Hood River – White Salmon BRIDGE REPLACEMENT PROJECT

Biological Assessment

September 10, 2020

Prepared for:

PORT OF HOOD RIVER

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LIST OF ACRONYMS AND ABBREVIATIONS

BA	biological assessment
BMPs	best management practices
Caltrans	California Department of Transportation
CIA	contributing impervious area
DA	discharge area
dB	decibel
dBA	A-weighted decibel
DPS	distinct population segment
DEQ	Oregon Department of Environmental Quality
DSL	Oregon Department of State Lands
Ecology	Washington State Department of Ecology
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FHWA	Federal Highway Administration
FHWG	Fisheries Hydroacoustic Working Group
FTA	Federal Transit Administration
I-	Interstate
IPaC	Information for Planning and Consultation
ISA	impervious surface area
IWWW	in-water work window
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries
OAR	Oregon Administration Rules
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHWM	ordinary high water mark
PBF	physical and biological function
PCE	primary constituent element
PCP	pollution control plan
Port, the	Port of Hood River
Proposed Action	Preliminary Preferred Alternative
Project, the	Hood River-White Salmon Bridge Replacement Project
RM	River Mile
RMS	root mean square
SEL	sound exposure level
SPCC	spill prevention, control, and countermeasures

SR	State Route
SWPPP	stormwater pollution prevention plan
TS&L	type, size, and location (study)
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQPMP	Water Quality Protection and Monitoring Plan
WSDOT	Washington State Department of Transportation

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EXECUTIVE SUMMARY

The Hood River-White Salmon Bridge Replacement Project (the "Project," formerly named the State Route 35 Columbia River Crossing Project) will construct a replacement bridge and then remove the existing Hood River Bridge between White Salmon, Washington, and Hood River, Oregon (Figure 1).

The Port of Hood River (the Port) is partnering with the Federal Highway Administration (FHWA), Oregon Department of Transportation (ODOT), and Washington State Department of Transportation (WSDOT) to resume and complete the National Environmental Policy Act (NEPA) compliance process for the Project. FHWA, ODOT, and the Port are joint-lead agencies for NEPA. The anticipated use of federal loan programs and/or grant programs to fund the construction of the Project represents a federal nexus requiring consultation under Section 7 of the Endangered Species Act (ESA), and the FHWA will be the lead agency for this ESA consultation. Though there may be additional federal participation, such as the issuance of permits by the U.S. Army Corps of Engineers (USACE) or United States Coast Guard, it is anticipated that FHWA will remain the lead Federal Action Agency.

The NEPA review is evaluating four project alternatives (no-action alternative and three build alternatives). This ESA consultation addresses only the Preliminary Preferred Alternative (referred to as "Alternative EC-2" in the environmental impact statement (EIS) and as the "Proposed Action" in this biological assessment [BA]).

The Proposed Action will construct a replacement bridge west of the existing bridge and then remove the existing bridge. The replacement bridge will be an approximately 4,412-foot, fixed-span segmental concrete box girder bridge with a concrete deck and no lift span. The bridge will include one 12-foot travel lane in each direction, an 8-foot shoulder on each side, and a 12-foot-wide shared-use path separated from traffic with a barrier on the west side. In the middle of the bridge, the shared-use path will widen an additional 10 feet in two locations to provide two overlooks over the Columbia River. Construction of the Proposed Action is expected to take approximately six years and require work within up to six in-water work windows.

Potential effects to ESA-listed species and critical habitats associated with the Proposed Action include the following: (1) temporary impacts to water quality during in-water and overwater construction; (2) temporary hydroacoustic impacts associated with impact pile driving; (3) temporary aquatic habitat impacts during construction; (4) permanent aquatic habitat impacts associated with the replacement bridge structure and removal of the existing bridge; (5) impacts associated with work area isolation and fish salvage; (6) impacts associated with overwater lighting and avian predation; and (7) impacts associated with stormwater from new and rebuilt impervious surfaces. Several impact minimization and avoidance measures and best management practices (BMPs) are proposed as part of this Proposed Action to reduce the extent and magnitude of these potential effects.

Table 1 provides a summary of the effect determinations for ESA-listed species and Table 2 shows the effect determinations for designated critical habitats that are addressed in this document.

Table 1. Effect Determinations Summary – Species

Species Name			Species Status/ Effect Determination	
Common Name	**Scientific Name**	**ESU or DPS**	**Federal Status***	**Effect Determination****
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	T	LAA
		UWR ESU	T	LAA
		UCR-SR ESU	T	LAA
		SR-SSR ESU	T	LAA
		SR-FR ESU	T	LAA
Chum salmon	*Oncorhynchus keta*	CR ESU	T	LAA
Coho salmon	*Oncorhynchus kisutch*	LCR ESU	T	LAA
Sockeye salmon	*Oncorhynchus nerka*	SR ESU	E	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	T	LAA
		UWR DPS	T	LAA
		MCR DPS	T	LAA
		UCR DPS	E	LAA
		SRB DPS	T	LAA
Bull trout	*Salvelinus confluentus*	Coastal Recovery Unit	T	LAA
Pacific eulachon	*Thaleichthys pacificus*	Southern DPS	T	LAA
North American green sturgeon	*Acipenser medirostris*	Southern DPS	T	LAA
Fisher	*Pekania pennanti*	West Coast DPS	PT	NE
Gray wolf	*Canis lupus*	NA	E - PDL	NE
North American Wolverine	*Gulo gulo luscus*	NA	PT	NE
Northern Spotted Owl	*Strix occidentalis caurina*	NA	T	NE
Yellow billed cuckoo	*Coccyzus americanus*	Western U.S. DPS	T	NE
Oregon spotted frog	*Rana pretiosa*	NA	T	NE

* E = Endangered; T = Threatened; PT = Proposed Threatened; PDL = Proposed for de-listing
** NE = No Effect; NLAA = May Effect, Not Likely to Adversely Affect; LAA = Likely to Adversely Affect
ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; NA = Not Applicable; LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

Table 2. Effect Determinations Summary – Critical Habitats

Species Name			Critical Habitat Status/ Effect Determination	
Common Name	**Scientific Name**	**ESU or DPS**	**Status***	**Effect Determination****
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	D	LAA
		UWR ESU	D	LAA
		UCR-SR ESU	D	LAA
		SR-SSR ESU	D	LAA
		SR-FR ESU	D	LAA
Chum salmon	*Oncorhynchus keta*	CR ESU	D	LAA
Coho salmon	*Oncorhynchus kisutch*	LCR ESU	D	LAA
Sockeye salmon	*Oncorhynchus nerka*	SR ESU	D	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	D	LAA
		UWR DPS	D	LAA
		MCR DPS	D	LAA

Species Name			Critical Habitat Status/ Effect Determination	
Common Name	**Scientific Name**	**ESU or DPS**	**Status***	**Effect Determination****
		UCR DPS	D	LAA
		SRB DPS	D	LAA
Bull trout	*Salvelinus confluentus*	Coastal Recovery Unit	D	LAA
Pacific eulachon (smelt)	*Thaleichthys pacificus*	Southern DPS	D	LAA
North American green sturgeon	*Acipenser medirostris*	Southern DPS	D	LAA
Fisher	*Pekania pennanti*	West Coast DPS	P	NE
Gray wolf	*Canis lupus*	NA	D	NE
North American Wolverine	*Gulo gulo luscus*	NA	NA	NE
Northern Spotted Owl	*Strix occidentalis caurina*	NA	D	NE
Yellow billed cuckoo	*Coccyzus americanus*	Western U.S. DPS	P	NE
Oregon spotted frog	*Rana pretiosa*	NA	D	NE

* D = Designated; P = Proposed
** NE = No Effect; NLAA = May Effect, Not Likely to Adversely Affect; LAA = Likely to Adversely Affect
ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; NA = Not Applicable; LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

The Proposed Action is **likely to adversely affect** LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead, and bull trout within the Coastal Recovery Unit. Adults and/or juveniles of these populations of salmon, steelhead, and bull trout may be present during portions of the year when construction and/or demolition activities will occur. Individual fish present during construction or demolition activities may be affected by (1) temporarily impaired water quality during in-water and overwater construction and demolition; (2) temporary hydroacoustic impacts associated with impact pile driving that exceeds established injury thresholds; (3) temporary aquatic habitat impacts during construction; (4) impacts associated with work area isolation and fish salvage; and (5) temporary impacts associated with overwater lighting and avian predation during construction. These populations will also be permanently affected by benthic habitat impacts and overwater shading from the replacement bridge and impacts associated with stormwater from new and rebuilt impervious surfaces.

The Proposed Action is also **likely to adversely affect,** UWR ESU Chinook salmon, UWR DPS steelhead, CR ESU chum salmon, Southern DPS Pacific eulachon, and Southern DPS green sturgeon. These species occur only in the lower river, below Bonneville Dam, and will not be subjected to any temporary impacts associated with construction or demolition activities, or from aquatic habitat impacts from the replacement bridge. However, aquatic habitat for these species will be affected by pollutants in treated stormwater from new and rebuilt impervious surfaces.

The Proposed Action is **likely to adversely affect** designated critical habitat for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead, bull trout within the Coastal Recovery Unit, Southern DPS Pacific eulachon, and Southern DPS green sturgeon. The project will temporarily reduce habitat suitability in the vicinity of the bridge during construction and demolition by (1) temporarily impaired water quality during in-water and overwater construction and demolition; (2) temporarily elevated underwater noise during impact pile driving; (3) temporary aquatic habitat impacts during construction; (4) impacts associated with work area isolation and fish salvage; and (5) temporary impacts associated with overwater lighting and avian predation during construction. Designated critical habitats for these populations will also be affected by benthic habitat impacts and overwater shading from the replacement bridge and from impacts associated with stormwater from new and rebuilt impervious surfaces. These impacts have the potential to result in adverse impacts to the function of one or more physical or biological features of designated critical habitat for the above-mentioned species.

The Proposed Action is also **likely to adversely affect,** designated critical habitat for UWR ESU Chinook salmon, UWR DPS steelhead, CR ESU chum salmon, Southern DPS Pacific eulachon, and Southern DPS green sturgeon. Designated critical habitat for these species and populations occurs only in the lower river, below Bonneville Dam, and will not be subjected to any temporary impacts associated with construction or demolition activities, or from aquatic habitat impacts from the replacement bridge. However, critical habitat for these species will be affected by pollutants in treated stormwater from new and rebuilt impervious surfaces.

The Proposed Action will have **no effect** on West Coast DPS fisher, gray wolf, North American wolverine, Northern spotted owl, western U.S. DPS yellow billed cuckoo, or Oregon spotted frog. These species do not occur within the action area and will not be affected by the Proposed Action.

Additionally, in accordance with the Magnuson-Stevens Fishery Conservation and Management Act, Appendix B of this BA addresses impacts to essential fish habitat (EFH). The portion of the Columbia River that is within the action area represents EFH for Chinook and coho salmon within the Pacific salmon guild. The Proposed Action will result in both temporary and permanent **adverse effects** to EFH for Pacific salmon. Temporary impacts include impaired water quality, elevated underwater noise, and temporary aquatic habitat impacts during construction. Permanent impacts include permanent aquatic habitat impacts from the replacement bridge, and delivery of pollutants in stormwater from new and rebuilt impervious surfaces (including stormwater that is contributing to the project area). The Proposed Action has incorporated several minimization and avoidance measures and BMPs to minimize impacts to EFH to the extent practicable.

1. INTRODUCTION

The Hood River-White Salmon Interstate Bridge (locally known as the Hood River Bridge) provides a critical connection for residents and visitors to the Columbia River Gorge National Scenic Area. One of only three bridges spanning the Columbia River in this region, the bridge is a critical rural freight network facility. The existing bridge is nearing the end of its serviceable life and is obsolete for modern vehicles with height, width, and weight restrictions and is also a navigational hazard for marine vessels. The existing bridge has no sidewalks or bicycle lanes for non-motorized travel and would likely not withstand a large earthquake, as the existing bridge has not been updated to meet current seismic standards.

The Hood River-White Salmon Bridge Replacement Project (the "Project," formerly named the State Route 35 Columbia River Crossing Project) will construct a replacement bridge and then remove the existing Hood River Bridge between White Salmon, Washington, and Hood River, Oregon (Figure 1).

1.1. Project Proponent

The Port of Hood River (the Port) is partnering with the Federal Highway Administration (FHWA), Oregon Department of Transportation (ODOT), and Washington State Department of Transportation (WSDOT) to resume and complete the National Environmental Policy Act (NEPA) compliance process for this Project. FHWA, ODOT, and the Port are joint-lead agencies for NEPA.

The NEPA review is evaluating three project alternatives (no-action alternative and two build alternatives). This ESA consultation addresses only the Preliminary Preferred Alternative (referred to as "Alternative EC-2" in the environmental impact statement (EIS) and as the "Proposed Action" in this biological assessment [BA]).

1.2. Federal Nexus

The anticipated use of federal loan programs and/or grant programs to fund the construction of the Proposed Action represents a federal nexus that requires FHWA to consult with the National Oceanic and Atmospheric Administration Fisheries and U.S. Fish and Wildlife Service (NOAA Fisheries [NMFS] and U.S. Fish and Wildlife Service [USFWS], respectively) to assess the potential for effects to species or critical habitats listed under Section 7 of the Endangered Species Act (ESA) and to essential fish habitat (EFH) under the provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (see Appendix B for a discussion of EFH). FHWA is the lead federal agency in this consultation.

1.3. Project History

The project began in 1999, with the completion of a feasibility study to determine if there was a need to replace the bridge and whether there was community support. The feasibility study ultimately resulted in the publication of a Draft EIS in 2003, which identified a Preliminary Preferred Alternative. The environmental review phase of the Project was put on hold after the public comment period on the Draft EIS ended in 2004 due to lack of funding for additional work.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, enacted in August 10, 2005, provided funding for a bridge type, size, and location (TS&L) study. Between April 2010 and October 2011, the bridge TS&L study advanced conceptual engineering and determined preferred bridge type for the Preliminary Preferred Alternative identified in the Draft EIS. The bridge TS&L study recommended a fixed-span, concrete segmental box girder bridge and refined the design related to stormwater, bridge hydraulics, right-of-way, river user input, and bridge construction assumptions.

In 2017, the Port received Oregon State funding to continue the Project. The Port is partnering with the FHWA, ODOT, and WSDOT to continue the environmental review phase. FHWA published a Notice of Intent to prepare a Supplemental Draft EIS in the Federal Register on May 23, 2019.

1.4. Purpose and Need

The stated purpose of the Proposed Action is to “improve multi-modal transportation of people and goods across the Columbia River between the communities of White Salmon and Bingen, Washington and Hood River, Oregon.” The stated overall need for the Proposed Action is to “rectify current and future transportation inadequacies and deficiencies associated with the existing bridge.” These include inadequacies and/or deficiencies related to capacity, system linkage, transportation demand, maintenance requirements, navigation, and safety.

The Proposed Action is intended to:

- Satisfy capacity needs and meet ODOT and WSDOT standards regarding traffic operations and queuing.
- Maintain a system linkage that provides a cross-river connection between Bingen and White Salmon, Washington, and Hood River, Oregon, as well as between I-84 and SR 14.
- Accommodate cross-river transportation demand.
- Minimize out-of-direction travel.
- Provide transportation infrastructure for the current and projected flow of goods, labor and consumers across the Columbia River between the cities of White Salmon, Bingen, and Hood River.
- Provide for efficient long-term operation and maintenance of the new crossing.
- Accommodate river navigation by providing a horizontal navigation clearance that meets current United States Coast Guard standards.
- Provide adequate facilities and safe travel for passenger and commercial vehicles, mass transit services, motorcycles, bicycles, and pedestrians.
- Reduce real and perceived safety hazards.
- Reduce noise created by motorized vehicles traveling on the existing bridge deck.
- Meet current seismic design standards.

1.5. Alternatives Development and Screening

A wide range of project design alternatives were considered in developing the 2003 Draft EIS. The alternatives considered included six different corridors to cross the Columbia River, specific alignments within the corridors, and various transportation type of facilities.

The development and screening of alternatives was organized into three sequential tiers. Tier I involved evaluation and narrowing of a range of crossing corridors and facility types. Tier II began with alternatives advanced from Tier I. Two successive screenings occurred during the Tier II and resulted in a further narrowing of the alternative corridors and facilities and the identification of three alternative alignments to be evaluated in the Draft EIS. Tier III involved comprehensive evaluation of environmental consequences to recommend a Preliminary Preferred Alternative in the Draft EIS. Detailed screening documentation and screening matrices are presented in the 2003 Draft EIS.

The result of the screening process identified a replacement bridge within the existing project corridor as the preferred combination, because this corridor/facility combination results in the lowest impacts to transportation, environment, recreation, and the lowest cost.

The Draft EIS evaluated three potential build alternative alignments within the existing corridor for the replacement bridge. Of these, the alignment and design that represents the Proposed Action for this consultation is the Preferred Alternative in the current Supplemental Draft EIS.

1.6. Consultation History

Throughout the development and design of this Proposed Action, WSP and the Port have coordinated closely with federal, state, and local regulatory agency staff to identify and resolve issues of concern.

An early coordination meeting was held on June 20, 2019, with ODOT and NOAA Fisheries liaisons to discuss the ESA consultation. A similar early coordination teleconference was conducted with USFWS on July 26, 2019. These early coordination discussions included an overview of the project, confirmation of species lists, and a discussion of impacts and preliminary effects determinations.

NOAA Fisheries and FHWA reviewed and provided comment on an initial draft of the BA for this project, dated August 29, 2019. A meeting was held with ODOT, FHWA, and NOAA Fisheries liaisons on November 6, 2019.

WSP and the Port refined the design and construction assumptions between December 2019 and June 2020, in close coordination with ODOT, FHWA, and NOAA Fisheries liaisons. 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.

2. PROJECT LOCATION

The project site[1] is located in the vicinity of the existing Hood River-White Salmon Bridge, located at approximately River Mile (RM) 169.8 on the Columbia River, on a reach of the river situated within the Columbia River Gorge National Scenic Area (Figure 1). The existing bridge is located at approximately milepost (MP) 65 of State Route 14 (SR 14) in Washington, and approximately MP 64.5 of Interstate 84 (I-84) in Oregon. The bridge is located in Sections 24 and 25 of Township 03 North, Range 10 West; and

[1] The “project site” is defined as all areas that will be directly impacted by the Proposed Action, including the footprint of the permanent and temporary structures, excavation and fill areas, stormwater facilities, staging and access areas, and areas in the Columbia River where work will occur from barges and temporary structures. The project site described is the immediate area involved in the action and is not equivalent to the “Action Area” defined in Section 5, a term required under the ESA to describe the area affected by the action.

Section 30 of Township 03 North, Range 11 East, Willamette Meridian. The portion of the Columbia River that is within the action area is in Water Resource Inventory Area #29 (Wind-White Salmon), and within Hydrologic Unit Code #170701051105 (Rowena Creek-Columbia River).

The existing bridge was built in 1924 and connects the communities of Hood River, Oregon, and White Salmon and Bingen, Washington. At the location of the existing and proposed bridges, the Columbia River is impounded by Bonneville Dam and is part of the Bonneville Pool. The river is approximately 4,200 feet wide, and the navigation channel has a width of 300 feet. The Hood River, in Oregon, drains to the Columbia River approximately 0.4 mile downstream of the existing bridge; and the White Salmon River, in Washington discharges to the Columbia approximately 1.6 miles downstream of the existing bridge. The existing steel deck truss bridge is 4,418 feet long with a steel-grated deck and is supported by 19 in-water piers founded on timber piles.

On the Washington side of the river, the majority of the shoreline properties are developed for a variety of commercial and industrial uses. A BNSF Railway main line track runs east/west through the riparian habitat on the Washington side of the river, and SR 14 runs parallel to the rail tracks, further bisecting habitat at the site. There is a steep, partially vegetated hillside located north of SR 14, with residential homes and commercial businesses in the city of White Salmon located at the top of the bluff to the north.

The White Salmon treaty fishing access site is located downstream of the proposed bridge on the Washington side of the river. This site is reserved exclusively for members of the treaty tribes to access the Columbia River. The work will not take place at the site nor affect access to this site. The project site is within Zone 6 of the Columbia River and is an exclusive treaty Indian commercial fishing area.

The Oregon side of the river is largely developed with commercial businesses, including the Port offices, a marina boat launch and parking, portions of East Port Marina Drive, East Marina Way, vacant land south of Department of Motor Vehicle offices, the Hood River County Chamber of Commerce offices, and commercial businesses and infrastructure in the area built up around the I-84 interchange.

The existing bridge does not currently have stormwater collection or conveyance structures; rather, vehicular pollutants with precipitation that encounters the bridge deck passes through the steel-grated deck into the Columbia River without treatment. On both the Washington side and the Oregon side, the paved parts of the bridge are flanked by guardrails on either side and stormwater sheds off the existing pavement into adjacent forested areas in Washington and to roadside ditches on the Oregon side. Existing roadway widths range from 18.8 feet at the bridge to approximately 70 feet wide at Button Bridge Road, on the Oregon side. Existing stormwater collection and conveyance facilities, including catch basins, storm pipes, and ditches or swales, intercept and convey stormwater in the Button Bridge Road in Oregon and SR 14 in Washington. On the Washington side, there is an existing treatment pond on the east side of the bridge touch down.

Additional information regarding the vegetation and habitat conditions within the action area is provided in Section 7.

3. PROJECT DESCRIPTION

3.1. Project Overview

The Proposed Action will construct a replacement bridge west and downstream of the existing bridge. The existing bridge will be removed following construction of the replacement bridge. A summary of the project elements is provided below, and a detailed description of project elements is provided in Section 3.3. A complete set of project figures is attached (Appendix A: Figures 1 to 21).

- **Alignment**: The main span of the replacement bridge will be located approximately 200 feet west of the existing span. The bridge terminus in White Salmon, Washington, will be located approximately 123 feet west of the existing SR 14/Hood River Bridge intersection, while the southern terminus will be in roughly the same location at the Button Bridge Road/East Marina Way intersection in Hood River, Oregon, as shown in Figures 2 and 3.
- **Type**: The replacement bridge will be an approximately 4,411-foot, fixed-span, segmental concrete box girder bridge with a concrete deck. The bridge will be founded on 15 bents, 13 of which will be entirely or partially below the ordinary high water mark (OHWM) of the Columbia River.
- **Ownership**: Various ownership options are being considered for the replacement bridge, which could be determined in part by, but not limited to, the funding source for construction, potential establishment of a bi-state bridge authority, or public-private partnership to build and maintain the bridge. If a new ownership option is not established, then the Port will be the owner of the replacement bridge.
- **Vehicle lanes**: The replacement bridge will include one 12-foot travel lane in each direction, and an 8-foot shoulder on each side, as shown in Figure 8.
- **Bicycle and pedestrian facilities**: The replacement bridge will include a 12-foot-wide, shared-use path separated from traffic with a barrier on the west side, as shown in Figure 8. In the middle of the bridge, the shared-use path will widen an additional 10 feet in two locations to provide two 40-foot-long overlooks over the Columbia River and west into the Columbia River Gorge National Scenic Area (with benches); the overlook locations are shown in Figures 5 and 6, and a cross section is shown in Figure 8.
- **Speed**: The design speed for the replacement bridge will be 50 mph with a posted speed limit of 35 mph.
- **Vehicle restrictions**: Vehicles will no longer be limited by height, width, or weight (as is the case with the existing bridge). Vehicles exceeding 80,000 pounds that have approved trip permits will be able to use the replacement bridge.
- **Tolling**: Tolls will be collected electronically so there will be no toll booth on either side of the replacement bridge.
- **Navigational clearance**: The replacement bridge will span the Columbia River navigation channel. Vertical clearance for marine vessels provided by the fixed span of the replacement bridge will be a minimum of 80 feet. The horizontal bridge opening for the navigation channel will be 450 feet, greater than the existing 300-foot-wide federally recognized navigation channel, as shown in Figure 7. Centered within this 450-foot opening, there will be a 250-foot-wide opening with a vertical clearance of 90 feet. Similar to the existing bridge, the replacement

bridge will cross the navigation channel at roughly a perpendicular angle as shown in Figures 5 and 6.

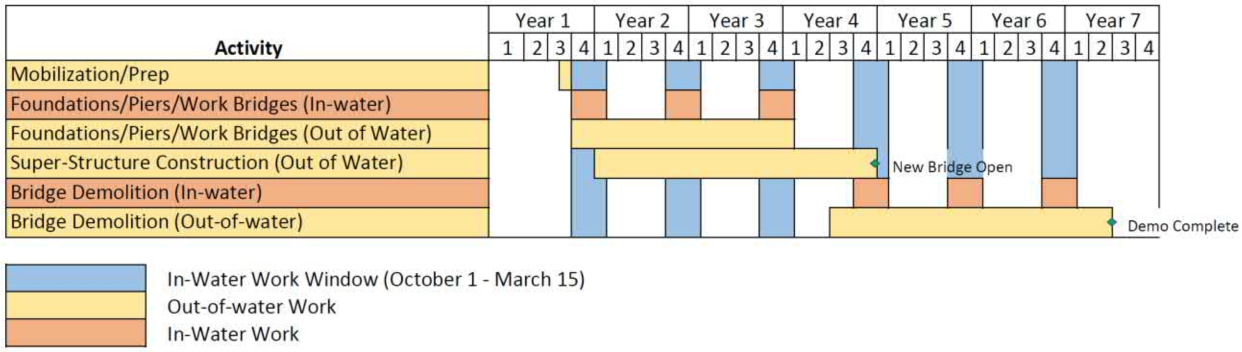
- **Seismic resilience**: The replacement bridge will be designed to be seismically sound under a 1,000-year event and operational under a Cascadia Subduction Zone earthquake.
- **Stormwater**: Stormwater from Contributing Impervious Area associated with the replacement bridge and reconstructed roadways will be collected and conveyed to detention and treatment facilities on both sides of the bridge as described in Section 3.3.10. On the Washington side, separate stormwater facilities will be used for the roadways and the bridge.
- **Roadway connections**: The replacement bridge will connect to SR 14 on the Washington side at a new two-lane roundabout slightly west of the existing SR 14/Hood River Bridge intersection, as shown in Figures 5 and 6. On the Oregon side, the southern end of the bridge will transition to Button Bridge Road, connecting to the local road network at the existing signalized Button Bridge Road/East Marina Way intersection north of I-84. The private driveway on Button Bridge Road north of East Marina Way may be closed under this alternative. Like the existing bridge, the replacement bridge will cross over the BNSF tracks on the Washington side and over the Hood River Waterfront Trail along the Oregon shoreline.
- **Bicycle and pedestrian connections**: The new shared-use path will connect to existing sidewalks along the south side of SR 14 in Washington and to roadway shoulders (for bicyclists) on both sides of SR 14 at the new roundabout with marked crosswalks, as shown in Figures 5 and 6. On the Oregon side, the shared-use path will connect to existing sidewalks, bicycle lanes, and local roadways at the signalized Button Bridge Road/East Marina Way intersection.

3.2. Project Timeline and Sequencing

The Proposed Action is currently undergoing NEPA review. It is anticipated that the NEPA process will be completed in late 2021. The timing of subsequent phases of the Project, including final design and permitting, will be dependent upon the availability of funding, and a starting year for construction cannot be specified at this time. The ultimate construction sequence and duration will be driven in part by the final design, and by funding availability. Contractor schedules, weather, materials, and equipment could also influence the duration of construction of the Project.

For purposes of this consultation, it has been preliminarily estimated that the Proposed Action will take approximately six years, and will require work within up to six in-water work windows. This schedule assumes that three in-water work windows will be necessary to construct the replacement bridge, and three work windows will be necessary to complete the demolition of the existing bridge. Table 3 below provides the anticipated sequence for construction and demolition of the Project and a conceptual schedule.

Table 3. Conceptual Construction Sequence and Schedule



3.2.1. In-Water Work Window

In order to minimize impacts to ESA-listed species and their designated critical habitat, certain work below the OHWM of the Columbia River will be restricted to an in-water work window (IWWW). The USACE, NOAA Fisheries, USFWS, ODFW and WDFW all have the ability to recommend and/or require restrictions on the timing of in-water work in the course of 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 15 – March 15 (ODFW 2008)

These published IWWWs are considered regulatory guidance, created to assist the public in minimizing potential impacts to important fish, wildlife, and habitat resources. There are individual project cases where it may be determined that it is appropriate to perform in-water work outside of the work windows indicated in these guidelines on a project-by-project basis. In practice, 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.

In order to establish an IWWW for purposes of this ESA consultation, several meetings were coordinated between December 2019 and May 2020 with representatives from ODOT, FHWA, NOAA, ODFW, and WDFW. The purpose of these meetings was 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 would be restricted to the IWWW.

The project team developed and presented several conceptual schedules that limited all in-water work to a standard work window of November 15 to March 15. These schedules assumed traditional construction practices, and would have required three in-water work periods over five years to construct the pier foundations, and an additional four in-water work periods to complete demolition of the existing bridge. The total duration of the Proposed Action was estimated between 8 to 11 years depending upon the number of pairs of form travelers that it was assumed the contractor would be able to employ to construct the superstructure. These schedules were determined to be undesirable from both a cost standpoint and for the impacts associated with a longer duration and multiple IWWWs.

In response to questions from ODOT and NOAA specific to likelihood of needing a longer IWWW and shorter project duration for constructability, the project team developed a more streamlined project schedule in April and May 2020. The primary limiting factors in the baseline schedule were determined to include the work window for pile installation and the installation of shoring casings for drilled shaft construction, the number of form travelers used to build the superstructure, and the time associated with installing and removing cofferdams for demolition, and removing pier footings to a depth 3 feet below the mudline. The proposed streamlined schedule that was developed extends the work window for pile and shoring casing installation, assumes the availability of four pairs of form travelers, and modifies the demolition approach to allow for a wire saw option, with no cofferdam, to remove the pier footings to the mudline. The wire saw option is carried forward with the original cofferdam option. Providing both options allows for the contractors to use the best alternative for each pier location to meet the environmental constraints of the Proposed Action. The combination of these modifications to the project approach, in addition to the IWWW extension discussed below, reduces the overall estimated duration of the Proposed Action to a six-year time frame.

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

- The IWWW will be established as October 1 through March 15. This was confirmed as the most biologically defensible window for this Proposed Action given the location on the river, as it allows for an expedited construction schedule, while still avoiding the peak run timing of both adult and juvenile salmon and steelhead.
    - In-water work activities that will be restricted to this IWWW will include all activities conducted below the OHWM that are conducted in contact with the wetted channel of the river, with the exception of vibratory pile removal. Such activities include (but are not limited to), vibratory and impact pile installation, installation of drilled shaft shoring casings, installation of cofferdams, and unconfined wire saw demolition of the existing pier foundations.

- The following activities will not be restricted to the IWWW, and may be conducted year-round, consistent with any applicable permit conditions.
    - Vibratory pile removal (temporary pipe piles and sheet piles).
    - 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) work within drilled shaft shoring casings (installation of temporary casings and slip casings, excavation, reinforcement, concrete placement), construction of formwork and concrete placement for spread footings, 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.

3.3. Detailed Description of Project Elements

This section provides a detailed description of the means and methods of construction of the various project elements. It is important to note that the project is in an early stage of design, and, as such, the description of the Proposed Action makes reasonable assumptions about construction timing, duration, methods, and impacts.

3.3.1. Mobilization and Site Preparation

Work will likely begin with the contractor mobilizing equipment and labor to the site. The contractor will most likely mobilize equipment to the site via barges and trucks. The contractor will install erosion control measures (silt fences, etc.) and debris containment devices (i.e., floating debris booms) consistent with a spill prevention, control, and countermeasures (SPCC) plan, pollution control plan (PCP), and construction stormwater pollution prevention plan (SWPPP). Clearing and grubbing limits will be established in the field prior to vegetation clearing.

3.3.2. Construction Access and Staging

Construction will require staging areas to store construction material, load and unload trucks, and conduct other construction support activities. It is estimated that a minimum of 2 acres will be necessary for staging and storage of materials and equipment.

Materials and equipment may be transported to the site by trucks and/or barges. Materials and equipment arriving by truck will be unloaded and staged in upland locations, either within the footprint of the Proposed Action or in approved off-site locations. It is anticipated that the larger construction materials will arrive at the site by barge. Materials and equipment delivered by barge may be offloaded to upland staging areas or may be temporarily staged on barges.

Specific off-site staging areas have not been identified at this stage of the design. Suitable site characteristics for material and equipment staging areas include: (1) large, previously developed sites suitable for heavy machinery and material storage; (2) proximity to the construction zone; (3) roadway or rail access for landside transportation of materials; and (4) waterfront access for barges. Specific staging locations will be established by the contractor during permitting and construction, and appropriate permits and access easements will be established at that time.

All material staging or equipment staging areas and any equipment fueling areas will be contained and located outside of environmentally sensitive areas. Staging and temporary access areas will occur in upland locations, on areas that are either already disturbed or that will be restored post-project. Material and equipment staging activities will be conducted consistent with the best management practices (BMPs) established in this BA (including consistency with the erosion and sediment control plan (ESCP), PCP, and SPCC plan for the Proposed Action), and consistent with conditions of permits issued for the Proposed Action. All temporarily disturbed areas will be revegetated upon completion of the Proposed Action, consistent with the requirements of any permit authorizations.

3.3.3. Temporary Work Structures

The Proposed Action will require the installation of several temporary in-water structures during the course of construction. These structures will include temporary work bridges, cofferdams, drilled shaft shoring casings, and temporary piles. These temporary features will be designed by the contractor after a contract is awarded, but prior to construction. These temporary structures are summarized in Table 4.

Table 4. Summary of Temporary Work Structure Types and Quantities

Project Element	Approximate Dimensions (ft)	Approximate Total Quantities	Temporary Benthic Impact (sq ft)	Temporary Overwater Coverage (sq ft)	Approximate Duration
Temporary Impacts					
Temporary Work Bridge (OR)	70 x 475	95, 24-inch steel pipe piles	298	20,825	3 years
Temporary Work Bridge (WA)	70 x 675	115, 24-inch steel pipe piles	361	28,875	3 years
Temporary Demo Work Bridge (WA)	70 x 700	120, 24-inch steel pipe piles	377	31,850	3 years
Cofferdams (Demolition) (up to 22 total)	Varies by bent 16 x 30 to 50 x 86	Up to 3,422 linear feet steel sheet pile	17,950	-	12-16 months (each)
Cofferdam (Spread footing)	30 x 38	136 linear feet of sandbags or similar	580	-	12-16 months
Drilled Shaft Shoring Casings	84-inch and 108-inch diameter	29, 84-inch-diameter casings and 13, 108-inch-diameter casings	426	-	4 months (each)
Other (non-load-bearing) Temporary Piles	24-inch diameter	200, 24-inch steel pipe piles	628	-	4 months (each)
Barges (15 total)	45' x 140'	15 barges, including spud piles and anchors	283	100,000	6 years

Temporary Work Bridges

Three temporary work bridges will be installed to support the construction of the Proposed Action. One temporary work bridge will be installed at each end of the proposed bridge alignment. The temporary construction work bridge on the Oregon side of the river will extend approximately 475 feet from the shoreline and will provide access to Bents 1, 2, and 3. The temporary construction work bridge on the Washington side of the river will extend approximately 675 feet from the shoreline, and will provide access to Bents 12, 13, and 14. These work bridges will most likely be installed at the beginning of the first in-water work window, and remain in place until construction of the replacement bridge is complete, a period of approximately three years.

A third temporary work bridge will be installed on the Washington side of the river to support the demolition of the existing bridge. This bridge is likely to be necessary because of the shallow water depths on the Washington side of the river, which may make barge access impractical. This work bridge will most likely be installed near the end of the new bridge construction period, and will remain in place until demolition of the existing bridge is complete, a period of approximately three years.

The exact design and configuration of the temporary work structures will be the responsibility of the contractor and will be developed as the design is advanced. For purposes of this consultation, the approximate locations of temporary work bridges have been identified and are shown on Figure 17. For purposes of this consultation, it is anticipated that temporary work structures will be supported by up to 330, 24-inch-diameter steel pipe piles.

Installation and removal of the temporary work bridges will be conducted consistent with the impact minimization BMPs described in Section 4, to further reduce the potential for impacts to ESA-listed species or critical habitats. These include the implementation of an SPCC plan and PCP that will specify the means and methods that will be employed to prevent the introduction of debris or contaminants into the water during installation and removal, as well as while they are present. The work bridges will be designed and installed so the bridge deck will not be inundated during high-water events, and containment will be provided consistent with the requirements of the permits that are ultimately issued for the project, including the 401 Water Quality Certifications.

The temporary work bridges will represent a temporary impact to approximately 1,036 square feet of benthic habitat from pile placement, and approximately 81,550 square feet of temporary impact to habitat quality from shading from the bridge deck. These impacts are described in more detail in Section 8. Temporary work bridges will be fully removed once construction and demolition activities are completed, which will result in the full restoration of function to the temporarily affected areas.

Other (Non-Load-Bearing) Temporary Piles

Additional temporary piles will be necessary throughout construction for a variety of purposes, including supporting falsework and formwork, pile templates, reaction piles, and for barge mooring. Temporary piles will likely be 24-inch-diameter, open-ended steel pipes. These piles will be non-load-bearing, and will be installed and removed solely with a vibratory pile driver. It is estimated that vibratory installation and removal of each temporary pile will take between 5 and 30 minutes per pile. Temporary piles will be removed after each relevant feature is completed.

It is estimated that approximately 200 such temporary piles may be required over the duration of the Proposed Action. The approximate number and dimensions of temporary piles, and anticipated duration are provided in Table 4.

Barges

Barges will be used as platforms to conduct work activities and to haul materials and equipment to and from the work site. Three barges will be needed at each pier during drilled shaft construction. At each pier, one barge for the oscillator and associated equipment, one for the companion crane and associated equipment, and one barge for drilled shaft spoils. At least one barge will remain at each pier after shaft construction to support column and superstructure construction.

Barges will vary in size, but will typically measure approximately 45 feet by 140 feet (approximately 6,300 square feet). No more than 15 barges are estimated to be moored or moving equipment for Columbia River bridge construction at a given time throughout the duration of the Proposed Action. The potential over-water footprint could be up to approximately 100,000 square feet at any given time (estimate based on a reasonable worst case estimate of 15 barges as shown in Table 4). Barges will most likely come from Portland or points downriver on the Columbia River, though it is possible that one or two barges could come from Puget Sound or elsewhere.

Construction barges will be secured via multiple means. Construction barges are typically equipped with "spuds," which are vertical piles in special brackets attached to the barge. These are lowered and anchored into the riverbed to secure the barge in-place. Because of wind, current, and wave action, the barges may also be anchored with multiple large anchors, so called "Danforth" anchors, which are attached to winches on the deck of the barges. These anchors are set up-river as well as transverse to the current to hold the barges in place and allow their location to be adjusted using the winches. Each barge will have up to four spuds, one at each corner of the barge. Each barge will also have four anchors, two of which will be set up-river, and one in each direction transverse to the current. Barges will have appropriate containment measures (outlined in the SPCC plan and PCP) to minimize the potential for release of contaminants to surface waters. Examples of typical BMPs include curbing, plugged scuppers, and the use of secondary containment for fuel and equipment.

There would likely be a ramp-up and down of barges at the beginning and end, but a conservative estimate is that all 15 barges could be present for the full construction period.

Cofferdams

A temporary cofferdam will be installed to create an isolated in-water work area for the construction of the spread footing foundation at Bent 14 on the Washington shoreline. The cofferdam for the spread footing at Bent 14 will be a gravity-based system, most likely consisting of sandbags or similar structure covered with an impervious material. A sheet pile system is not necessary because of the low water levels that occur at this location as well as the near-surface rock stratum. The system will be capable of completely isolating the work area from the active flowing channel and of completely excluding fish from the in-water work area (work area isolation and fish salvage would likely be required and is described in Section 3.3.4).

Sheet pile cofferdams may also be installed at one or more piers on the existing bridge to create an isolated work area for demolition of the existing bridge foundations (see Section 3.3.8 for additional detail regarding demolition). Up to 22 such cofferdams may be required. These sheet pile cofferdams will consist of interlocking steel sheet piles that will be installed either with a vibratory hammer or with press-in methods. Sheet pile cofferdams will be removed using a vibratory hammer or direct pull methods.

Table 4 provides an estimate of the dimensions of the sheet pile cofferdams and the approximate duration that they will be present in the water. The sheet pile cofferdams will be of variable dimensions, because the dimensions of the existing piers are also variable. For purposes of this consultation, it is assumed that cofferdams will be offset 5 feet from the edge of each existing footing. This will result in cofferdams ranging in size between approximately 30 feet by 16 feet (approximately 480 square feet), and approximately 50 feet by 86 feet (approximately 4,300 square feet) for the largest bents that flank the Navigation Channel. In total, the installation of the cofferdams will temporarily displace access to approximately 17,950 square feet of benthic habitat surrounding the existing in-water bridge piers.

Cofferdams will be installed in a manner that minimizes fish entrapment. Sheet piles will be installed from upstream to downstream, and sheet piles and sandbags will be lowered slowly until contact with the substrate to minimize benthic disturbance.

Drilled Shaft Shoring Casings

Installation of drilled shafts will be conducted by first oscillating a temporary outer steel shoring casing, with an outer diameter approximately 12-inches larger than that of the finished drilled shaft, to act as an isolation structure. The outer shoring casings will be 84 inches for the 72-inch shafts, and 108 inches for the 96-inch shafts.

Temporary drilled shaft shoring casings will be installed either with an oscillator or with a vibratory hammer and will be removed with a vibratory hammer. These shoring casings will temporarily displace an area approximately 6 inches around each drilled shaft location, which will represent a temporary impact to approximately 426 square feet of benthic habitat. Temporary drilled shaft shoring casings will be in place for approximately 12 to 16 months at each drilled shaft location. Shoring casings will be designed and installed such that they will not be inundated during high water events, and installation and removal will be conducted consistent with the requirements of the permits that are ultimately issued for the project, including the 401 Water Quality Certifications.

3.3.4. Work Area Isolation and Fish Salvage

In-water work areas that will be isolated from the active flow of the river to reduce potential effects include drilled shaft shoring casings, the sandbag cofferdam for the spread footing at Bent 14, and temporary sheet pile cofferdams for demolition (for those bents that a contractor elects to employ them when not using a wire saw).

Fish salvage measures will be employed to remove fish from the work area during and after the installation of drilled shaft shoring casings and cofferdams. Fish salvage within isolated work areas will be conducted according to the best practices established in the biological opinion for FHWA and ODOT's Federal Aid Highway Program programmatic consultation. 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. To minimize take, efforts will be made to capture ESA-listed fish known or likely to be present in an in-water isolated work area using methods that are effective, minimize fish handling, and minimize the potential for injury. Attempts to seine and/or net fish, or the use of minnow traps shall precede the use of electrofishing equipment. Isolation structures will be installed such that they will not be overtopped by high water.

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. A fish salvage report will be prepared and submitted to NOAA and USFWS following the completion of each in-water work season.

3.3.5. Bridge Foundation Construction

The replacement bridge will be founded upon a total of 15 bents, 13 of which will be located either entirely or partially below the OHWM of the Columbia River. The foundation design includes three different foundation types: (1) pile-supported foundations; (2) drilled-shaft-supported foundations; and (3) spread footings.

The proposed bridge foundation design was established in a TS&L study that was conducted for the Project in 2011. As part of this study, a preliminary geologic profile at the proposed bridge alignment was developed based on a review of historic construction documents, and project-specific investigations which included a bathymetric survey, a geophysical survey, and three geotechnical borings. The results of the geotechnical sampling revealed that, in general, the depth to bedrock is generally deep (50 to 100 feet) below the streambed surface on the Oregon side of the river, and is nearer to the surface on the Washington side.

The foundation design that is proposed in this Proposed Action was developed based upon this preliminary geotechnical assessment. The design assumes the use of driven pile foundations at locations where the depths to bedrock are relatively deep (greater than 50 feet below ground surface) while drilled shafts would be more economical in locations where depths to bedrock are nearer to the surface (less than 50 feet below ground surface). Spread footings are proposed where bedrock is located at or near the surface and deep foundations are not required.

Typical cross sections of the proposed foundation types are provided in Figure 9. Table 5 provides a summary of the sizes of the proposed footings, and the number of piles and/or drilled shafts anticipated at each footing. Each foundation type is described in greater detail in the subsections below.

Table 5. Summary of Replacement Bridge Foundation Types and Quantities

Bent Number	Foundation Type	Location	Dimensions (ft)	Total Quantities		
				48" Steel Pipe Piles	72" Drilled Shaft	96" Drilled Shaft
Bent 1	Pile Supported	Terrestrial	12 x 56	5	0	0
Bent 2	Drilled Shaft	Below OHWM	12 x 30	0	2	0
Bent 3	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 4	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 5	Pile Supported	Below OHWM	56 x 56	25	0	0
Bent 6	Pile Supported	Below OHWM	56 x 56	25	0	0
Bent 7	Pile Supported	Below OHWM	56 x 56	25	0	0
Bent 8	Drilled Shaft	Below OHWM	40 x 64	0	0	6
Bent 9	Drilled Shaft	Below OHWM	40 x 64	0	0	6
Bent 10	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 11	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 12	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 13	Drilled Shaft	Below OHWM	30 x 30	0	4	0
Bent 14	Spread Footing	Below OHWM	20 x 28	0	0	0
Bent 15	Spread Footing	Terrestrial	12 x 56	0	0	0
NA	Contingency	Below OHWM	NA	8	3	1
Totals				**88**	**29**	**13**
Totals below OHWM				**83**	**29**	**13**

Pile-Supported Foundations

The terrestrial-based foundation on the Oregon side of the River (Bent 1), and three of the proposed in-water foundations (Bents 5 through 7) will be pile-supported. Each of these foundations will be supported by 48-inch-diameter steel pipe piles.

Bent 1 will require a total of five 48-inch piles. These piles will all be located above the OHWM of the Columbia River. Bents 5 through 7 will each require twenty-five 48-inch piles. A contingency of an additional eight in-water piles is also factored into the analysis in this consultation to cover the potential need for additional piles as the design progresses. This represents a potential total of up to eighty-three 48-inch-diameter steel pipe piles to be installed below the OHWM of the Columbia River (Figure 17).

These structural piles will be installed with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. An impact hammer will be used to drive the piles to the final tip elevation, and/or to proof the piles to verify load-bearing capacity (additional detail regarding impact and vibratory pile driving is provided in Section 3.3.5). Piles will be driven into bedrock, which is located at depths between approximately 50 and 120 feet below ground surface.

Once the piles for the foundation are installed, a concrete pile cap will be installed atop the piles at the waterline, and the concrete pier and superstructure will be installed atop the pile cap. The pile caps will be either precast or cast-in-place. If pile caps are cast-in-place, the BMPs described in Section 4.4 will be implemented to avoid and minimize impacts to water quality. Superstructure construction is described in Section 3.3.6.

Drilled Shaft-Supported Foundations

In areas where subsurface conditions make driven piles less cost effective, drilled shafts will be used to support the foundations. A total of nine of the in-water foundations will be supported by drilled shafts (Figure 17). The design includes the installation of up to twenty-nine 72-inch-diameter drilled shafts, and up to thirteen 96-inch-diameter drilled shafts (these numbers include a 10 percent contingency). The larger-diameter drilled shafts will be used on the bents that flank the navigation channel (Bents 8 and 9). In general, drilled shafts will be installed where bedrock is encountered at depths of approximately 50 feet or less below ground surface.

Drilled shaft construction will occur within isolated work areas inside of shoring casings (described in Section 3.3.3) to minimize impacts to the aquatic environment. Once the shoring casings are installed, and fish salvage has been conducted as described in Section 3.3.4, the installation of drilled shafts will commence. Installation of drilled shafts will be conducted by first oscillating or vibrating a temporary steel casing to a specified design depth (design depth will vary by bent). As the temporary casing is being advanced to the design depth, soil will be removed from inside the casing using an auger and clamshell. Sediment excavation and handling will be conducted consistent with the BMPs described in Section 4. Excavated soils will be temporarily placed onto a barge with appropriate containment and ultimately placed at an approved upland site. No contaminated sediments have been documented at the project site, but if contaminated sediments are encountered, they will be managed and disposed of at a facility permitted for handling such materials.

Once the interior of the temporary casing has been excavated to the design depth, an interior slip casing of the finished diameter of the shaft will be installed. The slip casing allows the temporary casing to be removed. This casing will be installed either with an oscillator or vibratory hammer. Once the slip casing has been installed to the required depth, a steel reinforcement cage will be installed within the slip casing, and the shaft will be filled with concrete. Concrete will be installed via a tremie method. The interior of the temporary casing will either be dewatered prior to concrete installation, or the rising water will be collected off the surface of the concrete as the pour elevation increases. Water collected in this manner will be pumped into tanks, treated to meet state water quality standards, and disposed of at an approved location. Water levels within the temporary casing will be maintained at a lower elevation than the surrounding river surface elevation to maintain negative pressure.

Once the concrete is installed, it will be left to cure. Once cured, the temporary casing will be removed with a vibratory hammer. The slip casing may either be removed or may be left in place.

As with the pile-supported foundations, once the drilled shafts are installed, a concrete pile cap will be installed atop the shafts at the waterline, and the concrete pier and superstructure will be installed atop the pile cap. Pile caps will be either precast or cast-in-place. If pile caps are cast-in-place, the BMPs described in Section 4.4 will be implemented to avoid and minimize impacts to water quality. Superstructure construction is described in Section 3.3.6.

Installation of drilled shafts (including management of excavated soils and water) will be conducted consistent with the BMPs described in Section 4, and consistent with conditions of permits issued for the Proposed Action. These BMPs include the implementation of an SPCC plan and PCP designed to minimize impacts to water quality and maintain compliance with state water quality standards.

Spread Footing

The northern-most in-water foundation adjacent to the shoreline on the Washington side of the river (Bent 14) is proposed to be an approximately 20- by 28-foot reinforced concrete spread footing. This foundation design is due in part to the presence of bedrock near the ground surface elevation, making a pile-supported or drilled-shaft supported foundation unnecessary at this location.

Construction of the spread footing at Bent 14 will be conducted within a temporarily dewatered work area. As described in Section 3.3.3, the cofferdam will be a gravity-based system, most likely consisting of sandbags or similar structures placed by a crane on the river bed and covered with an impervious material such as plastic sheeting. The cofferdam will be of sufficient height and strength that it will be able to contain any concrete that could escape the forms in the event of a failure. Once the cofferdam is installed and the dewatered work area established, formwork will be installed for the spread footing. Formwork will be sealed to further minimize the potential for any uncured concrete coming into contact with the river.

Once the formwork is installed and sealed, steel reinforcing will be installed within the forms and the concrete for the footing poured. The cofferdam will remain in place until the concrete is cured to allow the concrete to cure in a dewatered environment. Once the concrete for the footing is cured, the formwork will be removed followed by the temporary cofferdam.

Installation and removal of the cofferdam has the potential to result in temporarily elevated turbidity, but this will be minimized through the implementation of the BMPs described in Section 4. These BMPs include the implementation of an SPCC plan and PCP designed to minimize impacts to water quality and maintain compliance with state water quality standards.

3.3.6. Impact and Vibratory Pile Driving

Vibratory Pile Driving and Removal

Installation of both temporary and permanent piles will be conducted with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. Drilled shaft casings (including shoring casings, temporary casings, and slip casings) will be installed either with an oscillator or with a vibratory hammer. In addition, installation and removal of steel sheet piles for temporary cofferdams will also be conducted with a vibratory hammer. Typically, only a single vibratory hammer will be in use on a given day, but it is possible that two or more vibratory hammers may be operated simultaneously.

Temporary Piles

Temporary hollow steel pile (HSP) piles for non-load-bearing structures (such as those for pile templates, temporary falsework, and many temporary barge mooring applications) will be installed and removed solely with a vibratory hammer and will not require impact hammer to proof bearing capacity. These piles will be vibrated into the sediment until refusal or specified elevation. Load-bearing temporary piles (such as those that will be used on the temporary work bridges) will also be installed to the extent practicable with a vibratory hammer before being finished and/or proofed, as necessary, with an impact hammer. In general, piles will be vibrated to the point of refusal, then finished and/or proofed with an impact hammer.

Vibratory installation is estimated to take between 5 and 30 minutes per pile, and vibratory removal is estimated to require a similar duration of activity. At this rate of production, it is anticipated that up to approximately 20 temporary, hollow steel pipe piles could be installed and/or removed on a given day. Because temporary piles for falsework and barge mooring applications will be installed and removed throughout the duration of construction, it is conservatively estimated that vibratory pile driving could be conducted on up to approximately 300 (nonconsecutive) days.

Steel Sheet Piles

Steel sheet piles for temporary cofferdams will be installed and removed solely with a vibratory hammer. Sheet piles for cofferdams will be vibrated approximately 50 feet into the sediment. Vibratory installation is estimated to take between 10 and 60 minutes per pile, and vibratory removal is estimated to require a similar duration of activity. At this rate of production, it is anticipated that up to approximately 50 linear feet of sheet pile (or approximately twenty-five 2-foot-wide sheet pile sections) could be installed and/or removed on a given day. It is further conservatively estimated that vibratory installation or removal of sheet piles could be conducted on up to approximately 100 (nonconsecutive) days.

Drilled Shaft Casings

Drilled shaft casings (including shoring casings, temporary casings, and slip casings) will be installed either with an oscillator or with a vibratory hammer. Installation and removal of the casings (all types) is estimated to take between 10 and 60 minutes per casing. At this rate of production, it is anticipated that up to approximately five casings could be installed and/or removed on a given day. However, on many days work may be limited to a single casing. It is further conservatively estimated that installation or removal of drilled shaft casings (all types) could be conducted on up to approximately 100 (nonconsecutive) days.

Permanent Piles

Permanent structural piles (HSP) will be first vibrated either to refusal or to a depth near the final tip elevation. An impact hammer will then be used to drive the piles to the final tip elevation, and/or to proof the piles to verify load-bearing capacity. Vibratory installation is estimated to take between 10 and 45 minutes per pile. At this rate of production, it is anticipated that up to approximately ten permanent structural piles could be vibrated into place on a given day, though on many days fewer piles would be installed. Assuming a typical rate of production, it is conservatively estimated that vibratory installation of permanent structural piles could be conducted on up to approximately 85 (nonconsecutive) days.

It is expected that only a single vibratory pile driver will be in use on the Project at a given time, but there is a potential that a contractor could elect to employ a second vibratory pile driving rig during certain periods of construction. In addition, the contractor may elect to have both a vibratory and impact pile driving rig in operation simultaneously.

Impact Pile Driving

An impact pile driver will be required to complete the installation of both load-bearing temporary piles and permanent structural piles, and/or to proof these piles to verify load bearing capacity.

Load-Bearing Temporary Piles

It is estimated that load-bearing HSP temporary piles (first vibrated to refusal as described above) could require approximately 150 to 300 strikes per pile to install to final tip elevations and to proof bearing capacity. This number of strikes will require a maximum of approximately 10 to 20 minutes of impact hammer activity. At this rate of production, up to approximately 10 temporary piles could be installed and/or proofed with an impact hammer per day, resulting in a maximum of up to 1,500 impact strikes per day on temporary piles if a single impact pile driver is in operation, or up to 3,000 impact strikes per day if two pile driving rigs are operated concurrently. These estimates are intended to be reasonable worst-case assumptions. Actual rates of installation will be determined by the type of installation equipment, substrate, and required load-bearing capacity of each pile.

Assuming an average rate of production, it is estimated that installation and proofing of load-bearing temporary piles for the temporary work bridges will require approximately 100 days of impact pile driving (non-continuous).

Permanent Piles

An impact hammer will also be used to complete installation and/or proofing of the 48-inch steel structural piles at Bents 5 through 7. It is estimated that between 1,000 and 1,500 impact strikes may be required to finish driving and/or proofing a given pile. This number of strikes will require a maximum of approximately 30 to 45 minutes of impact hammer activity. It is further estimated that up to a maximum of six piles per day may be installed and/or proofed with an impact hammer, with an estimated total maximum number of 3,000 impact strikes per day if a single impact pile driver is in operation, or up to 6,000 impact strikes per day if two pile driving rigs are operated concurrently. It is important to note that actual pile production rates will vary, and a typical day will likely have fewer strikes.

Assuming an average rate of production, it is estimated that installation of the structural piles for the replacement bridge will require up to approximately 100 days of impact pile driving (non-continuous).

It is expected that typically only a single impact pile driver will be in use at a given time, but there is a potential that a contractor could elect to employ a second impact pile driving rig during certain periods of construction. In addition, the contractor may elect to have both a vibratory and impact pile driving rig in operation simultaneously. In either scenario, the number of impact strikes from both rigs would not exceed the maximum number of 6,000 strikes per day.

Pile Driving Summary

Table 6 provides a summary of the anticipated vibratory and impacts pile driving activities, anticipated durations, and number of pile strikes for each activity.

Table 6. Pile Driving Summary

Pile Type	Size/Dimensions	Hammer Type	Estimated Duration				
			Estimated Time/Pile	Estimated Impact Strikes/Pile	Maximum Impact Strikes/Day	Estimated Piles/Casings per Day	Total Days of Pile Driving (Nonconsecutive)
Temporary Piles	24-inch-diameter steel pipe piles	Vibratory	5-30 min.	-	-	20 piles	300
		Impact	10-20 min.	150-300	1,500 (Single Pile Driver) 3,000 (Two Pile Drivers)	10 piles	100
Sheet Piles	Steel sheet piles	Vibratory	10-60 min.	-	-	50 linear feet	100
Drilled Shaft Casings (all types)	72- to 108-inch-diameter steel casings	Vibratory	10-60 min.	-	-	5 shafts	100
Permanent Piles	48-inch-diameter steel pipe piles	Vibratory	10-45 min.	-	-	10 piles	85
		Impact	30-45 minutes	1,000-1,500	3,000 (Single Pile Driver) 6,000 (Two Pile Drivers)	6 piles	100

An analysis of impacts associated with noise from vibratory and impact pile driving is provided in Section 8.2. The Proposed Action has been designed to minimize the extent of impacts resulting from pile installation activities. The Proposed Action will implement a bubble curtain during impact pile driving activities to attenuate underwater noise. The bubble curtain will be consistent with NOAA Fisheries/USFWS guidance (Appendix E). In addition, all in-water pile installation will be conducted within the approved in-water work period for the Proposed Action. Impacts will be further minimized through implementation of the avoidance and minimization measures described in Section 4.2.

3.3.7. Bridge Superstructure Construction

Once the foundations and pile caps have been installed, the superstructure of the bridge will be constructed and installed. The superstructure will consist of both precast and cast-in-place concrete segments. Additional finish work will also be conducted, including surfacing, paving, and installation of other finish features, such as striping and signage.

Work on the superstructure will be conducted from the bridge deck, from the deck of temporary work bridges, and/or from barges. Construction of the superstructure will require cranes, work barges, and material barges in the river year-round.

It is anticipated that the superstructure will be constructed using a balanced cantilever method that uses paired sets of form travelers (movable concrete forms) to build outwards from each pier. Once a pier is completed, that pier is used as an initial anchor point for a pair of form travelers. As each section of the superstructure is constructed, the paired form travelers are moved incrementally farther away from the center of the pier in tandem. In this way the static forces on the pier maintain equilibrium. The conceptual schedule that has been developed for this consultation assumes that a contractor may operate up to four pairs of form travelers at a given time to expedite the construction of the superstructure.

Construction of the superstructure, including cast-in-place concrete work, will occur either above the OHWM elevation or within isolated work areas below the OHWM (within sealed forms, cofferdams, or drilled shaft shoring casings) and, as such, would be fully isolated from the river. Therefore, these activities would not be restricted to an in-water work window.

Precast Concrete Elements

Many of the bridge superstructure components will be composed of precast concrete. Precast elements will likely include bridge columns, beams, girders, and deck panels. Precast bridge elements will be constructed in upland controlled environments and will be transported to the project site by either barge or truck. Specific casting sites and/or facilities have not been identified at this time, but this consultation assumes that casting sites will occur in permitted upland locations. The Proposed Action does not propose the construction of any new concrete casting facilities.

Precast bridge components arriving by barge or by truck may be temporarily offloaded to materials staging areas, and then installed using cranes mounted to temporary work bridges or barges. Once a precast member is installed, the superstructure components will be post-tensioned, in which steel reinforcing cables are placed in ducts within the structure, the steel is tensioned and then the ducts are pressure grouted. Epoxy is also used in the post-tensioning process.

Pressure grouting and epoxy work associated with post-tensioning precast elements of the bridge will be conducted consistent with the BMPs described in Section 4, and consistent with conditions of permits issued for the Project. These BMPs include the implementation of an SPCC plan and PCP designed to minimize impacts to water quality, and maintain compliance with state water quality standards.

Cast-in Place Concrete Elements

Components of the superstructure that may require cast-in-place concrete work include the foundation pile caps, pouring for the spread footing, filling drilled shafts, fixing precast segments together, and for paving the road surface along the top of the bridge.

Cast-in-place elements of the superstructure would be conducted in isolated conditions, to prevent any leaks of concrete or water that has come in contact with uncured concrete. Formwork for pile caps and spread footings, and slip casings for drilled shafts will be sealed and watertight, and will not allow uncured concrete to come in contact with the river.

Concrete for cast-in place applications will most likely be delivered by concrete pump trucks. These trucks may be operated from adjacent upland locations, from temporary work bridges, the bridge deck, or from barges. Regardless of the means or location of delivery or staging of concrete, the BMPs described in Section 4 will be implemented to maintain compliance with state water quality standards.

Work bridges, platforms and barges will have suitable containment measures (outlined in the SPCC plan and PCP) to prevent and/or contain accidental spills, and to ensure no uncured concrete or other debris discharges to surface waters. Examples of typical BMPs include curbing, plugged scuppers, and the use of secondary containment for fuel and equipment. These applications will be installed with a minimum vertical height appropriate to contain runoff water. Water that comes in contact with uncured concrete will be contained, collected, and treated consistent with the BMPs described in Section 4, and consistent with the requirements of permit conditions, including the 401 Water Quality Certifications for the Proposed Action.

3.3.8. Demolition and Removal of the Existing Bridge

The existing bridge will remain in place until the replacement bridge is constructed and operational, at which point it will be dismantled and removed. Demolition of the existing bridge will include dismantling of the superstructure, and removal of the in-water foundation structures. This work will be conducted via barges and/or temporary work platforms. Equipment required for bridge demolition will likely include barge-mounted cranes/hammers or hydraulic rams, and wire saws. Vibratory hammers will be used to install and remove sheet piles for cofferdams, where necessary, and pipe piles for barge moorings, as described in Section 3.3.5.

Superstructure Demolition

The superstructure of the existing bridge consists of steel trusses that are bolted and welded together. There is a lift span with two lift towers and a system of counterweights. The decking of the bridge consists of steel grating and there is no pavement.

Demolition of the superstructure will most likely be conducted by barge-mounted cranes. Demolition of the superstructure will likely begin with removal of the counterweights. The lift towers will likely be removed next. The lift towers and truss sections will then be cut into manageable pieces and loaded onto barges or trucks by a crane. Each section will then be either transported to an upland site for further dismantling or disposed of directly at an appropriately permitted upland facility.

Lead paint, asbestos-containing materials, and/or polychlorinated biphenyls (PCBs) may be present on portions of the existing bridge. These materials will need to be properly abated and disposed of consistent with state and/or federal requirements prior to demolition of the superstructure, to minimize the potential for any release into the aquatic environment. Demolition and removal of the existing bridge (including containment and abatement of any hazardous materials) will be conducted consistent with the impact minimization BMPs described in Section 4, to further reduce the potential for impacts to ESA-listed species or critical habitats. These include the implementation of an SPCC plan and PCP that will specify the means and methods that will be employed to prevent the introduction of debris or contaminants into the water during demolition. Containment and abatement of any hazardous materials will be consistent with the requirements of the permits that are ultimately issued for the project, including the 401 Water Quality Certifications.

Foundation Demolition

The existing bridge is founded on a total of 30 pile-supported, concrete bents. A total of 22 of these bents are located below the OHWM of the Columbia River, currently covering an area approximately 9,815 square feet. The two bents that are located on either side of the existing navigation channel are protected by riprap (approximately 7,800 cubic yards), which currently covers an area of approximately 16,600 square feet.

Removal of the existing foundations will be conducted by one of the two methods described below:

1. Wire saw removal to mudline, without a cofferdam. A diamond wire/wire saw will be used to cut the foundation into manageable pieces that will be transported to a barge and disposed of in a permitted offsite upland location. The foundations will be removed to the mudline and the substrate will be naturally restored with surrounding sediments. No clean sand or other fill material will be installed. This activity will be restricted to the in-water work window.

2. Wire saw or conventional pier removal techniques within a cofferdam. Conventional removal techniques will likely consist of using a hydraulic ram to break the piers into rubble and torches or other cutting methods to cut reinforcement. Materials will then be transported to a barge and disposed of in a permitted off site upland location. The foundations will be removed to the mudline and the substrate will be naturally restored with surrounding sediments. No clean sand or other fill material will be installed. Cofferdams will be installed within the in-water work window, but work within cofferdams, and cofferdam removal, may be conducted at any time of the year.

It is assumed that the cofferdam demolition option will be used at both of the bents (Bents 8 and 9) that flank the Navigation Channel, but may also be used in other pier locations. Where cofferdams are used for demolition, they will consist of sheet piles, and they will be installed consistent with the approach described in Section 3.3.3 and will include fish salvage consistent with NOAA's guidance as described in Section 3.3.4.

At the two Navigation Channel piers, once cofferdams are installed and fish salvage has occurred, the existing riprap will be removed. Riprap will be removed via a barge mounted clamshell, and loaded onto barges, and disposed of at an off-site permitted upland location. Once riprap has been removed, the existing piers will either be demolished using one of the methods described above.

Once foundations and riprap (where present) have been removed to the mudline and all debris has been captured, cofferdams will be removed and the substrate will be naturally restored with surrounding sediments. No clean sand or other fill material will be installed.

Removal of the existing bridge has the potential to result in similar impacts to water quality as those associated with construction of the replacement bridge. Removing the old foundations from the river will temporarily disturb benthic sediments and could result in temporarily elevated turbidity or pH locally. Removal of the existing bridge will also present a potential for debris or other deleterious materials to enter the water. Demolition and removal of the existing bridge will be conducted consistent with the impact minimization BMPs described in Section 4.2, to further reduce the potential for impacts to ESA-listed species or critical habitats.

3.3.9. Post-Project Site Restoration

Construction of the Proposed Action will result in temporary impacts to native and non-native vegetation on both the Oregon and Washington sides of the river. Areas temporarily disturbed during construction will be restored upon completion of the Proposed Action consistent with state and local regulations.

On the Oregon side of the river, most temporary disturbance will occur within areas that are either impervious or already developed. The Proposed Action will temporarily disturb approximately 1.86 acres of vegetation that is currently in landscaping, lawns, or similar heavily managed vegetation. Post-project site restoration in these areas will likely consist of replacement landscaping with similar ornamental species. No native plant communities will be disturbed on the Oregon side of the river.

On the Washington side of the river, vegetation will be cleared within a temporary work zone approximately 3.45 acres in size to allow construction equipment to access the site, to construct the replacement bridge abutments and stormwater treatment facilities (Figure 19), and to remove the existing bridge. Approximately 1.09 acres of this temporary vegetation clearing will occur within the

200-foot shoreline jurisdiction of the Columbia River, and is regulated by the City of White Salmon under its Shoreline Master Program. A large oak tree that is present east of the existing bridge will be preserved, and will not be affected by the Proposed Action.

The approximately 2.36 acres of temporary disturbance outside of the 200-foot shoreline buffer on the Washington side of the river will be revegetated upon completion of the Proposed Action consistent with state and local regulations. Temporarily disturbed areas within ODOT and WSDOT rights-of-way will be replanted consistent with applicable ODOT and WSDOT requirements and design standards

A total of approximately 1.38 acres of riparian shoreline buffer will be disturbed on the Washington side of the river. Approximately 0.29 acres of this disturbance will be permanent, where the replacement bridge approach will be located. The remaining approximately 1.09 acres of temporarily disturbed vegetation within the riparian shoreline buffer on the Washington side of the river will be restored with native vegetation once construction and demolition activities are complete. This restoration will be conducted consistent with requirements in the White Salmon Municipal Code Critical Areas Ordinance and Shoreline Master Program.

3.3.10. Stormwater Runoff Treatment

This section describes the stormwater management proposed for temporary construction activities and for runoff from permanent new impervious surface areas constructed by the Proposed Action, and contributing areas. For the purposes of this section, the “project footprint” is defined as areas of new and rebuilt pavement, existing pavement that will be resurfaced and existing pavement that will be removed. It does not include existing pavement that will not be affected, even if runoff from that surface will be treated by the Proposed Action.

Existing Conditions

Figure 10 shows the existing drainage systems and outfalls in the project corridor. Following is a brief description of these features. All stormwater within the project footprint currently is either infiltrated or discharges directly to the Columbia River. The existing bridge deck is approximately 1.9 acres in size, and no stormwater runoff control or water quality treatment is provided. Currently, any precipitation that hits the bridge deck passes directly to the aquatic environment untreated. Similarly, contaminants from vehicles using the existing bridge (fuel, oil, lubricants, PAHs, trace heavy metals [primarily copper and zinc] from brake pads, etc.) currently pass directly to the aquatic environment, uncaptured and untreated.

Table 7 shows the average monthly discharges for the Columbia River based on data available from a U.S. Geological Survey (USGS) gauging stations (Station #14105700) located at The Dalles, Oregon. These data provide an indication of the relative size of the receiving waterbody and permit a comparison of estimated project runoff with discharges in the receiving waterbody

Table 7. Mean Monthly Discharge

Month	Columbia River at The Dalles (USGS 14105700)
January	124,000
February	133,000
March	151,000
April	208,000
May	334,000

Month	Columbia River at The Dalles (USGS 14105700)
June	419,000
July	286,000
August	169,000
September	117,000
October	104,000
November	110,000
December	119,000

Temporary Construction Activities

Without proper management, construction activities could create temporary adverse effects on water quality in nearby water bodies, such as increased turbidity or the accidental release of fuels and soluble or water-transportable construction materials. Table 8 summarizes project-related areas of temporary disturbance by state and includes all areas within the proposed project footprint. It does not include potential staging areas on land outside the footprint, nor construction areas in or over water. Staging areas are described in Section 3.3.2.

Table 8. Areas of Potential Temporary Disturbance during Construction

Receiving Waterbody/State	Potential Area of Temporary Disturbance (acres)
Columbia River/Washington	4.24
Columbia River/Oregon	3.41

Staging activities will be required to comply with local and state stormwater treatment requirements. Typical runoff from these sites could include oils, greases, metals, solvents and/or high-pH water from concrete clean out. Stormwater treatment BMPs would be designed to treat specific areas of these sites. Site-specific BMPs 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. Appropriate BMPs for stormwater treatment are discussed further in Section 4.

National Pollutant Discharge Elimination System Construction Stormwater Discharge Permits will regulate the discharge of stormwater from construction sites. These permits include discharge water quality standards, runoff monitoring requirements, and provision for preparing and implementing a SWPPP for construction activities. The SWPPP and its implementation by construction personnel are essential for ensuring water quality standards are met during construction, and a single, comprehensive plan will facilitate project-wide consistency. Contractors will be required to have a certified Erosion and Sediment Control lead on staff to oversee proper implementation of the SWPPP.

Typical elements of a SWPPP are identified in Section 4. Water quality standards, which include standards for the discharge of turbidity and pH, are usually monitored at the point of discharge. The selection of specific construction BMPs is dependent on the specific site layout and sequence of construction activities.

Permanent Water Quality Systems

The following sections describe the general approach to the management and proposed treatment of stormwater from impervious surfaces associated with the Proposed Action. Table 9 provides the approximate areas of new and rebuilt impervious surfaces by project element and watershed. The acreages presented below include all impervious surface area (ISA) associated with the Proposed Action. The acreages presented later in this section, which are in relation to stormwater treatment design, include contributing impervious area (CIA), which can include impervious surfaces outside of the project site. Therefore, the values in Table 9 are similar to values presented in further discussion, but cannot be compared directly.

Table 9. Impervious Surface Area by Project Element and Watershed

State	Drainage Area	Pre-Project ISA (acres)	Post-Project ISA (acres)	Net New ISA (acres)	Change (%)
Oregon	Drainage Area A	9.79	12.64	2.85	29
	Drainage Area B	1.09	1.17	0.08	7
Washington	Drainage Area C	1.25	3.10	1.85	148
	Drainage Area D	1.30	1.52	0.22	17
	Drainage Area E	1.21	1.66	0.45	37
Totals		**14.64**	**20.09**	**5.45**	**37**

Figure 11 shows the project footprint and those parts of the Proposed Action that will be new or rebuilt versus those parts expected to be resurfaced. The Proposed Action will result in 2.93 acres of net new ISA within Oregon, which represents an increase of approximately 27 percent. Within Washington, the Proposed Action will result in 2.52 acres of new ISA, which represents an increase of approximately 67 percent. Within the project footprint as a whole, the Proposed Action will increase the overall ISA by approximately 5.45 acres which represents an approximately 37 percent increase.

Contributing Impervious Area

The intent of project stormwater management strategies is to reduce the potential impact on water quality and discharge from project-related changes in ISA. Stormwater treatment for the Proposed Action will be consistent with the ODOT Hydraulics Design Manual (ODOT 2014), which uses CIA to establish treatment requirements.

A project’s CIA has two components, the pavement within the project limits and impervious surfaces owned or controlled by the transportation agency outside of the project limits from which stormwater flows into the project. Off-site flow can be surface flow onto the project pavement or conveyed by the drainage system serving the project when that system has been installed or modified as part of the project. If the drainage system isn’t modified, then upstream sources of stormwater are not in the CIA. Non-highway-related impervious areas (commercial development, residences, agricultural land) are not part of the CIA. On the other hand, transportation-operated facilities, such as rest areas, are considered to be part of a project’s CIA. Sidewalks and bike paths, though on their own not triggers for water quality treatment, are part of the CIA for purposes of sizing BMPs.

For purposes of this analysis, the CIA includes all paved roadway and bridge surfaces, as well as impervious surfaces outside the project limits that contribute stormwater to the Project’s treatment

BMPs. Bike/pedestrian paths and sidewalks and pedestrian overlooks are also included within the CIA for purposes of conservatively estimating the size of the stormwater treatment BMPs[2].

Table 10. Contributing Impervious Area by Watershed and Drainage Area

State	Drainage Area/Location	Pre-Project CIA (acres)	New CIA (acres)	Post-Project CIA (acres)	Change (%)
Oregon	Drainage Area A – On Site	1.70	2.86	4.04	168
	Drainage Area A – Off Site	0	0.08	0.34	-
	Drainage Area B – On Site	0	1.17	1.17	-
	Drainage Area B – Off Site	0	0	0	-
Washington	Drainage Area C – On Site	0	3.09	3.09	-
	Drainage Area C – Off Site	0	0	0	-
	Drainage Area D – On Site	1.31	0.50	1.50	38
	Drainage Area D - Off-site Retrofit	0	0	0.30	NA
	Drainage Area E – On Site	1.21	0.47	1.64	39
	Drainage Area E - Off-site Retrofit	0	0	0.33	NA
Totals		**4.22**	**8.17**	**12.38**	**194**

The total Post-Project CIA for the Proposed Action is estimated to be approximately 12.38 acres. This area includes about 11.41 acres of new, rebuilt, and resurfaced impervious surface area created by the Proposed Action and approximately 0.97 acre of existing impervious area that, while unaffected by the Proposed Action, will contribute runoff to the area included in the project footprint. Runoff from 100 percent of the CIA will be treated or infiltrated.

Water Quality Best Management Practices

The stormwater water quality management approach is to treat runoff to reduce the following pollutants that are typically associated with transportation projects:

- Dissolved metals
- Debris and litter
- Suspended solids such as sand, silt, tire and brake dust, and particulate metals
- Oil and grease

Dissolved metals, especially dissolved copper and zinc, are of particular concern because of their potential impact on the olfactory systems of listed fish.

The preliminary stormwater treatment design that has been developed for the Proposed Action identifies the likely size and location of water quality treatment BMPs. The design is at a preliminary stage of development, and the specific size, type, and location of proposed treatment BMPs may change in the final design. The BMPs that are ultimately permitted and constructed for the Proposed Action will,

[2] Water quality treatment may ultimately not be required for the bike/pedestrian paths, sidewalks, or pedestrian overlooks, as these features are separated from the roadway and are considered non-pollution-generating. However, they will contribute runoff to the Project's stormwater treatment BMPs and, as such, they have been included in the CIA for purposes of conservatively estimating the size of the BMPs. The final stormwater design will, at minimum, provide treatment for all CIA and will meet the treatment standards established by the federal, state, and/or local agencies with jurisdiction.

at minimum, 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 and/or through proprietary treatment technologies such as cartridge filters. The preliminary stormwater design assumes the use of bioretention facilities, because these facilities have the largest potential footprint on the landscape. These are also generally preferred over proprietary BMPs because of their simpler and more cost-effective maintenance requirements.

A bioretention facility is an above ground basin or cell that is designed to capture stormwater runoff and infiltrate it through a water quality mix to remove pollutants through a variety of physical, biological, and chemical treatment processes. The ODOT Hydraulics Design Manual identifies bioretention facilities as being good for highway applications because of their moderate construction and maintenance cost. Opportunities for siting bioretention facilities include medians, interchanges, adjacent to ramps, parking-lot islands, and along rights-of-way adjacent to roads.

There are a wide range of proprietary structures that can (in certain instances) be used for stormwater treatment, but only a few have been approved on ODOT's Qualified Product List (QPL)[3]. The ODOT Hydraulics Design Manual requires that any proprietary BMPs, if ultimately selected as treatment BMPs in the final design, need to have General Use Level Designation (GULD) approval as providing "Enhanced Treatment" prior to be used as a stand-alone water quality facility.

Stormwater Management Facilities

The following subsections describe the proposed stormwater water quality facilities for each side of the river. As noted in the preceding sections, design development and refinements may necessitate considering BMPs other than those presented in this report and/or to result in changes to the size or location of the stormwater management facilities currently proposed. Refinement of the stormwater conveyance system design may result in changes in the specific areas draining to individual water quality facilities. The final stormwater design will be consistent with federal, state, and local requirements, and will, at minimum, provide treatment for an equal or greater area of ISA.

Table 11 provides a summary of the proposed treatment BMPs. The paragraphs following the table describe the individual water quality treatment facilities, the locations of which are shown on Figure 12.

Table 11. Stormwater Treatment Summary

State	Drainage Area	Treatment Method	BMP	ISA Treated (Acres)	Receiving Water
Oregon	Drainage Area A	On-site treatment; surface-discharge BMPs	Bioretention Facility	4.4	Columbia River
	Drainage Area B	On-site treatment; surface-discharge BMPs	Bioretention Facility	1.2	Columbia River

[3] ODOT relies on the Washington State Department of Ecology's (Ecology) "Technology Assessment Protocol – Ecology" (TAPE) protocol to determine which products are added to the QPL. Structures obtaining General Use Level Designation (GULD) through the TAPE Program are placed on the QPL and are considered to be "highly" capable of removing the category or target pollutant.

State	Drainage Area	Treatment Method	BMP	ISA Treated (Acres)	Receiving Water
Washington	Drainage Area C	On-site treatment; surface-discharge BMPs	Bioretention Facility	3.1	Columbia River
	Drainage Area D	On-site treatment; surface-discharge BMPs	Bioretention Facility	1.8	Columbia River
	Drainage Area E	On-site treatment; surface-discharge BMPs	Biofiltration Swale	2.0	Columbia River
Totals				**12.5**	-

Oregon

Drainage Area A

The Proposed Action will provide water quality treatment for approximately 4.4 acres of ISA within Drainage Area A. This includes approximately 4.1 acres of ISA within the project footprint, and an additional 0.3 acre of existing ISA outside of the project limits. The new ISA area is associated with part of the bridge deck and associated approaches.

Drainage Area B

The Proposed Action will provide water quality treatment for approximately 1.2 acres of ISA on the Oregon side of the river. This new ISA area is associated with the bridge deck.

The stormwater design assumes that water quality treatment for both Drainage Area A and Drainage Area B will be provided by bioretention facilities, designed for the water quality precipitation depth of 1.05 inches. This results in a facility footprint approximately 260 feet long and 100 feet wide for Drainage Area A, and a facility footprint of approximately 295 feet long and 45 feet wide for Drainage Area B. These footprints include 16-foot-wide access roads and pretreatment basins sized at 7 percent of the treatment capacity.

Washington

The Proposed Action will provide water quality treatment for approximately 6.9 acres of ISA on the Washington side of the river. This includes approximately 6.3 acres of ISA within the project footprint and an additional 0.6 acre of existing ISA outside of the project limits. The new ISA area is associated with the bridge deck and associated approaches, as well as new impervious surfaces associated with the roundabout and improvements at the interchange with SR 14. The 0.6 acre of existing ISA outside the project footprint and within WSDOT right-of-way will be treated to meet WSDOT's retrofit requirement[4].

On the Washington side of the river, stormwater will flow into three separate drainage areas. Drainage Area C will provide treatment for Port-owned properties associated with the bridge and approaches, while Drainage Areas D and E will provide treatment for stormwater draining from WSDOT-owned areas.

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[4] Existing highways in Washington State that were built before the federal Clean Water Act and the Washington Water Pollution Control Act were enacted may not have facilities to control stormwater flow or treat stormwater runoff. Where applicable, WSDOT addresses these deficiencies through a requirement for stormwater retrofits. Projects triggering retrofit requirements must retrofit applicable replaced impervious surfaces and/or replaced pollutant generating impervious surfaces within the project boundaries. Retrofit requirements are defined in detail in the WSDOT Highway Runoff Manual.

Separate facilities are proposed for areas draining Port-owned property and those draining WSDOT-owned areas.

Drainage Area C

The Proposed Action will provide water quality treatment for approximately 3.1 acres of ISA within Drainage Area B. This includes approximately 3.1 acres of ISA within the project footprint and no additional ISA outside of the project limits. Water quality treatment will be provided by a bioretention facility that will be located west of the replacement bridge, in the southwest corner of the proposed roundabout. The facility will measure approximately 2 feet deep, with an approximately 105- by 180-foot footprint to accommodate the bioretention facility, a pretreatment basin, and a 16-foot maintenance access road.

Drainage Area D

The Proposed Action will provide water quality treatment for approximately 1.8 acres of ISA within Drainage Area D. This includes approximately 1.5 acres of ISA within the project footprint and an additional 0.3 acre of existing ISA outside of the project limits. The additional area is treated to meet WSDOT's retrofit requirement. Water quality treatment will be provided by a bioretention facility that will be located east of the replacement bridge and south of SR 14. This facility is near the roundabout, close to the low point created by the proposed profile. The facility will measure approximately 2 feet deep and will have an approximately 85- by 155-foot footprint.

Drainage Area E

The Proposed Action will provide water quality treatment for approximately 2 acres of ISA within Drainage Area E. This includes approximately 1.7 acres of ISA within the project footprint and an additional 0.3 acre of existing ISA outside of the project limits. The additional area is treated to meet WSDOT's retrofit requirement. Due to limited space, water quality treatment will be provided by a biofiltration swale that will be located west of the replacement bridge near the western limit of the project. The swale will measure approximately 1.5 feet deep and will have an approximately 16- by 135-foot footprint. The swale is adjacent to the road, and no separate maintenance access road is provided because of limited space.

Stormwater Treatment Summary

The Proposed Action will result in approximately 5.5 acres of new ISA associated with the replacement bridge deck, as well as the approach areas and roadway improvements on both the Washington and Oregon sides of the replacement bridge.

The existing bridge is approximately 1.9 acres in size and receives no stormwater runoff control or water quality treatment. Currently, any precipitation that hits the bridge deck passes directly to the aquatic environment untreated. Similarly, contaminants from vehicles using the existing bridge (fuel, oil, lubricants, trace heavy metals from brake pads, etc.) currently pass directly to the aquatic environment, uncaptured and untreated.

At a minimum, the preliminary stormwater treatment design that has been developed for the Proposed Action, described in the section above, will provide treatment for all CIA and will meet the treatment standards established by the federal, state, and/or local agencies with jurisdiction.

An analysis of the potential impacts and benefits associated with stormwater from the Proposed Action is presented in Section 8. That analysis shows that the Proposed Action will result in a net reduction in the amount of pollutants discharged in stormwater than in the existing conditions, and as such will represent a net improvement in water quality condition compared to the existing condition.

3.3.11. Interrelated and Interdependent Activities

An interrelated activity is an action that is part of a larger action and depends on the larger action for its justification. An interdependent activity is one that has no independent utility apart from the Proposed Action. To determine if an action is interrelated or interdependent, the "but-for" test can be applied. That is, the action is interrelated or interdependent if it would not occur "but for" the larger action.

Interrelated and interdependent activities associated with the Proposed Action include long-term maintenance and operation of the replacement bridge and compensatory mitigation activities.

Maintenance Activities

ODOT, WSDOT, the Port, the City of Hood River, and/or the City of White Salmon 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.

The majority of these maintenance and operations activities are already ongoing, as the Proposed Action replaces an existing bridge. Current maintenance activities that would likely continue would 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. Because the replacement bridge will be a concrete, fixed-span structure, the maintenance needs will likely be less than those that are currently required for maintaining the existing lift span and steel superstructure.

Compensatory Mitigation

While the project as a whole is expected to result in a net beneficial effect to ESA-listed species and their habitats, it is anticipated that a compensatory mitigation plan will be required to offset unavoidable impacts to riparian and shoreline buffers and jurisdictional wetlands and buffers.

A specific compensatory mitigation plan has not yet been developed for this Proposed Action and specific compensatory mitigation actions/sites have not yet been established. However, Table 12 presents a summary of the project-related impacts that may require compensatory mitigation, and the potential types of compensatory mitigation actions that may ultimately be developed for the project.

Table 12. Impacts Summary and Potential Compensatory Mitigation Actions

Project Element/Impact	Net Quantity (Approx.)	Net Impact to Function	Potential Compensatory Mitigation Actions
Benthic Habitat Impact	-16,600 sq ft (net reduction due to removal of existing bridge and riprap)	Net restoration of benthic habitat function	None anticipated
Overwater Shading	+150,503 sq ft (net increase)	Minimal impact to function due to height of bridge, and open nature of the pier structure	None anticipated
Fill Within Floodplain	-5,267 cubic yards (net removal due to removal of existing bridge and riprap)	Net improvement to floodplain function/capacity	None anticipated

Project Element/Impact	Net Quantity (Approx.)	Net Impact to Function	Potential Compensatory Mitigation Actions
Temporary Aquatic Habitat Impacts	20,903 sq ft benthic 181,550 overwater structure	Temporary reduction. Avoided and minimized through BMPs, and fully restored post-project.	None anticipated
Riparian (Shoreline) Vegetation Impact	1.38 acres forested riparian/shoreline buffer impact 0.29 acre permanent 1.09 acres re-planted	Net reduction in riparian habitat function.	• Riparian plantings; • Invasive species removal; • Large woody debris placement, • Floodplain re-connection projects
Wetland and Wetland Buffer Impact	0.10 acre wetland impact; 0.23 acre wetland buffer impact	Net reduction in wetland function.	• Wetland creation, restoration, and/or enhancement projects; • Mitigation bank credit purchases
Stormwater Treatment	Treatment for all Contributing Impervious Area (CIA) and removal of source of untreated stormwater	Net restoration to water quality function	None anticipated

Compensatory mitigation activities for impacts to riparian and shoreline buffers associated with the project may include riparian and shoreline restoration projects, such as riparian plantings, invasive species removal, installation of large woody debris, and/or small-scale floodplain reconnection projects.

Compensatory mitigation activities for impacts to wetlands and associated wetland buffers may include a stand-alone permittee-responsible wetland mitigation project, or may include purchase of mitigation credits in an approved mitigation bank.[5] A permittee-responsible wetland mitigation project may include some combination of wetland creation (creating new wetlands from upland areas), or wetland rehabilitation, restoration, and/or enhancement (restoring function to existing wetland areas).

Compensatory mitigation activities 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, 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 waterbodies, 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 function will be fully restored once mitigation actions are completed.

The compensatory mitigation plan will be developed during the permitting phase of the project. The mitigation plan will identify the amount, type, and specific locations of any proposed compensatory mitigation 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 plan will be a condition of the applicable permit of the agencies with jurisdiction (i.e., USACE Section 404 permit, the Oregon Department of Environmental Quality [DEQ] and the Washington State Department of Ecology [Ecology] Section 401 permits, the Oregon Department of State Lands [DSL] Removal-Fill permit, WDFW Hydraulic Project Approval, and City of White Salmon

[5] The project site is not currently within the service area of any approved mitigation banks, but it is possible that a bank could be developed and approved prior to the project being constructed.

Shorelines and Critical Areas permits), and the mitigation will comply fully with all applicable permit terms and conditions.

4. IMPACT AVOIDANCE AND MINIMIZATION MEASURES

This section highlights the impact avoidance and minimization measures that will be implemented as part of the Proposed Action to further reduce the extent of impacts to 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 most current ODOT and/or WSDOT standard specifications.

4.1. General Measures and Conditions

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

- All work will be performed according to the requirements and conditions of the regulatory permits issued by federal, state, and local governments.
- Concrete placement within drilled shafts may occur while water is still present within the temporary casing. If this is the case, the temporary casing will contain and isolate the work. Water levels within the temporary casing will be maintained at a lower elevation than the surrounding river surface elevation to maintain negative pressure.
- Cofferdams 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. Fish salvage will be conducted within cofferdams according to the best practices established in the biological opinion for ODOT's Federal Aid Highway Programmatic consultation.
- The contractor will prepare a Water Quality Protection and Monitoring Plan (WQPMP) for conducting water quality monitoring, to satisfy the monitoring and reporting requirements of the 401 Water Quality Certifications that are ultimately issued for the project. The WQPMP will identify the timing and methodology for water quality sampling during construction of the Project, 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 and USFWS, may replace the contractor plan.
- State DOT policy and construction administration practice in Oregon and Washington is to have a DOT inspector on site during construction. The role of the inspector will be to monitor compliance with contract and permit requirements.
- Work barges will not be allowed to ground out.
- Excess or waste materials will not be disposed of or abandoned waterward of 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 inch (2.38 mm) in the narrow dimension, or any other shape that is no larger than 0.069 inch (1.75 mm) in the narrow dimension; and
    - each fish screen must be installed, operated, and maintained according to NOAA Fisheries fish screen criteria.

4.2. Spill Prevention and Pollution Control Measures

- The contractor will prepare a Spill Prevention, Control, and Countermeasures (SPCC) Plan and Pollution Control Plan (PCP) prior to beginning construction. The SPCC plan and PCP will identify the appropriate spill containment materials; as well as the means and methods of implementation. 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. The contractor will meet the requirements of and follow the process described in ODOT Standard Specifications 00290.00 through 00290.30. The ESC lead will be listed on the Emergency Contact List as part of ODOT Standard Specification 00290.20(g).
- 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 Columbia River 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, 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 or work decks, from the deck of the existing or replacement bridges, or from portions of the streambank above the OHWM. Any equipment operating in the water will use only vegetable-based oils in hydraulic lines.

- All 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.
- 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).

4.3. Site Erosion and Sediment Control Measures

- 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 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 at preconstruction discussions and the ESCP. The contractor will meet the requirements of and follow the process described in ODOT Standard Specifications Section 00280.30. The ESC lead will be listed on the Emergency Contact List as part of ODOT Standard Specification 00290.20(g). The ESC lead will also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.
- All ESCP measures will be inspected on a weekly basis. Contractor will follow maintenance and repair as described in ODOT Standard Specifications 00280.60 to 00280.70. Erosion control measures will be inspected immediately after each rainfall, and at least daily during for precipitation events of more than 0.5 inches in a 24-hour period.
- 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 towards 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 TESC Plan. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14(e).
- 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 re-vegetate 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. Re-vegetation 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.

4.4. Pile Installation and Removal BMPs

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.
- A bubble curtain or other similarly effective noise attenuation device will be employed during all impact pile proofing or installation. The bubble curtain will be consistent with standard NOAA Fisheries/USFWS bubble curtain specifications provided in Appendix E.
- Pile installation will only be conducted within the proposed in-water work window (October 1 - March 15). Vibratory pile removal may occur on a year-round basis.
- A hydroacoustic monitoring plan, based on the template developed by the Fisheries Hydroacoustic Working Group, will be developed and implemented to confirm the effectiveness of the noise attenuation devices. The plan will be provided to USFWS and NOAA Fisheries prior to any impact pile driving activity commencing.
- Piles that are not in an active construction area and are in place six months or longer will have cones or other anti-perching devices installed to discourage perching by piscivorous birds.

4.5. Fish Capture and Release BMPs

- A qualified fishery biologist (see footnote) 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 in-water 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 Ac*t" (NOAA Fisheries 2000), or most recent version.

4.6. Work Area Lighting BMPs

- Site work will follow local, state and federal permit restrictions for allowable work hours. If work occurs at night, temporary lighting may be required 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.

5. ACTION AREA

This section describes the defined geographic area that could be affected by the direct and indirect effects of the Proposed Action— or the "action area." The action area is established based on:

- The physical footprint of the proposed project, which includes the limits of proposed construction activities.
- The extent of underwater noise generated during pile installation and removal.
- The extent of terrestrial noise generated during pile installation and removal activities, as well as other upland construction activities.
- The anticipated extent of any temporarily elevated levels of turbidity during project activities.
- The downstream extent to which potential effects associated with stormwater could potentially occur.

Materials and equipment will be transported to and from the site via trucks and barges, though the specific origination points and destinations of each truck and barge is not known. Trucks will travel to and from the site over existing roads. Work barges will most likely come from Portland or points downriver on the Columbia River, though it is possible that one or two barges could come from other locations. Truck and barge traffic associated with the project would not be distinguishable from baseline levels of truck and/or barge traffic and, as such, specific routes for truck and barge travel are not considered to be part of the action area for this consultation.

5.1. Project Footprint

The project footprint portion of the action area consists of the physical location of the proposed project activities, as described in Section 3 and shown on Figure 20. This portion of the action area includes all of the upland areas where construction and/or materials staging associated with the Proposed Action will occur, as well as the physical locations of all proposed upland, in-water, and overwater structures.

5.2. Underwater Noise

The action area for underwater noise produced by pile driving activities was determined using the practical spreading loss model. This model, currently recognized by both the USFWS and NOAA Fisheries as the best method to determine underwater noise attenuation rates, assumes a 4.5 decibel (dB) reduction per doubling of distance (WSDOT 2020). In the absence of site-specific data, the baseline underwater noise level in the portion of the action area that is located at the project site is conservatively assumed to be approximately 120 dB_{RMS} (root mean square) (WSDOT 2020).

The loudest source of underwater noise from the Proposed Action will come from the impact installation of the structural piles for the replacement bridge. The Proposed Action will require the installation of both 24-inch and 48-inch-diameter steel piles, and installation of these piles will require the use of both vibratory and impact hammers. The impact pile driving methodology is described in detail in Section 3.3.5.

For purposes of this consultation, the estimated maximum underwater noise levels expected to be generated during impact pile-driving activities have been based upon data collected during a test pile program conducted in 2011 for the Columbia River Crossing (CRC) Project between Vancouver, Washington and Portland, Oregon (DEA 2011). The CRC test pile program measured sound pressure levels generated during vibratory and impact installation of 24-inch and 48-inch steel piles in a reach of the Lower Columbia River between Portland, Oregon and Vancouver, Washington. The Project site shares generally similar physical and geographical characteristics with the CRC site (i.e., similar water depths and substrate) and these measured sound pressure levels represent the best available estimate of the levels of underwater sound that would be produced during pile driving for the Proposed Action.

The highest levels of underwater noise will be generated during impact pile driving of 48-inch diameter steel pipe piles. This activity will generate underwater noise levels of approximately 214 dB_{PEAK}, 201 dB_{RMS}, and 184 dB_{SEL} (sound exposure level) (measured at a distance of 33 feet or 10 meters from the pile) prior to any attenuation[6]. Installation of 24-inch diameter steel pipe piles will generate noise levels of approximately 205 dB_{PEAK}, 190 dB_{RMS}, and 175 dB_{SEL} (sound exposure level) (measured at a distance of 33 feet or 10 meters from the pile) prior to any attenuation.

A bubble curtain or other similarly effective noise attenuation device will be employed during all impact pile driving. The bubble curtain will be consistent with standard NOAA Fisheries/USFWS bubble curtain specifications provided in Appendix E. These devices, when properly installed and maintained, typically provide 7 dB of attenuation for piles of this size and type, and frequently provide higher levels of attenuation (Caltrans 2015). NOAA Fisheries has indicated that a standard 7 dB source level reduction is an appropriately conservative estimate of the degree of attenuation that is typical for a properly

[6] Underwater sound generation and transmission is dependent upon environmental factors, such as substrate, bathymetry, water depth, etc.

installed unconfined bubble curtain. A hydroacoustic monitoring plan will implemented during impact pile driving to confirm the level of attenuation provided.

Non-load-bearing temporary piles (24-inch steel pipe piles) will be installed and removed solely with a vibratory pile driver. Load-bearing temporary piles (also 24-inch steel pipe piles) and 48-inch steel structural piles will be installed with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. Impact driving may be required to “proof” the piles to verify load bearing capacity. Steel sheet piles for cofferdams will be installed either with a vibratory hammer or with press-in methods, and will be removed using a vibratory hammer or direct pull methods. The vibratory pile driving methodology is described in detail in Section 3.3.5.

As with impact pile driving, the maximum underwater noise levels expected to be generated during vibratory pile-driving activities have been based upon data collected during a test pile program conducted for the CRC Project in 2011 (DEA 2011). That test pile program measured maximum underwater sound pressure levels of approximately 181 dB_{RMS}[7] for both 24-inch and 48-inch piles (DEA 2011).

A detailed assessment of underwater noise attenuation to established injury and behavioral noise levels is provided in Section 8.2, and NOAA’s underwater noise calculator is provided as Appendix D. For the purpose of establishing the limits of the action area for this consultation, and consistent with the principles of noise attenuation, the extent of potentially detectable temporarily elevated underwater noise during installation and removal of steel piles has been estimated to extend throughout the water column of the Columbia River in straight-line distances from the proposed pile-driving activities to the point of intersection with the nearest land mass or structure. This zone of influence extends a maximum of approximately 12 miles downstream, and approximately 5.5 miles upstream from the existing bridge. This zone of influence is shown graphically on Figure 20.

5.3. Terrestrial Noise

Baseline and construction-related terrestrial noise levels were inferred using information regarding average noise levels associated with construction equipment (Thalheimer 2000) and noise attenuation data from the Federal Transit Administration’s (FTA) Transit Noise and Vibration Impact Assessment Guidance (FTA 2006).

Impact driving of steel piles are expected to be the loudest terrestrial noise source during construction and is used to determine the action area for terrestrial noise. Peak terrestrial noise generated during impact pile installation has been estimated to be approximately 110 decibels (dBA), measured at 50 feet (FTA 2006). The action area is adjacent to two highways, two mainline railroads (BNSF and UPRR), and various industrial and commercial developments. For this reason, the baseline noise levels associated with the action area are estimated to be relatively high (at least 78 dBA measured at 50 feet). Hard site conditions were assumed for noise attenuation purposes because most of the surrounding landscape are either hardscape or open water.

Based on the noise attenuation assumptions listed in Table 13, terrestrial noise from impact pile driving is expected to attenuate to ambient conditions between approximately 1,600 and 3,200 feet from the location of project activities. For purposes of this consultation, the more conservative 3,200-foot

7 Single strike peak and cumulative SEL decibel levels are not relevant metrics for vibratory pile driving, and were not measured in the test pile program.

distance has been used to estimate the maximum extent of detectable terrestrial noise. This area is shown on Figure 20.

Table 13. Project-related Terrestrial Noise Attenuation

Distance from Source (ft)	Construction Noise in dBA (Point Source, Hard Site) (-6.0 dBA reduction per doubling of distance)
50	110
100	104
200	98
400	92
800	86
1,600	80
3,200	74

5.4. Temporarily Elevated Turbidity

In-water construction activities, including pile installation and removal, has the potential to temporarily elevate levels of turbidity. The area with potential temporarily increased levels of turbidity due to construction activities is based on the anticipated mixing zone that will be authorized under the two Section 401 Water Quality Certifications that will be obtained from DEQ and Ecology. The certifications will specify a distance beyond which turbidity may not exceed ambient levels downstream of the source. It is anticipated that the authorized mixing zone will extend a maximum of 300 feet downstream of turbidity-generating activities, as this is typical for water bodies the size of the Columbia River (that is, with flows of 300 cubic feet per second or greater). This area is shown on Figure 20.

5.5. Stormwater

The zone of influence associated with stormwater is defined based on standards established in recent NOAA Fisheries Biological Opinions, which state that the zone of influence for stormwater constituents ends where the Columbia River plume enters the Pacific Ocean; the point at which stormwater constituent pollutants can no longer be tracked as constituents of a distinct water mass (NOAA Fisheries 2018). This area is shown graphically on Figure 20.

6. PRESENCE OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT IN THE ACTION AREA

This section evaluates the potential for species listed or proposed for listing under the ESA to occur within the action area. Information for this section was obtained from a variety of sources, including a species list from USFWS (USFWS 2019a), the USFWS Information for Planning and Consultation (IPaC) database (USFWS 2019c), the USFWS website (USFWS 2019b), and the NOAA Fisheries website (NOAA Fisheries 2019a), including NOAA ESU coverage maps. Species lists are included in Appendix C.

Table 14 identifies the ESA-listed species and designated critical habitats that are either documented or may potentially occur within the action area.

Table 14. ESA-listed Species and Critical Habitats Addressed in this Biological Assessment

Species Name			Federal Status	Critical Habitat	Jurisdiction
Common Name	Scientific Name	ESU or DPS*			
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	Threatened	Designated	NOAA Fisheries
		UWR ESU	Threatened	Designated	
		UCR-SR ESU	Endangered	Designated	
		SR-SSR ESU	Threatened	Designated	
		SR-FR ESU	Threatened	Designated	
Chum salmon	*Oncorhynchus keta*	CR ESU	Threatened	Designated	NOAA Fisheries
Coho salmon	*Oncorhynchus kisutch*	LCR ESU	Threatened	Designated	NOAA Fisheries
Sockeye salmon	*Oncorhynchus nerka*	SR ESU	Endangered	Designated	NOAA Fisheries
Steelhead	*Oncorhynchus mykiss*	LCR DPS	Threatened	Designated	NOAA Fisheries
		UWR DPS	Threatened	Designated	
		MCR DPS	Threatened	Designated	
		UCR DPS	Endangered	Designated	
		SRB DPS	Threatened	Designated	
Bull trout	*Salvelinus confluentus*	Coastal Recovery Unit	Threatened	Designated	USFWS
Pacific eulachon (smelt)	*Thaleichthys pacificus*	Southern DPS	Threatened	Designated	NOAA Fisheries
North American green sturgeon	*Acipenser medirostris*	Southern DPS	Threatened	Designated	NOAA Fisheries

* ESU = evolutionarily significant unit; DPS = distinct population segment
LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

The species listed below may have current or historic ranges that overlap with the project area and/or vicinity based on USFWS species lists. However, these species are not likely to occur within the action area due to a lack of suitable habitat. These species are, therefore, unlikely to be affected by the Proposed Action. These species include the following.

Table 15. Species Listed but Not Addressed in this Biological Assessment

Common Name	Scientific Name	ESU or DPS	Federal Status	Critical Habitat	Jurisdiction
Gray wolf	*Canis lupus*	NA	Endangered (proposed for de-listing)	Designated	USFWS
North American wolverine	*Gulo gulo luscus*	NA	Proposed Threatened	NA	USFWS
Fisher	*Pekania pennanti*	West Coast DPS	Proposed Threatened	Proposed	USFWS
Northern Spotted Owl	*Strix occidentalis caurina*	NA	Threatened	Designated	USFWS
Yellow billed cuckoo	*Coccyzus americanus*	Western U.S. DPS	Threatened	Proposed	USFWS
Oregon spotted frog	*Rana pretiosa*	NA	Threatened	Designated	USFWS

* ESU = evolutionarily significant unit; DPS = distinct population segment; NA = Not Applicable

While information from USFWS (USFWS 2019a) identified the potential for fisher, gray wolf, North American Wolverine, Northern spotted owl, yellow-billed cuckoo, and Oregon spotted frog to occur within the vicinity, WDFW PHS data does not indicate any known occurrence of these species within the action area, and the action area does not provide any suitable habitat for these species. Based on the lack of suitable habitat for the species listed in Table 15, it is determined that the proposed project will have no effect on these species, and they are not addressed further in this BA.

6.1. Adult and Juvenile Migration Timing

Life history presence and run timing for species addressed in this BA are summarized below in the following tables. Table 16 below shows the times of year that juvenile salmonids may be outmigrating within the action area. Table 17 lists adult run timing within the action area. Table 18 lists the times of year that listed non-salmonid species may be present within the action area.

Table 16. Typical Timing of Juvenile Salmonid Outmigration within Action Area

Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Chinook Salmon																								
Lower Columbia River ESU					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Upper Willamette River ESU	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Upper Columbia River Spring-Run ESU				X	X	X	X	X	X	X	X	X	X	X	X	X								
Snake River Spring/Summer-Run ESU			X	X	X	X	X	X	X	X	X	X	X	X	X	X								
Snake River Fall-Run ESU											X	X	X	X	X	X	X	X	X	X				
Chum Salmon																								
Columbia River ESU			X	X	X	X	X	X	X	X	X													
Coho Salmon																								
Lower Columbia River ESU				X	X	X	X	X	X	X	X	X	X	X	X	X	X							
Sockeye Salmon																								
Snake River ESU								X	X	X	X	X												
Steelhead																								
Lower Columbia River DPS				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Upper Willamette River DPS							X	X	X	X	X	X												
Middle Columbia River DPS					X	X	X	X	X	X	X	X												
Upper Columbia River DPS					X	X	X	X	X	X	X	X												
Snake River Basin DPS					X	X	X	X	X	X	X	X												
Bull Trout																								
Coastal Recovery Unit																								

= Potential presence within action area

Table 17. Typical Timing of Adult Salmonid Migration within Action Area

Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Chinook Salmon																								
Lower Columbia River ESU				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Upper Willamette River ESU				X	X	X	X	X	X															

Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Upper Columbia River Spring-Run ESU				X	X	X	X	X	X	X	X	X	X	X	X	X	X							
Snake River Spring/Summer-Run ESU			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Snake River Fall-Run ESU													X	X	X	X	X	X	X	X	X	X		
Chum Salmon																								
Columbia River ESU	X	X																	X	X	X	X	X	X
Coho Salmon																								
Lower Columbia River ESU	X	X	X	X											X	X	X	X	X	X	X	X	X	X
Sockeye Salmon																								
Snake River ESU											X	X	X	X										
Steelhead																								
Lower Columbia River DPS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Upper Willamette River DPS			X	X	X	X	X	X	X	X	X													
Middle Columbia River DPS									X	X	X	X	X	X	X	X	X	X	X	X				
Upper Columbia River DPS									X	X	X	X	X	X	X	X	X	X	X	X				
Snake River Basin DPS											X	X	X	X	X	X	X	X	X	X				
Bull Trout																								
Coastal Recovery Unit						*Presence unlikely, but data incomplete*																		

= Potential presence within action area

Table 18. Typical Timing of Non-Salmonid Species Occurrence within Action Area

Species and ESU/DPS	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Pacific Eulachon																								
Southern DPS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
Green Sturgeon																								
Southern DPS										X	X	X	X	X	X	X	X							

= Potential presence within action area

6.2. Species

6.2.1. Chinook Salmon

The Columbia River within the action area represents potential habitat for five ESUs of Chinook salmon: Lower Columbia River, Upper Willamette River,[8] Upper Columbia River, Snake River spring/summer-run, and Snake River fall-run.

Compared to the other Pacific salmon, Chinook salmon have the most complex life history with a large variety of patterns. The length of freshwater and saltwater residency varies greatly (Myers et al. 1998).

[8] Willamette River and Lower Columbia River species are included in this document due to the potential for impacts to downstream waters associated with potential (beneficial) effects to downstream water quality from proposed stormwater treatment.

Channel size and morphology, substrate size and quality, water quality, and cover type and abundance may influence distribution and abundance of Chinook salmon (Lower Columbia Fish Recovery Board [LCFRB] 2010a). After three to five years in the ocean, Columbia River stocks return to spawn in the fall and spring. Spawning occurs in the mainstems of larger tributaries in coarse gravel and cobble (Myers et al. 1998).

The abundance of Chinook salmon is relatively high; however, most of the fish appear to be of hatchery origin. Native stocks are scarce or nonexistent (Myers et al. 1998; LCFRB 2010a). Habitat degradation due to stream blockages, forest practices, urbanization, and agriculture are listed as primary causes of decline.

Habitat use within the action area is variable, depending on the stock. Adult fish migrate through the action area almost year-round. Depending on the ESU, adults enter the river between February and November and spawn in tributaries from August through September (Myers et al. 1998, LCFRB 2010b). The action area does not provide any suitable spawning habitat for any ESU of Chinook salmon.

Juvenile movement through the action area is also variable depending on the stock. Juveniles often move into the Columbia River and estuary to over-winter (LCFRB 2010c). Spring Chinook tend to rear in tributary streams for a year, and yearlings outmigrate rapidly during the spring freshet (LCFRB 2010b). Fall Chinook tend to outmigrate as sub-yearlings in the late summer and fall of their first year (LCFRB 2010b). Over-wintering and outmigrating Chinook salmon juveniles tend to occupy the nearshore habitat in the lower Columbia River.

Individual ESUs of Chinook salmon differ in their spatial and temporal distribution within the action area, and are discussed in detail in the subsections below. In general, the portion of the action area that includes the project site represents documented migratory habitat for adult and juvenile Chinook salmon. Both adult and juvenile Chinook of one or more ESUs may be present within the lower river year-round.

Lower Columbia River Chinook

The Lower Columbia River (LCR) Chinook ESU includes all naturally spawned populations of Chinook from the Columbia River and its tributaries that occur from the river's mouth at the Pacific Ocean, upstream to a transitional point between Washington and Oregon east of the Hood and White Salmon Rivers (Federal Register [FR] 70 FR 37160). This geographic extent of this ESU also includes the Willamette River to Willamette Falls, Oregon, with the exception of spring-run Chinook in the Clackamas River. There are 17 artificial propagation programs for Chinook in this ESU.

LCR Chinook exhibit three life history types: early fall runs ("tules"), late fall runs ("brights"), and spring runs. Fall runs historically (e.g., pre-settlement) occurred throughout the entire range of the ESU, while spring runs historically occurred only in the upper portions of basins with snowmelt-driven flow regimes (e.g., western Cascade Crest and Columbia Gorge tributaries).

LCR Chinook use the Columbia River within the action area for migration, holding, and rearing. Rearing habitat is of limited quality and quantity at the project site, but is present in downstream portions of the action area (e.g., at the mouths of small tributaries, backwater areas, and other areas of low-velocity refugia).

Adults of the fall run migrate through the action area from August to December on their way to spawn in large mainstem tributaries. Upstream migrating adults of the spring run are present from February to

June on their way to spawn in upstream and headwater tributaries (Goodman 2005, CRC 2009; NOAA Fisheries 2005).

Spawning habitat is not documented within the portion of the Columbia River that is at the project site, however, some fall-run Chinook spawning occurs in the lower Columbia River mainstem near Ives Island and Hamilton Creek, at RM 143, approximately 3 miles downstream from Bonneville Dam (FPC 2008).

Spawning typically occurs between late September and December, and eggs incubate over the fall and winter months. Timing of fry emergence is dependent on egg deposition time and water temperature. Downstream juvenile migration occurs one to four months after emergence (NOAA Fisheries 2005). Stream-type Chinook, which typically rear in higher elevation tributaries for a year before outmigrating, begin downstream migration as early as mid-February and continue through August; they are most abundant in the Columbia River estuary (generally defined as the lower Columbia River between Bonneville Dam and the mouth) between early April and early June (Carter et al. 2009). Spring-run Chinook juveniles outmigrate from freshwater as yearlings (stream-type). The fall-run Chinook outmigration typically peaks between May and July, although juveniles are present through October (CRC 2009; Carter et al. 2009).

Adult LCR ESU Chinook salmon are typically present in the portion of the Columbia River at the project site between approximately February and December, and thus are likely to be present during a portion of the in-water work window. Juvenile LCR ESU Chinook salmon are typically present at the project site between approximately March and October. The in-water work window of October 1 to March 15 avoids the majority of this time frame. However, it is possible that juvenile LCR ESU salmon could be present at the project site during in-water work conducted during the first half of March and in the month of October.

Upper Willamette River Chinook

Upper Willamette River (UWR) Chinook includes all naturally spawned populations of spring-run Chinook in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon, as well as seven artificial propagation programs (70 FR 37160; June 28, 2005). All naturally spawned spring-run populations of Chinook (and their progeny) residing in these waterways are included in this ESU. Fall-run Chinook above Willamette Falls were introduced and are not considered part of this ESU (Myers et al. 1998).

The ESU is made up of seven historical populations: Clackamas, Molalla/Pudding, Calapooia, North Santiam, South Santiam, McKenzie, and the Middle Fork Willamette. Of these, significant natural production now occurs only in the Clackamas and McKenzie subbasins. The other naturally spawning populations are small and are dominated by hatchery-origin fish (NOAA Fisheries 2008).

Adult Chinook in this ESU are present in the Columbia River mainstem from approximately late February through early May (Myers et al. 1998). Juveniles exhibit a diverse migratory life history in the lower Willamette River, with separate spring and fall emigration periods, and may be present in the Columbia River mainstem at any time of year.

UWR Chinook salmon are only present in the downstream portion of the action area. They do not occur above Bonneville Dam, and would not be directly affected by any effects associated with construction of the Proposed Action. Juvenile UWR Chinook use downstream portions of the action area as a rearing and migration corridor, and may be present within the downstream portions of the action area year-round.

Upper Columbia River Spring-Run Chinook

The Upper Columbia River (UCR) spring-run Chinook ESU includes all naturally spawned populations of Chinook in all accessible river reaches in the mainstem Columbia River and its tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River (70 FR 37160). The ESU consists of one major population group composed of three existing subpopulations (the Entiat, Methow, and Wenatchee) and one extinct population (formerly distributed above Chief Joseph Dam). All of the existing three subpopulations migrate through the action area. Chief Joseph Dam was completed in 1961 and functions as a total passage barrier for further upstream migration of this ESU.

There are six artificial propagation programs for Chinook in this ESU. Within the action area, adult and juvenile UCR Chinook are present in the Columbia River during upstream adult migration, downstream juvenile outmigration, holding, and rearing. Tables 15 and 16 summarize the timing of Chinook presence in the action area. Upstream-migrating adults are present in the action area from approximately January to September (CRC 2009; NOAA Fisheries 2005). Juveniles outmigrating to the ocean are present in the action area from approximately mid-February through August (CRC 2009). Rearing juveniles may be present in the action area year-round. Because of the potential presence of individuals from this ESU at any time of year, UCR Chinook are likely to be present in the action area during the in-water work window of October 1 to March 15.

The Columbia River rearing and migration corridor extends from Rock Island Dam downstream through the action area to the Pacific Ocean (NOAA Fisheries 2005). Holding habitat is present in the action area in backwaters, pools, and other low-velocity areas.

Adult UCR ESU Chinook salmon are typically present in the portion of the Columbia River at the project site between approximately January and December, and thus are likely to be present during in-water work. Juvenile UCR ESU Chinook salmon are typically present within the action area between approximately mid-February and August, and the in-water work window of October 1 to March 15 avoids the majority of this time frame. It is possible that juvenile UCR ESU salmon could be present at the project site during in-water work conducted during the month of February and the first half of March.

Snake River Spring/Summer-Run Chinook

This ESU includes all naturally spawned populations of spring/summer-run Chinook in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (70 FR 37160; June 28, 2005). There are 15 artificial propagation programs for Chinook in this ESU.

Within the action area, adults and juveniles are present in the Columbia River during upstream adult migration and downstream juvenile outmigration. Adult spring-run Chinook migrate through the action area from approximately mid-February until the first week of June; adults classified as summer-run Chinook migrate through the action area from June through approximately mid-September (NOAA Fisheries 2005). Juveniles outmigrating to the ocean are potentially present in the action area between approximately February and August (CRC 2009). The in-water work window of October 1 to March 15 avoids the majority of the time in which this ESU may be present. However, it is possible that adults or juveniles may be present within the action area during February and the first half of March.

Snake River Fall-Run Chinook

The Snake River (SR) fall-run Chinook ESU includes all naturally spawned populations of fall-run Chinook in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins (70 FR 37160; June 28, 2005). There are four artificial propagation programs for Chinook in this ESU.

Data for the most recently published 10-year period (1994-2004) for this ESU show an average abundance of 1,273 returning adults; this number is below the 3,000 natural spawner average abundance threshold that has been identified as a minimum for recovery (NOAA Fisheries 2008). Total returns to Lower Granite Dam increased steadily from the mid-1990s to the present. Natural returns increased at approximately the same rate as hatchery origin returns through run year 2000, but since then, hatchery returns have increased disproportionately to natural-origin returns. On average, for full brood year returns from 1977 to 2004, the naturally spawned fish population has not replaced itself (NOAA Fisheries 2008). The long-term (100-year) extinction risk for this ESU has been characterized as moderate to high (ICTRT 2007a).

Within the action area, adult and juvenile SR fall-run Chinook use the Columbia River for upstream adult migration and holding, and for juvenile outmigration. Upstream-migrating adults are potentially present in the action area from approximately July to November (CRC 2009; NOAA Fisheries 2005). Juveniles outmigrating to the ocean are present in the action area between approximately June and October (CRC 2009). The in-water work window of October 1 to March 15 avoids the majority of the time in which this ESU may be present. However, it is possible that adults may be present in the action area during in-water work conducted in October, and juveniles may be present within the action area during in-water work conducted in February and the first half of March.

6.2.2. Chum Salmon

The action area is located within the Columbia River ESU of chum salmon. The Columbia River ESU of chum salmon includes all naturally spawning populations in all river reaches accessible to chum salmon in the Columbia River downstream from Bonneville Dam (Federal Register 2005).

Historically, chum salmon were very abundant in the Columbia River. They have the broadest spawning distribution of Pacific salmon species. Chum salmon have a very short freshwater residency time, and they require cool, clean water and substrate for spawning. Migration to salt water occurs immediately after emerging from the gravel; therefore, freshwater rearing habitat is a lesser concern for this species. After three to five years in salt water, Columbia River chum salmon return to spawn in the fall. Spawning typically takes place in the lower mainstems of rivers, including the Columbia River, frequently in locations within the tidal zone where there is an abundance of clean gravel (Johnson et al. 1997).

Columbia River ESU chum salmon are essentially extirpated upstream of Bonneville Dam. Columbia River ESU chum in the Columbia River primarily return to areas near the mouth of Hamilton and Hardy Creeks on the Washington side of the river, downstream of Bonneville Dam. A smaller subset of the run spawns in the mainstem near a small spring just upstream of the I-205 bridge near Vancouver. Currently, the remaining returning spawning populations represent less than 1 percent of historic levels. Habitat loss and degradation due to dam placement, forest practices, and urbanization are the most significant causes of decline in this ESU (Johnson et al. 1991; LCFRB 2010a).

Columbia River ESU chum salmon are not present upstream of Bonneville Dam, and are therefore not expected to be present in the portion of the action area at the project site at any time. Adult Columbia

River ESU chum salmon are typically present in downstream portion of the Columbia River between approximately October and January. Juvenile chum salmon are typically present in the Columbia River between approximately February and the first half of June.

6.2.3. Coho Salmon

The action area is located within the LCR ESU of coho salmon. This ESU includes all natural spawning populations in Columbia River tributaries below the Klickitat River in Washington and the Deschutes River in Oregon (including the Willamette River up to Willamette Falls) (Federal Register 2005).

Coho salmon have one of the shortest life cycles of all anadromous salmonids. Different patterns of life history are linked to different populations. Forming large schools, juveniles rear in fresh water for one year, migrate to the ocean, and return in 5 to 20 months to spawn. The distribution and abundance of coho salmon are most likely influenced by water temperature, stream size, flow, channel morphology, vegetation type and abundance, and channel substrate size and quality. Coho salmon return from the ocean to spawn during fall freshets in September and October. Spawning occurs in silt to large gravel of tributaries (LCFRB 2010c). Juvenile coho in the LCR ESU tend to rear in small tributaries, and outmigrate as smolts in the late spring of their second year (LCFRB 2010b).

Historically, the Lower Columbia River reach was the center of coho salmon abundance in the Columbia River basin, with the middle and upper reaches also containing large runs of coho salmon. These two populations have been significantly reduced, with the Lower Columbia River reach estimated at 5 percent of historic levels (LCFRB 2010b). Extensive hatchery production and over-harvest of this commercial production are the primary reasons for the decline of coho salmon in the Lower Columbia River ESU. Habitat blockage and destruction are also factors (LCFRB 2010b).

There are two types of run timing associated with coho: Type S, which are early run, and Type N, which are late run (Myers et al. 2006). Type S fish generally return to the Columbia River from August to October and spawn in October and November. Type N fish return to the Columbia River from October to November/December and spawn in November through January. Some Type N coho can spawn as late as mid-February (Myers et al. 2006). There is no suitable spawning habitat within the action area for either type, and the action area serves only as a migratory corridor.

Juveniles rear in smaller tributaries and likely do not rear in significant numbers within the portion of the action area that is within the immediate Project vicinity. Juvenile outmigration occurs in the spring and summer of the second year with the peak occurring in May (LCFRB 2010b).

Depending on the degree of maturation, some juveniles may forage within the portion of the action area that is at the project site during outmigration. Adult Lower Columbia River coho salmon may potentially be migrating through the action area between approximately August and February. Run times for adult Lower Columbia River coho salmon within the project action area overlap the in-water work window of October 1 to March 15 and this ESU may be potentially be present during in-water work. Outmigrating juvenile coho likely move quickly through this portion of the action area, as there is little suitable nearshore foraging or refuge habitat present.

6.2.4. Sockeye Salmon

The action area is located within the Snake River ESU of sockeye salmon. The Snake River ESU of sockeye salmon includes all river reaches and estuary areas presently or historically accessible to sockeye salmon in the Columbia River. This is defined as all river reaches east of a straight line connecting the west end of the Clatsop Jetty (Oregon side) and the west end of the Peacock Jetty (Washington side), and extending upstream to the confluence of the Snake River, upstream on the Snake River to the confluence of the Salmon River, and upstream on the Salmon River to the confluence of the Alturas Lake Creek and Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet tributaries) (Federal Register 2005).

Historically, adult sockeye salmon in the Snake River ESU enter the Lower Columbia River in June and July and migrate upstream through the Snake and Salmon Rivers, arriving at their natal lakes in August and September. Spawning peaks in October and occurs in lakeshore gravels. Fry emerge in late April and May and move immediately to the open waters of the lakes where they feed on plankton for one to three years before migrating to the ocean. Juvenile sockeye generally leave Redfish Lake from late April through May and migrate to the Pacific Ocean. Snake River ESU sockeye salmon spend two to three years in the Pacific Ocean before returning to their natal lakes to spawn.

The Snake River ESU of sockeye salmon is extremely close to extinction. Factors cited for the decline include overfishing, water diversion for irrigation, and obstacles to migration, including dams (LCFRB 2010c). The only extant sockeye salmon in the Snake River ESU spawn in lakes in the Stanley basin of Idaho.

In the Columbia River basin, sockeye salmon spawn and rear in lakes in the upper Snake River watershed. Adults typically migrate through the action area in June and July. Juvenile outmigration begins in early spring after ice breakup on the lakes (LCFRB 2010c), and outmigrating juveniles may be present within the portion of the action area that is within the immediate Project vicinity between approximately April and June. The in-water work window of October 1 to March 15 avoids the time in which this ESU may be present.

6.2.5. Steelhead

The action area represents potential habitat for five DPSs of steelhead: Lower Columbia River, Upper Willamette River, Middle Columbia River, Upper Columbia River, and Snake River. The portion of the Columbia River that is within the action area represents a migration corridor for these five DPSs. Steelhead that migrate to and from the Hood River in Oregon are within the Lower Columbia River DPS, whereas those that migrate to and from the White Salmon River in Washington are considered to be part of the Middle Columbia River DPS. As previously described, the Upper Willamette River and Lower Columbia River DPSs are only present within portions of the action area downstream of the Bonneville Dam.

Steelhead is the most widely distributed anadromous salmonid. The life history pattern of steelhead can be very complex, involving repeated spawnings and continuous reversals of freshwater to ocean phases (LCFRB 2010c). The distribution and abundance of steelhead are thought to be influenced by water temperature, stream size, flow, channel morphology, vegetation type and abundance, and channel substrate size and quality (LCFRB 2010c). Depending upon the specific requirements of a particular life stage, steelhead use a wide range of habitat types from low-order tributaries to river mainstems (Federal Register 1996). Steelhead that migrate within the Lower Columbia River return in the spring and fall to spawn. Spawning occurs in small to large gravel of tributaries and smaller rivers (LCFRB 2010b).

Factors contributing to the decline of the steelhead DPS in the Columbia River include predation and competition, blocked access to historical habitat, habitat degradation, hatchery practices, and urbanization. Despite the ability of steelhead to use a diversity of habitats, very few healthy stocks remain within the Columbia River basin (LCFRB 2010c).

Adult and juvenile steelhead primarily use the Project vicinity as a migration corridor. Adults migrate through the action area year-round, depending on the run type. Summer steelhead migrate upstream within the Columbia River between roughly May and October, with spawning occurring in tributaries between late February and early April. Winter-run adults enter the Columbia River between December and May, spawning in tributaries in late April and early May.

Peak adult spawning for both summer and winter runs occurs in the spring. Spawning occurs in the tributaries throughout the Columbia River basin (LCFRB 2010b). In streams that support both summer and winter steelhead runs, summer steelhead tend to spawn higher in the watershed. No suitable steelhead spawning habitat occurs within the action area, so the action area serves largely as a migratory corridor.

The peak juvenile outmigration through the Lower Columbia River occurs in the spring. Over-wintering and outmigrating juvenile steelhead occupy the nearshore habitat within the action area. Juvenile steelhead may be present in high numbers during migration periods, but juvenile steelhead likely move quickly through the Project vicinity. There is little in-stream or riparian habitat structural complexity within the Project vicinity that will provide suitable areas for foraging or refugia for outmigrating juvenile steelhead.

Lower Columbia River Steelhead

This DPS includes all naturally spawned anadromous steelhead populations below natural and man-made impassable barriers in tributaries to the Columbia River between (and including) the Cowlitz and Wind Rivers in Washington, and the Willamette and Hood Rivers in Oregon (71 FR 834, January 5, 2006). There are 10 artificial propagation programs for steelhead in this DPS.

In the lower Columbia River basin, migrating adult steelhead can occur in the action area year-round. There are both summer-run and winter-run populations of LCR steelhead. Of the 25 extant populations in this DPS, 6 are summer runs and 19 are winter runs. Returning adults of both runs are four to six years of age. Summer-run steelhead return to the Columbia River between May and October, and require several months in fresh water to reach sexual maturity and spawn. Spawning typically occurs between January and June (NOAA Fisheries 2005; CRC 2009). Winter-run steelhead return to the Columbia River between November and May as sexually mature individuals that spawn shortly after returning to fresh water (NOAA Fisheries 2005; CRC 2009).

In river systems that contain both summer- and winter-run fish, those with summer-run life history strategies usually spawn higher in the watershed than those of winter runs. In rivers where both winter and summer runs occur, they may be separated by a seasonal hydrologic barrier (e.g., a waterfall). Coastal streams are typically occupied by winter-run steelhead, and interior subbasins are typically occupied by summer-run steelhead. Historically, winter-run steelhead may have been excluded from interior Columbia River subbasins by Celilo Falls (NOAA Fisheries 2005).

LCR steelhead use the Columbia River within the action area for migration, holding, and rearing. Steelhead typically rear in freshwater tributaries for one to four years prior to outmigration, and spend limited time rearing in the lower mainstem Columbia River (Quinn 2005, as cited in Carter et al. 2009). Rearing winter-run steelhead use the lower Columbia River year-round (CRC 2009).

Outmigrating juvenile winter-run steelhead are present in the action area from mid-February through November; outmigrating juvenile summer-run steelhead are present in the action area from March to September (CRC 2009). Juvenile steelhead abundance in the Columbia River estuary peaks between late May and mid-June (Carter et al. 2009). Outmigrating kelts (adults that have spawned and are returning to the ocean) pass through the action area in March and April, and are primarily summer-run steelhead (Boggs et al. 2008). Given that adult LCR steelhead are documented in the Columbia River year round, they are likely to be present during in-water work.

Steelhead spawning in the Hood River occurs from February 15 to April 30. Outmigration extends from late March through July, peaking in early May. Screw trap data indicate that winter steelhead smolts primarily migrate from the East Fork in the fall and move into the upper mainstem Hood River. In contrast, winter steelhead smolts migrate from the Middle Fork primarily in the spring. Summer steelhead in the Hood River tend to remain and rear near their spawning reach and migrate from the West Fork in the spring (Coccoli et. al 2004). Adult steelhead in the White Salmon River typically spawn from February to June, with peak spawning in April. Outmigration occurs in spring and typically peaks in early May (NOAA Fisheries 2013).

Upper Willamette River Steelhead

This DPS includes all naturally spawned winter-run steelhead populations below natural and man-made barriers in the Willamette River and its tributaries from Willamette Falls upstream to the Calapooia River (inclusive). NOAA Fisheries originally listed this DPS as threatened on March 25, 1999, and reaffirmed its status on January 5, 2006 (71 FR 834). There are four subpopulations of the UWR steelhead: the Molalla, North Santiam, South Santiam, and Calapooia—all use the action area.

Steelhead of this DPS are late-migrating winter-run steelhead, entering fresh water primarily in March and April (Howell et al. 1985, as cited in 63 FR 11797) and entering the mouth of the Willamette River from March through May (Busby et al. 1996). Winter-run steelhead historically occurred above Willamette Falls, while summer-run steelhead did not. Juvenile outmigration past Willamette Falls occurs between early April and early June (Howell et al. 1985), with migration peaking in early to mid-May.

Most steelhead spend two years in the ocean before reentering fresh water to spawn (Busby et al. 1996). Steelhead in this DPS generally spawn once or twice. Repeat spawners are predominantly female and generally account for less than 10 percent of the total run size (Busby et al. 1996).

UWR DPS steelhead are only present in the downstream portion of the action area. They do not occur above Bonneville Dam, and would not be directly affected by any effects associated with construction of the Proposed Action. Juvenile UWR steelhead use downstream portions of the action area as a rearing and migration corridor, and may be present within the downstream portions of the action area between April and June.

Middle Columbia River Steelhead

Middle Columbia River (MCR) DPS steelhead includes all naturally spawned anadromous steelhead populations below natural and man-made impassable barriers in tributaries from above the Wind River, Washington, and the Hood River, Oregon, upstream to (and including) the Yakima River, Washington (71 FR 834; January 5, 2006). Steelhead from the Snake River basin and the Wind and Hood Rivers are not considered part of this DPS. There are seven artificial propagation programs for steelhead in this DPS.

MCR DPS steelhead are predominantly summer-run fish and use the Columbia River within the action area for migration and holding. Returning adults in this DPS are present in the action area from May through October. Outmigrating juveniles are present in the action area from approximately March to June (CRC 2009). The in-water work window of October 1 to March 15 avoids the majority of the time in which this DPS may be present. However, it is possible that adults may be present in the action area during in-water work conducted in October, and juveniles may be present within the action area during in-water work conducted in early March.

Upper Columbia River Steelhead

This DPS includes all naturally spawned anadromous steelhead populations below natural and man-made impassable barriers in tributaries in the Columbia River Basin upstream from the Yakima River, Washington, to the Canadian border (NOAA Fisheries 2008). There are six artificial propagation programs for steelhead in this DPS.

UCR steelhead are entirely summer-run fish, and use the Columbia River within the action area for migration and holding. Returning adults are present in the action area from May through October. Juveniles tend to rear higher in the watershed than steelhead juveniles from the Lower and Middle Columbia River DPSs (NOAA Fisheries 2005). Outmigrating juveniles are present in the action area from approximately March to late June (CRC 2009). Outmigrating kelts pass through the action area in March and April, and are primarily summer-run steelhead (Boggs et al. 2008.).

The in-water work window of October 1 to March 15 avoids the majority of the time in which this DPS may be present. However, it is possible that adults may be present in the action area during in-water work conducted in October, and juveniles may be present within the action area during in-water work conducted in early March.

Snake River Basin Steelhead

This DPS includes all naturally spawned anadromous steelhead populations below natural and man-made impassable barriers in tributaries in the Snake River basin of southeast Washington, northeast Oregon, and Idaho (71 FR 834; January 5, 2006). There are six artificial propagation programs for steelhead in this DPS. SR steelhead are generally classified as summer-run, based on their adult run timing patterns.

Adults use the Columbia River within the action area for migration and holding, and are present between June and October. Juveniles of this DPS tend to rear higher in the watershed than steelhead that occupy lower tributaries of the Columbia River. Outmigrating juveniles are present in the action area from March to late June (CRC 2009). Outmigrating kelts pass through the action area in March and April, and are primarily summer run steelhead (Boggs et al. 2008.).

The in-water work window of October 1 to March 15 avoids the majority of the time in which this DPS may be present. However, it is possible that adults may be present in the action area during in-water work conducted in October, and juveniles may be present within the action area during in-water work conducted in early March.

6.2.6. Bull Trout

The action area is located within the Coastal Recovery Unit for bull trout. Bull trout in the Coastal Recovery Unit are listed as threatened under the ESA. USFWS has developed the Coastal Recovery Unit Implementation Plan (RUIP) to document and describe the threats to bull trout and the site-specific management actions necessary for recovery of the species within the Coastal Recovery Unit (USFWS 2015).

Once widely distributed throughout the Pacific Northwest, bull trout have been reduced to approximately 44 percent of their historical range (LCFRB 2010c). Bull trout are thought to have more specific habitat requirements in comparison to other salmonids and are most often associated with undisturbed habitat with diverse cover and structure. Spawning and rearing are thought to be primarily restricted to relatively pristine cold streams, often within headwater reaches (Rieman and McIntyre 1993). Adults can reside in lakes, reservoirs, and coastal areas or they can migrate to salt water (Federal Register 1998). Juveniles are typically associated with shallow backwater or side-channel areas, while older individuals are often found in deeper pools sheltered by large organic debris, vegetation, or undercut banks (Federal Register 1998). Water temperature is also a critical factor for bull trout, and areas where water temperature exceeds 59°F (15°C) are thought to limit distribution (Rieman and McIntyre 1993).

Key factors in the decline of bull trout populations include habitat impacts related to legacy forest management and agricultural practices, water withdrawals and diversions, barriers to fish passage, and the isolation and fragmentation of populations. Changes in sediment delivery (particularly to spawning areas), degradation and scouring, shading (high water temperature), water quality, and low hydrologic cycles adversely affect bull trout. Therefore, impacted watersheds are negatively associated with current populations. Additionally, bull trout appear to be affected negatively by non-native trout species through competition and hybridization.

It is anticipated that the mainstem Columbia River will have increasing importance as key foraging and overwintering habitat for fluvial bull trout as passage improvements are made at hydroelectric facilities currently isolating individual core areas and as populations improve in status (USFWS 2015). In addition, if the anadromous life history can still be expressed within some core areas of the Lower Columbia River region, the Columbia River will also provide a critical connection to marine habitats. Historic records documented that bull trout (referred to as Dolly Varden at the time) were caught in fish wheels operated on the lower mainstem Columbia in the late 1800s (Donaldson and Cramer 1971), and historic observations have also been documented in the lower Columbia River near Jones Beach, and in the fish ladder at Bonneville Dam (USFWS 2010).

The Lower Columbia River is described as a “major geographic region” in the RUIP, as it is an important migratory waterway essential for providing habitat and population connectivity within the region. The RUIP also designates 21 existing bull trout core areas within the Coastal Recovery Unit, and an additional four historic core areas that could be reestablished. The Hood River watershed is identified as a core area, while the White Salmon River watershed is considered a historic core area.

Most core areas in the region historically supported a fluvial life history form, but many are now adfluvial due to reservoir construction. Most core populations in the Lower Columbia River region are not only isolated from one another due to dams or natural barriers, but they are internally fragmented as a result of man-made barriers. Local populations are often disconnected from one another or from potential foraging habitat. Adult abundances within the majority of core areas in the Lower Columbia River region are relatively low, generally 300 or fewer individuals, though adult abundance is lower in the Hood River core area which is thought to contain fewer than 100 adults (USFWS 2015). The Lower Deschutes core area, located upstream of the action area, is considered a relative stronghold, and individuals from this core area have been used as donor stock for re-introduction efforts in other regions

(USFWS 2015). Conservation measures, including the removal of Powerdale Dam in 2013, screening of diversions, and various stream habitat improvements have improved conditions for bull trout within the Hood River core area.

In southwest Washington, bull trout have been reported in the North Fork Lewis, White Salmon, and Klickitat River systems. The Lewis and Klickitat watersheds are identified as core areas, and the White Salmon watershed is identified as a historic core area. Historically, bull trout were found in the Cowlitz and Kalama basins but are not believed to be present there today. Bull trout populations occur in two drainages downstream of Bonneville Dam, the Willamette River and the Lewis River (Federal Register 1998).

Adult bull trout are likely present only infrequently within the action area between mid-March and September. The in-water work window of October 1 to March 15 avoids this time frame. Juvenile bull trout are not expected to occur within the mainstem Columbia River within the action area at any time of the year.

6.2.7. Pacific Eulachon

Pacific eulachon are small anadromous fish that occur offshore in marine waters and return to tidal areas of rivers to spawn in late winter and early spring (Washington Department of Fish and Wildlife [WDFW] 2001). Pacific eulachon (commonly called smelt) in the Lower Columbia River are considered part of the southern DPS and is a threatened species under the ESA (NOAA Fisheries 2010).

Pacific eulachon are endemic to the eastern Pacific Ocean ranging from northern California to southwest Alaska and into the southeastern Bering Sea. Eulachon typically spend three to five years in salt water before returning to fresh water to spawn from late winter through early summer. Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt and spawning typically occurs at night. Spawning occurs at temperatures from 39°F to 50°F (4°C to 10°C) in the Columbia River over sand, coarse gravel, or detrital substrates, in January, February, and March in the Columbia River. Eulachon eggs hatch in 20 to 40 days, and then are carried downstream and dispersed by estuarine and ocean currents.

Key threats to eulachon are overfishing in subsistence and commercial fisheries, continued/increased bycatch in commercial groundfish and shrimp fisheries, industry pollution of freshwater and marine habitats, human impact on spawning habitat through logging, dredging, and diversions, and climate change (Hay and McCarter 2000).

According to NOAA Fisheries (NOAA Fisheries 2010), most Pacific eulachon production for the southern DPS occurs in the Columbia River basin. In the Columbia River, spawning runs return to the mainstem of the river from RM 25, near the estuary, to immediately downstream of Bonneville Dam (RM 146).

Pacific eulachon occur only incidentally above Bonneville Dam. They are not expected to occur within the portion of the action area at the project site, and would not be directly affected by any effects associated with construction of the Proposed Action. Adult eulachon use downstream portions of the action area as a migration corridor, and spawning habitat, and may be present within the downstream portions of the action area between approximately January and mid-September.

6.2.8. North American Green Sturgeon

The Southern DPS of North American green sturgeon are listed as threatened under the ESA (NOAA Fisheries 2009). The Columbia River estuary below RM 46 has been designated as critical habitat.

Green sturgeon are distributed throughout Alaska, Oregon, Washington, and California (McCabe and Tracy 1994). The Southern DPS of green sturgeon includes individuals from coastal and Central Valley populations south of the Eel River in California, with the only known spawning population in the Sacramento River (Federal Register 2006). The Columbia River does not support spawning populations of green sturgeon (Federal Register 2006). Adults and sub-adults from this DPS migrate up the coast and use coastal estuaries, including the Lower Columbia River, for resting and feeding during the summer. In the mid-1930s before Bonneville Dam was constructed, green sturgeon were found in the Columbia River up to the Cascades Rapids; today, they occur upriver to Bonneville Dam but are predominantly found in the lower reach of the river. The estuaries of Willapa Bay, the Columbia River, and Grays Harbor are late summer concentration areas (NOAA Fisheries 2002).

Threats include commercial and sport fisheries, modification of spawning habitats (e.g., as a result of logging, agriculture, mining, road construction, and urban development in coastal watersheds), entrainment in water project diversions, and pollution. All known spawning rivers have flow regimes affected by water projects (NOAA Fisheries 2002).

Green sturgeon prefer more saline environments and are not typically found in the Columbia River upstream of RM 37. Adult and sub-adult green sturgeon are typically present in the lower Columbia River from mid-May to mid-September, with August the peak month (McCabe and Tracy 1994). Green sturgeon are not present within the portion of the action area at the project site, but are present within the downstream portion of the action area between mid-May and mid-September.

7. ENVIRONMENTAL BASELINE

7.1. Columbia River

The Project spans the mainstem of the Columbia River at approximately RM 169. 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. The Columbia River originates in British Columbia, flows southwest through Washington State, and then flows west along the Washington/Oregon border to the Pacific Ocean. The portion of the Columbia River that is in the vicinity of the project site experiences considerable human use, including intensive recreation, commercial fishing, and commercial and industrial vessel traffic.

Eleven hydroelectric dams on the Columbia River and four dams on the Snake River limit anadromous fish migration and affect resident fish habitat. These dams create impoundments that reduce flow rates, allow settling of sediments, and control water level elevations as compared to historical free-flowing conditions of the rivers. The Columbia River mainstem at the project location is an impoundment behind the Bonneville Dam, which is referred to as the Bonneville Pool. Benthic substrates in this reach of the river consist largely of silts and medium-to-coarse alluvial sands typical of this reach of the Lower Columbia River. No native aquatic vegetation was documented in the reach of the river at the project site or within the vicinity.

In-stream habitat complexity is limited at the site, and there is no overhanging vegetation or in-stream large woody debris providing structural complexity or areas of refuge. On the Oregon side of the river, the shoreline is almost entirely armored with riprap, and on the Washington side there are also several areas of bed rock outcropping. No substrate present is adequate for salmonid spawning. Below the riprapped and bedrock streambanks, there is an area of gradual transition to deep water that provides some shallow water nearshore habitat, which many juvenile species of fish prefer. However, the lack of riparian vegetative cover and limited in-stream structural diversity limits the function of this nearshore habitat.

At the location of the existing and proposed bridges, the Columbia River is approximately 4,200 feet wide and the navigation channel is maintained to a width of 300 feet. The depth of the channel generally exceeds the authorized depth and river traffic can use areas outside the defined channel wherever depths are available. National Oceanic and Atmospheric Administration (NOAA) Navigation Chart No. 18532 indicates approximate depths of 35 to 50 feet at the bridge location within the navigation channel. Depths west of the bridge and north of the navigation channel are approximately 50 to 75 feet.

In general, the environmental baseline conditions for aquatic habitat within the reach of the Columbia River that flows through the action area typify those associated with a modified and managed system. At the watershed scale, the natural fluvial processes of the river have been altered dramatically. The main channel is maintained as a navigation channel for vessel and barge traffic, and depth and flow of the Bonneville pool are regulated by upstream and downstream hydroelectric dams. In addition, dam construction and streambank armoring throughout the watershed have limited floodplain connectivity and greatly reduced the quantity and quality of available backwater and off-channel habitats. At the Project site scale, streambanks on the Oregon side of the river have been armored with riprap, and the entire portion of the site that is above the OHWM has been largely isolated from any functioning floodplain.

Nearshore aquatic habitat on the Washington side of the river at the location of the existing bridge consists of a combination of sandy shoreline and bedrock outcrops. Nearshore aquatic habitat on the Oregon side of the river drops off rapidly to water depths greater than 20 feet (Figure 3). The greatest water depths within the vicinity of the project site are approximately 40 feet (Navionics 2020). The distance between the north and south banks of the river is approximately three-quarters of a mile. The resulting nearshore shallow water transition zone is relatively narrow. The Hood River enters the Columbia River approximately 1,500 feet downstream of the location of the existing bridge. There is a sandbar that has formed at this location that provides a more gradual shallow water nearshore transition zone. Water quality conditions within the action area are generally appropriate for aquatic life. One of the most substantial limiting factors is water temperature. The reach of the Columbia River that is within the action area is identified on both Ecology and Oregon DSL 2012 303(d) lists for elevated water temperature. Data published by the U.S. Geological Survey in 2012 indicate that summer water temperatures in the Bonneville Pool routinely exceed 70°F (Tanner et al. 2012).

Sediments at the project site are predominantly fine-grained sand (Tetra Tech 1992), which is the natural condition for the lower reaches of a large river. As previously stated there is no substrate present that would support salmonid spawning, and no stocks of ESA-listed salmon are known or expected to spawn in the mainstem of the Columbia River at the Project site. The lack of riparian vegetative cover and limited in-stream structural diversity limits the function of nearshore habitats at the Project site.

In general, the reach of the Columbia River that is within the portion of the action area at the Project site provides aquatic habitat conditions suitable as a migratory corridor for several species of native Columbia River fish, including several native salmonids, trout, sturgeon, lamprey, minnows, and eulachon. Several non-native fish species are also present throughout the Lower Columbia River. Several of these non-native species are present in numbers that may affect native fish populations.

7.2. Washington

A terraced hillside rising from the Columbia River to an elevation of approximately 600 feet characterizes the north side of the Columbia River within the action area.

The area landward of the shoreline is characterized by two ecosystems – North Pacific Lowland Riparian Forest and Shrubland and North Pacific Oak Woodland (Rocchio and Crawford 2015). The lowland riparian forest and shrubland consists of Oregon white oak (*Quercus garryana*), black cottonwood (*Populus balsamifera*), ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). Oregon grape (*Mahonia nervosa*) and patches of Himalayan blackberry (*Rubus armeniacus*) dominate the understory. While the shoreline of the river on the Washington side retains more natural character than the Oregon shoreline, development (including the BNSF railway, SR 14, and residential and commercial uses) have fragmented natural corridors and degraded the functional condition of the riparian and terrestrial habitats at the project site.

Wetland habitats on the Washington side of the river provide potentially suitable habitat for a variety of species. Small mammals typically found in wetland habitats in the vicinity include beaver, raccoon, and coyote. Various reptile and amphibian species also rely on wetland habitats.

WDFW identifies five priority habitats within the terrestrial portion of the action area on the Washington side of the river (WDFW 2019d). These habitats include

- Oregon white oak woodland
- Oak/pine mixed forest
- Cliffs/bluffs
- Talus slopes
- Wetlands

Oregon White Oak Woodland and Oak Pine Mixed Forest

The Oregon white oaks woodland and oak/pine mixed forest priority habitats mapped by WDFW are located along the north shore of the Columbia River and among the bluffs along the cities of White Salmon and Bingen. A small stand of Oregon white oak woodland is mapped on the Washington side of the river, which includes the area surrounding the existing bridge landing on that side of the river. These Oregon white oak woodlands are defined by the WDFW as stands of pure oak or oak/conifer associations (e.g., oak/pine mixed forest) where the canopy coverage of the oak component of the stand is 25 percent; or where total canopy coverage of the stand is less than 25 percent, but oak accounts for at least 50 percent of the canopy coverage present. The latter is often referred to as oak savanna. In non-urbanized areas, east of the Cascades, priority oak habitat consists of stands 5 acres in size. In urban or urbanizing areas, single oaks or stands less than 1 acre may also be considered a priority when found to be particularly valuable to fish and wildlife (Larsen and Morgan 1998). Oak woodland and oak/pine mixed forest habitats within the vicinity of the Project site do not provide habitat for any ESA-listed species that are known or expected to occur within the action area.

Cliffs/Bluffs and Talus Slopes

Talus slopes are defined as homogenous areas of rock rubble ranging in average size of 0.5 to 6.5 feet, composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. These features may be associated with cliffs. Cliff/bluffs are those areas greater than 25 feet high and occurring below 5,000 feet. Columbia River basalt cliffs/bluff and talus slope habitats are present on the steep bluffs north of SR 14 within the API.

Cliff/bluff and talus slopes can provide habitats for special status species, including species endemic to the Columbia River Gorge. However, WDFW Priority Habitats and Species data (WDFW 2019d) does not document any occurrences of any ESA-listed species presence within the cliff, bluff, or talus slopes within the action area, and these terrestrial habitats do not provide habitat for any ESA-listed species that are known or expected to occur within the action area.

Wetlands

Wetlands are those lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following attributes: the land supports, at least periodically, predominantly hydrophytic plants; substrate is predominantly undrained hydric soils; and/or the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Wetlands habitats are identified on the National Wetland Inventory (USFWS 2019a) between SR 14 and the BNSF tracks and south of the BNSF tracks, west of South Dock Grade Road (USFWS 2019a). Additional wetland habitats are also mapped south of the BNSF tracks east of the existing bridge (USFWS 2019a). A wetland delineation conducted in July 2019 determined that the extent of the actual wetland boundaries in these locations is less than what is identified on the National Wetland Inventory mapping.

Wetlands provide habitat for a variety of terrestrial and avian wildlife species. Given the disturbed nature of the wetlands within the action area and the degree of habitat fragmentation, the degree of wildlife habitat function is limited. Wetlands within the action area do not provide habitat for any ESA-listed species, but they do provide a water quality function that indirectly affects aquatic habitat quality within the Columbia River.

7.3. Oregon

Terrestrial habitats on the Oregon side of the action area are generally of limited quality and function, as these areas have been substantially altered from their natural condition. Terrestrial habitats consist almost exclusively of either unvegetated impervious areas or managed landscaped areas, and these areas provide very little habitat function for fish or wildlife. There is a constructed stormwater facility, located north of the I-84 westbound on-ramp in the southern portion of the action area. Vegetation in this area consists of a mix of wetland-adapted species, including American speedwell (*Veronica americana*), water parsley (*Oenanthe sarmentosa*), and California brome (*Bromus carinatus*), and an overstory of scattered black locust (*Robinia pseudoacacia*) saplings. This area may provide some refuge and habitat function for terrestrial and avian species on the Oregon side of the river, but its presence in a highly developed area greatly limits its accessibility and level of function.

7.4. Critical Habitat

7.4.1. Salmon and Steelhead

The Proposed Action occurs within designated critical habitat for 13 ESU/DPS of listed salmon and steelhead. Table 19 provides a summary of the critical habitat designations.

Table 19. Salmon and Steelhead Critical Habitat Summary

Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
Chinook Salmon		
LCR ESU	2 September 2005	Columbia River to confluence with Hood River and tributaries.
UWR ESU	2 September 2005	Columbia River to confluence with Willamette River. Willamette River, including Willamette Channel, and tributaries.
UCR-SR ESU	2 September 2005	Columbia River to Island Dam and tributaries.
SR-SSR ESU	25 October 1999	Columbia River to confluence with Snake River. Snake River and tributaries.
SR-FR ESU	28 December 1993	Columbia River to confluence with Snake River. Snake River and tributaries.
Chum Salmon		
CR ESU	2 September 2005	Columbia River to confluence with Hood River and tributaries.
Coho Salmon		
LCR ESU	24 February 2016	Columbia River to confluence with Hood River and tributaries.
Sockeye Salmon		
SR ESU	28 December 1993	Columbia River to confluence with Snake River. Snake River and tributaries.
Steelhead		
LCR DPS	2 September 2005	Columbia River to confluence with Hood River and tributaries.
UWR DPS	2 September 2005	Columbia River to confluence with Willamette River. Willamette River, including Willamette Channel, and tributaries.
MCR DPS	2 September 2005	Columbia River to confluence with Yakima River and tributaries.
UCR DPS	2 September 2005	Columbia River to Chief Joseph Dam and tributaries.
SRB DPS	2 September 2005	Columbia River to confluence with Snake River. Snake River and tributaries.

ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; NA = Not Applicable; LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

Physical and Biological Features of Designated Critical Habitat for Salmon and Steelhead.

This section consists of a discussion of the physical or biological features (PBF),[9] which have been identified for ESA-listed salmon and steelhead and the potential for their presence within the action area.

[9] The original designation(s) of critical habitat for the ESA/DPS of salmon and steelhead addressed in this document use the term primary constituent element (PCE) to define critical habitat. The new critical habitat regulations (81 FR 7414) replace this term with the term "physical or biological features" (PBFs). In this BA, we use the term PBF to be consistent with the current regulatory framework. The change in terminology does not change the approach used in conducting the effects analysis.

Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Action Area: No freshwater spawning habitat exists for any listed salmon or steelhead ESU/DPS within the Project site or portions of the action area upstream of Bonneville dam. While there is some shallow water nearshore habitat at the Project site on the Washington side, in general, very little spawning occurs in the mainstem Columbia River. Most stocks spawn in tributary rivers or creeks. This PBF is not present within the portions of the action area that are at the Project site or within the vicinity. Some Columbia River ESU chum salmon do spawn within the mainstem Lower Columbia River, and this PBF is present within downstream portions of the action area, but not at the Project site.

Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover, such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Action Area: Freshwater rearing habitat within the portions of the action area that are at the Project site and within the vicinity is of moderate quality. The nearshore habitat at the site provides limited habitat function; the shoreline on the Oregon side of the river is armored and isolated from its historic floodplain. This reach of the river is managed for hydroelectric power, and water levels are carefully managed. On the Washington side of the river, the shoreline retains some natural character; however, hydrologic control of the river at dams up and downstream of the project site limit habitat complexity, and the river is largely disconnected from its current floodplain. The riparian habitat at the site provides only low to moderate aquatic habitat function. In-stream habitat complexity is similarly limited and there is little overhanging vegetation, in-stream large woody debris, or other in-stream structures that will provide structural complexity or areas of refuge. This PBF is not present throughout the aquatic portions of the action area.

Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Action Area: The action area serves as a migratory corridor for all 13 ESU/DPS of listed salmon and steelhead with designated critical habitat within the action area. However, habitat conditions limit its function at the Project site. As mentioned previously, there is little in-stream or riparian habitat complexity in the form of natural cover, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, or large rocks and boulders within the portions of the action area that are at the Project site or vicinity. This portion of the action area does, however, provide adequate water quality and quantity for adult and juvenile migration. This PBF is, therefore, present throughout the aquatic portions of the action area.

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

Action Area: No estuarine habitat is present in the portions of the action area that are at the Project site or within the Project vicinity. The action area includes aquatic portions of the Columbia River downstream of the project site that may be affected by improvements to the stormwater treatment associated with the Project, and extends as far as the mouth of the Columbia River at Astoria. The portions of the Lower Columbia River at the mouth do provide this PBF.

Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.

Action Area: No nearshore marine areas exist within the immediate vicinity of the Project site, and this PBF is not present in this portion of the action area. The action area does not extend into marine waters beyond the mouth of the river.

Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Action Area: No offshore marine habitat areas are present within the action area, and this PBF is not present

7.4.2. Bull Trout

The Proposed Action occurs within designated critical habitat for bull trout. Table 20 summarizes the critical habitat designation for bull trout within the Coastal Recovery Unit.

Table 20. Bull Trout Critical Habitat Summary

Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
Bull Trout		
Coastal Recovery Unit	17 November 2010	Mainstem Columbia River and major tributaries from mouth to Chief Joseph Dam.

Physical and Biological Features of Designated Critical Habitat for Bull Trout.

This section consists of a discussion of the PBFs of designated bull trout critical habitat and the potential for their presence within the action area.

Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

Action Area: No springs, seeps, or significant sources of groundwater occur within the portion of the action area that is at the Project site or within the vicinity. This PBF is not present within the action area in the immediate vicinity of the replacement bridge. As the action area extends to the mouth of the Columbia River, it is likely that this PBF is present within downstream portions of the action area.

Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

Action Area: The action area serves as a migratory corridor for bull trout. However, habitat conditions at the Project site, and within the Project vicinity, limit its function. As mentioned previously, no natural cover, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, or large rocks and boulders exist within the portion of the action area that is at the Project site or within the vicinity. The site is also upstream of the Bonneville Dam, which represents an impediment to migration. At minimum, the action area provides adequate water quality and quantity for adult migration, and this PBF is present, albeit in a somewhat degraded condition, throughout the action area.

An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

Action Area: While the overall quality of the aquatic habitat within the portion of the action area that is at the Project site is relatively low, this area does likely provide an adequate food base for migrating bull trout. The action area does provide habitat for native and non-native juvenile fishes and aquatic macroinvertebrates that serve as prey for bull trout. This PBF is, therefore, present throughout the action area.

Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks, and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

Action Area: The portion of the action area that is at the Project site and within the vicinity does not provide a complex riverine environment. The streambank throughout this portion of the action area on the Oregon side has been armored, and the river has been largely isolated from any functioning floodplain. This reach of the river is managed for hydroelectric power, and water levels are carefully controlled by dams upstream and downstream of the Project site. On the Washington side, the shoreline has retained more natural character; however, hydrologic control of the river has limited complexity of the shoreline environment, and neither side of the river exhibits necessary features, such as large wood, side channels, pools, and/or undercut banks. The portion of the action area that is at the project site does not exhibit a diversity of in-stream depths, gradients, velocities, or structure, and this PBF is not present within this portion of the action area. Habitats within downstream portions of the action area are similarly limited, though pockets of complex shoreline habitat remains, and this PBF is present in downstream portions of the action area.

Water temperatures ranging from 2°C to 15°C (36°F to 59°F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading; such as that provided by riparian habitat; streamflow; and local groundwater influence.

Action Area: Data published by the U.S. Geological Survey in 2012 indicate that summer water temperatures in the Columbia River can routinely exceed 70°F (Tanner et al. 2012). While these temperatures are likely suitable for bull trout migration, they are not within the range that will provide thermal refugia for bull trout. This PBF is not present within the action area.

In spawning and rearing areas, substrate of sufficient amount, size and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

Action Area: The mainstem Columbia River within the action area is not suitable for spawning or juvenile rearing of bull trout. Bull trout are not known or expected to spawn or rear within the mainstem Columbia River. This PBF is not present within the action area.

A natural hydrograph, including peak flow, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

Action Area: Water flows throughout the action area do not follow a natural hydrograph as they are controlled by dams both upstream and downstream. Water is released from dams according to electrical generation needs and regulatory spill requirements. These requirements are intended to mimic natural hydrograph and spring runoff events, but the requirements differ significantly from the natural hydrograph that will be expected in an uncontrolled system. This PBF is present in an impaired condition throughout the action area.

Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Action Area: Water quality throughout the action area is moderately impaired, but likely suitable for survival of migrating adults and outmigrating juveniles. Summer water temperatures in the Bonneville Pool frequently exceed thresholds considered necessary for salmonid growth and survival (Tanner et al. 2012). Water quantity, while artificially maintained by up- and downstream control structures, is assumed to be sufficient for survival of migrating adults and outmigrating juveniles. This PBF is present throughout the action area.

Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Action Area: The portion of the Columbia River that is at the Project site supports significant populations of several nonnative predatory species, including pikeminnow, walleye, and smallmouth bass. This PBF is not present within the action area.

7.4.3. Pacific Eulachon

Critical habitat for Pacific eulachon was designated on January 5, 2011, and includes the Lower Columbia River below Bonneville Dam and all of its tributaries. Table 21 summarizes the critical habitat designation and description of the southern DPS of Pacific eulachon. Eulachon access to areas upstream of Bonneville Dam is limited to opportunistic transport through the ship locks. Due to this passage barrier, the migration corridor essential feature in the Columbia River does not extend beyond Bonneville Dam, and NOAA Fisheries excluded areas above Bonneville Damn from the critical habitat designation (NOAA Fisheries 2011).

The project site does not occur within designated critical habitat for the southern DPS of Pacific eulachon. Critical habitat is present within the portion of the action area below Bonneville Dam that will be affected by stormwater.

Table 21. Pacific Eulachon Critical Habitat Summary

Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
Pacific Eulachon		
Southern DPS	5 January 2011	Lower Columbia River and tributaries

Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles.

Action Area: Due to the lack of a migration corridor to access the area upstream of Bonneville Dam, the spawning and incubation essential feature does not exist upstream of the dam. This PBF is not present in the vicinity of the replacement bridge. It is present within the portion of the action area below Bonneville Dam that will be affected by stormwater.

Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted.

Action Area: Water flow, water quality, and temperature conditions throughout the Middle and Lower Columbia River are suitable for eulachon freshwater migration; however, as previously described, the Bonneville Dam represents a migratory obstruction, and the portion of the action area that is located at the Project site is excluded from the critical habitat designation. This PBF is not present in the vicinity of the replacement bridge. It is present within the portion of the action area below Bonneville Dam that will be affected by stormwater.

Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.

Action Area: There is no marine habitat within the action area, and this PBF is not present within the action area.

7.4.4. North American Green Sturgeon

Critical habitat for North American green sturgeon was designated on October 9, 2009 and includes the Lower Columbia River from the mouth of the river up to RM 46 (approximately 124 river miles downstream of the project site), which is the approximate upstream limit of saltwater intrusion (NOAA Fisheries 2009). Table 22 summarizes the designation and a general description of the area designated for the Southern DPS of North American green sturgeon.

The project site does not occur within designated critical habitat for the Southern DPS of North American green sturgeon. However, downstream portions of the action area are within designated critical habitat.

Table 22. North American Green Sturgeon Critical Habitat Summary

Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
North American Green Sturgeon		
Southern DPS	Designated – October 9, 2009	Columbia River to River Mile 46

Physical and Biological Features of Designated Critical Habitat for the Southern DPS of North American Green Sturgeon in Freshwater Riverine Systems.

This section discusses the PBF designated for the Southern DPS of North American green sturgeon in freshwater riverine systems and the potential for their presence within the action area.

Abundant prey items for larval, juvenile, subadult, and adult life stages.

Action Area: Larval and juvenile green sturgeon are not likely to be present within the portions of the action area that are at the Project site or within the vicinity. Migrating adults and subadults typically feed on benthic species, such as shrimp, clams, and benthic fishes. The portion of the action area that is downstream of RM 46 within the Columbia River likely provides an adequate source of prey items for migrating adult and subadult green sturgeon. This PBF is not present within the action area in the vicinity of the replacement bridge; however, it does exist within a portion of the action area downstream of RM 46.

Substrates suitable for egg deposition and development (e.g., bedrock sills and shelves, cobble and gravel, or hard clean sand, with interstices or irregular surfaces to ''collect'' eggs and provide protection from predators, and free of excessive silt and debris that could smother eggs during incubation), larval development (e.g., substrates with interstices or voids providing refuge from predators and from high flow conditions), and subadults and adults (e.g., substrates for holding and spawning).

Action Area: The action area does not represent spawning habitat for green sturgeon. The Columbia River is not known to support any spawning populations of green sturgeon. Green sturgeon are believed to spawn in the Rogue River, Klamath River Basin, and the Sacramento River (NOAA Fisheries 2003). This PBF is not present within the action area.

A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages.

Action Area: Water regimes throughout the action area are likely adequate for subadult and adult green sturgeon migration and foraging, however, this species does not occur above Bonneville Dam. This PBF is not present within the action area in the vicinity of the replacement bridge; however, it does exist within a portion of the action area downstream of RM 46.

Water quality, including temperature, salinity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.

Action Area: Water quality conditions are adequate to support migrating adult and subadult green sturgeon that may be present within the action area; however, this species does not occur above Bonneville Dam. This PBF is not present within the action area in the vicinity of the replacement bridge; however, it does exist within a portion of the action area downstream of RM 46.

A migratory pathway necessary for the safe and timely passage of Southern DPS fish within riverine habitats and between riverine and estuarine habitats (e.g., an unobstructed river or dammed river that still allows for safe and timely passage).

Action Area: As the action area does not represent suitable spawning habitat, the downstream portions of the action area are most likely used only as foraging habitat during migration. This PBF is not present within the action area in the vicinity of the replacement bridge; however, it does exist within a portion of the action area downstream of RM 46.

Deep (≥ 5 m) holding pools for both upstream and downstream holding of adult or subadult fish, with adequate water quality and flow to maintain the physiological needs of the holding adult or subadult fish.

Action Area: The topography of the river bottom within the action area is largely human-influenced and artificially maintained for barge and vessel traffic. While the navigation channel is a deep-water habitat, it does not function as a holding pool, as the current is persistent throughout the action area and there is little opportunity for refuge. As a result, none of the deep-water habitat within the action area will be considered holding pool habitat. This PBF is not present within the action area.

Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

Action Area: While the chemical composition of sediments throughout the action area have not been characterized in detail, at a minimum, the action area, as it exists downstream of the Bonneville Dam does likely provide sediment quality conditions that are suitable for the normal behavior, growth, and viability of migrating adult and subadult green sturgeon, which are the only life stages that are expected to occur within the action area. This PBF is not present within the action area in the vicinity of the replacement bridge; however, it does exist within a portion of the action area downstream of RM 46.

8. EFFECTS OF THE ACTION

8.1. Temporary Effects to Water Quality

The Proposed Action will implement BMPs during in-water and upland construction activities to avoid and minimize impacts to water quality to the extent practicable. Without implementation of BMPs, water quality could be impacted in a number of ways. Chemical contamination could potentially occur through the accidental release of construction materials or wastes. In-water work activities could disturb sediment and generate turbidity directly in waterways. Upland ground-disturbing activities could lead to erosion, also causing turbidity in adjacent water bodies. The implementation of BMPs will help ensure that these effects will be localized and temporary, limited in duration, and will result in minimal impacts to water quality. This section describes the sources of effects to water quality, outlines the BMPs that will be used to contain them, and analyses the potential effects to listed species.

Temporarily Elevated Turbidity

The Proposed Action is likely to generate temporary, localized turbidity during the in-water work in the Columbia River. Activities associated with the Proposed Action that have the potential to disturb sediment and temporarily elevate turbidity levels within the action area include pile installation and removal, installation and removal of drilled shaft shoring casings, cofferdam installation and removal, and barge operations, including movement and anchoring. These activities could disturb sediments and temporarily elevate turbidity levels above background conditions within the portion of the action area located at the project site.

The Proposed Action will employ BMPs to minimize the extent and duration of turbidity. These BMPs include implementation of an ESCP, a WQPMP, and others as outlined in Section 4. These BMPs will 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, in particular the Section 401 Water Quality Certifications that will be obtained from DEQ and Ecology. These certifications will typically establish a temporary mixing zone for turbidity within which turbidity may temporarily exceed ambient background levels. The specific size of the mixing zone is not known, but this consultation assumes that the authorized mixing zone will extend 300 feet downstream from turbidity-generating activities, as this is a typical mixing zone for the Columbia River. Typically, the 401 Water Quality Certifications will require regular water quality monitoring in accordance with a WQPMP to document that the construction activities are consistent with the permits. Exceedances of the turbidity standard within the authorized mixing zone will generally be for short duration periods (1 hour or less).

Most of the construction activities described in this section are not expected to generate large amounts of turbidity, and are expected to dissipate to background levels before reaching the 300-foot mixing zone. Installation of piles, drilled shafts, and cofferdam piles disturb relatively small amounts of material, and the potential for generating turbidity is greatly reduced through the implementation of BMPs. 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 project site is sand, which settles in relatively short distances compared to finer sediments.

Activities conducted within cofferdams or other isolated work areas (excavation of material from within drilled shaft temporary casings and slip casings; formwork and concrete placement for the spread footing at Bent 14; and demolition activities conducted within cofferdams) will introduce only minimal amounts of sediment into the water. There is a potential for a pulse of turbid water when cofferdams are removed, and this turbidity will be managed consistent with the ESCP and permit conditions of the 401 Water Quality Certifications that will be issued for the Proposed Action. Water will be allowed to settle before removing cofferdams to minimize the turbidity plume, and turbidity will not be allowed to exceed the levels, distance, or duration specified in the permits for the activity.

Barges operating in shallow water have the potential to elevate turbidity temporarily. Barge propellers may produce turbulence that causes sediments to become suspended. Additionally, tugboats that position barges may also have propellers that generate suspended sediment. Once anchored, barges will be stationary while a given work element is being completed, and therefore have little potential to produce turbidity until moved again. Barges will be moved and repositioned multiple times in the course of construction and demolition. While the specific timing of any turbidity associated with barge operation is not known, the extent and duration of any temporary turbidity will not be allowed to exceed the levels, distance, or duration specified in the permits for the activity. In general, periods of elevated turbidity associated with barge movements will generally be for short duration periods (1 hour or less), and could occur on any given day of construction. Construction barges will not be allowed to ground out.

Upland ground-disturbing activities (including clearing, grubbing, and excavation) have the potential to cause erosion, which in turn may introduce sediment into adjacent waterbodies. In particular, vegetation removal within riparian areas on the Washington side of the river likely has the greatest potential for sediment delivery to adjacent waterbodies. However, given the ESCP and SWPPP that will be implemented, it is not likely that upland construction activities or riparian vegetation removal will cause appreciable turbidity in the Columbia River. The ESCP and SWPPP will establish BMPs, inspection protocols, and outline contingency plans that will be implemented in the case of failure.

Natural currents and flow patterns in the Columbia River routinely disturb sediments. Flow volumes and currents are affected by precipitation, as well as upstream and downstream water management at dams. High-volume flow events can result in hydraulic forces that resuspend benthic sediments, temporarily elevating turbidity locally. Additionally, the volume of flow through the action area will help minimize the intensity and duration of any temporary episodic increases in sediment suspension or turbidity. In-water work activities will adhere to the proposed impact minimization measures described in Section 4.

Chemical Contaminants and/or Debris

The Project has the potential to result in chemical contaminant and/or debris inputs to surface waters associated with in-water work in the Columbia River. The following activities have the potential to cause such inputs:

- The proposed overwater construction and demolition work creates the potential for construction debris to enter the waterway.
- Water may come into contact with uncured concrete for the construction of the shaft caps, piers, and superstructure for the new bridges, creating a potential pathway for contaminants into surface waters.
- Construction of the Proposed Action will require the use of various fuels, hydraulic fluids, lubricants, and other chemicals. Use and storage of these materials has the potential to result in leaks or spills of material into surface waters.
- Demolition of the existing bridge will occur both in and over the water and may release debris/contaminants such as concrete rubble, concrete dust, and lead paint and/or asbestos on elements of the superstructure.

Although there are several sources of potential chemical contaminants, and the potential for exposure would occur on every day of construction activity, there is a low risk that chemicals will actually enter surface waters. The contractor will be required to provide and implement conservation measures, including an SPCC plan and PCP (see Section 4.2). The SPCC plan and PCP will specify the BMPs and spill containment measures, as well as the means and methods of implementation. All work will also be conducted consistent with the requirements of the permits that are ultimately issued for the Proposed Action, including the 401 Water Quality Certifications. For these reasons, the potential for adverse effects associated with debris input or chemical contamination is low.

8.1.1. Effects Discussion

The assumptions presented in this document regarding anticipated turbidity concentrations that could be generated are based in part upon a literature review that was conducted for the ESA consultation for the Columbia River Crossing Project in 2011 (Parametrix 2010). That analysis concluded that activities, such as installation and removal of piles, drilled shaft casings, and cofferdams, were likely to generate turbidity between approximately 50 to 150 mg/L, with maximum potential concentrations of between 700 and 1,100 mg/L.

There are several mechanisms by which suspended sediment and elevated turbidity can potentially affect ESA-listed fish, including increased potential for gill tissue damage, physiological stress, behavioral changes, and direct mortality. These are described below.

Elevated turbidity levels, at sufficient concentration, can result in mortality of juvenile and even adult salmon, steelhead, and bull trout (NOAA Fisheries 2002). Turbidity levels from this Proposed Action are not expected to reach levels that cause mortality in fish. The highest sediment concentrations expected to occur (1,100 mg/L) will be well below levels known to kill fish (6,000 mg/L). Direct mortality from elevated turbidity levels is not expected to occur.

Suspended sediment can clog fish gills, thereby decreasing their capacity for oxygen exchange. The nature of the sediment particle, the concentration, water temperature, the duration of exposure, age, and species all affect salmonid response to suspended sediment. Gill tissue damage occurs at suspended sediment concentrations of approximately 3,000 mg/L, which is greater than the maximum levels that are expected from the Proposed Action (NOAA Fisheries 2002). However, when the filaments of salmonid gills are clogged with sediment, fish attempt to expunge the sediment by opening and closing their gills excessively, in a physiological process known as “coughing.” In response to the irritation, the gills may secrete a protective layer of mucus. Although this may interfere with respiration, it is not a lethal effect. This phenomena has been observed at concentrations between 30 and 60 mg/L, so it is possible that fish present within the action area during construction could be exposed to levels of turbidity that could elicit a coughing response.

Suspended sediments have been shown to cause physiological stress in adult and/or juvenile salmon, steelhead, and bull trout, but typically only when exposed to high levels for long durations (NOAA Fisheries 2002). Generally, stress is produced by prolonged exposure to high levels of suspended sediments. Because periods of elevated turbidity associated with the Proposed Action will be short-term in nature, and fish are not confined to the immediate project vicinity, prolonged exposure would not occur.

Behavioral responses to elevated levels of suspended sediment include feeding disruption and changes in migratory behavior. Migrating adult and/or juvenile salmon, steelhead, or bull trout that are exposed to elevated levels of turbidity may modify feeding and/or migratory behavior to avoid areas of high concentration. It is likely that fish present within the action area during construction could be exposed to levels of turbidity that could elicit a behavioral response.

Elevated turbidity can also have direct effects to habitat for ESA-listed salmon, steelhead, or bull trout. Mobilized sediment can settle in spawning gravels and, at high concentrations, can bury or smother eggs, and reduce spawning habitat suitability. However, there is no spawning habitat within the portion of the action area in which turbidity could be elevated during construction, and benthic substrates are uniformly composed of primarily coarse-grained sands. Re-settling of any mobilized sediment will not result in any effects to habitat function.

8.1.2. Effects to Species

Increased levels of turbidity could have temporary negative impacts on habitat for listed fish species and, if any listed fish species are present within the action area during the time of construction, could affect them directly. The following ESA-listed species have the potential to be exposed to the direct effects of temporarily impaired water quality conditions that could occur within the action area during project construction.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, UWR ESU steelhead, CR chum salmon, green sturgeon, and Pacific eulachon will not be exposed to any effects of temporarily elevated turbidity, as they do not occur within the portion of the action area where turbidity could potentially be elevated.

As discussed above, turbidity levels associated with the Proposed Action are not expected to reach levels that would result in any direct mortality or gill damage to fish. However, turbidity will likely reach levels that could cause coughing. Actual exposure to these levels is expected to be minimal, however, as regulatory permits will require a restricted mixing zone in which turbidity can be elevated. Additionally, because of the large size and the high dilution capacity of the Columbia River there are abundant accessible areas of turbidity refugia in the vicinity, and listed fish should not become trapped in turbid water. The turbidity will be localized and will not cause a complete barrier to movement.

The Proposed Action will result in turbidity concentrations that could result in physiological stress in fish, but the duration of exposure is not expected to be of sufficient duration to elicit a physiological response.

It is likely that turbidity generated during construction and demolition activities will result in some behavioral responses, including temporary avoidance and reduced foraging abilities, as these responses have been documented at very low turbidity levels. Tables 15-17 identify the timing of different runs and life stages of listed fish may be present in portions of the action area where they could be exposed to this effect. The in-water work window avoids the peak run timing for juvenile and adults in most ESU/DPSs of salmon steelhead and bull trout; however, certain turbidity-generating activities (such as pile removal and barge operation) may be conducted on a year-round basis. For this reason, adults and juveniles of all ESU/DPSs of salmon, steelhead and bull trout could potentially be exposed to elevated levels of turbidity that could result in behavioral responses. The geographic extent and duration of any potential increases in turbidity are expected to be limited and short-term and the conservation and impact minimization measures that will be implemented will be sufficient to minimize any effects.

8.1.3. Effects to Critical Habitats

The portion of the action area that could be affected by temporarily decreased water quality during construction is designated critical habitat for the following ESA-listed species:

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Chum salmon – CR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for UWR ESU Chinook salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects of temporarily elevated turbidity or reduced water quality, as they do not occur within the portion of the action area where turbidity could potentially be elevated. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends only to the mouth of the Hood River and its tributaries, which is outside the footprint of the Proposed Action, but within the zone of influence for temporary water quality impacts.

As described in the section above, designated critical habitats within the action area may experience temporarily increased levels of turbidity during construction and demolition activities. This has the potential to temporarily affect the following PBFs of designated critical habitat:

- “freshwater migration” BPF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.

- “freshwater rearing” PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “migratory” and “water quantity/quality” PBFs for bull trout.

As described above, the geographic extent and duration of any potential increases in turbidity or other decreases in water quality are expected to be temporary and localized (typically, periods of 1 hour or less within the authorized mixing zone), and the conservation and impact minimization measures that will be implemented will be sufficient to minimize the extent of any temporary effects. Re-settling of any mobilized sediment will not result in any effects to habitat function. Benthic substrates are uniformly composed of primarily coarse-grained sands, and any temporarily elevated turbidity or reduced water quality will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.2. Hydroacoustic Impacts

Construction of the replacement bridge has the potential to result in temporarily elevated underwater noise levels within the portion of the action area that is located at the project site during the installation of piles for the replacement bridge, installation and removal of temporary piles used during construction, removal of existing piles during demolition of the existing bridge, and impact pile driving for upland foundation supports.

Elevated underwater noise has the potential to affect fish in several ways. The effects can range from the alteration of behavior to physical injury or mortality, depending on the intensity and characteristics of the sound, the distance and location of the fish in the water column relative to the sound source, the size and mass of the fish, and the fish’s anatomical characteristics (Hastings and Popper 2005).

The Project will minimize the likelihood of any impacts resulting from pile installation activities. Pile installation will be performed to the greatest extent possible using a vibratory hammer, though piles will need to be driven to final tip elevation and/or proofed, as necessary, with an impact hammer. Proofing is the process of striking piles with an impact hammer to verify their load-bearing capacity.

The Project will implement a bubble curtain consistent with NOAA Fisheries/USFWS guidance (Appendix E) during all impact pile driving. In addition, all in-water pile installation and removal will be conducted within the approved in-water work period for the Proposed Action. Impacts will be further minimized through adherence to the impacts avoidance and minimization measures described in Section 4.2. Bubble curtains, when installed and operated properly, typically provide at least 5 dB of noise attenuation (Caltrans 2015) and the NOAA Fisheries Office of Protected Resources uses a 7 dB reduction as a general standard during bubble curtain application.

8.2.1. Effects Discussion

The current NOAA Fisheries hydroacoustic noise thresholds for injury and disturbance to fish are as follows (Fisheries Hydroacoustic Working Group [FHWG] 2008).

- Peak pressure of 206 dB_{PEAK}
- SEL of 187 dB_{SEL} for fish greater than or equal to 2 grams
- SEL of 183 dB_{SEL} for fish less than 2 grams

Current NOAA Fisheries thresholds for disturbance to fish are represented as an average pressure, or root mean square (RMS). The threshold for behavioral disturbance is 150 dB_{RMS} re: 1 µPa[10] (FHWG 2008). The areas within the action area that experience sound pressure levels exceeding the peak and cumulative SELs for injury are referred to as the "injury" zone, while those areas exceeding 150 dB_{RMS} re: 1 µPa for disturbance are referred to as the behavioral effect" zone.

Underwater noise above the injury thresholds may cause a range of lethal and sublethal injuries to fish. These include barotrauma which can result in ruptured swim bladders or other internal organs, and can also result in the formation of gas bubbles in tissue, causing inflammation, cellular damage, and blockage or rupture of blood vessels. These injuries may lead to immediate or delayed mortality.

Elevated underwater sound can also result in hearing loss in fish. Such hearing loss may be temporary and reversible (temporary threshold shift [TTS]), or permanent (permanent threshold shift [PTS]). TTS is the result of fatigue of the hair cells in the inner ear and is not a permanent tissue damage. PTS results from the irreversible damage of sensory hair cells in the inner ear. TSS and PTS may result in a general decrease in fitness, foraging success, ability to avoid predators, and ability to communicate. Thus, even if TTS or PTS does not directly result in death, it can potentially result in delayed mortality.

Project-generated noise above the 150 db_{RMS} behavioral noise level may cause behavioral changes in fish. These can include relatively immeasurable effects or minor effects, such as startling, momentary disruption in feeding, or avoidance of the action area. Depending on site conditions, behavioral effects may be significant, with consequences for survival and reproduction. For example, avoidance of the action area could presumably cause delays in feeding or migration that could in turn affect spawning or outmigration success.

Impact Pile Driving

Impact pile installation of approximately eighty-three 48-inch steel pipe piles has the potential to generate temporary underwater noise levels of approximately 214 dB_{PEAK}, 201 dB_{RMS}, and 184 dB_{SEL} (measured at a distance of 33 feet or 10 meters from the pile) prior to any attenuation (DEA 2011). Installation of 24-inch diameter steel pipe piles will generate noise levels of approximately 205 dB_{PEAK}, 190 dB_{RMS}, and 175 dB_{SEL} (sound exposure level) (measured at a distance of 33 feet or 10 meters from the pile) prior to any attenuation.

A bubble curtain or other similarly effective noise attenuation device will be employed during all impact pile proofing or installation. The bubble curtain will be consistent with standard NOAA Fisheries/USFWS bubble curtain specifications provided in Appendix E. These devices, when properly installed and maintained, typically provide 7 dB of attenuation for piles of this size and type, and frequently provide higher levels of attenuation (Caltrans 2015). NOAA Fisheries has indicated that a standard 7 dB source level reduction is an appropriately conservative estimate of the degree of attenuation that is typical for a properly installed unconfined bubble curtain. A hydroacoustic monitoring plan will implemented during impact pile driving to confirm the level of attenuation provided.

It is estimated that between 1,000 and 1,500 impact strikes may be required to finish driving and/or proofing a given pile. This number of strikes will require a maximum of approximately 30-45 minutes of impact hammer activity. It is further estimated that between two and three piles per day may be installed and/or proofed with an impact hammer, with an estimated total maximum number of 3,000 impact strikes per day if a single impact pile driver is in operation, or up to 6,000 impact strikes per day if

[10] dB_{RMS} re: 1 µPa = Root Mean Square decibels referenced to 1 micropascal

two pile driving rigs are operated concurrently. It is important to note that actual pile production rates will vary, and a typical day will likely have fewer strikes.

It is expected that only a single impact pile driver will be in use at a given time, but there is a potential that a contractor could elect to employ a second impact pile driving rig during certain periods of construction. In addition, the contractor may elect to have both a vibratory and impact pile driving rig in operation simultaneously. Operation of two pile driving rigs simultaneously is not expected to produce greater decibel levels. Pile strikes from both drivers would need to be synchronous (within 0.0 and approximately 0.1 seconds apart) in order to produce higher noise levels than a single pile driver operating alone. Because this level of synchronicity is highly unlikely, the analysis in this document assumes that pile drivers will not generate noise levels greater than that of a single pile driver.

Table 22 provides a summary of the modeled distances within which noise from impact pile driving is expected to exceed NOAA's established peak and cumulative injury thresholds for ESA-listed fish, as well as the established behavioral noise levels. These include the modeled distances for impact pile driving occurring both with and without the use of an attenuation device for comparison. The calculations assume that the noise attenuation device will achieve a 7dB noise reduction at the source. Graphical representations for the modeled distances to the thresholds are provided in Figures 13-16

Table 23. Impact Pile-Strike Summary

<table>
<tr><th rowspan="2">Number of Pile Drivers</th><th rowspan="2">Pile Type and Dimensions</th><th rowspan="2">Source Decibel Levels</th><th rowspan="2">Max Strikes Per Day</th><th colspan="4">Distance to Established Injury and Behavioral Noise Levels*</th></tr>
<tr><th>Single Strike Peak Injury Threshold (206 dB PEAK)</th><th>Cumulative Injury Threshold for Fish >2g (187 dB SEL)</th><th>Cumulative Injury Threshold for Fish <2g (183 dB SEL)</th><th>Behavioral Noise Level (150 dB RMS)</th></tr>
<tr><td colspan="8">Without Noise Attenuation Device</td></tr>
<tr><td rowspan="2">Single Impact Pile Driver</td><td>Temporary (24-inch Steel)</td><td>205 dB PEAK, 175 dB SEL, 190 dB RMS</td><td>75</td><td>28 ft. (9 m)</td><td>92 ft. (28 m)</td><td>171 ft. (52 m)</td><td>15,228 ft. (4,642 m)</td></tr>
<tr><td>Permanent (48-inch Steel)</td><td>214 dB PEAK, 184 dB SEL, 201 dB RMS</td><td>75</td><td>112 ft. (34 m)</td><td>368 ft. (112m)</td><td>680 ft. (207 m)</td><td>82,411 ft. (25,119 m)</td></tr>
<tr><td colspan="8">With Noise Attenuation Device (-7dB)</td></tr>
<tr><td rowspan="2">Single Impact Pile Driver</td><td>Temporary (24-inch Steel)</td><td>198 dB PEAK, 168 dB SEL, 183 dB RMS</td><td>1,500</td><td>10 ft. (3 m)</td><td>233 ft. (71 m)</td><td>430 ft. (131 m)</td><td>5,200 ft. (1,585 m)</td></tr>
<tr><td>Permanent (48-inch Steel)</td><td>207 dB PEAK, 177 dB SEL, 194 dB RMS</td><td>3,000</td><td>38 ft. (12 m)</td><td>1,470 ft. (448 m)</td><td>2,070 ft. (631 m)</td><td>28,140 ft. (8,577 m)</td></tr>
<tr><td rowspan="2">Two Impact Pile Drivers</td><td>Temporary (24-inch Steel)</td><td>198 dB PEAK, 168 dB SEL, 183 dB RMS</td><td>3,000</td><td>10 ft. (3 m)</td><td>369 ft. (113 m)</td><td>520 ft. (158 m)</td><td>5,200 ft. (1,585 m)</td></tr>
<tr><td>Permanent (48-inch Steel)</td><td>207 dB PEAK, 177 dB SEL, 194 dB RMS</td><td>6,000</td><td>38 ft. (12 m)</td><td>2,070 ft. (631 m)</td><td>2,070 ft. (631 m)</td><td>28,140 ft. (8,577 m)</td></tr>
</table>

*Data from NOAA Fisheries Pile Driving Calculator is provided in Appendix D.

Vibratory Pile Driving and Removal
Installation of both temporary and permanent piles will be conducted with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. Drilled shaft casings of all types (shoring casings, temporary casings, and slip casings) will be installed either with an oscillator or with a vibratory hammer. In addition, installation and removal of steel sheet piles for cofferdams will also be conducted with a vibratory hammer.

Currently there are no established injury thresholds for noise levels generated vibratory pile driving that are likely to cause injury or behavioral effects to fish. However, the 150 dB_{RMS} behavioral noise level remains applicable, and vibratory pile driving may cause behavioral effects to fish.

As described in Section 5.2.2, the maximum anticipated underwater sound pressure levels generated during vibratory pile driving are estimated to be approximately 181 dB_{RMS} for both 24-inch and 48-inch piles (DEA 2011).

It is conservatively estimated that vibratory pile driving activity could result in underwater noise above the 150 dB_{RMS} behavioral noise level throughout the in-water portion of the action area.

8.2.2. Effects to Species

The following ESA-listed species have the potential to be exposed to direct effects of temporarily increased underwater noise levels during pile installation because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, UWR ESU steelhead, CR chum salmon, green sturgeon, and Pacific eulachon will not be exposed to any effects of temporarily elevated underwater noise, as they do not occur within the portion of the action area where construction-related underwater noise could potentially occur.

Impact Pile Driving
Impact pile driving will result in effects to fish that may range from behavioral disturbance to mortality, depending on size of the fish, duration of exposure to sound pressure, proximity to the strike site, size of the pile, and the accumulated number of strikes in a given day of pile driving. As described in Section 3.3.5, and as summarized in Table 6, impact pile driving may be required on up to approximately 100 days over the entire three-year in-water construction period between October 1 and March 15th of each year. Within this time period, exposure will be further restricted to no more than approximately 100 to 150 minutes per 12-hour work day.

Given the nature and anticipated use of the habitat, most fish are expected to be moving through the portion of the action area where injury and behavioral noise levels could potentially be temporarily exceeded during impact pile driving. For this reason, ESA-listed fish are not expected to be exposed to the accumulated sound from all strikes in a given day. However, it is possible that some fish present in the vicinity could be exposed to levels of cumulative underwater noise that exceed the injury threshold.

As described in Section 3.3.5, and as summarized in Table 6, impact pile driving may be required on up to approximately 100 days over the entire three-year in-water construction period between October 1 and March 15 of each year. Within this time period, exposure will be further restricted to no more than approximately 100 to 150 minutes per 12-hour work day.

Adult and/or juvenile fish that are present within the areas identified in Table 23 during impact pile driving activity, could be exposed to injury- or disturbance-level underwater noise. While the in-water work window avoids the peak timing of the runs for adult and juvenile migration for each species and population, a portion of the run for all but one ESU/DPS may potentially occur within the in-water work window. The exception is SR ESU Sockeye salmon, which is typically not present within the action area during the in-water work window, and which would therefore likely not be affected by noise from impact pile driving.

Fish that are present within the injury zones during impact pile driving would likely be adversely affected and would constitute a "take" under ESA.

Vibratory Pile Driving and Removal

Vibratory pile installation and removal is not expected to generate levels of underwater noise that will result in adverse effects to ESA-listed fish. NOAA Fisheries has established a behavioral noise level of 150 dB_{RMS} for fish of any size. Vibratory pile installation and removal may result in maximum underwater sound levels that meet or exceed this noise level. This has the potential to result in behavioral responses which could include temporary avoidance of the area, changes in migratory routes, predator avoidance, or interruption of reproduction. While these behavioral responses could potentially affect some individuals, these disturbance-level effects will not be expected to rise to the level of adverse effect.

The estimated amount and duration of vibratory pile driving is described in Section 3.3.5, and summarized in Table 6. Vibratory pile driving and removal of temporary piles would be required for aspects of both construction and demolition, and as such, could be conducted throughout the 6-year project period. All vibratory pile installation (including installation of temporary and permanent pipe piles, drilled shaft shoring casings, and sheet piles) would be restricted to the in-water work window between October 1 and March 15th of each year. Vibratory removal of temporary pipe piles and sheet piles may be conducted year-round.

Adult and/or juvenile fish that are present within the area in which underwater noise will be temporarily elevated during vibratory pile driving may also be exposed to levels of underwater noise that could result in behavioral disturbance. However, this activity is unlikely to injure fish and is not expected to significantly interfere with behaviors such as migration, rearing, or foraging. Thus, vibratory pile driving and removal is not likely to adversely affect any of these species.

8.2.3. Effects to Critical Habitat

The portion of the action area that could be affected by temporarily elevated underwater noise during construction is designated critical habitat for the following ESA-listed species:

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Chum salmon – CR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS

- Bull trout – Coastal Recovery Unit

Designated critical habitats for UWR ESU Chinook salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects of temporarily elevated underwater noise, as they do not occur within the portion of the action area where noise could potentially be elevated. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends only to the mouth of the Hood River and its tributaries, which is outside the footprint of the Proposed Action, but within the zone of influence for construction-related hydroacoustic impacts

As described in the section above, designated critical habitats within the action area may experience temporarily elevated levels of underwater noise during construction and demolition activities. This has the potential to temporarily affect the following PBFs of designated critical habitat:

- "freshwater migration" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- "migratory" PBF for bull trout.

As described above, the geographic extent and duration of the elevated underwater noise will be temporary and localized, and the conservation and impact minimization measures that will be implemented will be sufficient to minimize the extent of any temporary effects. Background underwater noise levels will return to ambient conditions when construction is complete, and any temporarily elevated underwater noise levels will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.3. Terrestrial Noise

Terrestrial noise during impact pile driving activity and other construction activities could be elevated above background levels within a maximum distance of approximately 3,200 feet. Peak terrestrial noise generated during impact pile installation has been estimated to be approximately 110 decibels (dBA), measured at 50 feet (FTA 2006).

No ESA-listed species or species proposed for listing under the ESA are expected to be present within the portion of the action area where terrestrial noise levels could be temporarily elevated. No suitable terrestrial habitat exists within the portion of the action area where terrestrial noise levels could be elevated for any ESA-listed species, and ESA-listed species are therefore not expected to be affected by temporarily elevated terrestrial noise during construction.

No terrestrial environments are designated or proposed critical habitats for any species listed or proposed for listing under the ESA, and temporarily elevated terrestrial noise levels are not expected to result in any measurable or significant effects to any PBFs of designated or proposed critical habitat.

8.4. Aquatic Habitat Impacts

The Proposed Action will result in direct impacts to aquatic habitats for ESA-listed species associated with construction of the replacement bridge and removal of the existing bridge. These include both permanent habitat impacts associated with changes in the physical benthic and overwater footprint of the replacement bridge, 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 Section 4.

8.4.1. Effects Discussion

Table 24 provides a summary of the permanent aquatic habitat impacts associated with the Proposed Action. Table 25 provides a summary of the temporary aquatic habitat impacts associated with the Proposed Action. These impacts are discussed in detail in the sections below.

Table 24. Permanent Aquatic Impacts Summary

<table>
<tr><th rowspan="2">Bridge Element[1]</th><th rowspan="2">Dimensions (ft)</th><th colspan="3">Total Quantities</th><th rowspan="2">Benthic Impact (sq ft)</th><th rowspan="2">Overwater Coverage (sq ft)</th><th rowspan="2">Fill within Floodplain[2] (cubic yards)</th></tr>
<tr><th>48” Steel Pipe Piles</th><th>72” Drilled Shaft</th><th>96” Drilled Shaft</th></tr>
<tr><td colspan="7">Permanent Impacts/Restoration</td><td></td></tr>
<tr><td>Bent 2 (Drilled Shaft)</td><td>12 x 30</td><td>0</td><td>2</td><td>0</td><td>57</td><td rowspan="14">NA</td><td rowspan="14">8,449</td></tr>
<tr><td>Bent 3 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 4 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 5 (Pile Supported)</td><td>56 x 56</td><td>25</td><td>0</td><td>0</td><td>314</td></tr>
<tr><td>Bent 6 (Pile Supported)</td><td>56 x 56</td><td>25</td><td>0</td><td>0</td><td>314</td></tr>
<tr><td>Bent 7 (Pile Supported)</td><td>56 x 56</td><td>25</td><td>0</td><td>0</td><td>314</td></tr>
<tr><td>Bent 8 (Drilled Shaft)</td><td>40 x 64</td><td>0</td><td>0</td><td>6</td><td>302</td></tr>
<tr><td>Bent 9 (Drilled Shaft)</td><td>40 x 64</td><td>0</td><td>0</td><td>6</td><td>302</td></tr>
<tr><td>Bent 10 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 11 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 12 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 13 (Drilled Shaft)</td><td>30 x 30</td><td>0</td><td>4</td><td>0</td><td>113</td></tr>
<tr><td>Bent 14 (Spread Footing)</td><td>20 x 28</td><td>0</td><td>0</td><td>0</td><td>560</td></tr>
<tr><td>Contingency Piles</td><td>NA</td><td>8</td><td>3</td><td>1</td><td>237</td></tr>
<tr><td>Bridge Deck (Total)</td><td>56 x 4,411 (approx.)</td><td>-</td><td>-</td><td>-</td><td>-</td><td>230,965</td><td>N/A</td></tr>
<tr><td colspan="2">Total</td><td>83</td><td>29</td><td>13</td><td>3,078</td><td>230,965</td><td></td></tr>
<tr><td colspan="5">Existing Bridge to Be Removed (sq ft)</td><td>-9,815</td><td>-80,462</td><td>-5,916</td></tr>
<tr><td colspan="5">Existing Riprap to Be Removed (sq ft)</td><td>-16,600</td><td>-</td><td>-7,800</td></tr>
<tr><td colspan="5">Net Change (sq ft)</td><td>-23,337</td><td>+150,503</td><td>-5,267</td></tr>
</table>

1. Excludes Bents 1 and 15, as these Bents are located in terrestrial areas outside the OHWM of the Columbia River.
2. Volume of material fill/removal within the 100-year floodplain (below +90.4 feet NAVD88).

Table 25. Temporary Aquatic Impacts Summary

Project Element	Approximate Dimensions (ft)	Total Quantities	Temporary Benthic Impact (sq ft)	Temporary Overwater Coverage (sq ft)	Approximate Duration
Temporary Impacts					
Temporary Work Bridge (OR)	70 x 475	95 24" steel pipe piles	298	20,825	3 years
Temporary Work Bridge (WA)	70 x 675	115 24" steel pipe piles	361	28,875	3 years
Temporary Demo Work Bridge (WA)	70 x 700	120 24" steel pipe piles	377	31,850	3 years
Cofferdams (Demolition) (up to 22 total)	Varies by bent 16 x 30 to 50 x 86	Up to 3,422 linear feet steel sheet pile	17,950	-	12-16 months (each)
Cofferdam (Spread footing)	30 x 38	136 linear feet of sandbags or similar	580	-	12-16 months
Drilled Shaft Shoring Casings	84-inch and 108-inch diameter	29 84-inch diameter casings and 13 108-inch diameter casings	426	-	4 months (each)
Other (non-load-bearing) Temporary Piles	24-inch diameter	200 24" steel pipe piles	628	-	4 months (each)
Barges (15 total)	45' x 140'	15 barges, including spud piles and anchors	283	100,000	6 years

Benthic Habitat Impacts

As described in Section 3.3.4, the foundation design for the replacement bridge includes driven steel pipe piles, drilled shafts, and a spread footing. In total the replacement bridge will require the installation of approximately eighty-three 48-inch steel pipe piles, twenty-nine 72-inch drilled shafts, and thirteen 96-inch drilled shafts, as well as one spread footing. The pile counts include a 10 percent contingency, to accommodate the potential need for additional piles and/or drilled shafts as the structural design is finalized. These structures will impact approximately 3,078 square feet of benthic habitat.

The existing bridge is founded on a total of 30 pile-supported, concrete bents. A total of 22 of these bents are located below the OHWM of the Columbia River, currently displacing a total of approximately 9,815 square feet of existing benthic habitat. The two bents that are located on either side of the existing navigation channel are protected by riprap (approximately 7,800 cubic yards), which currently displaces an additional approximately 16,600 square feet of benthic substrate.

The existing bridge will be removed once the replacement bridge is in place and, as such, the Proposed Action will result in a net restoration of approximately 23,337 square feet of benthic habitat within the action area.

As described in Section 3.3.3, the Proposed Action will also require the installation of several temporary in-water structures during the course of construction. These structures will include temporary work bridges, cofferdams, drilled shaft shoring casings, temporary piles, and barge anchors. The anticipated quantities and estimated duration that each of these project features would be present during construction are described in Section 3.3.3, and summarized in Table 25.

Permanent and temporary benthic habitat impacts will represent a loss of physical benthic substrate for species that rely on aquatic habitats at the project site. Benthic habitat loss can affect primary productivity, as it eliminates substrate in which aquatic vegetation and benthic microorganisms can occupy. Structures that occupy benthic habitat can also represent impediments to foraging and migration, and movement within the action area. Structures in shallow water can cause outmigrating juveniles to move into deeper waters, where they may be more vulnerable to predation.

The extent of impact to benthic habitat function is tempered by the level of aquatic habitat function that is currently provided by the benthic habitats at the site. Aquatic habitat at the project site has been modified from its natural condition as a result of human alteration of the system. The river has been largely isolated from its historic floodplain, and hydrology is controlled by dams upstream and downstream of the project site. Benthic habitats that would be affected by the Proposed Action are neither rare nor of particularly high quality.

Temporarily affected benthic habitats, and benthic habitats that are restored from removal of the existing bridge, will rapidly recolonize with benthic microorganisms and return to full function.

Fill Within the Floodplain

New fill placement within the floodplain can affect aquatic habitat suitability by affecting peak and base flow conditions and by altering hydrodynamic conditions such as scour. Because the project site is located on the Columbia River within the Bonneville pool, where water levels are carefully managed, these potential effects are less pronounced.

The 100-year floodplain elevation at the Project site is at approximately +90.4 feet NAVD88. The extent of functional floodplain habitat below this elevation at the Project site is relatively limited given the degree of streambank armoring on the Oregon side of the river and the rapid transition to upland riparian habitat on the Washington side of the river.

The project would result in the installation of approximately 8,449 cubic yards of material below the +90.4-foot 100-year floodplain elevation. This material would be associated with the bents for the new bridge. The removal of the existing bridge would remove a total of approximately 13,716 cubic yards of material below this elevation (approximately 5,916 cubic yards associated with the bents for the existing bridge and an additional 7,800 cubic yards of riprap). The Proposed Action will therefore result in a net removal of fill material from within the floodplain.

The net removal of material from within the floodplain at the Project site will represent a small functional improvement to floodplain and hydrodynamic function at the site. However, given the limited extent of floodplain at the Project site and the highly managed nature of the water levels within the Bonneville pool, the extent of the improvement will be relatively minor.

Overwater Shading

The primary effects to aquatic habitat function associated with shading from overwater structures are the potential for: (1) effects to native aquatic vegetation and reduced primary productivity, and (2) reduced habitat suitability for aquatic species, particularly juvenile salmonids (Nightingale and Simenstad 2001).

Reduced sunlight penetration to benthic surfaces can reduce photosynthetic activity and lead to reduced habitat suitability for aquatic vegetation. However, there is little to no native aquatic vegetation at the project site, and the effect to primary productivity will be minimal.

Overwater shading can affect aquatic habitat suitability for fish, in particular for migrating and rearing juvenile salmonids. Juvenile salmonids rely on nearshore habitats during migration and rearing, and nearshore shading can affect patterns of movement, and can also provide habitat for predatory fish species, such as northern pikeminnow, largemouth bass, smallmouth bass, black crappie, white crappie, and walleye (NOAA Fisheries 2002).

A number of factors can reduce the potential effects to aquatic habitat function that could otherwise occur associated with overwater shading. These include the height of the structure, the orientation of the structure, the density of the piling, and the piling material and reflectivity (Nightingale and Simenstad 2001), in addition to overall duration (for temporary structures).

Increased structure height diminishes the intensity of shading by providing a greater distance for light to diffuse and refract around the bridge deck surface. The new structure will be elevated between approximately 20 and 94 feet above the water's surface over the length of the bridge. This will greatly reduce the potential impact of shading. The existing bridge is approximately 57 feet above the water. A north-south dock orientation has also been shown to increase underwater light availability by allowing varying shadow periods as the sun moves across the sky (Nightingale and Simenstad 2001). The shading created from the replacement bridge will be constantly moving, and the shape and intensity of the shading will not be a solid dark area but a more diffuse irregular shape. This reduces the extent of the functional impact of the shading.

An open-pile structure also reduces the effect to aquatic habitat function (Nightingale and Simenstad 2001). Large numbers of densely spaced piling, such as those associated with large marine terminals, can increase the shade cast by piling on the underwater environment, whereas open structures allow for more light penetration. The distance between the foundation members on the proposed replacement bridge allows for a substantial amount of light penetration, and reduces the potential for any effect to habitat function.

8.4.2. Effects to Species

The following ESA-listed species have the potential to be exposed to effects associated with benthic habitat short-term impacts and restoration and overwater shading because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, CR ESU chum salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any direct habitat impacts, as they do not occur within the portion of the action area where aquatic habitat impacts will occur.

Permanent aquatic habitat impacts will persist at the project site, so all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site will be exposed to the effects from permanent benthic habitat impacts and new overwater shading.

Similarly, temporary aquatic habitat impacts will occur at various times throughout the construction and demolition (see Table 25). For this reason, all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site could potentially be exposed to temporary loss of benthic habitat and temporary overwater shading.

As described in Section 8.4.1 above, temporary impacts to benthic habitat and overwater shading associated with temporary work structures will affect foraging and migration habitat suitability within the action area for both adult and outmigrating juvenile salmon, steelhead, and bull trout. However, the extent of the effect to function will be limited, given that the impacted habitat is not of particularly high quality or rarity, and there is abundant similar habitat immediately adjacent along the shorelines of the river upstream and downstream of the project site. The impacted habitat represents only a small fraction of the remaining habitat available for miles in either direction.

Similarly, permanent impacts to aquatic habitat associated with the replacement bridge will also affect foraging and migratory habitat suitability at the project site. The net effect to aquatic habitat function from the Proposed Action will be largely beneficial, as the Proposed Action will result in a net restoration of benthic habitat once the existing bridge is removed, and the height and open structure of the foundation design for the replacement bridge limits the functional effect of shading associated from the new structure.

8.4.3. Effects to Critical Habitat

The portion of the action area within the project footprint that could be affected by direct impacts to aquatic habitat during construction is designated critical habitat for the following ESA-listed species:

- Chinook salmon – UCR-SR, SR-SSR, SR-FR ESUs
- Sockeye Salmon – SR ESU
- Steelhead – MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for LCR and UWR ESU Chinook salmon, LCR ESU coho salmon, CR chum salmon, LCR and UWR DPS steelhead, green sturgeon, and Pacific eulachon will not be affected, as they do not occur within the portion of the action area where direct habitat impacts would occur. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends to the mouth of the Hood River and its tributaries, which is outside the footprint of the Proposed Action.

As described in the section above, designated critical habitats within the project footprint will be directly affected by both temporary and permanent benthic habitat impacts and overwater cover during construction.

Temporary work platforms and structures will likely temporarily degrade the following PBFs of designated critical habitat:

- “freshwater migration” PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “migratory” PBF for bull trout.

These structures will temporarily displace benthic habitats, and will generate overwater shading that may represent a partial impediment to movement for adults and/or outmigrating juvenile fish, which may potentially avoid passing under overwater structures.

Permanent structures associated with the replacement bridge will also result in some permanent effects to the freshwater migration PBF of critical habitat for the above-mentioned ESU/DPSs of ESA-listed salmon and steelhead, and the migratory PBF of critical habitat for bull trout. These structures will temporarily displace benthic habitats, and will generate overwater shading that may represent a partial impediment to movement for adults and/or outmigrating juvenile fish, which may potentially avoid passing under overwater structures.

However, as described in Section 8.4.1 and 8.4.2 above, the net effect to aquatic habitat function from the Proposed Action will be largely beneficial, as the Proposed Action will result in a net restoration of benthic habitat once the existing bridge is removed, and the height and open structure of the foundation design for the replacement bridge limits the functional effect of shading associated from the new structure. Habitat impacts have been minimized to the extent possible through the avoidance and minimization measures described in Section 4. The Proposed Action, therefore, will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.5. Terrestrial Habitat Impacts

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 non-native vegetation. None of these terrestrial areas within the action area provide suitable habitat for any ESA-listed species, and none are designated critical habitat for any ESA-listed species. However, impacts to riparian 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).

On the Oregon side of the river, most terrestrial habitat disturbance will occur within areas that are either impervious or already developed. The Proposed Action will temporarily disturb approximately 1.86 acres of vegetation that is currently in landscaping, lawns, or similar heavily managed vegetation. No functional riparian habitat would be affected. Post-project site restoration in these areas will likely consist of replacement landscaping with similar ornamental species. No native plant communities will be disturbed on the Oregon side of the river.

On the Washington side of the river, vegetation will be cleared within a temporary work zone approximately 3.45 acres in size to allow construction equipment to access the site, to construct the replacement bridge abutments and stormwater treatment facilities, and to remove the existing bridge. Approximately 1.09 acres of this temporary vegetation clearing will occur within the 200-foot shoreline jurisdiction of the Columbia River. This area is a forested riparian area that is regulated by the City of White Salmon under its Shoreline Master Program. A large oak tree that is present east of the existing bridge would be preserved, and would not be affected by the Proposed Action.

Areas temporarily disturbed during construction will be restored upon completion of the Proposed Action consistent with state and local regulations (Figure 19).

The approximately 2.36 acres of temporary disturbance outside of the 200-foot shoreline buffer on the Washington side of the river will be re-vegetated upon completion of the Proposed Action consistent with state and local regulations. Temporarily disturbed areas within DOT rights-of-way will be replanted consistent with applicable DOT requirements and design standards. The approximately 1.09 acres of temporarily disturbed vegetation within the riparian shoreline buffer on the Washington side of the river will be restored with native vegetation once construction and demolition activities are complete. This restoration will be conducted consistent with requirements in the White Salmon Municipal Code Critical Areas Ordinance and Shoreline Master Program.

The Proposed Action will result in permanent impacts to approximately 0.29 acre of forested riparian habitat within the City of White Salmon's 200-foot shoreline buffer, in the location of the replacement bridge landing on the Washington side of the river. The Proposed Action will also result in approximately 0.10 acre of permanent wetland impact and approximately 0.23 acre of wetland buffer impact. These permanent impacts have the potential to reduce aquatic habitat function within adjacent waters.

As described in Section 3.3.10, a compensatory mitigation plan will likely be required by the USACE, Ecology, WDFW, ODFW, and/or the City of White Salmon, to offset impacts to wetlands and riparian habitats. While a specific compensatory mitigation plan has not yet been developed for this Proposed Action, the mitigation will comply with applicable regulatory permit terms and conditions, including a requirement to achieve no net loss of habitat function. For this reason, impacts to riparian and wetland habitats will be fully offset, and are not expected to result in any measurable or significant effect to habitat function for any ESA-listed species or to any PBF of designated critical habitat for any species.

8.6. Work Area Isolation and Fish Salvage

As described in Section 3.3.4, 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 (described in Section 3.3.3 and Table 4) include drilled shaft shoring casings (426 square feet), the sandbag cofferdam for the spread footing at Bent 14 (580 square feet), and temporary sheet pile cofferdams for demolition (for those bents that a contractor elects to employ them rather than using a wire saw) (up to 17,950 square feet).

8.6.1. Effects Discussion

Drilled shaft shoring casings and cofferdams will be installed in a manner that minimizes the potential for fish entrapment. Sandbags and sheet piles will be installed from upstream to downstream and will be lowered slowly until contact with the substrate. Installation of drilled shaft shoring 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 in-water work area isolation structures, to remove fish from within the isolated work area. All fish salvage work will be conducted consistent with the best practices established in the Biological Opinion for ODOT's Federal Aid Highway Programmatic consultation, to minimize the potential for effects to fish or other aquatic organisms.

Methods may include seining, electrofishing, trapping, or other authorized methods. Captured fish will be released outside of the work area.

Despite the BMPs and impact minimization measures that will be employed, the salvage operation involves capture, direct handling, and transporting of fish; therefore, there is a reasonable risk that the operation may harass, injure, or kill individual fish. Similarly, if a fish remains trapped in an isolated work area during construction, mortality is likely.

8.6.2. Effects to Species

The following ESA-listed species have the potential to be exposed to effects during work area isolation and fish salvage, because of their potential or documented presence within the portion of the action area where these activities will occur.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, CR ESU chum salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects during work area isolation and fish salvage, as they do not occur within the portion of the action area where these activities will occur. SR ESU sockeye salmon will not be exposed to any effects during work area isolation and fish salvage, as they do not occur within the action area during the in-water work window.

As described in Section 3.3.3 and 3.3.4, work area isolation and fish salvage activities will be restricted to the in-water work window (October 1 to March 15th of each year). Because work area isolation activities will be conducted for both construction and demolition activities, these activities may be conducted during each of the six in-water work windows. While the in-water work window has been structured to avoid the peak timing of the runs for adult and juvenile migration for each species and ESU/DPS, the window overlaps with a portion of the run for most DPS/ESUs. For this reason, both adults and outmigrating juveniles of each ESU/DPS may potentially occur within the in-water work window.

Adult and/or juvenile fish that are present at the project site during installation of the work area isolation structures and fish salvage activities could be captured and directly handled. Any fish that are directly handled will represent a “take” under the ESA, which represents an adverse effect. While the Proposed Action could result in some individual fish being adversely affected by handling or disturbance during fish capture/release activities, these adverse effects will be appropriately minimized through the avoidance and minimization measures described in Section 4, and will not jeopardize the continued existence of any ESA-listed species.

8.6.3. Effects to Critical Habitat

The portion of the action area within the project footprint that could be affected during work area isolation and fish salvage is designated critical habitat for the following ESA-listed species:

- Chinook salmon – UCR-SR, SR-SSR, SR-FR ESUs
- Sockeye Salmon – SR ESU
- Steelhead – MCR, UCR, and SRB DPS

- Bull trout – Coastal Recovery Unit

Designated critical habitats for LCR and UWR ESU Chinook salmon, LCR ESU coho salmon, CR chum salmon, LCR and UWR DPS steelhead, green sturgeon, and Pacific eulachon will not be affected, as they do not occur within the portion of the action area where direct habitat impacts would occur. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends to the mouth of the Hood River and its tributaries, which is outside the area where work area isolation and fish salvage will be conducted.

Work area isolation and fish salvage within designated critical habitats within the action area may temporarily degrade the following PBFs of designated critical habitat:

- "freshwater migration" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- "migratory" PBF for bull trout.

As described above, the geographic extent and duration of any effect will be temporary and localized, and the conservation and impact minimization measures that will be implemented will be sufficient to minimize the extent of any temporary effects. Work area isolation and fish salvage activities will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.7. Overwater Lighting

8.7.1. Effects Discussion

The literature regarding effects of artificial lighting overwater on aquatic habitat function for salmonids is extensive, but also somewhat inconclusive.

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 in turn, 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, 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 bridge. Temporary lighting will be needed for all phases of construction, and as such will be relatively uniformly distributed throughout the entire construction period.

The barges and temporary in-water structures will cast light at the water surface during construction and demolition activities in the Columbia River. The specific intensity or duration of light likely to be cast on the water surface is not known. In general, overwater construction lighting could potentially be in use on any given night during each year of construction. However, the overall intensity of this effect will be low, as the Proposed Action will implement conservation measures that minimize the effects of lighting on fish including the use of directional lighting with shielded luminaries to the extent practicable, to control glare and to direct light onto work areas instead of surface waters.

The permanent lighting for the replacement bridge has not yet been designed, but it is expected to result in a reduced amount of light on the water's surface. The existing bridge is lit at night consistent with regulatory and safety requirements, and the grated surface of the existing bridge allows some of this light to pass through to the water surface. Permanent lighting for the replacement bridge deck 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 bridge 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.

8.7.2. Effects to Species

The following ESA-listed species have the potential to be exposed to effects associated with temporary and permanent overwater lighting, because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, CR ESU chum salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects, as they do not occur within the portion of the action area where these effects will occur.

Permanent overwater lighting will persist at the project site, so all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site will be exposed to the effects from overwater lighting.

Similarly, temporary overwater lighting impacts will occur at various times throughout the construction of the Proposed Action and demolition of the existing bridge (see Table 25). These impacts may occur during all months of the year, and as such, all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site could potentially be exposed to temporary effects of overwater lighting.

As described in Section 8.7.1 above, temporary overwater lighting associated with temporary work structures may affect migratory movement and/or increase predation pressure within the action area for both adult and outmigrating juvenile salmon, steelhead, and bull trout. However, while lighting may prompt fish to either avoid or congregate within illuminated areas, it will not constitute a complete barrier to migrating juvenile fish. Migrating juvenile salmonids that congregate under light sources, could be exposed to an increased risk of predation than they are currently.

As described in Section 8.7.1 above, impacts to aquatic habitat function associated with permanent overwater lighting are expected to be largely beneficial. The Proposed Action will remove the existing light sources on the existing bridge that currently pass through to the water's surface, and the lighting on the replacement bridge will use directional lighting with shielded luminaries to control glare and to direct light onto the bridge deck to the extent practicable.

8.7.3. Effects to Critical Habitat

The portion of the action area within the project footprint that could be affected by overwater lighting is designated critical habitat for the following ESA-listed species:

- Chinook salmon – UCR-SR, SR-SSR, SR-FR ESUs
- Sockeye Salmon – SR ESU
- Steelhead – MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for LCR and UWR ESU Chinook salmon, LCR ESU coho salmon, CR chum salmon, LCR and UWR DPS steelhead, green sturgeon, and Pacific eulachon will not be affected, as they do not occur within the portion of the action area where these effects would occur. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends to the mouth of the Hood River and its tributaries, which is also outside the portion of the action area where these effects would occur.

As described in the section above, designated critical habitats within the project footprint will be directly affected by both temporary and permanent overwater lighting. Lighting of temporary work platforms and structures may temporarily degrade the following PBFs of designated critical habitat:

- "freshwater migration" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead;
- "freshwater rearing" PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead; and
- "migratory" PBF for bull trout

This temporary lighting may represent a partial impediment to movement for adults and/or outmigrating juvenile fish, and may result in increased predation pressure.

As described in Section 8.7.1 above, the net effect to aquatic habitat function from the permanent lighting associated with the Proposed Action will be largely beneficial. The Proposed Action will remove the existing light sources on the existing bridge that currently pass through to the water's surface, and the lighting on the replacement bridge will use directional lighting with shielded luminaries to control glare and to direct light onto the bridge deck to the extent practicable. The Proposed Action, therefore, will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.8. Avian Predation

8.8.1. Effects Discussion

Overwater structures associated with the Proposed Action may have an effect the amount of avian predation of juvenile salmonids within the vicinity of the project site. This includes temporary work structures such as work platforms/bridges, cranes, barges, and cofferdams, as well as the permanent replacement bridge.

Avian predation of juvenile salmonids is documented as a limiting factor for salmon recovery in the Columbia River basin (LCFRB 2010a). 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 project vicinity. Predation rates are often higher in impoundments upstream of dams, dam bypass systems, and near dredge spoil islands. The existing bridge currently provides abundant perching opportunity for piscivorous birds.

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 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 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.

8.8.2. Effects to Species

The following ESA-listed species have the potential to be exposed to effects from avian predation, because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

UWR ESU Chinook salmon, CR ESU chum salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects, as they do not occur within the portion of the action area where these effects will occur.

Temporary overwater structures will be present at various times throughout the construction and demolition activities associated with the Proposed Action (see Table 25). These impacts may occur during all months of the year, and as such, all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site could potentially be exposed to temporary increased avian predation pressure.

Permanent overwater structures will persist at the project site, so all species and life stages of salmon, steelhead, and bull trout that are present within the portion of the action area that is at the project site will be exposed to the change in avian predation associated with the removal of the existing bridge, and construction of the replacement bridge.

As described in Section 8.8.1 above, temporary work structures may increase avian predation pressure within the action area for outmigrating juvenile salmon, steelhead, and bull trout. However, the extent of the effect is expected to be minimal as there are already ample perching opportunities in the vicinity, and the increase of additional temporary perches is not likely to significantly increase the amount of predation that occurs. The high level of activity during construction is also likely to limit perching on many temporary structures. Nevertheless, some juvenile salmonids may be subject to increased predation pressure.

As described in Section 8.8.1 above, impacts to avian predation associated with the replacement bridge are expected to be minimal. It is expected that the replacement bridge will provide comparable or less perching habitat than is available on the existing bridge. The steel superstructure of the existing bridge offers greater opportunities for birds to perch undisturbed, whereas the replacement structure will be open, and will have only limited overhead perching opportunities.

8.8.3. Effects to Critical Habitat

The portion of the action area within the project footprint that could be affected by avian predation is designated critical habitat for the following ESA-listed species:

- Chinook salmon – LCR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Chum salmon – CR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, MCR, UCR, and SRB DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for UWR ESU Chinook salmon, UWR ESU steelhead, green sturgeon, and Pacific eulachon will not be exposed to any effects of temporarily elevated turbidity, as they do not occur within the portion of the action area where turbidity could potentially be elevated. Critical habitat for LCR ESU Chinook salmon, LCR ESU coho salmon, CR ESU chum salmon, and LCR DPS steelhead extends only to the mouth of the Hood River and its tributaries, which is outside the footprint of the Proposed Action, but within the zone of influence for temporary water quality impacts

As described in the section above, designated critical habitats within the project footprint may be subject to increased avian predation pressure. Temporary structures may provide perching opportunities and increase predation pressure on juvenile salmon, steelhead and/or bull trout. This may temporarily degrade the following PBFs of designated critical habitat:

- “freshwater migration” PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “migratory” PBF for bull trout

The net effect to avian predation from the replacement bridge are expected to be minimal. It is expected that the replacement bridge will provide comparable or less perching habitat than is available on the existing bridge. The steel superstructure of the existing bridge offers greater opportunities for birds to perch undisturbed, whereas the replacement structure will be open, and will have only limited overhead perching opportunities. The Proposed Action, therefore, will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.9. Stormwater

The Proposed Action includes a preliminary stormwater design that documents how the Proposed Action will avoid and minimize impacts associated with temporary construction stormwater, and with stormwater runoff from new and re-built impervious surface areas constructed by the Proposed Action.

As noted in Section 3.3.10, the proposed stormwater design is preliminary. Design development and refinements may necessitate considering BMPs other than those presented in this report and/or to result in changes to the size or location of the stormwater management facilities currently proposed. Refinement of the stormwater conveyance system design may result in changes in the specific areas draining to individual water quality facilities. The final stormwater design will, at minimum, provide treatment for all CIA, and will meet the treatment standards established by the federal, state, and/or local agencies with jurisdiction.

8.9.1. Effects Discussion

Stormwater runoff from roads conveys pollutants to surface water bodies, sometimes at concentrations that are toxic to fish (Spence et al. 1996). The main pollutants of concern to ESA-listed fish species and aquatic habitats are heavy metals (zinc and copper) from vehicle sources and total suspended solids. Stormwater can also deliver other pollutants that accumulate on roadway surfaces. These can include petroleum hydrocarbons, excess nutrients, pesticides, and other trace pollutants. These pollutants can be toxic to fish even at very low concentrations. Many 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. They may also persist in streambed substrates, and be mobilized during high-flow events. Some of these pollutants may also persist and accumulate in the tissues of juvenile salmonids either directly or via biomagnification.

Stormwater-delivered pollutants can affect the physiological or behavioral performance of salmonids in ways that result in effects that range from reduced growth and reproduction, reduced migratory success, and at sufficient concentration can result in direct mortality. The likelihood and extent of effects on fish from the discharge of roadway pollutants to surface waters can vary spatially and temporally, and are dependent upon external variables that include background water quality conditions, life stage of the fish, duration of exposure, concentration and relative toxicity of the pollutants, and concurrent discharges and/or background levels of other contaminants.

Temporary Construction Stormwater

Construction activities including ground disturbing activities and vegetation disturbance have the potential to mobilize sediment, which can be delivered to surface waters as stormwater if not properly managed. Additionally, material staging and storage areas represent a potential source of pollutants.

Staging activities will be required to 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. Stormwater treatment BMPs would be designed to treat specific areas of these sites. Site-specific BMPs 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. Appropriate BMPs for stormwater treatment are discussed further in Section 4.

Temporary construction stormwater will be regulated and managed under National Pollutant Discharge Elimination System Construction Stormwater Discharge Permits. These permits include discharge water quality standards, runoff monitoring requirements, and provision for preparing an SWPPP for construction activities. These measures will effectively reduce the potential for impacts to ESA-listed species or critical habitats from construction stormwater.

Permanent Water Quality Treatment

As described in Section 3.3.10, all stormwater within the project footprint currently is either infiltrated or discharges to the Columbia River. The existing bridge deck is approximately 1.9 acres in size, and receives no stormwater runoff control or water quality treatment. Currently, any precipitation that hits the bridge deck passes directly to the aquatic environment untreated. Similarly, contaminants from vehicles using the existing bridge (fuel, oil, lubricants, trace heavy metals from brake pads, etc.) currently pass directly to the aquatic environment, uncaptured and untreated.

Figure 11 shows the ISA associated with the Proposed Action. This includes those parts of the Proposed Action that will be new or rebuilt versus those parts expected to be resurfaced. Table 9 in Section 3.3.10 documents the net change in ISA by drainage area. The Proposed Action will result in 2.93 acres of net new ISA within Oregon, which represents an increase of approximately 27 percent. Within Washington, the Proposed Action will result in 2.52 acres of new ISA, which represents an increase of approximately 67 percent. Within the project footprint as a whole, the Proposed Action will increase the overall ISA by approximately 5.45 acres which represents an approximately 37 percent increase.

Stormwater treatment for the Proposed Action will be consistent with the ODOT Hydraulics Design Manual (ODOT 2014), which uses CIA to establish treatment requirements (CIA is defined and described in greater detail in Section 3.3.10). For purposes of this analysis, the CIA includes all roadway and bridge surfaces, including non-vegetated shoulders. Bike/pedestrian paths and sidewalks, and pedestrian overlooks have also been included within the CIA, for purposes of sizing stormwater treatment BMPs.

The total Post-Project CIA for the Proposed Action is estimated to be approximately 12.38 acres in size (See Table 10 in Section 3.3.10). This area includes about 11.41 acres of new, rebuilt, and resurfaced impervious surface area created by the Proposed Action and approximately 0.97 acres of existing impervious area that, while unaffected by the Proposed Action, will contribute runoff to the area included in the project footprint. Runoff from 100 percent of the CIA will be treated or infiltrated.

Table 11 in Section 3.3.10 provides a summary of the acreage of impervious surface area that will be treated within each drainage area. Figure 12 shows the preliminary design for stormwater treatment. The Proposed Action will provide treatment for all post-project CIA.

For purposes of this consultation it is assumed that water quality treatment will be provided either through the use of bioretention facilities, and/or through proprietary treatment technologies ,as described in Section 3.3.10. These treatment BMPs will sequester pollutants before treated stormwater is ultimately infiltrated or discharged to a surface water body. It is important to note that even treated stormwater contains some level of pollutants. Treatment BMPs are not 100 percent efficient, and will not completely eliminate discharges of pollutants to receiving water bodies. Also, BMPs are sized to accommodate a design storm, and events that exceed that design storm will result in treatment BMPs being unable to treat all stormwater that passes through.

It is difficult to quantify the extent of the impact or benefit to aquatic habitat function that will be provided by the proposed stormwater treatment. The Proposed Action will create new impervious surface that will represent a new source of stormwater pollutants, but will provide substantial water quality treatment for both new and rebuilt impervious surfaces. The existing bridge will also be removed, which will remove a potentially significant source of direct discharge of stormwater pollutants from the system. For these reasons, it is expected that the proposed stormwater treatment scenario will result in a net benefit to water quality in the action area.

During storm events that exceed the design storm for the treatment BMPs, listed fish in the action area will continue to be exposed to pollutants in untreated stormwater, but because the Proposed Action removes the existing bridge as a vector for untreated stormwater, the total exposure level is expected to be less than is currently experienced.

8.9.2. Effects to Species

The following ESA-listed species and designated critical habitats have the potential to be exposed to effects associated with stormwater, because of their potential or documented presence within the portion of the action area in which stormwater impacts will occur.

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Chum salmon – CR ESU
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, UWR, MCR, and SRB DPS
- Bull trout – Coastal Recovery Unit
- Green sturgeon – Southern DPS
- Pacific eulachon – Southern DPS

Because many stormwater pollutants will persist in the aquatic environment, and can be mobilized downstream, the area that could be affected by stormwater from the Proposed Action includes the mainstem of the Columbia River from the location of the bridge downstream to the mouth.

Because stormwater-related impacts will occur on a year-round basis, all species and life stages of salmon, steelhead, bull trout, green sturgeon, and Pacific eulachon that are present within the portion of the action area that is at the project site will be exposed to the effects from stormwater from the Proposed Action.

As described in Section 8.9.1 above, the Proposed Action will create new impervious surface, which will generate stormwater pollutants. The Proposed Action will provide water quality treatment for all post-project CIA, and will also remove the existing bridge, which represents a potentially significant point source of untreated stormwater. For these reasons, it is expected that the proposed stormwater treatment scenario will result in a net benefit to water quality in the downstream portion of the action area.

During storm events that exceed the design storm for the treatment BMPs, listed fish in the action area may be exposed to pollutants in untreated stormwater. However, because the Proposed Action removes the existing bridge as a vector for untreated stormwater, and provides treatment for all CIA, the net loading and concentration of stormwater pollutants delivered to the system is expected to be less than current levels, and pollutants will dilute rapidly to levels below existing background concentrations. Nevertheless, listed fish that are present in the immediate vicinity could potentially be exposed to pollutants in concentrations that could result in an adverse effect.

8.9.3. Effects to Critical Habitat

The portion of the action area that could be affected by effects associated with stormwater from the Proposed Action is designated critical habitat for the following ESA-listed species:

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Chum salmon – CR ESU
- Coho salmon – LCR ESU
- Sockeye Salmon – SR ESU
- Steelhead – LCR, UWR, MCR, and SRB DPS
- Bull trout – Coastal Recovery Unit
- Green sturgeon – Southern DPS
- Pacific eulachon – Southern DPS

As described in the section above, designated critical habitats within the portion of the action area that extends from the bridge downstream to the mouth of the River will be potentially affected by stormwater from the Proposed Action.

Discharges of untreated stormwater from water quality treatment BMPs during storm events will degrade the following PBFs of designated critical habitat:

- "freshwater migration" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead in all downstream portions of the action area.
- "freshwater rearing" PBF for LCR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead in all downstream portions of the action area.
- "freshwater migration" PBF for UWR ESU Chinook salmon and UWR DPS steelhead in portions of the action area downstream of the Willamette River confluence.
- "freshwater migration" "freshwater spawning" and "freshwater rearing" PBF for CR chum salmon in portions of the action area downstream of Bonneville dam.
- "estuarine" PBF for all ESU/DPS of salmon and steelhead in tidally influenced portions of the action area.
- "migratory" and "water quantity/quality" PBF for bull trout in all downstream portions of the action area.
- "freshwater spawning" and "freshwater migration" PBF for Southern DPS Pacific eulachon.
- "water quality" and "sediment quality" PBF for Southern DPS green sturgeon.

The geographic extent and duration of these effects will be temporary and localized, and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the Proposed Action will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

8.10. Changes in Land Use

Effects often associated with transportation projects include (1) changes to ecological systems that result in altered predator/prey interactions; (2) changes to ecological systems that result in long-term habitat alteration; and (3) changes in human activities, including changes in land use. The Proposed Action will not result in any measurable changes to ecological systems within the action area that will result in any alteration of predator/prey interactions or any significant long-term habitat alteration.

Regarding indirect effects resulting from changes in land use patterns, the Proposed Action will replace an existing bridge and will not result in any significant increase in access or human activity, nor any change in development pressure or change in land use. The replacement bridge will improve access for bicycles and pedestrians, which will result in some additional human activity over the water, but will not result in a change in land use.

8.11. Effects Associated with Interrelated and Interdependent Actions and Activities

Effects of the action are all consequences to listed species or critical habitat that are caused by the Proposed Action, including the consequences of other activities that are caused by the Proposed Action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (50 CFR §402.17).

As described in Section 3.3.11, consequences that are reasonably certain to occur include long-term maintenance and operation of the replacement bridge, and compensatory mitigation activities. These activities will occur consistent with all required regulatory permits.

Most routine maintenance activities are expected to have no potential to affect ESA-listed species or critical habitats. If any specific maintenance activity or project has the potential to affect listed species or critical habitat, these projects will either undergo individual Section 7 consultation with NOAA Fisheries and/or USFWS, be covered under an existing programmatic ESA consultation, or be performed as an exempted action related to road maintenance activities under Section 4(d) of the ESA.

A specific compensatory mitigation plan has not yet been developed for this Proposed Action and specific compensatory mitigation actions/sites have not yet been established. However, Table 12 in Section 3.3.11 presents a summary of the project-related impacts that may require compensatory mitigation, and the potential types of compensatory mitigation actions that may ultimately be developed for the project. Potential compensatory mitigation activities associated with the Project may include riparian and shoreline restoration projects such as riparian plantings, invasive species removal, and/or small-scale floodplain reconnection projects, wetland creation and or enhancement, installation of large woody debris. Compensatory mitigation activities for impacts to wetlands and associated wetland buffers may include a stand-alone, permittee-responsible wetland mitigation project, or may include purchase of mitigation credits in an approved mitigation bank.[11] A permittee-responsible wetland mitigation project may include some combination of wetland creation (creating new wetlands from upland areas) or wetland rehabilitation, restoration, and/or enhancement (restoring function to existing wetland areas).

Compensatory mitigation activities outside of purchasing credits at an existing bank, 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, 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 waterbodies, 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 projects), and function will be fully restored once mitigation actions are completed.

While the present level of planning for these actions is not sufficient to develop detailed construction narratives, the effects to ESA-listed species or their designated critical habitats associated with the construction of any compensatory mitigation projects are expected to be comparable to those addressed in this document, and within the scope of the effects analysis considered in this BA. However, if NOAA Fisheries, USFWS, and/or the federal action agency determines that one or more compensatory mitigation activities associated with this project are ultimately outside the scope of this consultation, re-initiationreinitiation of consultation may be necessary.

8.12. Cumulative Effects

Cumulative effects are defined under the ESA as those "effects of future state or private activities that are reasonably certain to occur within the action area."[12] It is the responsibility of the USFWS and NOAA Fisheries to review all federal actions and the cumulative effects of all state and private actions when making a jeopardy/no jeopardy call on a species and when preparing a biological opinion. The conclusions of this BA are based on the direct and indirect effects and the interrelated and interdependent activities of the project but not the cumulative effects. This discussion of potential cumulative effects is intended only for the information of the federal agencies.

Future non-federal (state or private) activities that are known or expected to be likely to occur within the action area include a variety of recreational activities, such as recreational fishing, boating, passive recreation, etc. The effects associated with this proposed action would contribute cumulatively to the baseline level of effects associated with these non-federal activities. Most development projects that would occur on the Columbia River would require federal permits and/or review, and would not be considered as cumulative effects under the scope of the ESA.

[11] The project site is not currently within the service area of any approved mitigation banks, but it is possible that a bank could be developed and approved prior to the project being constructed.

[12] Cumulative effects for purposes of the ESA include only future non-federal actions. This is different than under NEPA which evaluates the cumulative effect of all past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions.

9. EFFECT DETERMINATION SUMMARIES

Based on the description of the Proposed Action and the analysis provided in this document, Table 26 lists the effects determinations for ESA-listed species and species proposed for listing, while Table 27 shows the effects determinations for designated critical habitats.

A summary description of how these effect determinations were reached for each species and critical habitat follows the tables.

Table 26. Effect Determination Summary – Species

Species Name			Species Status/Effects Determination	
Common Name	**Scientific Name**	**ESU or DPS**	**Federal Status***	**Effects Determination****
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	T	LAA
		UWR ESU	T	LAA
		UCR-SR ESU	T	LAA
		SR-SSR ESU	T	LAA
		SR-FR ESU	T	LAA
Chum salmon	*Oncorhynchus keta*	CR ESU	T	LAA
Coho salmon	*Oncorhynchus kisutch*	LCR ESU	T	LAA
Sockeye salmon	*Oncorhynchus nerka*	SR ESU	E	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	T	LAA
		UWR DPS	T	LAA
		MCR DPS	T	LAA
		UCR DPS	E	LAA
		SRB DPS	T	LAA
Bull trout	*Salvelinus confluentus*	Coastal Recovery Unit	T	LAA
Pacific eulachon	*Thaleichthys pacificus*	Southern DPS	T	LAA
North American green sturgeon	*Acipenser medirostris*	Southern DPS	T	LAA

* E = Endangered; T = Threatened;
** NE = No Effect; NLAA = May Effect, Not Likely to Adversely Affect; LAA = Likely to Adversely Affect
ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; NA = Not Applicable; LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

Table 27. Effect Determination Summary – Critical Habitats

Species Name			Critical Habitat Status/Effects Determination	
Common Name	**Scientific Name**	**ESU or DPS**	**Status***	**Effects Determination****
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	D	LAA
		UWR ESU	D	LAA
		UCR-SR ESU	D	LAA
		SR-SSR ESU	D	LAA
		SR-FR ESU	D	LAA
Chum salmon	*Oncorhynchus keta*	CR ESU	D	LAA
Coho salmon	*Oncorhynchus kisutch*	LCR ESU	D	LAA
Sockeye salmon	*Oncorhynchus nerka*	SR ESU	D	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	D	LAA
		UWR DPS	D	LAA
		MCR DPS	D	LAA
		UCR DPS	D	LAA
		SRB DPS	D	LAA
Bull trout	*Salvelinus confluentus*	Coastal Recovery Unit	D	LAA
Pacific eulachon (smelt)	*Thaleichthys pacificus*	Southern DPS	D	LAA
North American green sturgeon	*Acipenser medirostris*	Southern DPS	D	LAA

* D = Designated; P = Proposed
** NE = No Effect; NLTAA = May Effect, Not Likely to Adversely Affect; LTAA = Likely to Adversely Affect
ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; NA = Not Applicable; LCR = Lower Columbia River; UWR = Upper Willamette River; UCR-SR = Upper Columbia River Spring-Run; SR-SSR = Snake River Spring/Summer-Run; SR-FR = Snake River Fall-Run; CR = Columbia River; SR = Snake River; MCR = Middle Columbia River; SRB = Snake River Basin

9.1. Effect Determinations for Species

9.1.1. ESA-listed Salmon and Steelhead

The Proposed Action ***"may affect, and is likely to adversely affect"*** LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, UWR, MCR, UCR, and SRB DPS steelhead.

A "**may affect**" determination is warranted based on the following:

- The action area represents documented habitat for these ESU/DPS of salmon and steelhead.
    - The portion of the action area at the project site represents migratory habitat for adults, and migratory and rearing habitat for juveniles of LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; and LCR, MCR, UCR, and SRB DPS steelhead.
    - Portions of the action area downstream of the project site provide suitable migration and spawning habitat for adults, and migratory habitat for juvenile CR chum salmon.
    - Portions of the action area downstream of the project site provide suitable migration and spawning habitat for adults, and migratory and rearing habitat for UWR ESU Chinook salmon and UWR DPS steelhead.

- The proposed action will result in the following: (1) temporary impacts to water quality during in-water and overwater construction; (2) temporary hydroacoustic impacts associated with impact pile driving; (3) temporary aquatic habitat impacts during construction; (4) permanent aquatic habitat impacts associated with the replacement bridge structure and removal of the existing bridge; (5) impacts associated with work area isolation and fish salvage; (6) impacts associated with overwater lighting and avian predation; and (7) impacts associated with stormwater from new and rebuilt impervious surfaces.

A "**likely to adversely affect**" determination is warranted for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead based on the following:

- The Proposed Action will conduct in-water and over-water work at times of the year when adults and/or juveniles of these ESU/DPS could be present within portions of the action area at the project site.
    - Most in-water activities will be limited to the in-water work window (October 1 – March 15 of each year), which has been established to avoid the peak run timing of each ESU/DPS. Other activities will be conducted on a year-round basis, or will result in impacts that will persist year-round.

- The Proposed Action has the potential to result in temporarily impaired water quality within the vicinity of the project site.
    - If present during construction, ESA-listed salmon or steelhead could potentially be exposed to temporarily impaired water quality conditions during construction activities.
    - Temporary, localized turbidity will be at levels that may result in physiological stress and/or behavioral response. Implementation of BMPs, including implementation of a Water Quality Protection and Monitoring Plan (WQPMP) to document compliance with State water quality standards, and additional specific measures described in Section 4, will further reduce the potential for adverse effects.

- The Proposed Action will result in temporarily elevated underwater noise during impact pile driving, that will exceed peak and cumulative injury thresholds established for these populations of ESA-listed salmon and steelhead within portions of the action area during impact pile driving.
    - The work window for impact pile driving activities (October 1 – March 15) overlaps a portion of the run-timing for both adults and juveniles of each of the above-named ESU/DPS, with the exception of juvenile SR ESU sockeye salmon. Juvenile SR ESU sockeye salmon will not be exposed to elevated underwater noise.
    - Adult and juvenile fish that are present within the injury zones during impact pile driving will likely be adversely affected, and would be considered take under the ESA. Potential effects include delayed migration, tissue damage, temporary and/or permanent hearing impairment, and mortality.
    - The conservation measures described in Section 4, including the use of a bubble curtain, and in-water work timing restrictions will minimize, but not eliminate, the potential for adverse effects.

- The Proposed Action will result in temporary and permanent impacts to aquatic habitat associated with the construction of the replacement bridge, which could affect habitat suitability.
    - Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, temporary piles, cofferdams, drilled shaft shoring casings, and barges will temporarily reduce habitat availability and suitability at the project site. These effects will be temporary, and will return to full function upon project completion.
    - The project will result in new permanent benthic habitat impacts, new fill within the floodplain, and new overwater shading from the replacement bridge, but the proposed removal of the existing bridge and associated riprap will result in a net restoration of benthic habitat, net removal of floodplain fill, and the effects to habitat function from overwater shading will be minimal given the height and open structure of the replacement bridge.

- The Proposed Action has the potential to result in handling or other disturbance of individual salmon and/or steelhead during work area isolation and fish salvage activities.
    - Adult and/or juvenile fish that are present at the project site during installation of the work area isolation structures and fish salvage activities could be captured and directly handled.
    - The work window for work area isolation and fish handling activities (October 1 – March 15) overlaps a portion of the run-timing for both adults and juveniles of each of the above-named ESU/DPS, with the exception of juvenile SR ESU sockeye salmon. Juvenile SR ESU sockeye salmon will not be exposed to handling during work area isolation.
    - These adverse effects will be appropriately minimized through the avoidance and minimization measures described in Section 4, including limiting these activities to the in-water work window.

- The Project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Adult and/or juvenile fish of these ESU/DPS are present within the action area, and when present will be exposed to pollutants in stormwater from new and rebuilt impervious surfaces associated with the project.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. Any such stormwater will dilute rapidly to below background levels, but in the immediate vicinity of the outfalls pollutants could be present at concentrations that could cause injury or behavioral disturbance.

The "**likely to adversely affect**" determination is warranted for UWR Chinook salmon, CR chum salmon, and UWR steelhead based on the following:

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Adult and/or juvenile fish of these ESU/DPS are present within the action area, and when present will be exposed to pollutants in stormwater from new and rebuilt impervious surfaces associated with the project.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater.

9.1.2. Bull Trout – Coastal Recovery Unit

The Proposed Action ***"may affect, and is likely to adversely affect"*** bull trout within the Coastal Recovery Unit.

A "**may affect**" determination is warranted, based on the following:

- The action area represents documented habitat for bull trout.
    - Both the portion of the action area at the project site and downstream portions of the action area represent suitable migratory habitat for adult and subadult bull trout. Juvenile bull trout are not expected to occur within the action area at any time of the year.

- The Proposed Action will result in the following: (1) temporary impacts to water quality during in-water and overwater construction; (2) temporary hydroacoustic impacts associated with impact pile driving; (3) temporary aquatic habitat impacts during construction; (4) permanent aquatic habitat impacts associated with the replacement bridge structure and removal of the existing bridge; (5) impacts associated with work area isolation and fish salvage; (6) impacts associated with overwater lighting and avian predation; and (7) impacts associated with stormwater from new and rebuilt impervious surfaces.

A "**likely to adversely affect**" determination is warranted based on the following.

- The Proposed Action will conduct in-water and over-water work at times of the year when adult bull trout may be present within portions of the action area at the project site.
    - Most in-water activities will be limited to the in-water work window (October 1 – March 15 of each year), which avoids the peak run timing of bull trout. Other activities will be conducted on a year-round basis, or will result in impacts that will persist year-round.

- The Proposed Action has the potential to result in temporarily impaired water quality within the vicinity of the project site.
    - If present during construction, adult bull trout could potentially be exposed to temporarily impaired water quality conditions during construction activities.
    - Temporary, localized turbidity will be at levels that may result in physiological stress and/or behavioral response. Implementation of BMPs, including implementation of a

WQPMP to document compliance with State water quality standards, and additional specific measures described in Section 4, will further reduce the potential for adverse effects.

- The Proposed Action will result in temporarily elevated underwater noise during impact pile driving that will exceed peak and cumulative injury thresholds established for bull trout within portions of the action area during impact pile driving.
    - While not expected within the action area in large numbers, bull trout may be present within the action area during all months of the year, including during the time period when impact pile driving activities would be conducted (October 1 – March 15).
    - Adult and/or subadult bull trout that are present within the injury zones during impact pile driving (if any) will likely be adversely affected, and would be considered take under the ESA. Potential effects include delayed migration, tissue damage, temporary and/or permanent hearing impairment, and mortality.
    - The conservation measures described in Section 4, including the use of a bubble curtain, and in-water work timing restrictions will minimize, but not eliminate, the potential for adverse effects.

- The Proposed Action will result in temporary and permanent impacts to aquatic habitat associated with the construction of the replacement bridge, which could affect habitat suitability.
    - Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, temporary piles, cofferdams, drilled shaft shoring casings, and barges will temporarily reduce habitat availability and suitability at the project site. These effects will be temporary, and will return to full function upon project completion.
    - The project will result in new permanent benthic habitat impacts, new fill within the floodplain, and overwater shading from the replacement bridge, but the proposed removal of the existing bridge and associated riprap will result in a net restoration of benthic habitat, net removal of floodplain fill, and the effects to habitat function from overwater shading will be minimal given the height and open structure of the replacement bridge.

- The Proposed Action has the potential to result in handling or other disturbance of individual adult and/or subadult bull trout during work area isolation and fish salvage activities.
    - Adult and/or subadult bull trout that are present at the project site during installation of the work area isolation structures and fish salvage activities could be captured and directly handled.
    - While not expected within the action area in large numbers, bull trout may be present within the action area during all months of the year, including during the time period when work area isolation activities would be conducted (October 1 – March 15).
    - These adverse effects will be appropriately minimized through the avoidance and minimization measures described in Section 4, including limiting these activities to the in-water work window.

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Adult and or subadult bull trout may occur within the action area, and when present will be exposed to pollutants in stormwater from new and rebuilt impervious surfaces associated with the project.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
        - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. Any such stormwater will dilute rapidly to below background levels, but in the immediate vicinity of the outfalls pollutants could be present at concentrations that could cause injury or behavioral disturbance.

9.1.3. Southern DPS Pacific Eulachon

The Proposed Action ***"may affect, and is likely to adversely affect"*** Southern DPS Pacific eulachon. This determination is warranted based on the following.

- Southern DPS Pacific eulachon are not documented or expected to occur within the portion of the action area that at the project site. However, the portion of the action area downstream of Bonneville dam represents documented suitable habitat for Southern DPS Pacific eulachon.
    - The portion of the action area downstream of Bonneville dam represents suitable migratory and spawning habitat for adult Pacific eulachon and migratory habitat for larval and juvenile Pacific eulachon.

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Adult, juvenile, and larval Pacific eulachon present within the downstream portion of the action area will be exposed to pollutants in stormwater from new and rebuilt impervious surfaces associated with the project.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. Any such stormwater will dilute rapidly to below background levels. Pollution concentrations in the downstream portion of the action area will not rise to levels that could cause injury, but the delivery of stormwater pollutants will still affect habitat suitability downstream of the dam, and represents an adverse effect to Pacific eulachon.

9.1.4. Southern DPS Green Sturgeon

The Proposed Action ***"may affect, and is likely to adversely affect"*** Southern DPS green sturgeon. This determination is warranted based on the following.

- Southern DPS green sturgeon are not documented or expected to occur within the portion of the action area that at the project site. The portion of the action area downstream of Bonneville dam represents suitable habitat for Southern DPS green sturgeon, though they are typically found in the lower river below river mile 35.
    - The portion of the action area downstream of Bonneville dam represents suitable migratory habitat for adult green sturgeon. No spawning or juvenile rearing occurs in the Columbia River.
- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Adult green sturgeon present within the downstream portion of the action area will be exposed to pollutants in stormwater from new and rebuilt impervious surfaces associated with the project.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. Any such stormwater will dilute rapidly to below background levels. Pollution concentrations in the downstream portion of the action area will not rise to levels that could cause injury, but the delivery of stormwater pollutants will still affect habitat suitability downstream of the dam, and represents an adverse effect to green sturgeon.

9.2. Effect Determinations for Critical Habitats

9.2.1. Salmon and Steelhead

The waters of the action area have been designated critical habitat for LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; SR ESU sockeye salmon; LCR, UWR, MCR, UCR, and SRB DPS steelhead. The effects determination is that the proposed project ***"may affect, and is likely to adversely affect"*** these designated critical habitats.

A "**may affect**" determination is warranted, based on the following:

- The Proposed Action will require work below the OHWM of a portion of the Columbia River that has been designated critical habitat for the ESU/DPS of salmon and steelhead listed above.
    - The action area provides for adequate freshwater migration PBF of critical habitat for both adults and outmigrating juveniles of these ESUs/DPSs of salmon and steelhead.
    - Portions of the action area in the tidally influenced portion of the lower river also provide adequate estuarine PBF of critical habitat for these ESUs/DPSs of salmon and steelhead.
    - Portions of the action area downstream of the project site also provide adequate freshwater rearing PBF of critical habitat for LCR ESU Chinook, LCR ESU coho, and LCR DPS steelhead.
    - Portions of the action area downstream of Bonneville dam provide adequate freshwater rearing and freshwater spawning PBF of critical habitat for CR chum salmon.

A “**likely to adversely affect**” determination is warranted for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; SR ESU sockeye salmon; and LCR, MCR, UCR, and SRB DPS steelhead based on the following:

- The Proposed Action has the potential to result in temporarily impaired water quality within the vicinity of the project site.
    - Water quality impacts that may result during construction may temporarily degrade the freshwater migration PBF of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

- The Proposed Action will result in temporarily elevated underwater noise levels during impact pile driving and during vibratory pile driving and removal. These noise levels could exceed the peak and cumulative injury thresholds established for ESA-listed fish species within a portion of the action area.
    - Elevated underwater noise levels during construction may temporarily degrade the freshwater migration PBF of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

- The Proposed Action will result in temporary and permanent impacts to aquatic habitat associated with the construction of the replacement bridge, which could affect aquatic habitat suitability.
    - Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, temporary piles, cofferdams, drilled shaft shoring casings, and barges may temporarily degrade the freshwater migration PBF of critical habitat at the project site. These effects will be temporary and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
    - Permanent aquatic habitat impacts from the replacement bridge will be offset by the proposed removal of the existing bridge and associated riprap, and will result in a net restoration of benthic habitat, net removal of floodplain fill, and the effects to habitat function from overwater shading will be minimal given the height and open structure of the replacement bridge. Therefore, this aspect of the project will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

- The Proposed Action has the potential to result in handling or other disturbance of individual fish during work area isolation and fish salvage activities.
    - Fish salvage activities may temporarily degrade the freshwater migration PBF of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will

be a net reduction in the pollutant load and an improved condition from baseline conditions.

  - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will degrade the freshwater migration and estuarine PBFs of critical habitat in waters downstream of the project site to the mouth of the river for all ESU/DPSs of salmon and steelhead. It will also degrade the freshwater rearing PBF for LCR ESU Chinook, LCR ESU coho, and LCR DPS steelhead.
  - The geographic extent and duration of these effects will be temporary and localized and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
  - The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the project will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

The "**may affect, likely to adversely affect**" determination is warranted for designated critical habitats for UWR Chinook salmon, CR chum salmon, and UWR steelhead based on the following:

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
  - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
  - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will temporarily degrade the freshwater migration and estuarine PBFs of critical habitat in waters downstream of the project site to the mouth of the river for these ESU/DPSs of salmon and steelhead. It will also degrade the freshwater rearing and freshwater spawning PBFs for CR chum salmon.
  - The geographic extent and duration of these effects will be temporary and localized, and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
  - The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the project will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

9.2.2. Bull Trout – Coastal Recovery Unit

The waters of the action area have been designated critical habitat for bull trout.

The effects determination is that the proposed project ***"may affect, and is likely to adversely affect"*** this designated critical habitat.

A “**may affect**” determination is warranted, based on the following:

- The Proposed Action will require work below the OHWM of a portion of the Columbia River that has been designated critical habitat for bull trout.
    - The action area provides for adequate suitable migratory, food base, riverine aquatic habitat, hydrographic, and water quantity/quality PBFs of critical habitat for bull trout (described in Section 7.4.2).

A “**likely to adversely affect**” determination is warranted based on the following:

- The Proposed Action has the potential to result in temporarily impaired water quality within the vicinity of the project site.
    - Water quality impacts that may result during construction may temporarily degrade the migratory and water quantity/quality PBFs of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated critical habitat for bull trout.

- The Proposed Action will result in temporarily elevated underwater noise levels during impact pile driving and during vibratory pile driving and removal. These noise levels could exceed the peak and cumulative injury thresholds established for ESA-listed fish species within a portion of the action area.
    - Elevated underwater noise levels during construction may temporarily degrade the migratory PBF of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated critical habitat for bull trout.

- The Proposed Action will result in temporary and permanent impacts to aquatic habitat associated with the construction of the replacement bridge, which could affect aquatic habitat suitability.
    - Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, temporary piles, cofferdams, drilled shaft shoring casings, and barges may temporarily degrade the migratory PBF of critical habitat at the project site. These effects will be temporary and will not result in any long-term degradation of any PBF of designated critical habitat for bull trout.
    - Permanent aquatic habitat impacts from the replacement bridge will be offset by the proposed removal of the existing bridge and associated riprap, and will result in a net restoration of benthic habitat, net removal of floodplain fill, and the effects to habitat function from overwater shading will be minimal given the height and open structure of the replacement bridge. This aspect of the project will therefore not result in any long-term degradation of any PBF of designated critical habitat for bull trout.

- The Proposed Action has the potential to result in handling or other disturbance of individual adult and/or subadult bull trout during work area isolation and fish salvage activities.
    - Fish salvage activities may temporarily degrade the migratory PBF of critical habitat at the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of designated critical habitat for bull trout.

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will degrade the migratory and water quantity/quality PBFs of critical habitat in waters downstream of the project site to the mouth of the river for bull trout.
    - The geographic extent and duration of these effects will be temporary and localized, and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
    - The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the project will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

9.2.3. Designated Southern DPS Pacific Eulachon Critical Habitat

The waters of the action area have been designated critical habitat for Southern DPS Pacific eulachon. The effects determination is that the proposed project ***"may affect, and is likely to adversely affect"*** this designated critical habitat.

A "**may affect**" determination is warranted, based on the following:

- Portions of the action area downstream of Bonneville dam represent designated critical habitat for Southern DPS Pacific eulachon
    - The downstream portion of the action area provides for adequate freshwater spawning and freshwater migration PBFs of critical habitat for Southern DPS pacific eulachon (described in Section 7.4.3)

A "**likely to adversely affect**" determination is warranted based on the following:

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
    - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
    - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will degrade the freshwater spawning and freshwater migration PBFs of critical habitat in waters downstream of the project site to the mouth of the river for Southern DPS Pacific eulachon.

- The geographic extent and duration of these effects will be temporary and localized, and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
- The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the project will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

9.2.4. Designated Southern DPS Green Sturgeon Critical Habitat

The waters of the action area have been designated critical habitat for Southern DPS green sturgeon. The effects determination is that the proposed project ***"may affect, and is likely to adversely affect"*** this designated critical habitat.

A "**may affect**" determination is warranted, based on the following:

- Portions of the action area downstream of Bonneville dam represent designated critical habitat for Southern DPS Pacific eulachon.
  - Designated critical habitat for Southern DPS green sturgeon within the action area is limited to portions of the action area downstream of RM 46 in the Lower Columbia River.
  - The downstream portion of the action area provides for adequate prey items, flow regime, water quality, migratory, and sediment quality PBFs of critical habitat for Southern DPS green sturgeon (described in Section 7.4.4)

A "**likely to adversely affect**" determination is warranted based on the following:

- The project will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River.
  - Stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.
  - Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will degrade the water quality and sediment quality PBFs of critical habitat in waters downstream of the project site to the mouth of the river for Southern DPS green sturgeon.
  - The geographic extent and duration of these effects will be temporary and localized, and will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.
  - The proposed stormwater treatment and removal of the existing bridge as a source of untreated stormwater will reduce the amount of pollutants delivered to the aquatic system, and the project will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

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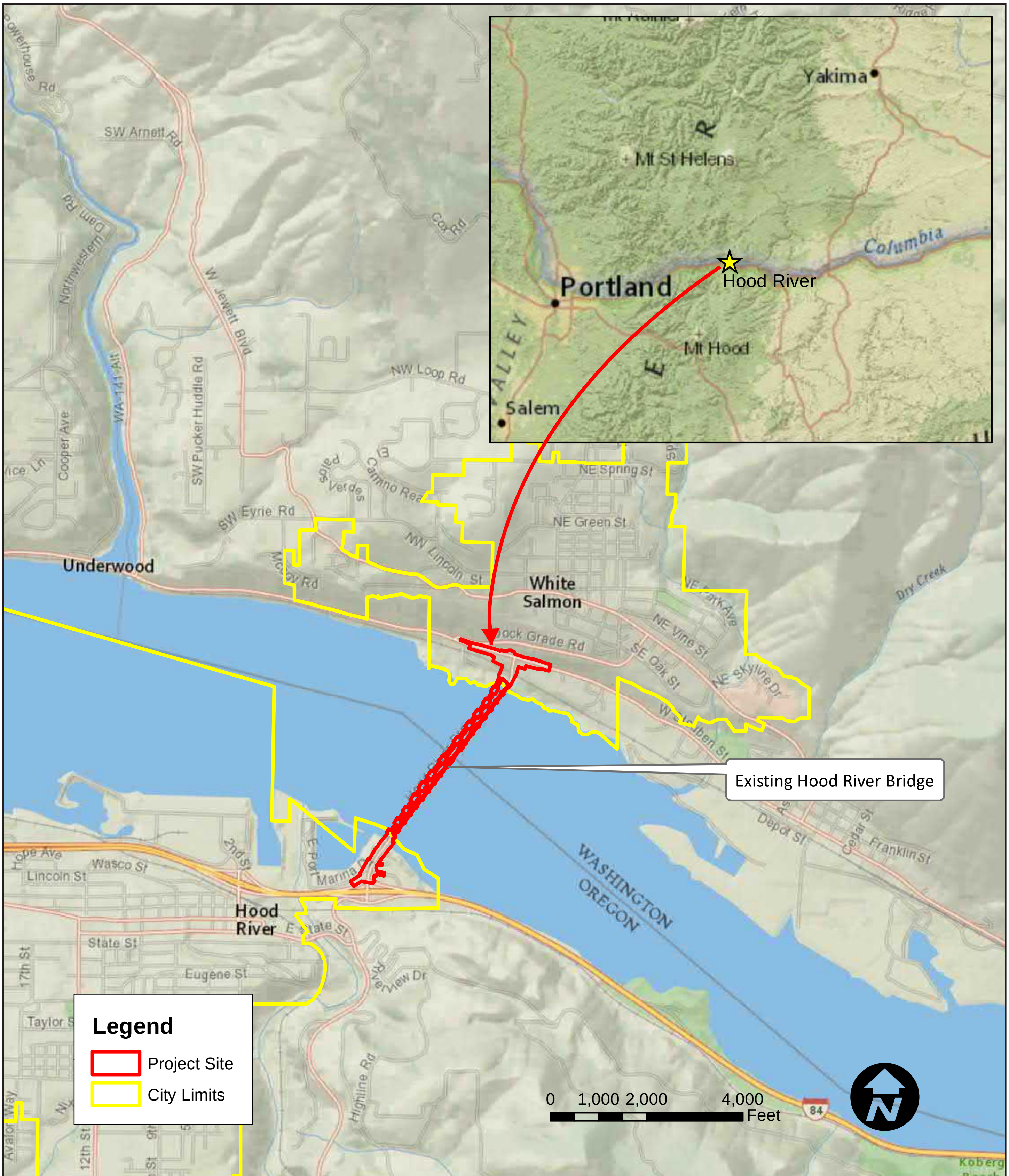
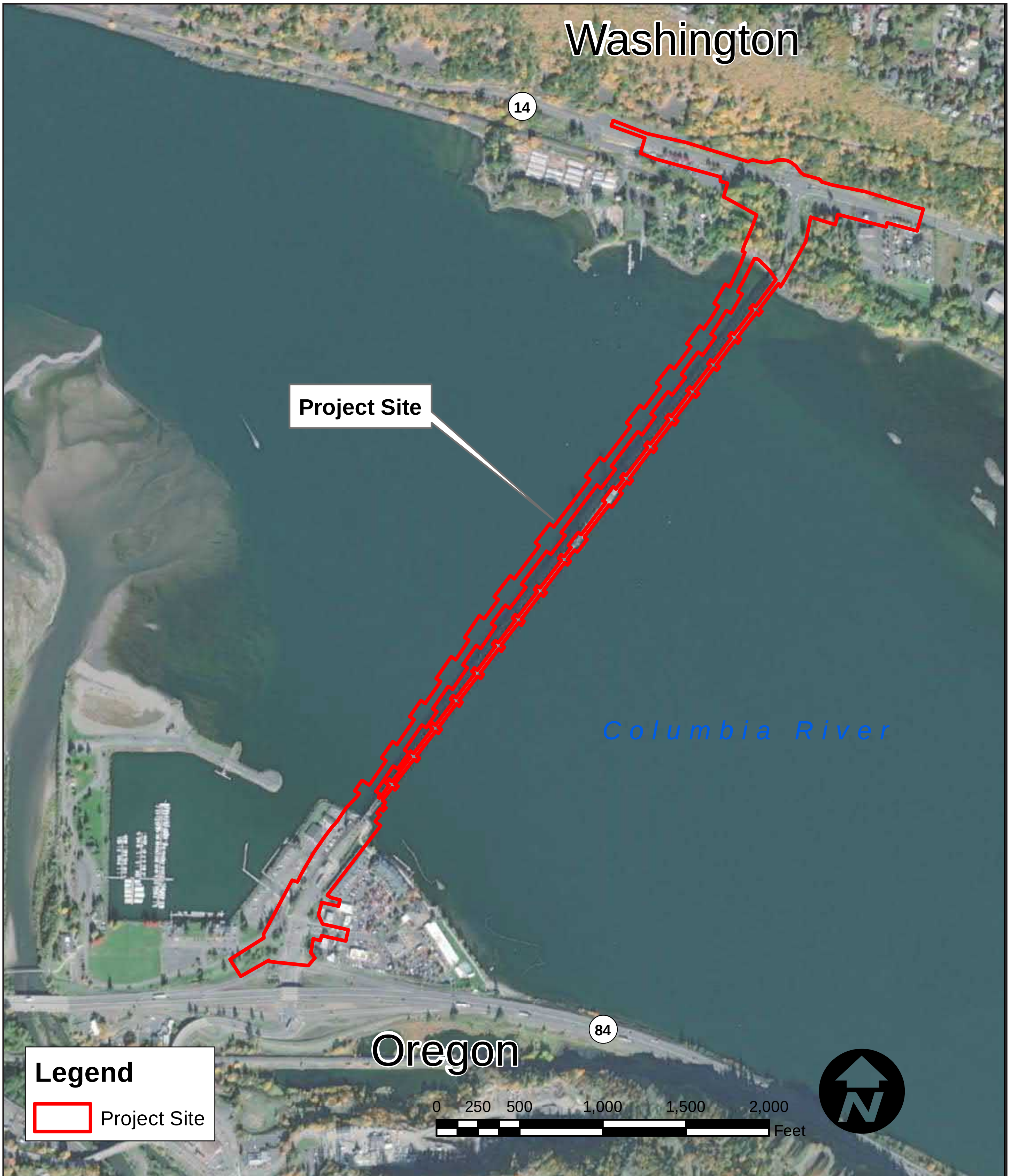
APPENDIX A

FIGURES



BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	**FIGURE 1. VICINITY MAP** wsp	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43'2.99"N LONGITUDE: 121°29'44.09"W DATUM: NAD_1983_StatePlane_Washington Sheet 1 of 21 September 2020



BIOLOGICAL ASSESSMENT

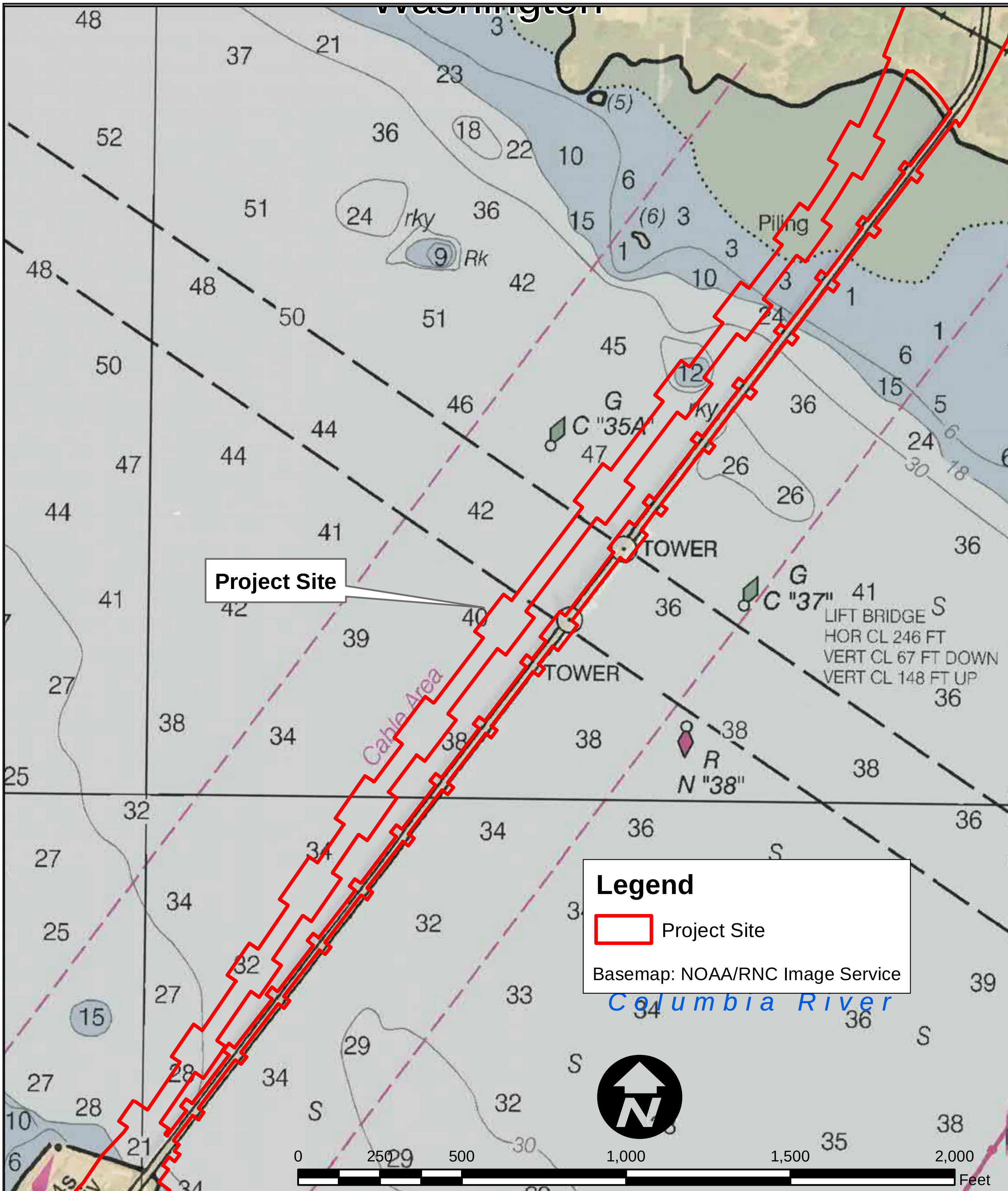
In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 2. PARCEL MAP

wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

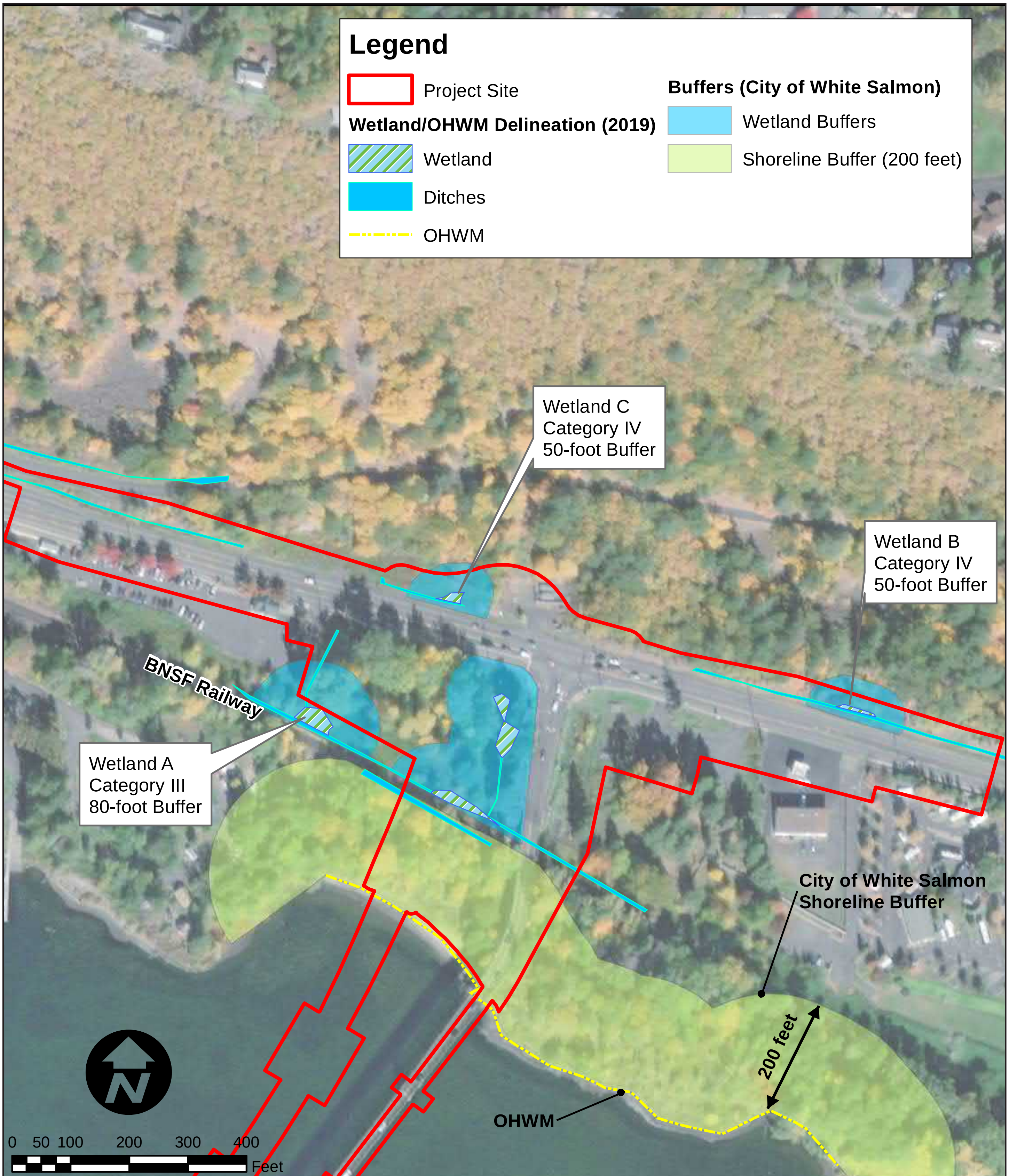
FIGURE 3. BASELINE AQUATIC HABITAT-BATHYMETRY

wsp

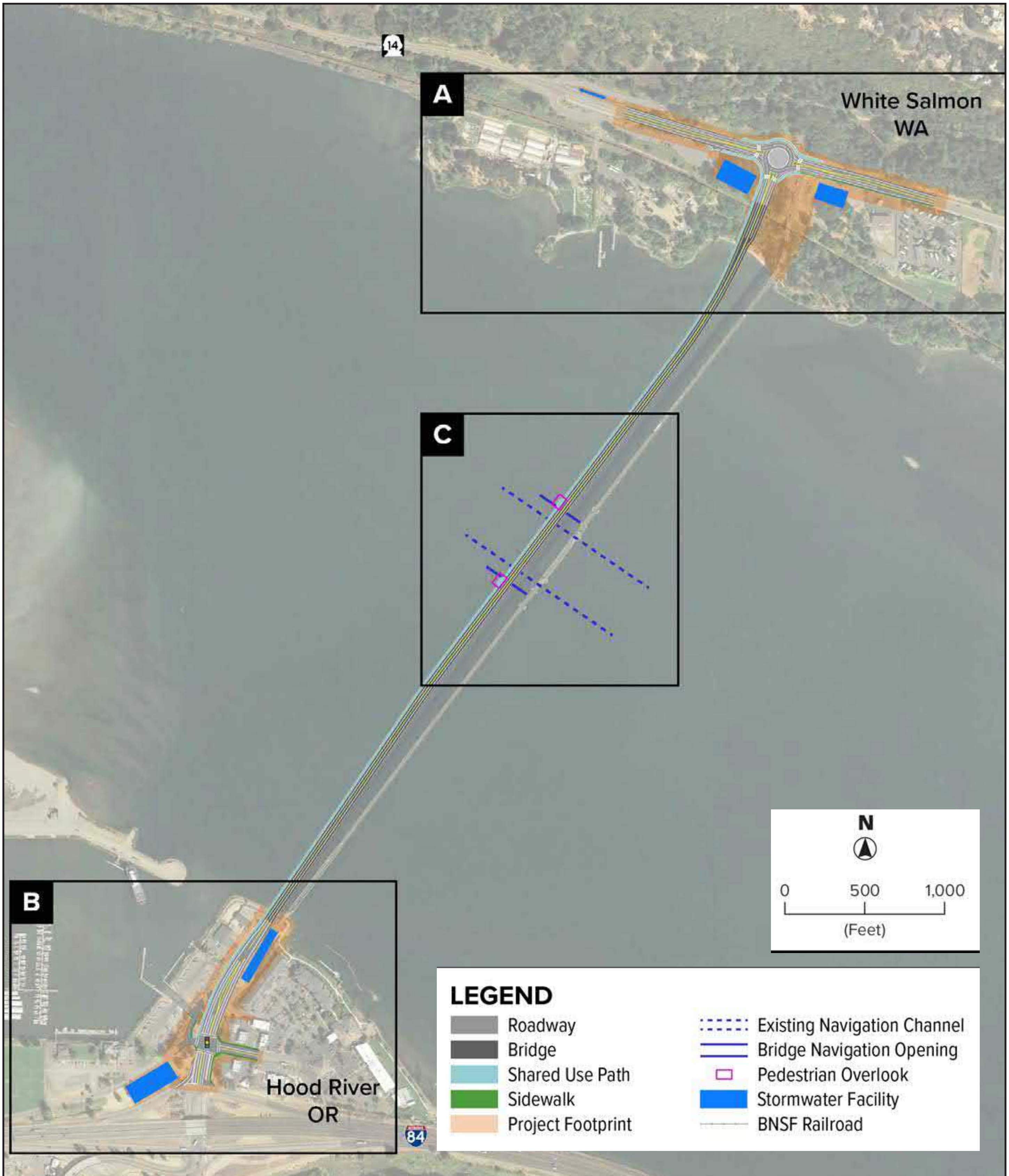
PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

Sheet 3 of 21

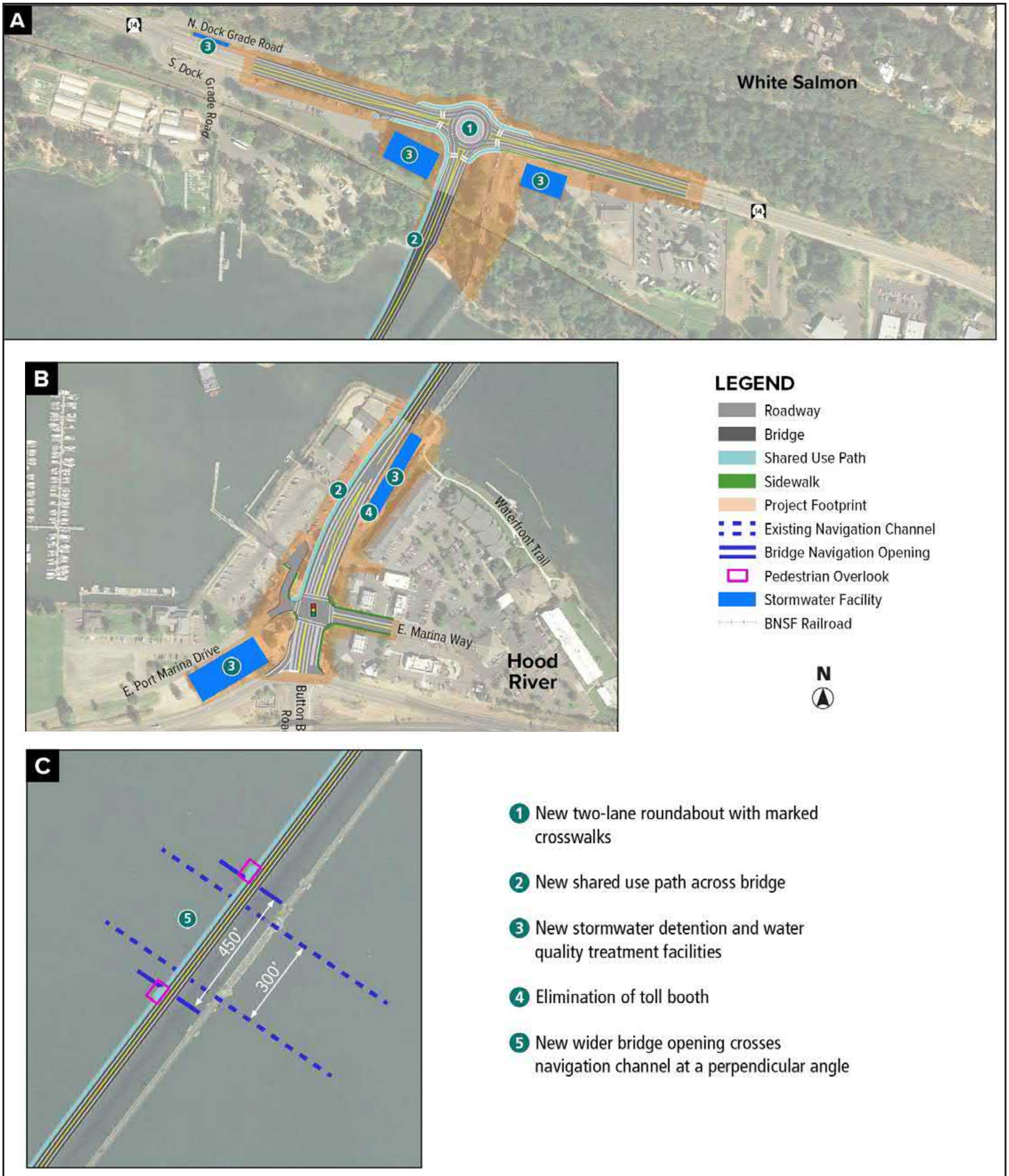
September 2020



BIOLOGICAL ASSESSMENT	**FIGURE 4. BASELINE TERRESTRIAL HABITAT CONDITIONS**	PROJECT: HOOD RIVER BRIDGE REPLACEMENT
In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	wsp	LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington Sheet 4 of 21 September 2020



BIOLOGICAL ASSESSMENT	**FIGURE 5. PROPOSED ACTION**	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington
In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	wsp	Sheet 5 of 21 September 2020



BIOLOGICAL ASSESSMENT

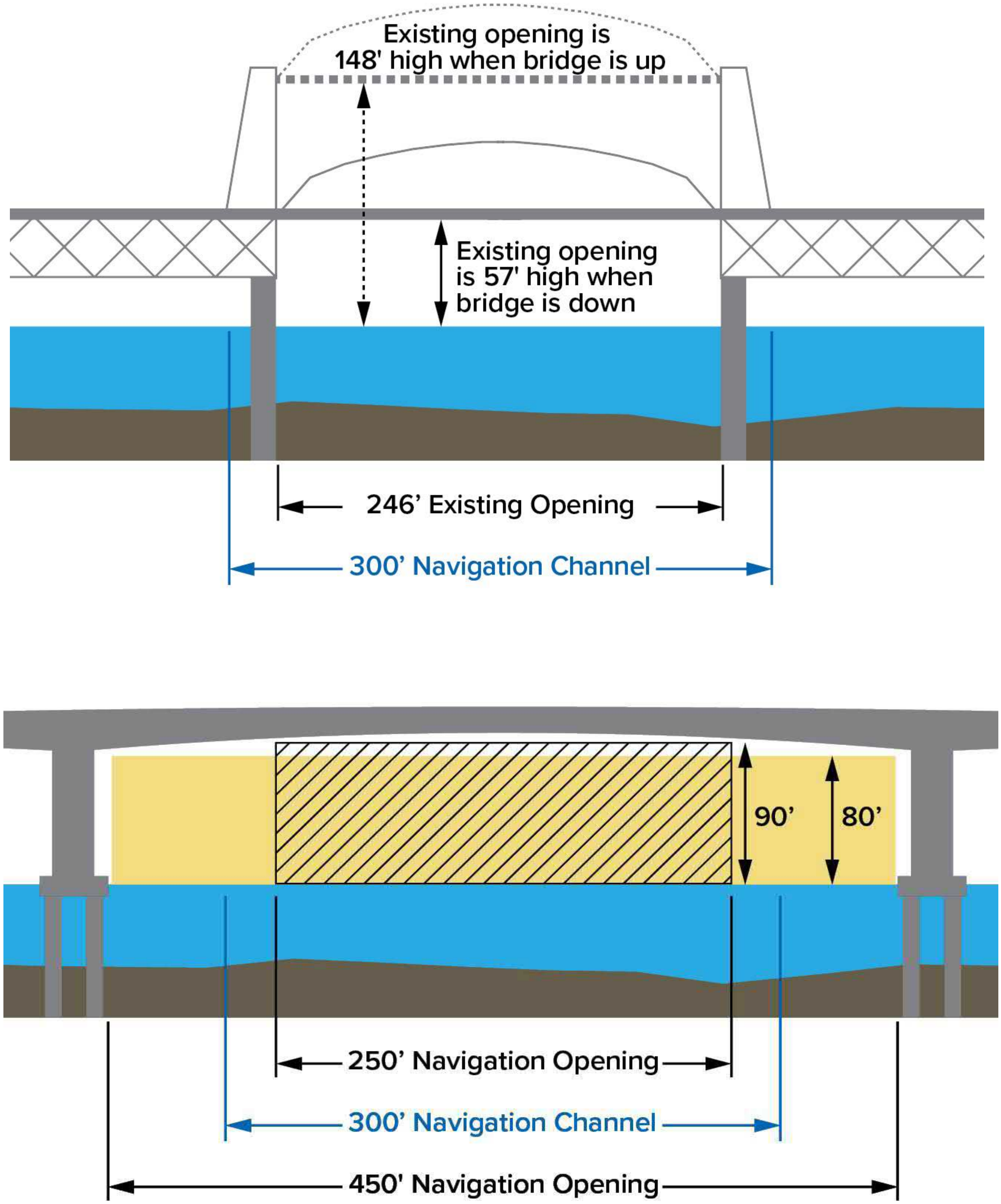
In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 6. PROPOSED ACTION ENLARGEMENTS

wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43'2.99"N
LONGITUDE: 121°29'44.09"W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



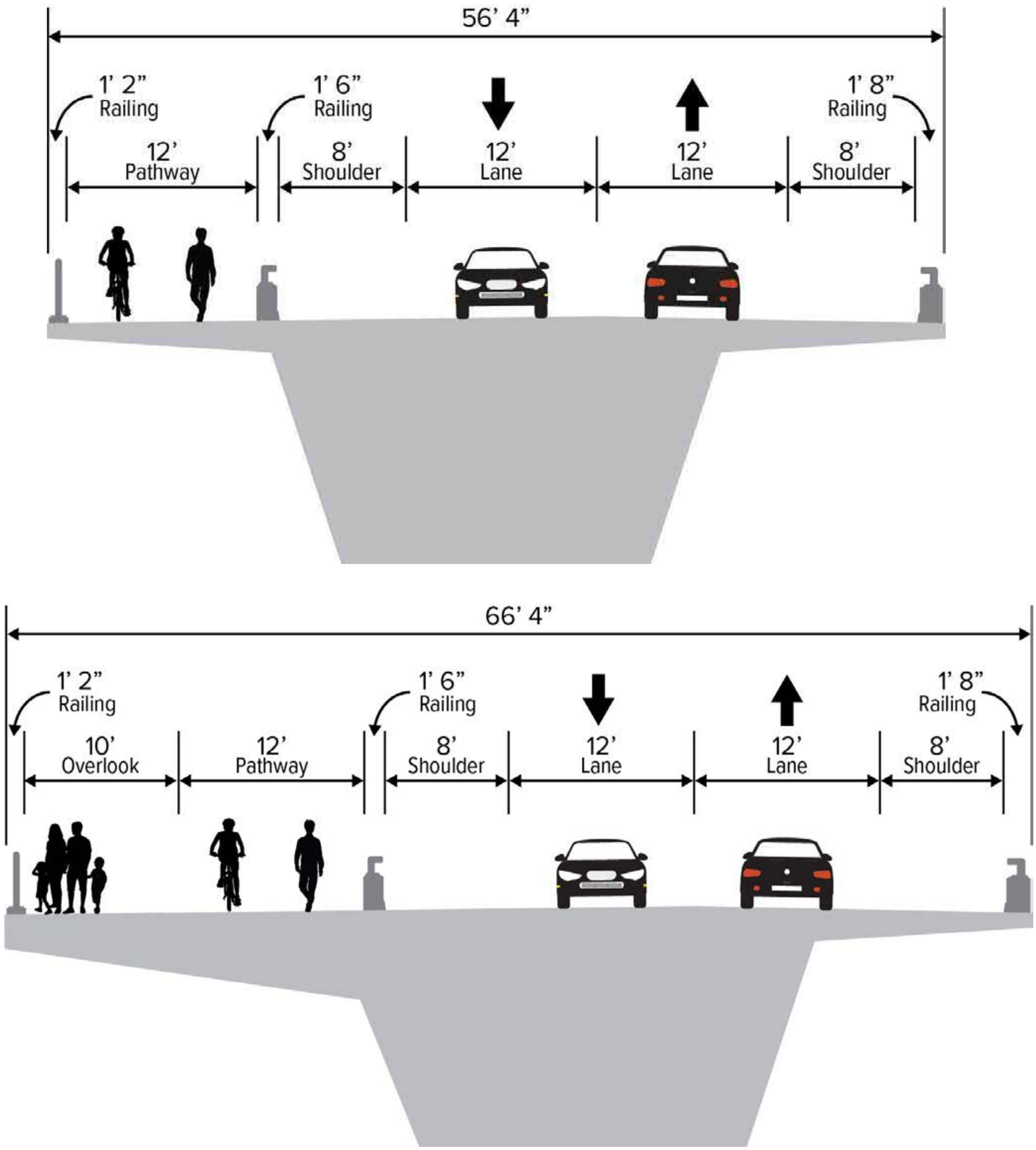
BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 7. NAVIGATION CLEARANCE SECTIONS

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43'2.99"N
LONGITUDE: 121°29'44.09"W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



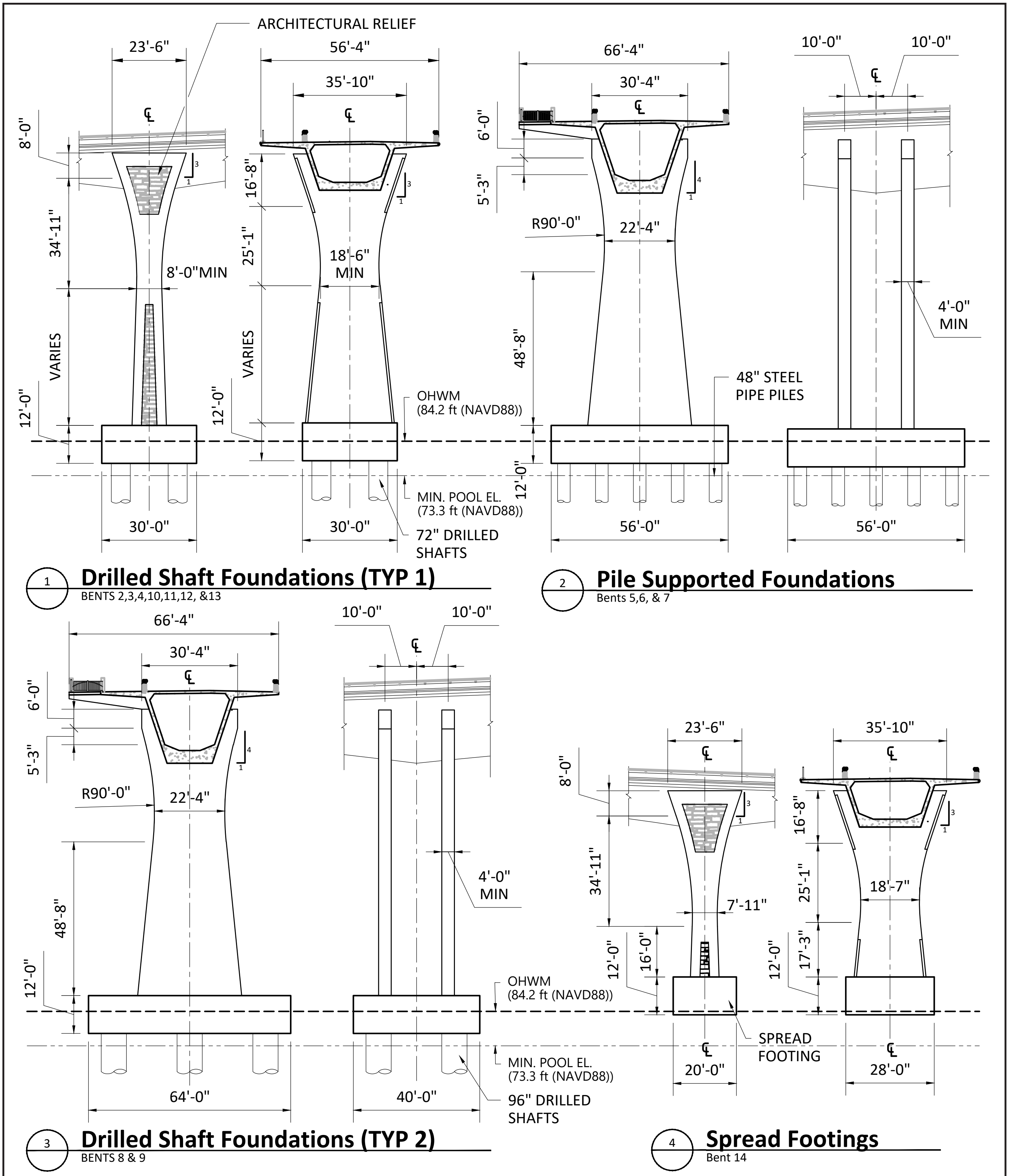
BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 8. REPLACEMENT BRIDGE CROSS SECTIONS

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43'2.99"N
LONGITUDE: 121°29'44.09"W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



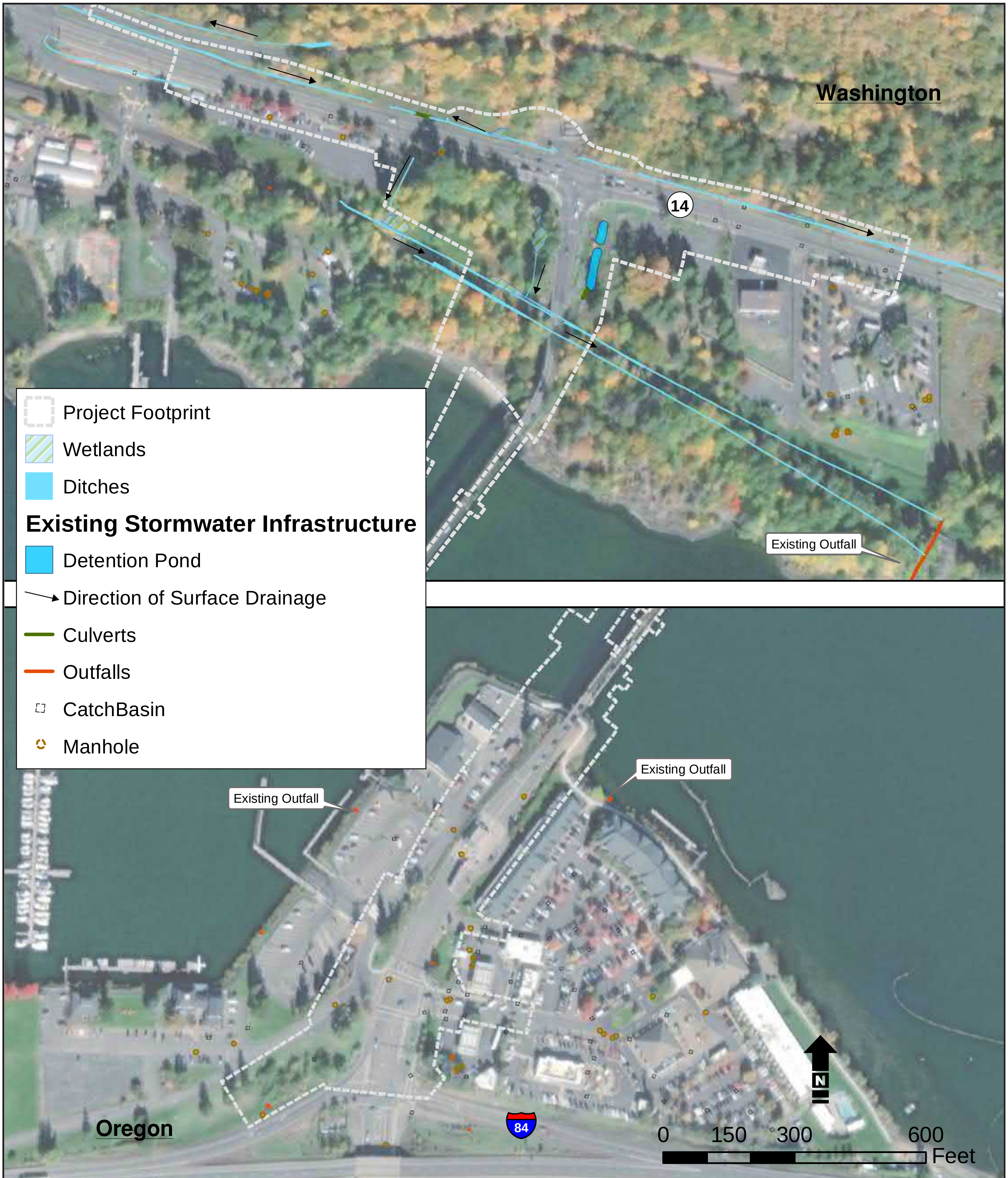
BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 9. FOUNDATION CROSS SECTIONS

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43'2.99"N
LONGITUDE: 121°29'44.09"W
DATUM: NAD_1983_StatePlane_Washington

September 2020



BIOLOGICAL ASSESSMENT

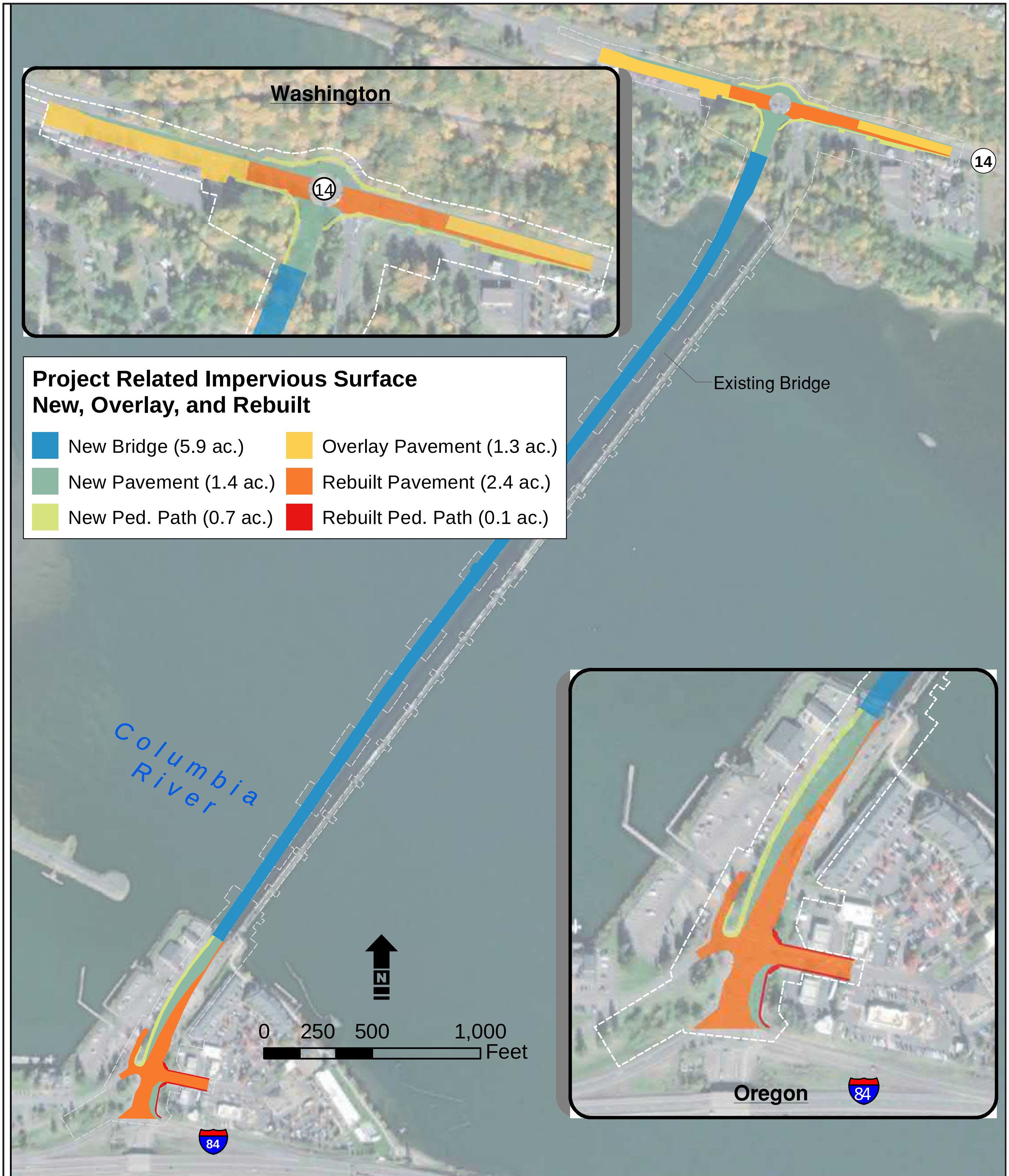
In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 10. STORMWATER-EXISTING CONDITIONS

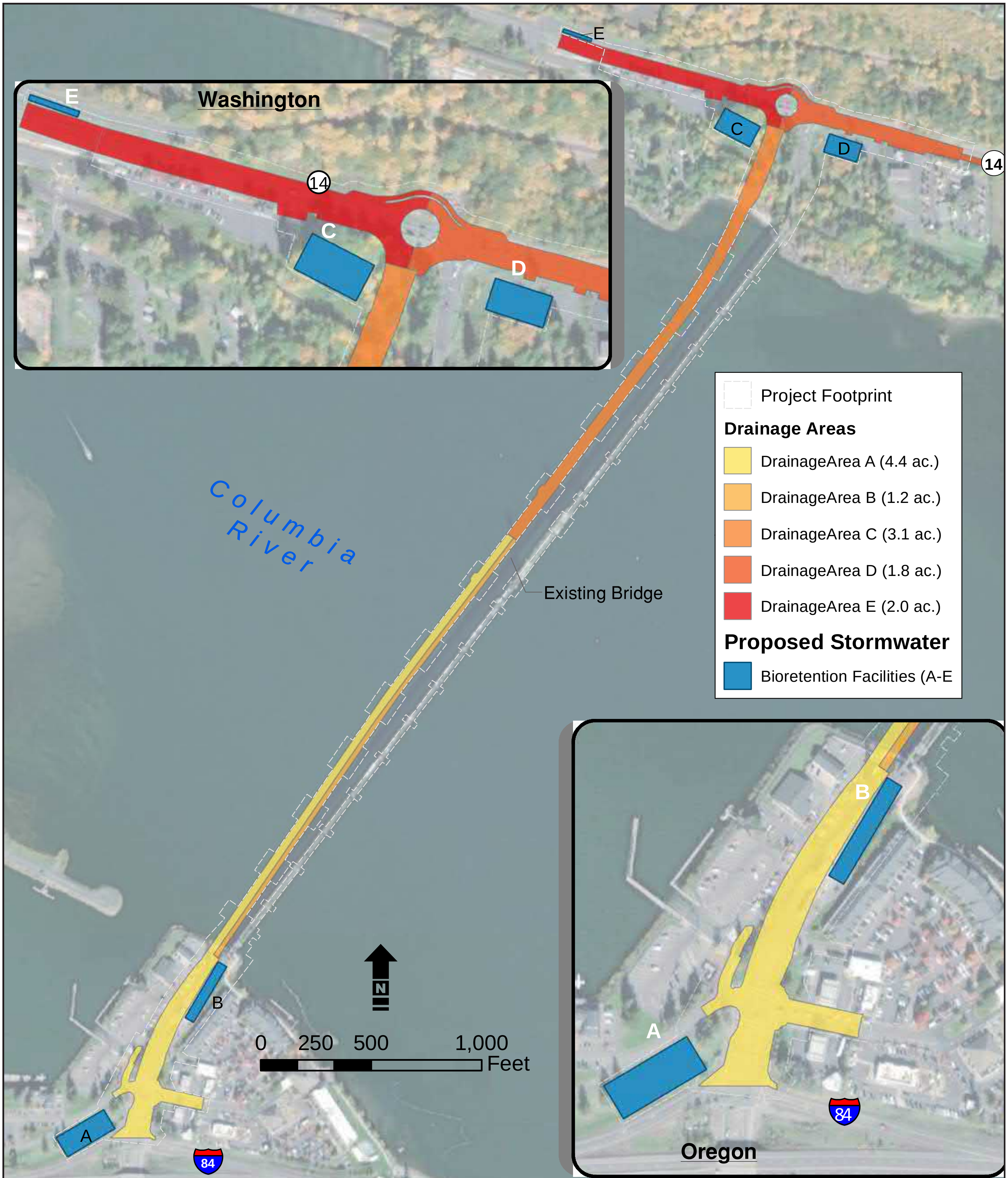
wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	**FIGURE 11. REBUILT, NEW, AND RESURFACED PAVEMENT** wsp	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington Sheet 11 of 21 September 2020



BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	FIGURE 12.PRELIMINARY STORMWATER DESIGN wsp	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington Sheet 12 of 21 September 2020

Project Footprint
Ordinary High Water Mark
Temporary Work Bridges
Typical Temporary 24" Piles
Permanent 48" Piles

Distance to Exeedance of Single Strike InjuryThreshold (206 dB PEAK)

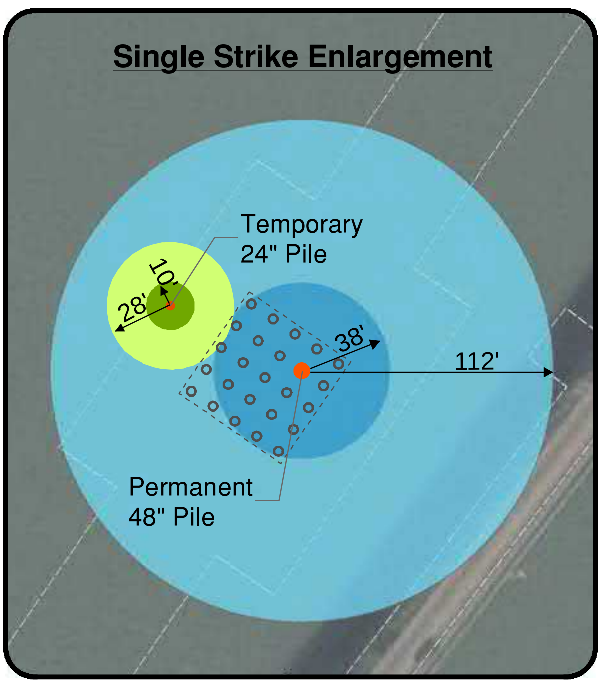
Temporary Piles

Without Attenuation (28 ft. Radius)
With -7dB Attenuation (10 ft. Radius)

Permanent Piles

Without Attenuation (112 ft. Radius)
With -7dB Attenuation (38 ft. Radius)

This is a conceptual diagram only. Threshold distances are not exact. Temporary pile locations are conceptual. Impact pile driving will not take place simultaneously at all piers.



BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	**FIGURE 13. DISTANCE TO 206 dB PEAK INJURY THRESHOLD FOR FISH DURING IMPACT PILE DRIVING**	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43'2.99"N LONGITUDE: 121°29'44.09"W DATUM: NAD_1983_StatePlane_Washington Sheet 13 of 21 September 2020

Cumulative Injury Threshold for Fish >2g (187 dB SEL)

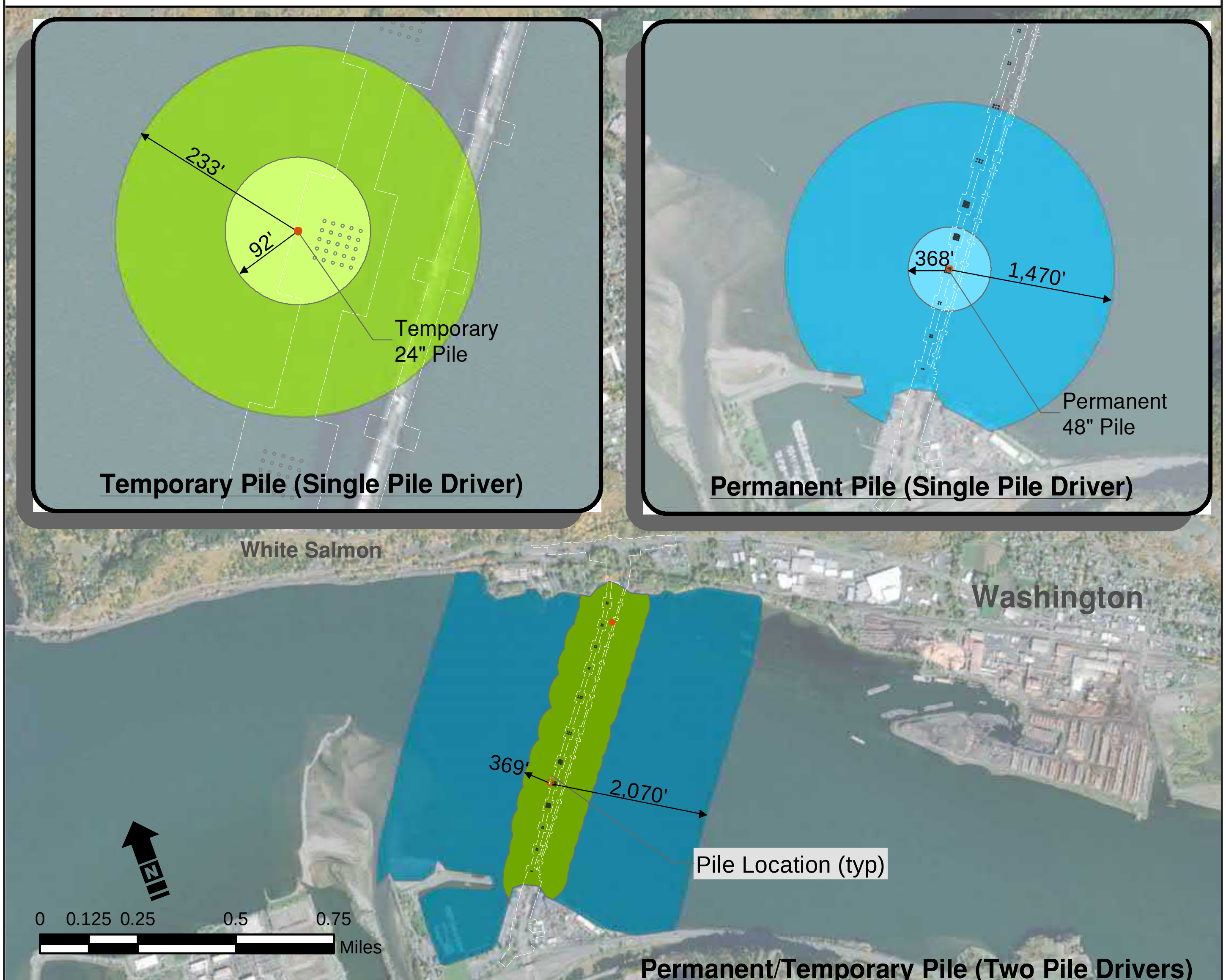
Temporary 24" Piles

- *Single Impact Pile Driver Without Attenuation (92 ft. Radius)*
- *Single Impact Pile Drivers With -7dB Attenuation (233 ft. Radius)*
- *Two Impact Pile Drivers With -7dB Attenuation (369 ft. Radius)*

Permanent 48" Piles

- *Single Impact Pile Driver Without Attenuation (368 ft. Radius)*
- *Single Impact Pile Drivers with -7dB Attenuation (1,470 ft. Radius)*
- *Two Impact Pile Drivers with -7dB Attenuation (2,070 ft. Radius)*

Note:This is a conceptual diagram only. Threshold distancesare not exact. Temporary pile locations are conceptual. Impact pile driving will not take place simultaneously at all piers.



BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	**FIGURE 14. DISTANCE TO 187 dB SEL CUMULATIVE INJURY THREHOLD FOR FISH > 2g DURING IMPACT PILE DRIVING**	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington Sheet 14 of 21 September 2020

Cumulative Injury Threshold for Fish <2g (183 dB SEL)

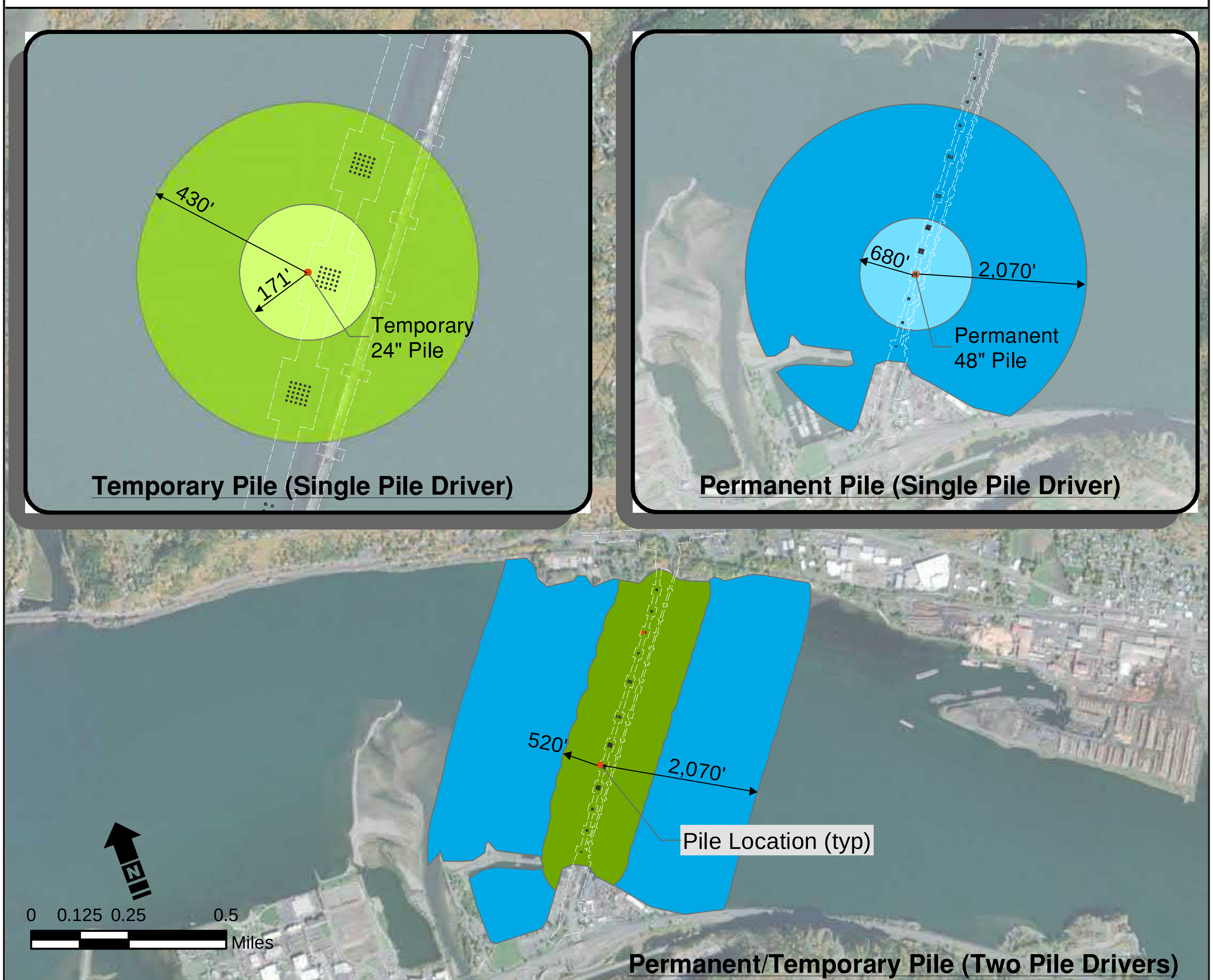
Temporary 24" Piles

- *Single Impact Pile Driver Without Attenuation (171 ft. Radius)*
- *Single Impact Pile Drivers With -7dB Attenuation (430 ft. Radius)*
- *Two Impact Pile Drivers with -7dB Attenuation (520 ft. Radius)*

Permanent 48" Piles

- *Without Attenuation (680' ft. Radius)*
- *Single and Two Impact Pile Drivers With -7dB Attenuation (2,070 ft. Radius)*

Note:This is a conceptual diagram only. Threshold distancesare not exact. Temporary pile locations are conceptual. Impact pile driving will not take place simultaneously at all piers.



BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 15. DISTANCE TO 183 dB SEL CUMULATIVE INJURY THREHOLD FOR FISH < 2g DURING IMPACT PILE DRIVING

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

Behavioral Disturbance Threshold (150 dB RMS)

Temporary 24" Piles

Single Impact Pile Driver Without Attenuation (15,228 ft. Radius)

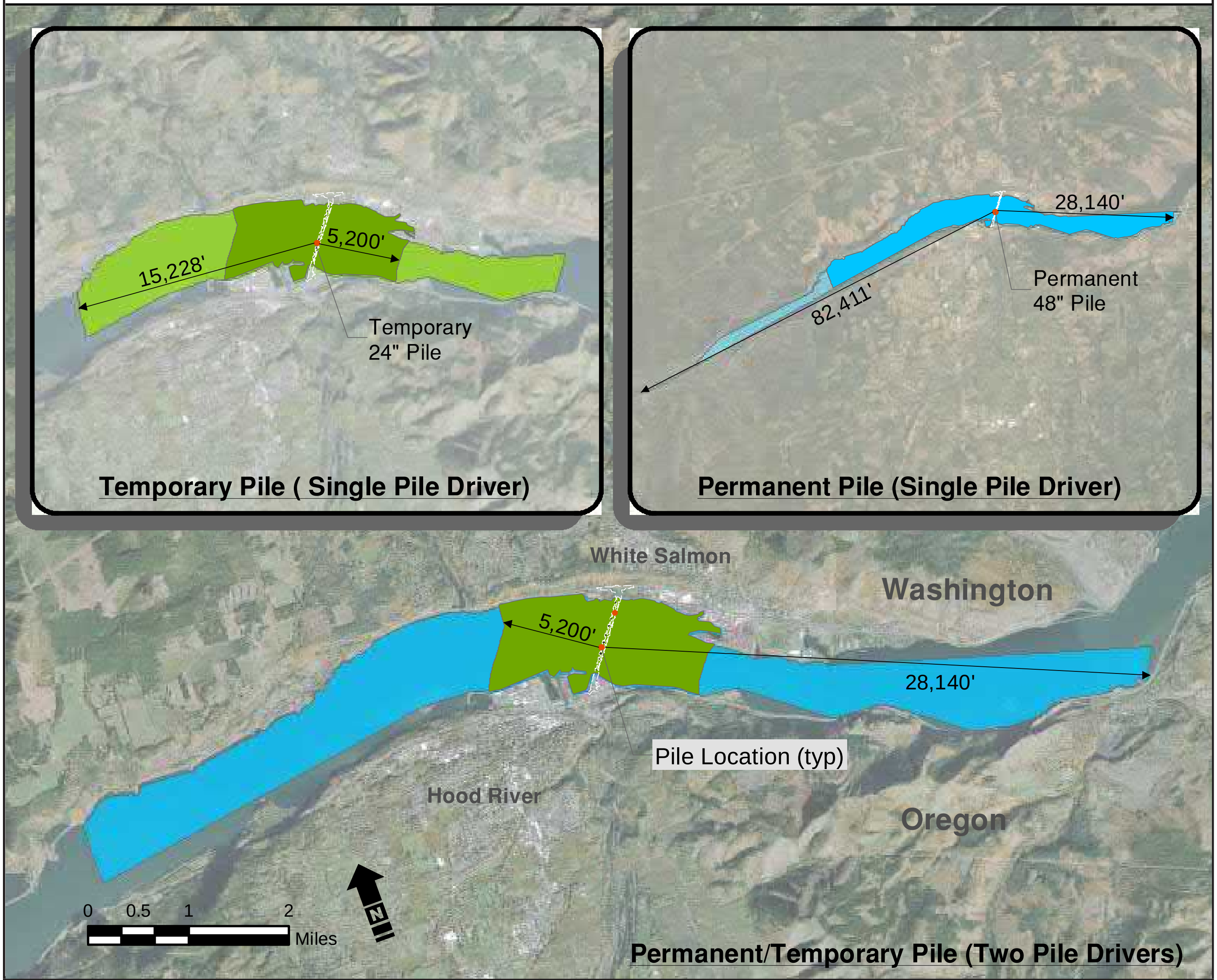
Single and Two Impact Pile Drivers With -7dB Attenuation (5,200 ft. Radius)

Permanent 48" Piles

Single Impact Pile Driver Without Attenuation (82,411 ft. Radius)

Single and Two Impact Pile Drivers With -7dB Attenuation (28,140 ft. Radius)

Note:This is a conceptual diagram only. Threshold distancesare not exact. Temporary pile locations are conceptual. Impact pile driving will not take place simultaneously at all piers.

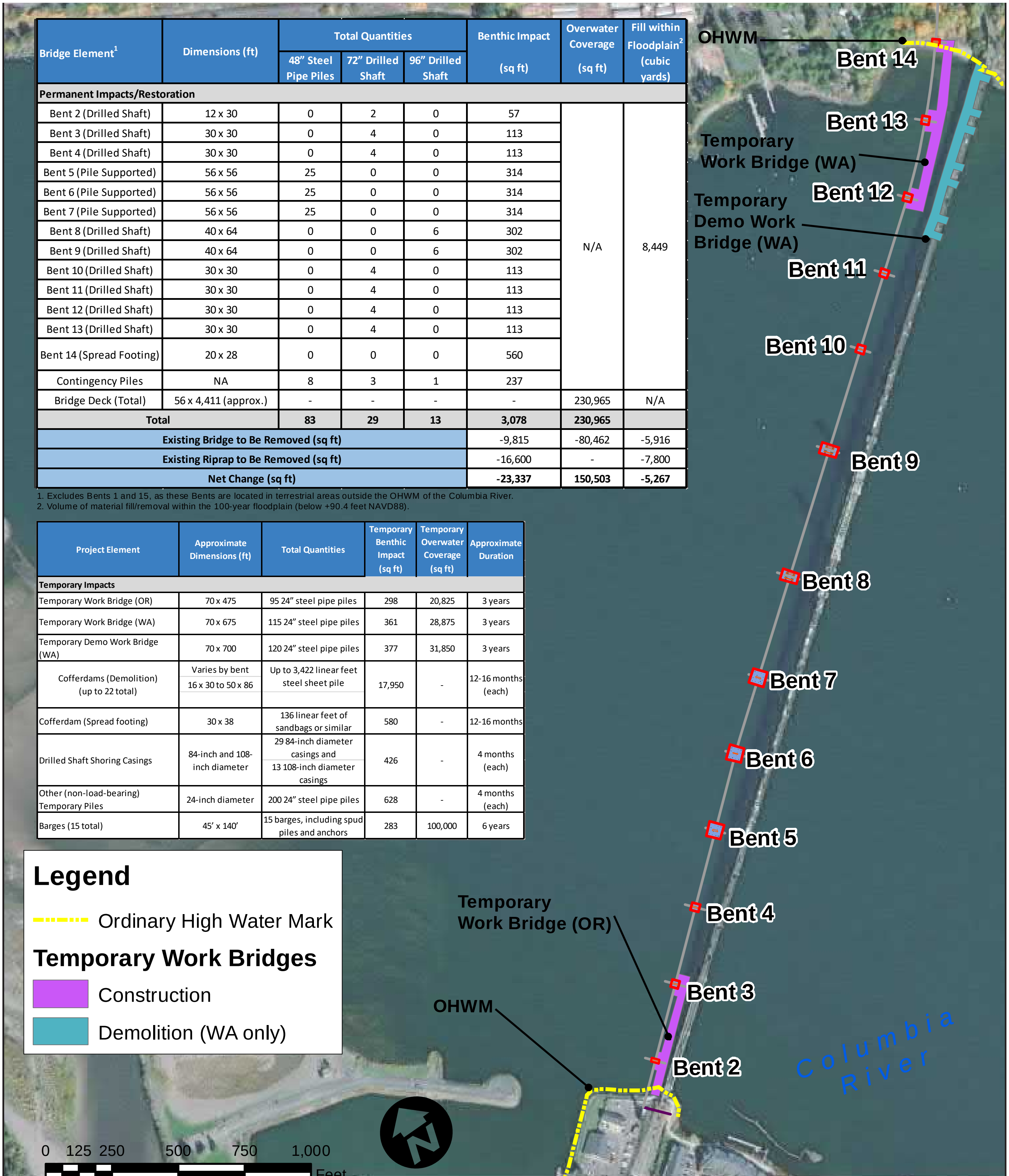


BIOLOGICAL ASSESSMENT In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	**FIGURE 16. DISTANCE TO 150 dB RMS DISTURBANCE THRESHOLDS DURING IMPACT PILE DRIVING**	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington Sheet 16 of 21 September 2020

Bridge Element[1]	Dimensions (ft)	Total Quantities			Benthic Impact	Overwater Coverage	Fill within Floodplain[2]
		48" Steel Pipe Piles	72" Drilled Shaft	96" Drilled Shaft	(sq ft)	(sq ft)	(cubic yards)
Permanent Impacts/Restoration							
Bent 2 (Drilled Shaft)	12 x 30	0	2	0	57	N/A	8,449
Bent 3 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 4 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 5 (Pile Supported)	56 x 56	25	0	0	314		
Bent 6 (Pile Supported)	56 x 56	25	0	0	314		
Bent 7 (Pile Supported)	56 x 56	25	0	0	314		
Bent 8 (Drilled Shaft)	40 x 64	0	0	6	302		
Bent 9 (Drilled Shaft)	40 x 64	0	0	6	302		
Bent 10 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 11 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 12 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 13 (Drilled Shaft)	30 x 30	0	4	0	113		
Bent 14 (Spread Footing)	20 x 28	0	0	0	560		
Contingency Piles	NA	8	3	1	237		
Bridge Deck (Total)	56 x 4,411 (approx.)	-	-	-	-	230,965	N/A
Total		**83**	**29**	**13**	**3,078**	**230,965**	
Existing Bridge to Be Removed (sq ft)					-9,815	-80,462	-5,916
Existing Riprap to Be Removed (sq ft)					-16,600	-	-7,800
Net Change (sq ft)					**-23,337**	**150,503**	**-5,267**

1. Excludes Bents 1 and 15, as these Bents are located in terrestrial areas outside the OHWM of the Columbia River.
2. Volume of material fill/removal within the 100-year floodplain (below +90.4 feet NAVD88).

Project Element	Approximate Dimensions (ft)	Total Quantities	Temporary Benthic Impact (sq ft)	Temporary Overwater Coverage (sq ft)	Approximate Duration
Temporary Impacts					
Temporary Work Bridge (OR)	70 x 475	95 24" steel pipe piles	298	20,825	3 years
Temporary Work Bridge (WA)	70 x 675	115 24" steel pipe piles	361	28,875	3 years
Temporary Demo Work Bridge (WA)	70 x 700	120 24" steel pipe piles	377	31,850	3 years
Cofferdams (Demolition) (up to 22 total)	Varies by bent 16 x 30 to 50 x 86	Up to 3,422 linear feet steel sheet pile	17,950	-	12-16 months (each)
Cofferdam (Spread footing)	30 x 38	136 linear feet of sandbags or similar	580	-	12-16 months
Drilled Shaft Shoring Casings	84-inch and 108-inch diameter	29 84-inch diameter casings and 13 108-inch diameter casings	426	-	4 months (each)
Other (non-load-bearing) Temporary Piles	24-inch diameter	200 24" steel pipe piles	628	-	4 months (each)
Barges (15 total)	45' x 140'	15 barges, including spud piles and anchors	283	100,000	6 years



BIOLOGICAL ASSESSMENT

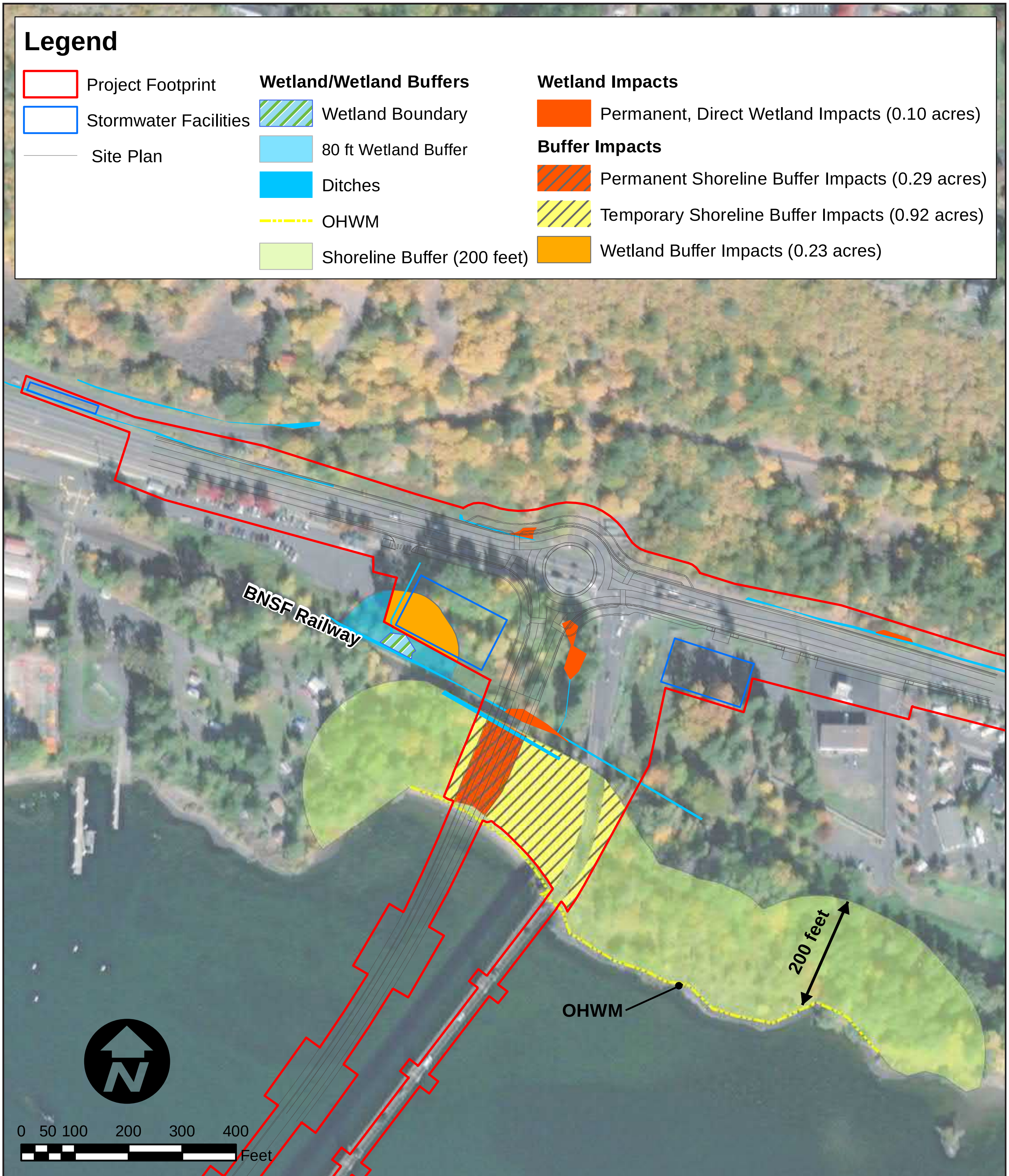
In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 17. AQUATIC HABITAT IMPACTS

wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43'2.99"N
LONGITUDE: 121°29'44.09"W
DATUM: NAD_1983_StatePlane_Washington

 September 2020



BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 18. WETLAND AND VEGETATION IMPACTS

wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

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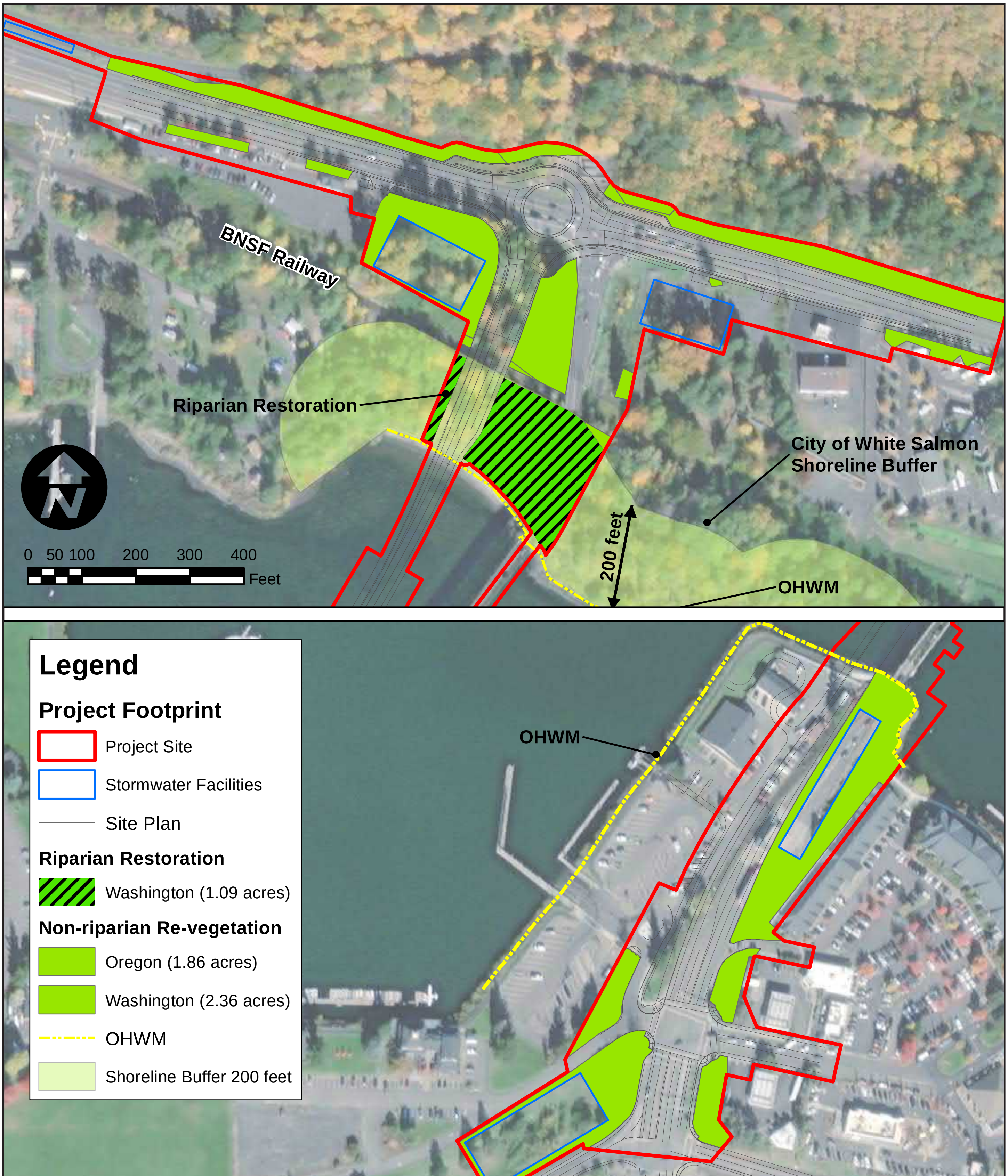
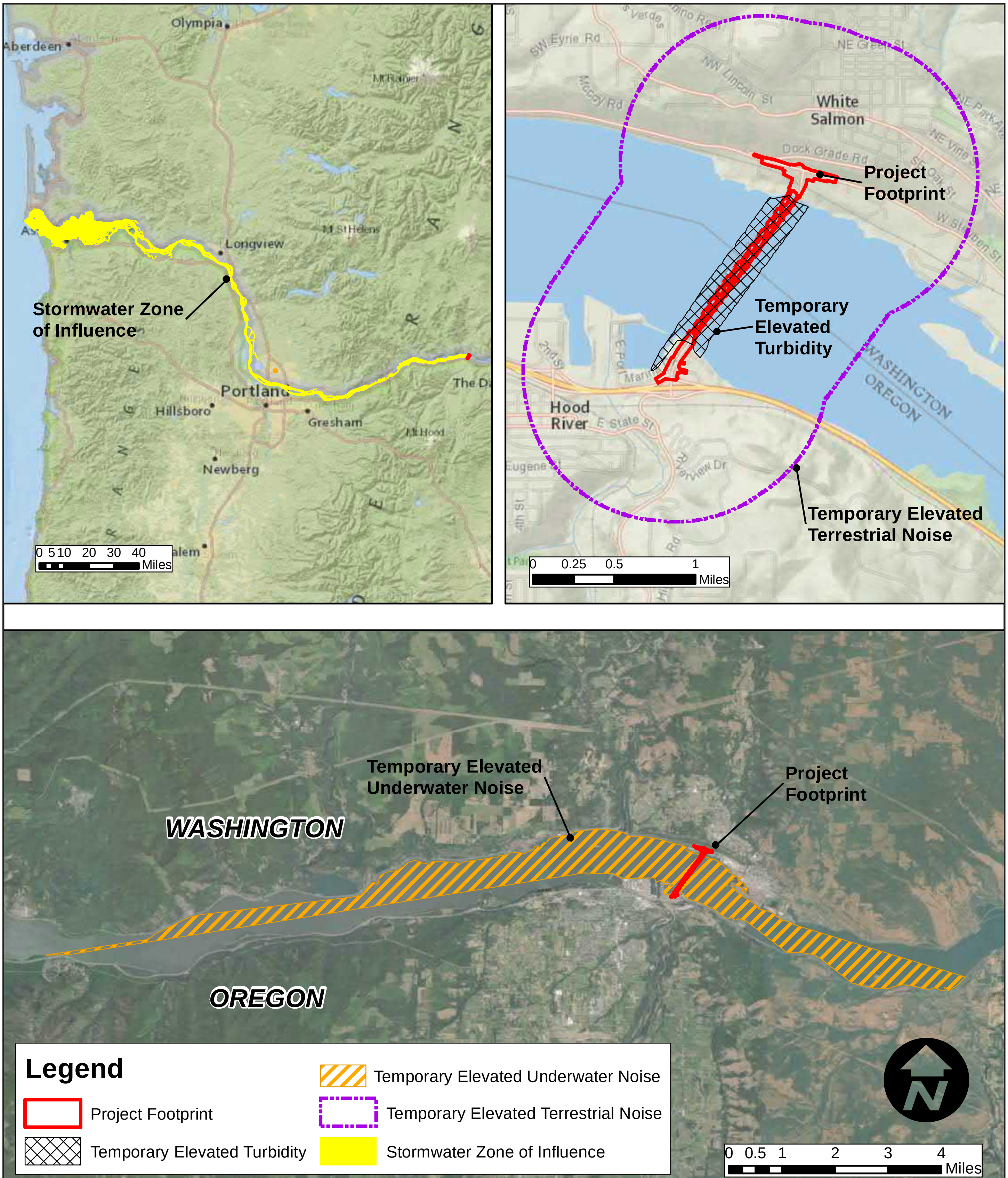


BIOLOGICAL ASSESSMENT	FIGURE 19. PRELIMINARY RESTORATION PLAN	PROJECT: HOOD RIVER BRIDGE REPLACEMENT
In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	wsp	LATITUDE: 45°43'2.99"N LONGITUDE: 121°29'44.09"W DATUM: NAD_1983_StatePlane_Washington Sheet 19 of 21 September 2020



BIOLOGICAL ASSESSMENT

In: Columbia River
Near/At: White Salmon, WA
State: Oregon and Washington

FIGURE 20. ACTION AREA

wsp

PROJECT: HOOD RIVER BRIDGE REPLACEMENT
LATITUDE: 45°43’2.99”N
LONGITUDE: 121°29’44.09”W
DATUM: NAD_1983_StatePlane_Washington

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Photo 1. Nearshore and OHWM conditions on
WA side, facing East

Photo 2. Typical roadside conditions north of SR-14,
facing West.JPG

Photo 3. Riparian forest condition west of bridge on
WA side, facing North

Photo 4. Existing bridge facing south from WA side

Photo 6. Developed upland conditions on OR side,
facing north

BIOLOGICAL ASSESSMENT	FIGURE 21. PHOTOSHEET	PROJECT: HOOD RIVER BRIDGE REPLACEMENT LATITUDE: 45°43’2.99”N LONGITUDE: 121°29’44.09”W DATUM: NAD_1983_StatePlane_Washington
In: Columbia River Near/At: White Salmon, WA State: Oregon and Washington	wsp	Sheet 21 of 21 September 2020

APPENDIX B

ESSENTIAL FISH HABITAT

APPENDIX B

MAGNUSON STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT ASSESSMENT

ESSENTIAL FISH HABITAT

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management (Magnuson-Stevens Act) to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans and to require federal agencies to consult with the NOAA Fisheries (NOAA Fisheries) on activities that may adversely affect EFH.

The Magnuson-Stevens Act requires consultation for all federal agency actions that may adversely affect EFH. EFH consultation with NOAA Fisheries is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under Section 305(b)(4) of the Magnuson-Stevens Act, NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NOAA Fisheries uses existing interagency coordination processes to fulfill EFH consultations with federal agencies. For the Proposed Action, this goal is being met by incorporating EFH consultation into the ESA Section 7 consultation, as represented by this biological evaluation.

EFH has been designated for three groups of species: Pacific salmon, groundfish, and coastal pelagic. The proposed project does not occur within EFH for groundfish or coastal pelagic species and they are not discussed further.

EFH for Pacific salmon in freshwater includes all streams, lakes, ponds, wetlands, and other currently viable bodies of freshwater and the substrates within those waterbodies accessible to Pacific salmon. Activities occurring above impassable barriers that are likely to adversely affect EFH below impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act. Designated EFH for salmonid species in estuarine and marine areas includes nearshore and tidally submerged environments within state territorial water out to the full extent of the exclusive economic zone (370.4 km) offshore from Washington (PFMC 1999).

The aquatic portion of the action area is within designated EFH for Pacific salmon (see Section 5 of this BA).

DESCRIPTION OF PROPOSED ACTION

The Hood River-White Salmon Bridge Replacement Project (the Project) will construct a replacement bridge and then remove the existing Hood River Bridge between White Salmon, Washington, and Hood River, Oregon. A NEPA review is being conducted for the Project, which is evaluating four project alternatives (no-action alternative and three build alternatives). This EFH consultation addresses only the Preliminary Preferred Alternative (referred to as “Alternative EC-2” in the environmental impact statement (EIS) and as the “Proposed Action” in this document). See Sections 1 through 3 of this BA for a complete description of the Proposed Action.

POTENTIAL ADVERSE EFFECTS OF PROJECT ACTIVITIES

The Proposed Action has the potential to affect EFH for Pacific salmon species. Specific elements of the Proposed Action that could impact EFH are summarized here (see Section 8 for a detailed analysis of the potential effects of the project).

The Proposed Action has the potential to result in the following effects to EFH for Pacific salmon: (1) temporary impacts to water quality during in-water and overwater construction; (2) hydroacoustic impacts associated with underwater noise generated during pile driving; (3) temporary aquatic habitat impacts during construction; (4) permanent aquatic habitat impacts associated with the replacement bridge structure and removal of the existing bridge; (5) impacts associated with work area isolation and fish salvage; (6) impacts associated with overwater lighting and avian predation; and (7) impacts associated with stormwater from new and rebuilt impervious surfaces.

Pile installation activities could disturb sediments and temporarily increase turbidity within waterbodies that represent EFH for Pacific salmon. There is also slight potential for leaks and spills of fuel, hydraulic fluids, lubricants, and other chemicals from equipment and storage containers associated with the project. Discharge of vehicle and equipment wash water, etc., could also add pollutants to the soil that will then be delivered to the waters of the Columbia River.

Pile driving activities have the potential to temporarily elevate underwater noise levels within the action area. Temporarily elevated underwater noise levels during impact pile installation and during vibratory pile driving and removal activities have the potential to temporarily reduce rearing and migration habitat suitability during construction.

The Proposed Action has the potential to temporarily affect aquatic habitat during construction by benthic impacts and overwater shading from temporary work structures, including temporary work bridges, temporary piles, cofferdams, drilled shaft shoring casings, and barges. These impacts may temporarily degrade rearing and migratory habitat suitability at the project site during construction.

The Proposed Action will also result in permanent effects to aquatic habitat from the installation of the replacement bridge. The foundation of the replacement bridge will represent a loss of physical benthic substrate for species that rely on aquatic habitats at the project site. However, the proposed removal of the existing bridge and associated riprap will result in a net restoration of approximately of approximately 23,337 square feet of benthic habitat impact. These proposed benthic habitat improvements will result in a net improvement in aquatic habitat quality at the site as a result of the Proposed Action. The Proposed Action will also result in new overwater shading from the replacement bridge, but the proposed removal of the existing bridge will reduce the net quantity, and the effects to habitat function from overwater shading will be minimal given the height and open structure of the replacement bridge.

The Proposed Action has the potential to result in handling or other disturbance of individual fish during work area isolation and fish salvage activities. These impacts may temporarily degrade rearing and migratory habitat suitability at the project site during construction.

The Proposed Action will result in temporary and permanent overwater lighting. Temporary lighting may temporarily degrade rearing and migratory habitat suitability at the project site during construction. Impacts to aquatic habitat function associated with permanent overwater lighting are expected to be largely beneficial. The Proposed Action will remove the existing light sources on the existing bridge that currently pass through to the water's surface, and the lighting on the replacement bridge will use directional lighting with shielded luminaries to control glare and to direct light onto the bridge deck to the extent practicable.

The Proposed Action will result in temporary and permanent effects to avian predation. Temporary structures that provide perching opportunities for piscivorous birds may increase predation pressure, and may temporarily degrade rearing and migratory habitat suitability at the project site during construction. Permanent impacts to avian predation associated with the replacement bridge are expected to be minimal. It is expected that the replacement bridge will provide comparable or less perching habitat than is available on the existing bridge.

The Proposed Action will install new impervious surfaces and rebuild existing impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River. Stormwater treatment BMPs will be designed to treat a design storm event, and storm events that exceed this level will result in discharge of untreated stormwater. This pollutant discharge will degrade the migratory and rearing habitat for Pacific salmon throughout the downstream portion of the action area to the mouth of the river. However, stormwater treatment will be provided for all post-project CIA, and the removal of the existing bridge will remove a significant source of untreated stormwater. The result will be a net reduction in the pollutant load and an improved condition from baseline conditions.

MINIMIZATION MEASURES AND BMPS

The Proposed Action will implement several conservation measures and BMPs to reduce, eliminate, or minimize the effects of the Proposed Action to listed species and/or critical habitats. These include in-water work timing restrictions to avoid peak run timing for adult and juvenile Pacific salmon, use of bubble curtains during impact pile driving to reduce underwater noise, and implementation of SPCC, PCP, and ESCP to minimize impacts to water quality during construction and demolition. A comprehensive discussion of impact avoidance and minimization measures and BMPs is provided in Section 4 of this BA.

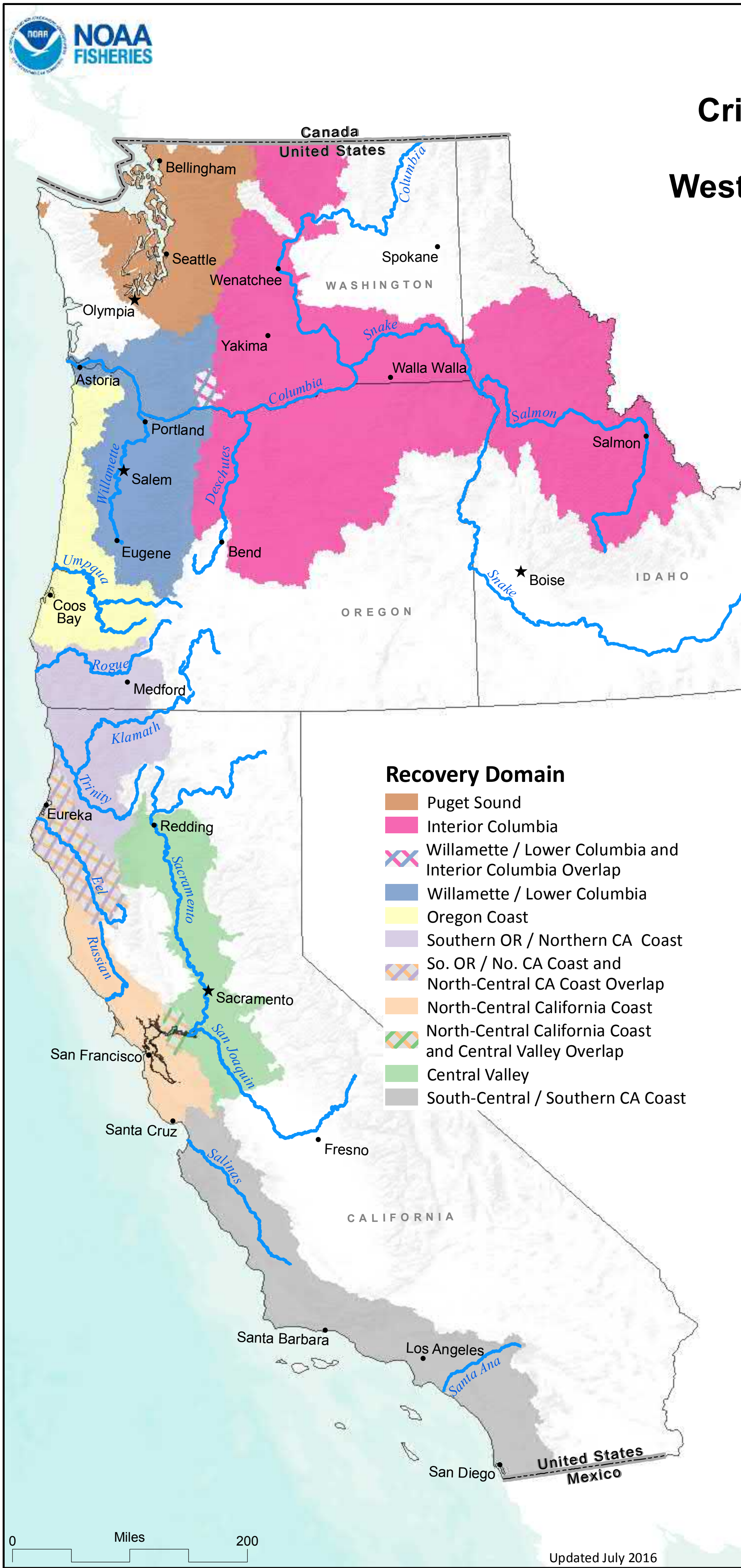
CONCLUSIONS

In accordance with the EFH requirements of the Magnuson-Stevens Act, it has been determined that the project “**will adversely affec**t” EFH for Pacific salmon. The Proposed Action will have both short-term and permanent adverse effects on EFH function within the action area. Impact minimization measures and BMPs will be implemented to avoid and/or minimize the extent of these effects to the extent practicable.

APPENDIX C

SPECIES LISTS

Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead



Evolutionarily Significant Unit / Distinct Population Segment	ESA Status	Date of ESA Listing	Date of CH Designation
Puget Sound Recovery Domain			
Hood Canal Summer-run Chum Salmon	T	3/25/1999	9/2/2005
Ozette Lake Sockeye Salmon	T	3/25/1999	9/2/2005
Puget Sound Chinook Salmon	T	3/24/1999	9/2/2005
Puget Sound Steelhead	T	5/11/2007	2/24/2016
Interior Columbia Recovery Domain			
Middle Columbia River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Snake River Fall-run Chinook Salmon	T	4/22/1992	12/28/1993
Snake River Spring / Summer-run Chinook Salmon	T	4/22/1992	10/25/1999
Snake River Sockeye Salmon	E	11/20/1991	12/28/1993
Snake River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Upper Columbia River Spring-run Chinook Salmon	E	3/24/1999	9/2/2005
Upper Columbia River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Willamette / Lower Columbia Recovery Domain			
Columbia River Chum Salmon	T	3/25/1999	9/2/2005
Lower Columbia River Chinook Salmon	T	3/24/1999	9/2/2005
Lower Columbia River Coho Salmon	T	6/28/2005	2/24/2016
Lower Columbia River Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Upper Willamette River Chinook Salmon	T	3/24/1999	9/2/2005
Upper Willamette River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Oregon Coast Recovery Domain			
Oregon Coast Coho Salmon	T	2/11/2008	2/11/2008
Southern Oregon / Northern California Coast Recovery Domain			
Southern OR / Northern CA Coasts Coho Salmon	T	5/6/1997	5/5/1999
North-Central California Coast Recovery Domain			
California Coastal Chinook Salmon	T	9/16/1999	9/2/2005
Central California Coast Coho Salmon	E	10/31/1996 (T) 6/28/2005 (E) 4/2/2012 (RE)	5/5/1999
Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Northern California Steelhead	T	6/7/2000 1/5/2006	9/2/2005
Central Valley Recovery Domain			
California Central Valley Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Central Valley Spring-run Chinook Salmon	T	9/16/1999	9/2/2005
Sacramento River Winter-run Chinook Salmon	E	11/5/1990 (T) 1/4/1994 (E)	6/16/1993
South-Central / Southern California Coast Recovery Domain			
South-Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Southern California Steelhead	E	8/18/1997 5/1/2002 (RE) 1/5/2006	9/2/2005

ESA = Endangered Species Act, CH = Critical Habitat, RE = Range Extension
E = Endangered, T = Threatened,

Updated July 2016

Critical Habitat Rules Cited

- 2/24/2016 (81 FR 9252) Final Critical Habitat Designation for Puget Sound Steelhead and Lower Columbia River Coho Salmon
- 2/11/2008 (73 FR 7816) Final Critical Habitat Designation for Oregon Coast Coho Salmon
- 9/2/2005 (70 FR 52630) Final Critical Habitat Designation for 12 ESU's of Salmon and Steelhead in WA, OR, and ID
- 9/2/2005 (70 FR 52488) Final Critical Habitat Designation for 7 ESU's of Salmon and Steelhead in CA
- 10/25/1999 (64 FR 57399) Revised Critical Habitat Designation for Snake River Spring/Summer-run Chinook Salmon
- 5/5/1999 (64 FR 24049) Final Critical Habitat Designation for Central CA Coast and Southern OR/Northern CA Coast Coho Salmon
- 12/28/1993 (58 FR 68543) Final Critical Habitat Designation for Snake River Chinook and Sockeye Salmon
- 6/16/1993 (58 FR 33212) Final Critical Habitat Designation for Sacramento River Winter-run Chinook Salmon

ESA Listing Rules Cited

- 4/2/2012 (77 FR 19552) Final Range Extension for Endangered Central California Coast Coho Salmon
- 2/11/2008 (73 FR 7816) Final ESA Listing for Oregon Coast Coho Salmon
- 5/11/2007 (72 FR 26722) Final ESA Listing for Puget Sound Steelhead
- 1/5/2006 (71 FR 5248) Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead
- 6/28/2005 (70 FR 37160) Final ESA Listing for 16 ESU's of West Coast Salmon
- 5/1/2002 (67 FR 21586) Range Extension for Endangered Steelhead in Southern California
- 6/7/2000 (65 FR 36074) Final ESA Listing for Northern California Steelhead
- 9/16/1999 (64 FR 50394) Final ESA Listing for Two Chinook Salmon ESUs in California
- 3/25/1999 (64 FR 14508) Final ESA Listing for Hood River Canal Summer-run and Columbia River Chum Salmon
- 3/25/1999 (64 FR 14517) Final ESA Listing for Middle Columbia River and Upper Willamette River Steelhead
- 3/25/1999 (64 FR 14528) Final ESA Listing for Ozette Lake Sockeye Salmon
- 3/24/1999 (64 FR 14308) Final ESA Listing for 4 ESU's of Chinook Salmon
- 3/19/1998 (63 FR 13347) Final ESA Listing for Lower Columbia River and Central Valley Steelhead
- 8/18/1997 (62 FR 43937) Final ESA Listing for 5 ESU's of Steelhead
- 5/6/1997 (62 FR 24588) Final ESA Listing for Southern Oregon / Northern California Coast Coho Salmon
- 10/31/1996 (61 FR 56138) Final ESA Listing for Central California Coast Coho Salmon
- 1/4/1994 (59 FR 222) Final ESA Listing for Sacramento River Winter-run Chinook Salmon
- 4/22/1992 (57 FR 14653) Final ESA Listing for Snake River Spring/summer-run and Snake River Fall Chinook Salmon
- 11/20/1991 (56 FR 58619) Final ESA Listing for Snake River Sockeye Salmon
- 11/5/1990 (55 FR 46515) Final ESA Listing for Sacramento River Winter-run Chinook Salmon

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon Fish And Wildlife Office
2600 Southeast 98th Avenue, Suite 100
Portland, OR 97266-1398
Phone: (503) 231-6179 Fax: (503) 231-6195
https://www.fws.gov/oregonfwo/articles.cfm?id=149489416

In Reply Refer To: May 09, 2019
Consultation Code: 01EOFW00-2019-SLI-0375
Event Code: 01EOFW00-2019-E-00756
Project Name: Hood River-White Salmon Bridge Replacement Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to investigate opportunities for incorporating conservation of threatened and endangered species into project planning processes as a means of complying with the Act. If you have questions regarding your responsibilities under the Act, please contact the Endangered Species Division at the Service's Oregon Fish and Wildlife Office at (503) 231-6179. For information regarding listed marine and anadromous species under the jurisdiction of NOAA Fisheries Service, please see their website (http://www.nwr.noaa.gov/habitat/habitat_conservation_in_the_nw/habitat_conservation_in_the_nw.html).

Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oregon Fish And Wildlife Office
2600 Southeast 98th Avenue, Suite 100
Portland, OR 97266-1398
(503) 231-6179

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
(360) 753-9440

Project Summary

Consultation Code: 01EOFW00-2019-SLI-0375

Event Code: 01EOFW00-2019-E-00756

Project Name: Hood River-White Salmon Bridge Replacement Project

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Description: The proposed project includes replacing the existing bridge between the cities of Hood River and White Salmon, over the Columbia River.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/45.71919879891615N121.49367358120182W

Counties: Hood River, OR | Klickitat, WA

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Fisher *Pekania pennanti* Population: West coast DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3651	Proposed Threatened

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Fishes

NAME	STATUS
Bull Trout *Salvelinus confluentus* Population: U.S.A., conterminous, lower 48 states There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Bull Trout *Salvelinus confluentus* https://ecos.fws.gov/ecp/species/8212#crithab	Final

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
Phone: (360) 753-9440 Fax: (360) 753-9405
http://www.fws.gov/wafwo/

In Reply Refer To: May 09, 2019
Consultation Code: 01EWFW00-2019-SLI-0954
Event Code: 01EWFW00-2019-E-01931
Project Name: Hood River-White Salmon Bridge Replacement Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated and proposed critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. The species list is currently compiled at the county level. Additional information is available from the Washington Department of Fish and Wildlife, Priority Habitats and Species website: http://wdfw.wa.gov/mapping/phs/ or at our office website: http://www.fws.gov/wafwo/species_new.html. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether or not the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). You may visit our website at http://www.fws.gov/pacific/eagle/for information on disturbance or take of the species and information on how to get a permit and what current guidelines and regulations are. Some projects affecting these species may require development of an eagle conservation plan: (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Also be aware that all marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The importation of marine mammals and marine mammal products into the U.S. is also prohibited. More information can be found on the MMPA website: http://www.nmfs.noaa.gov/pr/laws/mmpa/.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Related website:
National Marine Fisheries Service: http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
(360) 753-9440

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Oregon Fish And Wildlife Office
2600 Southeast 98th Avenue, Suite 100
Portland, OR 97266-1398
(503) 231-6179

Project Summary

Consultation Code: 01EWFW00-2019-SLI-0954

Event Code: 01EWFW00-2019-E-01931

Project Name: Hood River-White Salmon Bridge Replacement Project

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Description: The proposed project includes replacing the existing bridge between the cities of Hood River and White Salmon, over the Columbia River.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/45.71919879891615N121.49367358120182W

Counties: Hood River, OR | Klickitat, WA

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Wolf *Canis lupus* Population: U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA. Mexico. There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/4488	Endangered
Gray Wolf *Canis lupus* Population: Western Distinct Population Segment No critical habitat has been designated for this species.	Proposed Endangered
North American Wolverine *Gulo gulo luscus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5123	Proposed Threatened

Birds

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Fishes

NAME	STATUS
Bull Trout *Salvelinus confluentus* Population: U.S.A., conterminous, lower 48 states There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

APPENDIX D

UNDERWATER NOISE CALCULATIONS

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

Fill in 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**

	Distance (m) to threshold			
Cumulative SEL at measured distance	Onset of Physical Injury			Behavior
194	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
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)

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

Fill in 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)

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 1,500 strikes/day

Fill in 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	**1,500**

Cumulative SEL at measured distance
200

	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**	**71**	**131**	**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)

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 3,000 strikes/day

Fill in 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	**3,000**

Cumulative SEL at measured distance
212

	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**	**448**	**631**	**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)

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 3,000 strikes/day

Fill in 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	**3,000**

Cumulative SEL at measured distance
203

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**3**	**113**	**158**	**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)

Model last updated January 26, 2009

Project Title	Hood River Bridge Replacement
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 6,000 strikes/day

Fill in 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	**6,000**

Cumulative SEL at measured distance
215

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak	Cumulative SEL dB**		RMS
	dB	Fish ≥ 2 g	Fish < 2 g	dB
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**631**	**631**	**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)

APPENDIX E

NOAA FISHERIES AND USFWS BUBBLE CURTAIN SPECIFICATIONS

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), Western Washington Fish and Wildlife Office
Impact Pile Driving Sound Attenuation Specification
Revised: October 31, 2006

INTRODUCTION

Air bubbles can reduce sound pressure levels (SPLs) at some frequencies by as much as 30 dB (Gisiner et al. 1998). Bubble curtains are essentially perforated pipes or hoses, surrounding the pile being driven, that produce bubbles when air is pumped through the perforations. Bubble curtains can also reduce particle velocity levels (MacGillivray and Racca 2005).

Bubble curtain designs are highly variable, but can generally be grouped in two categories: unconfined and confined. Unconfined systems are simply a frame which allows for transmission of air bubbles around a pile being driven. Confined systems add a sleeve around the pile to contain the bubbles. The sleeve can consist of fabric, hard plastic, or a larger pile (casing). Spacing of the bubble manifolds, air pressure, tidal currents, and water depth are all factors influencing effectiveness. Improper installation or operation can decrease bubble curtain effectiveness (Pommerenck 2006; Visconty 2004).

Reyff et al. (2002) evaluated the effectiveness of a confined system which used a foam-filled casing and bubble curtain. The casing was 3.8 meters in diameter with the interior coated with 2.54 centimeter closed cell foam. The casing surrounded the pile being driven, and contained the bubble flow. This system dramatically reduced both peak pressure and rms levels. Peak pressure was reduced by 23 to 24 dB and rms levels were reduced by 22 to 28 dB.

A confined bubble curtain used in driving 24 inch octagonal concrete piles at the Port of Benicia in San Francisco Bay, California, attenuated SPLs between 20 and 30 dB (Rodkin, 2003). At the Benicia Martinez Bridge project in California, the project proponents used a casing that was either dewatered, or included an air bubble system. Both techniques yielded substantial reductions in SPLs. The sleeve with an air bubble curtain reduced peak SPLs by up to 34 dB, which the authors note, equates to a 99 percent reduction in the overall energy of the impulse (Reyff et al, 2002). A confined bubble curtain used in driving 30 inch steel piles at a Washington State Ferries facility in Eagle Harbor, Washington, attenuated SPLs by an average of 9.1 dB (MacGillivary and Racca, 2005).

During impact installation of steel piles in an embayment on the Columbia River an unconfined bubble curtain built using a design by Longmuir and Lively (2001) achieved a maximum reduction of 17 dB, although the results were variable (Laughlin 2006). Unconfined bubble curtains used in driving very large steel piles for bridges in San Francisco Bay, California, have attenuated SPLs by as much as 20 dB (Abbott and Reyff 2004). An unconfined bubble curtain used during installation of 24 inch steel piles in the City of Vancouver, British Columbia, reduced SPLs by 17 dB (Longmuir and Lively, 2001). At Friday Harbor, Washington, the Washington State Ferries monitored steel pile driving with and without a bubble curtain (Visconty 2004). Initially, the bubble curtain was improperly installed and no sound attenuation was observed. The bubble curtain was not placed firmly on the bottom; therefore, unattenuated sound escaped under the bubble curtain. After the bubble curtain was modified by adding weight and a canvas skirt to conform to the bottom contour of Puget Sound, the sound was reduced by up to 12 dB, with an average of 9 dB reduction. Vagle (2003) reported reductions of between 18 dB and 30 dB when using a properly designed bubble curtain.

In Washington, the effectiveness of both unconfined and confined systems has been variable and below that of other locations. This may be attributable to an incomplete understanding of design, deployment, and performance, and/or to site specific parameters such as substrate and driving depth. With a common set of design and performance specifications, variability should be minimized and limited to site specificity.

Unconfined Bubble Curtain Specifications:

1. General - An unconfined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe, and a frame. The frame facilitates transport and placement of the system, keeps the aeration pipes stable, and provides ballast to counteract the buoyancy of the aeration pipes in operation.

2. The aeration pipe system shall consist of multiple layers of perforated pipe rings, stacked vertically in accordance with the following:

Water Depth (m)	No. of Layers
0 to less than 5	2
5 to less than 10	4
10 to less than 15	7
15 to less than 20	10
20 to less than 25	13

3. The pipes in all layers shall be arranged in a geometric pattern which shall allow for the pile being driven to be completely enclosed by bubbles for the full depth of the water column and with a radial dimension such that the rings are no more than 0.5 meters from the outside surface of the pile.

4. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without burial and shall accommodate sloped conditions.

5. Air holes shall be 1.6 mm (1/16-inch) in diameter and shall be spaced approximately 20 mm (3/4 inch) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

6. The system shall provide a bubble flux of 3.0 cubic meters per minute per linear meter of pipe in each layer (32.91 cubic feet per minute per linear foot of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

   V_t = 3.0 m^3/min/m * Circum of the aeration ring in m
   or
   V_t = 32.91 ft^3/min/ft * Circum of the aeration ring in ft

7. Meters shall be provided as follows:

   a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.

   b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.

   c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

Performance: In Washington, unconfined bubble curtains have achieved a maximum of 17 dB attenuation and more typically range between 9 to 12 dB. Should hydroacoustic monitoring reveal that an unconfined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

Confined Bubble Curtain Specifications:

1. General - A confined bubble curtain is composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipe(s), and a means of confining the bubbles.

   a. The confinement (e.g. fabric, plastic or metal sleeve, or equivalent) shall extend from the substrate to a sufficient elevation above the maximum water level expected during pile installation such that when the air delivery system is adjusted properly, the bubble curtain does not act as a water pump (i.e., little or no water should be pumped out of the top of the confinement system).

   b. The confinement shall contain resilient pile guides that prevent the pile and the confinement from coming into contact with each other and do not transmit vibrations to the confinement sleeve and into the water column (e.g. rubber spacers, air filled cushions).

2. In water less than 15 meters deep, the system shall have a single aeration ring at the substrate level. In waters greater than 15 meters deep, the system shall have at least two rings, one at the substrate level and the other at mid-depth.

3. The lowest layer of perforated aeration pipe shall be designed to ensure contact with the substrate without sinking into the substrate and shall accommodate for sloped conditions.

4. Air holes shall be 1.6 mm (1/16-inch) in diameter and shall be spaced approximately 20 mm (3/4 inch) apart. Air holes with this size and spacing shall be placed in four adjacent rows along the pipe to provide uniform bubble flux.

5. The system shall provide a bubble flux of 3.0 cubic meters per minute per linear meter of pipe in each layer (32.91 cubic feet per minute per linear foot of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

   V_t = 3.0 m^3/min/m * Circ of the aeration ring in m

   or

   V_t = 32.91 ft^3/min/ft * Circ of the aeration ring in ft

6. Meters shall be provided as follows:

   a. Pressure meters shall be installed at all inlets to aeration pipelines and at points of lowest pressure in each branch of the aeration pipeline.

   b. Flow meters shall be installed in the main line at each compressor and at each branch of the aeration pipelines at each inlet. In applications where the feed line from the compressor is continuous from the compressor to the aeration pipe inlet the flow meter at the compressor can be eliminated.

   c. Flow meters shall be installed according to the manufactures recommendation based on either laminar flow or non-laminar flow.

Performance: In Washington, few projects have used confined bubble curtains so there is a lack of data. Based on performance in other locations, the effectiveness of a confined system could range from 9 dB to 30 dB. Should hydroacoustic monitoring reveal that a confined bubble curtain is not achieving (to be determined based on site and project specific considerations), the NMFS and/or USFWS staff person on the project should be contacted immediately regarding modifications to the proposed action. Should attenuation rates continue at less than (to be determined based on site and project specific considerations), re-initiation of consultation may be necessary.

Terms and Conditions:

1. A bubble curtain meeting the above design specifications and performance requirements shall be used for all impact pile driving.

2. The bubble curtain design specifications shall be submitted to NMFS and/or the USFWS a minimum of 60 days prior to impact pile driving. The specification shall include, but not be limited to, details regarding hole size, hole spacing, hammer type and energy level, and air supply configuration and level. For confined systems the specification shall include details of the sleeve size, length, and guide system.

3. A hydroacoustic monitoring plan shall be submitted to NMFS and/or the USFWS for approval a minimum of 60 days prior to impact pile driving. The hydroacoustic monitoring plan must be prepared and implemented by someone with proven expertise in the field of underwater acoustics and data collection and shall include the name and qualifications of the biologist to be present during impact pile driving.

4. The contractor shall perform a performance test of the bubble curtain, prior to any impact pile driving, in order to confirm the calculated pressures and flow rates at each manifold ring. The contractor shall submit an inspection/performance report to NMFS and/or USFWS within 72 hours following the performance test.

5. Impact pile driving shall not take place between one hour after sunset and one hour before sunrise. (Note: Implementation of this condition will depend on site specific considerations)

6. A qualified biologist shall be present during all impact pile driving operations to observe and report any indications of dead, injured or distressed fishes, including direct observations of these fishes or increases in bird foraging activity.

7. If a barge is used to house the pile-driver, it shall be isolated from the noise-producing operations. This isolation shall be such that noise from the pile driving operation is not transmitted through the barge to the water column.

8. FHWA shall document the effectiveness of the bubble curtain through hydroacoustic monitoring of a minimum of five piles, as early in the project as possible. Factors to consider in identifying the piles to be monitored include, but are not limited to: bathymetry of project site, total number of piles to be driven, sizes of piles, and distance from shore. Peak and rms SPLs, and sound exposure levels (SEL), with and without a bubble curtain, shall be monitored at a distance of 10 meters from each pile at mid-water depth.

9. If the hydroacoustic monitoring indicates that the SPLs will exceed the extent of take exempted in the Biological Opinion(s), the FHWA shall contact NMFS and/or the USFWS within 24 hours. The FHWA shall consult with the Service(s) regarding modifications to the proposed action in an effort to reduce the SPLs below the limits of take and continue hydroacoustic monitoring.

10. FHWA shall submit a monitoring report to the consulting biologist(s) at NMFS and/or the USFWS within 60 days of completing hydroacoustic monitoring. The report shall include the following information:

    a. size and type of piles;
    b. a detailed description of the bubble curtain, including the design specifications identified above;
    c. the impact hammer force used to drive the piles;
    d. a description of the monitoring equipment;
    e. the distance between hydrophone and pile;
    f. the depth of the hydrophone;
    g. the distance from the pile to the wetted perimeter;
    h. the depth of water the pile was driven;
    i. the depth into the substrate the pile was driven;
    j. the physical characteristics of the bottom substrate into which the piles were driven; and
    k. the results of the hydroacoustic monitoring, including the frequency spectrum, peak and rms SPLs, and single-strike and cumulative SEL with and without the bubble curtain. The report must also include the ranges and means for peak, rms and SELs for each pile.

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