Interstate BRIDGE Replacement Program

Biological Assessment

September 2023

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
BA	Biological assessment
BMP	Best management practice
BNSF	Burlington Northern Santa Fe Railway
BO	Biological opinion
C-TRAN	Clark County Public Transportation Benefit Area
CD	Collector-distributor
CESCL	Certified Erosion and Sediment Control Lead
CIA	Contributing Impervious Area
CR	Columbia River
CRC	Columbia River Crossing
CRD	Columbia River Datum
dB	Decibels
dBA	A-weighted decibels
dB_{PEAK}	Peak decibels
dB_{RMS} re: 1 μPa	Root mean square decibels referenced to 1 micropascal
dB_{RMS}	Root mean square decibels
dB_{SEL}	Decibels sound equivalent level
DEQ	(Oregon) Department of Environmental Quality
DPS	Distinct Population Segment
DSL	(Oregon) Department of State Lands
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESH	Essential Salmonid Habitat
ESU	Evolutionarily Significant Units
FAHP	Federal Aid Highway Program
FHWA	Federal Highway Adminstration

Fisheries	National Marine Fisheries Service
FTA	Federal Transit Administration
GHG	Greenhouse gas
I-5	Interstate 5
IBR	Interstate Bridge Replacement
IWWW	In-water work window
ISA	Impervious Surface Area
LCR	Lower Columbia River
LPA	Locally Preferred Alternative
LRT	Light-rail transit
LRV	Light-rail vehicle
MAX	Metropolitan Area Express
MCR	Middle Columbia River
Metro	Oregon Metro
mg/L	Milligrams per liter
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRI	Natural Resources Inventory
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OHWM	Ordinary High Water Mark
PAH	Polycyclic aromatic hydrocarbons
PBF	Physical or biological features
PCB	Polychlorinated biphenyls
PCP	Pollution Control Plan
PMLS	Portland Metro Levee System
PRM	Permittee-responsible mitigation
PTS	Permanent Threshold Shift
RMS	Root Mean Square
ROD	Record of Decision
RUIP	Recovery Unit Implementation Plan
SEIS	Supplemental Environmental Impact Statement
SEL	Sound Exposure Level
SPCC	Spill Prevention, Control, and Countermeasures

SR	State Route
SR-FR	Snake River fall run
SR-SSR	Snake River spring/summer run
SRKW	Southern Resident (Distinct Population Segment) Killer Whale
SROTF	Southern Resident Orca Task Force
TMDL	Total Maximum Daily Load
TriMet	Tri-County Metropolitan Transportation District
TTS	Temporary Threshold Shift
UCR	Upper Columbia River
UCR-SR	Upper Columbia River spring run
USACE	United States Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
UWR	Upper Willamette River
WDFW	Washington Department of Fish and Wildlife
WQPMP	Water Quality Protection and Monitoring Plan
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

The Interstate Bridge Replacement (IBR) Program will replace the aging Interstate Bridge across the Columbia River with a modern, seismically resilient, multimodal structure. The proposed infrastructure improvements are located along a 5-mile stretch of the Interstate 5 (I-5) corridor in Portland, Oregon, and Vancouver, Washington.

The IBR Program was originally developed and evaluated as the Columbia River Crossing (CRC) project. The environmental review processes (including a National Environmental Policy Act [NEPA] Record of Decision and Section 7 Endangered Species Act [ESA] consultations) for the CRC project were completed between 2005 and 2013, and the project was suspended in 2014. In 2019, a bistate legislative committee requested that the Oregon Department of Transportation and the Washington State Department of Transportation reinitiate the CRC project, and it was re-named the IBR Program.

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) are co-lead federal agencies for the IBR Program, with responsibility for the environmental review and compliance with the NEPA and associated regulations and policies, including the ESA and the Magnuson-Stevens Fishery Conservation and Management Act.

In 2021, a NEPA reevaluation was conducted, and FHWA and FTA determined that a supplemental environmental impact statement (SEIS) would be necessary to identify and disclose new impacts and mitigation associated with the IBR Program. The SEIS will evaluate one project build alternative (the Modified Locally Preferred Alternative [LPA]) and the No-Build Alternative. Design options for certain components of the Modified LPA are also being evaluated in the SEIS. The "proposed action" that is addressed in this biological assessment is the IBR Modified LPA and all the design options being evaluated in the SEIS.

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

Potential effects to ESA-listed species and critical habitats associated with the proposed action include the following:

1. Degradation of water quality during construction.
2. Increased hydroacoustic and terrestrial noise during construction.
3. Displacement of aquatic and terrestrial habitats during construction.

4. Permanent loss of aquatic and terrestrial habitats associated with new and replacement structures.
5. Restoration of aquatic and terrestrial habitats associated with removal of existing structures.
6. Increased hydraulic shadowing from new in-water bridge piers.
7. Injury or mortality to individual fish associated with work area isolation and fish salvage.
8. Increased overwater lighting from temporary and permanent structures.
9. Increased avian predation pressure.
10. Permanent impacts associated with contaminants in stormwater runoff from contributing impervious surfaces.

The proposed action includes several impact minimization and avoidance measures and best management practices to reduce the extent and magnitude of these potential effects.

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

Table ES-1. Effect Determination Summary – Species

Common Name	Scientific Name	ESU or DPS[a]	Federal Status[b]	Effect Determination[c]
Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	T	LAA
		UWR ESU	T	LAA
		UCR-SR ESU	E	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*	Snake River ESU	E	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	T	LAA
		UWR DPS	T	LAA
		MCR DPS	T	LAA
		UCR DPS	T	LAA
		SRB DPS	T	LAA
Pacific Eulachon	*Thaleichthys pacificus*	Southern DPS	T	LAA
North American Green Sturgeon	*Acipenser medirostris*	Southern DPS	T	LAA
Bull Trout	*Salvelinus confluentus*	Coastal Recovery Unit	T	NLAA
Killer whale	*Orcinus orca*	Southern Resident DPS	E	NLAA
Streaked horned lark	*Eremophila alpestris strigata*	N/A	T	NLAA

Notes:

a ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; N/A = 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

b E = Endangered; T = Threatened

c NE = No Effect; NLAA = May Effect, Not Likely to Adversely Affect; LAA = Likely to Adversely Affect

Table ES-2. Effect Determination Summary – Critical Habitats

Common Name	Scientific Name	ESU or DPS[a]	Status[b]	Effect Determination[c]
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*	Snake River 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
Pacific Eulachon	*Thaleichthys pacificus*	Southern DPS	D	LAA
North American Green Sturgeon	*Acipenser medirostris*	Southern DPS	D	LAA
Bull Trout	*Salvelinus confluentus*	Coastal Recovery Unit	D	NLAA
Killer whale	*Orcinus orca*	Southern Resident DPS	D	NLAA
Streaked horned lark	*Eremophila alpestris strigata*	N/A	D	NE

Notes:

a ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment; N/A = 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

b D = Designated

c NE = No Effect; NLAA = May Effect, Not Likely to Adversely Affect; LAA = Likely to Adversely Affect

The proposed action is **likely to adversely affect** the following ESA-listed species:

- Lower Columbia River (LCR), Upper Willamette River (UWR), Upper Columbia River Spring-Run (UCR-SR), Snake River Spring/Summer-Run (SR-SSR), and Snake River Fall-Run (SR-FR) Evolutionarily Significant Unit (ESU) Chinook salmon (*Oncorhynchus tshawytscha*)
- Columbia River (CR) ESU chum salmon (*Oncorhynchus keta*)
- LCR ESU coho salmon (*Oncorhynchus kisutch*)
- Snake River ESU sockeye salmon (*Oncorhynchus nerka*)
- LCR, UWR, Middle Columbia River (MCR), Upper Columbia River (UCR), and Snake River Basin (SRB) Distinct Population Segment (DPS) steelhead (*Oncorhynchus mykiss*)
- Southern DPS Pacific eulachon (*Thaleichthys pacificus*)
- Southern DPS North American green sturgeon (*Acipenser medirostris*)

These populations are known to occur within the lower Columbia River and will be adversely affected by permanent aquatic habitat impacts associated with bridge replacement and impacts associated with stormwater from contributing impervious surfaces. Adults and juveniles of these populations may also be present and adversely affected during portions of the year when construction and demolition activities will occur. Individual fish present during construction activities may be adversely affected by temporarily impaired water quality, temporary hydroacoustic impacts associated with impact pile driving that exceeds established injury thresholds, temporary aquatic habitat impacts, and impacts associated with work area isolation and fish salvage.

The proposed action is also **likely to adversely affect** designated critical habitat for the following ESA-listed species:

- LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon
- CR ESU chum salmon
- LCR ESU coho salmon
- Snake River ESU sockeye salmon
- LCR, UWR, MCR, UCR, and SRB DPS steelhead
- Southern DPS Pacific eulachon
- Southern DPS North American green sturgeon

Designated critical habitats for these populations will be adversely affected by permanent aquatic habitat impacts associated with bridge replacement, and impacts associated with stormwater from contributing impervious surfaces. Habitat function will also be temporarily adversely affected during construction by temporarily impaired water quality, temporarily elevated underwater noise during impact pile driving, temporary aquatic habitat impacts, and impacts associated with work area isolation and fish salvage.

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 **not likely to adversely affect** bull trout within the Coastal Recovery Unit. Bull trout have only rarely been documented within the portions of the action area that is within the mainstem Columbia River or North Portland Harbor. Given the lack of documented recent sightings, their presence is unlikely, and they are extremely unlikely to be subjected to any permanent or temporary impacts associated with the proposed action. The proposed action is also **not likely to adversely affect** designated critical habitat for bull trout within the Coastal Recovery Unit. Given the lack of use of the action area by bull trout, and the nature of the aquatic habitat effects, the proposed action is unlikely to significantly affect the function of the physical or biological features of bull trout designated critical habitat.

The proposed action is **not likely to adversely affect** Southern Resident DPS killer whales (SRKW). Effects to salmon and steelhead associated with the proposed action have the potential to indirectly affect the prey base for SRKW. However, the extent of the effect to salmon and steelhead populations will be avoided, minimized, and compensated for consistency with federal, state, and local regulatory requirements; therefore, the proposed action will not result in any measurable or significant effect on the distribution or abundance of potential prey species for SRKW. For this same reason, the proposed action is also **not likely to adversely affect** designated critical habitat for SRKWs, as it will not affect the function of any physical or biological features of designated critical habitat for killer whales.

The proposed action is **not likely to adversely affect** streaked horned lark. While streaked horned larks use habitats within the terrestrial portion of the action area, the proposed action will not directly disturb any suitable nesting habitat. If individual birds are present in the vicinity of construction activities, they may experience temporary auditory or visual disturbance, or may temporarily avoid the vicinity, but the potential for adverse effect is unlikely and discountable. The proposed action will have **no effect** on designated critical habitat for streaked horned lark, as no designated critical habitat occurs within the action area.

Additionally, in accordance with the Magnuson-Stevens Fishery Conservation and Management Act, Appendix B of this biological assessment addresses impacts to essential fish habitat (EFH). The portions of the Columbia River, North Portland Harbor, Columbia Slough, Burnt Bridge Creek, and Fairview Creek that are within the action area represent EFH for Chinook and coho salmon within the Pacific salmon guild. Portions of the Columbia River estuary that are within the action area near the mouth of the river are also designated EFH for groundfish and coastal pelagic species.

The proposed action **will adversely affect** EFH for Pacific salmon, groundfish, and coastal pelagic species. Temporary impacts to EFH for Pacific salmon include impaired water quality, elevated underwater noise, and temporary aquatic habitat impacts during construction. Permanent impacts include permanent aquatic habitat impacts from the replacement bridges, and delivery of pollutants in stormwater from new and rebuilt impervious surfaces (including stormwater from contributing impervious surfaces). Stormwater pollutants from these impervious surfaces will also result in adverse effects to groundfish and coastal pelagic species. The proposed action has incorporated several minimization and avoidance measures and best management practices to minimize impacts to EFH to the extent practicable.

1. INTRODUCTION

The Interstate Bridge Replacement (IBR) Program is a renewal of the previously suspended Columbia River Crossing (CRC) project. The Program will replace the aging Interstate Bridge across the Columbia River with a modern, seismically resilient multimodal structure. The proposed infrastructure improvements are located along a 5-mile stretch of the Interstate 5 (I-5) corridor in Portland, Oregon, and Vancouver, Washington.

1.1 Project Proponent

The IBR Program team includes a number of regional transportation partners, including the Oregon Department of Transportation (ODOT), Washington State Department of Transportation (WSDOT), Clark County Public Transportation Benefit Area (C-TRAN), Tri-County Metropolitan Transportation District (TriMet), Oregon Metro (Metro), Southwest Washington Regional Transportation Council, the Cities of Portland and Vancouver, and the Ports of Portland and Vancouver.

1.2 Federal Nexus

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) are co-lead federal agencies for the IBR Program, with responsibility for the environmental review and compliance with the National Environmental Policy Act (NEPA) and associated regulations and policies, including the Endangered Species Act (ESA), and the Magnuson-Stevens Fishery Conservation and Management Act.

The IBR Program anticipates the use of federal funding through FHWA and FTA for construction and will also require approval of an Interstate Modification (23 U.S. Code [USC] 111) from FHWA. These actions represent the federal nexus for which FHWA and FTA are conducting this consultation with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (Fisheries) and U.S. Fish and Wildlife Service (USFWS).

In addition to the FHWA and FTA federal nexuses described above, the IBR Program anticipates the need for permits and approvals from the following federal agencies, which also represent federal nexuses for the proposed action. Per 50 Code of Federal Regulations (CFR) 402.07, FHWA and FTA are designated co-lead agencies for this ESA consultation and will take the lead in conducting consultation on behalf of these other action agencies.

- U.S. Army Corps of Engineers (USACE): Permits and approvals under Section 404 of the Clean Water Act (33 USC 1344), Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403), and Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408)
- U.S. Coast Guard (USCG): General Bridge Act of 1946 Permit
- NOAA Fisheries: Marine Mammal Protection Act Incidental Harassment Authorization

- Federal Aviation Administration: Permit for Permanent Obstruction; Permit for Construction Obstruction
- U.S. Environmental Protection Agency (EPA): Sole Source Aquifer Protection Act; Clean Air Act
- National Park Service: Archaeological Resources Protection Act Permit

1.3 Project History

The components that comprise the IBR Program were originally developed and evaluated as the CRC project. The environmental review process for the CRC project was conducted between 2005 and 2013.

Significant technical work was completed to support the development of the CRC project. Multiple build alternatives were evaluated in the environmental impact statement (EIS) documentation prepared for the CRC project. The results of these analyses were used to inform project planning, design, and preconstruction activities for the IBR Program. Significant agency and interested party coordination was also conducted for both projects.

In 2011, the CRC Locally Preferred Alternative (LPA) was selected as the preferred alternative following the evaluation of four build alternatives. The CRC project completed its NEPA compliance with a signed Record of Decision (ROD) in 2011 (CRC 2011) and two NEPA reevaluations that were completed in 2012 and 2013 (CRC 2012, CRC 2013). The CRC project was discontinued in 2014.

In 2019, a bistate legislative committee requested that ODOT and WSDOT reinitiate the CRC project, renaming it the IBR Program. In 2021, a third NEPA reevaluation was prepared to evaluate the effect of changes in conditions and regulations since 2013, as well as potential design changes. The federal co-lead agencies, FHWA and FTA, determined that a supplemental environmental impact statement (SEIS) is necessary to identify and disclose new adverse impacts and mitigation associated with the IBR Program.

The IBR Program's Modified LPA is a modification of the CRC LPA. The IBR Program worked extensively with federal, tribal, state, regional, and local partners to identify and screen design options to modify the CRC LPA.

Design options for certain components of the Modified LPA are also being evaluated in the SEIS. The "proposed action" that is addressed in this biological assessment (BA) is the IBR Modified LPA, inclusive of all design options being evaluated in the SEIS.

1.4 Purpose and Need

The Purpose and Need for the CRC project was developed by the joint lead agencies[1] and the CRC Task Force, a 39-member task force comprised of leaders from a broad cross section of Washington and Oregon communities.

The Purpose and Need statement for the IBR Program,[2] provided below, remains the same as documented in the 2011 Final EIS and 2011 ROD for the CRC project. Please see the 2021 Community Engagement Summary Report (IBR 2021a) and the NEPA reevaluation (IBR 2021b) for additional details on how interested party outreach and public engagement helped confirm the Purpose and Need statement.

1.4.1 Project Purpose

The purpose of the proposed action is to improve I-5 corridor mobility by addressing present and future travel demand and mobility needs in the program area. The IBR Program area extends from approximately Columbia Boulevard in the south to State Route (SR) 500 in the north. Relative to the No-Build Alternative, the proposed action is intended to achieve the following objectives: (a) improve travel safety and traffic operations on the I-5 river crossing and associated interchanges; (b) improve connectivity, reliability, travel times, and operations of public transportation modal alternatives in the program area; (c) improve highway freight mobility and address interstate travel and commerce needs in the program area; and (d) improve the I-5 river crossing's structural integrity (seismic stability).

1.4.2 Project Need

The specific needs to be addressed by the proposed action include:

- **Growing travel demand and congestion:** Existing travel demand exceeds capacity in the Interstate Bridge and associated interchanges. This corridor experiences heavy congestion and delay lasting 4 to 6 hours daily[3] during the morning and afternoon peak travel periods and when traffic crashes, vehicle breakdowns, or bridge lifts occur. Due to excess travel demand and congestion in the I-5 corridor, many trips take the longer, alternative I-205 route across the river. Spillover traffic from I-5 onto parallel arterials such as Martin Luther King Jr. Boulevard and

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[1] The joint lead agencies for the CRC project were the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Oregon State Department of Transportation (ODOT), Washington State Department of Transportation (WSDOT), Oregon Metro (Metro), Southwest Washington Regional Transportation Council, Tri-County Metropolitan Transportation District (TriMet), and Clark County Public Transportation Benefit Area (C-TRAN).

[2] The Purpose and Need as presented here has not been edited from its original wording as established under the CRC project, with the exception of references to the name of the Program. Additional information and context can be found in Chapter 1 of the Draft SEIS.

[3] The hours of congestion and delay refers to the total number of hours that the corridor experiences congestion.

Interstate Avenue increases local congestion. In 2005, the two crossings[4] carried 280,000 vehicle trips across the Columbia River daily. Daily traffic demand over the Interstate Bridge is projected to increase by more than 35% during the next 20 years, with stop-and-go conditions increasing to approximately 15 hours daily if no improvements are made.

- **Impaired freight movement:** I-5 is part of the National Truck Network, and the most important freight highway on the West Coast, linking international, national, and regional markets in Canada, Mexico, and the Pacific Rim with destinations throughout the western United States. In the center of the Program area, I-5 intersects with the Columbia River's deep-water shipping and barging channels, as well as two river-level, transcontinental rail lines. The Interstate Bridge provides direct and important highway connections to the Port of Vancouver and Port of Portland facilities located on the Columbia River, as well as the majority of the area's freight consolidation facilities and distribution terminals. Freight volumes moved by truck to and from the area are projected to more than double over the next 25 years. Vehicle-hours of delay on truck routes in the Portland-Vancouver area are projected to increase by more than 90% over the next 20 years. Growing demand and congestion will result in increasing delay, costs, and uncertainty for all businesses that rely on this corridor for freight movement.
- **Limited public transportation operation, connectivity, and reliability:** Due to limited public transportation options, a number of transportation markets are not well served. The key transit markets include trips between Portland Central City and the city of Vancouver and Clark County, trips between north/northeast Portland and the city of Vancouver and Clark County, and trips connecting the city of Vancouver and Clark County with the regional transit system in Oregon. Current congestion in the corridor adversely impacts public transportation service reliability and travel speed. Southbound bus travel times across the bridge are currently up to three times longer during parts of the AM peak compared to off-peak. Travel times for public transit using general-purpose lanes on I-5 in the Program area are expected to increase substantially by 2030.
- **Safety and vulnerability to incidents:** The Interstate Bridge and its approach sections experience crash rates more than two times higher than statewide averages for comparable facilities. Incident evaluations generally attribute these crashes to traffic congestion and weaving movements associated with closely spaced interchanges and short merge distances. Without breakdown lanes or shoulders, even minor traffic accidents or stalls cause severe delay or more serious accidents.
- **Substandard bicycle and pedestrian facilities:** The bike/pedestrian lanes on the Interstate Bridge are about 3.5 to 4 feet wide, narrower than the 10-foot standard, and are located extremely close to traffic lanes, thus impacting safety for pedestrians and bicyclists. Direct pedestrian and bicycle connectivity are poor in the Program area.
- **Seismic vulnerability:** The existing Interstate Bridge is located in a seismically active zone. It does not meet current seismic standards and is vulnerable to failure in an earthquake.

[4] The two crossings are the I-5 Interstate Bridge and the I-205 Glenn Jackson Bridge.

1.5 Alternatives Development and Screening

Multiple alternatives were developed and screened during the environmental review process for the CRC project. The LPA that was developed for CRC (and analyzed in the 2010 and 2013 ESA consultations for CRC) was developed through a years-long process that began with a multi-step, multi-agency alternatives screening process. This screening effort evaluated a wide range of potential river crossing and transit design options. Design options that passed the screening were ultimately combined into multimodal alternatives that were evaluated in detail in the CRC project's EIS, with an LPA identified in the 2011 ROD, and updated in two NEPA reevaluations prepared in 2012-2013.

The 2013 LPA was used as a starting point for the IBR Program's identification and development of design options. The IBR Program team conducted a design option and development screening process in 2021 and 2022 to identify changes, develop and screen design options, and ultimately establish the "Modified LPA" that represents this proposed action. The specific design-related assumptions that comprise the proposed action in this BA, have been further refined throughout 2022 and 2023, through coordination with regulatory agencies, tribes, and other interested parties.

1.6 Consultation History

The BA for the CRC project (Parametrix 2010) was developed between 2005 and 2010, in coordination with the NEPA environmental reviews for the project. Extensive coordination was conducted to support the technical analysis that was ultimately presented in the BA, including regular meetings with a multi-agency technical working group, and extensive consultation and coordination with 10 federally recognized tribes and one non-federally recognized tribe.

Key milestones in the CRC consultation are identified below:

- June 24, 2010 – FHWA and FTA initiate consultation with USFWS (informal) and NOAA Fisheries (formal);
- August 27, 2010 – USFWS issues letter of concurrence;
- January 19, 2011 – NOAA Fisheries issues Biological Opinion (BO);
- May 13, 2013 – FHWA and FTA reinitiate consultations with USFWS and NOAA Fisheries;
- July 12, 2013 – USFWS issues letter of concurrence; and
- August 30, 2013 – NOAA Fisheries issues BO.

In April 2021, the IBR Program convened an internal ESA working group to begin early coordination on the ESA consultation for the Program. The ESA working group included IBR biologists, and representatives from FHWA, FTA, ODOT, WSDOT, and NOAA Fisheries. This working group met monthly between April 2021 and August 2023 during the BA development to guide content and analysis. Early coordination meetings were also held with USFWS to help determine the appropriate consultation pathway and inform the BA content.

Early coordination was also conducted with the other federal agencies with applicable federal nexuses (Section 1.2) to confirm that FHWA and FTA would serve as co-leads for the Section 7 consultation, and to confirm that the BA appropriately characterized and analyzed the effects associated with their respective federal actions.

As the proposed action was developed and refined, meetings outside of the Section 7 consultation process were coordinated and conducted with additional interested parties including state and local regulatory agencies, consulting tribes, and conservation groups, and others. Specific topics coordinated and discussed with these parties that are pertinent to the ESA consultation include: avoidance and minimization measures, mitigation and conservation considerations, species presence and run timing, and in-water work timing.

2. PROJECT LOCATION

The project site[5] includes approximately 5 miles of the I-5 corridor between the I-5/SR 500 interchange in Vancouver, Washington, and the I-5/Victory Boulevard interchange in Portland, Oregon (Figure 2-1). It is located within Sections 22, 23, 26, 27, and 34 of Township 02 North, Range 1 East, Willamette Meridian. The Interstate Bridge is located at approximately River Mile (RM) 106 on the Columbia River, and is located within portions of Hydrologic Unit Code #17090012 (Lower Willamette) and #17080003 (Lower Columbia-Clatskanie).

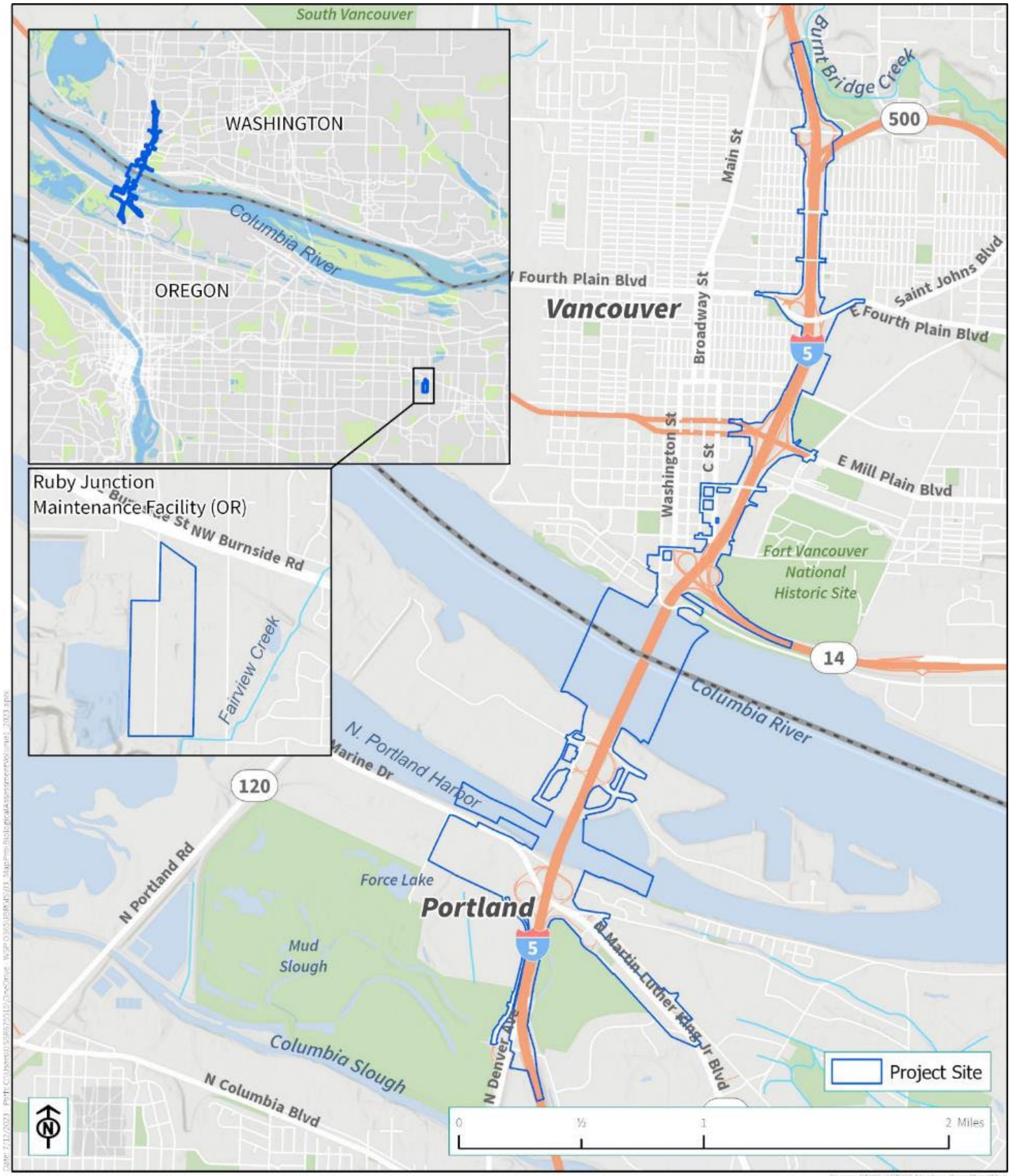
The northern end of the project site, within Washington State, begins at the I-5/SR 500 interchange and extends south along the I-5 corridor to the Columbia River shoreline. It includes the portions of the roadways and associated roadway infrastructure that will be improved as part of the proposed action. The project site in Washington includes portions of downtown Vancouver where project activities will occur.

The central portion of the project site spans the Columbia River, Hayden Island, and North Portland Harbor. It includes areas within both Washington State and Oregon. It includes the existing Columbia River and North Portland Harbor bridges, the locations of the replacement bridges, and temporary work areas within both the Columbia River and North Portland Harbor where construction activities will be conducted via barges and temporary structures. It also includes portions of Hayden Island where project activities will occur.

The southern portion of the project site is located within Oregon, and extends from the Columbia River shoreline south to the Victory Boulevard interchange. This southern portion of the project site is located within the City of Portland, and includes the proposed improvements associated with Victory Boulevard and Marine drive interchanges, and a portion of the Expo Center property where a proposed overnight light-rail vehicle (LRV) facility will be constructed. The southern portion of the project site also includes an approximately 22.8-acre site in Gresham, Oregon for the expansion and improvement of the Ruby Junction Maintenance Facility.

[5] For purposes of this document, the term “project site” is used to refer to those areas that comprise the physical footprint of the proposed action, including permanent and temporary structures, excavation and fill areas, contributing impervious surface areas, stormwater facilities, likely temporary staging and access areas, and areas in the Columbia River and North Portland Harbor where work will occur from barges and temporary structures. The “project site” is not equivalent to the “Action Area” (defined in Section 5), a term defined under the ESA to describe the geographical extent of all effects of the action.

Figure 2-1. Vicinity Map



3. PROJECT DESCRIPTION

As described in Section 1, the proposed action is a renewal of the previously suspended CRC project. The Program will replace the aging Interstate Bridge across the Columbia River with a modern, seismically resilient multimodal structure. The proposed infrastructure improvements are located along a 5-mile stretch of the I-5 corridor in Portland, Oregon, and Vancouver, Washington.

A detailed discussion of the elements of the proposed action is presented in the subsections below.

It is important to note that this consultation is being conducted at an early stage of project design, and only preliminary design is available. To provide the level of technical specificity that is necessary for formal Section 7 consultation (quantities, area estimates, durations, etc.), appropriate assumptions have been made based on engineering standards and the best professional judgment of the design team.

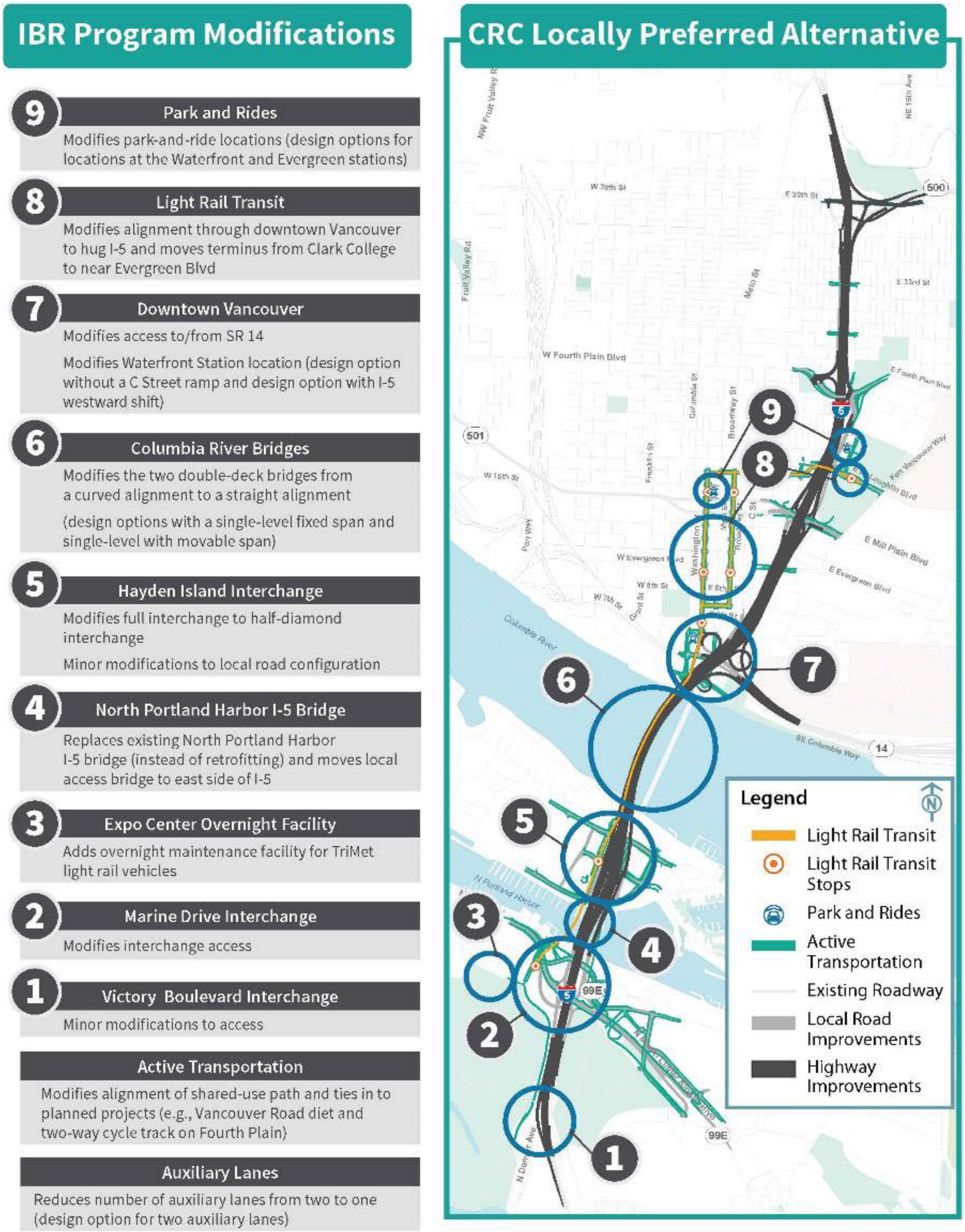
The Modified LPA includes several design options for key aspects of the proposed action, and the project description presented in this section is intended to be inclusive of all the design options that are currently under evaluation. Where specific quantities or impacts differ between the various design options, this BA analyzes the effects associated the design option with the greatest impact, or the largest quantities.

In this way, the effects analyzed in this BA appropriately address the full range of potential impacts to ESA-listed species and critical habitats that are reasonably certain to occur as a result of the proposed action, regardless of which (if any) design options are ultimately selected and constructed.

3.1 Comparison to CRC Proposed Action

As described in Section 1.3, the IBR proposed action is a modification of the CRC proposed action as it was defined in 2013 at the time of the most recent ESA consultation. Figure 3-1 provides a visual overview of the key components of the IBR proposed action that differ from the proposed action as it was defined at the time of the 2013 CRC consultation.

Figure 3-1. Comparison to CRC Proposed Action



3.2 Proposed Action Overview

The basic components of the Modified LPA include:

- A new pair of bridges over the Columbia River—one for northbound and one for southbound travel—built west of the existing Interstate Bridge.[6] The new bridges will include three through lanes, safety shoulders, and one auxiliary lane (a ramp-to-ramp connection on the highway that improves safety and mobility by giving drivers more space and time to exit and merge safely) in each direction. When all highway, transit and active transportation are moved to the new Columbia River bridges, the existing Interstate Bridge (both spans) will be removed. The primary navigation channel will be relocated approximately 500 feet south (measured by channel centerline) of its existing location near the Vancouver shoreline.
  - Three bridge configurations are under consideration: double-deck truss bridges with fixed spans, single-level bridges with fixed spans, and single-level bridges with movable spans over the primary navigation channel. The fixed-span bridges would provide up to 116 feet of vertical navigation clearance, and the movable spans would provide at least 178 feet of vertical navigation clearance depending on the movable-span type (such as lift or double leaf bascule).
  - A two-auxiliary-lane design option (two ramp-to-ramp lanes connecting interchanges) across the Columbia River is also being evaluated. The second auxiliary lane in each direction of I-5 would be added from approximately Marine Drive to Mill Plain Boulevard.
- A 1.9-mile light-rail transit (LRT) extension of the current Metropolitan Area Express (MAX) Yellow Line from the Expo Center Station in North Portland, where it currently ends, to a terminus near Evergreen Boulevard in Vancouver. Improvements include new stations at Hayden Island, downtown Vancouver (Waterfront Station), and near Evergreen Boulevard (Evergreen Station), as well as revisions to the existing Expo Center MAX Station. Park and rides to serve LRT riders in Vancouver could be included near the Waterfront Station and Evergreen Station.
  - Potential site options for park and rides include three site options near the Waterfront Station and two near the Evergreen Station (up to one park and ride could be built for each station location in Vancouver).
- Associated LRT improvements, such as traction power substations, overhead catenary system, signal and communications support facilities, an overnight LRV facility at the Expo Center, 19 new LRVs, and an expanded maintenance facility at TriMet's Ruby Junction.
- Wider shoulders on I-5 from Victory/Interstate Boulevard to SR 500/39th Street to accommodate express bus-on-shoulder service in each direction. Associated improvements include three additional bus bays for eight new electric double-decker buses at the C-TRAN operations and

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[6] The existing Interstate Bridge is also comprised of two separate bridge structures. Where it is capitalized and referred to in the singular in this document, the term "Interstate Bridge" refers to both existing bridge structures.

maintenance facility (see Section 3.2.7, Transit Operating Characteristics, for more information about this service).

- Improvements to seven I-5 interchanges and I-5 mainline improvements between Victory/Interstate Boulevard in Portland and SR 500/39th Street in Vancouver. Some adjacent local streets will be reconfigured to complement the new interchange designs, and improve local east-west connections.
  - An option that shifts the I-5 mainline up to 40 feet westward in downtown Vancouver between the SR 14 interchange and Mill Plain interchange is being evaluated.
  - An option that eliminates the existing C Street ramps in downtown Vancouver is also being evaluated.
- Six new adjacent bridges across North Portland Harbor: one on the east side of the existing I-5 North Portland Harbor bridge and five on the west side or overlapping with the existing bridge (which will be removed). The bridges will carry (from west to east) LRT tracks, southbound I-5 off-ramp to Marine Drive, southbound I-5 mainline, northbound I-5 mainline, northbound I-5 on-ramp from Marine Drive, and an arterial bridge for local traffic with a shared-use path for pedestrians and bicyclists.
- A variety of improvements for people who walk, bicycle, and roll throughout the project site including a system of shared-use paths, bicycle lanes, sidewalks, enhanced wayfinding, and facility improvements to comply with the Americans with Disabilities Act. These are referred to in this document as “active transportation” improvements.
- Integration of local bus transit service, including bus rapid transit, in addition to the proposed new LRT service.
- Variable-rate tolling for motorists using the river crossing as a demand-management and financing tool.
- Stormwater management for all post-project contributing impervious area (CIA).

As described in the introduction to Section 3 of this document, where specific quantities or impacts differ between the various design options, this BA analyzes the effects associated with the design option with the greatest impact, or the largest quantities.

An overview of the proposed action is shown in Figure 3-2. Section 3.2.1 describes the overall configuration of the I-5 mainline through the project site, and Sections 3.2.2 through 3.2.5 provide additional detail on four geographic subareas (A through D), which are shown on Figure 3-3. In each subarea, improvements to I-5, its interchanges, and the local roadways are described first, followed by transit and active transportation improvements. Design options are described under separate headings in the subareas in which they will be located. Figures in each section show both the anticipated limit of ground disturbance, which includes disturbance from temporary construction activities, and the location of permanent infrastructure elements.

Figure 3-2. Proposed Action Overview

Figure 3-3. Proposed Action – Index Map

3.2.1 Interstate 5 Mainline

Today, within the project site, I-5 has three 12-foot-wide through lanes in each direction, a 6- to 11-foot-wide inside shoulder, and a 10- to 12-foot-wide outside shoulder, with the exception of the existing Interstate Bridge, which has approximately 2- to 3-foot-wide inside and outside shoulders. There are intermittent auxiliary lanes between the Victory Boulevard and Hayden Island interchanges in Oregon and between SR 14 and SR 500 in Washington.

The Modified LPA will include three 12-foot through lanes from Victory Boulevard to SR 500 and a 12-foot auxiliary lane from approximately the Marine Drive interchange to the Mill Plain interchange in each direction. Many of the existing auxiliary lanes on I-5 between the SR 14 and Main Street interchanges in Vancouver will remain, although they will be reconfigured. The existing auxiliary lanes between the Victory Boulevard and Hayden Island interchanges will be replaced with changes to on- and off-ramps and interchange reconfigurations. The Modified LPA will also include wider shoulders (12-foot inside shoulders and 10- to 12-foot outside shoulders) to be consistent with ODOT and WSDOT design standards for safety, maintenance, and maintenance of traffic during construction. The wider inside shoulder will be used by express buses to bypass mainline congestion, known as "bus on shoulder." The shoulder would be available for express buses whenever general-purpose speeds drop below 35 miles per hour.

Figure 3-4 shows the proposed auxiliary lane layout. The Modified LPA will add one auxiliary lane in each direction across the new Columbia River bridges. On I-5 northbound, the auxiliary lane that begins at the on-ramp from Marine Drive will continue across the Columbia River bridge and end at the off-ramp to the collector-distributor (CD)[7] roadway, north of SR 14. The on-ramp from SR 14 westbound will join the off-ramp to the CD roadway, forming the northbound CD roadway. The CD roadway will provide access from I-5 northbound to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard. The CD roadway will also provide access from SR 14 westbound to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard, and to the on-ramp to I-5 northbound.

On I-5 northbound, the Modified LPA will also add one auxiliary lane beginning at the on-ramp from the CD roadway and ending at the on-ramp from 39th Street, connecting to an existing auxiliary lane from 39th Street to the off-ramp at Main Street. Another existing auxiliary lane would remain between the on-ramp from E Mill Plain Boulevard to the off-ramp to SR 500.

On I-5 southbound, the off-ramp to the CD roadway will join the on-ramp from E Mill Plain Boulevard to form a CD roadway. The CD roadway will provide access from I-5 southbound to the off-ramp to SR 14 eastbound and from E Mill Plain Boulevard to the off-ramp to SR 14 eastbound and the on-ramp to I-5 southbound.

On I-5 southbound, an auxiliary lane will begin at the on-ramp from the CD roadway and will continue across the Columbia River bridge and end at the off-ramp to Marine Drive. The combined on-ramp from SR 14 westbound and C Street will merge into this auxiliary lane on the Columbia River bridge.

3.2.1.1 Two Auxiliary Lane Design Option

The two auxiliary lane design option, if selected, will add a second 12-foot-wide auxiliary lane in each direction of I-5 to the single auxiliary lane proposed for the Modified LPA with the intent to further optimize travel flow in the corridor. This design option could be applied to any of the bridge design options that are being evaluated. This second auxiliary lane will extend from approximately the Marine Drive interchange to the SR 500 interchange.

On I-5 northbound, one auxiliary lane will begin at the combined on-ramp from N Interstate Avenue and N Victory Boulevard, and a second auxiliary lane will begin at the on-ramp from N Marine Drive. Both auxiliary lanes will continue across the Columbia River bridge, and the on-ramp from Hayden

[7] A collector-distributer roadway parallels and connects the main travel lanes of a highway and frontage roads or on-ramps.

Island will merge into the second auxiliary lane on the Columbia River bridge. At the off-ramp to the CD roadway, the second auxiliary lane will end but the first auxiliary lane will continue. A second auxiliary lane will begin again at the on-ramp from E Mill Plain Boulevard. The second auxiliary lane will end at the off-ramp to SR 500, and the first auxiliary lane will connect to an existing auxiliary lane at SR 500 that continues north.

On I-5 southbound, two auxiliary lanes will begin at the on-ramp from SR 500. Between the on-ramp from E Fourth Plain Boulevard and the off-ramp to E Mill Plain Boulevard, one auxiliary lane would be added to the existing two auxiliary lanes. The second auxiliary lane will end at the off-ramp to the CD roadway but the first auxiliary lane will continue. A second auxiliary lane will begin again at the on-ramp from the CD roadway. Both auxiliary lanes will continue across the Columbia River bridge, and the combined on-ramp from SR 14 westbound and C Street will merge into the second auxiliary lane on the Columbia River bridge. The second auxiliary lane will end at the off-ramp to N Marine Drive, and the first auxiliary lane will end at the combined off-ramp to N Interstate Avenue and N Victory Boulevard.

Figure 3-4 shows a comparison of the one auxiliary lane and two auxiliary lane design options. Figure 3-5 shows a comparison of the footprints (i.e., the limit of permanent improvements) of the one auxiliary lane and two auxiliary lane design options. The footprints of the two options differ only over the Columbia River and in downtown Vancouver. The rest of the corridor would have the same footprint. The two auxiliary lanes would add 16 feet in total roadway width compared to the one auxiliary lane option due to the reduced shoulder width.

Figure 3-4. Comparison of Auxiliary Lane Design Options

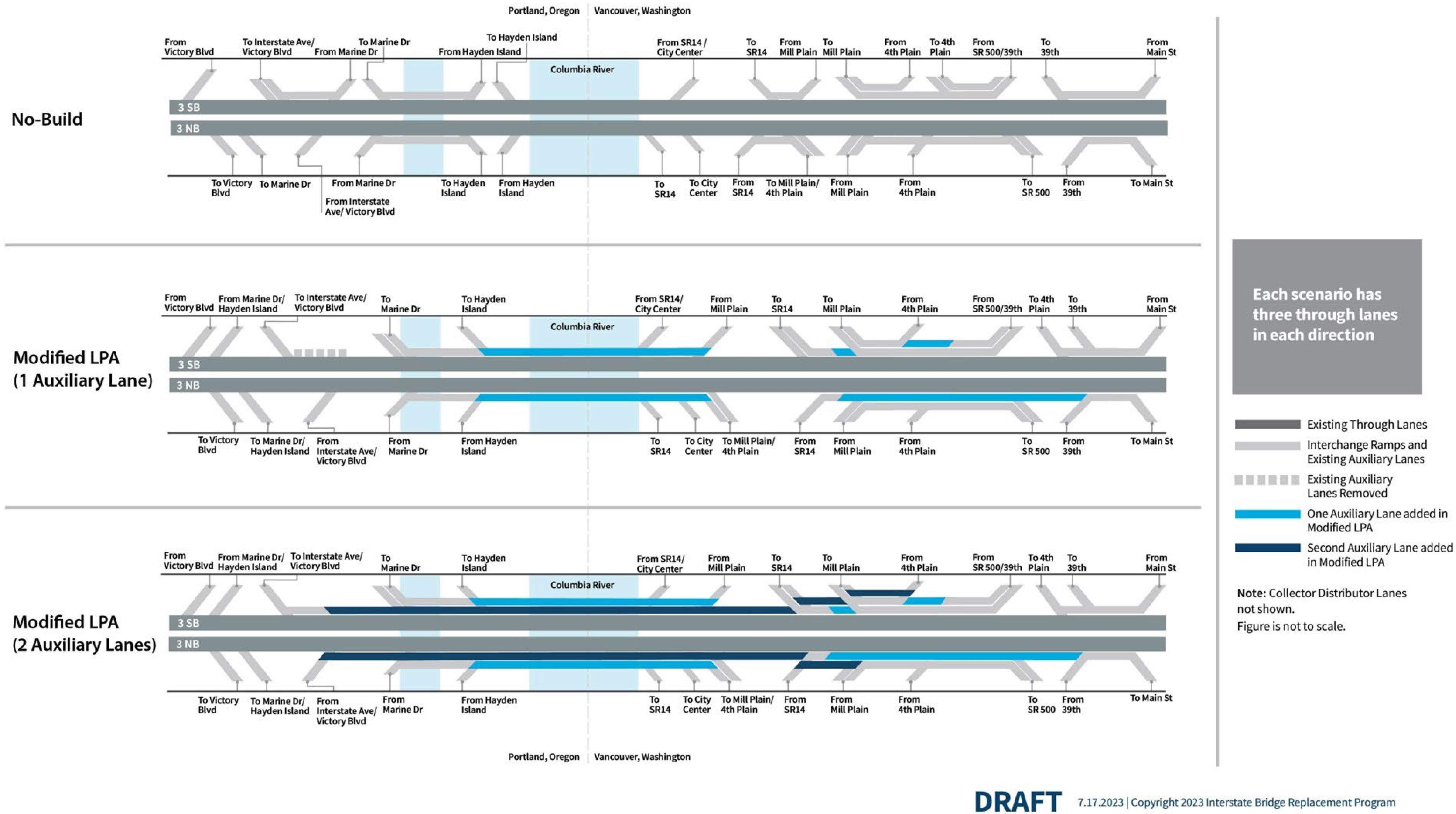
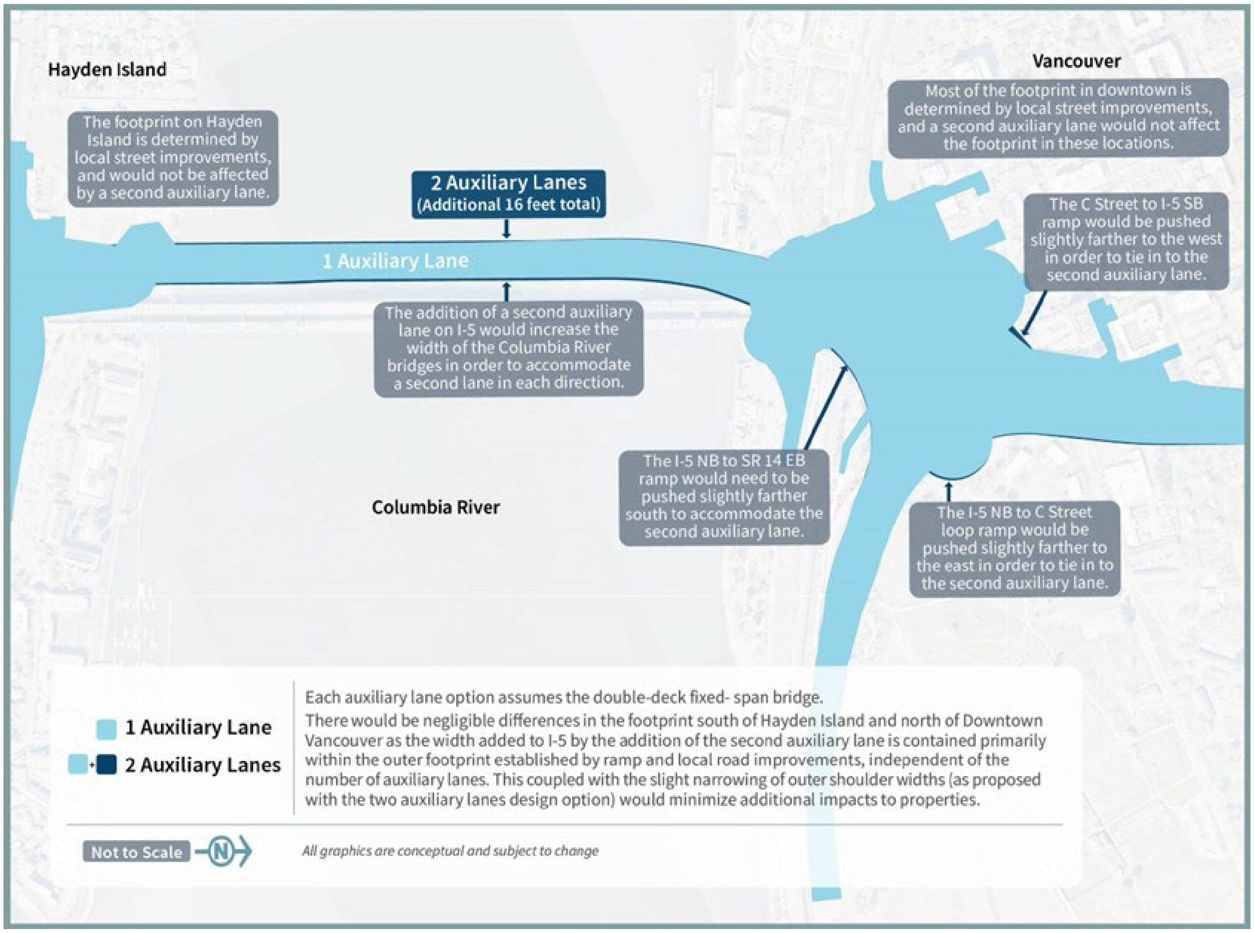


Figure 3-5. Auxiliary Lane Configuration Footprint Differences



3.2.2 Portland Mainland and Hayden Island (Area A)

See Figure 3-6 for all highway and interchange improvements in Area A, including the North Portland Harbor bridge. Refer to Figure 3-3 for an overview of the geographic subareas.

3.2.2.1 Highways, Interchanges, and Local Roadways

Victory Boulevard Interchange Area

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

Figure 3-6. Portland Mainland and Hayden Island (Area A)

Marine Drive Interchange Area

The next interchange north of the Victory Boulevard interchange is at Marine Drive. All movements within this interchange will be reconfigured to reduce congestion for motorists entering and exiting

I-5. The new configuration will be a single-point urban interchange. See Figure 3-6 for the Marine Drive interchange's layout and construction footprint.

The Marine Drive to I-5 southbound on-ramp will be braided over I-5 southbound to the N Victory Boulevard/N Denver Avenue off-ramp (see the Victory Boulevard Interchange Area section above). NE Martin Luther King Jr. Boulevard will have a new direct connection to I-5 northbound. Motorists traveling from N Marine Drive eastbound to I-5 southbound and those traveling from NE Martin Luther King Jr. Boulevard westbound to I-5 northbound will access I-5 without stopping at the entries to the on-ramps unless the pedestrian signal crossings of the ramp entrances were activated.

The new interchange configuration will change the westbound N Marine Drive and westbound N Vancouver Way connections to NE Martin Luther King Jr. Boulevard. An improved connection farther east of the interchange (near NE Haney Street) will provide access to westbound NE Martin Luther King Jr. Boulevard for these two streets. On the south side of NE Martin Luther King Jr. Boulevard, the existing loop connection will be replaced with a new connection farther east (near the access to the East Delta Park Owens Sports Complex).

N Expo Road from N Victory Boulevard to the Expo Center will be reconstructed with improved active transportation facilities. North of the Expo Center, N Expo Road will be extended under N Marine Drive and loop under I-5 to the east, connecting with N Vancouver Way through three roundabouts. Two of the new roundabouts will provide connections from the new local street extension to I-5 southbound and from I-5 northbound. An arterial bridge crossing North Portland Harbor will connect to the local road extension with a third roundabout.

To access Hayden Island using the arterial bridge from the east on NE Martin Luther King Jr. Boulevard, motorists will exit NE Martin Luther King Jr. Boulevard at the existing off-ramp to NE Vancouver Way just west of the NE Walker Street overpass. Then motorists travel west on NE Vancouver Way, through the intersection with N Marine Drive and straight through the roundabout to the arterial bridge.

From Hayden Island, motorists traveling south to Portland via NE Martin Luther King Jr. Boulevard will turn onto the arterial bridge southbound and travel straight through the roundabout onto NE Vancouver Way. At the intersection of NE Vancouver Way and N Marine Drive, motorists will turn right onto N Union Court and follow the existing road southeast to the existing on-ramp onto NE Martin Luther King Jr. Boulevard.

North Portland Harbor Bridges

To the north of the Marine Drive interchange is the Hayden Island interchange area, which is shown in Figure 3-6. I-5 crosses over the North Portland Harbor when traveling between these two interchanges. The existing Interstate Bridge spanning North Portland Harbor will be replaced to improve seismic resiliency.

Six new parallel bridges will be built across the waterway: one on the east side of the existing North Portland Harbor bridge and five on the west side or overlapping the location of the existing bridge (which will be removed). From west to east, these bridges will carry:

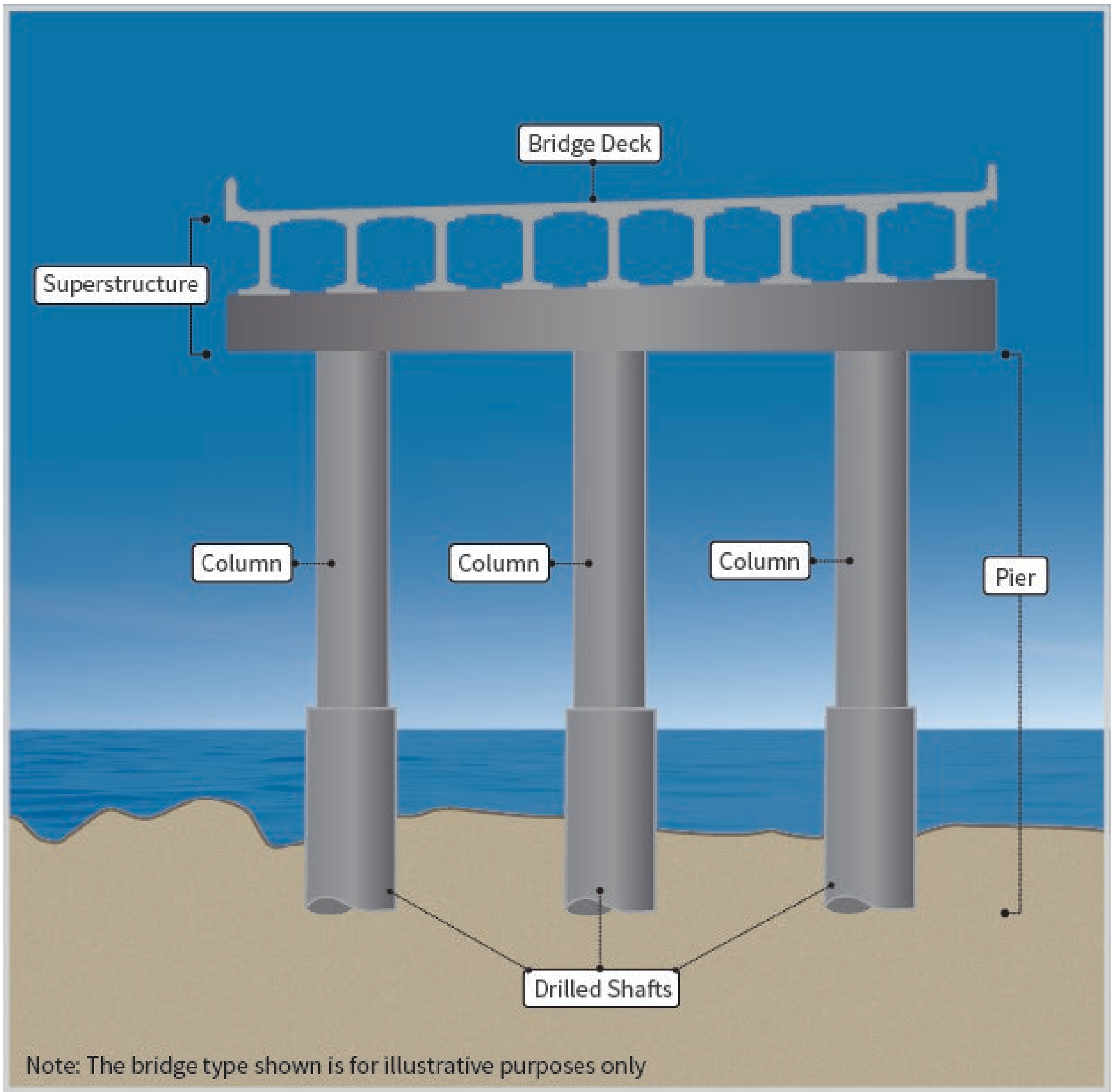
- The LRT tracks.
- The southbound I-5 off-ramp to N Marine Drive.
- The southbound I-5 mainline.
- The northbound I-5 mainline.
- The northbound I-5 on-ramp from N Marine Drive
- An arterial bridge between the Portland mainland and Hayden Island for local traffic; this bridge will also include a shared-use path for pedestrians and bicyclists.

Each of the six replacement North Portland Harbor bridges will be supported on foundations constructed of 10-foot diameter drilled shafts. Concrete columns will rise from the drilled shafts and connect to the superstructures of the bridges. All new structures will have at least as much vertical navigation clearance over North Portland Harbor as the existing North Portland Harbor bridge.

There is an existing levee along the south side of North Portland Harbor. All Modified LPA improvements will be coordinated with the USACE, in partnership with the Multnomah County Drainage District and the City of Portland, to preserve current and planned future improvements to the levees (the Levee Ready Project).

See Figure 3-7 for a conceptual cross section identifying the key structural features of the North Portland Harbor bridges. Additional technical detail regarding bridge construction is provided in Section 3.4.6.

Figure 3-7. North Portland Harbor Bridge Pier – Schematic Cross Section



Hayden Island Interchange Area

All traffic movements for the Hayden Island interchange will be reconfigured. See Figure 3-6 for a layout and construction footprint of the Hayden Island interchange.

A half-diamond interchange will be built on Hayden Island with a northbound I-5 on-ramp from Jantzen Drive and a southbound I-5 off-ramp to Jantzen Drive. This will lengthen the I-5 ramps and improve merging speeds compared to the existing substandard ramps that require acceleration and deceleration in a short distance. The I-5 mainline will be partially elevated and partially on fill across the island.

There will not be a southbound I-5 on-ramp or northbound I-5 off-ramp on Hayden Island. Connections to Hayden Island for those movements will be via the local access bridge connecting North Portland and Hayden Island. Vehicles traveling northbound on I-5 wanting to access Hayden Island would exit with traffic going to the Marine Drive interchange, cross under N Marine Drive to the new N Expo Road local street extension, and use the arterial bridge to cross North Portland Harbor. Vehicles on Hayden Island looking to enter I-5 southbound would use the new arterial bridge to cross North Portland Harbor, cross under I-5 using the new N Expo Road local street extension, cross under N Marine Drive, merge with the Marine Drive southbound on-ramp, and enter I-5 southbound near Victory Boulevard.

Improvements to Jantzen Avenue include additional left-turn and right-turn lanes at the interchange ramp terminals and active transportation facilities. Improvements to N Hayden Island Drive include new connections to the new arterial bridge over North Portland Harbor. The existing I-5 northbound and southbound access points from N Hayden Island Drive will also be removed. A new extension of N Tomahawk Island Drive will travel east-west through the middle of Hayden Island and under the I-5 interchange, thus improving connectivity across I-5 on the island.

3.2.2.2 Transit

A new light-rail alignment for northbound and southbound trains will be constructed within Area A (see Figure 3-6) to extend from the existing Expo Center MAX Station over North Portland Harbor to a new station at Hayden Island. An overnight LRV facility will be constructed on the southeast corner of the Expo Center property to provide storage for trains during hours when MAX is not in service. This facility is described in Section 3.2.6. The existing Expo Center MAX Station will be modified to remove the westernmost track and platform. Other platform modifications are also anticipated to transition to the extension alignment. Immediately north of the Expo Center MAX Station, the alignment will curve east toward I-5, pass beneath Marine Drive, cross the proposed N Expo Road local street extension and the 40-Mile Loop Trail at grade, then rise over the existing levee onto a light-rail bridge to cross North Portland Harbor.

On Hayden Island, proposed transit components include northbound and southbound LRT tracks over Hayden Island; the tracks will be elevated at approximately the height of the new I-5 mainline. An elevated LRT station will also be built on the island immediately west of I-5. The light-rail alignment will extend north on Hayden Island along the western edge of I-5 before transitioning onto the lower level of the new double-deck western bridge over the Columbia River (see Figure 3-6). For single-level bridge configurations, the light-rail alignment will extend to the outer edge of the western bridge over the Columbia River.

3.2.2.3 Active Transportation

In the Victory Boulevard interchange area (see Figure 3-6), active transportation facilities will be provided along N Expo Road between N Victory Boulevard and the Expo Center; this will provide a direct connection between the Victory Boulevard and Marine Drive interchange areas, as well as links to the Delta Park and Expo Center MAX Stations.

New shared-use path connections throughout the Marine Drive interchange area will provide access between the Bridgeton neighborhood (on the east side of I-5), Hayden Island, and the Expo Center MAX Station. There will also be connections to the existing portions of the 40-Mile Loop Trail, which runs north of Marine Drive under I-5 through the interchange area. The path will continue along the extension of N Expo Road under the interchange to the intersection of N Marine Drive and N Vancouver Way, where it will connect under NE Martin Luther King Jr. Boulevard to Delta Park.

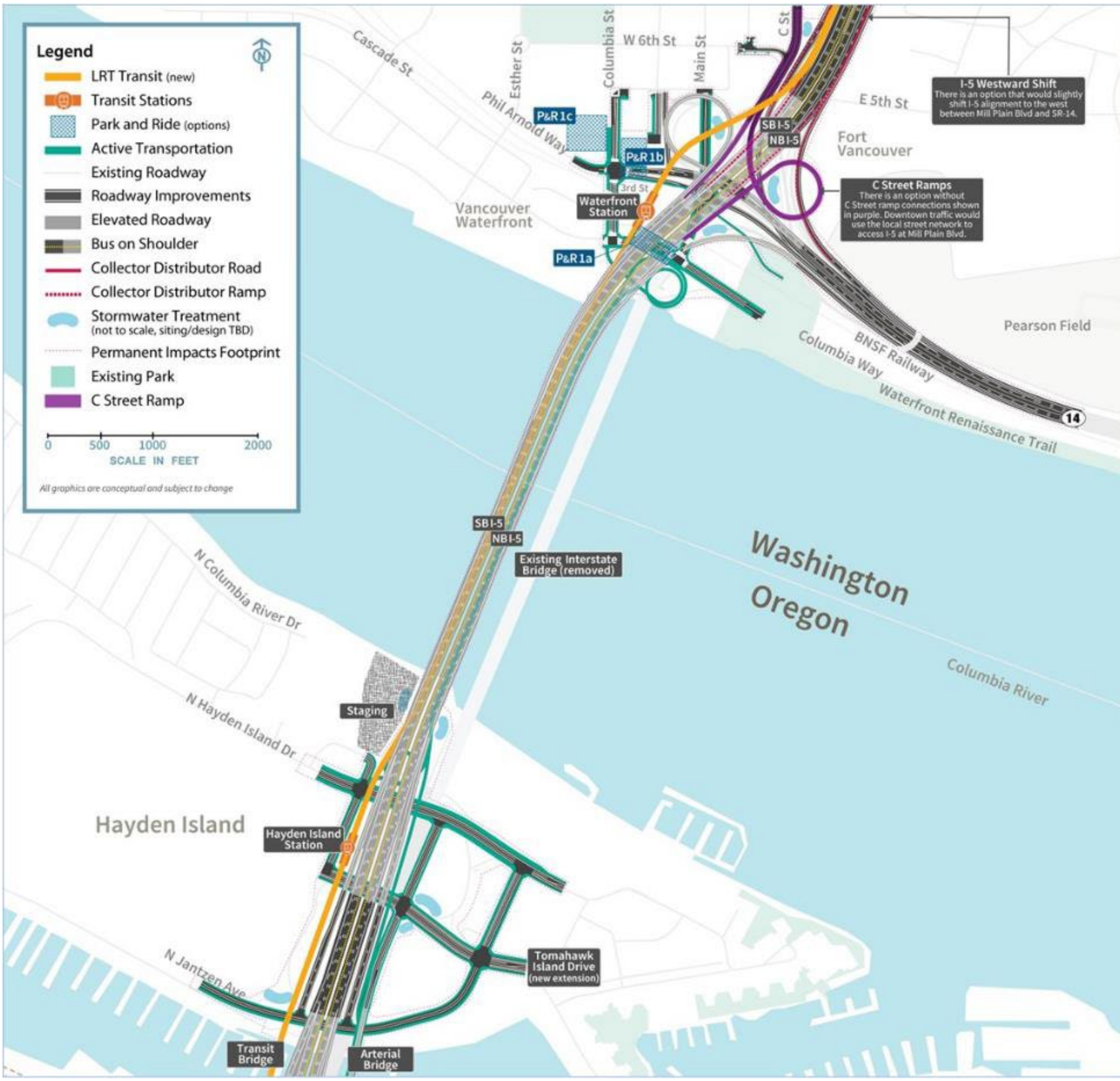
East of the Marine Drive interchange, new shared-use paths on NE Martin Luther King Jr. Boulevard and on the parallel street, N Union Court, will connect travelers to N Marine Drive and across the arterial bridge to Hayden Island. The shared-use facilities on NE Martin Luther King Jr. Boulevard will provide westbound and eastbound cyclists and pedestrians with off-street crossings of the interchange and will also provide connections to both the Expo Center MAX Station and the 40-Mile Loop Trail to the west.

The new arterial bridge over North Portland Harbor will include a shared-use path for pedestrians and bicyclists. On Hayden Island, pedestrian and bicycle facilities will be provided on Jantzen Avenue, N Hayden Island Drive, and N Tomahawk Island Drive. The shared-use path on the arterial bridge will continue along the arterial bridge to the south side of N Tomahawk Island Drive. A parallel elevated path from the arterial bridge will continue adjacent to I-5 across Hayden Island and cross above Tomahawk Island Drive and Hayden Island Drive to connect to the lower level of the new double-deck eastern bridge or the outer edge of the new single-level eastern bridge over the Columbia River. A ramp down to the north side of Hayden Island Drive will be provided from the elevated path.

3.2.3 Columbia River Bridges (Area B)

See Figure 3-8 for highway and interchange improvements in Area B. Refer to Figure 3-3 for an overview of the geographic subareas.

Figure 3-8. Columbia River Bridges (Area B)



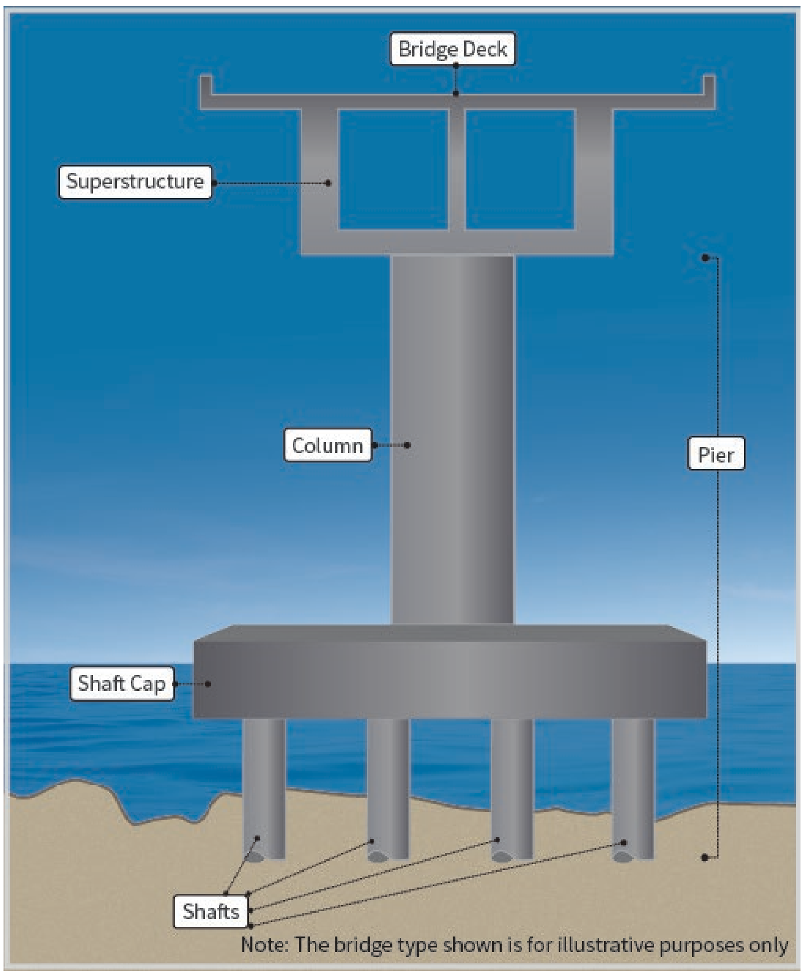
3.2.3.1 Highways, Interchanges, and Local Roadways

The existing Interstate Bridge will be replaced by two new parallel bridges, located west of the Interstate Bridge (see Figure 3-8). The new eastern (upstream) bridge will accommodate northbound highway traffic and a bicycle and pedestrian path. The new western (downstream) bridge will carry southbound traffic and two-way light-rail tracks.

Whereas the existing bridges each have three lanes with no shoulders, each of the two new bridges will be wide enough to accommodate three through lanes, one or two auxiliary lanes, and shoulders on both sides of the highway. Lanes and shoulders will be built to full design standards.

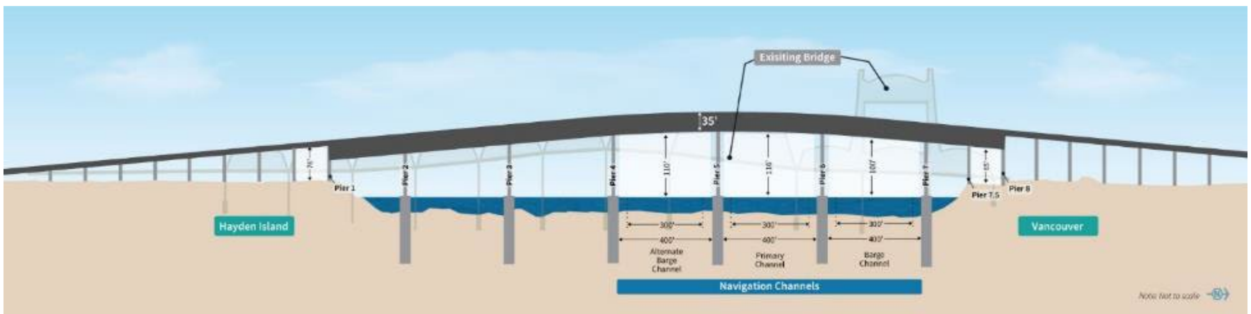
The existing Interstate Bridge has nine in-water pier sets, whereas the new Columbia River bridges will be built on six in-water pier sets, plus multiple piers on land. Each in-water pier set will be supported by a foundation of drilled shafts; each group of shafts would be tied together with a concrete shaft cap. Columns or pier walls will rise from the shaft caps and connect to the superstructures of the bridges (see Figure 3-9).

Figure 3-9. Columbia River Bridge Piers – Typical Section



As with the existing bridge, the new Columbia River bridges will provide three navigation channels: a primary channel and two barge channels (see Figure 3-10). The current location of the primary navigation channel is near the Vancouver shoreline where the existing lift spans are located. Under the Modified LPA, the primary navigation channel would be shifted south approximately 500 feet (measured by channel centerlines), and the existing center barge channel would shift north. Each of the three navigation channels will be 400 feet wide (this width includes a 300-foot congressionally or USACE-authorized channel plus a 50-foot channel maintenance buffer on each side of the authorized channel). See Section 3.4.14.2 for additional information regarding the navigation channels.

Figure 3-10. Columbia River Bridges – Profile and Vertical Navigation Clearance (Double-Deck, Fixed-Span Bridge)



Columbia River Bridges Configuration Options

There are three bridge configuration options: a double-deck fixed-span bridge, a single-level fixed-span bridge, and a single-level movable-span bridge. The two fixed-span bridge options each provide 116 feet of vertical navigation clearance, as was assumed at the time the CRC project was suspended in 2013. The double-deck fixed-span configuration was the assumed bridge configuration for the CRC project. The single-level fixed-span was developed in response to physical and contextual changes since 2013 that warranted examination of a refinement in the double-deck bridge configuration based on current design and operational requirements. The single-level movable-span option is the only bridge option that provides a vertical navigation clearance of at least 178 feet (in the movable-span open position) per the USCG Preliminary Navigation Clearance Determination (USCG 2022).

Each of the bridge configuration options assumes one auxiliary lane; two auxiliary lanes could be applied to any of the bridge configurations.

Double-Deck Fixed-Span Bridge Configuration

The double-deck fixed-span bridges configuration would be two side-by-side, double-deck fixed-span steel truss bridges. Figure 3-11 is an example of this configuration (this image is subject to change and is shown as a representative concept; it does not depict the final design). The double-deck fixed-span bridges configuration would provide 116 feet of vertical navigation clearance for river traffic using the primary navigation channel and 400 feet of horizontal navigation clearance at the primary navigation channel and barge channels. This bridge height would not impede takeoffs and landings by aircrafts using Pearson Field or Portland International Airport.

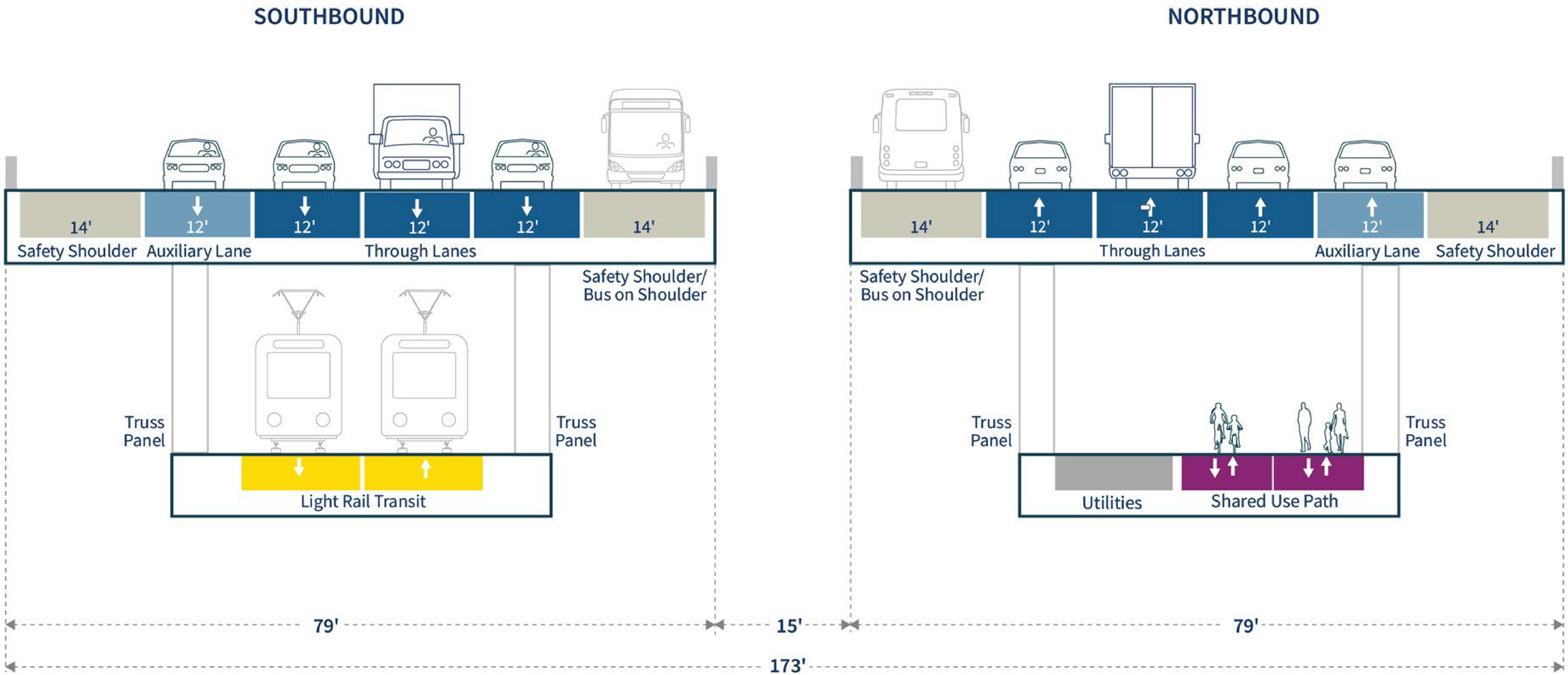
The eastern bridge would accommodate northbound highway traffic on the upper level and a bicycle and pedestrian path and utilities underneath. The western bridge would carry southbound traffic on the upper level and two-way light-rail tracks below. Each bridge deck would be 79 feet wide, with a total out-to-out width of 173 feet. Figure 3-12 is a cross section of the two parallel double-deck bridges.

Like all bridge configurations, the double-deck fixed-span bridge configuration would have six in-water pier sets. Each pier would require 12 in-water drilled shafts, for a total of 72 in-water drilled shafts. Each shaft cap would be approximately 50 feet by 85 feet.

This bridge configuration would have a 3.8% maximum grade on the Oregon side of the bridge and a 4% maximum grade on the Washington side.

Figure 3-11. Example of a Double-Deck Fixed-Span Truss Bridge

Figure 3-12. Columbia River Bridges Deck Cross Section – Double-Deck, Fixed-Span Bridge



Single-Level, Fixed-Span Bridge Configuration

The single-level fixed-span bridges configuration will have two side-by-side, single-level fixed-span steel or concrete bridges. The single-level fixed-span bridge has several bridge type options including, but not limited to, a girder bridge, an extradosed bridge, or a finback bridge. Conceptual examples of each of these options are shown on Figure 3-13. These images are subject to change and do not represent final design.

This configuration will provide 116 feet of vertical navigation clearance for river traffic using the primary navigation channel and 400 feet of horizontal navigation clearance at the primary navigation channel and barge channels. This bridge height will not impede takeoffs and landings by aircrafts using Pearson Field or Portland International Airport.

The eastern bridge would accommodate northbound highway traffic and provide a bicycle and pedestrian path; the bridge deck will be 104 feet wide. The western bridge will carry southbound traffic and two-way light-rail tracks; the bridge deck would be 113 feet wide. I-5 highway, light-rail tracks, and the shared-use path will be on the same level across the two bridges, instead of the double-deck configuration. The total out-to-out width of the single-level fixed-span configuration will be 272 feet at its widest point, approximately 99-feet wider than the double-deck bridge. Figure 3-14 shows a typical cross section of the single-level bridge design option. This cross section is a representative example of an extradosed or finback bridge as shown by the 10-foot-wide superstructure above the bridge deck.

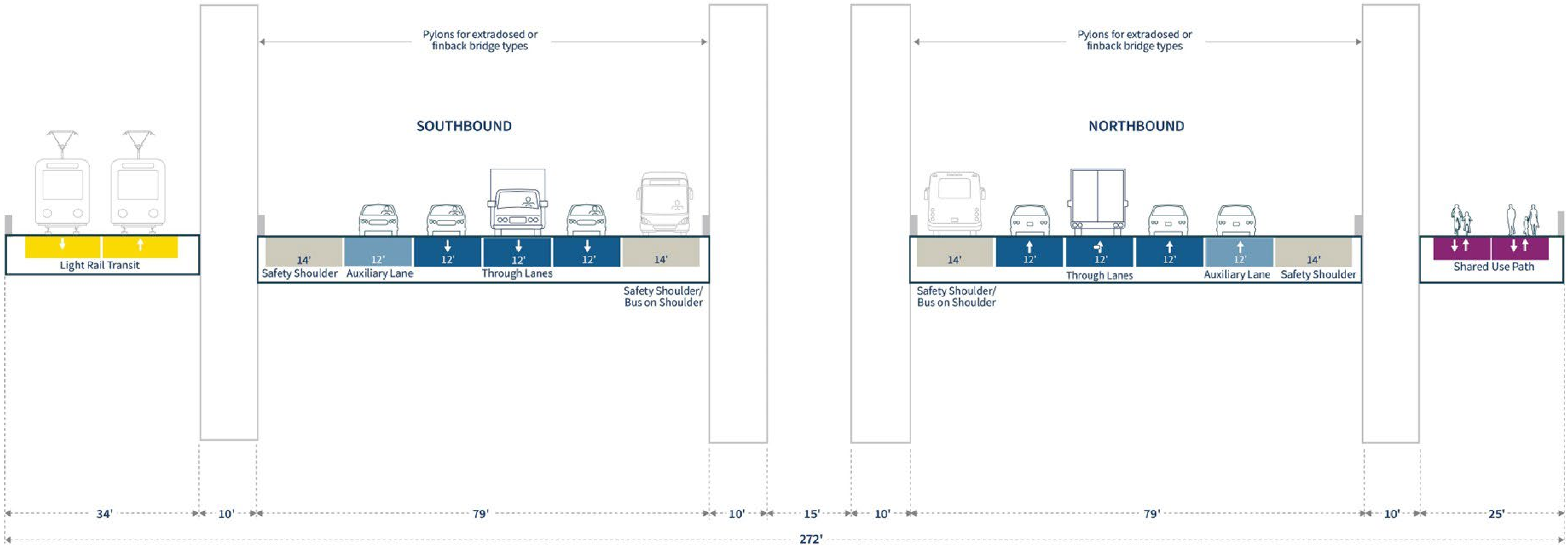
There will be the six in-water piers per bridge and two piers on land per bridge. Each pier will require 16 in-water drilled shafts, for a total of 96 in-water drilled shafts. The shaft caps would be 50 feet by 230 feet.

This bridge configuration will have a 3% maximum grade on the Oregon side of the bridge and a 1.5% maximum grade on the Washington side.

Figure 3-13. Examples of Single-Level Fixed-Span Bridge Types

Visualizations are for illustrative purposes only. They do not reflect property impacts or represent final design.

Figure 3-14. Columbia River Bridges Deck Cross Section – Single-Level, Fixed-Span Bridge Option



Single-Level Movable-Span Bridge Configuration

The single-level movable-span bridges configuration will have two side-by-side, single-level steel girder bridges with movable lift spans between Piers 5 and 6. A conceptual example of this bridge type is shown on Figure 3-15. These images are subject to change and do not represent final design.

The movable-span configuration will be a vertical lift span with counterweights.[8] The lift span towers will be approximately 243 feet high (the existing lift span tower is 247 feet high). A movable-lift span needs to be located on a straight and flat bridge section (i.e., without curvature and with minimal slope). With this requirement, and in order for the bridge to maintain the highway, transit, and active transportation connections on Hayden Island and in Vancouver, the lift span will need to be located farther south than the existing lift span, between Piers 5 and 6. To accommodate this location of the movable-span configuration, the IBR Program is coordinating with USACE to obtain authorization for changing the location of the primary navigation channel, which currently aligns with the Interstate Bridge lift spans near the Washington shoreline.

The single-level movable-span will would provide 89 feet of vertical navigation clearance over the existing primary navigation channel when the movable lift spans are in the closed position. The 89-foot vertical clearance was determined based on a requirement to provide a minimum of 72 feet of vertical clearance (the existing maximum clearance of the Interstate Bridge when the lift span is in the closed position), achieving a straight, flat bridge span, while maintaining an acceptable grade for transit operations. In the open position, the bridges would provide 178 feet of vertical navigation clearance over the proposed relocated primary navigation channel. Similar to the fixed-span configurations, this configuration will provide 400 feet of horizontal navigation clearance at the primary navigation channel and two barge channels.

Similar to the single-level fixed-span configuration, the eastern bridge will accommodate northbound highway traffic and a bicycle and pedestrian path and the western bridge will carry southbound traffic and two-way light-rail tracks. I-5 highway, light-rail tracks, and the shared-use path will be on the same level across the two bridges instead of the double-deck configuration. The cross section of the single-level movable-span bridge design option is shown on Figure 3-16. The cross section of the movable spans (Piers 5 and 6) is shown in the top image, and the cross section of the fixed spans (Piers 2, 3, 4, and 7) is shown in the bottom image. The cross sections are slightly different because, for the movable-span configuration, the cross section requires lift towers, which are not required for the fixed-span configurations.

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

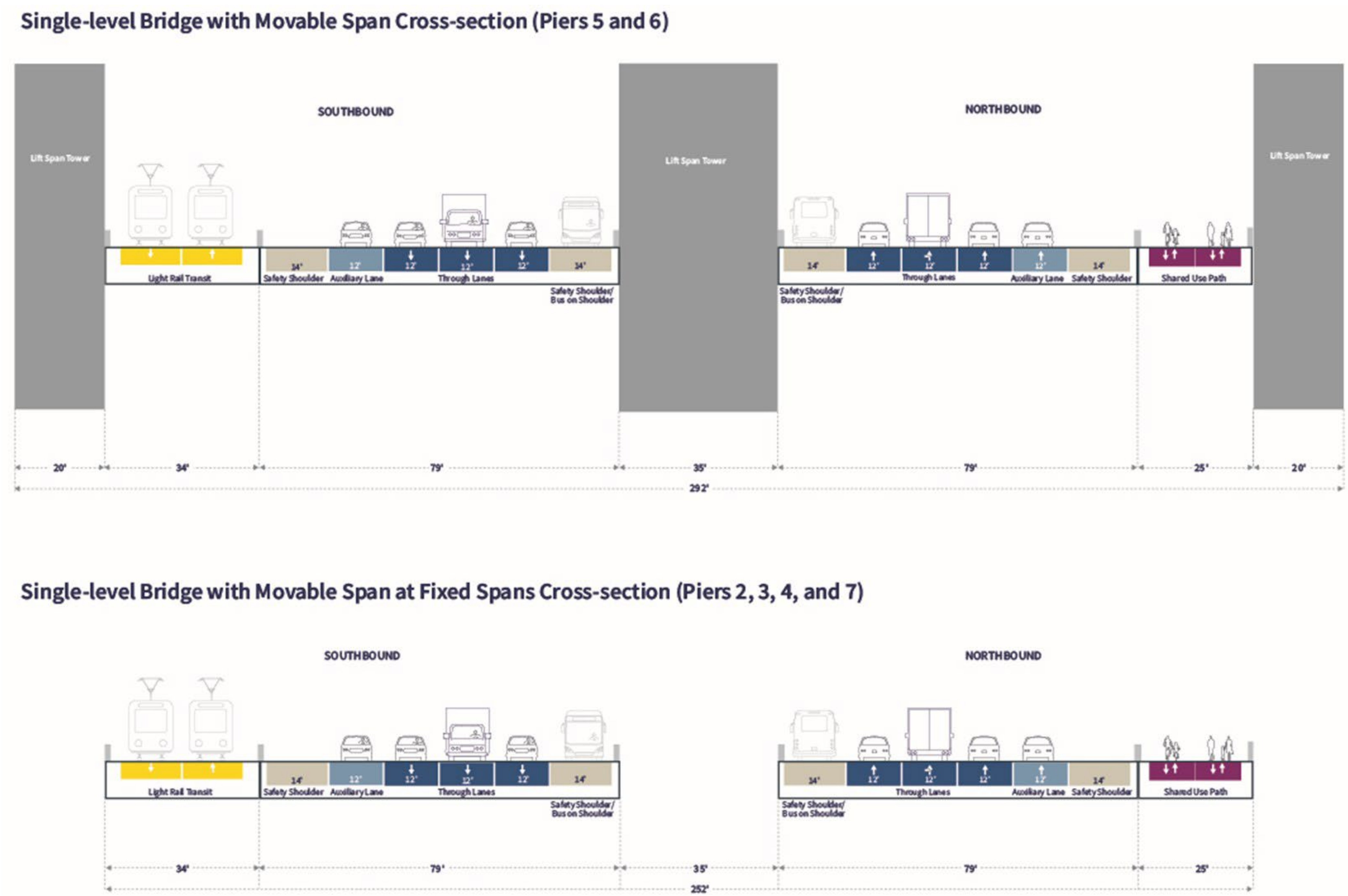
This bridge configuration would have a 1% maximum grade on the Oregon side of the bridge and a 4% maximum grade on the Washington side.

[8] Other types of movable spans, such as a bascule and swing spans, may be considered as the design advances.

Figure 3-15. Example of Single-Level Movable-Span Girder Bridge in the Closed and Open Positions

Visualizations are for illustration purposes only. They do not reflect property impacts or final design.

Figure 3-16. Columbia River Bridges Deck Cross Section – Single-Level Bridge with Movable-Span Option



Summary of Bridge Configurations

This section summarizes and compares each of the bridge configuration options.

Table 3-1 lists the key considerations for each bridge configuration. Figure 3-17 compares each bridge configuration's footprint. The footprints of each configuration would only differ in three locations: over the Columbia River and at the bridge landings in Hayden Island and Vancouver. The rest of the I-5 corridor would have the same footprint. Over the Columbia River, the single-level fixed-span option would be approximately 99 feet wider than the double-deck fixed-span option. The single-level movable-span configuration would have the same footprint as the single-level fixed-span configuration, except at Piers 5 and 6, where larger bridge foundations would be required to support the movable span. The single-level options would have a wider footprint at the bridge landings on Hayden Island and Vancouver because transit and active transportation would be located adjacent to the highway, rather than below the highway in the double-deck option.

Figure 3-18 shows a comparison of the profile of each bridge configuration. The lower deck of the double-deck fixed-span and the single-level fixed-span configurations have similar profiles. The single-level movable-span configuration has a lower profile than the fixed-span configurations when the span is in the closed position.

Figure 3-17. Bridge Configurations Footprint Comparison

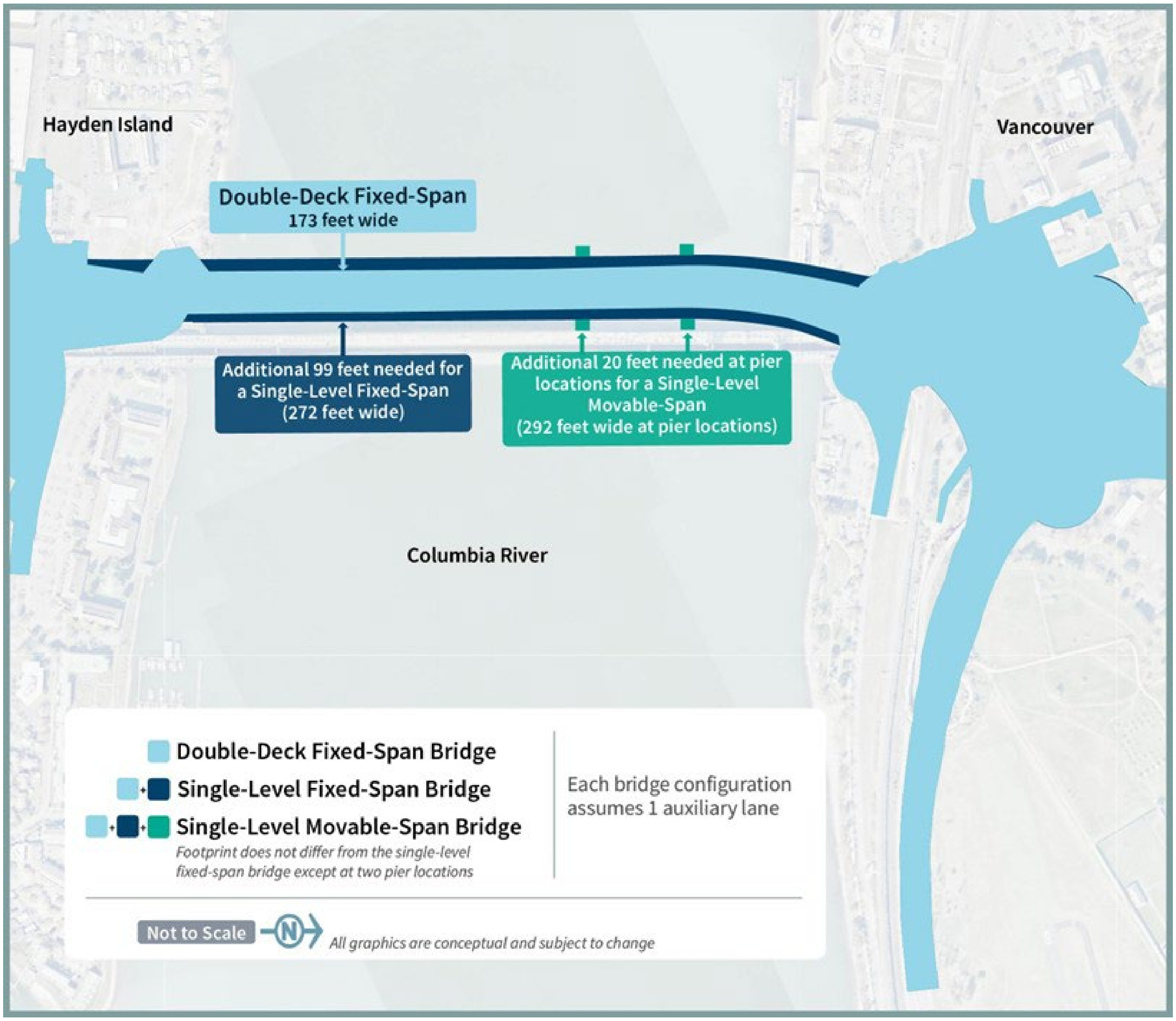

Hayden Island
Vancouver
Double-Deck Fixed-Span
173 feet wide
Additional 99 feet needed for a Single-Level Fixed-Span (272 feet wide)
Additional 20 feet needed at pier locations for a Single-Level Movable-Span (292 feet wide at pier locations)
Columbia River
Double-Deck Fixed-Span Bridge
Single-Level Fixed-Span Bridge
Single-Level Movable-Span Bridge
Footprint does not differ from the single-level fixed-span bridge except at two pier locations
Each bridge configuration assumes 1 auxiliary lane
Not to Scale
N
All graphics are conceptual and subject to change

Figure 3-18. Bridge Design Option Profile Comparision

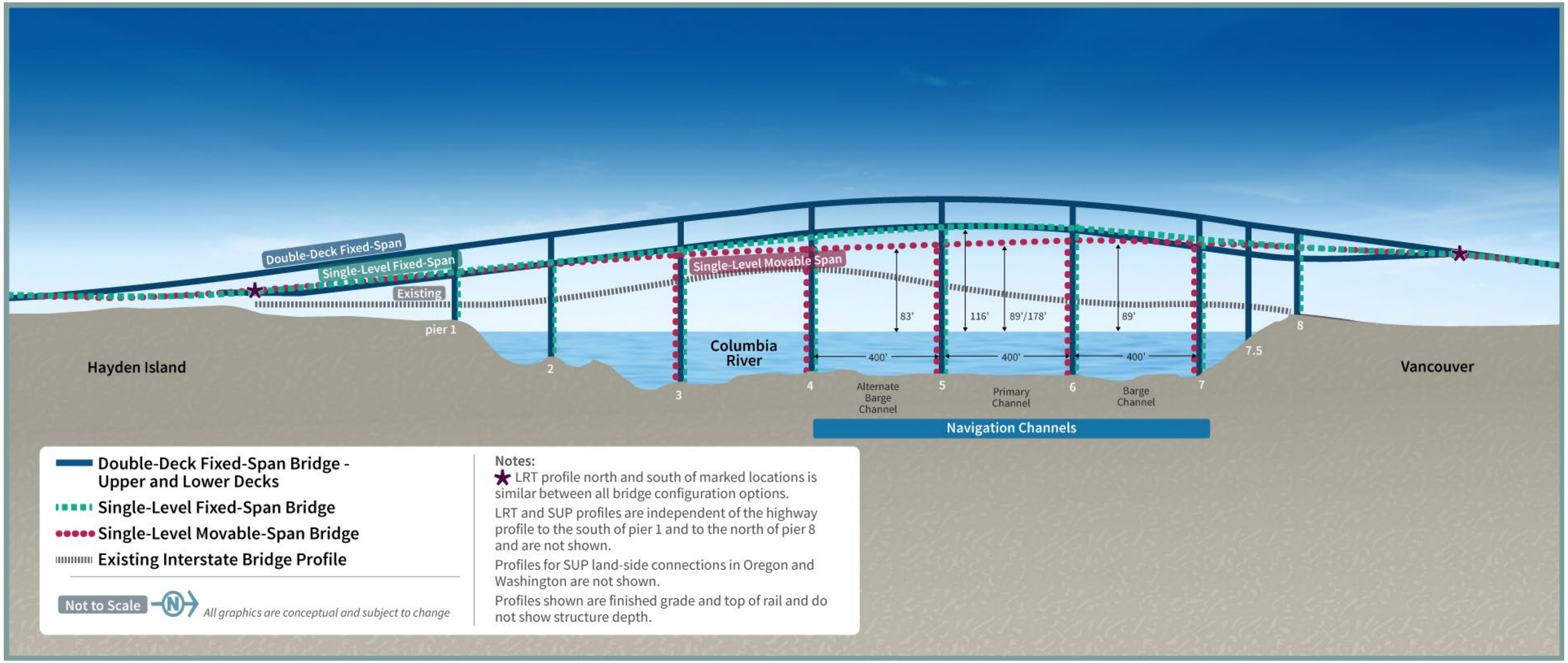


Table 3-1. Summary of Columbia River Bridge Design Options

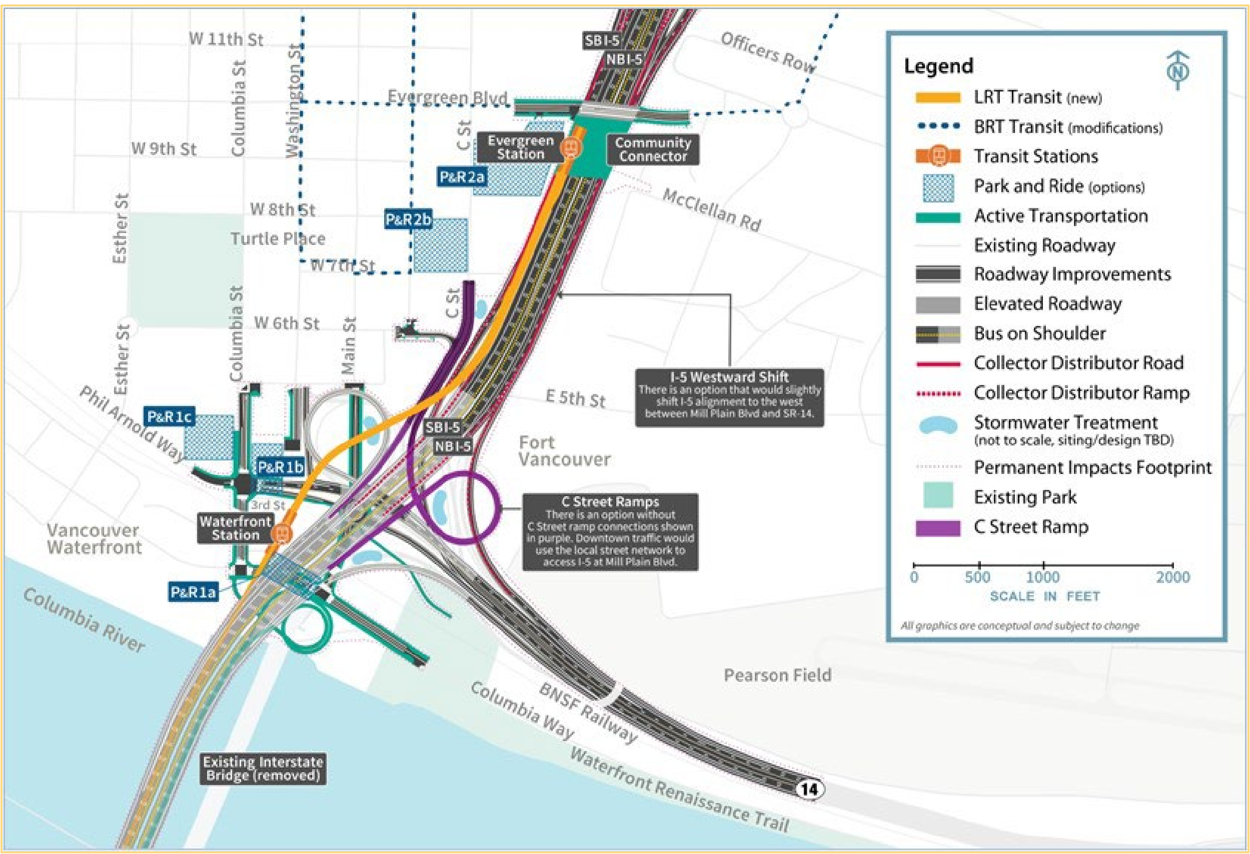
	Existing Interstate Bridge	Modified LPA with Double-Deck Bridges	Modified LPA with Single-Level Fixed-Span Bridges	Modified LPA with Single-Level Movable-Span Bridges
Bridge type	Steel through-truss spans	Double-deck truss	Single-level, concrete or steel girders, extradosed or finback	Single-level, steel girders, with movable lift span between piers 5 and 6
Number of bridges	Two	Two	Two	Two
Movable-span type	Vertical lift span with counterweights.	N/A	N/A	Vertical lift span with counterweights
Movable-span location	Adjacent to Vancouver shoreline	N/A	N/A	Between Piers 5 and 6
Out-to-out width[2]	138 feet total width	173 feet total width	272 feet total width	292 feet at the movable span 252 feet at the fixed span
Deck widths	52 feet (SB) 52 feet (NB)	79 feet (SB) 79 feet (NB)	113 feet (SB) 104 feet (NB)	113 feet SB fixed span 104 feet NB fixed span
Approximate tower height	247 feet	N/A	N/A	243 feet
Span length between Piers 5 and 6 (from center of pier to center of pier)	278 feet	450 feet	450 feet	450 feet
Number of in-water piers	Nine	Six pier sets per bridge	Six pier sets per bridge	Six pier sets per bridge
Number of drilled shafts	N/A	72	96	108
Shaft cap dimensions	N/A	50 feet by 85 feet	50 feet by 230 feet[3]	Piers 2, 3, 4, and 7: 50 feet by 230 feet Piers 5 and 6: 50 feet by 312 feet (one combined footing at each location to house tower/equipment for the lift span)

Notes:
1 "Out-to-out width" is the measurement between the outside edges of the bridge across its width at the widest point.
2 Dimensions are associated with the extradosed or finback bridge type (with cantilevered deck). A steel or concrete girder bridge type may have slightly different dimensions
Key: LPA = Locally Preferred Alternative; N/A = not applicable; NB = northbound; SB = southbound

3.2.4 Downtown Vancouver (Area C)

See Figure 3-19 for all highway and interchange improvements in Area C. Refer to Figure 3-3 for an overview of the geographic subareas.

Figure 3-19. Downtown Vancouver (Area C)



3.2.4.1 Highways, Interchanges, and Local Roadways

North of the Interstate Bridge in downtown Vancouver, improvements are proposed to the SR 14 interchange (Figure 3-19).

SR 14 Interchange

The new Columbia River bridges will touch down just north of the SR 14 interchange (Figure 3-19). The function of the SR 14 interchange will remain essentially the same as it is now, although the interchange will be elevated. Direct connections between I-5 and SR 14 will be rebuilt. Access to and from downtown Vancouver will be provided as it is today, but the connection points will be relocated.

Downtown Vancouver I-5 access to and from the south will be at C Street as it is today, while downtown connections to and from SR 14 will be from Columbia Street at W 3rd Street.

Main Street will be extended between 5th Street and Columbia Way. Vehicles traveling from downtown Vancouver to access SR 14 eastbound will use the new extension of Main Street to the roundabout underneath I-5. If coming from the west or south (waterfront) in downtown Vancouver, vehicles will use the Phil Arnold Way/3rd Street extension to the roundabout, then continue to SR 14 eastbound. The existing Columbia Way roadway under I-5 will be realigned to the north of its existing location and will intersect both the new Main Street extension and Columbia Street with T intersections.

In addition, the existing overcrossing of I-5 at Evergreen Boulevard will be reconstructed.

Design Option Without C Street Ramps

Under this design option, downtown Vancouver I-5 access to and from the south will be through the Mill Plain interchange rather than C Street. There will be no eastside loop ramp from I-5 northbound to C Street and no directional ramp on the west side of I-5 from C Street to I-5 southbound. The existing eastside loop ramp will be removed.

Design Option to Shift I-5 Westward

This design option shifts the I-5 mainline and ramps approximately 40 feet to the west between SR 14 and Mill Plain Boulevard. The westward I-5 alignment shift could also be paired with the design option without C Street ramps.

3.2.4.2 Transit

Light-Rail Alignment and Stations

After crossing the Columbia River, the light-rail tracks will exit the highway bridge and be supported by their own bridge along the west side of the I-5 mainline (see Figure 3-19). The light-rail bridge will cross approximately 35 feet over the Burlington Northern Santa Fe Railway (BNSF) railway tracks. An elevated station near the Vancouver waterfront (Waterfront Station) will be situated near the crossing of the BNSF tracks between Columbia Way and W 3rd Street. Access to the elevated station will primarily be by elevator as the station is situated approximately 75 feet above existing ground. A stairwell(s) will be provided for emergency egress. The number of elevators and stairwells provided will be determined based on the ultimate platform configuration, station location relative to the BNSF trackway, projected ridership, and fire and life safety requirements. Passenger drop-off facilities will be located at ground level and will be coordinated with the C-TRAN bus service at this location. The elevated light-rail tracks will continue north, cross over the westbound SR 14 on-ramp and the C Street/6th Street on-ramp to southbound I-5, and then straddle the southbound I-5 CD roadway. Transit components in the downtown Vancouver area are similar between the two SR 14 interchange area design options discussed above.

North of the Waterfront Station, the light-rail tracks will continue to the Evergreen Station, which will be the terminus of the IBR Program light-rail extension (see Figure 3-19). The light-rail tracks from downtown Vancouver to the terminus will be entirely on an elevated structure supported by single columns, where feasible, or by columns on either side of the roadway where needed. The light-rail tracks will be a minimum of 27 feet above the I-5 roadway surface. The Evergreen Station will be located at the same elevation as Evergreen Boulevard, on the proposed Community Connector, and will provide connections to C-TRAN's existing bus rapid transit system. Passenger drop-off facilities will be located in proximity to the station and will be coordinated with the C-TRAN bus service at this location.

Park and Rides

Up to two park and rides could be built in Vancouver along the light-rail alignment: one near the Waterfront Station and one near the Evergreen Station. There is also an option where no park and ride is constructed at either of the stations.

Waterfront Station Park-and-Ride Options

There are three options for the park and ride near the Waterfront Station (see Figure 3-19). Each will accommodate up to 570 parking spaces.

1. Columbia Way (below I-5) – This park-and-ride site will be a multilevel aboveground structure located below the new Columbia River bridges immediately north of a realigned Columbia Way.
2. Columbia Street/SR 14 – This park-and-ride site will be a multilevel aboveground structure located along the east side of Columbia Street. It could span across (or over) the SR 14 westbound off-ramp to provide parking on the north and south sides of the off-ramp.
3. Columbia Street/Phil Arnold Way (Waterfront Gateway Site) – This park-and-ride site will be located along the west side of Columbia Street immediately north of Phil Arnold Way. This park-and-ride will be developed in coordination with the City of Vancouver's Waterfront Gateway program and will be a joint use parking facility not constructed exclusively for park-and-ride users.

Evergreen Station Park-and-Ride Options

There are two options for the park and ride near the Evergreen Station (see Figure 3-19).

1. Library Square – This park-and-ride site will be located along the east side of C Street and south of Evergreen Boulevard. It will accommodate up to 700 parking spaces in a multilevel belowground structure according to future agreement on City-owned property associated with Library Square. Current design concepts suggest the park and ride most likely will be a joint use parking facility for park-and-ride users and patrons of other uses on the ground or upper levels as negotiated as part of future decisions.
2. Columbia Credit Union – This park-and-ride site is an existing multistory garage that is located below the Columbia Credit Union office tower along the west side of C Street between E 7th

Street and E 8th Street. The existing parking structure currently serves the office tower above it and the Regal City Center across the street. This will be a joint use parking facility, not for the exclusive use of park-and-ride users, that could serve as additional or overflow parking if the 700 required parking spaces cannot be accommodated elsewhere.

3.2.4.3 Active Transportation

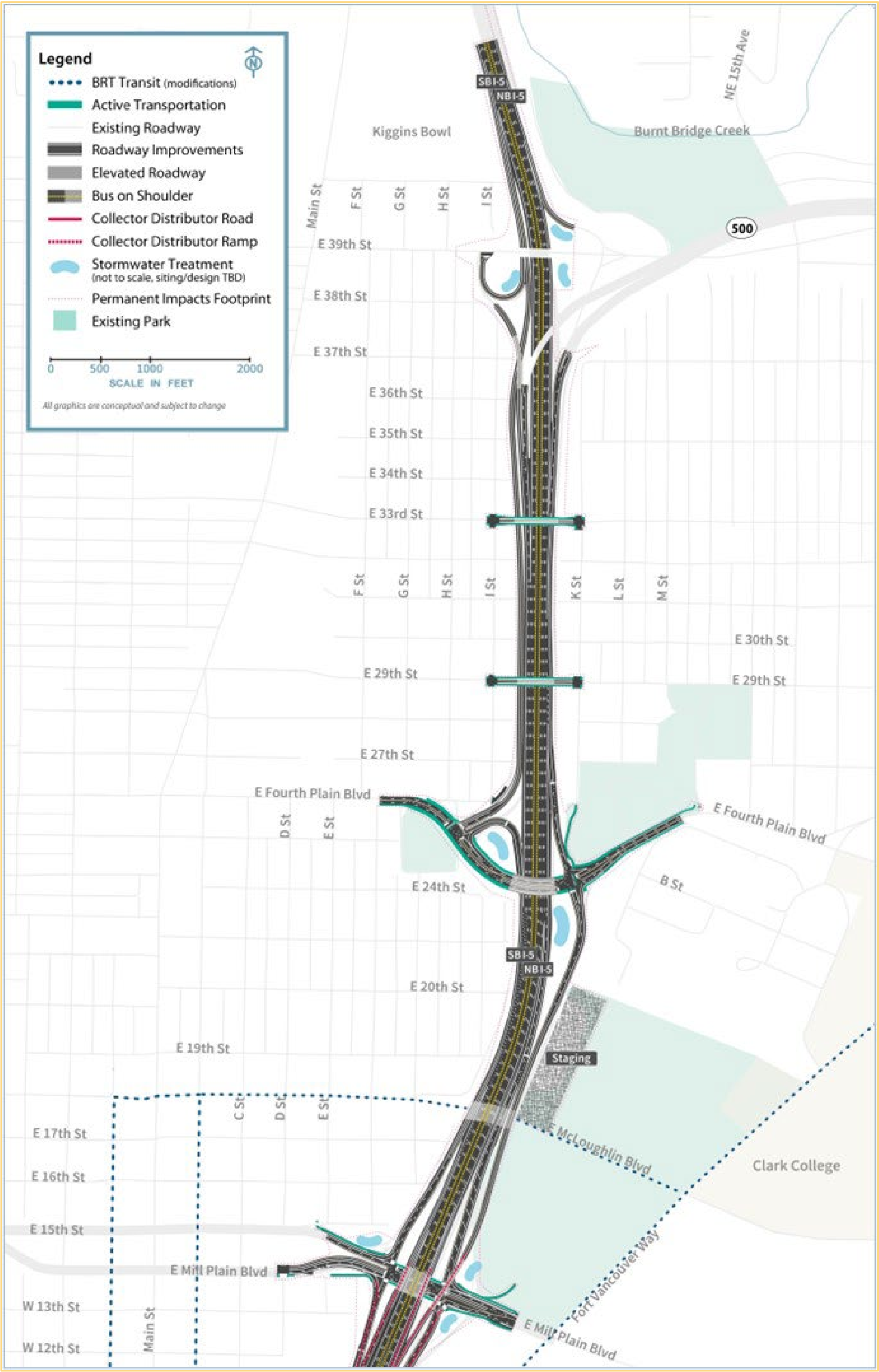
Within the downtown Vancouver area, the shared-use path on the eastern, northbound bridge will exit the bridge at the SR 14 interchange, loop down on the east side of I-5 via a vertical spiral path, and then cross back to the west side of I-5 to connect onto the Waterfront Renaissance Trail on Columbia Street and into Columbia Way (see Figure 3-19). Active transportation components in the downtown Vancouver area will be similar without the C Street ramps and with the I-5 westward shift.

An active transportatin overcrossing will be built above I-5 just south of Evergreen Boulevard. The overcrossing will be constructed as a public open space (referred to as the Community Connector) with pedestrian connections between the east and west sides of I-5 (see Figure 3-19). The light-rail terminus at the Evergreen Station will be located just west of the Community Connector.

3.2.5 Upper Vancouver (Area D)

See Figure 3-20 for all highway and interchange improvements in Area D. Refer to Figure 3-3 for an overview of the geographic subareas.

Figure 3-20. Upper Vancouver (Area D)



3.2.5.1 Highways, Interchanges, and Local Roadways

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

Mill Plain Boulevard Interchange

The Mill Plain Boulevard interchange is north of the SR 14 interchange (see Figure 3-20). This interchange will be reconstructed as a tight-diamond configuration but will otherwise remain similar in function to the existing interchange. The ramp terminal intersections will be sized to accommodate high, wide heavy freight vehicles that travel between the Port of Vancouver and I-5. The off-ramp from I-5 northbound to E Mill Plain Boulevard will continue to provide access to E Fourth Plain Boulevard via a CD roadway. The off-ramp to E Fourth Plain Boulevard will be reconstructed and will cross over E Mill Plain Boulevard east of I-5, similar to the way it functions today.

Fourth Plain Boulevard Interchange

At the Fourth Plain Boulevard interchange (Figure 3-20), improvements will include reconstruction of the overpass of I-5 and the ramp terminal intersections. Northbound I-5 traffic exiting to E Fourth Plain Boulevard will first exit to the northbound CD roadway which provides off-ramp access to E Fourth Plain Boulevard and E Mill Plain Boulevard. The westbound SR 14 to northbound I-5 on-ramp also joins the northbound CD roadway before continuing north past the Fourth Plain Boulevard and Mill Plain Boulevard off-ramps as an auxiliary lane. The southbound I-5 off-ramp to E Fourth Plain Boulevard will be braided below the E 39th Street on-ramp to southbound I-5. This change will eliminate the existing nonstandard weave between the SR 500 interchange and the off-ramp to E Fourth Plain Boulevard. It will also eliminate the existing westbound SR 500 to Fourth Plain Boulevard off-ramp connection. The existing overcrossing of I-5 at E 29th Street will be reconstructed to accommodate a widened I-5, provide adequate vertical clearance over I-5, and provide pedestrian and bicycle facilities.

SR 500 Interchange

The northern terminus of the I-5 improvements will be in the SR 500 interchange area (Figure 3-20). The improvements will be minor and primarily connect the Modified LPA to existing ramps. The off-ramp from I-5 southbound to E 39th Street will be reconstructed to establish the beginning of the braided ramp to E Fourth Plain Boulevard and restore the loop ramp to E 39th Street. Ramps from existing I-5 northbound to SR 500 eastbound and from E 39th Street to I-5 northbound will be partially reconstructed. The existing bridges for E 39th Street over I-5 and SR 500 westbound to I-5 southbound will be retained. The E 39th Street to I-5 southbound on-ramp will be reconstructed and braided over (i.e., grade separated or pass over) the new I-5 southbound off-ramp to E Fourth Plain Boulevard.

The existing overcrossing of I-5 at E 33rd Street will also be reconstructed to accommodate a widened I-5, provide adequate vertical clearance over I-5, and provide pedestrian and bicycle facilities.

3.2.5.2 Transit

There will be no LRT facilities in upper Vancouver. Proposed operational changes to bus service, including I-5 bus-on-shoulder service, are described in Section 3.2.7.

3.2.5.3 Active Transportation

Several active transportation improvements will be made in Area D consistent with City of Vancouver plans and policies. At the Fourth Plain Boulevard interchange, there will be improvements to provide better bicycle and pedestrian mobility and accessibility; these include bicycle lanes, neighborhood connections, a tie-in to the planned city of Vancouver road diet,[9] and two-way cycle track on E Fourth Plain Boulevard. The reconstructed overcrossings of I-5 at E 29th Street and E 33rd Street will provide pedestrian and bicycle facilities on those cross streets. No new active transportation facilities are proposed in the SR 500 interchange area. Active transportation improvements at the Mill Plain Boulevard interchange include buffered bicycle lanes and sidewalks, pavement markings, lighting, and signing.

3.2.6 Transit Support Facilities

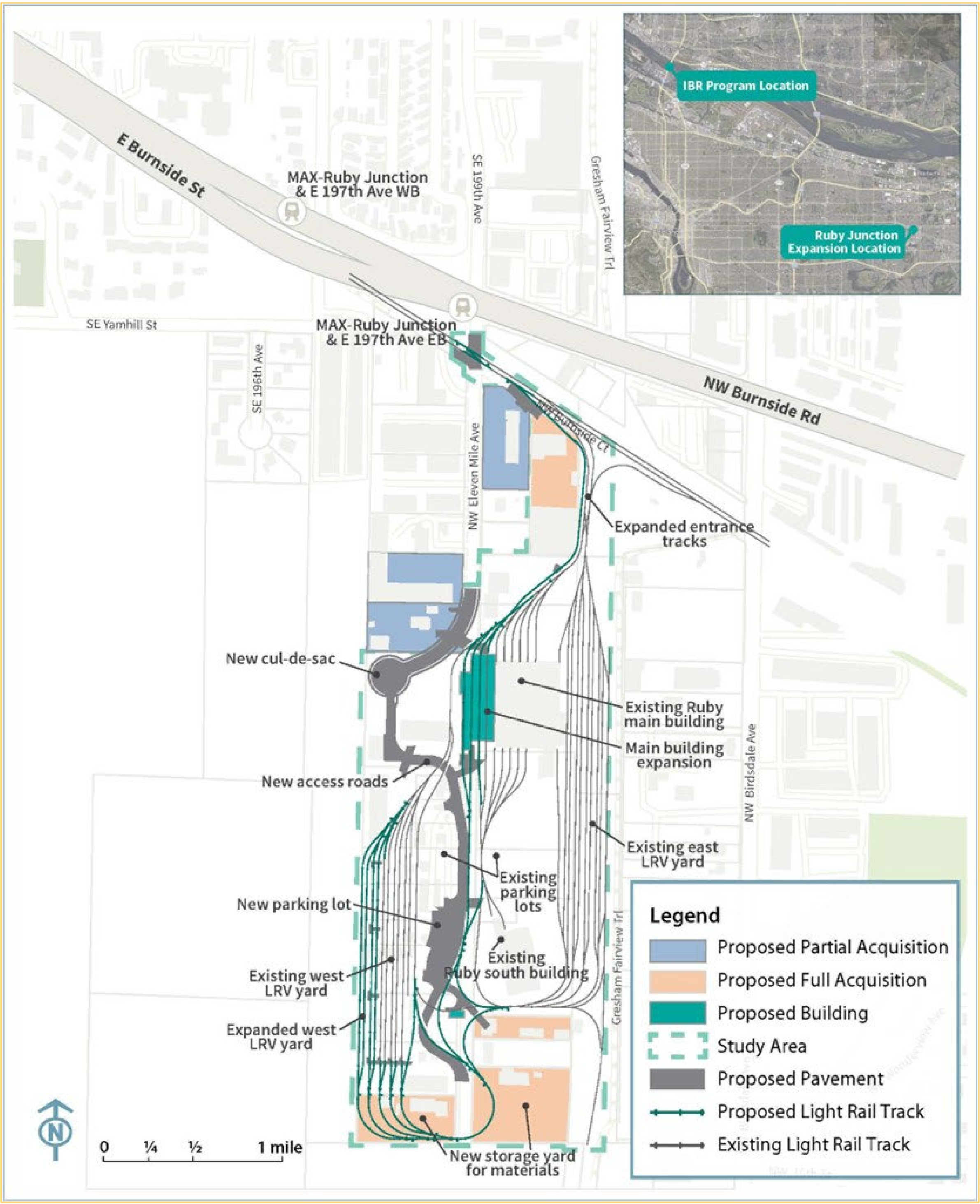
3.2.6.1 Ruby Junction Maintenance Facility Expansion

The TriMet Ruby Junction Maintenance Facility in Gresham, Oregon, will be expanded to accommodate the additional LRVs associated with the Modified LPA's LRT service (the Ruby Junction location relative to the project site is shown in Figure 3-21). Improvements will include additional storage for LRVs and maintenance materials and supplies, expanded LRV maintenance bays, expanded parking for additional personnel, and a third track at the northern entrance to Ruby Junction. Figure 3-21 shows the proposed footprint of the expansion.

The existing main building will be expanded west to provide additional maintenance bays. To make space for the building expansion, NW Eleven Mile Avenue will be vacated and will terminate in a new cul-de-sac west of the main building. New access roads will be constructed to maintain access to TriMet buildings south of the cul-de-sac.

[9] A road diet is a roadway reconfiguration that involves narrowing or eliminating travel lanes to calm traffic and increase the safety of all roadway users.

Figure 3-21. Ruby Junction Maintenance Facility



The existing LRV storage yard, west of NW Eleven Mile Avenue, will be expanded to the west to accommodate additional storage tracks and a runaround track (a track constructed to bypass congestion in the maintenance yard). This expansion will require partial demolition of an existing TriMet building (just north of the LRV storage) and will require relocating the material storage yard to the properties just south of the south building.

All tracks in the west LRV storage yard will also be extended southward to connect to the proposed runaround track. The runaround track will connect to existing tracks near the existing south building. The connections to the runaround track will require partial demolition of an existing TriMet building plus full demolition of one existing building and partial demolition of another existing building on the private property west of the south end of NW Eleven Mile Avenue. The function of the existing TriMet building will either be transferred to existing modified buildings or to new replacement buildings on site.

The existing parking lot west of NW Eleven Mile Avenue will be expanded toward the south to provide more parking for TriMet personnel.

A third track will be needed at the north entrance to Ruby Junction to accommodate increased train volumes without decreasing service. Adding the third track will require reconstruction of NW Burnside Court east of NW Eleven Mile Avenue. An additional crossover will also be needed on the mainline track where it crosses NW Eleven Mile Avenue; it will require reconstruction of the existing track crossings for vehicles, bicycles, and pedestrians.

3.2.6.2 Expo Center Overnight Light-Rail Vehicle Facility

An overnight facility for LRVs will be constructed on the southeast corner of the Expo Center property (as shown on Figure 3-6) to reduce deadheading between Ruby Junction and the northern terminus of the MAX Yellow Line extension. Deadheading occurs when LRVs travel without passengers to make the vehicles ready for service. The facility will provide a yard access track, storage tracks for approximately 10 LRVs, one building for light LRV maintenance, an operator break building, a parking lot for reporting operators, and space for security personnel. This facility will necessitate relocation and reconstruction of the N Expo Road entrance to the Expo Center (including the parking lot gates and booths). However, it will not affect any of the existing Expo Center buildings.

The overnight facility will connect to the mainline tracks by crossing N Expo Road just south of the existing Expo Center MAX Station. The connection tracks will require relocation of one or two existing LRT facilities, including a traction power substation building and potentially the existing communication building, which are both just south of the Expo Center MAX Station. Existing artwork at the station may require relocation.

3.2.6.3 Additional Bus Bays at the C-TRAN Operations and Maintenance Facility

Three bus bays will be added to the C-TRAN operations and maintenance facility. These new bus bays will provide maintenance capacity for the additional express bus service on I-5. Modifications to the facility will accommodate new vehicles as well as maintenance equipment.

3.2.7 Transit Operating Characteristics

3.2.7.1 Light-Rail Transit Operations

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

3.2.7.2 Express Bus Service and Bus-on-Shoulder

C-TRAN provides bus service that connects to LRT and augments travel between Washington and Oregon with express bus service to key employment centers in Oregon. Beginning in 2022, the main express route providing service in the IBR corridor, Route 105, had two service variations. One pattern provides service between Salmon Creek and downtown Portland with a single intermediate stop at the 99th Street Transit Center, and one provides service between Salmon Creek and downtown Portland with two intermediate stops: 99th Street Transit Center and downtown Vancouver. This route currently provides weekday service with 20-minute peak and 60-minute off-peak headways.

Once the Modified LPA is constructed, C-TRAN Route 105 will be revised to provide the direct service from the Salmon Creek Park and Ride and 99th Street Transit Center to downtown Portland operating at 5-minute peak headways with no service in the off-peak. The C-TRAN Route 105 intermediate stop service through downtown Vancouver will be replaced with C-TRAN Route 101 which will provide direct service from downtown Vancouver to downtown Portland at 10-minute peak and 30-minute off-peak headways.

Two other existing C-TRAN express bus service routes will remain unchanged after completion of the Modified LPA. C-TRAN Route 190 will continue to provide service from the Andresen Park and Ride in Vancouver to Marquam Hill in Portland. This route will continue to operate on SR 500 and I-5 within the project site. Route headways would be 10 minutes in the peak periods with no off-peak service. C-TRAN Route 164 will continue to provide service from the Fisher's Landing Transit Center to downtown Portland. This route will continue to operate within the study area only in the northbound direction during PM service to utilize the I-5 northbound high-occupancy vehicle lane in Oregon before exiting to eastbound SR 14 in Washington. Route headways will be 10 minutes in the peak and 30 minutes in the off-peak.

C-TRAN express bus Routes 105 and 190 are currently permitted to use the existing southbound inside shoulder of I-5 from 99th Street to the Interstate Bridge in Vancouver. However, the existing shoulders are too narrow for bus-on-shoulder use in the rest of the I-5 corridor. The proposed action will include inside shoulders on I-5 that will be wide enough (14 feet on the Columbia River bridges and 11.5 to 12 feet elsewhere on I-5) to allow northbound and southbound buses to operate on the shoulder, except where I-5 will have to taper to match existing inside shoulder widths at the north and south ends of the project site. Figure 3-6, Figure 3-8, Figure 3-19, and Figure 3-20 show the areas of potential bus-on-shoulder use over the Columbia River bridges. Additional approvals (including a continuing control agreement), in coordination with ODOT, may be needed for buses to operate on the shoulder on the Oregon portion of I-5.

After completion of the Modified LPA, two C-TRAN express bus routes operating on I-5 through the study area will be able to use bus-on-shoulder operations to bypass congestion in the general-purpose lanes. C-TRAN Route 105 will operate on the shoulder for the full length of the study area. C-TRAN Route 190 will operate on the shoulder for the full length of the corridor except for the distance required to merge into and out of the shoulder as the route exits from and to SR 500. These two express bus routes (105 and 190) will have a combined frequency of every 3 minutes during the 2045 AM and PM peak periods. To support the increased frequency of express bus service, eight electric double-decker or articulated buses will be purchased.

If the C Street ramps were removed from the SR 14 interchange, C-TRAN express bus Route 101 could also use bus-on-shoulder operations south of Mill Plain Boulevard; however, if the C Street ramps remained in place, Route 101 could still use bus-on-shoulder operations south of the SR 14 interchange but will need to begin merging over to the C Street exit earlier than if the C Street ramps were removed. Route 101 will operate at 10-minute peak and 30-minute off-peak headways. C-TRAN express bus Route 164 would not be anticipated to use bus-on-shoulder operations because of the need to exit to SR 14 from northbound I-5.

3.2.7.3 Local Bus Route Changes

The TriMet Line 6 bus route will be changed to terminate at the Expo Center MAX Station, requiring passengers to transfer to the new LRT connection to access Hayden Island. TriMet Line 6 is anticipated to travel from NE Martin Luther King Jr. Boulevard through the newly configured area providing local connections to N Marine Drive. It will continue west to the Expo Center MAX Station.

As part of the proposed action, several local C-TRAN bus routes will be changed to better complement the new light-rail extension. Most of these changes will re-route existing bus lines to provide a transfer opportunity near the new Evergreen Station. In addition to these changes, other local bus route modifications would move service from Broadway to C Street.

3.2.8 Tolling

To help fund construction and future maintenance, and to encourage alternative mode choice for trips across the Columbia River, tolling is proposed for cars and trucks that cross the new bridges. The IBR Program plans to toll the I-5 river bridge under the federal tolling authorization program codified in 23 U.S. Code Section 129 (Section 129). It is anticipated that, prior to tolling I-5, the Oregon Transportation Commission and the Washington State Transportation Commission will enter into a bistate tolling agreement to establish a cooperative process for setting toll rates, and similarly, the two states will enter into a separate agreement and guiding the sharing and use of toll revenues for bridge construction and future maintenance. WSDOT and ODOT will also enter into one or more agreement addressing implementation logistics, toll collection, and maintenance for tolling the bistate facility.

Tolls would be collected using an all-electronic toll collection system using transponder tag readers and license plate cameras mounted to structures over the roadway. Toll collection booths would not be required. Instead, motorists could obtain a transponder tag and set up a payment account that would automatically bill the account holder associated with the transponder each time the vehicle crossed the bridge. Customers without transponders, including out-of-area vehicles, would be tolled by a license plate recognition system that would bill the address of the owner registered to that license plate. The toll system would be designed to be nationally interoperable. Transponders for tolling systems elsewhere in the country could be used to collect tolls on I-5, and drivers with Oregon Toll Program or *Washington Good to Go!* transponders could use their transponder tag and associated account to pay tolls in other states with reciprocity agreements.

3.2.9 Transportation System and Demand Management Measures

Many well-coordinated transportation demand management and transportation system management programs are already in place in the Portland-Vancouver region. In most cases, the impetus for the programs comes from state regulations: Oregon’s Employee Commute Options rule and Washington’s Commute Trip Reduction law.

The physical and operational elements of the proposed action provide the greatest transportation demand-management opportunities by promoting other modes to fulfill more of the travel needs in the project corridor. These include:

- Major new light-rail line in exclusive right of way, as well as express bus routes and bus routes that connect to new light-rail stations.
- I-5 inside shoulders that accommodate express buses.
- Modern bicycle and pedestrian facilities that accommodate more bicyclists and pedestrians and improve connectivity, safety, and travel time.
- Park-and-ride facilities.
- A variable toll on the new Columbia River bridges.

In addition to these fundamental elements of the program, facilities and equipment will be implemented that could help existing or expanded transportation system management programs maximize the capacity and efficiency of the system. These include:

- Replacement or expanded variable message signs. These signs alert drivers to incidents and events, allowing them to seek alternate routes or plan to limit travel during periods of congestion.

- Replacement or expanded traveler information systems with additional traffic monitoring equipment and cameras.
- Expanded incident response capabilities, which help traffic congestion to clear more quickly following accidents, spills, or other incidents.
- Queue jumps or bypass lanes for transit vehicles where multilane approaches are provided at ramp signals for on-ramps. Locations for these features will be determined during the detailed design phase.
- Active traffic management including strategies such as ramp metering, dynamic speed limits, and transit signal priority. These strategies are intended to manage congestion by controlling traffic flow or allowing transit vehicles to enter traffic before single-occupant vehicles.

3.3 Construction Timeline and Sequencing

Table 3-2 provides a summary of the estimated duration to construct each element of the proposed action. The project will likely commence with the construction of the Columbia River and North Portland Harbor bridges, and these bridges are expected to require the longest timelines.

For purposes of this consultation, it has been preliminarily estimated that construction activities associated with the proposed action will commence in 2025. This schedule further assumes that the proposed action will take between 9 and 15 years to complete, and will require work within up to nine in-water work seasons. This schedule assumes that up to six in-water work seasons will be necessary to construct the in-water components of the replacement bridges, and three in-water work seasons will be necessary to complete the demolition and removal of the in-water portions of the existing bridges. However, construction timing, sequencing, and duration will depend on a multitude of factors. Funding will be a large factor in determining the overall sequencing and construction duration. Design assumptions will also be refined as design progresses, which could result in changes to timing, sequencing, and duration. Contractor schedules, weather, materials, and equipment will also influence construction timing, sequencing, and duration during the construction phases of the project.

Table 3-2. Construction Activities and Estimated Duration

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

Key: LRT = light-rail transit; SR = State Route

3.3.1 In-Water Work Window

In order to minimize impacts to ESA-listed species and their designated critical habitat, certain work below the ordinary high water mark (OHWM) of the Columbia River and North Portland Harbor will be restricted to defined timing restrictions, referred to here as the in-water work window (IWWW). The USACE, NOAA Fisheries, USFWS, Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fish and Wildlife (WDFW) all can recommend and/or require restrictions on the timing of in-water work during their regulatory review processes. The following agencies have published regulatory guidance regarding the preferred timing for in-water work to minimize impacts to aquatic species on the reach of the Columbia River at the project site:

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

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.

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

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

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

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

- **Impact pile driving** will be confined to **September 15 through April 15** of each year. This was confirmed as the most biologically defensible window for this proposed action, as it allows for an expedited construction schedule that minimizes the number of in-water work seasons, while still avoiding the peak run timing of each Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) of ESA-listed fish to the greatest extent practicable.
- **In-water debris removal with a bucket dredge** will be confined to **November 1 and February 28** of each year. This is the standard published work window for this reach of the river, and will appropriately avoid impacts to each ESU/DPS of ESA-listed fish in the river. However, limited, diver-assisted removal of specific individual pieces of debris or large riprap necessary to place a drilled shaft may be conducted at any time of year.

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

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

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

3.4 Detailed Description of the Project Elements

This section provides a detailed description of the means and methods of construction of the various project elements. Note that the project is in an early stage of design, and, therefore, the description of the proposed action makes “reasonable worst-case” assumptions about construction timing, duration, methods, and impacts.

Furthermore, since the Modified LPA includes several design options for key aspects of the proposed action, the descriptions of construction means and methods are intended to be inclusive of all of the proposed design options. Where specific quantities or impacts differ between the various design options, the description reflects the design option with the greatest impact, or the largest quantities. In this way, the effects analyzed in this BA appropriately address the full range of potential impacts to ESA-listed species and critical habitats from the proposed action, regardless of which design options are ultimately selected and constructed.

3.4.1 Mobilization and Site Preparation

Work will likely begin with the contractor mobilizing materials, equipment and labor to the site. The contractor will most likely mobilize materials and equipment to the site via rail, barges and trucks.

The contractor will install erosion control measures (silt fences, etc.), debris containment devices (i.e., floating debris booms) and other BMPs consistent with a spill prevention, control, and countermeasures (SPCC) plan, pollution control plan (PCP), and an erosion and sediment control plan (ESCP). Clearing and grubbing limits will be established in the field prior to vegetation clearing. Federal, state, and local permits may include additional specific regulatory requirements regarding mobilization and site preparation, and contract specifications will dictate that all such activities be conducted consistent with these permit requirements.

3.4.2 Construction Access, Staging, and Casting Yards

Materials and equipment arriving by truck or rail will be unloaded and staged either within the limits of the project site 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.

Staging of equipment and materials will occur in many locations within the project site throughout construction, generally within existing or newly purchased right of way or on nearby vacant parcels. At least one large site will be required for construction offices, to stage the larger equipment such as cranes, and to store materials such as rebar and aggregate.

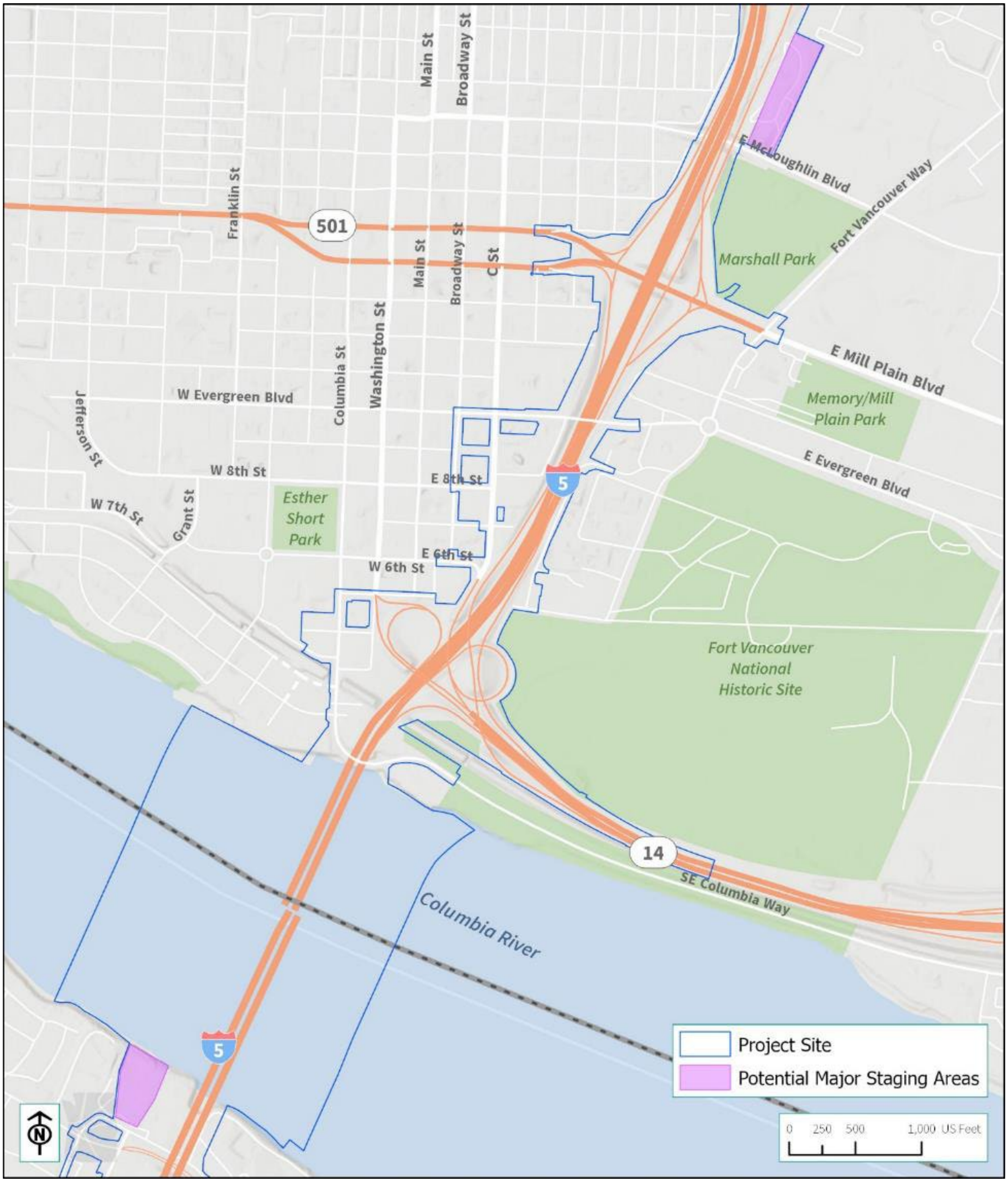
Two potential major staging areas have been identified and are shown on Figure 3-22. The first site is the vacant 5.6-acre former Thunderbird Hotel site on Hayden Island. The second is a former rest-area site east of I-5 north of McLoughlin that is currently used as auxiliary parking for the Clark College Athletic Annex. Following construction of the Modified LPA, the staging sites could be converted for other uses. Other staging locations will be established by the contractor during permitting and construction, and appropriate compliance documentation, approvals, permits and access easements will be acquired at that time. Key considerations for staging sites include: (1) size and capacity to provide for heavy machinery and material storage; (2) waterfront access for barges (either a slip or a dock capable of handling heavy equipment and material); and (3) roadway or rail access for landside transportation of materials by truck or train.

In addition to on-land sites, some staging activities for construction of the new Columbia River and North Portland Harbor bridges will take place on the river itself. Temporary work structures, barges, barge-mounted cranes, derricks, and other construction vessels and equipment will be present on the river during most or all of the bridges' construction period. The IBR Program is working with the USACE and USCG to obtain necessary clearances for these activities.

A casting or staging yard could also be required for construction of the overwater bridges if a precast concrete segmental bridge design is used. If such a casting yard is required it will require access to the river for barges including either a slip or a dock capable of handling heavy equipment and material; a large area suitable for a concrete batch plant and associated heavy machinery and equipment; and access to a highway or railway for delivery of materials. Such a site will likely be between approximately 50 and 100 acres in size. As with the staging sites, casting yards will be identified during the design process or by the contractor, and will be subject to the same contract and permit requirements to implement the BMPs described in this document unless more stringent permitting requirements and conditions are required at the time of identification.

All material staging, equipment staging areas, equipment fueling areas, and casting yards will be contained and located outside of environmentally and culturally sensitive areas. To the extent practicable these sites will be located in upland locations, on areas that are already or have been previously disturbed. These activities will be conducted consistent with the BMPs established in this BA (including consistency with the 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.

Figure 3-22. Potential Major Staging Areas



3.4.3 Temporary Work Structures

The proposed action will require the installation of several temporary in-water and overwater structures, both during new bridge construction and existing bridge demolition, to facilitate equipment access, materials delivery and debris removal. These structures will likely include a variety of temporary work platforms, bridges and piers, temporary isolation/confinement systems, barges, and temporary piles associated with these structures.

Temporary work structures will be designed by the contractor after a contract is awarded, but prior to construction. For this reason, the exact size, quantity, type, and configuration of temporary work structures are unknown. The proposed action is designed based on reasonable assumptions, and typical construction practices, and is intended to represent a reasonable worst-case scenario. All temporary structures will be installed, operated, and maintained consistent with the BMPs established in Section 4 of this document, as well as with any federal, state, or local permit requirements.

Table 3-3 provides a summary of the type and quantity of temporary work structures that are anticipated, and Figure 3-23 and Figure 3-24 provide a conceptual graphic overview.

Table 3-3. Summary of Temporary Work Structure Types and Quantities

Temporary In-Water and Overwater Work Elements	Columbia River				North Portland Harbor			
	Approx. Quantity	Temporary Benthic Impact (sf)	Temporary Overwater Shading (sf)	Approx. Max. Duration (days)	Approx. Quantity	Temporary Benthic Impact (sf)	Temporary Overwater Shading (sf)	Approx. Max. Duration (days)
Work Platforms/ Bridges/Piers and Associated Piles	2 work bridges; 4 work platforms; 2 piers; 764 (24-inch) piles; 447 (48-inch) piles	8,017	184,187	500 days each	8 work bridges; 912 (24-inch) piles; 208 (48-inch) piles	5,479	208,800	850 days each
Other Temporary Piles	100 (24-inch) piles	314	0	150 days each	100 (24-inch) piles	314	0	150 days each
Suspended Shaft Cap Isolation System	4	0	11,008	120 days each	–	–	–	–
Sheet Pile Cofferdams (Construction)	2	25,095	0	500 days each	–	–	–	–
Sheet Pile Cofferdams (Demolition)	9	37,587	0	50 days each	–	–	–	–
Drilled Shaft Isolation Casings	–	–	–	–	52	10,659	0	50 days each
Barges and Barge Mooring Piles (Construction)	12 barges; 160 (24-inch) mooring piles	503	120,000	120 days each	6 barges; 216 (24-inch) mooring piles	679	105,000	50 days each
Barges and Barge Mooring Piles (Demolition)	6 barges; 304 (24-inch) mooring piles	955	28,500	50 days each	6 barges; 100 (24-inch) mooring piles	314	23,100	50 days each
Total	**1,328 (24-inch) 447 (48-inch)**	**72,471**	**343,695**	**–**	**1,328(24-inch) 208 (48-inch)**	**17,445**	**336,100**	**–**

Figure 3-23. Temporary Work Structures – Columbia River

Figure 3-24. Temporary Work Structures – North Portland Harbor

3.4.3.1 Temporary Work Platforms, Bridges, and Piers

Construction of the Columbia River and North Portland Harbor bridges will require a combination of temporary work bridges, platforms, and piers. For purposes of this discussion, work bridges are structures that have a point of connection with, and that can be accessed from, the adjacent land, whereas work platforms and piers are stand-alone structures that are accessed via barges.

Temporary work bridges, platforms, and piers will be supported by a combination of 24-inch and 48-inch diameter hollow, steel pipe piles (pile installation and removal is described in Section 3.4.7). All temporary structures will be fully removed prior to project completion. Bridge decking will be removed using appropriate containment measures, and temporary piles will be removed with a vibratory hammer or via direct pulling.

Installation and removal of all temporary work bridges, platforms, and piers will be conducted consistent with the impact minimization BMPs described in Section 4, and the permits that are ultimately issued for the project, to further reduce the potential for impacts to ESA-listed species or critical habitats.

Columbia River

The size and exact configuration of the temporary work bridges, platforms and piers for the Columbia River bridge will likely differ from what is conceptually proposed as shown on Figure 3-23.

Temporary work bridges will be constructed at nearshore pier complexes 2 and 7. The Pier 2 temporary work bridge will measure approximately 22,770 square feet in size, and will require a total of approximately 100, 24-inch-diameter piles, and approximately 54, 48-inch diameter piles. The Pier 7 temporary work bridge will measure approximately 16,755 square feet in size, and will require a total of approximately 73, 24-inch-diameter piles, and approximately 40, 48-inch-diameter piles.

Temporary work platforms will be installed at the locations of Piers 3 through 6, to support the construction of the foundations for those piers. The temporary platforms will be used for the installation of the drilled shafts, and will also support the suspended shaft cap isolation system and construction of the shaft caps at these piers. The temporary work platforms at Piers 3 and 4 will each measure approximately 27,431 square feet in size, and will each be supported by approximately 120, 24-inch-diameter steel pipe piles, and approximately 65, 48-inch-diameter steel pipe piles. The temporary platforms at Piers 5 and 6 will each be approximately 39,900 square feet in size, and will each be supported by approximately 175, 24-inch-diameter piles, and approximately 95, 48-inch-diameter piles.

Additionally, two new temporary piers will be constructed near upland piers 1 and 8 to facilitate construction of the spans between piers 1 and 2, and piers 7 and 8. Each of these temporary piers will measure approximately 5,000 square feet in size, and will require a total of approximately 16, 48-inch-diameter piles.

In total, it is estimated that the temporary work bridges, platforms, and piers for construction of the Columbia River bridge will require up to 764, 24-inch-diameter piles, and approximately 447, 48-inch-diameter piles. These structures will temporarily displace approximately 8,017 square feet of benthic habitat, and will temporarily shade approximately 184,187 square feet of water surface within the Columbia River. However, not all of these temporary structures will be in place at the same time, as construction will progress in a sequenced fashion and temporary work structures will be removed prior to project completion. It is estimated that a given temporary bridge, platform, or pier could be in place for up to approximately 500 days each.

North Portland Harbor

Within North Portland Harbor, a total of eight temporary work bridges of various sizes will be required to facilitate access, construction, and demolition activities. The size and exact configuration of these work bridges will vary, but a conceptual layout is shown on Figure 3-24.

These temporary work bridges will be supported by a combination of 24-inch and 48-inch diameter steel pipe piles. In total it is estimated that each work bridge will be approximately 23,111 square feet in size (on average), and will be supported by approximately 80, 24-inch diameter steel pipe piles, and approximately 23, 48-inch piles.

In total, it is estimated that approximately 912, 24-inch-diameter piles, and approximately 208, 48-inch diameter piles will be required for the temporary work bridges in North Portland Harbor. These structures will temporarily displace approximately 5,479 square feet of benthic habitat, and temporarily shade approximately 208,000 square feet of water surface within North Portland Harbor. It is estimated that only two of these temporary work bridges will typically be in place at any one time, though a contractor could potentially install a greater number of work bridges. For purposes of this consultation it is assumed that no more than approximately 100,000 square feet of temporary work bridge will be installed at any given time. Each temporary bridge in North Portland Harbor could be in place for up to approximately 850 days each.

3.4.3.2 Suspended Shaft Cap Isolation System

The shaft caps for the foundations of Piers 3 through 6 of the Columbia River bridges will be constructed utilizing a suspended shaft cap isolation system. The use of this system avoids the need for cofferdams and permanent concrete seals on the bottom of the riverbed. The suspended shaft cap isolation system will be constructed on top of the permanent drilled shafts for each pier (drilled shaft installation is described in Section 3.4.6.1).

Precast concrete sections will be placed over each drilled shaft above the water line, suspended by a steel frame which is in turn supported by the shaft casing. The precast segments will be linked together and watertight forms will be constructed to allow for the sides and concrete floor of the shaft cap to be cast-in-place. Once this is complete and the concrete has cured, the temporary formwork will be removed, and the whole, watertight assembly will be lowered into place and the rest of the concrete shaft cap will be constructed and cast-in place.

The suspended shaft cap isolation system will rest on the permanent drilled shafts, and will not displace any benthic habitat. The system will extend approximately 4 feet beyond the edge of each shaft cap, which will temporarily shade approximately 2,752 square feet per pier, for a total of approximately 11,008 square feet of temporary water surface shading within the Columbia River. The suspended shaft cap isolation system will be in place at each of the four piers (3 through 6) for up to approximately 120 days.

3.4.3.3 Sheet Pile Cofferdams

Sheet pile cofferdams will likely be used to isolate certain in-water work areas from active flow during construction. It is assumed that two cofferdams will be required for the construction of nearshore Piers 2 and 7 in the Columbia River. The shallow water depth at these piers renders other methodologies less feasible. Sheet pile cofferdams may also be required during demolition of the nine existing bridge piers (though demolition may also occur without a cofferdam if a wiresaw method is used [See Section 3.4.8]).

The two cofferdams used during construction of piers 2 and 7 In the Columbia River will temporarily affect a combined area of approximately 25,095 square feet of benthic habitat. These two cofferdams will be constructed of steel sheet piles, which will be installed and removed with a vibratory hammer, which would be operated from temporary work bridges or barges. Once sheet piles are installed, a permanent concrete seal will be installed at the base of each cofferdam, and they will be dewatered (dewatering and fish salvage activities are described in Section 3.4.4). Once construction of the pier is complete, sheet piles will be removed with a vibratory hammer, but the concrete seals will remain.

Each of the two sheet pile cofferdams for construction at Piers 2 and 7 will be in place for a maximum of 500 calendar days, which includes approximately 10-15 days for installation and removal. It is anticipated that these cofferdams will not be installed at the same time. However, the specific sequencing of installation and removal will be dependent upon contractor means and methods, and other scheduling factors. In order to make a conservative estimate, it is assumed that that both cofferdams could potentially be in place at the same time.

Up to nine additional cofferdams may be installed in the Columbia River during demolition of the existing in-water Columbia River bridge piers 2 through 10. Each cofferdam will measure approximately 175 feet by 45 feet, and will temporarily displace approximately 4,176 square feet of benthic habitat (the area of the cofferdam minus the area of the existing bridge foundation it surrounds). In total, these temporary sheet pile cofferdams will temporarily displace approximately 37,587 square feet of benthic habitat.

Each cofferdam used for demolition will require approximately 10 days to install, be in place for approximately 20 additional work days apiece, and require approximately 10 work days to remove. For purposes of making a conservative estimate of duration, it is assumed that each cofferdam installed for demolition of the existing bridge piers will be in place for up to approximately 50 days. Not all cofferdams would be installed at a single time, though it is possible that a contractor may have up to two of these demolition cofferdams in place at one time.

Sheet pile cofferdams will not be required for construction or demolition activities in North Portland Harbor. Installation of drilled shafts in North Portland Harbor will be conducted within temporary isolation casings (See Section 3.4.3.4) rather than sheet pile cofferdams. Removal of existing foundations in North Portland Harbor are expected to be able to be conducted via wiresaw at the mudline and will not require sheet pile cofferdams.

3.4.3.4 Drilled Shaft Isolation Casings

Temporary 19-foot diameter hollow steel casings will be installed within North Portland Harbor to isolate in-water work areas in which the permanent drilled shafts for the bridge foundations can be constructed. These casings are required in North Portland Harbor due to the specific design requirements of these drilled shafts and the way they attach to the columns. This same constraint is not applicable to the Columbia River bridges, and for this reason, drilled shaft isolation casings are not required for installation of the drilled shafts for the Columbia River bridges.

These temporary casings will be screened at the bottom to avoid fish entrapment (see Section 4), then placed on the river bottom and then either pushed into the substrate approximately 5 to 10 feet with weighted equipment, or vibrated into place with a vibratory hammer (See Section 3.4.7.1). Once installed, a permanent concrete seal will be cast-in-place at the base, which will allow them to be dewatered (See Section 3.4.6.2).

A total of 52 temporary drilled shaft isolation casings will be required in North Portland Harbor (one for each drilled shaft). Each of these temporary isolation casings will be approximately 19 feet in diameter (285 square feet in size). In total, the drilled shaft isolation casings will temporarily displace an area approximately 10,659 square feet in size within North Portland Harbor. However, not all isolation casings will be installed at a single time. It is estimated that a contractor may have up to 36 of these casings in place at one time. It is further estimated that each isolation casing will be in place for approximately 50 days each.

3.4.3.5 Barges and Barge Mooring Piles

Barges will be used as platforms to conduct work activities within the Columbia River, and to haul materials and equipment to and from the work site.

Although multiple barges will be in use over the course of construction, there will be a limited number of stationary barges in place at any one time. During construction in the Columbia River, there will likely be a maximum of up to 12 stationary barges operating in the Columbia River at one time, casting no more than 120,000 square feet of overwater shading at once. Because of wind, current, and wave action, temporary mooring piles will likely be installed for some of these barges to anchor in place. Some barges will be able to moor to temporary bridges or platforms and may not need additional mooring piles. For purposes of this consultation it is estimated that up to 160 temporary mooring piles (18- to 24-inch-diameter steel pipe piles) will be installed within the Columbia River (these are in addition to the other temporary piles described in this section), and that a given barge will be present in a given location for up to approximately 120 days each, on average.

Barges and temporary barge mooring piles will also be required for the demolition of the existing structures in the Columbia River. It is anticipated that demolition of the existing bridges will require up to six stationary barges at any one time, with a maximum shade footprint of approximately 28,500 square feet at once. Since there will not be any temporary work bridges or platforms to moor to, these barges for demolition may require more mooring piles than those that are used for construction. It is estimated that up to 304 temporary mooring piles (18- to 24-inch-diameter steel pipe piles) will be used to anchor and support the work and material barges necessary for demolition. Barges used for demolition of the existing Columbia River bridge foundations will be in place for up to approximately 50 days each.

Construction within North Portland Harbor will most likely occur from temporary work bridges, and barges are not expected to be used extensively during construction or demolition within North Portland Harbor. However, a contractor may elect to use barges, and barges will also likely be used for delivery of materials. It is anticipated that up to six barges may be present at a given time within North Portland Harbor during construction and demolition. Construction barges may require up to 216 temporary mooring piles (18- to 24-inch-diameter steel pipe piles), and barges used during demolition may require up to 100 such temporary mooring piles. These barges will be in place for up to approximately 50 days each.

3.4.3.6 Other Temporary Piles

In addition to the piles that will be needed for the temporary structures described above, additional temporary piles will likely be necessary throughout construction for a variety of purposes. Typical uses are expected to include supporting falsework and formwork, pile templates, reaction piles, and other purposes. These additional temporary piles will 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 (See Section 3.4.7). These temporary piles will be fully removed prior to project completion.

It is estimated that approximately 200 such additional temporary piles may be required over the duration of construction, split approximately evenly between the Columbia River and North Portland Harbor. These piles will temporarily displace approximately 628 square feet of benthic habitat, and will be in place for up to approximately 150 days each.

3.4.4 Work Area Isolation and Fish Salvage

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 include drilled shaft isolation casings and temporary sheet pile cofferdams. Sheet pile cofferdams for construction of Piers 2 and 7, and the drilled shaft isolation casings in North Portland Harbor will be dewatered to provide a work area for construction. Sheet pile cofferdams for demolition of the existing Columbia River bridges (if used), will not be dewatered, as their primary purpose will be to contain sediment and debris and dry work conditions are not required for demolition activities.

All sheet pile cofferdams and drilled shaft isolation casings will be installed in a manner that minimizes the potential for fish entrapment. Sheet piles will be installed from upstream to downstream and will be lowered slowly until contact with the substrate. Drilled shaft isolation casings will be screened at the bottom and lowered slowly into place, to minimize potential for fish entrapment during installation (see Section 4).

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

Fish salvage will be conducted both during and after the installation of the sheet pile cofferdams, to remove fish from within the isolated work area. Since the drilled shaft isolation casings will be screened prior to installation, fish salvage will not be required within these structures prior to dewatering.

All fish salvage work will be conducted consistent with the best practices established in the BO for ODOT's Federal Aid Highway Program (FAHP) Programmatic Consultation (NOAA Fisheries 2021b). A fish biologist with the experience and competence to ensure the safe capture, handling, and release of all fish will supervise all fish capture and release. 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 designed and installed consistent with the ODOT Hydraulics Manual, which establishes criteria to avoid these structures being overtopped during high water events.

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.

Table 3-4 provides a summary of the proposed in-water work area isolation structures and fish salvage activities.

Table 3-4. Summary of Work Area Isolation Structures, De-watering, and Fish Salvage Activities

Structure Type	Quantity	De-watered? (Y/N)	Fish Salvage Required? (Y/N)
Sheet Pile Cofferdams (Construction)	2	Y	Y
Sheet Pile Cofferdams (Demolition)	9	N	Y
Drilled Shaft Isolation Casings	52	Y	N (screened)

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

3.4.5 Upland Ground Improvements

This section describes the upland ground improvements that are proposed for the proposed action.

An upland ground improvement program will be implemented as part of the proposed action to protect the bridge structures from earthquake-induced liquefaction. Ground improvement is a common means to densify or otherwise strengthen weak soil so that it becomes sufficiently resistant to excessive settlement and horizontal movement.

There are several methods that could potentially be used to conduct upland ground improvements, including but not limited to deep soil mixing, jet grouting, and stone columns. This consultation assumes that deep soil mixing and jet grouting are the most likely applications. These activities are all performed from the ground surface. The process generally involves drilling augers or inserting probes to specified depths on a regular grid pattern. Cementitious materials and/or aggregate is then mixed into the soils as the auger or probe is withdrawn.

A ground improvement test program will be conducted prior to contractor procurement in order to confirm the method and efficacy of upland ground improvements. For purposes of this consultation it is assumed that upland ground improvements in the form of deep soil mixing and jet grouting will be conducted within an approximately 188,000 square foot area, in specific upland locations along the north and south shorelines of North Portland Harbor in and on a portion of the northern shoreline of Hayden Island. The approximate area defining the limits of these activities are shown on Figure 3-25. These activities will extend to a depth approximately 90 feet below ground surface, though actual final depths will be informed by the results of the ground improvement study.

The sequencing and duration of upland ground improvement activities is dependent on several factors including overall project sequencing, access, and the availability of equipment. For purposes of this consultation, it is estimated that the ground improvement program will require approximately one year to complete.

Upland ground improvement activities will be conducted consistent with the BMPs established in this BA (including consistency with the ESCP, PCP, and SPCC plan for the proposed action), and consistent with conditions of permits issued for the proposed action. A Water Quality Protection and Monitoring Plan (WQPMP) will also be required 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 proposed action, including during any upland ground improvement activities.

Figure 3-25. Potential Upland Ground Improvements

3.4.6 Bridge Construction

This section describes the conceptual design and construction of the foundations for the replacement bridges in the Columbia River and North Portland Harbor.

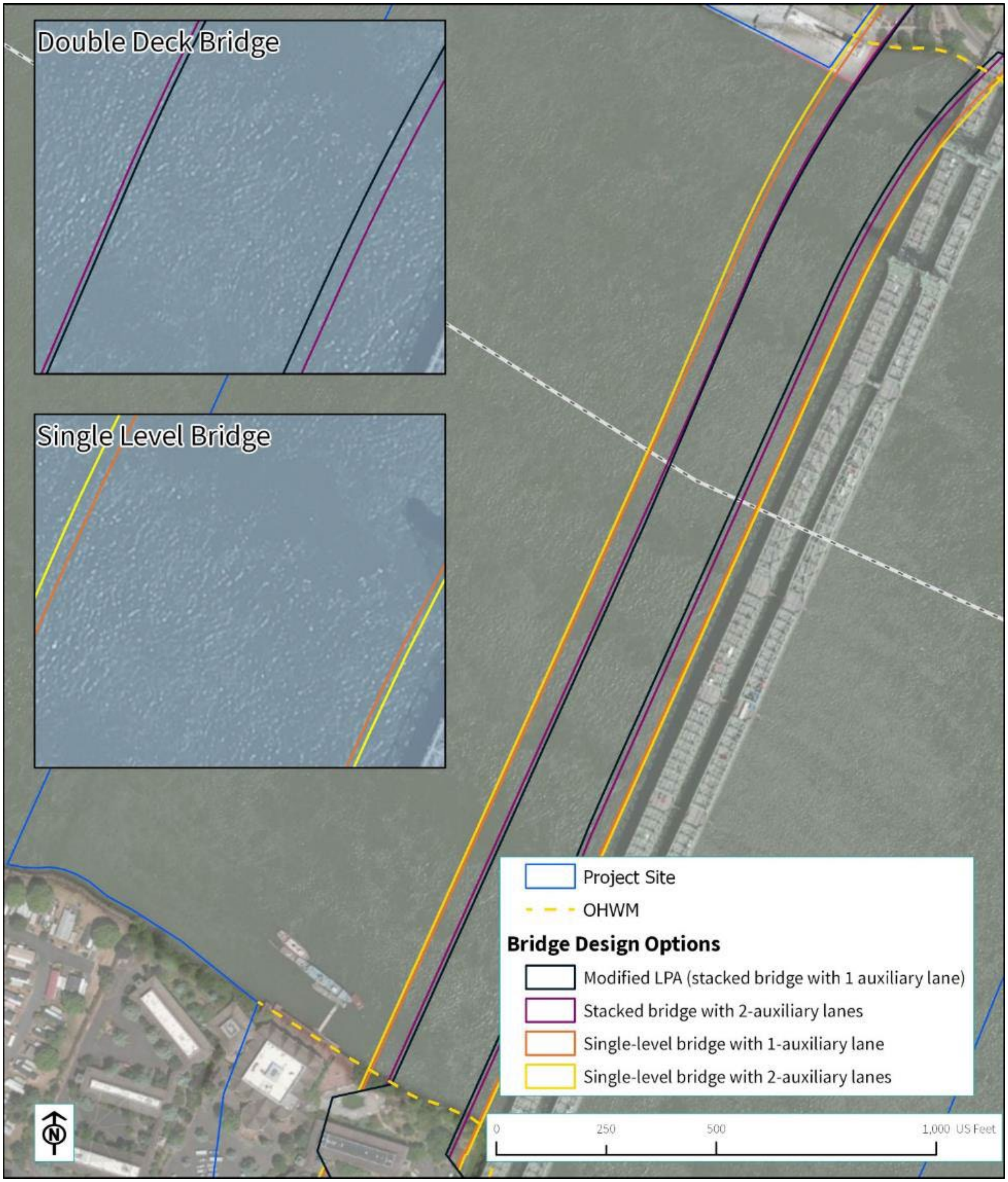
3.4.6.1 Columbia River Bridges

The basic layout and configuration of the proposed bridge piers and deck associated with the proposed replacement bridges over the Columbia River (in the single-level movable-span and two-auxiliary lane configuration) is shown in Figure 3-26. Figure 3-27 shows the relative sizes and configurations of the bridge foundations under the bridge design options, and Figure 3-28 shows the relative differences in the bridge deck footprint under the various combinations of bridge type and auxiliary lanes that are included in the proposed action.

Figure 3-26. Columbia River Bridges – Overview

Figure 3-27. Columbia River Bridges – Design Option Foundations

Figure 3-28. Columbia River Bridges – Design Option Bridge Deck Configurations



The proposed replacement bridges over the Columbia River mainstem will consist of a steel or concrete superstructure constructed on top of a series of pier complexes, supported on foundations consisting of 10-foot diameter drilled shafts with concrete shaft caps. Six of these pier complexes will be located below the OHWM of the Columbia River.

In the double-decked bridge configuration that is proposed under the Modified LPA, each pier set will require approximately 12 drilled shafts with a single shaft cap measuring approximately 50 by 170 feet at the water line.

The single-level bridge configurations will require the same number of piers as the Modified LPA (six in-water piers per bridge and two upland piers per bridge), however, each pier will require more drilled shafts (16 drilled shafts per in-water pier, and 96 total in-water drilled shafts), and longer shaft caps (approximately 230 feet in length) compared to the Modified LPA configuration.

The single-level bridges with movable-span configuration will require the largest foundations of the three options. The foundations for Piers 2, 3, 4, and 7 will be the same as the single-level fixed-span configuration. The foundations for Piers 5 and 6, which will support the towers for the lift span, will require 22 drilled shafts each, and a continuous shaft cap measuring approximately 50 by 312 feet at the water line.

Accounting for all potential design options under consideration, the proposed action may require up to 108 drilled shafts to support the in-water foundations for the Columbia River bridges to accommodate the single-level bridge with a movable-span-design option.

The foundations for nearshore piers 2 and 7 will be constructed within dewatered sheet pile cofferdams (See Section 3.4.3.3). The concrete seals that will be placed to allow the cofferdam to be dewatered and isolated will remain when the cofferdams are removed, and represent a permanent benthic impact.

In total, the foundations for the Columbia River bridges will permanently displace approximately 33,577 square feet of benthic habitat. Approximately 13,804 square feet of this permanent impact will occur in shallow water habitat (less than 20 feet deep). All other pier foundations associated with the Columbia River bridges will be located in deep-water areas.

Table 3-5 provides a summary of the proposed permanent in-water and overwater elements associated with the Columbia River bridges.

Table 3-5. Permanent In-Water and Over-water Structures – Columbia River Bridges

Existing/ Proposed	Permanent In-Water and Over-water Work Elements	Approx. Quantity	Benthic Impact (s.f)	Overwater Shading (water surface-level) (s.f)	Overwater Shading (elevated bridge deck) (s.f)	Fill Volume Within Functional Floodplain (c.y)
Proposed Bridges	Drilled Shafts (10-foot diameter) [a]	108	8,482	0	0	6,600
	Cofferdam Concrete Seals [a]	2	25,095	0	0	1,400
	Shaft Caps [a]	6	0	68,718	0	54,400
	Replacement Bridges Overwater Deck (total) [b]	2 spans	0	0	704,823	0
Existing Bridges (To be removed)	Existing Bridge Foundations	9 foundations; 2,664 timber piles	-33,289	0	0	-12,000
	Existing Bridge Deck (total)	2 existing spans	0	0	-308,449	0
Net Change	–	–	**+288**	**+68,718**	**+396,374**	**+50,400**

Notes:
a Single-level bridge with movable-span configuration.
b Single-level bridge with two-auxiliary-lane design option.
Key: sf = square feet; cy = cubic yards

Conceptual Construction Sequence and Timeline

A conceptual construction sequence for construction of the Columbia River bridge is included as Appendix A. However, it is important to note that the specific means and methods of construction, including sequencing, will be developed by the contractors that are awarded the contract for construction. A contractor may sequence the construction in a way that may not conform exactly to the conceptual sequence. However, all work will be conducted consistent with the avoidance and minimization measures described in Section 4 of this document, and consistent with the permits that are ultimately issued for the proposed action.

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

- Mobilization, staging, and installation of BMPs
- Install and dewater temporary cofferdam (Piers 2 and 7 only).
- Install temporary piles for barge mooring.
- Install temporary work bridges, platforms, and/or piers (including associated piles).
- Install drilled shafts for each pier
- Install shaft cap isolation system (Piers 3 through 6 only)
- Install shaft caps at the water level.

- Remove cofferdam (Piers 2 and 7 only), or shaft cap isolation system (Piers 3 through 6).
- Construct columns on the shaft caps.
- Construct bridge superstructure.
- Connect superstructure spans with mid-span closures.
- Remove all temporary work platforms, bridges, piers and associated piles.

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

Foundation Construction

The piers supporting the Columbia River bridge will be supported on foundations of 10-foot diameter drilled shafts. Construction of these drilled shaft foundations requires installing a permanent 10-foot diameter steel casing to a specified depth to the top of the competent geological layer known as the Troutdale Formation. The top layer of river substrate is composed of loose to very dense alluvium (primarily sand and some fines), beneath which is approximately 20 feet of dense gravel, underlain by the Troutdale Formation.

Figure 3-29 shows typical operations and equipment used in drilled shaft construction. Installation of drilled shafts will be conducted by first placing steel casing on the bottom of the river channel with a crane. The top of the casing will be above the waterline to provide containment during construction. The drilled shaft casing will be installed with an oscillator which will be operated from a work bridge or platform. As the shaft casing is being advanced, sand and substrate will be removed from inside the casing using an auger and clamshell. These pieces of equipment may be operated from a work bridge or platform, or may also be operated from a barge. Excavated soils will be temporarily placed onto a barge with appropriate containment, and ultimately taken to an approved upland site for disposal. All excavation activity and handling of material will be conducted consistent with the BMPs described in Section 4, and consistent with the permits that are ultimately issued for the proposed action. 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 a given drilled shaft casing has been excavated to the design depth (design depth will depend on design and will vary for each shaft), a steel reinforcement cage will be installed within the casing, and the shaft will be filled with concrete. Concrete will most likely be transported to the site via trucks, and pump trucks will be operated from the decks of temporary bridges, platforms, or from barges. Concrete will be installed via a tremie method. The interior of the 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 casing will be permanent and left in place to support the shaft cap isolation system.

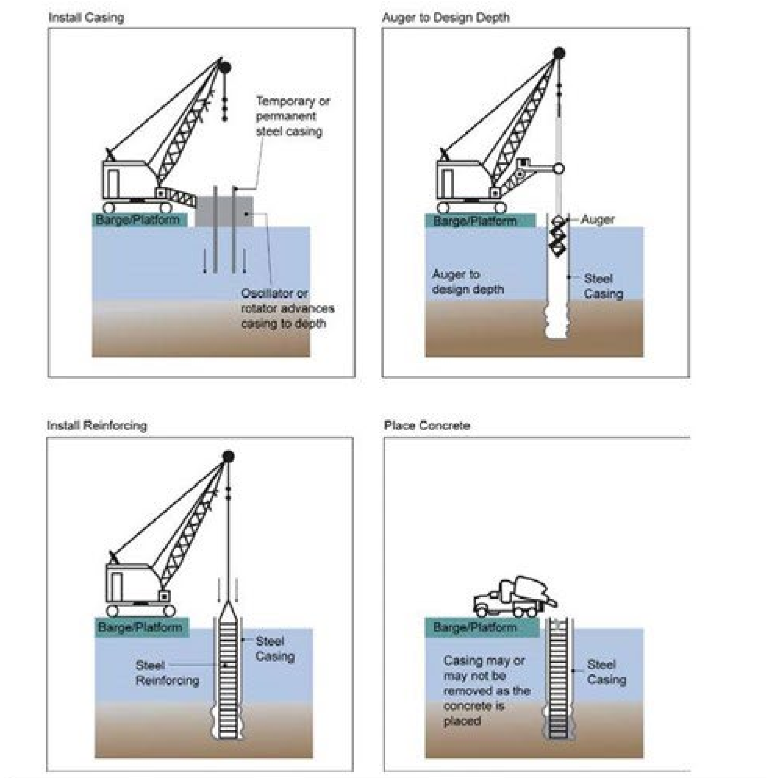
Once the drilled shafts are installed, a concrete shaft cap will be constructed atop the shafts at the waterline, and the concrete pier and superstructure will be installed atop the pile cap. The means and methods for the construction of the shaft caps will vary depending upon the pier being constructed.

Construction of the shaft caps for Piers 2 and 7 will occur within de-watered work areas within sheet pile cofferdams (See Section 3.4.3.3). Construction of these shaft caps will occur primarily from the temporary work bridges, but will likely be supported by one or more work barges and material barges. These shaft caps may be entirely cast-in-place, or may contain precast elements. Precast shaft cap elements, if any, will be fabricated off-site at a casting yard and then transported to the site and set into place.

Construction of the shaft caps for Piers 3 through 6 will occur within a suspended shaft cap isolation system, as described in Section 3.4.3.2. Construction of these shaft caps will occur primarily from temporary work platforms, and will likely be supported by one or more work barges and material barges.

Construction of the bridge foundations (including management of excavated soils and water, and containment for cast-in-place concrete work) 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.

Figure 3-29. Drilled Shaft Installation – Typical Operations and Equipment



Typical Drilled Shaft Installation from Barge or Platform

Typical Water-Based Drilled Shaft Installation

Clamshell Used for Removing Material from Drilled Shaft Casing

Superstructure Construction

Once the foundations and shaft 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 may be conducted from the bridge deck, from the deck of temporary work platforms and bridges, and/or from barges. Construction of the superstructure will require cranes, work barges, and material barges in the river year-round. 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 casings); therefore, this work will be fully isolated from the river.

Portions of the superstructure may be constructed of structural steel, cast-in-place concrete, or precast concrete or combinations thereof.

Precast Concrete Work

Precast bridge elements will be constructed in permitted and approved upland 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, consistent with all applicable BMPs described in Section 4.

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 Program. 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 Work

Components of the superstructure that may require cast-in-place concrete work include the foundation shaft caps, 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 fully contained conditions (sealed forms, not in contact with surface waters), to prevent any leaks of concrete or water that has come in contact with uncured concrete. Formwork 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.

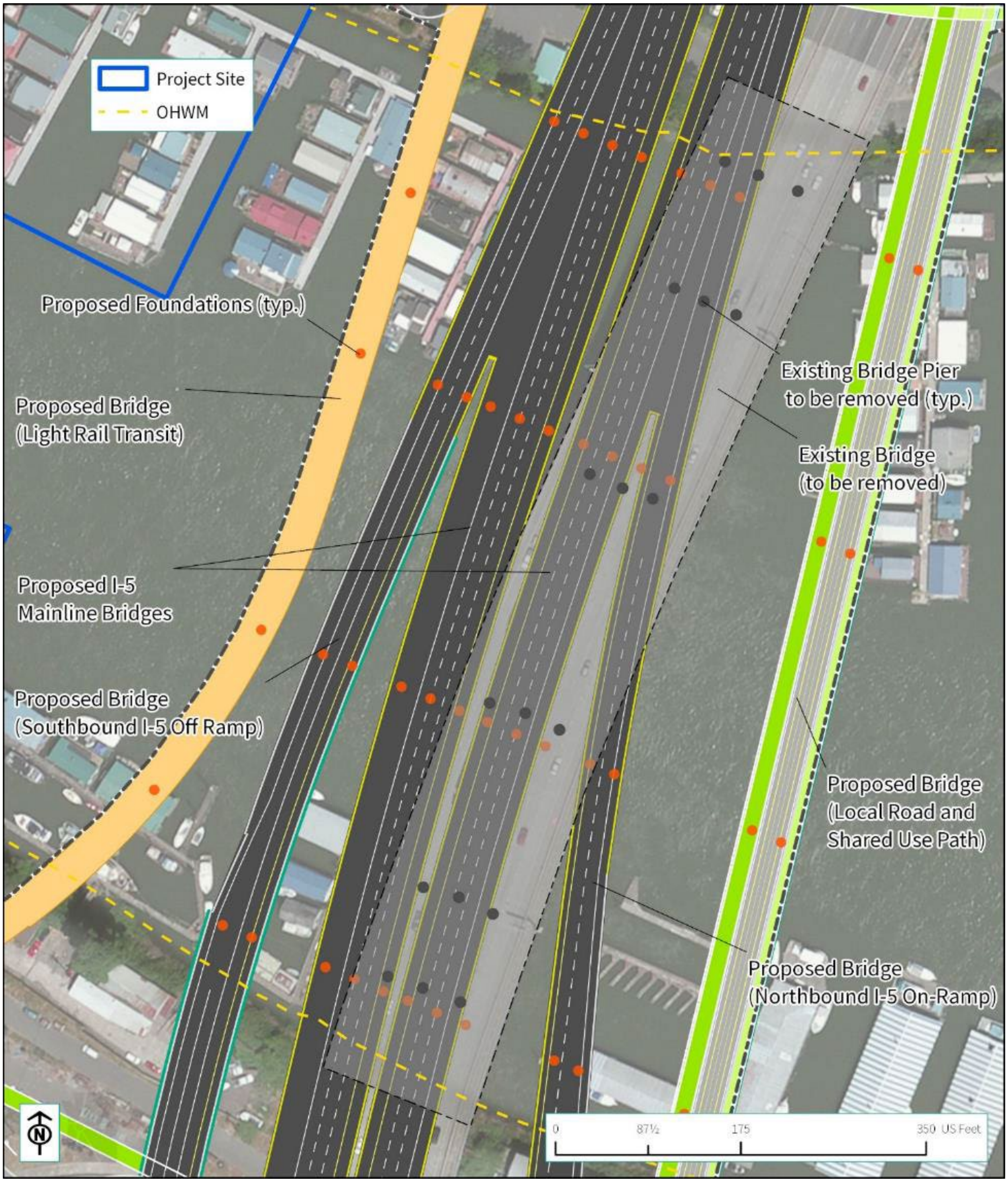
Work bridges, platforms, and barges will have suitable containment measures (outlined in the SPCC plan and PCP) to prevent and/or contain accidental spills, and to ensure no uncured concrete or other debris discharges to surface waters. Examples of typical BMPs include curbing, plugged scuppers, and 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.

3.4.6.2 North Portland Harbor Bridges

The existing North Portland Harbor bridge was constructed in the early 1980s of pre-stressed concrete girders and reinforced concrete bents. The bents are supported by driven steel piling. Two previous bridges, constructed in 1917 and 1958, were built at the same location as the current bridge, but may not have been fully removed during subsequent replacement efforts. These bridges had reinforced concrete bents supported on timber piles. Some of this material may still be present, but this will not be confirmed until construction begins. Some removal of debris associated with the previous bridges is likely to be necessary to accommodate the installation of the drilled shaft foundations for the replacement bridges, including the installation of temporary drilled shaft isolation casings, permanent drilled shaft casings, or the installation of temporary piles for the temporary work bridges. Unexpected debris removal may require additional work and could cause delays that may impact the project schedule.

Each of the six replacement North Portland Harbor bridges will be supported on 10-foot diameter drilled shaft foundations. An overview showing the general layout and configuration of the replacement bridges and their drilled shaft foundations is shown in Figure 3-30.

Figure 3-30. North Portland Harbor Bridge– - Overview



Approximately 52 in-water drilled shafts will be required to support the foundations for the North Portland Harbor bridges. These structures will impact approximately 4,084 square feet of benthic habitat. All portions of North Portland Harbor at the bridge location are less than 20 feet deep, and as such all piers would be located in shallow water habitat.

Table 3-6 provides a summary of the proposed permanent in-water and overwater elements associated with the North Portland Harbor Bridges.

Table 3-6. Permanent In-Water and Over-water Structures – North Portland Harbor Bridges

Existing/ Proposed	Permanent In-Water and Over-water Work Elements	Approx. Quantity	Benthic Impact (sf)	Overwater Shading (elevated bridge deck) (sf)	Fill Volume Within Functional Floodplain (cy)
Proposed Bridges	Drilled Shafts (10-foot diameter)	52	4,084	0	4,400
	Isolation Casing Seal (19-foot diameter)	52	10,659	0	1,200
	Shaft Caps	0	0	0	0
	Replacement Bridges Overwater Deck (total)	6 structures	0	378,884	0
Existing Bridges (To be removed)	Existing Bridge Foundations (25'x25' & 28'x28' pile caps)	18	-12,204	0	-1,250
	Existing Bridge Deck (total)	1 existing structure	0	-198,869	0
Net Change	–	–	**2,539**	**180,015**	**+4,350**

Key: cy = cubic yard; sf = square feet

Conceptual Construction Sequence and Timeline

As with the Columbia River bridges, the general sequence of construction of the North Portland Harbor bridges is expected to proceed in a manner comparable to that which was developed for the CRC project. However, the specific means and methods of construction, including sequencing, will be developed by the contractors that are awarded the contract for construction. As with the Columbia River bridges, regardless of the sequence, all work will be conducted consistent with the I avoidance and minimization measures described in Section 4 of this document, and consistent with the permits that are ultimately issued for the proposed action.

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

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

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

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

Debris Removal

Debris from previous structures, including foundations from the 1917 and 1953 bridges, may be present at some locations where drilled shafts will be installed. This debris is likely to consist of large rock or old concrete. Because casings cannot advance through this type of material, it must be removed.

Debris removal will be conducted using a clamshell bucket, and only minimal amounts of sediment are expected to be disturbed. Debris will be temporarily placed on a barge or in an upland location, and will be and disposed of at a facility permitted for handling such materials.

Debris removal will only occur in the precise locations where material overlaps with the footprint of temporary piles or proposed drilled shafts, greatly minimizing the extent of the temporary disturbance. The project may remove debris in an area of approximately 4,000 square feet, and a maximum of approximately 250 cubic yards of material may be removed.

Debris removal activities will be conducted in accordance with the SPCC and PCP plan described in Section 4.

Foundation Construction

Installation of drilled shafts for the North Portland Harbor bridges would be conducted in a manner similar to that described for the Columbia River bridges, with two exceptions.

In North Portland Harbor, drilled shafts will be installed within a temporary drilled shaft isolation casing (see Section 3.4.3 for description). These casings will be approximately 19 feet in diameter, and will have a permanent tremie concrete seal at the base, which will allow them to be dewatered. The top of the seal will be established at a depth 3 feet below the mudline.

Temporary isolation casings will be placed on the river bottom and then either pushed into the substrate approximately 5 to 10 feet with weighted equipment, or with a vibratory hammer (See Section 3.4.7.1). Once installed, a permanent concrete seal will be cast-in-place at the base, which will allow them to be dewatered (See Section 3.4.4).

Once a given temporary isolation casing has been installed, sealed, and dewatered, a single 10-foot diameter permanent drilled shaft casing will then be installed through the concrete seal. Installation of these permanent casings will be conducted with an oscillator, operated from one of the temporary work bridges.

Once the permanent casing has been installed to design depth, steel reinforcement will be installed within the casing, and the shaft will be filled with concrete in a manner similar to that described for the Columbia River bridges (Section 3.4.6.1). Once this process is complete, the temporary isolation casing will be removed, but the permanent concrete seal will remain.

The other difference in the construction of the foundations for the North Portland Harbor bridges is that no shaft caps will be constructed on the piers for the North Portland Harbor bridges. Once a given drilled shaft has been completed and structurally approved, cast-in-place columns will be installed directly on top of each drilled shaft. Cast-in-place concrete work for the columns will be conducted as described for the Columbia River bridges.

Superstructure Construction

Construction of the superstructure for the North Portland Harbor bridges will also be similar to the Columbia River bridges. Portions of the superstructure may be constructed of structural steel, cast-in-place concrete, or precast concrete. 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 may 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. 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 casings) and, as such, will be fully isolated from the river.

3.4.7 Pile Driving and Drilled Shaft Oscillation

3.4.7.1 Vibratory Pile Driving and Removal

Installation of temporary piles will be conducted with a vibratory hammer to the extent practicable, as a means of minimizing impacts associated with underwater noise. In addition, vibratory methods will be used to install steel sheet piles for temporary cofferdams with removal happening via a vibratory hammer or by direct pulling. Vibratory pile driving and removal activities are proposed to occur year-round with the possibility of up to two hammers operating simultaneously.

Steel Pipe Piles

Piles for non-load-bearing structures (e.g., falsework, battered piles, pile templates, barge mooring piles) 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 and platforms) 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, load-bearing piles will be vibrated to the point of refusal, then finished and/or proofed with an impact hammer.

Vibratory installation of temporary steel pipe piles is estimated to take between 5 and 30 minutes per pile, and vibratory removal is estimated to require a similar duration of activity. Up to two vibratory pile-driving rigs could be in operation on a given day. At this rate of production, with two vibratory pile-driving rigs in operation, it is anticipated that up to approximately 20 temporary, hollow steel pipe piles could be installed and/or removed on a given day. However, on an average day, there will likely be fewer piles driven.

Because temporary piles 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 320 (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 generally 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. Up to two vibratory pile-driving rigs could be in operation installing sheet pile on a given day. At this rate of production, with two vibratory pile-driving rigs in operation, 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. However, on an average day, there will likely be fewer sheet piles driven. It is further conservatively estimated that vibratory installation or removal of sheet piles could be conducted on up to approximately 200 (nonconsecutive) days.

Temporary Drilled Shaft Isolation Casings

Temporary drilled shaft isolation casings (See Section 3.4.3.4) will be placed on the river bottom with a crane, and then either pushed into the substrate approximately 5 to 10 feet deep with weighted equipment, or vibrated to this depth with a vibratory hammer.

If a vibratory hammer is used for installation, it will be operated from a temporary work bridge or from a barge. Installation and removal of these temporary casings is estimated to take between 30 and 60 minutes per casing. At this rate of production, it is anticipated that up to approximately four casings could be installed and/or removed on a given day, depending upon available workspace on the temporary platforms and other factors. For purposes of this consultation, it is conservatively estimated that installation or removal of these temporary isolation casings could be conducted on up to approximately 50 (nonconsecutive) days.

3.4.7.2 Impact Pile Driving

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

It is estimated that a total of approximately 3,311 temporary piles will be installed and removed during the multi-year construction of the Columbia River and North Portland Harbor bridges. These piles will be staged throughout the in-water construction and demolition periods, and it is assumed that between 100 and 400 temporary piles may be in the water at any given time.

An average of six temporary, load-bearing piles could be installed per day using up to two impact drivers at the same time. It is estimated that some amount of impact pile driving in the Columbia River or North Portland Harbor will occur on approximately 735 days spread over the estimated nine in-water work seasons that will be required for the construction of the replacement bridges and demolition of the existing bridges.

It is estimated that up to approximately 300 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 three piles per day may be installed and/or proofed with an impact hammer, with an estimated total maximum number of 900 impact strikes per day if a single impact pile driver is in operation, or up to 1,800 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.

A bubble curtain or similarly effective noise attenuation device will be implemented during all impact pile driving, and a hydroacoustic monitoring plan will be implemented during impact pile driving to confirm the attenuation device is installed and functioning as designed. This monitoring program will require some unattenuated pile strikes to confirm the amount of attenuation provided by the system. Some amount of unattenuated pile strikes are also factored in to account for periods when the bubble curtain may not be providing sufficient attenuation. For purposes of this consultation, it is estimated that up to 75 unattenuated strikes may be required for a period of approximately 10 minutes approximately one day per week. Testing will occur on up to approximately 40 (nonconsecutive) days total over the course of the nine in-water work seasons.

During construction up to two impact pile drivers may operate simultaneously in close proximity to one another. In addition, the contractor may elect to have both a vibratory and impact pile-driving rig in operation simultaneously.

3.4.7.3 Drilled Shaft Oscillation

Permanent Drilled Shaft Casings

The 10-foot diameter, hollow steel casings for the permanent drilled shafts will be installed with an oscillator, which will be operated from a temporary work bridge or platform. A total of 160 such casings will be required (108 for the Columbia River bridge, and 52 for the North Portland Harbor bridges. See Section 3.4.6 for a description of the drilled shaft installation.

The amount of time that an oscillator will be operated to install a given permanent shaft casing will vary depending on the design depth of each shaft, its location, and other factors. For purposes of this consultation, it is estimated that it will take up to five days to completely install a typical 10-foot diameter casing. Some casings may be able to be installed more quickly, and others may proceed more slowly. However, it is conservatively estimated that oscillation of permanent drilled shaft casings could be conducted on up to approximately 800 (nonconsecutive) days.

3.4.8 Demolition of Existing Bridges

The proposed action includes the removal of the existing Columbia River and North Portland Harbor bridges. Demolition of the existing bridges will include dismantling and removal of the superstructure, and removal of the in-water foundation structures. These activities are described in the subsections below.

Interstate Bridge Demolition

Superstructure Removal

The existing Interstate Bridge structures are comprised of steel through-truss spans with reinforced concrete decks, including one pair of movable spans over the primary navigation channel. In addition to these trusses, there are reinforced concrete approach spans (over land) on either end of the bridges. Demolition of the superstructure will likely begin with removal of the counterweights. The lift span will be locked into place and the counterweights will be cut into pieces and transferred off-site via truck or barge. Next, the lift towers will be cut into manageable pieces and loaded onto barges by a crane. Prior to removal of the trusses, the deck will be removed by cutting it into manageable pieces; these pieces will be transported by barge or truck or by using a breaker (hydraulic hoe ram), in which case debris will be caught on a barge or other containment system below the work area. After demolition of the concrete deck, trusses will be lifted off of their bearings and onto barges and transferred to a shoreline dismantling site.

Lead paint, asbestos-containing materials, and/or polychlorinated biphenyls (PCBs) may be present on portions of the existing bridges. 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 bridges (including containment and abatement of any hazardous materials) will be conducted consistent with the impact avoidance and minimization measures 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 and National Pollutant Discharge Elimination System Construction Stormwater Discharge Permits.

Foundation Demolition

Demolition of the concrete piers and timber piling foundations for the existing bridges will be accomplished using one of two methods:

- 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 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. This activity will be restricted to the IWWW.
- 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 a depth at least 3 feet below the mudline and the substrate will be naturally restored with surrounding sediments. No clean sand or other fill material will be installed.

Where cofferdams are used for demolition, they will consist of sheet piles, and they will be installed consistent with the approach described in Section 3.4.3 and will include fish salvage consistent with NOAA's guidance as described in Section 3.4.4. Once foundations have been removed 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 bridges 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 localized temporarily elevated turbidity. 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 avoidance and minimization measures described in Section 4, to further reduce the potential for impacts to ESA-listed species or critical habitats.

North Portland Harbor Bridge Demolition

Superstructure Removal

Demolition of the existing North Portland Harbor bridge would likely occur in stages, and would be sequenced with construction of the replacement bridges to maintain traffic movement. The specific sequence will be dependent on the final design and on the means and methods of the contractor.

It is assumed that the existing bridge will be removed after the completion of the replacement southbound I-5 bridge structure and off-ramp, but prior to the construction of the northbound I-5 bridge and on-ramp. Traffic will be temporarily moved to the replacement southbound I-5 structure during demolition and removal of the existing bridge, and construction of the remaining bridges.

The means and methods of demolition of the superstructure will likely be similar to that described for the Columbia River bridge. The existing concrete bridge spans and deck will 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.

Foundation Demolition

Demolition of the concrete pile caps and steel piling foundations for the existing North Portland Harbor bridge will be accomplished using the wire saw method described for the Columbia River bridge. This activity will be conducted without a sheet pile cofferdam. A diamond wire/wire saw will be used to cut the foundations into manageable pieces that will 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 allowed to fill in through natural deposition. No clean sand or other fill material will be installed.

Removal of the existing bridge foundations has the potential to result in similar impacts to water quality as those associated with construction of the replacement bridges. Removing the old foundations from the river will temporarily disturb benthic sediments and could result in localized temporarily elevated turbidity. 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 avoidance and minimization measures described in Section 4, to further reduce the potential for impacts to ESA-listed species or critical habitats.

3.4.9 Roadway Improvements

As described in Section 3.2, the proposed action includes improvements to seven interchanges along a 5-mile segment of I-5 between Victory Boulevard in Portland and SR 500 in Vancouver. These improvements also include some reconfiguration of adjacent local streets to complement the new interchange designs, as well as new facilities for bicyclists and pedestrians.

Typical roadway construction activities associated with the proposed action will generally involve a sequence of activities described in this section; however, the specific means and methods of construction will be developed by the contractors that are awarded the construction contracts for each portion of the project, and may differ from the methods described here.

During construction, the existing mainline will continue to be under traffic while new facilities are built offline, or temporary mainline facilities will be constructed to provide space for permanent work. Temporary earthwork, drainage, surfacing, and paving activities will be required, utilities may need to be relocated, drainage appurtenances put in place, and access to and from the freeway rerouted to accommodate the new roadway or interchange. Permanent work will proceed once traffic has been relocated to temporary facilities, if necessary.

Earthwork equipment will build embankments or excavate earth to a subgrade elevation (the bottom of the eventual pavement section that traffic will drive on). Because of the tight areas, large earthmoving equipment is not envisioned for use in this work. Wheel loaders, back hoes, and similar equipment will likely be the most commonly used equipment. Dump trucks will be used to transport material to and from the project. Embankments are typically constructed in layers with thorough compaction to ensure stability. Large rollers are typically used for this compaction. Once completed, rock will be placed on the subgrade with several lifts of asphalt or concrete pavement following. Rock will be placed by dump trucks and compacted with rollers. Asphalt will be placed with a paving machine that is fed by dump trucks then compacted by rollers. Final drainage fixtures will be installed either before or after the final surfacing operation. Illumination, Intelligent Transportation Systems, and signal conduits will generally be installed prior to surfacing. Foundations and other appurtenances may be installed either prior to or after the surfacing work. Concrete barriers, guardrails, and other safety devices are typically installed after the surfacing work, followed by landscaping and other finishing work. Temporary barriers may be used until roadways are fully completed. Permanent stand-alone sound walls may be required in certain locations, and these may be constructed at any time during the overall roadway construction sequence.

As the various stages are completed, the new roadways will be striped to accommodate the shifting of traffic to allow areas to be cleared for future stages of work. A final level of asphalt will be placed and permanent striping and signing installed prior to returning traffic to the roadway. This may be preceded by illumination and concrete median barrier being installed between adjacent roadways.

3.4.10 Light-Rail Construction and Operation

The proposed action includes construction of LRT guideways, both at-grade and elevated, park-and-ride facilities, and transit stations; and expansion of TriMet's Ruby Junction Maintenance Facility in Gresham, and an overnight LRV storage facility at the Expo Center.

Final design of the LRT system, and integration of automobile, pedestrian, and bicycle traffic facilities will occur in the future. However, construction of the various components of the LRT system generally will include:

- Mobilization and site reparation
- Grading and excavation
- Installation of underground utilities and signal tie-ins
- Construction of systems foundations
- Installation of overhead catenaries
- Concrete surface work
- Finish work and landscaping

Most of the LRT track will be comprised of new impervious surfaces, though some portion of the in-ground tracks may be constructed with pervious tie-and-ballast construction. Elevated trackways and bridges will be impervious, as will tracks that are constructed over existing impervious surfaces. (Section 3.4.11 below discusses stormwater treatment for impervious surfaces, including those associated with the LRT system.

At-grade LRT tracks will require clearing, grading, and typically shallow excavations. This will generally require relocation of utilities. Clearing may include demolition and removal of pavement, vegetation, and other surface features. During the grading phase, contractors will install culverts or other permanent drainage structures and below-grade light-rail infrastructure. Shallow, near-surface excavations will be required to construct the subgrade and track and station platform slabs for at-grade segments.

Elevated guideways and stations for the LRT system will be constructed of steel, reinforced concrete, or combinations of both. Construction will likely begin with preparation to build foundations, which may consist of shallow spread footings, deep driven or augered piles, or drilled shafts. Once foundations are in place, concrete columns and crossbeams will be constructed. The superstructure of each elevated structure may be built of steel, cast-in-place concrete, or precast concrete. If steel or precast concrete is used, sections can be transported to the site and lifted into place from the street. If cast-in-place concrete is used, then temporary structures will be required to support the superstructure until the cast concrete has gained enough strength (through curing) to support itself.

The LRT system will also require construction of an overhead catenary system over the guideway to provide electrical power to the trains. Additionally, it will likely be necessary to seek temporary construction easements or small permanent easements on some properties adjacent to the light-rail alignment to allow construction workers to encroach on several feet of a property to place specific elements.

Transit construction will also require staging areas adjacent to or within the guideway to store construction equipment and materials. Most of this staging activity will occur on land that is already in the public right of way or in public ownership and that is not being used for other purposes, such as vacant lots.

The proposed action also includes an expansion of the TriMet's Ruby Junction Maintenance Facility on NW Eleven Mile Avenue in Gresham. This expansion will include the need to acquire additional right of way and to build new storage tracks. The expansion will convert some pervious surfaces to impervious surfaces; however, it will result in a slight net decrease in impervious surface overall. Portions of the site are within the 100-year floodplain of Fairview Creek. Although no buildings will be constructed in the floodplain, portions of the floodplain may be developed for track and outside storage. A floodplain permit will likely be required from the City of Fairview, and a floodplain analysis will be conducted to demonstrate that activities conducted within the floodplain would result in no net-rise of flood elevations.

The proposed action also includes building an overnight LRV storage facility at the Expo Center, adjacent to the Expo station. This facility will include the need to acquire right of way to build new storage tracks, including an at-grade track crossing of Expo Road. This new facility will be located in an existing paved parking lot.

LRT construction activities will all be conducted consistent with the BMPs established in this BA (including consistency with the ESCP, PCP, and SPCC plan for the proposed action), and consistent with conditions of permits issued for the proposed action. Temporarily disturbed areas will be revegetated upon completion of the proposed action, consistent with the requirements of any permit authorizations.

3.4.11 Construction Stormwater Management

Without proper management, construction activities (including ground-disturbing activities and material staging) can create temporary adverse effects on water quality in nearby waterbodies, such as increased turbidity or the accidental release of fuels and soluble or water-transportable construction materials. Anticipated areas of disturbance from construction activities are summarized in Table 3-7.

Table 3-7. Areas of Potential Temporary Disturbance during Construction

Receiving Waterbody/State	Potential Area of Temporary Disturbance (acres)
Columbia Slough/Oregon	72.80
Columbia River/Oregon	15.85
Columbia River/Washington	36.57
Burnt Bridge Creek/Washington	11.84

Construction and staging activities will be required to be conducted in compliance with local and state construction stormwater treatment requirements. Stormwater generated during temporary construction activities could include oils, greases, metals, solvents and/or high-pH water from concrete clean out. Construction stormwater treatment BMPs would be designed to treat specific areas of these sites. Site-specific construction stormwater BMPs could include pre-treatment facilities, such as oil-water separators and sediment traps, or other facilities to meet water quality and water quantity issues, as appropriate. Appropriate BMPs for construction stormwater treatment are discussed further in Section 4.

National Pollutant Discharge Elimination System Construction Stormwater Discharge Permits will regulate the discharge of stormwater from temporarily disturbed areas. These permits include discharge water quality standards, runoff monitoring requirements, and provision for preparing and implementing an ESCP that details stabilization during each stage of construction activities. The ESCP 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 (CESCL) on staff to oversee proper implementation of the ESCP.

Typical elements of an ESCP 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.

3.4.12 Post-Project Stormwater Management

This section describes the approach to post-project management of stormwater runoff from impervious surface areas (ISA) constructed or affected by the proposed action.

3.4.12.1 Design Criteria and Objectives

Stormwater Management Design Criteria

Stormwater management for the proposed action will comply with all applicable federal, state, and local standards, as well as with the standards established in the BO for ODOT's FAHP Programmatic ESA Consultation (NOAA Fisheries 2021b). The IBR Program will not be covered under the FAHP programmatic consultation, but the proposed stormwater management approach for this proposed action has been designed to adhere closely to the applicable criteria and standards established in the FAHP BO.

The FAHP BO uses CIA as the metric to establish the stormwater management requirements for a proposed action. The FAHP BO establishes project design criteria that define when and what type of post-project stormwater management is required. Projects seeking coverage under the FAHP programmatic that require water quality treatment are required to provide treatment for stormwater runoff generated by the Water Quality Design Storm from the project's CIA (or from an equivalent off-site area with equal or greater Annual Average Daily Traffic [AADT] volume) using BMPs that are highly effective at removing the full range of highway runoff pollutants.

Contributing Impervious Area

The FAHP BO defines CIA to include all ISA associated with public highways, roads, streets, roadside areas, and auxiliary features (e.g., rest areas, roadside parks, viewpoints, heritage markers, park-and-ride facilities, and pedestrian and bicycle paths). A project's CIA includes both ISA within the project limits and ISA from areas contiguous to the project that discharge runoff into the project area prior to discharging directly or indirectly into a stream, wetland, or subsurface water through a ditch, gutter, storm drain, drywell, or other under underground system. Non-highway-related impervious areas (commercial development, residences, agricultural land) are not included in a project's CIA.

The FAHP programmatic project design criteria exempts certain types of actions from post-construction stormwater management for water quality. These actions include projects that do not reconstruct pavement down to subgrade. Such actions are not included in a project's CIA for purposes of establishing the water quality treatment requirements.

For purposes of this consultation, the CIA associated with the proposed action is assumed to include all post-project ISA within the project footprint (including new, reconstructed, and existing ISA), and post-project ISA that contiguous to the project footprint that generates runoff that flows into the project limits, except for overlay pavement improvements that do not flow into the project's CIA. This applies to approximately 1.8 acres of pavement overlay within the Columbia Slough basin that does not contribute runoff to the project CIA.

It is important to note that the design is at a preliminary stage of development, and the specific quantity and location of CIA will likely continue to be refined as the design progresses. While the specific quantities may change, the proposed action will, at minimum, meet the treatment standards established in the FAHP BO, and will be consistent with the requirements of the federal, state, and local agencies with jurisdiction.

Stormwater Management Objectives

To minimize permanent stormwater-related impacts, the following stormwater management objectives were adopted for the proposed action:

- Provide water quality treatment for 100% of the project CIA, consistent with the standards in the FAHP BO, and consistent with or exceeding applicable federal, state, and local requirements.
- Provide water quantity management (flow control) for project discharges consistent with the standards in the FAHP BO, and consistent with applicable federal, state, and local requirements.
- Select and provide water quality treatment and water quantity management facilities that comply with the specific requirements of the agencies with jurisdiction over the affected drainage areas.
- Prioritize the use of biofiltration (or similar BMPs that are highly effective at reducing 6PPD and 6PPD-q in stormwater) for water quality treatment wherever possible.

- Where practical and cost-effective, provide additional water quality treatment for runoff from resurfaced (or overlaid) project areas and/or from existing non-CIA impervious surfaces where none currently exists.

3.4.12.2 Existing Conditions

Figure 3-31 through Figure 3-34 show the existing drainage conveyance systems and features, major watershed boundaries, existing impervious surfaces, and existing stormwater management infrastructure (conveyances, existing treatment, outfalls, etc.) within the project site. Existing impervious surfaces within the project site include pavement associated with roadways and bridges, transit facilities, parking lots, sidewalks, and bicycle/pedestrian pathways.

Brief descriptions of the watersheds and project drainage conditions within each is provided in Table 3-8. The project drainage areas are defined by the waterbody to which runoff is discharged. These waterbodies are the Columbia Slough, Columbia River (including North Portland Harbor), Burnt Bridge Creek, and Fairview Creek. For purposes of this discussion, areas draining to the Columbia River are divided into those within Oregon (Columbia River South) and Washington (Columbia River North).

Table 3-8 summarizes discharges for each watercourse based on data available from U.S. Geological Survey gauging stations. These data provide an indication of the relative size of each receiving waterbody and permit a comparison of estimated project runoff with discharges in waterbodies receiving that runoff.

Table 3-8. Mean Monthly Discharge (cubic feet per second) of Receiving Waters

Month	Columbia Slough at Portland (USGS 14211820)[a]	Columbia River at Vancouver (USGS 14144700)[b]	Burnt Bridge Creek near Mouth (USGS 14211902)[c]	Fairview Creek near Gresham (USGS 14211814)[d]
January	160	164,000	44	10
February	155	181,000	41	8.5
March	127	179,000	44	8.6
April	103	223,000	31	6.9
May	49[e]	308,000	23	5.2
June	88[f]	363,000	16	4.2
July	97	242,000	11	2.5
August	82	150,000	8.4	2.0
September	72	107,000	7.5	2.3
October	91	110,000	14	3.9
November	104	127,000	33	6.8
December	131	144,000	39	9.6

Notes:

a USGS (2023a) from October 1989–September 2020.

b USGS (2023b) from October 1963–May 1970, April 2016–September 2021.

c USGS (2023c) from October 1998–September 2000, October 2010–October 2012.

d USGS (2023d) from October 1992–March 2020.

e Average monthly reverse flow from the Willamette River was recorded in 1997, 2006, 2008, 2011, and 2018.

f Average monthly reverse flow from the Willamette River was recorded in 1990.

Key: USGS = U.S. Geological Survey

Figure 3-31. Stormwater Existing Conditions – Oregon (South)

Figure 3-32. Stormwater Existing Conditions – Oregon (North)

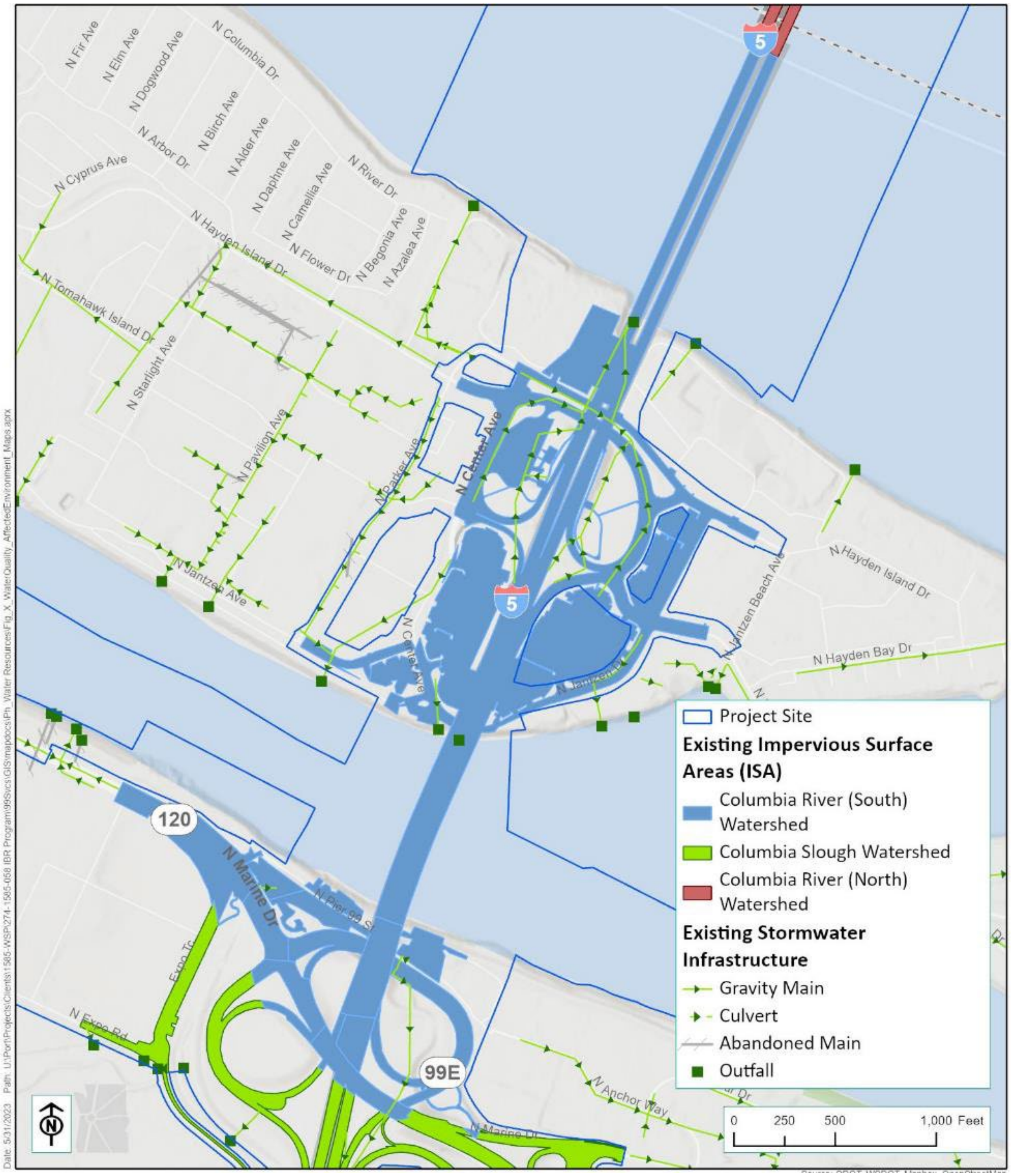


Figure 3-33. Stormwater Existing Conditions – Washington (South)

Figure 3-34. Stormwater Existing Conditions – Washington (North)

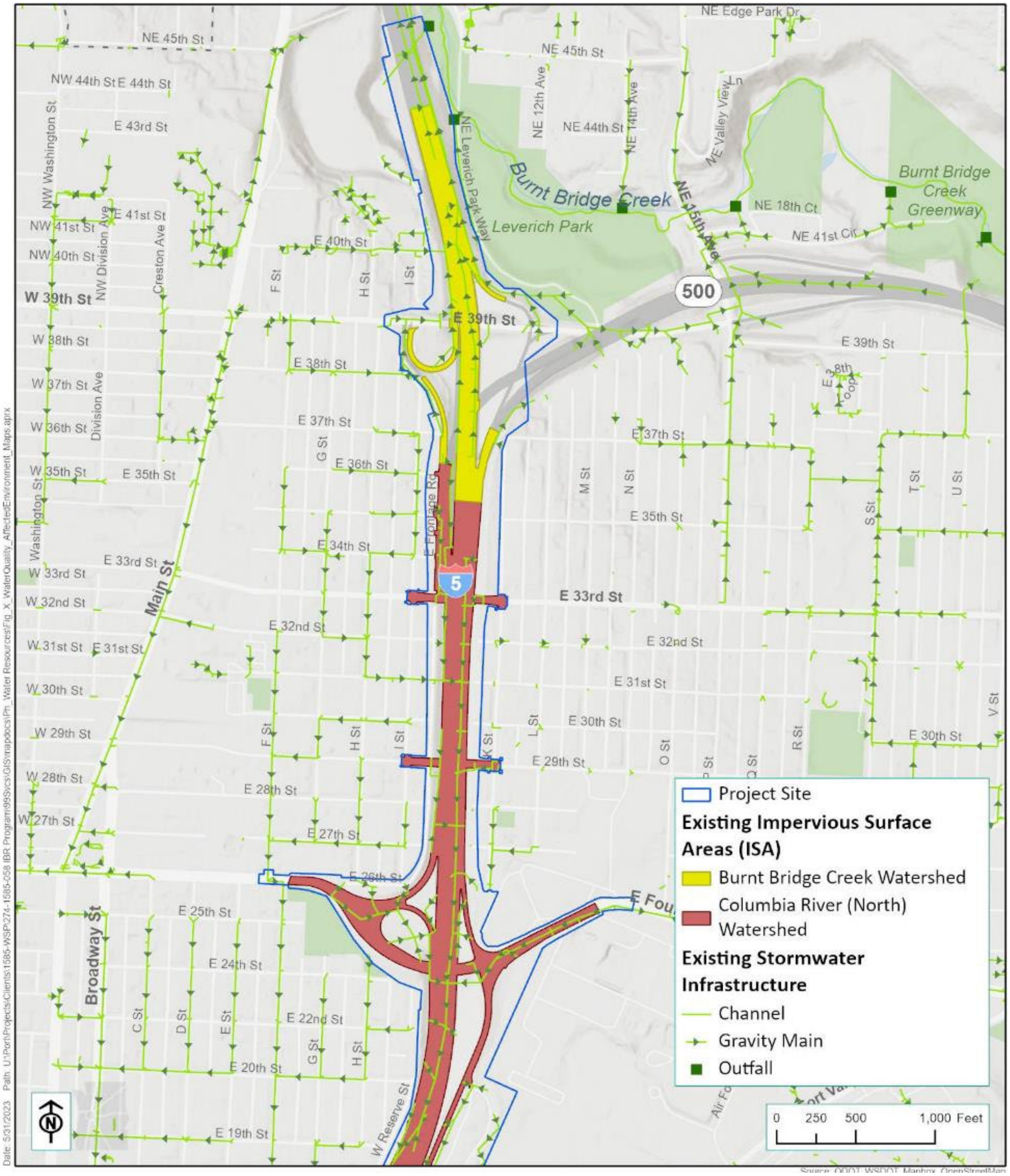


Table 3-9 provides a summary of the existing impervious areas and stormwater treatment within the project site by receiving waterbody.

Table 3-9. Existing Impervious Surface Area and Stormwater Treatment

Receiving Waterbody	Existing ISA (acres)	Infiltrated ISA (acres)	Untreated ISA acres)
Columbia Slough	38.5	3.0	35.5
Columbia River – South	45.8	0.0	45.8
Columbia River – North	76.4	3.0	73.4
Burnt Bridge Creek	9.6	7.9	1.7
Fairview Creek	7.3	7.3	0.0
Totals	**177.6**	**21.2**	**156.4**

Key: I-5 = Interstate 5; ISA = Impervious Surface Area; SR = State Route

Columbia Slough Watershed

The Columbia Slough is a slow-moving, low-gradient drainage channel running nearly 19 miles from Fairview Lake in the east to the Willamette River in the west. The slough is a remnant of the historic system of lakes, wetlands, and channels that once dominated the south floodplain of the Columbia River. The Columbia Slough watershed currently drains approximately 32,700 acres of land in portions of Troutdale, Fairview, Gresham, Maywood Park, Wood Village, and Multnomah County.

This watershed includes portions of the former Columbia River floodplain and before the construction of a levee system and pump stations, would have been subjected to frequent inundation. Near I-5, the original ground surface is below the OHWM for the Columbia River. There are two drainage districts within the project footprint: Peninsula Drainage Districts No. 1 and No. 2 (or Pen 1 and Pen 2, respectively). I-5 is the boundary between the two districts with No. 1 to the west and No. 2 to the east. Daily operations of both districts are managed by the Multnomah County Drainage District.

Runoff from the project area within the Columbia Slough Watershed drains to a system of sloughs before being discharged to the Columbia Slough via pump stations which are sized to handle storm events with a 1% recurrence interval (generally referred to as the 100-year event). A portion of Marine Drive west of I-5, while within the confines of the levee system, drains to outfalls on North Portland Harbor and is included in the Columbia River South Watershed.

The total ISA within the project limits in the Columbia Slough Watershed is approximately 38.5 acres (Figure 3-31). There are currently no constructed water quality treatment facilities providing treatment for stormwater from existing ISA within the project footprint in the Columbia Slough watershed. However, stormwater from approximately 3.0 acres of existing ISA is infiltrated, and not discharged to surface waters. Stormwater from the remaining 35.5 acres of existing ISA is delivered untreated to surface waters.

Based on data available from the Natural Resources Conservation Service, surficial soils in this area mainly comprise the Sauvie-Rafton-Urban land complex. These soils belong to Hydrologic Group D and have a low infiltration rate and high runoff potential.

I-5, Marine Drive, and Martin Luther King Jr. Boulevard are elevated on embankments or structures, and the drainage systems that serve these roads do not handle runoff from outside the right of way. These embankments are also part of the levee system. Surface runoff from I-5 and roads within the project footprint is generally confined to the roadway surface by continuous concrete barriers or curbs and is collected almost entirely by closed gravity drainage systems with inlets and stormwater pipes. The one notable exception is Martin Luther King Jr. Boulevard east of I-5, where runoff is shed off the south shoulder.

Fairview Creek

Fairview Creek is a 5-mile-long urban stream that originates in a wetland near Grant Butte in Gresham, Oregon, and drains to Fairview Lake, and is a tributary to the eastern portion of the Columbia Slough. The Fairview Creek contributing watershed is approximately 6.5 square miles and receives stormwater runoff from Gresham, Wood Village, and Fairview. Fairview Creek is impounded by a dam that forms Fairview Lake.

The only portion of the proposed action that will occur within the Fairview Creek watershed are the proposed improvements to the Ruby Junction Maintenance Facility. The area in which the project modifications will be conducted includes approximately 7.3 acres of existing ISA. Stormwater from all 7.3 acres of this existing ISA is infiltrated through the use of dry wells, ultimately recharging the groundwater aquifer and contributing to flows in waterbodies within the Columbia Slough watershed.

Columbia River South Watershed (Oregon)

The Columbia River South Watershed includes the portion of the project area south of North Portland Harbor that drains to that waterbody (as mentioned above), the North Portland Harbor Bridge, Hayden Island, and the portions of the Columbia River bridges located south of the bridge high point. The total existing ISA within the project limits in the Columbia River South Watershed is 45.8 acres (Figure 3-32). There are currently no constructed water quality treatment facilities providing treatment for stormwater from existing ISA within the project limits in the Columbia River South watershed, and no appreciable infiltration is provided either. Stormwater from all existing ISA is delivered untreated to surface waters.

Like the Columbia Slough Watershed, the project footprint within this watershed is in what was part of the Columbia River floodplain. The portion south of North Portland Harbor is protected against flooding by a levee system, material dredged from the Columbia River has been used to raise the overall ground surface on Hayden Island east of the BNSF railroad tracks above the 100-year flood event.

Mapped surficial soils on Hayden Island comprise the Pilchuck-Urban land complex, based on available Natural Resources Conservation Service data. These are Hydrologic Group A soils that have a high infiltration rate and consist mainly of deep, well drained to excessively drained sands or gravelly sands. The historic placement of dredged sand on Hayden Island may have influenced the actual characteristics of the surface soils on portions of Hayden Island somewhat, though the material that was placed (dredged sands) would likely have similar infiltration and drainage characteristics.

I-5 is elevated on an embankment across Hayden Island. Surface runoff from I-5 and local roads within the project footprint is generally confined to the roadway surface by continuous concrete barriers or curbs. Except for the North Portland Harbor and Interstate Bridge, runoff is collected entirely by closed gravity drainage systems with inlets and stormwater pipes that discharge directly to North Portland Harbor or the Columbia River. Runoff from the bridges is discharged through scuppers directly to the water surface below.

Columbia River North Watershed (Washington)

This watershed comprises the project portion of the footprint extending from the Washington state line in the south to the SR 500 interchange in the north. It encompasses the current I-5 corridor as well as Vancouver city streets. Land west of I-5 comprises downtown Vancouver and residential neighborhoods to the north. The area east of I-5 and south of Fourth Plain Boulevard contains the Pearson Airpark and Fort Vancouver Historic Park, both of which are low-density land uses. North of Fourth Plain Boulevard, land east of the highway comprises residential development. The total ISA within the project limits in the Columbia River North Watershed is 76.4 acres (Figure 3-34). There are currently no constructed water quality treatment facilities within the Columbia River North project footprint. However, stormwater from approximately 3.0 acres of existing ISA is infiltrated, and not discharged to surface waters. Stormwater from the remaining 73.4 acres of existing ISA is delivered untreated to surface waters.

Within the project footprint, the land is formed of the gently sloping Wind River and Lauren surficial soils. These soils belong to Hydrologic Group B and have a moderate infiltration rate.

Surface runoff from I-5 and local streets is generally confined to the roadway by continuous curbs and concrete barriers and is collected almost entirely by closed drainage systems. The only exceptions are the Columbia River bridges and a few ditches adjacent to the highway. These closed systems discharge runoff directly to the Columbia River via outfalls in the vicinity of the existing highway bridges, while runoff from the bridges themselves drains through scuppers to the river below. A pump station located southeast of the SR 14 interchange discharges runoff from lower lying portions of the interchange to the Columbia River during high river levels. The vertical grade of I-5 is generally below the surrounding areas and as a result, the drainage system serving the highway also handles runoff from built-up areas outside the highway right of way.

Burnt Bridge Creek Watershed

The project footprint within this watershed includes the SR 500 interchange and portions of I-5 to the north and SR 500 to the east. Typical of an urban environment, surface runoff from the highways and local streets is generally confined to the roadway by continuous curbs and concrete barriers and is collected almost entirely by closed drainage systems. The total ISA within the project limits in the Burnt Bridge Creek watershed is approximately 9.6 acres (Figure 3-34).

Surficial soils in this area typically consist of Wind River loams. These soils belong to Hydrologic Group B and are considered to have a moderate infiltration rate. Residential developments are located south of the SR 500 interchange. There is a school to the northwest of the SR 500 interchange and a park to the northeast. Available information suggests that the groundwater table in this area is deep.

Stormwater from approximately 7.9 acres of existing ISA is conveyed to an infiltration pond at the Main Street interchange. Stormwater from the remaining approximately 1.7 acres of existing ISA is conveyed to a wet pond north of SR 500 (Figure 3-34). The primary water quality function of the wet pond is to reduce sediment only, and therefore runoff from the area served by this pond is not included in this report as receiving water quality treatment according to current treatment standards.

3.4.12.3 Post-Project Conditions and Contributing Impervious Area

The proposed action will create approximately 36.6 acres of net new ISA.[10] A summary of the pre-project and post-project ISA by drainage area is summarized in Table 3-10. The existing pre-project ISA was presented in Figure 3-31 through Figure 3-34.

Table 3-10. Existing and Proposed Impervious Surface Area by Watershed

State	Drainage Area	Pre-Project ISA (acres)	Post-Project ISA (acres)*	Net New ISA (acres)*	Change (%)*
Oregon	Columbia Slough	38.5	40.6	2.1	5.5
	Columbia River (South)	45.8	55.0	9.2	20.1
	Fairview Creek	7.3	6.8	-0.5	-6.8
Washington	Columbia River (North)	76.4	101.1	24.7	32.3
	Burnt Bridge Creek	9.6	10.7	1.1	11.5
	Totals	**177.6**	**214.2**	**36.6**	**20.6**

Note:
* The ISA quantities reported and analyzed in this document reflect the combined ISA associated with the single-level, movable-span design option for the Columbia River bridges and the two-auxiliary-lane design option. All other design options would result in equal or lesser amounts of ISA.

Table 3-11 provides a summary of the post-project CIA by state and receiving waterbody. These areas are shown on Figure 3-35 through Figure 3-38. The total post-project CIA associated with the proposed action is estimated to be approximately 214.2 acres. This area includes about 210.8 acres of ISA associated with the proposed action and approximately 3.4 acres of existing ISA that, while unaffected by the proposed action, will contribute runoff to the area included within the project footprint.

Non-contributing ISA within the project site includes approximately 1.8 acres of proposed pavement overlay within the Columbia Slough basin that does not contribute runoff to the project CIA. These overlays do not trigger water quality treatment, and are considered non-contributing, and are not included in the CIA.

Runoff from 100% of the post-project CIA will be provided water quality treatment that is consistent with the standards in the FAHP programmatic BO (NOAA Fisheries 2021b), and that

[10] Post-project ISA and CIA quantities reported and analyzed in this document reflect the combined ISA and CIA associated with the “single level, movable span” bridge design option, and the “2 auxiliary lane” design option. Any other combination of design options will result in either equal or lesser amounts of CIA, so this represents a reasonable worst-case estimate of ISA/CIA that will occur as a result of the proposed action.

complies with the requirements and design criteria of the agencies with jurisdiction over the affected drainage areas, whichever is most conservative.

Table 3-11. Contributing Impervious Area by Watershed and Drainage Area

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

Key: CIA = Contributing Impervious Area

Figure 3-35. Contributing Impervious Area – Oregon (South)

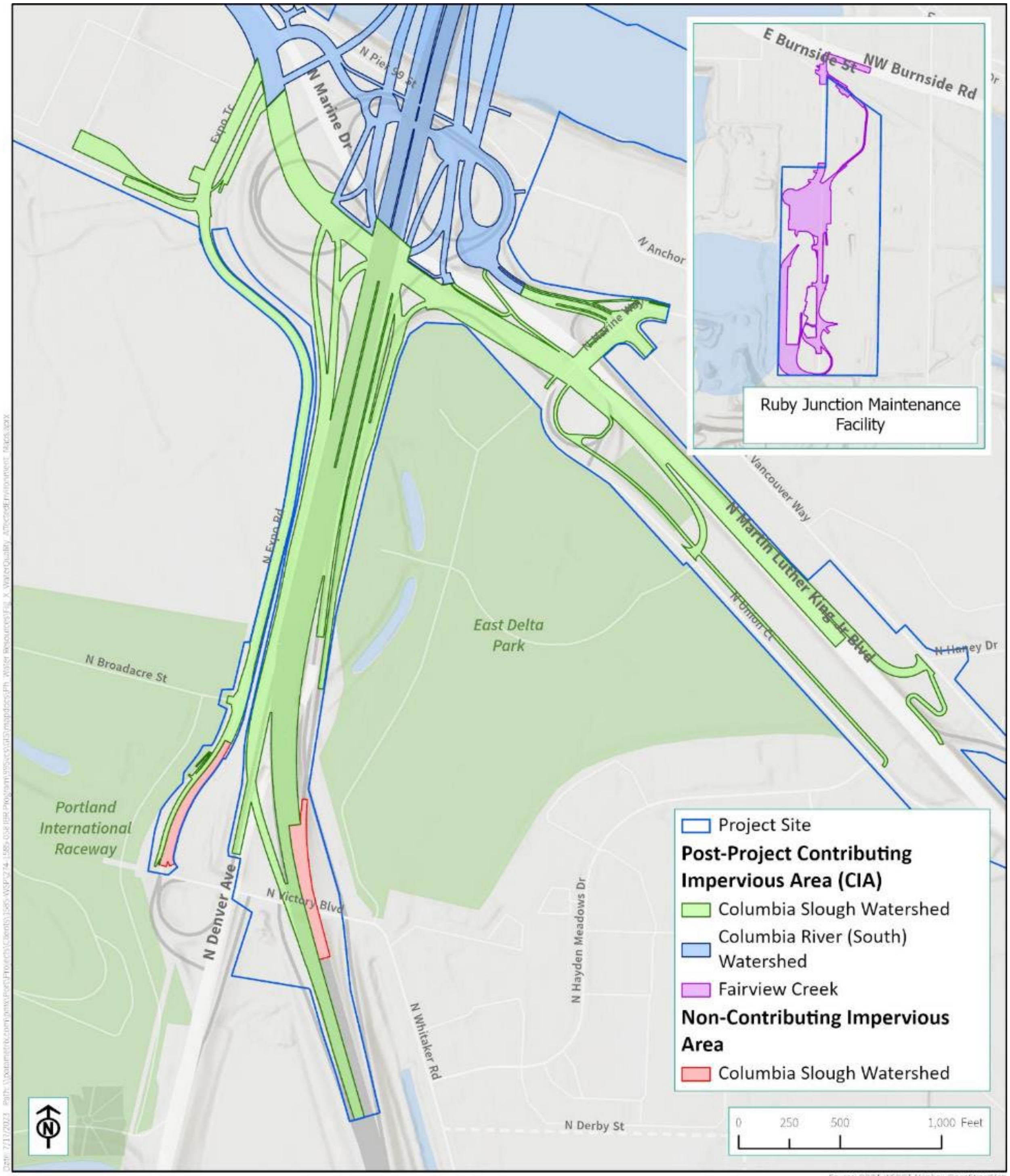


Figure 3-36. Contributing Impervious Area – Oregon (North)

Figure 3-37. Contributing Impervious Area – Washington (South)

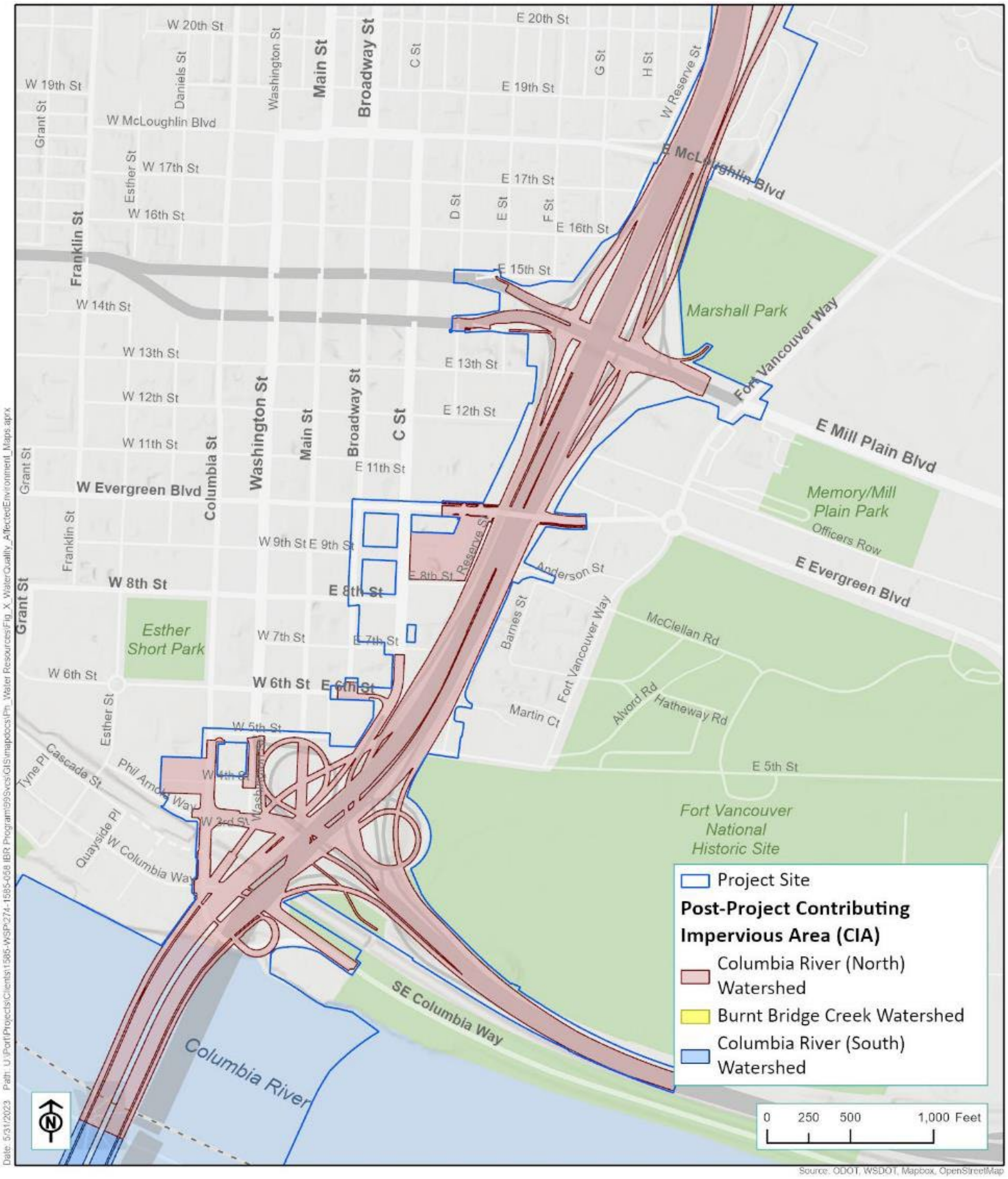


Figure 3-38. Contributing Impervious Area – Washington (North)

3.4.12.4 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, and particulate metals
- Oil and grease
- Other chemicals of emerging concern, including 6PPD-quinone (6PPD-Q)

Dissolved metals, especially dissolved copper and zinc, are of particular concern because of their potential impact on the olfactory systems of listed fish. 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. Emerging research related to a phenomenon known as urban runoff mortality syndrome (Tian et al. 2021) indicates that adult and juvenile coho salmon are particularly vulnerable to lethal effects of exposure to a chemical known as 6PPD-Q, which is a chemical derivative of 6PPD, an organic chemical that is widely used as an antiozonant and antioxidant in rubber tires.

A preliminary stormwater treatment design has been developed for the proposed action that 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, 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, where space allows, through the use of bioretention facilities. 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. Where space is not available for bioretention treatment, the project will most likely use either biofiltration swales or compost-amended vegetated filter strips.

One reason for prioritizing the use of biofiltration BMPs is their effectiveness at reducing levels of 6PPD-q in stormwater. The Washington Department of Ecology (Ecology) funded a literature review on the effectiveness of stormwater treatment BMPs to reduce levels of tire-derived chemicals including 6PPD-q (Ecology 2022b). The published findings of this study (Ecology 2022b) indicated that the flow and treatment BMPs that provide the highest levels of reduction in 6PPD and 6PPD-q are (1) dispersion BMPs, (2) infiltration BMPs, (3) biofiltration BMPs that use bioretention soil media or compost (where the underlying soils meet soil suitability criteria), and (4) other BMPs that provide the treatment process sorption (Ecology 2022b). The literature review also notes the importance of source control (design considerations that separate a source of pollutants from stormwater).

3.4.12.5 Water Quantity Best Management Practices

The FAHP BO requires water quantity management (flow control) for projects that discharge stormwater to an intermittent or perennial water body with an upstream drainage area of less than 100 square miles, and that increase the net new impervious area within the project footprint by more than 0.25 acre.

Water quantity management for the proposed action is expected to only be required for discharges to Burnt Bridge Creek. The Columbia River and Columbia Slough are considered large water bodies and are exempt from flow control requirements for direct discharges unless the conveyance systems indicate capacity limitations. Improvements at Ruby Junction will result in a net reduction in impervious area, therefore flow control will not be required for discharges to Fairview Creek.

Existing conveyance systems will be evaluated to confirm the capacities of the systems for conveyance to outfall locations. Some downstream conveyance systems could require upgrades to meet changes in discharge volumes that result from the proposed action. Upgrades to conveyance systems could include replacement of pipe systems or outfalls, or construction of new outfalls. Based on the current level of design, it is assumed that one additional outfall will need to be constructed to convey treated stormwater from the Columbia River (South) watershed to North Portland Harbor.

The FAHP requires post-project stormwater management for water quantity (flow control) to limit the channel-eroding storm event and the 10-year, 24-hour storm event for the post-project conditions. Flow control for Burnt Bridge Creek will also comply with City of Vancouver criteria, which requires limiting post-development discharge durations to pre-development durations for storm events ranging from 50% of the two-year peak to the 50-year peak. The City of Vancouver flow control requirements also comply with the FAHP criteria.

3.4.12.6 Stormwater Management Summary

The following subsections describe the BMPs that are proposed to provide post-project stormwater management for the proposed action. As noted in the preceding sections, the current design is conceptual, and will be refined as the level of design is advanced. The current design identifies the type and approximate location of the proposed treatment BMP within each drainage basin, but the precise shape and configuration of the various BMPs will not be developed until a future phase of the design. Future design refinements will likely result in changes to the size or location of the BMPs that are currently proposed, and/or may also necessitate the use of BMPs that differ from those presented in this report. Nevertheless, post-project stormwater management will be consistent with all applicable federal, state, and local requirements, and will, at minimum, provide treatment for all CIA associated with the proposed action.

A number of agencies and entities (ODOT, WSDOT, TriMet, C-TRAN, and the Cities of Vancouver and Portland) may ultimately have responsibility for managing and maintaining one or more of the stormwater BMPs associated with the proposed action. The specific maintenance requirements may vary by agency, however, all stormwater BMPs will be maintained consistent with applicable design standards and regulatory requirements such that they provide the full level of design treatment throughout their service life.

Columbia Slough Watershed

Table 3-12 provides a summary of the stormwater management approach that is proposed for each drainage area within the Columbia Slough watershed in Oregon. The approximate locations of proposed BMPs are shown on Figure 3-39.

Table 3-12. Stormwater Management Summary – Columbia Slough

State	Receiving Water	Drainage Area	Proposed ISA Treated (acres)	BMP Type
Oregon	Columbia Slough	CS-01	3.7	Bioretention Facility
		CS-02	7.0	Bioretention Facility
		CS-03	5.7	Bioretention Facility
		CS-04	5.8	Bioretention Facility
		CS-05*	4.6	Bioretention Facility
		CS-06*	4.1	Bioretention Facility
		Local Streets	11.9	Street Planters and/or Dispersion
		Total	**42.8**	

Note:
* Includes treatment for approximately 2.2 acres of non-contributing ISA.
Key: BMP = best management practice; ISA = impervious surface area

Water Quality Treatment

The proposed action will provide water quality treatment for approximately 42.8 acres of CIA within the Columbia Slough watershed in Oregon. This includes treatment for approximately 40.1 acres of CIA within the project footprint, and an additional 0.5 acres of existing CIA from outside of the project limits. Treatment is also provided for an additional 1.8 acres of stormwater from non-triggering impervious surfaces associated with pavement overlays, and an additional 0.4 acres from non-triggering impervious areas not associated with the project.

The preliminary stormwater design assumes that water quality treatment for ODOT-generated stormwater within the Columbia Slough watershed will be provided primarily by bioretention facilities. It is estimated that a total of approximately six such facilities will be required. Runoff generated on most of the City of Portland local streets within the basin will likely be provided treatment by roadside planters located within the street landscape areas, and/or through dispersion.

Water Quantity Management

Stormwater discharges to the Columbia Slough are expected to be exempt from flow control requirements, provided that the downstream conveyance systems have available capacity. No formal water quantity management BMPs are proposed, however, the bioretention facilities described above will provide a flow control function by regulating the conveyance and discharge of stormwater.

Fairview Creek (Oregon)

Water Quality Treatment

The proposed action will provide water quality treatment for approximately 6.8 acres of CIA within the Fairview Creek watershed for modifications to the Ruby Junction facility. This includes treatment for approximately 6.4 acres of CIA within the project footprint, and an additional 0.4 acre of existing CIA from outside of the project limits (from NW Burnside Road). The type and location for the treatment facilities at Ruby Junction is not currently known based on the level of design completed for the site, however the entire 6.8 acres (or equivalent area) will be provided with water quality treatment consistent with the standards in the FAHP BO, and consistent with City of Fairview requirements.

Water Quantity Management

The proposed action will result in a net reduction of approximately 0.5 acres of ISA at Ruby Junction. Since this portion of the proposed action will not result in an increase in CIA, activities associated with the Ruby Junction Maintenance Facility will not require post-construction stormwater management for flow control.

Columbia River South Watershed (Oregon)

Table 3-13 provides a summary of the stormwater management approach that is proposed for each drainage area within the Columbia River (South) watershed in Oregon. The approximate locations of proposed BMPs are shown on Figure 3-40.

Table 3-13. Stormwater Management Summary – Columbia River (South)

State	Receiving Water	Drainage Area	Proposed Action CIA Treated (acres)	BMP Type
Oregon	Columbia River (South)	CRS-01	3.86	Bioretention Facility
		CRS-02	2.24	Bioretention Facility
		CRS-03	2.34	Bioretention Facility
		CRS-04	3.36	Bioretention Facility
		CRS-05	2.41	Bioretention Facility
		CRS-06	2.10	Biofiltration Swale
		CRS-07	3.50	Biofiltration Swale
		CRS-08	4.42	Bioretention Facility
		CRS-09	7.30	Bioretention Facility
		CRS-10	5.60	Bioretention Facility
		CRS-11	6.0	Bioretention Facility
		Local Streets	11.8	Street Planters
		Total	**55.0**	

Key: BMP = best management practice; CIA = contributing impervious area

Water Quality Treatment

The proposed action will provide water quality treatment for approximately 55.0 acres of CIA within the Columbia River (South) watershed in Oregon. This includes approximately 54.5 acres of CIA within the project footprint, and an additional 0.5 acres of existing CIA from outside of the project limits.

The preliminary stormwater design assumes that water quality treatment for ODOT-generated stormwater within the Columbia River (South) watershed will be provided primarily by bioretention facilities. It is estimated that a total of approximately 10 such facilities will be required. Stormwater from drainage area CRS-07 will likely be provided by a biofiltration swale, due to space constraints. Runoff generated on City of Portland local streets within the project area will likely be provided treatment by roadside planters located within the street landscape areas.

Water Quantity Management

Stormwater discharges to the Columbia River (South) in Oregon are expected to be exempt from flow control requirements, provided that the conveyance system has available capacity. No formal water quantity management BMPs are proposed. At least one new outfall may be required to provide discharge to the North Portland Harbor for runoff collected from and adjacent to the new bridges.

Columbia River North Watershed (Washington)

Table 3-14 provides a summary of the stormwater management approach that is proposed for each drainage area within the Columbia River (North) watershed in Washington. The approximate locations of proposed BMPs are shown on Figure 3-41 and Figure 3-42.

Table 3-14. Stormwater Management Summary – Columbia River (North)

State	Receiving Water	Drainage Area	Proposed Action CIA Treated (acres)	BMP Type
Washington	Columbia River (North)	CRN-01	3.86	Bioretention Facility
		CRN-02	2.24	Bioretention Facility
		CRN-03	2.34	Bioretention Facility
		CRN-04	3.36	Bioretention Facility
		CRN-05	2.41	Bioretention Facility
		CRN-06	2.10	Bioretention Facility
		CRN-07	3.50	Bioretention Facility
		CRN-08	4.42	Bioretention Facility
		CRN-09	7.30	Bioretention Facility
		CRN-10	5.60	Biofiltration Swale
		CRN-11	6.04	Bioretention Facility
		Local Streets	11.8	Landscape Planters or Proprietary Facilities
		Totals	**101.1**	

Key: BMP = best management practice; CIA = contributing impervious area

Water Quality Treatment

The proposed action will provide water quality treatment for approximately 101.1 acres of CIA within the Columbia River (North) watershed in Washington. This includes approximately 99.6 acres of CIA within the project footprint, and an additional 1.5 acres of existing CIA from outside of the project limits.

The preliminary stormwater design assumes that water quality treatment for most of the stormwater from CIA within the Columbia River (North) watershed will be provided by bioretention facilities. It is estimated that a total of approximately 10 such facilities will be required. Stormwater from approximately 5.6 acres of CIA in drainage area CRN-10 will likely be provided by a biofiltration swale, due to space constraints. Water quality treatment for CIA from City of Vancouver local streets will likely be planters or similar Low Impact Development facilities located within the street landscape areas or within the public right of way depending on space constraints.

Water Quantity Management

Stormwater discharges to the Columbia River (North) in Washington are expected to be exempt from flow control requirements, provided that the conveyance system has available capacity. No formal water quantity management BMPs are proposed.

Burnt Bridge Creek Watershed

Table 3-15 provides a summary of the stormwater management approach that is proposed for each drainage area within the Columbia River (North) watershed in Washington. The approximate locations of proposed BMPs are shown on Figure 3-42.

Table 3-15. Stormwater Management Summary – Burnt Bridge Creek

State	Receiving Water	Drainage Area	Proposed Action CIA Treated (acres)	BMP Type
Washington	Burnt Bridge Creek	BBC-01	1.38	Bioretention Facility
		BBC -02	3. 77	Bioretention Facility
		BBC -03	3.10	Bioretention Facility
		BBC -04	2.45	Compost-Amended Vegetated Filter Strip
		Totals	**10.7**	

Note:
* Includes treatment for approximately 0.67 acres of non-project ISA to treat an equivalent area of project CIA that can't be captured for treatment.
Key: BMP = best management practice; CIA = contributing impervious area

Water Quality Treatment

The proposed action will provide water quality treatment for approximately 10.7 acres of CIA within the Burnt Bridge Creek watershed in Washington. This includes approximately 10.2 acres of CIA within the project footprint, and an additional 0.5 acres of existing CIA from outside of the project limits.

The preliminary stormwater design assumes that water quality treatment for stormwater within the Burnt Bridge Creek watershed will be provided primarily by bioretention facilities. It is estimated that a total of approximately three such facilities will be required. Stormwater from drainage area Burnt Bridge Creek (BBC) 04 will likely be provided by a compost-amended vegetated filter strip, due to space constraints.

Water Quantity Management

Stormwater discharges to Burnt Bridge Creek in Washington will require flow control consistent with City of Vancouver requirements. The City of Vancouver requires that stormwater discharges to Burnt Bridge Creek be reduced to pre-development (forested) conditions for peak discharges between 50% of the two-year event and the 50-year event. The proposed bioretention BMPs will be designed and sized accordingly to provide this level of flow control and to meet or exceed these standards.

Figure 3-39. Preliminary Stormwater Treatment Design – Oregon (South)

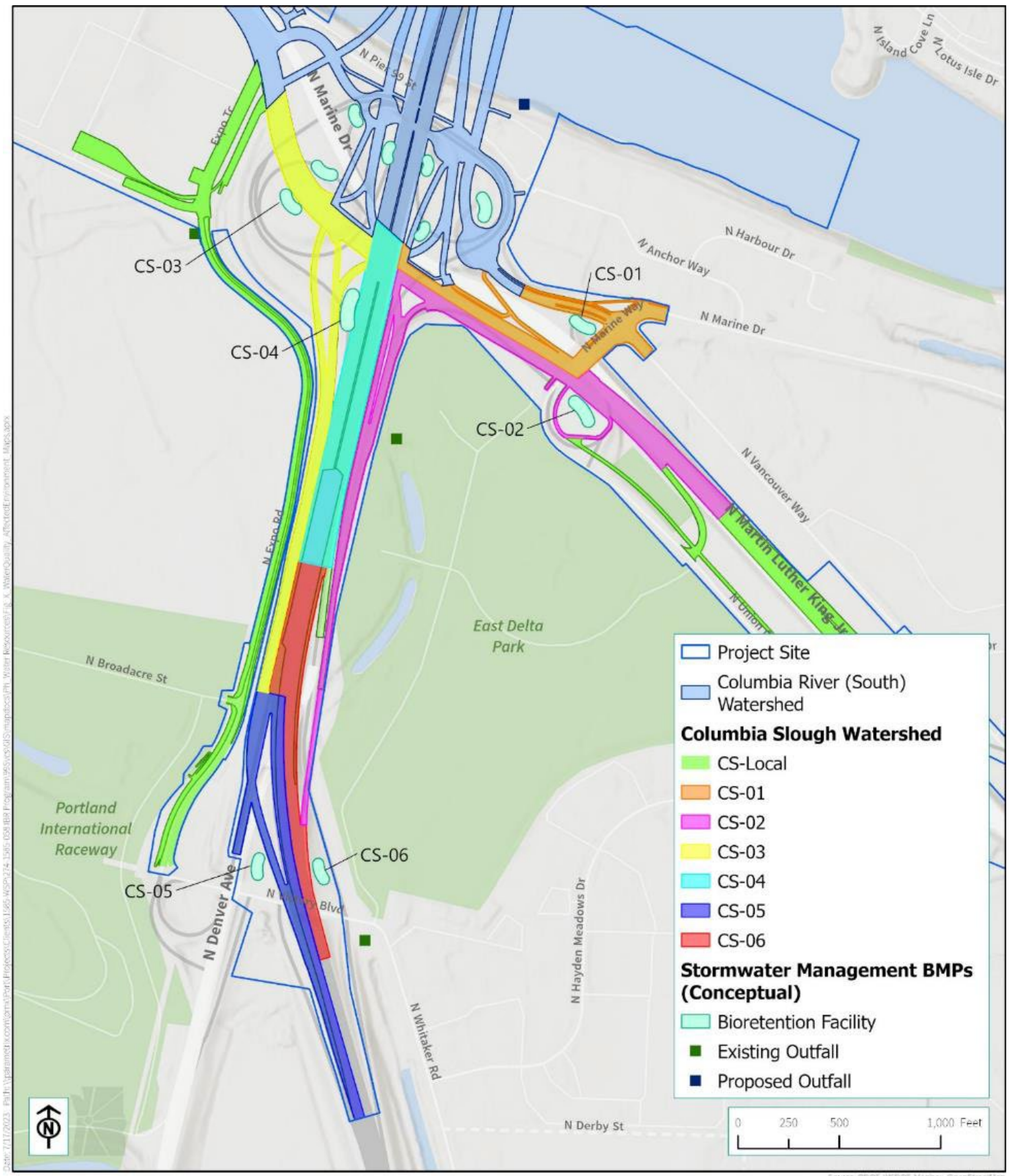


Figure 3-40. Preliminary Stormwater Treatment Design – Oregon (North)

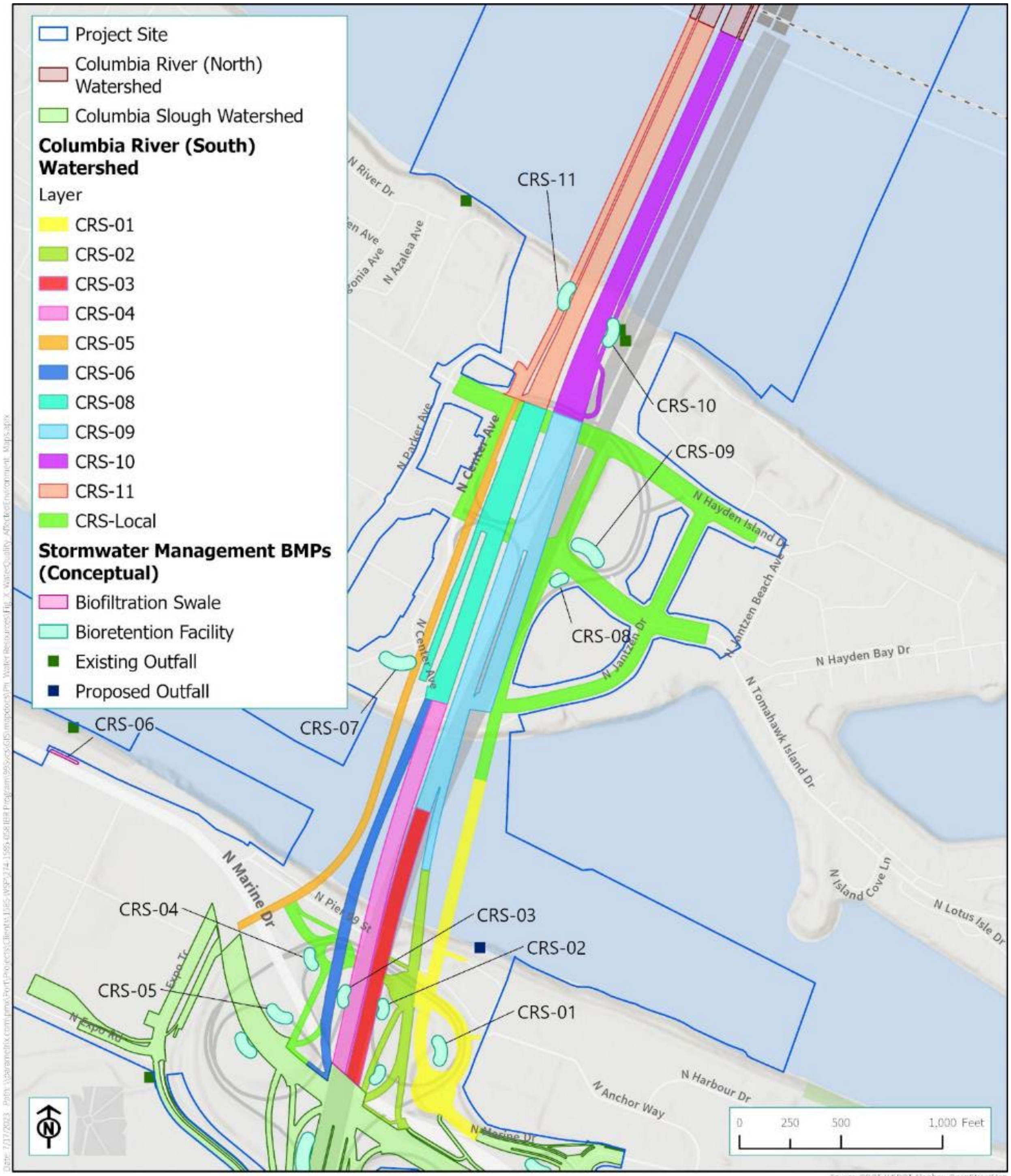


Figure 3-41. Preliminary Stormwater Treatment Design – Washington (South)

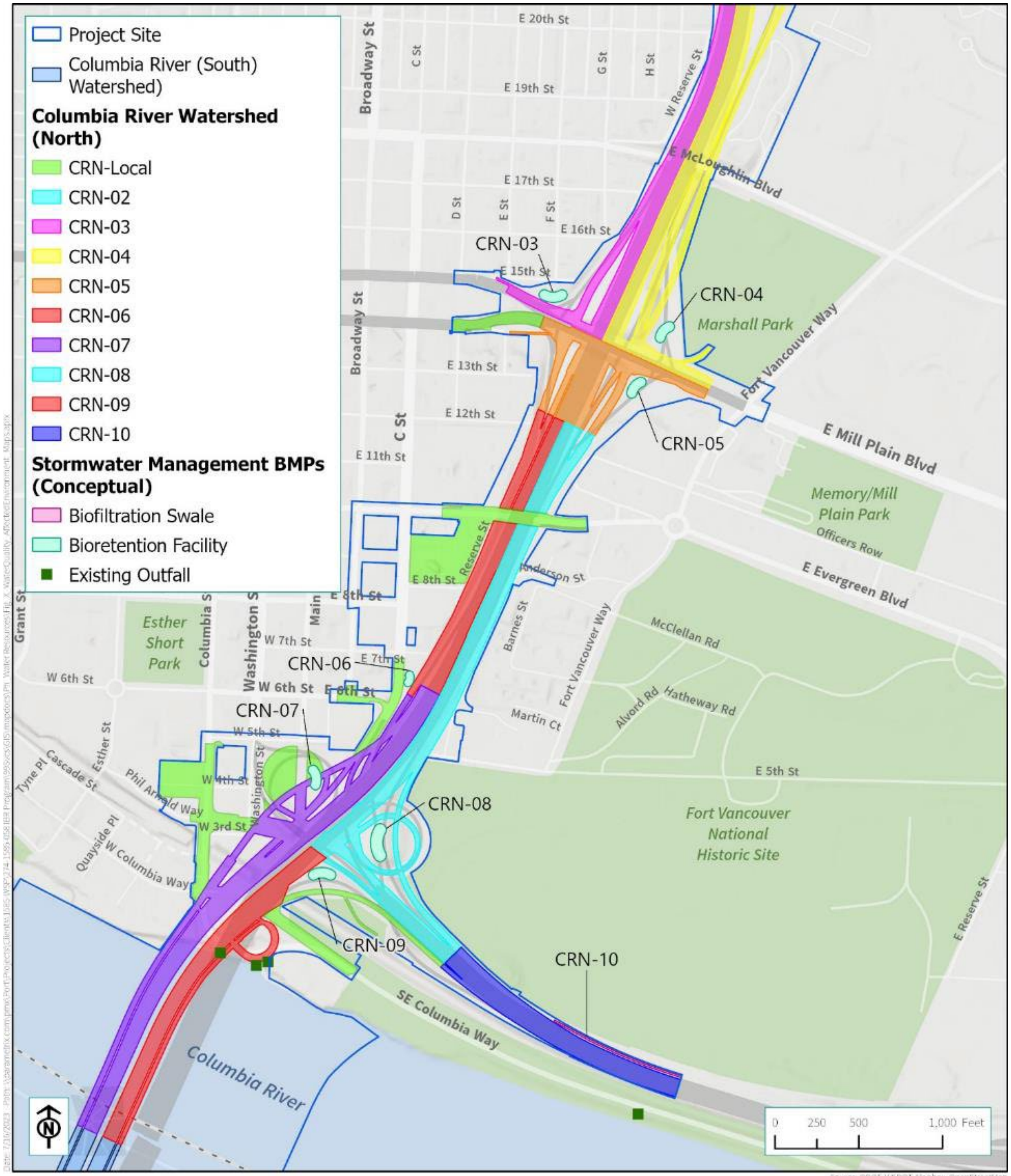
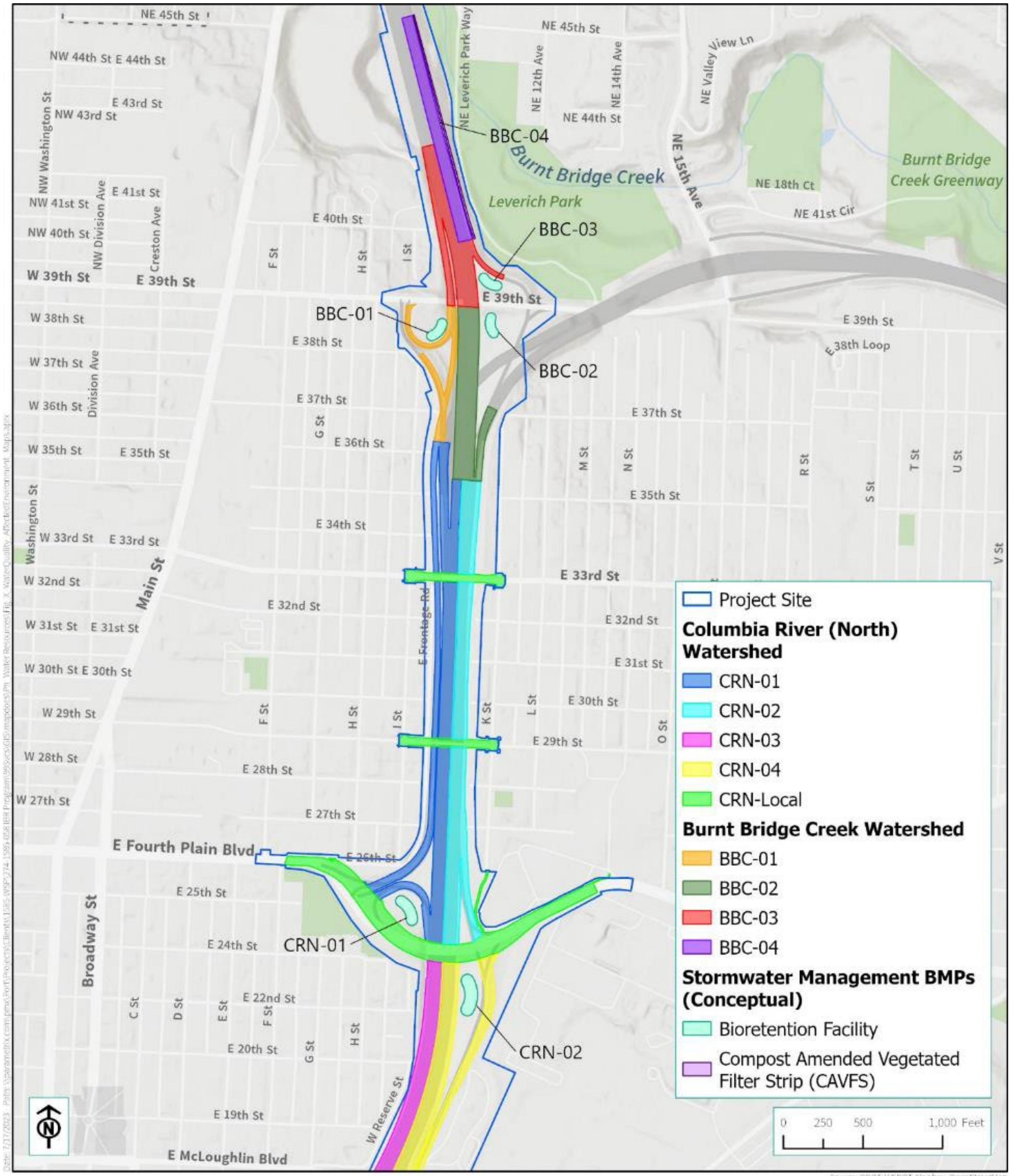


Figure 3-42. Preliminary Stormwater Treatment Design – Washington (North)



3.4.12.7 Stormwater Treatment Summary

As described in the preceding sections, the proposed action will result in the creation of approximately 36.6 acres of net new ISA. The proposed action will provide treatment for approximately 214.2 acres of CIA, including approximately 156.4 acres of existing ISA that is currently untreated. This represents treatment of over 5.8 times the area of net new impervious area. The proposed action will also provide water quality treatment for approximately 2.2 acres of non-contributing ISA that would not otherwise require treatment.

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 post-project 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 quantity 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.

3.4.13 Project-Related Mitigation/Conservation Activities

As described in the introduction, the IBR Program will be designed to avoid, minimize, rectify, and reduce impacts to sensitive natural resources to the extent practicable. However, it is anticipated that the Program will result in some unavoidable impacts that will require mitigation under one or more regulatory frameworks. A compensatory mitigation plan will be prepared to provide compensation for any such unavoidable impacts to regulated resources (wetlands, waters, sensitive habitats) and to demonstrate that the Program will achieve “no net loss” of function of these resources. In addition, the IBR Program has established a commitment to identify appropriate opportunities to provide additional conservation benefit outside of the regulatory framework.

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

- Mitigation banks: A mitigation bank is a third-party sponsor that has constructed a mitigation site and gained approval to sell mitigation “credits.” Permittees can purchase these credits to satisfy the compensatory mitigation requirements of their projects. There are several approved mitigation banks in Washington and Oregon that provide credits for specific types of impacts including wetlands, buffers, and fish and wildlife habitat credits. Each state has a different process for reviewing and approving banks. Mitigation ratios are established in the mitigation bank instrument, which is the regulatory document that guides the operation of the bank.

- Permittee-responsible mitigation (PRM): PRM consists of a stand-alone project or projects that are developed and implemented by the permittee. In this scenario, permittees (or their legal designees) retain full responsibility to implement, manage, and maintain the compensatory mitigation site until performance criteria have been satisfied. The Program may elect to contract with a third party to implement or manage a given PRM project.
- PRM may be conducted concurrently with a project/impact or may occur in advance of a project. Advance PRM is typically considered to provide relatively greater level of function, given the additional time the site has to develop and the greater certainty of success.
- In-lieu fees and/or payment-in-lieu mitigation program: Both Oregon and Washington have programs in place to accept payments in lieu of mitigation under certain specific circumstances. The state then uses these payments to fund, design, and manage a variety of restoration and mitigation projects. These are typically seen as a last resort option, when there are no other options are available. In-lieu fees are not anticipated to be applicable to the IBR Program, as there are no in-lieu fee programs available in the Washington portion of the study area, and in-lieu fees would not satisfy the USACE's mitigation requirements.

Conservation measures will likely consist of additional measures incorporated to provide conservation uplift outside of the specific regulatory framework that is established for compensatory mitigation. These may include voluntary measures conducted to address conservation recommendations established under Section 7(a)(1) of the ESA or other measures identified through coordination with interested party. Conservation actions may include project-specific performance commitments and/or design criteria that provide a conservation benefit (such as stormwater treatment), or may include opportunistic on- or off-site restoration or habitat enhancement activities (such as pile removals or plantings). They may also be provided through the purchase of additional bank credits, PRM mitigation, in-lieu fee payments, and/or project funding as deemed appropriate. A specific compensatory mitigation plan has not yet been developed for this proposed action and specific mitigation and conservation actions have not yet been established. However, Table 3-16 provides a summary of potential mitigation and conservation actions that may ultimately be developed for the IBR Program.

Table 3-16 Summary of Potential Mitigation and Conservation Actions

Project Element/Impact	Potential Mitigation/Conservation Actions
Benthic Habitat Impacts (Permanent and Temporary)	• Removal of derelict piles/structures/debris • Aquatic habitat creation/enhancement addressing limiting factors • Mitigation bank credits
Overwater Coverage (Permanent and Temporary)	• Removal of derelict piles/structures/debris • Aquatic habitat creation/enhancement addressing limiting factors • Mitigation bank credits
Fill within Floodplain/Functional Floodplain	• Balanced cut/fill to satisfy regulatory requirements. • Mitigation bank credits
Terrestrial Habitat Impacts (Permanent and Temporary)	• On-site riparian enhancements (plantings/invasive species management) • Terrestrial habitat creation/enhancements • Mitigation bank credits
Wetland and Buffer Impacts (Permanent and Temporary)	• Wetland creation, restoration, enhancement, or preservation • Could be combined with habitat mitigation for additional benefit • Mitigation bank credits
Stormwater from new/rebuilt impervious surfaces	• Substantial conservation benefit provided by proposed treatment.
Species-specific Impacts	• Species-specific conservation considerations may be developed in coordination with interested parties and agencies.

Construction of the types of PRM and conservation activities shown in Table 3-16 have the potential to result in temporary disturbance of aquatic, riparian, wetland, and/or upland terrestrial habitats. These types of activities typically require vegetation clearing and/or ground disturbance, in-air construction noise associated with earthwork, and temporary effects to water quality during construction. Floodplain reconnection projects may require work below the OHWM of fish-bearing 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 mitigation plan development), and function will be fully restored once construction activities are completed.

A mitigation plan will be developed during the permitting phase of the project. The plan will identify the amount, type, and specific locations of any proposed mitigation and conservation actions, specific impact avoidance and minimization measures to be implemented, as well as the goals, objectives, and performance standards for measuring success. Full implementation of the compensatory mitigation plan will be a condition of the applicable permits of the agencies with jurisdiction (i.e., USACE Section 10/404 permit, the Oregon Department of Environmental Quality [DEQ] and Ecology Section 401 certifications, the Oregon Department of State Lands

[DSL] Removal-Fill permit, WDFW Hydraulic Project Approval, City of Vancouver Shorelines and Critical Areas permits, and City of Portland Environmental Reviews), and the mitigation will comply fully with all applicable permit terms and conditions. The mitigation plan will be provided to NOAA Fisheries for review and approval.

3.4.14 Related Activities

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

3.4.14.1 Maintenance Activities

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

Most of these maintenance and operations activities are already ongoing, as the proposed action replaces existing bridges and transportation infrastructure. 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 bridges will be new, modern structures, the maintenance needs will likely be less than those that are currently required for maintaining the existing bridges.

3.4.14.2 Federal Navigation Channel Reconfiguration

Portions of the Columbia River mainstem are designated and maintained for navigation as part of the Columbia and Lower Willamette and Vancouver to The Dalles Federal Navigation Channel projects by the USACE. Within the vicinity of the Interstate Bridge, there are four federally authorized navigation projects on the Columbia River: three federally authorized navigation channels that pass beneath the Interstate Bridge (the primary navigation channel, barge channel, and alternate barge channel) and the federally authorized Upper Vancouver Turning Basin located immediately downstream of the Interstate Bridge. This turning basin has historically provided a turning location for deep-draft ships navigating up to, but not beyond, the Interstate Bridge. There is no federally authorized navigation channel within North Portland Harbor.

As described in Section 3.2.3, the federal projects will be maintained with the proposed project (see Figure 3-12). However, the primary navigation channel will be swapped with the existing barge channel which will move the primary navigation channel closer to the center of the river than its current location.

No changes are proposed to authorized or maintained channel depths, and no dredging is proposed or reasonably certain to occur as a result of the proposed action. The existing bathymetry at the location of the proposed channels provides sufficient depth. Activities associated with the proposed action to accommodate the reconfiguration of these channels will likely include the relocation of one or more navigation markers. These markers are floating buoys that are attached to concrete or steel anchors. Work activities associated with relocating the navigation markers will consist of picking up the buoy and anchor, placing them temporarily on a barge or small vessel, and redeploying the buoy and anchor in the desired location.

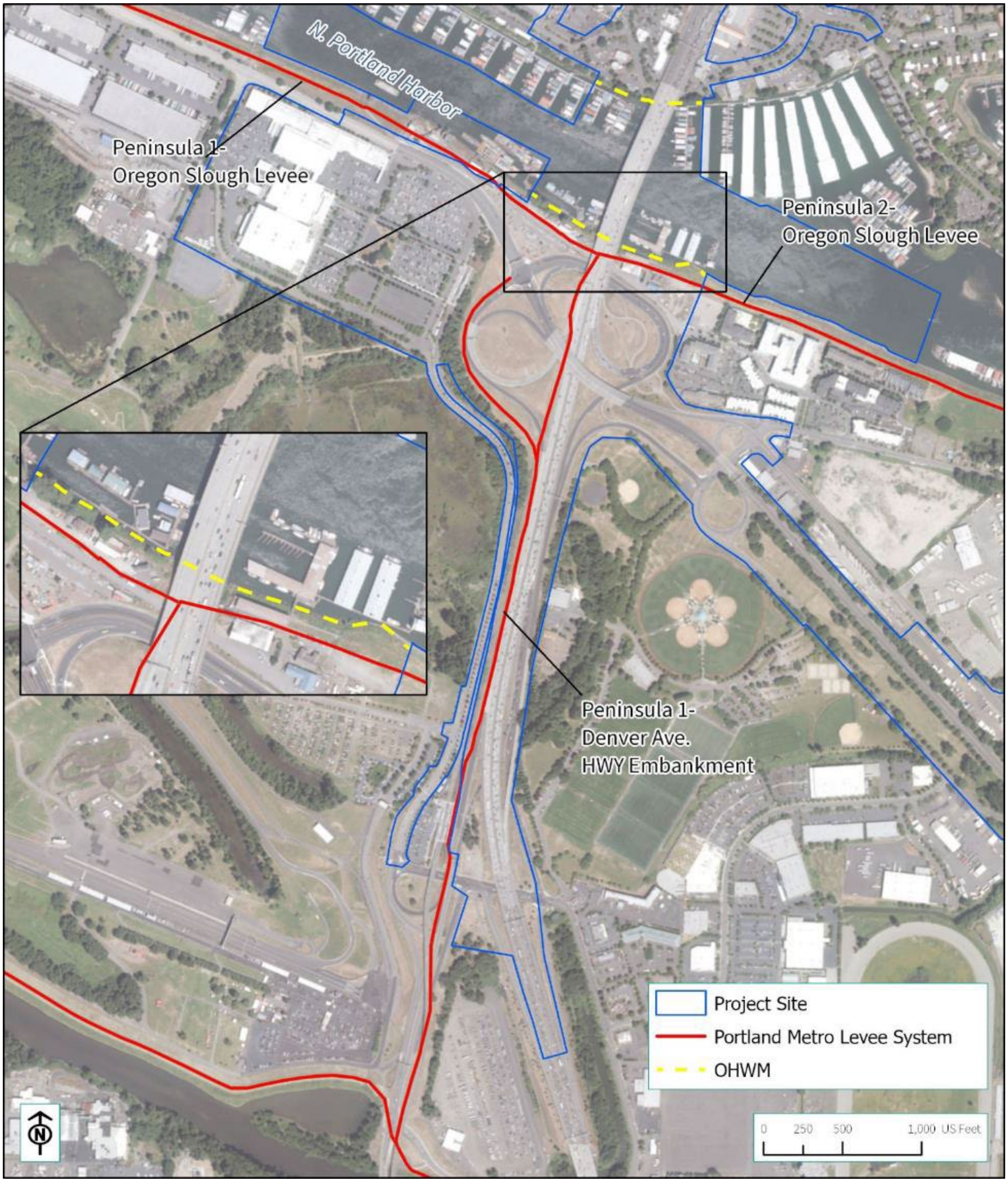
3.4.14.3 Federal Levee Modifications

The Portland Metro Levee System (PMLS) is a system of federal flood control levees located along the south bank of the Columbia River, from its confluence with the Sandy River to just upstream of its confluence with the Willamette River. The PMLS consists of four integrated and contiguous levee systems: Peninsula Drainage District No. 1, Peninsula Drainage District No. 2, Multnomah County Drainage District No. 1, and Sandy Drainage Improvement Company. The USACE and drainage districts are partner entities in the Levee Ready Columbia project, an ongoing project to modernize the PMLS, which includes raising the height of the levees in Peninsula Drainage District No. 1 and Peninsula Drainage District No. 2 (see Figure 3-43).

The construction activities associated with the proposed action (described in the sections above) will likely require both temporary and permanent modifications to portions of the PMLS in Peninsula Drainage District No. 1 and Peninsula Drainage District No. 2. The specific design of any such modifications have not yet been developed, but will likely include restoration of any temporarily disturbed portions of the levees, or permanent modifications where proposed infrastructure will intersect with the existing levee, or where access will change as a result of reconfiguration of the roadways. Modifications may also include improvements to existing levee function, if such improvements are requested or required by the USACE or others. Any modifications or improvements would also be coordinated for consistency with the planned future condition of the levees under the Levee Ready Columbia project. Work activities associated with levee modifications will likely include excavation, vegetation clearing, grading, and other upland earthwork activities, as described in Sections 3.4.1 through 3.4.14 of this document. There may also be a need for some work below the OHWM to repair or replace bank armoring, or reconstruct temporarily affected portions of the levee. All work will be conducted consistent with the avoidance and minimization measures described in Section 4, and the conditions of any permits that are ultimately issued for the proposed action.

Any temporary or permanent modifications to the PMLS will be coordinated with the Portland District USACE (including review and approval under Section 408), as well as the applicable drainage districts and local jurisdictions. The proposed action will maintain the existing level of flood control function of the PMLS.

Figure 3-43. Portland Metro Levee System – Peninsula Drainage Districts 1 and 2



3.4.14.4 Other Related Activities

Additional actions that are reasonably certain to occur include the following:

- Utility relocation during project construction. Utilities would likely be relocated in multiple locations throughout the project site. Utilities on the existing bridge will be relocated onto the replacement bridges prior to demolition of the existing bridges.
- Construction and operation of staging and/or casting areas not specifically identified in Section 3.4.2.
- Acquisition and relocation of existing floating homes from moorages in North Portland Harbor will likely be required prior to construction of the North Portland Harbor Bridges. Up to 35 floating homes in the Portland Harbor will be displaced. Floating homes will likely either be purchased or relocated to other locations. In either case, the homes will likely ultimately continue to be operated as floating structures within the lower Columbia River subbasin.

4. AVOIDANCE AND MINIMIZATION MEASURES

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

4.1 General Measures and Conditions

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

- All work will be performed according to the requirements and conditions of the regulatory permits that are issued for the proposed action.
- The contractor will prepare a WQPMP to satisfy the monitoring and reporting requirements of the 401 Water Quality Certifications that are ultimately issued for the project. The WQPMP will be provided to NOAA Fisheries for review and approval prior to implementation. The WQPMP will identify the timing and methodology for water-quality sampling during construction of the proposed action, as well as methods of implementation and reporting. If, in the future, a standard water-quality monitoring plan is adopted by ODOT and/or WSDOT, this plan, with the agreement of NOAA Fisheries may replace the contractor plan.
- State Department of Transportation policy and construction administration practice in Oregon and Washington is to have one or more Department of Transportation inspectors on site during construction. The role of the inspector(s) will be to monitor compliance with contract and permit requirements.
- If in-water dredging is required outside of a cofferdam, a clamshell bucket shall be used. Dredging and handling and disposal of dredged materials shall be conducted consistent with the requirements and conditions of the regulatory permits issued for the proposed action.
- Work barges will not be allowed to ground out.
- Work barges will be inspected and certified to be free of aquatic invasive species prior to mobilization to the site.
- Excess or waste materials will not be disposed of or abandoned waterward of the OHWM or allowed to enter waters of the state. Waste materials will be disposed of in an appropriate manner consistent with applicable local, state, and federal regulations.
- All pumps must employ a fish screen that meets the following specifications:
  - An automated cleaning device with a minimum effective surface area of 2.5 square feet per cubic foot per second and a nominal maximum approach velocity of 0.4 foot per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second and a nominal maximum approach rate of 0.2 foot per second; and

- A round or square screen mesh that is no larger than 0.094 inches (2.38 millimeters) in the narrow dimension, or any other shape that is no larger than 0.069 inches (1.75 millimeters) in the narrow dimension; and
- Each fish screen must be installed, operated, and maintained according to NOAA Fisheries fish screen criteria.

4.2 Spill Prevention/Pollution Control

- The contractor will prepare an SPCC plan and PCP prior to beginning construction. These plans will be provided to NOAA Fisheries for review and approval. The SPCC plan and PCP will identify the appropriate spill containment materials and the means and methods of implementation, response, and reporting. All elements of the SPCC plan and PCP will be available at the project site at all times. For additional detail, consult ODOT Standard Specification 00290.00 to 00290.90.
- The contractor will designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead will be responsible for the implementation of the SPCC plan and PCP. 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 OHWM of any waterbody using secondary containment to minimize potential for spills or leaks entering the waterway.
- All equipment to be used for construction activities will be cleaned and inspected prior to arriving at the project site, to ensure no potentially hazardous materials are exposed, no leaks are present, free of noxious weeds, and the equipment is functioning properly. Daily inspection and cleanup procedures will be identified.
- Should a leak be detected on heavy equipment used for the project, the equipment will be immediately removed from the area and not used again until adequately repaired. Where off-site repair is not practicable, the SPCC plan and PCP will document measures to be implemented to prevent and/or contain accidental spills in the work/repair area to ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.
- Operation of construction equipment used for project activities will occur from on top of floating barges, from the decks of temporary work bridges and platforms, the decks of the existing or replacement bridges, or from portions of the streambank above the OHWM. Barges and support vessels will be operated in the water.
- All equipment (including barges, work decks, stationary power equipment, and storage facilities) will have suitable containment measures outlined in the SPCC plan and PCP to prevent and/or contain accidental spills to ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.

- Temporary work bridges and platforms, cofferdams, and drilled shaft isolation casings will be designed and installed consistent with the ODOT Hydraulics Manual, which establishes criteria to avoid these structures being overtopped during high water events.
- Process water generated on site from construction, demolition or washing activities will be contained and treated to meet applicable water-quality standards before entering or reentering surface waters.
- No paving, chip sealing, or stripe painting will occur during periods of rain or wet weather.
- The SPCC plan and PCP will establish a concrete truck chute cleanout area to properly contain wet concrete as part of ODOT Standard Specification 00290.30(a).

4.3 Site Erosion/Sediment Control

- The contractor will prepare an ESCP to be implemented during project construction to minimize impacts associated with clearing, vegetation removal, grading, filling, compaction, or excavation. The BMPs identified in the ESCP will be used to control sediments from all vegetation removal or ground-disturbing activities. Additional temporary control measures may be required beyond those described in the ESCP if it appears pollution or erosion may result from weather, nature of the materials or progress on the work. For additional detail, consult ODOT Standard Specifications 00280.00 to 00280.90.
- As part of the ESCP, contractor will delineate clearing limits with orange barrier fencing wherever clearing is proposed in or adjacent to a stream/wetland or its buffer and install perimeter protection/silt fence as needed to protect surface waters and other critical areas. Location will be specified in the field, based upon site conditions and the ESCP. For additional silt fence detail, consult ODOT Standard Specification 00280.16(c).
- The contractor will identify at least one employee as the CESCL. The contractor will meet the requirements of and follow the process described in ODOT Standard Specifications Section 00280.30. The CESCL will be identified in the ESCP, and listed on the Emergency Contact List as part of ODOT Standard Specification 00290.20(g). The CESCL 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 and maintained as required by applicable permit requirements. Contractor will also conduct maintenance and repair of ESCP measures as described in ODOT Standard Specifications 00280.60 to 00280.70.
- For landward construction and demolition, project staging and material storage areas will be located a minimum of 150 feet from surface waters, in currently developed areas such as parking lots or managed fields, unless a site visit by an ODOT/WSDOT biologist determines (and an ODOT/ NOAA Fisheries liaison confirms) that the topographic features or other site characteristics allow for site use closer to the edge of surface waters.
- Excavation activities will be accomplished in the dry. All surface water flowing toward the excavation will be diverted through utilization of cofferdams and/or berms. Cofferdams and berms must be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material.

- Bank shaping will be limited to the extent as shown on the approved grading plans. Minor adjustments made in the field will occur only after engineer's review and approval.
- Bio-degradable erosion control blankets will be installed on areas of ground-disturbing activities on steep slopes (1V:3H or steeper) that are susceptible to erosion and within 150 feet of surface waters. Areas of ground-disturbing activities that do not fit the above criteria will implement erosion control measures as identified in the approved ESCP. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14I.
- Erodible materials (material capable of being displaced and transported by rain, wind or surface water runoff) that are temporarily stored or stockpiled for use in project activities will be covered to prevent sediments from being washed from the storage area to surface waters. Temporary storage or stockpiles must follow measures as described in ODOT Standard Specification 00280.42.
- All exposed soils will be stabilized as directed in measures prescribed in the ESCP. Hydro-seed all bare soil areas following grading activities and revegetate all temporarily disturbed areas with native vegetation indigenous to the location. For additional detail, consult ODOT Standard Specifications 01030.00 to 01030.90
- Where site conditions support vegetative growth, native vegetation indigenous to the location will be planted in areas temporarily disturbed by construction activities. Revegetation of construction easements and other areas will occur after the project is completed. Trees will be planted when consistent with highway safety standards. Riparian vegetation will be replanted with species native to geographic region. Planted vegetation will be maintained and monitored to meet regulatory permit requirements. For additional detail, consult ODOT Standard Specifications 01040.00 to 01040.90.

4.4 Pile Installation and Removal Best Management Practices

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

- A vibratory hammer will be used to drive steel piles to the maximum extent possible, to minimize noise levels.
- Impact pile driving below the OHWM will only be conducted between September 15 and April 15. Vibratory pile installation and removal (as well as certain other in-water construction activities) may occur on a year-round basis, provided they are conducted in compliance with all regulatory approvals.
- No more than two impact pile drivers will be operated simultaneously within the same waterbody channel.
- A bubble curtain or other similarly effective noise attenuation device will be employed during all impact pile driving conducted in water depths greater than 0.67 meter (2 feet).
- A hydroacoustic monitoring plan, based on the template developed by the Fisheries Hydroacoustic Working Group, will be developed and implemented in coordination with FHWA and FTA to confirm the effectiveness of the noise attenuation devices and that predicted noise

levels adequately capture the area of the potential onset of injury. The plan will be provided to NOAA Fisheries for review and approval prior to any impact pile-driving activity commencing.

- Open-ended pipe piles will have cones or other anti-perching devices installed to discourage perching by piscivorous birds.
- Temporary piles shall be removed with a vibratory hammer, or by direct pulling, and shall never be intentionally broken by twisting or bending.
- In the event a temporary pile cannot be removed it will be cut or pressed at least 3 feet below the mudline. At locations where hazardous materials are present or adjacent to utilities, temporary piles may be cut off at the mud line with underwater torches, if such activity wouldn't conflict with navigation elements.

4.5 Work Area Isolation and Fish Salvage Best Management Practices

- A Temporary Water Management Plan, consistent with the requirements of ODOT Special Provision Section 00245.03, will be developed and provided to NOAA Fisheries for review and approval prior to any work area isolation of fish salvage activities.
- Cofferdams and isolation casings will be installed in a manner that minimizes fish entrapment. Sheet piles will be installed from upstream to downstream, lowering the sheet piles slowly until contact with the substrate.
- Drilled shaft isolation casings will be screened at the bottom, to minimize potential for fish entrapment during installation. Screen shall have maximum openings of approximately 0.094 inches (2.38 millimeters) measured on a diagonal (NOAA Fisheries 2022).
- Fish salvage will be conducted according to the best practices established in the BO for ODOT's Federal Aid Highway Programmatic consultation.
- A qualified fishery biologist[11] 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 Act" (NOAA Fisheries 2000), or most recent version.

[11] The qualified biologist shall have a bachelor's degree in biology, fisheries or equivalent, and have a minimum of two years of experience identifying northwest fish and aquatic species. If electrofishing is required, the lead biologist shall be competent with electrofishing procedures and have completed at least 100 hours of fish salvage following NOAA Fisheries, USFWS, ODFW, and/or WDFW fish salvage/fish removal protocols.

4.6 Work Area Lighting Best Management Practices

- Construction activities will be conducted consistent with local, state and federal permit restrictions for allowable work hours. If work occurs at night, temporary lighting may be required 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.

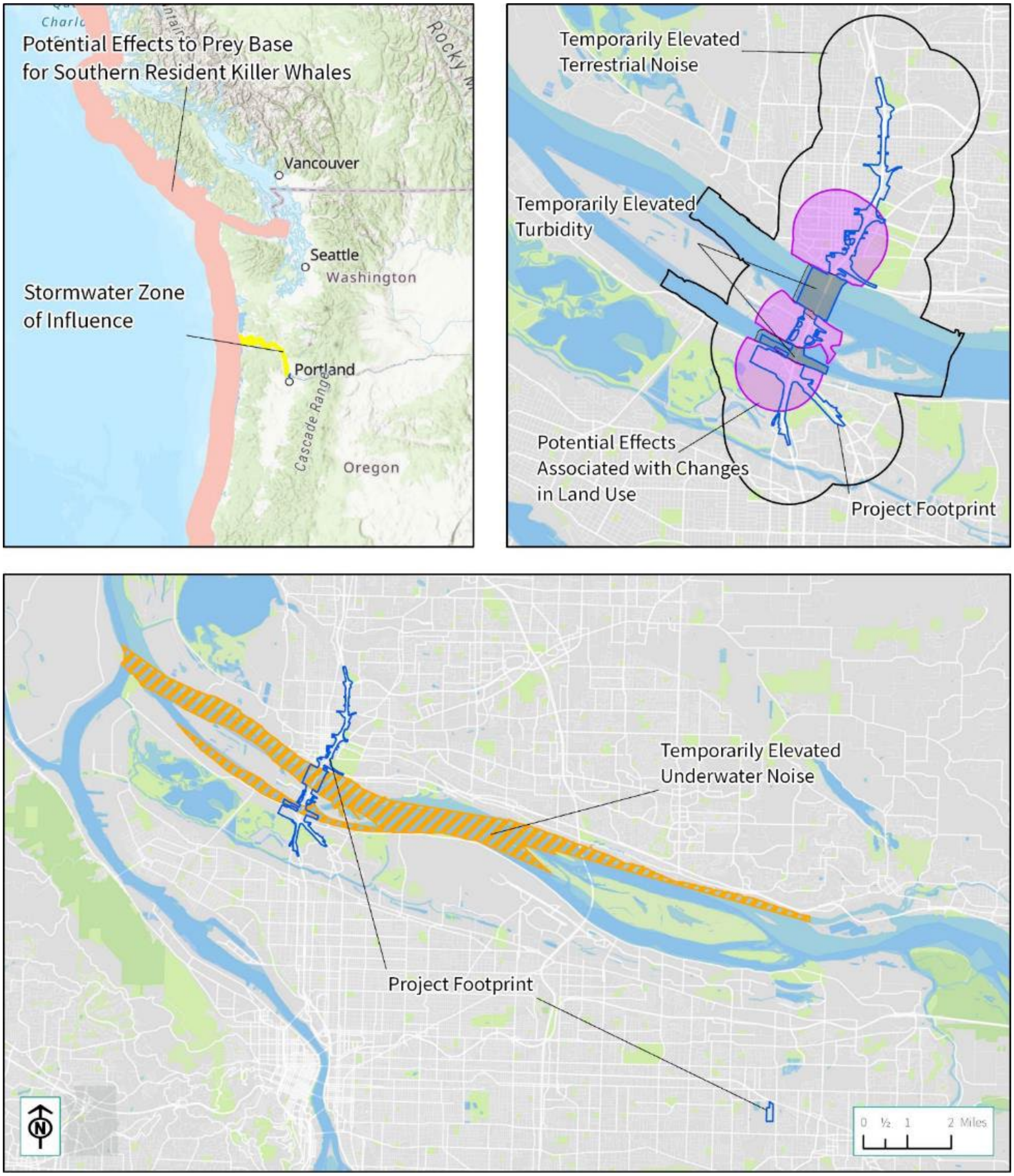
5. ACTION AREA

This section describes the defined geographic area that could be affected by all effects of the proposed action— or the "action area" (Figure 5-1). The action area is established based on:

- The physical footprint of the proposed project (the project site), which includes the limits of proposed construction activities.
- The extent of underwater noise generated during pile installation and removal.
- 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 turbidity during project activities.
- The downstream extent to which effects associated with stormwater could potentially occur.
- The maximum extent of potential effects associated with changes in land use that are reasonably certain to occur because of the proposed action.
- The estimated extent of where salmonid species from the Columbia River may be available as prey for Southern Resident DPS killer whales (SRKWs).

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 upstream or downstream on the Columbia River, though it is possible that one or more barges could come from other locations outside of the Columbia River. 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.

Figure 5-1. Action Area



5.1 Project Footprint

The project footprint portion of the action area consists of the physical location of the proposed project activities (the project site), as described in Section 3 and shown on Figure 5-1. This portion of the action area includes the physical locations of all proposed upland, in-water, and overwater structures associated with the proposed action, as well as all areas where construction and/or materials staging associated with the proposed action are expected to occur.

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 2022). In the absence of site-specific data, the baseline underwater noise level in the reach of the Columbia River associated with the project site is conservatively assumed to be approximately 120 dB_{RMS} (root mean square) (WSDOT 2022).

The loudest source of underwater noise from the proposed action will come from the impact driving of steel pipe piles to support temporary work platforms, work bridges, falsework, and vessel tethers that will support equipment and people necessary to construct the piers and the superstructure of the bridge itself.

The proposed action will require the installation of steel pipe piles that are expected to fall into two diameter size classes: 18 to 24 inches, and 36 to 48 inches. For purposes of hydroacoustic impacts analysis, the larger diameter in each size class (24-inches and 48-inches, respectively) is assumed to provide the most conservative estimate of potential underwater noise generation. Installation of these piles will require the use of both vibratory and impact hammers. Pile-driving methodologies are described in detail in Section 3.3.

The estimated maximum underwater noise levels from impact pile driving are based on test pile data for the CRC project (DEA 2011). This data includes sound pressure levels generated during vibratory and impact installation of 24-inch and 48-inch steel piles at the Project Site.

Impact pile driving the largest diameter pile (48-inch) will create the highest noise levels: 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). These noise levels will be used to estimate the extent of the underwater noise zone of influence. This accounts for pile strikes that will be applied without standard attenuation to test bubble curtain (or similar device) effectiveness.

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 C. 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 and North Portland Harbor, 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 5.5 miles downstream, and approximately 12.5 miles upstream from the existing bridge. This zone of influence is shown graphically on Figure 5-1.

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 FTA's Transit Noise and Vibration Impact Assessment Manual (FTA 2018).

Impact driving of steel piles is expected to be the loudest terrestrial noise source during construction and is used to determine the limits of the action area for terrestrial noise. Pile driving could occur at any of the seven project interchanges and will occur in the Columbia River and North Portland Harbor. Peak terrestrial noise levels generated during impact pile installation are estimated to be approximately 110 A-weighted decibels (dBA), measured at 50 feet (FTA 2006).

The action area is centered along a major highway (I-5), a mainline railroad (BNSF), and various industrial and commercial developments. Baseline noise levels adjacent to these noise sources are estimated to be relatively high (at least 78 dBA measured at 50 feet). However, ambient noise levels further from the road are expected to be lower, and have been assumed to be 65 dBA, typical of an urban residential area (Cavanaugh and Tocci, 1998, as cited in WSDOT 2022).

Terrestrial noise attenuation was estimated using the following spherical spreading loss model (WSDOT 2022):

$TL = \alpha * Log(R_1/R_2)$

TL = amount of spreading loss (known noise level – ambient noise level)

α = 20 for hard site conditions, and 25 for soft site conditions

R_1 = distance at which noise attenuates

R_2 = range of known noise level (50 feet in this case)

Hard site conditions were assumed for noise attenuation purposes over water, while soft site conditions were assumed over land. Solving this equation for R_1 under both conditions yields the following results:

Hard Site: $R_1 = (10^{(TL/20)})(R2) = (10^{(110-65/20)})(50) = 8{,}891$ feet

Soft Site: $R_1 = (10^{(TL/25)})(R2) = (10^{(110-65/25)})(50) = 3{,}154$ feet

This indicates that terrestrial noise associated with impact pile driving would be expected to attenuate to ambient noise levels within a maximum of 9,000 feet over open water, and within a maximum of approximately 3,500 feet over land. This area is shown on Figure 5-1.

5.4 Temporarily Elevated Turbidity

In-water construction activities that disturb sediment (including pile installation and removal, drilled shaft construction, barge operation, debris removal, and demolition activities) have 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 upstream and downstream of turbidity-generating activities, as this is typical for waterbodies the size of the Columbia River (that is, with flows of 300 cubic feet per second or greater). This area is shown on Figure 5-1.

5.5 Stormwater

The zone of influence associated with stormwater is defined based on standards established in recent NOAA Fisheries Biological Opinions, including the FAHP BO (NOAA Fisheries 2021b), which indicate that the zone of influence for stormwater constituents extends from the upstream-most stormwater outfall, down to and including the mouth of the Columbia River. This is 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 5-1.

5.6 Effects Associated with Changes in Land Use

The proposed action may indirectly induce changes in land use, development, and/or traffic patterns. These induced changes could in turn result in effects associated with new impervious surface, in-water work, and impacts to aquatic and terrestrial habitat features.

The zone of influence for potential effects from changes in land use is established in Section 8.11, and includes: (1) Areas within approximately 0.50 mile from each of the transit stations associated with the proposed action; (2) portions of Hayden Island included in the Hayden Island Plan; and (3) portions of the City of Vancouver that are included in the Vancouver City Center Vision (see Section 8.11).

5.7 Effects to Prey Base for Southern Resident DPS Killer Whale

The zone of influence for potential effects on the prey base for SRKW includes all areas off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This area encompasses the whales' entire coastal range from the mouth of the Columbia River and its plume, south as far as central California (Weitkamp 2010; Shelton et al. 2019) and north as far as Southeast Alaska (NMFS 2008d; Hanson et al. 2013; Caretta et al. 2021). Small numbers of Chinook salmon from the Columbia River also enter the Salish Sea (Weitkamp 2010; Shelton et al. 2019). This approximate area is shown graphically on Figure 5-1.

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 NOAA Fisheries (NOAA Fisheries 2021a), USFWS (USFWS 2021a, 2021b, 2021c), ODFW (ODFW 2021), and WDFW (WDFW 2021a, 2021b). Species lists are included in Appendix E.

Table 6-1 identifies the ESA-listed species and designated critical habitats that are either documented or may potentially occur within the action area.

Table 6-1. ESA-listed Species and Critical Habitats Addressed in this Biological Assessment

	Species Common Name	Species Scientific Name	ESU or DPS [a]	Federal ESA Status [b]	Critical Habitat
Fish	Chinook salmon	*Oncorhynchus tshawytscha*	LCR ESU	LT	Designated
			UWR ESU	LT	Designated
			UCR Spring-Run ESU	LE	Designated
			SR-SSR ESU	LT	Designated
			SR-FR ESU	LT	Designated
	Chum salmon	*Oncorhynchus keta*	CR ESU	LT	Designated
	Coho salmon	*Oncorhynchus kisutch*	LCR ESU	LT	Designated
	Sockeye salmon	*Oncorhynchus nerka*	Snake River ESU	LE	Designated
	Steelhead	*Oncorhynchus mykiss*	LCR DPS	LT	Designated
			UWR DPS	LT	Designated
			MCR DPS	LT	Designated
			UCR DPS	LT	Designated
			SRB DPS	LT	Designated
	Bull trout	*Salvelinus*	CR DPS	LT	Designated

	Species Common Name	Species Scientific Name	ESU or DPS [a]	Federal ESA Status [b]	Critical Habitat
		confluentus			
	Pacific eulachon	*Thaleichthys pacificus*	Southern DPS	LT	Designated
	North American green sturgeon	*Acipenser medirostris*	Southern DPS	LT	Designated
Marine Mammals	Killer whale	*Orcinus orca*	Southern Resident DPS	LE	Designated
Birds	Streaked horned lark	*Eremophila alpestris strigata*	N/A	LT	Designated

Notes:

a CR = Columbia River; SR = Snake River; DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; LCR = Lower Columbia River; MCR = Middle Columbia River; SRB = Snake River Basin; SR-FR = Snake River Fall-Run; SR-SSR = Snake River Spring/Summer-Run; UCR = Upper Columbia River; UWR = Upper Willamette River; b Federal status: LT = Listed Threatened; LE = Listed Endangered; (NOAA Fisheries 2021a; USFWS 2021a).

Key: N/A = Not applicable

6.1 Typical Run Timing for ESA-listed Fish Within the Lower Columbia River below Bonneville Dam

Life history presence and run timing in the Lower Columbia River for the ESA-listed fish species addressed in this BA are summarized below. Table 6-2 shows the times of year that adult salmonids may be migrating, Table 6-3 lists the timing of potential presence of rearing or outmigrating juvenile salmonids; and Table 6-4 lists the times of year that non-salmonid species may be present within the river. It is important to note that timing in these tables is for general illustrative purposes. Run timing depends on a multitude of both biological and environmental conditions and may vary in any given year.

In general, due to the number of species that rely on the Columbia River as a migratory corridor, and the variety of life history strategies among these species, both adult and juvenile salmonids are likely to be present in portions of the action area year-round. However, peak presence generally occurs between March and October in most years.

Table 6-2. Timing of Typical Adult Salmonid Presence within the Lower Columbia River below Bonneville Dam

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

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

Table 6-3. Timing of Typical Juvenile Salmonid Presence within the Lower Columbia River below Bonneville Dam

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

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

Table 6-4. Timing of Typical Presence of Non-Salmonid ESA-listed Fish within the Lower Columbia River below Bonneville Dam

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

Key: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

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, 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). Channel size and morphology, substrate size and quality, water quality, and cover type and abundance may influence distribution and abundance of Chinook salmon (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 lower river 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 subyearlings 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 portions of the Columbia

River and North Portland Harbor that are within the project site represents documented migratory habitat for adult Chinook salmon, and suitable migratory and rearing habitat for juvenile Chinook salmon. Both adult and juvenile Chinook of one or more ESUs may be present within the lower river year-round. However, the relative distribution of both species and life stages between the two waterbodies likely varies throughout the year in response to species-specific biological factors (e.g., run timing and life history), and environmental variables (e.g., water temperature, flow velocity) (ODFW 2023).

6.2.1.1 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. 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 15 artificial propagation programs for Chinook in this ESU (70 Federal Register [FR] 37160). This ESU comprises 32 independent populations.

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 spring Chinook salmon spawn primarily in upstream, higher elevation portions of large subbasins. Adults enter the lower Columbia River from March through June, well in advance of spawning in August and September. Early fall Chinook salmon spawn in moderate-sized streams and large river mainstems, including most tributaries of the lower Columbia River. These fish enter freshwater from August to September and spawn from late September to November, with peak spawning activity in mid-October. Late fall Chinook salmon generally return later in the year, entering the Columbia River from August to October, and spawn later—from November to December, with peak spawning in mid-November (LCFRB 2010a; NOAA Fisheries 2013).

There is no suitable spawning habitat within the mainstem Columbia River or North Portland Harbor within the action area. The nearest mainstem spawning for Chinook salmon occurs near Ives Island and Hamilton Creek, at RM 143, approximately 3 miles downstream from Bonneville Dam and 37 miles upstream from the existing Interstate Bridge (PSMFC 2021).

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 2013). 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 (Carter et al. 2009).

The Columbia River and North Portland Harbor provide suitable migratory habitat for adult LCR ESU Chinook salmon, and suitable migratory and rearing habitat for outmigrating juveniles. Adults may be present between approximately March and December, and rearing juveniles may be present year-round. Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site. Higher quality rearing habitat (e.g., accessible areas of small tributaries, backwater areas, and other low-velocity refugia), is present in downstream portions of the action area within the stormwater zone of influence, particularly in the lower estuary.

LCR ESU Chinook salmon use the Columbia Slough for juvenile rearing, foraging, and refuge from high flows. They are documented as occurring within the Columbia slough to a point upstream of North Portland Road, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021). Juveniles of this ESU may be present within the Columbia Slough year-round.

LCR ESU Chinook salmon are not documented within Burnt Bridge Creek. However, WDFW identifies potentially accessible habitat upstream of the confluence with Vancouver Lake (WDFW 2021a, 2021c). No suitable or documented spawning habitat is present within portions of Burnt Bridge Creek that are within the action area, though rearing and/or outmigrating Chinook may be present year-round.

6.2.1.2 Upper Willamette River Chinook

Upper Willamette River (UWR) Chinook includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River subbasin and from the Willamette River subbasins upstream of Willamette Falls, Oregon, as well as six 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 Upper Willamette 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 2020).

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.

The portions of the Columbia River and North Portland Harbor that are within the action area provide suitable migratory habitat for adult UWR Chinook salmon, and suitable migratory and rearing habitat for outmigrating juveniles. They are not known to use North Portland Harbor, though access to this side-channel habitat is not precluded. Adults may be present between approximately mid-February and mid-May, and rearing juveniles may be present year-round.

UWR Chinook use the Columbia Slough for juvenile rearing, foraging, and refuge from high flows. They are documented as occurring within the Columbia Slough to a point upstream of the rail bridge, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021). Juveniles of this ESU may be present within the Columbia Slough year-round.

UWR Chinook do not occur within Burnt Bridge Creek (70 FR 37160).

6.2.1.3 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 comprises three extant independent populations (Wenatchee, Entiat, and Methow), and fish from six artificial propagation programs. All the existing three subpopulations migrate through the action area. Chief Joseph Dam, constructed in 1961, functions as a total passage barrier for further upstream migration of this ESU (NOAA Fisheries 2016b).

Adult UCR spring-run Chinook salmon begin returning from the ocean in April and May, with the run into the Columbia River peaking in mid-May. They enter the upper Columbia River tributaries from April through July. After migration, they hold in freshwater tributaries until spawning occurs in the late summer, peaking in mid-to-late August. Juveniles follow a stream-type freshwater cycle, meaning that they typically outmigrate after one year of rearing in freshwater, typically between mid-March and late June (NOAA Fisheries 2007, 2016b; USACE et al. 2020).

The portions of the Columbia River and North Portland Harbor that are within the action area provide a suitable migratory corridor for adult and juvenile UCR Chinook salmon. Adults may be present between approximately April and July. Outmigrating juveniles may be present between mid-March and late June, though some rearing juveniles may be present year-round.

Since most juvenile rearing occurs in the upper watershed, the extent to which juvenile UCR spring-run Chinook use the Columbia Slough is likely minimal. Nevertheless, the Columbia Slough is accessible to, and provides potentially suitable habitat for rearing and outmigrating juveniles. UCR Chinook do not occur in Burnt Bridge Creek.

6.2.1.4 Snake River Spring/Summer-Run Chinook

The Snake River spring/summer-run (SR-SSR) ESU of Chinook salmon 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; NOAA Fisheries 2016b). The ESU includes 28 extant natural populations (plus three functionally extirpated populations and one extirpated population). There are also 11 artificial propagation programs for Chinook salmon in this ESU.

Spring-run Chinook salmon within this ESU enter freshwater primarily from March through May and migrate to spawning reaches, then spawn in mid to late August with some spawning extending into early September. Summer-run Chinook salmon within this ESU enter freshwater primarily from June to July and wait to migrate to spawning areas until late summer (NOAA Fisheries 2017b; USACE et al. 2020). Most SR-SSR ESU Chinook salmon migrate to the ocean as yearlings, but the species does exhibit diversity in its freshwater life-history strategy. Some juveniles may spend less than one year (migrating as subyearlings), or may rear for one or two years in freshwater habitats before migrating to the ocean (NOAA Fisheries 2017b). Yearling outmigrants generally pass downstream of Bonneville Dam from late April through early June, and spend relatively little time in the estuary compared to subyearling ocean-type fish. (NOAA Fisheries 2017b; USACE et al. 2020). Subyearlings may reside for longer duration. As such, SR-SSR Chinook may potentially be present in portions of the Lower Columbia River year-round (NOAA Fisheries 2017b).

The portions of the Columbia River and North Portland Harbor that are within the action area provide a suitable migratory corridor for adult and juvenile SR-SSR ESU Chinook salmon. Adults may be present between approximately March and July, and outmigrating or rearing juveniles may be present year-round.

Since most juvenile rearing occurs in the upper watershed, the extent to which juvenile SR-SSR ESU Chinook salmon use the Columbia Slough is likely minimal. Nevertheless, the Columbia Slough is accessible to, and provides potentially accessible refugia habitat for, rearing or outmigrating juveniles. SR-SSR ESU Chinook salmon do not occur in Burnt Bridge Creek.

6.2.1.5 Snake River Fall-Run Chinook

The Snake River fall-run (SR-FR) Chinook ESU includes all natural-origin fall-run Chinook salmon originating from 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; NOAA Fisheries 2017a). There are also four artificial propagation programs for Chinook in this ESU.

Most SR-FR ESU Chinook salmon production historically came from large mainstem reaches that supported a subyearling, or “ocean-type,” life history strategy. Adults migrated up the Columbia and Snake Rivers from July to August through November and spawned from late September to early October through November. Eggs developed rapidly in the relatively warm lower mainstem reaches of several tributary rivers, which facilitated emergence during late winter and early spring and accelerated growth such that juveniles could become smolts and migrate to the ocean in May and June (NOAA Fisheries 2017a). At present, this life history strategy contributes most of the natural-origin adult returns to the ESU, and the timing of adult migration and spawning plus egg incubation, fry emergence, and juvenile emigration is similar to historical patterns. However, a yearling life history strategy is also supported, mostly for juveniles from the cooler Clearwater River subbasin which overwinter in the lower Snake River reservoirs or other cool-water refuge areas and migrate downstream the following spring (NOAA Fisheries 2017a).

Adult and juvenile SR-FR Chinook use the Columbia River for upstream adult migration and holding, and for juvenile outmigration. Adult SR-FR Chinook salmon enter the Columbia River from early

August to September, typically passing Bonneville Dam from mid-August to the end of September, with a median passage date of mid-September (NOAA Fisheries 2017a). Adults spawn in the Snake River and tributaries through early December. Juveniles emerge in mid-March, and downstream migration begins between mid-March and late May. The yearling and subyearling components of the ESU exhibit different strategies during migration through the Columbia River estuary. Yearling SR-FR Chinook salmon migrate rapidly through the estuary, generally moving through in less than a week. Subyearlings may reside for longer duration. As such, SR-FR Chinook may be present in portions of the Lower Columbia River year-round: as juveniles in winter, as fry from March to May, and as fingerlings throughout the summer and fall (NOAA Fisheries 2017a).

The portions of the Columbia River and North Portland Harbor that are within the action area provide a suitable migratory corridor for adult and juvenile SR-FR ESU Chinook salmon. Adults may be present between early August and mid-October, and outmigrating or rearing juveniles may be present year-round.

Since most juvenile rearing occurs in the upper watershed, the extent to which juvenile SR-FR ESU Chinook salmon use the Columbia Slough is likely minimal. Nevertheless, the Columbia Slough is accessible to, and provides potentially accessible refugia habitat for rearing or outmigrating juveniles. SR-FR ESU Chinook salmon do not occur in Burnt Bridge Creek.

6.2.2 Chum Salmon

Chum salmon that spawn within the Columbia River are within the Columbia River ESU. This ESU includes all naturally spawning populations in all river reaches accessible to chum salmon in the Columbia River downstream from Bonneville Dam (LCFRB 2010a). The ESU consists of 17 historical populations in three distinct ecological regions: Coast, Cascade, and Gorge. The ESU also includes two artificial propagation programs (70 FR 37160).

Historically, chum salmon were abundant in the Columbia River. However, currently, the remaining returning spawning populations represent less than 1% of historic levels. Habitat loss and degradation has been identified as the most significant causes of decline in this ESU (LCFRB 2010a; NOAA Fisheries 2016a). 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 (approximately 7 river miles upstream of the existing Interstate Bridge) (NOAA Fisheries 2016a; PSMFC 2021).

Adults arrive in freshwater from mid-October through November after two to six years and spawn in the mainstem of the river from November through December (NOAA Fisheries 2013; USACE et al. 2020). During chum salmon spawning and egg incubation, the water surface elevation of the Bonneville tailrace is controlled to protect chum salmon redds. CR ESU chum salmon juveniles rear in freshwater very briefly after emerging from gravel. Chum salmon fry emerge from March through May (LCFRB 2010a) and are believed to migrate promptly downstream to the estuary for rearing. Juveniles typically outmigrate to the Lower Columbia River estuary as subyearlings from March through late

May, where they spend several weeks to months before continuing to the ocean (NOAA Fisheries 2013; USACE et al. 2020).

The portions of the Columbia River and North Portland Harbor that are within the action area provide a suitable migratory corridor for adult and juvenile CR ESU chum salmon. Adults may be present between October and December, and rearing and outmigrating juveniles may be present from March through June. A documented chum salmon spawning site (located upstream of the I-205 bridge) is also within the action area, and adult fish are typically spawning in this location between October and December each year.

CR ESU chum salmon are not known or expected to occur within Columbia Slough or within Burnt Bridge Creek (PSMFC 2021; WDFW 2021a, 2021c).

6.2.3 Coho Salmon

The LCR coho salmon ESU includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the White Salmon and Hood Rivers (inclusive) and any such fish originating from the Willamette River and its tributaries below Willamette Falls. The ESU also includes coho salmon from 21 artificial propagation programs (70 FR 37160). The ESU contains 24 independent populations in three ecological regions (Coast, Cascade, and Gorge).

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. It is impossible to accurately estimate the decline in LCR stocks of coho salmon, but a NOAA Fisheries review estimated that the runs may have been reduced to less than 5% of historical levels by the late 1950s (LCFRB 2010b). Extensive hatchery production and over-harvest of this commercial production are the primary reasons for the decline of coho salmon in the LCR ESU. Habitat blockage and destruction are also factors (LCFRB 2010b). In addition, current research related to a phenomenon known as urban runoff mortality syndrome (Tian et al. 2021) indicates that adult and juvenile coho salmon are particularly vulnerable to lethal effects of exposure to a chemical known as 6PPD-q, which is a chemical derivative of 6PPD, an organic chemical that is widely used as an antiozonant and antioxidant in rubber tires.

Coho salmon have one of the shortest life cycles of all anadromous salmonids. Different patterns of life history are linked to different populations. 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 in the late summer and early fall, with spawning occurring in silt to large gravel of tributaries (LCFRB 2010c; NOAA Fisheries 2013). Eggs incubate for a period of one to six months. Fry emerge in the spring, and juveniles rear in small tributaries for their first year, outmigrating as smolts in the late spring of their second year (LCFRB 2010c; NOAA Fisheries 2013). LCR ESU coho salmon prefer shallow, low-velocity rearing areas, primarily along stream edges and in side channels. They congregate in quiet backwaters, side channels, and small creeks, especially in shady areas with overhanging branches (LCFRB 2010c).

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. 1998; NOAA Fisheries 2013). While there is some overlap between these populations, Type S coho salmon generally move south of the Columbia River mouth once smolts outmigrate, and Type N coho salmon smolts and adults generally move north of the Columbia River mouth (NOAA Fisheries 2013).

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 March (LCFRB 2010c). Spawning occurs in silt to large gravel of tributaries (LCFRB 2010c; NOAA Fisheries 2013).

The portions of the Columbia River and North Portland Harbor that are within the action area provide a suitable migratory corridor for adult and juvenile CR ESU coho salmon. Upstream migrating adults are typically present within this portion of the action area from approximately August to January, with some present as late as March (LCFRB 2010c; NOAA Fisheries 2013). There is no suitable spawning habitat within the mainstem Columbia River or North Portland Harbor within the action area.

Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site. However, rearing juveniles may be present within this portion of the action area year-round. Higher quality rearing habitat (e.g., accessible areas of small tributaries, backwater areas, and other low-velocity refugia), is present in downstream portions of the action area within the stormwater zone of influence.

LCR ESU coho salmon are known to be present within the Columbia Slough, and can access portions of the slough upstream t° NE 18th Avenue, where an earthen levee blocks passage (City of Portland 2021). There is no documented coho salmon spawning within the Columbia Slough, and conditions are not suitable for coho spawning. Rearing juveniles may be present year-round.

LCR ESU coho salmon are also known to be present within Burnt Bridge Creek. Coho salmon have been documented downstream of I-5, and are presumed to be present upstream of I-5 (WDFW 2021a, 2021c). No spawning habitat is present within portions of Burnt Bridge Creek that are within the action area, though rearing and outmigrating coho may be present year-round.

6.2.4 Sockeye Salmon

Sockeye salmon that migrate through the action area are within the Snake River ESU. The Snake River ESU of sockeye salmon includes fish within all river reaches and estuary areas presently or historically accessible to sockeye salmon in the Columbia River. This includes 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) (79 FR 20802, April 14, 2014).

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 the Sawtooth Valley lakes in August and September (NOAA Fisheries 2020). Spawning peaks in October and occurs in lakeshore gravels. Fry emerge in late April and May and move immediately to the open waters of their natal lakes. Juvenile outmigration occurs between April through early-July, with peak migration typically occurring in mid-April to early May. 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.

Within the action area, adult Snake River ESU sockeye are present in the Columbia River and North Portland Harbor during upstream migration in June and July (LCFRB 2010c; NOAA Fisheries 2016b). Juveniles may be present during outmigration from April to August. There is no spawning or rearing habitat within the action area, though both adult and juvenile sockeye may use the mainstem and North Portland Harbor for holding and resting during their migration.

Snake River ESU sockeye salmon are not known or expected to occur in Columbia Slough or within Burnt Bridge Creek (PSMFC 2021; WDFW 2021a, 2021c).

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 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 (61 FR 41541). 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 2010c).

Factors contributing to the decline of the steelhead 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).

Individual DPSs of steelhead differ in their spatial and temporal distribution within the action area, as 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 steelhead, and suitable migratory and rearing habitat for juvenile steelhead. Both adult and juvenile steelhead of one or more DPSs may be present within the action area year-round.

6.2.5.1 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 (79 FR 20802). There are seven artificial propagation programs for steelhead in this DPS.

There are both summer-run and winter-run populations of LCR steelhead. Of the 23 extant populations in this DPS, six are summer runs and 17 are winter runs. Returning adults of both runs are four to six years of age. 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 2013).

Summer-run steelhead within the LCR DPS 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 February and April. Winter-run steelhead return to the Columbia River between December and May and sexually mature and spawn in the spring between April and May (LCFRB 2010c; NOAA Fisheries 2013). Juveniles typically rear in freshwater tributaries for one to four years prior to outmigration (Quinn 2005, as cited in Carter et al. 2009).

Outmigrating juvenile steelhead are present in the action area from mid-February through November LCFRB 2010c; NOAA Fisheries 2013). 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).

The Columbia River and North Portland Harbor provide suitable migratory habitat for adult and juvenile LCR DPS steelhead. Adults may be present within this portion of the action area year-round, and outmigrating juveniles may be present in most months of the year (February through November). Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site. Most juvenile rearing occurs in tributary streams and not in the mainstem.

LCR DPS steelhead use the Columbia Slough for juvenile rearing, foraging, and refuge from high flows. They are documented as occurring within the Columbia Slough below North Portland Road, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021). Since juveniles rear in freshwater for multiple years, rearing juveniles of this DPS may be present within the Columbia Slough year-round.

LCR DPS steelhead are documented within Burnt Bridge Creek (WDFW 2021a, 2021c). No suitable or documented spawning habitat is present within portions of Burnt Bridge Creek that are within the action area, though rearing and/or outmigrating steelhead may be present year-round.

6.2.5.2 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). The status was upheld on April 14, 2014 (79 FR 20802). There are four subpopulations of the UWR steelhead: the Molalla, North Santiam, South Santiam, and Calapooia—all use the action area.

UWR DPS steelhead are a winter-run fish, returning to freshwater in January through April, and spawning in March through June, with peak spawning in late April and early May. They typically migrate farther upstream than Chinook salmon and can spawn in smaller, higher gradient streams and side channels. UWR steelhead may spawn more than once, although the frequency of repeat spawning is relatively low. Juvenile steelhead rear in headwater tributaries and upper portions of the subbasins for one to two years (most often two years), then migrate quickly downstream in April through May, through the mainstem Willamette River and Columbia River estuary and into the ocean. Most steelhead forage in the ocean for one to four years (most often two years) (NOAA Fisheries 2011a, 2020).

The Columbia River (primarily the portion downstream of the Willamette River confluence) provides suitable migratory habitat for adult and juvenile UWR DPS steelhead. Adults may be present within this portion of the action between January and mid-June. Outmigrating juveniles may be present in April and early June. Most juvenile rearing occurs in tributary streams higher in the watershed, and not in the mainstem. UWR DPS steelhead are not known to use North Portland Harbor (which is upstream of the Willamette River confluence), though access to this side-channel habitat is not precluded.

UWR DPS steelhead are not known to use the Columbia Slough extensively for rearing, since most rearing within this DPS occurs in tributary streams higher in the watershed. The Columbia Slough may provide habitat for foraging and refugia during outmigration, primarily during April and May. However, since juveniles rear in freshwater for multiple years, rearing juveniles of this DPS may be present within the Columbia Slough year-round. Steelhead may potentially access portions of the Slough as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021).

UWR DPS steelhead are not known or expected to occur within Burnt Bridge Creek.

6.2.5.3 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. On March 25, 1999, NOAA Fisheries listed the MCR steelhead DPS as a threatened species (64 FR 14517). The threatened status was reaffirmed on January 5, 2006 (71 FR 834). The most recent status review, in 2016, concluded the species should remain listed as a threatened species (81 FR 33468). This DPS does not include steelhead in the upper Deschutes River basin, which are designated as part of an experimental population (79 FR 20802, 76 FR 28715). The DPS is comprised of 20 historical populations, and steelhead from seven artificial propagation programs.

Two distinct forms are recognized for MCR DPS steelhead: the stream-maturing type (summer-run steelhead) that require several months in freshwater prior to spawning and the ocean-maturing type (winter-run steelhead) that enter freshwater and spawn shortly after winter entry. Summer steelhead within this DPS enter freshwater from April through October and overwinter in larger rivers, such as the Columbia River. Winter steelhead enter freshwater from November to April and migrate to spawning areas immediately. Most middle Columbia River steelhead are summer-run steelhead (USACE et al. 2020). Both summer and winter steelhead spawn from March through June, and juveniles of both types outmigrate March through June (LCFRB 2010c; USACE et al. 2020).

The Columbia River and North Portland Harbor provide suitable migratory habitat for adult and juvenile MCR DPS steelhead. Adults may be present within this portion of the action area year-round. Outmigrating juveniles may be present March through June). Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site, and most juvenile rearing occurs in tributary streams and not in the mainstem.

MCR DPS steelhead may use the Columbia Slough for juvenile foraging and refuge during outmigration between March and June. Steelhead are documented as occurring within the Columbia Slough below North Portland Road, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021).

Steelhead within Burnt Bridge Creek are within the LCR DPS, and MCR DPS steelhead are not known or expected to occur within Burnt Bridge Creek.

6.2.5.4 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 2016c). The DPS comprises four independent native steelhead populations, as well as steelhead from five artificial propagation programs (71 FR 834). On March 25, 1999, NOAA Fisheries listed the UWR steelhead as threatened (64 FR 14517) and reaffirmed that status on January 5, 2006 (71 FR 834). The status was upheld on April 14, 2014 (79 FR 20802). The most recent status review, in 2016, concluded that this ESU should retain its threatened status (NOAA Fisheries 2016c).

Adult UCR DPS steelhead return to the Columbia River in the late summer and early fall (August to October) (NOAA Fisheries 2020; USACE et al. 2020). Adults overwinter in larger rivers, including the Columbia River, before migrating to upstream tributaries to spawn. Adults spawn from approximately April through mid-June (NOAA Fisheries 2007). Juveniles rear in the Columbia River for one to three years before outmigrating. Most rearing occurs in tributaries in the upper Columbia River watershed (NOAA Fisheries 2016c). Juvenile outmigration occurs from mid-April through early June, with peak migration typically occurring in mid-May (USACE et al. 2020).

The Columbia River and North Portland Harbor provide suitable migratory habitat for adult and juvenile UCR DPS steelhead. Adults may be present within this portion of the action area between August and October. Outmigrating juveniles may be present mid-April through early June. Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site, and most juvenile rearing occurs in tributary streams and not in the mainstem.

UCR DPS steelhead may use the Columbia Slough for juvenile foraging and refuge during outmigration between mid-April and early June. Steelhead are documented as occurring within the Columbia Slough below North Portland Road, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021).

Steelhead within Burnt Bridge Creek are within the LCR DPS, and UCR DPS steelhead are not known or expected to occur within Burnt Bridge Creek.

6.2.5.5 Snake River Basin Steelhead

The Snake River Basin (SRB) DPS of steelhead includes all naturally spawned anadromous steelhead populations below natural and man-made impassable barriers in tributaries in the SRB of southeast Washington, northeast Oregon, and Idaho (79 FR 20802, April 14, 2014). The DPS includes 24 extant populations (and one extirpated population), and steelhead from six artificial propagation programs (NOAA Fisheries 2017b).

SRB DPS steelhead are primarily summer-run fish. Adults enter freshwater from June through August and continue migrating during September before overwintering in the mainstem rivers and tributaries throughout their range. Adults then migrate to tributaries to spawn between March and early June. SR DPS steelhead have high variability in the duration juveniles rear in their natal streams; typically, juveniles smolt between two and three years, and then migrate to the ocean from April to June with peak migration typically occurring in mid-May (NOAA Fisheries 2017b; USACE et al. 2020)

The Columbia River and North Portland Harbor provide suitable migratory habitat for adult and juvenile SRB DPS steelhead. Adults may be present within this portion of the action area between June and September. Outmigrating juveniles may be present April through June. Rearing habitat suitability is of limited quality and quantity within the portions of the mainstem Columbia River and North Portland Harbor that are within the project site, and most juvenile rearing occurs in tributary streams and not in the mainstem.

SRB DPS steelhead may use the Columbia Slough for juvenile foraging and refuge during outmigration between April through June. Steelhead are documented as occurring within the Columbia Slough below North Portland Road, and may potentially access areas as far upstream as 18th Avenue, where an earthen berm precludes passage (City of Portland 2021; PSMFC 2021).

Steelhead within Burnt Bridge Creek are within the LCR DPS, and SRB DPS steelhead are not known or expected to occur within Burnt Bridge Creek.

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% 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 (USFWS 2015). Adults can reside in lakes, reservoirs, and coastal areas or they can migrate to salt water. 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. 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 (USFWS 2015).

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.

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.

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 (USFWS 2015). 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.

Bull trout in the lower Columbia River below Bonneville Dam primarily inhabit tributary systems, including the Lewis, Klickitat, and Hood Rivers. Within the Lewis River system, local populations of bull trout occur in Cougar, Pine, and Rush Creeks. These populations are restricted to portions of the Lewis River upstream of Merwin Dam. Anecdotal reports of bull trout below Merwin Dam suggest that bull trout may occasionally be flushed below the dam; however, the dam does not allow fish passage, and any bull trout below the dam would not have access to upstream habitat (USFWS 2015). One local population is known in the West Fork of the Klickitat River (USFWS 2015).

There are few documented records of bull trout in the Lower mainstem Columbia River in recent decades (USFWS 2015; FPC 2022). Historic records documented that bull trout (referred to as Dolly Varden at the time) were caught in fish wheels operated on the lower mainstem in the late 1800s, and historic observations have also been documented in the lower Columbia River near Jones Beach, and in the fish ladder at Bonneville Dam (USFWS 2015).

If present, adult bull trout could potentially occur in the mainstem Columbia River or North Portland Harbor between approximately late March and early September. However, given the lack of documented recent sightings, their presence is not likely. Juvenile bull trout, which rear in headwater streams, are not expected to occur within the mainstem Columbia River within the action area at any time of the year.

Bull trout are not documented or expected to occur within the Columbia Slough or Burnt Bridge Creek (PSMFC 2021; WDFW 2021a, 2021c).

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 (WDFW and ODFW 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 2017c). Primary threats to eulachon identified in the most recent status review are impacts on ocean conditions and freshwater habitat related to climate change, bycatch in offshore shrimp trawl fisheries, changes in downstream flow-timing and intensity due to dams or water diversions, and predation (NOAA Fisheries 2016d).

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 in the Lower Columbia River occurs between January and March when water temperatures range between approximately 39°F to 50°F (4°C to 10°C) over sand, coarse gravel, or detrital substrates. Eulachon eggs hatch in 20 to 40 days, and then are carried downstream and dispersed by estuarine and ocean currents.

Most Pacific eulachon production for the southern DPS occurs in the Columbia River basin (NOAA Fisheries 2017c). 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). Southern DPS eulachon use the mainstem Columbia River within the action area for adult migration, spawning, incubation, and downstream migration of larvae.

Adult eulachon typically enter the Lower Columbia River from December to March, though a small run of eulachon can occur as early as mid-November (WDFW and ODFW 2001; NOAA Fisheries 2020). Peak abundance typically occurs between February and March. Eggs are released and fertilized in the water column in a broadcast spawning strategy. Fertilized eggs in the water column slowly sink as they drift downstream and adhere to river substrates, typically in areas of pea-sized gravel and coarse sand (WDFW and ODFW 2001). Fertilized eggs typically require 30 to 40 days for larval development before hatching. After this incubation period, the eggs hatch and the larvae drift downstream to the estuary and into marine waters where they generally remain for two to five years before returning to spawn as adults (NOAA Fisheries 2017c, 2020).

Adult DPS Pacific eulachon may be present within the Columbia River and North Portland Harbor within the action area from November through June, though the peak of the run occurs in February and March. Eulachon eggs and larval eulachon may be present in the action area from approximately mid-April through August.

Pacific eulachon are not documented or expected to occur within the Columbia Slough or Burnt Bridge Creek (PSMFC 2021; WDFW 2021a, 2021c).

6.2.8 North American Green Sturgeon

The Southern DPS of North American green sturgeon are listed as threatened under the ESA, and the Columbia River estuary below RM 46 has been designated as critical habitat (NOAA Fisheries 2018).

Green sturgeon are distributed throughout Alaska, Oregon, Washington, and California. 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 (NOAA Fisheries 2018). The Columbia River does not support spawning populations of green sturgeon (NOAA Fisheries 2018). Adults and subadults 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 2018).

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 2018).

Green sturgeon prefer more saline environments and are not typically found in the Columbia River upstream of RM 37. Adult and subadult green sturgeon are typically present in the lower Columbia River from mid-May to mid-September, with August being the peak month (NOAA Fisheries 2018). Green sturgeon are not frequently present within the portion of the action area that is at the project site, but are present within the downstream portion of the river between approximately mid-May and mid-September.

Green sturgeon do not occur within the Columbia Slough, or Burnt Bridge Creek (PSMFC 2021; WDFW 2021a, 2021c).

6.2.9 Southern Resident DPS Killer Whale

The SRKW was listed as endangered on February 16, 2006 (70 FR 69903). A recovery plan was completed in 2008 (NOAA Fisheries 2008). Critical habitat in inland waters of Washington for SRKW was designated on November 29, 2006 (71 FR 69054). This critical habitat designation was updated in 2021, to add six additional areas along the U.S. West Coast (86 FR 41668). In the most recent five-year status review, NOAA Fisheries evaluated information on the status of the DPS including threats and research results and publications and concluded that SRKW should remain listed as endangered.

SRKW occur in large, stable pods with memberships ranging from 10 to approximately 60 whales. The SRKW DPS is comprised of three distinct pods (J pod, K pod, and L pod). These pods reside for part of the year in the inland waterways of Washington State and British Columbia known as the Salish Sea (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound), principally during the late spring, summer, and fall (Caretta et al. 2021). The whales also visit outer coastal waters off Washington and Vancouver Island, especially in the area between Grays Harbor and the Columbia River, but travel as far south as central California and as far north as the Southeast Alaska (Caretta et al 2021).

The diet of thI SRKW is composed almost entirely of salmon, with adult male orcas needing approximately 325 pounds of Chinook to meet their daily prey energy requirements (SROTF 2018; Hanson et al. 2021). Although their diet tends to vary slightly throughout the year, feeding on smaller amounts of salmon species such as coho, chum and steelhead, about 80% of their total diet comes from Chinook salmon (SROTF 2018; Hanson et al. 2021).

The abundance of salmon has declined significantly since the late 1800s and early 1900s, due to compounded effects of harvest, impacts to habitat modifications, water quality and quantity impacts, predation, and impacts to their own prey base (SROTF 2018). The Southern Resident Orca Task Force (SROTF) has identified impacts to prey availability, specifically the availability of Chinook salmon, as a key threat to the recovery of the SRKW.

The action area includes marine waters off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This area encompasses the whales' entire coastal range from the mouth of the Columbia River and its plume, south as far as central California, and north as far as Southeast Alaska. While these marine waters would not be directly affected by the implementation of the program, effects to salmon and steelhead could in turn effect the prey base for SRKW that occurs within these waters (SROTF 2018).

6.2.10 Streaked Horned Lark

The streaked horned lark is endemic to the Pacific Northwest (British Columbia, Oregon, and Washington). It is listed as threatened species under the federal ESA, listed as endangered in Washington state, and is listed as sensitive-critical in Oregon. Critical habitat has been designated under the federal ESA (78 FR 61505), but none occurs within the action area.

Streaked horned larks historically selected habitat in relatively flat, open areas maintained by flooding, fire, and sediment transport dynamics. The interruption of these historical processes due to flood control dams, fire suppression, and reduction of sediment transport by dams resulted in a steep decline in the extent of historical habitat for the lark. Currently, larks are found in open areas free from visual obstructions like grasslands, prairies, wetlands, beaches, dunes, and modified or temporarily disturbed habitats (such as agricultural or grass seed fields, airports, dredged material placement sites, and gravel roads). Habitat used by larks is generally flat with substantial areas of bare ground and sparse low-stature vegetation (USFWS 2019).

Streaked horned lark are known to both nest and winter on dredge placement sites and agricultural fields in the Lower Columbia River floodplain. They have not been documented within the action area, but are known to occur within the vicinity. Streaked horned larks have been documented at the St. Johns Prairie site (which is located on a former landfill southwest of Smith and Bybee Lakes, approximately 3 miles west of I-5. They have also been observed on four different locations on Sauvie Island.

There is no suitable habitat for streaked horned lark within the project footprint, and only limited potentially suitable habitat within the terrestrial portions of the action area. The sandy shorelines within the terrestrial portion of the action area (on Hayden Island, in North Portland Harbor, and the Columbia River shoreline in Washington) provide potentially suitable foraging habitat, but do not provide suitable nesting habitat. Habitat usage within the action area is expected to be limited to occasional opportunistic foraging by larks passing through the vicinity.

6.3 Critical Habitat

6.3.1 Salmon and Steelhead

The proposed action occurs within designated critical habitat for 13 ESU/DPS of listed salmon and steelhead. Table 6-5 provides a summary of the critical habitat designations.

Table 6-5. Salmon and Steelhead Critical Habitat Summary

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

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

6.3.1.1 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),[12] which have been identified for ESA-listed salmon and steelhead and the potential for their presence within the action area.

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

Spawning habitat is extremely limited in the action area, and is present for only CR ESU chum salmon. There is an existing documented chum salmon spawning location within the action area, near a small spring just upstream of the I-205 bridge near Vancouver (approximately 7 river miles upstream of the existing Interstate Bridge) (NOAA Fisheries 2016a; PSMFC 2021). Habitat conditions at this site are suitable for spawning, and this PBF of critical habitat is present within the action area for CR ESU chum salmon.

For all other ESU/DPSs of salmon and steelhead, the action area generally lacks suitable spawning habitat. There is no documented salmon or steelhead spawning within Columbia Slough or Burnt Bridge Creek, and water quality and substrate conditions within these waterbodies is not suitable for salmon or steelhead spawning. This PBF of critical habitat is not present within the action area for LCR, UWR, Upper Columbia River spring-run (UCR-SR), SR-SSR, or SR-FR ESU Chinook salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; or LCR, UWR, MCR, UCR, and SRB DPS steelhead.

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.

Portions of the action area provides freshwater rearing habitat for juveniles of four ESUs of salmon (LCR and UWR ESU Chinook salmon; LCR ESU coho salmon; LCR ESU chum salmon) and one DPS of steelhead (LCR DPS steelhead). Other ESU/DPSs of salmon and steelhead rear in upstream portions of the watershed, or in tributary streams outside of the action area, and the action area does not provide this PBF of critical habitat for these populations.

Within the portions of the Columbia River and North Portland Harbor that are within the project site, water quality is impaired, floodplain connectivity is limited, and aquatic and riparian habitat complexity is limited or absent due to the highly altered and managed nature of the river. Water

[12] 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.

quantity is carefully managed by upstream dams and the natural hydrograph has been altered. Conditions are similarly impaired within the portions of the Columbia Slough and Burnt Bridge Creek that are within the action area.

Higher quality rearing habitat (e.g., accessible areas of small tributaries, backwater areas, and other low-velocity refugia), is present in downstream portions of the Columbia River mainstem within the stormwater zone of influence, particularly in the lower estuary.

At minimum, the action area provides adequate habitat and water quality conditions for rearing of juvenile salmonids, and this PBF of critical habitat is present within the aquatic portions of the action area within the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek.

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.

The action area functions 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 within the action area.

As described previously, water quantity, water quality, and habitat conditions are impaired within the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek. Within the portions of the Columbia River and North Portland Harbor that are within the project site, water quality is impaired, floodplain connectivity is limited, and aquatic and riparian habitat complexity is limited or absent due to the highly altered and managed nature of the river. Water quantity is carefully managed by upstream dams and the natural hydrograph has been altered. Conditions are similarly impaired within the portions of the Columbia Slough and Burnt Bridge Creek that are within the action area.

Higher quality habitat conditions are present in downstream portions of the Columbia River mainstem within the stormwater zone of influence, particularly in the lower estuary.

Nevertheless, the aquatic portions of the action area within the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek do provide adequate water quality and quantity for both adult and juvenile migration of salmon and steelhead. This PBF of critical habitat is, therefore, present throughout the aquatic portions of the action area within the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek.

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.

By definition, the Columbia River Estuary includes all portions of the Columbia River where tidal forces and river flows interact. This encompasses areas from the mouth of the river upstream to Bonneville Dam (RM 146). However, this PBF refers to those portions of the estuary with salinity conditions conducive to the physiological changes required for juveniles to transition between freshwater and the saltwater marine environment.

No estuarine habitat is present in the portions of the action area that are within the project site. The upstream extent of saltwater influence into the lower Columbia River is generally limited to Harrington Point at RM 23; however, at lower daily flows saltwater intrusion can extend past Pillar Rock at RM 28 (NOAA Fisheries 2011b). This saline-influenced reach of the river is approximately 78 miles downstream of the Interstate Bridge.

The action area includes aquatic portions of the mainstem Columbia River downstream of the project site that may be affected by stormwater associated with the proposed action, and extends as far as the mouth of the Columbia River. These portions of the Columbia River mainstem, from RM 28 to the mouth of the river, do provide this PBF of critical habitat for all 13 ESU/DPSs of salmon and steelhead.

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.

No nearshore marine areas exist within the Columbia River mainstem and this PBF is not present in any freshwater portion of the action area.

As discussed in Section 5, the action area includes marine waters off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This marine portion of the action area does provide this PBF of critical habitat for all 13 ESU/DPSs of salmon and steelhead.

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

No offshore marine areas exist within the Columbia River mainstem and this PBF is not present in any freshwater portion of the action area.

As discussed in Section 5, the action area includes marine waters off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This marine portion of the action area does provide this PBF of critical habitat for all 13 ESU/DPSs of salmon and steelhead.

6.3.2 Bull Trout

The proposed action occurs within designated critical habitat for bull trout. Table 6-6 summarizes the critical habitat designation for bull trout within the Coastal Recovery Unit.

Table 6-6. Bull Trout Critical Habitat Summary

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

6.3.2.1 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.

No springs, seeps, or significant sources of groundwater occur within the aquatic portions of the action area that are within the project site, and this PBF is not present within this portion of the action area. It is likely that this PBF is present within downstream portions of the action area, within the stormwater zone of influence.

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.

The action area functions as a potentially suitable migratory corridor for bull trout. However, habitat conditions limit this function within the aquatic portions of the action area that are within the zone of direct effects.

As described previously, water quantity, water quality, and habitat conditions are impaired within the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek. Within the portions of the action area that are within the project site, water quality is impaired, floodplain connectivity is limited, and aquatic and riparian habitat complexity is limited or absent due to the highly altered and managed nature of the river. Water quantity is carefully managed by upstream dams and the natural hydrograph has been altered.

Higher quality habitat conditions are present in downstream portions of the Columbia River mainstem within the stormwater zone of influence, particularly in the lower estuary.

This PBF of critical habitat is present throughout the aquatic portions of the action area within the Columbia River and North Portland Harbor.

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

The overall habitat quality of the portions of the Columbia River and North Portland Harbor that are within the action area is relatively impaired. Nevertheless, these aquatic habitats do likely provide an adequate food base for migrating bull trout. The Columbia River provides habitat for a variety of native and non-native juvenile fishes and aquatic macroinvertebrates that serve as prey for bull trout. This PBF is, therefore, present throughout the portions of the Columbia River and North Portland Harbor that are within 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.

The portions of the Columbia River and North Portland Harbor that are within the project site do not provide a complex riverine environment. The complexity of riverine habitat in this portion of the action area has been impaired compared to historical conditions, and does not provide 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 Columbia River within the stormwater zone of influence are similarly impaired, 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.

Portions of the Columbia River and North Portland Harbor within the project site are 303(d) listed for high water temperature (Ecology 2018; DEQ 2020). In August 2021, EPA issued a draft total maximum daily load (TMDL) for addressing exceedances of various state and tribal criteria for temperature in the Columbia River and lower Snake River (EPA 2021). While 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.

The mainstem Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek are not suitable for bull trout spawning or juvenile rearing. Bull trout are not known or expected to spawn or rear within the action area. 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.

Water flows throughout the action area do not follow a natural hydrograph as they are controlled by upstream dams. 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.

As discussed above, water quality is impaired throughout the aquatic portion of the action area, and flows have been altered from historical conditions. Water quality and quantity throughout the action area is impaired, but likely suitable for survival of migrating adults. This PBF is present throughout the aquatic portion of the action area.

Sufficiently low levels of occurrence of non-native 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.

The mainstem Columbia River and North Portland Harbor support populations of several non-native predatory species, including northern pike, walleye, and smallmouth bass. This PBF is not present within the action area.

6.3.3 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 6-7 summarizes the critical habitat designation and description of the southern DPS of Pacific eulachon (NOAA Fisheries 2011c).

Table 6-7. Pacific Eulachon Critical Habitat Summary

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

Key: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

6.3.3.1 Physical and Biological Features of Designated Critical Habitat for Pacific eulachon

This section consists of a discussion of the PBFs of critical habitat which have been identified for Pacific eulachon and the potential for their presence within the action area.

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.

The portion of the mainstem Columbia River that is within the action area represents a suitable corridor for eulachon spawning. While the portion of the mainstem Columbia River that is within the project site is not documented as a location where extensive eulachon spawning occurs, water quality and habitat conditions are potentially suitable for eulachon spawning. Downstream portions of the action area, within the stormwater zone of influence, provide documented locations for eulachon spawning activity. This PBF is present within the portion of the action area within the Columbia River and North Portland Harbor.

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.

Water flow, water quality, and temperature conditions throughout the Lower Columbia River are suitable for eulachon freshwater migration. Conditions within the Columbia River mainstem downstream of RM 28 are suitable for estuarine migration. This PBF is present throughout the aquatic portions of the action area within the Columbia River and North Portland Harbor.

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

No nearshore or offshore marine areas exist within the Columbia River mainstem and this PBF is not present in any freshwater portion of the action area.

As discussed in Section 5, the action area includes marine waters off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This marine portion of the action area does provide this PBF of critical habitat for Pacific eulachon.

6.3.4 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 60 river miles downstream of the project site) (NOAA Fisheries 2009). Table 6-8 summarizes the designation and a general description of the area designated for the Southern DPS of North American green sturgeon.

Table 6-8. 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

Key: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

6.3.4.1 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 PBFs of designated critical habitat 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.

Larval and juvenile green sturgeon are not likely to be present within the action area. The Columbia River is not known to support any spawning populations of green sturgeon. 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 within the stormwater zone of influence likely provides an adequate source of prey items for migrating adult and subadult green sturgeon. This PBF is present within the portion of the mainstem Columbia River that is 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).

The action area does not provide 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 2009). This PBF is not present within any portion of the action area.

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

Water regimes throughout the portion of the action area that is downstream of RM 46 within the Columbia River within the stormwater zone of influence are likely adequate for subadult and adult green sturgeon migration and foraging. This PBF is present within the portion of the mainstem Columbia River that is 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.

Water quality conditions are adequate to support migrating adult and subadult green sturgeon that may be present within the action area. This PBF is present within the portion of the mainstem Columbia River that is 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).

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 present within the portion of the mainstem Columbia River that is downstream of RM 46.

Deep (≥ 5 meters) 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.

The topography of the river bottom within the Lower Columbia River is human-influenced and artificially maintained for barge and vessel traffic. While the federal 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. Nevertheless, there are likely sufficient deep-water areas for holding in the lower river, and this PBF is present within the portion of the mainstem Columbia River that is downstream of RM 46.

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

While the chemical composition of sediments throughout the action area have not been characterized in detail, at a minimum, the mainstem Columbia River 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 present within the portion of the mainstem Columbia River that is downstream of RM 46.

6.3.5 Southern Resident DPS Killer Whale

Critical habitat for SRKW was designated in 2006 (71 FR 69054), and was updated on August 2, 2021 (86 FR 41668). The updated critical habitat designation includes specific inland marine waters of Washington State, as well as certain coastal waters off of the Washington, Oregon, and California coasts. The coastal portion of the designated critical habitat includes approximately 15,910 square miles of coastal waters between the 6.1-meter and 200-meter depth contours from the U.S.-Canada border to Point Sur, California. Table 6-9 summarizes the designation and a general description of the area designated for SRKW.

Table 6-9. Southern Resident DPS Killer Whale Critical Habitat Summary

	Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
Southern Resident DPS Killer Whale	Southern Resident DPS	Designated – October 9, 2009	Specific inland marine waters within Washington State, and coastal waters adjacent to Washington, Oregon, and California

Key: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

6.3.5.1 Physical and Biological Features of Designated Critical Habitat for the Southern Resident DPS Killer Whale

This section discusses the PBFs of designated critical habitat for the SRKW and the potential for their presence within the action area.

Water quality to support growth and development;

Marine offshore waters that are within the action area do likely provide sufficient water quality to support the growth and development of SRKW.

Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth;

As discussed previously, the diet of the SRKW is composed almost entirely of salmon, the abundance of which has declined significantly since the late 1800s and early 1900s. Impacts to prey availability, specifically the availability of Chinook salmon, has been identified as a key threat to the recovery of the SRKW (SROTF 2018). Nevertheless, marine offshore waters that are within the action area do provide a prey base that supports the SRKW population, and this PBF is present within marine portions of the action area.

Passage conditions to allow for migration, resting, and foraging.

Marine offshore waters that are within the action area do provide sufficient passage conditions to support migration, resting and foraging for SRKW.

6.3.6 Streaked Horned Lark

Critical habitat for streaked horned lark was designated on October 3, 2013 (78 FR 61505). The designated critical habitat includes several specific sandy islands in the Lower Columbia River and Washington coastal estuaries, as well as a few specific prairie sites in the Willamette Valley and Puget Sound prairie. Table 6-10 summarizes the designation and a general description of the areas designated for streaked horned lark.

Table 6-10. Streaked Horned Lark Critical Habitat Summary

	Species and ESU/DPS	Date of Critical Habitat Designation	Description of Critical Habitat
Streaked Horned Lark	N/A	Designated – October 3, 2013	Specific sandy islands in the Columbia River and Washington Coast. Prairie Sites in the Willamette Valley.

Key: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; N/A = Not applicable

There is no designated critical habitat for streaked horned lark within the action area. The nearest designated critical habitat is located on terrestrial portions of Sandy Island, near Kalama, which is approximately 30 miles downstream from the existing Interstate Bridge.

7. ENVIRONMENTAL SETTING/BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the effects to the listed species or designated critical habitat caused by the proposed action. ’This section presents an overview of the environmental setting and a description of the current condition of habitat for listed species within the action area.

7.1 Overview

7.1.1 Aquatic Habitats

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

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

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

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

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

7.1.2 Terrestrial Habitats

The region is classified within the western forest ecoregion (Omernik 1987), with elevations ranging from sea level to 11,240 feet. Historically, terrestrial habitat in the action area was characterized by closed upland forest/woodland, with patches of grassland savannah and prairie in lowland areas near water (Aikens 2006). Forest types in the region included old-growth conifers such as Douglas-fir (*Pseudotsuga menziesii*), spruce (*Picea* sp.), and hemlock (*Tsuga* sp.); remnant hardwoods (e.g., Oregon oak [*Quercus garryana*] woodlands); and riparian, wetland, and aquatic systems (Omernik 1987).

Native Americans lived in the region for 11,000 years before the arrival of Euro-American settlers. However, human populations were relatively low in the region prior to settlement, when compared to levels that have established since settlement by Euro-Americans (Aikens 2006). Since approximately the mid-1800s, human population growth and development has gradually displaced and reduced the quality and quantity of wildlife habitat. These changes have made terrestrial habitats within the action area unsuitable for many native species that were once common.

The suite of wildlife species originally inhabiting the action area and surrounding landscape in the Lower Columbia basin included a wide variety of native birds, mammals, amphibians, and reptiles (Aikens 2006). The action area is located within the Pacific Flyway, the major north-south route for migratory birds that extends from Patagonia to Alaska, and migratory birds use a variety of habitats within the action area and vicinity for resting, feeding, and breeding.

In general, terrestrial habitat within the action area exists in relatively small, fragmented patches that currently support species that are tolerant of human disturbance. The most highly functioning terrestrial habitats are those remaining forested riparian and wetland habitats, particularly those that have connectivity to other areas of intact habitat.

7.2 Existing Environmental Setting/Baseline

7.2.1 Aquatic Habitats

The action area includes portions of the following waterbodies: the mainstem Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek. Because of potential impacts to the prey base for SRKWs, the action area also includes marine waters off the Pacific coast where the ranges of SRKW and salmon from the Columbia River overlap.

A discussion of the relevant baseline condition of each waterbody is provided below.

7.2.1.1 Columbia River and North Portland Harbor

The action area includes the mainstem of the Columbia River from the location of the existing bridges (at approximately RM 106, downstream to the mouth of the river at RM 0. The North Portland Harbor is a large side channel of the Columbia River, separated from the mainstem by Hayden Island. The harbor branches off the Columbia River upstream (east) of the existing bridges and flows approximately 5 miles downstream (west) before rejoining the mainstem Columbia. I-5 crosses the North Portland Harbor at approximately RM 4.

Existing Bridge Structures

The existing Interstate Bridge and North Portland Harbor bridge represent part of the environmental baseline condition for aquatic habitats within the action area.
The existing Columbia River bridge consists of two separate structures, one for each direction travel. Each structure is approximately 3,500 feet long by 45 feet wide, and the two structures in total represent approximately 308,449 square feet of existing overwater coverage at the height of the bridge decks. The bottom deck of each structure ranges between approximately 25 to 60 feet above the water surface. The existing Columbia River bridge is supported by a total of 11 bridge piers, nine of which are located below the OHWM of the Columbia River. Each pier measures approximately 32 feet wide by 50 feet long at the footing. In total, the in-water piers occupy approximately 33,289 square feet of substrate and represent approximately 44,000 cubic yards of fill below OHWM. At the existing structures, maximum water depth is approximately 40 to 45 feet, with an average water depth of approximately 27 feet. Two of the 11 existing piers (piers 10 and 11) are located in water depths shallower than -20 feet Columbia River Datum (CRD) (Figure 7-1).

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

Figure 7-1. Baseline Aquatic Habitat Conditions – Columbia River Bathymetry

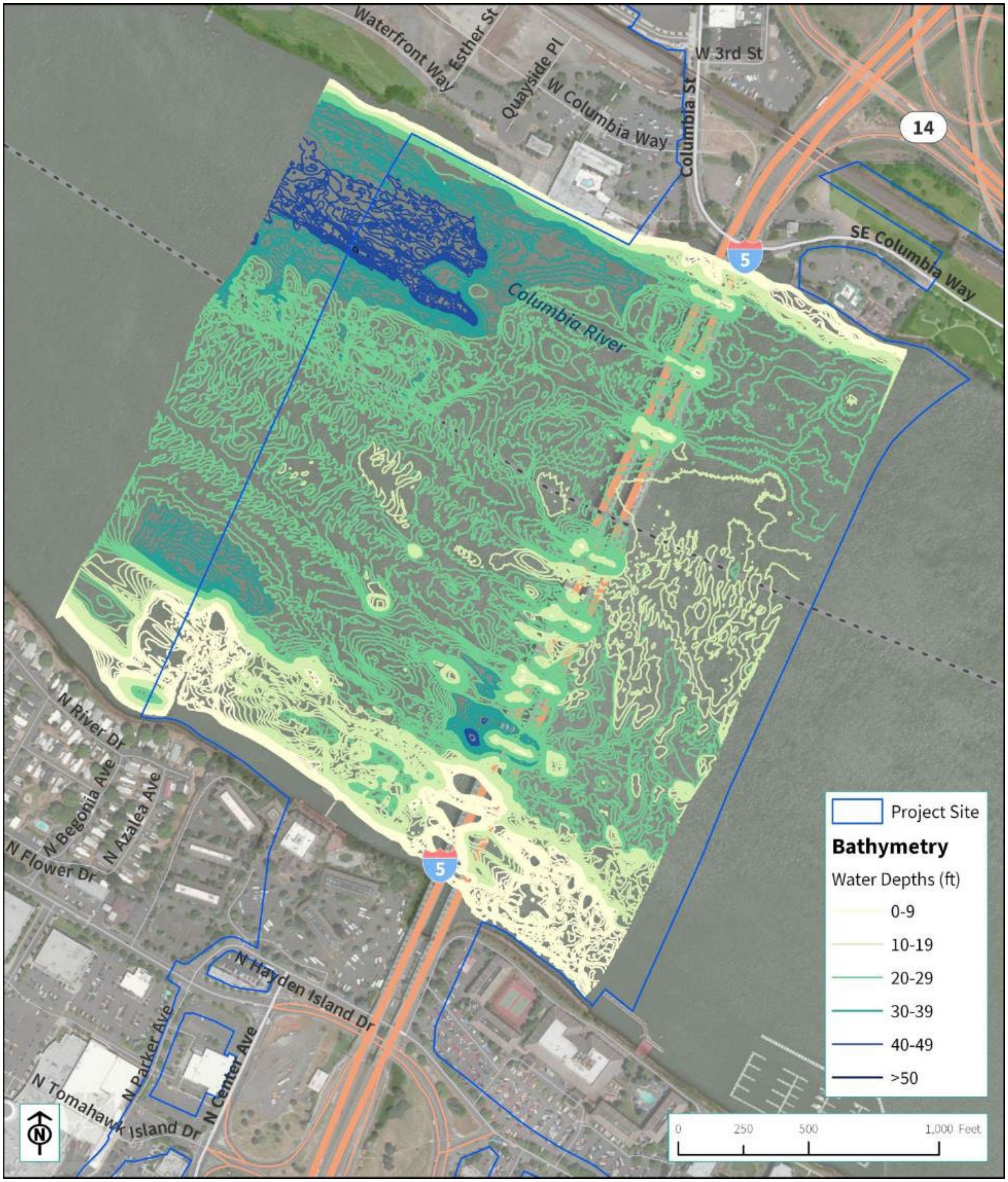


Figure 7-2. Baseline Aquatic Habitat Conditions – North Portland Harbor Bathymetry

Hydrology

The 12 major dams located in the Columbia Basin are the primary factors affecting flow conditions in the action area. Consequently, the Columbia River, including the action area, is a highly managed waterbody that resembles a series of slack-water lakes rather than its original free-flowing state. Development of the hydropower system on the Columbia River has significantly influenced peak seasonal discharges and the velocity and timing of flows in the river. The Columbia River estuary historically received annual spring freshet flows that were on average 75 to 100% higher than current flows (ISAB 2000). Historical winter flows (October through March) also were approximately 35 to 50% lower than current flows (ISAB 2000). The second major contributor to stream flow conditions in the action area is tidal influence from the Pacific Ocean. Although the saltwater wedge does not extend into the action area, high-tide events affect flow and stage in the Columbia up to Bonneville Dam.

Upstream dams, levees located along shorelines, and channel modifications (e.g., armoring, reshaping) have restricted habitat-forming processes such as sediment transport and deposition, erosion, and natural flooding. In the action area, natural landforms and constructed landforms (e.g., dikes and levees) are the dominant floodplain constrictions, while bridge footings are the subdominant floodplain constrictions. Nine bridge pier pairs associated with the existing Interstate Bridge is located below OHWM of the Columbia River, and six bridge piers are located below the OHWM of North Portland Harbor.

Water Quality

Water quality conditions are impaired in portions of both the Columbia River and North Portland Harbor within the action area.

The portions of the Columbia River and North Portland Harbor that are within the action area in the vicinity of the bridge are water quality impaired. The current Oregon 303(d) list includes listings for temperature, PCBs, polycyclic aromatic hydrocarbons (PAHs), dichlorodiphenyltrichloroethane metabolites, and arsenic (DEQ 2020). The most recent approved Washington 303(d) list includes listings for temperature, PCBs, and dissolved oxygen (Ecology 2021). The EPA has approved TMDLs for portions of the within the Columbia River and North Portland Harbor that are within the action area for total dissolved gas (DEQ and Ecology 2002) dioxin (EPA 1991), and temperature (EPA 2021).

Recent studies indicate that there are high levels of chemical contaminants in the salmonid food chain in the Columbia River estuary (LCEP 2007). A report by the Lower Columbia Estuary Partnership (LCEP 2007) report noted widespread presence of PCBs and PAHs in the food web of the Lower Columbia River. Pesticides and heavy metal contaminants have also been documented in Columbia River sediments.

Municipal and industrial waste discharges upstream within the watershed also contribute to impaired water quality conditions in the Columbia River and North Portland Harbor. Common water-quality issues with these types of discharges include warmer water temperatures, lowered dissolved oxygen, increased nutrient loading, and increased levels of fecal coliform bacteria (LCEP 2007).

Terrestrial portions of the action area that drain to the Columbia River and North Portland Harbor are highly developed. Much of the terrestrial portion of the action area consists of a network of impervious surfaces including I-5, and various state highways, local access roads, residential streets, parking lots, and other impervious surfaces. Pollutants commonly occurring in stormwater runoff include total suspended solids, nutrients, oil and grease, other fluids associated with automobiles, PAHs, agricultural chemicals, and dissolved metals. Dissolved metals, especially dissolved copper and zinc, are of particular concern because of their potential impact on the olfactory systems of listed fish. There is also emerging research related to 6PPD-q, a ubiquitous chemical in tires, which has been linked to mortality of coho salmon under certain conditions (Tian et al. 2021), and which may also be negatively affecting other aquatic species including Chinook salmon and steelhead (Brinkmann et al. 2022; Lo et al. 2023). However, among the Pacific salmonid species, coho salmon are the most sensitive to 6PPD-q and the most exposed to pollutants in urban stormwater runoff, given their habitat preference for small, lowland streams (Ecology 2022a) (see Section 8.10.2 for an assessment of stormwater-related effects).

Portions of the Columbia River and North Portland Harbor within the action area are 303(d) listed for high water temperature (Ecology 2018; DEQ 2020). In August 2021, EPA issued a draft TMDL for addressing exceedances of various state and tribal criteria for temperature in the Columbia River and lower Snake River (EPA 2021). This TMDL documented that water temperature impairments are widespread, and primarily due to the cumulative impacts of climate change and dam impoundments. Elevated water temperatures increase the risk of risk of disease, delay adult migration, increase the foraging rate of predators, and decrease the survival rate of smolts (NOAA Fisheries 2020).

Sediment transport, and associated turbidity, within the mainstem Columbia River and North Portland Harbor is relatively low compared to historical conditions (Bottom et al. 2005). The series of dams and reservoirs on the Columbia and Snake Rivers have blocked natural sediment transport, with total sediment discharge into the estuary and Columbia River plume only one-third of 19-century levels (NOAA Fisheries 2020). These reductions in sediment transport and turbidity levels pose a risk to fish and fish habitat. The sediment supply is an important source of the organic material that was historically the basis the food web. Floodplain inundation continually replenished organic material and recharged primary production. With the loss of overland flow and this source organic detritus, the food web is currently driven by phytoplankton. This has decreased the available food supply for salmonids (Bottom et al. 2005). Lower turbidity levels may also pose a risk to individual fish. Decreased turbidity may lower visual cover for juvenile salmonids, making them more vulnerable to predation by birds and other fish. Low turbidity combined with reduced spring freshets pose particularly high risks to outmigrating juvenile salmonids (Bottom et al. 2005).

Substrate

The substrate of the Columbia River within the action area is predominantly composed of sand, with relatively small percentages of fine sediments and organic material (DEA 2006). A bathymetric study completed in 2006 found significant scouring on the upstream side of each bridge pier, and scour channels on the downstream side (DEA 2006). The scouring ranged from approximately 10 to 15 feet deep. Bedload transport patterns were evident in the form of sandwaves, a natural feature of the river bottom that indicates the influence of the currents and that continuously moves and shifts with the currents.

The substrate in North Portland Harbor within the action area is predominantly composed of sand with relatively small percentages of fine sediments and organic material. A bathymetric study completed in 2006 found deep scouring near the ends of the downstream piers of the existing North Portland Harbor bridge on the north bank, with scour holes approximately 8 to 10 feet deep (DEA 2006). Scouring around the upstream piers was approximately 3 to 7 feet deep. Scouring was more pronounced around the northern piers than the southern piers. A particularly deep area (approximately 21 feet deep) on the south side of the channel downstream of the existing bridge is indicative of a fast-moving current through the harbor.

Dredging and dredge material placement are commonly occurring activities the Lower Columbia River. Dredging is conducted on a regular basis by the USACE for maintenance of the Columbia River federal navigation channel. Once maintained at a depth of 20 feet, the channel is now dredged to an average depth of 43 feet (ISAB 2000). USACE has also realigned the navigation channel and installed hydraulic control structures, such as in-water fills, channel constrictions, and pile dikes (ISAB 2000). Many Lower Columbia River ports and industrial businesses conduct dredging for construction and maintenance of vessel berthing areas and marinas. In some areas, dredging is also conducted for sand and gravel mining purposes. These activities have modified the bathymetric profile of portions of the river, and also result in periodically elevated turbidity.

Physical Habitat Features

Shallow water habitat (defined as areas between 0 feet and -20 feet CRD) is present in the action area on both the Oregon and Washington sides of the river and is influenced by flow and sediment input from tributaries and the mainstem river that eventually settles to form shoals and shallow flats. This shallow water habitat is used extensively by both juvenile and adult salmonids for migrating, feeding, and holding.

Water depths within the Columbia River within the action area range between approximately 0 feet and -50 feet. The average water depth is approximately 27 feet (DEA 2006). Shallow water habitat is present along both shorelines, but is relatively more abundant along the Oregon side of the river (Figure 7-1). Water depths within North Portland Harbor within the action area range between approximately 0 feet and -20 feet. The average water depth is approximately 14 feet (DEA 2006). All of the aquatic habitat within the action area in North Portland Harbor meets the criteria to be considered shallow water habitat (Figure 7-2).

Adults and/or juveniles from one or more DPS/ESUs of salmon and steelhead may be present in both the Columbia River mainstem and North Portland Harbor during all months of the year. However, the relative distribution of both species and life stages between the two waterbodies likely varies throughout the year in response to species-specific biological factors (e.g., run timing and life history), and environmental variables (e.g., water temperature, flow velocity) (ODFW 2023).

Migrating adult salmonids tend to prefer deep-water habitats (>20 feet of water), which are not present in North Portland Harbor. For this reason, most (but not all) adult migration past the Interstate Bridge likely occurs in deep-water portions of the mainstem Columbia River. Adult salmon and steelhead may be somewhat more likely to enter North Portland Harbor when flows in the mainstem are high, and North Portland Harbor represents an area of refuge from high velocity flows in the mainstem north of Hayden Island. In the warmer summer months (July to September), when water temperatures are likely elevated in the shallow waters of North Portland Harbor, there is likely little adult salmonid movement through North Portland Harbor (ODFW 2023).

Juvenile salmon and steelhead, both outmigrants and those that are rearing or overwintering, are generally closely associated with shallow water and nearshore habitats. Since these habitats are present in both the mainstem Columbia River and North Portland Harbor, there is likely less distinction in the relative distribution of juveniles between the two waterbodies. Smaller-bodied outmigrants such as chum salmon, who are not strong swimmers, are generally carried downstream by the mainstem currents, and are less likely to enter North Portland Harbor unless they happened to be entrained in the currents along the south river shore directly above the island. Other species and life stages, which have greater ability to move volitionally, are more equally likely to be present within the shallow water habitats in North Portland Harbor or along the mainstem Columbia river shoreline. However, the same seasonal variability expected with adult migration is likely applicable to juveniles as well. In the spring when flows are high in the mainstem, juveniles may preferentially choose habitats within North Portland Harbor as refuge from high velocity flows. Similarly, in the summer months, juveniles may be more likely to stay in the mainstem where water temperatures are slightly (0.5 degrees F or more) cooler (ODFW 2023).

Overall, the extent and condition of shallow water habitat has been greatly reduced from historical levels throughout the Lower Columbia River. As river stage has declined with the operation of the hydropower system, shallow water habitat has decreased concurrently (Bottom et al. 2005). Dredging, diking, armoring, and other shoreline alterations have exacerbated the problem, such that shallow water habitat is rare in the action area. What little shallow water and nearshore habitat that remains is of low quality. Shoreline armoring has reduced the quality of shallow water habitat areas by providing habitat for predaceous fish, increasing water temperatures, removing resting and holding areas for juvenile fish, and reducing primary productivity. Numerous overwater structures in shallow water habitat areas likely provide habitat for predaceous fish and birds and may cause interference with juvenile migration. North Portland Harbor, in particular, contains a high density of permanently moored floating homes and docks.

Riparian habitats adjacent to the Columbia River and North Portland Harbor are limited in both extent and habitat function. Streambank armoring and development activities limit the width of the riparian area at each of the bridge locations to a narrow band of small shrubs, low-growing herbaceous vegetation, and invasive species.

Tree canopy in riparian areas within the action area is generally absent or sparse. Where present, typical canopy dominants include native willows (*Salix* spp.) and black cottonwood (*Populus balsamifera*) species as well as invasive species such as tree-of heaven (*Ailanthus altissima*). The understory is typically dominated by invasive species such as Himalayan blackberry (*Rubus* *armeniacus*), and native species such as roses (*Rosa* sp.) and willows. The herbaceous layer is typically dominated by non-native species including English ivy (*Hedera helix*), and reed canarygrass (*Phalaris arundinacea*), but also includes a mix of native and non-native annual grasses and forbs.

Because riparian areas are limited in size and are unlikely to expand within this urban setting, there is little potential for future large wood recruitment within the action area. Organic inputs through leaf litter, and thermal regulation functions are generally absent due to the lack of a canopy cover. Habitat complexity is limited, although some boulders and artificial structures (for example, docks and pilings) are present.

Extensive habitat restoration efforts have been, and continue to be, undertaken throughout the Lower Columbia River watershed. The activities are being conducted by a wide variety of interested parties including non-profits, land trusts, government agencies, electrical utilities, tribes, and private landowners. Restoration activities are being conducted at all scales, from small riparian plantings and stream enhancement projects to large-scale land acquisitions and conservation protections.

7.2.1.2 Columbia Slough

The Columbia Slough watershed drains over 32,000 acres of land in portions of Portland, Troutdale, Fairview, Gresham, Maywood Park, Wood Village, and Multnomah County (unincorporated areas). The Columbia Slough is a remnant of the historic system of lakes, wetlands, and channels that dominated the south floodplain of the mainstem Columbia River. The Slough and surrounding area were historically used by Native Americans for fishing, hunting, and gathering food (City of Portland 2021).

Hydrology

In its current configuration, the Columbia Slough is a slow-moving, low-gradient drainage canal running nearly 19 miles from Fairview Lake in the east to the Willamette River in the west. Today, the original inlet is blocked at the upstream end, and it no longer receives flows from the Columbia. Drainage and flood control in the Slough is provided via a system of dikes, pumps, weirs, and levees (USACE 2020).

The slough is divided into upper, middle, and lower reaches. The upper and middle sloughs are highly managed with piped surface water, dikes and levees, and a system of pumps that provide watershed drainage and flood control.

The action area includes a portion of the lower slough, which extends from the Peninsula Drainage Canal to the Willamette River, less than 1 mile south of its confluence with the Columbia River (City of Portland 2021). The lower slough is tidally influenced, and experiences from 1 to 3 feet of tidal fluctuation in its water surface daily. Water levels within the lower slough closely correspond with the levels at the confluence of the Columbia and Willamette Rivers (USACE 2020).

Water Quality

The Columbia Slough is a highly managed, low-gradient, shallow body of water that lacks significant shading and has few cold-water inputs. It is generally characterized by warm water temperatures, eutrophication (excessive growth of algae and macrophytes), wide pH and dissolved oxygen fluctuations, and elevated turbidity (City of Portland 2021).

Columbia Slough is water quality limited and is identified as an impaired water on the current Oregon 303(d) list with TMDL listings for aquatic weeds, iron, and biological criteria (DEQ 2020).

Substrate

Benthic substrates within in the Lower Slough consist primarily of sand derived from alluvial deposits, though silts and other fine sediments are also prevalent (USACE 2020). The abundance of silts and fine sediments can lead to elevated turbidity.

Because the Columbia Slough is a highly managed waterbody in an urban watershed, the sediments contain elevated levels of contaminants. Heavy metals (lead, zinc, chromium, copper) and toxic organic chemicals (pesticides, PAHs, and PCBs are common contaminants.

The diversity of benthic macroinvertebrates is relatively low throughout the Columbia Slough, limiting the available food resources for other aquatic and terrestrial species. This low diversity is caused primarily by the abundance of fine sediments, and impaired water quality. Polluted sediments may also be a factor (City of Portland 2021).

Physical Habitat Features

Aquatic habitat function within the Columbia Slough is limited. Development throughout the watershed has resulted in extensive habitat loss and loss of connectivity. Large woody debris is scarce and because the riparian area is largely devoid of trees and the potential for future large woody debris recruitment is limited. Habitat complexity is limited, and habitat structures such as boulders and undercut banks are largely absent.

Overbank flow occurs very infrequently, and the stream is isolated from its historic floodplain. Likewise, low-energy off-channel areas (such as backwaters, ponds, and oxbows) are also scarce. However, remnant wetlands and restored wetlands do exist in the lower slough, and these provide important habitat function. Smith and Bybee Lakes is accessible to fish from the main channel of the lower slough, and provides important off-channel habitat for salmonids (USACE 2020).

Riparian habitat along the Slough has been significantly impacted by urban development along most portions of the Slough. Remaining areas of vegetation generally consist of narrow bands of native trees (primarily black cottonwood, Oregon ash, and big-leaf maple), shrubs (willows, red osier dogwood (*Cornus sericea*), and common snowberry (*Symphoricarpos albus*), and extensive presence of invasive Himalayan blackberry and reed canarygrass. While riparian habitat function is impaired within the action area, existing riparian areas do provide a suite of functions including microclimate and shade, bank stabilization and sediment control, pollution control, streamflow moderation, organic matter input, large woody debris, and wildlife travel corridors.

Several restoration efforts are ongoing in the Columbia Slough area. The City of Portland's Watershed Revegetation Program and its community partners are conducting non-native species removal and native plantings in many areas along the Slough. The City of Portland Bureau of Environmental Services has conducted several successful restoration projects throughout the watershed since 1996 and has successfully reestablished native vegetation along many parts of the Slough (City of Portland 2021).

7.2.1.3 Burnt Bridge Creek

Burnt Bridge Creek flows through the city of Vancouver and is a direct tributary to Vancouver Lake. The Burnt Bridge Creek watershed covers 27 square miles. The stream flows approximately 13 miles through the city of Vancouver and Clark County to its outlet at Vancouver Lake, which in turn drains into the lower Columbia River via Lake River. Burnt Bridge Creek crosses I-5 within the northern portion of the action area, approximately 2 miles upstream of its confluence with Vancouver Lake.

Hydrology

The Burnt Bridge Creek subbasin has been heavily impacted by disconnecting of floodplains, dredging, draining, and rerouting of flows. This subbasin is one of the most heavily urbanized in Clark County (CCC 2010). Historically, the upper portion of Burnt Bridge Creek was a series of interconnected wetlands that flowed westerly to Vancouver Lake. Currently, the stream flows for a nearly half of its length in a narrow, excavated ditch. The modifications have increased peak flows, reduced base flows, and altered flow timing in comparison to historical conditions.

Stream flow from late fall through spring is driven by precipitation, while summer flow is maintained by natural groundwater inflow coupled with industrial discharge from a manufacturing facility located east of Interstate 205 (I-205). The industrial processes at the manufacturing facility extract groundwater for cooling operations and contribute a significant amount of discharge water, which helps sustain summer base flow in the creek (Herrera 2019).

Water Quality

Burnt Bridge Creek is water quality limited, and the reach of the creek that is within the action area is listed on Ecology's current 303(d) list for temperature, dissolved oxygen, fecal coliform, and pH (Ecology 2020). Water quality in Burnt Bridge Creek has been monitored extensively for more than 40 years, including a TMDL study by Ecology with 19 monitoring sites along the stream and its tributaries in 2008 through 2009. The most recent available monitoring data was collected in 2018 (Herrera 2022).

A temperature monitoring gauge at Leverich Park (gauge BBC-2.6) indicated that from June 25 to October 15, 2021, the highest annual running seven-day average of maximum temperatures exceeded 17.5 degrees Celsius (63.5 degrees Fahrenheit) approximately 86 times (Herrera 2022). These measurements indicate that temperatures in Burnt Bridge Creek exceed standards for salmonid spawning, migration, and rearing for all of the summer and over half of the year.

Between October 2020 and September 2021, dissolved oxygen levels measured at the monitoring gauge at Leverich Park were at or above the state water-quality standard of 8 milligrams per liter (mg/L) in all but one sampling event on October 20, 2020. This indicates generally acceptable dissolved oxygen conditions, with some potential impairment to salmonid habitat function during the summer months.

Fecal coliform bacteria results measured at Leverich Park between October 2020 and September 2021 exceeded the state water-quality standard for both the geometric mean (shall not exceed 100 colony-forming units per 100 milliliters and the 90th percentile (shall not exceed 200 colony-forming units per 100 milliliters) during all base flow events. The upper reaches of the creek pass through farmland, where the use of chemical fertilizers and pesticides likely contribute chemical contamination and nutrients to the stream.

Measured pH levels in Burnt Bridge Creek at Leverich Park between October 2020 and September 2021 met the state water-quality standard (6.5 to 8.5) in all months (Herrera 2022).

Substrate

The dominant substrate within Burnt Bridge Creek is sand and silt with some small patches of heavily embedded spawning gravel in the upper reaches of the watershed. Some fine gravels are present within the lower reaches of the creek. Sedimentation within Burnt Bridge Creek has been identified as an acute problem and a major limiting factor for salmonid production within the stream (CCC 2010).

Physical Habitat Features

In general, physical habitat has been substantially modified throughout Burnt Bridge Creek, and habitat function has been diminished from historic conditions. The upper reaches of the creek were historically a series of associated wetlands and marshes which were filled, ditched, and drained. In addition, most of the tributary streams have been channelized or routed underground (CCC 2010). The watershed has had significant restoration work in recent years to reconstruct side-channel wetland and floodplain areas and improve habitat.

The portion of Burnt Bridge Creek that is within the action area includes a reach that flows through Arnold Park and Leverich Park, north of SR 500. In this location, the creek has a riparian canopy of mature trees and shrubs along most of its length. Dominant tree species in this portion include natives such as Douglas-fir, black cottonwood, willow, and ash. The understory is dominated by non-native Himalayan blackberry, reed canarygrass, and teasel (Dipsacus sylvestris), but also includes native trees and shrubs including red alder (Alnus rubra), red osier dogwood, and beaked hazelnut (Corylus cornuta). In the more open areas within the park, the banks are highly eroded by regular visitor usage and mowing of herbaceous vegetation in the vicinity of the channel.

Downstream of Leverich Park, the creek passes through a series of culverts and short channelized sections as it flows north along the east side of I-5. Habitat condition and function within this portion of the creek is moderate. Where vegetated areas of open channel exist, banks are generally undercut and eroding. There is a mixed forested riparian canopy in this location, and some native understory shrubs, though reed canarygrass and Himalayan blackberry are prevalent.

The creek is conveyed under I-5 via a concrete box culvert near the northern end of the action area. The portion of the Creek that is located downstream of I-5 within the action area is characterized by low-gradient pool and marsh habitat with moderate canopy cover.

There are no documented total barriers to fish passage within Burnt Bridge Creek downstream of the action area, although several partial barriers do exist. The WDFW Fish Passage and Diversion Screening Inventory database documents several culverts within the portion of the creek that is within the action area that function as partial barriers, including the I-5 culvert at milepost 3.07 (RM 1.9), which is an undersized box culvert with less than 1% slope (WDFW 2021c).

7.2.1.4 Fairview Creek

Fairview Creek is an approximately 5-mile-long urban creek, that flows from spring-fed wetlands on the northeast side of Grant Butte in Gresham. The creek drains approximately 7,000 acres of urban watershed, flowing through the cities of Gresham and Fairview. The creek receives flow from two tributaries (No Name Creek and Clear Creek), and runoff from paved surfaces before flowing into Fairview Lake and, eventually, the Columbia River via the Columbia Slough (Multnomah County 2014; LRC 2017).

Fairview Creek receives stormwater runoff from portions of the cities of Gresham, Wood Village, and Fairview, an area of about 6.5 square miles. Average flow in Fairview Creek at the U.S. Geological Survey gauging station near Glisan Street, approximately 1.4 miles downstream of the Ruby Junction Maintenance Facility, was 6.39 cubic feet per second from 1992 to 1999 (Metro 2003). The 100-year floodplain for Fairview Creek is approximately 1,288 feet wide at its widest point, adjacent to the proposed maintenance facility expansion area (Metro 2003).

DEQ has placed Fairview Creek on its 303(d) list for biological criteria (year-round); it also has approved TMDLs for E. coli (year-round), pH (spring/summer) and summer water temperature (DEQ 2020).

Fairview Creek has been physically altered through the construction of dikes and levees, channelization, and through historic gravel mining activity. These activities resulted altered hydrology, increased sedimentation, and water quality effects that had a significant impact on the physical, chemical and biological condition of the stream. (Multnomah County 2014).

In recent decades, some restoration of stream and riparian habitat function has occurred. The East Multnomah Soil and Water Conservation District, Metro, Smith Presbyterian Church, ODFW, Fairview Village, the City of Gresham and others have conducted a variety of activities that have contributed to riparian and stream restoration in the watershed. These include land acquisitions, conservation easements, riparian planting projects, and installation of large woody debris and boulders as in stream habitat structures. Undeveloped lands have also been preserved as parks and green spaces.

Anadromous salmonids are not currently present in Fairview Creek (PSMFC 2021; City of Portland 2021). There is an impassable barrier between the lower and middle sections of the Columbia Slough approximately 10 miles downstream of Fairview Creek. In addition, temperature regimes and other habitat conditions within the Creek limit habitat suitability for anadromous salmonids. Fairview Creek does likely provide suitable habitat for resident native and introduced fish.

7.2.1.5 Pacific Coastal Waters

As described in Section 5, the action area includes marine waters off the Pacific Coast where salmonid species from the Columbia River that are affected by the proposed action are available as prey for SRKW. This area encompasses the whales' entire coastal range from the mouth of the Columbia River and its plume, south as far as central California, and north as far as Southeast Alaska. Marine waters would not be directly affected by the implementation of the proposed action. Potential effects to SRKW analyzed in this BA are limited to effects to their prey base.

The diet of the SRKW is composed almost entirely of salmon, with adult male orcas needing approximately 325 pounds of Chinook to meet their daily prey energy requirements (SROTF 2018). Although their diet tends to vary slightly throughout the year, feeding on smaller amounts of salmon species such as coho, chum and steelhead, about 80% of their total diet comes from Chinook salmon (SROTF 2018). Although Chinook are dense in calories and the largest of the Pacific salmon species, they are also the least abundant and many populations are experiencing long-term reductions in size.

The abundance of salmon has declined significantly since the late 1800s and early 1900s, due to compounded effects of harvest, impacts to habitat modifications, water quality and quantity impacts, predation, and impacts to their own prey base (SROTF 2018). The SROTF has identified impacts to prey availability, specifically the availability of Chinook salmon, as a key threat to the recovery of the SRKW.

7.2.2 Terrestrial Habitats

Most of the terrestrial habitats within the action area have been either lost (converted to impervious surface) or substantially modified from historic conditions as a result of development. Remaining areas of terrestrial habitat are generally small, fragmented, and have been modified from their historic conditions. Nevertheless, these areas can provide some level of habitat function for ESA-listed species. Figure 7-3 provides an overview of the baseline habitat conditions within the action area.

Substantially developed portions of the action area include much of the downtown Vancouver core, commercial and residential areas of Jantzen Beach, and industrial and commercially developed properties adjacent to North Portland Harbor and in the vicinity of Delta Park. These habitats generally provide very little natural habitat function for ESA-listed species. The only ESA-listed terrestrial species with the potential to occur within the action area is the streaked horned lark. Streaked horned lark are not known or expected to forage or nest within, or otherwise use these habitats.

Forested upland habitats within the action area is limited to isolated patches, typically surrounded by urban and mixed environs habitats, or at the upland edge of riparian habitats associated with Burnt Bridge Creek. WDFW also identifies two small patches of priority oak woodland habitat associated with the northern portion of Esther Short Park, and the Fort Vancouver National Historic Site within the action area. These areas generally provide limited habitat function for terrestrial ESA-listed species due to their isolated and fragmented nature. Streaked horned lark are not closely associated with these upland forested habitats, and they would likely avoid these habitats.

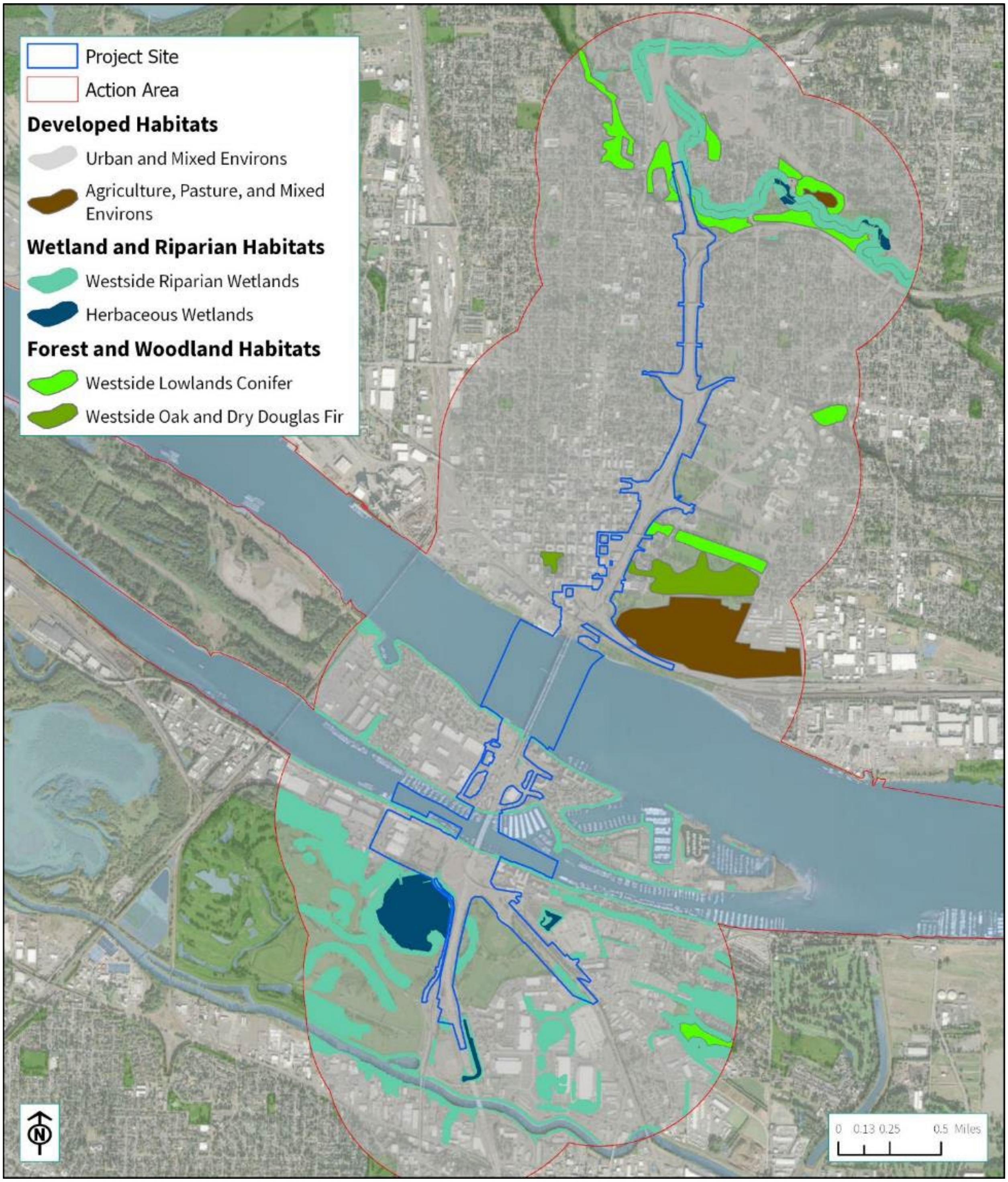
The area at the south end of the Fort Vancouver National Historic Site, and the west end of the Pearson Airport, consists of a mowed/maintained pasture. Small portions of the riparian floodplain associated with Burnt Bridge Creek provides a similar habitat function. Streaked horned larks are not known or expected to use either of these sites. Streaked horned lark have not been documented at either site, and neither site provides suitable nesting habitat for streaked horned lark. They may provide some limited foraging opportunity for streaked horned larks that are traveling between areas of more suitable habitat in the vicinity.

Terrestrial sandy beach habitats straddle the OHWM of the Columbia River and North Portland Harbor within the action area, including the portion of the shoreline within the action area on Hayden Island. These sandy and sparsely vegetated shoreline habitats provide limited potentially suitable habitat for streaked horned lark. Streaked horned larks are not known or expected to nest on the narrow sandy beaches, which are generally too narrow and too frequently disturbed. Streaked horned larks do nest on sandy dredge placement sites elsewhere on the Lower Columbia River however, and may occasionally forage within the sandy beach habitats on Hayden Island while transiting between areas of more suitable habitat.

Narrow bands of riparian habitat are present adjacent to surface waters within the action area, including the Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek. In general, riparian habitats within the action area are fragmented and disturbed from their natural condition, though these areas do provide important habitat function for aquatic habitats.

Wetland habitats are present within the action area in the Vanport complex of wetlands (south of the Expo Center), immediately surrounding the open water pond/wetland system east of I-5 near Delta Park, and within the closed slough east of I-5 along Whitaker Road. Given the disturbed nature of the wetlands within the action area, and the degree of habitat fragmentation, the degree of habitat function for terrestrial ESA-listed species is limited. Streaked horned lark are not closely associated with wetland habitats, though they may forage opportunistically within these habitats. Wetland habitats also provide a water quality function that is relevant to habitat function for aquatic ESA-listed species.

Figure 7-3. Baseline Terrestrial Habitat Conditions



7.2.3 Climate and Climate Change

The earth's climate is changing. According to the EPA, multiple lines of evidence show changes in weather, oceans, and ecosystems (EPA 2022a). Examples include:

- Changing temperature and precipitation patterns.
- Increases in ocean temperatures, sea level, and acidity.
- Melting of glaciers and sea ice.
- Changes in the frequency, intensity, and duration of extreme weather events.
- Shifts in ecosystem characteristics, like the length of the growing season, timing of flower blooms, water temperatures for fish, and migration of birds.

These changes are due to a buildup of greenhouse gases (GHGs) in the atmosphere. GHGs absorb energy, slowing or preventing the loss of heat to space. They act like a blanket, making the earth warmer than it would otherwise be. This process, commonly known as the "greenhouse effect," is natural and necessary to support life. However, the recent buildup of GHGs in the atmosphere from human activities has changed 'he earth's climate and resulted in dangerous effects on human health and welfare and to ecosystems (EPA 2022b). Most models project long-term increases in winter precipitation and decreases in summer precipitation. These changes in temperature and precipitation will in turn affect the snowpack, stream flow, and water quality in the Columbia Basin in the following ways:

- Warmer temperatures will result in more precipitation falling as rain rather than snow
- Snow pack will diminish, and stream flow timing will be altered
- Peak river flows will likely increase
- Water temperatures will continue to rise

According to the Independent Scientific Advisory Board, these changes will have a variety of impacts on aquatic and terrestrial habitats in the Columbia Basin, including depletion of important cold-water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species (ISAB 2007).

8. EFFECTS OF THE ACTION

8.1 Temporary Effects to Water Quality

Water quality can be temporarily affected during both in-water and upland construction activities in several 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 and transport of pollutants, causing increased turbidity, contamination, and sedimentation in adjacent waterbodies. The implementation of avoidance and minimization measures detailed in Section 4 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.

8.1.1 Temporarily Elevated Turbidity

The construction of the proposed action will likely result in temporary, localized turbidity during in-water work in the Columbia River and North Portland Harbor. Activities associated with the construction of the proposed action that have the potential to disturb sediment and temporarily elevate turbidity levels within the action area include pile installation and removal, drilled shaft casing installation and removal, cofferdam installation and removal, debris removal, demolition activities and barge operations, including movement, anchoring, and spudding. These activities could disturb sediments and temporarily elevate turbidity levels above background conditions within the approximately 300 feet of any given activity.

BMPs will be implemented 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 require that the amount and extent of turbidity would meet the terms and conditions of water quality permits that would ultimately be issued for the project, in particular the Section 401 Water Quality Certifications that will be obtained from DEQ and Ecology. These certifications typically establish a temporary mixing zone for turbidity within which turbidity may temporarily exceed ambient background levels. 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.

Most of the construction activities described in this section are not expected to generate large amounts of turbidity, and turbidity is expected to be appropriately minimized through containment and other BMPs. For this reason, any temporarily impaired water quality conditions are expected to dissipate to background levels more quickly than the anticipated mixing zone. Pile installation, drilled shaft casings, and sheet piles for cofferdams will disturb relatively small amounts of material, and the potential for generating turbidity is minimal. The Columbia River is a large waterbody that provides for increased dilution and reduces the size of the potential mixing zone. Additionally, the dominant substrate at the project bridge sites is sand, which settles in relatively short distances compared to finer sediments.

Activities conducted within cofferdams, isolation casings, or other isolated work areas (excavation of material from within permanent drilled shaft casings) will introduce only minimal amounts of sediment into the water. There is a potential for a pulse of turbid water when temporary piles, cofferdams, and isolation casings are removed, and this turbidity will be managed consistent with the ESCP and permit conditions of the 401 Water Quality Certifications that would be issued for the proposed action. Water will be allowed to settle before removing cofferdams and isolation casings 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 could disturb 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. 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. However, given the ESCP that will be implemented, it is not likely that upland construction would cause significant levels of elevated turbidity in any surface waters. The ESCP will establish BMPs, inspection protocols, and outline contingency plans that will be implemented in the case of failure.

It is important to note that 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.

8.1.2 Chemical Contaminants and/or Debris

The proposed action has the potential to result in chemical and/or debris contamination of surface and ground waters. The following activities have the potential to result in chemical or debris contamination:

- Overwater construction and demolition work creates the potential for construction debris to enter surface waters.

- Water may come into contact with uncured concrete, creating a potential pathway for contaminants or elevated pH 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 bridges will occur both in and over the water and may release contaminants such as concrete debris, concrete dust, creosote, and lead-based paint and/or asbestos on elements of the superstructure.
- Upland ground improvements will mix and inject cementitious materials into underlying substrates to improve stability and loading potential in targeted locations within the project site, which has the potential to affect groundwater movement, and to introduce contaminants or elevated pH into groundwater or nearby surface waters. Ground improvements can also entrap contaminants, and can limit the movement of contaminants in soil into groundwater or adjacent surface waters.

Although there are several sources of chemical contaminants, there is a low risk that chemicals would actually enter ground or surface waters. The contractor will be required to provide and implement avoidance and minimization measures, including a PCP and SPCC plan(see Section 4). The PCP and SPCC plan will specify the required BMPs and spill containment measures, as well as the means and methods of implementation. The contractor will also be required to prepare a WQPMP to satisfy the monitoring and reporting requirements of the 401 Water Quality Certifications that are ultimately issued for the project. The WQPMP will identify the timing and methodology for water-quality sampling during construction of the proposed action, as well as methods of implementation and reporting. All work will be conducted consistent with the requirements of the permits that are ultimately issued for the Program, including the 401 Water Quality Certifications and construction stormwater permits. For these reasons, the potential for adverse effects associated with debris input or chemical contamination is low.

8.1.3 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 CRC project in 2011 (Parametrix 2010). That analysis, which remains valid, 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 phenomenon 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 portion of the action area in which turbidity levels could potentially be elevated 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. The geographic extent and duration of any potential short-term increases in sedimentation or turbidity will be limited and are not expected to measurably exceed typical ambient conditions.

8.1.4 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 portion of the action area in which turbidity levels could potentially be elevated 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 during project construction.

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark will not be exposed to any temporary water quality effects, as they do not occur within the portion of the action area where these effects will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where temporary water quality effects will occur, and their potential for exposure is discountable.

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. Table 6-2 through Table 6-4 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. Since turbidity-generating activities may be conducted on a year-round basis, adults and juveniles of all ESU/DPSs of salmon, steelhead, and Pacific eulachon 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 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 any effects.

8.1.5 Effects to Critical Habitats

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

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU

- Chum salmon – CR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be exposed to any temporary water quality effects, as they do not occur within the portion of the action area where these effects will occur.

As described in Section 8.1.1, 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” PBF for LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; LCR, UWR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; LCR DPS steelhead.
- “migratory” and “water quantity/quality” PBFs for bull trout.
- “freshwater spawning” and “freshwater migration” PBFs for Pacific eulachon

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 proposed action has the potential to result in temporarily elevated underwater noise levels within the portion of the Columbia River and North Portland Harbor that are approximately 5.5 miles downstream, and approximately 12.5 miles upstream of the Interstate Bridge (see Section 5.2).

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 proposed action has been developed and refined to 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.

A bubble curtain or similarly effective noise attenuation device will be implemented during all impact pile driving. These devices, when installed and operated properly, can conservatively be expected to provide at least 5 dB of noise attenuation (Caltrans 2020), and the NOAA Fisheries Office of Protected Resources uses a 7 dB reduction as a general standard during bubble curtain application. For purposes of this analysis, a minimum 7 dB reduction has been assumed for all impact pile strikes, except for those necessary for testing the attenuation system. A hydroacoustic monitoring plan will be implemented during impact pile driving to confirm the level of attenuation provided. Impacts will be further minimized through adherence to the effect avoidance and minimization measures described in Section 4.

8.2.1 Effects Discussion

The current NOAA Fisheries hydroacoustic noise thresholds for injury and disturbance to fish are as follows (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 guidance 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[13] (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 “onset of 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 (e.g., eye embolisms). 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. TTS and PTS may result in a

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

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 affected area. Depending on timing of the work, site conditions, amount of habitat affected, and duration, behavioral effects may be significant, with consequences for survival and reproduction. Table 8-1 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 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 7 dB noise reduction at the source. Graphical representations for the modeled distances to the thresholds are provided in Figure 8-1 through Figure 8-10.

Table 8-1. Distances to Established Thresholds for Fish During Impact Pile Driving

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

Note: Data from NOAA Fisheries Pile Driving Calculator are provided in Appendix C.
Key: g = grams; dB = decibel; dB_{PEAK} = peak decibels; dB_{RMS} = root mean square decibels; dB_{SEL} = decibels sound equivalent level

Figure 8-1. Distance to 206 dB Peak Injury Threshold for Fish During Impact Pile Driving – 36 to 48-inch Pile

Figure 8-2. Distance to 206 dB Peak Injury Threshold for Fish During Impact Pile Driving – 18 to 24-inch Pile

Figure 8-3. Distance to 187 dB SEL Cumulative Injury Threshold for Fish >2 g During Impact Pile Driving – 36 to 48-inch Pile, Single Pile Driver

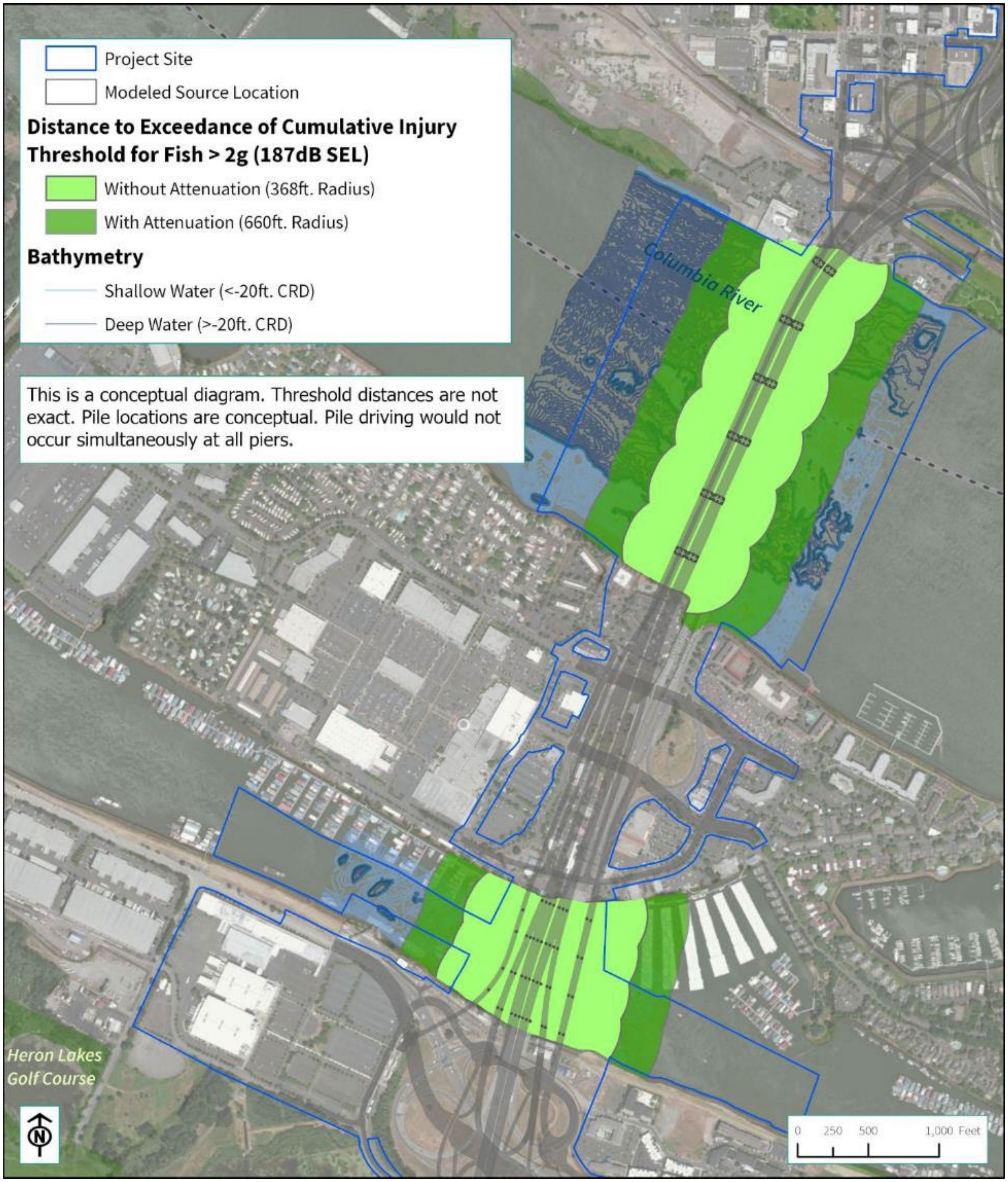


Figure 8-4. Distance to 187 dB SEL Cumulative Injury Threshold for Fish >2 g During Impact Pile Driving – 18 to 24-inch Pile, Single Pile Driver

Figure 8-5. Distance to 187 dB SEL Cumulative Injury Threshold for Fish >2 g During Impact Pile Driving – All Pile Sizes, Multiple Pile Drivers

Figure 8-6. Distance to 183 dB SEL Cumulative Injury Threshold for Fish <2 g During Impact Pile Driving – 36 to 48-inch Pile, Single Pile Driver

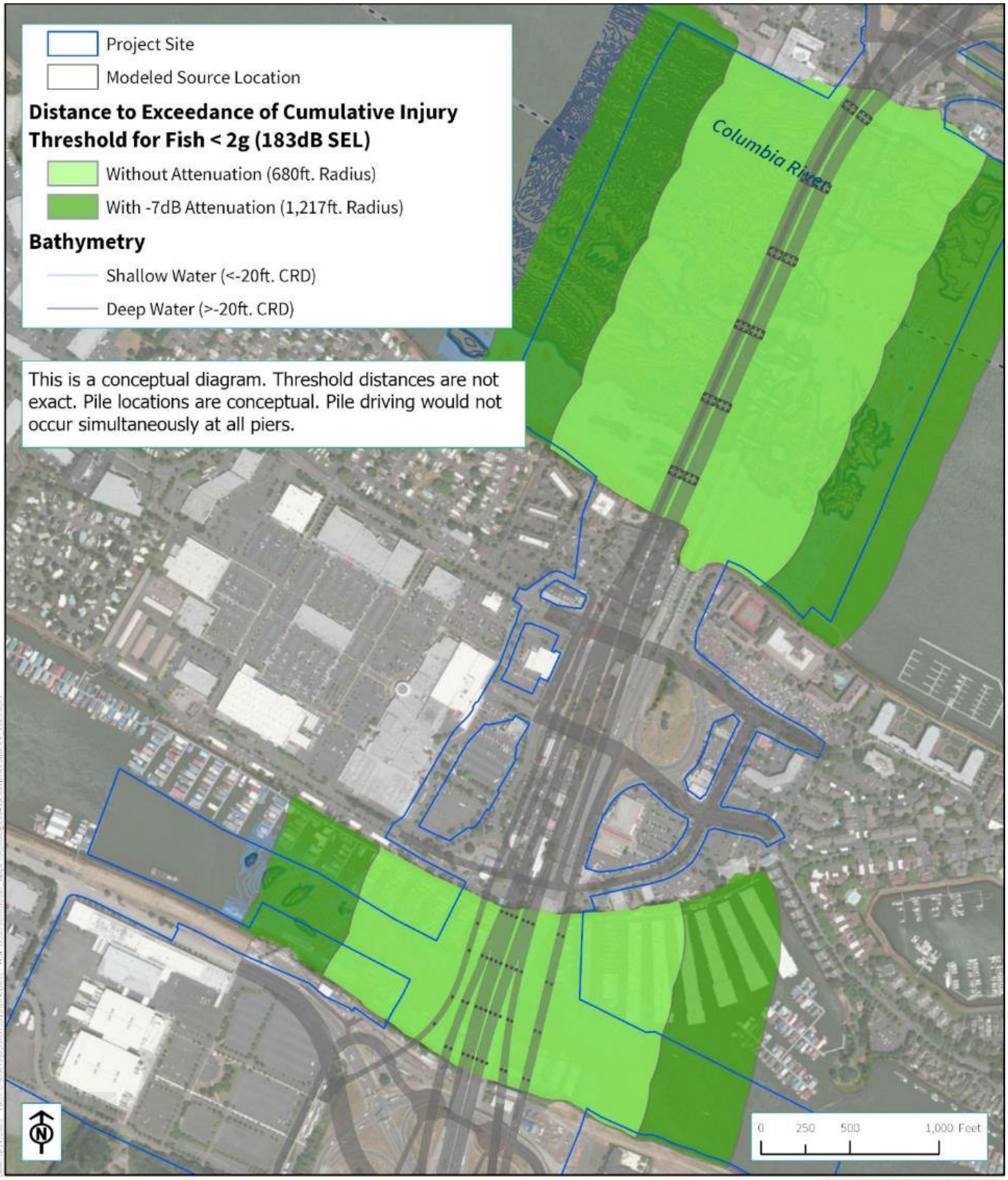


Figure 8-7. Distance to 183 dB SEL Cumulative Injury Threshold for Fish <2 g During Impact Pile Driving – 18 to 24-inch Pile, Single Pile Driver

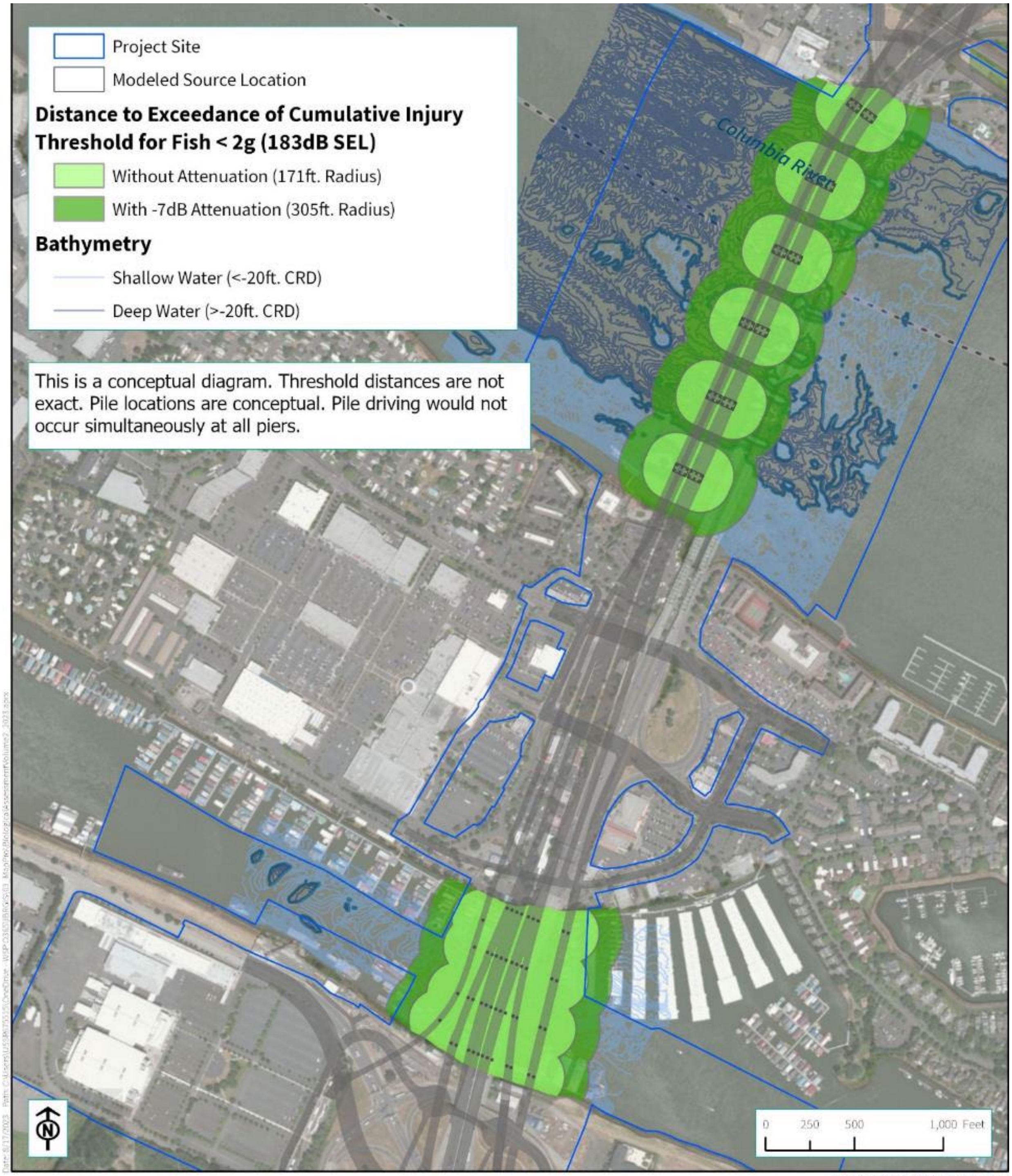


Figure 8-8. Distance to 183 dB SEL Cumulative Injury Threshold for Fish <2 g During Impact Pile Driving – All Pile Sizes, Multiple Pile Drivers

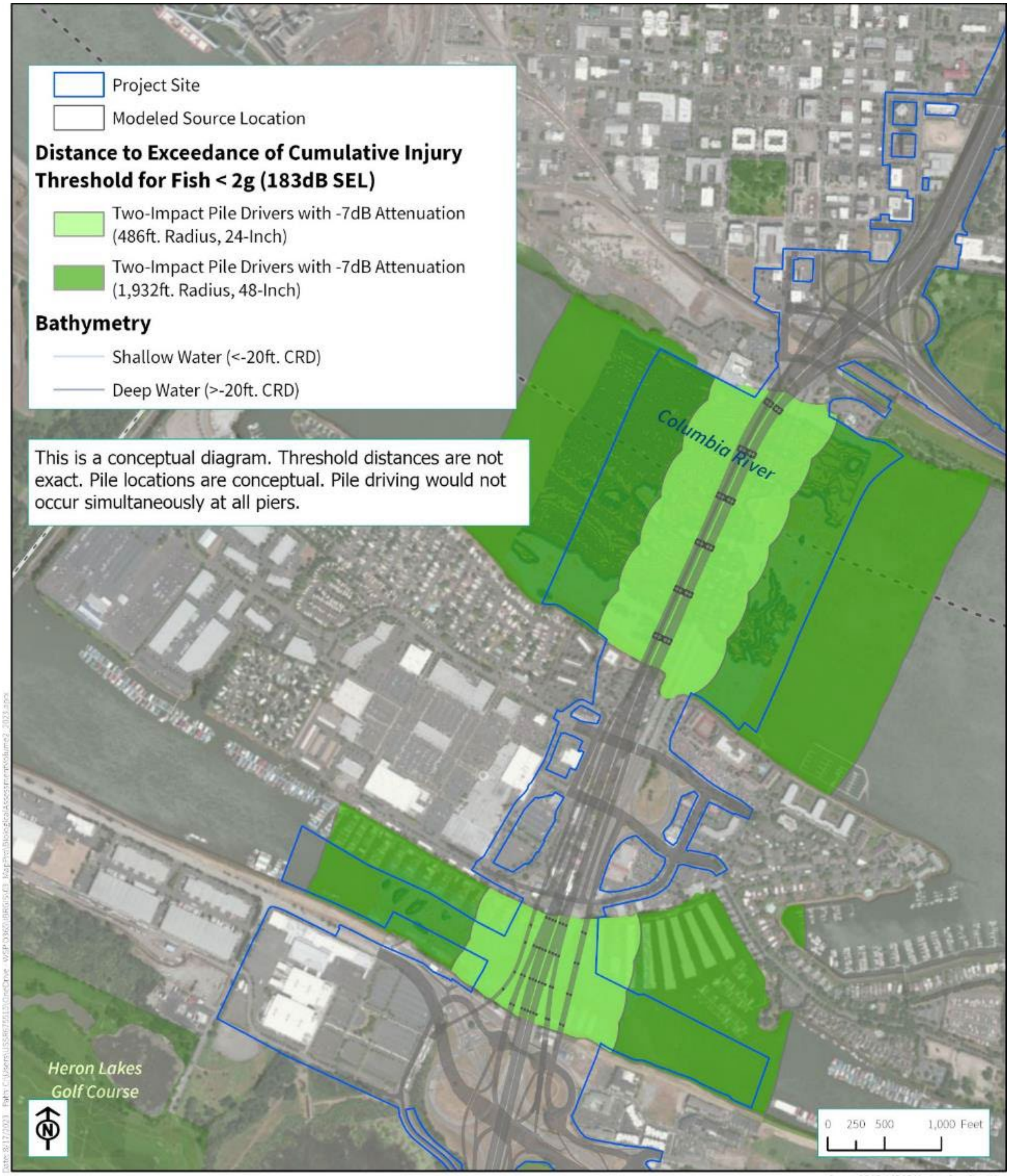


Figure 8-9. Distance to 150 dB RMS Disturbance Thresholds During Impact Pile Driving – 36 to 48-inch Pile

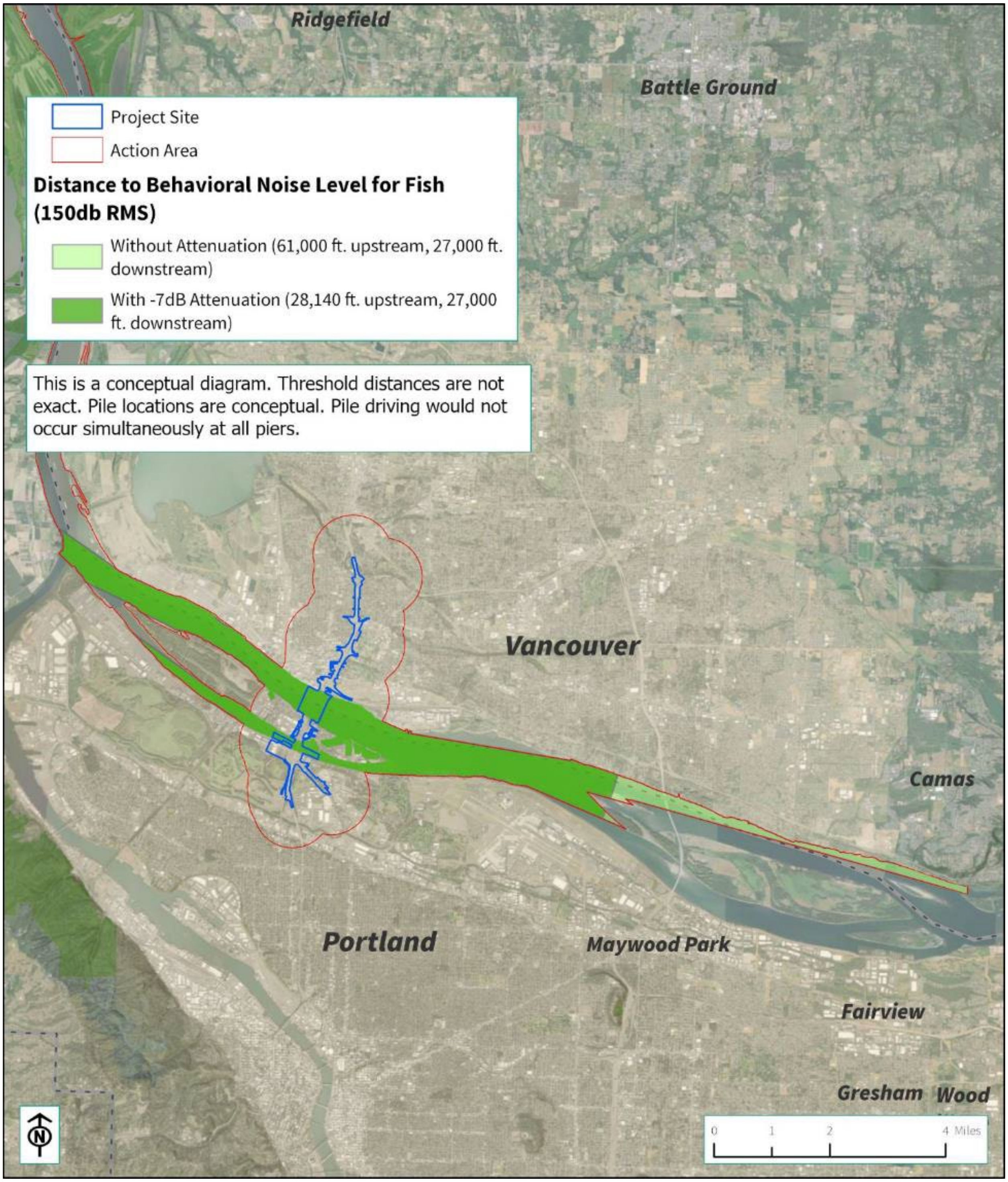
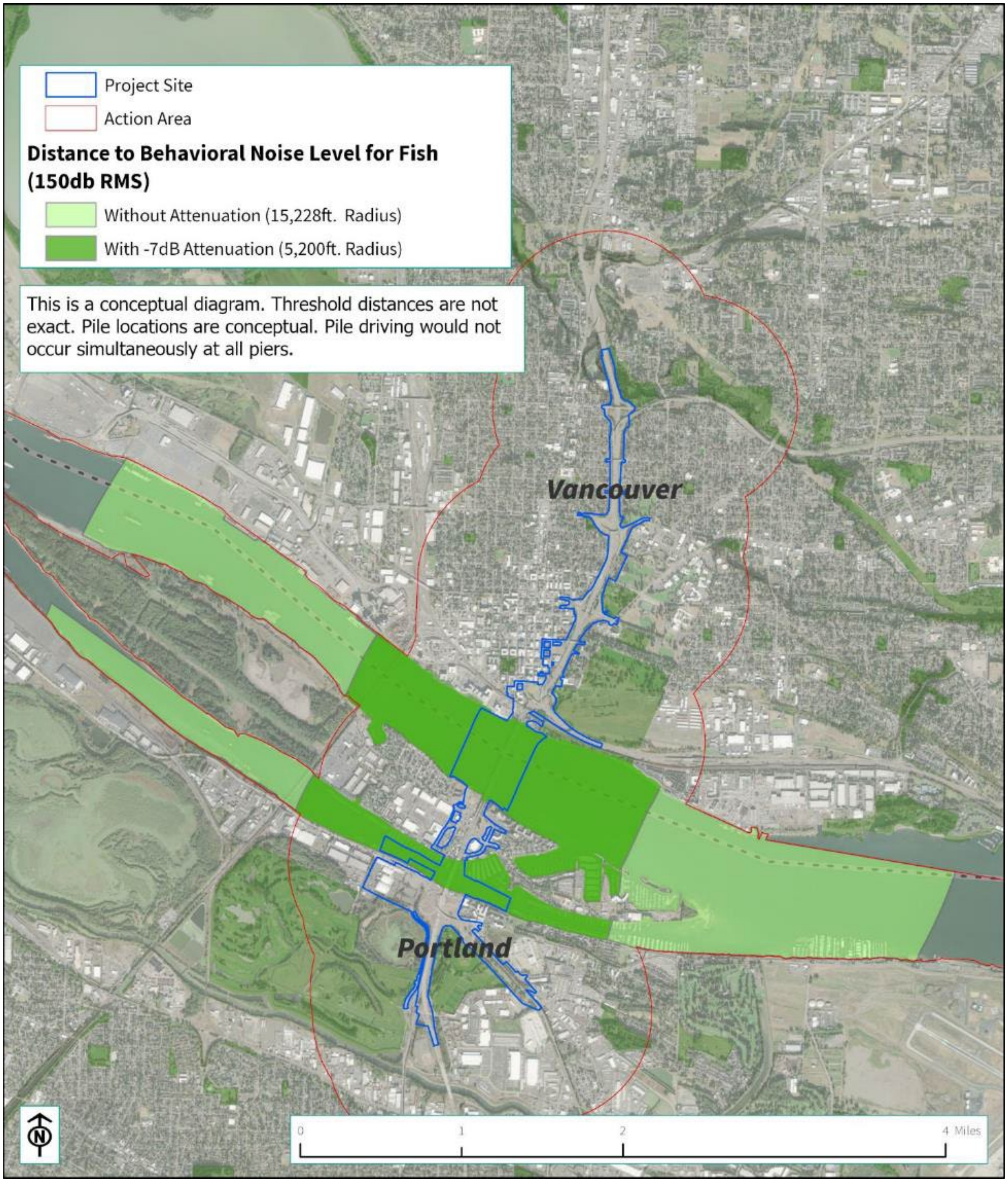


Figure 8-10. Distance to 150 dB RMS Disturbance Thresholds During Impact Pile Driving – 18 to 24-inch Pile



8.2.1.1 Impact Pile Driving

Impact pile driving would occur during installation of temporary in-water work structures in the Columbia River and North Portland Harbor. These structures include temporary work bridges, work platforms, and work piers, as well as temporary mooring piles for barges, and other temporary piles. See Section 3.4.3 for a description of the temporary structures (and the temporary piles) that are anticipated to be required for the construction of the proposed action.

Temporary piles are expected to be steel pipe piles, and will fall into two size classes: 18 to 24 inches and 36 to 48 inches in diameter. Since larger diameter piles generally generate greater levels of underwater sound pressure, this analysis conservatively assumes that all piles within each category will be of the larger diameter (24-inches and 48-inches respectively).

Impact pile installation of the 36- to 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 18- to 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.

During construction, up to two impact pile drivers may operate simultaneously in close proximity to one another. Due to the principle of decibel addition, this could potentially result in greater noise levels than those that would be generated by a single pile driver. However, an analysis of pile-driving noise conducted for the CRC project demonstrated that pile strikes from two impact pile 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, and found that this level of synchronicity is highly unlikely, and not reasonably certain to occur. The analysis in this document, therefore, assumes that the operation of two impact pile drivers simultaneously will not generate underwear noise levels that are greater than those associated with a single pile driver.

It is estimated that a total of approximately 3,200 temporary piles would be installed and removed during the multi-year construction of the Columbia River and North Portland Harbor bridges. These piles would be staged throughout the in-water construction and demolition periods, and it is assumed that between 100 and 400 piles may be in the water at any given time.

An average of six temporary, load-bearing piles could be installed per day using one or two impact drivers. It is estimated that some amount of impact pile driving in the Columbia River or North Portland Harbor would occur on approximately 735 days over the course of the approximately nine seasons of in-water work to construct the new bridges and demolish the existing bridges.

Up to approximately 300 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 between two and three piles per day may be installed and/or proofed with an impact hammer, with an estimated total maximum number of 900 impact strikes per day if a single impact pile driver is in operation, or up to 1,800 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.

As described previously, a bubble curtain or similarly effective noise attenuation device will be implemented during all impact pile driving, and a hydroacoustic monitoring plan would be implemented during impact pile driving to confirm the level of attenuation provided. This monitoring program will require some unattenuated pile strikes to be able to confirm the amount of attenuation provided by the system. It is estimated that up to 75 unattenuated strikes may be required, approximately one day per week, to accomplish this testing. Testing would occur on up to approximately 40 days total over the course of construction, and on each day of testing, unattenuated pile strikes would occur over a period of less than 10 minutes.

During construction up to two impact pile drivers may operate simultaneously in close proximity to one another. 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) 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.

8.2.1.2 Vibratory Pile Driving and Removal

Installation of temporary 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 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. These vibratory driving activities are proposed to occur year-round and without the use of an attenuation device.

Currently there are no established injury thresholds for noise levels generated during vibratory pile driving or removal that are likely to cause injury or behavioral effects to fish. As described in Section 5.2, the maximum anticipated underwater sound pressure levels generated during vibratory pile driving are estimated to be approximately 185 dB_{PEAK} and 175 dB_{RMS} for piles of all size classes (Caltrans 2020).

8.2.1.3 Vessel Noise

Various types of vessels, including barges, tugboats, and small craft, will be present during construction. These vessels will move and operate within the Columbia River and North Portland Harbor on a year-round basis. Such vessels already use this portion of the project site in relatively high numbers; therefore, the vessels to be used in the construction of the proposed action do not represent a new noise source, only a potential increase in the frequency and duration of this type of activity. Vessels of the type and size that will be used for construction of the proposed action do not generate underwater noise levels that would exceed the 150 dB_{RMS} behavioral threshold for fish. While underwater noise from construction-related vessels may exceed background levels, they will not likely be significantly louder background noise levels. Background hydroacoustic data collected as part of the CRC test pile program in 2010 measured ambient background underwater noise levels between 111 and 118 dB_{RMS}, and maximum levels between 145 and 157 dB_{RMS} (DEA 2011). As such, underwater noise from vessels associated with the construction of the proposed action will not have an effect on any ESA-listed species.

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, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS
- Green sturgeon – Southern DPS

SRKW, and streaked horned lark 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. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to temporarily elevated underwater noise will occur, and their potential for exposure is discountable.

8.2.2.1 Impact Pile Driving

Impact pile driving would result in effects to fish that may range from behavioral disturbance to mortality, depending on size of the fish, physiology, 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.

Actual exposure to noise that could result in injury would be relatively limited, restricted to the periods when impact pile driving is occurring, from mid-September through mid-April, during each year of in-water work. It is estimated that impact pile driving within the Columbia River could be conducted on a total of approximately 170 days over the course of the construction period, and will occur for approximately 45 minutes per day on days that impact pile driving occurs. Impact pile driving within North Portland Harbor could be conducted on a total of approximately 565 days over the course of the construction period, and will occur for approximately 23 minutes per day on days that impact pile driving occurs.

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.

Fish with swim bladders, including salmon and steelhead, are particularly sensitive to underwater impulsive sounds (Hastings and Popper 2005). Pacific eulachon do not have swim bladders and may be less susceptible to injury associated with elevated underwater noise levels (Caltrans 2020). However, they are likely still susceptible to general pressure wave injuries and damage to the auditory system, and elevated levels of underwater noise may also result in temporary behavioral effects to these species.

In summary, all species and life stages of salmon, steelhead, Pacific eulachon, and green sturgeon are likely to be subject to potential injury and disturbance effects if present during impact pile driving. Bull trout within the Coastal Recovery Unit are not expected to be present within the portion of the action area where these effects will occur, and their potential for exposure is discountable.

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

8.2.2.2 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. Vibratory pile installation and removal 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.

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 nine-year in-water construction period. It is further estimated that some amount of vibratory pile driving or removal could be conducted seven days per week, and year-round throughout the in-water construction period. It is estimated that up to 5 hours of vibratory pile driving or removal could be conducted on a given day.

All species and life stages of salmon, steelhead and Pacific eulachon that utilize aquatic habitats within the Columbia River and North Portland Harbor could be exposed to these effects when they are present in this portion of the project area. 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, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Chum salmon – CR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS
- Bull trout – Coastal Recovery Unit

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be exposed to any temporary water quality effects, as they do not occur within the portion of the action area where these effects will occur.

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, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; LCR, UWR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR, UWR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; CR ESU chum salmon; LCR ESU coho salmon; LCR DPS steelhead.
- "migratory" and "water quantity/quality" PBFs for bull trout.
- "freshwater spawning" and "freshwater migration" PBFs for Pacific eulachon

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 A-weighted 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. Streaked horned lark may occasionally forage within terrestrial portions of the action area, but would not be expected to be present during construction, and the terrestrial portions of the action area do not provide suitable nesting habitat for streaked horned lark. 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 bridges and removal of the existing bridges. These include both permanent habitat impacts associated with changes in the physical benthic and overwater footprint of the replacement bridges, and temporary impacts associated with temporary work structures. The extent and nature of these impacts have been minimized and avoided to the extent possible through the implementation of BMPs described in Section 4.

8.4.1 Effects Discussion

Table 8-2 provides a summary of the permanent aquatic habitat impacts associated with the proposed action. Table 8-3 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 8-2. Permanent Aquatic Habitat Impacts Summary

			Shallow Water			Deep Water		
Waterbody	Impact Type	Impact from New Bridges (sf)	Restored Area from Removal of Existing Bridges (sf)	Net change (sf)	Impact from New Bridges (sf)	Restored Area from Removal of Existing Bridges (sf)	Net change (sf)	Total Net Change
Columbia River	Benthic Habitat Impact	13,804	-3,217	10,587	19,773	-30,072	-10,299	**288**
	Overwater Shading (Water Surface)	10,244	0	10,244	58,474	0	58,474	**68,718**
	Overwater Shading (Elevated Deck)	90,645	-27,942	62,703	614,178	-280,507	333,671	**396,374**
North Portland Harbor	Benthic Habitat Impact	14,743	-12,204	2,539	0	0	0	**2,539**
	Overwater Shading (Water Surface)	0	0	0	0	0	0	**0**
	Overwater Shading (Elevated Deck)	378,884	-198,869	180,015	0	0	0	**180,015**
Totals	**Benthic Habitat Impact**	**28,547**	**-15,421**	**13,126**	**19,773**	**-30,072**	**-10,299**	2,827
	Overwater Shading (Water Surface)	**10,244**	**0**	**10,244**	**58,474**	**0**	**58,474**	68,718
	Overwater Shading (Elevated Deck)	**469,529**	**-226,811**	**242,718**	**614,178**	**-280,507**	**333,671**	576,389

Key: sf = square feet

Table 8-3. Temporary Aquatic Habitat Impacts Summary

Temporary In-Water and Overwater Work Elements		Columbia River				North Portland Harbor			
		Approx. Quantity	Temporary Benthic Impact (sf)	Temporary Overwater Shading (sf)	Approx. Max. Duration (days)	Approx. Quantity	Temporary Benthic Impact (sf)	Temporary Overwater Shading (sf)	Approx. Max. Duration (days)
Work Platforms/Bridges/Piers and Associated Piles	764 (24-inch) 447 (48-inch)	8,017	184,187		500 days each	912 (24-inch) 208 (48-inch)	5,479	208,800	850 days each
Other Temporary Piles	100 (24-inch)	314	0		150 days each	100 (24-inch)	314	0	150 days each
Suspended Shaft Cap Isolation System	4	0	11,008		120 days each	–	–	–	–
Sheet Pile Cofferdams (Construction)	2	25,095	0		500 days each	–	–	–	–
Sheet Pile Cofferdams (Demolition)	9	37,587	0		50 days each	–	–	–	–
Drilled Shaft Isolation Casings	–	–	–		–	52	10,659	0	50 days each
Barges and Barge Mooring Piles (Construction)	160 (24-inch)	503	120,000		120 days each	216 (24-inch)	679	105,000	50 days each
Barges and Barge Mooring Piles (Demolition)	304 (24-inch)	955	28,500		50 days each	100 (24-inch)	314	23,100	50 days each
Total	**1,328 (24-inch) 447 (48-inch)**	**72,471**	**343,695**		**–**	**1,328(24-inch) 208 (48-inch)**	**17,445**	**336,100**	**–**

8.4.1.1 Benthic Habitat Impacts

The proposed action will result in new in-water structures that will displace benthic (river bottom) habitat within the Columbia River and North Portland Harbor, as well as the removal of existing in-water structures that will restore areas of benthic habitat (Figure 8-11 and Figure 8-12).

As described in Section 3.4.6, the in-water foundations for the replacement bridges will be founded on 10-foot diameter drilled shafts.

The bridge design option with the largest benthic footprint is the single-level, movable-span bridge configuration. In this configuration, the new Columbia River bridges will require a total of 108 drilled shafts. Other design options will require fewer drilled shafts and a smaller benthic footprint.

In total, depending on the bridge design option that is ultimately selected, the replacement bridges will require the installation of approximately 160, 10-foot diameter drilled shafts (108 in the Columbia River, and 52 in North Portland Harbor). These drilled shafts will displace approximately 12,566 square feet of benthic habitat (4,084 square feet in the Columbia River and 8,482 square feet in North Portland Harbor).

The concrete seals for the sheet pile cofferdams at Piers 2 and 7 in the Columbia River, and for the drilled shaft isolation casings in North Portland Harbor will also represent permanent benthic impacts, as they will remain in place when the temporary structures are removed. These concrete seals will permanently displace approximately 35,754 square feet of benthic habitat (approximately 25,095 square feet in the Columbia River and approximately 10,659 square feet in North Portland Harbor). The benthic impact quantities reported for the concrete seals in North Portland Harbor exclude the benthic impact from the permanent 10-foot diameter drilled shafts themselves, to avoid double counting (see Figure 8-12).

In total, the replacement bridges will permanently displace approximately 48,320 square feet of benthic habitat (25,095 square feet in the Columbia River and 14,743 square feet in North Portland Harbor). Of this area, approximately 28,547 square feet will be in shallow water habitat (waters less than 20’ CRD), and approximately 19,773 square feet will be in deep-water habitat.

The proposed action also includes the removal of the existing Columbia River and North Portland Harbor bridges, which will restore benthic habitat that is currently displaced by existing structures. The existing Columbia River bridges are founded on a total of nine in-water piers, which consist of concrete piers supported on a network of timber piles. It is estimated that there are approximately 2,664 timber piles supporting the in-water foundations, and the foundations currently displace a total of approximately 33,289 square feet of existing benthic habitat. The existing North Portland Harbor bridges are founded on a total of six existing in-water piers, each pier is supported by a network of steel piles and a concrete pile cap that is located at the benthic surface of the riverbed. These structures currently displace a total of approximately 12,204 square feet of existing benthic habitat in North Portland Harbor.

Together the bridges currently displace approximately 45,493 square feet of benthic habitat. As such, the construction of the proposed action will result in a net permanent impact to only 2,827 square feet of benthic habitat (approximately 288 square feet in the Columbia River, and approximately 2,539 square feet in North Portland Harbor). This represents a net permanent impact to approximately 13,126 square feet of shallow water habitat, and a net restoration of approximately 10,299 square feet of deep-water habitat.

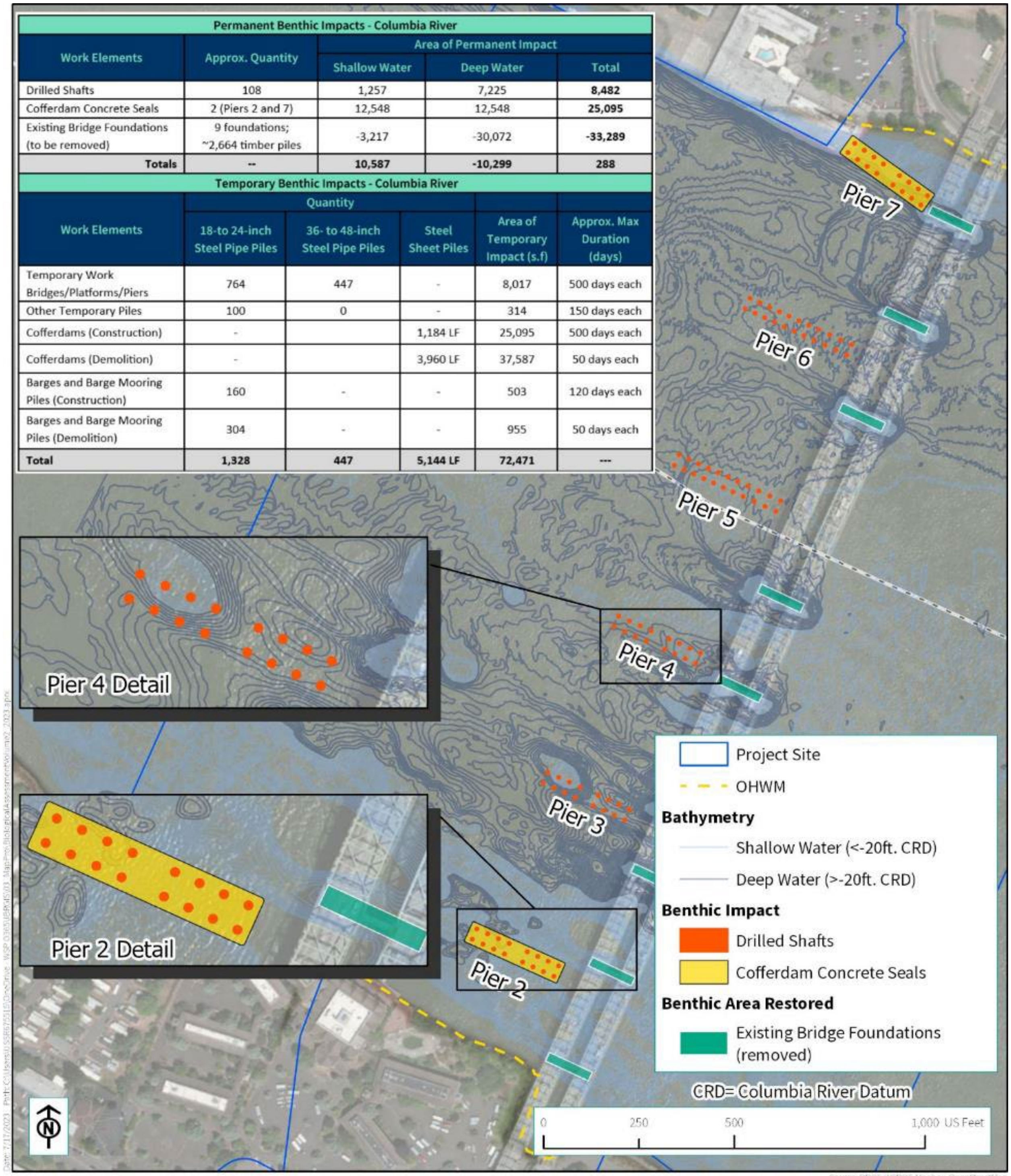
As described in Section 3.4.3, and summarized in Table 8-3, the proposed action will also require several temporary in-water and over-water structures. These structures will include a variety of temporary work platforms, bridges, piers, isolation casings, cofferdams, barges, and associated temporary piles.

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 of the project site. For these reasons, the benthic habitats that would be affected by the proposed action are relatively degraded.

Temporarily affected benthic habitats, and benthic habitats that are restored from removal of the existing bridge, will rapidly recolonize with benthic microorganisms (NOAA Fisheries 2002) and return to full function.

Figure 8-11. Benthic Habitat Impacts – Columbia River



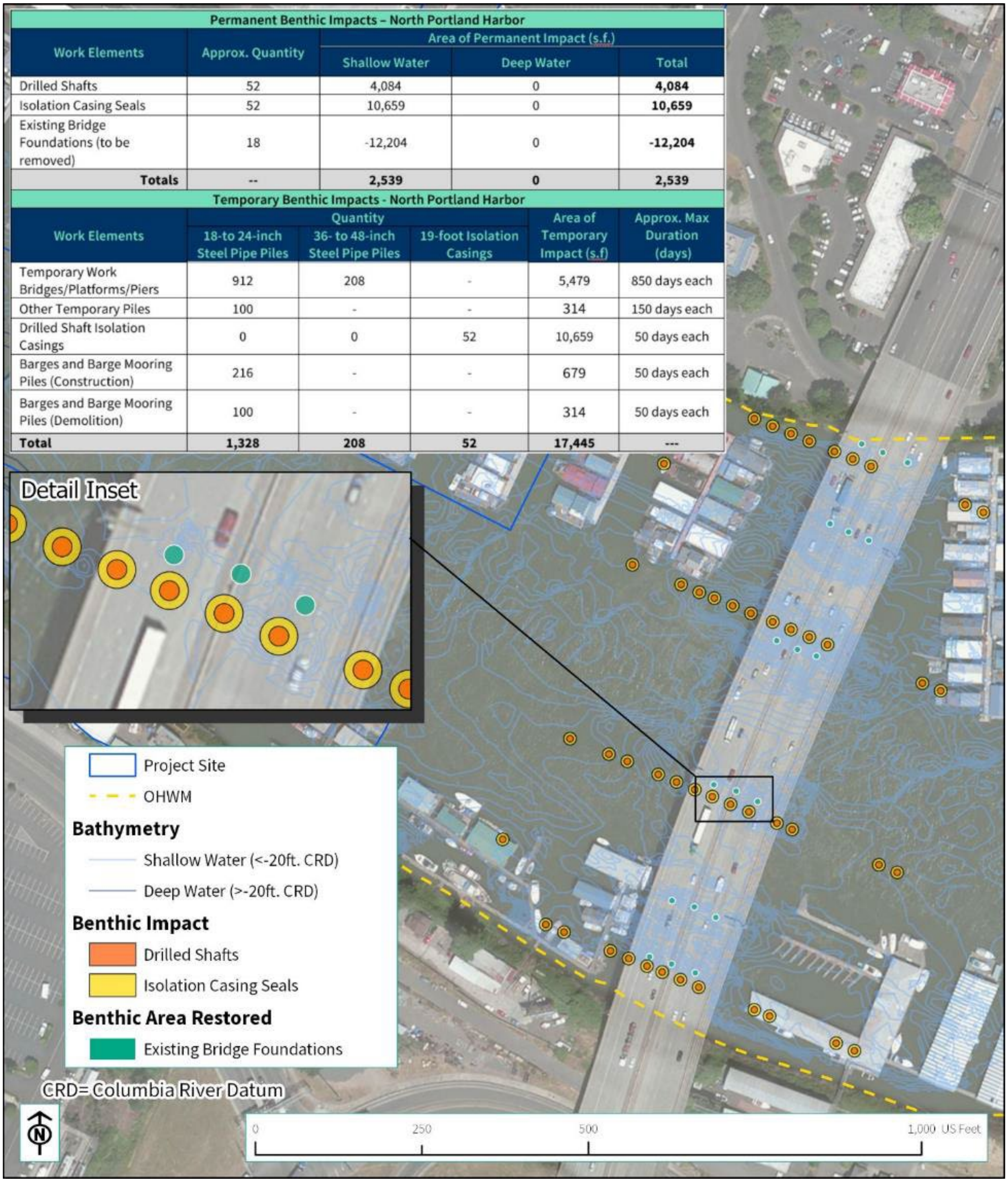
Permanent Benthic Impacts - Columbia River

Work Elements	Approx. Quantity	Area of Permanent Impact		
		Shallow Water	Deep Water	Total
Drilled Shafts	108	1,257	7,225	**8,482**
Cofferdam Concrete Seals	2 (Piers 2 and 7)	12,548	12,548	**25,095**
Existing Bridge Foundations (to be removed)	9 foundations; ~2,664 timber piles	-3,217	-30,072	**-33,289**
Totals	--	**10,587**	**-10,299**	**288**

Temporary Benthic Impacts - Columbia River

Work Elements	Quantity			Area of Temporary Impact (s.f)	Approx. Max Duration (days)
	18-to 24-inch Steel Pipe Piles	36- to 48-inch Steel Pipe Piles	Steel Sheet Piles		
Temporary Work Bridges/Platforms/Piers	764	447	-	8,017	500 days each
Other Temporary Piles	100	0	-	314	150 days each
Cofferdams (Construction)	-		1,184 LF	25,095	500 days each
Cofferdams (Demolition)	-		3,960 LF	37,587	50 days each
Barges and Barge Mooring Piles (Construction)	160	-	-	503	120 days each
Barges and Barge Mooring Piles (Demolition)	304	-	-	955	50 days each
Total	**1,328**	**447**	**5,144 LF**	**72,471**	---

Figure 8-12. Benthic Habitat Impacts – North Portland Harbor



Permanent Benthic Impacts – North Portland Harbor				
Work Elements	Approx. Quantity	Area of Permanent Impact (s.f.)		
		Shallow Water	Deep Water	Total
Drilled Shafts	52	4,084	0	**4,084**
Isolation Casing Seals	52	10,659	0	**10,659**
Existing Bridge Foundations (to be removed)	18	-12,204	0	**-12,204**
Totals	**--**	**2,539**	**0**	**2,539**

Temporary Benthic Impacts - North Portland Harbor					
Work Elements	Quantity			Area of Temporary Impact (s.f)	Approx. Max Duration (days)
	18-to 24-inch Steel Pipe Piles	36- to 48-inch Steel Pipe Piles	19-foot Isolation Casings		
Temporary Work Bridges/Platforms/Piers	912	208	-	5,479	850 days each
Other Temporary Piles	100	-	-	314	150 days each
Drilled Shaft Isolation Casings	0	0	52	10,659	50 days each
Barges and Barge Mooring Piles (Construction)	216	-	-	679	50 days each
Barges and Barge Mooring Piles (Demolition)	100	-	-	314	50 days each
Total	**1,328**	**208**	**52**	**17,445**	**---**

8.4.1.2 Overwater Shading

The proposed action will result in new overwater structures that will cast shading on the water surface within the Columbia River and North Portland Harbor, as well as the removal of existing structures that will remove sources of overwater shading (Figure 8-13 and Figure 8-14).

Water Surface-Level Shading

The permanent overwater structures that are expected to have potential effects on aquatic habitat function for ESA-listed species are the shaft caps for the Columbia River bridge, which are located at the water's surface. The bridge design option with the largest foundations, and consequently the largest shaft caps, is the single-level, movable-span bridge configuration. In this configuration, the new Columbia River bridges will result in a total of approximately 68,718 square feet of new solid overwater coverage, approximately 10,244 square feet of which would be located in shallow water habitats, and approximately 58,474 square feet would be over deep-water areas. The North Portland Harbor Bridges will not have shaft caps at the water's surface.

Elevated Bridge Decks

The replacement bridges will also result in new overwater shading from the elevated bridge decks, and removal of elevated shading from the existing bridge decks, however, the height of the deck limits the effect to aquatic habitat function as described in the sections below.

The combination of bridge and lane configurations with the largest elevated overwater shading footprint is the single-level, movable-span bridge configuration with the two auxiliary lanes. In this design option, the new Columbia River bridges will represent approximately 704,823 square feet of new elevated overwater coverage, and the removal of the existing Columbia River bridges will remove approximately 308,449 square feet of existing overwater coverage. The new North Portland Harbor bridges will represent approximately 378,884 square feet of new elevated overwater coverage, and the removal of the existing North Portland Harbor bridge will remove approximately 198,869 square feet of existing overwater coverage.

In total, depending upon the design option selected, the proposed action will result in a net increase of up to approximately 576,389 square feet of elevated overwater coverage.

The primary effects to aquatic habitat function associated with shading from overwater structures are the potential for: (1) effects to aquatic vegetation and reduced primary productivity, and (2) reduced habitat suitability for aquatic species, particularly juvenile salmonids (Nightingale and Simenstad 2001a). There is no rooted aquatic vegetation along the shoreline of the Columbia River or North Portland Harbor at this location, and overwater structures would not result any effects to aquatic vegetation.

Overwater shading affects aquatic habitat suitability for fish, especially 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 both native and non-native predatory fish species such as northern pikeminnow, largemouth bass, smallmouth bass, black crappie, white crappie, and walleye (NOAA 2003).

Several 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 supporting structural elements, and the material and reflectivity of the structure and supporting elements (Nightingale and Simenstad 2001a). The existing and proposed bridge spans in the Columbia River are more than 30 feet above the water surface and are therefore not likely to cast a dense shadow on the water surface. 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 bridges 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.

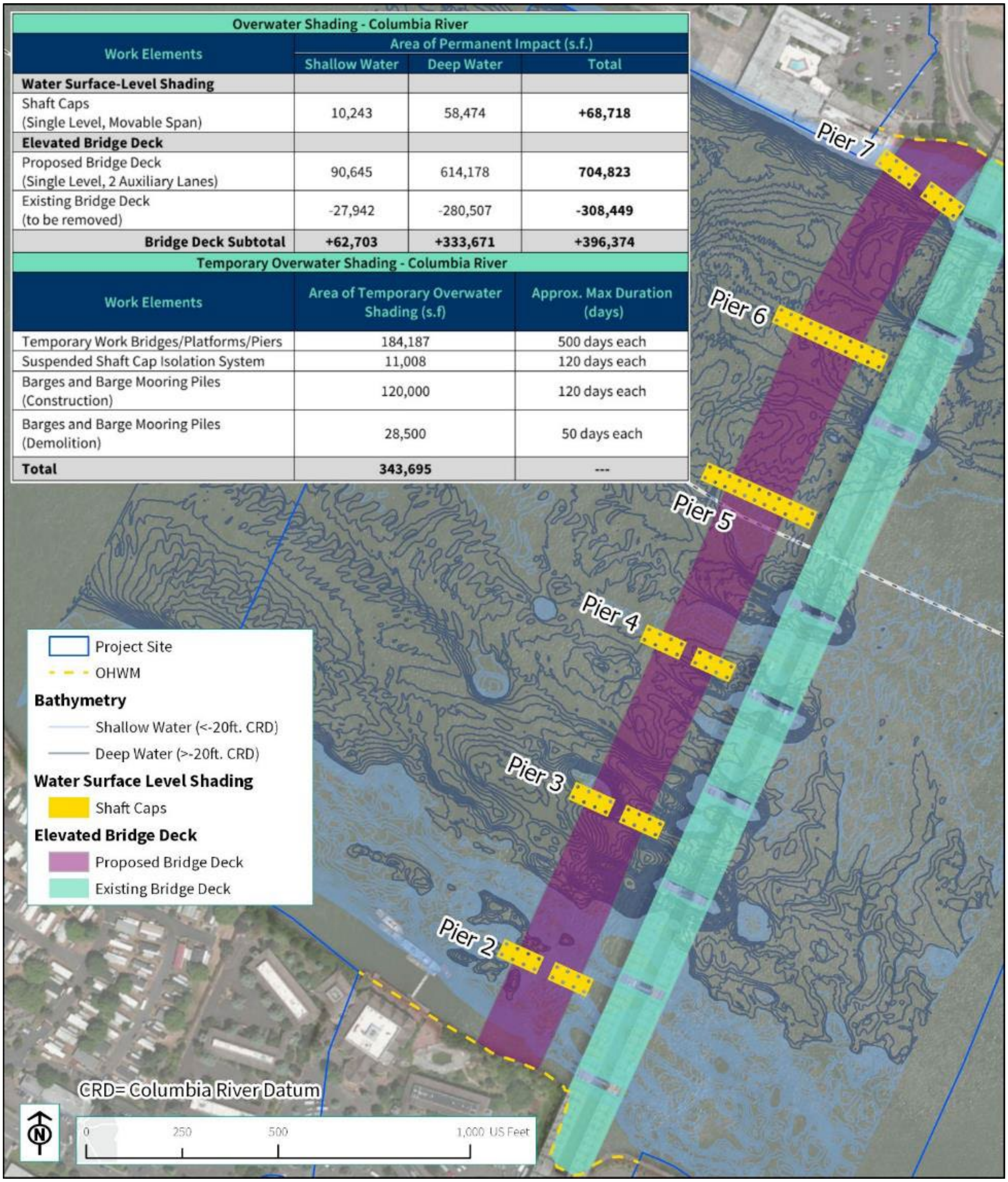
An open-pile structure also reduces the effect to aquatic habitat function (Nightingale and Simenstad 2001). Large numbers of densely spaced piling (such as those associated with large marine terminals), can increase the shade cast by piling on the underwater environment, whereas open structures allow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

Temporary overwater structures such as work bridges, platforms, piers, and barges also represent a source of overwater shading, and have the potential to result in similar effects as the permanent structures. The relatively small size and temporary nature of these structures limits the extent of the potential effect to habitat function for ESA-listed species. In addition, only a portion of the total quantity of temporary structures will be installed at any one time. The temporary structures that will be required in the Columbia River will occupy only a small portion of the available habitat at any one time.

The relatively more constrained channel width in North Portland Harbor means that the proposed work bridges will potentially occupy a relatively larger percentage of the available habitat. However, as with the Columbia River structures, not all the work bridges will be installed at the same time, and work bridges will be added and removed as construction of the bridges in North Portland Harbor proceeds. In addition, the relative distribution of ESA-listed salmon and steelhead (both species and life stages) between the two waterbodies likely varies throughout the year (ODFW 2023).

Temporary structures will be removed prior to project completion, and habitat function will be restored to full function when the structures are removed.

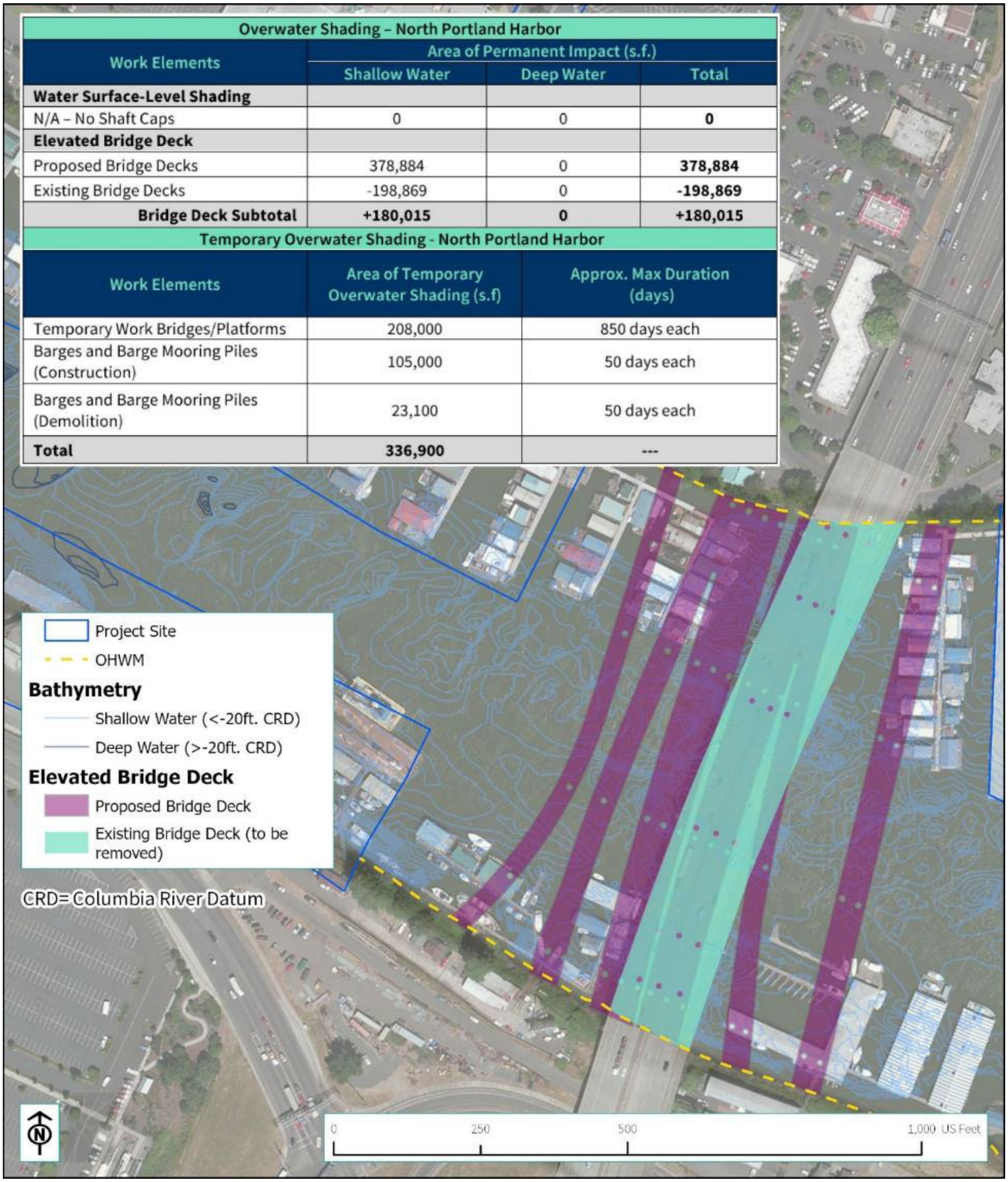
Figure 8-13. Overwater Shading – Columbia River



Overwater Shading - Columbia River			
Work Elements	Area of Permanent Impact (s.f.)		
	Shallow Water	Deep Water	Total
Water Surface-Level Shading			
Shaft Caps (Single Level, Movable Span)	10,243	58,474	**+68,718**
Elevated Bridge Deck			
Proposed Bridge Deck (Single Level, 2 Auxiliary Lanes)	90,645	614,178	**704,823**
Existing Bridge Deck (to be removed)	-27,942	-280,507	**-308,449**
Bridge Deck Subtotal	**+62,703**	**+333,671**	**+396,374**

Temporary Overwater Shading - Columbia River		
Work Elements	Area of Temporary Overwater Shading (s.f)	Approx. Max Duration (days)
Temporary Work Bridges/Platforms/Piers	184,187	500 days each
Suspended Shaft Cap Isolation System	11,008	120 days each
Barges and Barge Mooring Piles (Construction)	120,000	120 days each
Barges and Barge Mooring Piles (Demolition)	28,500	50 days each
Total	**343,695**	---

Figure 8-14. Overwater Shading – North Portland Harbor



Overwater Shading – North Portland Harbor			
Work Elements	Area of Permanent Impact (s.f.)		
	Shallow Water	Deep Water	Total
Water Surface-Level Shading			
N/A – No Shaft Caps	0	0	**0**
Elevated Bridge Deck			
Proposed Bridge Decks	378,884	0	**378,884**
Existing Bridge Decks	-198,869	0	**-198,869**
Bridge Deck Subtotal	**+180,015**	**0**	**+180,015**

Temporary Overwater Shading - North Portland Harbor		
Work Elements	Area of Temporary Overwater Shading (s.f)	Approx. Max Duration (days)
Temporary Work Bridges/Platforms	208,000	850 days each
Barges and Barge Mooring Piles (Construction)	105,000	50 days each
Barges and Barge Mooring Piles (Demolition)	23,100	50 days each
Total	**336,900**	---

8.4.1.3 Fill Within the Floodplain

The 100-year floodplain elevation at the project site is at approximately +32 feet North American Vertical Datum of 1988 (NAVD88). The extent of functional floodplain habitat below this elevation at the project site is relatively limited given the degree of streambank armoring on both sides of the river. In addition, most of the land south of North Portland Harbor is isolated from the active floodplain by an existing system of levees.

The FAHP BO establishes fluvial performance standards for bridge replacement projects seeking coverage under that programmatic consultation. While these standards don't specifically apply to the proposed action, they are applicable guiding principles for avoiding impacts to floodplain function. The FAHP BO fluvial performance standards are based in part on the concept of maintaining the physical and biological processes associated with a "functional floodplain." The FAHP defines the functional floodplain for constrained river channels such as coinciding with the flood prone area, but notes also that the functional floodplain may be reduced by the presence of natural constrictions, flow regulation, or encroachment of built infrastructure.

The project will require both removal and placement of material below the 100-year floodplain elevation. While specific volumes have not yet been calculated, it is anticipated that the net change in fill within the regulatory floodplain will be relatively small. The City of Portland's current zoning code requires balanced cut and fill within floodplains and the City is currently evaluating updates to these existing regulations as part of their proposed Floodplain Resilience Plan (City of Portland 2022). The updates are intended in part to bring the City's code into compliance with the recommendations of the 2016 Federal Emergency Management Agency National Flood Insurance Program BO that was issued by NOAA Fisheries in 2016. These regulation changes may increase the quantities of compensatory excavation required to mitigate placement of both fill and structure in the floodplain, in addition to other changes designed to improve the function and resiliency of floodplains. These regulations are expected to be in place in 2023. The City of Fairview and City of Vancouver also regulate cut and fill activities within the floodplain and require demonstration of no net-rise through their local environmental approval process.

The project will also require both removal and placement of material within the functional floodplain. Specific quantities have only been estimated at this time, and will depend substantially on final design and permitting details. Approximate quantities are provided in Table 3-5 and Table 3-6 in Section 3.4.6. The proposed action will install approximately 62,400 cubic yards of new material within the functional floodplain of the Columbia River and North Portland Harbor, and will remove approximately 13,250 cubic yards of existing material from within the functional floodplain. It is estimated, therefore, that the proposed action will result in a net increase of approximately 55,000 cubic yards of material within the functional floodplain. Most of this volume is associated with the shaft caps for the Columbia River bridge, which are approximately 20 feet thick, and most of which will be below the OHWM elevation. Despite this increase, the proposed action will fully comply with applicable requirements to maintain floodplain function as described above, and will maintain floodplain function and hydrologic processes at the site.

Given the limited extent of functioning floodplain at the project site, and the likely small quantity of net change in fill within the regulatory floodway/floodplain, the effects to floodplain function from construction of the proposed action is expected to be minimal.

8.4.2 Effects to Species

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

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects of aquatic habitat impacts, as they do not occur within the portion of the action area where these impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where aquatic habitat impacts will occur, and their potential for exposure is discountable.

Permanent aquatic habitat impacts will persist at the project site, and temporary aquatic habitat impacts will occur at various times throughout the construction and demolition over an approximately nine-year in-water construction period. For this reason, all species and life stages of salmon, steelhead, and Pacific eulachon that are present within the portion of the action area that utilize habitats within the vicinity of the existing or proposed bridges will be exposed to the effects of permanent and temporary loss of benthic habitat, overwater shading, and floodplain fill.

As described in Section 8.4.1 above, the proposed action will result in both permanent and temporary impacts to aquatic habitats. 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. Temporarily affected habitats will rapidly recolonize once the temporary structure is removed, and will return to full function.

Impacts to aquatic habitats have been avoided and minimized through design refinement and screening. Unavoidable impacts will be offset through one or more compensatory mitigation projects, which will be developed to comply with applicable federal, state, and local regulatory requirements. A compensatory mitigation plan will be prepared, which will be required to demonstrate “no net loss” of aquatic habitat function.

8.4.3 Effects to Critical Habitat

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

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

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects associated with aquatic habitat impacts, as they do not occur within the portion of the action area where these effects will occur.

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.

These impacts 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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- "migratory" and "water quantity/quality" PBFs for bull trout.
- "freshwater spawning" and "freshwater migration" PBFs for Pacific eulachon

Permanent structures will displace benthic habitats, and generate overwater shading that may reduce habitat suitability for adults and/or outmigrating juvenile fish. Temporary structures will result in similar impacts, but impacted habitat function will be fully restored once these structures are removed.

As described in Section 8.4.1 and 8.4.2 above, the proposed action will result in both permanent and temporary impacts to aquatic habitats. 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 proposed action will likely result in a small net impact to benthic habitat once the existing bridges are removed, which will be offset through regulatory compensatory mitigation to achieve no net loss. Shading from shaft caps will affect aquatic habitat suitability within a relatively small portion of the Columbia River. The height and open structure of the replacement bridges limits the functional effect of shading from the elevated bridge decks.

Habitat impacts have been minimized to the extent possible through the avoidance and minimization measures described in Section 4, and any unavoidable impacts will be offset through a compensatory mitigation plan that will comply with applicable federal, state, and local regulatory requirements, and will demonstrate no net loss of aquatic habitat function. Aquatic habitat impacts associated with 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 Hydraulic Shadowing

8.5.1 Effects Discussion

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

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

The analysis conducted for the CRC project indicated that the hydraulic shadow associated with the existing Columbia River bridges extends between 200 to 1,100 feet downstream of the existing piers, with velocities in the shadow ranging from 0 to 3 feet per second. It was estimated that the hydraulic shadow associated with the piers for the replacement Interstate Bridge would extend up to approximately 1,600 feet downstream of each pier, with velocities in the shadow remaining in the 0 to 3-feet-per-second range. However, due to the reduction in the total number of piers in the water compared to the existing bridges, there will also be more unaffected area between piers.

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

8.5.2 Effects to Species

The following ESA-listed species have the potential to be exposed to effects associated with hydraulic shadowing because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects of hydraulic shadowing, as they do not occur within the portion of the action area where these impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to hydraulic shadowing will occur, and their potential for exposure is discountable.

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

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

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

Although the size of the hydraulic shadow would increase, the net effect of the change will be insignificant. The range of velocities found in the hydraulic shadow is within the range which fish encounter in the natural environment. Therefore, no species or life stages are expected to become trapped or significantly delayed by the hydraulic shadow. Additionally, none are likely to be directed towards or away from shallow water habitat because the structures neither pose a complete physical blockage to the shallow water habitat, produce water velocities low enough to trap fish, nor produce velocities high enough to direct fish into deeper water. While it possible that some individuals may be subject to increased exposure to predation as a result of the increase in hydraulic shadowing associated with the replacement bridges under the proposed action, is anticipated that the net effect of the change will be insignificant, due in part to the relatively small area that would be affected by the change.

8.5.3 Effects to Critical Habitats

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

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

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects from the hydraulic shadow of the replacement bridge piers, as they do not occur within the portion of the action area where these effects will occur.

Impacts from changes in the hydraulic shadow from replacement bridge piers have the potential to 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; Snake River 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.
- "freshwater spawning" and "freshwater migration" PBFs for Pacific eulachon

As described in Section 8.4.1 above, however, while the size of the hydraulic shadow will increase, the net effect of the change on habitat function will be insignificant. The area that will be affected is relatively small, and the range of velocities found in the hydraulic shadow is within the range which fish encounter in the natural environment. The change in hydraulic shadow associated with the proposed action, therefore, will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.6 Terrestrial Habitat Impacts

The proposed action will result in both permanent and temporary impacts to terrestrial habitats associated with construction of the replacement bridges and associated roadway and interchange improvements. 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.

8.6.1 Effects Discussion

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

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

In Washington, the proposed action will result in permanent impacts to approximately 0.79 acre of riparian vegetation, approximately 0.15 acre of a designated biodiversity area, 0.01 acres mapped as oak woodland habitat, and approximately 0.06 acre of wetland buffer (these habitat designations overlap and are not cumulative (Figure 8-15).

In Oregon, the project would result in approximately 0.58 acre of permanent wetland impacts, approximately 7.39 acres of wetland buffer impact, and approximately 7.32 acres of permanent impact within terrestrial habitats identified as either “high” or “medium” quality riparian habitats in the City’s Natural Resource Inventory (NRI) (these areas overlap and are not cumulative). However, it is worth noting that these designations in the City’s NRI extend in some locations into paved areas, riprap, and other areas that do not currently provide a riparian habitat function (Figure 8-16). These are reasonable worst-case estimates and the specific quantities may be further reduced as design progresses.

The proposed action will also result in temporary impacts to approximately 1.15 acres of riparian buffer, approximately 2.87 acres of a designated biodiversity area, approximately 0.03 acre of priority oak woodland habitat and approximately 1.19 acres of wetland buffer in Washington, and approximately 2.56 acres of wetland, 7.11 acres of wetland buffer, and approximately 10.3 acres of habitat identified as having a “high” or “medium” combined wildlife/riparian value in Portland’s NRI, and approximately 2.56 acres of wetland in Oregon (these habitat designations overlap and are not cumulative). Areas temporarily disturbed during construction will be restored upon completion of the proposed action consistent with state and local regulations.

Impacts to riparian and wetland vegetation can reduce habitat complexity, affect water temperature, and reduce the potential for large woody debris recruitment in a watershed over the long term. However, the affected terrestrial habitats in this location provide only moderate habitat function in their current state, as they are fragmented, and located immediately adjacent to I-5. Impacts to sensitive terrestrial habitats will be avoided and minimized to the extent practicable, and unavoidable impacts will be offset through compensatory mitigation consistent with federal, state, and local regulations. The net result will be no net loss of riparian or terrestrial habitat function in the long term. and for this reason, terrestrial habitat impacts are not expected to significantly affect habitat function for ESA-listed fish.

Figure 8-15. Terrestrial Habitat– Impacts - Washington

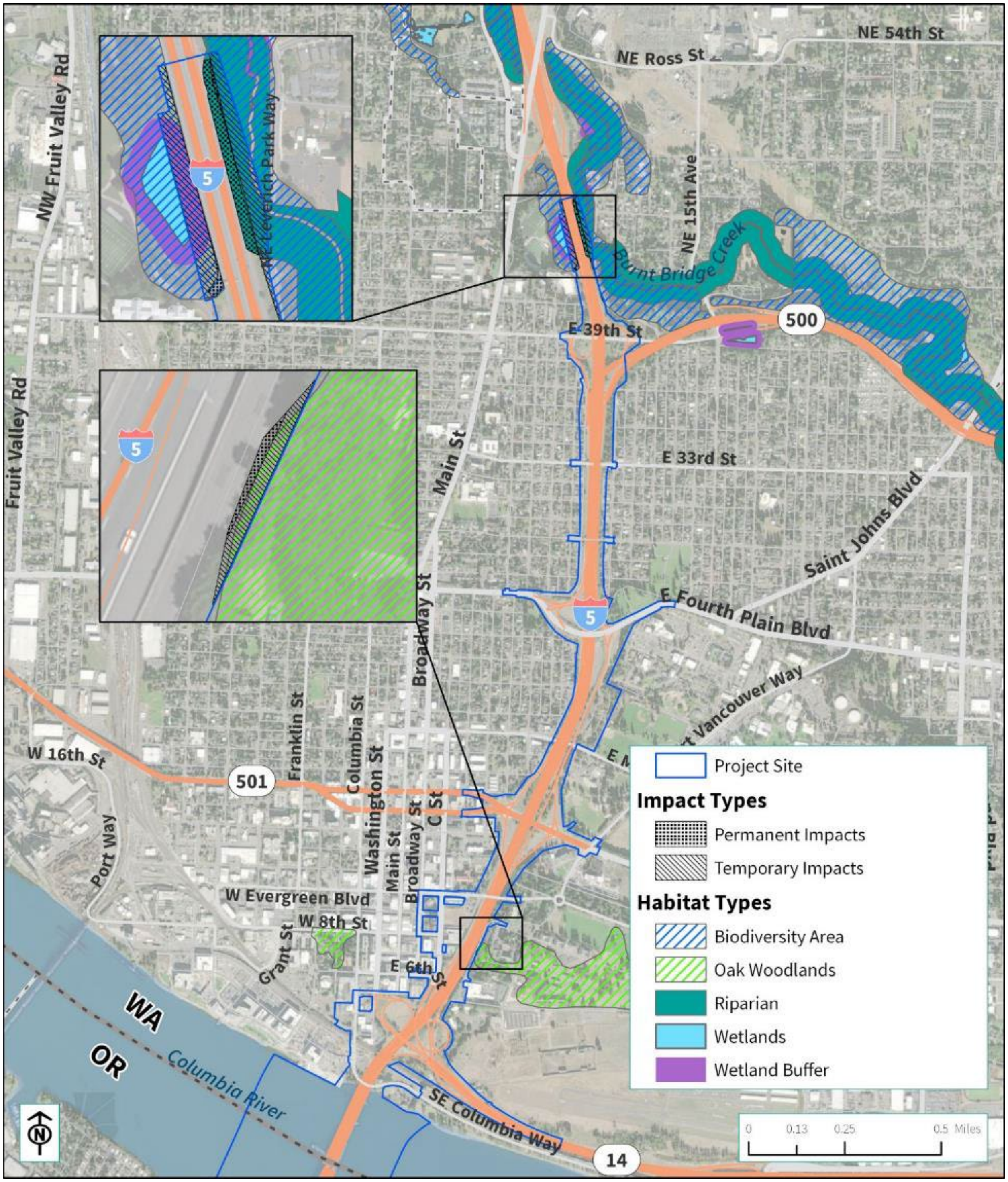
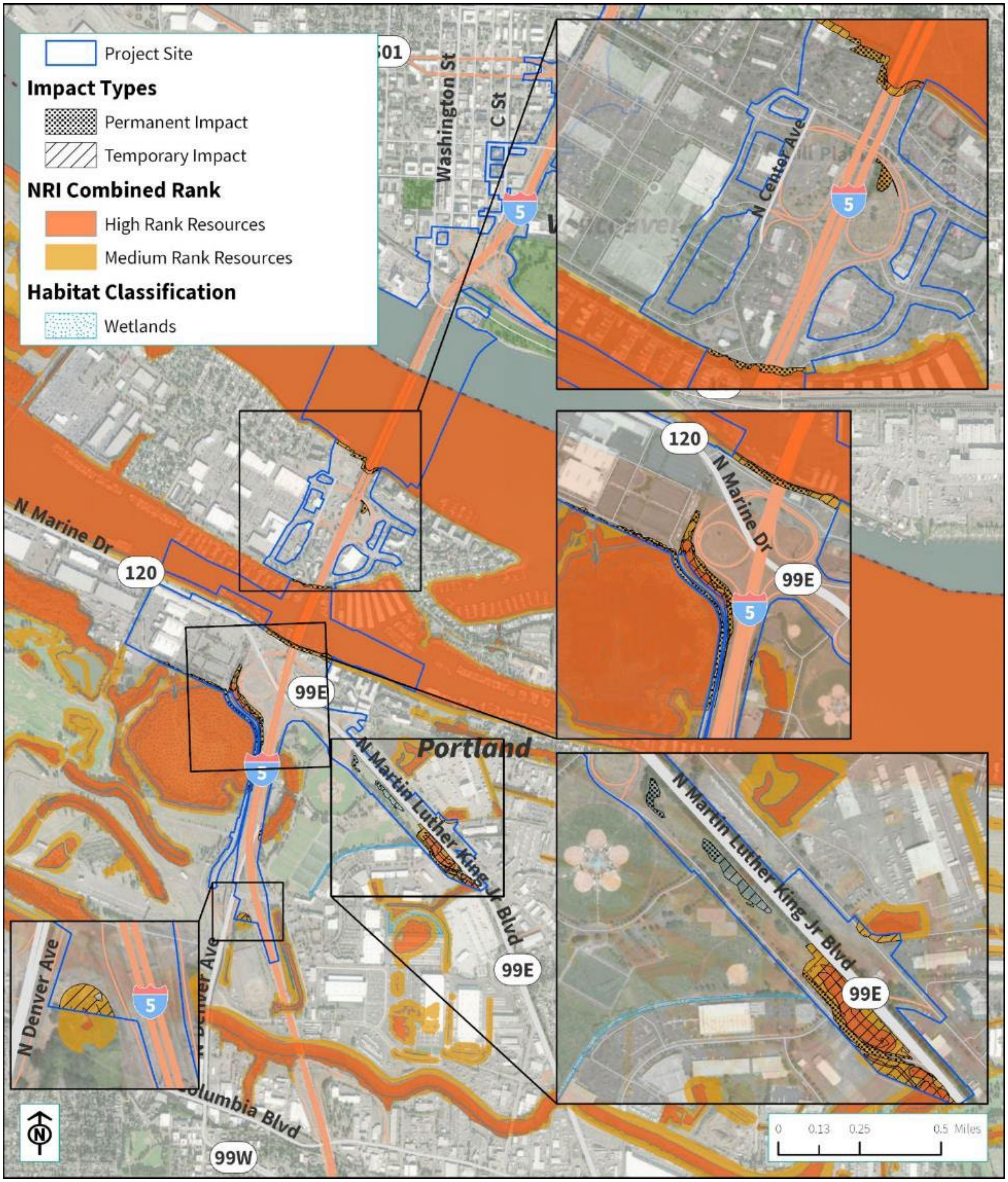


Figure 8-16. Terrestrial Habitat– Impacts - Oregon



8.6.2 Effects to Species

The following ESA-listed species have the potential to be exposed to effects as a result of terrestrial habitat impacts because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS
- Streaked horned lark

Southern DPS green sturgeon and SRKW will not be exposed to any direct effects from terrestrial habitat impacts, as they do not occur within the portion of the action area where these impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to terrestrial habitat impacts will occur, and their potential for exposure is discountable.

Streaked horned lark is the only terrestrial-based ESA-listed species with potential to occur within the portion of the action area where terrestrial habitat impacts will occur. However, there is no suitable habitat for streaked horned lark within the project footprint, and only limited potentially suitable habitat within the action area. The sandy shorelines within the terrestrial portion of the action area (on Hayden Island, in North Portland Harbor, and the Columbia River shoreline in Washington) provide potentially suitable foraging habitat for streaked horned larks are located outside the area of temporary and permanent ground disturbance and would not be affected. Streaked horned larks are not known to forage within forested riparian or wetland habitats, and as such would not be affected by the impacts to these terrestrial habitats.

Impacts to terrestrial habitats such as riparian habitats and wetlands can affect habitat suitability in adjacent aquatic systems, and could affect ESA-listed fish in adjacent aquatic habitats. However, as described above, the extent of the terrestrial habitat impacts will be relatively small, and will impact habitats that are adjacent to existing highway infrastructure, and do not provide high levels of function. Impacts to riparian habitat adjacent to Burnt Bridge Creek will likely require some tree removal, but will largely affect relatively disturbed vegetation on a sloping embankment between I-5 and NE Leverich Park Way. Some restoration of the riparian buffer in this location may be able to be restored and/or enhanced, and any net unavoidable impact will be offset through compensatory mitigation.

Riparian areas adjacent to the Columbia River and North Portland Harbor are armored with riprap, and provide very little riparian function. The proposed action will likely require removal of some trees that have established along the riprapped banks, which will need to be replaced or otherwise compensated for consistent with local regulations.

Some tree removal will also be required in other areas mapped as having “high” or “medium” combined wildlife/riparian value in Portland’s NRI. Trees in these areas are primarily associated with wetlands and adjacent buffer areas and are not directly associated with a surface water.

Impacts to terrestrial habitats have been avoided and minimized through design refinement and screening. Unavoidable impacts will be offset through one or more compensatory mitigation projects, which will be developed to comply with applicable federal, state, and local regulatory requirements. A compensatory mitigation plan will be required to demonstrate no net loss of habitat function.

8.6.3 Effects to Critical Habitat

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

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

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects from terrestrial habitat impacts, as they do not occur within the portion of the action area where these effects will occur.

As described in the section above, impacts to terrestrial habitats such as riparian habitats and wetlands can affect habitat suitability in adjacent aquatic systems, which could in turn affect designated critical habitat function in adjacent waters.

These impacts could 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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “migratory” and “water quantity/quality” PBFs for bull trout.
- “freshwater spawning” and “freshwater migration” PBFs for Pacific eulachon

As described in Section 8.6.1 and 8.6.2 above, the extent of the terrestrial habitat impacts will be relatively small, and will impact habitats that are adjacent to existing highway infrastructure, and do not provide high levels of function.

Impacts to terrestrial habitats have been minimized to the extent possible through the avoidance and minimization measures described in Section 4, and any unavoidable impacts will be offset through a compensatory mitigation plan that will comply with applicable federal, state, and local regulatory requirements, and will demonstrate no net loss of aquatic habitat function. Terrestrial habitat impacts associated with the proposed action, therefore, will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.7 Work Area Isolation and Fish Salvage

As described in Section 3.4.4, 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 include drilled shaft casings and temporary sheet pile cofferdams.

8.7.1 Effects Discussion

Cofferdams and drilled shaft isolation casings will be installed in a manner that minimizes the potential for fish entrapment. Sheet piles will be installed from upstream to downstream and will be lowered slowly until contact with the substrate. Installation of drilled shaft isolation casings and cofferdams is likely to generate low-level noise and visual disturbance, and many fish will actively avoid the work area during the construction of cofferdams. Nevertheless, it is likely that some fish may become trapped within the isolated work area, and will need to be manually removed.

Fish salvage will be conducted both during and after the installation of 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 BO 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.

8.7.2 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, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU

- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark 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 impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to work area isolation and fish salvage will occur, and their potential for exposure is discountable.

Because work area isolation and fish salvage activities may take place year-round, all species and life stages of fish that are present within the portion of the Columbia River and North Portland Harbor where these activities will be conducted may be exposed to this effect.

Adult and/or juvenile salmon, steelhead, and Pacific eulachon 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.

8.7.3 Effects to Critical Habitats

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

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be affected by work area isolation and fish salvage, as they do not occur within the portion of the action area where these effects will occur.

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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “migratory” and “water quantity/quality” PBFs for bull trout.
- “freshwater spawning” and “freshwater migration” PBFs for Pacific eulachon

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.

8.8 Overwater Lighting

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

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

8.8.2 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, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects of temporary overwater lighting, as they do not occur within the portion of the action area where these impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to overwater lighting will occur, and their potential for exposure is discountable.

Permanent overwater lighting will persist at the project site, so all species and life stages of salmon, steelhead, 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 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. These impacts may occur during all months of the year, and as such, all species and life stages of salmon, steelhead, and Pacific eulachon 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.

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 adult and juvenile Pacific eulachon. 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 or eulachon that congregate under light sources, could be exposed to an increased risk of predation than they are currently.

Impacts to aquatic habitat function associated with permanent overwater lighting are expected to be minimal, as overwater lighting is expected to be comparable to that associated with the existing bridges. 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.

8.8.3 Effects to Critical Habitats

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

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be affected by overwater lighting, as they do not occur within the portion of the action area where these effects will occur.

Overwater lighting associated with the proposed action 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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- "migratory" and "water quantity/quality" PBFs for bull trout.
- "freshwater spawning" and "freshwater migration" PBFs for Pacific eulachon

Temporary overwater lighting associated with temporary work structures may represent a partial impediment to movement for adults and/or outmigrating juvenile fish, and may result in increased predation pressure.

Impacts to aquatic habitat function associated with permanent overwater lighting are expected to be minimal, as overwater lighting is expected to be comparable to that associated with the existing bridges. 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. Overwater lighting associated with 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 Avian Predation

Temporary and permanent overwater structures associated with the proposed action may have an effect on avian predation on juvenile salmonids and eulachon in the vicinity of the existing and proposed bridges.

8.9.1 Effects Discussion

Avian predation of juvenile salmonids is documented as a limiting factor for salmon recovery in the Columbia River basin (LCFRB 2010a). Adult and juvenile Pacific eulachon are also subject to avian predation. Caspian terns, double-crested cormorants, and various gull species are the principal avian predators in the lower Columbia River, and all of these species occur within the vicinity of the project site. The existing bridges currently provide abundant perching opportunity for piscivorous birds, though extensive use by terns, cormorants, or other piscivorous birds has not been documented.

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.

8.9.2 Effects to Species

The following ESA-listed species have the potential to be exposed to effects associated with changes in avian predation pressure because of their potential or documented presence within the action area.

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

Southern DPS green sturgeon, SRKW, and streaked horned lark will not be exposed to any effects of avian predation pressure, as they do not occur within the portion of the action area where these impacts will occur. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to avian predation pressure will occur, and their potential for exposure is discountable.

Permanent overwater structures will persist at the project site, so all species and life stages of salmon, steelhead, and Pacific eulachon that are present within the portion of the action area that is at the project site will be exposed to potential effects of changes in avian predation pressure.

Similarly, temporary overwater structures will occur at various times throughout the construction of the proposed action and demolition of the existing bridge. These impacts may occur during all months of the year, and as such, all species and life stages of salmon, steelhead, and Pacific eulachon that are present within the portion of the action area that is at the project site could potentially be exposed to these potential effects.

Caspian terns, double-crested cormorants, and various gull species are the principal avian predators in the lower Columbia River. The existing bridges currently provide perching opportunity for piscivorous birds, though extensive use by terns, cormorants, or other piscivorous birds has not been documented.

Temporary work structures may increase avian predation pressure within the action area for outmigrating juvenile salmon, steelhead, and for adult and juvenile Pacific eulachon. 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 human and mechanical activity during construction is also likely to deter perching on many temporary structures. Nevertheless, some individuals may be subject to increased predation pressure.

The permanent replacement bridges would 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 Columbia River bridges that is located above the bridge deck offers greater opportunities for birds to perch undisturbed. The new Columbia River bridges will likely provide fewer overhead perching opportunities. Perching opportunity on the replacement North Portland Harbor bridges would be comparable to that associated with the existing North Portland Harbor bridge, though it could be slightly higher given the increase in the total number of permanent structures.

8.9.3 Effects to Critical Habitats

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

- Chinook salmon – LCR, UWR, UCR-SR, SR-SSR, SR-FR ESUs
- Coho salmon – LCR ESU
- Chum salmon – CR ESU
- Sockeye Salmon – Snake River ESU
- Steelhead – LCR, UWR, MCR, UCR, and SRB DPS
- Pacific eulachon – Southern DPS

- Bull trout – Coastal Recovery Unit

Designated critical habitats for green sturgeon, SRKW, and streaked horned lark will not be affected by changes in avian predation pressure, as they do not occur within the portion of the action area where these effects will occur.

Changes in avian predation pressure associated with the proposed action 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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- "freshwater rearing" PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- "migratory" and "water quantity/quality" PBFs for bull trout.
- "freshwater spawning" and "freshwater migration" PBFs for Pacific eulachon

Temporary changes in avian predation pressure associated with temporary work structures may reduce habitat suitability for adults and/or outmigrating juvenile fish, by exposing individual fish to increased predation pressure. 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.

Impacts to aquatic habitat function associated with the replacement bridges are expected to be minimal. It is expected that the replacement bridges will provide comparable or less than the perching habitat that is available on the existing bridge. The steel superstructure of the existing Columbia River bridges that is located above the bridge deck offers greater opportunities for birds to perch undisturbed. The new Columbia River bridges will likely provide fewer overhead perching opportunities. Perching opportunity on the replacement North Portland Harbor bridges would be comparable to that associated with the existing North Portland Harbor bridge, though it could be slightly higher given the increase in the total number of permanent structures. Changes in avian predation pressure associated with the proposed action will not result in any long-term degradation of any PBF of designated or proposed critical habitat for any species.

8.10 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 rebuilt impervious surfaces, and CIAs, by the proposed action.

As noted in Section 3.4.12, the proposed post-project stormwater management 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.

8.10.1 Effects Discussion

Stormwater runoff from roads conveys pollutants to surface waterbodies, sometimes at concentrations that are toxic to fish (Spence et al. 1996). Stormwater runoff from roads is known to contain pollutants such as hydrocarbons and heavy metals, which could reach aquatic systems and degrade water quality. The primary pollutants of concern to aquatic species and habitats have historically been heavy metals (zinc and copper) and total suspended solids (turbidity).

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. Additionally, current research indicates that adult and juvenile coho salmon are particularly vulnerable to lethal effects of exposure to a chemical known as 6PPD-q, which is a chemical derivative of 6PPD, an organic chemical that is widely used as an antiozonant and antioxidant in rubber tires. Related research from Canada suggests that Chinook salmon and steelhead could potentially be negatively affected by 6PPD-q (Brinkmann et al. 2022).

Many stormwater pollutants are persistent in the aquatic environment, travel long distances in solution or adsorbed onto suspended sediments, and may become remobilized or re-enter solution as they move through the system. 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 aquatic species, either directly or via biomagnification. For this reason, effects associated with stormwater pollutants in riverine systems have the potential to affect aquatic species and habitats not only where they enter the surface waters, but also downstream.

Stormwater-delivered pollutants can affect the physiological or behavioral performance of fish and other aquatic species 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 and other aquatic species 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.

8.10.1.1 Temporary Construction Stormwater

Construction activities associated with the proposed action, 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 casting areas represent a potential source of pollutants. Construction stormwater runoff from these sites could include sediment, oils, greases, metals, and/or high-pH water from concrete clean out.

Construction activities, including materials staging and casting, will be conducted consistent with federal, state, and local regulatory requirements regarding construction stormwater management. 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 ESCP for construction activities. 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.

BMPs that will be implemented to avoid and minimize potential effects from construction stormwater are identified in Section 4.3. These measures will effectively reduce the potential for impacts to ESA-listed species or critical habitats from construction stormwater.

8.10.1.2 Permanent Water Quality Treatment

As described in Section 3.4.12, most of the stormwater runoff from existing ISA associated with the proposed action is currently untreated. At present, approximately 21.2 acres out of the 177.6 acres of existing ISA receives water quality treatment or dispersion and infiltration. Stormwater from the existing Columbia River bridges currently passes directly to the aquatic environment untreated. Similarly, contaminants from vehicles using these existing bridges (fuel, oil, lubricants, trace heavy metals from brake pads, etc.) currently pass directly to the aquatic environment, uncaptured and untreated.

Figures 3-29 through 3-32 in Section 3.4.12 identify the ISA associated with the proposed action. This includes those impervious surfaces that will be either new, rebuilt, or resurfaced as a result of the proposed action. Table 3-10 documents the net change in ISA by drainage area. The proposed action will result in approximately 36.6 acres of net new ISA, which represents an increase of approximately 20.6%.

Stormwater treatment for the proposed action will be consistent with the standards established in the FAHP BO, which uses CIA to establish treatment requirements (CIA is defined and described in greater detail in Section 3.4.12). Table 3-11 provides a summary of the post-project CIA by watershed. The total Post-Project CIA for the proposed action is estimated to be approximately 214.2 acres.

Water quality treatment will be provided for 100% of the approximately 214.2 acres of post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current conditions.

Table 3-12 through Table 3-15 provide a summary of the preliminary design for stormwater treatment. Runoff from 100%of the CIA will be treated or infiltrated. For purposes of this consultation, it is assumed that water quality treatment will be provided, where space allows, through the use of bioretention facilities. Where space is not available for bioretention treatment, the project will most likely use either biofiltration swales or compost-amended vegetated filter strips.

One reason for prioritizing the use of biofiltration BMPs is their effectiveness at reducing levels of 6PPD-q in stormwater. Ecology funded a literature review on the effectiveness of stormwater treatment BMPs to reduce levels of tire-derived chemicals including 6PPD-q (Ecology 2022b). The published findings of this study indicated that the flow and treatment BMPs that provide the highest levels of reduction in 6PPD and 6PPD-q are (1) dispersion BMPs, (2) infiltration BMPs, (3) biofiltration BMPs that use bioretention soil media or compost (where the underlying soils meet soil suitability criteria), and (4) other BMPs that provide the treatment process sorption (Ecology 2022b). The literature review also notes the importance of source control (design considerations that separate a source of pollutants from stormwater).

It is important to note that even treated stormwater contains some level of pollutants. Treatment BMPs are not 100% efficient, and will not completely eliminate discharges of pollutants to receiving waterbodies. 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 new, existing, and rebuilt impervious surfaces. The existing bridges 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 of the significant increase in the level of treatment proposed for existing impervious surfaces, the total exposure level is expected to be less than is currently experienced.

8.10.2 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 – Snake River 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 existing stormwater outfalls, downstream to the mouth of the river.

Because stormwater-related impacts will occur on a year-round basis, all species and life stages of salmon, steelhead, 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. Bull trout within the Coastal Recovery Unit are not known or expected to occur frequently within the portion of the action area where impacts related to stormwater will occur, and their potential for exposure is discountable.

As described in Section 8.10.1 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 bridges, which represent 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 bridges 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. 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.

8.10.3 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 – Snake River 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 existing stormwater outfalls downstream to the mouth of the river will be potentially affected by stormwater from the proposed action.

Discharges of both treated and untreated stormwater from water quality treatment BMPs 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; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- “freshwater rearing” PBF for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- “estuarine” PBF for all ESU/DPS of salmon and steelhead in tidally influenced portions of the action area.
- “migratory” and “water quantity/quality” PBFs for bull trout.
- “freshwater spawning” and “freshwater migration” PBFs for Pacific eulachon
- “prey items”, “flow regime”, “water quality”, “migratory”, and “sediment quality” PBF for Southern DPS green sturgeon.

As described in Section 8.10.1 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 bridges, which represent 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.

The proposed stormwater treatment and removal of the existing bridges as a source of untreated stormwater will reduce both the loading and concentration of pollutants delivered to the aquatic system in stormwater, and the proposed action will therefore have a net long-term beneficial effect to the above-described PBFs of designated critical habitat.

8.11 Changes in Land Use

An extensive body of research provides insight into the complex relationship between transportation infrastructure and land use. Different types of transportation system changes can have different types and degrees of effects on land use. For example, some types of roadway improvement projects can reduce travel times between points and improve access to developable areas further from the urban center, shifting a portion of future growth to the periphery and encouraging automobile-oriented development (Tidd et al. 2013). Other types of roadway improvements do not have this effect. Similarly, some transit projects can lead to increased development density around transit stations, while others do not. Integration of regional transportation planning with local land use planning can help to coordinate the nature and pattern of land development with available transportation services (NCHRP 1999). Effective local plans and policies of the types that exist in Oregon and Washington have been shown to control potential unplanned growth and land use changes resulting from transportation investments (CH2M Hill 2006).

Because the IBR Program is a multimodal project, it has the potential to promote both automobile-oriented and/or transit-oriented development. In general, automobile-oriented development tends to occur at relatively low densities around the urban periphery; while local and regional land use plans allow some of this type of development, they generally attempt to limit it because it is considered to be an inefficient method of accommodating population and employment growth and results in relatively higher costs, higher environmental impacts, and a greater consumption of land.

In contrast, transit-oriented development is often higher density, in an already urbanized area, and is typically a more efficient method of accommodating future growth. Concentrating growth may help protect listed species and their habitat from habitat loss or conversion. However, other potential effects, such as vehicle-generated stormwater contaminants, may worsen with increased traffic densities in growing urban areas, without proper environmental protections. The proposed action may encourage redevelopment adjacent to or near proposed light-rail stations in downtown Vancouver and on Hayden Island. Because these areas are already within a highly developed corridor adjacent to the interstate, habitat for terrestrial species is of limited quantity and quality and impacts to terrestrial species would be minimal. Impacts to aquatic habitats associated with redevelopment activities could result from fill placement within wetlands or waterbodies, or from stormwater runoff from new impervious surfaces.

Applicable federal, state, and local environmental regulations would minimize impacts from any such redevelopment activities. Local regulations require the avoidance and minimization of impacts to sensitive resources including shorelines, wetlands, and riparian habitats. For activities that require fill within wetlands or waterbodies, federal laws such as the Clean Water Act, the Rivers and Harbors Act, and the ESA require analysis and approval by federal agencies to ensure that impacts are avoided, minimized, and compensated for. Likewise, State agencies including WDFW, ODFW, DSL, and Ecology have policies and regulatory frameworks in place that require avoidance, minimization, and compensation. State land use laws and local land use code requirements would minimize the potential for unplanned growth and land use changes by requiring all development to be consistent with existing comprehensive plans and zoning regulations.

The proposed action also has the potential to affect how traffic moves through the action area. The tolling program that will likely be implemented for the replacement bridge crossing (See Section 3.2.8) could cause some drivers to seek an alternate crossing at the I-205 bridge. If enough vehicles were to divert to an alternate route, this could result in effects such as increased stormwater pollutant loads in areas where vehicle traffic increases occur.

A regional travel demand model was run for both a no-build scenario and for the proposed action. The model considered background assumptions that included highway, transit, and tolling changes, all of which will have the potential to impact overall travel demand and traffic patterns regionally, including crossings on both I-5 and I-205 between the Portland area and Clark County in Washington.

Table 8-4 highlights the anticipated overall change in vehicle crossings for both I-5 and I-205 as well as overall totals, which are expected to be lower than the no-build scenario by approximately 3% on an average weekday. The model indicates that the proposed action is likely to result in an approximately 2% shift in the relative distribution of crossings at the I-205 bridge. This relatively minor increase would not result in any measurable or significant effects to listed species or critical habitats that would otherwise expand the action area.

Results of the regional travel demand model indicate a likely increase in the transit mode share, as a result of both the improved transit investment as part of the Program and from the introduction of variable-rate tolling on the Interstate Bridge. This is expected to result in a corresponding decrease in the relative amount of vehicle traffic compared to the no-build scenario. The net reduction in vehicular traffic and increase in transit mode share results in an overall lower amount of vehicle miles traveled on an average weekday in the Portland region. The overall reduction is close to 93,000 miles reduced per weekday which is approximately 1% change from the No-Build Alternative.

Table 8-4. 2045 Forecast Average Weekday Daily Traffic Volumes

Location	Existing AWDT	2045 No-Build AWDT [1]	2045 Proposed Action AWDT [2]
Total River Crossing	313,000	400,000 (+28%)	389,000 (-3%)
I-5 Bridge	143,400	180,000 (+26%)	175,000 (-3%)
I-205 Bridge	169,600	220,000 (+30%)	214,000 (-3%)

Source: ODOT/WSDOT, Metro/RTC Regional Travel Demand Model, IBR Analysis 2022

1 Percentages reflect change from existing 2019 conditions.

2 Percentages reflect change from 2045 No-Build Alternative.

AWDT = average weekday daily traffic

In summary, the proposed action is expected to encourage more compact development and/or redevelopment within existing urban areas that should accommodate future growth more efficiently, reducing potential loss of habitat and impervious surface throughout the region. By concentrating future regional population and employment growth in North Portland and downtown Vancouver, the proposed action should reduce development pressure in outlying areas that is more likely to result in loss of previously undisturbed habitat and incur a greater development footprint to accommodate this growth. Any redevelopment or development activities that are induced as an effect of the proposed action will be required to be conducted in compliance with the laws and regulations described above, and as such, any indirect changes in land use patterns are not expected to result in adverse effects to any ESA-listed species or to designated critical habitats.

8.12 Effects to Prey Base for Southern Resident Killer Whales

Salmon and steelhead are a critical dietary component for SRKW. The Columbia River and North Portland Harbor provide migration and foraging habitat for habitat for juvenile and adult salmon and steelhead, as well as some limited rearing habitat for certain populations of juvenile salmon and steelhead. Direct effects to these species associated with the proposed action have the potential to affect the prey base for SRKW.

Construction of the proposed action would be conducted consistent with federal, state, and local regulatory requirements, and consistent with the BMPs and minimization measures outlined in Section 4. Given the short-term nature of effects to individual fish, and the long-term beneficial effects to fish habitat that are anticipated to occur as a result of mitigation and conservation measures, the construction of the proposed action will not result in any measurable or significant effect on the distribution or abundance of potential prey species for SRKW.

For this same reason, the proposed action is also not likely to adversely affect designated critical habitat for SRKW, as it will not significantly affect the function of any physical or biological features of designated critical habitat for killer whales.

8.13 Effects Associated with Consequences of other 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 3.4.8, consequences that are reasonably certain to occur include long-term maintenance and operation of the replacement bridge, and project-related mitigation and conservation 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 3-16 presents a summary of the project-related impacts that may require compensatory mitigation, and the potential types of mitigation and conservation actions that may ultimately be developed for the project. Potential mitigation and conservation actions associated with the proposed action 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, or installation of large woody debris. Mitigation activities may also include purchase of mitigation credits in an approved mitigation bank.

Mitigation and conservation 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 the federal action agencies determine that one or more compensatory mitigation activities associated with this project are ultimately outside the scope of this consultation, re-initiation of consultation may be necessary.

8.14 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."[14] 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 BO. 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.

[14] 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 9-1 lists the effects determinations for ESA-listed species and species proposed for listing, while Table 9-2 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 9-1. Effect Determination Summary – Species

Common Name	Scientific Name	ESU or DPS	Federal Status[a]	Effect Determination[b]
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*	Snake River ESU	E	LAA
Steelhead	*Oncorhynchus mykiss*	LCR DPS	T	LAA
		UWR DPS	T	LAA
		MCR DPS	T	LAA
		UCR DPS	T	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
Killer whale	*Orcinus orca*	Southern Resident DPS	E	NLAA
Streaked horned lark	*Eremophila alpestris strigata*	N/A	T	NLAA

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

Table 9-2. Effect Determination Summary – Critical Habitats

Common Name	Scientific Name	ESU or DPS	Critical Habitat Status[a]	Effect Determination[b]
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*	Snake River 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
Killer whale	*Orcinus orca*	Southern Resident DPS	D	NLAA
Streaked horned lark	*Eremophila alpestris strigata*	N/A	D	NE

a D = Designated; P = Proposed

b 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; Snake River 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.

- Portions of the action area provide migratory habitat for adult and juvenile LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- Portions of the action area also provide suitable rearing habitat for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- The proposed action will result in the following: (1) temporary impacts to water quality during construction; (2) temporary hydroacoustic and terrestrial noise impacts during construction; (3) temporary impacts to aquatic and terrestrial habitats during construction; (4) permanent impacts to aquatic and terrestrial habitats associated with new and replacement structures, and restoration of aquatic and terrestrial habitats associated with removal of existing structures; (5) permanent effects related to hydraulic shadowing from in-water bridge piers; (6) permanent impacts to individual fish associated with work area isolation and fish salvage; (7) temporary and permanent impacts associated with overwater lighting, (8) temporary and permanent changes in avian predation pressure, and (9) impacts associated with stormwater runoff from contributing 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 adults and/or juveniles of these ESU/DPS could be present within portions of the action area at the project site.

- Impact pile driving and debris removal will be limited to specific IWWWs. However, 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 approximately 300 feet upstream and downstream of the project site.

- If present in this portion of the action area during construction, ESA-listed salmon or steelhead could potentially be exposed to temporarily impaired water quality conditions.
- 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 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 (September 15 – April 15) overlaps a portion of the run timing for adults and juveniles of each of the above-named ESU/DPS.
- Adult and juvenile fish that are present within the injury zones during impact pile driving will likely be adversely affected. 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 bridges, which could affect habitat suitability.

- Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, platforms, and piers, drilled shaft isolation casings, sheet pile cofferdams, barges and temporary piles associated with these structures will temporarily reduce habitat availability and suitability at the project site. These effects will be temporary and will return to full function upon removal.
- The project will result in new permanent benthic habitat impacts, water-surface level and elevated overwater shading from the replacement bridges, and new fill within the floodplain. These impacts will be appropriately avoided and minimized, and compensatory mitigation will be provided as necessary to satisfy regulatory requirements and achieve no net loss of habitat function.

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 within the project site during installation of the work area isolation structures and fish salvage activities could be captured and directly handled.
- Work area isolation and fish handling activities may be conducted at any time of the year, and as such may overlap a portion of the run timing for both adults and juveniles of each of the above-named ESU/DPS.
- These adverse effects will be appropriately minimized through the avoidance and minimization measures described in Section 4.

The proposed action will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the action area.

- Adult and/or juvenile fish of these ESU/DPS are known to occur within the action area, and when present will be exposed to pollutants delivered by stormwater runoff from contributing impervious surfaces associated with the proposed action.
- Stormwater treatment will be provided for all post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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.

9.1.2 Bull Trout – Coastal Recovery Unit

The proposed action **"may affect, and is not 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 potentially suitable habitat for bull trout.

- The portion of the action area that is within the Columbia River and North Portland Harbor at the project site and downstream represent potentially 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.

A **"not likely to adversely affect"** determination is warranted based on the following:

- Bull trout have only rarely been documented within the portions of the action area that are within the mainstem Columbia River and North Portland Harbor. There are few documented bull trout sightings, and most are historic.
- Given the lack of documented recent sightings, their presence is unlikely, and they are extremely unlikely to be subjected to any permanent or temporary impacts associated with the proposed action.

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.

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

The action area represents documented habitat for Southern DPS Pacific eulachon.

- The Columbia River and North Portland Harbor provide suitable migratory and spawning habitat for adult Pacific eulachon and migratory habitat for larval and juvenile Pacific eulachon.
- The proposed action will result in the following: (1) temporary impacts to water quality during construction; (2) temporary hydroacoustic and terrestrial noise impacts during construction; (3) temporary impacts to aquatic and terrestrial habitats during construction; (4) permanent impacts to aquatic and terrestrial habitats associated with new and replacement structures, and restoration of aquatic and terrestrial habitats associated with removal of existing structures; (5) permanent effects related to hydraulic shadowing from in-water bridge piers; (6) permanent impacts to individual fish associated with work area isolation and fish salvage; (7) temporary and permanent impacts associated with overwater lighting, (8) temporary and permanent changes in avian predation pressure, and (9) impacts associated with stormwater runoff from contributing 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 adults juvenile, or larval Pacific eulachon could be present within portions of the action area at the project site.

- Impact pile driving and debris removal will be limited to specific IWWWs. However, 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 approximately 300 feet upstream and downstream of the project site.

- If present in this portion of the action area during construction, adult, juvenile, or larval Pacific eulachon could potentially be exposed to temporarily impaired water quality conditions.
- 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 ESA-listed fish within portions of the action area during impact pile driving.

- The work window for impact pile-driving activities (September 15 – April 15) overlaps a portion of the run timing for adult or juvenile Pacific eulachon.
- While Pacific eulachon are non-swim-bladdered fish, and may be less susceptible to injury from underwater sound pressure, adult or juvenile Pacific eulachon that are present within the injury zones during impact pile driving may be adversely affected. 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 bridges, which could affect habitat suitability.

- Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, platforms, and piers, drilled shaft isolation casings, sheet pile cofferdams, barges and temporary piles associated with these structures will temporarily reduce habitat availability and suitability at the project site. These effects will be temporary, and will return to full function upon removal.
- The project will result in new permanent benthic habitat impacts, water-surface level and elevated overwater shading from the replacement bridges, and new fill within the floodplain. These impacts will be appropriately avoided and minimized, and compensatory mitigation will be provided as necessary to satisfy regulatory requirements and achieve no net loss of habitat function.

The proposed action has the potential to result in handling or other disturbance of individual Pacific eulachon during work area isolation and fish salvage activities.

- Adult and/or juvenile Pacific eulachon that are present within the project site during installation of the work area isolation structures and fish salvage activities could be captured and directly handled.
- Work area isolation and fish handling activities may be conducted at any time of the year, and as such may overlap a portion of the run timing for both adult and juvenile Pacific eulachon.
- These adverse effects will be appropriately minimized through the avoidance and minimization measures described in Section 4.

The proposed action will install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the action area.

- Adult and juvenile Pacific eulachon are known to occur within the Columbia River, and when present will be exposed to pollutants delivered by stormwater runoff from contributing impervious surfaces associated with the proposed action.
- Stormwater treatment will be provided for all post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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.

9.1.4 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.

- The portion of the Columbia River or North Portland Harbor that are within the action area represents suitable migratory habitat for adult green sturgeon. No spawning or juvenile rearing occurs in the Columbia River.
- Southern DPS green sturgeon are not documented or expected to occur within the portions of the Columbia River or North Portland Harbor that are within the project site. However, they are typically found in the lower reaches of the Columbia River, generally below river mile 46.

The proposed action will result in temporarily elevated underwater noise during impact pile driving, that will exceed peak and cumulative injury thresholds established for ESA-listed fish within portions of the action area during impact pile driving.

- The work window for impact pile-driving activities (September 15 – April 15) overlaps a portion of the run timing for Southern DPS green sturgeon.
- While green sturgeon are not frequently present within the portion of the action area where underwater noise will be temporarily elevated, any green sturgeon that are present within the injury zones during impact pile driving may be adversely affected. 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 install new impervious surfaces, which will contribute pollutants to stormwater, and could affect receiving waters in the Columbia River that are habitat for Southern DPS green sturgeon.

- Adult green sturgeon are known to occur seasonally within downstream portions of the action area, and when present will be exposed to pollutants delivered by stormwater runoff from contributing impervious surfaces associated with the proposed action.
- Stormwater treatment will be provided for all post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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 Southern DPS green sturgeon.

9.1.5 Southern Resident DPS Killer Whale

The proposed action **"may affect, and is not likely to adversely affect"** SRKW.

This determination is warranted, based on the following:

- SRKW rely heavily on salmon, particularly Chinook salmon, as their primary prey species. The proposed action will result in adverse effects to several ESUs/DPSs of Columbia River salmon and steelhead, and affected fish likely contribute to the prey base for SRKW during the marine phase of their lifecycle.
- While the proposed action has the potential to result in adverse effects to juvenile and adult salmonids, the extent of the effect to these populations will be avoided, minimized, and compensated for consistent with federal, state, and local regulatory requirements. As such, the proposed action will not result in any measurable or significant effect on the distribution or abundance of potential prey species for SRKW.

9.1.6 Streaked Horned Lark

The proposed action **"may affect, and is not likely to adversely affect"** streaked horned lark.

This determination is warranted, based on the following:

- Terrestrial portions of the action area represent potentially suitable foraging habitat for streaked horned lark. However, larks are not frequently documented or expected to occur within the action area. The project site does not provide suitable nesting habitat for larks, and they are unlikely to be present during construction.
- The proposed action will result in temporarily elevated terrestrial noise during construction, and temporary and permanent impacts to terrestrial habitats. While streaked horned larks utilize habitats within the terrestrial portion of the action area, the proposed action will not directly disturb any suitable nesting habitat. If individual birds are present in the vicinity of construction activities they may be temporarily affected, but the potential for adverse effect is unlikely and discountable.

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; Snake River 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 and North Portland Harbor that has been designated critical habitat for the ESUs/DPSs of salmon and steelhead listed above.

- Portions of the action area provide adequate freshwater migration PBF of critical habitat for adult and juvenile LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.
- Portions of the action area also provide adequate freshwater rearing habitat for LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon, LCR coho salmon, and LCR DPS steelhead.
- Portions of the action area in the portions of the lower river near the estuary also provide adequate estuarine PBF of critical habitat for adult and juvenile LCR, UCR-SR, SR-SSR, and SR-FR ESU Chinook salmon; LCR ESU coho salmon; Snake River ESU sockeye salmon; LCR, MCR, UCR, and SRB DPS steelhead.

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 approximately 300 feet upstream and downstream of the project site.

- Water quality impacts that may result during construction may temporarily degrade the freshwater migration and freshwater rearing 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 or proposed critical habitat for any species.

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.

- Elevated underwater noise levels during construction may temporarily degrade the freshwater migration and freshwater rearing 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 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 bridges, which could affect habitat suitability.

- Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, platforms, and piers, drilled shaft isolation casings, sheet pile cofferdams, barges and temporary piles associated with these structures will temporarily degrade the freshwater migration and freshwater rearing PBFs 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.
- The project will result in new permanent benthic habitat impacts, water-surface level and elevated overwater shading from the replacement bridges, and new fill within the floodplain. These impacts will be appropriately avoided and minimized, and compensatory mitigation will be provided as necessary to satisfy regulatory requirements and achieve no net loss of habitat

function. 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 salmon and/or steelhead during work area isolation and fish salvage activities.

- Fish salvage activities may temporarily degrade the freshwater migration and freshwater PBFs of critical habitat within 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 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, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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, freshwater rearing, 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. However, 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 quantity 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 not 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 and North Portland Harbor that has been designated critical habitat for bull trout within the Coastal Recovery Unit.

- Portions of the Columbia River and North Portland Harbor within the action area provide adequate migratory and water quantity/quality PBFs of critical habitat for bull trout.

A **"not likely to adversely affect"** determination is warranted based on the following:

The proposed action 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, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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. Given the lack of use of the action area by bull trout, and the nature of the aquatic habitat effects, the proposed action is unlikely to significantly affect the function of the physical or biological features of bull trout 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:

The proposed action will require work below the OHWM of a portion of the Columbia River and North Portland Harbor that has been designated critical habitat for Southern DPS Pacific eulachon.

- Portions of the action area provide adequate freshwater spawning and freshwater migration PBF of critical habitat for Pacific eulachon.

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 approximately 300 feet upstream and downstream of the project site.

- Water quality impacts that may result during construction may temporarily degrade the freshwater spawning and freshwater migration 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 critical habitat for Pacific eulachon.

The proposed action will result in temporarily elevated underwater noise during impact pile driving, that will exceed peak and cumulative injury thresholds established for ESA-listed fish within portions of the action area during impact pile driving.

- Elevated underwater noise levels during construction may temporarily degrade the freshwater spawning and freshwater migration 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 critical habitat for Pacific eulachon.

The proposed action will result in temporary and permanent impacts to aquatic habitat associated with the construction of the replacement bridges, which could affect habitat suitability.

- Temporary aquatic habitat impacts associated with temporary work structures including temporary work bridges, platforms, and piers, drilled shaft isolation casings, sheet pile cofferdams, barges and temporary piles associated with these structures will temporarily degrade the freshwater spawning and freshwater migration PBFs 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 critical habitat for Pacific eulachon.
- The project will result in new permanent benthic habitat impacts, water-surface level and elevated overwater shading from the replacement bridges, and new fill within the floodplain. These impacts will be appropriately avoided and minimized, and compensatory mitigation will be provided as necessary to satisfy regulatory requirements and achieve no net loss of habitat function. Therefore, this aspect of the project will not result in any long-term degradation of any PBF of critical habitat for Pacific eulachon.

The proposed action has the potential to result in handling or other disturbance of individual Pacific eulachon during work area isolation and fish salvage activities.

- Fish salvage activities may temporarily degrade the freshwater spawning and freshwater migration PBFs of critical habitat within the project site, but these effects will be temporary and will not result in any long-term degradation of any PBF of critical habitat for Pacific eulachon.

The proposed action 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, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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 spawning and freshwater migration PBFs of critical habitat in waters downstream of the project site to the mouth of the river. However, 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 critical habitat for Pacific eulachon.
- The proposed stormwater treatment and removal of the existing bridges as a source of untreated stormwater will reduce the quantity 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 critical habitat for Pacific eulachon.

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 Columbia River downstream of River Mile 46 within the action area represent designated critical habitat for Southern DPS Green Sturgeon.

- This 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.

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

The proposed action 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, including approximately 170 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current 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 water quality PBF of critical habitat in waters downstream of River Mile 46 to the mouth of the river. However, 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 critical habitat for green sturgeon.
- The proposed stormwater treatment and removal of the existing bridges as a source of untreated stormwater will reduce the quantity 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 critical habitat for green sturgeon.

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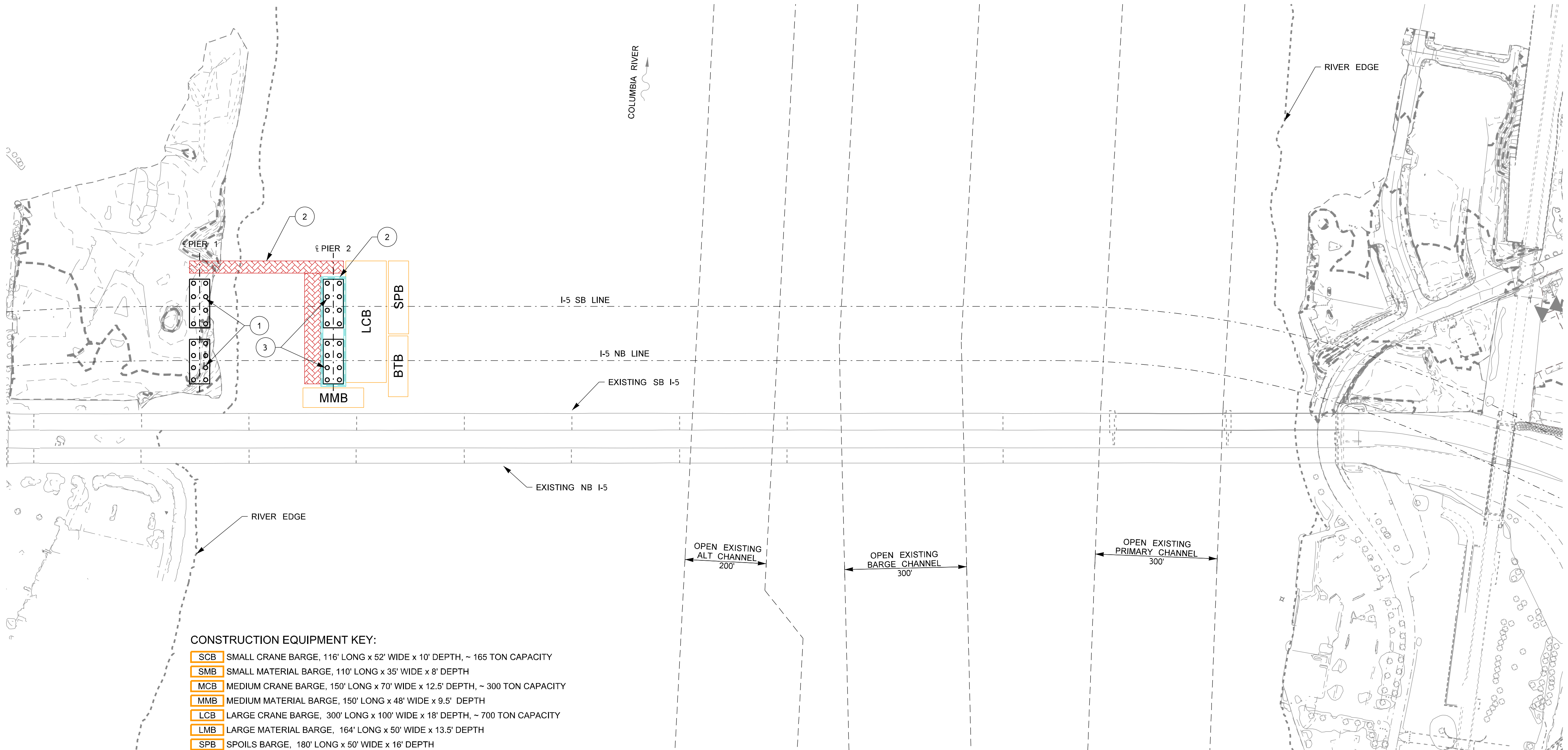
Appendix A. Conceptual Columbia River Bridges Construction Sequencing Drawings

DRAFT

CONSTRUCTION SEQUENCE:

1. CONSTRUCT DRILLED SHAFTS, SHAFT CAPS AND PIER AT PIER 1.
2. INSTALL COFFERDAM AND WORK BRIDGE AT PIER 2 FOR CONSTRUCTION OF NB AND SB SHAFTS AND SHAFT CAPS.
3. INSTALL TEMPORARY WORKS AT PIER 2, INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING, AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES.



CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

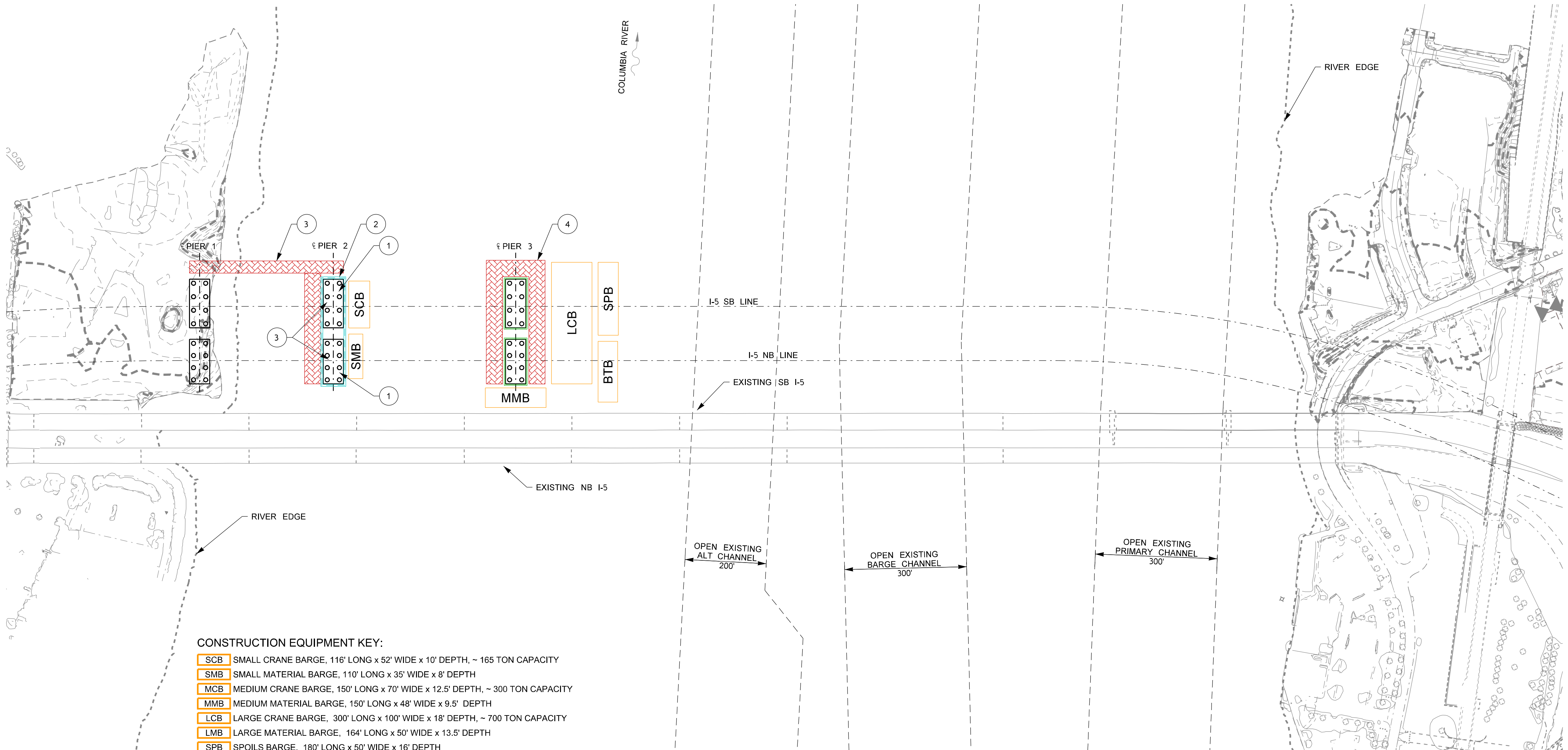
PHASE 1
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. CONSTRUCT NB AND SB SHAFT CAPS AT PIER 2.
2. REMOVE COFFERDAM AT PIER 2.
3. CONSTRUCT COLUMNS AND PIER CAP AT PIER 2 FOR NB AND SB STRUCTURES. REMOVE WORK BRIDGE.
4. INSTALL TEMPORARY WORKS AT PIER 3. INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES.



CONSTRUCTION EQUIPMENT KEY:

- SCB — SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
- SMB — SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
- MCB — MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
- MMB — MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- LCB — LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
- LMB — LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
- SPB — SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
- BTB — BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- SCIS — SHAFT CAP ISOLATION SYSTEM
- TEMPORARY WORK PLATFORM
- COFFERDAM
- PREFABRICATED SHAFT CAP

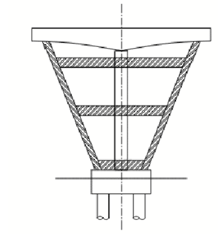
PHASE 2
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. INSTALL PERFABRICATED SHAFT CAP SEGMENTS AT PIER 3 AND CONSTRUCT SHAFT CAP ISOLATION SYSTEM. CONSTRUCT NB AND SB SHAFT CAPS.
2. CONSTRUCT COLUMNS AND PIER CAP AT PIER 3 FOR NB AND SB STRUCTURES. REMOVE TEMPORARY WORKS.
3. INSTALL TEMPORARY WORKS AT PIER 4, INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING, AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES.
4. CONSTRUCT TEMPORARY BENT NEAR PIER 1 NB.
5. INSTALL TEMPORARY BENTS ON THE PILE CAP AT EACH SIDE OF PIER 2 NB.
6. ERECT THE SOUTH END OF THE NB GIRDERS FROM PIER 1 ACROSS THE TEMPORARY BENT.
7. ERECT THE NB PIER TABLE GIRDERS AT PIER 2 ACROSS THE TEMPORARY BENTS.
8. STRAND JACK NB GIRDER PACKS INTO PLACE TO CLOSE SPAN 1.
9. REMOVE TEMPORARY BENTS FOR NB BRIDGE AND REPEAT PROCEDURE FOR SPAN 1 OF THE SB BRIDGE



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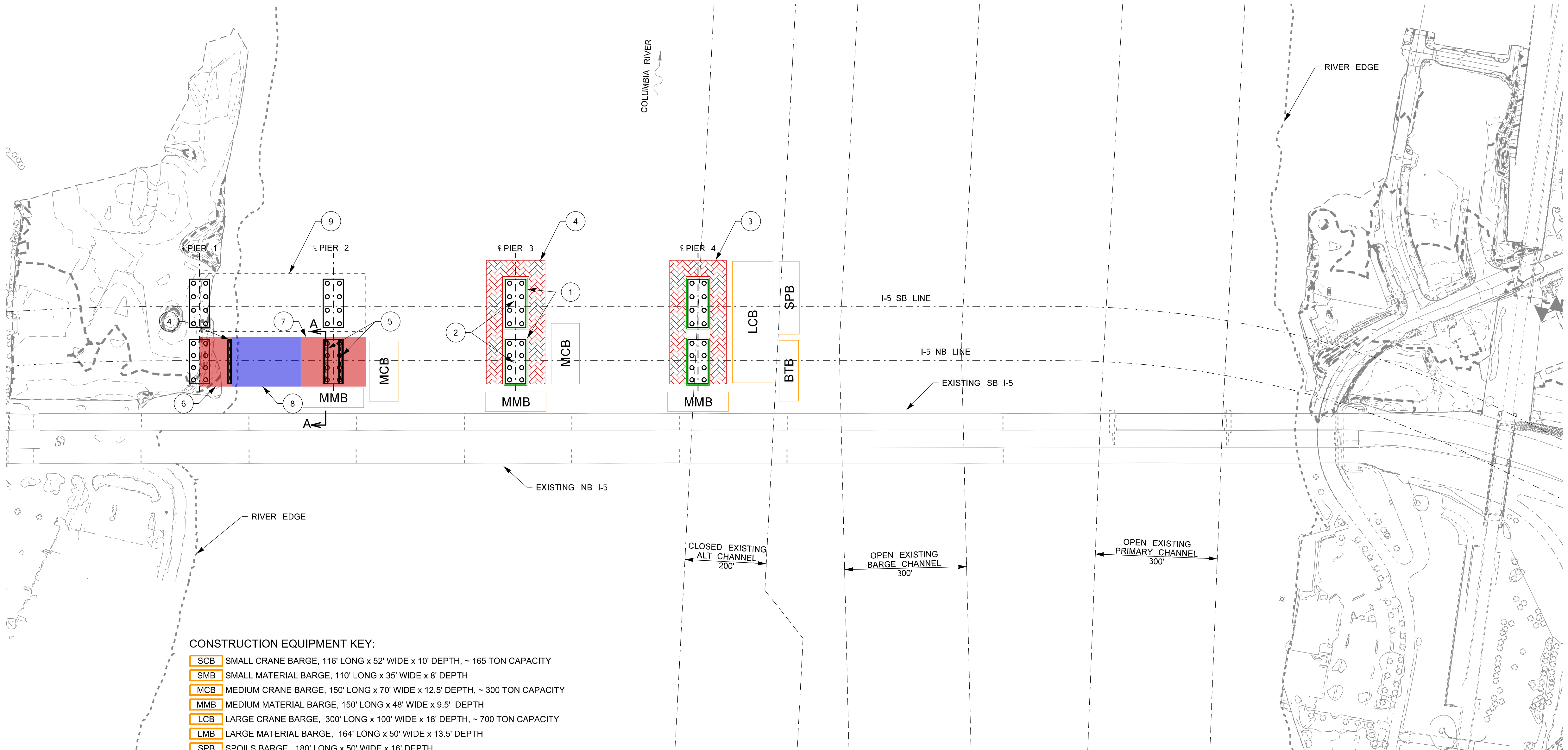


CONSTRUCTION EQUIPMENT KEY:

- SCB SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
- SMB SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
- MCB MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
- MMB MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- LCB LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
- LMB LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
- SPB SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
- BTB BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- SCIS SHAFT CAP ISOLATION SYSTEM
- TEMPORARY WORK PLATFORM
- COFFERDAM
- PREFABRICATED SHAFT CAP

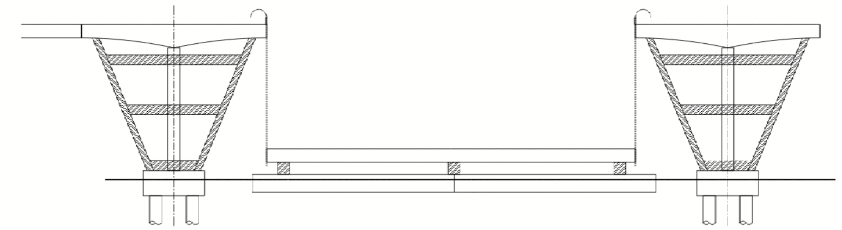
PHASE 3
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. INSTALL PREFABRICATED SHAFT CAP SEGMENTS AT PIER 4 AND CONSTRUCT SHAFT CAP ISOLATION SYSTEM. CONSTRUCT NB AND SB SHAFT CAPS.
2. CONSTRUCT COLUMNS AND PIER CAP AT PIER 4 FOR NB AND SB STRUCTURES. REMOVE TEMPORARY PIER 4 & OPEN TEMPORARY ALTERNATE BARGE CHANNEL.
3. CLOSE EXISTING BARGE CHANNEL. INSTALL TEMPORARY WORKS AT PIER 5. INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES.
4. PREASSEMBLE GIRDER PACKS FOR NB SPAN 2 ON BARGES IN STAGING NEAR SHORE.
5. INSTALL TEMPORARY BENTS ON THE SHAFT CAP AT EACH SIDE OF PIER 3 NB.
6. ERECT THE NB PIER TABLE GIRDERS AT PIER 3 ACROSS THE TEMPORARY BENTS.
7. STRAND JACK NB GIRDER PACKS INTO PLACE TO CLOSE SPAN 2.
8. REMOVE TEMPORARY BENTS FROM NB SHAFT CAP AT PIER 3 AND REPEAT PROCEDURE FOR SPAN 2 OF THE SB BRIDGE.



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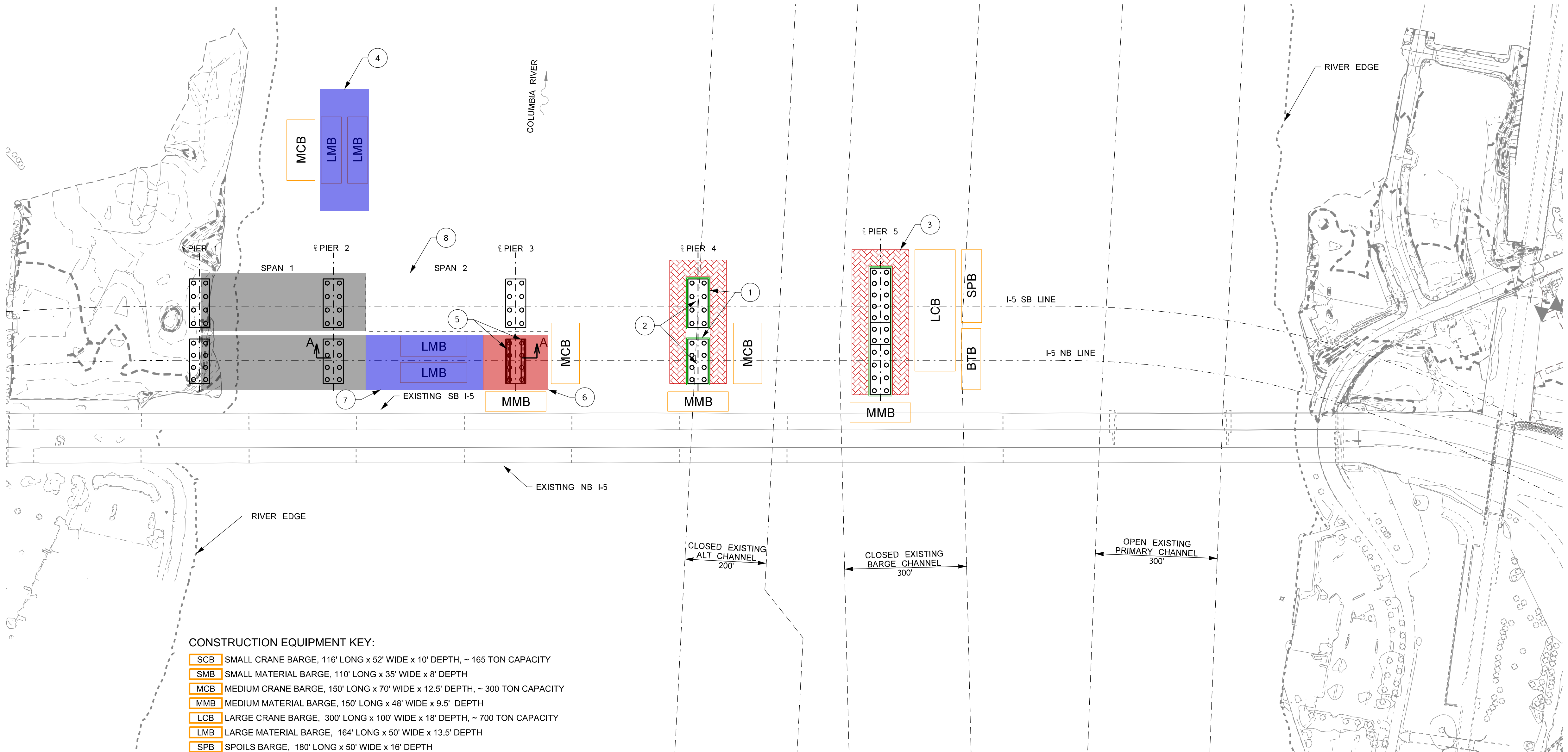


CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

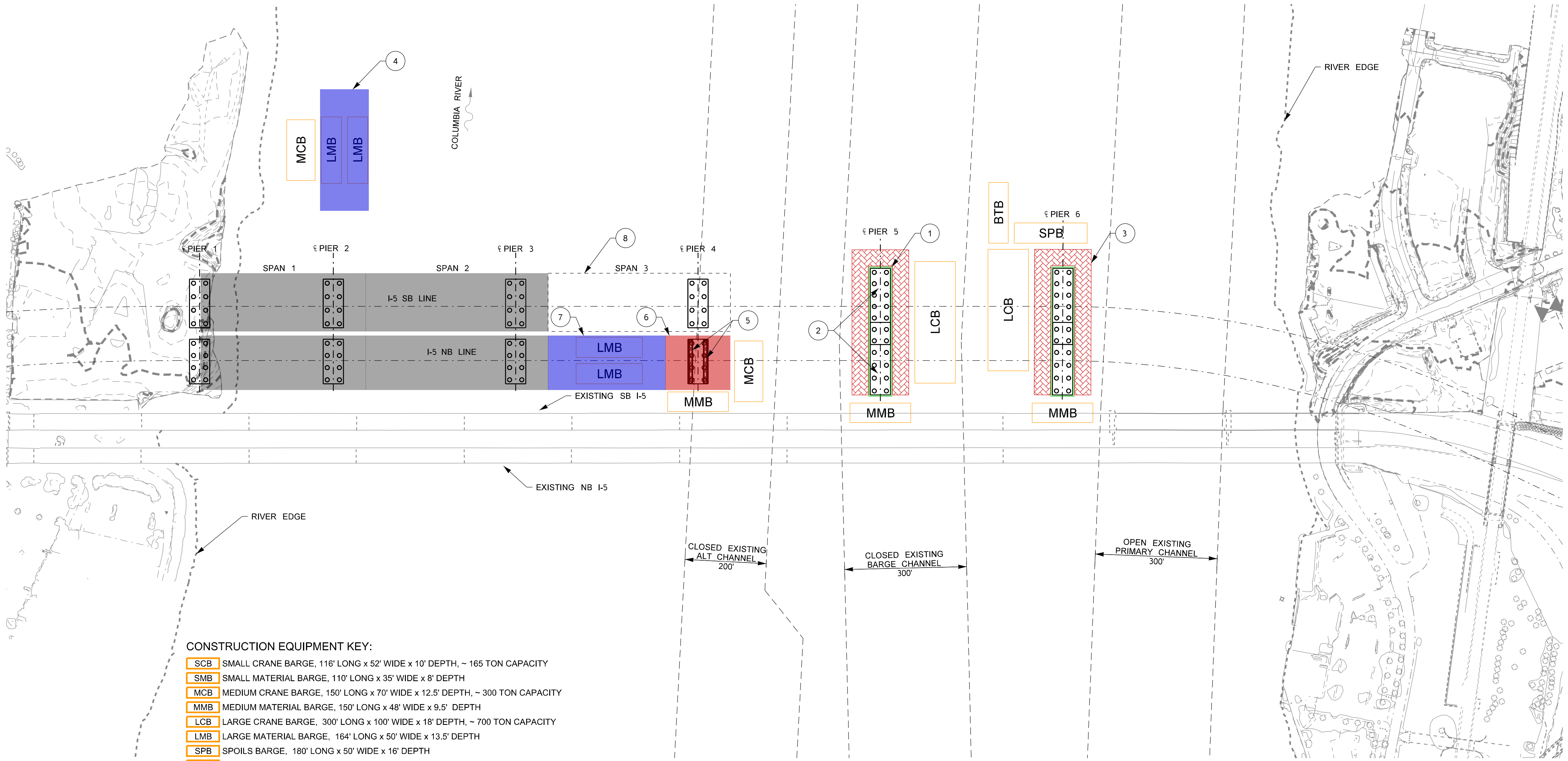
PHASE 4
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. INSTALL PREFABRICATED SHAFT CAP SEGMENTS AT PIER 5 AND CONSTRUCT SHAFT CAP ISOLATION SYSTEM. CONSTRUCT NB AND SB SHAFT CAPS.
2. CONSTRUCT COLUMNS, PIER CAP, AND VERTICAL LIFT TOWERS FOR NB AND SB STRUCTURES AT PIER 5. REMOVE TEMPORARY WORKS.
3. INSTALL TEMPORAY WORKS AT PIER 6. INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES.
4. PREASSEMBLE GIRDER PACKS FOR NB SPAN 3 ON BARGES IN STAGING NEAR THE SHORE.
5. INSTALL TEMPORARY BENTS ON THE SHAFT CAP AT EACH SIDE OF PIER 4 NB.
6. ERECT THE NB PIER TABLE GIRDERS AT PIER 4 ACROSS THE TEMPORARY BENTS.
7. STRAND JACK NB GIRDER PACKS INTO PLACE TO CLOSE SPAN 3.
8. REMOVE TEMPORARY BENTS FROM NB SHAFT CAP AT PIER 4 AND REPEAT PROCEDURE FOR SPAN 3 OF THE SB BRIDGE.



CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

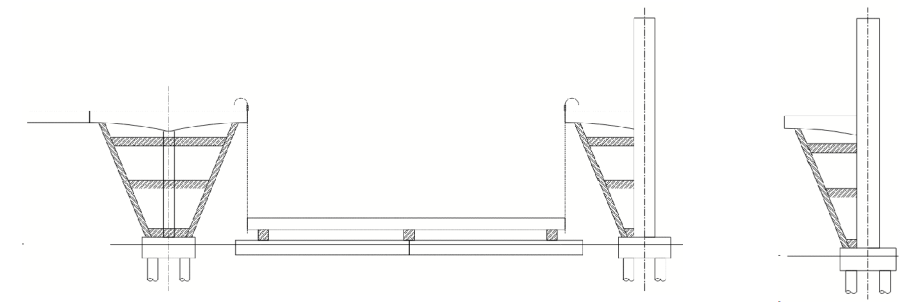
PHASE 5
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

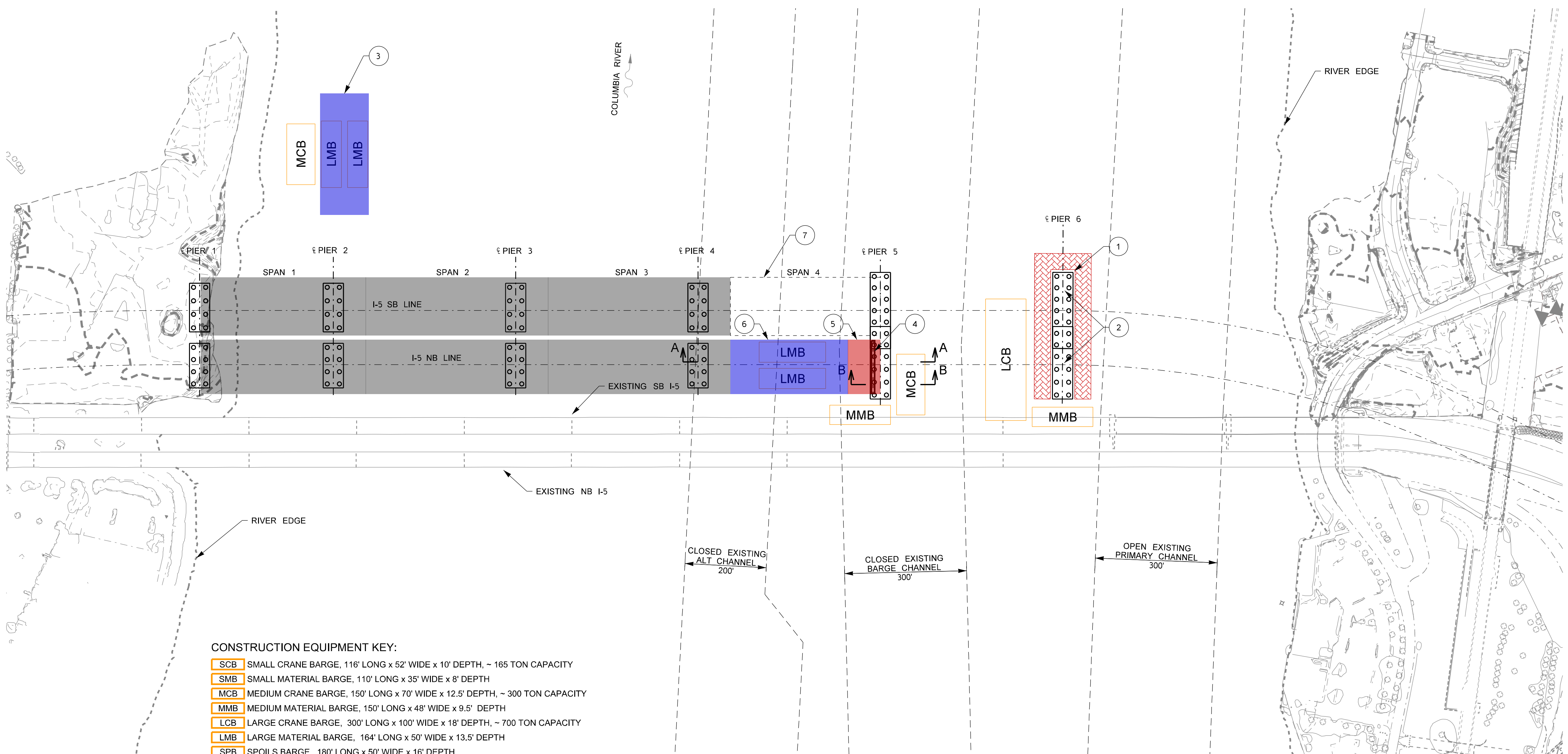
Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. INSTALL PREFABRICATED SHAFT CAP SEGMENTS AT PIER 6 AND CONSTRUCT SHAFT CAP ISOLATION SYSTEM. CONSTRUCT NB AND SB SHAFT CAPS.
2. CONSTRUCT COLUMNS, PIER CAP, AND VERTICAL LIFT TOWERS FOR NB AND SB STRUCTURES AT PIER 6. REMOVE TEMPORARY WORKS.
3. PREASSEMBLE GIRDER PACKS FOR NB SPAN 3 ON BARGES IN STAGING NEAR THE SHORE.
4. INSTALL TEMPORARY BENT ON THE SHAFT CAP ON THE SOUTH SIDE OF PIER 5 NB.
5. ERECT THE NB GIRDER ENDS AT PIER 5 ACROSS THE TEMPORARY BENT.
6. STRAND JACK NB GIRDER PACKS INTO PLACE TO CLOSE SPAN 4.
7. REMOVE TEMPORARY BENT FROM NB SHAFT CAP AT PIER 5 AND REPEAT PROCEDURE FOR SPAN 4 OF THE SB BRIDGE.





CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

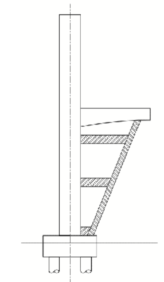
PHASE 6
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. CONSTRUCT DRILLED SHAFTS, SHAFT CAPS AND PIER AT PIER 8 SB.
2. INSTALL COFFERDAM AND WORK BRIDGE AT PIER 7 FOR CONSTRUCTION OF NB AND SB SHAFTS AND SHAFT CAPS.
3. INSTALL TEMPORARY WORKS AT PIER 7, INSTALL SHAFTS, CLEAN-OUT, INSTALL REINFORCING, AND PLACE SHAFT CONCRETE FOR NB AND SB STRUCTURES. CONSTRUCT COLUMNS AND PIER CAP AT PIER 7 FOR NB AND SB STRUCTURES. REMOVE COFFERDAM AND WORK BRIDGE.
4. CONSTRUCT TEMPORARY BENT NEAR PIER 6 SB.
5. ERECT THE SB GIRDER ENDS AT PIER 6 ACROSS THE TEMPORARY BENT.



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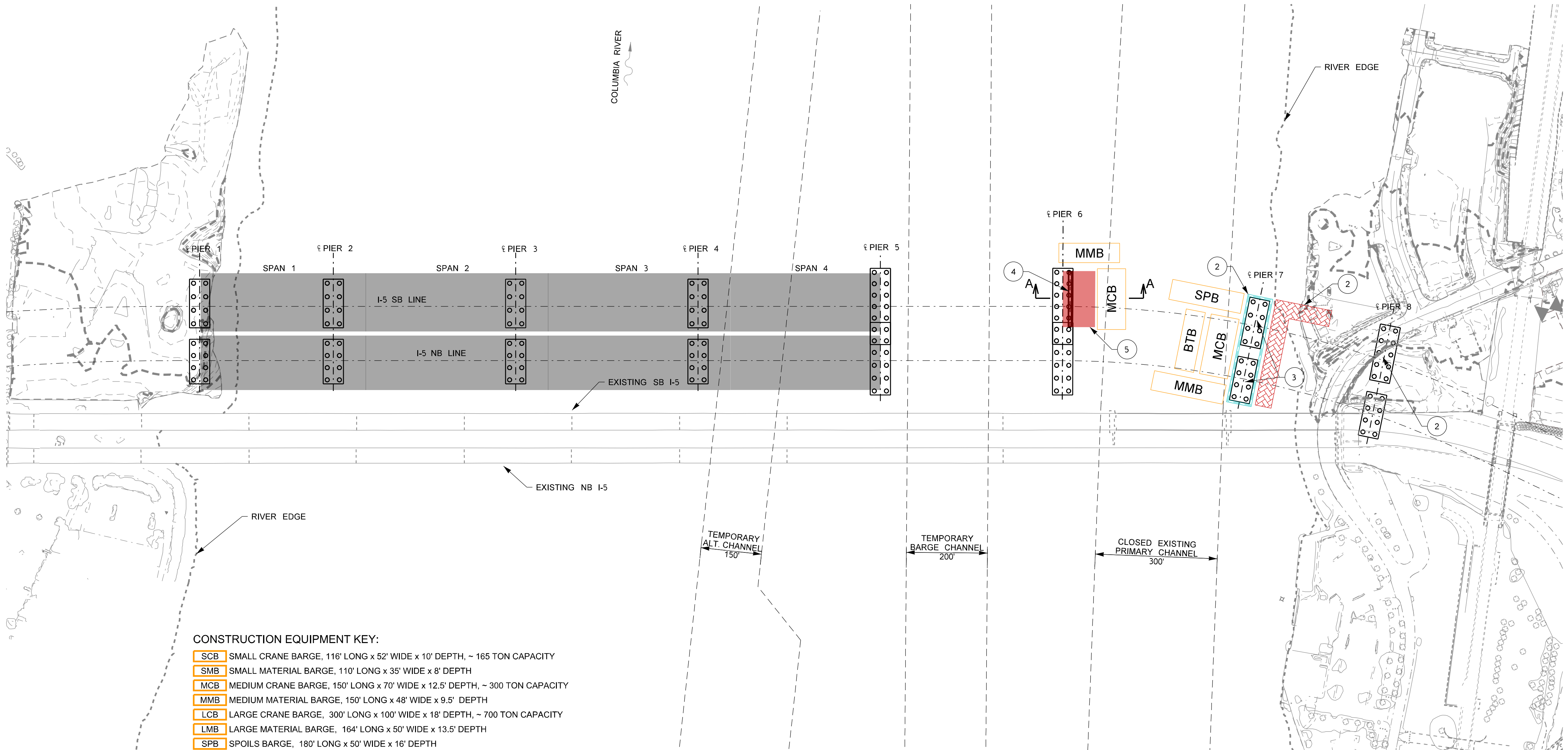

CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
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LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
(hatched red)	TEMPORARY WORK PLATFORM
(cyan dashed)	COFFERDAM
(green)	PREFABRICATED SHAFT CAP

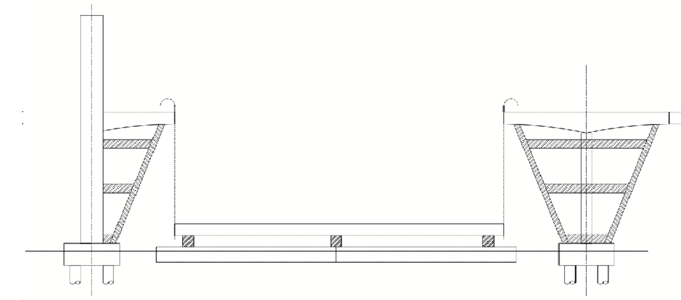
PHASE 7
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

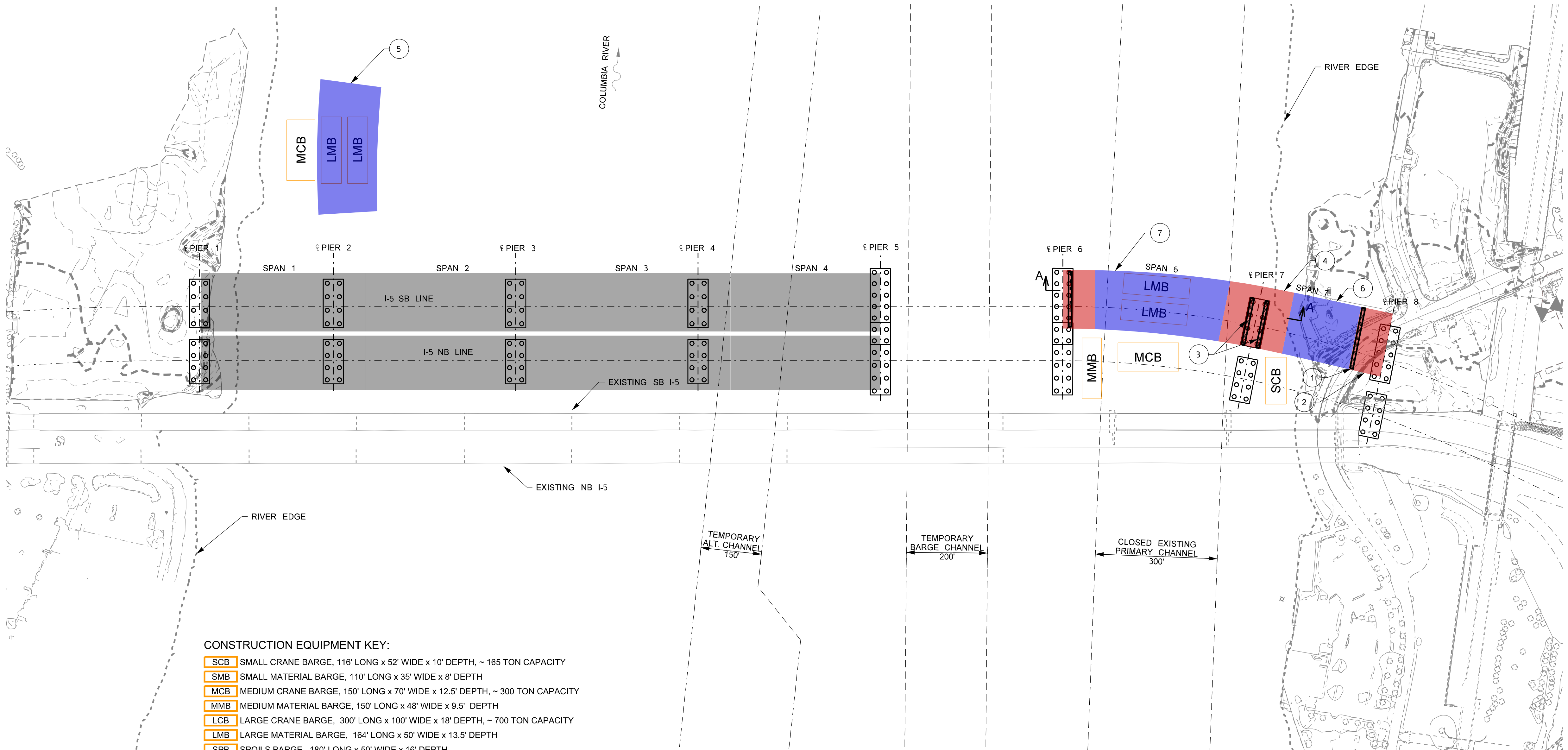
DRAFT

CONSTRUCTION SEQUENCE:

1. CONSTRUCT TEMPORARY BENT NEAR PIER 8 SB
2. ERECT THE NORTH END OF THE SB GIRDERS FROM PIER 8 ACROSS THE TEMPORARY BENT.
3. INSTALL TEMPORARY BENTS ON THE PILE CAP AT EACH SIDE OF PIER 7 SB.
4. ERECT THE SB PIER TABLE GIRDERS AT PIER 7 ACROSS TEMPORARY BENTS.
5. PREASSEMBLE GIRDER PACKS FOR SB SPAN 6 ON BARGES IN STAGING NEAR THE SHORE.
6. ERECT GIRDERS TO CLOSE SPAN 7 SB.
7. STRAND JACK SB GIRDER PACKS INTO PLACE TO CLOSE SPAN 6.



SECTION A



CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

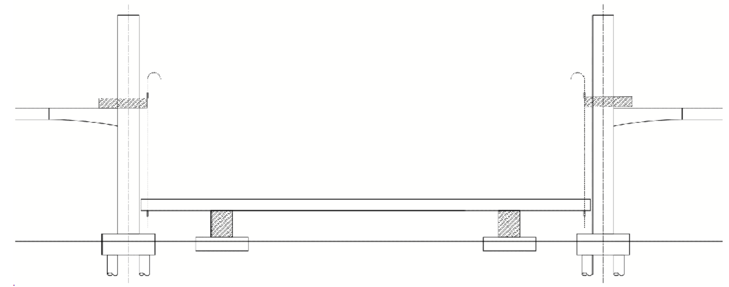
PHASE 8
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

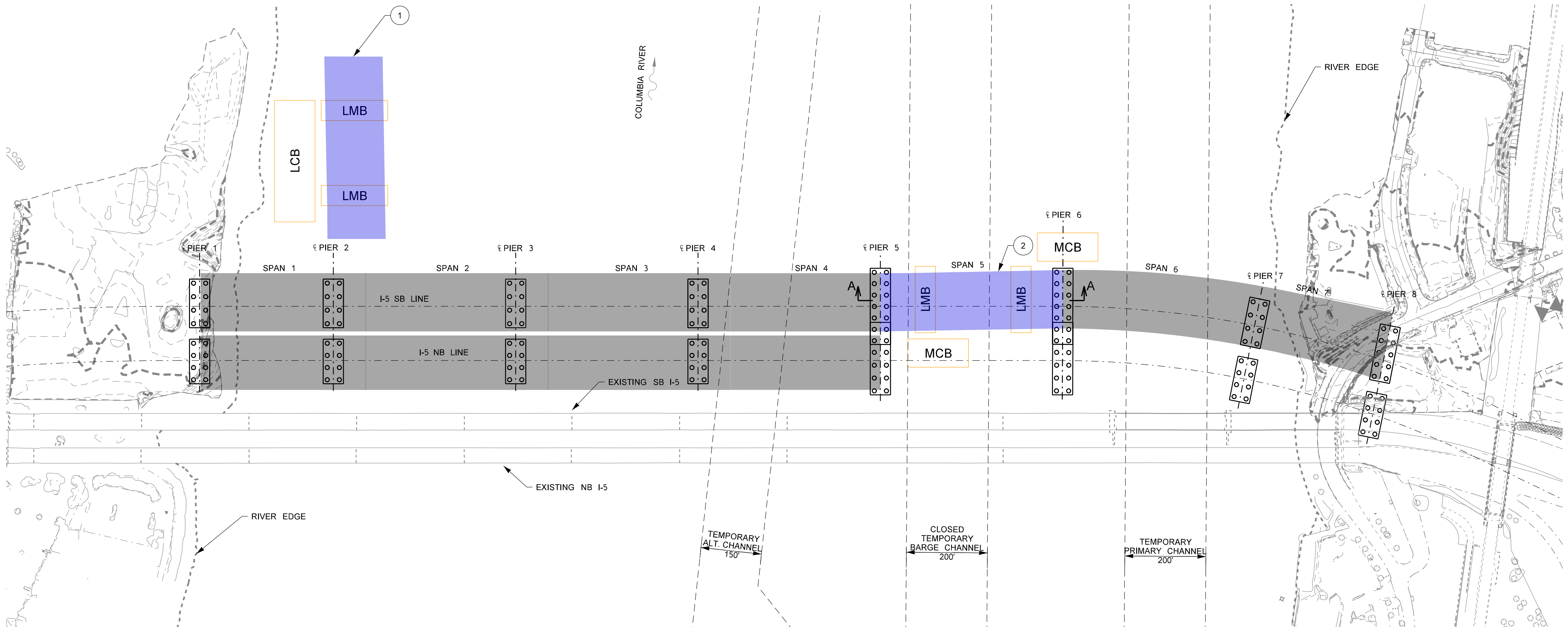
DRAFT

CONSTRUCTION SEQUENCE:

1. PREASSEMBLE LIFT SPAN FOR SB SPAN 5 ON BARGES IN STAGGING NEAR THE SHORE.
2. ERECT LIFT SPAN FOR SB SPAN 5.



SECTION A



CONSTRUCTION EQUIPMENT KEY:

- SCB — SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
- SMB — SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
- MCB — MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
- MMB — MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- LCB — LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
- LMB — LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
- SPB — SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
- BTB — BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- SCIS — SHAFT CAP ISOLATION SYSTEM
- TEMPORARY WORK PLATFORM
- COFFERDAM
- PREFABRICATED SHAFT CAP

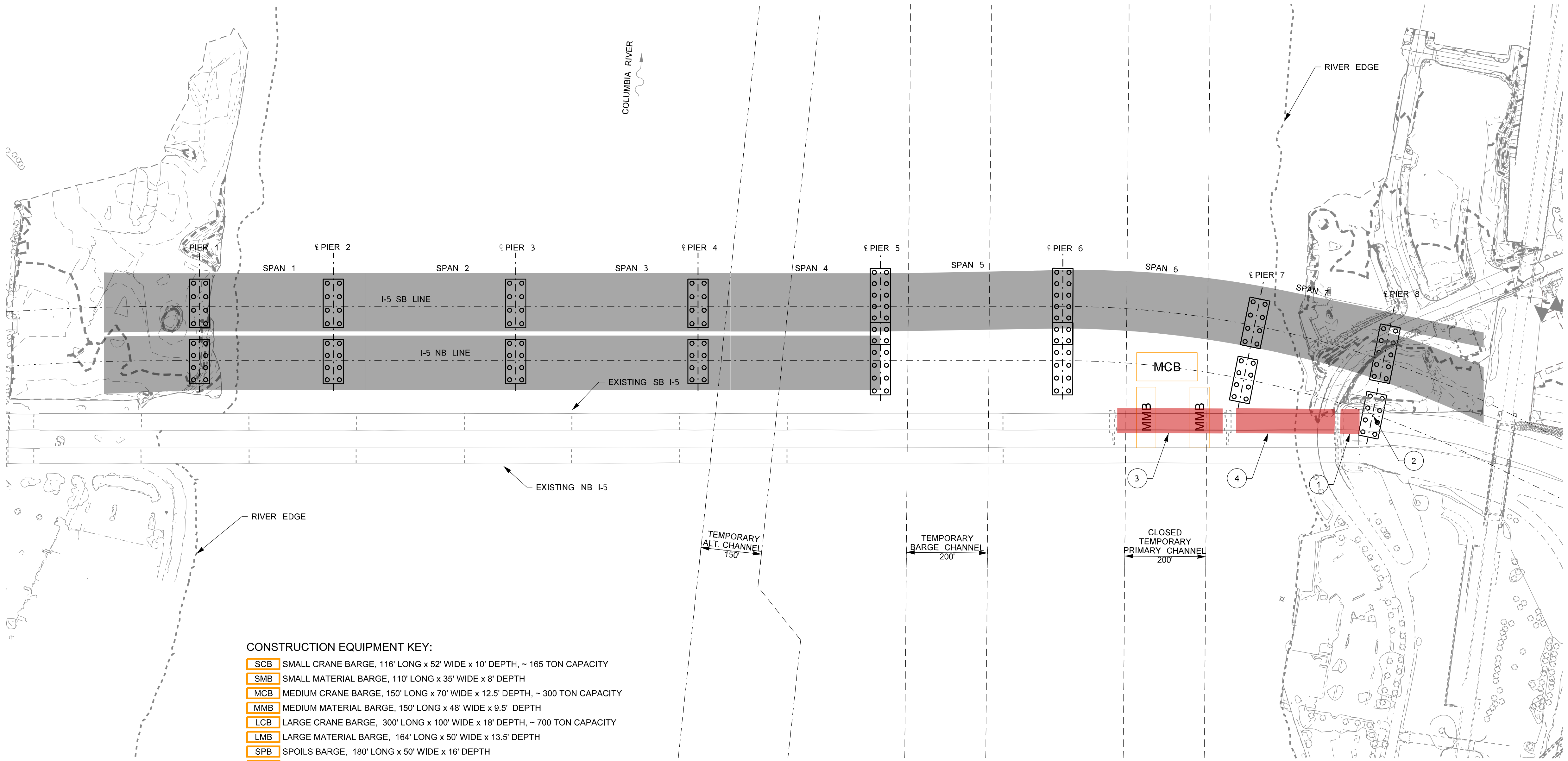
PHASE 9
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. REMOVE SPAN 1 SB OF EXISTING STRUCTURE.
2. CONSTRUCT DRILLED SHAFTS, SHAFT CAPS AND PIER AT PIER 8 NB.
3. REMOVE COUNTERWEIGHTS EXISTING SB LIFT SPAN. REMOVE EXISTING SB LIFT SPAN.
4. REMOVE SPAN 2 SB OF EXISTING STRUCTURE. EXISTING PIER 2 TO REMAIN.



CONSTRUCTION EQUIPMENT KEY:

SCB	SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
SMB	SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
MCB	MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
MMB	MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
LCB	LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
LMB	LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
SPB	SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
BTB	BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
SCIS	SHAFT CAP ISOLATION SYSTEM
	TEMPORARY WORK PLATFORM
	COFFERDAM
	PREFABRICATED SHAFT CAP

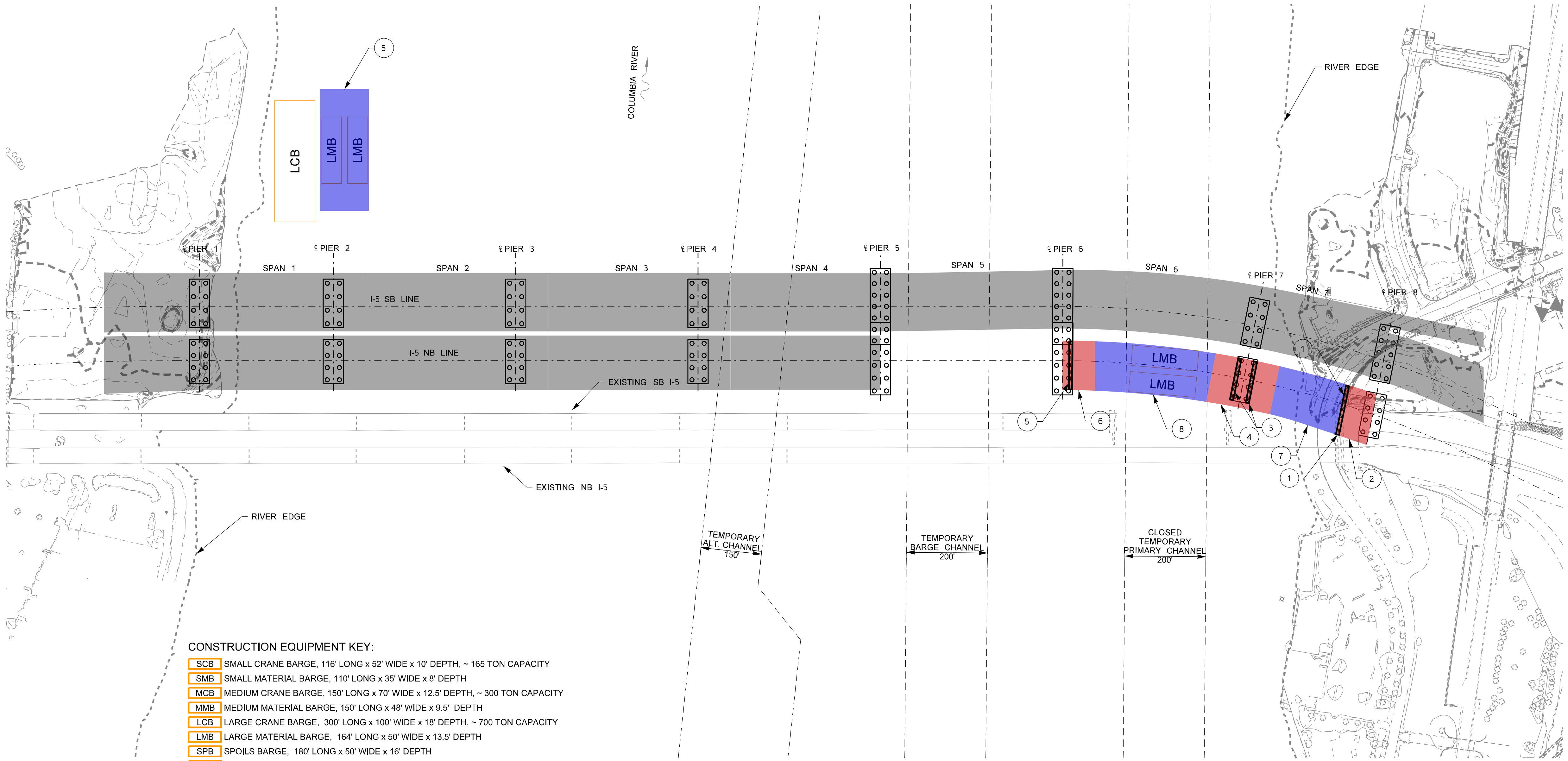
PHASE 10
COLUMBIA RIVER BRIDGE CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. CONSTRUCT TEMPORARY BENT NEAR PIER 8 NB.
2. ERECT THE NORTH END OF THE NB GIRDERS FROM PIER 8 ACROSS THE TEMPORARY BENT.
3. INSTALL TEMPORARY BENTS ON THE PILE CAP AT EACH SIDE OF PIER 7 NB.
4. ERECT THE NB PIER TABLE GIRDERS AT PIER 7 ACROSS THE TEMPORARY BENTS.
5. CONSTRUCT TEMPORARY BENT NEAR PIER 6 NB.
6. ERECT THE NB GIRDER ENDS AT PIER 6 ACROSS THE TEMPORARY BENT.
7. ERECT GIRDERS TO CLOSE SPAN 7 NB.
8. PREASSEMBLE GIRDER PACKS FOR NB SPAN 6 ON BARGES IN STAGGING NEAR THE SHORE.
9. STRAND JACK NB GIRDER PACKS INTO PLACE TO CLOSE SPAN 6.



CONSTRUCTION EQUIPMENT KEY:

- SCB SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
- SMB SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
- MCB MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
- MMB MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- LCB LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
- LMB LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
- SPB SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
- BTB BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- SCIS SHAFT CAP ISOLATION SYSTEM
- TEMPORARY WORK PLATFORM
- COFFERDAM
- PREFABRICATED SHAFT CAP

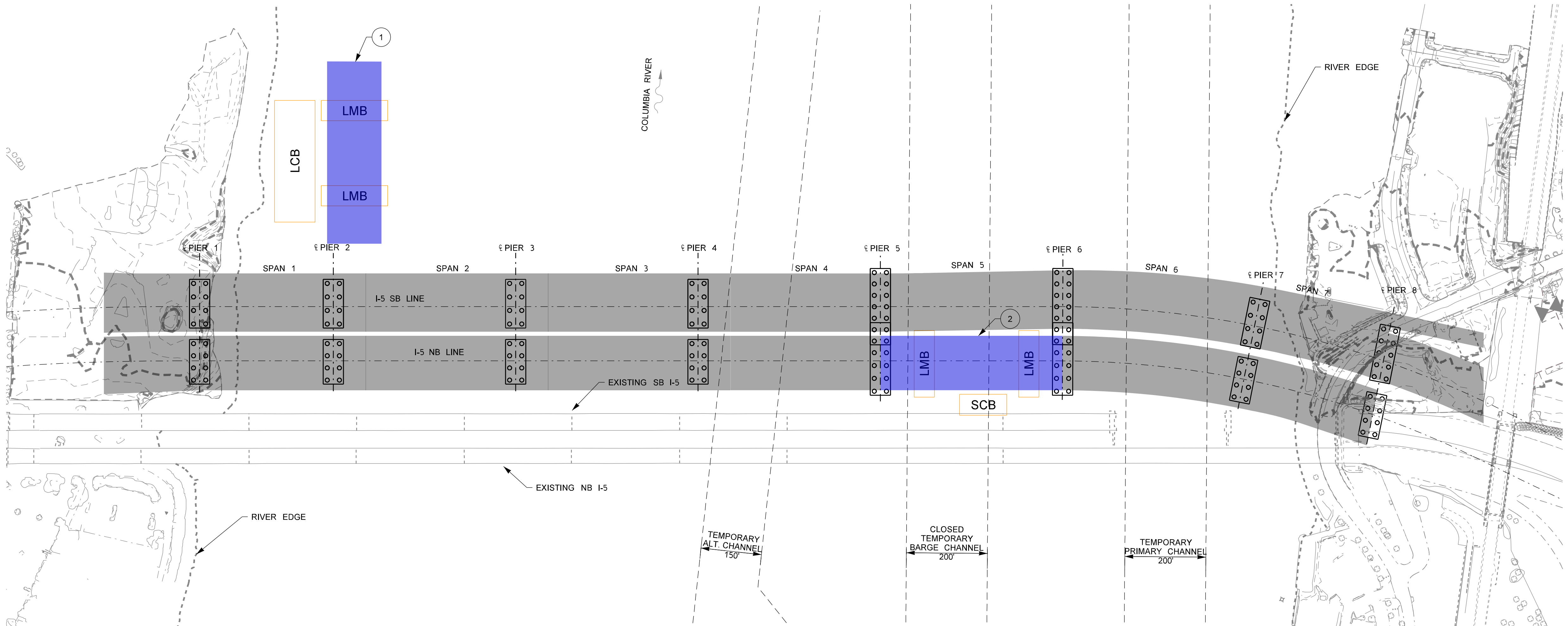
PHASE 11
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

DRAFT

CONSTRUCTION SEQUENCE:

1. PREASSEMBLE LIFT SPAN FOR NB SPAN 5 ON BARGES IN STAGING NEAR THE SHORE.
2. ERECT LIFT SPAN FOR NB SPAN 5.



CONSTRUCTION EQUIPMENT KEY:

- SCB SMALL CRANE BARGE, 116' LONG x 52' WIDE x 10' DEPTH, ~ 165 TON CAPACITY
- SMB SMALL MATERIAL BARGE, 110' LONG x 35' WIDE x 8' DEPTH
- MCB MEDIUM CRANE BARGE, 150' LONG x 70' WIDE x 12.5' DEPTH, ~ 300 TON CAPACITY
- MMB MEDIUM MATERIAL BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- LCB LARGE CRANE BARGE, 300' LONG x 100' WIDE x 18' DEPTH, ~ 700 TON CAPACITY
- LMB LARGE MATERIAL BARGE, 164' LONG x 50' WIDE x 13.5' DEPTH
- SPB SPOILS BARGE, 180' LONG x 50' WIDE x 16' DEPTH
- BTB BAKER TANK BARGE, 150' LONG x 48' WIDE x 9.5' DEPTH
- SCIS SHAFT CAP ISOLATION SYSTEM
- TEMPORARY WORK PLATFORM
- COFFERDAM
- PREFABRICATED SHAFT CAP

PHASE 12
COLUMBIA RIVER BRIDGE
CONSTRUCTION SEQUENCE

Interstate BRIDGE Replacement Program

Appendix B. Essential Fish Habitat

APPENDIX B

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

ESSENTIAL FISH HABITAT ASSESSMENT

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 species.

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 (PSMFC 2014). EFH for groundfish and coastal pelagic species includes all waters from the mean high water line along the coasts of Washington upstream to the extent of saltwater intrusion and seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PSMFC 2014).

The aquatic portion of the action area is within designated EFH for Chinook and coho salmon within the Pacific salmon guild (see Section 5 of this BA). Portions of the Columbia River estuary that are within the action area near the mouth of the river are also designated EFH for groundfish and coastal pelagic species.

DESCRIPTION OF PROPOSED ACTION

The Interstate Bridge Replacement (IBR) Program is a renewal of the previously suspended Columbia River Crossing (CRC) project. The Program will replace the aging Interstate 5 (I-5) Bridge across the Columbia River with a modern, seismically resilient multimodal structure. The proposed infrastructure improvements are located along a 5-mile stretch of the I-5 corridor in Portland, Oregon, and Vancouver, Washington

The project activities that comprise the IBR Program were originally developed and evaluated as the Columbia River Crossing (CRC) project. The environmental review processes (including a National Environmental Policy Act [NEPA] Record of Decision, and Section 7 ESA consultations) for the CRC project were completed between 2005 and 2013, and the project was suspended in 2014. In 2019, a bistate legislative committee requested that ODOT and WSDOT reinitiate the CRC project, and it was re-named the IBR Program.

In 2021, a third NEPA re-evaluation was conducted, and FHWA and FTA determined that a supplemental environmental impact statement (SEIS) would be necessary to identify and disclose new impacts and mitigation associated with the IBR Program. The SEIS is evaluating one project alternative (the Modified Locally Preferred Alternative [Modified LPA]) and a no-build alternative. Design Options for certain components of the Modified LPA are also being evaluated in the SEIS. The "proposed action" that is addressed in this biological assessment [BA] is the IBR Modified LPA, inclusive of all Design Options.

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, groundfish, and coastal pelagic 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) degradation of water quality during construction;

(2) increased hydroacoustic and terrestrial noise during construction;

(3) displacement of aquatic and terrestrial habitats during construction;

(4) permanent loss of aquatic and terrestrial habitats associated with new and replacement structures;

(5) restoration of aquatic and terrestrial habitats associated with removal of existing structures;

(6) increased hydraulic shadowing from new in-water bridge piers;

(7) injury or mortality to individual fish associated with work area isolation and fish salvage;

(8) increased overwater lighting from temporary and permanent structures;

(9) increased avian predation pressure; and

(10) permanent impacts associated with contaminants in stormwater runoff from contributing impervious surfaces.

Stormwater runoff from contributing impervious surfaces associated with the proposed action will also affect EFH for groundfish and coastal pelagic species.

Construction 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 and North Portland Harbor.

Pile-driving activities have the potential to temporarily elevate underwater noise levels within a portion of the Columbia River and North Portland Harbor. 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 and platforms, temporary piles, cofferdams, drilled shaft isolation 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 bridges. The foundations of the replacement bridges will permanently displace physical benthic substrate for species that rely on aquatic habitats at the project site. The proposed action will also result in new fill within the floodplain, and new overwater shading from the replacement bridges. These impacts will be offset in part by the proposed removal of the existing bridges and, if necessary, by compensatory mitigation actions that will be implemented to demonstrate no net loss of habitat function. Temporary structures will result in similar types of effects to EFH, except that impacted habitat function will be fully restored once these structures are removed.

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. Lighting on the replacement bridges is expected to be comparable to that on the existing bridges. The lighting on the replacement bridges 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 bridges are expected to be minimal. It is expected that the replacement bridges will provide comparable or less perching habitat than is available on the existing bridges.

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, North Portland Harbor, Columbia Slough, Fairview Creek, and Burnt Bridge Creek. 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 stormwater discharge will degrade the migratory and rearing habitat for Pacific salmon throughout the aquatic portions of the action area downstream to the mouth of the Columbia River. Since pollutants in stormwater will be carried all the way to the mouth of the river, this stormwater discharge will also affect habitat function for groundfish and coastal pelagic species in the estuary. However, stormwater treatment will be provided for all post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. The proposed action will therefore remove a significant source of untreated stormwater, and the net result of the proposed action will be a net reduction in the pollutant load and an improved water quality condition compared to current conditions.

MINIMIZATION MEASURES AND BMPS

The proposed action will implement several avoidance and minimization 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 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 affect**” EFH for Pacific salmon, groundfish, and coastal pelagic species. The proposed action will have both temporary 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. NOAA Fisheries Underwater Noise Calculators

Model last updated January 26, 2009

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

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**

Cumulative SEL at measured distance
194

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**9**	**28**	**52**	**4642**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Model last updated January 26, 2009

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - Unattenuated Single Pile Driver Max. 75 strikes/day

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	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 900 strikes/day

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	**900**

Cumulative SEL at measured distance
198

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**3**	**50**	**93**	**1585**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Model last updated January 26, 2009

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Single Pile Driver Max. 900 strikes/day

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	**900**

Cumulative SEL at measured distance
207

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**201**	**371**	**8577**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Model last updated January 26, 2009

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	24-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 1,800 strikes/day

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	**1,800**

Cumulative SEL at measured distance
201

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**3**	**80**	**148**	**1585**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Model last updated January 26, 2009

Project Title	Interstate Bridge Replacement (IBR) Program
Pile information (size, type, number, pile strikes, etc.)	48-inch steel pipe piles - W/ 7dB Attenuation Two Pile Drivers Operating Concurrently Max. 1,800 strikes/day

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	**1,800**

Cumulative SEL at measured distance
210

	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
15	**12**	**319**	**589**	**8577**

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

Appendix D. NOAA Fisheries/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.

Literature Cited

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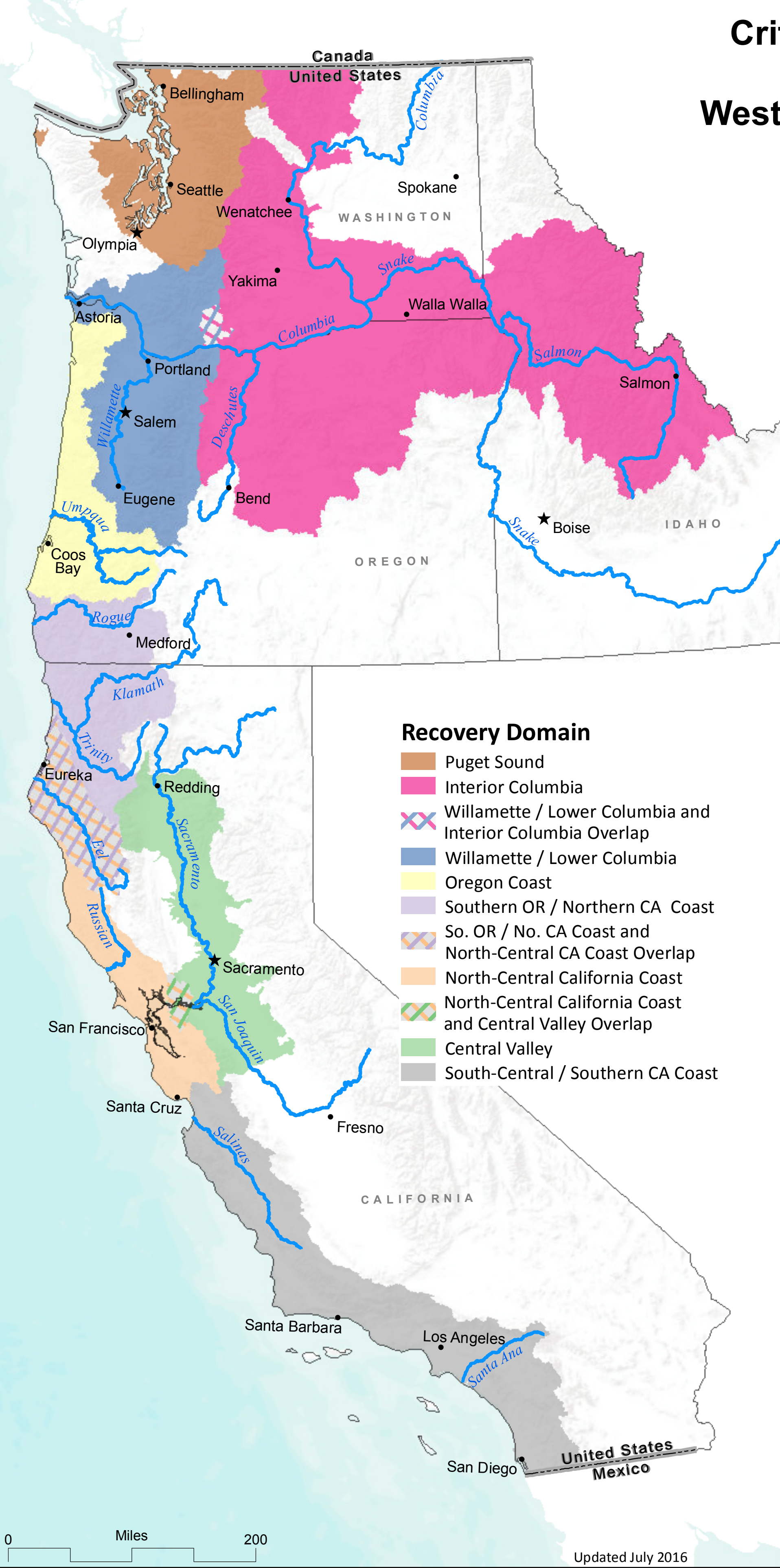
Appendix E. Species List

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: October 14, 2021
Consultation Code: 01EOFW00-2022-SLI-0022
Event Code: 01EOFW00-2022-E-00072
Project Name: Interstate Bridge Replacement Program

Subject: List of threatened and endangered species that may occur in your proposed project location 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: 01EOFW00-2022-SLI-0022
Event Code: Some(01EOFW00-2022-E-00072)
Project Name: Interstate Bridge Replacement Program
Project Type: TRANSPORTATION
Project Description: The Program would replace the aging I-5 Interstate Bridge across the Columbia River between Oregon and Washington with a modern, seismically resilient, multimodal structure that provides improved mobility for people, goods and services.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@45.6202921,-122.67292995096753,14z

Counties: Oregon and Washington

Endangered Species Act Species

There is a total of 10 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
Columbian White-tailed Deer *Odocoileus virginianus leucurus* Population: Columbia River DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/154	Threatened

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* 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/1123	Threatened
Streaked Horned Lark *Eremophila alpestris strigata* 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/7268	Threatened
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS 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/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

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Golden Paintbrush *Castilleja levisecta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7706	Threatened
Kincaid's Lupine *Lupinus sulphureus ssp. kincaidii* 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/3747	Threatened
Nelson's Checker-mallow *Sidalcea nelsoniana* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7340	Threatened
Willamette Daisy *Erigeron decumbens* 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/6270	Endangered

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: October 14, 2021
Consultation Code: 01EWFW00-2022-SLI-0064
Event Code: 01EWFW00-2022-E-00194
Project Name: Interstate Bridge Replacement Program

Subject: List of threatened and endangered species that may occur in your proposed project location 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: 01EWFW00-2022-SLI-0064
Event Code: Some(01EWFW00-2022-E-00194)
Project Name: Interstate Bridge Replacement Program
Project Type: TRANSPORTATION
Project Description: The Program would replace the aging I-5 Interstate Bridge across the Columbia River between Oregon and Washington with a modern, seismically resilient, multimodal structure that provides improved mobility for people, goods and services.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@45.6202921,-122.67292995096753,14z

Counties: Oregon and Washington

Endangered Species Act Species

There is a total of 7 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
Columbian White-tailed Deer *Odocoileus virginianus leucurus* Population: Columbia River DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/154	Threatened

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* 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/1123	Threatened
Streaked Horned Lark *Eremophila alpestris strigata* 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/7268	Threatened
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS 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/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

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Golden Paintbrush *Castilleja levisecta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7706	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