRB) steelhead, Middle Columbia River (MCR) steelhead, Pacific Eulachon, Green Sturgeon, and the Sunflower Sea Star are incorporated here by reference and available on the NOAA Fisheries website at: ESA Section 7 Consultations on the West Coast| NOAA Fisheries

Table 2-1. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this Opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022b; Ford 2022	This ESU comprises 32 independent populations. Relative to baseline VSP levels identified in the recovery plan (Dornbusch 2013), there has been an overall improvement in the status of a number of fall-run populations although most are still far from the recovery plan goals; Spring-run Chinook salmon populations in this ESU are generally unchanged; most of the populations are at a "high" or "very high" risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Overall, we conclude that the viability of the Lower Columbia River Chinook salmon ESU has increased somewhat since 2016, although the ESU remains at "moderate" risk of extinction	• Degraded water quality • 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 • Contaminants
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NMFS 2016; Ford 2022	This ESU comprises three independent populations. Current estimates of natural-origin spawner abundance decreased substantially relative to the levels observed in the prior review for all three extant populations. Productivities also continued to be very low, and both abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Salmon Recovery Plan for all three populations. Based on the information available for this review, the Upper Columbia River spring-run Chinook salmon ESU remains at high risk of extinction, with viability largely unchanged since 2016.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NMFS 2016; Ford 2022	This ESU comprises 28 extant and four extirpated populations. There have been improvements in abundance/productivity in several populations relative to the time of listing, but the majority of populations experienced	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				sharp declines in abundance in the recent five-year period Overall, at this time we conclude that the Snake River spring/ summer-run Chinook salmon ESU continues to be at moderate-to-high risk of extinction.	• Predation
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NMFS 2024; Ford 2022	This ESU comprises seven populations. Abundance levels for all but Clackamas River DIP remain well below their recovery goals. Overall, there has likely been a declining trend in the viability of the Upper Willamette River Chinook salmon ESU since the last review. The magnitude of this change is not sufficient to suggest a change in risk category, however, so the Upper Willamette River Chinook salmon ESU remains at "moderate" risk of extinction.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NMFS 2016; Ford 2022	This ESU has one extant population The single extant population in the ESU is currently meeting the criteria for a rating of "viable" developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction.	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022b; Ford 2022	This species has 17 populations divided into 3 MPGs. 3 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). The remaining populations have unknown abundances. Abundances for these populations are assumed to be at or near zero. The viability of this ESU is relatively unchanged since the	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				last review (moderate to high extinction risk), and the improvements in some populations do not warrant a change in risk category, especially given the uncertainty regarding climatic effects in the near future.	• An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022b; Ford 2022	Of the 24 populations that make up this ESU, only six of the 23 populations for which we have data appear to be above their recovery goals. Overall abundance trends for the Lower Columbia River coho salmon ESU are generally negative. Natural spawner and total abundances have decreased in almost all DIPs, and Coastal and Gorge MPG populations are all at low levels, with significant numbers of hatchery-origin coho salmon on the spawning grounds. Improvements in spatial structure and diversity have been slight, and overshadowed by declines in abundance and productivity. For individual populations, the risk of extinction spans the full range, from "low" to "very high." Overall, the Lower Columbia River coho salmon ESU remains at "moderate" risk, and viability is largely unchanged since 2016.	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NMFS 2016; Ford 2022	This single population ESU is at remains at "extremely high extinction 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 environmental variation modeling supports the "extremely high risk" rating with the potential for extirpation in the near future (Crozier et al. 2020). The viability of the Snake River sockeye salmon ESU therefore has likely declined since	• 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	Status Summary	Limiting Factors
				the time of the prior review, and the extinction risk category remains "high."	
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NMFS 2016; Ford 2022	This DPS comprises four independent populations. The most recent estimates (five year geometric mean) of total and natural-origin spawner abundance have declined since the last report, largely erasing gains observed over the past two decades for all four populations). Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The overall Upper Columbia River steelhead DPS viability remains largely unchanged from the prior review, and the DPS is at high risk of extinction driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NMFS 2022b; Ford 2022	This DPS comprises 23 historical populations, 17 winter-run populations and 6 summer-run populations. 10 are nominally at or above the goals set in the recovery plan (Dornbusch 2013); however, it should be noted that many of these abundance estimates do not distinguish between natural- and hatchery- origin spawners. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk.,	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NMFS 2024; Ford 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. Although the recent magnitude of these declines is relatively moderate, continued	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				declines would be a cause for concern. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk. Overall, the Upper Willamette River steelhead DPS is therefore at "moderate-to-high" extinction risk, with a declining viability trend.	• Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NMFS 2016; Ford 2022	This DPS comprises 17 extant populations. Recent (five-year) returns are declining across all populations, the declines are from relatively high returns in the previous five-to-ten year interval, so the longer-term risk metrics that are meant to buffer against short-period changes in abundance and productivity remain unchanged. The Middle Columbia River steelhead DPS does not currently meet the viability criteria described in the Middle Columbia River steelhead recovery plan.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NMFS 2016; Ford 2022	This DPS comprises 24 populations. Based on the updated viability information available for this review, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain. Of particular note, the updated, population-level abundance estimates have made very clear the recent (last five years) sharp declines that are extremely worrisome, were they to continue.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2021a	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon,	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	NMFS 2022a	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to environmental variation, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation
Sunflower Sea Star	Proposed Rule to List as Threatened 3/16/2023	NA	Lowry et al. 2022	From 2013-17 sea star wasting syndrome (SSWS) reached pandemic levels, killing an estimated 90%+ of the population. Impacts varied by region across the range of the species and generally progressed from south to north. By 2017, *P. helianthoides* was rare south of Cape Flattery, WA, where it had been conspicuous and ecologically important in the benthic marine ecosystems. Declines in coastal British Columbia and the Aleutian Islands exceeded at least 60%, and more likely 80%. Environmental factors (e.g. temperature, dissolved oxygen) likely contributed to the pandemic and continue to interact with the disease to suppress recovery.	• Disease – Sea Star Wasting Disease SSWD • Elevated Ocean Temperatures and other Environmental Variation related effects (correlated with SSWD) • Lack of Regulation on Environmental variation • Lack of direct species protection

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				The species is facing a moderate risk of extinction over the foreseeable future.	

The Sunflower Sea Star (*Pycnopodia helianthoides*) occupies nearshore intertidal and subtidal marine waters shallower than 450 m (~1400 ft) deep from Adak Island, AK, to Bahia Asunción, Baja California Sur, MX. They are occasionally found in the deep parts of tide pools. The species is a habitat generalist, occurring over sand, mud, and rock bottoms both with and without appreciable vegetation. Critical habitat is currently indeterminable because information does not exist to clearly define primary biological features. Prey include a variety of epibenthic and infaunal invertebrates, and the species also digs in soft substrate to excavate clams. It is a well-known urchin predator and plays a key ecological role in control of these kelp consumers. More information about sea star biology, ecology, and their life history cycle is found in the proposed listing (88 FR 2023).

From 2013 to 2017, the sunflower sea star experienced a range-wide epidemic of sea star wasting syndrome (SSWS) (Gravem et al. 2021; Hamilton et al. 2021; Lowry et al. 2022). While the cause of this disease remains unknown, prevalence of the outbreak has been linked to a variety of environmental factors, including temperature change, sustained elevated temperature, low dissolved oxygen, and decreased pH (Hewson et al. 2018; Aquino et al. 2021; Heady et al. 2022; Oulhen et al. 2022). As noted above, changes in physiochemical attributes of nearshore waters are expected to change in coming decades as a consequence of anthropogenic environmental variation, but the specific consequences of such changes on SSWS prevalence and severity are currently impossible to accurately predict.

2.2.2 Status of Designated Critical Habitat

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

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

For southern DPS green sturgeon, a team similar to the CHARTs — a critical habitat review team (CHRT) — identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas necessary to ensure the conservation of the species (USDC 2009). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries,

and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For southern DPS eulachon, critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). We designated all of these areas as migration and spawning habitat for this species.

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

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

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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005a). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005a). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005a). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005a). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005a). 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 2005a). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.

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

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

NMFS has designated critical habitat for all 13 salmon and steelhead species, Pacific eulachon and green sturgeon that would be likely adversely affected by the proposed action. Across these designated critical habitats, watershed processes have been disrupted by human activities and environmental variation, reducing water and habitat quality and quantity as well as habitat complexity. This has weakened what were once healthy ecosystems for these species. Human activities that have contributed to this change include intensive agriculture, channel modifications and diking, disturbance of riparian vegetation, draining and converting wetlands, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Water withdrawals for agriculture, particularly when overlapping with low-flow periods, often increase summer stream temperatures, block fish migration, strand fish in shallow pools, and alter sediment transport (Spence et al. 1996). Many of the designated stream reaches are on the Clean Water Act 303(d) list for impaired water quality, such as elevated water temperature. Water quality in spawning and rearing areas has also been impaired by sedimentation and by contaminants related to agricultural chemicals, stormwater runoff, and mining, and other human activities.

The construction and operation of water storage and hydropower projects in the Columbia River basin, including the eight run-of-river dams on the mainstem lower Snake and lower Columbia Rivers, have altered the PBFs of the mainstem migration corridor. Hydro system development modified natural flow regimes, resulting in warmer late summer and fall water temperature. Changes in fish communities led to increased rates of piscivorous predation on juvenile salmon. Reservoirs and project tailraces created habitats where avian predators successfully forage for smolts, and the dams themselves created migration delays for both adult and juvenile salmonids. Physical features of the dams, such as turbines, also kill out-migrating fish. However, some of these conditions have improved since the first ESA listings in the 1990s. The Bureau of Reclamation and Unites States Army Corps of Engineers (USACE) have implemented measures to improve safe passage and water quality including 24-hour volitional spill, surface passage routes, upgrades to juvenile bypass systems, predator management measures, and systems that cool adult ladders.

Measures taken through the efforts of Federal, tribal, State, local, and private entities in the decades since critical habitat was designated have improved the functioning of the spawning, rearing, and migration area PBFs. These include protecting and improving instream flow, improving habitat complexity, improving the condition of riparian areas, reducing fish entrainment at water diversions, and removing barriers to spawning and rearing habitat. However, more improvements will be needed before critical habitat functions at levels that support the recovery of the listed species.

2.2.3 Environmental Variation

Environmental variation generally exacerbates threats and limiting factors, including those currently impairing salmon and steelhead survival and productivity. The growing frequency and magnitude of environmental variation related environmental downturns will increasingly imperil many ESA-listed stocks in the Columbia River basin and amplify their extinction risk (Crozier et al. 2019, 2020, 2021). This environmental variation context means that opportunities to rebuild these stocks will likely diminish over time. As such, management actions that increase resilience

and adaptation to these changes should be prioritized and expedited. For example, the importance of improving the condition of and access and survival to and from the remaining functional, high elevation spawning and nursery habitats is accentuated because these habitats are the most likely to retain remnant snowpack under predicted environmental variation (Tonina et al. 2022).

Environmental variation will continue to affect air temperatures, precipitation, and wind patterns in the Pacific Northwest (ISAB 2007, Philip et al. 2021), resulting in increased droughts and wildfires and variation in river flow patterns. These conditions differ from those under which native anadromous and resident fishes evolved and will likely increase risks posed by invasive species and altered food webs. The frequency, magnitude, and duration of elevated water temperature events have increased with environmental variation and are exacerbated by the Columbia River hydro system (EPA 2020a, 2020b; Scott 2020). Thermal gradients (i.e., rapid change to elevated water temperatures) encountered while passing dams via fish ladders can slow, reduce, or altogether stop the upstream movements of migrating salmon and steelhead (e.g., Caudill et al. 2013). Additional thermal loading occurs when mainstem reservoirs act as a heat trap due to upstream inputs and solar irradiation over their increased water surface area (EPA 2020a, 2020b, 2021). Consider the example of the adult sockeye salmon, both Upper Columbia and Snake River stocks, in 2015, when high summer water temperatures contributed to extremely high losses during passage through the mainstem Columbia and Snake River (Crozier et al. 2020), and through tributaries such as the Salmon and Okanogan rivers, below their spawning areas. Some stocks are already experiencing lethal thermal barriers during a portion of their adult migration. The effects of longer or more severe thermal barriers in the future could be catastrophic. For example, Bowerman et al. (2021) concluded that environmental variation will likely increase the factors contributing to pre-spawn mortality of Chinook salmon across the entire Columbia River basin.

Columbia River basin salmon and steelhead spend a significant portion of their life-cycle in the ocean, and as such the ocean is a critically important habitat influencing their abundance and productivity. Environmental variation is also altering marine environments used by Columbia River basin salmon and steelhead. This includes increased frequency and magnitude of marine heatwaves, changes to the intensity and timing of coastal upwelling, increased frequency of hypoxia (low oxygen) events, and ocean acidification. These factors are already reducing, and are expected to continue reducing, ocean productivity for salmon and steelhead. This does not mean the ocean is getting worse every year, or that there will not be periods of good ocean conditions for salmon and steelhead. For example, near-shore conditions off the Oregon and Washington coasts were considered “good” in 2011-2012, “bad” 2015-2019, “good” in 2021, and “fair” in 2022 and 2023 (NOAA 2024). Unfortunately, the magnitude, frequency, and duration of downturns in marine conditions are expected to increase over time due to environmental variation. Any long-term effects of the stressors that fish experience during freshwater stages that do not manifest until the marine environment will be amplified by the less-hospitable conditions there due to environmental variation. Together with increased variation in freshwater conditions, downturns will further impair the abundance, productivity, spatial structure, and diversity of the region’s native salmon and steelhead stocks (ISAB 2007, Isaak et al. 2018). As such, these climate dynamics will likely reduce fish survival through direct and indirect impacts at all life stages.

All habitats used by Pacific salmon and steelhead will be affected by climate dynamics. However, the impacts and certainty of the changes will likely vary by habitat type. Some changes affect salmon at all life stages in all habitats (e.g., increasing temperature), while others are habitat-specific (e.g., stream-flow variation in freshwater, sea-level rise in estuaries, upwelling in the ocean). How environmental variation will affect each individual salmon or steelhead stock also varies widely, depending on the extent and rate of change and the unique life-history characteristics of different natural populations (Crozier et al. 2008). The continued persistence of salmon and steelhead in the Columbia basin relies on restoration actions that enhance climate resilience (Jorgensen et al. 2021) in freshwater spawning, rearing, and migratory habitats, including access to high elevation, high quality cold-water habitats, and the reconnection of floodplain habitats across the interior Columbia River basin.

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 IBR Bridge crosses the Columbia River at approximately RM 106.5, 42 miles downstream from the Bonneville Dam. For purposes of this consultation, the action area includes the mainstem Columbia River from RM 106.5 downstream to the mouth of the Columbia River (including the estuary) and 12.5 miles upstream from the bridge. The downstream extent of the action area extends to the mouth of the Columbia River and marine waters off the Pacific coast where the ranges of salmon, steelhead, and other listed species from the Columbia River overlap with the effects of the proposed action. This is the largest geographic extent of those effects and is based on the anticipated changes to the physical environment associated with dissolved and suspended pollutants caused by stormwater runoff that will persist into the future with use of the new structure. The upstream extent of the action area is based on the anticipated underwater sound pressure levels generated during impact pile driving 24-inch and 48-inch steel pile (hollow steel pile) using a confined bubble curtain for noise abatement (i.e., root mean square [RMS] pressure isopleth of approximately 66,000 feet or 12.5 miles). The action area also includes, the upland staging and project access areas as described in Section 5 of the BA (page 4-8).

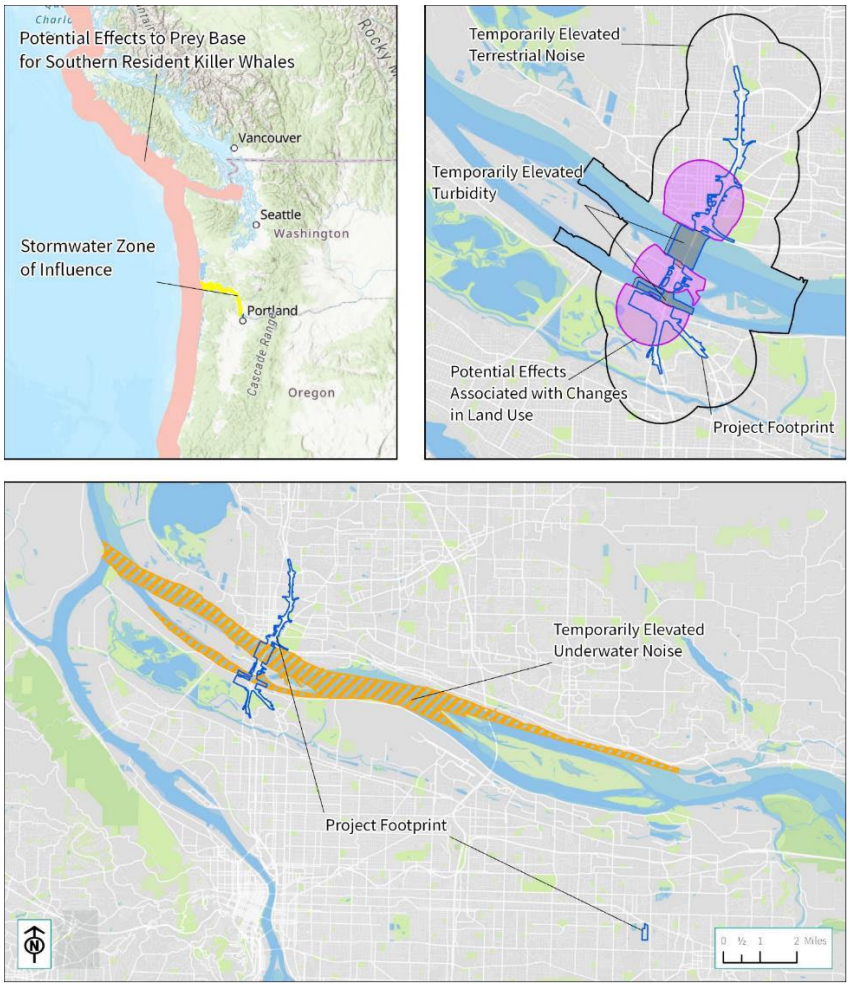

Figure 2-1. Action Area

The action area (Figure 7) includes portions of the following waterbodies: the mainstem Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek.
The physical footprint of the proposed project (the project site), which includes the limits of proposed construction activities.

- The extent of underwater noise generated during pile installation and removal. This zone of influence extends a maximum of approximately 5.5 miles downstream, and approximately 12.5 miles upstream from the existing bridge.

- The extent of terrestrial noise generated during pile installation and removal activities, as well as other upland construction activities. Using the spherical spreading loss model (WSDOT 2022): terrestrial noise associated with impact pile driving would be expected to attenuate to ambient noise levels within a maximum of 9,000 feet over open water, and within a maximum of approximately 3,500 feet over land.

- The anticipated extent of any temporarily elevated turbidity during project activities. The authorized mixing zone will extend a maximum of 300 feet upstream and downstream of turbidity-generating activities.

- The downstream extent to which effects associated with stormwater could potentially occur. Due to the fate and transport of dissolved metals like copper and zinc this extends down to the Pacific Ocean.

- The maximum extent of potential effects associated with changes in land use that are reasonably certain to occur because of the proposed action. Areas within approximately 0.50 mile from each of the transit stations associated with the proposed action; portions of Hayden Island included in the Hayden Island Plan; and portions of the City of Vancouver that are included in the Vancouver City Center Vision.

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).

The action area includes the mainstem Columbia River from 12.5 miles upstream of the existing IBR Crossing at RM 106.5 downstream to the mouth of the Columbia River (including the estuary) and all upland staging and project access areas.

2.4.1 Presence of ESA-Listed Species in the Action Area

The action area is used by all 13 salmon and steelhead ESUs/DPSs, and sunflower sea stars, green sturgeon, and eulachon included in this opinion for rearing, feeding, and migration, and, below Bonneville Dam, by CR chum salmon for spawning, UWR Chinook salmon and UWR steelhead for rearing and migration; eulachon for spawning, rearing, feeding and migration; and green sturgeon for rearing, feeding and migration. The time of year when most salmonids are likely to be near the existing bridge and thus most exposed to effects of the action are illustrated in Tables 2-3 and 2-4.

Table 2-3. Timing of Typical Adult Salmonid Presence within the Lower Columbia River below Bonneville Dam.

	Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Chinook Salmon	LCR ESU					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	UWR ESU				■	■	■	■	■	■															
	UCR-SR ESU							■	■	■	■	■	■	■	■										
	SR-SSR ESU					■	■	■	■	■	■	■	■	■	■										
	SR-FR ESU															■	■	■	■	■	■				
Chum Salmon	CR ESU																			■	■	■	■	■	■
Coho Salmon	LCR ESU	■	■	■	■	■	■									■	■	■	■	■	■	■	■	■	■
Sockeye Salmon	Snake River ESU											■	■	■	■										
Steelhead	LCR DPS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	UWR DPS	■	■	■	■	■	■	■	■	■	■	■													
	MCR DPS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	UCR DPS															■	■	■	■	■	■				
	SRB DPS											■	■	■	■	■	■	■	■						
Bull Trout	Coastal Recovery Unit						*	*	*	*	*	*	*	*	*	*	*	*	*						

Note: *Presence not anticipated, but data are incomplete

Key: CR = Columbia River; DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; LCR = Lower Columbia River; MCR = Middle Columbia River; SRB = Snake River Basin; SR-FR = Snake River Fall-Run; SR-SSR = Snake River Spring/Summer-Run; UCR-SR = Upper Columbia River Spring-Run; UWR = Upper Willamette River

Table 2-4. Timing of Typical Juvenile Salmonid Presence within the Lower Columbia River below Bonneville Dam

	Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Chinook Salmon	LCR ESU																								
	UWR ESU																								
	UCR-SR ESU																								
	SR-SSR ESU																								
	SR-FR ESU																								
Chum Salmon	CR ESU																								
Coho Salmon	LCR ESU																								
Sockeye Salmon	Snake River ESU																								
Steelhead	LCR DPS																								
	UWR DPS																								
	MCR DPS																								
	UCR DPS																								
	SRB DPS																								
Bull Trout	Coastal Recovery Unit*																								

Note: *Presence not anticipated, but data are incomplete
Key: CR = Columbia River; DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; LCR = Lower Columbia River; MCR = Middle Columbia River; SRB = Snake River Basin; SR-FR = Snake River Fall-Run; SR-SSR = Snake River Spring/Summer-Run; UCR-SR = Upper Columbia River Spring-Run; UWR = Upper Willamette River

Green Sturgeon. The southern DPS (sDPS) of green sturgeon is only present in the Lower Columbia River portion of the action area, and only the migrating subadult and adults are found during summer and fall (NMFS 2021a). No spawning occurs in the action area. Individuals from the sDPS of North American green sturgeon could migrate through and hold in deeper areas of the action area as subadults or adults mainly between July and September or October.

Eulachon. Eulachon spawning in the Sandy River and Columbia River tributaries upstream migrate through the Lower Columbia River portion of the action area. Adult and larval eulachon may be present in the Lower Columbia River from December to May each year, with peak spawning expected to occur in February or March (ODFW and WDFW 2009).

Sunflower Sea Star The sunflower sea star occupies nearshore subtidal marine waters shallower than 450 meters (approximately 1400 feet) deep and is occasionally found in the deep parts of tide pools. Areas with substantial freshwater input, such as the Columbia River mouth, are known to have a lower likelihood of sunflower sea star occurrence.

2.4.2 ESA – listed fish

All species considered in this opinion have populations of fish that spawn above Bonneville Dam and will migrate through the action area during the proposed action and over the life of the new structure. Few of these populations are rated as "viable" and their overall risk of extinction varies from low (1 to 5% chance of extinction in 100 years) to very high (greater than 60% chance of extinction in 100 years). The current status (i.e., overall viability or risk of extinction) of the populations of the 13 salmon and steelhead ESUs/DPSs included in this opinion are as follows (from Ford 2022):

The action area is located within the Lower Columbia River sub basin, and the Columbia River plume. The Columbia River and its tributaries are the dominant aquatic system in the Pacific Northwest. The 1,214-mile-long Columbia River drains 259,000 square miles of the northwestern United States and southern British Columbia, Canada, into the Pacific Ocean. Currently, 23 mainstem and more than 300 tributary dams regulate the flow of the Columbia River to the Pacific Ocean (Bottom et al. 2005). Saltwater intrusion from the Pacific Ocean extends approximately 23 miles upstream from the river mouth at Astoria. Coastal tides influence the flow rate and river level up to Bonneville Dam at RM 146.1 (ISAB 2000).

Historic and current human activities and governmental policies acting in concert with natural events have affected abundance, productivity, spatial structure, and diversity of populations of these 13 salmon and steelhead ESUs/DPSs, and sunflower sea star, and green sturgeon, within the action area. Many factors within the action area are limiting the recovery of each of these species, most notably degraded habitat (especially floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, stream substrate and streamflow), the hydropower system (i.e., fish passage at Bonneville Dam and the inundation of Bonneville Reservoir), hatchery production, harvest, and pathogens/predation/competition.

Mainstem habitat in the Lower Columbia River has been substantially altered by basin-wide water management operations, the construction and operation of mainstem hydroelectric projects, the growth of native avian and pinniped predator populations, the introduction of non-native species (e.g., smallmouth bass, walleye, channel catfish, and invertebrates), and other human practices that have degraded water quality and habitat function.

Within the Lower Columbia River subbasin, including the action area, flooding was historically a frequent occurrence, contributing to habitat diversity via flow to side channels and deposition of woody debris. The Lower Columbia River estuary is estimated to have once had 75% more tidal swamps than the current estuary because tidal waters could reach floodplain areas that are now diked. These areas provided feeding and resting habitat for juvenile salmonids in the form of low velocity marshland and tidal channel habitats (Bottom et al. 2005).

Dams built on the river between the 1930s and 1970s significantly altered the timing and velocity of hydrologic flow and reduced peak season discharges. Availability of aquatic habitat for native fish, particularly those that rely heavily on low-velocity side-channel habitat for holding, feeding, and rearing, has declined as a result of these changes to habitat-forming processes. Aquatic

habitat components that have been affected by these changes include the amount and distribution of woody debris (e.g., controlled flows and navigation management discourage free transport of large wood), rates of sand and sediment transport, variations in temperature patterns, the complexity and species composition of the food web, the distribution and abundance of salmonid predators, the complexity and extent of tidal marsh vegetation, and seasonal patterns of salinity.

2.4.3 Critical Habitat

The action area is designated critical habitat for all species except sunflower sea star, considered in this opinion. The mainstem Columbia River migration corridor is among the areas of high conservation value to the salmon and steelhead ESUs/DPSs included in this opinion because it connects each population with the ocean. Fish from all 13 species of salmon and steelhead, pacific eulachon, and green sturgeon; use mainstem Columbia River habitat for rearing and migration. As discussed below, critical habitat within the action area is degraded relative to historic conditions and many improvements will be needed before it functions at levels that support the recovery of these listed species.

Numerous anthropogenic features or activities near the existing bridge and throughout the action area (e.g., docks, roads, railroads, bank stabilization, and landscaping) have become permanent fixtures on the landscape and have displaced and altered native riparian habitat. Consequently, the potential for normal riparian processes (e.g., litterfall, channel complexity, and large wood recruitment) to occur is diminished and aquatic habitat has become simplified. Furthermore, riparian species that evolved under the environmental gradients of riverine ecosystems are not well suited to the present hydraulic setting of the action area, and are thus often replaced by invasive, non-native species. The riparian system is fragmented, poorly connected, and provides inadequate protection of habitats and refugia for sensitive aquatic species.

Shoreline development has reduced natural vegetation, disconnected floodplains, and reduced available off-channel refugia. The Columbia River shoreline, shallow water habitat, and natural vegetation is altered with in-water structures, rock, and riprap. Shoreline developments and alterations have reduced rearing habitat suitability (e.g., less habitat complexity, reduced forage base), reduced spring water velocities (which hampers downstream migration by smolts), and created better habitat for juvenile salmonid predators (e.g., birds, and native and non-native fish). These factors further limit habitat function by reducing cover, attracting predators, and reducing foraging efficiency for juvenile salmonids.

The Columbia River in the action area is considered water quality limited by DEQ and it is on the Clean Water Act section 303(d) list for 2,3,7,8-TCDD (Dioxin), 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aldrin/Dieldrin, Arsenic, Benz(a)anthracene [PAH], Benzo(a)pyrene [PAH] , Benzo(b)fluoranthene 3,4 [PAH] , Benzo(k)fluoranthene [PAH], Chlordane , Chlorpyrifos, Chromium VI, Chrysene, Copper, Cyanide, Diazinon, Endosulfan, Endosulfan Sulfate, Endrin Aldehyde, Ethylbenzene, Ethylhexyl Phthalate bis 2, Guthion, Heptachlor, Heptachlor Epoxide, Hexachlorobenzene, Indeno (1,2,3-cd)pyrene, Iron, Lead, Malathion, Mercury, Methylmercury, Parathion, Polychlorinated Biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs), Silver, Tetrachloroethylene, Thallium, Trichloroethylene, Zinc (ODEQ 2020). Water

temperatures in the action area are often elevated (ODEQ 2020). Temperature, chemical contamination, nutrients and dissolved oxygen are also issues of water quality concern in the area. Water quality and salmon samples from locations downstream of the Portland, Oregon, and Vancouver, Washington, major population and industrial centers showed higher concentrations of toxic contaminants than samples from upstream locations, suggesting that much of the contaminant load seen in juvenile salmon is coming from their time spent rearing and feeding in the lower Columbia River (LCREP 2007) below Bonneville Dam. More recently, 6PPD-quinone (6PPD-q), a degradation product of tires, has been linked to salmonid mortalities (Peter et al. 2018, Tian et al. 2020). 6PPD-q has been found to be ubiquitous where both rural and urban roadways drain into waterways (Feist et al. 2018, Sutton et al. 2019).

Since 1878, the USACE has dredged 100 miles of river channel within the mainstem Columbia River and its estuary. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The dredging, along with diking, draining, and fill material placed in wetlands and shallow habitat, disconnects the river from its floodplain, resulting in the loss of shallow-water rearing habitat and the ecosystem functions that floodplains provide (e.g., supply of prey, refuge from high flows, temperature refugia) (Bottom et al. 2005) and, as discussed above, results in the creation of suitable habitat for juvenile salmonid predators.

2.4.4 The Existing Interstate Bridge and Project Site

The existing Columbia River bridge consists of two separate structures, one for each direction of travel. Each structure is approximately 3,500 feet long by 45 feet wide, and the two structures in total represent approximately 308,449 square feet of existing overwater coverage at the height of the bridge decks. The bottom deck of each structure ranges between approximately 25 to 60 feet above the water surface. The existing Columbia River bridge is supported by a total of 11 bridge piers, nine of which are located below the OHWM of the Columbia River. Each pier measures approximately 32 feet wide by 50 feet long at the footing. In total, the in-water piers occupy approximately 33,289 square feet of substrate and represent approximately 44,000 cubic yards of fill below OHWM. At the existing structures, maximum water depth is approximately 40 to 45 feet, with an average water depth of approximately 27 feet. Two of the 11 existing piers (piers 10 and 11) are located in water depths shallower than -20 feet Columbia River Datum (CRD).

The existing North Portland Harbor bridge conveys I-5 from Hayden Island to the mainland. The structure is approximately 1,325 feet long by 150 feet wide, and represents approximately 198,869 square feet of existing overwater coverage at the height of the bridge decks. The bottom of the deck ranges from 25 to 30 feet above the water surface. The North Portland Harbor bridge is supported by a total of 10 bridge bents, six of which are located below the OHWM. Each bent consists of three piers, each measuring approximately 24 by 24 feet at the mudline. In total, the piers occupy approximately 12,204 square feet of substrate below OHWM. Water depths at the existing crossing range from 0 to 20 feet. Figures 7-1 and 7-2 in the BA show the configuration of these two crossing areas.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.02).

Exposure and Presence. Project construction is expected to take 9-15 years to complete within up to nine IWW periods. Most in-water work will occur during the IWW period, November 1 through February 28. The timing of various components of the in-water work are described below:

- November 1 through February 28 - In-water debris removal with a bucket dredge
- September 15 through April 15 – In-water impact pile driving

Other construction activities that will occur year around with BMP's include:

- Pile installation with a vibratory hammer.
- Pile removal with a vibratory hammer or by direct pulling.
- Sheet pile installation or removal with a vibratory hammer.
- Drilled shaft casing installation via vibratory hammer or oscillator.
- Wire saw/diamond wire cutting to demolish and remove existing piers.
- Operation of barges and other water-based construction vessels (small skiffs etc.), including movement, anchoring, and repositioning.
- Work conducted below the OHWM elevation but in isolated and/or dewatered conditions, or above the wetted channel. Such activities include, but are not limited to, fish salvage activities; work within drilled shaft casings (excavation, reinforcement, concrete placement); construction of formwork and concrete placement for cast-in place concrete work; and demolition work within cofferdams.
- Work conducted waterward of OHWM, but above the OHWM elevation (overwater work). Such activities include, but are not limited to, installation of superstructure elements of the bridge, cast-in-place concrete work, and overwater demolition activities.

Based on the life histories of salmon and steelhead in the Columbia Basin, we expect adults of most species covered in this opinion will migrate through the action area and potentially be exposed to project construction and demolition effects that occur year-round for up to 9 years. In addition, adults of all species covered in this opinion will be exposed to effects from the presence and use of the new structure into the future. Based on run-timing shown in (Table 6), we expect migrating adult CR chum salmon and the bulk of migrating adult LCR coho salmon will be exposed to effects of the action that occur during the fall portion of the IWW period. In addition, we expect early and late adult migrators of LCR, SR-SSR, and SR-FR Chinook salmon to be exposed to effects of the action that will occur during the IWW Period. UWR steelhead and UWR Chinook salmon will be migrating during the latter part of the IWW period. LCR and MCR steelhead migrate through the action area at all parts of the year. Therefore, we focus on the following ESUs and DPSs for the remainder of this section when discussing effects to adult

salmon and steelhead during the IWW period: LCR, UWR, SR-SSR, and SR-FR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR, MCR, UCR, and UWR steelhead. For ease of reading, we refer to this list as "adults present during the IWWW."

Millions of juvenile salmonids migrate through the Columbia River each year. We expect juveniles of most species covered in this opinion will migrate through the action area and potentially be exposed to project construction and demolition effects that occur year-round for up to 9 years. In addition, juveniles of all species covered in this opinion will be exposed to effects from the presence and use of the new structure into the future. Based on the life histories of salmon and steelhead in the Columbia Basin, the vast majority of out-migrating salmon and steelhead juveniles will pass through the project area outside the IWW period. .

During the 9 years of IWW construction (Table 6-4 in the BA) green sturgeon are expected in the area outside of the IWW period (May through September).

Pacific eulachon adult and juvenile life history stages are present in the winter (adult spawning) and the spring (larvae drifting downstream) and will be in the area during part of the IWW period.

2.5.1. Effects on Listed Species

2.5.1.1 Work Area Isolation and Fish Salvage Operations

Certain in-water work activities will be isolated from the active flow of the river to reduce potential effects to fish and aquatic habitats. Areas that will be isolated in this manner are described in Section 3.4.4 and Table 3.4 of the BA (page 3-71) and included here by reference. These areas include drilled shaft isolation casings and temporary sheet pile cofferdams. Sheet pile cofferdams for construction of Piers 2 and 7, and the drilled shaft isolation casings in North Portland Harbor will be dewatered to provide a work area for construction. Sheet pile cofferdams (if used) for demolition of the existing Columbia River bridges, will not be dewatered.

All sheet pile cofferdams and drilled shaft isolation casings will be installed in a manner that minimizes the potential for fish entrapment. Sheet piles will be installed from upstream to downstream and will be lowered slowly until contact with the substrate. Drilled shaft isolation casings will be screened at the bottom and lowered slowly into place, to minimize potential for fish entrapment during installation. Pumps used during work area isolation will be screened meeting NOAA Fish Passage Criteria. Without adequate screens, ESA-listed fish could be impinged on the screens or pulled through the impeller in the pump. Proper screen surface area will allow fish to swim near the screen without becoming impinged.

Installation of drilled shaft isolation casings and cofferdams is likely to generate low-level noise and visual disturbance, and many fish will actively avoid the work area during the construction of cofferdams. Nevertheless, it is likely that some fish may become trapped within the isolated work area, and will need to be manually removed.

Fish salvage will be conducted both during and after the installation of the sheet pile cofferdams, to remove fish from within the isolated work area. Since the drilled shaft isolation casings will be

screened prior to installation, fish salvage will not be required within these structures prior to dewatering.

At West Hayden Island and the Columbia Bottomlands Mitigation sites, work area isolation will be necessary to complete the mitigation work. Columbia Bottomlands project will be covered under another Section 7 consultation. At West Hayden Island, because sediment curtains will be deployed in a way that will exclude fish, this will be the primary method of minimizing take. Due to site conditions, there could be areas where electrofishing is more effective. The number of sites on West Hayden Island is unknown at this time, but for this consultation it is reasonable to assume 3 sites using the same methods listed above because the IBR project team estimated between 1 and 3 areas.

Of the ESA-listed species considered in this opinion, only juvenile salmon and steelhead are likely to be captured during work area isolation. This is because timing and place restrictions make this process extremely unlikely to overlap with the juvenile life history stage of eulachon, and any adult salmon or steelhead, southern green sturgeon, or eulachon that may be present when the isolation area is being staged are likely to leave by their own volition, or can otherwise be easily excluded without capture or other direct contact before the isolation is complete. All fish salvage work will be conducted consistent with the best practices established in the Federal Aid Highway Program (FAHP) Programmatic Consultation (NOAA Fisheries 2021b). A fish biologist with the experience and competence to ensure the safe capture, handling, and release of all fish will supervise all fish capture and release.

All work area isolation and fish salvage activity will be conducted consistent with an approved Temporary Water Management Plan, consistent with the requirements of ODOT Special Provision Section 00245.03. The Temporary Water Management Plan will be developed by the contractor, and will be provided to NOAA Fisheries for review prior to any work area isolation of fish salvage activities.

Fish salvage will be conducted both during and after the installation of in-water work area isolation structures. To further minimize the potential for effects to fish or other aquatic organisms, all fish salvage work will be consistent with the "General Measures and Conditions" and the "Fish Capture and Release BMPs" in Appendix A. Further, as stated above, all work will be consistent with the "Fish Herding Capture and Removal" PDC established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation (PDC No.13 in Section 1.3.2 of WCRO-2021-00004). Methods may include seining, electrofishing, trapping, or other authorized methods. Attempts to seine and/or net fish, or the use of minnow traps will precede the use of electrofishing equipment. Isolation structures will be installed such that they will not be overtopped by high water.

Capturing and handling fish causes them stress though they typically recover fairly rapidly from the process and, therefore the overall effects of the procedure are generally short-lived (NMFS 2002). The primary contributing factors to stress and death from handling are differences in water temperature between the river where the fish are captured and wherever the fish are held, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on fish increases rapidly from handling if the water

temperature exceeds 64°F or dissolved oxygen is below saturation. We don't expect more than 5% of each species' juveniles per year to be injured/killed from fish salvage. The FHWA's conservation measures regarding fish capture and release, use of pump screens during the de-watering phase, and fish passage around the isolation area are based on standard NMFS guidance to reduce the adverse effects of these activities (NMFS 2011).

Captured fish will be released outside of the work area. At best, all fish are captured without injury and successfully released. However, in many cases some fish are difficult to capture, sustain injuries, and experience high stress after capture. Seining, netting, capture, and handling may injure fish and can increase stress, resulting in harm or death to some individuals. Similarly, if a juvenile fish remains trapped in an isolated work area during construction, injury that results in mortality is highly likely. If electrofishing is used, the methods will be consistent with NOAA Fisheries "Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" (NOAA Fisheries 2000), or most recent version. A fish salvage report will be prepared and submitted to NOAA and USFWS following the completion of each in-water work season.

The exact timing of each work area isolation is unknown. Therefore, we divided the timing into work that will occur during in-water construction (6 IWW periods) and work that will occur due to in-water demolition activities (3 IWW periods). A total of approximately 61,565 ft^2 of riverbed (44,434 ft^2 in the Columbia River and 17,131 ft^2 in the N. Portland Harbor) will be isolated from the mainstem over the course of 6 in-water work periods for in-water construction. A total of approximately 39,170 ft^2 of riverbed (38,542 ft^2 in the Columbia River and 314 ft^2 in the N. Portland Harbor) will be isolated from the mainstem over the course of 3 in-water work periods for in-water demolition.

These work area isolations include:

- 52 drilled shaft isolation casings will be in place up to 50 days each, (excluding fish with screened bottoms)
- Two sheet pile cofferdams at Bent 2 and 7 will be in place for 500 days each, (will need fish salvage)
- Nine sheet pile cofferdams for demolition, if needed, for 50 days each, (will need fish salvage) and
- Four suspended shaft cap isolations for up to 120 days each. (excluding fish with screens)

Given the affected rearing and migration habitat represents only a small fraction of the remaining habitat available for miles in either direction, coupled with the isolation work occurring when few juveniles are likely to be present, we expect that only a very small number of juveniles of all species covered in this opinion are likely to be adversely affected by work area isolation and fish salvage activities. We expect the number directly injured or killed to be proportional to the total area isolated requiring fish salvage (25,095 ft^2 square feet for the 6 IWW periods associated with in-water construction in the Columbia River and 37,587 ft^2 over 3 IWW periods in the Columbia River for demolition). In this context, "proportional" is in reference to an average density of ESA-listed fish per square foot. In the North Portland Harbor, there will not be any fish salvages in isolation areas because the casings will be screened to exclude fish and the existing bents will be demolished using a wire saw and a crane.

We also expect a very small number of these juveniles to be adversely affected by habitat displacement due to work area isolation, which increases the risk of predation to piscivorous fish and birds. Predation rates will depend on the numbers of predators and smolts present at any given time, which is highly uncertain. We expect the risk of increased predation to be very small, proportional to the total area isolated (61,565 ft^2 for the 6 IWW periods associated with in-water construction and 39,170 ft^2 for the 3 IWW periods associated with the demolition of the existing structures), and associated with the duration of the period these structures are in place (50 days each for the drilled shaft isolation casings, 500 days each for the Pier 2 and 7 bent construction, and 50 days each for the nine interior pier cofferdams.

2.5.1.2 Behavioral Noise Effects from Pile Driving, drilled shaft boring, and Wire Sawing

Underwater noise due to pile driving would occur from the installation of piles via vibratory or impact hammer during the nine IWW periods. Underwater noise may also occur year-round from the installation and removal of temporary piles via vibratory hammer, oscillation of casings for drilled shafts, or the use of a wire saw to remove the concrete foundations of the existing bridge for up to 9 years.

Criteria for Behavioral Responses. NMFS uses the Federal Hydroacoustic Working Group (FHWG) behavioral response criteria (FHWG 2008) of 150 dB re: 1 µPa RMS as a threshold for examining the potential for behavioral responses by listed fish to noise with frequency less than 1 kiloHertz (kHz). Responses to temporary exposure to noise of this level are expected to be a range of responses indicating that a fish detects the sound; these can be brief startle responses or, in the worst case, we expect that fish would completely avoid the area ensonified above 150 dB re: 1 µPa RMS. The potential for behavioral disturbance decreases with the distance from the source (Caltrans (2020) Currently, there are no PK or SEL_{cum} thresholds from noise with frequency less than 1 kHz. NMFS considers vibratory pile driving to create noise with a frequency less than 1 kHz. At this time, NMFS considers vibratory driving to cause only behavioral effects to ESA-listed fishes.

2.5.1.3 Impact Pile Driving

Piles may be started, installed fully, or removed (in the case of temporary piles) via a vibratory hammer. Vibratory installation and vibratory removal may occur year-round. Noise attenuation methods are not proposed during vibratory pile driving or removal. NMFS considers vibratory pile driving (and removal) to cause only behavioral effects to ESA-listed fishes. No injury is expected to occur as a result of vibratory driving.

The 24-inch and 48-inch steel piles (solid or hollow) may be finished using an impact hammer, during the nine IWW seasons. We estimated the distance to the onset of injury and behavioral effects for piles proposed to be finished via impact hammer using the NMFS Pile Driving Calculator and the information in Table 9. PK, SEL, and RMS decibels presented below are attenuated values from David Evans and Associates (DEA 2011) referenced in the BA based on the use of a confined bubble curtain. The NMFS pile driving calculator was used for all pile sizes and the calculations are in Appendix B.

Table 2-5. Distances to established thresholds for fish during impact pile driving. Strikes without noise attenuation is only for monitoring purposes

	Number of Pile Drivers	Pile Type and Dimensions	Source dB Levels	Max. Strikes Per Day	Distance to Single Strike Peak Injury Threshold (206 dB_{PEAK})	Distance to Cumulative Injury Threshold for Fish >2g (187 dB_{SEL})	Distance to Cumulative Injury Threshold for Fish <2g (183 dB_{SEL})	Distance to Behavioral Noise Level for Fish (150 dB_{RMS})
Without Noise Attenuation Device	Single Impact Pile Driver	24-inch Steel	205 dB_{PEAK}, 175 dB_{SEL}, 190 dB_{RMS}	75	28 feet (9 meters)	92 feet (28 meters)	171 feet (52 meters)	15,228 feet (4,642 meters)
		48-inch Steel	214 dB_{PEAK}, 184 dB_{SEL}, 201 dB_{RMS}	75	112 feet (34 meters)	368 feet (112 meters)	680 feet (207 meters)	82,411 feet (25,119 meters)
With Noise Attenuation Device (-7dB)	Single Impact Pile Driver	24-inch Steel	198 dB_{PEAK}, 168 dB_{SEL}, 183 dB_{RMS}	900	10 feet (3 meters)	164 feet (50 meters)	305 feet (93 meters)	5,200 feet (1,585 meters)
		48-inch Steel	207 dB_{PEAK}, 177 dB_{SEL}, 194 dB_{RMS}	900	39 feet (12 meters)	660 feet (201 meters)	1,217 feet (371 meters)	28,140 feet (8,577 meters)
	Two Impact Pile Drivers	24-inch Steel	198 dB_{PEAK}, 168 dB_{SEL}, 183 dB_{RMS}	1,800	10 feet. (3 meters)	262 feet (80 meters)	486 feet (148 meters)	5,200 feet (1,585 meters)
		48-inch Steel	207 dB_{PEAK}, 177 dB_{SEL}, 194 dB_{RMS}	1,800	39 feet (12 meters)	1,047 feet (319 meters)	1,932 feet (589 meters)	28,140 feet (8,577 meters)

Impact pile driving increases sound pressure levels and noise. Fish with swim bladders (including salmonids) are sensitive to underwater impulsive sounds (i.e., sounds with a sharp sound pressure peak occurring in a short interval of time). As the pressure wave passes through a fish, the swim bladder is rapidly compressed due to the high pressure, and then rapidly expanded as the "under-pressure" component of the wave passes through the fish. Injuries resulting from compression and decompression from a sound pressure pulse are known as barotrauma (Halvorsen et al. 2012; Popper et al. 2019). Injuries from intense or continuous underwater sound pressure can include damage to the auditory system. This can result in a temporary or permanent loss of hearing known as either a "temporary threshold shift" (Carlson et al. 2007) or a long-term "permanent threshold shift" (Liberman 2016). The level of injuries can vary based on the intensity and characteristic of the high pressure, distance to the pressure source, and the size and species of the fish (CalTrans 2020; Hastings and Popper 2005). Barotrauma injuries can include external and internal damage including bulging eyes, ruptured organs and swim bladders, hemorrhaging, and death (Brown et al. 2009, 2012; Halvorsen et al. 2012). Fish respond differently to sounds produced by impact drivers than to sounds produced by vibratory drivers. Vibratory drivers produce a more rounded sound pressure wave with a slower rise time. Because the more rounded sound pressure wave produced by vibratory drivers produces a slower increase in pressure, the potential for injury and mortality is reduced. In this section, peak (PK; which is the greatest value of the sound signal) and RMS (which is the average intensity of the sound signal over time) are referenced to decibel (dB) re: 1 µPA, the relative unit used to specify the intensity of sound underwater. Further, sound exposure level (SEL), which is a measure of the energy that considers both received level and duration of exposure), and sound exposure cumulative (SELcum), which is a measure of the energy that considers the received sound

pressure level over given period, are referenced to dB re: 1 µPA^2-second. For underwater sounds, a reference pressure of 1 micropascal (µPa) is commonly used to describe sounds in terms of decibels (dB). Thus, 0 dB on the decibel scale would be a measure of sound pressure of 1 µPA.

Criteria for Injury or Morality. The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, USFWS, FHWA, USACE, and the California, Washington, and Oregon DOTs, supported by national experts on underwater sound producing activities that affect fish and wildlife species of concern. In June 2008, the agencies signed a Memorandum of Agreement (MOA) documenting criteria for assessing potential fish injury or mortality from impact pile driving (Fisheries Hydroacoustic Working Group 2008). The criteria were developed for the acoustic levels at which injury or mortality to fish could be expected. It should be noted that these criteria are for the onset of injurious effects (Stadler and Woodbury 2009), not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all fish species. The interim criteria are:

- PK: 206 dB re: 1 µPa, for instant injury or death
- SELcum: 187 dB re: 1µPa^2-second for fishes 2 grams (0.07 ounces) or larger, for injury from cumulative strikes
- SELcum: 183 dB re: 1µPa^2-second for fishes less than 2 grams (0.07 ounces), for injury from cumulative strikes

At this time, these criteria represent the best available information on the thresholds at which injury or morality to salmonids are likely to occur from impact pile driving. It is important to note that these effects may range from minor injuries, from which individuals are anticipated to completely recover with no impact to fitness, to significant injuries that will lead to death. The severity of injury is related to the distance from the pile being installed and the duration of exposure. The closer to the source and the greater the duration of the exposure, the higher likelihood of injury.

2.5.1.3.1 Assumptions and Limitations

NMFS conducted an analysis of potential effects from sound caused by impact pile driving using NMFS Pile Driving Calculator. The assumptions and limitations that inform our impact pile driving analysis and drilled shaft (vibratory oscillation) are as follows:

- We assumed that a contained bubble curtain would provide a noise attenuation of at least 5 db. This is a reasonable assumption based on data presented by Rodkin and Pommerenck (2014), which show typical sound level reductions of 10-19 dB with bubble curtain use.
- The NMFS Pile Driving Calculator assumes that cumulative effects "reset" overnight based on assumed fish movement; therefore, only strikes via impact hammer in a single 24-hour period count toward cumulative impacts.
- We assumed that pile driving will occur intermittently over the course of a workday (up to 12 hours, during daylight hours only). This assumption is based on information obtained from the IBR team.

- Actual exposure to noise that could result in injury would be relatively limited, restricted to the periods when impact pile driving is occurring, from mid-September through mid-April, during each year of in-water work. It is estimated that impact pile driving within the Columbia River could be conducted on a total of approximately 735 days over the course of the construction period, and will occur for approximately 4.5 hours per day on days that impact pile driving occurs. Impact pile driving within North Portland Harbor could be conducted on a total of approximately 735 days over the course of the construction period, and will occur for approximately 4.5 hours per day on days that impact pile driving occurs.
- Vibratory pile driving may occur on 320 nonconsecutive days for the entire construction period of the project for 24-inch and 48-inch temporary steel piles; 200 non-consecutive days for sheet piles, 50 days each non-consecutive for the temporary drilled shaft casings.
- It is estimated that up to 5 hours of vibratory pile driving or removal could be conducted on a given day.
- The 120-in steel drilled shaft casings will be installed over 800 non-consecutive days.
    - 160 total casings (108 in the Columbia River and 52 in North Portland Harbor).
    - Installation time is 5 days per casing.
- Our analysis is based on two pile drivers in operation at a time. We note here that the Columbia River is fairly wide (approximately 1.0 mile) wide at the site of the existing bridge. Simultaneous pile driving has the potential to ensonify the entire width of the river, depending on pile type, size, location, and installation method.

Instantaneous Injurious Effects. Impact hammer installation will occur during the 9 IWW periods designated for impact pile driving from September 15th to April 15th. There could be small numbers of fish covered in this opinion that have instantaneous injury or death from the impact hammer installation of the 24-inch steel piles using a confined bubble curtain within 0 to 10 feet from the pile because attenuated PK values for these piles is between 198 dB re: 1 µPA instantaneous injury threshold and PK 206 dB re: 1 µPa. Similarly, there could be small numbers of fish that have instantaneous injury or death from the impact hammer installation of the 48-inch steel piles using a confined bubble curtain within 0 to 39 feet from the pile, because attenuated PK values for these piles is estimated at 207 dB re: 1 µPA instantaneous injury threshold and PK 206 dB re: 1 µPa. Most likely, fish that are this close to sites where pile driving will occur, will move away from the area prior to the onset of pile driving in response to construction-related disturbance. Therefore, we expect very few mortalities to result from exposure to instantaneous pile strike PK levels over 206 dB. We expect that the staging of the piles, the use of the vibratory hammer to start each pile, and the use of a confined bubble curtain will cause adults present during the IWW period and most juveniles covered in this opinion to move away from the sound and outside the radius of instantaneous injurious effects (i.e., 39-feet). Therefore, injurious noise generated during impact pile driving of 48-inch steel pile during the IWW period is highly unlikely to adversely affect adults present during the IWW period. We expect some juveniles may remain within 52 feet of the 48-inch piles during impact installation because they are less mobile and cannot move away due to river flow and their small size; these

juveniles will be killed or injured by noise. We expect the number of juveniles instantaneously injured or killed by noise from the installation of the 48-inch piles to be very small due to the contractor "waking" the pile slowly, allowing fish to move away from the activity. "Waking the pile" is a method of slowly beginning the pile driving and ramping up to full pile strikes.

Cumulative SEL Effects. Installing the 24-inch steel piles with one impact hammer using a confined bubble curtain may cause SEL_{cum} injurious noise effects to salmon and steelhead at distances 164 feet for 187 dB threshold and 305 for the 183 dB threshold; for 48-inch pile the distances are 660 feet for 187 dB threshold and 1,217 for the 183 dB threshold (Table 8). Installing the 48-inch steel piles with two impact hammers using confined bubble curtains may cause SEL_{cum} injurious noise effects to salmon and steelhead at distances 262 feet for 187 dB threshold and 486 feet for the 183 dB threshold; for 48-inch pile the distances are 1,047 feet for 187 dB threshold and 1,932 feet for the 183 dB threshold (Table 8). We expect that the staging of the piles, the use of the vibratory hammer to start each pile, and the use of a confined bubble curtain will cause adults present during the IWW period and most juveniles covered in this opinion to move away from the sound. The contractor will be "waking" the pile slowly so we expect adults will flee the project area once impact pile driving begins and not be injured or killed by the cumulative effects of repeated pile strikes. However, juveniles that do not flee and remain within the respective SEL_{cum} radii will be injured or killed by the cumulative effects of repeated pile strikes. Over IWW periods through construction of the project, we expect the number of juveniles injured or killed by cumulative noise from the impact installation of these piles to be very low. First, impact hammer installation of 24-inch and 48-inch steel piles is expected to take place during the shorter pile driving IWW period. Second, impact pile driving may occur for up to 4.5 hours on any in-water workday, during daylight hours only.

Although there is little information regarding the effects on fish from underwater sound pressure waves generated during the piling installation (Anderson and Reyff 2006; Laughlin 2006), laboratory research on the effects of sound on fish has used a variety of species and sounds (Hastings *et al.* 1996; Popper and Clarke 1976; Scholik and Yan. 2002). Because those data are not reported in a consistent manner and most studies did not examine the type of sound generated by pile driving, it is difficult to directly apply the results of those studies to pile driving effects on salmon, steelhead, and sturgeon. However, it is well established that elevated sound can cause injuries to fish swim bladders and internal organs and temporary and permanent hearing damage. These effects are presumed to extend across the stream channel regardless of width, and as far as the sound wave can travel within the line of site upstream and downstream for a total distance that varies with stream sinuosity and width, water depth, pile characteristics, pile driving technology, and sound attenuation methods used.

Behavioral effects. The installation of piles by impact hammer may cause RMS values of 150 dB re: 1 µPA, which could result in behavioral effects to salmon and steelhead from 5,200 feet to 82,411 feet away (up to 15.7 miles from the existing bridge) (Table 9). We expect varying levels of behavioral responses to the use of the impact hammer from adult and juvenile salmon and steelhead. These responses range from no change in behavior, to mild awareness, to a startle response (Hastings and Popper 2005). These fish are expected to move short and long distances or seek cover. We expect that the staging of the piles, the use of the vibratory hammer to start each pile, and the use of a confined bubble curtain will cause adults present during the IWW

period and most juveniles covered in this opinion to move away from the sound. Using sound attenuation devices like bubble curtains and slowly waking the pile before impact pile driving occurs, we expect adults will flee the project area once impact pile driving begins. We expect adults to experience migration delays for up to 4.5 hours each day that impact installation occurs over the IWW periods of the project. Due to most migration occurring at dawn and dusk, we don't expect this to significantly delay migration due to pile driving occurring during daylight hours. We do not expect these temporary migratory delays to affect spawning success.

Similar habitat types exist throughout this reach of the lower Columbia River and are expected to provide forage and hiding cover similar to the areas from where juveniles are displaced. Relocation of juveniles is expected to occur up to 4.5 hours each day impact installation happens over the IWW periods of the project. Relocation is not expected to affect juvenile growth. However, we expect that a small number of juveniles that alter their behavior within 15.7 miles upstream and downstream of the existing bridge in response to pile driving during the IWW periods will be killed as a result of increased exposure to predation by fish and birds.

A vibratory hammer will be used to install or remove piles year-round for up to 9 years of the project. The installation or removal of piles by vibratory hammer may cause RMS values that could result in behavioral effects to salmon and steelhead. We expect varying levels of behavioral responses to the use of the vibratory hammer from adult and juvenile salmon and steelhead covered in this opinion. These responses range from no behavioral change, to mild awareness, to a startle response (Hastings and Popper 2005). We expect that the use of the vibratory hammer to install or remove piles will cause species covered in this opinion to move away from the sound and out of the radius of behavioral effects. These fish are expected to move short and long distances or seek cover. Vibratory installation and removal is conservatively expected to occur no more than 320 total days over all 9 years of the in-water work portions of the project, and vibratory hammer use can only occur up to a maximum of 5 hours per day. Therefore, we expect adults of all species covered in this opinion to experience migration delays intermittently for up to 5 hours each day averaging 35 days per year during the 9 years of the in-water work portions of the project. We do not expect these temporary migratory delays to affect spawning success.

Similar habitat types exist throughout this reach of the Columbia River and are expected to provide forage and hiding cover similar to the areas from where juveniles are displaced. Juvenile (all species covered in this Opinion) avoidance of vibratory pile driving activity is expected to occur up to 5 hours each day vibratory installation happens but no more than 320 days during the 9 in-water work periods of the project. Avoidance of vibratory pile driving is not expected to effect juvenile growth. However, we expect that a small number of juveniles of all species covered in this opinion will alter their behavior within 15.7 miles of the existing bridge, based on size of pile or casings installed, and experience increased risk of predation to larger fish and birds from avoiding sound pressure levels during vibratory pile driving.

An unconfined wire saw may be used year-round during the demolition of the bridge foundations of the project. This will likely be in the latter 3 IWW periods of the project. The use of an unconfined wire saw may cause an RMS value similar to that of vibratory pile driving ~ 150 dB re: 1 µPA, which could result in behavioral noise effects to salmon and steelhead. We expect

varying levels of behavioral responses to the use of an unconfined wire saw from adult and juvenile salmon and steelhead covered in this opinion. These responses range from no behavioral change, to mild awareness, to a startle response (Hastings and Popper 2005). We expect that the use of the wire saw will cause adults of species covered in this opinion to move away from the sound and out of the radius of behavioral effects; however, we do not expect wire sawing to create adult migratory delays or affect spawning success.

Similar habitat types exist throughout this reach of the lower Columbia River and are expected to provide forage and hiding cover similar to the areas from where juveniles are displaced during unconfined wire sawing. Juvenile (all species covered in this Opinion) avoidance of vibratory pile driving activity is expected to occur up to 12 hours each day wire sawing happens during the final 3 IWW periods of the project, especially during the removal of existing bents closest to the shoreline. Juvenile avoidance is not expected to effect juvenile growth. However, we expect that a small number of juveniles of all species covered in this opinion will alter their behavior due to wire sawing activities and experience increased risk of predation to larger fish and birds from avoiding sound pressure levels during wire sawing that will occur in the final 3 IWW periods of the project.

2.5.1.4 Water Quality Impacts

Minor temporary water quality impacts may occur for up to 9 years in the form of elevated turbidity during in-water work, chemical contamination during overwater and in-water work, and stormwater entering the Columbia River during construction and demolition of the project. Permanent water quality impacts will result from the presence and use of the new structure into the future.

Utility relocations during project construction would likely occur in multiple locations throughout the project site. Utilities on the existing bridge will be relocated onto the replacement bridges prior to demolition of the existing bridges. Opening up ground could lead to soil erosion. We expect any effects associated with this to be minor and BMP's will be in place to minimize the opportunity for soil erosion to enter the channel.

Construction and operation of staging and/or casting areas not specifically identified in the proposed action could happen in or near the project site. Due to containment BMP's and erosion control BMP's we expect any effects associated with construction and staging areas to be minor. Erosion control measures will be applied to reduce disturbance. These measures constrain and secure the site against erosion and inundation during high flow events. This minimizes the amount of fine sediment entering the Columbia River.

In-water work associated with the West Hayden Island mitigation sites is likely to result in turbidity during work area isolation. There is likely to be a pulse of turbidity during the installation and removal of containment measures at all three locations. Upland work and open ground associated with the channel creation and sloping will have sediment fences and other BMP's in place to minimize erosion and turbidity in the wetted channel.

Elevated Turbidity

Suspended sediment has the potential to increase turbidity, a measure of water clarity. Sediment is likely to become suspended into the water column by the following activities: pile installation and removal, installation and removal of drilled shaft shoring casings, mitigation and restoration activities, cofferdam installation and removal, and barge operations, including movement and anchoring. Low to moderate levels of turbidity can provide cover from predation (Gregory and Levings 1998). However, increased fine sediment can be detrimental to juvenile salmon and steelhead in several ways including avoidance of the area, abandonment of cover, stress, and reduced growth rates (Newcombe and Jensen 1996). Turbidity from increased fine sediment may disrupt feeding and territorial behavior and may displace fish from preferred feeding and resting areas. It can also delay adult migration to spawning habitat. Direct mortality can occur at very high concentrations or extended exposure to suspended solids. The severity of effect of suspended sediment increases as a function of the sediment concentration and exposure time (Bash et al. 2001; Newcombe and Jensen 1996).

Turbidity will be controlled through the implementation of the BMPs in Appendix A ("General Measures and Conditions", "Spill Prevention and Pollution Control Measures", and "Site Erosion and Sediment Control Measures"). In addition, the project will be conducted consistent with the sedimentation and turbidity best practices established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation (Section 1.3.2 of WCRO-2021-00004; PCD Nos. 8 "Barge Use," 10 "Construction Discharge Water,", 11 "Drilling and Boring," 12 "Erosion and Pollution Control," 17 "Heavy Duty Vehicles and Equipment," 23 "Painting and Coating", 27 "Site Preparation," and 28 "Site Restoration"). The BMPs include implementation of monitoring plans to ensure that the amount and extent of turbidity will meet the terms and conditions of water quality permits that are ultimately issued for the project. These permits and certifications typically establish a temporary mixing zone for turbidity 300 feet downstream from turbidity-generating activities in rivers with flows 300 cfs or greater. Water quality monitoring will occur to document increases in turbidity and to ensure compliance with the state and federal certifications and permits. The Columbia River is a large water body that provides for increased dilution and reduces the size of the potential mixing zone. Additionally, the dominant substrate at the existing bridge is sand, which settles in relatively short distances compared to finer sediments. Therefore, any turbidity that is generated is expected to dissipate to background levels within the 300-foot mixing zone and any exceedances of the turbidity standard within the authorized mixing zone will generally be for short duration periods (up to 12 hours per day, during daylight hours only). Further, turbidity levels will decrease as suspended sediment settles out in-between activities and at night when construction or demolition is not occurring.

The best management practices used to minimize the release of suspended sediments to the waterway for the protection of salmonids are also applicable to eulachon. BMP's are expected to easily meet state and federal water quality standards. Any downriver turbidity increases associated with project activities would be localized to a small portion of the project action area and are expected to dissipate rapidly. Any substrate disturbing activities in the lower Columbia River have the potential to affect migratory behavior or impact eulachon spawning or egg incubation. However, any project related substrate disturbance will have a negligible effect on eulachon due to the proposed IBR Program's avoidance and minimization measures and lack of

eulachon presence anticipated during project activities. In the rare event that an adult eulachon is present during project activities, it will either migrate around any localized plume or be exposed for such a short time to that no significant effects would occur. Adult eulachon have better swimming abilities than juvenile salmonids and thus, have a stronger ability to avoid obstructions, such as turbidity plumes.

In the segment of the action area where the bridge replacement will occur there is a lack of preferred habitat for spawning and egg incubation. As such, these life stages are not expected to be adversely affected by the proposed action.

In the final rule for eulachon critical habitat, NMFS states that "dredging operations and [placement] of dredged materials may result in the resuspension and spread of contaminated sediments, which may adversely affect eulachon migration and spawning, as well as larval growth and development (76 FR 65324). Pile driving and removal, casing oscillation, and removal or artificial fill from Hayden Island will result in short-term, intermittent, and localized reductions in water quality (i.e., turbidity, resuspension of sediment contaminants) within the immediate vicinity of the bridges and the fill removal sites. However, although some short-term effects to water quality are anticipated, it is unlikely that the project would significantly reduce water quality suitable for spawning, reduce the viability of any eulachon life stages, or reduce the suitability for survival and migration of spawning adults.

Larval growth and development would be minimally impacted since this life stage is expected to drift through the area during some project activities.

We expect effects to all species covered in this opinion from turbidity generating activities. Because of the large size of the Columbia River, there are abundant accessible areas of turbidity refugia in the vicinity, and fish should not become trapped in turbid water. That is, we do not expect turbidity to cause a complete barrier to movement, but turbidity pulses may reach levels that could cause coughing. We expect adults and most juveniles will flee the areas of higher turbidity. We expect a very small number of juveniles of all species covered in this opinion to experience turbidity at sufficient concentration to cause coughing. We expect that each pulse of turbidity generated over the course of the project will cause short-term behavioral changes year-round to a small number of salmon and steelhead. These behavioral changes are not expected to result in any adverse effect to adults of species covered in this opinion; however, behavioral changes may increase the risk of predation to juveniles of species covered in this opinion. Predation rates will depend on the numbers of predators and smolts present at any given time, which is highly uncertain. Therefore, we expect behavioral changes to a small number of juveniles of all species covered in this opinion up to 300 feet upstream and downstream of turbidity generating activities for up to 1 hour during each event, and up to 12 hours per day, for 9 years, increasing their risk of predation.

Chemical Contamination

The project has the potential to result in chemical contaminant inputs to surface waters from accidental releases of fuel, oil, and other chemical contaminants during construction and demolition that can injure or kill aquatic organisms. Petroleum-based contaminants, such as fuel,

oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can kill salmon at high levels of exposure, and cause sublethal, adverse effects at lower concentrations (Meador et al. 2006). Use of heavy equipment for vegetation removal and earthwork compacts the soil, thus reducing permeability and infiltration. Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain PAHs, which are acutely toxic to salmon, steelhead, and other fish and aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 2000; Heintz *et al.* 1999; Incardona *et al.* 2005; Incardona *et al.* 2004; Incardona *et al.* 2006). It is likely that petroleum-based contaminants have similar effects on southern green sturgeon and eulachon. The operation of equipment and heavy machinery will occur from causeways, temporary work structures, and barges. NMFS anticipates that only very small quantities (ounces) of PAHs are likely with each accidental release or spill. The contractor will be required to provide monitoring plans that ensure that the "General Measures and Conditions", "Spill Prevention and Pollution Control Measures", and "Site Erosion and Sediment Control Measures" BMPs (Appendix A) are implemented. The project will also be conducted consistent with the best practices established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation referenced above in Section 1.3.3. In addition, all work will be conducted consistent with the requirements of the permits that are ultimately issued for the proposed action, including the 401 Water Quality Certifications from the USACE. These measures should minimize the risk of a spill and opportunity for contaminants to enter the waterway and affect salmon and steelhead. If a spill does occur, we expect containment will occur quickly with emergency spill kits located on site, and conservation measures will minimize its dispersal, limiting exposure and related impacts of adult and juvenile salmon and steelhead. For these reasons, we expect that it is improbable that any salmon and steelhead covered in this opinion will be exposed to accidental releases of fuel, oil, and other contaminants during the proposed action and, if an accidental spill occurs, effects to salmon and steelhead will be minor or undetectable.

Stormwater During Construction

Construction activities, including ground disturbing activities and vegetation disturbance, have the potential to mobilize sediment, which can be delivered to surface waters via stormwater if not properly managed. Additionally, material staging and storage areas represent a potential source of pollutants. All staging activities will comply with local and state stormwater treatment requirements. Typical runoff from these sites could include oils, greases, metals, and/or high-pH water from concrete clean out. The BMPs in Appendix A are designed to treat specific areas of these sites (see "General Measures and Conditions", "Spill Prevention and Pollution Control Measures", "Site Erosion and Sediment Control Measures", and "Water Quality Best Management Practices"). Site-specific stormwater BMPs ("Water Quality Best Management Practices" in Appendix A) could include pre-treatment facilities such as oil-water separators and sediment traps and standard facilities to meet water quality and water quantity issues, as appropriate. In addition, the project will be conducted consistent with the stormwater best practices established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation (Section 1.3.2 of WCRO-202100004; PCD Nos. "Erosion and Pollution Control,"

27 “Site Preparation,” 28 “Site Restoration,” and 29 “Stormwater Management”). Finally, temporary construction stormwater will be regulated and managed under National Pollutant Discharge Elimination System Construction Stormwater Discharge Permits issued by the EPA. These permits include discharge water quality standards, runoff monitoring requirements, and provision for preparing a Stormwater Pollution Prevention Plan for construction activities, effectively reducing the potential for impacts to ESA-listed species or critical habitats from construction stormwater. Based on the BMPs for erosion control and stormwater management, we expect only infrequent and small amounts of stormwater will enter the Columbia River during the 9-15 years of project construction and demolition. Therefore, we expect that it is improbable that any salmon and steelhead covered in this opinion will be exposed to degraded water quality due to improperly managed stormwater during the construction phase of the proposed action and, if stormwater enters the Columbia River during construction, effects to salmon and steelhead will be consistent with the effects described below, but of lesser magnitude.

Stormwater from Operation and Maintenance of Bridge

Stormwater runoff from the bridge surfaces intended for vehicular use, will occur into the future as a result of the proposed action. Given the upgrades of the replacement bridge and continued population growth, we expect increased vehicle use of the bridge over time.

Stormwater runoff from roads (including bridges) conveys pollutants to nearby surface waters. The main pollutants of concern to ESA-listed fish species and aquatic habitats are those from vehicular sources (e.g., zinc, copper, 6PPD-q) and suspended solids. Stormwater can also deliver other pollutants that accumulate on roadway surfaces (e.g., petroleum hydrocarbons, excess nutrients, and pesticides). Many stormwater runoff pollutants are persistent in the aquatic environment, travel long distances in solution or adsorbed onto suspended sediments, and may become remobilized or re-enter solution as they move through the system, especially during high-flow events. These pollutants can be toxic to fish even at very low concentrations, ranging in effects from reduced growth, reproduction, and migratory success to direct mortality.

Stormwater runoff from impervious surfaces associated with the IBR Project, including roads, interchanges, bus and rail stations, and bridges, deliver a wide variety of pollutants to adjacent aquatic ecosystems. These pollutants may include nutrients, metals, petroleum-related compounds, sediment washed off the road surface, and agricultural chemicals used in highway maintenance (Buckler and Granato 1999; Colman *et al.* 2001; Driscoll *et al.* 1990; Kayhanian *et al.* 2003). These ubiquitous pollutants are a source of potent adverse effects to salmon and steelhead, even at ambient levels (Hecht *et al.* 2007; Johnson *et al.* 2007; Loge *et al.* 2006; Sandahl *et al.* 2007; Spromberg and Meador 2006) and are among the identified threats to sturgeon.

Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by next high flow (Alpers *et al.* 2000b; Alpers *et al.* 2000a; Anderson *et al.* 1996). These contaminants also accumulate in the prey and tissues of juvenile salmon and steelhead where, depending on the level of exposure, they may cause a variety of lethal and sublethal effects including disrupted behavior, reduced

olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (Fresh *et al.* 2005; Hecht *et al.* 2007; Lower Columbia River Estuary Partnership 2007). Projects included in the proposed action will likely result in a small net increase in impervious surfaces within the project footprint, thereby increasing the potential for additional stormwater runoff.

Pollutants included in stormwater travel long distances in rivers either in solution, adsorbed to suspended particles, or retained in sediments until mobilized and transported by future sediment moving flows (Alpers *et al.* 2000b; Alpers *et al.* 2000a; Anderson *et al.* 1996). The toxicity of these pollutants varies in other water quality speciation and concentration. Regarding dissolved heavy metals, Santore *et al.* (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (increase and decrease).

Impacts to eulachon at each life stage are assumed to be similar to salmon and steelhead, although impacts of contaminants on adult eulachon reproductive behavior are undocumented. Eulachon can take up and store pollutants from their spawning rivers, even though they do not feed in fresh water and remain there only a few weeks (NMFS 2017), and eulachon avoid polluted waters when possible (Smith and Saalfeld 1955).

No detrimental long-term effects to salmonids, green sturgeon, eulachon, or sunflower sea stars are expected for the Lower Columbia River portion of the action area. Contaminant loading is expected to decrease over time due to the proposed action.

Little is known about specific effects of toxic contaminants on sunflower sea stars, or how stress from exposure to such chemicals affects susceptibility to sea star wasting syndrome. Laboratory challenge tests have exposed larval stages of various marine invertebrates to hydrocarbons, heavy metals, pesticides, and other contaminants commonly found in stormwater runoff. Documented impacts range from developmental abnormalities to behavioral augmentation, and mortality is common at concentrations as low as several parts per million (e.g., Hudspith et al. 2017, de Almeida Rodrigues et. al 2022). For juvenile and adult marine invertebrates, including sea stars and other echinoderms, a variety of sublethal behavioral and physiological effects from these toxic contaminants have been documented, but mortality is also possible. Suspended sediment in stormwater may also be a concern as stars that become covered by sediment may experience greater risk of wasting disease. Absent species-specific data for the sunflower sea star, ecologically and physiologically similar species can be used as proxies to state that stormwater runoff is likely to harm, injure, or kill sunflower sea stars, having the greatest effects during the larval life history stage.

Stormwater runoff from I-5 and the surrounding roadways carries a wide variety of toxic contaminants known to affect organismal health and vitality in marine systems. While studies have not been conducted with sunflower sea stars, bioaccumulation of chemicals, with both sublethal and lethal effects, has been documented in various life stages of other mesopredators with planktonic larvae (e.g., herring, rockfish). Using these species as proxies, both sublethal and lethal effects to sunflower sea stars can be presumed, with the greatest impact likely occurring at the larval stage.

Additionally, organics (living and dead) can adsorb and absorb other pollutants such as PAHs. The variables of organic decay further complicate the path and cycle of pollutants. The persistence and speciation of these pollutants also cause effects and, consequently, the action area, to extend from the point where highway runoff discharges into eventually discharged into a river mouth, bay, or estuaries, and then into coastal waters where they impact aquatic habitat, fish populations, and other coastal resources. Once in coastal waters, these pollutants have been linked to a wide variety of ecological stressors affecting the water column, sediments, and the diversity and abundance of aquatic life (EPA 2008; Hayslip *et al.* 2006; U.S. Commission on Ocean Policy 2004).

The permanent stormwater treatment design proposed by the FHWA is preliminary. Figures 3-36 through 3-39 of the BA (pages 3-109 through 3-112) show the project's Contributing Impervious Area (CIA). Figures 3-49 through 3-42 in the BA (pages 3-122 through 3-125) show the preliminary stormwater quality treatment design. We incorporate these figures here by reference. However, the final stormwater design will, at minimum, provide treatment for all contributing impervious area and will meet the treatment standards established by the federal, state, and/or local agencies with jurisdiction. For purposes of this consultation, it is assumed that water quality treatment will be provided through the use of bioretention facilities as described in Section 3.4.12.4 of the BA (page 3-113). These treatment facilities will sequester pollutants before treated stormwater is ultimately infiltrated or discharged to a surface water body. This project is prioritizing the use of biofiltration BMPs due to their effectiveness at reducing levels of 6PPD-q and dissolved metals (copper and zinc) in stormwater. NMFS also assumes based on commitments made in the proposed action that stormwater treatment will be based on, at minimum, a design storm (50 percent of the 2-year, 24-hour storm) that will generally result in more than 95% of the runoff from all impervious surfaces within the replacement bridge area being infiltrated for the CIA of the project. This is consistent with the best practices established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation (WCRO-2021-00004 dated January 29, 2021).

Stormwater treatment for the proposed action will be consistent with the ODOT Hydraulics Design Manual (ODOT 2014), which uses the CIA to establish treatment requirements.

The FHWA's FAHP Opinion defines CIA to include all impervious surface area (ISA) associated with public highways, roads, streets, roadside areas, and auxiliary features (e.g., rest areas, roadside parks, viewpoints, heritage markers, park-and-ride facilities, and pedestrian and bicycle paths). A project's CIA includes both ISA within the project limits and ISA from areas contiguous to the project that discharge runoff into the project area prior to discharging directly or indirectly into a stream, wetland, or subsurface water through a ditch, gutter, storm drain, drywell, or other under underground system.

The proposed action will result in 214.2 acres of CIA (Table 2-6), which will be a source of stormwater pollutants for the life of the new structure. The proposed action will also provide permanent water quality systems to treat stormwater runoff for all of both the new and rebuilt impervious surfaces through the use of bioretention facilities. The existing bridge does not have stormwater collection or conveyance structures so we anticipate the proposed action will result in reduced water quality impacts compared to current conditions. We recognize that stormwater

treatment facilities cannot completely eliminate discharges of pollutants to receiving water bodies. Stormwater treatment will, at minimum, result in more than 95 percent of the runoff from the CIA being retained and infiltrated on-site. In addition, we assume that permanent water quality systems at the replacement bridge will treat the design storm for 6PPD-quinone, a compound widely used by multiple tire manufacturers that has been shown to cause mortality in salmonids in the wild (Peter et al. 2018, Tian et al. 2020; Feist et al. 2018, Sutton et al. 2019). This assumption is based on the proposed action prioritizing those BMP's that have shown effectiveness in treating for 6PPD-quinone (bio-filtration BMP's). We expect salmon, steelhead, pacific eulachon, green sturgeon, and sunflower sea star covered in this opinion will be adversely affected by degraded water quality from stormwater runoff at the replacement bridge because of untreated stormwater released into the Columbia River over the life of the new structure.

Table 2-6. Contributing Impervious Area by Watershed and Drainage Area

State	Drainage Area	Project Area CIA (acres)	Off-Site CIA (acres)	Total CIA (acres)
	Columbia Slough	40.1	0.5	40.6
Oregon	Columbia River (South)	54.5	0.5	55.0
	Fairview Creek	6.4	0.4	6.8
Washington	Columbia River (North)	99.6	1.5	101.1
	Burnt Bridge Creek	10.2	0.5	10.7
	Totals	**210.8**	**3.4**	**214.2**

Water Quantity Management

The majority of the stormwater on the project outfalls to the Columbia River so flow control is not required. Stormwater that discharges to Burnt Bridge Creek in Washington will require flow control consistent with City of Vancouver requirements. The City of Vancouver requires that stormwater discharges to Burnt Bridge Creek be reduced to pre-development (forested) conditions for peak discharges between 50% of the two-year event and the 50-year event. The proposed bioretention BMPs will be designed and sized accordingly to provide this level of flow control and to meet or exceed these standards.

2.5.1.5 Altered Behavior and Predation Due to Overwater and In-water Structures

Juvenile salmon and steelhead rely heavily on light perception to orient themselves in space, capture prey, avoid predators, shoal, and migrate along the shoreline to the ocean (Ono and Simenstad 2014). The reduction of ambient light (e.g., light attenuation and shading) is one of the primary mechanisms by which over-water (barges, moored vessels) and in-water structures (piers and pilings) adversely affect salmon and steelhead. Reduced light levels can impair fitness

and survival in juvenile salmonids by altering certain behaviors, such as migration, feeding success, and predator avoidance (Nightingale and Simenstad 2001; Rondorf et al. 2010). Darkly shaded areas can delay fish migration and drive juvenile salmon into deeper waters during daylight. This, in turn, increases the risk of predation by exposing young salmon to larger fish and diving birds. Predators such as smallmouth bass and northern pikeminnow select and use in-water and overwater structures (Pribyl et al. 2004; Celedonia et al. 2008), and juvenile salmonids account for high portions of northern pikeminnow diets (Poe et al. 1991; Zimmerman and Ward 1999; Harnish et. al 2014) and avian predator diets (Collis et al. 2002). Construction of overwater structures (e.g. docks and pilings) also creates habitat for predatory, perching birds such as cormorants and gulls. Factors that can reduce the potential effects to aquatic habitat function from overwater shading include the height of the structure, the orientation of the structure, and the density/placement of the foundation.

Once complete, we expect the in-water presence of 8,432 square feet of new foundation in the Columbia River and 14,743 square feet of new foundation in the North Portland Harbor will represent an obstacle in the juvenile migration pathway and, therefore, alter the behavior and increase predation risk for a small number of juveniles of all species covered in this opinion for the life of the new structure. In addition, the existing bridge and riprap will continue to adversely affect 33,289 square feet of juvenile migration (altering behavior and increasing predation risk for small numbers of juveniles) for up to 9 years during construction and demolition.

Shading from Temporary Work Structures

Temporary work structures will be installed during 6 IWW periods during the project. No temporary work structure will remain in place for more than 1,500 days in the Columbia River and no more than 850 days in North Portland Harbor. These include temporary overwater structures - work bridges, platforms, suspended shaft cap isolation systems, and spudded barges, totaling 343,965 square feet for the Columbia River and 336,100 square feet for the temporary structures in the North Portland Harbor. Barges may be moved throughout the action area at the site of the project as needed. We expect adults of all species covered in this opinion to avoid shading caused by the presence of temporary overwater structures. We do not expect this avoidance to affect spawning success. We expect juveniles of all species covered in this opinion to avoid shading caused by the presence of temporary overwater structures. Avoidance is not expected to affect juvenile growth. However, while the temporary overwater structures are in place, they may provide nearshore ambush habitat for fish species that prey on juvenile salmonids. Therefore, we expect the presence of 343,965 square feet of temporary overwater structures in the Columbia River and the 336,100 square feet in North Portland Harbor to increase the risk of predation for a small number of juveniles of all species covered in this opinion for up to 9 years. We incorporate by reference Table 3-3 in the BA (page 3-50) that summarizes the temporary overwater shade.

This project will require the use of multiple barges as a temporary bridge, to carry cargo, or as a platform for workers or machinery, such as a drill, oscillator, crane, dredge, hopper, or pile driver. The effects of a barge, separate from its role as a platform, include displacement of habitat area and shade under otherwise well-lighted conditions. When shade is in the path of downstream migrating juveniles or upstream migrating adults, those fish may avoid the shade or

slow their migration, causing them to be more vulnerable to predation as well. Northern pikeminnow (*Ptychocheilus oregonensis*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*) all consume juvenile salmon and have an affinity for in-water structures.

Shading from Permanent Structures

Permanent structures will be installed during 6 IWW periods during the project. These include the permanent bridges and the water level elevation decks, totaling 68,718 square feet for the water level elevation decks and 396,374 square feet for the elevated decks in the Columbia River and 180,015 square feet for the elevated deck in the North Portland Harbor. We expect adults of all species covered in this opinion to avoid shading caused by the presence of these permanent overwater structures. The elevated bridge decks are well above the channel and will create very little shade, depending on the time of year. The water level decks will, however, create shade for the life of the project. We do not expect this avoidance to affect spawning success. We expect juveniles of all species covered in this opinion to avoid shading caused by the presence of elevated overwater structures. Avoidance is not expected to effect juvenile growth. However, with the water level overwater structures in place, they may provide nearshore ambush habitat for fish species that prey on juvenile salmonids. This overwater water level shading could be offset by the proposed mitigation for this project. However, we do not know enough about the mitigation to account for its beneficial effects in our analysis. Therefore, we will focus solely on the adverse effects of the overwater structures. We expect the presence of 68,718 square feet of water level overwater structures in the Columbia River to increase the risk of predation for a small number of juveniles of all species covered in this opinion for the life of the structures. Juveniles are out-migrating and are not expected to spend much time in this part of the action area due to habitat constraints. We incorporate by reference Tables 3-5 and 3-6 in the BA that summarize the permanent overwater shade (pages 3-77, 3-78, and 3-85)

The new structure in the Columbia River will create an overwater area of 396,374 square feet; however, it will have a minimum navigational channel clearance height of 116 feet, which will diminish the intensity of shading by providing a large distance for light to diffuse and refract around the new structure deck surface. The new structure, like the existing bridge, will be orientated in a north-south fashion; therefore, the shading created by the new structure will be constantly moving. The new structure will have 6 in-water bents. The distance between the bents on the new structure will be far enough to allow a substantial amount of light to reach the water. Therefore, we do not expect overwater shading from the I-5 bridge to adversely affect any species covered in this opinion.

Acquisition and relocation of existing floating homes from moorages in North Portland Harbor will likely be required prior to construction of the North Portland Harbor Bridges. Up to 35 floating homes in the Portland Harbor will be displaced. Floating homes will likely either be purchased or relocated to other locations. In either case, the homes will likely ultimately continue to be operated as floating structures within the lower Columbia River subbasin. The effects associated with the moving of these structures are expected to be minor. Future effects from the structures themselves such as overwater shading, avian predation, and potential chemical

contamination would continue, but these structures will not increase in size they will just change location.

2.5.1.6 Overwater Lighting

Artificial light sources associated with overwater structures or construction activities have been shown to attract fish and can result in effects associated with delayed migration (Collis et al. 1995; Celedonia et al. 2008). Juvenile salmon have been documented as being attracted to work lights and have also been observed congregating at night near streetlights on floating bridges. Artificial lights can also create sharp boundaries between dark and light areas under water, which can cause juvenile fish to become disoriented and avoid these areas of sharp light-dark contrast.

Artificial overwater light sources may also provide an advantage to predators such as smallmouth bass, largemouth bass and northern pikeminnow. If an overwater light source causes juvenile salmonids to congregate, this can improve the ability of predatory species to successfully prey on them. However, it has also been documented that artificial lights may also improve prey detection and predator avoidance in some circumstances (Tabor et al. 1998).

Temporary overwater lighting will be required throughout construction and demolition to provide adequate lighting for barges, work platforms/bridges, construction of the replacement bridge deck, and demolition of the existing structures. Temporary lighting will be needed for all phases of construction, and as such, will be relatively uniformly distributed throughout the entire construction period. If temporary lighting is required, the contractor will use directional lighting with shielded luminaries to control glare and direct light onto work area, not surface waters. Therefore, we expect any artificial light from temporary work structures that reaches the water's surface to be temporary and minimal and not adversely affect any species covered in this opinion.

The permanent lighting for the replacement bridges has not yet been designed, but it is not expected to result in an increase in the amount of light on the water's surface. The existing bridges are lit at night in a manner consistent with regulatory and safety requirements. Permanent lighting for the replacement bridge decks will use directional lighting with shielded luminaries to control glare and to direct light onto the bridge deck to the extent practicable. The solid nature of the bridge deck will reduce the amount of light that illuminates the water's surface. The replacement bridges will require some navigation lighting, comparable to what is on the existing bridge. These lights are typically small, dim, and do not represent a significant source of lighting. Therefore, we do not expect permanent overwater lighting at the new structure that reaches the water's surface to result in injury or mortality of any species covered in this opinion.

2.5.1.7 Avian Predation Associated with Temporary and Permanent Overwater Structures.

Avian predation of juvenile salmonids is documented as a limiting factor for salmon recovery in the Columbia River basin (LCFRB 2010a). Adult and juvenile Pacific eulachon are also subject to avian predation. Caspian terns, double-crested cormorants, and various gull species are the principal avian predators in the lower Columbia River, and all of these species occur within the vicinity of the project site. The existing bridges currently provide abundant perching opportunities for piscivorous birds, though extensive use by terns, cormorants, or other

piscivorous birds has not been documented. Avian predation of juvenile salmonids from temporary work structures during the proposed action may occur year-round in the project area. Predation of juvenile salmonids by birds using the new structure would persist for the life of the new structure.

The temporary overwater structures associated with the proposed action are not likely to attract large concentrations of avian predators. Nevertheless, because avian predators are known to congregate on overwater structures, and because the proposed action will temporarily increase the number of available perches during construction, it is possible that the temporary overwater structures could increase avian predation rates to a minor extent within the immediate project area.

The permanent replacement bridge will also provide perching opportunities for piscivorous birds, but it is expected to be comparable or less than the perching habitat that is available on the existing bridge. The steel superstructure of the existing bridge that is located above the bridge deck offers greater opportunities for birds to perch undisturbed, whereas the replacement structure will be open and will have only limited overhead perching opportunities.

Temporary Overwater Structures

Temporary overwater structures for this project consist of temporary work bridges, barges, and suspended shaft caps. Barges will be in one place no more than 120 days at a time. The proposed action will require 343,695 square feet of temporary over-water work structures in the Columbia River for up to 9 years during the project and 336,100 square feet of temporary over-water work structures in the North Portland Harbor for up to 9 years during the project (Table 3-3 of the BA [page 3-61] and included here by reference). These structures, however, will be in place for no more than 1,500 days in the Columbia River and no more than 850 days in the North Portland Harbor. Temporary work structures are not likely to attract large numbers of avian predators; however, they could increase the ability of piscivorous birds to prey on juvenile salmonids. These include piles and other temporary structures such as work platforms/bridges, cranes, barges, and cofferdams. High levels of construction activity are likely to limit use of these structures during working hours (up to 12 hours during daylight hours only). To minimize the potential for effects to juvenile fish from avian predation, piles that are not in the active construction area and are in place for 6 months or longer will have cones or other anti-perching devices installed to discourage perching, as shown in Pile Installation and Removal BMPs in Appendix A. These could include hazing during construction, using deterrent methods, and anti-perching cones on the tops of the pile.

Predation rates from temporary structures and barges will depend on the numbers of predators and smolts present at any given time, which is highly uncertain. However, we expect this number to be proportional to the total overwater area of temporary structures (343,695 square feet in the Columbia River and 336,100 square feet in the North Portland Harbor) and associated with the duration of the period these structures are in place (up to 1,500 days and 850 days respectively) over the 9 years of in-water work. Therefore, we expect a small number of juveniles of all species covered in this opinion to be killed by avian predation associated with temporary structures.

The IBR team is currently working with ODFW and WDFW to develop BMPs to prevent and minimize avian perching on the temporary work structures. These could include hazing during construction, using deterrent methods, and anti-perching cones on the tops of the pile.

Permanent Perching Opportunities

The permanent replacement bridge will also provide perching opportunity for piscivorous birds, but it is expected to be comparable or less than the perching habitat that is available on the existing bridge. The steel superstructure above the existing bridge deck offers greater opportunities for birds to perch undisturbed, whereas the replacement structure will be open and will have only limited overhead perching opportunities.

The water level shaft caps on the new structure will also provide perching opportunities for piscivorous birds. However, the replacement bridge will be relatively open and provide fewer perching opportunities for piscivorous birds than the existing bridge. Cormorants and gulls could nest on the foundation caps, similar to use of the cribs on the Astoria-Megler Bridge (Lawonn 2022, Evans et al. 2023). Figure 3-27 in the BA (page 3-75) (incorporated here by reference) shows the flat areas on the foundation caps for the new structure that may be used by piscivorous birds for perching or nesting. The foundation caps will provide 68,718 square feet of horizontal areas for perching.

Avian predation rates associated with the new structure will depend on the numbers of avian predators and smolts present at any given time, which is highly uncertain. However, we expect this number to be proportional to the horizontal areas of the foundation caps (68,718 square feet) over the life of the new structure. Therefore, we expect a small number of juveniles from all species covered in this opinion to be killed by avian predation associated with the new structure. The IBR team is currently working with ODFW and WDFW to develop BMP's to prevent and minimize avian perching on the permanent shaft caps.

2.5.1.8 Hydraulic Shadowing

Hydraulic shadowing may affect habitat suitability for ESA-listed fish by creating low-velocity eddies that have the potential to increase exposure to predation, interfere with movement patterns, and alter sediment transport.

A detailed assessment of the hydraulic shadow associated with the existing and replacement Columbia River and North Portland Harbor bridges was conducted for the CRC project (DEA 2006). Given the similarity of the design of the in-water foundations for the replacement bridges associated with the proposed action, it is assumed that the effect to aquatic habitat function associated with hydraulic shadowing will be similar to the effects that were modeled and described for the CRC project.

The analysis conducted for the CRC project indicated that the hydraulic shadow associated with the existing Columbia River bridges extends between 200 to 1,100 feet downstream of the existing piers, with velocities in the shadow ranging from 0 to 3 feet per second. It was estimated that the hydraulic shadow associated with the piers for the replacement Interstate Bridge would

extend up to approximately 1,600 feet downstream of each pier, with velocities in the shadow remaining in the 0 to 3-feet-per-second range. However, due to the reduction in the total number of piers in the water compared to the existing bridges, there will also be more unaffected area between piers.

The hydraulic footprint was not modeled for the existing North Portland Harbor bridges during the CRC project (DEA 2006). However, the CRC analysis concluded that the hydraulic shadow would likely increase in length given the increase in the number of shafts and the increase in size of the proposed supporting piers. The CRC analysis concluded that the hydraulic shadow of the completed North Portland Harbor bridges would extend up to approximately 400 feet downstream of each pier, with velocities in the shadow ranging from 0 to 2 feet per second.

In general, hydraulic shadowing and resulting low-velocity areas may affect juvenile salmon and steelhead, as well as both adult and juvenile eulachon. Low-velocity areas within the hydraulic shadow may enhance the foraging ability of predators, and thereby, may expose these species and life stages to increased risk of predation. They may also delay outmigration for salmonid smolts. Increased travel time exposes smolts to a variety of mortality vectors, including predation, disease, poor water quality, and thermal stress. Migration delays may also deplete energy reserves and disrupt arrival times in the lower estuary. The latter may cause salmonids to arrive in the estuary when predation levels are high and/or prey species are limited (NOAA Fisheries 2008e). The extent of the effect may be reduced in the Columbia River due to the reduction in the total number of piers in the water and likely increased within North Portland Harbor due to the increase in the total number of piers.

The change in the hydraulic shadow from the replacement bridges is not expected to increase predation on adult salmon and steelhead, as adults are generally of sufficient size to be unaffected by the slight change in hydraulic conditions within the hydraulic shadow, and predation on fish of these size classes is rare except for predation by marine mammals.

Increased hydraulic shadowing may also benefit salmonids by creating velocity refugia for both adults and juveniles during periods of high flow. Velocity refugia allow fish to rest and replenish energy reserves. Without such resting areas, migrating adults use larger amounts of energy, posing risks to spawning success (Brown and Geist 2002). Again, given the relatively small area that would be affected by the change in hydraulics, the extent to which this change would benefit habitat suitability for aquatic species is probably slight.

The range of velocities found in the hydraulic shadow is within the range that fish encounter in the natural environment. Therefore, no species or life stages are expected to become trapped or significantly delayed by the hydraulic shadow. Additionally, none are likely to be directed towards or away from shallow water habitat because the structures neither pose a complete physical blockage to the shallow water habitat, produce water velocities low enough to trap fish, nor produce velocities high enough to direct fish into deeper water. In summary, the proposed removal of the current bridge will remove some hydraulic shadow, while construction of the new bridge will add a slightly larger amount. This is expected to result in an increase in predation of juvenile salmonids and eulachon.

2.5.1.9 Levees

As part of the proposed action, the existing PMLS at the new bridge location will be modified to accommodate bridge construction. All proposed levee work will be limited to upland areas, and no associated in-water activities will occur. The proposed levee work is not expected to change how the levees operate, nor will the proposed work meaningfully extend the life of the levees. Accordingly, impacts from the existence and operation of the levees themselves, such as disconnection of the Columbia River from its floodplain, are not considered consequences of the proposed action.

2.5.1.10 Floodplain Fill

The proposed action includes placement of approximately 55,000 cubic yards of material within the functional floodplain at the bridge site. Most of this volume is associated with the shaft caps for the Columbia River Bridge, which are approximately 20 feet thick and will be below the OHWM elevation but not on the bottom of the river. All fill placement will occur within the project footprint. Placement of the fill will displace water/floodwater and contribute to floodplain disconnection at the project site. Although mitigation is proposed to offset the impacts of floodplain fill resulting from the project, not enough is known about this mitigation for us to consider its potential beneficial effects in our analysis.

2.5.2. Effects on Critical Habitat

Portions of the action area are designated as critical habitat for all species included is this opinion, except for the sunflower sea star, and consist of freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas, and their PBFs as stated in Section 2.2.2. The PBFs that will be affected by the proposed action include water quality, substrate/spawning gravel, forage, natural cover/riparian vegetation, water velocity, and migration obstruction. The effects of the proposed action on these features are summarized below as a subset of the habitat-related effects of the action to species that were discussed more fully above.

2.5.2.1 Water Quality

The proposed action is expected to temporarily increase sediment delivery to the waterway and suspend fine sediment and, thereby, increase turbidity in the water column during the following aspects of the project: pile installation and removal, installation and removal of drilled shaft shoring casings, cofferdam installation and removal, bridge demolition, and barge operations, including movement and anchoring for up to 9 years. Because turbidity control measures and BMPs (Appendix A) will be implemented during construction, very little sediment is expected to be released. Localized pulses of increased turbidity and suspended sediment concentration are expected up to 300 feet upstream and downstream of the in-water work area. Intermittent barge movements will also suspend sediment and create turbidity plumes up to 300 feet upstream and downstream. Therefore, we expect small (no more than 300 feet upstream or downstream), temporary (up to 12 hours per day, during daylight hours only), and intermittent negative effects to water quality due to increased turbidity during construction and demolition for up to 9 years.

The operation of equipment and heavy machinery will occur from causeways, temporary work structures, and barges and may result in associated accidental releases or spills of contaminants. NMFS anticipates that only very small quantities (ounces) of PAHs are likely with each accidental release or spill. The contractor will be required to provide monitoring plans that ensure that BMPs in Appendix A are implemented. The project will also be conducted consistent with the best practices established in the Biological Opinion for FHWA's Federal Aid Highway Programmatic consultation. The proposed best practices are expected to minimize the risk of a spill and opportunity for contaminants to enter the waterway. If a spill does occur, we expect containment will occur quickly using emergency spill kits located on site, and conservation measures will minimize its dispersal, limiting exposure. Therefore, we expect that it is improbable water quality will be degraded from accidental releases of fuel, oil, and other contaminants during the proposed action and, if an accidental spill occurs, negative effects to water quality will be minor and temporary.

During project construction, stormwater will be managed in an appropriate manner consistent with applicable local, state, and federal regulations. Based on the BMPs for erosion control and stormwater management, we expect only infrequent and small amounts of stormwater will enter the Columbia River during the 9 years of project construction and demolition. Therefore, we expect that it is improbable that water quality will be degraded due to improperly managed stormwater during the construction phase of the proposed action; however, if stormwater enters the Columbia River during construction, negative effects to water quality will be minor and temporary, especially given the volume and flow of the river.

The proposed action will result in 214.2 acres of CIA, which will be a source of stormwater pollutants for the life of the new structure. The proposed action will also remove the CIA associated with the old bridge. The proposed action will also provide permanent systems to treat stormwater runoff for all new and rebuilt impervious surfaces through the use of bioretention facilities. We recognize that stormwater treatment facilities cannot completely eliminate discharges of pollutants to receiving water bodies. Stormwater treatment will, at a minimum, treat the volume of water equal to 50% of the 2-year, 24-hour storm event, resulting in a large portion of the runoff from all impervious surfaces within the replacement bridge area being retained and treated between the roadway discharges and the Columbia River. In addition, we assume that permanent water quality systems at the replacement bridge will treat the design storm for 6PPD-quinone, a compound widely used by tire manufacturers that has been shown to cause mortality in salmonids in the wild (Peter et al. 2018, Tian et al. 2020; Feist et al. 2018, Sutton et al. 2019). Therefore, we expect degraded water quality from stormwater runoff from the replacement bridge downstream to the Pacific Ocean to be persistent because the fate and transport of dissolved metals in untreated stormwater will continue to be discharged into the Columbia River over the life of the new structure, and any untreated stormwater pollutants will eventually get to levels approaching background concentrations at the Pacific Ocean.

2.5.2.2 Substrate/Spawning Gravel

For up to 9 years, substrate conditions are expected to experience minor levels of sediment deposition as small turbidity plumes settle out within 300 feet downstream of turbidity generating activities within the action area. Therefore, we expect small (no more than 300 feet

upstream and downstream), temporary (up to 12 hours per day, during daylight hours only), and intermittent negative effects to substrate due to increased turbidity during construction and demolition for 9 years.

Temporary work structures will displace up to 74,471 square feet of substrate in the Columbia River and 17,445 square feet in the North Portland Harbor for up to 9 years. Therefore, we expect a relatively small (no more than 91,916 square feet), temporary (up to 9 years) negative effect to substrate due to the placement of temporary work structures. These temporary structures will be in place no more than 1,500 and 850 days, respectively (barges 120 days).

Installation of the new structure will permanently displace 33,577 square feet of substrate in the Columbia River for the life of the new structure, which is an increase of 288 square feet over the existing structure. Installation of the new structures in North Portland Harbor will permanently displace 14,743 square feet of substrate for the life of the new structures, which is an increase of 2,539 square feet over the existing structure. The area affected represents only a small fraction of the remaining habitat available for miles in either direction. Therefore, we expect a relatively small (no more than 48,320 square feet) permanent negative effect to substrate due to the placement of the new, permanent in-water structures. Most substrate near the project area is sand and not suitable for salmon or steelhead spawning and is of marginal suitability for eulachon

As stated above, although very small amounts of untreated stormwater may still enter the Columbia River for the life of the replacement bridge, it is highly unlikely they will degrade substrate or spawning habitat.

2.5.2.3 Forage

As discussed above, the minor temporary and permanent effects to benthic habitat from construction and demolition represents only a small fraction of the remaining forage habitat available for miles in either direction and the proposed action will not affect continual invertebrate drift. Therefore, benthic habitat impacts are not expected to result in any measurable effect to forage habitat. Further, the new bridge and associated riprap will lose only 288 square feet of benthic habitat compared to the existing bridge and in Portland Harbor will lose 2,827 square feet with the new bridges.

The proposed action will result in direct impacts to aquatic habitats for ESA-listed species associated with construction of the replacement bridges and removal of the existing bridges. These include both permanent habitat impacts associated with changes in the physical benthic and overwater footprint of the replacement bridges and temporary impacts associated with temporary work structures. The extent and nature of these impacts have been minimized and avoided to the extent possible through the implementation of BMPs described in Appendix A.

Table 8-3 (Page 8-29) and Figures 8-11 through 8-14 in the BA (Pages 8-33 through 8-38) in the BA provide a summary of the temporary aquatic habitat impacts associated with the proposed action. Table 8-2 in the BA (Page 8-28) provides a summary of the permanent aquatic habitat impacts associated with the proposed action. We incorporate those tables and figures here by reference. We conservatively estimate that temporary aquatic habitat losses may occur year-

round for up to 9 years. Foraging habitat in the action area is not limited and fish of all affected species will have still be able to forage in habitat next to the project site.

Loss of Forage Opportunities Due to In-water Structures

The project will have minor temporary and permanent effects on benthic invertebrate prey species by crushing, covering, or dislodging them during construction and demolition. Food availability has the potential to limit stream salmonid production (McCarthy et al. 2009; Rosenfeld et al. 2005; Wipfli and Baxter 2010), and reducing food availability generally leads to reduced growth, and, ultimately, survival (Spence et al. 1996). In lotic environments (i.e., environments with actively moving water), salmonids primarily forage on aquatic and terrestrial invertebrates drifting in the water column (Allan et al. 2003; Dedual and Collier 1995; Elliott 1973; Nielsen 1992; Romaniszyn et al. 2007; Wipfli 1997). Invertebrate drift in the Columbia River will maintain a source of forage for salmon and steelhead below the project. We also expect macroinvertebrates will begin to recolonize disturbed areas via drift and migration within a few days and fully recolonize disturbed areas within a few months after project completion (Fowler 2004; Griffith and Andrews 1981; Yount and Nemi 1990).

Benthic Impacts from Temporary Structures

Temporary structures, including spudded barges, totaling 343,695 square feet of benthic impact in the Columbia River and 336,100 square feet in the North Portland Harbor, will affect juvenile foraging for up to 9 years. However, any given structure will only be in place for 1,500 days each in the Columbia River and 850 days each in the North Portland Harbor. These structures include piles for work bridges and platforms, cofferdams, suspended shaft caps, drilled shaft isolation casings, and barge anchors. Barges may be moved throughout the action area at the site of the existing/new structure as needed. Spudding from these barges can impact benthic habitat every time they move and anchor.

Benthic Impacts from Permanent Structures in the Columbia River and the North Portland Harbor

Benthic habitats affected consist of shallow water benthic habitat and deep-water benthic habitat, and we incorporate by reference Table 8-2 in the BA (page 8-28) that quantifies these impacts.

<u>Columbia River Bridge Crossing</u>

The current permanent foundation design for the replacement bridge includes 108 drilled shafts to support the in-water foundations and 2 concrete cofferdam seals resulting in an initial loss of approximately 33,577 square feet of benthic habitat. Removal of the existing bridge and protection will be 33,289 square feet. In addition, the existing bridge and associated riprap will continue to impact benthic habitat in 66,866 square feet for up to 3 years (demolition in the last 3 years of in-water work of the project, but will restore approximately 33,289 square feet of benthic habitat upon removal. There will be a net loss of 288 square feet of benthic habitat.

During construction, there will be a period of time (up to 3 years) where both structures are in place. During this period there will be a continued benthic impact of 66,866 square feet of benthic habitat.

The impacted benthic habitat represents only a small fraction of the remaining forage habitat available for miles in either direction and the proposed action will not affect continual invertebrate drift. Any short-term adverse impacts at the mitigation sites will be consistent with those covered in the SLOPES V Restoration Programmatic Opinion. Due to uncertainty about the proposed mitigation, we are not considering any beneficial impacts in this analysis. Due to the small scale of the impact, we expect that temporary and permanent benthic habitat impacts will not result in population-level effects on any species covered in this opinion.

North Portland Harbor Bridge Crossings

North Portland Harbor currently has one bridge crossing. This project will replace the current crossing and add 5 more crossings. Two previous bridges, constructed in 1917 and 1958, were built at the same location as the current bridge but may not have been fully removed during subsequent replacement efforts. It is likely that some debris removal will need to occur to construct some of the new drilled shafts. The replacement bridge and the additional 5 crossings will need 52 10-foot drilled shafts and 19-foot casing seals for each, resulting in an initial loss of approximately 14,743 square feet of benthic habitat. Removal of the existing bridge and protection will be 12,204 square feet. In addition, the existing bridge and associated riprap will continue to impact benthic habitat in 26,947 square feet for up to 3 years (demolition in the last 3 years of in-water work of the project) but will restore approximately 12,204 square feet of benthic habitat upon removal. There will be a net loss of 2,539 square feet of benthic habitat.

The impacted benthic habitat represents only a small fraction of the remaining forage habitat available for miles in either direction, and the proposed action will not affect continual invertebrate drift. The final mitigation plans may, ultimately, offset this loss of benthic habitat. However, we are not considering the potential beneficial effects of proposed mitigation for the purposes of our analysis. Overall, we expect that temporary and permanent benthic habitat impacts will not result in a measurable effect to juveniles of any species covered in this opinion.

We expect temporary losses of 1.15 acres of riparian buffer, approximately 2.87 acres of a designated biodiversity area, approximately 0.03 acre of priority oak woodland habitat, and approximately 1.19 acres of wetland buffer in Washington. In Oregon, we expect temporary losses of approximately 2.56 acres of wetland, 7.11 acres of wetland buffer, approximately 10.3 acres of habitat identified as having a “high” or “medium” combined wildlife/riparian value in Portland’s NRI, and approximately 2.56 acres of wetland. Therefore, we expect a negative effect to forage habitat for many years due to temporary losses during construction.

2.5.2.4 Natural Cover/Riparian Vegetation

Construction of the proposed action will result in both temporary and permanent impacts to terrestrial habitats that include riparian areas, wetlands, and areas vegetated with native and nonnative vegetation. None of these terrestrial areas within the action area provide suitable

habitat for ESA-listed species, and none are designated critical habitat. However, impacts to riparian habitats, wetlands, and other terrestrial habitats can affect habitat suitability in adjacent aquatic systems by affecting water quality, reducing shading and thermal cover, reducing inputs of organic matter, and reducing opportunities for large woody debris recruitment.

Permanent impacts to terrestrial habitats associated with the proposed action will be relatively small, as the proposed action occurs largely within developed transportation corridor and is designed to avoid encroachment into sensitive resources, to the extent practicable.

Establishing access roads and staging areas requires disturbance of vegetation and soils that support floodplain and riparian function, such as delivery of large wood and particulate organic matter, shade, development of root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff (Darnell 1976; Spence *et al.* 1996). Denuded areas will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed and soil and water temperature. Water tables and spring flow in the immediate area may be temporarily reduced. Loose soil will temporarily accumulate in the construction area. In dry weather, part of this soil is dispersed as dust and in wet weather part is transported to streams by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of sediment to lowland drainage areas and, eventually, to aquatic habitats where they increase total suspended solids and sedimentation.

Impacts to riparian and wetland vegetation can reduce habitat complexity, affect water temperature, and reduce the potential for large woody debris recruitment in a watershed over the long term. However, the affected terrestrial habitats in this location provide only moderate habitat function in their current state, as they are fragmented and located immediately adjacent to I-5. Impacts to sensitive terrestrial habitats will be avoided and minimized to the extent practicable.

Riparian plantings take many years to mature into functional forested riparian/shoreline habitat for juvenile salmon and steelhead rearing (i.e., habitat that provides shade and thermal cover, inputs of organic matter, and opportunities for large woody debris recruitment). Therefore, we expect a negative effect to natural cover and riparian vegetation for many years due to permanent loss of 0.79 acre of riparian vegetation, approximately 0.15 acre of a designated biodiversity area, 0.01 acre mapped as oak woodland habitat, and approximately 0.06 acre of wetland buffer on the Washington side of the river and the permanent losses of 0.58 acre of permanent wetland impacts, approximately 7.39 acres of wetland buffer impact, and approximately 7.32 acres of permanent impact within terrestrial habitats on the Oregon side of the river. We also expect negative effects to natural cover and riparian vegetation from the temporary losses of 1.15 acres of riparian buffer, approximately 2.87 acres of a designated biodiversity area, approximately 0.03 acre of priority oak woodland habitat, and approximately 1.19 acres of wetland buffer in Washington and approximately 2.56 acres of wetland, 7.11 acres of wetland buffer, approximately 10.3 acres of habitat identified as having a “high” or “medium” combined wildlife/riparian value in Portland’s NRI, and approximately 2.56 acres of wetland in Oregon.

2.5.2.5 Unobstructed Passage

We expect a small, temporary obstruction to passage due to elevated underwater noise levels and the structures and shading created by piers, temporary work structures, and barges year-round for up to 9 years. Once complete, we expect a small permanent obstruction to juvenile passage for the life of the new structures due the presence of the new structure foundations.

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 environmental variation 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).

Resource-based activities such as timber harvest, agriculture, irrigation withdrawals, mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater habitat in the action area. Additional effects to ESA-listed salmon and steelhead are anticipated with population growth and development in the action area, which are expected to continue at similar rates to the last 10 years. Increased development in areas near the IBR Program stations is anticipated in the regional travel demand model, which includes changes to overall transit ridership beyond the study area. The mode of access to and from stations may shift as a result of increased development near the IBR Program stations. This may result in a greater percentage of active transportation or transit transfers and a lower percentage of automobile access as population and employment densities increase within station area walksheds and bikesheds. Increased active transportation trips to stations, particularly if higher-density residential and commercial development occurs in surrounding areas, may involve increased travel along streets that lack ADA accessibility or facilities to accommodate active transportation. However, increased development and transportation activity along these streets could encourage infrastructure improvements by local jurisdictions.

Future non-federal (state or private) activities that are known or expected to occur and increase within the action area include a variety of recreational activities, such as fishing and boating. Also, the project is intended to address a range of issues related to regional travel safety and mobility. More than 10 million people are expected to live in the Columbia River Basin by 2030. This trend is likely to include continued growth of human density in areas with recreational and scenic values adjacent to federal lands, conflict between demands for fresh-water and needs for salmon, continued urbanization and human density in areas previously sparsely populated, and land conversion from agriculture to urban uses (ISAB 2007). This trend also includes the positive effects of ongoing regional and local salmon conservation and planning efforts that are

underway to address all salmon species within the Columbia River Basin and will involve stakeholders on a more local level (LCFRB 2010).

Most development projects that may occur within the action area will likely require federal permits and/or review and would be subject to section 7 consultation under the ESA and EFH consultation under the MSA.

Based on the analysis above, the cumulative effects of future non-federal activities will have a continued negative effect on ESA-listed fish and their critical habitat.

2.7. Integration and Synthesis

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

2.7.1. ESA Listed Species

Of the 13 species of ESA-listed salmonids, Pacific eulachon, green sturgeon, that are likely to be adversely affected by the proposed action, the overall risk of extinction varies from low (1 to 5% chance of extinction in 100 years) to very high (greater than 60% chance of extinction in 100 years). In our recovery plans available for these species, we identified many factors within the action area as limiting their recovery, most notably degraded habitat (especially floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, stream substrate and streamflow), the hydropower system (upstream of the action area), hatchery production, harvest, and pathogens/predation/competition.

The environmental baseline within the action area includes a channelized mainstem river with highly regulated streamflow, simplified channel habitats, and a river that is disconnected from its floodplain. Extensive development for residential, commercial, and recreational use converted much of the shoreline below Bonneville Dam to riprap with little relief, few trees, and many over and in-water structures. Recent improvements at Bonneville Dam have increased downstream juvenile survival and the removal of the Condit Dam on the White Salmon River and the Powerdale Dam on the Hood River has reestablished access to spawning habitat for those populations that use the Columbia Gorge tributaries for spawning.

The existing Interstate Bridge and North Portland Harbor bridge represent part of the environmental baseline condition for aquatic habitats within the action area.

The existing Columbia River bridge consists of two separate structures, one for each direction travel. Each structure is approximately 3,500 feet long by 45 feet wide, and the two structures in total represent approximately 308,449 square feet of existing overwater coverage at the height of

the bridge decks. The bottom deck of each structure ranges between approximately 25 to 60 feet above the water surface. The existing Columbia River Bridge is supported by a total of 11 bridge piers, 9 of which are located below the OHWM of the Columbia River. Each pier measures approximately 32 feet wide by 50 feet long at the footing. In total, the in-water piers occupy approximately 33,289 square feet of substrate and represent approximately 44,000 cubic yards of fill below OHWM. At the existing structures, maximum water depth is approximately 40 to 45 feet, with an average water depth of approximately 27 feet. Two of the 11 existing piers (piers 10 and 11) are located in water depths shallower than -20 feet Columbia River Datum (CRD).

The existing North Portland Harbor bridge conveys I-5 from Hayden Island to the mainland. The structure is approximately 1,325 feet long by 150 feet wide and represents approximately 198,869 square feet of existing overwater coverage at the height of the bridge decks. The bottom of the deck ranges from 25 to 30 feet above the water surface. The North Portland Harbor Bridge is supported by a total of 10 bridge bents, 6 of which are located below the OHWM. Each bent consists of three piers, each measuring approximately 24 by 24 feet at the mudline. In total, the piers occupy approximately 12,204 square feet of substrate below OHWM. Water depths at the existing crossing range from 0 to 20 feet.

The project will replace the existing Interstate 5 Bridge with a new, improved structure. The existing bridge was built in 1916 and connects the communities of Portland, Oregon, and Vancouver, Washington, at a location on the Columbia River at River Mile 106 that is downstream of all of the dams on the Columbia River.

The action area is located within the Lower Columbia River subbasin. The Columbia River and its tributaries are the dominant aquatic system in the Pacific Northwest. The 1,214-mile-long Columbia River drains 259,000 square miles of the northwestern United States and southern British Columbia, Canada, into the Pacific Ocean. Currently, 23 mainstem and more than 300 tributary dams regulate the flow of the Columbia River to the Pacific Ocean (Bottom et al. 2005). Saltwater intrusion from the Pacific Ocean extends approximately 23 miles upstream from the river mouth at Astoria. Coastal tides influence the flow rate and river level up to Bonneville Dam at RM 146.1 (ISAB 2000).

Mainstem habitat in the Lower Columbia River has been substantially altered by basinwide water management operations, the construction and operation of mainstem hydroelectric projects, the growth of native avian and pinniped predator populations, the introduction of non-native species (e.g., smallmouth bass, walleye, channel catfish, and invertebrates), and other human practices that have degraded water quality and habitat function.

Within the Lower Columbia River subbasin, including the action area, flooding was historically a frequent occurrence, contributing to habitat diversity via flow to side channels and deposition of woody debris. The Lower Columbia River estuary is estimated to have once had 75% more tidal swamps than the current estuary because tidal waters could reach floodplain areas that are now diked. These areas provided feeding and resting habitat for juvenile salmonids in the form of low velocity marshland and tidal channel habitats (Bottom et al. 2005).

Dams built on the river between the 1930s and 1970s significantly altered the timing and velocity of hydrologic flow and reduced peak season discharges. Availability of aquatic habitat for native fish, particularly those that rely heavily on low-velocity side-channel habitat for holding, feeding, and rearing, has declined as a result of these changes to habitat-forming processes. Aquatic habitat components that have been affected by these changes include the amount and distribution of woody debris (e.g., controlled flows and navigation management discourage free transport of large wood), rates of sand and sediment transport, variations in temperature patterns, the complexity and species composition of the food web, the distribution and abundance of salmonid predators, the complexity and extent of tidal marsh vegetation, and seasonal patterns of salinity.

In general, aquatic habitats in the action area have been extensively modified from their historical condition, yet they continue to provide a wide range of important habitat functions for ESA-listed species.

We also expect the cumulative effects of state and private actions within the action area and environmental variation to continue to have negative effects on these listed species and their habitat.

We expect adults and juveniles of all species (except the sunflower sea star) covered in this opinion will migrate through the action area and potentially be exposed to project construction and demolition effects that occur year-round for up to 9 years as well as presence and use of the new structure into the future. We also expect juveniles of all species (except the sunflower sea star) covered in this opinion and adults of LCR, SR-SSR, UWR and SRFR Chinook salmon, CR chum salmon, LCR coho salmon, LCR, MCR, UCR, UWR and SRB steelhead, eulachon and green sturgeon to be exposed to effects of the action occurring during the 9 IWW periods.

The proposed action affects a very small portion of habitat for sunflower sea star, and the available habitat in the Columbia River estuary is marginal.

Work Area Isolation and Fish Salvage Effects

We do not expect adults of any species covered in this opinion to be captured, handled, injured, or killed by work area isolation and fish salvage activities.

Over the nine IWW periods, we expect a very small number of juveniles of all species covered in this opinion, except the sunflower sea star, to be captured, handled, injured, or killed by work area isolation and fish salvage activities. We expect this number to be proportional to the total area isolated (62,282 square feet during the isolation in cofferdams and associated with the duration that these structures are in place [50 days each for 9 of the cofferdams during demolition; and 500 days each for two of the cofferdams during construction]).

Up to three sites may be subject to work area isolation at West Hayden Island. Fish exclusion while deploying the sediment curtains at each site will help to minimize the number of fish exposed to electrofishing.

During each IWW period, we expect the risk of increased predation for juveniles of all species covered in this opinion, except the sunflower sea star, due to habitat displacement from work area isolation structures to be very small, proportional to the total area isolated (62,282 square feet for the cofferdams in the Columbia River and associated with the duration of the period these structures are in place [50-500 days each] and 10,659 square feet for the drilled shaft isolation casings and associated with the duration of the period these structures are in place [50 days for each]).

Underwater Noise Effects

We expect few instantaneous injuries or death of any salmon and steelhead covered in this opinion from the impact hammer installation of the 24-inch, 36-inch, or 48-inch steel piles using a confined bubble curtain.

We expect that it is improbable that instantaneous injury or death of adult salmon and steelhead present during the IWW period will occur from the impact hammer installation of the 48-inch steel piles using a confined bubble curtain.

Over years 1-6 of the project, we expect a very small number of juveniles of all fish species covered in this opinion to be instantaneously injured or killed by noise from the impact installation of the 24-inch and 48-inch piles for up 4.5 hours per day during daylight hours only (likely during the first 6 IWW periods).

We do not expect that adult fish covered in this opinion that are present during the IWW period will be injured or killed by the cumulative effects of repeated pile strikes from the installation of the 24-inch or 48-inch steel pile.

Over years 1-6 of the project, we expect adult fish present during the IWW period to experience migratory delays during impact driving piles. Migratory delays may happen for up to 4.5 hours per day during daylight hours. We do not expect these temporary migratory delays to affect spawning success.

Over years 1-6 of the project, we expect juveniles of all species covered in this opinion, except the sunflower sea star, to avoid the construction area during impact driving for up to 4.5 hours per day during daylight hours. Avoidance of the pile driving area is not expected to effect juvenile growth. However, we expect that a small number of juveniles will alter their behavior during impact driving to avoid sound pressure levels and experience an increased risk of predation by larger fish and birds for up to 4.5 hours per day during daylight hours.

We expect adults of all species covered in this opinion, except the sunflower sea star, to experience migratory delays during vibratory installation or removal of piles for up to 6 hours per day during daylight hours. We do not expect these temporary migratory delays to affect spawning success.

We expect juveniles of all fish species covered in this opinion to avoid the pile driving area during vibratory installation or removal of piles for up to 6 hours per day during daylight hours.

Avoidance of the pile driving area is not expected to effect juvenile growth. However, we expect that a small number of juveniles will alter their behavior during vibratory pile installation and removal to avoid sound pressure levels and experience an increased risk of predation by larger fish and birds for up to 6 hours per day during daylight hours only over the 9 IWW periods of the project.

We expect minor and temporary behavioral effects to adults of any species covered in this opinion, except the sunflower sea star, from the use of an unconfined wire saw. We do not expect the use of an unconfined wire saw to create adult migratory delays or affect spawning success.

Over years 7-9 of the project, we expect juveniles of all species covered in this opinion, except the sunflower sea star, to avoid the work area during unconfined wire saw use for up to 12 hours each day that wire saw use occurs. This avoidance is not expected to effect juvenile growth. However, we expect that a small number of juveniles of all species covered in this opinion, except the sunflower sea star, will alter their behavior while the wire saw is in use and experience an increased risk of predation by larger fish and birds from avoiding sound during unconfined wire sawing during years 4-7 of the project.

Water Quality Effects

We expect a very small number of juveniles of all species covered in this opinion, except the sunflower sea star, will experience turbidity at sufficient concentration to cause coughing, gill abrasion, or slower growth. We do not expect adults to experience coughing or gill abrasion due to increased turbidity.

We expect that a small number of juveniles of all species covered in this opinion, except the sunflower sea star, will alter their behavior up to 300 feet downstream of turbidity generating activities for up to 1 hour during each event, and up to 12 hours per day, for 9 years and experience increased risk of predation by larger fish and birds.

NMFS expects that for projects with sediment disturbing activities, the elevated levels of suspended sediment and re-suspended contaminants resulting from construction actions will reach background levels within a 300-foot buffer from the point of suspended sediment generation. Listed fish and their prey resources can be harmed from a wide range of elevated sediment levels, and we expect that the harm will cease at the point where sediment levels return to background levels. Thus, the maximum extent of take caused by turbidity levels shall not exceed the take associated with an increase of up to five nephelometric turbidity units (NTUs) above background turbidity levels when the background turbidity is 50 NTUs or less, or there shall not be more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTUs. At no time should turbidity exceed 50 NTUs over background. This limit will be observable as the EPA will monitor turbidity according to PDC 9 (Turbidity Monitoring). Additionally, this potential increase in turbidity shall be limited to within a 300-foot buffer from the activity that causes the increased sediment.

We expect that it is improbable that any fish species covered in this opinion will be exposed to accidental releases of fuel, oil, and other contaminants during the proposed action and; however,

if an accidental spill occurs, effects to fish species covered in this opinion will be minor or undetectable.

Use of heavy equipment for vegetation removal and earthwork compact the soil, thus reducing permeability and infiltration. Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain PAHs, which are acutely toxic to salmon, steelhead, and other fish and aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz et al. 2000; Heintz et al. 1999; Incardona et al. 2005; Incardona et al. 2004; Incardona et al. 2006). It is likely that petroleum-based contaminants have similar effects on southern green sturgeon and eulachon.

We expect that it is improbable that any fish species covered in this opinion will be exposed to degraded water quality due to improperly managed stormwater during the construction phase of the proposed action; however, if stormwater enters the Columbia River during construction, effects to fish species covered in this opinion will be minor or undetectable.

We expect that salmon, steelhead, green sturgeon, and sunflower sea stars covered in this opinion will be exposed to degraded water quality from stormwater runoff at the replacement bridges and, as stormwater enters the Columbia River over the life of the bridge, we expect associated adverse effects to salmon, steelhead, Pacific eulachon, green sturgeon, and the sunflower sea star will occur through time down to the Pacific Ocean. The proposed treatment for stormwater is expected to significantly reduce, but not eliminate, contaminants entering waterways.

Effects Due to Aquatic Habitat Loss

We expect that temporary and permanent benthic habitat impacts will result in minor effects to juveniles of any species covered in this opinion, except for the sunflower sea star which will be unaffected. Further, removing the existing bridge and associated riprap will result in a net decrease in benthic habitat within the project area, consisting of 288 square feet in the Columbia River and 2,539 square feet in the North Portland Harbor.

We expect effects from overwater shading of the new structure to any salmon, steelhead, eulachon, and green sturgeon covered in this opinion to be minor or undetectable due to the height, orientation, and design of the new structure.

We expect effects from the presence of the new foundation to any adult salmon, steelhead, Pacific eulachon, and green sturgeon covered in this opinion to be minor or undetectable.

We expect the presence of the new foundation will alter the behavior and increase predation risk for a small number of juveniles of all species covered in this opinion, except the sunflower sea star, for the life of the new structure.

We expect adults of all species covered in this opinion, except the sunflower sea star, to avoid shading caused by the presence of 343,695 square feet of temporary overwater structures for up to 9 years (1,500 days each structure) in the Columbia River and 336,100 square feet of temporary overwater structures for up to 9 years (850 days each structure) in the North Portland Harbor. We do not expect any resulting temporary migratory delays to affect spawning success.

We expect juveniles of all species covered in this opinion, except the sunflower sea star, to relocate to avoid shading caused by the presence of 343,695 square feet of temporary overwater structures for up to 9 years (1,500 days each structure) in the Columbia River and 336,100 square feet of temporary overwater structures for up to 9 years (850 days each structure) in the North Portland Harbor. Avoidance of the shading in the construction area is not expected to affect juvenile growth. However, while the temporary structures are in place, they may provide nearshore ambush habitat for piscivorous fish species. Therefore, we expect the presence of 343,695 and 336,100 (respectively) square feet of temporary overwater structures to increase the risk of predation for juveniles of all species covered in this opinion, except the sunflower sea star, for up to 9 years (1,500 and 850 days respectively for each structure).

We expect effects from the presence of 72,471 square feet temporary in-water structures in the Columbia River and 17,445 square feet temporary in-water structures in the North Portland Harbor to any adult salmon, steelhead, eulachon, and green sturgeon covered in this opinion to be minor or undetectable.

We expect the presence of 72,471 square feet of in-water structures in the Columbia River and 17,445 square feet temporary in-water structures in the North Portland Harbor will alter the behavior and increase predation risk for a small number of juveniles of all species covered in this opinion, except for sunflower sea star, for up to 9 years. In addition, while still in the water, the existing bridges and riprap will continue to adversely affect juvenile migration for up to 9 years for 33,577 square feet in the Columbia River and 14,743 square feet in the North Portland Harbor.

Effects Due to Terrestrial Habitat Loss

In Washington, the proposed action will result in permanent impacts to approximately 0.79 acre of riparian vegetation, approximately 0.15 acre of a designated biodiversity area, 0.01 acres mapped as oak woodland habitat, and approximately 0.06 acre of wetland buffer (these habitat designations overlap).

In Oregon, the project would result in approximately 0.58 acre of permanent wetland impacts, approximately 7.39 acres of wetland buffer impact, and approximately 7.32 acres of permanent impact within terrestrial habitats identified as either “high” or “medium” quality riparian habitats in the City’s Natural Resource Inventory (NRI) (these areas overlap). These estimates assume the largest possible footprint, and the specific quantities may be further reduced as design progresses.

The proposed action will also result in temporary impacts to approximately 1.15 acres of riparian buffer, approximately 2.87 acres of a designated biodiversity area, approximately 0.03 acre of

priority oak woodland habitat, and approximately 1.19 acres of wetland buffer in Washington, and approximately 2.56 acres of wetland, 7.11 acres of wetland buffer, approximately 10.3 acres of habitat identified as having a "high" or "medium" combined wildlife/riparian value in Portland's NRI, and approximately 2.56 acres of wetland in Oregon (these habitat designations overlap). Areas temporarily disturbed during construction will be restored upon completion of the proposed action consistent with state and local regulations.

We expect these permanent and temporary losses of riparian habitat, wetlands, wetland buffers, oak woodland habitat, and high- and medium-quality habitats to adversely affect a small number of juveniles of all species covered in this opinion, except for the sunflower sea star, for many years in the form of lost terrestrial forage and lost cover resulting in an increased risk of predation.

Overwater Lighting Effects

We expect effects from artificial light from temporary work structures that reach the water's surface to any fish species covered in this opinion to be minor and temporary.

We do not expect permanent overwater lighting at the new structure that reaches the water's surface to affect any fish species covered in this opinion. Both temporary and permanent lighting will be shielded to minimize light getting to the water surface.

Effects Due to Avian Predation

We expect a small number of juveniles of all species covered in this opinion, except the sunflower sea star, to be injured or killed as a result of increased predation by piscivorous birds using temporary work structures for perching. We expect this number to be proportional to the total overwater area of temporary structures, which will be 343,695 square feet of temporary overwater structures for up to 9 years (1,500 days for each structure) in the Columbia River and 336,100 square feet of temporary overwater structures for up to 9 years (850 days for each structure) in the North Portland Harbor.

We also expect a small number of juveniles of all species covered in this opinion, except the sunflower sea star, to be injured or killed as a result of increased predation from piscivorous birds using the permanent new structure for perching. We expect this number to be proportional to the horizontal areas of the shaft caps (68,718 square feet) over the life of the new structure.

Effects Due To Hydraulic Shadowing

The ESA-listed species in this Opinion have the potential to be exposed to effects associated with hydraulic shadowing because of their potential or documented presence within the action area, except for Southern DPS green sturgeon and Sunflower Sea Star; which do not occur in this portion of the action area where the effect of hydraulic shadowing occur.

In general, hydraulic shadowing and resulting low-velocity areas may affect juvenile salmon and steelhead, as well as both adult and juvenile Pacific eulachon. Low-velocity areas within the

hydraulic shadow may provide enhance the foraging ability of predators, and thereby may expose these species and life stages to increased risk of predation. They may also delay outmigration for juvenile salmonid smolts. Increased travel time exposes smolts to a variety of mortality vectors, including predation, disease, poor water quality, and thermal stress. Migration delays may also deplete energy reserves and disrupt arrival times in the lower estuary. The latter may cause salmonids to arrive in the estuary when predation levels are high and/or prey species are limited. The extent of the effect may be reduced in the Columbia River, due to the reduction in the total number of piers in the water, and likely increased within North Portland Harbor, due to the increase in the total number of piers.

The change in the hydraulic shadow from the replacement bridges is not expected to increase predation on adult salmon and steelhead, as adults are generally of sufficient size to be unaffected by the slight change in hydraulic conditions within the hydraulic shadow, and predation on fish of these size classes is rare.

Increased hydraulic shadowing may also benefit salmonids by creating areas of velocity refugia for both adults and juveniles during periods of high flow. Velocity refugia allow fish to rest and replenish energy reserves. Without such resting areas, migrating adults use larger amounts of energy, posing risks for spawning success (Brown and Geist 2002). Again, given the relatively small area that would be affected by the change in hydraulics, the extent to which this change would benefit habitat suitability for aquatic species is probably slight and therefore insignificant. Although the size of the hydraulic shadow would increase, the net effect of the change will be insignificant. The range of velocities found in the hydraulic shadow is within the range which fish encounter in the natural environment. Therefore, no species or life stages are expected to become trapped or significantly delayed by the hydraulic shadow. Additionally, none are likely to be directed towards or away from shallow water habitat because the structures neither pose a complete physical blockage to the shallow water habitat, produce water velocities low enough to trap fish, nor produce velocities high enough to direct fish into deeper water. While it possible that some individuals may be subject to increased exposure to predation as a result of the increase in hydraulic shadowing associated with the replacement bridges under the proposed action, is anticipated that the net effect of the change will be insignificant, due in part to the relatively small area that would be affected by the change.

Environmental Variation

Environmental variation will likely affect species covered in this opinion in the following ways: 1) changes in ocean survival, 2) changes in growth and development rates, 3) changes in disease resistance, and 4) changes in flow regime (especially flooding and low-flow events) that could affect survival and behavior (run timing, spawning timing, etc.).

Summary

Overall, the status of the species included in this opinion are poor, the environmental baseline is degraded, and cumulative effects from activities such as timber harvest, agriculture, irrigation withdrawals, mining, shipping, energy development, and human population increases are expected to continue. Many improvements will be needed before listed species may recover.

Adults and juveniles of all species covered in this opinion, except the sunflower sea star, will migrate through the action area and potentially be exposed to project construction and demolition effects that occur year-round for up to 9 years as well as presence and use of the new structure into the future. The majority of the proposed action's effects are minor, temporary, and localized, and any adverse effects will affect a relatively small numbers of juveniles of these species. Therefore, when scaled up to the listed unit size, the impacts from the proposed action are not expected to appreciably alter the abundance, productivity, spatial structure, or diversity of any of these populations, even when environmental variation is considered.

NMFS examined the effects of the proposed action on affected populations of the salmonids covered in this Opinion, as well as the sunflower sea star, eulachon, and green sturgeon. The proposed action is likely to result in adverse effects on individuals exposed to effects of the proposed action discussed above; however, those adverse effects are not likely to translate into detectable population-level effects. Therefore, adverse effects on individuals that result from the proposed action are not likely to affect the overall viability of the species covered in this Opinion.

2.7.2. Critical Habitat

Critical habitat is present in the action area for all 15 ESUs/DPSs considered in this opinion. The mainstem Columbia River migration corridor is among the areas of high conservation value for the salmon and steelhead ESUs/DPSs included in this opinion because it connects each population with the ocean. Fish from all 15 fish species considered in this opinion use the mainstem Columbia River for rearing and migration, and CR chum salmon and eulachon also use some portions of the mainstem Columbia River for spawning.

Critical habitat in the action area is degraded due to transportation infrastructure, the hydrosystem, marinas, docks, and riprap. Bonneville Dam and Bonneville Reservoir have altered the river environment and affected fish passage. Recent improvements at Bonneville Dam have increased downstream juvenile survival.

Water impoundment, dam operations, and upstream land use activities affect downstream water quality characteristics. Salmon, steelhead, and eulachon are exposed to high rates of natural predation from fish, birds, and marine mammals, exacerbated in some locations (by providing perch sites or hiding spots for predators) by development. Shoreline development has reduced the quality of nearshore salmon and steelhead habitat by eliminating native riparian vegetation, displacing shallow water habitat with fill materials, and further disconnecting the White Salmon and Columbia Rivers from historic floodplain areas. Further, riparian species that evolved under the environmental gradients of riverine ecosystems are not well suited to the present hydraulic setting of the action area, and are, thus, often replaced by non-native species. The riparian system provides inadequate protection of habitats and refugia for sensitive aquatic species. In addition, the cumulative effects of state and private actions within the action area are anticipated to continue to have negative effects on the ESA-listed fish considered in this opinion.

Environmental variation is likely to further impact designated critical habitat (Section 2.2.3). Increases in water temperature and changes to the hydrological regime will reduce suitable salmon habitat and cause earlier migration of smolts. Warmer temperatures will likely lead to

increased predation on juvenile salmonids in mainstem reservoirs (ISAB 2007). This is particularly true of non-native species such as bass and channel catfish where environmental variation will likely further accelerate their expansion (ISAB 2007). In addition, the warmer water temperatures will increase consumption rates by predators due to increased metabolic rates, which influence food demand.

The relevant PBFs for green sturgeon include food resources, water flow, water quality, depth, and migratory corridors, and sediment quality to support migration, aggregation and holding, and feeding by subadult and adult green sturgeon, for both freshwater riverine and estuarine habitats. Because the effects are the same, both habitats are summarized together. There are minor effects on food, water flow, water quality, depth, or migratory corridor PBFs. Water and sediment quality may be impacted due to the dispersal of suspended sediments from bridge replacement and fill removal at Hayden Island activities in the Columbia River, which have the potential for downriver transport of fine-grained sediments and any associated contamination downstream to the mouth of the Lower Columbia River. Over time, it is expected that the proposed action will reduce sediment loading to downriver areas.

The following is the list of effects of the proposed action to the water quality PBF of critical habitat:

- We expect minor, temporary, and intermittent, negative effects to water quality due to increased turbidity during construction and demolition for up to 9 years.
- We expect minor and temporary negative water quality effects from accidental releases of fuel, oil, and other contaminants during the proposed action.
- We expect minor and temporary negative effects to water quality due to improperly managed stormwater during the construction phase of the proposed action.
- We expect negative effects to water quality from stormwater runoff at the replacement bridge and downstream to the Pacific Ocean over the life of the new structure.
- We expect permanent stormwater treatment at the new structure and the stormwater triggered areas on both sides of the river to provide treatment for the direct discharge into the Columbia River, which will improve water quality relative to current conditions.

The following effects are effects to the substrate PBF of critical habitat:

- We expect a relatively small, temporary negative effect to substrate due to the placement of temporary work structures.
- We expect a relatively small permanent negative effect to substrate due to the placement of the new, permanent in-water structures due to hydraulic shadowing.
- We expect removal of the existing bridge will slightly decrease available substrate.
- We expect minor and temporary negative effects to substrate and spawning from stormwater runoff at the replacement bridge over the life of the new structure for CR Chum salmon and eulachon.

The following is the list of effects to the forage PBF of critical habitat:

- We expect that neither temporary nor permanent benthic habitat impacts will result in any measurable effect to forage habitat, but there will be a slight decrease.
- We expect removal of the existing bridge will increase available substrate, which may be beneficial to forage habitat.
- We expect minor negative effects to forage habitat from the loss of terrestrial habitat on the Oregon and Washington sides of the bridge.
- We expect a negative effect to forage habitat for many years due to permanent and temporary riparian losses of 17.62 acres on the Oregon side of the river and 1.94 acres of riparian habitat on the Washington side of the river.

The following is the list of effects to the natural cover and riparian vegetation PBF of critical habitat:

- We expect a negative effect to natural cover and riparian vegetation for many years due to permanent and temporary loss of functional riparian habitat on the Oregon and Washington sides of the river.

The following is the list of effects to the unobstructed safe passage PBF of critical habitat:

- We expect negative effects to natural cover and riparian vegetation from the permanent and temporary losses of functional riparian habitat (17.62 acres) on the Oregon side of the bridge.
- We expect hydraulic shadowing to cause changes in velocities and some delayed migration for juveniles.
- We expect a negative effect to natural cover and riparian vegetation for many years due to permanent and temporary losses of 1.94 acres of functional riparian habitat on the Washington side of the bridge.

Overall, critical habitat in the action area is degraded, the environmental baseline is highly modified, and cumulative effects like timber harvest, agriculture, irrigation withdrawals, mining, shipping, energy development, and human population increases are expected to continue. Although the mainstem Columbia River migration corridor is among the areas of high conservation value to the salmon and steelhead ESUs/DPSs included in this opinion, effects from the proposed action will cause only a small and localized decline in the quality and function of PBFs in the action area. Because of the small scale and extent of the effects to PBFs, we do not expect a reduction in the conservation value of critical habitat in the action area. As we scale up from the action area to the designated critical habitat for each species, and consider the status of critical habitat, the environmental baseline, and cumulative effects; the proposed action is not expected to appreciably reduce the conservation value of the designated critical habitat. Where it will be adversely impacted, FHWA will implement mitigation to offset those effects to ensure no net loss of habitat or habitat function. However, we do not know enough about the proposed mitigation to account for its potential beneficial effects in our analysis.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological

opinion that the proposed action is not likely to jeopardize the continued existence of LCR, UCR-SR, SR-SSR, UWR and SR-FR Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR, MCR, UCR, UWR and SRB steelhead, eulachon, green sturgeon, or sunflower sea star or destroy or adversely modify their designated critical habitat.

2.9. Incidental Take Statement

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

2.9.1. Amount or Extent of Take

In this biological opinion, NMFS determined that incidental take of juvenile LCR, UCR-SR, SR-SSR, UWR, and SR-FR Chinook salmon; CR chum salmon; LCR coho salmon; SR sockeye salmon; LCR, MCR, UCR, UWR, and SRB steelhead; green sturgeon; eulachon; and sunflower sea stars (post-construction stormwater effects only) will include:

- Electrofishing and other fish salvage efforts within cofferdams and other isolated work areas.
- Injury, death, and behavioral effects caused by pile driving
- Decreased water quality and increased sediment, noise, light, and riparian loss during construction; and,
- Increased avian and aquatic predation due to shading associated with overwater structures.
- Adverse effects caused by the Interstate Bridge and North Portland Harbor bridges separate from those associated with construction, including, but not limited to, the impact of post-construction stormwater discharge and hydraulic and hydrological impacts, including those resulting from floodplain fill.

The amount and extent of take in this ITS serves two functions: (1) it identifies the quantity of incidental take exempted for the action agency and applicant. In the case of a species without 4(d) protective regulations, such as eulachon or the sunflower sea star, which is only proposed to be listed, the exemption is not needed because incidental take is not prohibited, (2) The amount or extent of take identifies the anticipated level of take NMFS considered in reaching its

conclusion that the proposed action will not jeopardize the continued existence of a listed species. If this level of take is exceeded, reinitiation of consultation is triggered to ensure that NMFS's no-jeopardy conclusion remains valid.

The distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. In such circumstances, we use a take surrogate or take indicator that rationally reflects the incidental take caused by the proposed action. For the best available indicators for the extent of incidental take caused by the proposed action, we have identified the following:

1. The best available indicator for the extent of take associated with harm due to impaired feeding, resting, and sheltering caused by decreased habitat function associated with degraded water quality during construction of the Interstate Bridge and the North Portland Harbor Bridges, is the extent of suspended sediment plumes.

   NMFS expects that the elevated levels of suspended sediment resulting from construction actions will reach background levels within a 300-foot buffer from the point of suspended sediment generation. Listed fish and their prey resources can be harmed from a wide range of elevated sediment levels, and we expect that the harm will cease at the point where sediment levels return to background levels. Thus, the maximum extent of take caused by turbidity levels shall not exceed the take associated with an increase of up to 5 nephelometric turbidity units (NTUs) above background turbidity levels when the background turbidity is 50 NTUs or less, or there shall not be more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTUs. At no time should turbidity exceed 50 NTUs over background. Additionally, this potential increase in turbidity shall be limited to within a 300-foot buffer from the activity that causes the increased sediment.

   The extent of a suspended sediment plume is an effective indicator of take because 1) it is a leading indicator for the most critical type of off-site damage caused by construction practices, 2) turbidity monitoring is consistent with National Pollutant Discharge Elimination System (NPDES) requirements and Section 401 water quality certification requirements by the Oregon Department of Environmental Quality for construction activities that will take place in or near water bodies, and 3) the FHWA has contractual authority to take actions to address non-compliance.

2. The best available indicator for harm associated with the continuing presence of the Interstate Bridge and the North Portland Harbor Bridges is the as-built footprint for the new bridge footings in both channels. Take in the form of injury or death will occur as a result of associated increases in water velocities, hydraulic shadowing, and predation.

Specifically, the anticipated take for harm associated with the continued existence of the replaced Interstate Bridge and the North Portland Harbor Bridges will be exceeded if the proposed action is completed in a way that results in an as-built footprint that exceeds the size and volume shown by tables 3-5 and 3-6 of the BA incorporated by reference here (BA pages 3-77 and 3-85).

The as-built footprint of the Interstate Bridge and the North Portland Harbor Bridges project is an effective reinitiation trigger because it is directly correlated to the area over which harm due to floodplain fill is likely to occur, as well as the level of impacts to species (the more area filled by the Interstate Bridge and the North Portland Harbor Bridges, the greater the loss of available habitat). Such drawings are required by the FHWA as part of the close-out process for completed work to identify whether actual conditions deviate from plans and specification documents, and the FHWA and FTA have the authority to modify contracts or issue other directions as necessary to ensure that all contract terms have been met.

Therefore, the extent of take will be exceeded if:

- The size of the in-water structure exceeds 33,577 square feet in the Columbia River (not including shaft caps at water surface elevation).
- The size of the in-water structure exceeds 14,743 square feet in the North Portland Harbor.

3. The best available indicator for harm associated with the impact of post-construction stormwater discharge are a combination of stormwater facility design, construction, and maintenance and operations as described in NMFS (2021) because they will determine whether the stormwater treatment system is operated and maintained in way that continues to minimize the concentration of pollutants in stormwater runoff as designed, and thus, reflects the amount of incidental take analyzed in the opinion. Take in the form of injury or death will occur during stormwater discharges to the Columbia River for volumes of stormwater above the design storm of the BMP's. Stormwater BMPs will be designed to treat petroleum products and other chemicals and metals such as dissolved copper, dissolved zinc and the chemical byproduct of vehicle tire wear, 6PPD-Quinone. This extent of take includes the maintenance and operations of all BMP's for the life of the project. If FHWA fails to provide maintenance and monitoring reports for stormwater management facilities as described in the stormwater management plan; or if stormwater treatment systems are not designed and built to meet success criteria, take will be exceeded.

4. The best available indicator for harm associated with the impact hammer pile driving will be the number of impact driven pile strikes per day, and pile strikes per day with two pile drivers operating at once. Take in the form of injury or death may occur during impact pile driving. It is not possible to determine the number of juveniles that will be injured or killed by impact pile driving and the peak sound pressure wave or cumulative effects of sound pressure waves from repeated pile strikes during impact pile driving due to the highly

variable number of juveniles that will be present in the action area at any given time and difficulties in the ability to observe predation rates. Therefore, we use a surrogate for incidental take. The surrogate is causally linked to the take pathways because the risk of injury and severity of injury from sound pressure waves increase with peak sound level and additional pile strikes, and more fish are exposed to possible injury when the time period of pile driving is longer.

Therefore, the extent of take will be exceeded if:

- The number of pile strikes per day with one pile driver in operation exceeds 900 pile strikes, or the number of pile strikes per day with two pile drivers operating at once exceeds 1,800 pile strikes.

5. The best available indicator for incidental take associated with fish salvage due to electrofishing, seining, and use of minnow traps in isolated work areas and cofferdams during construction of the Interstate Bridge and the North Portland Harbor Bridges, is the square footage of areas isolated for containment needing fish salvage. Take of juvenile ESA-listed species in the form of injury or death will be caused by work area isolation and fish salvage operations. The total area to be isolated is approximately 25,095 square feet during IWW periods 1 through 6 and 37,587 square feet during IWW periods 7-9. Due to the highly variable number of juveniles that will be present in the action area at any given time and the impracticality of identifying/counting fish, it is not possible to determine the number of juveniles injured or killed during these operations. Therefore, we use a surrogate for incidental take. The surrogate for take is the square footage of isolated work area. The surrogate is causally linked to the take pathway because the scale of the effect is related to the size of the isolated area. Thus, the extent of take will be exceeded if the total isolated work area for the project is larger than 25,095 square feet during IWW construction and 37,587 square feet during IWW demolition. This surrogate functions as an effective reinitiation trigger because the area isolated will be monitored as it is happening, and the FHWA is obligated to notify NMFS and stop all activities if the extent of take is exceeded. For the mitigation areas at West Hayden Island, since they will be excluding fish using a sediment curtain, we are estimating 16,000 square feet per isolated area (3 isolated areas at West Hayden Island) for a total of 48,000 square feet of isolated areas. Therefore, if more than 48,000 square feet of area is isolated during work area isolation at West Hayden Island, then incidental take will be exceeded.

6. The best available indicator for harm associated with avian and piscine predation would be the size of the pier caps associated with the Interstate Replacement Bridge. It is not possible to determine the number of juveniles that will be injured or killed by avian and piscine predation due to the highly variable number of juveniles that will be present in the action area at any given time and difficulties associated with observing predation rates. Therefore, we use a surrogate for incidental take. The square footage of the pier caps associated with the Interstate Replacement Bridge is causally linked to the take pathway because it corresponds to the extent of habitat for predatory bird and fish species that would be created as a result of the proposed action. Thus, the extent of take will be

exceeded if the total surface area for the shaft caps is larger than 68,718 square feet. This surrogate functions as an effective reinitiation trigger because the amount of area isolated will be tracked as it is happening, and the FHWA is obligated to notify NMFS and stop all activities if the extent of take is exceeded.

Exceeding any of the indicators for extent of take will trigger the reinitiation.

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 incidental take (50 CFR 402.02). The FHWA and FTA shall:

1. Minimize incidental take from design, construction, in-water work, and pile driving, of the Interstate Bridge Replacement Project by applying conditions to the proposed construction actions that avoid or minimize adverse effects to water quality and the ecology of aquatic systems.
2. Ensure completion of a monitoring and reporting program to confirm that incidental take is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4. Terms and Conditions

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

Many elements of the Interstate Bridge Replacement Program will be consistent with the Design Criteria outlined in the Federal Aid Highway Programmatic (FAHP) associated with bridge replacement and stormwater management and will not be restated here.

1. To implement reasonable and prudent measure #1 (design, construction, in-water work, pile driving, of the Interstate Bridge Replacement Project), the FHWA shall ensure that the Interstate Bridge Replacement Project rehabilitation is completed as follows:
    a. When the construction of Interstate Bridge Replacement Program is complete, the FHWA and FTA will ensure that all equipment is removed, temporary buildings and other infrastructure are removed, post-construction cleanup is complete, and that the

project was completed with the dimensions consistent with, or reduced from those in the proposed action.

b. Minimize Impact Area. Confine construction impacts to the minimum area necessary to achieve project goals.

c. Pre-construction Activity. Before significant alteration of the project area, the following actions are completed:
    i. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of riparian vegetation, wetlands and other sensitive sites beyond the flagged boundary.
    ii. Emergency erosion controls. Ensure that the following materials for emergency erosion control are onsite.
        1. A supply of sediment control materials (e.g., silt fence, straw bales).
        2. An oil-absorbing floating boom whenever surface water is present. iii. Erosion controls. Erosion controls must be in place and appropriately installed downslope of riparian areas to be disturbed until site restoration is complete.

d. Site Preparation. Native materials will be conserved for site restoration.
    i. If possible, native material must be left where they are found.
    ii. Materials that are removed, damaged, or destroyed must be replaced with a functional equivalent during site restoration.
    iii. Any large wood, native vegetation, weed-free topsoil and native channel material displaced by construction must be stockpiled for use during site restoration.

e. Site restoration. Any significant disturbance of riparian vegetation, soils, streambanks, or stream channel must be cleaned up and restored after the action is complete. Although no single criterion is sufficient to measure restoration success, the intent is that the following features should be present in the upland parts of the project area, within reasonable limits of natural and management variation.
    i. Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.
    ii. Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.
    iii. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.
    iv. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
    v. Plant litter is well distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion (“litter dams”).
    vi. A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank.

f. Revegetation

i. Plant and seed disturbed areas before or at the beginning of the first growing season after construction.
ii. Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, etc. When feasible, use vegetation salvaged from local areas scheduled for clearing due to development.
iii. Use species native to the project area or region that will achieve shade and erosion control objectives, including forb, grass, shrub, or tree species that are appropriate for the site.
iv. Short-term stabilization measures may include use of non-native sterile seed mix if native seeds are not available, weed-free certified straw, jute matting, and similar methods.
v. Do not apply surface fertilizer within 50 feet of any wetland or water body.
vi. Install fencing as necessary to prevent access to revegetated sites by unauthorized persons.
vii. Do not use invasive or non-native species for site restoration.
viii. Conduct post-construction monitoring and treatment to remove or control invasive plants until native plant species are well-established.

2. Ensure completion of a monitoring and reporting program to confirm that take is not exceeded, compensatory mitigation plans are developed by the IBR project team and reviewed by NOAA Fisheries, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.
    a. Turbidity. The FHWA must record all turbidity monitoring in daily logs. The daily logs must include calibration documentation; background NTUs; compliance point NTUs; comparison of the points in NTUs; location; date; time; and tidal stage (if applicable) for each reading. Additionally, a narrative must be prepared discussing all exceedances with subsequent monitoring, actions taken, and the effectiveness of the actions. The FHWA must make available copies of daily logs for turbidity monitoring to ODEQ, NOAA Fisheries, USFWS, WDFW and ODFW upon request.
    b. Extent of Take. The FHWA must monitor and record data pertaining to extent of take metrics (turbidity mixing zone, daily pile strikes during impact pile driving, elevated pile cap surface area, the as-built footprint for construction actions related to the total and increased size of the bridge footings in both channels, work area isolation and fish salvage area in square feet during construction and demolition, and stormwater BMP maintenance and operation).
        i. For Stormwater Discharge, report the following:
            1. Number and type of stormwater BMPs installed, inspected and maintained (Claytor and Brown 1996; Santa Clara Valley Urban Runoff Pollution Prevention Program 1999; Santa Clara Valley Urban Runoff Pollution Prevention Program 2001), to ensure that facilities proposed to treat highway runoff meet approved design specifications are installed and maintained in a fully operational condition, including a process to identify which facilities and areas

require additional management attention to maintain service level over time. This indicator will be evaluated using the following information, as applicable to this project. "Preliminary Stormwater Recommendations" as developed by ODOT (2011b) in Chapter 4.6.2 Preliminary Stormwater Recommendations in the ODOT Hydraulics Manual, including specifically all LID practices and BMP alternatives considered and the proposed offset alternatives. This report should be sealed by a registered professional engineer.

2. "Stormwater Design Report" as developed by ODOT (2011b) in Chapter 4.6.4 Stormwater Design Report. This report should be sealed by a registered professional engineer and include, specifically:
    a. Any references to published design material
    b. Analysis methods used
    c. Narrative and calculations used in the design
    d. The number and type of stormwater LID practices that are applied and BMPs that are installed
    e. Inspection and maintenance requirements "Stormwater Operation and Maintenance Manual" as developed by ODOT (2011b) in Chapter 4.6.6 Stormwater Operation and Maintenance Manual with site-specific information on facility operation and maintenance, including specifically:
        i. Required and recommended maintenance actions
        ii. Inspection and maintenance schedule
        iii. A photograph of the stormwater outfall and a map showing the exact location of the project, stormwater outfall, and receiving water.

c. Project completion report. The FHWA must provide a report with the following information within 60 days of completing all construction:
    i. As-built drawings of the bridge bents and configuration in the Interstate Bridge Replacement Program corresponding to maps and drawings in the BA Appendix, and a table or set of tables as necessary to summarize the final dimensions of the project footprint, including:
        1. The total area affecting benthic communities of internal bents in the functional floodplain.
        2. Dimensions of isolated work areas requiring fish salvage
        3. The final project CIA and associated BMP's with maintenance schedules.
        4. A pile driving summary describing the locations, type, driving method, size and number of pile driven on the project. Include a summary of daily impact pile driving counts.
        5. Fish salvage records (species and numbers) including any data required under the NOAA Electrofishing Guidelines must be reported annually within 60 days of fish salvage operations.
        6. Stormwater Design Report.
    ii. Evidence of compliance with fish screen criteria for any pump used

iii. A summary of the results of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.

d. Post Construction Stormwater Management. The FHWA must record all monitoring required by the Post-Construction Stormwater Management Plan described in the proposed action in an annual monitoring report for a period of three years after project completion.

e. Compensatory Mitigation Plans. Compensatory mitigation plans will be developed and submitted to NOAA Fisheries for review. The plans must address all compensatory mitigation needs including those in Table 1-1 in Section 1.3 of this Opinion and section 3.4.13 of the BA.

f. Hydro-acoustic Monitoring. A Hydro-acoustic monitoring plan will be submitted for NOAA Fisheries review for all pile larger than 24". If the FHWA determines that an experimental attenuation method is likely to provide as much or more attenuation as an already approved method, it may substitute the experimental method, provided that an attenuation and monitoring plan are developed collaboratively with NMFS, and NMFS confirms that the effects of the experimental method are within the range of effects considered in this opinion.

   i. Monitoring is required to ensure the effectiveness of the technique or method.

   ii. The monitoring plan and implementation should include real-time monitoring so that in the event that onset of injury thresholds are exceeded, work can cease to check the effectiveness of the BMP's.

g. Reporting. Submit all monitoring reports to: projectreports.wcr@noaa.gov, Attn: WCRO-2023-02287

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).

- Several new impact pile sound attenuation methods are being researched and tested on the West Coast (e.g., double-walled piles). NMFS recommends that the FHWA look for opportunities to apply new attenuation methods during this project or partner with other agencies to test and research new attenuation methods on FHWA funded projects that cross the Columbia River.

- Look for opportunities to provide stormwater quality treatment in areas not required by the project.

Please notify NMFS if the FHWA carries out this recommendation so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit the listed species or their designated critical habitats.

2.11. Reinitiation of Consultation

This concludes formal consultation for the I-5 Interstate Bridge replacement project.

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

2.12. "Not Likely to Adversely Affect" Determinations

NMFS received the FHWA's request for written concurrence that the proposed action is not likely to adversely affect SRKW and its designated critical habitat in the BA dated September 18, 2023. NMFS prepared this response to the FHWA request pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for the preparation of letters of concurrence.

2.12.1. Southern Resident Killer Whale

NMFS listed the SRKW DPS, composed of J, K, and L pods, as endangered on February 16, 2006, (70 FR 69903) and updated the listing in 2014 (79 FR 20802). NMFS designated critical habitat in inland waters of Washington for the DPS in 2006 (71 FR 69054) and updated the listing to include certain coastal waters off Washington, Oregon, and California in 2021 (86 FR 41668). NMFS completed a recovery plan in 2008 (NMFS 2008b). Additionally, in our 2021 five-year status review we concluded that SRKWs should remain listed as endangered and we included recent information on the population, threats, and new research results and publications (NMFS 2021).

NMFS considers SRKWs to be one of the eight most at-risk species because the population has relatively high mortality and low reproduction and they are currently well below the population growth goals identified in their ESA Recovery Plan (NMFS 2008b). Unlike other North Pacific killer whale populations, which have generally been increasing since federal protection was initiated in the 1970s, the Southern Resident population remains small and vulnerable and has not had a net increase in abundance since the mid-1980s.

2.12.1.1 Effects to the Species

The proposed action may affect SRKWs indirectly through adverse effects to their primary prey, Chinook salmon. For purposed of SRKW, the action area extends into the Pacific Ocean where SRKW could be affected by a reduction in prey base. We determined that the project will cause mortality of a small number of migrating and rearing wild (i.e., natural-origin) juvenile LCR,

UCR-SR, SR-SSR, UWR, and SR-FR Chinook salmon, due to:(1) work area isolation and fish salvage activities, (2) underwater noise during pile driving, (3) reduced water quality during construction and demolition, (4) lost functional riparian habitat; (5) increased temporary overwater and in-water structures, (6) perching opportunities for avian predators, (7) the new in-water foundations, and (8) stormwater pollutant discharge. Mortalities will be spread out among ESUs that have populations that spawn upstream of the action area. Although some of these juveniles would not survive to adult, we assume the loss of juveniles from each ESU and DPS during the 9-15 year project and the annual loss of a very small number of juveniles from each ESU over the life of the new structure will result in the loss of a very small number of adult Chinook salmon each year in the ocean.

Chinook salmon stocks from the Columbia River comprise over half of the Chinook salmon consumed by the K and L pods in winter and spring (Hanson et al. 2021). Chinook salmon consumed across winter months in outer coast waters tend to be mainly from LCR fall-run stocks and UCR summer- and fall-run stocks in the early part of winter, and Middle or UCR spring-run stocks later in winter. According to a NMFS and WDFW 2018 analysis of priority Chinook stocks for the SRKW's diet, out of 31 stocks analyzed, fall runs from the LCR tied for third as most important and fall runs from the SR and spring runs from the LCR tied for fifth. The SR fall-run of Chinook salmon and the LCR White Salmon River spring-run and fall-run, Hood River spring-run and fall-run, Upper Gorge tule fall-run populations, and the UWR Chinook salmon will be adversely affected by the proposed action. All of these populations are currently small (the status of the Upper Gorge tule fall-run population is unknown) and comprise very low percentages of the five-year geometric mean of raw natural spawner counts and total spawner counts for their respective runs. Therefore, we do not expect the loss of juvenile LCR spring- and fall-run Chinook salmon, UCR spring-run Chinook salmon, SR-SSR Chinook salmon, SR-FR Chinook salmon, and UWR Chinook salmon during the 9 IWW years of the project, or the annual loss of these juveniles over the life of the new structure, which would result in the loss of a very small number of adult Chinook salmon in the ocean, will detectably alter prey availability for SRKWs. We also do not expect the annual loss of juveniles from the White Salmon River spring-run and fall-run, Hood River spring-run and fall-run, Upper Gorge tule fall-run populations of LCR Chinook salmon, and UWR Chinook salmon, which may translate into a possible loss of a few adults each year, will appreciably alter the availability of food for SRKWs. And thus, we expect the effect of the proposed action on SRKWs and their prey base to be insignificant.

2.12.1.2 Effects to the Critical Habitat

NMFS designated critical habitat for the SRKW DPS on November 29, 2006 (71 Fed. Reg. 69054). On September 1, 2021, NMFS revised the critical habitat designation for the SRKW DPS by designating six additional coastal critical habitat areas along the U.S. West Coast (86 FR 41668). Critical habitat consists of nine specific areas: (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; (4) Coastal Washington/Northern Oregon Inshore Area; (5) Coastal Washington/Northern Oregon Offshore Area; (6) Coastal Washington/Northern Oregon Offshore Area; (7) Northern California Coast Area; (8) North Central California Coast Area; and (9) Monterey Bay Area. These areas comprise approximately 18,470 square miles of marine habitat.

Based on the natural history of the SRKWs and their habitat needs, NMFS identified the following PBFs essential to conservation: (1) water quality to support growth and development; (2) prey species of sufficient quantity, quality and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The effects of the proposed action on salmonids occur outside of the designated SRKW critical habitat. However, Chinook salmon are an important component of the SRKW's diet. Age, size, and caloric content all affect the quality of prey, as do contaminants and pollution. The availability of key prey is essential to the whales' conservation. Availability of prey along the coast is likely limited at particular times of year due to the small run sizes of some important Chinook salmon stocks, as well as the distribution of preferred adult Chinook salmon that may be relatively spread out prior to their aggregation when returning to their natal rivers.

We considered the effects to SRKW throughout the extent of the action area, which for SRKW, includes those areas in the ocean that could experience prey reduction. We determined the effect to the prey base PBF of SRKWs will be permanent, but small in magnitude, and therefore insignificant, for the following reasons:

- The Columbia River Chinook salmon ESUs that will be affected by the proposed action are only a minority portion of the SRKW summer prey base (Fraser River stocks dominate the diet).
- We expect the number of adult and juvenile Chinook salmon adversely affected by the proposed action will be very small in magnitude compared Columbia Basin Chinook salmon production.
- Hatchery fish comprise 50-80 percent of Chinook salmon runs in the Columbia Basin, suggesting a large portion of hatchery Chinook salmon comprise the diet of K and L pods in the mid-winter/early spring.

2.12.1.3 Conclusion

Based on this analysis, NMFS concurs with the FHWA that the proposed action is not likely to adversely affect SRKWs or its designated critical habitat.

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 FHWA and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council (PFMC 2005), coastal pelagic species (CPS) (PFMC 1998), Pacific Coast salmon (PFMC 2014); and highly migratory species (HMS) (PFMC 2007)] contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The proposed action area for this consultation is described in Section 2.3 of this document and includes areas designated EFH for various life-history stages of two Pacific Coast salmon species: Chinook salmon and coho salmon (PFMC 2014), coastal pelagic species (PFMC 1998), and Pacific Groundfish species (PFMC 2005). Habitat areas of particular concern (HAPC) within the action area include estuaries, complex channel and floodplain habitat, and thermal refugia (PFMC 2005, 2014).

Freshwater EFH for Pacific Coast Chinook and coho salmon consists of four major components: 1) spawning and incubation, 2) juvenile rearing, 3) juvenile migration corridors, and 4) adult migration corridors and holding habitat, and overall, can include any habitat currently or historically occupied within Washington, Oregon, and Idaho. The important components of Pacific salmon marine EFH are: 1) estuarine rearing, 2) ocean rearing; and 3) juvenile and adult migration. The only marine EFH habitat found within the action area for this consultation is the estuarine rearing habitat in the lower Columbia River. Freshwater EFH found within the action area for this consultation includes components noted above for Chinook salmon and coho salmon. Detailed descriptions and identifications of EFH for salmon are found in Appendix A of Amendment 18 of the Pacific Coast Salmon Plan (PFMC 2014).

3.2. Adverse Effects on Essential Fish Habitat

The proposed action has the potential to affect EFH for Pacific salmon species. Specific elements of the proposed action that could impact EFH are discussed in detail in section 2.5.2 of this document.

Specifically, NMFS has determined that the action will adversely affect EFH as follows:

- Temporary reduction in juvenile and adult rearing and migration habitat due to work area isolation structures.
- Temporary reduction in juvenile and adult rearing and migration habitat due to underwater noise during pile driving.

- Temporary reduction in juvenile and adult rearing and migration habitat due to reduced water quality during construction and demolition.
- Long-term reduction in juvenile rearing and migration habitat due to the permanent and temporary loss of functional riparian habitat.
- Temporary reduction in juvenile rearing and migration habitat due to temporary overwater and in-water structures.
- Long-term reduction in juvenile rearing and migration habitat due to permanent overwater structures allowing avian predator perching opportunities.
- Permanent loss of juvenile rearing and migration habitat due to the new, in-water foundations.
- Long-term reduction in juvenile rearing and migration habitat due to the permanent and temporary loss of functional riparian habitat.

3.3. Essential Fish Habitat Conservation Recommendations

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

We provide the following conservation recommendations:

Implement RPM 1 Ensuring that design, construction, in-water work, pile driving; avoid or minimize adverse effects to water quality and the ecology of aquatic systems, and its terms and conditions described in the ITS in section 2.9.4 of this document, to minimize adverse effects to EFH due to reduced water quality, ensonified habitat due to pile driving, and reducing the potential for predation.

Implement RPM 2 Ensure completion of a monitoring and reporting program to confirm that take is not exceeded, and that compensatory mitigation is developed and applied to offset the impacts of habitat degradation due to the bridge construction., and its terms and conditions described in the ITS in section 2.9.4 of this document, to minimize adverse effects to EFH due to the loss and degradation of essential habitat.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, 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, FHWA 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 FHWA must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion is FHWA. Other interested users could include ODOT, the City of Portland, the City of Vancouver. Individual copies of this opinion were provided to the FHWA. 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 was reviewed in accordance with West Coast Region ESA quality control and assurance processes.

5. REFERENCES

88 FR 2023, Proposed Rule To List the Sunflower Sea Star as Threatened Under the Endangered Species Act. National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. Federal Register / Vol. 88, No. 51 / Thursday, March 16, 2023 / Proposed Rules. 16212.

Allan et al. 2003 Allan, J. D., M. S. Wipfli, J. P. Caouette, A. Prussian, and J. Rodgers. 2003. Influence of streamside vegetation on inputs of terrestrial invertebrates to salmonid food webs. Canadian Journal of Fisheries and Aquatic Sciences 60(3): 309–320.

Alpers, C.N., R.C. Antweiler, H.E. Taylor, P.D. Dileanis, and J.L. Domagalski, (editors). 2000a. Volume 2: Interpretation of metal loads. In: Metals transport in the Sacramento River, California, 1996-1997, Water-Resources Investigations Report 00-4002. U.S. Geological Survey. Sacramento, California.

Alpers, C.N., R.C. Antweiler, H.E. Taylor, P.D. Dileanis, and J.L. Domagalski, (editors). 2000b. Volume 1: Methods and Data. In: Metals Transport in the Sacramento River, California, 1996-1997, Water-Resources Investigations Report 99-4286. U.S. Geological Survey. Sacramento, California.

Anderson, C.W., F.A. Rinella, and S.A. Rounds. 1996. Occurrence of selected trace elements and organic compounds and their relation to land use in the Willamette River Basin, Oregon, 1992–94. U.S. Geological Survey. Water-Resources Investigations Report 964234. Portland, Oregon.

Anderson, C.R., and J.A. Reyff. 2006. Port of Oakland Berth 23 – Underwater sound measurement data for the driving of sheet steel piles and square concrete piles: November 17 and December 3, 2005. Illingsworth and Rodkin, Inc. Petaluma, California. Report.

Aquino, C. A., Besemer, R. M., DeRito, C. M., Kocian, J., Porter, I. R., Raimondi, P. T., Rede, J. E., Schiebelhut, L. M., Sparks, J. P., Wares, J. P., and I. Hewson. 2021. Evidence that microorganisms at the animal-water interface drive sea star wasting disease. Frontiers in Microbiology. 11(3278)

Baird, R. W. 2000. The killer whale: Foraging specialization and group hunting. Cetacean Societies: Field Studies of Dolphins and Whales. 127-153.

Barnett-Johnson, R., C. B. Grimes, C. F. Royer, and C. J. Donohoe. 2007. Identifying the contribution of wild and hatchery Chinook salmon (Oncorhynchus tshawytscha) to the ocean fishery using otolith microstructure as natural tags. Canadian Journal of Fisheries and Aquatic Sciences 64(12):1683-1692.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. University of Washington.

Bottom, D. L., C. A. Simenstad, J. Burke, A. M. Baptista, D. A. Jay, K. K. Jones, E. Casillas, and M. H. Schiewe. 2005. Salmon at River's End: The role of the Estuary in Decline and Recovery of Columbia River Salmon. NOAA Technical Memorandum NMFS-NWFSC-68, Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington.

Bowerman, T., M. L. Keefer, and C. C. Caudill. 2021. Elevated stream temperature, origin, and individual size influence Chinook salmon prespawn mortality across the Columbia River Basin. Fisheries Research 237:105874.

Brown, R. S., T. J. Carlson, A. E. Welch, J. R. Stephenson, C. S. Abernethy, B. D. Ebberts, M. J. Langeslay, M. L. Ahmann, D. H. Feil, J. R. Skalski, and R. I. Townsend. 2009. Assessment of barotrauma from rapid decompression of depth-acclimated juvenile Chinook salmon bearing radiotelemetry transmitters. Transactions of the American Fisheries Society 138(6):1285–1301.

Brown, R. S., T. J. Carlson, A. J. Gingerich, J. R. Stephenson, B. D. Pflugrath, A. E. Welch, M. J. Langeslay, M. L. Ahmann, R. L. Johnson, J. R. Skalski, A. G. Seaburg, and R. L. and Townsend. 2012. Quantifying mortal injury of juvenile Chinook salmon exposed to simulated hydro-turbine passage. Transactions of the American Fisheries Society, 141(1), 147-157.

Brown, R., and D. Geist.. 2002. Determination of Swimming Speeds and Energetic Demands of Upriver Migrating Fall Chinook Salmon (*Oncorhynchus tshawytscha*) in the Klickitat River, Washington. Project No. 2001-02400, BPA Report DOE/BP-00000652-9). August 2002.

Buckler, D.R., and G.E. Granato. 1999. Assessing biological effects from highway-runoff constituents. U.S. Geological Survey, Open File Report 99-240. Northborough, Massachusetts. 45 p.

California Department of Transportation. (Caltrans 2020). Technical guidance for assessment of the hydroacoustic effects of pile-driving on fish. Department of Environmental Analysis, Environmental Engineering. Sacramento, California. Available online at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/hydroacoustic-manual.pdf

Carlson et al. 2007 Carlson, T., M. Hastings, and A. N. Popper. 2007. Update on Recommendations for Revised Interim Sound Exposure Criteria for Fish during Pile Driving Activities. Memorandum to Suzanne Theiss (California Department of Transportation) and Paul Wagner (Washington State Department of Transportation).

Carretta, J. W., E. M. Olson, K. A. Forney, M. M. Muto, D. W. Weller, A. R. Lang, J. Baker, B. Hanson, A. J. Orr, J. Barlow, J. E. Moore, R. L. Brownell. 2021. U.S. Pacific Marine Mammal Stock Assessments: 2021. NOAA- TM-NMFS-SWFSC-646.

https://media.fisheries.noaa.gov/2021-07/Pacific%202020%20SARs%20Final%20Working%20508.pdf?null%09

Caudill, C. C., M. L. Keefer, T. S. Clabough, G. P. Naughton, B. J. Burke, and C. A. Peery. 2013. Indirect effects of impoundment on migrating fish: temperature gradients in fish ladders slow dam passage by adult Chinook Salmon and steelhead. PLoS ONE 8:e85586. DOI: 10.1371/journal.pone.0085586.

Celedonia, M. T., R. A. Tabor, S. Sanders, S. Damm, D. W. Lantz, T. M. Lee, Z. Li, J. Pratt, B. E. Price, and L. Seyda. 2008. Movement and Habitat Use of Chinook Salmon Smolts, Northern Pikeminnow, and Smallmouth Bass Near the SR 520 Bridge. 2007 Acoustic Tracking Study. Final Report to WSDOT. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Fisheries Division, Lacey, Washington. October 2008.

City of Portland. 2022. Floodplain Resilience Plan Proposed Draft. Available at < https://efiles.portlandoregon.gov/record/15354113 > Accessed April 6, 2023.

Claytor, R.A., and W.E. Brown. 1996. Environmental Indicators to Assess Stormwater Control Programs and Practices: Final Report. Center for Watershed Protection. Silver Spring, Maryland.

Colman, J.A., K.C. Rice, and T.C. Willoughby. 2001. Methodology and significance of studies of atmospheric deposition in highway runoff. U.S.G. Survey, Open-File Report 01-259. Northborough, Massachusetts. 63 p.

Collis et al. 2002, Collis, K., D. D. Roby, D. P. Craig, S. Adamany, J. Y. Adkins, and D. E. Lyons. 2002. Colony size and diet composition of piscivorous waterbirds on the lower Columbia River: implications for losses of juvenile salmonids to avian predation. Transactions of the American Fisheries Society 131:537– 550.

Collis, K., R.E. Beaty and B.R. Crain. 1995. Changes in catch rate and diet of northern squawfish associated with the release of hatchery-reared juvenile salmonids in a Columbia River reservoir. North American Journal of Fisheries Management 15:346-357.

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

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I.C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T. H. Williams, and E. Willis-Norton. 2019. Climate vulnerability assessment for Pacific salmon and steelhead

in the California Current Large Marine Ecosystem: PLoS ONE, https://doi.org/10.1371/journal.pone.0217711.

Crozier, L. G., J. E. Siegel, L. E. Wiesebron, E. M. Trujillo, B. J. Burke, B. P. Sandford, and D. L. Widener. 2020. Snake River sockeye and Chinook salmon in a changing climate: Implications for upstream migration survival during recent extreme and future climates. PLoS ONE 15(9): e0238886. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238886.

Crozier, L. G., B. J. Burke, B. E. Chasco, D. L. Widener, and R. W. Zabel. 2021. Climate change threatens Chinook salmon throughout their life cycle. Available at: https://www.nature.com/articles/s42003- 021-01734-w.pdf.

Darnell, R.M. 1976. Impacts of construction activities in wetlands of the United States. U.S. Environmental Protection Agency, Environmental Research Laboratory. Ecological Research Series, Report No. EPA-600/3-76-045. U.S. Environmental Protection Agency, Environmental Research Laboratory. Corvallis, Oregon.

DEA (David Evans and Associates). 2011. Columbia River Crossing Test Pile Project Hydroacoustic Monitoring Final Report. July 2011.

DEA. 2006. Columbia River Crossing Hydrographic and Geophysical Investigation: High Resolution Bathymetric Mapping, River Bed Imaging, and Subbottom Investigation. Prepared for the Oregon Department of Transportation and Washington State Department of Transportation.

Dedual, M., and K. J. Collier. 1995. Aspects of juvenile rainbow trout (*Oncorhynchus mykiss*) diet in relation to food supply during summer in the lower Tongariro River, New Zealand. New Zealand Journal of Marine and Freshwater Research (29).

Driscoll, E.D., P.E. Shelley, and E.W. Strecher. 1990. Pollutant loadings and impacts from highway runoff, Volume III: Analytical investigation and research report. Federal Highway Administration, Office of Engineering and Highway Operations Research and Development. FHWD-RD-88-0088. McLean, Virginia.

Elliott, J. M. 1973. The food of brown and rainbow trout (*Salmo trutta and S. gairdneri*) in relation to the abundance of drifting invertebrates in a mountain stream. Oecologia 12(4):329–347.DeLacy, A.C. and Batts, B.S. 1963. Possible population heterogeneity in the Columbia River smelt. College of Fisheries, Fisheries Research Institute Circular No. 198, University of Washington, Seattle.

Erickson, A. W. 1978. Population studies of killer whales (*Orcinus orca*) in the Pacific Northwest: a radio-marking and tracking study of killer whales. Contract PB-285 615, Marine Mammal Commission, Washington, D.C., 31 p.

Evans, A. F., K. Collis, N. V. Banet, J. Marchiani, E. Casey, Q. Payton, B. Cramer, D. D. Roby, and T. J. Lawes.2023. Avian Predation in the Columbia River Basin: 2022 Final Annual Report. Submitted by Real Time Research, Inc., and Oregon State University to Bonneville Power Administration, Grant County Public Utility District, and the Priest Rapids Coordinating Committee. March 31, 2023.

EPA (Environmental Protection Agency). 2020a. Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. U.S. Environmental Protection Agency, Seattle, WA. May 2020. Available at TMDL for Temperature in the Columbia and Lower Snake Rivers. US EPA.

EPA (Environmental Protection Agency). 2020b. Assessment of Impacts to Columbia and Snake River Temperatures using the RBM10 Model Scenario Report: Appendix D to the Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. U.S. Environmental Protection Agency, Seattle, WA. May 2020. Available at TMDL for Temperature in the Columbia and Lower Snake Rivers. US EPA.

EPA (Environmental Protection Agency). 2021. Columbia River Cold Water Refuges Plan. U.S. Environmental Protection Agency, Seattle, WA. January 2021. Available at https://www.epa.gov/columbiariver/columbia-river-cold-water-refuges-plan.

EPA (U.S. Environmental Protection Agency). 2008. Third National Coastal Condition Report (NCCR III). U.S. Environmental Protection Agency, Office of Water and Office of Research and Development. EPA/842-R-08-002. Washington, D.C.

Feist, B.E., E.R. Buhle, D.H. Baldwin, J.A. Spromberg, S.E. Damm, J.W. Davis, N.L. Scholz. 2018. Roads to Ruin: Conservation Threats to Sentinel Species across an Urban Gradient. Ecological Applications 27(8):2382-2396.

Fisheries Hydroacoustic Working Group. 2008. Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities. Memorandum dated June 12, 2008. Available online at: http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf

Ford, J. K. B., G. M. Ellis, L. G. Barrett-Lennard, et al. 1998. Dietary specialization in two sympatric populations of killer whales (*Orcinus orca*) in coastal British Columbia and adjacent waters. Canadian Journal of Zoology 76:1456-1471.

Ford, J. K. B., G. M. Ellis, and K. C. Balcomb. 2000. Killer whales: the natural history and genealogy of Orcinus orca in British Columbia and Washington. Second edition. UBC Press, Vancouver, British Columbia.

Ford, J. K. B. 2002. Killer whale Orcinus orca. Pages 669-676 in W. F. Perrin, B. Würsig, and J. G. M. Thewissen, editors. Encyclopedia of marine mammals. Academic Press, San Diego, California.

Ford, J. K. B., and G. M. Ellis. 2006. Selective foraging by fish-eating killer whales Orcinus orca in British Columbia. Marine Ecology Progress Series 316:185-199.

Ford J. K. B, G. M. Ellis, P. B. Olesiuk, and K. C. Balcomb, Ford et.al 2010. Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator? Biology Letters 6(1):139–42.

Ford, M. J., J. Hempelmann, and M. Hanson, et al. 2016. Estimation of a Killer Whale (*Orcinus orca*) Population's Diet Using Sequencing Analysis of DNA from Feces. PLoS ONE 11(1):69-82.

Ford, M. J., K. M. Parsons, E. J. Ward, J. A. Hempelmann, C. K. Emmons, M. Bradley Hanson, K. C. Balcomb, and L. K. Park, L. K. 2018. Inbreeding in an endangered killer whale population. Animal Conservation 21:423-432.

Ford, M. J., editor. 2022. Biological viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-171.

Fowler 2004; Fowler, R. T. 2004. The recovery of benthic invertebrate communities following dewatering in two braided rivers. Hydrobiologia 523:17–28.

Fresh, K.L., E. Casillas, L.L. Johnson, and D.L. Bottom. 2005. Role of the estuary in the recovery of Columbia River Basin salmon and steelhead: An evaluation of the effects of selected factors on salmonid population viability. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-69. 105 p.

Gravem SA, Heady WN, Saccomanno VR, Alvstad KF, Gehman ALM, Frierson TN, Hamilton SL. 2021. *Pycnopodia helianthoides*. IUCN Red List of Threatened Species 2021. 43.

Gregory, R.S., and Levings, C.D. 1998. Turbidity Reduces Predation on Migrating Juvenile Pacific Salmon. Transactions of the American Fisheries Society, 127:275-285.

Griffith and Andrews 1981 Griffith, J. S., and D. A. Andrews. 1981. Effects of a Small Suction Dredge on Fishes and Aquatic Invertebrates in Idaho Streams. North American Journal of Fisheries Management 1:21–28.

Halvorsen, M.B., Casper, B.M., Woodley, C.M., Carlson, T.J., and Popper, A.N. 2012. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLoS ONE 7(6): e38968. doi:10.1371/journal.pone.0038968

Hamilton SL, Saccomanno VR, Heady WN, Gehman AL, Lonhart SI, Beas-Luna R, Francis FT, Lee L, Rogers-Bennett L, Salomon AK, and SA Gravem. 2021. Disease-driven mass mortality event leads to widespread extirpation and variable recovery potential of a

marine predator across the eastern pacific. Proceedings of the Royal Society B. 288(1957): 20211195.

Hanson, M. B., R. W. Baird, J. K. B. Ford, J. Hempelmann-Halos, D. M. Van Doornik, J. R. Candy, C. K. Emmons, G. S. Schorr, B. Gisborne, K. L. Ayres, S. K. Wasser, K. C. Balcomb, K. BalcombBartok, J. G. Sneva, and M. J. Ford. 2010. Species and stock identification of prey consumed by endangered Southern Resident killer whales in their summer range. Endangered Species Research 11:69–82. DOI: 10.3354/esr00263.

Hanson, M. B., J. A. Nystuen, and M. O. Lammers. 2013. Assessing the coastal occurrence of endangered killer whales using autonomous passive acoustic recorders. Journal of the Acoustical Society of America 134(5):3486–3495.

Hanson, M. B., E. J. Ward, C. K. Emmons, M. M. Holt, and D. M. Holzer. 2017. Assessing the movements and occurrence of Southern Resident Killer Whales relative to the U.S. Navy's Northwest Training Range Complex in the Pacific Northwest. Prepared for: U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI. Prepared by: National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center under MIPR N00070-15-MP-4C363. 30 June 2017. 23 pp.

Hanson, M. B., E. J. Ward, C. K., Emmons, and M. M. Holt. 2018. Modeling the occurrence of endangered killer whales near a U.S. Navy Training Range in Washington State using satellitetag locations to improve acoustic detection data. Prepared for: U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI. Prepared by: National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center under MIPR N00070-17-MP-4C419. 8 January 2018. 33 p.

Hanson, M. B., C. K. Emmons, M. J. Ford, M. Everett, K. Parsons, L. K., Park, J. Hempelmann, D. M. Van Doornik, G. S. Schorr, J. K. Jacobsen, M. F. Sears, M. S. Sears, J. G. Sneva, R. W. Baird, and L. Barre, L. 2021. Endangered predators and endangered prey: Seasonal diet of Southern Resident killer whales. PLoS One 16(3).

Harnish et al. 2014) Harnish, R. A., E. D. Green, K. A. Deters, K. D. Ham, Z. Deng, H. Li, B. Rayamajhi, K. W. Jung, and G. A. McMichael. 2014. Survival of Wild Hanford Reach and Priest Hatcheries Fall Chinook Salmon Juveniles in the Columbia River: Predation Implications.

PNNL-23719. Battelle Pacific Northwest National Laboratory prepared for the Pacific Salmon Commission under U.S. Department of Energy contract #DE-AC05-76RL01830. Richland, Washington. October.

Halvorsen, M.B., Casper, B.M., Woodley, C.M., Carlson, T.J., and Popper, A.N. 2012. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLoS ONE 7(6): e38968. doi:10.1371/journal.pone.0038968

Hastings and Popper 2005) Hastings, M. C., and A. N. Popper. 2005. Effects of Sound on Fish. Report prepared for Jones and Stokes and to California Department of Transportation. Sacramento, California.

Hayslip, G., L. Edmond, V. Partridge, W. Nelson, H. Lee, F. Cole, J. Lamberson, and L. Caton. 2006. Ecological Condition of the Estuaries of Oregon and Washington. U.S. Environmental Protection Agency, Office of Environmental Assessment, Region 10. EPA 910-R-06-001. Seattle, Washington.

Hastings, M.C., A.N. Popper, J.J. Finneran, and P. Lanford. 1996. Effects of low frequency sound on hair cells of the inner ear and lateral line of the teleost fish Astronotus ocellatus. Journal of the Acoustical Society of America 99:1759-1766.

Heady W, Beas-Luna R, Dawson M, Eddy N, Elsmore K, Francis F, Frierson T, Gehman AL, Gotthardt T, Gravem SA, Hamilton SL, Hannah L, Harvell CD, Hodin J, Kelmartin I, Krenz C, Lee L, Lorda J, Lowry D, Mastrup S, Meyer E, Raimondi PT, Rumrill SS, saccomanno VR, Schiebelhut LM, and C Siddon. 2022. Roadmap to recovery for the sunflower sea star (*Pycnopodia helianthoides*) along the west coast of North America. Sacramento, CA: The Nature Conservancy. 44 pp

Hecht, S.A., D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: Applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. U.S. Department of Commerce, NOAA Fisheries, NOAA Technical Memorandum NMFSNWFSC-83. 39 p.

Heintz, R.A., J.W. Short, and S.D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil: Part II. Increased mortality of pink salmon (Oncorhynchus gorbuscha) embryos incubating downstream from weathered Exxon Valdez crude oil. Environmental Toxicology and Chemistry 18:494-503.

Heintz, R.A., S.D. Rice, A.C. Wertheimer, R.F. Bradshaw, F.P. Thrower, J.E. Joyce, and J.W. Short. 2000. Delayed effects on growth and marine survival of pink salmon Oncorhynchus gorbuscha after exposure to crude oil during embryonic development. Marine Ecology Progress Series 208:205-216.

Hewson I, Bistolas KSI, Quijano Cardé EM, Button JB, Foster PJ, Flanzenbaum JM, Kocian J, Lewis CK. 2018. Investigating the complex association between viral ecology, environment, and Northeast Pacific sea star wasting. Frontiers in Marine Science. 5.

Hilborn, R., S. P. Cox, F. M. D. Gulland, D. G. Hankin, N. T. Hobbs, D. E. Schindler, and A. W. Trites. 2012. The Effects of Salmon Fisheries on Southern Resident Killer Whales: Final Report of the Independent Science Panel. Prepared with the assistance of D.R. Marmorek and A.W. Hall, ESSA Technologies Ltd., Vancouver, B.C. for National Marine Fisheries Service (Seattle. WA) and Fisheries and Oceans Canada (Vancouver. BC).

Incardona, J.P., T.K. Collier, and N.L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicology and Applied Pharmacology 196:191-205.

Incardona, J.P., M.G. Carls, H. Teraoka, C.A. Sloan, T.K. Collier, and N.L. Scholz. 2005. Aryl hydrocarbon receptor-independent toxicity of weathered crude oil during fish development. Environmental Health Perspectives 113:1755-1762.

Incardona, J.P., H.L. Day, T.K. Collier, and N.L. Scholz. 2006. Developmental toxicity of 4-ring polycyclic aromatic hydrocarbons in zebrafish is differentially dependent on AH receptor isoforms and hepatic cytochrome P450 1A metabolism. Toxicology and Applied Pharmacology 217:308-321.

Isaak, D. J., C. H. Luce, D. L. Horan, G. L. Chandler, S. P. Wollrab, and D. E. Nagel. 2018. Global warming of salmon and trout rivers in the northwestern U.S.: road to ruin or path through purgatory? Transactions of the American Fisheries Society 147:566–587.

ISAB (Independent Scientific Advisory Board). 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife.

ISAB. 2000. The Columbia River Estuary and the Columbia River Basin Fish and Wildlife Program. A Review of the Impacts of the Columbia River's Hydroelectric System on Estuarine Conditions. Conducted for the Northwest Power Planning Council in conjunction with studies by NOAA Fisheries.

Johnson, L.L., G.M. Ylitalo, M.R. Arkoosh, A.N. Kagley, C.L. Stafford, J.L. Bolton, J. Buzitis, B.F. Anulacion, and T.K. Collier. 2007. Contaminant exposure in outmigrant juvenile salmon from Pacific Northwest estuaries. Environmental Monitoring and Assessment 124:167-194.

Jorgensen, J. C., C. Nico, C. Fogel, and T. J. Beechie. 2021. Identifying the potential of anadromous salmonid habitat restoration with life cycle models. PLoS ONE 16(9): e0256792.

Kayhanian, M., A. Singh, C. Suverkropp, and S. Borroum. 2003. Impact of annual average daily traffic on highway runoff pollutant concentrations. Journal of Environmental Engineering 129:975-990.

Krahn, M. M., D. P. Herman, G. M. Ylitalo, et al. 2004. Stratification of lipids, fatty acids and organochlorine contaminants in blubber of white whales and killer whales. Journal of Cetacean Research and Management 6:175–189.

Krahn, M. M., M. B. Hanson, G. S. Schorr, C. K. Emmons, D. G. Burrows, J. L. Bolton, R. W. Baird, and G. Ylitalo. 2009. Effects of age, sex and reproductive status on persistent organic pollutant concentrations in "Southern Resident" killer whales. Marine Pollution Bulletin 58:1522-1529.

Lacy, R. C., R. Williams, E. Ashe, K. C. Balcomb, J. N. Brent, C. W. Clark, and P. C. Paquet. 2017. Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans. Scientific Reports 7:14119. DOI: 10.1038/s41598-017-14471-0.

Lawonn, J. 2022. Draft Proposal for Adaptive Management of Double-crested Cormorants in the Columbia River Estuary. Oregon Department of Fish and Wildlife, Salem, Oregon.

Laughlin, J. 2006. Underwater sound levels associated with pile driving at the Cape Disappointment Boat Launch Facility Wave Barrier Project. Washington State Department of Transportation, Office of Air Quality and Noise. Seattle.

LCREP (Lower Columbia River Estuary Partnership). 2007. Lower Columbia River and estuary ecosystem monitoring: Water quality and salmon sampling report. Lower Columbia River Estuary Partnership.

LCFRB (Lower Columbia River Fish Recovery Board). 2010. Washington Lower Columbia Salmon Recovery and Fish and Wildlife Plan. Longview, Washington. (May 28, 2010, Final)

Levin, P. S., and J. G. Williams. 2002. Interspecific effects of artificially propagated fish: An additional conservation risk for salmon. Conservation Biology 16:1581-1587.

Liberman 2016 Liberman, M. C. 2016. Noise-induced hearing loss: Permanent versus temporary threshold shifts and the effects of hair cell versus neuronal degeneration. *In* A. N. Popper & A. D. Hawkins (editors), The Effects of Noise on Aquatic Life II (pp. 1–7). New York: Springer.

Loge, F., M.R. Arkoosh, T.R. Ginn, L.L. Johnson, and T.K. Collier. 2006. Impact of environmental stressors on the dynamics of disease transmission. Environmental Science & Technology 39(18):7329-7336.

Lower Columbia River Estuary Partnership. 2007. Lower Columbia River and estuary ecosystem monitoring: Water quality and salmon sampling report. Portland, Oregon.

Lowry, D., Pacunski, R., Hennings, A., Blaine, J., Tsou, T., Hillier, L., Beam, J., and E. Wright. 2022. Assessing bottomfish and select invertebrate occurrence, abundance, and habitat associations in the U.S. Salish Sea with a small, remotely operated vehicle: results of the Page 249 of 292 2012-13 systematic survey. Olympia, WA: Washington Department of Fish and Wildlife. FPT 22-03. 67 pp.

McCarthy et al. 2009 McCarthy, S. G., J. J. Duda, J. A. Emlen, G. R. Hodgson, and D. A. Beauchamp. 2009. Linking habitat quality with trophic performance of steelhead along forest gradients in the South Fork Trinity River watershed, California. Transactions of the American Fisheries Society 138:506–521.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S.

Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, 6/1/2000.

McElhany P., M. Chilcote, J. Myers, R. Beamesderfer. 2007. Viability Status of Oregon Salmon and Steelhead Populations in the Willamette and Lower Columbia Basins. Part 4: Lower Columbia Coho. Prepared for Oregon Department of Fish and Wildlife and National Marine Fisheries Service. 57p.

Meador, J., Sommers, F., Ylitalo, G.M., and Sloan, C.A. 2006. Altered growth and related physiological responses to juvenile Chinook salmon (Oncorhynchus tshawytscha) from dietary exposure to polycyclic aromatic hydrocarbons (PAH). Canadian Journal of Fisheries and Aquatic Sciences 63(10):2364-2376. DOI:10.1139/f06-127.

Naish, K. A., J. E. Taylor, III, P. S. Levin, T. P. Quinn, J. R. Winton, D. Huppert, and R. Hilborn. 2007. An evaluation of the effects of conservation and fishery enhancement hatcheries on wild populations of salmon. Advances in Marine Biology 53:61-194.

Nelson, B.W., E.J. Ward, D.W. Linden, E. Ashe, and R. Williams. 2024. Identifying Drivers of Demographic Rates in an At-Risk Population of Marine Mammals Using Integrated Population Models. Ecosphere 15(2): e4773. https://doi.org/10.1002/ecs2.4773

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

Nickelson, T. E., M. F. Solazzi, and S. L. Johnson. 1986. Use of hatchery coho salmon (*Oncorhynchus kisutch*) presmolts to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43:2443-2449.

Nielsen 1992) Nielsen, J. L. 1992. Microhabitat-specific foraging behavior, diet and growth of juvenile coho salmon. Transactions of the American Fisheries Society 121:617–634.

Nightingale, B. and C. A. Simenstad. 2001. Overwater Structures: Marine Issues. White Paper. Dated May 9, 2001. Seattle, Washington. Available at <https://wdfw.wa.gov/publications/00051/ wdfw00051.pdf>. Accessed March 20, 2023.

NMFS (National Marine Fisheries Service). 2002. Biological opinion on the collection, rearing, and release of salmonids associated with artificial propagation programs in the middle Columbia River steelhead evolutionarily significant unit (ESU). National Marine Fisheries Service. Portland, Oregon. February 14, 2002.

NMFS (National Marine Fisheries Service). 2008a. Endangered Species Act 7(a)(2) consultation biological opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat consultation. Consultation on remand for operation of the Federal Columbia River Power System, 11 Bureau of Reclamation projects in the Columbia basin and ESA Section 10(a)(1)(A) permit for Juvenile Fish Transportation Program (revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D.

Oregon)). NMFS Consultation (Log) Number: F/NWR/2005/05883. National Marine Fisheries Service, Northwest Region, 5/5/2008.

NMFS. 2008b. Recovery plan for Southern Resident killer whales (*Orcinus orca*). NMFS, Northwest Region, Seattle, Washington, 1/17/2008.

NMFS (National Marine Fisheries Service). 2011. Anadromous salmonid passage facility design. NMFS, Northwest Region, Portland, Oregon.

NMFS. 2013a. Programmatic Biological Opinion for Revisions to Standard Local Operating Procedures for Endangered Species to Administer Stream Restoration and Fish Passage Improvement Actions Authorized or Carried Out by the U.S. Army Corps of Engineers in Oregon (SLOPES V Restoration) NMFS Consultation Number: NWR-2013-9717. in N. O. a. A. A. National Marine Fisheries Service, Commerce, editor.

NMFS. 2013b. Reinitiation of the Endangered Species Act Section 7 Formal Programmatic Conference and Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Aquatic Restoration Activities in the States of Oregon and Washington (ARBO II) NMFS Consultation Number: NWR-2013-9664. in N. O. a. A. A. National Marine Fisheries Service, Commerce, editor.

NMFS. 2013c. Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS) by the U.S. Fish and Wildlife Service Using the Partners for Fish and Wildlife, Fisheries, Coastal, and Recovery Programs and NOAA Restoration Center Using the Damage Assessment, Remediation and Restoration Program (DARRP), and Community-Based Restoration Program (CRP) in the States of Oregon, Washington, and Idaho NMFS Consultation Number: NWR-2013-10221. in N. O. a. A. A. National Marine Fisheries Service, Commerce, editor.

NOAA Fisheries. 2016a. 2016 5-Year Review: Summary & Evaluation of Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, Lower Columbia River Coho Salmon, Lower Columbia River Steelhead. Available at <https://repository.library.noaa.gov/view/noaa/17021> Accessed August 25, 2023.

NMFS. 2016b. Southern Resident Killer Whales (*Orcinus orca*) 5-Year Review: Summary and Evaluation. National Marine Fisheries Service. West Coast Region. Seattle, Washington, 12/1/2016.

NMFS. 2017. Recovery Plan for the Southern Distinct Population Segment of Eulachon (Thaleichthys pacificus). National Marine Fisheries Service, West Coast Region, Protected Resources Division, Portland, OR, 97232. September

NMFS (National Marine Fisheries Service). 2021b. Endangered Species Act - Section 7 consultation. Issuance of NPDES Permits for the Lower Columbia and Lower Snake River Federal Hydropower Projects. NMFS consultation number WCRO-2021-01520. National Marine Fisheries Service, Northwest Region, 9/10/2021.

NMFS (National Marine Fisheries Service. 2012a. Endangered Species Act Programmatic Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Response for the Federal-Aid Highway Program in the State of Oregon. (Refer to NMFS No.: 2011/02095) (November 28, 2012).

NOAA (National Oceanic and Atmospheric Administration). 2024. Ocean Conditions Indicators Trends web page accessed on January 24, 2024. https://www.fisheries.noaa.gov/content/oceanconditions-indicators-trends.

NOAA Fisheries. 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act, June 2000.

ODOT (2014) Oregon Department of Transportation Highway Division Hydraulics Design Manual prepared by Engineering and Asset Management Unit Geo-Environmental Section. April 2014. 1866pp.

Ono, K, and C. Simenstad. 2014. Reducing the effect of overwater structures on migrating juvenile salmon; an experiment with light. Journal of Ecological Engineering 71:180-189.

O'Neill, S. M., G. M. Ylitalo, and J. E. West. 2014. Energy content of Pacific salmon as prey of northern and southern resident killer whales. Endangered Species Research 25:265–281.

Osborne, R. W. 1999. A historical ecology of Salish Sea "resident" killer whales (*Orcinus orca*): with implications for management. Doctoral dissertation. University of Victoria, Victoria, British Columbia.

Oulhen N, Byrne M, Duffin P, Gomez-Chiam M, Hewson I, Hodin J, Konar B, Lipp E, Miner B, Newton A, Schiebelhut LM, Smolowitz R, Wahltinez SJ, Wessel GM, Work TM, Zaki HA, and JP Wares. 2022. A review of asteroid biology in the context of sea star wasting: Possible causes and consequences. The Biological Bulletin. 243(1): 50-75.

Peter, K.T., Z. Tian, C. Wu, P. Lin, S. White, B. Du, J.K. McIntyre, N.L. Scholz, E.P. Kolodziej. 2018. Using High-resolution Mass Spectrometry to Identify Organic contaminants linked to Urban Stormwater Mortality Syndrome in Coho salmon. Environmental Science and Technology 52:10317-10327.

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

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

PFMC (Pacific Fishery Management Council). 2005. Pacific Coast Groundfish Fishery Management Plan: Essential Fish Habitat Designation and Minimization of Adverse Impacts--Final Environmental Impact Statement. Pacific Fishery Management Council, Portland, Oregon.

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

Philip, S. Y., S. F. Kew, G. J. van Oldenborgh, F. S. Anslow, S. I Seneviratne, R. Vautard, D. Coumou, K. L. Ebi, J. Arrighi, R. Singh, M. van Aalst, C. Pereira Marghidan, M. Wehner, W. Yang, S. Li, D. L. Schumacher, M. Hauser, R. Bonnet, L. N. Luu, F. Lehner, N. Gillett, J. Tradowsky, G. A. Vecchi, C. Rodell, R. B. Stull, R. Howard, and F. E. L. Otto. 2021. Rapid attribution analysis of the extraordinary heatwave on the Pacific Coast of the US and Canada. Earth System Dynamics. DOI: 10.5194/esd-2021-90.

Poe, T. P., H. C. Hansel, S. Vigg, D. E. Palmer, and L. A. Predergast. 1991. Feeding of predaceous fishes on out-migrating juvenile salmonids in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120:405–420.

Popper, A.N., and N.L. Clarke. 1976. The auditory system of goldfish (Carassius auratus): effects of intense acoustic stimulation. Compendium of Biochemical Physiology 53:1118.

Pribyl, A. L., J. S. Vile, and T. A. Friesen. 2004. Population structure, movement, habitat use, and diet of resident piscivorous fishes in the Lower Willamette River, Oregon Department of Fish and Wildlife: 139–184.

PSMFC (Pacific States Marine Fisheries Council). 2021. Streamnet: Fish data for the Northwest. Interactive mapper. Available at: https://psmfc.maps.arcgis.com/apps/webappviewer/index.html?id=3be91b0a32a9488a901c3885 bbfc2b0b. Accessed November 5, 2021.

Rodkin Richard and Pommerenck, Keith. 2014. Caltrans compendium of underwater sound data from pile driving –2014 update. Available at: https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p690.pdf

Romaniszyn, E. D., J. J. Hutchens, and J. B. Wallace. 2007. Aquatic and terrestrial invertebrate drift in southern Appalachian mountain streams: implications for trout food resources. Freshwater Biology 52(1):1–11.

Rondorf, D. W., G. L. Rutz, and J. C. Charrier. 2010. Minimizing effects of over-water docks on federally listed fish stocks in McNary Reservoir: a literature review for criteria. Cook, Washington, U.S. Geological Survey, Western Fisheries Research Center: 41.

Rosenfeld J. S., T. Leiter, G. Lindner, and L. Rothman. 2005. Food abundance and fish density alters habitat selection, growth, and habitat suitability curves for juvenile coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 62(8):1691–1701.

Sandahl, J.F., D.H. Baldwin, J.J. Jenkins, and N.L. Scholz. 2007. A sensory system at the interface between urban stormwater runoff and salmon survival. Environmental Science & Technology 41(8):2998-3004.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1999. Stormwater Indicators Pilot Demonstration Project - Technical Memorandum: Indicators 18, 22 and 26. Santa Clara Valley Water District. Oakland, California.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Stormwater Indicators Demonstration Project – Final Report. Water Environment Research Foundation. Project 96-IRM-3, U.S. Environmental Protection Agency Cooperative Agreement #CX 8236660102. January.

Santore, R.C., D.M. Di Toro, P.R. Paquin, H.E. Allen, and J.S. Meyer. 2001. Biotic ligand model of the acute toxicity of metals. 2. Application to acute copper toxicity in freshwater fish and Daphnia. Environmental Toxicology and Chemistry 20(10):2397-2402.

Scholik, A.R., and H.Y. Yan. 2002. Effects of boat engine noise on the auditory sensitivity of the fathead minnow, Pimephales promelas. Environmental Biology of Fishes 63:203-209.

Scott, M. H. 2020. Statistical Modeling of Historical Daily Water Temperatures in the Lower Columbia River. 2020. Dissertations and Theses. Paper 5594. https://doi.org/10.15760/etd.7466

Shelton, A. O., W. H. Satterthwaite, E. J. Ward, B. E. Feist, and B. Burke. 2019. Using hierarchical models to estimate stock-specific and seasonal variation in ocean distribution, survivorship, and aggregate abundance of fall run Chinook salmon. Canadian Journal of Fisheries and Aquatic Sciences 76:95–108.

Smith and Saalfield 1955. Studies on Columbia River Smelt, Thaleichthys pacificus (Richardson). Washington Dept. Fisheries, Olympia. Fish. Res. Pap. 1(3):3–26.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki, R.P. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon.

Spromberg, J.A., and J.P. Meador. 2006. Relating chronic toxicity responses to population-level effects: A comparison of population-level parameters for three salmon species as a function of low-level toxicity. Ecological Modeling 199:240-252.

Stadler, J.H. and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. In Proceedings of the 38th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2009). Ottawa, Canada. (August 23-29, 2009).

Sutton, R., L.D. Sedlak, M. Box, C. Gilbreath, A. Holleman, R. Miller, L. Wong, A. Munno, K. X, Zhu, and C. Rochman. 2019. Understanding Microplastic Levels, Pathways, and Transport in the San Francisco Bay Region, SFEI-ASC Publication #950.

Tabor, R. A., G. Brown, and V. Luiting. 1998. The Effect of Light Intensity on Predation of Sockeye Salmon Fry by Prickly Sculpin and Torrent Sculpin. U.S. Fish and Wildlife Service, Western Washington Office, Lacey, Washington. May 1998.

Tian, Z., H. Zhao, K. T. Peter, M. Gonzalez, J. Wetzel and C. Wu. 2021. A ubiquitous tire rubber-derived chemical induces acute mortality in coho salmon. Science Journal 371(6525), January 8, 2021.

Tonina, D., J. A. McKean, D. Isaak, R. M. Benjankar, C. Tang, and Q. Chen. 2022. Climate change shrinks and fragments salmon habitats in a snow dependent region. Geophysical Research Letters, 49, e2022GL098552. https://doi.org/10.1029/2022GL098552

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century Washington, D.C. Report.

USCG. 2022. Preliminary Navigation Clearance Determination for the Interstate Bridge Replacement Program. Letter to Thomas D. Goldstein, PE, IBR Program Oversight Manager, FHWA, from B. J. Harris, Chief, Waterways Management Branch, Coast Guard District 13. June 17. Available at https://www.interstatebridge.org/media/fi2b3xei/ibr_next_steps_bridge_permitting_june202 2_remediated.pdf.

Ward, E. J., E. E. Holmes, K. C. Balcomb. 2009. Quantifying the effects of prey abundance on killer whale reproduction. Journal of Applied Ecology 46(3):632–640.

Ward, E. J., M. J. Ford, R. G. Kope, J. K. B. Ford, L. A. Velez-Espino, C. K. Parken, L. W. LaVoy, M. B. Hanson, and K. C. Balcomb. 2013. Estimating the Impacts of Chinook Salmon Abundance and Prey Removal by Ocean Fishing on Southern Resident Killer Whale Population Dynamics. U.S. Department Commerce, NOAA Technical Memorandum NMFS-NWFSC-123, 6/1/2013.

Warlick, A. J., G. M. Ylitalo, S. M. O'Neill, M. B. Hanson, C. Emmons, and E. J. Ward. 2020. Using Bayesian stable isotope mixing models and generalized additive models to resolve diet changes for fish-eating killer whales (*Orcinus orca*). Marine Ecology Progress Series. 649:189-199.

Wasser S. K, J. I. Lundin, K. Ayres, E. Seely, D. Giles, K. Balcomb, et al. 2017. Population growth is limited by nutritional impacts on pregnancy success in endangered Southern Resident killer whales (*Orcinus orca*). Plos One 12(6):22 pp.

Weitkamp, L. A. 2010. Marine distributions of Chinook salmon from the west coast of North America determined by coded wire tag recoveries. Transactions of the American Fisheries Society 139:147– 170.

Wiles, G. J. 2004. Washington State Status Report for the Killer Whale. March 2004. WDFW, Olympia, Washington. 120p.

Wipfli, M. S. 1997. Terrestrial invertebrates as salmonid prey and nitrogen sources in streams: contrasting old-growth and young-growth riparian forests in southeastern Alaska, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 54(6):1259–1269.

Wipfli, M. S., and C. V. Baxter. 2010. Linking Ecosystems, Food Webs, and Fish Production: Subsidies in Salmonid Watersheds. Fisheries 35(8):373–387.

Yount, J. D., and G. J. Niemi. 1990. Recovery of lotic communities and ecosystems from disturbance— a narrative review of case studies. Environmental Management 14(5):547–569.

Zamon, J. E., T. J. Guy, K. Balcomb, and D. Ellifrit. 2007. Winter Observations of Southern Resident Killer Whales (*Orcinus orca*) near the Columbia River Plume during the 2005 Spring Chinook Salmon (*Oncorhynchus tshawytscha*) Spawning Migration. Northwestern Naturalist 88(3):193198.

Zimmerman, M. P., and D. L. Ward. 1999. Index of predation on juvenile salmonids by northern pikeminnow in the Lower Columbia River Basin, 1994–1996. Transactions of the American Fisheries Society 128:995–1007.

6. APPENDICES

6.1. APPENDIX A – MINIMIZATION MEASURES

AVOIDANCE AND MINIMIZATION MEASURES

This section highlights the avoidance and minimization measures that will be implemented as part of the proposed action to further reduce the extent of effects on ESA-listed species and critical habitats. These measures will be placed into contracts for this proposed action. For specific construction BMPs and minimization measures, consult the applicable ODOT and/or WSDOT standard specifications.

General Measures and Conditions

The following general construction BMPs will be implemented to avoid and minimize effects associated with construction and/or demolition activities.

• All work will be performed according to the requirements and conditions of the regulatory permits that are issued for the proposed action.

• The contractor will prepare a WQPMP to satisfy the monitoring and reporting requirements of the 401 Water Quality Certifications that are ultimately issued for the project. The WQPMP will be provided to NOAA Fisheries for review and approval prior to implementation. The WQPMP will identify the timing and methodology for water-quality sampling during construction of the proposed action, as well as methods of implementation and reporting. If, in the future, a standard water-quality monitoring plan is adopted by ODOT and/or WSDOT, this plan, with the agreement of NOAA Fisheries may replace the contractor plan.

• State Department of Transportation policy and construction administration practice in Oregon and Washington is to have one or more Department of Transportation inspectors on site during construction. The role of the inspector(s) will be to monitor compliance with contract and permit requirements.

• If in-water dredging is required outside of a cofferdam, a clamshell bucket shall be used. Dredging and handling and disposal of dredged materials shall be conducted consistent with the requirements and conditions of the regulatory permits issued for the proposed action.

• Work barges will not be allowed to ground out.

• Work barges will be inspected and certified to be free of aquatic invasive species prior to mobilization to the site.

• Excess or waste materials will not be disposed of or abandoned waterward of the OHWM or allowed to enter waters of the state. Waste materials will be disposed of in an appropriate manner consistent with applicable local, state, and federal regulations.

• All pumps must employ a fish screen that meets the following specifications:

– An automated cleaning device with a minimum effective surface area of 2.5 square feet per cubic foot per second and a nominal maximum approach velocity of 0.4 foot per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second and a nominal maximum approach rate of 0.2 foot per second; and

– A round or square screen mesh that is no larger than 0.094 inches (2.38 millimeters) in the narrow dimension, or any other shape that is no larger than 0.069 inches (1.75 millimeters) in the narrow dimension; and

– Each fish screen must be installed, operated, and maintained according to NOAA Fisheries fish screen criteria.

Spill Prevention/Pollution Control

• The contractor will prepare an SPCC plan and PCP prior to beginning construction. These plans will be provided to NOAA Fisheries for review and approval. The SPCC plan and PCP will identify the appropriate spill containment materials and the means and methods of implementation, response, and reporting. All elements of the SPCC plan and PCP will be available at the project site at all times. For additional detail, consult ODOT Standard Specification 00290.00 to 00290.90.

• The contractor will designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead will be responsible for the implementation of the SPCC plan and PCP.

• Applicable spill response equipment and material designated in the SPCC plan and PCP will be maintained at the job site.

• With the exception of barges and stationary large equipment (cranes, oscillators) operating from barges or work platforms, equipment will be fueled and maintained at least 150 feet from the OHWM of any waterbody using secondary containment to minimize potential for spills or leaks entering the waterway.

• All equipment to be used for construction activities will be cleaned and inspected prior to arriving at the project site, to ensure no potentially hazardous materials are exposed, no leaks are present, free of noxious weeds, and the equipment is functioning properly. Daily inspection and cleanup procedures will be identified.

• Should a leak be detected on heavy equipment used for the project, the equipment will be immediately removed from the area and not used again until adequately repaired. Where off-site repair is not practicable, the SPCC plan and PCP will document measures to be implemented to prevent and/or contain accidental spills in the work/repair area to

ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.

• Operation of construction equipment used for project activities will occur from on top of floating barges, from the decks of temporary work bridges and platforms, the decks of the existing or replacement bridges, or from portions of the streambank above the OHWM. Barges and support vessels will be operated in the water.

• All equipment (including barges, work decks, stationary power equipment, and storage facilities) will have suitable containment measures outlined in the SPCC plan and PCP to prevent and/or contain accidental spills to ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.

• Temporary work bridges and platforms, cofferdams, and drilled shaft isolation casings will be designed and installed consistent with the ODOT Hydraulics Manual, which establishes criteria to avoid these structures being overtopped during high water events.

• Process water generated on site from construction, demolition or washing activities will be contained and treated to meet applicable water-quality standards before entering or reentering surface waters.

• No paving, chip sealing, or stripe painting will occur during periods of rain or wet weather.

• The SPCC plan and PCP will establish a concrete truck chute cleanout area to properly contain wet concrete as part of ODOT Standard Specification 00290.30(a).

Site Erosion/Sediment Control

• The contractor will prepare an ESCP to be implemented during project construction to minimize impacts associated with clearing, vegetation removal, grading, filling, compaction, or excavation. The BMPs identified in the ESCP will be used to control sediments from all vegetation removal or ground-disturbing activities. Additional temporary control measures may be required beyond those described in the ESCP if it appears pollution or erosion may result from weather, nature of the materials or progress on the work. For additional detail, consult ODOT Standard Specifications 00280.00 to 00280.90.

• As part of the ESCP, contractor will delineate clearing limits with orange barrier fencing wherever clearing is proposed in or adjacent to a stream/wetland or its buffer and install perimeter protection/silt fence as needed to protect surface waters and other critical areas. Location will be specified in the field, based upon site conditions and the ESCP. For additional silt fence detail, consult ODOT Standard Specification 00280.16(c).

• The contractor will identify at least one employee as the ESC lead. The ESC lead will be responsible for the implementation of the SPCC plan and PCP, and will also be

responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.

• All ESCP measures will be inspected and maintained as required by applicable permit requirements. Contractor will also conduct maintenance and repair of ESCP measures as described in ODOT Standard Specifications 00280.60 to 00280.70.

• For landward construction and demolition, project staging and material storage areas will be located a minimum of 150 feet from surface waters, in currently developed areas such as parking lots or managed fields, unless a site visit by an ODOT/WSDOT biologist determines (and an ODOT/ NOAA Fisheries liaison confirms) that the topographic features or other site characteristics allow for site use closer to the edge of surface waters.

• Excavation activities will be accomplished in the dry. All surface water flowing toward the excavation will be diverted through utilization of cofferdams and/or berms. Cofferdams and berms must be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material.

• Bank shaping will be limited to the extent as shown on the approved grading plans. Minor adjustments made in the field will occur only after engineer's review and approval.

• Bio-degradable erosion control blankets will be installed on areas of ground-disturbing activities on steep slopes (1V:3H or steeper) that are susceptible to erosion and within 150 feet of surface waters. Areas of ground-disturbing activities that do not fit the above criteria will implement erosion control measures as identified in the approved ESCP. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14I.

• Erodible materials (material capable of being displaced and transported by rain, wind or surface water runoff) that are temporarily stored or stockpiled for use in project activities will be covered to prevent sediments from being washed from the storage area to surface waters. Temporary storage or stockpiles must follow measures as described in ODOT Standard Specification 00280.42.

• All exposed soils will be stabilized as directed in measures prescribed in the ESCP. Hydro-seed all bare soil areas following grading activities and revegetate all temporarily disturbed areas with native vegetation indigenous to the location. For additional detail, consult ODOT Standard Specifications 01030.00 to 01030.90

• Where site conditions support vegetative growth, native vegetation indigenous to the location will be planted in areas temporarily disturbed by construction activities. Revegetation of construction easements and other areas will occur after the project is completed. Trees will be planted when consistent with highway safety standards. Riparian vegetation will be replanted with species native to geographic region. Planted vegetation will be maintained and monitored to meet regulatory permit requirements. For additional detail, consult ODOT Standard Specifications 01040.00 to 01040.90.

Pile Installation and Removal Best Management Practices

The following BMPs will be implemented to avoid and minimize impacts associated with pile installation.

• A vibratory hammer will be used to drive steel piles to the maximum extent possible, to minimize noise levels.

• Impact pile driving below the OHWM will only be conducted between September 15 and April 15. Vibratory pile installation and removal (as well as certain other in-water construction activities) may occur on a year-round basis, provided they are conducted in compliance with all regulatory approvals.

• No more than two impact pile drivers will be operated simultaneously within the same waterbody channel.

• A bubble curtain or other similarly effective noise attenuation device will be employed during all impact pile driving conducted in water depths greater than 0.67 meter (2 feet).

• A hydroacoustic monitoring plan, based on the template developed by the Fisheries Hydroacoustic Working Group, will be developed and implemented in coordination with FHWA and FTA to confirm the effectiveness of the noise attenuation devices and that predicted noise levels adequately capture the area of the potential onset of injury. The plan will be provided to NOAA Fisheries for review and approval prior to any impact pile-driving activity commencing.

• Open-ended pipe piles will have cones or other anti-perching devices installed to discourage perching by piscivorous birds.

• Temporary piles shall be removed with a vibratory hammer, or by direct pulling, and shall never be intentionally broken by twisting or bending.

• In the event a temporary pile cannot be removed it will be cut or pressed at least 3 feet below the mudline. At locations where hazardous materials are present or adjacent to utilities, temporary piles may be cut off at the mud line with underwater torches, if such activity wouldn’t conflict with navigation elements.

Work Area Isolation and Fish Salvage Best Management Practices

• A Temporary Water Management Plan, consistent with the requirements of ODOT Special Provision Section 00245.03, will be developed and provided to NOAA Fisheries for review and approval prior to any work area isolation of fish salvage activities.

• Cofferdams and isolation casings will be installed in a manner that minimizes fish entrapment. Sheet piles will be installed from upstream to downstream, lowering the sheet piles slowly until contact with the substrate.

• Drilled shaft isolation casings will be screened at the bottom, to minimize potential for fish entrapment during installation. Screen shall have maximum openings of approximately 0.094 inches (2.38 millimeters) measured on a diagonal (NOAA Fisheries 2022).

• Fish salvage will be conducted according to the best practices established in the BO for FHWA's Federal Aid Highway Programmatic consultation.
• A qualified fishery biologist11 will conduct and supervise fish capture and release activity to minimize risk of injury to fish.

• A fish salvage report will be prepared and submitted to NOAA Fisheries, USFWS, ODFW, and WDFW following project completion.

• A reasonable effort will be made to capture ESA-listed fish known or likely to be present in an inwater isolated work area using methods that minimize the risk of injury. Attempts to seine and/or net fish will precede the use of electrofishing equipment.

• If electrofishing must be used, it will be conducted consistent with NOAA Fisheries "Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" (NOAA Fisheries 2000), or most recent version.

Work Area Lighting Best Management Practices

• Construction activities will be conducted consistent with local, state and federal permit restrictions for allowable work hours. If work occurs at night, temporary lighting may be required 11 The qualified biologist shall have a bachelor's degree in biology, fisheries or equivalent, and have a minimum of two years of experience identifying northwest fish and aquatic species. If electrofishing is required, the lead biologist shall be competent with electrofishing procedures and have completed at least 100 hours of fish salvage following NOAA Fisheries, USFWS, ODFW, and/or WDFW fish salvage/fish removal protocols. to provide better visibility for driver and worker safety. If temporary lighting is required, contractor will use directional lighting with shielded luminaries to control glare and direct light onto work area, not surface waters.

6.2. APPENDIX B. NMFS Pile Driving Calculator Spreadsheet Calculations. (From the BA)

Notes (source for estimates, etc.)
(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**205**	**175**	**190**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**75**			
Cumulative SEL at measured distance				
194				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**9**	**28**	**52**	**4642**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**214**	**184**	**201**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**75**			
Cumulative SEL at measured distance				
203				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**34**	**112**	**207**	**25119**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 900 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**198**	**168**	**183**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**900**			
Cumulative SEL at measured distance				
198				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**3**	**50**	**93**	**1585**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 900 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**207**	**177**	**194**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**900**			
Cumulative SEL at measured distance				
207				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**201**	**371**	**8577**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 1,800 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmision loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**198**	**168**	**183**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**1,800**			
Cumulative SEL at measured distance				
201				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**3**	**80**	**148**	**1585**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Fill in

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 1,800 strikes/day

green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmission loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	**207**	**177**	**194**	**150**
Distance (m)	**10**	**10**	**10**	
Estimated number of strikes	**1,800**			
Cumulative SEL at measured distance				
210				

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**319**	**589**	**8577**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

EFH CONSERVATION RECOMMENDATION RESPONSE AND POINT OF CLARIFICATION FOR THE INTERSTATE BRIDGE REPLACEMENT PROGRAM (WCRO-2023-02287)

U.S. Department of Transportation

U. S. DEPARTMENT OF TRANSPORTATION

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August 28, 2025

Kathleen Wells
Assistant Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
West Coast Region
1201 NE Lloyd Boulevard, Suite 110
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RE: EFH Conservation Recommendation Response and Point of Clarification for the Interstate Bridge Replacement Program (WCRO-2023-02287)

Dear Ms. Wells:

On June 27, 2025, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) received the Endangered Species Act Section 7(a)(2) Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat consultation. The FHWA and FTA are required to provide written response within 30-days after receiving an EFH Conservation Recommendations pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)]. We are confirming that we accept the two conservation recommendations provided by your agency – Implement Reasonable and Prudent Measures (RPM) 1 and Implement RPM 2.

In addition, FHWA and FTA wish to clarify an inconsistency that we identified in the Biological Opinion (BO). In Section 1.3, Proposed Federal Action (page 13, In-Water Work Window), the authorized timing for various activities is described accurately, allowing vibratory installation and removal year-round. However, in section 2.5.1.3, pg. 55 second paragraph, there is a conflicting statement that vibratory installation, “may occur only during the in-water work window.” There are multiple mentions of timing of this work, and this is the only conflicting statement so we believe it is a simple error and will assume that year-round vibratory hammer

use for installation and removal activities is allowed, per extensive negotiations with regulatory and resource agencies.

We appreciate your attention to this matter and look forward to your confirmation regarding the permissible activities as clarified. Please do not hesitate to contact us should you require any further information or clarification.

THOMAS D GOLDSTEIN
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Thomas Goldstein
IBR Program Oversight Manager
Federal Highway Administration

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Scot Rastelli
Deputy Regional Administrator
Federal Transit Administration

cc: Cindy Callahan - FHWA, Lead Endangered Species Specialist
Bill Warncke - Deputy Environmental Manager IBR Program
Tom Loynes - Oregon Department of Transportation, NOAA Liaison