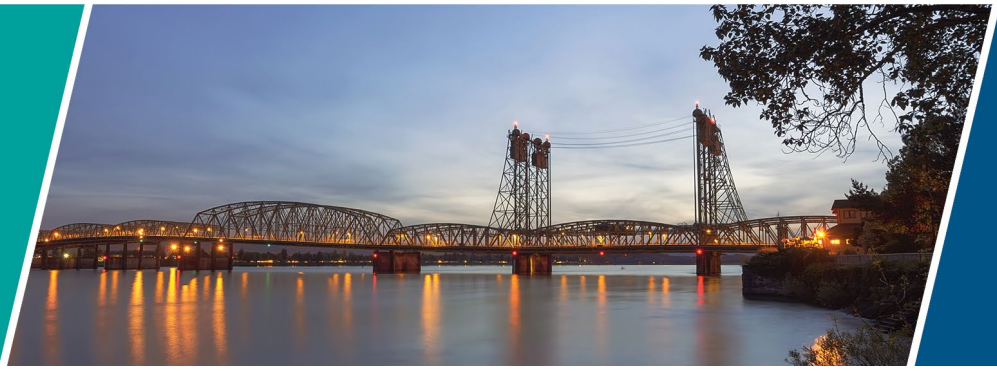
Interstate BRIDGE Replacement Program

Considering the importance of our natural environment



Cumulative Effects Technical Report

May 2026

Oregon

For Americans with Disabilities Act (ADA) or Civil Rights Title VI accommodations, translation/interpretation services, or more information call 503-731-4128, TTY 800-735-2900 or Oregon Relay Service 7-1-1.

Washington

Accommodation requests for people with disabilities in Washington can be made by contacting the Washington State Department of Transportation (WSDOT) Diversity/ADA Affairs team at wsdotada@wsdot.wa.gov or by calling toll-free, 855-362-4ADA (4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equity and Civil Rights (OECR) Title VI Coordinator by contacting (360) 705-7090.

Cumulative Effects Technical Report

CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

Acronyms/Abbreviations	Definition
AASHTO	American Association of State Highway and Transportation Officials
APE	area of potential effects
AVE	Area of Visual Effect
BIPOC	Black, Indigenous, and People of Color
BMP	best management practice
BRT	bus rapid transit
CCFS	Columbia Corridor Flood Safety
CCRA	Vancouver City Center Redevelopment Authority
C-D	collector-distributor
CFR	Code of Federal Regulations
CIA	contributing impervious area
CRC	Columbia River Crossing
CRC	Columbia River Crossing
CTR	Commute Trip Reduction
C-TRAN	Clark County Public Transit Benefit Area Authority
DEQ	Oregon Department of Environmental Quality
Ecology	Washington State Department of Ecology
EJ	environmental justice
EMF	electromagnetic field
FHWA	Federal Highway Administration
FLP	Federal Lands to Parks
FSCR	Flood Safe Columbia River
FTA	Federal Transit Administration
GHG	greenhouse gas
HBE	Historic built environment

Acronyms/Abbreviations	Definition
I-205	Interstate 205
I-5	Interstate 5
IBR	Interstate Bridge Replacement
LEED	Leadership in Energy and Environmental Design
LPA	Locally Preferred Alternative
LRT	light-rail transit
LRV	light-rail vehicle
MAX	Metropolitan Area Express
MCR	Middle Columbia River
Metro	Oregon Metro
NAVD 88	North American Vertical Datum of 1988
ND	Neighborhood
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NRHP	National Register of Historic Places
ODOT	Oregon Department of Transportation
OHP	Oregon Highway Plan
OMF	Operations and Maintenance Facility
ORS	Oregon Revised Statutes
OTC	Oregon Transportation Commission
OTP	Oregon Transportation Plan
PA	Programmatic Agreement
PDX	Portland International Airport
PMLS	Portland Metro Levee System
PNCD	Preliminary Navigation Clearance Determination
ROD	Record of Decision

Acronyms/Abbreviations	Definition
RTC	Southwest Washington Regional Transportation Commission
RTP	Regional Transportation Plan
SEIS	Supplemental Environmental Impact Statement
SOI	Species of Interest
SOV	single-occupancy vehicle
SR	State Route
STC	Southwest Washington Regional Transportation Council
STS	Statewide Transportation Strategy
TMDL	Total Maximum Daily Load
TPSS	traction power substation
TriMet	Tri-County Metropolitan Transportation District of Oregon
U.S.C.	United States Code
UFSWQD	Urban Flood Safety and Water Quality District
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
VCCV	Vancouver City Center Vision
VMT	vehicle miles traveled
VNHR	Vancouver National Historic Reserve
WSDOT	Washington State Department of Transportation
WSTC	Washington State Transportation Commission

1. PROGRAM OVERVIEW

1.1 Introduction

The Interstate Bridge Replacement (IBR) Program is a continuation of the previously suspended Columbia River Crossing (CRC) project with the same purpose to 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 that extends from approximately Victory Boulevard in Portland to State Route (SR) 500 in Vancouver, as shown in Figure 1-1.

Figure 1-1. IBR Program Location Overview

1.2 Components of the Modified LPA

The basic proposed components of the Modified Locally Preferred Alternative (LPA)[1] include:

- A new pair of Columbia River bridges—one for northbound and one for southbound travel—built west of the existing bridge. The new bridges would each include three through lanes, safety shoulders, and one auxiliary lane in each direction. When all highway, transit, and active transportation would be moved to the new Columbia River bridges, the existing Interstate Bridge (both spans) would be removed.[2] The primary navigation channel would be relocated approximately 500 feet south (measured by the channel centerline) of its existing location near the Vancouver shoreline.
- A 1.9-mile light-rail transit (LRT) extension of the current Metropolitan Area Express (MAX) Yellow Line from the Expo Center MAX Station in North Portland, where it currently ends, to a terminus near Evergreen Boulevard in Vancouver. Improvements would include new stations at Hayden Island, downtown Vancouver (Waterfront Station), and near Evergreen Boulevard (Evergreen Station), as well as reconstruction of the existing Expo Center MAX Station. The Tri-County Metropolitan Transportation District of Oregon (TriMet), which operates the MAX system, would also operate the Yellow Line extension.
- Associated LRT improvements such as traction power substations (TPSS),[3] an overhead catenary system, signal and communications support facilities, an overnight light-rail vehicle (LRV) facility at the Expo Center, 19 new LRVs, and an expanded maintenance facility at TriMet's existing Ruby Junction Light-Rail Operations and Maintenance Facility (OMF).
- Connections to local bus transit service, including bus rapid transit (BRT) and express bus routes, in collaboration with the Clark County Public Transit Benefit Area Authority (C-TRAN), in addition to the proposed new LRT service.
- Shoulders on I-5 from Interstate Avenue/Victory Boulevard to SR 500/39th Street to accommodate express bus-on-shoulder service in each direction.
- Associated bus transit service improvements, including three additional bus bays for new buses at the existing C-TRAN OMF (see Section 1.2.7, Transit Operating Characteristics, for more information about this service).
- Improvements to seven I-5 interchanges and I-5 mainline improvements between Interstate Avenue/ Victory Boulevard in Portland and SR 500/39th Street in Vancouver. Some adjacent local streets would be reconfigured to complement the new interchange designs and improve local east–west connections.
- Six new adjacent bridges across North Portland Harbor: one on the east side of the existing I-5 North Portland Harbor bridge and five on the west side or overlapping with the existing bridge (which would be removed). The bridges would carry (from west to east) LRT tracks, southbound I-5 off-ramp to Marine Drive, southbound I-5 mainline, northbound I-5 mainline,

[1] All transportation facilities would be designed to current AASHTO, WSDOT, and ODOT specifications.

[2] For purposes of this report, the existing I-5 bridges over the Columbia River are referred to as the "Interstate Bridge." The new replacement I-5 bridges over the Columbia River are referred to as the "Columbia River bridges."

[3] Each TPSS would be approximately 75 feet by 50 feet, including parking and access areas.

northbound I-5 on-ramp from Marine Drive, and an arterial bridge for local traffic to Hayden Island with a shared-use path for pedestrians and bicyclists.

- A variety of improvements for people who walk, bike, and roll throughout the study area, 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."
- Variable-rate tolling, including signage and equipment, for motorists using the river crossing as a demand-management and financing tool.

In addition to the basic components described above, the Modified LPA includes five sets of design options. The design options are related to (1) the number of auxiliary lanes; (2) the bridge configuration; (3) the presence of the C Street ramps; (4) the I-5 alignment in downtown Vancouver; and (5) the park and rides. The Recommended Design Options are identified with bold text and an asterisk in Table 1-1.

- **Auxiliary Lanes.** Options for one or two auxiliary lanes. Auxiliary lanes are ramp-to-ramp connections on the highway that improve interchange safety by providing drivers with more space and time to merge, diverge, and weave at highway access points.
  - The one auxiliary lane design option would extend across the Columbia River bridges between the Marine Drive interchange and the Mill Plain Boulevard interchange.
  - The two auxiliary lane design option would extend a second auxiliary lane in each direction of I-5 in addition to the one auxiliary lane included in the Modified LPA. The second auxiliary lane would also extend across the Columbia River bridges in addition to and in combination with the existing auxiliary lanes from approximately Interstate Avenue/Victory Boulevard to SR 500/39th Street.
- **Bridge Configurations.** Three bridge configurations are under consideration.
  - Double-deck fixed-span bridges: 116 feet of vertical navigation clearance over the primary navigation channel.
  - Single-level fixed-span bridges: 116 feet of vertical navigation clearance over the primary navigation channel.
  - Single-level movable-span bridges: with the movable spans over the primary navigation channel: 178 feet of vertical navigation clearance in the open position and 90 feet in the closed position (the north barge channel would have 99 feet of vertical navigation clearance and the south barge channel would have 90 feet of vertical navigation clearance).
- **C Street Ramps.** Options that retain or eliminate the existing C Street ramps in downtown Vancouver.
- **I-5 Alignment in Downtown Vancouver.** Options that maintain the I-5 mainline at its current location or shift the I-5 mainline up to 40 feet westward in downtown Vancouver between the SR 14 interchange and Mill Plain Boulevard interchange.
- **Park and Rides.** Options to provide parking capacity to accommodate 1,270 vehicles at designated park and rides near the Waterfront Station and Evergreen Station to serve LRT riders.

Table 1-1. Modified LPA Design Options

Modified LPA Component	Design Options
Auxiliary lanes	• **One auxiliary lane in each direction on the new Columbia River bridges and nearby sections of I-5*** • Two auxiliary lanes in each direction of I-5 would extend across the Columbia River bridges in addition to and in combination with existing auxiliary lanes from approximately Interstate Avenue/Victory Boulevard to SR 500/39th Street
Bridge configuration	• Double-deck fixed-span bridge configuration • **Single-level fixed-span bridge configuration*** • Single-level movable-span bridge configuration
C Street ramps	• **With C Street ramps*** • Without C Street ramps
I-5 Alignment in downtown Vancouver	• **Centered I-5 alignment*** • Westward shift of I-5 alignment
Park and Rides	• Provide parking capacity to accommodate 1,270 vehicles distributed across just two park and rides: one park and ride with 570 parking spaces near the Waterfront Station and one park and ride with 700 parking spaces near the Evergreen Station. The locations for park and rides that were evaluated included: ➢ Potential Waterfront Station park and rides ➢ Columbia Way (below I-5)Potential Evergreen Station park and rides ➢ Columbia Street/SR 14 ➢ Columbia Street/Phil Arnold Way ▪ Library Square ▪ Columbia Credit Union ▪ **Provide parking capacity to accommodate 1,270 vehicles dispersed among five park and rides listed above *[a]**

Notes:

* Recommended Design Options are in bold.

a Depending on final design considerations, the decision may be made to use fewer than the five sites. The analysis assumes all five sites as it encompasses all physical impacts.

The transportation improvements proposed for the Modified LPA and the design options are shown in Figure 1-2. The Modified LPA includes all of the components listed above. If there are differences in environmental effects or benefits between the design options, they are identified in the sections below.

Section 1.2.1, Interstate 5 Mainline, describes the overall configuration of the I-5 mainline through the study area, and Sections 1.2.2, Portland Mainland and Hayden Island (Subarea A), through Section 1.2.5, Upper Vancouver (Subarea D), provide additional detail on four geographic subareas (A through D), which are shown on Figure 1-3. 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 would be located. The description of the Modified LPA and design options are based on conceptual design and are subject to refinement as the design is finalized. The IBR Program will continue to consult with regulatory agencies, local agencies with jurisdiction, and tribes to seek opportunities for improvements and avoidance and minimization of impacts.

Figure 1-2. Modified LPA Components

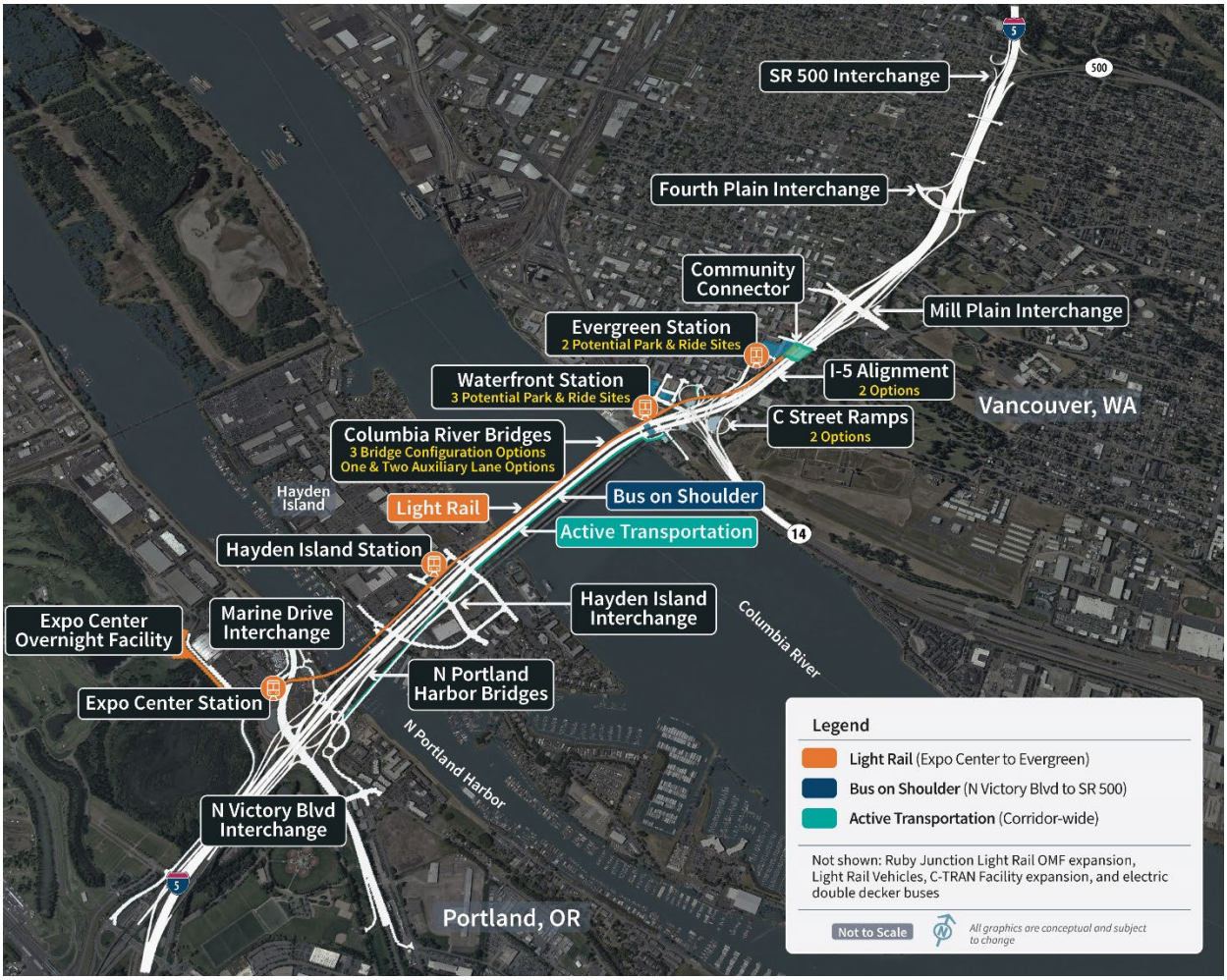


Figure 1-3. Modified LPA – Geographic Subareas

1.2.1 Interstate 5 Mainline

Today, within the 5-mile corridor, I-5 has three, typically 12-foot-wide, through lanes in each direction, an approximately 6- to 12-foot-wide inside shoulder, and an approximately 6- to 12-foot-wide outside shoulder, with the exception of the Interstate Bridge, which has approximately 1- to 2-foot-wide inside and outside shoulders. There are currently intermittent one and two auxiliary lane sections between the Victory Boulevard and Hayden Island interchanges in Oregon and between SR 14 and SR 500 in Washington.

The Modified LPA would include three 12-foot through lanes from Interstate Avenue/Victory Boulevard to SR 500/39th Street and one or two 12-foot auxiliary lanes, as detailed below and shown on Figure 1-4. Many of the existing auxiliary lanes on I-5 between the SR 14 and Main Street interchanges in Vancouver would remain, although they would be reconfigured. The existing auxiliary lanes between the Victory Boulevard and Hayden Island interchanges would be replaced with changes to

on- and off-ramps and interchange reconfigurations. The existing Interstate Bridge over the Columbia River does not have auxiliary lanes; the Modified LPA would add one or two auxiliary lanes in each direction across the new Columbia River bridges.

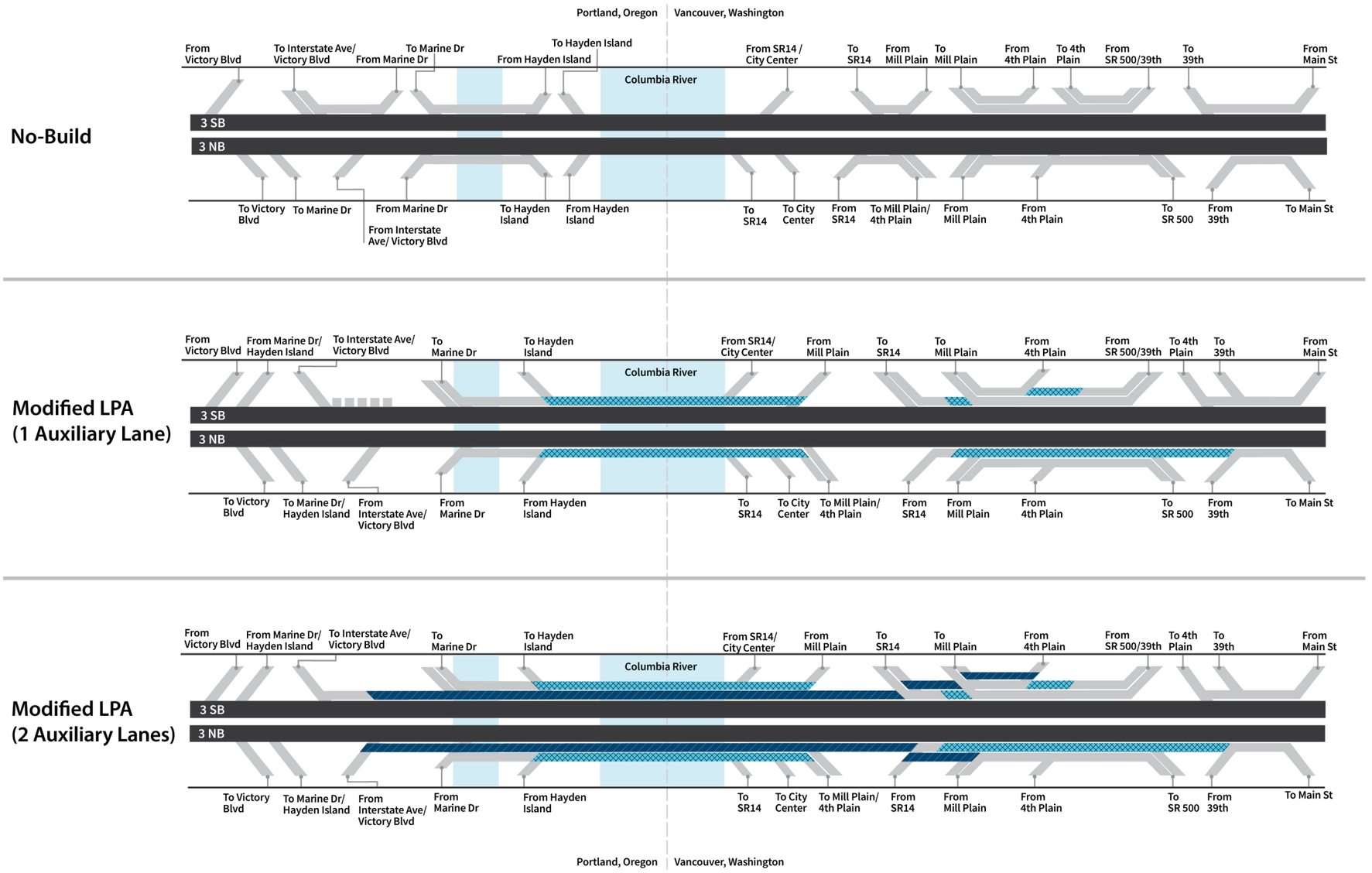
The Modified LPA would also include shoulders (11- to 14-foot inside shoulders and 10- to 14-foot outside shoulders) to be consistent with the design standards of the Oregon Department of Transportation (ODOT) and Washington State Department of Transportation (WSDOT). The inside shoulder would be used by express bus service to bypass mainline congestion, known as "bus on shoulder" (refer to Section 1.2.7, Transit Operating Characteristics). The shoulder would be available for express bus service when general-purpose speeds are below 35 miles per hour (mph).

1.2.1.1 Auxiliary Lane Design Options

The Modified LPA includes design options for one auxiliary lane in each direction or two auxiliary lanes in each direction across the Columbia River bridges in addition to and in combination with existing auxiliary lanes in the area. The one auxiliary lane design option would include an auxiliary lane in each direction across the Columbia River bridges between the Marine Drive interchange and the Mill Plain Boulevard interchange. The two auxiliary lane design option would include a second auxiliary lane from the Interstate Avenue/Victory Boulevard interchange and the SR 500/39th Street interchange, including on the Columbia River bridges (see Figure 1-4). This section provides an overview of the one auxiliary lane and the two auxiliary lane design options.

Figure 1-5, which shows a single-level fixed-span bridge configuration for comparison purposes, shows that the scale of the physical impacts (footprint, or the limits of permanent improvements) would be similar for the Modified LPA with one auxiliary lane design option and the Modified LPA with two auxiliary lanes design option, except over the Columbia River and in downtown Vancouver. For all bridge configuration design options, the two auxiliary lane design option would add a net of approximately 16 feet (8 feet in each direction) in total roadway width to the Columbia River bridges compared to the one auxiliary lane design option.

Figure 1-4. Auxiliary Lane Configurations



Each scenario has three through lanes in each direction

- Existing Through Lanes
- Interchange Ramps and Existing Auxiliary Lanes
- Existing Auxiliary Lanes Removed
- One Auxiliary Lane added in Modified LPA
- Second Auxiliary Lane added in Modified LPA

Notes:

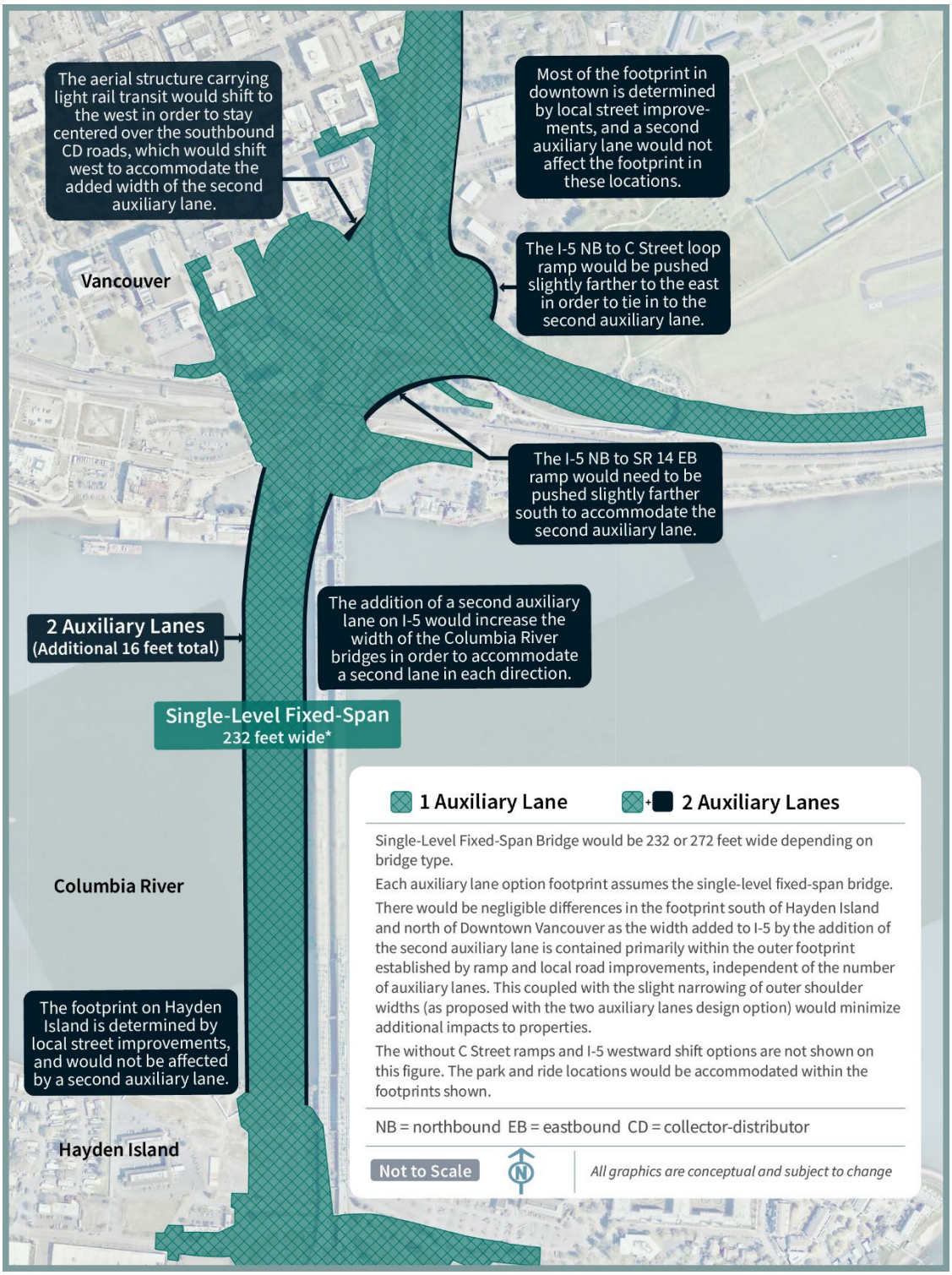
Collector Distributor Lanes not shown.

The traffic operations analysis incorporating both the one and two auxiliary lane design option applies equally to all bridge configuration options in this Draft SEIS.

The C Street ramp (NB to City Center) is an option.

Figure is not to scale.

Figure 1-5. Auxiliary Lane Configuration Footprint Differences



Note: All dimensions are approximate.

One Auxiliary Lane Design Option – Recommended Design Option

The one auxiliary lane design option would include a 12-foot-wide auxiliary lane in each direction across the Columbia River bridges between the Marine Drive interchange and the Mill Plain Boulevard interchange.

On northbound I-5, the auxiliary lane would extend the existing auxiliary from the Marine Drive on-ramp to the Hayden Island off-ramp to continue across the Columbia River bridge, and end at the combined off-ramp to Mill Plain/Fourth Plain Boulevard, north of SR 14 (see Figure 1-4). The existing auxiliary lane from the SR 14 on-ramp to the Mill Plain/Fourth Plain off-ramp would be extended to connect to the existing auxiliary lane from the 39th Street on-ramp to the Main Street off-ramp, creating an auxiliary lane beginning at the SR 14 on-ramp and ending at the Main Street off-ramp. The existing auxiliary lane located between the Mill Plain Boulevard on-ramp and the SR 500 off-ramp would remain.

The IBR Program recommends advancing the one auxiliary lane in each direction of I-5 design option. The one and two auxiliary lane design options would provide important benefits to highway operations and safety. Both options received a mix of positive and negative feedback from the public. The one auxiliary lane design option is recommended because it would reduce overall environmental impacts while improving transportation operations and safety. The one auxiliary lane design option is also supported by local transportation agencies.

On southbound I-5, the two existing auxiliary lanes between SR 500/39th Street and Mill Plain Boulevard would remain, with some reconfiguration due to the braided ramps between the SR 500/39th Street and Fourth Plain Boulevard interchanges. The new auxiliary lane across the Columbia River would begin at the Mill Plain Boulevard on-ramp and would continue across the Columbia River bridge, connecting to the existing auxiliary lane on Hayden Island and ending at the Marine Drive off-ramp. The existing southbound auxiliary lane between Marine Drive and Victory Boulevard/Interstate Avenue would be removed due to ramp reconfigurations as part of the Marine Drive braided ramp with the Victory Boulevard/Interstate Avenue off-ramp.

TWO AUXILIARY LANE DESIGN OPTION

The two auxiliary lane design option would include the same improvements as described under the one auxiliary lane design option and would add a second 12-foot-wide auxiliary lane in each direction of I-5 across the Columbia River bridges to further improve safety and operations in the corridor.

On northbound I-5, the inside auxiliary lane would extend from the combined Interstate Avenue/Victory Boulevard on-ramp, continue across the Columbia River bridge, and end at the SR 500/39th Street interchange, connecting to the existing auxiliary lane between the SR 14 on-ramp and Mill Plain on-ramp and the existing auxiliary lane between the 39th Street on-ramp and the Main Street off-ramp. The outside auxiliary lane would extend from the Marine Drive on-ramp across the Columbia River bridge and end at the Mill Plain/Fourth Plain Boulevard off-ramp. A new outside auxiliary lane would begin at the SR 14 on-ramp connecting to the existing auxiliary lane between the Mill Plain Boulevard on-ramp and the SR 500/39th Street off-ramp.

On southbound I-5, the two existing auxiliary lanes between SR 500/39th Street and Mill Plain Boulevard would remain, with some reconfiguration because of the braided ramps between the SR 500/39th Street and Fourth Plain Boulevard interchanges. In addition, there would be a third auxiliary lane between the Fourth Plain Boulevard on-ramp and the Mill Plain Boulevard off-ramp to improve operations and safety between these two closely spaced ramps. The existing auxiliary lane between the SR 500/39th Street on-ramp would extend to the SR 14 collector-distributor off-ramp. This auxiliary lane would then continue across the Columbia River bridge to the Interstate Avenue/Victory Boulevard off-ramp. The outside auxiliary lane would extend from the Mill Plain on-ramp across the Columbia River bridge to connect to the existing auxiliary lane between Hayden Island and the Marine Drive off-ramp.

1.2.2 Portland Mainland and Hayden Island (Subarea A)

This section discusses the geographic Subarea A (Figure 1-3 provides an overview of the geographic subareas). Figure 1-6 shows highway and interchange improvements in Subarea A, including the North Portland Harbor bridges.

1.2.2.1 Levee System Improvements

Within Subarea A, the IBR Program has the potential to alter three federally authorized levee systems:

- The Oregon Slough segment of the Peninsula Drainage District Number 1 levee (PEN 1).
- The Oregon Slough segment of the Peninsula Drainage District Number 2 levee (PEN 2).
- The PEN1/PEN2 Cross Levee segment of the PEN 1 levee (Cross Levee).

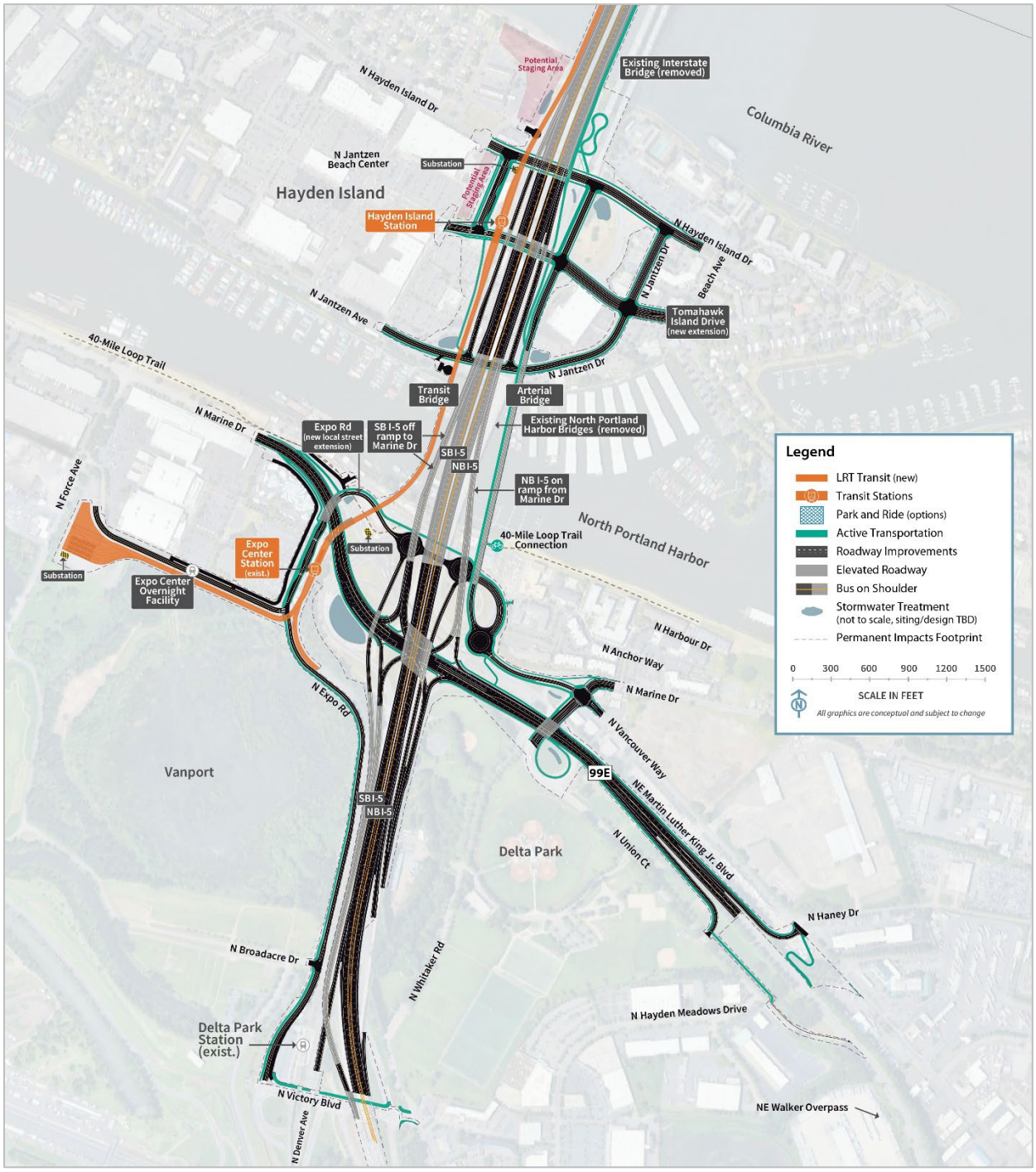
The levee systems are shown on Figure 1-7, and intersections with Modified LPA components are described throughout this section (Section 1.2.2, Portland Mainland and Hayden Island (Subarea A)), where appropriate. Within Subarea A, the IBR Program study area intersects with PEN 1 to the west of I-5 and with PEN 2 to the east of I-5. PEN 1 and PEN 2 include a main levee along the south side of North Portland Harbor and are part of a combination of levees and floodwalls. PEN 1 and PEN 2 are separated by the Cross Levee that is intended to isolate the two districts if one of them were to fail. The Cross Levee is located along the I-5 mainline embankment, except in the Marine Drive interchange area, where it is located on the west edge of the existing ramp from Marine Drive to southbound I-5.[4]

There are two concurrent projects underway that are planning improvements to PEN1, PEN2, and the Cross Levee to reduce flood risk:

- The U.S. Army Corps of Engineers (USACE) Portland Metro Levee System (PMLS) project.
- The Columbia Corridor Flood Safety (CCFS) projects (formerly known as “Flood Safe Columbia River” and “Levee Ready Columbia”).

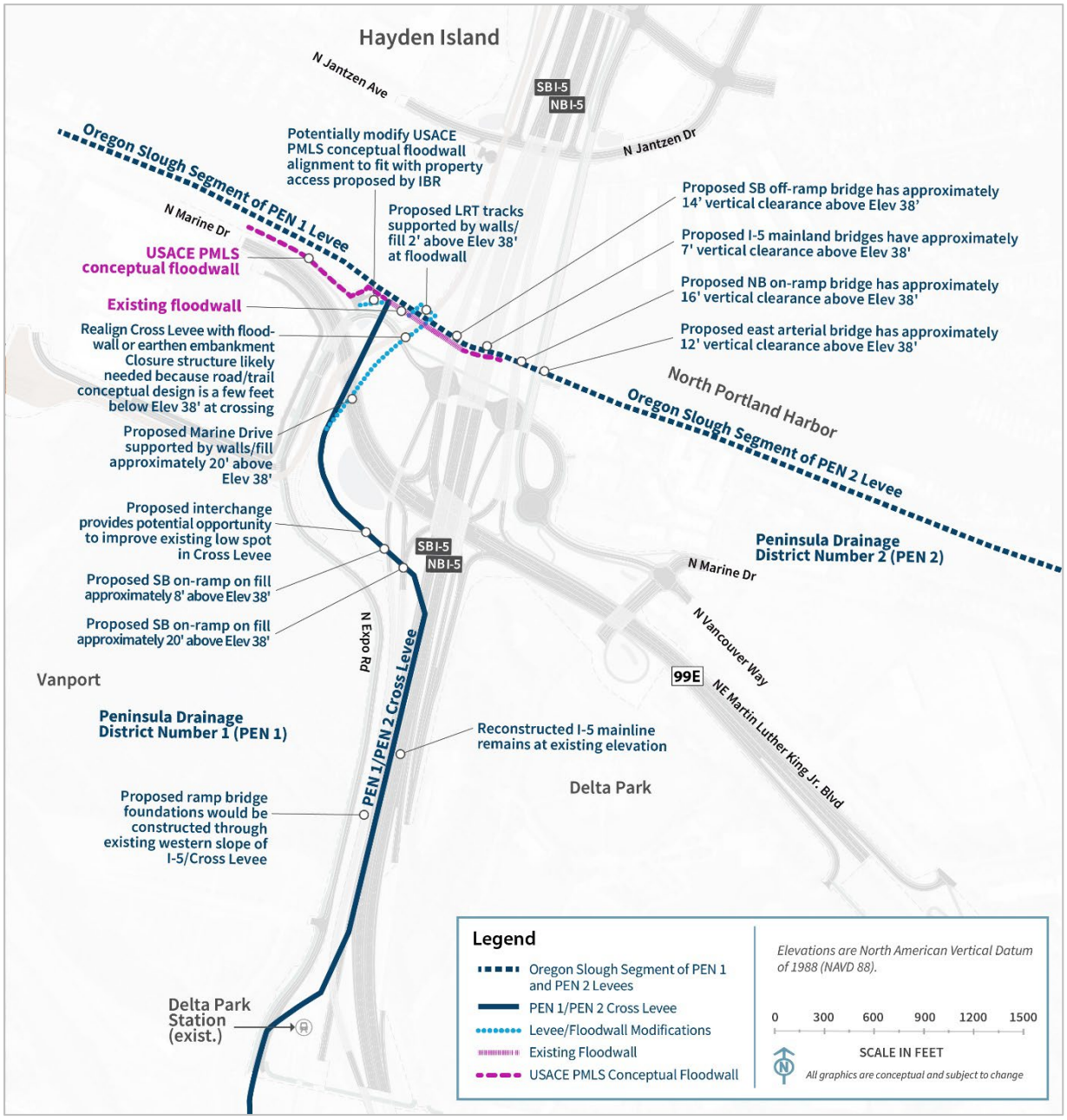
[4] The portion of the original Denver Avenue levee alignment within the Marine Drive interchange area is no longer considered part of the levee system by UFSWQD.

Figure 1-6. Portland Mainland and Hayden Island (Subarea A)



LRT = light-rail transit; NB = northbound; SB = southbound; TBD = to be determined

Figure 1-7. Levee Systems in Subarea A



The Urban Flood Safety and Water Quality District (UFSWQD)[5] is working in partnership with the USACE on the PMLS project, which includes improvements at PEN 1 and PEN 2 (e.g., raising these levees to elevation 38.2 feet for earthen levees and 39.2 feet for flood walls North American Vertical Datum of 1988 [NAVD 88]).[6] Additionally, as part of the CCFS projects, UFSWQD has identified the need to raise a low spot in the Cross Levee on the southwest side of the Marine Drive interchange.

The IBR Program is in close coordination with UFSWQD and the USACE to ensure that the IBR Program's design efforts consider the timing and scope of the PMLS and the CCFS proposed modifications. The intersection of the IBR Program proposed actions to both the existing levee configuration and the anticipated future condition based on the proposed PMLS and CCFS projects are described below, where appropriate.

1.2.2.2 Highways, Interchanges, and Local Roadways

VICTORY BOULEVARD/INTERSTATE AVENUE INTERCHANGE AREA

The southern extent of the Modified LPA would improve two ramps at the Victory Boulevard/Interstate Avenue interchange (see Figure 1-6 and Figure 1-8). The first ramp improvement would be the southbound I-5 off-ramp to Victory Boulevard/Interstate Avenue; this off-ramp would be braided below (i.e., grade separated or pass below) the Marine Drive to the I-5 southbound on-ramp (see the Marine Drive Interchange Area section below). The other ramp improvement would lengthen the merge distance for northbound traffic entering I-5 from Victory Boulevard and from Interstate Avenue.

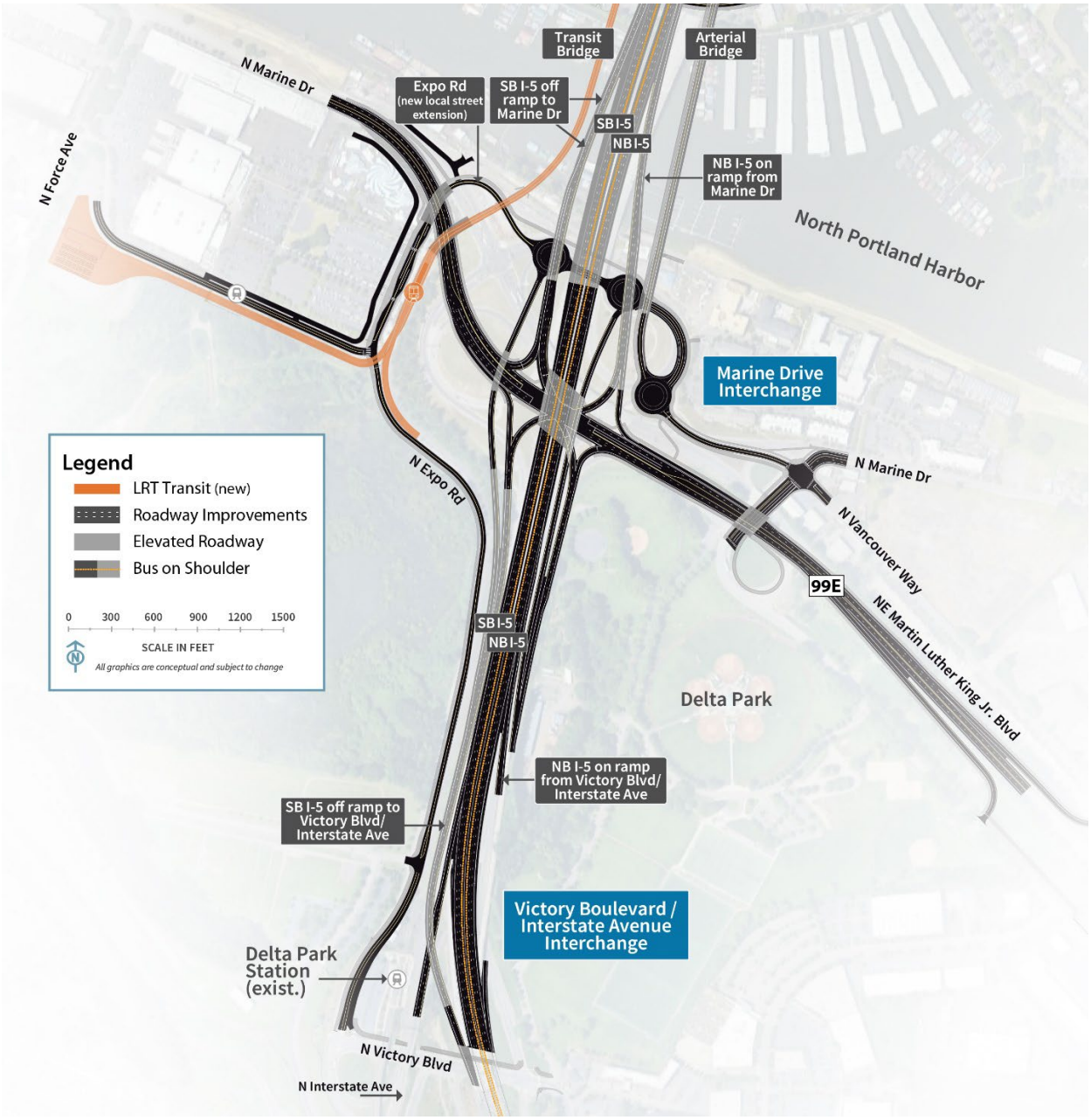
The existing I-5 mainline between Victory Boulevard/Interstate Avenue and Marine Drive is part of the Cross Levee (see Figure 1-7). The Modified LPA would require some pavement reconstruction of the mainline in this area; however, the improvements would mostly consist of pavement overlay, and the profile and footprint would be similar to existing conditions.

MARINE DRIVE INTERCHANGE AREA

The next interchange north of the Victory Boulevard/Interstate Avenue interchange is at Marine Drive. All movements within this interchange would be reconfigured to improve safety and operations for motorists entering and exiting I-5, and all active transportation users accessing areas in the vicinity of the interchange. In addition, Marine Drive would be raised over the proposed LRT extension to separate motorist and transit users. The proposed Marine Drive interchange configuration would be a single-point urban interchange. Figure 1-8 shows Marine Drive interchange's layout and construction footprint.

[5] UFSWQD includes PEN 1 and PEN 2, Urban Flood Safety and Water Quality District No. 1, and the Sandy Drainage Improvement Company.
[6] NAVD 88 is a vertical control datum (reference point) used by federal agencies for surveying.

Figure 1-8. Transit and Roadway Improvements in North Portland



Martin Luther King Jr. Boulevard would have new more direct connections to I-5. The new interchange configuration would change the westbound Marine Drive and westbound Vancouver Way connections to Martin Luther King Jr. Boulevard. An improved connection farther east of the interchange (near Haney Drive) would provide access to westbound Martin Luther King Jr. Boulevard for these two streets. The existing access to westbound Martin Luther King Jr. Boulevard from Vancouver Way east of Haney Drive would be closed. For eastbound travelers on Martin Luther King Jr. Boulevard exiting to Union Court, the existing loop connection would be replaced with a new connection farther east (between the access to the East Delta Park Owens Sports Complex and N Hayden Meadows Drive).

Expo Road from Victory Boulevard to the Expo Center would be reconstructed with improved active transportation facilities. North of the Expo Center, Expo Road would be extended under Marine Drive and continue under I-5 to the east, connecting with Marine Drive and Vancouver Way through three new connected intersections. The westernmost intersection would connect the new local street extension to I-5 southbound. The middle intersection would connect the I-5 northbound off-ramp to the local street extension. The easternmost intersection would connect the new local street extension to an arterial bridge crossing North Portland Harbor to Hayden Island. This intersection would also connect the local street extension to Marine Drive and Vancouver Way.

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

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

The conceptual floodwall alignment from the proposed USACE PMLS project is located on the north side of Marine Drive, near two industrial properties, with three proposed closure structures[7] for property access. The Modified LPA would realign Marine Drive to the south to maintain traffic on existing Marine Drive during construction. The Modified LPA would provide access to the two industrial properties via the new local road extension from Expo Road. Therefore, the change in access for the two industrial properties could require small modifications to the floodwall alignment (a potential shift of approximately 5 to 10 feet to the south) and closure structure locations. The IBR Program is coordinating with USACE PMLS and the UFSWQD on modifications to the floodwall alignment.

Marine Drive and the two southbound on-ramps would travel over the Cross Levee approximately 10 to 20 feet above the proposed elevation of the improved levee, and they would be supported by fill and retaining walls near an existing low spot in the Cross Levee.

The I-5 southbound on-ramp from Marine Drive would continue on a new bridge structure. Although the bridge's foundation locations have not been determined yet, they would be constructed through the western slope of the Cross Levee (between the existing I-5 mainline and the existing light-rail).

NORTH PORTLAND HARBOR BRIDGES

To the north of the Marine Drive interchange is the Hayden Island interchange area, which is shown in Figure 1-6. I-5 crosses over the North Portland Harbor when traveling between these two interchanges. The Modified LPA proposes to replace the existing I-5 bridge spanning North Portland Harbor to improve seismic resilience.

[7] Levee closure structures are put in place at openings along the embankment/floodwall to provide flood protection during high water conditions.

Six new parallel bridges would be built across the waterway under the Modified LPA: one on the east side of the existing I-5 North Portland Harbor bridge and five on the west side or overlapping the location of the existing bridge (which would be removed). From west to east, these bridges would carry:

- The LRT tracks.
- The southbound I-5 off-ramp to Marine Drive.
- The southbound I-5 mainline.
- The northbound I-5 mainline.
- The northbound I-5 on-ramp from Marine Drive.
- An arterial bridge between the Portland mainland and Hayden Island with a shared-use path for pedestrians and bicyclists.

All new structures would have at least as much vertical navigation clearance over North Portland Harbor as the existing North Portland Harbor bridge.

All of the six bridges would be designed and constructed to have sufficient clearance over the levees for access and maintenance. The foundation locations for the five roadway bridges have not been determined at this stage of design, but some foundations could be constructed through landward or riverward levee slopes.

HAYDEN ISLAND INTERCHANGE AREA

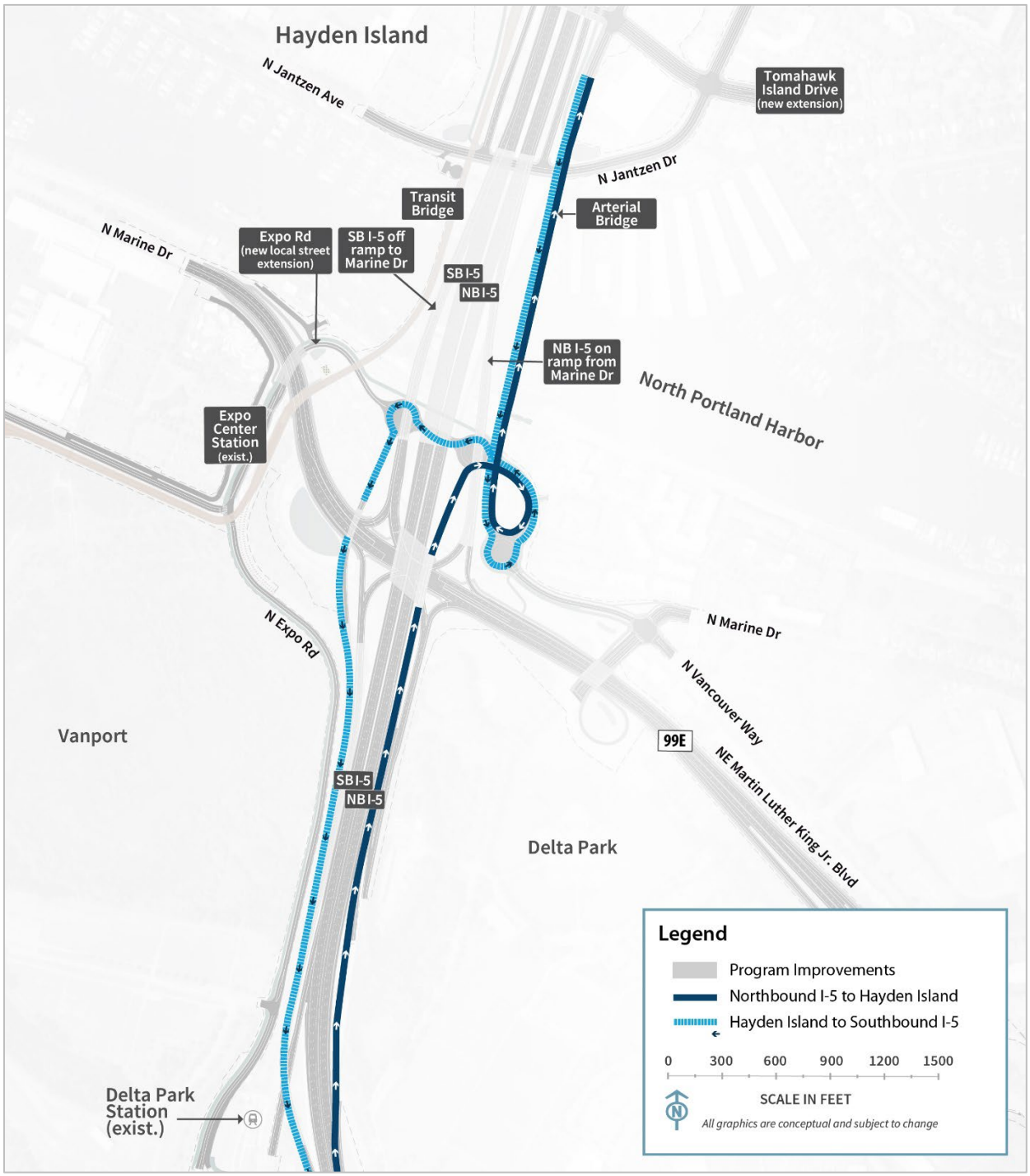
All traffic movements for the Hayden Island interchange would be reconfigured. Figure 1-6 shows the layout and construction footprint of the Hayden Island interchange. A partial interchange would be built on Hayden Island with a northbound I-5 on-ramp from Jantzen Drive and a southbound I-5 off-ramp to Jantzen Drive. This would improve ramp lengths to provide sufficient merging/diverging areas compared to the existing substandard ramps that require acceleration and deceleration in a short distance. The I-5 mainline would be partially located on fill across the island and partially elevated to provide east–west connections on Hayden Island.

There would not be a southbound I-5 on-ramp or northbound I-5 off-ramp located on Hayden Island. Connections to Hayden Island for those movements would be via the local access (i.e., arterial) bridge connecting North Portland to Hayden Island (Figure 1-9). Vehicles traveling northbound on I-5 wanting to access Hayden Island would exit with traffic going to the Marine Drive interchange, cross under Martin Luther King Jr. Boulevard to the new intersection at the 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 arterial bridge to cross North Portland Harbor, cross under I-5 using the new Expo Road local street extension to the westernmost intersection, cross under Marine Drive, merge with the Marine Drive southbound on-ramp, and merge with I-5 southbound south of Victory Boulevard.

Improvements to Jantzen Avenue may include additional left-turn and right-turn lanes at the interchange ramp terminals and active transportation facilities. Improvements to Hayden Island Drive would include new connections to the new arterial bridge over North Portland Harbor. The existing I-5 northbound and southbound access points from Hayden Island Drive would also be removed. A new

extension of Tomahawk Island Drive would travel east–west through the middle of Hayden Island and under the I-5 interchange, thus improving connectivity across I-5 on the island.

Figure 1-9. Vehicle Circulation between Hayden Island and the Portland Mainland



NB = northbound; SB = southbound

1.2.2.3 Transit

A new light-rail alignment for northbound and southbound trains would be constructed within Subarea A (Figure 1-6) to extend from the existing Expo Center MAX Station over North Portland Harbor to a new station at Hayden Island. An overnight LRV facility would be constructed on the southwest corner of the Expo Center property (Figure 1-6) to provide storage for trains during hours when the MAX is not in service. This facility is described in Section 1.2.6, Transit Support Facilities. The existing Expo Center MAX Station would be modified to remove the westernmost track and platform. Other platform modifications, including track realignment and regrading the station, are anticipated to transition to the extension alignment. This could require reconstruction of the operator break facility, signal/communication buildings, and TPSSs. The existing TPSS at the end of TriMet's MAX Yellow Line would be decommissioned. A new TPSS would be constructed to the east of the LRT tracks and south of Expo Road, as well as at the overnight LRV facility, east of N Force Avenue. Immediately north of the Expo Center MAX Station, the LRT alignment would curve east toward I-5, pass beneath an elevated Marine Drive, cross the proposed 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.

After crossing the new Expo Road extension, the new light-rail track would cross over the main levee (Figure 1-7). The light-rail profile is anticipated to provide sufficient clearance above the improved levees at the existing floodwall (and improved floodwall), and the tracks would be constructed on fill supported by retaining walls above the floodwall. North of the floodwall, the light-rail tracks would continue onto the new light-rail bridge over North Portland Harbor.

As the Modified LPA's light-rail extension would cross the north end of the existing Cross Levee, the IBR Program is proposing to realign the Cross Levee to the east of the light-rail alignment. This realigned Cross Levee would intersect the new Expo Road extension. A levee closure structure would be required because the proposed roadway is a few feet lower than the proposed elevation of the improved levee.

On Hayden Island, proposed transit components include northbound and southbound LRT tracks over Hayden Island; the tracks would be elevated at approximately the height of the new I-5 mainline. An elevated LRT station would also be built on the island immediately west of I-5. Active transportation facilities, described below, would connect to the new Hayden Island Station. A new TPSS would be constructed at the Hayden Island Station, north of the transit platform. If a single-level fixed-span or movable-span Columbia River bridge configuration were implemented, the light-rail alignment would extend north on Hayden Island along the western edge of I-5 before transitioning onto the outer (western) edge of the new western single-level bridge over the Columbia River. For the double-deck configuration, the light-rail alignment would transition to the lower level of the new double-deck southbound I-5 bridge over the Columbia River.

1.2.2.4 Active Transportation

In the Victory Boulevard interchange area (Figure 1-6), active transportation facilities would be provided on Victory Boulevard beneath I-5 and Interstate Avenue between Expo Road and the northbound on/off-ramp terminal east of I-5. Active transportation facilities would also be provided along Expo Road between Victory Boulevard and the Expo Center. These facilities would provide direct connections 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 would provide access between the Bridgeton neighborhood (on the east side of I-5), Hayden Island, and the Expo Center MAX Station. There would 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 would continue along the extension of Expo Road under the interchange to the intersection of Marine Drive and Vancouver Way, where it would connect under Martin Luther King Jr. Boulevard to Delta Park.

East of the Marine Drive interchange, active transportation facilities on Martin Luther King Jr. Boulevard and on the parallel street, Union Court, would connect travelers to Marine Drive and across the arterial bridge to Hayden Island. The active transportation facilities on Martin Luther King Jr. Boulevard would provide westbound and eastbound cyclists and pedestrians with off-street crossings of the interchange and would 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 would include a shared-use path for pedestrians and bicyclists (Figure 1-6). On Hayden Island, active transportation facilities would be provided on Jantzen Avenue, Hayden Island Drive, and Tomahawk Island Drive and would connect to the Hayden Island Station. The shared-use path on the arterial bridge would continue along the arterial bridge to the south side of Tomahawk Island Drive. A parallel, elevated path from the arterial bridge would continue adjacent to I-5 across Hayden Island and cross above Tomahawk Island Drive and Hayden Island Drive to connect to the outer edge of the new single-level, or lower level of the double-deck eastern bridge over the Columbia River. A ramp down to the north side of Hayden Island Drive would be provided from the elevated path.

1.2.3 Columbia River Bridges (Subarea B)

This section discusses the geographic Subarea B (Figure 1-3 provides an overview of the geographic subareas). Figure 1-10 shows highway and interchange improvements in Subarea B.

Figure 1-10. Columbia River Bridges (Subarea B)

1.2.3.1 Highways, Interchanges, and Local Roadways

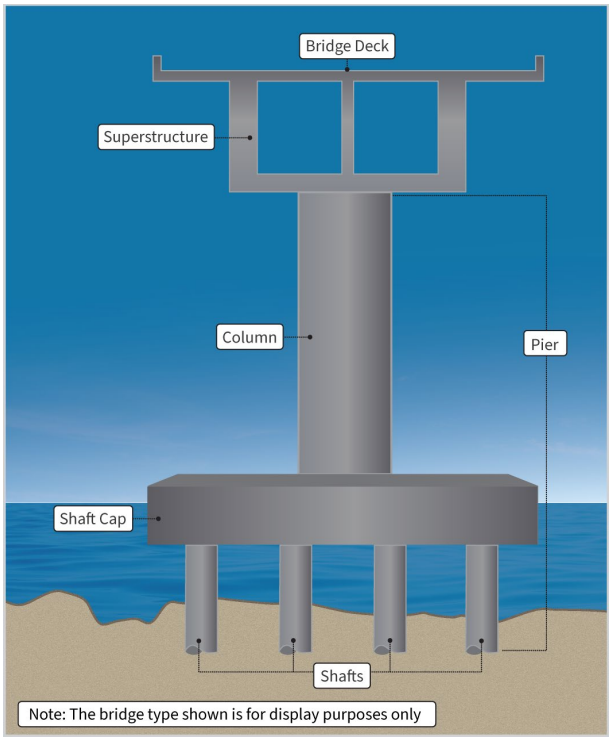
The two existing parallel northbound and southbound I-5 bridges that cross the Columbia River were constructed in 1917 and 1958, respectively. When the 1958 bridge was constructed, pier 5 of the 1917 bridge was removed and the profile was raised to match the new bridge. For the IBR Program, the two existing bridges would be replaced by two new parallel bridges, located west of the existing bridges (Figure 1-10). The new bridges would be designed to current American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design Bridge Design Specifications and AASHTO Seismic Guide Specifications and in compliance with ODOT and WSDOT design criteria.

With all bridge configuration design options, the new eastern bridge would accommodate northbound highway traffic and a shared-use path. The new western bridge would carry southbound traffic and light-rail tracks. Whereas the existing bridges each have three lanes with no shoulders, each of the two new bridges would accommodate three through lanes, one or two auxiliary lanes, and shoulders on both sides of the highway. Lanes and shoulders would be built to full design standards.

As with the existing bridge (Figure 1-12), the new Columbia River bridges would provide three navigation channels: a primary navigation channel (Figure 1-13). The current location of the primary navigation channel is near the Vancouver shoreline where the existing lift spans are located. The IBR Program is coordinating with the USACE to obtain authorization to change the location of the primary navigation channel. 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 and become the north barge channel. The new primary navigation channel would be 400 feet wide (this width includes a 300-foot USACE-authorized channel and a 50-foot channel maintenance buffer on each side of the authorized channel), and the two barge channels would also each be 400 feet wide.

The existing Interstate Bridge has nine in-water pier sets[8] and four pier sets on land (pier locations are shown on Figure 1-12). The new Columbia River bridges (any bridge configuration) would be built on six in-water pier sets, plus multiple piers on land (pier locations are shown on Figure 1-13). Each in-water pier set would 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 would rise from the shaft caps and connect to the superstructures of the bridges (Figure 1-11).

Figure 1-11. Bridge Foundation Concept



BRIDGE CONFIGURATION OPTIONS

Three bridge configuration options are being considered: (1) double-deck fixed-span (with one bridge type); (2) a single-level fixed-span (with various potential bridge types); and (3) a single-level movable-span (with one bridge type). Both the double-deck and single-level fixed-span configurations would provide 116 feet of vertical navigation clearance at their respective highest spans, which was the vertical navigation clearance of the CRC LPA. The CRC LPA included a double-deck fixed-span bridge configuration. The single-level fixed-span configuration was developed and is being considered as part of the IBR Program in response to the physical and contextual changes (e.g., design and operational considerations) since

[8] A pier set consists of the pier supporting the northbound bridge and the pier supporting the southbound bridge at a given location.

2013 that allowed for opportunities to examine a refinement in the double-deck bridge configuration (e.g., ingress and egress of transit from the lower level of the double-deck fixed-span configuration on the north end of the southbound bridge).

Consideration of the single-level movable-span configuration as part the IBR Program was necessitated by the U.S. Coast Guard's (USCG) review of the Program's navigation impacts on the Columbia River and issuance of a Preliminary Navigation Clearance Determination (PNCD) (USCG 2022). The USCG PNCD set the preliminary vertical navigation clearance recommended for the issuance of a bridge permit at 178 feet; this is the current vertical navigation clearance of the Interstate Bridge. On January 16, 2026, the USCG issued a revised PNCD for the new Columbia River bridges and set the preliminary vertical navigation clearance at 116 feet or greater (USCG 2026).

The IBR Program is carrying forward the three bridge configurations, each of which meets the IBR Program's Purpose and Need, to address changed conditions to ensure a permittable bridge configuration is within the range of options considered in the Supplemental Environmental Impact Statement (SEIS). Each of the bridge configuration design options provides at least 116 feet of vertical navigation clearance and is consistent with the January 2026 PNCD issued by the USCG. Additional discussion on pending actions to obtain authorizations from USCG and USACE for the Columbia River bridges' primary navigation channel location are described in Section 2.6, Additional Compliance, of the Final SEIS.

Each of the bridge configurations assumes one auxiliary lane; two auxiliary lanes could be applied to any of the bridge configurations. All typical sections with one auxiliary lane would provide 14-foot shoulders to accommodate bus on shoulder and maintain traffic during construction of the Modified LPA and future maintenance.

Figure 1-12. Existing Navigation Clearances of the Interstate Bridge

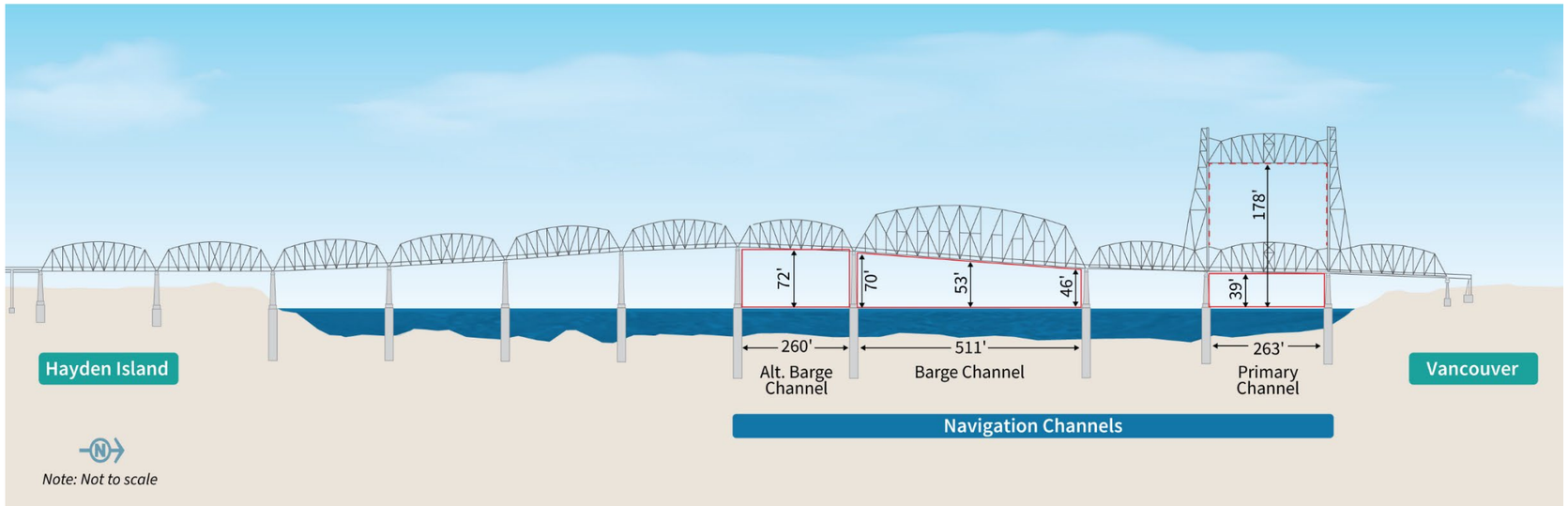
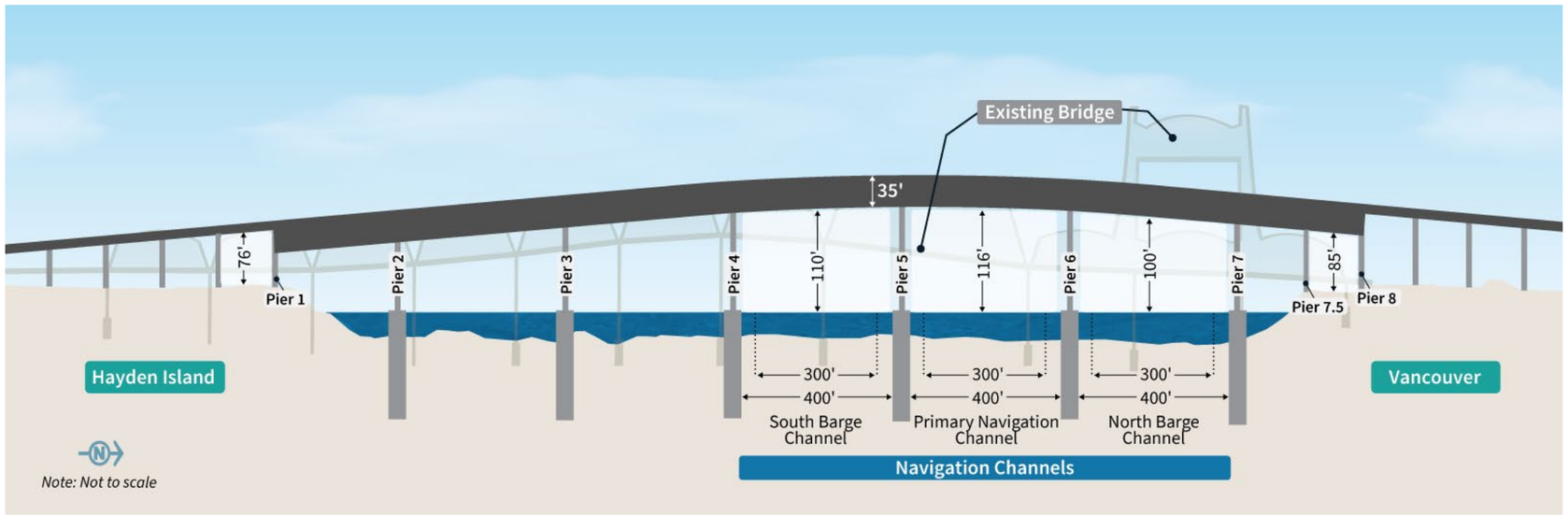


Figure 1-13. Navigation Clearances and Proposed Profile of the Modified LPA Columbia River Bridges with a Double-Deck Fixed-Span Configuration



Note: The location and widths of the proposed navigation channels would be same for all bridge configuration and bridge type options. The three navigation channels would each be 400 feet wide (this width includes a 300-foot USACE-authorized channel (shown in dotted lines) plus a 50-foot channel maintenance buffer on each side of the authorized channel). The vertical navigation clearance would vary, as described in the following sections.

Double-Deck Fixed-Span Configuration

The double-deck fixed-span configuration would be two side-by-side, double-deck, fixed-span steel truss bridges. Figure 1-14 shows 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 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, as well as barge channels.

The eastern bridge would accommodate northbound highway traffic on the upper level and the shared-use path and utilities on the lower level. The western bridge would carry southbound traffic on the upper level and one set of light-rail tracks (one northbound track and one southbound track) on the lower level. Each bridge deck would typically be 79 feet wide, with a total out-to-out width of approximately 173 feet.[9]

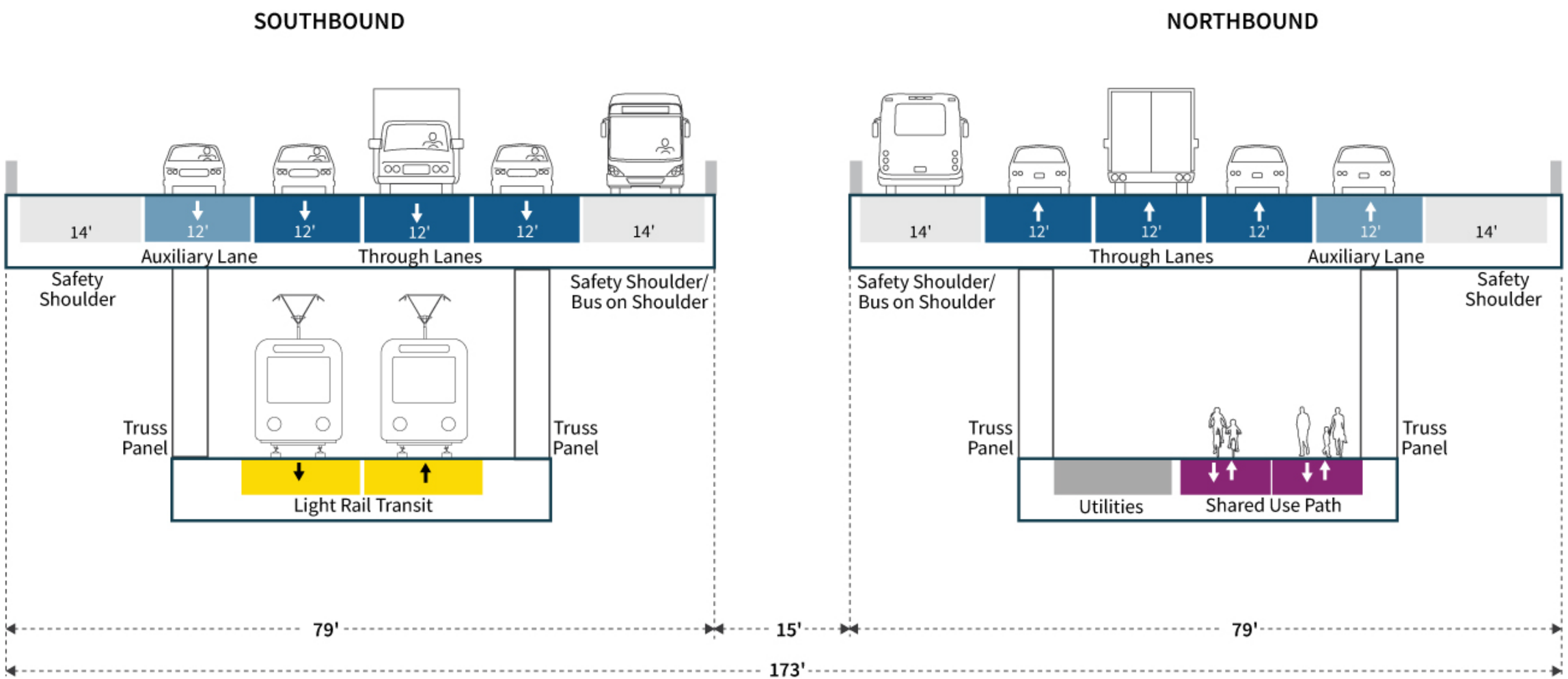
Figure 1-14. Conceptual Drawing of a Double-Deck Fixed-Span Configuration

Note: Visualization is looking southeast from Vancouver.

Figure 1-15 shows a typical cross section of the two parallel double-deck bridges. Like all bridge configuration design options under consideration, the double-deck fixed-span configuration would have six in-water pier sets. Each pier set would require 12 in-water drilled shafts, for a total of 72 in-water drilled shafts. Each individual shaft cap would be approximately 50 feet by 85 feet. This bridge configuration would have up to a 4% maximum grade on both the Oregon and Washington sides. All vertical profiles would follow AASHTO, WSDOT, and ODOT design standards.

[9] "Out-to-out width" is the measurement between the outside edges of the bridge across its width at the widest point.

Figure 1-15. Typical Cross Section of the Double-Deck Fixed-Span Configuration



Note: Design is not final and subject to change. Widths may vary with final design. The one auxiliary lane design option is used for illustration purposes. The two auxiliary lane design option would add approximately 8 feet to each bridge (i.e., 16 feet to the total width).

Single-Level Fixed-Span Configuration – Recommended Design Option

The single-level fixed-span configuration would have two side-by-side, single-level, fixed-span steel or concrete bridges. This report considers two single-level fixed-span bridge type options: a girder (steel or concrete segmental) bridge and an extradosed bridge.[10] The description in this section applies to both bridge types (unless otherwise indicated). Conceptual examples of both options are shown on Figure 1-16. These images are subject to change and do not represent final design.

This 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, as well as barge channels, which is consistent with the January 2026 PNCD issued by the USCG.

The eastern bridge would accommodate northbound highway traffic and the shared-use path; the bridge deck would be approximately 104 feet wide. The western bridge would carry southbound traffic and light-rail tracks; the bridge deck would be approximately 113 feet wide. The I-5 highway, light-rail tracks, and the shared-use path would be on the same level across the two bridges, instead of being divided between two levels as with the double-deck configuration. The total out-to-out width of the single-level fixed-span configuration (extradosed option) would be approximately 272 feet at its widest point, approximately 99 feet wider than the double-deck configuration. The total out-to-out width of the single-level fixed-span configuration (girder option) would be approximately 232 feet at its widest point. Figure 1-17 shows a typical cross section of the single-level configuration with an extradosed bridge as shown by the 10-foot-wide bridge columns. Figure 1-18 shows a

The IBR Program recommends advancing the single-level fixed-span bridge configuration. All bridge configurations would provide important benefits to highway operations and safety and have similar impacts to many resources. The main differences between either of the fixed-span configurations and the movable-span configuration is that the latter would provide more vertical clearance to accommodate larger vessels and a lower grade for all land-based transportation modes (which would benefit freight and active transportation users in particular), but this configuration would also periodically disrupt all other land-based transportation modes (personal vehicles, freight, transit, and active transportation) with bridge openings. The main differences between the double-deck and single-level fixed-span configurations are that the slightly higher grade of the former would impact freight traffic and active transportation users, and the latter would have faster emergency response times (although there would also be more exposure to vehicles) and give users of the shared-use path a greater sense of security due to "eyes on the path." The fixed-span configurations received generally positive comments from the public, while there was mixed feedback on the movable-span because of the tradeoffs given above.

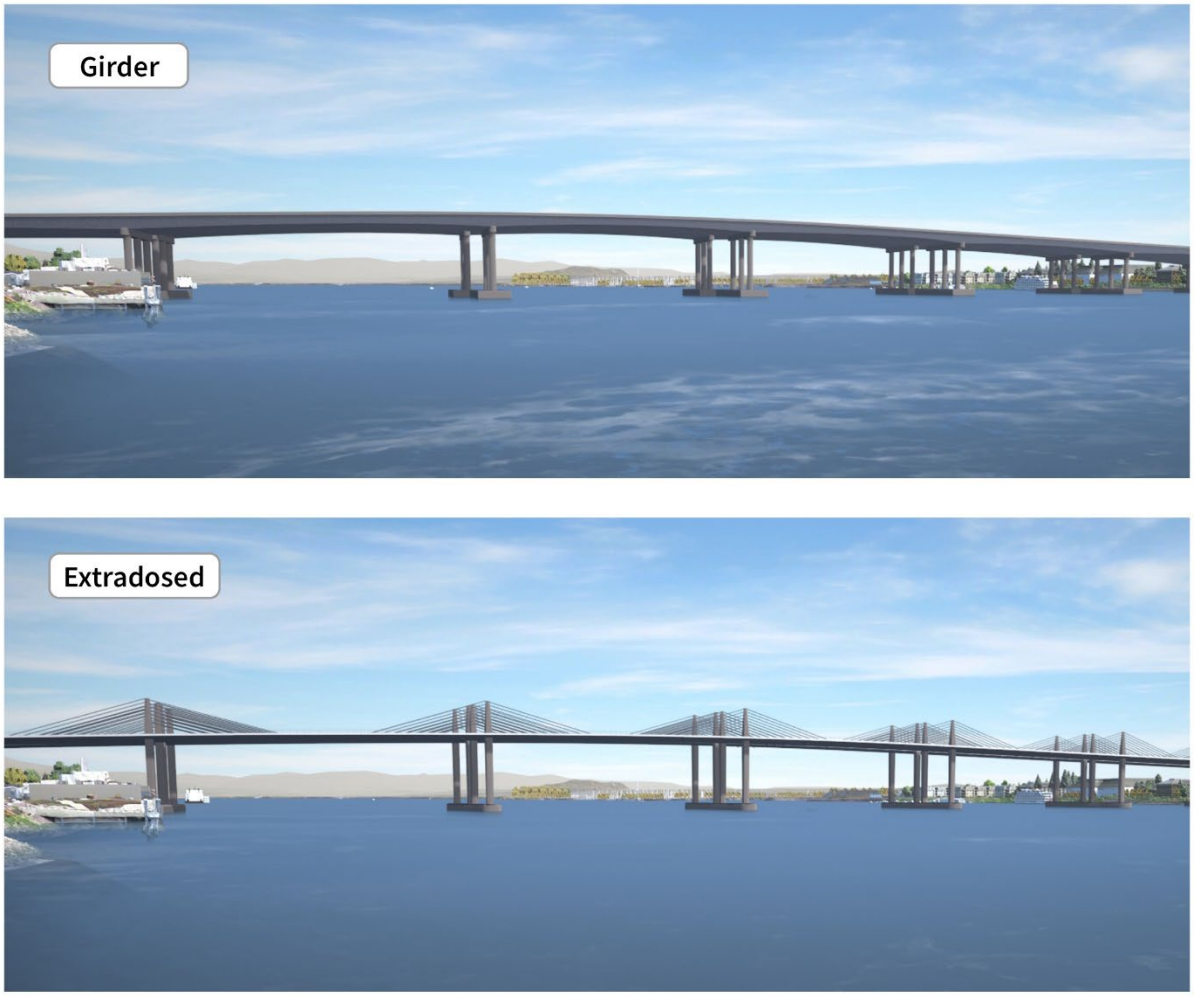
[10] The Draft SEIS also included a finback as a single-level fixed-span bridge type. As the design of the various bridge types progressed, it was determined that the finback would have higher risks associated with increased cost and construction schedule because this bridge type is less common and applying this bridge type to the scale of the new Columbia River bridges would introduce more design and construction challenges than the other bridge type options. Other bridge types, such as concrete or steel girder or extradosed, would have fewer risks and would be a more suitable for this location. As a result, the finback bridge type was dropped from further consideration.

typical cross section with a girder bridge, which would not have the 10-foot-wide bridge columns shown on Figure 1-17.

There would be six in-water pier sets with 16 in-water drilled shafts on each combined shaft cap, for a total of 96 in-water drilled shafts. The combined shaft caps for each pier set would be approximately 50 feet by 230 feet.

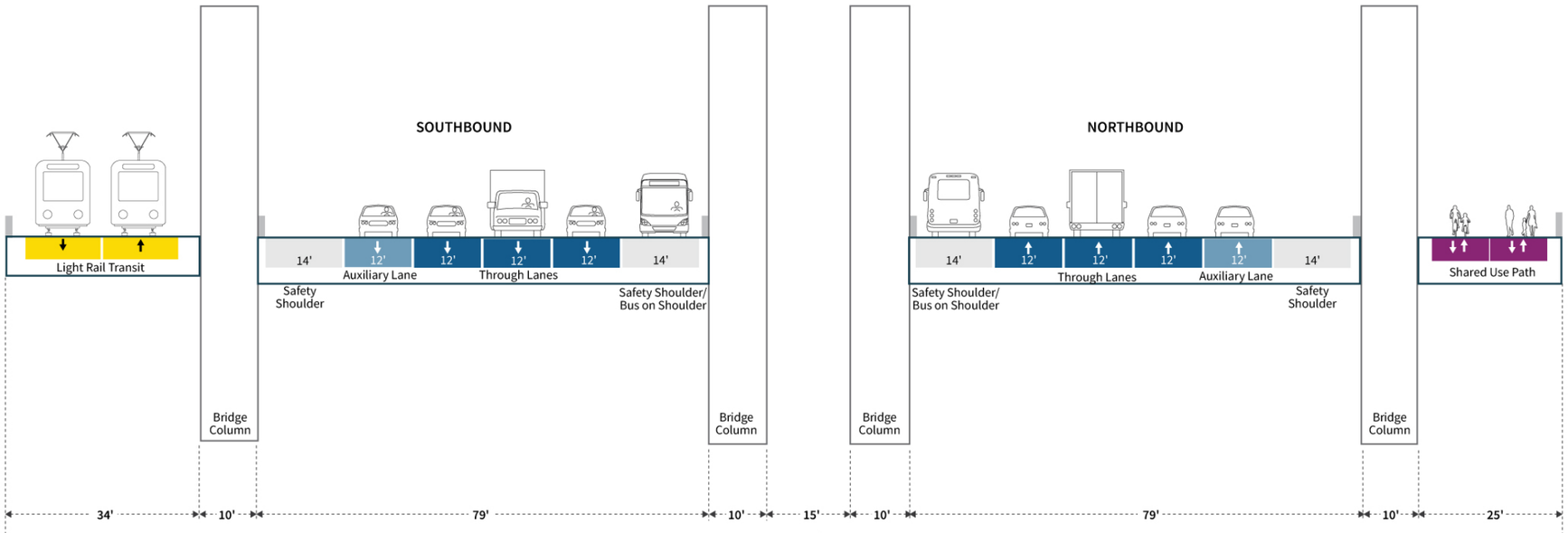
This bridge configuration would be expected to have an approximate grade of 3% on both the Oregon and Washington sides of the bridge. All vertical profiles would follow AASHTO, WSDOT, and ODOT design standards.

Figure 1-16. Conceptual Drawings of Single-Level Fixed-Span Bridge Types



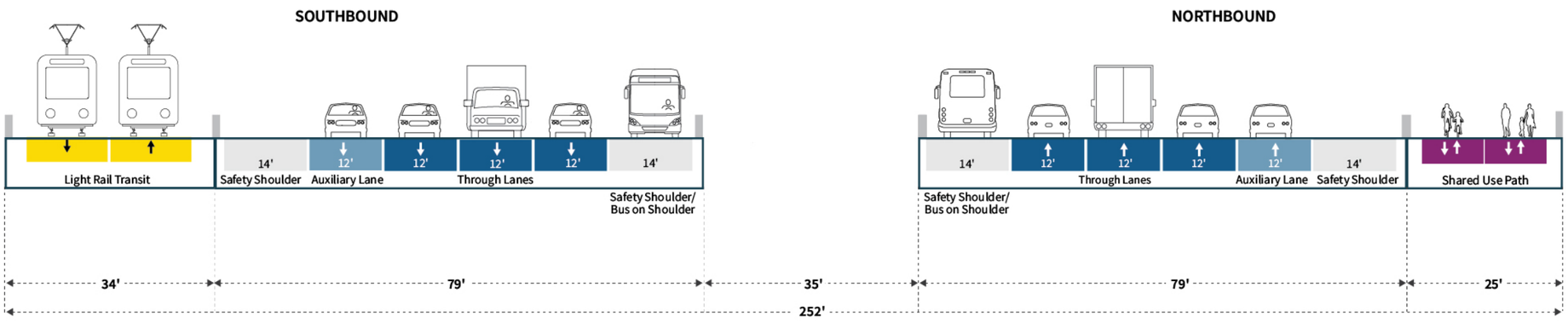
Note: Visualizations are for illustrative purposes only. They do not reflect property impacts or represent final design. Visualization is looking southeast from Vancouver.

Figure 1-17. Typical Cross Section of the Single-Level Fixed-Span Configuration (Extradosed Type)



Note: Design is not final and subject to change. Widths may vary with final design. The two auxiliary lane design option would add approximately 8 feet to each bridge (i.e., 16 feet to the total width).

Figure 1-18. Typical Cross Section of the Single-Level Fixed-Span Configuration (Girder Type)



Note: Design is not final and subject to change. Widths may vary with final design. The cross section for a girder bridge type would be the same as an extradosed bridge type except that it would not have the four 10-foot bridge columns. The distance between the two bridges could be reduced to 10 feet. The one auxiliary lane design option is used for illustration purposes. The two auxiliary lane design option would add approximately 8 feet to each bridge (i.e., 16 feet to the total width).

Single-Level Movable-Span Configuration

The single-level movable-span configuration would have two side-by-side, single-level steel girder bridges with movable spans between Piers 5 and 6. For the purpose of this report, the IBR Program assessed a vertical lift movable-span configuration with counterweights based on the analysis in the *River Crossing Bridge Clearance Assessment Report – Movable-Span Options,* included as part of Attachment C in Appendix D, Design Options Development, Screening, and Evaluation Technical Report to the Final SEIS. A conceptual example of a vertical lift-span bridge is shown in Figure 1-19. These images are subject to change and do not represent final design.

A movable span must be located on a straight and flat bridge section (i.e., without horizontal curvature and with minimal grade). To comply with these requirements, and for the bridge to maintain the highway, transit, and active transportation connections on Hayden Island and in Vancouver while minimizing property acquisitions and displacements, the movable span is proposed to be located approximately 500 feet south of the existing lift span, between Piers 5 and 6.

The single-level movable-span configuration would provide approximately 90 feet of vertical navigation clearance over the proposed relocated primary navigation channel when the movable spans are in the closed position, with 99 feet of vertical navigation clearance available over the north barge channel. It satisfies the requirement of a minimum of 72 feet of vertical navigation clearance (the existing Interstate Bridge's maximum clearance over the alternate [southernmost] over the barge channel when the existing lift span is in the closed position).

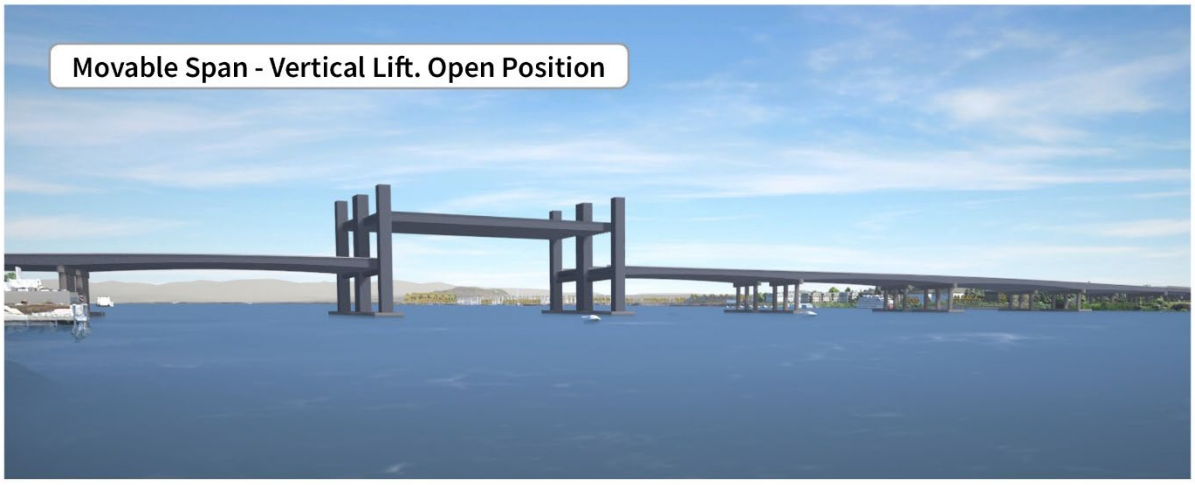
In the open position, the movable span would provide 178 feet of vertical navigation clearance over the proposed relocated primary navigation channel. Similar to the fixed-span configurations, the movable span would provide 400 feet of horizontal navigation clearance for the primary navigation channel and for each of the two barge channels. The vertical lift-span towers would be approximately 243 feet high, which would be slightly shorter than the existing lift-span towers, which are 247 feet high.

Similar to the single-level fixed-span configuration, the eastern bridge would accommodate northbound highway traffic and the shared-use path, and the western bridge would carry southbound traffic and light-rail tracks. The I-5 highway, light-rail tracks, and shared-use path would be on the same level across the bridges instead of on two levels as with the double-deck configuration. Typical cross sections of the single-level movable-span configuration are shown in Figure 1-20; the top section depicts the vertical lift spans (Piers 5 and 6), and the bottom section depicts the fixed spans (Piers 2, 3, 4, and 7). The movable and fixed cross sections are slightly different because the movable span requires lift towers, which are not required for the fixed spans of the bridges.

There would be six in-water pier sets and two piers on land per bridge. The vertical lift span would have 22 in-water drilled shafts each for Piers 5 and 6; the shaft caps for these piers would be approximately 50 feet by 312 feet to accommodate the vertical lift spans. Piers 2, 3, 4, and 7 would have 16 in-water drilled shafts each; the shaft caps for these piers would be the same as for the fixed-span options (approximately 50 feet by 230 feet). The single-level movable-span configuration (with a vertical lift span) would have a total of 108 in-water drilled shafts.

This single-level movable-span configuration would be expected to have an approximate grade of 3% on the Oregon side of the bridge and an approximate grade of 1.5% on the Washington side. All vertical profiles would follow AASHTO, WSDOT, and ODOT design standards.

Figure 1-19. Conceptual Drawings of Single-Level Movable-Span Configurations in the Closed and Open Positions

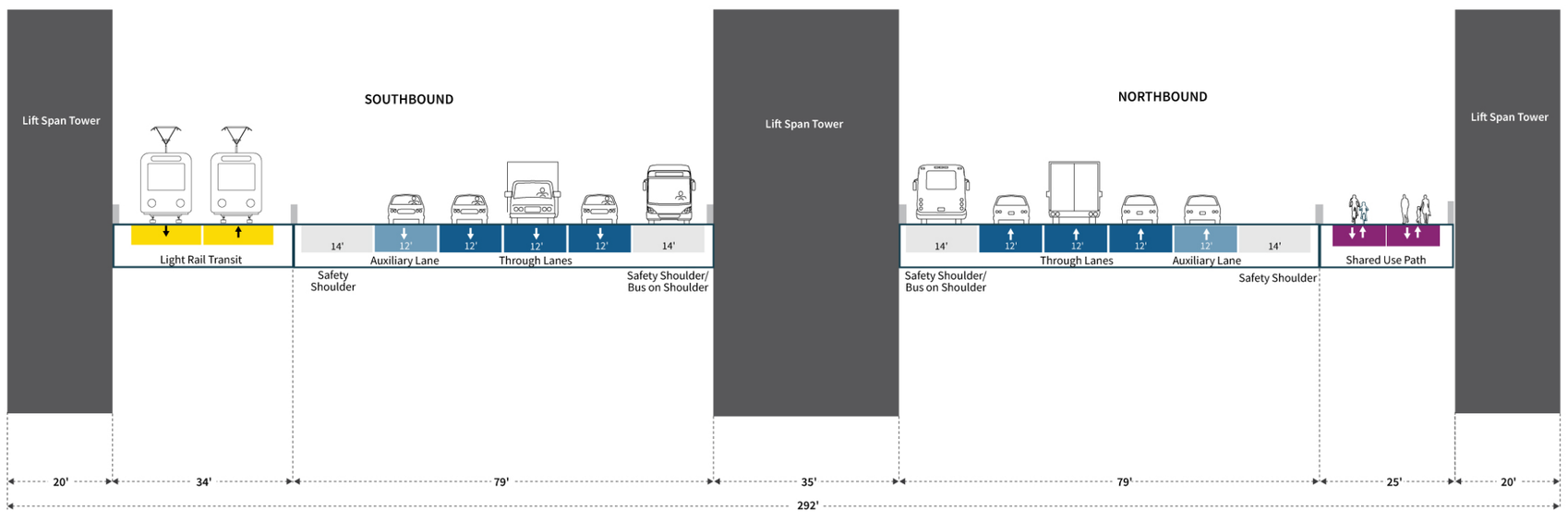


Visualizations are for illustration purposes only. They do not reflect property impacts or represent final design.

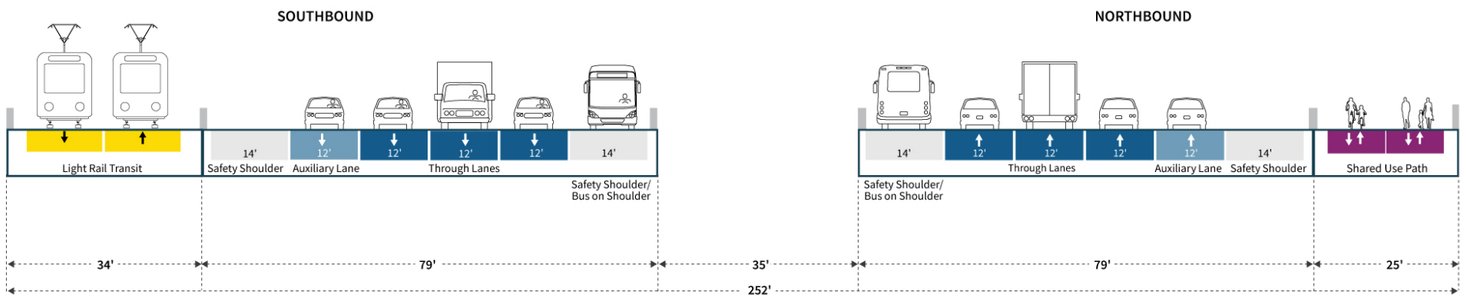
Note: Visualization is looking southeast (upstream) from Vancouver.

Figure 1-20. Typical Cross Section of the Single-Level Movable-Span Bridge Type

Single-level Bridge with Movable Span - Vertical Lift Span Cross-section (Piers 5 and 6)



Single-level Bridge with Movable Span - Fixed Spans Cross-section (Piers 2, 3, 4, and 7)



Note: Design is not final and subject to change. Widths may vary with final design. The one auxiliary lane design option is used for illustration purposes. The two auxiliary lane design option would add approximately 8 feet to each bridge (i.e., 16 feet to the total width).

Bridge Configuration Comparison

This section summarizes and compares each of the bridge configurations. Table 1-2 lists the key considerations for each bridge configuration. Figure 1-21 compares each of the three bridge configurations' footprints with the one auxiliary lane design option (refer to Figure 1-5 for a comparison of the one and two auxiliary lane design options footprints). The footprints of each configuration would differ in only three locations: over the Columbia River and at the bridge landings on Hayden Island and Vancouver. The rest of the I-5 corridor would have the same footprint. Over the Columbia River, the footprint of the double-deck fixed-span configuration would be approximately 173 feet wide. Comparatively, the extradosed bridge type of the single-level fixed-span configuration would be approximately 272 feet wide (approximately 99 feet wider), and the single-level fixed-span configuration with a girder bridge type would be approximately 232 feet wide (approximately 59 feet wider). The single-level movable-span configuration would be approximately 252 feet wide (approximately 79 feet wider than the double-deck fixed-span configuration), except at Piers 5 and 6, where larger bridge foundations would require an additional width of approximately 40 feet to support the movable span. The single-level configurations 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 1-22 compares the basic profile and elevation of each configuration. The single-level fixed-span configuration and the lower deck of the double-deck fixed-span would have similar elevations, but the upper deck of the double-deck bridge would be approximately 35 feet higher. The single-level movable-span configuration would have a lower profile than the fixed-span configurations when the span is in the closed position.

Figure 1-21. Bridge Configuration Footprint Comparison

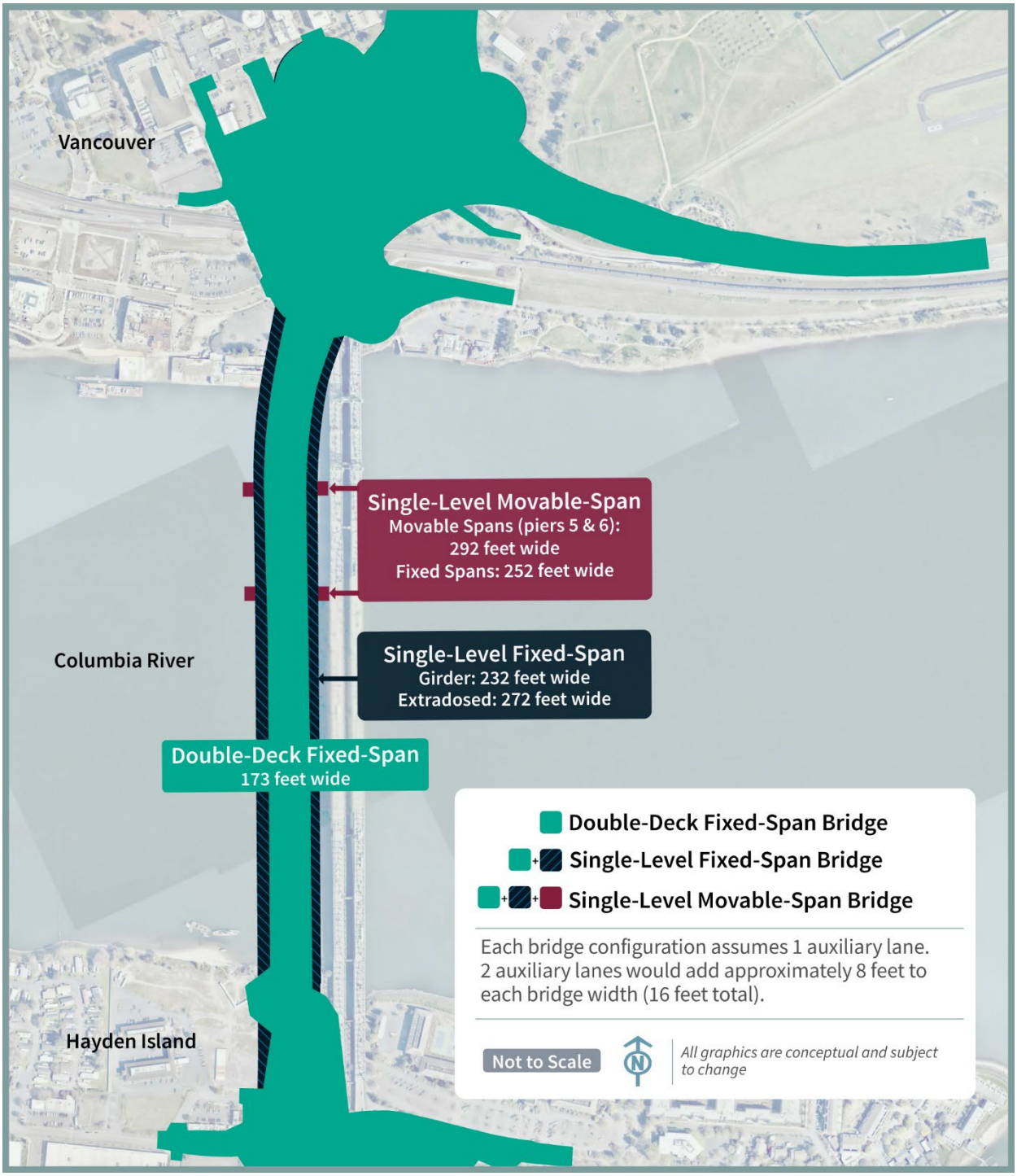
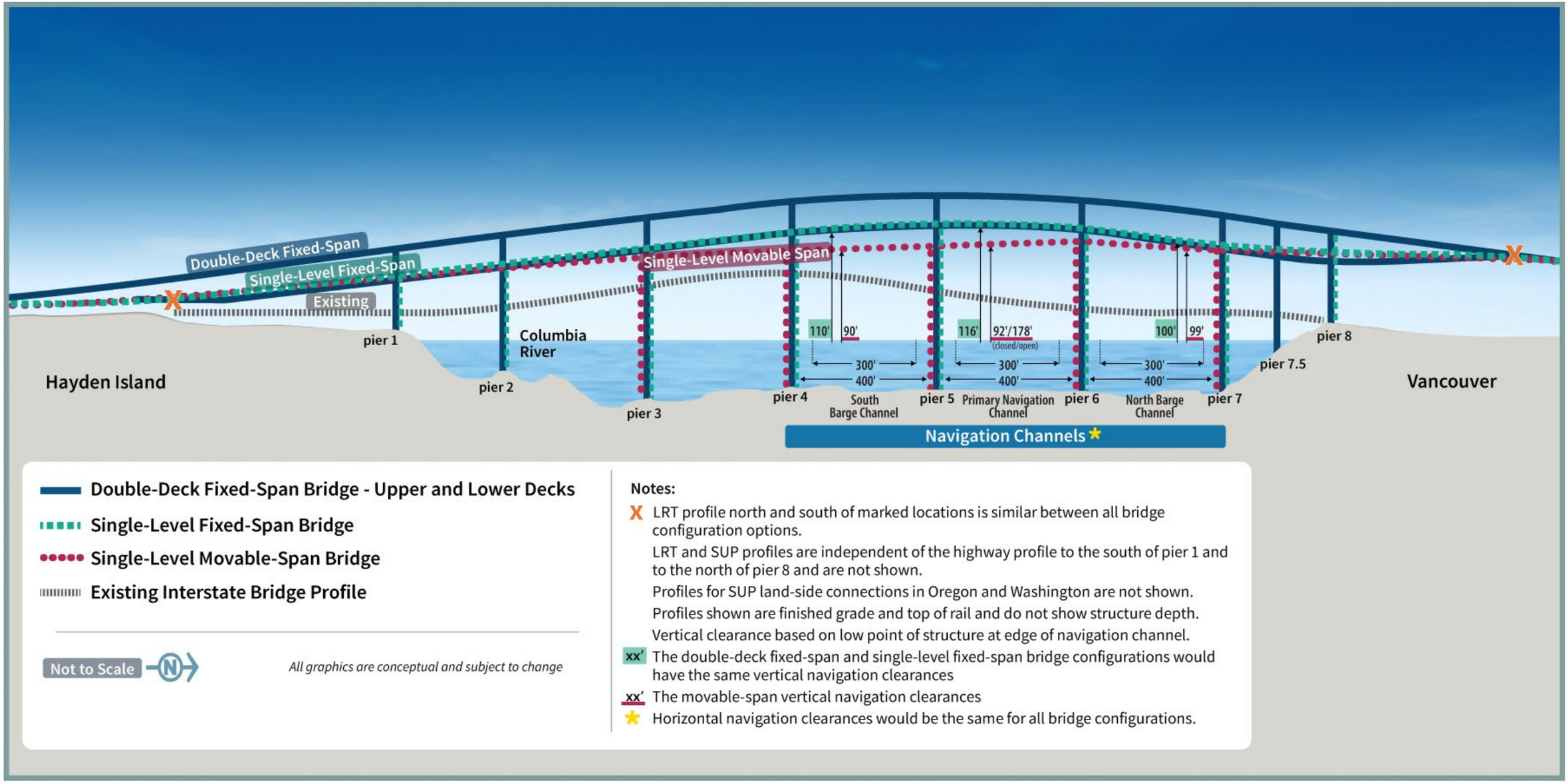


Figure 1-22. Bridge Configuration Profile Comparison



LRT = light-rail transit; SUP = shared-use path

Table 1-2. Summary of Bridge Configurations

Component	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Bridge type	Steel through-truss spans	Double-deck steel truss	Single-level, concrete or steel girders, or extradosed	Single-level, steel girders with vertical lift span
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 (approximately 500 feet south of the existing lift span)
Lift opening restrictions for vessels	Weekday peak AM and PM highway travel periods. [b] Typical bridge opening/gate closure durations are approximately 9 to 27 minutes depending on the purpose of the bridge lift (i.e., maintenance or vessel traffic) and lift elevation (i.e., partial lift or full lift). From 2007 to 2024, there was an average of 152 lifts per year (IBR 2025a).	N/A	N/A	• Considering 2007–2024 trends in vessels transiting under the Interstate Bridge, there would be fewer bridge lifts compared to the No-Build Alternative due to increased vertical navigation clearance in the closed position (99 feet compared to 72 feet). • Additional restrictions to daytime bridge openings would be requested to

Component	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
				consolidate fewer bridge openings outside of morning, midday, and evening peak hours when vehicle and transit demand is high in order to improve LRT on-time performance and system reliability and reduce highway congestion. Changes to bridge opening restrictions would require future federal rulemaking process and authorization by USCG (beyond the assumed No-Build Alternative bridge restrictions for peak AM and PM highway travel periods). [b] • Typical opening durations are assumed to be 9 to 18 minutes [c] for the purposes of impact analysis but would ultimately depend on various operational considerations related to vessel traffic and river and weather conditions.

Component	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
				Additional time would also be required to stop traffic prior to opening and restart traffic after the bridge closes.
Out-to-out width [d]	138 feet total width	~173 feet total width	Girder: ~232 feet total width Extradosed: 272 feet total width	~292 feet at the movable span ~252 feet at the fixed spans
Deck widths	52 feet (SB) 52 feet (NB)	~79 feet (SB) ~79 feet (NB)	Girder: ~113 feet (SB) ~104 feet (NB) Extradosed: ~133 feet (SB) ~124 feet (NB)	~113 feet (SB) ~104 feet (NB)
Vertical navigation clearance	Primary navigation channel: • 39 feet when closed • 178 feet when open Barge channel: • 46 feet to 70 feet Alternate barge channel: • 72 feet	Primary navigation channel: • 116 feet maximum North barge channel: • 100 feet maximum South barge channel: • 110 feet maximum	Primary navigation channel: • 116 feet maximum. North barge channel: • 100 feet maximum South barge channel: • 110 feet maximum	Primary navigation channel: • Closed position: ~90 feet. • Open position: 178 feet North barge channel: • ~99 feet maximum South barge channel: • ~90 feet maximum
Horizontal navigation clearance	• 263 feet for primary navigation channel • 511 feet for barge channel	400 feet for all navigation channels (300-foot USACE authorized channel plus a 50-	400 feet for all navigation channels (300-foot USACE authorized channel plus a 50-	400 feet for all navigation channels (300-foot USACE authorized channel plus a

Component	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
	• 260 feet for alternate barge channel	foot channel maintenance buffer on each side)	foot channel maintenance buffer on each side)	50-foot channel maintenance buffer on each side)
Maximum height of bridge component (elevation relative to NAVD 88) [e]	247 feet at top of lift tower	~166 feet	Girder: ~137 feet. Extradosed: ~179 feet at top of pylons	~243 feet at top of lift tower
Movable-span length (from center of pier to center of pier)	278 feet	N/A	N/A	450 feet
Number of in-water pier sets	Nine	Six	Six	Six
Number of in-water drilled shafts	N/A	72	96	108
Shaft cap sizes	N/A	50 feet by 85 feet	50 feet by 230 feet	• 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)

Component	No-Build Alternative	Modified LPA with Double-Deck Fixed-Span Configuration	Modified LPA with Single-Level Fixed-Span Configuration [a]	Modified LPA with Single-Level Movable-Span Configuration
Conceptual vertical grade [f]	4.8%	~4% on the Washington side ~4% on the Oregon side	~3% on the Washington side ~3% on the Oregon side	~1.5% on the Washington side. ~3% on the Oregon side
LRT location	N/A	Below highway on SB bridge	West of highway on SB bridge	West of highway on SB bridge
Express bus	Shared roadway lanes	Inside shoulder of NB and SB (upper) bridges	Inside shoulder of NB and SB bridges	Inside shoulder of NB and SB bridges
Shared-use path location	Sidewalk adjacent to roadway in both directions	Below highway on NB bridge	East of highway on NB bridge	East of highway on NB bridge

All dimensions and quantities are approximate.

a When different bridge types are not mentioned, data apply to both bridge types under the single-level fixed-span bridge configuration.

b The No-Build Alternative assume existing conditions that restrict bridge openings during weekday peak periods (Monday through Friday 6:30 a.m. to 9 a.m.; 2:30 p.m. to 6 p.m., excluding federal holidays). For the Modified LPA with a single-level movable-span bridge configuration design option, additional timing restrictions, which would increase restrictions on the timing for and duration of bridge openings, except for emergencies, would be requested and coordinated with the USCG. Bridge openings would be required for vessels and/or cargo with heights greater than 72 feet under the No-Build Alternative; whereas, bridge openings for vessels and/or cargo requiring more than 99 feet of clearance would be required for the Modified LPA with the movable-span bridge configuration design option.

c For the purposes of the transportation analysis in the Final SEIS (Section 3.1, Transportation of the Final SEIS), the movable-span opening time is assumed to be an average of 13.2 minutes.

d "Out-to-out width" is the measurement between the outside edges of both northbound and southbound bridge across its width at the widest point and includes the space between the two bridges. The deck width is the measurement of the outer edges of either the northbound bridge or the southbound bridge.

e NAVD 88 (North American Vertical Datum of 1988) is a vertical control datum (reference point) used by federal agencies for surveying.

f The maximum allowable vertical grade according to ODOT and WSDOT standards on the I-5 mainline is 4%.

I-5 = Interstate 5; LPA = Locally Preferred Alternative; LRT = light-rail transit; N/A = not applicable; NAVD 88 = North American Vertical Datum of 1988; NB = northbound; ODOT = Oregon Department of Transportation; SB = southbound; SEIS = Supplemental Environmental Impact Statement; USACE = U.S. Army Corps of Engineers; USCG = U.S. Coast Guard; WSDOT = Washington State Department of Transportation

1.2.4 Downtown Vancouver (Subarea C)

This section discusses the geographic Subarea C (Figure 1-3 shows an overview of the geographic subareas). Figure 1-23 shows all highway and interchange improvements in Subarea C.

1.2.4.1 Highways, Interchanges, and Local Roadways

North of the Columbia River bridges in downtown Vancouver, improvements are proposed to the SR 14 interchange (Figure 1-23).

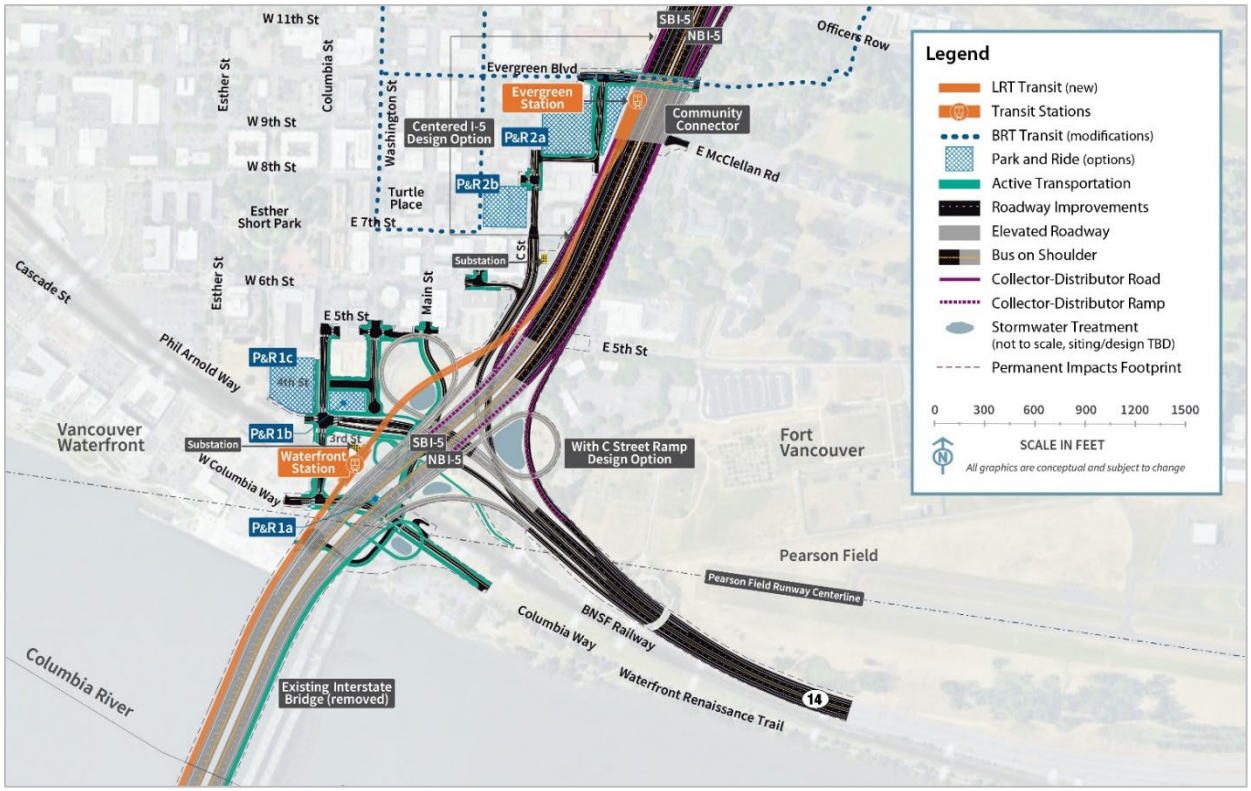
SR 14 INTERCHANGE/DOWNTOWN VANCOUVER

The new Columbia River bridges would touch down just north of the SR 14 interchange (Figure 1-23). The function of the SR 14 interchange configuration would remain essentially the same as it is now, but the interchange would be elevated to meet the new Columbia River bridges that cross over the BNSF Railway tracks. Direct connections between I-5 and SR 14 would be rebuilt. Access to and from downtown Vancouver would be provided as it is today, but the connection points would be relocated. Access from downtown Vancouver to eastbound SR 14 would be relocated from the Washington Street and W 5th Street intersection to a new intersection at Columbia Street and W 3rd Street. Access from westbound SR 14 would also be shifted from C Street to the new Columbia Street and W 3rd Street intersection. Access from downtown Vancouver to southbound I-5 would be relocated from the Washington Street and W 5th Street intersection to C Street. Access from northbound I-5 to downtown Vancouver would remain at C Street. Connections to downtown Vancouver would vary under the two design options under consideration for this area (with C Street ramps and without C Street ramps), as detailed below.

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

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

Figure 1-23. Downtown Vancouver (Subarea C)



BRT = bus rapid transit; LRT = light-rail transit; NB = northbound; P&R = park and ride; SB = southbound

C Street Ramp Design Options

With C Street Ramps – Recommended Design Option

The design option with C Street ramps would provide access to and from downtown Vancouver similar to existing conditions but with some of the connection points relocated. Access from northbound I-5 to downtown Vancouver would be rebuilt in the same location as the current connection. Downtown Vancouver I-5 access to and from the south would be consolidated at C Street with SR 14 connections to and from downtown at Columbia Street/ W 3rd Street (Figure 1-24).

Without C Street Ramps

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

I-5 Alignment Design Options

Centered I-5 – Recommended Design Option

This design option would maintain the location of the existing I-5 mainline alignment through downtown Vancouver between the SR 14 interchange and the Mill Plain Boulevard interchange.

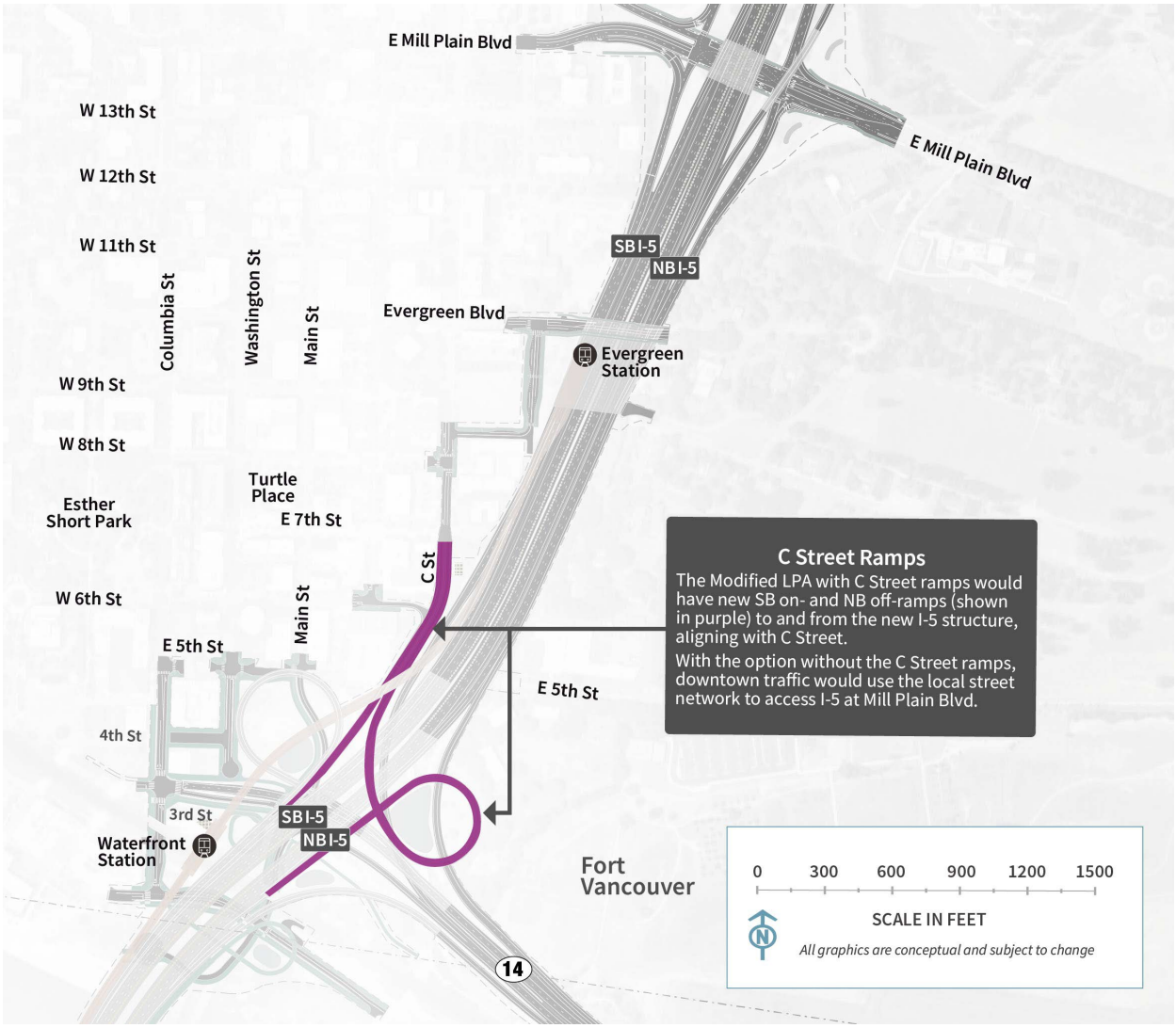
I-5 Shifted West

This design option would shift the I-5 mainline and ramps approximately 40 feet to the west between SR 14 and Mill Plain Boulevard.

The IBR Program recommends advancing the with C Street ramps design option. Both C Street ramp design options would provide important benefits to highway operations and safety and have similar impacts to many other resources, particularly the natural environment. While there would be some short-term construction cost savings and reduced visual impacts without C Street ramps, there would be greater impacts to local traffic as traffic that would have used the C Street ramps would be routed to the Mill Plain interchange, thereby increasing traffic volumes on the local street network and requiring additional mitigation. Both design options received a mix of positive and negative feedback from the public; however, there were more comments in support of the with C Street ramps design option. The with C Street ramps design option also has more support from the local partner agencies.

The IBR Program recommends advancing the centered I-5 alignment design option. Both I-5 mainline alignments would provide important benefits to highway operations and safety and have similar impacts to many other resources, particularly the natural environment. The westward shift design option would notably increase acquisitions resulting in the displacement of an additional three businesses (with approximately 140 employees) and 33 residential units, and the physical removal of the historic Normandy Apartments. However, the westward shift would reduce the area of acquisition and other impacts to the Vancouver National Historic Reserve (VNHR) Historic District (which includes the Fort Vancouver National Historic Site). While some public comments noted the reduced impacts to the VNHR Historic District from the westward shift design option, others raised concerns about its effects on safety, congestion, and increased residential and business displacements.

Figure 1-24. Modified LPA with C Street Ramps



COLLECTOR-DISTRIBUTOR ROADWAYS

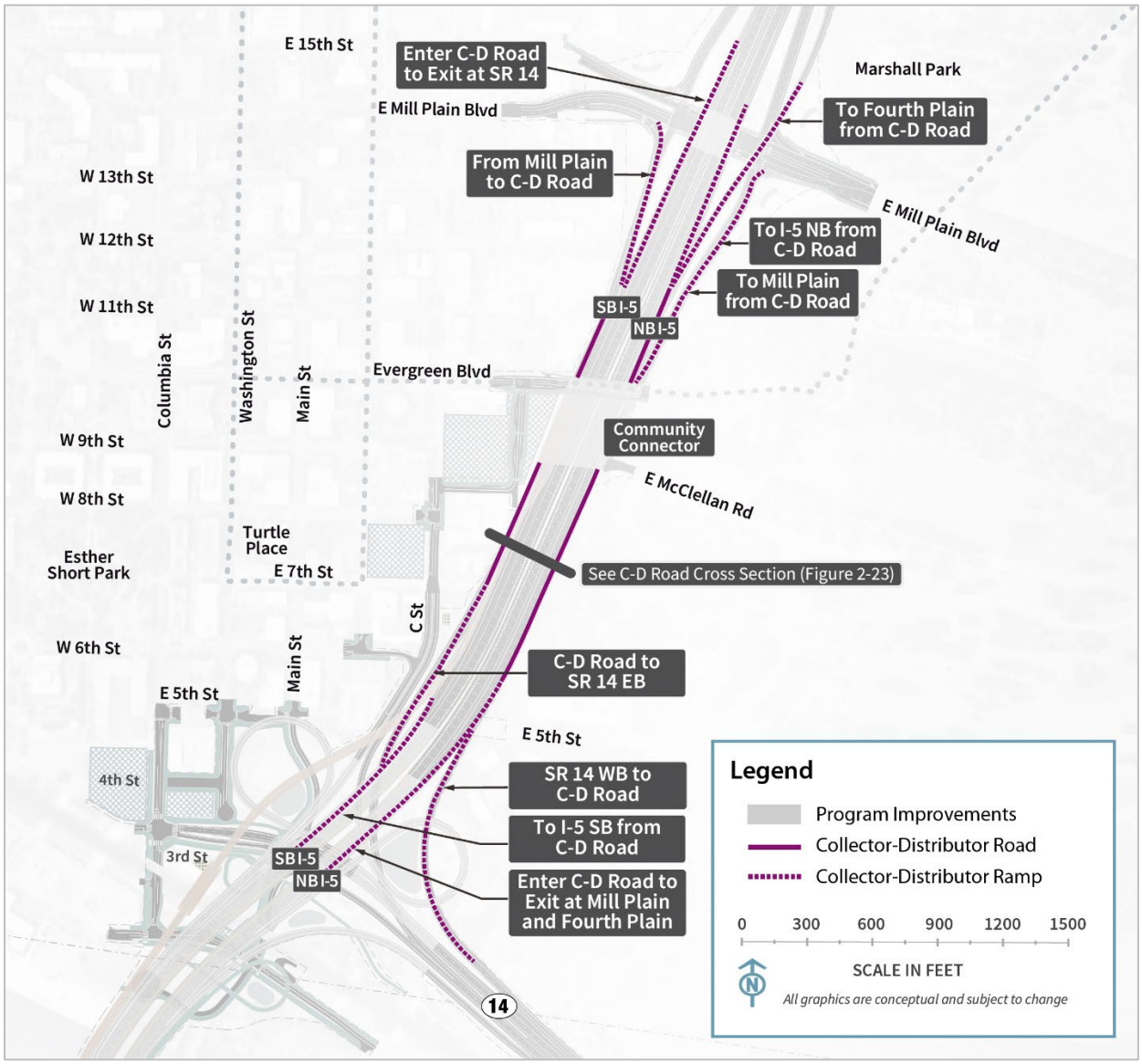
Figure 1-25 shows the location of the collector-distributor (C-D)[11] roadways in downtown Vancouver, and Figure 1-26 shows a typical cross section of the C-D roadways.

The on-ramp from SR 14 westbound would join the I-5 northbound off-ramp to Mill Plain/Fourth Plain Boulevard, forming the northbound C-D roadway between SR 14 and Fourth Plain Boulevard. The C-D roadway would provide access from northbound I-5 to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard. The C-D roadway would also provide access from westbound SR 14 to the off-ramps at Mill Plain Boulevard and Fourth Plain Boulevard, and to the on-ramp to northbound I-5.

[11] A collector-distributor roadway parallels and connects the main travel lanes of a highway and frontage roads or entrance ramps.

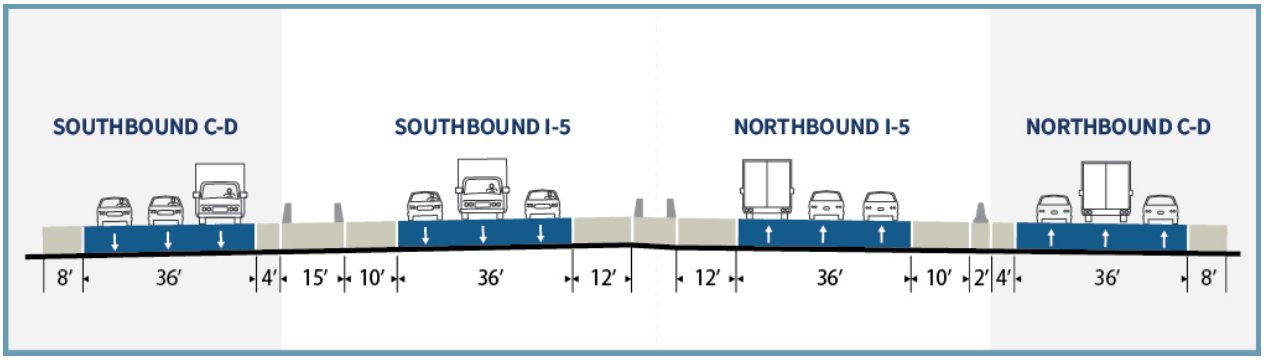
On southbound I-5, the off-ramp to SR 14 would join the southbound I-5 on-ramp from Mill Plain Boulevard to form a C-D roadway. The C-D roadway would provide access from southbound I-5 to the off-ramp to eastbound SR 14 and from Mill Plain Boulevard to the off-ramp to eastbound SR 14 and the on-ramp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

Figure 1-25. Collector-Distributor Roadways



C-D = collector-distributor; EB = eastbound; NB = northbound; SB = southbound; WB = westbound

Figure 1-26. Typical Cross Section of the Collector-Distributor Roadways



The location of this cross section is shown on Figure 1-25.

1.2.4.2 Transit

LIGHT-RAIL ALIGNMENT AND STATIONS

Under the Modified LPA, the light-rail tracks would exit the highway bridge and be on their own bridge along the west side of the I-5 mainline after crossing the Columbia River (see Figure 1-23). The light-rail bridge would cross over the BNSF Railway tracks. An elevated light-rail station near the Vancouver waterfront (Waterfront Station) would be situated near the overcrossing of the BNSF tracks between Columbia Way and 3rd Street. Access to the elevated station would be primarily by elevator because the station would be situated approximately 90 feet above existing ground level. A stairwell(s) would be provided for emergency egress. The number of elevators and stairwells provided would be 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 would be located at ground level and would be coordinated with the C-TRAN bus service at this location. Active transportation facilities, described below, would connect to the new Waterfront Station. A new TPSS would be constructed north of the transit platform. The elevated light-rail tracks would 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 C-D roadway. Transit components in the downtown Vancouver area would be similar between the C Street ramp and I-5 westward shift design options discussed above.

North of the Waterfront Station, the light-rail tracks would continue to the Evergreen Station, which would be the terminus of the light-rail extension (Figure 1-23). The light-rail tracks from downtown Vancouver to the terminus would be entirely on an elevated structure supported by single columns, where feasible, or by straddle bents[12] on either side of the roadway where needed. The Evergreen Station would be located at the same elevation as Evergreen Boulevard and the proposed Community Connector, and it would provide connections to the existing C-TRAN BRT system. Passenger drop-off facilities would be near the station and would be coordinated with the C-TRAN bus service at this location. Active transportation facilities, described below, would connect to the new Evergreen

[12] A straddle bent is a type of bridge support structure that “straddles” vehicle lanes and supports a flyover ramp.

Station. A new TPSS would be located on the south side of 7th Street, approximately 750 feet south of Evergreen Station.

PARK AND RIDES

The Modified LPA would provide parking capacity to accommodate 1,270 vehicles at designated park and rides in Vancouver along the LRT alignment (Figure 1-23) located near the Waterfront and Evergreen LRT stations. Parking capacity would be provided for 570 vehicles near the Waterfront Station and for 700 vehicles near the Evergreen Station.

Park and rides can expand the catchment area of public transit systems (the geographic area from which a station draws ridership), making transit more accessible to people who live farther away from fixed-route transit service, and attracting new riders who might not have considered using public transit otherwise.

The park and rides would be designed to accomplish the following:

- Support transit ridership.
- Promote station access by walking, biking, rolling, and transit.
- Support City of Vancouver objectives to increase mobility and access for a vibrant downtown.
- Include existing parking facilities in downtown Vancouver to help meet the projected demand for park and rides in areas where City of Vancouver studies show surplus parking supply.

Additional information regarding the park and rides can be found in the Transportation Technical Report.

As presented in the Draft SEIS, the Modified LPA would provide parking capacity for LRT riders by locating a single park and ride near the Waterfront Station with approximately 570 parking spaces; three sites were considered for this facility. Similarly, a single park and ride near the Evergreen Station would provide approximately 700 parking spaces; two sites were considered. Based on further design analysis, public comment received on the Draft SEIS, and coordination with local agencies, the approach to providing parking capacity for LRT riders was adjusted to focus on dispersed parking across more facilities, including using all three sites previously identified near the Waterfront Station and both sites previously identified near the Evergreen Station. The approach to disperse parking capacity across more sites would correlate to smaller sites in terms of structure size above or below ground.

The sites under consideration are described below, and the evaluation of impacts and benefits to developing a single, large park and ride at each of the two LRT station or five smaller park and rides are evaluated in this report.

Waterfront Station Park and Rides

Studies included in Appendix D to the Final SEIS have shown the need for park-and-ride capacity to accommodate 570 vehicles in the vicinity of the Waterfront Station. Three possible sites are analyzed (Figure 1-23):

- 1a. Columbia Way (below I-5). This 0.75-acre site could be developed as a new aboveground one-level parking structure. Access would be via Columbia Way. It could support approximately 70 parking spaces.
- 1b. Columbia Street/SR 14. This 0.50-acre site could be developed as a new aboveground six-level structure along the east side of Columbia Street and north of the SR 14 westbound off-ramp. Access would be via Washington Street. It could accommodate approximately 250 parking spaces. To provide all 570 parking spaces at this site, the structure would need to be 10 to 12 levels.
- 1c. Columbia Street/Phil Arnold Way (Waterfront Gateway Site). This 1.5-acre site could be developed as a new surface lot along the west side of Columbia Street, north of Phil Arnold Way. Access would be via Phil Arnold Way. A surface lot would provide approximately 250 parking spaces. To provide all 570 parking spaces at this site, a new four-level structure would be needed.

The IBR Program recommends advancing 1,270 park-and-ride spaces dispersed across five sites in Vancouver along the light-rail alignment, including three sites near the Waterfront Station and two sites near the Evergreen Station. All of the park and rides would provide similar benefits to the community by increasing the transit stations' catchment areas and making transit more accessible. There could be minor localized differences in traffic patterns and transit ridership depending on the location of spaces. Dispersing the 1,270 parking spaces across five park and rides rather than concentrating the spaces at a single location each near the Waterfront Station and Evergreen Station would promote compatibility with local planning goals and plans for multiuse development, multimodal access, and attractive public spaces. As the FTA's Capital Investment Grant process progresses, the IBR Program team will refine the Program's transit components, which will contribute to further information on parking needs to support transit ridership.
Studies (Appendix D to the Final SEIS) leading to the Modified LPA in 2022 evaluated a mix of light-rail station sites and park and rides and found that 1,270 spaces serving the Waterfront and Evergreen Stations, combined with bus and active transportation improvements, would attract the most riders.

Evergreen Station Park and Rides

Studies included in Appendix D to the Final SEIS have shown the need for park and rides to accommodate 700 vehicles in the vicinity of the Evergreen Station. Two possible sites are analyzed in this technical report (see Figure 1-23):

- 2a. Library Square. This 3.2-acre site could be developed as a new underground three- to four-level structure east of C Street and south of Evergreen Boulevard. It could accommodate approximately 400 parking spaces. To provide all 700 parking spaces at this site, the structure

would require seven or more levels below ground.[13] This site could be combined with Site 2b to provide a total of 700 spaces.

- 2b. Columbia Credit Union. This approximately 1-acre site is an existing parking structure/commercial building and provides an estimated 400 parking spaces to current users on four levels above ground. The parking capacity would not be exclusively available for transit users; however, up to 300 spaces could be used for transit riders. This site could be combined with Site 2a to provide a total of 700 spaces.

1.2.4.3 Active Transportation

Within the downtown Vancouver area, the shared-use path on the northbound (or eastern) bridge would exit the bridge at the SR 14 interchange, loop down on the east side of I-5 via a vertical helix path, cross back below I-5 to the west side of I-5, run beneath the elevated light-rail crossing over BNSF, and then loop down to connect to the Main Street extension at the intersection underneath I-5 with connections to the Waterfront Station from the active transportation facilities. Connections to the Waterfront Renaissance Trail would be made by facilities along Main Street and Columbia Way (Figure 1-23). Access would be provided across state right of way beneath the new bridges to provide a connection between the recreational areas along the city's Columbia River waterfront east of the bridges and existing and future waterfront uses west of the bridges.

Active transportation components in the downtown Vancouver area would be similar for all design options.

As part of the Modified LPA, a Community Connector is proposed to be built over I-5 just south of Evergreen Boulevard and east of the Evergreen Station (Figure 1-23). The structure is proposed to include off-street pathways for active transportation modes including pedestrians, bicyclists, and other micro-mobility modes, and public space and amenities to support the active transportation facilities with connections to the Evergreen Station from the active transportation facilities. The primary intent of the Community Connector is to improve connections between downtown Vancouver on the west side of I-5 and the Vancouver National Historic Reserve on the east side.

1.2.5 Upper Vancouver (Subarea D)

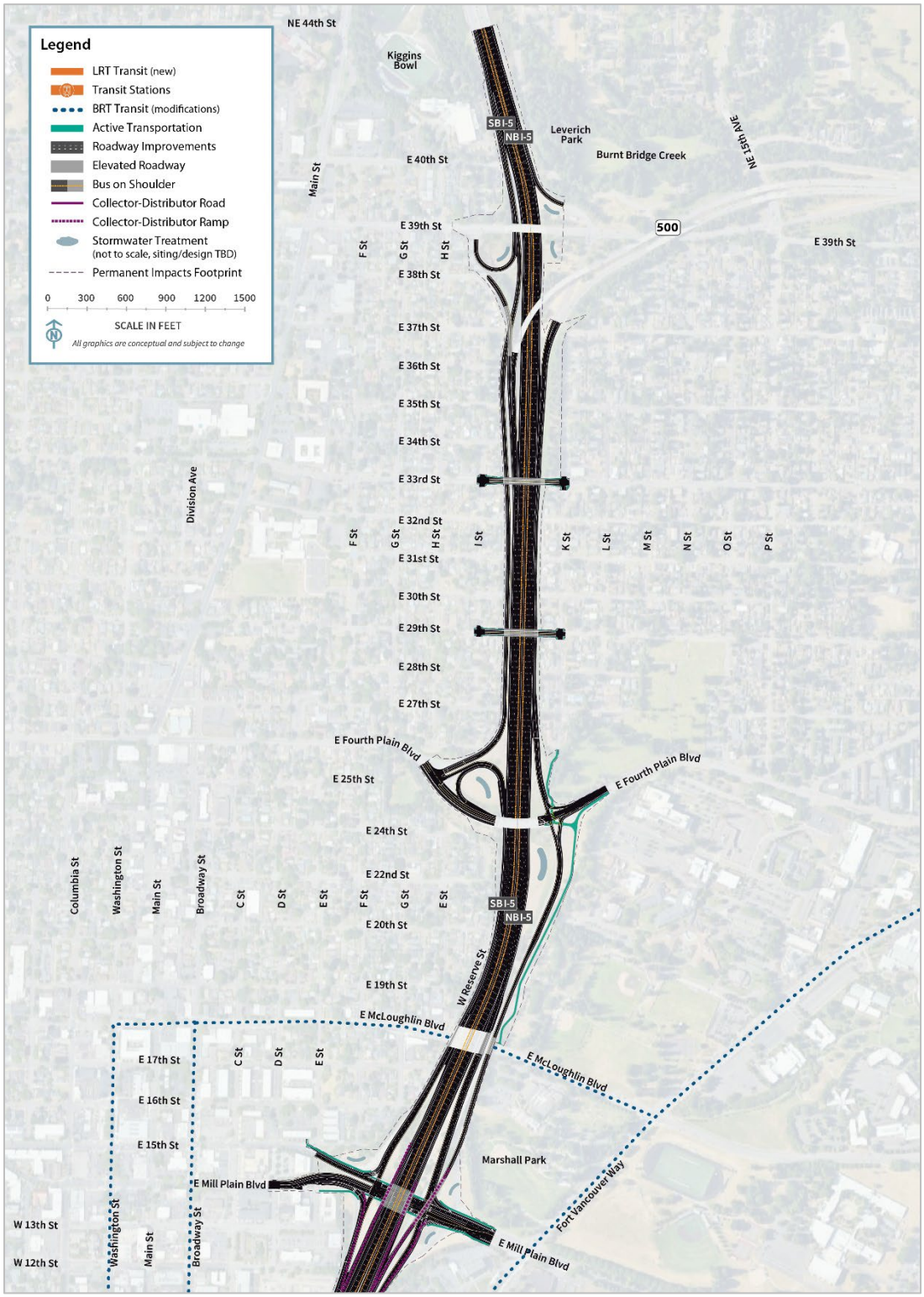
This section discusses the geographic Subarea D (Figure 1-3 shows an overview of the geographic subareas). Figure 1-27 shows all highway and interchange improvements in Subarea D.

1.2.5.1 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.

[13] The maximum depth of an underground parking structure at Library Square is provided for comparative purposes only. An underground parking structure would likely not exceed 3 or 4 levels because of engineering and environmental constraints.

Figure 1-27. Upper Vancouver (Subarea D)



BRT = bus rapid transit; LRT = light-rail transit; TBD = to be determined

MILL PLAIN BOULEVARD INTERCHANGE

The Mill Plain Boulevard interchange is north of the SR 14 interchange (Figure 1-27). This interchange would be reconstructed as a tight-diamond configuration but would otherwise remain similar in function and footprint to the existing interchange. The ramp terminal intersections would 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 Mill Plain Boulevard would diverge from the C-D road that would continue north, crossing over Mill Plain Boulevard, to provide access to Fourth Plain Boulevard via a C-D roadway. The off-ramp to Fourth Plain Boulevard would be reconstructed and would cross over 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 1-27), improvements would include reconstruction of the I-5 ramp terminal intersections. The existing bridge for Fourth Plain Boulevard over I-5 would be retained. Northbound I-5 traffic exiting to Fourth Plain Boulevard would first exit to the northbound C-D roadway, which provides off-ramp access to Fourth Plain Boulevard and Mill Plain Boulevard. The westbound SR 14 to northbound I-5 on-ramp also joins the northbound C-D 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 Fourth Plain Boulevard would be braided below the 39th Street on-ramp to southbound I-5. This change would eliminate the existing nonstandard weave between the SR 500 interchange and the off-ramp to Fourth Plain Boulevard. It would also eliminate the existing westbound SR 500 to Fourth Plain Boulevard off-ramp connection. The existing overcrossing of I-5 at 29th Street would be reconstructed to accommodate a widened I-5, provide adequate vertical clearance over I-5, and provide pedestrian and bicycle facilities.

SR 500/39TH STREET INTERCHANGE AREA

The northern terminus of the I-5 improvements would be in the SR 500 interchange area (Figure 1-27). The improvements would primarily be to connect the Modified LPA to existing ramps. The off-ramp from I-5 southbound to 39th Street would be reconstructed to establish the beginning of the braided ramp to Fourth Plain Boulevard and restore the loop ramp to 39th Street. Ramps from existing I-5 northbound to SR 500 eastbound and from 39th Street to I-5 northbound would be partially reconstructed. The existing bridges for 39th Street over I-5 and SR 500 westbound to I-5 southbound would be retained. The 39th Street to I-5 southbound on-ramp would be reconstructed and braided over (i.e., grade separated or pass over) the new I-5 southbound off-ramp to Fourth Plain Boulevard.

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

1.2.5.2 Transit

There would be no LRT facilities in upper Vancouver. Proposed operational changes to bus service, including I-5 bus-on-shoulder service, are described in Section 1.2.7, Transit Operating Characteristics.

1.2.5.3 Active Transportation

Several active transportation improvements would be made in Subarea D consistent with City of Vancouver plans and policies. On the east side of I-5, a new shared-use path would connect E McLoughlin Boulevard to Fourth Plain Boulevard. At the Fourth Plain Boulevard interchange, there would be improvements to provide better bicycle and pedestrian mobility and accessibility; these include bicycle lanes, neighborhood connections, and a connection to the City of Vancouver's planned two-way cycle track on Fourth Plain Boulevard. The reconstructed overcrossings of I-5 at 29th Street and 33rd Street would 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.

1.2.6 Transit Support Facilities

1.2.6.1 Ruby Junction Light-Rail Operations and Maintenance Facility Expansion

The TriMet Ruby Junction Light-Rail OMF in Gresham, Oregon, would be expanded to accommodate the additional LRVs associated with the Modified LPA's LRT service (the Ruby Junction location relative to the study area is shown in Figure 1-28). Improvements would include additional storage tracks for LRVs and maintenance materials and supplies; expanded LRV maintenance bays; expanded parking and employee support areas for additional personnel; an additional maintenance building for daily cleaning and periodic weather-dependent treatments for LRV maintenance, demolition, and relocation of a maintenance building (Ruby West); tenant improvements and new structures for affected operations; and a third lead track at the northern entrance to the Ruby Junction Light-Rail OMF. Adjacent parcels would be acquired to accommodate maintenance and storage needs required for or impacted by the Modified LPA. Figure 1-28 shows the proposed footprint of the expansion.

The existing main building would be expanded west to provide additional maintenance bays. Today, Eleven Mile Avenue extends from NW Burnside Road and dead ends at the southern limits of the existing OMF. To make space for the building expansion, the existing Eleven Mile Avenue public right of way would be vacated and would terminate in a new cul-de-sac west of the main building. A new cul-de-sac would be required to meet City of Gresham code requirements for fire access and turnaround. New internal/nonpublic access roads would be constructed to maintain access to TriMet buildings south of the cul-de-sac; these would impact an existing maintenance building (Ruby West), which would be demolished and rebuilt within Ruby Junction Light-Rail OMF.

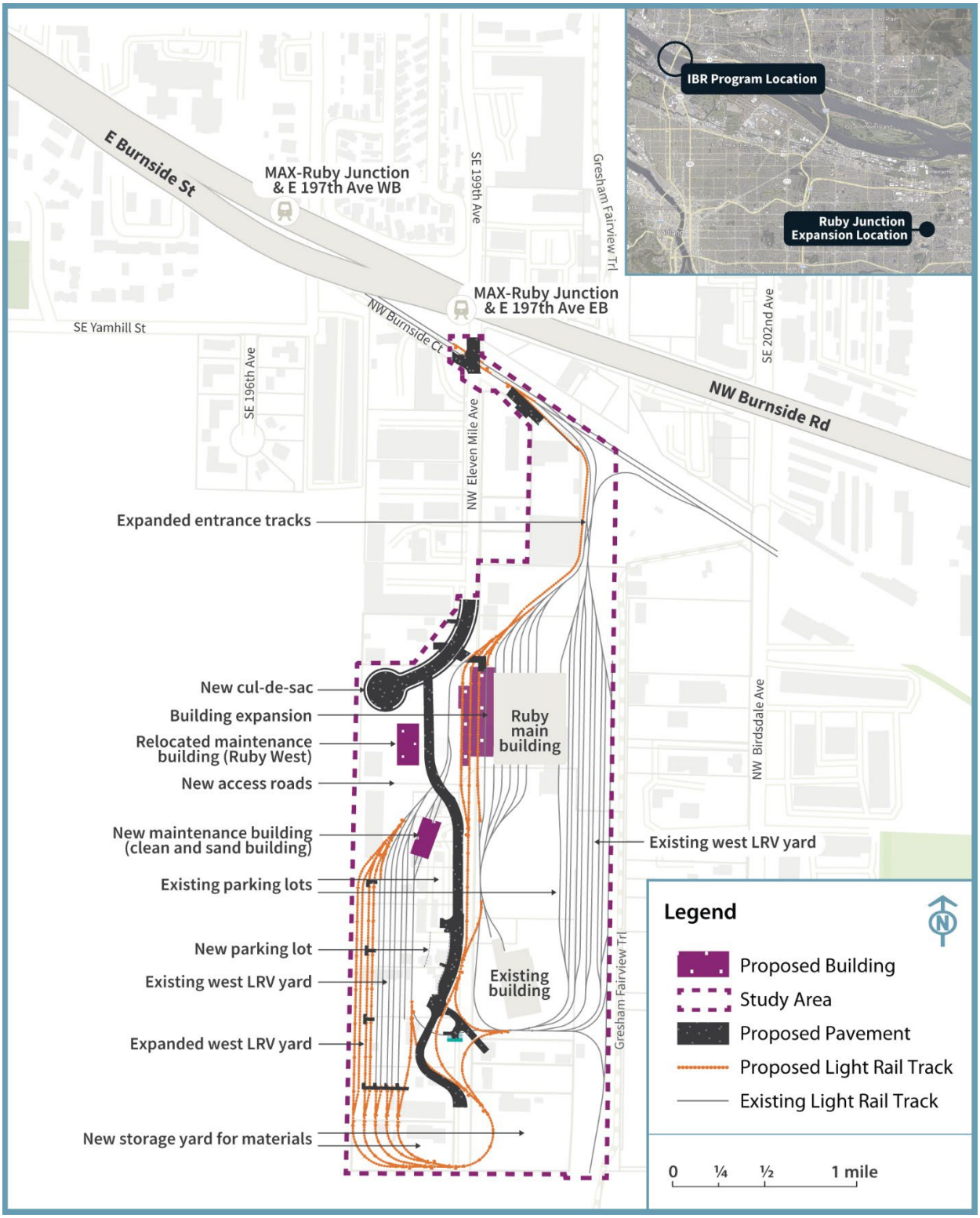
The existing western LRV storage yard, west of Eleven Mile Avenue, would be expanded to the west to accommodate additional storage tracks and a runaround track (a track constructed to bypass congestion in the maintenance yard). This expansion would require partial demolition of an existing TriMet building (just north of the LRV storage) and would require relocating the material storage yard to the southeastern corner of the campus. Immediately east of the storage yard, a double track LRV maintenance building would be constructed impacting existing parking. Various other surface parking areas in the west yard would also be relocated north of the cul-de-sac.

All tracks in the west LRV storage yard would also be extended southward to connect to the proposed runaround track. The runaround track would connect to existing and proposed tracks adjacent to the

existing Ruby Junction building located to the south. The connections to the runaround track would require partial demolition of an existing TriMet building and, full demolition of one existing building and partial demolition of another building on the adjacent private property to the south. These affected functions would be housed in a new replacement building on site.

A third track would be needed at the north entrance to the Ruby Junction Light-Rail OMF to accommodate increased train volumes without decreasing service. The additional track would also reduce operational impacts during construction and maintenance outages for the yard. Constructing the third track would require reconstruction of Burnside Court east of Eleven Mile Avenue. An additional crossover would also be needed on the mainline track where it crosses Eleven Mile Avenue; it would require reconstruction of the existing track crossings for vehicles, bicycles, and pedestrians.

Figure 1-28. Ruby Junction Light-Rail Operations and Maintenance Facility Study Area



EB = eastbound; LRV = light-rail vehicle; WB = westbound

1.2.6.2 Expo Center Overnight Light-Rail Vehicle Facility

An overnight facility for LRVs would be constructed on the southwest corner of the Expo Center property (as shown on Figure 1-29). The inclusion of the Expo Overnight Facility allows TriMet the ability to maintain current service and maintenance operations on their Blue Line system and reduce deadheading between Ruby Junction and the northern terminus of the MAX Yellow Line extension. Deadheading occurs when LRVs travel without paying passengers to move the vehicles to and from service. Currently, Blue Line is maintained through a limited nighttime work window. With the inclusion of the Expo Overnight Facility, trains originating service at Evergreen have substantially less deadhead time, reducing Yellow Line operating costs, and Blue Line maintenance windows are retained.

The facility would provide a yard access track, storage tracks for approximately 13 LRVs, one building for light LRV maintenance and operator facilities, a TPSS, a sand silo, a parking lot for operators and facility staff, space for security personnel, and other associated facilities. This facility and the lead tracks connecting to it would necessitate relocation and reconstruction of the internal circulation road from the Expo Road entrance to approximately 100 feet west of Building E of the Expo Center (including southern areas of the parking lot, including gates and booths). However, it would not affect existing Expo Center buildings.

The overnight facility lead track would connect to the mainline tracks by crossing Expo Road just south of the existing Expo Center MAX Station. The connection tracks would require relocation of one or two existing LRT facilities, including a TPSS building and potentially the existing signals/communication building, which are both just south of the Expo Center MAX Station. Existing artwork at the station may require relocation.

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

Three bus bays would be added to the existing C-TRAN OMF located at 2425 NE 65th Avenue in Vancouver. These additional bus bays, which would not require the acquisition of any new property, would provide maintenance capacity for the additional express bus service on I-5 (Section 1.2.7, Transit Operating Characteristics). Modifications to the facility would accommodate new vehicles as well as maintenance equipment.

Figure 1-29. Expo Center Overnight LRV Facility

1.2.7 Transit Operating Characteristics

1.2.7.1 Light-Rail Transit Operations

Nineteen new LRVs would be purchased to operate the extension of the MAX Yellow Line. These vehicles would be similar to those currently used for the TriMet MAX system. With the Modified LPA including all design options, LRT service in the new and existing portions of the Yellow Line in 2045

would operate with 6.7-minute average headways[14] during the 2-hour morning peak period. Midday and evening headways would be 15 minutes, and late-night headways would be 30 minutes. LRT service would 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 would be deadheaded at Evergreen Station before beginning service each day. A third track at this northern terminus would accommodate layovers.

1.2.7.2 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 I-5 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: the 99th Street Transit Center and downtown Vancouver. This route currently provides weekday service with 20-minute peak and 60-minute off-peak headways.

In 2045, for both the No-Build Alternative and Modified LPA, C-TRAN Route 105 would be revised to only provide direct service from the Salmon Creek Park and Ride and 99th Street Transit Center to downtown Portland with no intermediate stops in downtown Vancouver. Under the Modified LPA with all design options, this route would operate at 5-minute peak headways with no service in the off-peak, compared to 10-minute peak headways under the No-Build Alternative. Under both the No-Build Alternative and the Modified LPA, C-TRAN Route 105 intermediate stop service through downtown Vancouver would be replaced with C-TRAN Route 101, which would provide direct service from downtown Vancouver to downtown Portland and would operate at 15-minute peak and 30-minute off-peak headways and 10-minute peak and 30-minute off-peak headways, respectively.

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

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 in the study area. The Modified LPA would include inside shoulders on I-5 that would be wide enough (approximately 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 would have to taper to match existing inside

[14] Headways are defined as gaps between arriving transit vehicles.

shoulder widths at the north and south ends of the corridor. Figure 1-6, Figure 1-10, Figure 1-23, and Figure 1-27 show the potential bus-on-shoulder use over the Columbia River bridges. Bus on shoulder could operate on any of the Modified LPA bridge configurations and bridge types. 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 would be able to use bus-on-shoulder operations to bypass congestion in the general-purpose lanes. C-TRAN Route 105 would operate on the shoulder for the full length of the study area. C-TRAN Route 190 would 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) would 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 double-decker or articulated buses would be purchased.

With the C Street ramps design option, C-TRAN Route 101 would use bus on shoulder south of the SR 14 interchange but would not use the full extent of bus-on-shoulder lanes that would be included in the Modified LPA because the route would need to begin merging over early to use the C Street off-ramp to access downtown Vancouver. Without the C Street ramps design option, C-TRAN Route 101 would be rerouted to use the Mill Plain interchange to access downtown Vancouver. Under this design option, the Route 101 would also not use the full extent of bus-on-shoulder lanes that would be included in the Modified LPA but would use the bus on shoulder south of Mill Plain Boulevard and begin merging over early to use the Mill Plain off-ramp.

C-TRAN 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.

1.2.7.3 Local Bus Route Changes

Two TriMet bus routes would be adjusted to accommodate the transit improvements associated with the Modified LPA. TriMet Line 6 bus route would be changed to terminate at the Expo Center MAX Station instead of Hayden Island, where it terminates currently and in the No-Build Alternative. The new Line 6 route would require passengers to transfer to the new LRT connection to access Hayden Island. TriMet Line 6 is anticipated to travel from Delta Park MAX Station north along Expo Road to the Expo Center MAX Station. Table 1-3 shows the existing service and anticipated future changes to TriMet Line 6. In addition to Line 6, TriMet Route 11 could require slight modifications to maintain transfers to the Expo Center MAX Station, depending on the final design of the station and surrounding area.

As part of the Modified LPA, several local C-TRAN bus routes would be changed to better complement the new light-rail extension. Most of these changes would reroute existing bus lines to provide a transfer opportunity at the proposed new Evergreen Station. Table 1-3 shows existing service and anticipated future changes to C-TRAN bus routes. In addition to the changes noted in Table 1-3, other local bus route modifications may move service from Broadway to C Street.

For both TriMet and C-TRAN detailed service planning analysis, including obtaining public feedback for service changes associated with the Modified LPA, would be conducted prior to the start of revenue service.

Table 1-3. Proposed TriMet and C-TRAN Bus Route Changes

Bus Route	Existing Route	Changes with Modified LPA
TriMet Line 6	Connects Goose Hollow, Portland City Center, N/NE Portland, Jantzen Beach, and Hayden Island. Within the study area, service currently runs between Delta Park MAX Station and Hayden Island via I-5.	Route would be revised to terminate at the Expo Center MAX Station. Route is anticipated to travel from the Delta Park MAX Station, north along Expo Road to connect via facilities on the west side of I-5 with the Expo Center MAX Station.
TriMet Line 11	Connects East Columbia, Expo Center, Smith/Bybee lakes, Rivergate and St. Johns via Marine Drive, Lombard, Columbia, Fessenden, and Ivanhoe.	Stops along Marine Drive would be relocated or the line would be rerouted slightly to connect via facilities on the west side of I-5 with the Expo Center MAX Station.
C-TRAN Fourth Plain and Mill Plain bus rapid transit (The Vine)	Runs between downtown Vancouver and the Vancouver Mall Transit Center via Fourth Plain Boulevard, with a second line along Mill Plain Boulevard. In the study area, service currently runs along Washington and Broadway Streets through downtown Vancouver.	Route would be revised to begin/end near the Evergreen Station in downtown Vancouver and provide service along Evergreen Boulevard to Fort Vancouver Way, where it would travel to or from Mill Plain Boulevard or Fourth Plain Boulevard depending on clockwise/counterclockwise operations. The Fourth Plain Boulevard route would continue to serve existing Vine stations beyond Evergreen Boulevard.
C-TRAN #2 Lincoln	Connects the 99th Street Transit Center to downtown Vancouver via Lincoln and Kaufman Avenues. Within the study area, service currently runs along Washington and Broadway Streets between 7th and 15th Streets in downtown Vancouver.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.
C-TRAN #25 St. Johns	Connects the 99th Street Transit Center to downtown Vancouver via St. Johns Boulevard and Fort Vancouver Way. Within the study area, service currently runs along Evergreen Boulevard, Jefferson Street/Kaufman Avenue, 15th Street, and Franklin Street in downtown Vancouver.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.
C-TRAN #30 Burton	Connects the Fisher's Landing Transit Center with downtown Vancouver via 164th/162nd Avenues and 18th, 25th, 28th, and 39th Streets. Within the study area, service currently runs along McLoughlin Boulevard and on Washington and Broadway Streets between 8th and 15th Streets.	Route would be modified to begin/end near C Street and 9th Street in downtown Vancouver.

Bus Route	Existing Route	Changes with Modified LPA
C-TRAN #60 Delta Park Regional	Connects the Delta Park MAX Station in Portland with downtown Vancouver via I-5. Within the study area, service currently runs along I-5, Mill Plain Boulevard, and Broadway Street.	Route would be discontinued.

1.2.8 Tolling

Consistent with the CRC LPA, tolling cars and trucks that would use the new Columbia River bridges is proposed as a method to help fund the bridge construction and future maintenance, as well as to provide different mode, time, and destination choices for trips across the Columbia River. The sections below describe the tolling authority and tolling operations.

1.2.8.1 Tolling Authority

Federal and state laws provide authority to toll the I-5 crossing. The IBR Program plans to toll the new Columbia River bridges under the federal tolling authorization program codified in 23 U.S. Code (U.S.C.) § 129 (Section 129). Section 129 allows public agencies to impose new tolls on federal-aid interstate highways for the reconstruction or replacement of toll-free bridges or tunnels. In 2023, the Washington State Legislature authorized tolling on the Interstate Bridge, with toll rates and policies to be set by the Washington State Transportation Commission (WSTC). In Oregon, the legislature authorized tolling on the Interstate Bridge in 2013 and gave the Oregon Transportation Commission (OTC) the authority to set toll rates and policies. Subsequently, in January 2025, the OTC reviewed and approved the I-5 tollway project application that designated the IBR Program as a "tollway project" and the facility (the I-5 bridge) as a tollway for construction as defined in Oregon Revised Statutes (ORS) 383.003(8) and pursuant to ORS 383.015.

At the beginning of 2024, the OTC and the WSTC entered into a bi-state tolling agreement to establish a cooperative process for setting toll rates and policies. This included the formation of the I-5 Bi-State Tolling Subcommittee, which consists of two commissioners each from the OTC and WSTC, and tasked the subcommittee with developing toll rate and policy recommendations for joint consideration and adoption by each state's commission. At the direction of the commissions, all toll scenarios being analyzed in the next round of tolling analysis (referred to as a level 3 toll traffic and revenue study) for the IBR Program assume a low-income discount. Formal action is still needed by the commissions to implement rates and policies, including discounts and exemptions.

In December 2024, a memorandum of understanding was executed by both states that outlined their shared understanding of tolling operations, including cooperation between the state Departments of Transportation and roles and responsibilities for the IBR Program. Toll collection would be managed by WSDOT, including drivers' option to use *Good To Go!* accounts for paying tolls. In addition to the memorandum, the two states plan to enter into a separate agreement guiding the sharing and uses of toll revenues, including the order of uses (flow of funds) for bridge construction, debt service, and other required expenditures. WSDOT and ODOT also plan to enter into one or more agreements addressing implementation logistics, toll collection, and operations and maintenance for tolling the bi-state facility.

1.2.8.2 Tolling Operations

The Modified LPA includes a proposal to apply variable tolls on vehicles using the Columbia River bridges with the toll collected electronically in both directions. Tolls would vary by time of day with higher rates during peak travel periods and lower rates during off-peak periods. The IBR Program evaluated multiple toll scenarios with two different variable toll schedules by time of day. For purposes of this National Environmental Policy Act (NEPA) analysis, the lowest toll schedule was analyzed, with tolls assumed to range between $1.50 and $3.15 (state fiscal year 2026 dollars) for passenger vehicles and light trucks (i.e., vehicles with two axels) with a *Good To Go!* account. The assumed toll range and other assumptions are documented in the IBR Program Level 2 Toll Traffic and Revenue Study (IBR 2023). Medium and heavy trucks (i.e., vehicles with more than two axels) would be charged a higher toll than passenger vehicles and light trucks. Passenger vehicles and light trucks without a *Good To Go!* account would pay an additional $2.00 per trip to cover the cost of identifying the vehicle owner from the license plate and invoicing the toll by mail.

Tolling Equipment

Below are the key types of equipment used to collect data for billing purposes.

Transponders: Small tags affixed to vehicles that communicate with tolling equipment as the vehicle passes.

Antenna/Readers: As a vehicle with a transponder enters a toll zone, an antenna transmits a signal between the transponder and the reader. The reader then transmits pertinent information to the toll zone controller.

Automatic Vehicle Classification: Various roadway devices installed overhead and/or in pavement to detect and identify the vehicle type (e.g., truck, bus, personal vehicle, etc.).

License Plate Image Capture Cameras: Cameras and software that capture images of license plates as vehicles pass.

Digital Video Audit System: Various types of cameras monitor traffic flow and equipment locations.

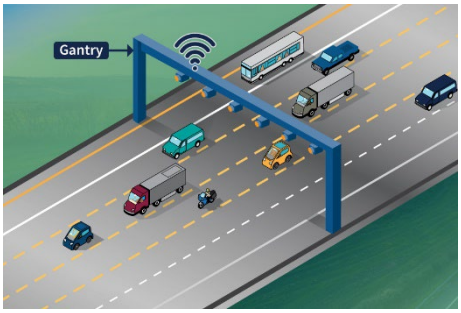
It is assumed that tolling would begin on the existing Interstate Bridge, referred to as "pre-completion tolling," in 2027, allowing time after receiving a Record of Decision to hire a contractor, install tolling equipment, and conduct the rate-setting process. The purpose of pre-completion tolling would be to generate initial capital construction funding on a pay-as-you-go basis. Later, toll revenue would be used to secure a portion of Program financing to pay back bonds or loans. Pre-completion tolling would also help pay current interest on the debt to minimize interest costs. Once the new Columbia River bridges are completed, the traffic and tolling operations would shift from the existing Interstate Bridge over to the new bridges, and 24-hour tolls would be implemented; this is referred to as "post-completion tolling."

The start dates for pre-completion tolling would be determined based on the IBR Program environmental and construction timelines; placeholders for tolling start dates were used in this NEPA analysis. This NEPA analysis assumed that pre-completion tolling on the existing Interstate Bridge would be toll-free overnight between 11 p.m. and 5 a.m. (IBR 2023). The OTC and WSTC are also considering this as an option during the level 3 toll traffic and revenue study; however, a decision has not been made on whether these toll-free hours would be implemented. This toll-free period could help avoid situations where users would be charged during lane or partial bridge closures when construction delays may occur.

Tolls would be collected using an all-electronic toll collection system using transponder pass readers and license plate cameras mounted to structures over the roadway. Each traffic lane and shoulder would have a pass reader and license plate camera to ensure accurate detection of vehicles. Toll collection booths would not be required. Instead, motorists could obtain a pass and set up a *Good To Go!* account that would automatically bill the account holder associated with the pass each time the vehicle crossed the bridge. Customers without passes would be tolled by a license plate recognition system that would bill the address of the owner registered to that vehicle's license plate.

There would be two separate "toll zones," which are the area in which the tolling system would detect and classify passing vehicles and then transmit pertinent information to the toll zone controller (Figure 1-30). There would be one zone for northbound traffic and one zone for southbound traffic. During pre-completion tolling, the toll zones would be located on I-5 in Vancouver, between the Interstate Bridge and the BNSF Railway. The location of the post-completion toll zones would be determined at a later date, but it is anticipated that both toll zones would remain in Vancouver.

Figure 1-30. Toll Zone



One gantry (i.e., overheard structure) would be located in each toll zone (Figure 1-30). Generators and equipment cabinets would be located nearby, which would house various equipment needed to support toll operations. Additional equipment cabinets would be placed throughout the Program area to support tolling operations, such as near the toll rate signage (see below).

As previously noted, a key element of tolling would be variable-rate pricing, where toll rates would differ based on the time of day a vehicle uses the bridge. To accomplish this, toll rate signs would be installed at route decision points on local roads, I-5 on-ramps, and on I-5, including locations north and south of the bridges where drivers make informed route decisions (e.g., I-5/Interstate 205 junction and I-5/Interstate 84 junction). The intent of the toll rate signs is to provide both static and variable pricing information. The static sign would contain details such as direction, wayfinding, or other information. These signs would also include a variable message sign panel that would show toll rate(s) in effect at that time.

1.2.9 Transportation System- and Demand-Management Measures

Many well-coordinated transportation demand-management and system-management programs are already in place in the Portland-Vancouver metropolitan 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 (described in the sidebar).

State Laws to Reduce Commute Trips

Oregon and Washington have both adopted regulations intended to reduce the number of people commuting in single-occupancy vehicles (SOVs). Oregon's Employee Commute Options Program, created under Oregon Administrative Rule 340-242-0010, requires employers with over 100 employees in the greater Portland area to provide commute options that encourage employees to reduce auto trips to the work site. Washington's 1991 Commute Trip Reduction (CTR) Law, updated as the 2006 CTR Efficiency Act (Revised Code of Washington §70.94.521) addresses traffic congestion, air pollution, and petroleum fuel consumption. The law requires counties and cities with the greatest traffic congestion and air pollution to implement plans to reduce SOV demand. An additional provision mandates "major employers" and "employers at major worksites" to implement programs to reduce SOV use.

The physical and operational elements of the Modified LPA provide the greatest transportation demand-management opportunities by promoting other modes to fulfill more of the travel needs in the 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 rides.
- A variable-rate toll on the new Columbia River bridges.

In addition to these fundamental elements of the Modified LPA, facilities and equipment would be implemented that could help existing or expanded transportation system–management measures maximize the capacity and efficiency of the system. These include:

- Replacement or expanded variable message signs in the primary study area. 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 strategies including ramp metering and dynamic speed limits. These strategies are intended to manage congestion by controlling traffic flow.

1.2.10 Off-Site Mitigation Sites

The IBR Program will provide off-site mitigation for unavoidable impacts to natural resources, including fish and wildlife species and their habitats, wetlands, surface waters, floodplains, and other regulated habitat features (refer to the Final SEIS, Sections 3.14, Water Quality and Hydrology; 3.15, Wetlands; and 3.16, Ecosystems).[15] Applicable federal, state, and local regulatory frameworks require mitigation sequencing that includes avoidance and minimization of impacts, and compensatory mitigation to achieve "no net loss" of the resource or its functions. Mitigation must fully offset the impacts of the Modified LPA and achieve this "no net loss" standard. The Modified LPA would result in unavoidable impacts to natural resources, which would require mitigation under one or more regulatory frameworks. Mitigation plans and mitigation bank use plans will be prepared to provide compensation for any such unavoidable impacts to regulated resources (wetlands, waters, floodplain, sensitive habitats) and to demonstrate that the IBR Program will achieve "no net loss" of function of these resources. The IBR Program is preparing functional assessments and coordinating with regulatory agencies to quantify the amount and type of compensatory mitigation required to offset Program impacts and achieve "no net loss."

It is anticipated that compensatory mitigation for unavoidable impacts to aquatic and terrestrial habitats and species in Washington will be provided through the purchase of credits from the proposed Wapato Valley Mitigation and Conservation Bank (Figure 1-31). The bank is approximately 876 acres and is located in the Columbia River floodplain at the mouth of the Lewis River, approximately 19 river miles downstream of the Interstate Bridge. Approval of the bank is expected in 2026.

It is anticipated that compensatory mitigation for unavoidable impacts to wetlands, and aquatic and terrestrial habitats and species in Oregon will be provided partially through the purchase of advance mitigation credits at ODOT's proposed Columbia Bottomlands Advance Mitigation/Conservation Site, and partially through the purchase and protection under conservation easement of a site on West Hayden Island (shown on Figure 1-31). The Columbia Bottomlands Advanced Mitigation/Conservation site is located in Scappoose Bay, a slough of Multnomah Channel, in Columbia County, Oregon. The site is located approximately 1 mile upstream of where the Multnomah Channel meets the Columbia River and approximately 20 river miles downstream of the Interstate Bridge. The site has been designed to provide advance mitigation credits for impacts to wetlands and aquatic and terrestrial habitats and species for future ODOT projects. All impacted wetlands and other water features would be mitigated in accordance with current USACE mitigation policies, and the conditions of the Section 404 Permit. All compensatory mitigation plans would be developed in coordination with the USACE

[15] On-site mitigation is identified and analyzed in relevant subsections of Chapter 3, Existing Conditions and Environmental Consequences of the Final SEIS.

and other appropriate agencies as part of the Section 404 permitting process. The USACE and other appropriate agencies would determine the appropriate level of mitigation based upon the functions lost or adversely affected as a result of impacts to aquatic resources.

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

In addition to the compensatory wetland and habitat mitigation described above, the IBR Program may need to excavate material from within the 100-year floodplain to address the compensatory excavation requirements of the City of Portland's recently updated floodplain ordinance. If such activity is required, it is anticipated that this material would be removed from upland portions of the 65-acre parcel on West Hayden Island described above or from aquatic areas adjacent to this parcel. If such excavation activities are conducted, excavated materials will be disposed of at a location approved to receive that type of material.

Figure 1-31. Potential Compensatory Mitigation Sites

1.3 Modified LPA Construction

Construction of the IBR Program would be sequenced in accordance with many factors, such as the scale of improvements, different types of infrastructure and associated construction specialties required, timing of funding received, maintenance of traffic on I-5, navigation on the Columbia River, seasonal and weather constraints, permit conditions, and other considerations. Multiple construction packages are anticipated to be developed and delivered by different agencies—WSDOT, ODOT, TriMet, and C-TRAN—that will use various delivery methods (e.g., design-bid-build, design-build, progressive design-build, construction manager/general contractor).

The first construction packages are anticipated to be the new Columbia River bridges and approaches. Subsequent construction packages would be sequenced throughout the Program area. Early construction activities may occur in the Program area to prepare for the bridge replacement work. Demolition of the existing Interstate Bridge would take place after the new Columbia River bridges were opened to traffic. Construction of other components of the Modified LPA would be sequenced during and after the construction of the new Columbia River bridges begins.

Electronic tolling infrastructure for the existing Interstate Bridge would be constructed and operational near the start of construction on the new Columbia River bridges and would be constructed and operational for the new Columbia River bridges in time for their opening. The toll rates and policies for tolling (including pre-completion tolling) would be determined by the OTC and WSTC (refer to Section 1.2.8, Tolling).

1.3.1 Construction Components, Packaging Plan, and Duration

Table 1-4 lists the main construction components of the Modified LPA along with the estimated construction durations and descriptions of the associated work. Construction packages are also listed in Table 1-4 and illustrated in Figure 1-32. These main construction components would be defined by some functional improvement to the Program corridor; for example, construction of the new bridges would be coordinated with the construction of the connections to the existing I-5, enabling use of the new bridges while other components of the Program are constructed. Each listed component would require multiple construction packages—small and large, general and specialty. As construction progresses, interim connections may be in place while subsequent components are built and final connections and finishes are completed. This preliminary construction plan may change as the Program advances toward construction. Construction packages may further be combined or separated throughout delivery of the Program. Construction of all components identified in the Program could last more than 10 years.

The estimated durations are shown as ranges to reflect the potential for Program funding to be sequenced over time. In addition to funding, contractor schedules, regulatory restrictions on in-water work, river navigation considerations, permits and approvals, weather, materials, and equipment could all influence construction duration and overlap of construction of certain components. Certain work below the ordinary high-water mark of the Columbia River and North Portland Harbor would be restricted to minimize impacts to species listed under the Endangered Species Act and their designated critical habitat.

Throughout most periods of construction, three travel lanes in each direction on I-5 (accommodating personal vehicles, freight, and buses) would remain open during peak hours. Off-peak and weekend restrictions and closures could be required during construction. Active transportation connections would be maintained throughout construction. Advanced coordination and public notice would be given for restrictions, intermittent or longer-term closures, and detours for highway, local roadway, transit, and active transportation users via accessible facilities and wayfinding (refer to the Final SEIS, Section 3.1, Transportation, for additional information, including for local street and ramp or interstate access closures). At least one Columbia River navigation channel would remain open to shipping throughout construction. Advanced coordination and notice would be given for restrictions or intermittent closures to navigation channels as required (refer to the Final SEIS Section 3.2, Navigation, for additional information).

Table 1-4. Preliminary Construction Packaging Plan

Component and General Location	Estimated Duration	Description	Construction Packages
Columbia River bridges, approaches, and demolition of Interstate Bridge *Hayden Island to Evergreen Boulevard*	6 to 8 years	• General sequence for new bridges would include initial preparation and installation of foundation piles, shaft caps, pier columns, superstructure, and deck elements, followed by systems and finish work. • SR 14 interchange would be constructed in a separate construction package and must be completed before all traffic could be transferred to the new Columbia River bridges. • Demolition of the existing Interstate Bridge could begin only after traffic is transferred to the new Columbia River bridges.	• Columbia River Bridges [a] • Approaches [a] • Pre-completion Tolling Signage and Equipment Installation • SR 14 A • Evergreen Bridge • Interstate Bridge Demolition
Light-rail and bus-on-shoulder transit *Expo Station to Evergreen Station; Ruby Junction*	4 to 7 years	• The light-rail alignment would be partially supported by the southbound Columbia River bridge and approach structure guideways. • Light-rail construction would include all infrastructure associated with light-rail elements of the Transit Packages construction package (e.g., overhead catenary system, tracks, stations, and park and rides). • Bus on shoulder would include corresponding bus elements of the Transit Packages construction package.	• North Portland Harbor Transit Bridge • Marine Drive A (supports transit improvements) • Hayden Island A (supports transit improvements) • Light-rail Overnight Facility • Transit Packages • Ruby Junction
Marine Drive and Hayden Island interchanges and	4 to 10 years	• Hayden Island interchange construction duration would not necessarily entail continuous active construction.	• Hayden Island Surface Streets

Component and General Location	Estimated Duration	Description	Construction Packages
North Portland Harbor bridges *Marine Drive to Hayden Island*		• The North Portland Harbor bridges could include sequenced construction of southbound bridges, northbound bridges, and demolition of the existing North Portland Harbor bridge to maintain traffic mobility during construction. • Hayden Island and Marine Drive interchanges could be broken into several contracts, which could spread work over a longer duration.	• Hayden Island Interchange • North Portland Harbor Bridges • Oregon I-5 Southbound • Oregon I-5 Northbound • North Portland Harbor Bridge Removal • Marine Drive Interchange • North Expo Road
Mill Plain Boulevard, Fourth Plain Boulevard, and SR 500/39th Street interchanges *Mill Plain Boulevard to SR 500*	3 to 4 years	• Construction of these interchanges could be independent from each other.	• Mill Plain Boulevard Interchange • Washington North

a The Columbia River Bridges and Approaches construction packages include light-rail guideway from the Hayden Island Bridge Approach, the Columbia River bridges, north to Evergreen Boulevard.

Figure 1-32. Preliminary Construction Packages

1.3.2 Potential Staging Sites and Casting Yards

Equipment and materials would be staged in the primary study area throughout construction generally within existing or newly purchased right of way, on land vacated by existing transportation facilities (e.g., I-5 on Hayden Island), or on nearby parcels. However, at least one large site could be required for construction offices, equipment maintenance and storage, maintenance of traffic equipment, employee parking, and construction material storage and other needs. Criteria for suitable sites include large, open areas for heavy machinery and material storage, waterfront access for barges (either a slip or a dock capable of handling heavy equipment and material) to convey material to the construction zone, and roadway or rail access for landside transportation of materials by truck or train.

Two potential major staging sites have been identified (see Figure 1-6). Both sites are located on Hayden Island on the west side of I-5. A large portion of both parcels would be required for new right of way for the Modified LPA. Other staging sites may be identified during the design process or by the contractor. Following construction of the Modified LPA, the staging sites could be converted to other uses.

In addition to on-land sites, some staging activities for construction of the new Columbia River and North Portland Harbor bridges would take place on the river itself. Temporary work structures, barges, barge-mounted cranes, derricks, and other construction vessels and equipment would be present on the river during most or all of the bridges' construction period. The IBR Program is working with USACE, USCG, and the Federal Aviation Administration 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. A casting yard would require access to the river for barges, 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 would likely be between approximately 50 and 100 acres. As with the staging sites, casting yards would be identified during the design process or by the contractor and would be subject to the same contract and permit requirements to implement the best management practices (BMPs) described in Appendix M to the Final SEIS 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 would be contained and located outside of environmentally and culturally sensitive areas. To the extent practicable, these sites would be located in upland locations, on areas that are already or have been previously disturbed. These activities would be conducted consistent with the impact minimization BMPs described in Appendix M to the Final SEIS. Construction of the Modified LPA would also include revegetating temporarily disturbed areas consistent with federal, state, and local regulations, and the net result would be no net loss of habitat function in the long term. As with the staging sites, casting or staging yard sites may be identified as the design progresses or by the contractor and would be evaluated via a NEPA re-evaluation or supplemental NEPA document for potential environmental impacts at that time.

1.4 No-Build Alternative

The No-Build Alternative illustrates how transportation and environmental conditions would likely change by the year 2045 if the Modified LPA is not built. This alternative makes the same assumptions as the Modified LPA regarding population and employment growth through 2045, and it assumes that the same transportation and land use projects in the region would occur as planned.

Regional transportation projects included in the No-Build Alternative are those in the financially constrained 2018 *Regional Transportation Plan* (RTP) adopted in December 2018 by the Metro Council (Metro 2018) and in March 2019 (RTC 2019) by the Southwest Washington Regional Transportation Council (RTC) Board of Directors (referred to collectively as the 2018 RTP in this report).[16] The 2018 RTP has a planning horizon year of 2040 and includes projects from state and local plans necessary to meet transportation needs over this time period; financially constrained means these projects have identified funding sources. The Transportation Technical Report lists the projects included in the financially constrained 2018 RTP.

The implementation of regional and local land use plans is also assumed as part of the No-Build Alternative. For the IBR Program analysis, population and employment assumptions used in the 2018 RTP were updated to 2045 in a manner consistent with regional comprehensive and land use planning. In addition to accounting for added growth, adjustments were made within Portland to reallocate the households and employment based on the most current update to Portland's comprehensive plan, which was not complete in time for inclusion in the 2018 RTP.

Other projects assumed as part of the No-Build Alternative include major development and infrastructure projects that are in the planning stage, permitting stage, or partway through phased development. They include the Waterfront Vancouver project, Terminal 1 development, the Renaissance Boardwalk, the Waterfront Gateway project, improvements to the levee system, several restoration and habitat projects, and the Portland Expo Center.

In addition to population and employment growth and the implementation of local and regional plans and projects, the No-Build Alternative assumes that the existing Interstate Bridge would continue to operate as it does today. As the bridge ages, needs for repair and maintenance would potentially increase, and the bridge would continue to be at risk of mechanical failure or damage from a seismic event.

[16] The 2018 RTP was the adopted regional transportation plan available when the IBR Program initiated the SEIS. In 2023, Oregon Metro and RTC updated their respective RTPs as part of their five-year update cycle, as required under 23 CFR § 450.324. The 2023 RTP was adopted by Oregon Metro in 2023 and RTC in 2024, several years after the IBR Program Draft SEIS analysis was initiated in early 2021. To use the regional travel demand model supporting the 2023 RTP, additional refinement and coordination would be necessary for it to be ready for use in a facility-specific study, such as the IBR Program. This refinement and coordination process is lengthy and can take up to a year and a half for a complex project with numerous partner agencies, like the IBR Program. Therefore, the NEPA lead agencies exercised their discretion and determined, based on their technical expertise, that the 2018 RTP and Travel Demand Model continued to be the most appropriate base tool for the purposes of comparing the No-Build Alternative to the Modified LPA and design options in the Final SEIS.

2. METHODS

2.1 Introduction

The Washington State Environmental Policy Act (SEPA) rules stipulate that the range of impacts to be analyzed in an Environmental Impact Statement (EIS) includes direct, indirect, and cumulative effects (Washington Administrative Code [WAC] 197-11-792). This technical report evaluates the cumulative effects of the Modified LPA consistent with SEPA and other relevant state regulations and guidance for Oregon and Washington (see Section 2.3). The Washington SEPA Handbook (Ecology 2025) defines cumulative effects (also known as cumulative impacts) as impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (or projects). Review of cumulative effects includes consideration of the existing environment plus the impacts of the proposed project, including any future project phases.

This report evaluates the anticipated cumulative effects of the Modified LPA on the resources evaluated in the NEPA/SEPA Draft and Final SEIS and the SEPA Addendum.[17] The effects on individual resources are evaluated in those documents, and this report evaluates the combination of those effects with the effects of other past, present, and reasonably foreseeable future actions. Consultations with agencies, tribes, and the public contributed to defining the scope and scale of the cumulative effects analysis.

The IBR Program team has limited modifications to the methodology and analysis that was published in the NEPA/SEPA Draft SEIS for public review as much as possible, while continuing to comply with SEPA requirements.

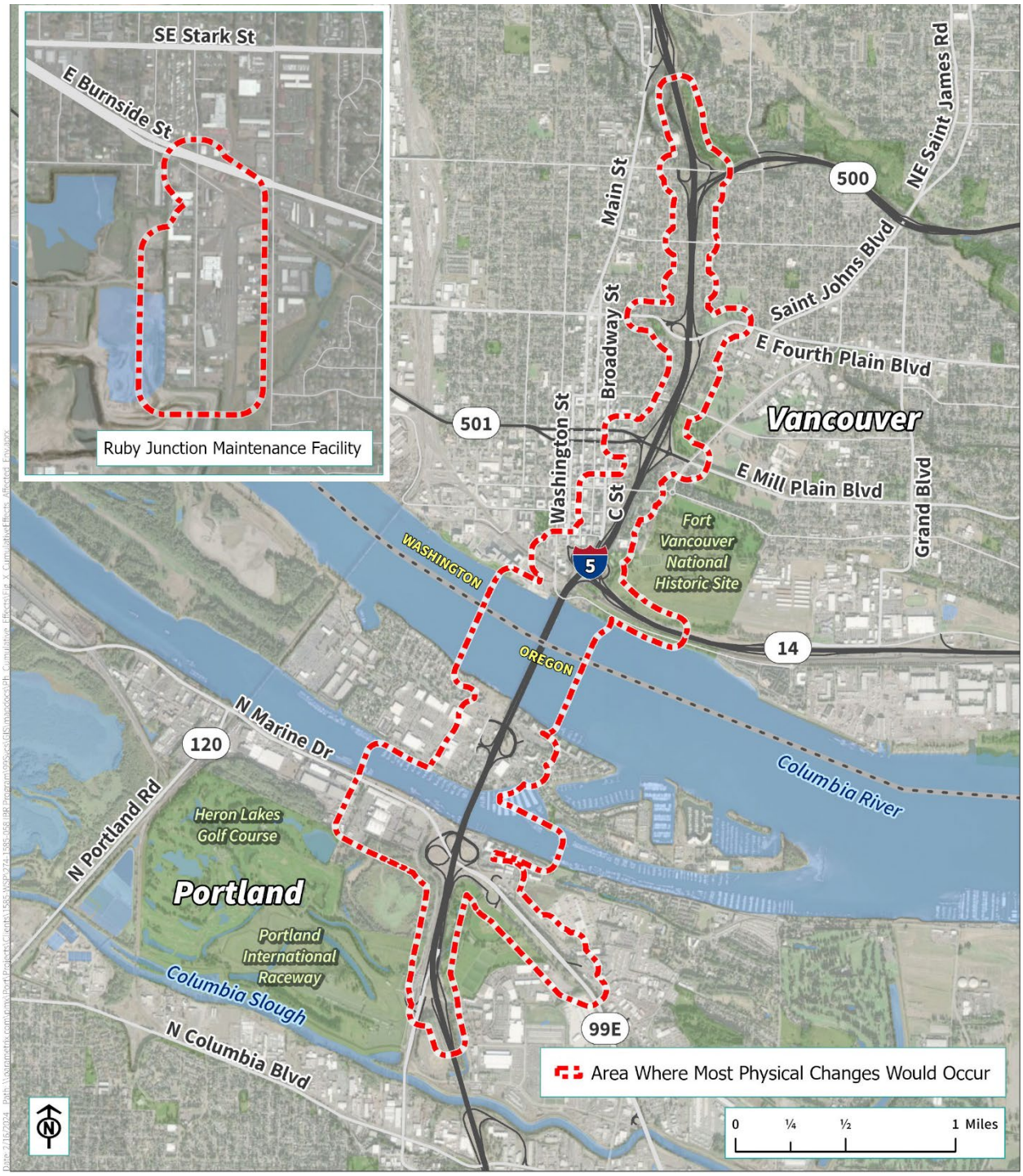
2.2 Study Areas

Each resource-specific technical report identifies a study area for evaluating effects on that particular resource (e.g., ecosystems has a different study area than acquisitions). Because the geographic scale of analysis varies by discipline, the cumulative effects analysis uses the study area identified in each technical report when evaluating cumulative effects on a particular resource. A map of the study area for each resource can be found in the respective technical reports.

Several technical reports identified a common study area, referred to as the primary study area, that runs along a 5-mile segment of I-5, between approximately the SR 500 interchange in Washington and the I-5/Columbia Boulevard interchange in Oregon, the expansion of the TriMet-owned Ruby Junction Light-Rail OMF in Gresham, Oregon. The primary study area (Figure 2-1) is with the construction footprint of the Modified LPA (though mitigation could still occur outside of it). Some resources, such as air quality and economics, use larger secondary study areas.

[17] The benefits and adverse effects of the Modified LPA on most resources (e.g., wetlands, neighborhoods, and communities, etc.) are evaluated in the NEPA/SEPA Draft and Final SEIS for the IBR Program. The benefits and adverse effects on climate and environmental justice are evaluated in the SEPA Addendum.

Figure 2-1. Area Where Most Physical Changes Would Occur



2.3 Relevant Laws and Regulations

The following state laws, regulations, and guidance were used to guide or inform the assessment of cumulative effects. While some of the guidance documents are related to NEPA, they provide a valuable framework for conducting a cumulative effects analysis outside of NEPA. The IBR Program team has limited modifications to the methodology and analysis that was published in the NEPA/SEPA Draft SEIS for public review as much as possible, while continuing to comply with SEPA requirements.

2.3.1 Washington

- **Chapter 197-11 WAC, SEPA Rules.** The SEPA procedural provisions require the consideration of environmental impacts, with attention to impacts that are likely, not merely speculative (WAC 197-11-060). The range of impacts to be analyzed in an EIS includes direct, indirect, and cumulative impacts (WAC 197-11-792).
- **Washington SEPA Handbook** (Ecology 2025). This handbook serves as the state's primary guidance and includes information on SEPA's relationship with other environmental laws, as well as recommendations on completing the review process. Consistent with Chapter 197-11 WAC, the handbook notes that agencies should identify and evaluate probable impacts, emphasizing important environmental impacts (including cumulative, short-term, long-term, direct, and indirect impacts).
- **WSDOT Environmental Manual, Chapter 412, NEPA reasonably foreseeable effects and SEPA cumulative impacts** (WSDOT 2026). This chapter provides WSDOT's policy direction regarding the assessment of cumulative effects for projects requiring NEPA documentation and for projects that require consideration of cumulative impacts per SEPA. The manual notes that, when adopting a NEPA EIS for SEPA purposes, "WSDOT prepares a SEPA addendum as necessary to provide the cumulative effects analysis required under SEPA. The addendum supplements the NEPA document by explicitly considering past, present, and reasonably foreseeable future actions, and their combined impacts on the affected resources."
- **AASHTO Practitioners Handbook, Chapter 12, Assessing Indirect Effects and Cumulative Impacts Under NEPA** (AASHTO 2016). This handbook is intended to assist practitioners in assessing cumulative impacts in the evaluation of transportation projects under NEPA. The guidance is referenced in WSDOT's Environmental Manual and was reviewed to inform the general analytical approach to the cumulative effects analysis.

In addition to the regulations and guidance listed above, the Washington State Court of Appeals decision on *Boehm v. City of Vancouver* (May 10, 2002) was reviewed to frame the analysis. Per the court decision:

- *"…[A]s a general proposition, the nature of cumulative impacts is prospective and not retrospective."*
- *"A cumulative impact analysis need only occur when there is some evidence that the project under review will facilitate future action that will result in additional impacts."*

- *"Further, we hold that SEPA review need not address cumulative impacts when speculative, and that when … no specific impact* [can be identified]*, those impacts are speculative."*

2.3.2 Oregon

- **ODOT's NEPA EIS Template** (ODOT 2020). The purpose of this annotated outline, prepared by staff from ODOT and the Federal Highway Administration (FHWA) Oregon Division Office, is to provide the framework for discussion expected to be contained within EIS documents in Oregon. The document was reviewed to inform the general analytical approach to the cumulative effects assessment.

The following section describes the overall analytical approach (or process) used to conduct the analysis, consistent with these regulations and guidance.

2.4 General Analytical Approach

The IBR Program team assessed which environmental and community resources would be affected by the Modified LPA and how other reasonably foreseeable future actions may affect the same resources. The cumulative effects analysis concentrates on resources that the Modified LPA is anticipated to affect and focuses on important issues of national, regional, or local significance. Methods and impact criteria were continued from the Draft SEIS analysis.

This analysis considers past major actions and trends as context for existing conditions. The Modified LPA and other public and private projects that are under development or reasonably expected to occur were evaluated for the potential to cumulatively impact the environment. This approach is consistent with the state regulations and guidance described in Section 2.3. The temporal scale (i.e., time frame) and geographic scale (i.e., study areas) of analysis for the assessment of cumulative effects can vary for each discipline. For some cumulative effects—namely, climate change—the analysis also assesses how global trends could affect the No-Build Alternative or Modified LPA and, conversely, how each alternative could affect the resource.

The analysis of cumulative effects for the IBR Program first employed quantitative methods where applicable. The analysis is also qualitative, which allows the appropriate context to be used in considering and comparing the two alternatives, based on available data.

The cumulative effects analysis evaluates the change in conditions since the CRC Record of Decision (ROD) and updates the analysis to incorporate new or greater cumulative effects. The analysis followed an eight-step process, listed below, which is consistent with the ODOT's NEPA EIS Template (ODOT 2010), chapter 12 of the American Association of State Highway and Transportation Officials Practitioners Handbook (AASHTO 2016), and chapter 412 of the Washington Department of Transportation's (WSDOT's) Environmental Manual (WSDOT 2026). As previously noted, while some of these documents are related to NEPA, they provide a valuable framework for conducting a cumulative effects analysis under SEPA.

- Identify the resources affected by the Modified LPA that may have cumulative effects to consider in the analysis.

- Define the study area and time frame for each affected resource.
- Describe the current health and historical context for each affected resource.
- Identify reasonably foreseeable effects that may contribute to a cumulative effect.
- Identify other historic, current, and reasonably foreseeable future actions that may affect resources.
- Assess potential cumulative effects on each resource; determine their magnitude and significance.
- Report the results.
- Assess and discuss potential mitigation measures for all adverse impacts.[18]

2.5 Past, Present, and Reasonably Foreseeable Future Actions

To address cumulative effects, the Program team established a temporal frame of reference for the analysis, as follows:

- "Past" actions vary by component of the environment.
  - Built environment analysis starts in the early 1950s, with the construction of I-5.
  - Natural environment analysis considers broad changes beginning in the 1800s.
  - Cultural environment analysis begins 15,000 years before present.
- "Present" actions are those ongoing in nature, such as maintenance of the existing transportation system.
- "Future" actions are those that will occur between 2024 (year of publication of the NEPA/SEPA Draft SEIS) and 2045 (the design year of the IBR Program).

The time periods and types of projects included in the analysis are described in greater detail below.

2.5.1 Past Actions

Generally, it is not necessary to evaluate the impacts of individual past actions to describe cumulative effects; existing conditions reflect the collective impacts of past actions. Nevertheless, there is value in understanding how current conditions were shaped by historic actions. One example is that past projects were not always planned and implemented with meaningful public input and communication. Involving communities and understanding impacts has become an essential part of project planning. The general past trends and major actions that have shaped the current built, natural, and cultural environment in the study area are outlined below. These trends and actions were identified through conversations with technical experts, members of the IBR Program's advisory groups and consulting tribes.

[18] For further details on avoidance, minimization, and mitigation measures, see Appendix M of the NEPA/SEPA Final SEIS and Appendix B of the SEPA Addendum.

Past built environment projects include transportation, urbanization, housing, and other developments that have influenced the social, economic, and natural environment reflected in the existing conditions of the region and primary study area (see Table 2-1). Prior to the 1917 construction of a bridge across the Columbia River in this location, ferries and other boats were used to transport people and goods between Oregon and Washington. A second bridge, currently carrying southbound I-5 traffic, was added in 1958 to provide increased capacity and to separate southbound and northbound traffic. At that time, the bridges were linked to Oregon 99, the main north/south highway. The bridges later became part of the interstate system when I-5 was opened in the study area in the early 1960s.

Native Americans have occupied and/or traveled through the study area for thousands of years. These activities are no longer easily identifiable in the study area's current natural and built environment; however, there are numerous cultural resources in the study area associated with this time period. In the 1800s Euro-American settlement began and expanded, and the Portland and Vancouver area population began to dramatically increase. The following key historic events provide a basis for analysis of past actions that have helped shape current environmental conditions; more detailed descriptions of actions that have affected a particular resource are presented in Chapters 3, 4, and 5.

Table 2-1. Past Actions

Time Period	Action
Pre-1800s	Native Americans thrived for centuries on the shores of the lower Columbia River until the 19th century, when settlers brought disease and ultimately removed Indigenous peoples to reservations.
1810 to 1850	Settlement of Fort Vancouver and the Hudson Bay Company. Commercial fur trapping on the Columbia River and associated waterways developed between 1810 and the 1850s. Fur trappers from the Hudson Bay Company operating out of Fort Vancouver adopted the Siskiyou Trail as a major transport corridor between the Northern Oregon Territory and California.
1840s	Oregon's Constitution prohibited Black people from entering or residing in the state and was later updated to exclude Chinese Americans and Japanese Americans from basic rights, including property ownership.
1846	Ferry service across the Columbia between Vancouver and Portland was established by Carl Switzler. Private ferry service between Vancouver and Portland was offered intermittently after that time by various operators. The State of Washington later began offering ferry service at other points along the Columbia in the 1930s.
1855–1885	Reservations and removal: Treaties signed that established Yakama, Umatilla, Nez Perce, and Warm Springs reservations. Additional treaties signed by other tribes were never ratified or reduced reservation land. Colville Reservation was established by executive order.
1870s to present	Congress authorized the federal navigation system on the lower Columbia River beginning in 1878, providing for a channel of 20 feet deep from the mouth of the river to the Portland area. The channel was progressively deepened to 43 feet

Time Period	Action
	(completed in 2010) and extended to include Vancouver upstream to the current bridge location and adding the Oregon Slough. The Vancouver to The Dalles channel was authorized in 1937 with a depth of 27 feet. There are several ongoing and planned navigation maintenance projects upstream and downstream of the Interstate Bridge, including maintenance dredging by the USACE as well as dredging by ports and private entities to maintain adequate waterway depth at marinas and marine terminals. Navigation is presently maintained to 17 feet upstream to Lewiston, Idaho.
1890s to present	The advent of the trolley line system in Portland and Vancouver encouraged greater urbanization and development of neighborhoods east of the Willamette in Oregon, and north to Fourth Plain Boulevard in Vancouver. The automobile was introduced in the early 1900s, and by the 1930s many middle-class families could afford cars and travel greater distances for work, shopping, or leisure. This greatly influenced the urbanization of Portland and Vancouver.
1905	Pearson Field became a dirigible landing area. It was officially dedicated as Pearson Field in 1925. *U.S. v Winans* affirms treaty fishing rights.
1910 to present	Railroad construction, including a rail bridge over the Columbia River in 1910, allowed increased freight transport and increased the viability of the Port of Vancouver and Port of Portland in interstate trade. Industrialized farming, irrigation and water impoundment, and grain shipment increased.
1917	Prior to 1917, unlimited vertical navigation clearance at the Interstate Bridge location was available. The Columbia River Interstate Bridge opened in 1917 and allowed easier transport of cargo and people between Vancouver and Portland, as well as the broader Pacific Northwest. This supported the expansion of industry and commerce in the region. However, the bridge limited this clearance to 178 feet when the bridge lift was full opened. At that time, it was not expected that any navigation would have been reduced as larger vessels and cargo shipments began to transit the Columbia River in the 1930s to support building hydroelectric dams and the 1940s to support World War II shipbuilding activities. In 1958, a second parallel bridge was constructed and the original 1917 bridge was converted to northbound only I-5 traffic (NPCC 2010). The opening of the bridge also included streetcar service, as well as bridge tolls. Streetcar service began in 1917 and was discontinued in 1926. Bridge tolls were first implemented to fund the construction of the bridge in 1917 and were removed in 1929, followed by the addition of tolls once again from 1960 to 1967 for the construction of the second bridge (CRC 2011b).
1930s to 1970s	Several hydroelectric dams were built on the Columbia River between the 1930s and 1970s, including Bonneville, The Dalles, and John Day dams, to control flooding and provide electricity and irrigation water for the Pacific Northwest. Overfishing, construction of these dams, and other actions dramatically decreased salmon runs. This had a negative impact on the well-being of Native American tribes, for whom the salmon were a significant material and cultural resource.

Time Period	Action
1940s	Mobilization of shipyard manufacturing in support of World War II brought wartime employment in the Portland and Vancouver area to 75,000. This massive influx of workers from all over the U.S. created a housing shortage, and many nearby areas were affected by the temporary increase in housing demand and resulting building boom.
1942	President Roosevelt signed Executive Order 9066, which ordered the removal of Japanese Americans from the West Coast to inland internment camps. The Portland Expo Center (formerly named the Pacific International Livestock Exposition Center) was used as a temporary detainment camp.
1948	The Vanport Flood occurred in 1948, when the Columbia River flooded and displaced approximately 20,000 public housing residents, including many minorities. Relocation occurred throughout the area, and the Vanport community's residential base never recovered to the levels supported in 1948.
1950s	Post–World War II housing construction was financed through federal grants and GI loans and created a greater supply and demand of outer urban and suburban housing in both Oregon and Washington.
1958	The Vancouver-Portland Interstate Toll Bridge was constructed in 1958. This development doubled automobile capacity across the Columbia, reduced congestion, and allowed further commuting across the river. This bridge continues to carry southbound traffic today.
1953 to 1954	The Western Oregon Indian Termination Act terminated federal recognition of 60+ tribes in Oregon, including the reservations at Grand Ronde and Siletz.
1960s	Portland International Raceway and Delta Park were established on former roads and land from the Vanport community that was destroyed by floods in 1948.
1952–60s	Construction of the interstate highway system in the 1950s and early 1960s was followed by increased freight and automobile traffic. The new highway separated neighborhoods in Portland and Vancouver. Construction of the interstate highway system also increased access to downtown Vancouver.
1950s to present	Urban renewal projects and large-scale transportation projects, including construction of I-5, the Memorial Coliseum, and the Emanuel Hospital expansion, led to the displacement of low-income and minority populations, including Black Portlanders in North and Northeast Portland (City of Portland 2019).
1969 to 1974	A series of court cases upheld treaty fishing rights and held that tribes reserved a "fair and equitable share" of fish on the Columbia River.
1973 to 1990s	A shopping mall opened on Hayden Island, at the location of a former amusement park. Originally an indoor mall, the site was redeveloped as an outdoor mall in the 1990s and renamed the Jantzen Beach Center.
1973 to present	Growth management and implementation of Oregon planning laws in the 1970s have limited urban sprawl in the Portland metropolitan area.

Time Period	Action
1970s to 1990s	High tech firms settling in Beaverton, Hillsboro, and other nearby suburbs were major players in the national high tech boom of the latter 20th century, an area that became known as the Silicon Forest. As the area's economy shifted from timber processing and sales to high tech and services, a high demand for professional workers emerged. This encouraged commuting from throughout the Portland metropolitan area, including Vancouver, which increased commuting across the Columbia.
1977	Confederated Tribes of Siletz Indians were restored to federal recognition.
1983	Confederated Tribes of Grand Ronde were restored to federal recognition.
1990	The Washington Growth Management Act passed in 1990; like the growth management and planning laws adopted by Oregon in the 1970s, this act sought to restrict unplanned urban sprawl and concentrate growth in existing urban areas.
1990s to present	An increased focus on climate change has led to calls for action in Oregon and Washington. Greenhouse gas emissions reduction targets were established at the state and local levels, with additional goals and policies identified to increase resiliency to climate-related impacts, such as drought.
2000 to 2020	The region experienced significant population growth between 2000 and 2020, with Multnomah County growing by 23% and Clark County by 46%, with most of the growth in BIPOC and/or Hispanic/Latino populations (USCB 2010, 2020).
2001 to present	The Port of Portland conducted mitigation at the 90-acre Vanport Wetlands mitigation site. Efforts included the removal of invasive species, grading for improved functionality, and landscaping with native plants.
2008 to present	Beginning in 2008, the City of Vancouver worked with public and private partners to transform Vancouver's historic waterfront area into a mixed-use area featuring office space, restaurants, shops, housing, and public spaces.
2000s to present	An increased focus on equity considerations leads to commitments at the state and local level. Equity goals and policies are adopted by Oregon State, Washington State, and the Cities of Portland and Vancouver.

BIPOC = Black, Indigenous, and People of Color; USACE = U.S. Army Corps of Engineers

The following transportation and development projects in or near the primary study area give a sense of the recent development trends.

2.5.1.1 Recently Completed Transportation Projects

- Port of Vancouver's West Vancouver Freight Access Project (Vancouver, west of I-5).
- Waterfront Renaissance Trail (Vancouver, east of I-5).
- Interstate Bridge northbound trunnion replacement (Vancouver/Portland).
- Interstate Bridge northbound active traffic management (Vancouver).
- Clark County Public Transit Benefit Area Authority (C-TRAN) bus-on-shoulder service (Vancouver, I-5, and Interstate 205 [I-205]).

- New metering on southbound I-5 at the 39th Street/SR 500 off-ramp (Vancouver).
- C-TRAN's The Vine on Mill Plain and Fourth Plain (BRT) (Vancouver)

2.5.1.2 Other Recently Completed Projects

- Multifamily residential buildings along Marine Drive and N Anchor Way (Portland, east of I-5).
- Vanport wetlands restoration (Portland, west of I-5).
- Jantzen Beach Center redevelopment (outdoor mall) (Portland, Hayden Island, west of I-5).
- Floor & Decor (commercial store) (Portland, Hayden Island, east of I-5).
- Vancouver Waterfront (mixed-use development) (Vancouver, west of I-5).
- Hurley Building condominium (Vancouver, west of I-5).
- New Seasons (grocery store) (Vancouver, west of I-5).
- West Barracks renovation (commercial properties) (Vancouver, east of I-5).
- Vancouver Community Library (Vancouver, west of I-5).
- Providence Academy (site redevelopment) (Vancouver, west of I-5).
- Aeon Apartments (formerly Aegis) (mixed-use development) (Vancouver, west of I-5).
- Block 10 (mixed-use development) (Vancouver, west of I-5).
- Office buildings at 210 W 4th Street and 101 E 6th Street (Vancouver, west of I-5).
- Vancouver Center Condo (Vancouver, west of I-5).
- Vancouver Innovation, Technology and Arts Elementary School (Vancouver, east of I-5).

2.5.2 Present Actions

Present actions are those that are ongoing in nature, such as regional population growth and maintenance of the existing transportation system and ongoing transportation safety improvements. These include maintenance of the Interstate Bridge, the City of Vancouver's Pavement Management program, and the City of Portland's Fixing Our Streets program.

2.5.3 Reasonably Foreseeable Future Actions

When identifying the future actions to be included in the cumulative effects analysis, only future actions that are "reasonably foreseeable," meaning they are likely or reasonably likely to occur within the time frame established for the analysis (2024 to 2045), are considered. Reasonably foreseeable also means that the direct and indirect effects of those actions can be reasonably identified and evaluated. If it is not reasonably likely that an action would occur, or if the parameters of the action are unknown and its effects cannot be reasonably identified, then the evaluation of its contribution to cumulative effects would be speculative. There is inherently some uncertainty in assessing cumulative effects and the contribution of reasonably foreseeable future actions, because conditions would be influenced by a large number of factors (e.g., economic fluctuations, changing development patterns, and the design and timing of individual projects, among others). The cumulative effects analysis focuses on reasonably foreseeable effects based on currently available information.

For many resources, anticipated changes over time are linked to future changes in population, employment, traveler behavior, transportation system performance, and land use patterns. The IBR Program team forecasted future travel demand using the 2018 Oregon Metro (Metro)/RTC RTP Regional Travel Demand Model (Metro/RTC 2018 RTP RTDM), which includes regionally adopted land use assumptions (Metro 2018). This demand-forecasting approach is reinforced by long-standing federal and state-level guidance and by transportation and environmental planning best practices. Therefore, the analyses based on regional traffic forecast modeling are already cumulative(air quality, climate, energy, noise and vibration, and transportation).

Uncertainty in forecasting is expected because traffic forecast volumes, while based in part on available existing counts, also use regionally developed assumptions about future conditions within the regional plans. While all future-year forecasting involves some degree of uncertainty, the techniques used here reflect accepted professional practice and provide a sound basis for evaluating impacts under each IBR Program alternative.

Multiple plans contain lists of reasonably foreseeable future projects. These plans include transportation system plans, neighborhood plans, and comprehensive plans, among others. Discussions with partner agencies also provided insight into planned projects in the region.

The following three sections identify the list of reasonably foreseeable future actions included in the cumulative effects analysis, which have been organized into three categories: (1) future transportation projects, (2) other future projects (non-transportation), and (3) future growth and regional changes as identified in adopted state, regional, and local plans.

2.5.3.1 Reasonably Foreseeable Future Transportation Projects

The list of reasonably foreseeable future transportation projects included in the cumulative effects analysis is based primarily on the transportation modeling conducted for the IBR Program, which is detailed in Appendix A of the Transportation Technical Report.[19] This includes a variety of projects that are assumed to be built and in operation before 2045. Sources for this future transportation project list include the financially constrained project list in the Metro Regional Transportation Plan (Metro 2018 including amendments) and the RTC RTP (RTC 2019). The specific design and timeline for implementation of these projects is not determined at this time.

The IBR Program forecasted future travel demand using the Metro/RTC 2018 RTP RTDM, which includes regionally adopted land use assumptions. This demand-forecasting approach is reinforced by long-standing federal and state-level guidance and by transportation and environmental planning best practices.

The basis for the identified reasonably foreseeable future transportation projects is the list of projects identified as “financially constrained” by Metro and the RTC (for a complete list, see the RTPs for

[19] ODOT’s Regional Mobility Pricing Project was not included in the modeling or cumulative effects analysis as that project was not included in the Metro/RTC 2018 RTP RTDM. Additionally, all work on the Regional Mobility Pricing Project was halted in March 2024 at the direction of the Oregon Governor, and the project is not anticipated to be reinitiated at this time.

Metro [2018] and RTC [2019]).[20] The financially constrained project list does not identify any major capacity improvements on I-5 near the study area. Outside of the study area, there are I-5 capacity enhancements and several major maintenance projects. Capacity improvements on I- 5 will provide additional vehicular and freight mobility and reduce travel times. The reasonably foreseeable future projects will also require materials, equipment, and energy to complete and will have temporary traffic impacts associated with construction.

Improvements include the reconfiguration of the roadway, sidewalks, and adjacent outdoor spaces to improve safety and accessibility for residents and businesses. The City of Vancouver secured funding for the project in 2021, and it is anticipated that construction will occur in winter 2023 through winter 2024.

The list of future transportation projects considered for the No-Build Alternative does not include the improvements proposed under the Modified LPA and assumes that bridge tolling will not be in place. The Modified LPA assumes the same reasonably foreseeable future transportation projects as the No-Build Alternative, with the addition of the Modified LPA components, including additional auxiliary lanes on I-5, LRT extension from Expo Center in Portland to downtown Vancouver, active transportation improvements, and variable-rate tolling on the Columbia River bridges.

In Vancouver, three transportation projects in Vancouver would improve connectivity and mobility in the Program area: the Main Street Promise project, Fourth Plain Boulevard and Fort Vancouver Way Safety and Mobility Project, and the 29th and 33rd Streets Safety and Mobility Project.

The RTP transit projects and the service levels they include reflect regional growth priorities and policies emphasizing lower reliance on driving and more transit and active transportation to meet future regional mobility needs. The Transportation Technical Report provides further detail on the other transportation projects included in the Metro/RTC 2018 RTP RTDM.

2.5.3.2 Other Reasonably Foreseeable Future Projects

Other reasonably foreseeable future projects near the Modified LPA are listed below and identified on Figure 2-2. When identifying non-transportation projects that could contribute to cumulative effects, a project's proximity to the Modified LPA improvements was considered a factor in whether that action and the Modified LPA activities would result in additional impacts (see Figure 2-1). The list of projects, described below, was confirmed with local and regional partner agencies. On a discipline-by-discipline basis, additional projects and trends were considered, including projects located farther from the Modified LPA improvements, if relevant to the analysis of cumulative effects for that resource. As with future-looking assumptions, the specific design and timeline of these future actions is subject to change, and their evaluation is based on the available information at the time of analysis.

[20] Federal regulations require that an RTP be financially constrained. This means that total transportation expenditure levels identified within the RTP must not exceed the total revenue level reasonably expected to be available for the metropolitan region over the life of the plan; this includes existing revenues and new revenues that may be reasonably anticipated. Transportation modeling typically includes only projects in the fiscally constrained RTP. However, one transportation project, the Fourth Plain Safety and Mobility project, is not listed on the financially constrained list in the RTC's RTP but was incorporated into the modeling at the request of partner agencies.

Figure 2-2. Other (Non-Transportation) Reasonably Foreseeable Future Projects in the Program Vicinity

Note: No reasonably foreseeable non-transportation projects were identified near the Ruby Junction Maintenance Facility that are anticipated to contribute to cumulative effects.

The Waterfront Vancouver: This ongoing project is a large-scale mixed-use development led by a public/private collaborative partnership between the City of Vancouver and private development interests. The Waterfront Vancouver is located within the greater waterfront area of Vancouver. A master plan was approved for the 20-block, 32-acre site, which included new office and residential space, in addition to a public park and multiuse trail. The first phase of construction began in 2015, and the first buildings opened in 2018. While the City's improvements are largely complete, private properties continue to be developed. No specific timeline is currently available for when the remaining blocks would be developed, but construction could overlap with construction of the Modified LPA.

Terminal 1: The Port of Vancouver USA is developing a 10-acre property known as Terminal 1, located between The Waterfront Vancouver (described above) and the existing Interstate Bridge. The plan for Terminal 1 is a mixed-use development with a hotel, office and retail space, outdoor gathering areas, and a public marketplace. Terminal 1 would also complete a missing segment of the Vancouver Waterfront Renaissance Trail, connecting the existing trail at the Vancouver Waterfront to the existing Columbia River Renaissance Trail east of Terminal 1. The Terminal 1 master plan is certified as Leadership in Energy and Environmental Design (LEED) Neighborhood (ND) Gold by the U.S. Green Building Council, and the Port's design standards call for all new buildings to be constructed to achieve a LEED Gold Certification or higher. Vancouver Landing, Terminal 1's first completed project, opened in June 2022 and consists of a boardwalk with green space and public seating, Renaissance Trail connections, and signage displaying historical significance of the site. The Terminal 1 site currently includes a hotel, two office towers, and new residential buildings under construction. In the next few years, the Port anticipates additional residential, retail, and commercial development, including the public marketplace. Construction of other features is underway, with an anticipated completion date of 2027.

Renaissance Boardwalk: The Renaissance Boardwalk project is a public-private partnership between Kirkland Development LLC and the City of Vancouver to develop a 3.5-acre site directly to the east of the Interstate Bridge. The development plans include two new buildings and underground parking, with approximately 220 apartments and retail, office, and restaurants space. A public boardwalk along the water's edge would be included in the development and connect to existing trails. The project would also demolish a City-owned pier (built in 1991). The development would include several efforts to meet the City's climate goals, including meeting LEED Gold standards, using electric power for the residential units (no natural gas), and 100 charging stations for electric vehicles (Campbell 2021a, 2021b). The anticipated dates of construction are not available at this time.

Waterfront Gateway: This project, run by the Vancouver City Center Redevelopment Authority (CCRA), would redevelop a 6.4-acre City-owned site in downtown Vancouver near City Hall. The CCRA selected a development team to move forward with efforts to turn the site into a mixed-use destination including office, retail, and residential uses, and that connects Vancouver's waterfront with its historic downtown. This project is eligible for the Affordable Housing Fund and would include 100 apartment units reserved for residents making 60% or less of the area's median income. Initial plans call for 545 parking spaces to be located underground or at the podium levels of the buildings. The City is currently working with the developer to create a comprehensive development plan for the site. The City has identified this project as a major opportunity for housing and economic growth. The City and project partners held a ceremonial groundbreaking in August 2025 to begin construction of a

new affordable housing community (City of Vancouver n.d.). Construction of the Waterfront Gateway project is projected to continue for the next several years, though a specific timeline is not available at this time.

Levee System Improvements: There are two concurrent efforts underway to improve the existing levee system along the Columbia River near the Interstate Bridge: the USACE and UFSWQD PMLS project and the UFSWQD CCFS projects (formerly Flood Safe Columbia River and Levee Ready Columbia). Proposed improvements include raising the elevation of the levees. Anticipated environmental impacts for this project are documented in the Final Integrated Feasibility Report and Environmental Assessment (USACE and CCDD 2021), with a Finding of No Significant Impact signed in April 2022. The IBR Program is coordinating with the agencies involved to ensure that design efforts consider the timing and scope of the proposed modifications to the levees.

Restoration and Habitat Projects: There are several planned restoration projects within the area where most physical changes would occur (Figure 2-1) and along habitat corridors or waterways that pass through or near this area. Restoration activities are planned along Burnt Bridge Creek in Vancouver and the Columbia Slough in Portland (Ecology n.d. [a]; Lee and Stamberger 2018, respectively). These projects are led by various agencies and organizations, including the cities of Vancouver and Portland and the Columbia Slough Watershed Council. Restoration actions are likely to occur as funding becomes available, and there is currently no specific timeline available.

Portland Expo Center Redevelopment (Expo Future): Metro owns the Portland Expo Center, which is a 53-acre employment and exhibition site located west of I-5. Following a development opportunity study, Metro recommended redeveloping of the Expo Center into a sports and cultural complex. The vision for the Expo Center includes upgraded sports equipment for existing facilities, a new ice sports center, a new court sports facility, a new family athletic and entertainment center, a new community cultural center and garden, connection to natural areas, and parking enhancements. Successive phases would include a hotel, food and beverage expansion, and installation of an indoor track (Metro n.d.). While general future uses has been recommended, many project details are still to be determined and therefore many potential effects (and contributions to cumulative effects) cannot be described quantitatively at this time. No detailed construction schedule or timeline is currently available for this project. The IBR Program will continue to coordinate with Metro as the Expo Center project progresses.

Cascade Renewable Transmission Project. Installation of a new high-voltage transmission cable buried in the bed of the Columbia River below the Interstate Bridge and will transfer energy from utility-scale wind, solar, and other renewables to help meet renewable energy demand in Oregon and Washington. The cable will extend from The Dalles to Portland, traveling approximately 100 miles beneath the Columbia River until it transitions to an underground cable on Hayden Island, to the west of the Interstate Bridge. The project submitted a permit application to Washington's Energy Facility Site Evaluation Council in October 2025. Transmission facility construction is targeted to commence in 2026, and the start of commercial operation is targeted for 2029 (Cascade Renewable Transmission 2025). The IBR Program will coordinate with the utilities involved to consider the timing and location of the proposed facility.

2.5.3.3 Future Growth and Regional Changes Identified in Adopted State, Regional and Local Plans

Several adopted state, regional, and local plans include visions of growth or change in the region over the next 20 years. Anticipated growth and change as identified in these plans is reflected in this analysis, as the inputs were part of the regional modeling conducted for air quality, climate, energy, noise and vibration, and transportation. Details on how projected changes in population, land use, employment, and other factors are reflected in the regional modeling are provided in Appendix A of the Transportation Technical Report.

STATE PLANS

The Washington Transportation Plan, developed by WSDOT, establishes a 20-year vision for the development of the statewide transportation system. This plan is based on the six transportation system policy goals established by the Washington Legislature (Revised Code of Washington 47.04.280): preservation, safety, mobility, environment, stewardship, and economic vitality (WSDOT and WSTC n.d.).

The Oregon Statewide Planning Goals encourage urbanized growth within the Portland metropolitan area. Applicable goals include (but are not limited to) Goal 2 (Land Use Planning); Goal 5 (Natural Resources, Scenic and Historic Areas, and Open Spaces); and Goal 12 (Transportation).

The Oregon Transportation Planning Rule requires local jurisdictions to consider changes to land use densities as a way to meet transportation needs and encourages transit and multimodal transportation systems. The Oregon Transportation Plan (OTP) is the overarching policy document among a series of plans that together form the state transportation system plan. An update to the OTP is currently underway and is scheduled for completion in 2023.

In 2018, the Oregon Transportation Commission adopted an amendment to incorporate the Statewide Transportation Strategy (STS) as part of the OTP. The Oregon STS is a state-level scenario planning effort that examines all aspects of the transportation system, including the movement of people and goods, and identifies a combination of strategies to reduce GHG emissions.

The Oregon Highway Plan (OHP) includes contextual statements and policies that may have an impact on the alternatives analysis for the IBR Program (ODOT 1999). The OHP has been updated multiple times since 1999 to incorporate amendments, most recently in 2023. The OHP identifies I-5 as a major truck freight route. The OHP grants alternative standards to the Portland metropolitan area due to its established higher minimum densities, mixed-use development, and multimodal transportation options. The plan requires the adoption of Interchange Area Management Plans for all new or upgraded highway interchanges where the function of the interchange may be hindered due to changes in adjacent land uses.

REGIONAL PLANS

C-TRAN's Service Preservation Plan requires equitable service hours for local urban service, paratransit services, commuter services to Portland, and service to smaller Clark County cities. The

plan includes high-capacity transit planning and its integration with other services, as well as both LRT and BRT improvements.

The RTC adopted the RTP for Clark County in 2019, which identifies future regional transportation system needs, plans, and improvements necessary to maintain mobility within and through the region, as well as access to land uses within the region. The RTP incorporates light-rail as a component of the multimodal transportation system in the Vancouver metropolitan region.

The Metro RTP is a 25-year blueprint for the Portland metropolitan region's transportation system that is updated every five years (most recently in 2018). The RTP establishes policies and priorities for all forms of transportation and anticipates the region's current and future transportation needs.

Metro also has a Growth Concept, Regional Framework Plan, and Climate Smart Strategy. The Metro 2040 Growth Concept encourages efficient use of land, a balanced transportation system, and other elements that will aid Portland metropolitan area cities to manage growth.

The Metro Regional Framework Plan (2014) includes policies to provide adequate transportation facilities to support adopted land use plans and enhance jobs, housing, and community identity. It also provides for a system of arterials and collectors to connect the central city, regional centers, industrial areas, and intermodal facilities.

The Climate Smart Strategy was adopted in 2014 by Metro to reduce the region's per capita GHG emissions from cars and light trucks at least 20% by 2035. The plan is a regional strategy to realize local visions for land use and transportation while also reducing GHG emissions.

TriMet's Transportation Improvement Plan utilized input from public engagement with transit riders and community partners to establish transit improvement priorities and possible funding allocations. The plan establishes a five-year roadmap for the roll-out of future services and programs to improve service in low-income communities. It also provides for planned revenue and service improvements and programs within the next two years (fiscal year 2021 to fiscal year 2023).

LOCAL PLANS

Vancouver

The Vancouver City Center Vision (VCCV) Plan (2007) for the Vancouver downtown area expands the city center boundary to approximately 130 city blocks, including the city center waterfront. It includes high-density residential uses, especially along the waterfront, with public access to the river's shoreline area. Other planned uses include recreation, cultural, hospitality, entertainment, and commercial uses. The plan identifies several new city blocks in the area of the existing I-5 downtown Vancouver interchange that may be available for development as a result of the Modified LPA.

The plan proposes easy access to Oregon from downtown Vancouver through high-capacity transit and a new southbound I-5 off-ramp to 6th Street. It proposes easy access to the Vancouver National Historic Reserve and an integrated pedestrian, bicycle, transit, and automobile transportation system. The plan would improve downtown connectivity through a new arterial route south of the railroad berm extending from east of I-5 to Jefferson Street, connecting with Columbia, Esther, and Jefferson Streets.

The City of Vancouver's Comprehensive Plan (2011–2030), last updated in 2011 and currently being updated through 2025, encourages compact urban centers, transit, and supportive development regulations for areas along the defined high-capacity transit corridors identified along I-5 and SR 500. The City maintains a separate Transportation Plan that includes policy statements. The Comprehensive Plan applies to downtown Vancouver and North Vancouver.

The Comprehensive Plan designates future growth within the primary impact area from the Columbia River to Mill Plain Boulevard as Public Facilities, Commercial, and Open Space/Parks. Designations north of Mill Plain Boulevard within the primary impact area include Public Facilities; Urban High, Medium, and Low Density; and Commercial.

The Vancouver Shoreline Master Program (2021) includes goals and policies for physical and visual access to the shoreline, design that enhances the waterfront, an integrated trail system, good transportation networks, and strong bike and pedestrian circulation. Shoreline designations include High Intensity from the western extent of the study area to the eastern end of Fort Vancouver, with Fort Vancouver designated Urban Conservancy.

Other local plans in Vancouver include the Port of Vancouver Waterfront Development Master Plan, Downtown Vancouver Transportation System Plan, Central Park Plan, and Highway 99 Subarea Plan, Climate Action Framework, among others.

Zoning in the study area includes City Center, High and Low Density Residential, Central Park Mixed Use, and Open Space/Parks. The City of Vancouver has several zoning overlay districts within the study area. These include a Historic Preservation Overlay that preserves significant architectural character and areas within the city with cultural significance. A Noise Impact Overlay District is established along the Columbia River shoreline and extending west to the Esther Short Park neighborhood and along blocks that abut I-5 up to McLoughlin Boulevard. An Office Development Overlay District protects neighborhoods from noise, light, and increased pedestrian and automotive traffic, or other community aesthetic changes. Transit overlay districts within the study area encourage high-density residential and commercial development along main traffic corridors. The Central Park Plan District preserves and enhances the established urban civic character of the area and its significant historical, natural, educational, recreational, public utility, and social service resources.

Portland

The City of Portland's 2035 Comprehensive Plan, amended in March 2020, is built on the 2012 Portland Plan, the Climate Action Plan, and Portland's 1980 Comprehensive Plan. The Comprehensive Plan is a long-range land use and public facility investment plan to guide future growth and physical development of the city. The plan continues the commitment to linking land use and transportation decisions. It expands the reasons for, and approaches to, improving Portland as a place that is walkable, bikeable, and transit-friendly with active main streets. There are a variety of Comprehensive Plan designations within the study area, including Open Space, Industrial Sanctuary, General Industrial, Mixed Use – Neighborhood, and Commercial Employment. Most of the areas within the study area are developed; however, further redevelopment on Hayden Island is anticipated.

Zoning designations in the study area include Open Space, Heavy Industrial, Commercial Mixed Use, and various Residential zones. There are several zoning overlay districts within the study area, including Environmental and Conservation overlays, which protect natural resources; Design Overlay, which preserves areas of the City with special scenic, architectural or cultural value; and Aircraft Landing Overlay, which provides safer operating conditions for aircraft in the vicinity of Portland International Airport (PDX).

In early 2009, the City of Portland Bureau of Planning and Sustainability published the Hayden Island Plan. The plan includes goals, objectives, proposed Comprehensive Plan and zoning changes, an implementation strategy, a street plan, development standards, a conservation strategy, and an affordable housing preservation strategy.

3. BUILT ENVIRONMENT CUMULATIVE EFFECTS

The built environment includes the following disciplines or resource areas:

- Acquisitions and displacements
- Air quality
- Aviation
- Climate change
- Economic activity
- Electric and magnetic fields
- Energy
- Environmental justice
- Hazardous materials
- Land use
- Navigation
- Neighborhoods and communities
- Noise and vibration
- Public services and utilities
- Transportation
- Visual quality

Key elements of the built environment in the study area include the roadway and transit network, downtown Vancouver and surrounding neighborhoods, and the neighborhoods and commercial uses on Hayden Island and North Portland near the river. Development projects considered in the analysis include large commercial developments (especially near highway interchanges), highway-oriented developments, industrial developments or redevelopment (e.g., the area between Columbia Boulevard and Columbia Slough), and housing developments near the highway or urban edge.

The temporal frame of reference for the built environment "past" for this analysis is generally from 1950, prior to the opening of I-5 through Oregon and Washington, to the present. As data allow and are relevant, some parts of the cumulative effects discussion refer back to 1917, the time of construction and opening of the first bridge across the Columbia River. The current year is 2022 and the temporal frame of reference for the "future" is generally 2045, which is the planning horizon for the Program and the year to which impacts can be reliably identified (either quantitively or qualitatively) without speculation. Long-term cumulative effects extending beyond the 2045 planning horizon that are related to the Modified LPA life cycle are considered qualitatively.

For a discussion of temporary cumulative effects on the built environment, see Chapter 6.

3.1 Acquisitions and Displacements

Please see the Acquisitions Technical Report for additional information.

3.1.1 Program Effects

3.1.1.1 No-Build Alternative

The No-Build Alternative would not require any acquisitions or displacement of businesses or residences. Other reasonably foreseeable future actions in the study area would continue under the No-Build Alternative; however, most future actions are not currently anticipated to result in acquisitions or displacements. Renaissance Boardwalk may displace one business. Based on recent and proposed developments in Vancouver, ongoing infill development may displace additional businesses (see the Land Use Technical Report for additional details).

3.1.1.2 Modified LPA

Under the Modified LPA, property would be permanently acquired for construction staging locations and for long-term operation and maintenance of the Modified LPA improvements, including permanent subsurface easements. Acquisitions and displacements would include residences, that would need to be relocated, along with commercial uses and public facilities. In Oregon, most of the acquisitions and displacements resulting from the Modified LPA would be commercial properties and floating homes on Hayden Island. Current regulations and a lack of other moorage spaces limit opportunities for relocating displaced floating homes.

In Washington, most acquisitions and displacements would be commercial properties and multifamily dwellings in downtown Vancouver. Some single-family residences would be acquired and displaced along I Street in Vancouver's Shumway neighborhood. The Modified LPA would displace three businesses in downtown Vancouver. Reasonably foreseeable future actions, such as the planned redevelopment associated with the Hayden Island Plan, would likely require the additional displacement of existing businesses, while providing commercial space for the relocation of others (see the Land Use Technical Report for additional details).

Acquisitions and displacements have the potential to affect resources such as the economy (Section 3.5), neighborhoods and communities (Section 3.12), and environmental justice (Section 3.8).

While there are some changes in direct and indirect impacts and/or benefits associated with the various design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.1.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Most of the area directly affected by the Modified LPA is already occupied by public right of way (approximately 84%) resulting from previous transportation or other capital construction projects.

The original construction of I-5 during the late 1950s and early 1960s involved significant property acquisitions and displacements in Portland and Vancouver. For example, when the segment of I-5 known as the Minnesota Freeway was constructed from the Rose Garden area to the Columbia River Slough in northeast Portland, it removed more than 180 dwellings and displaced more than 400 residents (Kramer 2004). Construction of I-5, I-205, the Memorial Coliseum, and the Emanuel Hospital expansion collectively displaced thousands of Black Portlanders from the 1950s through the 1970s.

No known reasonably foreseeable future projects would require displacements on the Hayden Island floating home community along North Portland Harbor. Existing state and federal regulations have made it difficult to permit new moorages for floating homes, making it unlikely that new slips would be available in the future. In addition to the existing floating home sites along North Portland Harbor, there are slips along the Multnomah Channel in northwest Portland, St. Helens, and Scappoose and in Washington near Caterpillar Island on the Columbia River. In June 2023, 76 floating homes were available for purchase in the Portland metro area, with 30 located on owned slips (versus rented from the moorage) (Portland Floating Homes 2023). A review of publicly available information did not identify any information suggesting that moorages have been declining.

Most of the reasonably foreseeable future projects would not result in the displacement of existing residential or commercial properties, with the exception of one potential business displacement from the Renaissance Boardwalk development. As noted above, ongoing infill development may displace additional businesses (see the Land Use Technical Report for additional details).

While redevelopment of the Expo Center would change the underlying use of the site to a sports and cultural complex, the property would remain under the control of Oregon Metro and does not constitute a displacement.

3.1.3 Conclusions

Past actions, including the construction of I-5 and other major roadways, have required substantial acquisitions and displacements in the study area. Most of the present and reasonably foreseeable future actions are not anticipated to acquire or displace businesses or residences (with the exception of one potential business displacement). Reasonably foreseeable future transportation actions would follow federal and state guidelines, such as the Uniform Relocation and Real Property Acquisitions Policies Act of 1970, as amended, to provide replacement housing and relocation benefit packages.

The No-Build Alternative would not contribute to cumulative acquisitions and displacements. The acquisition of property for the Modified LPA would be substantially smaller than the acquisitions associated with the original construction of I-5 in the corridor but would make a small cumulative contribution to the conversion of residential and commercial land to transportation use, and to the total number of acquisitions and displacements that have occurred within the study area.

Under the No-Build Alternative, cumulative effects on acquisitions and displacements would be driven by the continued conversion of private property to public infrastructure due to past, present, and reasonably foreseeable actions.

In addition to the adverse cumulative effects on acquisition from reasonably foreseeable future actions, the Modified LPA, combined with past, present, and reasonably foreseeable future

actions, would have an incremental adverse effect because of the additional property acquired for public right of way.

Under the No-Build Alternative, cumulative effects on acquisitions and displacements would be driven by the continued conversion of private property to public infrastructure due to past, present, and reasonably foreseeable actions.

In addition to the adverse cumulative effects on acquisition from reasonably foreseeable future actions, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would have an incremental adverse effect because of the additional property acquired for public right of way.

3.2 Air Quality

Please see the Air Quality Technical Report for additional information.

3.2.1 Program Effects

The air quality analysis prepared for the IBR Program is cumulative in nature as it incorporates projected increases in traffic, regional growth, and reasonably foreseeable future transportation projects. The analysis indicates that future regional air pollutant emissions from I-5 traffic exhaust would be lower than the existing conditions with or without the Modified LPA.

3.2.1.1 No-Build Alternative and Modified LPA

Under both the No-Build Alternative and the Modified LPA, air pollutant emissions are expected to be substantially lower in the future than under existing conditions for most mobile source air toxins and criteria pollutants. For all pollutants analyzed, future 2045 emissions are projected to be lower than existing conditions under both the Modified LPA and No-Build Alternative.

The Modified LPA would result in lower pollutant emissions compared to the No-Build Alternative. Reductions in vehicle miles traveled (VMT) and improved traffic flow under the Modified LPA would result in lower emissions of mobile source air toxins and criteria air pollutants in the Portland metropolitan region, with decreases ranging from 1% to 14%, varying by pollutant. The Modified LPA may also contribute to beneficial cumulative effects through the expansion of public transit and active transportation networks or other projects, resulting in lower emissions and beneficial effects on air quality.

However, traffic volumes on some roadway links would increase with the Modified LPA, which could increase localized air pollutant concentrations in those areas. The localized changes in air pollutant concentrations are likely to be the most pronounced from traffic volumes on roadway links that are expected to increase under the Modified LPA compared to the No-Build Alternative. These increases are likely due to vehicle diversion from highways to avoid tolling on the Columbia River bridges.

However, the magnitude and duration of these potential localized concentration increases cannot be reliably quantified due to the absence of an approved methodology to forecast Modified LPA -specific mobile source air toxic concentrations and related health impacts. Additionally, the region's

attainment status implies that localized transportation projects are unlikely to cause an exceedance of the National Ambient Air Quality Standards. Regional improvements, such as increased transit capacity and extension of active transportation networks, would further reduce additional future emissions and have a positive effect on air quality (though wildfires in the region have recently caused temporary exceedances of ozone and particulate matter less than or equal to 2.5 microns in diameter [$PM_{2.5}$]). Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on air quality (identified in the air quality analysis in Section 3.10 of the NEPA/SEPA Final SEIS and the Air Quality Technical Report) would continue under the No-Build Alternative, though any impacts from those actions would be subject to applicable regulatory requirements for air pollutant emissions from mobile sources or other sources.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.2.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

In the 1800s, there were limited air pollutant emissions as the study area and region were characterized by natural wilderness landscapes and human settlements were significantly smaller than they are in the present day. Since the 1950s, several actions, including the construction of I-5 and increased urbanization have resulted in the incremental introduction of air pollutants from vehicles and development. Starting in the early 1970s, and more recently in the early 2000s, regulatory controls on air pollutant emissions have substantially reduced emissions, including industrial and vehicle emissions, and are expected to yield additional projected vehicle emissions reductions over the next 25 to 30 years.

Long-term monitoring has shown that air quality has improved over the years. The Oregon Department of Environmental Quality (DEQ) measures air pollutant levels with a network of air monitoring and sampling equipment at more than 40 sites throughout the state, including the study area. The Washington State Department of Ecology (Ecology) does not operate many monitors in the Vancouver area because the monitors operated by DEQ fulfill the federal monitoring requirements for the metropolitan area. Over the last 10 years, pollutant concentrations have been trending downward for most locations, with most exceptions corresponding to wildfire smoke events. However, Ecology has identified Vancouver as “overburdened and highly impacted by criteria air pollution” for fine particles (PM2.5) and cumulative criteria air pollution (Ecology n.d. [b]).

The implementation of current regulations would continue to reduce pollutant emissions from mobile sources and other sources into the future and, along with vehicle electrification, are expected to yield additional vehicle emission reductions over the next 25 to 30 years (FHWA 2016; DEQ 2021).

Traffic data used in the air quality analysis are based on projected land use and employment information and include expected overall growth in the region and the study area, as well as the transportation projects identified as reasonably foreseeable future actions. Non-transportation projects may increase emissions, such as general commercial and residential development in the

area. Tolling of I-205 (Abernethy Bridge), [21] if advanced in Oregon, may reduce emissions through a mode shift away from single- occupancy vehicles to carpooling, public transit, or active transportation, as well as a reduction in emissions associated with congestion.

Background concentrations representing the cumulative emissions of other sources in the area are included in the predicted local concentrations for carbon monoxide at intersections. Long-term monitoring has shown that air quality has improved over the years. Current and new regulations will continue to reduce pollutant emissions from mobile sources and other sources in the future, and air quality should continue to improve (DEQ 2021; FHWA 2016).

3.2.3 Conclusions

Past actions affecting air quality in the study area and region include population growth and accompanying development leading to an increase in the number of emission sources, including single-occupancy and freight vehicles, industrial sites, and the expansion of and demand for utilities. Recent actions have started to reverse course and reduce air pollutants, primarily due to vehicle turnover and the implementation of programs and regulations to control pollutant emissions. In addition, recent and reasonably foreseeable future regional improvements to the transportation system (e.g., congestion reduction, increased transit capacity, active transportation networks, and regulations on other sources of emissions) would reduce additional future emissions and have a positive effect on air quality. Long-term monitoring of air quality in the Portland metropolitan region over the last 10 years is showing a downward trend in pollutant concentrations, though ozone and $PM_{2.5}$ sometimes exceed national standards. Reasonably foreseeable future actions in the study area that affect air quality would be required to meet applicable regulations that control air pollutant emissions.

Because of long-term air quality trends and other actions, future air pollutant emissions under the No-Build Alternative are expected to be reduced for most mobile source air toxics and criteria pollutants. The Modified LPA would further reduce emissions compared to the No-Build Alternative, through reductions in VMT, improved traffic flow, and expansion of public transit and active transportation networks.

Under the No-Build Alternative, cumulative effects on air quality would continue to be driven by past, present, and reasonably foreseeable actions. Pollutant emissions would continue to be reduced as older vehicles are replaced, continuing existing beneficial cumulative trends; however, the No-Build Alternative would not contribute to these trends.

Compared to the No-Build Alternative, the cumulative effects on air quality from the Modified LPA and past, present, and reasonably foreseeable future actions would be incrementally more beneficial because of the improved traffic flow and reduced VMT (in part as a consequence of a mode shift to public transportation and active transportation).

[21] Tolling of I-205 (Abernethy Bridge) and the Regional Mobility Pricing Program (congestion pricing) are currently indefinitely on hold. Because tolling of I-205 is included in the Metro/RTC 2018 RTP RTDM, it is still considered reasonably foreseeable per the criteria established for cumulative effects (see Section 2.5.3 of the Cumulative Effects Technical Report).

3.3 Aviation

Please see the Aviation Technical Report for additional information.

3.3.1 Program Effects

3.3.1.1 No-Build Alternative

The No-Build Alternative would not affect existing aviation conditions. Under this alternative, the towers of the existing Interstate Bridge would continue to penetrate into the Pearson Field Part 77 airspace. The airport currently has special departure procedures that help aircrafts avoid the towers. The Interstate Bridge creates no intrusion or hazard for aircraft navigation at PDX. Earthquakes are unpredictable and could occur at any time or not occur during the time frame of this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridge structures, potentially altering existing aviation conditions.

There are no known reasonably foreseeable future actions in the study area that would contribute to cumulative effects on airspace; however, any impacts from future actions would be subject to federal aviation regulations, in addition to local airport overlay zoning regulations and Pearson Field departure procedures.

3.3.1.2 Modified LPA

The Modified LPA would have no effect on aviation at PDX. The Modified LPA with a single-level or double-deck fixed-span bridge configuration would contribute to beneficial cumulative effects on operations at Pearson Field by removing the lift towers that were introduced when the existing Interstate Bridge was constructed. The single-level fixed-span bridge configuration would avoid intrusions into protected airspace. The roadway deck for the double-deck fixed-span bridge configuration design option would be outside protected airspace as well; however, the current design assumes that some signs and lighting would penetrate the horizontal surface to a maximum depth of 12.5 feet.

The Modified LPA with the movable-span bridge configuration would also remove the existing lift towers but would introduce new penetrations into the Pearson Field airspace and would contribute to existing cumulative effects on aviation. The lift towers for the vertical lift span, based on the preliminary design, would be similar in elevation to the existing lift towers and permanently penetrate the Pearson Field airspace. The Modified LPA would reduce wildlife strike risk at Pearson Field by including bridge design features to reduce the potential for bird nesting and roosting combined with continued deterrence measures.

3.3.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Two airports are located near the study area: Pearson Field and PDX. Both airports were in operation prior to construction of I-5 in the early 1950s (though improvements at both airports have occurred

since then), and the airports and the existing Interstate Bridge pre-date federal aviation regulations. Past actions that affected aviation include development in the region that penetrates the airspace of aircraft landing or departing at Pearson Field. The towers of the existing Interstate Bridge and several buildings in downtown Vancouver currently penetrate the Pearson Field airspace that is regulated under 23 CFR Part 77. There are no known planned reasonably foreseeable future projects in the area that would contribute to cumulative effects on airspace.

3.3.3 Conclusions

Past actions, including development in downtown Vancouver and construction of I-5, led to airspace penetrations for aircraft landing or departing at Pearson Field. Present actions would comply with Federal Aviation Administration requirements to ensure compliance with airspace regulations. There are no reasonably foreseeable future actions in the study area that would affect aviation airspace.

The No-Build Alternative would not change existing airspace conditions; several buildings in downtown Vancouver and the existing Interstate Bridge would continue to penetrate the Pearson Field Part 77 airspace and require specific departure procedures to help aircraft avoid the bridge towers. The Modified LPA could reduce bird nesting and bird strike risk at Pearson Field. The Modified LPA would have no effect on aviation at PDX but, depending on the bridge configuration, could result in new airspace penetrations for Pearson Field airspace.

Under the No-Build Alternative, cumulative effects on aviation would continue to be driven by past, present, and reasonably foreseeable future actions. The towers of the existing Interstate Bridge would continue to penetrate protected airspace, while other reasonably foreseeable future actions would continue to comply with Federal Aviation Administration requirements, continuing existing cumulative conditions.

Compared to the No-Build Alternative, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would have minor and beneficial cumulative effects because of the reduced potential for bird nesting and, if a fixed-span configuration is selected, reduced penetration into protected airspace. If a movable-span configuration is selected, there would be minor adverse cumulative effects because of the continued penetration into protected airspace.

3.4 Climate Change

Please see the Climate Change Technical Report for additional information.

3.4.1 Program Effects

The GHG emissions modeling prepared for the IBR Program incorporates output from the transportation modeling, which includes anticipated regional growth and reasonably foreseeable future actions. As such, the results of the modeling for both the No-Build Alternative and the Modified LPA reflect cumulative effects on annual GHG emissions in the study area that include projected vehicle volumes in 2045.

3.4.1.1 No-Build Alternative

Although VMT would increase in the study area by 2045 under both the No-Build Alternative and the Modified LPA, GHG emissions are expected to decline substantially over this period due to the implementation of fuel and engine regulations. However, the No-Build Alternative would not directly or indirectly contribute to this cumulative reduction in GHG emissions. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on climate change (identified below) would continue under the No-Build Alternative, though any impacts from those actions would be subject to regulatory requirements to reduce emissions and improve resiliency.

3.4.1.2 Modified LPA

While the sources of GHG emissions during construction would be temporary, the GHG emissions would remain in the atmosphere. GHG emissions from construction would include exhaust from construction equipment and vehicles used to transport materials to and from the study area. There would also be GHG emissions associated with the embodied carbon of construction materials, which refers to emissions from raw material mining/extraction, transportation to the production facility, and material production. GHG exhaust during construction would be mitigated and reduced by following current standard specifications and regulatory guidance from ODOT and WSDOT to conserve the use of construction materials and fuels and by implementing BMPs.

In addition to activities designed to minimize emissions, the Modified LPA includes features that would improve local and regional resiliency to the anticipated effects of climate change. These features include avoiding fragmentation and degradation of floodplain hydrology by sensitively locating new and modified transportation and utility project components; maximizing management of stormwater by restoring existing unused impervious paved areas to natural, permeable, and vegetated conditions during the design phase to the maximum extent practical; and ensuring that the bridge design will accommodate potential effects of climate change such as larger water volumes from winter storms and more frequent snow and ice storms.

During operations, the Modified LPA would result in fewer user GHG emissions than the No-Build Alternative because of a mode shift to public transit and active transportation, as well as decreases in VMT, congestion, and vehicle idling.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.4.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

The Earth's climate is changing. Evidence shows changes in weather, oceans, and ecosystems across the world. In the next century, the region is projected to experience an increase in average temperature and in the number of extremely hot days. Additionally, changes to patterns of heavy precipitation are expected. While the region is anticipated to experience roughly the same overall volume of rain, it is expected to come in more severe storm events, such as atmospheric rivers.

Increasing global temperatures may yield more precipitation falling as rain rather than snow, particularly in the Cascade Mountains and other areas of the lower Columbia River basin. Rain falling on snow can further reduce accumulated snowpack, which would result in higher river flows during the rainy season and lower flows during the summer. Increased winter river flows and prevalence of severe storms result in a higher chance of flooding, which could impact low-lying land in the study area.

Globally, GHG concentrations have risen substantially because of human activities, and they have been a primary driver of climate change. Both Ecology and the Oregon Global Warming Commission publish reports every two years measuring their respective state's GHG emissions and progress toward state goals to reduce GHG emissions. Per the most recent reports, transportation (including highway, rail, and air transport) is the greatest contributor to GHG emissions nationally and in Oregon and Washington; other major contributors include electric power generation, industrial uses, residential and commercial energy consumption, and agriculture.

In an effort to address the current trends in GHG emissions, particularly in the transportation sector, multiple state, regional, and local regulations and policies have been enacted to guide the development and evaluation of transportation projects and local communities' management of GHG emissions. Many state environmental policies now require project sponsors to quantify the GHG emissions of their projects. Policy efforts aimed at reducing transportation GHG emissions include incentives for purchasing electric vehicles, funding of electric vehicle charging infrastructure, and funding to increase less-polluting travel modes like transit, walking, and biking.

At the state level, both Oregon and Washington have enacted policies aimed at reducing GHG emissions in the transportation sector. Examples of these policies include Ecology's zero-emission vehicles policy, Oregon's Climate Protection Program, and Washington's Clean Energy Transition Act. At the local level, local jurisdictions such as the City of Portland and City of Vancouver have implemented Climate Action Plans outlining programs and strategies aimed at meeting climate change goals and emissions reductions targets. The local transit agencies in the region, TriMet and C-TRAN, have also identified climate change goals. Two examples are C-TRAN's use of electric buses, and wind turbines serving as the primary source of energy for TriMet's trains.

Future actions related to the policies and plans from state, regional, and local jurisdictions have the potential to contribute to future projects that may influence the decrease in GHG emissions in the transportation and land use sectors. Policies that directly regulate the emissions of vehicles, such as a clean fuels standard, have the greatest potential to reduce GHG emissions. Additional ancillary benefits may also come from transitions to renewable energy sources in the energy sector. For example, the Cascade Renewable Transmission Project would transfer approximately 1,100 megawatts (MW) of large-scale wind, solar, and other renewable energy sources to help meet renewable energy goals in Washington and Oregon. Renewable energy sources emit fewer upstream GHG emissions than energy generated from fossil fuels. Other actions currently being legislated or encouraged to reduce GHG emissions include limits on industrial emissions, strategies to reduce home and commercial energy use or switch to green sources, and efforts to curb methane production by the agricultural industry. Collectively, these efforts have reduced emissions in the U.S. by approximately 3% since 1990 (EPA 2024).

Compared to existing conditions, GHG emissions associated with the transportation sector are expected to decline in future years because of improvements in vehicle fuel technologies and the transition away from using gasoline and diesel fuels to power vehicles. Should state regulations promoting electric vehicle use increase the proportion of electric cars in the vehicle fleet, the decarbonization of the electric grid in Washington and Oregon would further decrease GHG emissions associated with vehicle travel.

Because the effects of regional growth and reasonably foreseeable future actions are incorporated into the transportation modeling, the results of the GHG emissions modeling for both the No-Build Alternative and the Modified LPA reflect cumulative effects on annual GHG emissions in the study area that include projected vehicle volumes in 2045.

3.4.3 Conclusions

Past actions, primarily transportation projects and population growth and development, have led to an increase in GHG emissions and climate hazards. Present actions include additional transportation projects that could increase GHG emissions, as well as efforts, such as the Cascade Renewable Transmission Project, that seek to lower GHG emissions and/or improve climate resiliency. Reasonably foreseeable future actions are expected to generate GHG emissions as well as seek to reduce VMT and GHG emissions as roadway users shift to transit and active transportation modes and a reduction in roadway congestion.

The No-Build Alternative would not contribute to a reduction in GHG emissions; it would continue past trends of car-centric transportation networks. In addition, it would not improve local and regional resiliency to the anticipated effects of climate change. While construction of the Modified LPA would generate GHG emissions from construction equipment and materials, in the long-term the Modified LPA would provide transit and active transportation options to lower VMT and GHG emissions and improve climate resiliency.

Under the No-Build Alternative, cumulative effects on climate would continue to be driven by past, present, and reasonably foreseeable actions. The No-Build Alternative would not individually alter GHG emissions. GHG emissions would continue to be reduced by other actions, continuing existing beneficial cumulative conditions.

Compared to the No-Build Alternative, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would have incrementally more beneficial cumulative effects because of the reduced VMT and GHG emissions in the I-5 corridor and the improvements in climate resiliency.

3.5 Economic Activity

Please see the Economics Technical Report for additional information.

3.5.1 Program Effects

3.5.1.1 No-Build Alternative

Under the No-Build Alternative, increasing congestion and unreliable travel times on I-5 could result in negative economic effects, as. planned economic development for this area may occur more slowly than under the Modified LPA because business owners may be reluctant to locate in an area with poor access and mobility for employees and customers. Freight reliability decreases as congestion spreads beyond the peak hour, into times when trucks tend to travel. Customers may elect to shop in other areas with easier access and improved mobility.. Earthquakes are unpredictable and could occur at any time or not occur at all during the time frame established for this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridge structures, temporarily restricting or preventing travel and disrupting economic activities. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects through an increase in jobs and commerce (identified below) would continue under the No-Build Alternative.

3.5.1.2 Modified LPA

The Modified LPA would have both adverse and beneficial effects, and the overall long-term economic effects after construction are expected to be positive (short-term cumulative effects during construction are addressed in Chapter 6). This is due to the Modified LPA's suite of highway, active transportation, and transit improvements that effectively and efficiently move people and commerce through this corridor, which serves a variety of interstate, regional, and local needs. The Modified LPA would provide a slight improvement to marine commerce and the movement of marine traffic along the Columbia River, as noted in Section 3.11, for many vessels as most vessels would be able to pass under the bridges without timing restrictions, providing more flexibility in operating schedules and reducing wait times. However, with a fixed-span configuration, some larger vessels would no longer be able to pass under the bridges; as described in the Navigation Impact Report, the IBR Program developed measures to avoid economic impacts through vessel or cargo modifications and other accommodations (IBR 2025b). The Navigation Impact Report also discusses the agreements with the impacted river users that would allow these river users to operate successfully after construction of the proposed replacement bridge and continue to advance the regional economic vitality.

The Modified LPA would acquire additional rights of way from taxable property with the potential for decreasing property tax revenues. Sales tax revenue is not anticipated to decrease substantially, given that most of the affected businesses would be commercial offices. The bulk of potential negative economic impacts would result from business displacements, losses in parking, or changes in access to businesses.

Extending LRT across the Columbia River is a great improvement to the regional network and would attract some riders from their vehicles, potentially lowering VMT and the overall forecasted volumes of single-occupancy vehicles. This would extend the service life of the Modified LPA's highway improvements. Furthermore, transit improvements are often linked to economic development around station areas.

Enhanced vehicular and transit access to downtown Vancouver and across the Columbia River is expected to positively affect employers and businesses in the area. The Modified LPA could increase the attractiveness of commercial and industrial properties located in the vicinity of the interchanges by improving highway and transit access. This in turn may attract new businesses and make the location more attractive to employees. Variable tolls are likely to benefit freight-dependent businesses and businesses that rely on just-in-time deliveries because the predictability of travel would also increase. This benefit is somewhat offset by the fact that truck movements during peak periods would incur higher toll charges; however, peak freight travel times tend to fall outside the current peak periods for general-purpose traffic.

In addition, the proposed Community Connector, which would be located adjacent to the proposed light-rail station near Evergreen Boulevard, would improve access to the new transit hub, as well as downtown businesses, Fort Vancouver, parks, schools, and other cultural amenities. The Community Connector, in combination with the Modified LPA, could help stimulate and improve connectivity between existing and new economic activities on either side of I-5.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.5.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

I-5 runs continuously from Mexico, through the United States, and into Canada and is used for freight, business, and personal travel. The I-5 corridor serves as the backbone of the region's transportation network. Many past projects have worked to solidify I-5 as the central component of the regional infrastructure, though development in recent decades has accompanied increased growth in other parts of the region. I-5 is used for freight, business, and personal travel. Freight needs are an important driver for future improvements along the I-5 corridor.

The Columbia River is the regional backbone of marine commerce. Commercial vessels on the Columbia River include cruise vessels, tugs, tows, barges, and marine contractors' vessels. Commercial tugs and barges have the highest share of river usage and transit year-round and accounted for approximately 54% of the bridge opening events across a 35-year study period.

The Ports of Portland and Vancouver are critical to the economic growth and prosperity of the region. In order for the ports to remain competitive with other West Coast ports, efficient and cost-effective multimodal transportation systems must be available. The total annual tonnage moving through the two ports is expected to double from approximately 300 million tons in 2007 to almost 600 million tons in 2040 (Cambridge Systematics 2015). This growth has implications for the transportation network, as well as the Columbia River, as products move to, from, and within the region.

Similarly, economic growth in the region would increase demands along the I-5 corridor, as Metro forecasts that the number of jobs in the Portland–Vancouver Standard Metropolitan Statistical Area would increase by approximately 1.6% per year. This is slightly higher than the Oregon-area growth rate of 1.1% per year and the Washington state area growth rate of 1.0% per year.

Planned improvements along Columbia Boulevard, Lombard Street, and Marine Drive would generally improve conditions for commercial trucks. Travel times for commercial trucks traveling along I-5 are expected to improve as a result of capacity projects associated with the 2015 Connecting Washington funding package, as well as additional projects north of Vancouver and south of the Expo Center, but gains would be offset by projected growth in population and employment.

There is inherently some uncertainty about future economic conditions, which would continue to be influenced by a large number of factors, including changes in market conditions and national economic trends. The following reasonably foreseeable future actions in the study area that could contribute to cumulative effects on economic activity have been identified:

- Continued development of Terminal 1 by the Port of Vancouver, which will expand the mixed-use waterfront of Vancouver nearer to the I-5 corridor and is anticipated to enhance the waterfront as a regional attraction for commercial and retail jobs.
- The Waterfront Gateway development, whose stated goal is to strengthen the economy by creating a "bustling center with high-quality jobs." While no job estimate is available at this time, the development would include new office and retail uses, which will support job creation in the study area.
- The Portland Expo Center is a 53-acre redevelopment site that has been recommended by Metro to be redeveloped into a sports and cultural complex. Project materials indicate that approximately 2,100 construction jobs and 350 new permanent jobs (direct, indirect, and induced) would be created by the project (Hunden Partners 2024).
- The Metro/RTC 2018 RTP RTDM includes short- and long-term strategies and transportation projects. These strategies and projects are integral to the local and regional economy, and address economic growth, environmental health, and equitable mobility.
- The Cascade Renewable Transmission Project is estimated to support 300 to 400 jobs and apprenticeship programs during construction and generate revenues that would strengthen local tax bases (Cascade Renewable Transmission n.d.). The cables would also add east-to-west energy transfer capability in the region and assist in the distribution of increased power flows, especially during extreme heat events, which would help maintain power supply for commercial activities.

3.5.3 Conclusions

The Portland-Vancouver region and economy are largely dependent on the area's role as a gateway and distribution center for domestic and international markets. The development of corridors along the Columbia and Willamette Rivers, the BNSF Railway and Union Pacific Railroad transcontinental rail lines, PDX, and marine terminals of Portland and Vancouver are all integral components to the region's ability to transport goods, with the I-5 corridor serving as the backbone of the region's transportation network. Many past projects have worked to solidify I-5 as the central component of regional infrastructure (including construction of the Interstate Bridge and development of the ports). Freight needs are an important driver for future improvements along the I-5 corridor, and economic growth in the region would increase demands along the I-5 corridor.

Several reasonably foreseeable future actions would support job creation and improve freight mobility and connectivity in the area, thereby benefiting economic activity. The Metro/RTC 2018 RTP RTDM includes several capacity and safety projects west of I-5 that are designed to improve safety and flow for commercial trucks traveling between I-5 and industrial areas to the west (see Table 4-21 of the Transportation Technical Report). While these future projects would generally improve travel conditions for commercial trucks, those improvements could be offset by congestion resulting from projected growth in population and employment.

Increased congestion, decreased freight reliability, and unreliable travel times on I-5 associated with the No-Build Alternative, as well as past, present, and reasonably foreseeable future actions, would contribute to adverse cumulative effects on economic activity by slowing planned economic development. Economic activity requires reliable transportation; therefore, the improvements in capacity, safety, and reliability provided by the Modified LPA, in combination with past, present, and reasonably foreseeable future actions, would cumulatively benefit economic activity by allowing commercial and industrial activity that is constrained by existing transportation conditions to improve.

Under the No-Build Alternative, cumulative effects on economic conditions would continue to be driven by past, present, and reasonably foreseeable actions. Without improvements to I-5 and related infrastructure, economic activity could be limited by increased congestion and decreased freight reliability, which would occur as future travel demand would not be met by the available transportation infrastructure.

The Modified LPA, in combination with these reasonably foreseeable future actions, would cumulatively benefit employers, businesses, marine commerce, and economic activity through job creation, reduced congestion, enhanced marine operating schedules, freight mobility, transit access, and vehicular circulation when compared to the No-Build Alternative.

3.6 Electric and Magnetic Fields

Please see the Electromagnetic Fields Technical Report for additional information.

3.6.1 Program Effects

Electromagnetic fields (EMF) are produced by power lines, electric wiring, and electric equipment and appliances, and other sources.

3.6.1.1 No-Build Alternative

The No-Build Alternative would not create any new sources of EMF, and future EMF exposure would likely remain similar to existing conditions. Other reasonably foreseeable future actions in the study area that could contribute to a cumulative effect on EMF would continue under the No-Build Alternative, but no proposed significant sources or sensitive facilities have been identified.

3.6.1.2 Modified LPA

The extension of the light-rail line under the Modified LPA would result in the generation of additional EMF at certain locations along the light-rail extension within the study area, but the levels would be similar to those under the No-Build Alternative and would remain well below exposure guidelines (there would be no EMF-related impacts related to the highway components). EMF levels from Portland's light-rail system are below the International Commission on Non-Ionizing Radiation Protection and American Conference of Governmental Industrial Hygienists exposure standards. Future levels of EMF along the extended LRT line would be similar to those produced in the current light-rail system, since the proposed elements of the system such as power levels, substation ratings, and facility and system design would be the same as the existing MAX system. There is no evidence that light-rail-generated EMF would change the human health risk associated with cumulative EMF exposure. Therefore, as with the existing light-rail system, the Modified LPA would not have adverse effects associated with EMF emissions.

Light-rail-generated EMF would be just one of many sources of EMF that make up the cumulative personal EMF field exposure. Because field strength decreases rapidly with distance from the source, cumulative EMF effects would only occur if other sources are co-located with the Modified LPA electrical infrastructure. The five proposed TPSS would not be located near residential buildings or EMF-sensitive land uses.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.6.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Federal regulations addressing EMF were introduced in response to incremental increases in the presence of EMF sources such as AM and FM radio, television, and wireless sources. Sensitive receptors to EMF include hospitals and research facilities.

The existing EMF environment in the study area varies depending on location, as EMF levels are site- and time-specific. Sensitive receptors to EMF, such as hospitals and research facilities, are not located within the study area. The main sources of EMF within the study area are the traction power system and TPSS associated with the TriMet MAX LRT system.

Present and reasonably foreseeable future actions that could contribute to cumulative effects on EMF include new sources of high-voltage power or high frequency transmission, such as increasing use of hybrid and electric vehicles, electronic equipment in general, wireless devices, or the introduction of new EMF-sensitive receptors. The frequencies and field strengths of different types of equipment vary widely.

None of the reasonably foreseeable future actions are anticipated to create new sensitive receptors, and only the Cascade Renewable Transmission Project would create potential new sources of EMF, as the project would install an underwater and underground cable bundle through the study area.

However, the cables would be shielded so that they produce no external electric fields (Cascade Renewable Transmission 2025).

3.6.3 Conclusions

Past actions, primarily electrification in the 20th century and the introduction of LRT, led to an increase in EMF exposure in the environment. None of the present or reasonably foreseeable future actions in the study area are anticipated to contribute to EMF levels in the study area. Sensitive receptors to EMF, such as hospitals and research facilities, do not exist in the study area, and none are currently proposed.

The No-Build Alternative would not contribute to cumulative effects on EMF exposure, and it would not change the overall trends in EMF exposure from other actions. The Modified LPA would introduce a new source of EMF emissions that would increase EMF variation slightly at certain locations along the light-rail extension but would remain well below exposure guidelines.

Under the No-Build Alternative, cumulative effects on EMF would continue to be driven by past, present, and reasonably foreseeable actions. Cumulative effects on EMF exposure would be negligible as exposure would remain well below exposure guidelines, continuing existing cumulative conditions.

When combined with past, present, and reasonably foreseeable future actions, the No-Build Alternative would have negligible cumulative effects on EMF exposure because increases in EMF emissions would remain well below exposure guidelines. The Modified LPA, combined with past, present, and reasonably foreseeable future actions, would also have negligible effects on EMF exposure for the same reason.

3.7 Energy

Please see the Energy Technical Report for additional information.

3.7.1 Program Effects

The energy analysis prepared for the IBR Program is cumulative in nature as it incorporates projected increases in traffic and regional growth and reasonably foreseeable future transportation projects.

3.7.1.1 No-Build-Alternative

Because the energy model is informed by the transportation model, and consistent with established analysis methodology, the energy analysis in Section 3.12 of the NEPA/SEPA Final SEIS incorporates projected increases in traffic, regional growth, and reasonably foreseeable future transportation projects. The analysis showed that under the No-Build Alternative, energy consumption in 2045 is expected to be substantially lower than existing values for the region, which is consistent with national trends. There would be no energy consumption associated with construction of the Modified LPA, but energy consumption would continue to occur for the reasonably foreseeable future actions described above.

3.7.1.2 Modified LPA

Like the No-Build Alternative, the analysis showed that energy consumption in 2045 under the Modified LPA is expected to be substantially lower than existing values for the region, consistent with national trends.

Operation of the Modified LPA would lower the transportation demand for petroleum relative to the No-Build Alternative because the Modified LPA would result in a mode shift to public transportation and active transportation options as described in Section 3.1 of the NEPA/SEPA Final SEIS. Daily regional VMT would decrease by approximately 0.15%, and total regional transportation energy consumption would decrease by approximately 0.27% in 2045 under the Modified LPA compared to the No-Build Alternative. Total traffic assignment area energy consumption would be approximately 1.13% lower in 2045 under the Modified LPA compared to the No-Build Alternative.

Energy consumption from transit operations would increase under the Modified LPA due to electricity needs of increased transit vehicles, stations, and park and rides. Energy consumption from increased express bus service was included in the roadway operations estimates. The additional energy needs for new transit vehicles and new transit facilities are less than 8% of the energy consumption by on-road vehicles.

Construction of the Modified LPA would require approximately 289,000 million British thermal units to power construction equipment and transport materials to and from project locations. This increased demand for petroleum during construction would be partially offset by the benefits achieved from the decrease in roadway user energy demand after several years of operations.

3.7.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past actions that contributed to the cumulative energy demand and use in the region, including general development, such as the Vancouver waterfront and multifamily buildings along Marine Drive, as well as population growth and transportation projects that led to an increase in the number of single-occupancy and freight vehicles. Some transportation projects, such as the expansion of C-TRAN's bus service in Vancouver (including the introduction of BRT and electric express buses) and various improvements in TriMet's bus and light-rail system (including the extension of light-rail to the Expo Center and the use of wind generated electricity for the MAX), contribute to a small incremental benefit for cumulative energy demand and consumption due to the use of alternative energy sources, and supporting a mode shift from personal vehicles to public transit.

The future demand for energy will depend on trends in population, economic activity, energy prices, and adoption and implementation of technology, all of which have uncertainties in future projection. As noted above, the energy analysis is cumulative and concluded that energy consumption is expected to be substantially lower than existing values for the region. The U.S. Energy Information Administration projects that energy consumption in the transportation sector would remain lower than 2019 levels through 2050 because of improvements in fuel economy. As a result, energy consumption by light-duty and heavy-duty vehicles is projected to remain lower than 2019 levels through 2045.

Planned developments—including Terminal 1 and the Renaissance Boardwalk development—will be designed and constructed to meet LEED Gold standards, which include requirements for reducing energy use.

Tolling of I-205 (Abernethy Bridge) is on hold indefinitely,[22] but, if advanced in Oregon, may reduce energy use through a reduction in the number of single-occupancy vehicles on the road caused by a mode shift to carpooling, public transit, and active transportation.

The Cascade Renewable Transmission Project would add approximately 1,100 MW of east-to-west energy transfer capability in the region and assisting in the distribution of increased power flows on the networked transmission system, especially during extreme heat events.

One of the U.S. Government's objectives for the Columbia River Treaty modernization (underway) includes ensuring a reliable and economical power supply, which would support future energy needs (USACE n.d.).

3.7.3 Conclusion

Past actions have increased regional energy demand and use in the study area, largely as a result of general development patterns, which have been increasingly dense and urban. Current trends from present and reasonably foreseeable future actions, including the adoption of renewable energy sources and public transit improvements in the region, are increasing the use of alternative energy sources and supporting a mode shift from personal vehicles to public transit. Reasonably foreseeable future actions would continue to incrementally decrease energy demand.

Energy consumption under the No-Build Alternative would continue to decline due to other past, present, and reasonably foreseeable future actions. The Modified LPA would further reduce energy consumption and GHG emissions compared to the No-Build Alternative, through reductions in VMT and a mode shift to public transit and active transportation.

The Modified LPA and other actions would contribute to an increase in energy through the energy demand required to construct the projects, as well as beneficial cumulative effects on energy by lowering the transportation demand for petroleum due to mode shift.

Under the No-Build Alternative, cumulative effects on energy would continue to be driven by past, present, and reasonably foreseeable actions. Energy consumption would be reduced through the implementation of fuel and efficiency regulations, continuing existing beneficial cumulative trends.

The Modified LPA, combined with past, present, and reasonably foreseeable future actions, would have incrementally greater beneficial cumulative effects to energy than the No-Build

[22] Tolling of I-205 (Abernethy Bridge) and the Regional Mobility Pricing Program (congestion pricing) are currently on hold. Because tolling of I-205 is included in the Metro/RTC 2018 RTP RTDM, it is still considered reasonably foreseeable for the purposes of this analysis per the criteria established for cumulative effects (see Section 2.5.3 of the Cumulative Effects Technical Report).

Alternative because of reduced VMT and a lower transportation demand for petroleum because of the mode shift to public transportation and active transportation options.

3.8 Environmental Justice

This section on environmental justice (EJ) is included in accordance with agency policy direction and as provided for within Ecology's SEPA Handbook (Ecology 2025). Inclusion of this section does not constitute a continuing policy or procedural direction. Please see the Environmental Justice Technical Report for additional information.

3.8.1 Program Effects

3.8.1.1 No-Build Alternative

The No-Build Alternative would not change the existing conditions that affect EJ populations. It would not acquire or displace residences or businesses or provide an extension of light-rail, improvements to active transportation facilities, or improved bus service in the corridor. Therefore, the No-Build Alternative would not contribute to beneficial or adverse cumulative effects on EJ populations. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on EJ populations would continue under the No-Build Alternative, although impacts from actions subject to review would follow federal and state guidelines to provide mitigation for displacement or other adverse impacts.

3.8.1.2 Modified LPA

The Modified LPA would acquire right of way from residences and businesses along I-5 and the LRT alignment (see Section 3.1). It would displace households throughout the study area, and most of the displacements would occur in neighborhoods that have similar or lower proportions of EJ populations relative to the region. In accordance with the Uniform Act,[23] potentially displaced residents and businesses would be contacted and surveyed, and any displacements would be mitigated with a dedicated relocation plan.

Approximately 31 businesses on Hayden Island would be displaced, which would affect approximately 130 employees. These service- and sales-sector jobs are sources of employment for low-income residents of Vancouver and North Portland. Some of these displaced businesses may choose not to relocate locally. Even with relocation assistance, some employees may be unable to retain their jobs; for example, an employee may have to accept a new job during the transition period of relocation.

For low-income populations, among which Black, Indigenous, and People of Color (BIPOC) communities are overrepresented, the impacts of tolling associated with the Modified LPA, such as the share of total household income spent on transportation costs, may be a disproportionate and

[23] Title 42 USC Section 4601, Uniform Relocation Assistance and Real Property Policies Act (1970) provides uniform and equitable treatment of persons displaces from their homes or businesses by federal and federally assisted programs and establishes uniform and equitable land acquisitions policies for federal and federally assisted programs.

adverse impact. The Oregon Transportation Commission and WSTC are anticipated to implement tolling discounts and exemptions, which would address these impacts.

EJ populations would benefit from the Modified LPA through the construction of LRT; increased transit frequencies; improved travel times on I-5; improved bicycle and pedestrian facilities; and safer vehicle, bicycle, and pedestrian travel. Like all communities, EJ populations would benefit from increased jobs and economic development opportunities near I-5 and near transit stations.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.8.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

EJ populations in the study area have been affected by past actions that generate air and noise pollution (see Sections 3.2 and 3.13), that have displaced residents and businesses (see Section 3.1), and that have had socioeconomic impacts on these populations (see Sections 3.4 and 3.10). The Vanport Flood and subsequent displacements, in particular, had a disproportionate impact on EJ populations.

Some past actions have also provided benefits to one or more of these populations, including improved access and mobility associated with roadway and transit improvements, programs and regulations put into place to control air pollution emissions, public housing development, and employment and training opportunities associated with commercial and educational development. Generally, the development of transit by C-TRAN and TriMet, including the MAX Yellow Line through North Portland, benefits the general population as well as communities with a higher reliance on transit, including low-income populations and people with disabilities.

The original construction of I-5 through Portland had significant effects on the populations in and adjacent to the highways. The increased proximity of mobile source air pollutants resulting from the construction of these roadways elevated the risk of these populations to an increased incidence and severity of health problems. ODOT cleared entire blocks for development of the roadway, dividing neighborhoods, displacing residences, and affecting businesses in the historic epicenter of Portland's Black community. The construction of I-5 through Vancouver changed the city by closing 5th Street (the route heading east) and encouraging development of housing to the north of downtown. Fewer displacements occurred in Vancouver because the area was less densely developed than Portland at that time.

Ecology has identified Vancouver as "overburdened and highly impacted by criteria air pollution" for fine particles (PM2.5) and cumulative criteria air pollution (Ecology n.d.(b)).

One socioeconomic impact attributed to the cumulative effect of population growth and development is an increase in the cost of living. Between 2000 and 2021, median gross rent increased 52% in Portland, 48% in Multnomah County, 40% in Vancouver, and 41% in Clark County (adjusted for inflation) (USCB 2000, 2021). In the same time period, median household income increased just 15% in Portland and 11% in Multnomah County, and median household income decreased 4% in Vancouver

and 7% in Clark County (USCB 2021). As the cost of living increases, low-income households often move farther from jobs and services to find affordable housing. This can result in longer commute times and higher transportation costs for low-income households.

Tolling of I-205 (Abernethy Bridge) is on hold indefinitely,[24] but if advanced in Oregon, could increase transportation costs for EJ populations. Before it was placed on hold, the tolling project considered low-income or equitable tolling policies to subsidize or offset the economic burden of tolling on low-income and minority populations. There are no other known reasonably foreseeable future actions within the study area that would contribute to a cumulative effect on EJ populations, such as displacement or increasing the cost of living. Reasonably foreseeable future transportation actions would follow federal and state guidelines, such as the Uniform Relocation Act, to provide replacement housing and relocation benefit packages.

Future development and redevelopment projects include projects in downtown Vancouver and north Portland. Reasonably foreseeable future projects such as Terminal 1, Waterfront Gateway, Renaissance Boardwalk, and Portland Expo Center Redevelopment would add new buildings or redevelop existing buildings. There is not enough information at this time to determine the exact impacts; however, future development projects may lead to the displacement of encampments of homeless populations and the Renaissance Boardwalk could displace an existing commercial property.

3.8.3 Conclusions

Past actions, such as the original construction of I-5, displaced residences, affected businesses, and influenced development patterns and growth in Portland and Vancouver. Present actions include population growth and continued development that have resulted in residential and business displacements and increases in the cost of living. Reasonably foreseeable actions include continued development and population growth that could impact low-income households and their access to affordable housing and result in longer commute times and higher transportation costs. Present and reasonably foreseeable future actions in the study area that affect EJ populations would be required to follow state and federal guidelines to provide mitigation for displacement and other adverse impacts.

The No-Build Alternative would not cause displacements that would affect EJ populations or provide improvements to the transportation system, including active transportation facilities and transit, that would improve mobility for EJ populations. The Modified LPA would affect EJ populations, including minority and low-income individuals, through the displacement of businesses and residents and disturbance from noise, dust, and traffic during construction. For low-income populations, tolling of the Columbia River bridges would affect transportation costs. As noted in Section 2.2 of the SEPA Addendum, subsidized and low-income tolling policies are under consideration that would address these impacts. The Modified LPA would improve conditions (such as air pollution, access, and transit

[24] Tolling of I-205 (Abernethy Bridge) and the Regional Mobility Pricing Program (congestion pricing) are indefinitely on hold. Because tolling of I-205 is included in the Metro/RTC 2018 RTP RTDM, it is still considered reasonably foreseeable per the criteria established for cumulative effects (see Section 2.5.3).

service) for EJ populations and neighborhoods. The Modified LPA would provide beneficial cumulative effects to EJ populations through a variety of transportation improvements to public transportation, traffic congestion, active transportation, and traffic safety.

Under the No-Build Alternative, the cumulative effects on EJ populations would continue to be driven by past, present, and reasonably foreseeable actions. While the No-Build Alternative would not directly displace individuals or businesses, there would be potential displacements from other actions that could affect EJ individuals and businesses, as well as continued rising transportation costs and increasing travel times.

Compared to the No-Build Alternative, the cumulative effects on EJ populations from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be slightly more adverse because of the additional transportation costs associated with tolling and the potential displacement of EJ individuals and businesses. However, other cumulative effects on EJ populations such as improvements in access, traffic safety, transit service, air quality, and noise reduction, would be more beneficial.

3.9 Hazardous Materials

Please see the Hazardous Materials Technical Report for additional information.

3.9.1 Program Effects

The study area is heavily urbanized, and many of the past and present land uses have generated, used, and/or stored hazardous materials. Hazardous material sites that are most likely to impact the Modified LPA are those being acquired for right of way or near the roadway or guideway alignments.

3.9.1.1 No-Build Alternative

Because there would be no acquisitions or displacements under the No-Build Alternative, there is no potential for hazardous materials liability resulting from property acquisition. However, the potential for adverse effects from spills or releases of hazardous substances or petroleum products is higher under the No-Build Alternative than for the Modified LPA as the improvements identified below would not be implemented, and adverse effects on the environment could occur from the operation and maintenance of the existing stormwater conveyance and treatment facilities. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on hazardous materials would continue under the No-Build Alternative, though any activities on contaminated sites would be subject to applicable regulatory requirements for managing and mitigating contamination.

3.9.1.2 Modified LPA

The Modified LPA would require ODOT and WSDOT to acquire properties or portions of properties that have been identified as contaminated sites. Contamination may also exist within portions of existing right of way. Based on the conclusions and recommendations of the Phase I Environmental Site Assessments, seven Phase II Environmental Site Assessments were completed in Oregon and Washington following publication of the NEPA/SEPA Draft SEIS. The Phase II investigations generally

found little to no notable contamination. There are four potentially acquired properties that were not investigated because they were inaccessible; these properties are likely to require more complex subsurface investigation and future cleanup. It is anticipated that all of the remaining Phase II investigations would occur during the property acquisition process, following the ROD. Additional acquisitions would need subsequent Phase I and Phase II processes.

Construction activities for the Modified LPA would involve cleanup of contamination associated with past releases of hazardous materials, which would reduce the risk of future contamination and risks to human health. The discovery of contamination within new or existing right of way would be the responsibility of the property owners, including ODOT and WSDOT, who would be subject to applicable remediation and cleanup requirements. Construction and excavation workers or ecologic receptors could be subject to cumulative exposure to hazardous materials. Contamination may also exist within portions of WSDOT's existing right of way.

Construction of the Modified LPA, or other reasonably foreseeable future construction actions, creates a potential for the release of hazardous substances or petroleum products into the environment from the improper transfer of fuel or spills from construction equipment. Other pollutants, such as paints, acids for cleaning masonry, solvents, raw concrete, paving, striping products, and concrete-curing compounds, are often present at construction sites and may enter the environment if not managed correctly. It is not anticipated that the operation or maintenance of the Modified LPA would increase the occurrence or transport of hazardous materials within the study area.

Construction of the Modified LPA would include updated road and bridge designs, and these updates would include controls associated with the stormwater system to contain and/or better manage releases on roadways and bridges. Additional updates include improvements in roadway access and traffic safety, thereby benefiting emergency response vehicles.

Long-term adverse effects on human health and the environment from hazardous materials would likely be reduced because the Modified LPA would involve:

- Upgrades or enhancements to the current stormwater conveyance and treatment system, which would reduce the spread of existing residual contaminants to soil, surface water, and groundwater from stormwater runoff and infiltration.
- Likely placement of surficial caps or barriers at any sites identified with existing contamination, which would decrease likelihood of direct exposure to potential receptors.
- Increases and enhancements of roadway and transit system capacities. This could lower the frequency of incidental spills or releases of hazardous substances associated with trucking and automotive transit.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.9.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

The evaluation of risks to the Modified LPA from existing hazardous materials is based on a review of past actions and their effects on existing and potential soil and groundwater contamination.

There are over 560 sites that could contain hazardous materials within the study area, and the Ruby Junction OMF is a small-quantity generator for hazardous wastes, including solvents, batteries, and paints. High-priority hazardous materials sites include the U.S. Army Vancouver Barracks, Hayden Island landfill, and Jantzen Beach car wash, among others. Many of these contaminated areas have been documented, and in some cases cleanup actions have been initiated or completed. There may also be unknown contamination caused by past land uses and actions in the study area that pose additional risks. Reports of spills and releases of hazardous materials within the study area vary by location and year, averaging approximately zero to three incidents annually. Reported incidents of hazardous substances are managed by the Oregon State Fire Marshal's Hazardous Substance Incident database and reported spill incidents are managed by Ecology's Reported Spills to Water database.

Identified reasonably foreseeable future actions in the study area that could contribute to cumulative effects on hazardous materials include development and redevelopment of existing buildings and paved areas, particularly on sites with a history of industrial use. Properties in older urban areas, such as downtown Vancouver or Hayden Island, would be more likely to contain existing contamination. However, new development and redevelopment would be required to remediate known or discovered hazardous materials, including lead or asbestos-containing materials, to comply with local land use plans.

Future unrelated development in the study area could add exposure risks, as well as provide cleanup and remediation benefits. Population and employment growth could cause increased traffic that may result in slightly more incidents of hazardous materials spills from vehicle collisions as congestion remains at current levels or worsens over time. Since 1964, several laws have been implemented that have led to improved handling of hazardous materials, reducing the amount of new hazardous materials released into the soil and groundwater. Environmental liability laws generally require identification and cleanup of hazardous materials during property transfers, which have resulted in the overall reduction of hazardous material contamination near the study area.

3.9.3 Conclusions

Past actions include spills and releases of hazardous materials from commercial and industrial land uses, which have resulted in contaminated sites in the study area. Present actions include continued spills and releases of hazardous materials (reported incidents of hazardous substances and spills vary by location and year) and also efforts to clean up contaminated sites in the study area. Reasonably foreseeable future actions in the study area that would affect hazardous materials would include the continued potential for spills and cleanup efforts to meet applicable regulatory requirements for managing and mitigating contamination.

The No-Build Alternative would not result in the potential disruption of contaminants on properties within the study area or cleanup of previously contaminated property as part of the Program. The

Modified LPA would clean up and remediate previously contaminated areas on disturbed or acquired sites and would improve safety and operations on I-5, which would potentially reduce spills as a result of highway crashes.

Under the No-Build Alternative, cumulative effects on the environment and human health from hazardous materials would continue to be driven by past, present, and reasonably foreseeable actions. The No-Build Alternative, on its own, would not directly contribute to cumulative effects. Cleanup of existing or new hazardous materials would occur as part of future actions, consistent with regulatory requirements, although increased development could increase the risk for spill events.

Compared to the No-Build Alternative, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be incrementally more beneficial with respect to hazardous materials because acquired sites within the study area that are contaminated would be cleaned.

3.10 Land Use

Please see the Land Use Technical Report for additional information.

3.10.1 Program Effects

3.10.1.1 No-Build Alternative

The No-Build Alternative would not address current deficiencies in the Interstate Bridge structure, design, or capacity. Other reasonably foreseeable future actions would be expected to proceed and would address some elements of state, regional, and local agency visions; however, without improvements associated with the Modified LPA, the existing and future land uses that rely on I-5 to travel within the region could be affected by high levels of congestion, unsafe conditions, and potential earthquake-induced failure. Congestion would impair freight movement and reduce area productivity, which could indirectly impact the implementation of land use plans and goals for economic development. Earthquakes are unpredictable and could occur at any time or not occur during the time frame of this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridges, temporarily restricting or preventing the travel necessary to support existing and future land uses.

Under the No-Build Alternative, there would also be no high-capacity transit service to connect the regional centers of downtown Vancouver and downtown Portland, which would be inconsistent with the stated policies and goals of applicable regional transportation plans. In addition, the No-Build Alternative would not meet certain goals in the Hayden Island Neighborhood Plan or the VCCV and Subarea Plan, such as providing LRT service or improving connectivity within the neighborhoods.

Other reasonably foreseeable future actions would contribute to cumulative impacts to land use as new development and redevelopment would continue to change the landscape of existing and future land use.

3.10.1.2 Modified LPA

The Modified LPA is consistent with and would support local plans and policies, which encourage investment in inner urban infrastructure, multimodal transportation, freight mobility, economic development, and compact urban development. The Modified LPA would continue the historic trend of developing land for transportation use by converting approximately 128 acres of land, currently zoned as commercial, industrial, residential, mixed-use, and open space, into transportation use, including areas for associated stormwater facilities and landscaping (see Section 3.1). Although these conversions could reduce the area of land potentially available for non-transportation uses to a small extent, they would account for only a small portion of the total land in the Portland/Vancouver area and therefore would not be substantial in a regional context. Further, these changes, which would result from the extension of LRT and the development of parking structures and other transportation infrastructure, are consistent with the goals and policies of adopted climate and transportation plans. The greatest direct impacts on existing land uses would result from the displacement of an estimated 31 businesses on Hayden Island and, potentially, the construction of a large park-and-ride facility in downtown Vancouver, depending on the location chosen. Additional impacts are expected to result from the displacement of single-family dwellings in Upper Vancouver as well as multifamily dwellings and commercial properties in downtown Vancouver to accommodate the reconstruction of the SR 14, Mill Plain, Fourth Plain, and SR 500 interchanges; the realignment of I-5 between those interchanges; and the extension of light-rail to Evergreen Station.

The addition of light-rail stations in Hayden Island and downtown Vancouver is expected to contribute to economic development with vibrant mixed-use urban nodes. There is a moderate to high potential for transit-oriented development on Hayden Island and in the city of Vancouver (particularly the Mill Plain district). Plans adopted by the City of Portland and Metro call for the extension of light-rail to Hayden Island. Land use and development in Oregon and Washington is governed by state and growth-management laws, local land use plans, zoning regulations, and other controls. These land use controls require all development to be consistent with existing zoning and comprehensive planning in order to be permitted. The Modified LPA is not expected to lead to different future land uses than would occur with the No-Build Alternative.

The addition of the Community Connector near Evergreen Boulevard would balance roadway and transit development with improved bicycle and pedestrian facilities to address existing gaps in active transportation connectivity between residential and commercial land uses created by the past construction and presence of I-5.

Variable-rate tolling as part of the Modified LPA would support regional and local policies for managing traffic congestion. Tolling is not expected to change land use patterns because land use and development in the study area are governed by state land use and growth-management laws, local land use plans, zoning regulations, and other controls. However, the combination of improved transit service and the introduction of tolling would shift some trips from vehicle to transit and reduce overall VMT across the Columbia River on an average weekday by approximately 1% compared to the No-Build Alternative.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.10.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past development in the area transformed land use over time from wilderness to ever-increasing urbanization. Since the 1950s, actions affecting land use have included the construction of I-5 and other transportation projects, increasing urbanization, and new growth-management regulations. Modeling also suggests that regional land use plans that channeled growth and transportation development to other parts of the region may have reduced employment growth and housing demand in the North Portland and Vancouver portions of the I-5 corridor. The lack of any major improvements to I-5 highway operations in this location since the 1960s has also allowed gradual deterioration of highway operations and safety and reliability, which in turn could further contribute to the distribution of some portion of population and employment growth to other parts of the region.

Land use on Hayden Island has changed from recreational to residential development and commercial development, including the Jantzen Beach Center (a regional large-format retail shopping center) and surrounding retailers. Residential uses in the area include manufactured homes and floating homes associated with small marinas, as well as other low- to medium-density developments.

Vancouver's downtown has changed greatly during the past decade. The focus of the downtown and waterfront areas has broadened from predominantly office (and some industrial) uses to tourism and recreation development, retail shopping, meeting and convention activities, housing, and entertainment. Along with revitalizing overall downtown activity, new residential opportunities and revitalization of the retail core and central waterfront have been emphasized. New office and mixed-use development has increased in the last decade, with projects such as the Vancouver Waterfront and numerous smaller projects. New and growing uses in the downtown area include retail, office/commercial, and multifamily residential.

There is inherent uncertainty about future land use, which would be influenced by market demand, changing development patterns, and other factors, though state and local land use planning would continue to guide land use patterns. The following reasonably foreseeable future actions in the study area that could contribute to cumulative effects on land use have been identified:

- Improvements to public transit, state highways, local road networks, and active transportation facilities, as identified in the Metro/RTC 2018 RTP RTDM. Land use cumulative effects from foreseeable future transportation-related improvements have been evaluated by using results of the transportation analysis.
- Metro's future redevelopment of the Expo Center would replace the exhibition hall use that currently occurs at this location. The preferred site concept includes new sport facilities and a community center surrounded by a community garden, park, and playground.
- The redevelopment of Hayden Island's commercial core from the current large-scale retail land use pattern to a more urban form with more mixed uses, pedestrian-scale design, and

transit orientation. The City of Portland's 2009 plan also identifies a replacement bridge over the Columbia River and the addition of high-capacity transit—both of which the Modified LPA would provide—as important elements of future development on the island.

- Several redevelopments along the Vancouver waterfront. These redevelopments include (1) the Port of Vancouver's Terminal 1 project (including a hotel, office and retail space, outdoor gathering areas, and a public marketplace), which also includes trail connection to the Vancouver Waterfront Renaissance Trail; (2) Renaissance Boardwalk, which is public-private partnership for a mix of apartments, retail and underground parking: and, (3) the Waterfront Gateway project, run by the Vancouver CCRA, to redevelop an area between the waterfront and downtown Vancouver with mixed-use office, retail, and residential uses. These future Vancouver waterfront developments would continue to expand the present and recent past developments to create more commercial-residential uses than past industrial uses along the waterfront.
- Adopted state, regional, and local agency and port plans that identify future visions for growth and land use planning to accommodate that growth. Population is projected to increase and increase the need for employment opportunities, which also necessitate adequate levels of housing, utilities, recreation facilities, schools, and other services.

3.10.3 Conclusions

Past actions have changed land use throughout the study area, typically increasing the density of development and converting undeveloped or residential areas to commercial or transportation uses. None of the present actions are anticipated to convert land uses or alter land use patterns. Reasonably foreseeable future actions include planned transportation projects, which may include the conversion of land currently in non-transportation uses to transportation use, and development and redevelopment that would create additional residential, commercial, industrial, and recreational land uses in the study area. All present and reasonably foreseeable future actions would be required to comply with the applicable adopted land use plans.

The No-Build Alternative, combined with past, present, and reasonably foreseeable future actions, would not convert existing land uses to a transportation use; however, it would be inconsistent with adopted land use plans, such as the Hayden Island Neighborhood Plan and the VCCV and Subarea Plan, which include goals of providing LRT service. Although the Modified LPA would include right-of-way acquisitions that would convert existing land uses to a transportation use, it would be consistent with the goals of local land use plans to provide LRT service and transit stations near planned land use development.

Under the No-Build Alternative, cumulative effects on land use caused by past, present, and reasonably foreseeable future actions would continue current patterns. Land use would continue to comply with local land use plans.

Compared to the No-Build Alternative, the cumulative effects on land use from the Modified LPA, when combined with past, present, and reasonably foreseeable future actions, would be beneficial because planned projects may facilitate planned growth and development in station areas consistent with local and regional land use plans.

3.11 Navigation

Please see the IBR Program's Navigation Impact Report (IBR 2025) for additional information.

3.11.1 Program Effects

3.11.1.1 No-Build Alternative

Columbia River navigation conditions would not be expected to change under the No-Build Alternative, and navigation would continue to be affected by the existing piers and bridge lift restrictions. Under the No-Build Alternative, the primary navigation channel would remain in its current position. The alternative channels under the Interstate Bridge are located toward the center and south bank of the river. Navigation clearances (horizontal and vertical) would remain as they are today, and vessels transiting under the bridge would continue to operate within the existing Interstate Bridge configuration, which includes nine in-water pier sets and requires an S-curve maneuver to transit through the Interstate Bridge and the swing span opening of the BNSF Railway Bridge.

If the existing lift span becomes stuck in the closed position, vessels that are unable to pass under one of the fixed spans would be unable to continue downriver or upriver of the I-5 corridor. Vessels would also be unable to complete the necessary S-curve maneuver to align with the BNSF bridge opening.[25] Routine maintenance dredging performed by the USACE's dredge *Yaquina* would continue the maintenance of the federal navigation channel to an adequate depth to support current navigation needs. Earthquakes are unpredictable and could occur at any time or not occur during the time frame of this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridges, temporarily restricting or preventing navigation.

3.11.1.2 Modified LPA

Under the Modified LPA (including all bridge configurations), river navigation safety in the main channel of the Columbia River would be improved by: (1) reducing the need for an "S" curve maneuver (to align with the BNSF Railway Bridge opening) for many vessels that currently use the barge or alternative barge channels and could use the northern channel under the Modified LPA, which would provide a straighter route between the two bridges, (2) increasing horizontal navigation clearance by reducing the number of in-water pier sets, and (3) improving seismic resiliency.[26] In addition to the main channel, the Modified LPA would improve navigation safety in North Portland Harbor through improved seismic resilience and wider pier spacing, which will allow more room for smaller vessels to

[25] The primary navigation channel under the Interstate Bridge lines up with the opening in the BNSF bridge, while the alternative channels under the Interstate Bridge are located toward the center and south bank of the river, thus requiring vessels to make an S-curve maneuver between the Interstate Bridge and the BNSF bridge opening.

[26] All vessels that can transit with 100-feet of vertical clearance (for the fixed-span configurations) or 89-feet of vertical clearance (for the movable-span configuration) could use the relocated north barge channel, which would provide the straightest route between the new Columbia River bridges and the BNSF Railway Bridge. Only those vessels or cargo requiring a higher vertical clearance would need to use the relocated primary navigation channel and make an "S" curve maneuver.

pass under the new bridges.

There would be some differences in impacts to navigation from a double-deck or single-level fixed-span configuration compared to a single-level movable-span configuration, associated with vertical navigation clearance (VNC). The single-level movable-span configuration is the only configuration that provides a VNC of 178 feet (in the open position). The two fixed-span configurations would provide 116 feet VNC, which would prohibit some existing vessels from transiting unless modifications or other accommodations were made to those vessels, cargo, or several local business operations (see the Navigation Impact Report for additional details [IBR 2025b]).. A fixed-span configuration would permanently prevent vessels with VNC requirements of greater than 116 feet (and unable to modify the vessel) from transiting under the bridge for its 100+ year service life. On January 16, 2026, the U.S. Coast Guard issued a revised PNCD for the new Columbia River bridges and set the preliminary VNC at 116 feet or greater.

Under a movable-span configuration, vessels requiring a bridge opening would be restricted during specified time periods to transit the new Columbia River bridges; timing restrictions would be updated from those in place today and formalized during a federal rulemaking process. Under the single-level fixed-span configuration and double-deck fixed-span configuration, all vessels would pass under the bridges without timing restrictions.

Mutual agreements have been reached with each of the businesses and vessel owners that have transited the Interstate Bridge prior to construction for the new Columbia River bridges and have required between 116 feet and 178 feet to transit or ship large cargo, to avoid impacts on future business operations. In addition, ongoing coordination with USACE is occurring to provide passage for the dredge *Yaquina.*

3.11.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past actions have both improved and limited navigation conditions in the study area. The establishment of federal navigation channels and associated dredging improved navigation and allowed for deeper-draft vessels to transit the Columbia River from the Pacific Ocean to the BNSF Railway bridge in Vancouver, while the construction of bridges, dams, and overhead utilities across the river as well as land use restrictions have limited navigation along the full length of the Columbia River. Past, present, and reasonably foreseeable future actions along with the No-Build Alternative would retain the existing Interstate Bridge with nine in-water pier sets and narrow horizontal navigation clearances. Vessels that do not require a bridge opening, including most tugboats with barges, would continue to use the barge and alternate barge channels requiring S-curve maneuvers, which can be hazardous to navigation in inclement weather and high-water conditions, to align with the nearby BNSF Railway bridge. Ongoing and planned maintenance of the navigation channels by USACE and others would continue under the No-Build Alternative.

Prior to 1917, unlimited VNC at the Interstate Bridge location was available; however, construction of the bridge limited this clearance to 178 feet when opened. At that time, it is not expected that any navigation would have been reduced as larger vessels and cargo shipments began to transit the

Columbia River in the 1930s to support building hydroelectric dams and the 1940s to support World War II shipbuilding activities.

The federal navigation channel at and upstream of the bridge was established as a deep-draft (27 foot) navigation channel to accommodate ocean-going ships upstream to The Dalles. This shipping traffic never materialized, and the USACE currently maintains the channel to 17 feet reflecting the current traffic on the river. If the USACE were to deepen the channel from Vancouver to The Dalles to 27 feet as authorized, it would allow some deeper-draft vessels to traverse the study area, which would contribute to a change in waterway use. [27]

The construction of Bonneville Dam and the navigation locks, as well as other dams and locks, allowed navigation to extend upriver to Lewiston, Idaho, on the Snake River. Navigation does not extend past the Tri-Cities on the Columbia River due to river conditions and the lack of accommodation at upriver dams. The depth of the channel, size of the locks that allow passage past the dams, and height of existing bridges across the Columbia and Snake River system limit the size of vessels that can navigate upstream past Bonneville Dam. Few properties exist within this reach of the river (BNSF Railway Bridge in Vancouver to Celilo Falls BNSF bridge) that have current commercial/industrial facilities using waterborne shipping or the potential for such facilities in the future. An analysis of upriver land uses showed that there is limited potential for development that could result in different navigation on the waterway. Existing political and geographic constraints limit the areas for future water-dependent land uses, including restrictions imposed by the Columbia River Gorge National Scenic Area, topography, transportation access parallel to shorelines (SR 14, Interstate 84, and BNSF and Union Pacific railroads), and existing open spaces. Industrial uses generating marine vessel traffic are typically located within industrial parks in urban areas.

Several ongoing and planned navigation maintenance projects downriver and upriver of the Interstate Bridge could contribute to long-term beneficial cumulative effects on navigation in the study area. The USACE maintains the federal navigation channels to the authorized and/or maintained depths by conducting maintenance dredging on a yearly basis for the federal navigation channel along the Columbia River. The USACE is developing an updated Channel Maintenance Plan with lower Columbia River ports to ensure that the federal navigation channel downstream is maintained and operational for another 20 years. Dredging is also conducted by ports and private entities in the area to maintain adequate waterway depth at marinas and marine terminals.

No reasonably foreseeable future actions were identified that would contribute to a long-term adverse cumulative effect by restricting reasonable navigation. Upriver navigation and marine commerce development would continue to be restricted by existing political, geographic, and built constraints, such as the National Scenic Area and the navigation clearance under the I-205 bridge and other upriver structures (e.g., bridges, utility lines).

[27] The deep-draft vessels could operate in -27 feet, whereas the larger vessels require over -40 feet.

3.11.3 Conclusions

Past actions have both improved and limited navigation conditions in the study area. The establishment of federal navigation channels and associated dredging improved navigation and allowed some deeper-draft vessels to transit the Columbia River from the Pacific Ocean to the Interstate Bridge, while the construction of bridges, dams, and overhead utilities across the river, as well as land use restrictions, have limited navigation along the full length of the Columbia River. Currently, the most restrictive vertical clearance is the Celilo Bridge at river mile 201.2, which provides 20 feet of vertical clearance with the lift span closed and 79 feet of vertical clearance with the lift span open.

The deep-draft navigation system provides for a 43-foot-deep by 600-foot-wide channel from inside the Columbia Bar to Portland, Oregon, and Vancouver, Washington, on the Columbia River. The shallow-draft navigation system begins just downstream of the existing Interstate Bridge (at river mile 106.5). The Vancouver to The Dalles portion of this section was authorized as a deep-draft system (27 feet authorized depth). However, the USACE currently maintains the channel to 17 feet based on usage. The controlling depth for the rest of the shallow-draft system (from The Dalles to Lewiston, Idaho) is 14 feet. Additionally, the locks along the Columbia River are compatible with barge traffic but not deep-draft container ships such as container vessels. These limitations impact transit of deep-draft cargo ships beyond the lower river system, regardless of bridge height.

Past, present, and reasonably foreseeable future actions along with the No-Build Alternative would retain the existing Interstate Bridge with nine in-water pier sets and narrow horizontal navigation clearances. Vessels that do not require a bridge opening, including most tugboats with barges, would continue to use the barge and alternate barge channels requiring S-curve maneuvers, which can be hazardous to navigation in inclement weather and high-water, fast-flow conditions, to align with the nearby BNSF Railway Bridge. Ongoing and planned maintenance of the navigation channels by USACE and others would continue under the No-Build Alternative.

The Modified LPA, as well as maintenance of the navigation channels, would improve navigation by providing a straighter route for many vessels to transit through the new Columbia River bridges and the BNSF Railway Bridge via the relocated barge channel (north) and a reduction in the number of in-water piers, and would also provide improved seismic resiliency. Vessels using the primary navigation channel (center) and alternate barge channel (south) would need to make an S-curve maneuver. However, the wider HNC would enable vessels to begin this maneuver earlier in downbound transits and provide greater distance before they need to transit the BNSF Railway Bridge, resulting in improved navigation safety.

Under the Modified LPA with a fixed-span configuration, navigation for some vessels would be prohibited. A 116-foot VNC would impact a total of four river users: a marine contracting company that operates two vessels with height restrictions, a shipyard services company, and two marine fabricators with vessels transiting the river with height-limited cargo. The IBR Program has reached agreements with the four impacted river users that would address impacts to their known operations from the proposed 116-foot VNC (see the Navigation Impact Report for additional details [IBR 2025b]) under the Modified LPA fixed-span bridge configuration design options.

It is difficult to predict maritime transportation system demands and associated need for bridge openings for the 100+ year service life of the bridge because vessel traffic and river-level conditions vary from year to year and economic trends for maritime commerce may change over time. If a fixed-span configuration is selected, the Modified LPA would contribute to a cumulative adverse effect on navigation by further limiting navigation upstream on the Columbia River, which has been limited by past and present actions, such as construction of roads and rail lines, creation of the National Scenic Area, and construction of bridges with less than 178 feet of VNC.

Under the No-Build Alternative, cumulative effects on navigation would generally maintain existing conditions, which are the result of past, present, and reasonably foreseeable future actions.

Compared to the No-Build Alternative, the cumulative effects on navigation from the Modified LPA with a double-deck or single-level fixed-span configuration, when combined with past, present, and reasonably foreseeable future actions, would be adverse for some vessels or fabricators shipping large cargo because of the reduction in VNC. The Modified LPA with a single-level movable-span would retain the existing VNC so all vessels and cargo that currently transit the bridge would continue to do so. Beneficial effects on navigation from the Modified LPA, under all bridge configurations, would occur as a result of increased HNC and increased use of the northern channel for many vessels, thereby improving navigation safety as vessels transit through both the new Columbia River bridges and the BNSF Railway Bridge.

3.12 Neighborhoods and Communities

Please see the Neighborhoods and Communities Technical Report for additional information.

3.12.1 Program Effects

3.12.1.1 No-Build Alternative

The No-Build Alternative would not change the existing conditions that affect neighborhoods and communities. There would be no acquisitions or displacements of residences or businesses. It would not provide the benefits that the Modified LPA would provide, including the extension of light-rail, improvements to active transportation facilities, and improved bus service in the corridor. The current limited multimodal options hinder access to jobs and services—in particular, for segments of the population that use transit at a higher rate, including low-income individuals and people with disabilities. In addition, there would be no job creation, as associated with construction of the Modified LPA.

The No-Build Alternative would also not displace any residences or businesses and would not impact community cohesion. However, traffic congestion and safety would continue to worsen, and there would be no improved access associated with the extension of light-rail service and improvements to the active transportation network. Neighborhoods in the study area would continue to develop according to local and regional plans, although their development might not be fully consistent with goals that assume improved mobility in the I-5 corridor and expanded transit access. Communities would not benefit from increased mobility and accessibility resulting from construction of light-rail,

active transportation facilities, or highway improvements. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on neighborhoods and communities would continue under the No-Build Alternative.

3.12.1.2 Modified LPA

The Modified LPA would have both beneficial and adverse effects on neighborhoods and communities. The Modified LPA would provide benefits in terms of increased mobility and accessibility, particularly due to the high-capacity transit and active transportation elements. The decrease in transit travel time and increase in transit reliability would be a key benefit for all those traveling through the area, but particularly for low-income individuals and people with disabilities, who ride transit proportionally more than people with higher incomes or without a disability. Transit access would be improved for all communities within the study area, with an increase in access to jobs compared to existing conditions and the No-Build Alternative. Furthermore, under the Modified LPA, air quality would improve for the region.

The largest neighborhood-related adverse impact from the Modified LPA would occur on Hayden Island, where the Modified LPA would displace floating homes in North Portland Harbor (see Section 3.1).

The Modified LPA is expected to continue the positive trend in the corridor of improving neighborhood access and mobility. The provision of a light-rail station, the connection of N Tomahawk Island Drive under I-5, and the improved access and capacity of the Hayden Island interchange may contribute to the viability and success of redevelopment plans for the island (see the Land Use Technical Report). However, the Modified LPA would displace several commercial/retail businesses on Hayden Island, most of which are chain restaurants directly adjacent to the current location of the highway. Although restaurants are not typically considered community resources, the loss of these businesses, if not relocated on the island or replaced by other businesses, would result in fewer dining choices on Hayden Island and could impact neighborhood cohesion. This is a notably smaller contribution to cumulative effects than the CRC project, which would have displaced approximately 40 businesses on Hayden Island, including the only grocery store and bank on the island (which have since closed).

One major difference, however, between these impacts and the impacts of past actions, is that past projects were not always planned and implemented with meaningful input from and communication with the public. Involving communities and understanding impacts has become an essential part of the IBR Program.

The Modified LPA would improve circulation on Hayden Island and reduce the hours of congestion in this area along I-5. Additionally, the bike and pedestrian connection to the existing Interstate Bridge, which is currently substandard and difficult to navigate, would be replaced by a new shared-use path, and an LRT station would serve the island. The Modified LPA would also affect other neighborhoods. In the Kenton neighborhood, the Modified LPA would displace several structures around the Marine Drive interchange, including three floating homes and one single-family home on land. Three businesses would also be displaced in this area.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.12.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

As described in Section 3.8, past highway development had significant effects on neighborhoods along the I-5 corridor. The development of I-5 required the acquisition of right of way and the relocation of many businesses and homes, and contributed to a loss of community cohesion. Local planning efforts serve to strategically place and design current and future transportation so as to maximize benefits and minimize negative impacts. Neighborhoods within Portland and Vancouver formally adopt neighborhood plans as part of their respective comprehensive plans and typically include goals, objectives, proposed comprehensive plan and zoning changes, and an implementation strategy. Neighborhood plans and comprehensive plans for each respective city will contribute to the current trend of improving neighborhood access and mobility.

In the Rockwood neighborhood in Gresham, the original development of the Ruby Junction Maintenance Facility (opened in 1984), and subsequent expansions and improvements displaced existing uses from that site, including single-family residences.

The only supermarket on Hayden Island (Safeway) closed in 2018, leaving residents of Hayden Island without a full grocery store. However, groceries are available at the Target in the Jantzen Beach Shopping Center, and simple groceries are also available at the Plaid Pantry on North Hayden Island Drive. The only bank in the neighborhood, Wells Fargo on Jantzen Drive, closed in 2020. Now, financial services on Hayden Island are limited to a handful of ATMs. While past actions, such as the construction of I-5, have reduced community cohesion on Hayden Island, potential future redevelopment of the area that is less auto-oriented and more pedestrian-friendly could improve community cohesion.

Reasonably foreseeable future actions in the study area that could contribute to cumulative effects on neighborhoods and communities include transportation and development projects with the potential for displacement or relocation of businesses and homes or actions that affect connectivity and cohesion. Many of the reasonably foreseeable future projects have yet to complete environmental assessments, but at this time none have been identified that would require the displacement or relocation of homes. Renaissance Boardwalk may result in one business displacement, although it would also improve connectivity along the waterfront. There are no known encampments of homeless populations at the sites of the reasonably foreseeable future actions; however, encampments are typically transient and the potential for displacement would need to be evaluated for each project prior to construction.

The Bridgeton Trail will complete a missing link in the Marine Drive trail and improve connectivity for neighborhoods along the waterfront in Portland. In Vancouver, four projects would help improve neighborhood connectivity and safety: Waterfront Gateway, the Main Street Promise project, Fourth Plain Boulevard and Fort Vancouver Way Safety and Mobility Project, and the 29th and 33rd Streets Safety and Mobility Project.

would improve safety and connectivity in downtown Vancouver through improvements to vehicle and active transportation infrastructure. Other transportation improvements in the adopted RTPs would contribute to the cumulative effect of improving connectivity in neighborhoods in the study area.

3.12.3 Conclusions

Past transportation projects, such as the original construction of I-5, had significant effects on neighborhoods and communities in the I-5 corridor, leading to a loss of community cohesion and displacement of businesses and homes. Recent and present actions typically seek to avoid, minimize, and mitigate impacts on communities through closer analysis of how a project could affect neighborhoods and specific populations, and the same is expected of reasonably foreseeable future actions. Most of the reasonably foreseeable future actions are anticipated to improve connectivity and cohesion, either as their intended purpose or through required mitigation (e.g., Waterfront Gateway, the I-5 Rose Quarter Improvement Project). Local land use plans, including neighborhood plans in Portland and Vancouver, would continue the trend of improving neighborhood access and mobility.

The No-Build Alternative would not contribute to adverse or beneficial cumulative effects on neighborhoods and communities created by past, present, and reasonably foreseeable future actions. The Modified LPA would contribute to adverse cumulative effects from past and reasonably foreseeable future actions that have displaced commercial and residential uses. The Modified LPA and reasonably foreseeable future actions that would affect neighborhoods and communities would be required to follow federal and state guidelines for potential displacement and other adverse impacts. The Modified LPA and other reasonably foreseeable future actions would also contribute to the positive trends of improving neighborhood access and mobility, and providing public engagement opportunities for neighborhoods and communities.

Under the No-Build Alternative, cumulative effects on neighborhoods and communities would continue to be driven by past, present, and reasonably foreseeable actions. Displacement of existing, and development of new, commercial, and residential uses would continue, although other future actions would expand access and mobility.

Compared to the No-Build Alternative, the cumulative effects on neighborhoods and communities from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be slightly more adverse due to potential displacement. However, the cumulative effects would also be more beneficial due to consistency with local land use plans, improved access, and pedestrian-oriented development.

3.13 Noise and Vibration

As detailed in Section 3.11 of the NEPA/SEPA Final SEIS, noise was analyzed from traffic and LRT sources and vibration was analyzed from construction activities and LRT operations. Vibration from highway use is rare, as vibration-sensitive uses would need to be in very close proximity to highway traffic, and highway vibration was, therefore, not assessed.

A traffic noise impact occurs when noise levels approach or exceed noise abatement criteria thresholds established by the ODOT, WSDOT, and FHWA at sensitive receptors (e.g., residences, parks,

schools, and hotels) or if there is a "substantial increase" over existing noise levels (defined as 10 decibels or more). A transit noise or transit vibration impact occurs when noise or vibration levels exceed impact criteria thresholds established by the Federal Transit Administration (FTA) at sensitive receptors. Additional details on the analysis of noise and vibration, and what constitutes a noise impact and vibration impact, are included in the Noise and Vibration Technical Report of the NEPA/SEPA Final SEIS.

Please see the Noise and Vibration Technical Report for additional information.

3.13.1 Program Effects

The noise modeling prepared for the IBR Program incorporates anticipated regional growth and foreseeable transportation projects. As such, the results of the modeling reflect cumulative effects on noise and vibration conditions in the study area.

3.13.1.1 No-Build Alternative

At present, there are 160 traffic noise impacts in the study area. Under the No-Build Alternative, increased noise and vibration levels in the future would be expected to increase as population, employment, highway traffic, public transit service, air traffic, and freight rail traffic continue to increase and planned development and redevelopment are implemented. The No-Build Alternative would result in highway noise impacts to 216 sensitive receptors where noise levels approach or exceed noise abatement criteria thresholds established by ODOT, WSDOT, and FHWA. As LRT would not be extended, no transit noise and vibration impacts would occur under the No-Build Alternative. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects related to noise and vibration would continue under the No-Build Alternative. These reasonably foreseeable future actions would include would include permanent noise and vibration effects associated with highway traffic, and temporary effects associated with construction of transportation facilities.

3.13.1.2 Modified LPA

As documented in the Noise and Vibration Technical Report, the noise analysis incorporated regional growth and foreseeable transportation projects; therefore, the noise modeling results include transportation-related cumulative effects associated with noise and vibration from the Modified LPA in combination with other transportation projects in the study area. Noise and vibration impacts under the Modified LPA would include permanent impacts such as increased noise to sensitive receptors along I-5, existing and new transit facilities, and along local streets that would be modified in the study area. Approximately 196 sensitive receptors would experience highway-related noise levels that approach or exceed noise criteria thresholds established by ODOT, WSDOT, and FHWA (the I-5 westward shift design option would have fewer traffic noise impacts because of acquisitions near the new Columbia River bridge alignment). This is an increase of 36 noise impacts over existing conditions and a decrease of 20 compared to the No-Build Alternative.

Transit-related noise would have moderate-level impacts that exceed FTA thresholds to approximately 12 sensitive receptors (this would be reduced to zero with mitigation) and vibration

impacts to 13 sensitive receptors along the extended LRT facilities. Construction activities would result in increased noise and vibration due to construction equipment, drilling or pile driving, and other related construction activities. Construction-related noise impacts are regulated by local jurisdictions through permits or variance requests.

Noise abatement proposed for the Modified LPA, such as noise walls, would reduce local traffic noise to below the noise abatement criteria levels at 118 of the 196 noise-impacted sensitive receptors with predicted noise impacts from the Modified LPA (combined with noise from prior actions). Mitigation measures will be developed in accordance with FHWA's highway traffic noise mitigation regulations and the FTA's transit noise and vibration impact assessment manual (see Section 3.11.7 of the NEPA/SEPA Final SEIS).

No transit-related vibration impacts are predicted in the Portland area. In Vancouver, vibration impacts would affect 12 residences at the Normandy Apartments and a multiuse building that includes a cinema and commercial businesses.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.13.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past actions affecting noise and vibration include urban development in the region that led to the introduction of urban noise sources in the study area. In addition to existing urban noise sources, residential and commercial construction activities in the study area could be a substantial, intermittent source of noise and vibration in the future.

The noise environment in the general Program vicinity has long been characterized by typical urban noise sources and noise levels. Sources include traffic on I-5, SR 14, SR 500, Martin Luther King Jr. Boulevard, Marine Drive, and various arterials and other roadways. Air traffic associated with PDX and Pearson Field is also a substantial source of noise that has increased over time. Marine vessels on the river, trains on two rail lines, and industrial uses and the Portland International Raceway further add to the cumulative noise environment.

Present and future transportation and transit projects are required to evaluate noise and vibration impacts resulting from permanent facility improvements and from construction activities. If cumulative transportation noise levels exceed thresholds established by ODOT, WSDOT, FHWA, and FTA, then mitigation analysis must be conducted. Past projects were not always subject to these requirements; thus, present and future projects, through required mitigation analysis and implementation, are often able to reduce overall transportation noise, as the applied mitigation would also reduce noise produced by existing transportation sources. In the future, projected growth in both air traffic and freight rail traffic is expected to increase noise levels in the study area. If the land use plans for the City of Vancouver and Hayden Island are realized, then residential and commercial construction activities could be a substantial, intermittent source of noise and vibration into the future.

The following reasonably foreseeable future actions in the study area that could contribute to cumulative effects on noise and vibration have been identified:

- Transportation improvements to public transit, state highways, local road networks, and active transportation facilities as identified in the Metro/RTC 2018 RTP RTDM. The projects identified as fiscally constrained are included in the transportation model of the Modified LPA and No-Build Alternative, and as such are reflected in the noise and vibration analysis. As noted above, while some transportation projects may contribute to temporary and long-term noise and vibration levels, others may reduce these levels.
- Metro's future redevelopment of the Expo Center, which would include a sports and cultural complex, may contribute to temporary and long-term noise and vibration through increased development and activity.
- Two concurrent efforts are underway to improve the existing levee system along the Columbia River near the Interstate Bridge: the PMLS project and CCFS projects. Proposed improvements include raising the elevation of the levees. It is anticipated that construction of the improvements would result in temporary increases in noise and vibration. Once constructed, the improvements are not anticipated to contribute to noise and vibration levels.
- The City of Portland's 2009 plan for Hayden Island calls for redevelopment of the commercial core from the current large-scale retail land use pattern to a more urban form with more mixed uses, pedestrian-scale design, and transit orientation. The plan identifies a replacement bridge over the Columbia River and the addition of high-capacity transit, both of which the Modified LPA would provide, as important elements of future development on the island. Increased development and activity on the island could contribute to both temporary and long-term noise and vibration levels.
- Several developments are planned along the Vancouver waterfront, including (1) the Port of Vancouver's Terminal 1 mixed-use (i.e., hotel, office and retail space, outdoor gathering areas, and a public marketplace) project, which also includes a trail connection to the Vancouver Waterfront Renaissance Trail; (2) the Renaissance Boardwalk, which is public-private partnership for a mix of apartments, retail, and underground parking: and (3) the Waterfront Gateway Project run by the Vancouver CCRA to redevelop an area between the waterfront and downtown Vancouver with mixed-use office, retail, and residential uses. These future Vancouver waterfront developments would continue to expand the present and recent past developments to create more commercial-residential uses compared to past industrial uses along the waterfront. Increased development and activity along the waterfront could contribute to temporary and long-term noise and vibration levels.

3.13.3 Conclusions

Past actions include urban development in the region that led to the introduction of urban noise sources in the study area. Many residences and other uses in the study area have experienced increased noise levels over time, driven by the growth in urban noise sources. Under the No-Build Alternative, no new transit-related noise and vibration impacts would occur, though continued population, employment, highway traffic, public transit service, air traffic, and freight rail traffic growth, and planned development and redevelopment from reasonably foreseeable future actions,

would contribute to increased noise and vibration levels in the future. Under the No-Build Alternative, 215 sensitive receptors in the study area would experience increased traffic noise.

While the Modified LPA would increase transportation noise in and introduce transit vibration to the study area, it would also provide mitigation that would reduce noise levels at sensitive receptors affected by cumulative transportation noise from past, present, and reasonably foreseeable future actions. Including mitigation benefits, the Modified LPA would result in cumulative highway traffic noise impacts to 118 sensitive receptors as compared to 160 existing receptors and 216 receptors under the No-Build Alternative.

Under the No-Build Alternative, cumulative effects on noise and vibration would continue to be driven by past, present, and reasonably foreseeable actions. Without the proposed infrastructure improvements, and the associated proposed mitigation measures, transportation noise and vibration in the study area would increase, continuing existing adverse cumulative conditions.

When combined with past, present, and reasonably foreseeable future actions, the Modified LPA would have both adverse and beneficial cumulative effects on noise and vibration. It would increase noise and vibration generated by highway and transit sources compared to existing levels, but it also would provide noise abatement measures that would reduce the number of sensitive receptors affected by cumulative highway noise levels.

3.14 Public Services and Utilities

Please see the Public Services Technical Report and Utilities Technical Report for additional information.

3.14.1 Program Effects

3.14.1.1 No-Build Alternative

The No-Build Alternative would not change existing utility connections and would, therefore, not have a cumulative effect on utilities. While the No-Build Alternative would not change the types of public services provided, increased congestion could slow response times for emergency vehicles, and ongoing bridge openings would continue to disrupt traffic and cause potential delays for emergency vehicles, which would be an adverse effect on public services. In addition, public services such as schools and libraries would continue to be hindered by limited public transit and substandard bicycle and pedestrian facilities. The North Portland Harbor bridge and Interstate Bridge are not designed to current seismic standards and could fail and possibly collapse in the event of a catastrophic earthquake, which would disrupt both utility connections and public services.

I-5 is an important north–south access route through the study area, and it is the only emergency access route to and from Hayden Island. Increased congestion under the No-Build Alternative would decrease the ability of the public, particularly Hayden Island residents, to reliably reach or receive public services due to increased travel times and lower travel speeds.

Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on public services and utilities (identified below) would continue under the No-Build Alternative. Impacts from those actions would be included in long-range plans and growth assumptions.

3.14.1.2 Modified LPA

The Modified LPA would enhance transit service that provides access to public service facilities such as medical facilities, police and fire facilities, or schools. The Modified LPA would provide transportation reliability improvements through changes in roadway and traffic operations to critical access routes that would generally improve emergency response times to serve the planned growth. These improvements would also include changes in roadway design from the Modified LPA that would improve the mobility of public service providers.

Overall, the direct physical impacts to public services from the Modified LPA would be minor. The Modified LPA would directly impact three public service facilities: one police department building, one school site, and two "other" (non-categorized) facilities. Of these facilities, the police department building, school, and one of the "other" facilities would undergo limited impacts that would not affect their operations or services. The FHWA's Western Federal Lands office property would lose some parking, landscaping, and signage under the Modified LPA, but, with the exception of the loss of some parking and potentially altered access routes, the operations would not be adversely affected. The ODOT Permit Station and Field Office on Hayden Island would be permanently displaced by the Modified LPA. The property is planned for full acquisition, and the mainline of the new Columbia River bridges would pass directly through the current location of the facility. It is undecided at this time where ODOT would relocate the functions of the station.

The Modified LPA would impact several major utilities, including water, power, gas, and communications infrastructure in Vancouver, as well as on or near the North Portland Harbor bridge. Proposed mitigation would generally consist of either protecting a utility in situ or relocating it. The goal would be to ensure that Modified LPA -related changes do not impair existing overall levels public service. Utilities would be protected in place or relocated during construction; following completion of construction, utilities are expected to operate as well as or better than they do currently.

Projected traffic congestion on local streets under the No-Build Alternative and the Modified LPA would include some intersections performing at unacceptable levels of service. Intersections with unacceptable levels of service negatively impact the mobile services of public service providers and cause delays in response times for emergency vehicles. Mitigation is proposed under the Modified LPA to reduce the number of failing intersections, which would lessen the impact to public services. While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.14.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past population growth has incrementally increased demand on public services and utilities. It is anticipated that the primary effects from most reasonably foreseeable future projects would be

changes to traffic patterns and increased demand on services and utilities. These effects are mitigated via coordination with and participation from affected service providers. These providers are generally included in planning processes and have adequate time to make needed adjustments prior to changes in development patterns and the street network.

Forecasted population and development patterns reflected in the long-range comprehensive plans of the jurisdictions served by each public service and utility provider would affect public services and utilities. Service providers evaluate future population growth and calculate provider needs such as increased numbers of police officers, expanded treatment plants, new equipment, or new station locations. Anticipated density increases in downtown Vancouver and on Hayden Island are consistent with current long-range plans and growth assumptions, and increased services for new development would occur in urbanized areas that already have public services and utilities. This anticipated development would not require the extension of service to a new geographic area.

Current emergency response time trends are increasing. Annual performance reports by the City of Portland Fire and Rescue show that from 2017 to 2022, fire and medical emergency response times at the 90th percentile increased (City of Portland Fire and Rescue 2022). The City of Vancouver Fire Department reports an increase in standard response times from 2022 to-2023 (City of Vancouver 2023). Similarly for law enforcement, the Portland Police Bureau's Dispatched Calls Dashboard indicates that the average emergency response times within the study area increased between 2017 and 2022 (City of Portland Police Bureau 2022). Forecasted changes in response times are not available, although service providers are anticipated to plan for future needs based on forecast population and development patterns found in long-range comprehensive plans.

3.14.3 Conclusions

Past actions, including population growth, have incrementally increased demand for public services and utilities. Current trends in emergency response times have increased, and, consistent with current practices, public service providers would continue to evaluate reasonably foreseeable future population growth to meet demand. Reasonably foreseeable future actions in the study area that could affect public services and utilities include increased service and associated new or improved facilities, as well as an increase in utility services based on forecast population and development patterns found in comprehensive long-range plans. The Cascade Renewable Transmission Project would provide renewable energy and additional energy capacity to the Oregon and Washington electrical grid.

The No-Build Alternative, combined with past, present, and reasonably foreseeable future actions, would not contribute to cumulative effects on utilities but would contribute to cumulative effects on public services (see Table 3.6-5 in the NEPA/SEPA SEIS). Under the No-Build Alternative, increased congestion in the study area would continue to slow response times for emergency vehicles, ongoing bridge openings would continue to disrupt traffic and cause potential delays for emergency vehicles, and the public would have a decreased ability to reliably receive or reach public services. The Modified LPA and other reasonably foreseeable future actions would support planned growth in the study area, such as by facilitating the types and densities of development envisioned in local and regional land use plans (especially in Hayden Island and downtown Vancouver), providing new light-rail service, and/or improving the reliability of bus transit.

Little to no cumulative effect on utilities from either alternative would occur. Under the No-Build Alternative, cumulative effects on public services would continue to be driven by past, present, and reasonably foreseeable actions. Without improvements to I-5 and related infrastructure, emergency response times would increase, continuing existing adverse cumulative conditions.

The cumulative effects on public services from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, when compared to the No-Build Alternative, would be beneficial because of the improvements in transportation reliability serving emergency access routes and expanded access to high-capacity transit.

3.15 Transportation

Please see the Transportation Technical Report for additional information.

3.15.1 Program Effects

The traffic and transit modeling prepared for the IBR Program incorporates anticipated regional growth and reasonably foreseeable future transportation projects. As such, the results of the modeling reflect cumulative effects on transportation conditions in the study area. As previously noted, uncertainty in forecasting is expected as traffic forecast volumes, while based in part on available existing counts, also use regionally developed assumptions about future conditions within the regional plans. The modeling also assumes tolling would be in place. A sensitivity analysis was performed to understand the impact of higher and lower toll rates. Future decisions on toll rates may affect traffic volumes and transit mode share.

3.15.1.1 No-Build Alternative

Under the No-Build Alternative, congestion would continue to increase and the active transportation and transit improvements proposed under the Modified LPA would not be constructed. Congestion and safety concerns at the bridge would continue to be caused by overall high traffic volumes, the structure's limited capacity, limited sight distance, substandard shoulders, short merge and diverge locations north and south of the bridge, high-volume on- and off-ramp flows north of the river, and high truck volumes. Earthquakes are unpredictable and could occur at any time or not occur at all during the time frame of this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridges, temporarily restricting or preventing travel.

Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on transportation (identified below) would continue under the No-Build Alternative. Future growth and development would continue to increase transportation demand. Although other transit projects may be implemented in the region, their benefits would be reduced without the Modified LPA. Active transportation systems would be expanded but not between Portland and Vancouver.

Tolling of I-205 (Abernethy Bridge), is indefinitely on hold[28], but, if advanced in Oregon, would likely contribute to a beneficial cumulative effect of reduced regional congestion and increased use of public transit and active transportation.

3.15.1.2 Modified LPA

The Modified LPA would reduce freight and vehicle congestion, improve safety, and improve the connectivity, capacity and reliability of active transportation and transit networks. The highway, transit, and active transportation network improvements would make the I-5 corridor more attractive to users, and the shift in traffic patterns would result in increased traffic volumes on some local roads. Future travel demand would be more efficiently served by the multimodal transportation improvements included in the Modified LPA, as well as other improvements in the region, consistent with adopted regional transportation plans.

The region's goals for higher levels of transit and active transportation use would be better supported by the completed transit and trail connections between Portland and Vancouver, in combination with other regional projects. The key drivers of transportation demand—future population growth and accompanying developments—would continue to affect conditions for all transportation modes and facilities in the study area and region.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

3.15.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Past and present actions affecting transportation in the study area (and region) include population growth and accompanying development, which have subsequently led to an increase in the number of single-occupancy and freight vehicles on roads, as well as the expansion of public transit and active transportation networks. The increase in congestion and vehicle collisions can largely be attributed to this growth. Past public transportation improvements in the area include expansion and increase in service of TriMet's bus and light-rail system (including the extension of light-rail to the Expo Center in 2004), as well as the C-TRAN bus service (including the recent introduction of BRT along Fourth Plain Boulevard and Mill Plain Boulevard in 2017 and 2023). Tolling of I-205 (Abernethy Bridge), which is currently on hold, but if advanced in Oregon, is anticipated to have notable effects on those transportation conditions with spillover effects onto other roads in the region. The introduction of congestion pricing would likely contribute to the cumulative effects of several reasonably foreseeable future projects, including the Modified LPA, that will reduce congestion and increase the use of public transit and active transportation.

[28] Tolling of I-205 (Abernethy Bridge) and the Regional Mobility Pricing Program (congestion pricing) are indefinitely on hold. Because tolling of I-205 is included in the Metro/RTC 2018 RTP RTDM, it is still considered reasonably foreseeable for the purposes of this analysis, per the criteria established for cumulative effects (see Section 2.5.3 of the Cumulative Effects Technical Report).

Many of the reasonably foreseeable future actions, primarily those identified in the Metro/RTC 2018 RTP RTDM, are transportation projects that address the anticipated needs of the community for travel by vehicles, freight, public transit, and active transportation. The non-transportation reasonably foreseeable future actions reflect the ongoing growth and development in the region that would rely on the existing and planned transportation networks, including new commercial and residential units at Waterfront Gateway, Renaissance Boardwalk, Terminal 1, and the new sports and cultural complex at the Expo Center.

Primary transportation trends in the study area include the growing number of vehicles on the roads (with increasing congestion and crash rates) and a growing demand for more public transit and active transportation options.

3.15.3 Conclusions

Past actions affecting transportation in the study area include the construction of I-5 and the Interstate Bridge, construction of state and local transportation networks, implementation of public transit service, and establishment of local transit agencies (TriMet, C-TRAN) and regional metropolitan planning organizations (Metro, RTC). These actions, taken in response to rapid regional growth, have had a cumulative effect of providing additional transportation capacity, safety improvements, transportation demand management, and transportation systems management enhancements on highways, public transit systems, and active transportation networks. Some areas continue to experience congestion where the demand for transportation exceeds capacity, and safety challenges are still present. Recent projects, such as development in downtown Vancouver, along with population growth, have continued the trend of more vehicles on the road and exacerbated congestion, while other projects, such as The Vine, have improved access to alternative transportation options. Planned reasonably foreseeable future actions included in the Metro/RTC 2018 RTP RTDM would contribute to managing congestion, improving safety, and expanding the transit and active transportation networks; however, under the No-Build Alternative (including the effects of past, present, and future actions), congestion would continue to grow and safety would continue to worsen. As compared to the No-Build Alternative with past, present, and reasonably foreseeable future actions, the cumulative effect of the Modified LPA (including the effects of past, present, and reasonably foreseeable future actions) would be an improvement to congestion and safety (see Tables 3.1-10 and 3.1-12 in the NEPA/SEPA Final SEIS).

Under the No-Build Alternative, cumulative effects on transportation would continue to be driven by past, present, and reasonably foreseeable actions. Without improvements to I-5 and related infrastructure, congestion and the number of crashes would increase, continuing existing adverse cumulative conditions.

The cumulative effects on transportation from the Modified LPA combined with past, present, and reasonably foreseeable future actions, when compared to the No-Build Alternative, would be beneficial with fewer vehicle hours of delay and lower crash frequency on I-5.

3.16 Visual Quality

Please see the Visual Quality Technical Report for additional information.

3.16.1 Program Effects

3.16.1.1 No-Build Alternative

While the existing bridges, ramps, interchanges, roadways, and other structures would remain in place, the visual environment would not be static or unchanging with the No-Build Alternative. Ongoing and upcoming developments within the area of visual effect (AVE)[29] would continue to impact the visual character. Furthermore, the No-Build Alternative would lead to heightened traffic congestion within the AVE, potentially diminishing the overall visual cohesiveness of the project environment. However, the No-Build Alternative would not significantly influence the existing visual character and would not contribute to cumulative adverse effects on visual quality.

Other reasonably foreseeable future actions in the study area could contribute to cumulative effects on visual quality as identified below, although projects would be required to be consistent with existing zoning and design standards, which would maintain visual consistency with existing development and minimize additional adverse effects to visual quality.

3.16.1.2 Modified LPA

The primary elements of the Modified LPA that would affect visual quality and character are new highway bridge structures across North Portland Harbor and the Columbia River; revised roadways and interchanges; LRT guideway, stations, and park-and-ride facilities; and LRT guideways. The visual quality of the entire length of the study area and all landscape units would be affected. These new elements are likely to be notably more visible to adjacent recreational viewers in the Greater Central Park landscape unit, which includes Fort Vancouver. Existing roadside vegetation serves to soften the effect of the built environment within the transportation corridor. Elimination of roadside vegetation without restoration of such would reduce natural elements within the corridor.

Other visual changes would result from new transit stations and accompanying park-and-ride structures. Details on anticipated changes in visual quality from specific locations and viewpoints are available in Section 3.9, Visual Quality, of the NEPA/SEPA Final SEIS.

Lighting elements would be unified throughout the improvements by using similar lines, colors, and styles; furthermore, light and glare impacts from fixed light sources are expected to be less than under the No-Build Alternative, as replacement lights would be designed with modern fixtures and materials that limit light spill and glare and reduce ambient light levels.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

[29] The AVE is shown in Figure 3.9-1 of the NEPA/SEPA Final SEIS.

3.16.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

In the Columbia River, Portland, and Vancouver areas, visual character has steadily evolved from a more natural character, through rural and agriculture, to suburban and urban. The I-5 corridor has steadily grown in development intensity and in use as a major transportation route.

The continued intensification of the corridor has led to a decline in the quality of many views due to obstruction of scenic or natural landscapes by buildings, walls, signage, berms and ramps, pilings, columns, bridges, and loss of vegetation. Continued decline is not inevitable if cities and the region implement well-designed, visually coherent urban design that protects scenic or important views. Existing regulations include City of Vancouver, City of Portland, Clark County, Multnomah County, and other local, regional, state, and federal agency plans containing policies that protect views and aesthetic resources.

Unrelated projects involving transportation, urban design, and development will be implemented and continue the transformation of the landscapes of the Columbia River, Portland, and Vancouver region. The trend has been, and is likely to continue to be, one of increasing urbanization. The following projects are being considered by various jurisdictions and agencies:

- Interchange improvements such as constructing or rebuilding highway ramps.
- Bridge upgrades, replacement, or construction.
- Local street network and regional access route improvements.
- New traffic signals, wider sidewalks, curb extensions, bike lanes, on-street parking and street trees, pedestrian crossings, and pavement reconstruction.
- Intersection realignment.
- Various urban development projects throughout downtown Vancouver.
- The redevelopment of the central Hayden Island commercial area.

Identified reasonably foreseeable future actions that would alter the existing and cumulative visual character in the study area include development and redevelopment projects in downtown Vancouver and north Portland. Reasonably foreseeable future projects such as Terminal 1, Waterfront Gateway, Renaissance Boardwalk, and Portland Expo Center would add new buildings or redevelop existing buildings, adding to the development intensity along the I-5 corridor and existing visual character of the project environment in downtown and along the waterfront in Vancouver and in north Portland. Future transportation projects within the study area would contribute to changes in the visual character of the physical and project environment through visual changes from traffic congestion and constructed elements within the road, public transit, and active transportation network.

3.16.3 Conclusions

Past actions transitioned the visual character of the study area from a natural to an urban environment as Portland and Vancouver developed and as rail routes and the I-5 corridor were

constructed. The current trend of urban development would continue, and present and reasonably foreseeable future actions would continue to change visual character as the area continues to develop and transition to a denser urban environment.

The No-Build Alternative would not change the overall trends in visual quality with reasonably foreseeable future actions continuing the trend of urban development in the study area. The Modified LPA and reasonably foreseeable future actions would add to beneficial and adverse cumulative effects on visual character through ongoing and upcoming urban development creating new visual elements. To the extent that projects would be consistent with existing zoning and design standards to maintain visual consistency with existing development, their visual character would be consistent with the long-standing trend of an increasingly urban landscape.

Under the No-Build Alternative, cumulative effects on visual quality would continue to be driven by past, present, and reasonably foreseeable actions. Cumulative effects would be either adverse or beneficial, depending on the viewers' location, activity, and visual sensitivity, continuing the existing cumulative conditions.

Compared to the No-Build Alternative, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would contribute an urban structure to the urban setting, which would be either cumulatively beneficial or adverse, depending on the viewers' location, activity, and visual sensitivity.

4. NATURAL ENVIRONMENT CUMULATIVE EFFECTS

This section discusses the cumulative effects on the natural environment. Local, state, and federal regulations require protection of natural areas, slowing the destruction of these habitats and mandating replacement of their functions. Where feasible, the approach for analyzing cumulative effects under the federal Endangered Species Act and other state or federal regulations, as applicable, was coordinated to develop a common area of analysis.

The natural environment includes the following resource areas:

- Ecosystems (terrestrial and aquatic habitats, and plant and animal species)
- Geology and groundwater
- Water quality and hydrology
- Wetlands and other waters

Key natural resources in the vicinity of the Modified LPA improvements include Burnt Bridge Creek, the Columbia River, North Portland Harbor, the Columbia Slough, and associated riparian habitats. Non-transportation-related projects that are considered in the analysis include the Columbia River levee project and active habitat improvement and restoration activities on the Columbia Slough and Burnt Bridge Creek.

Historical environmental conditions within the study area were greatly influenced by the seasonal flows of the Columbia River. Historically, river volumes were highest between April and September during basin-wide snowmelt, and lowest from December to February, when much of the basin's moisture can be locked up in snow and ice.

Flood-control measures have been implemented that affect the entire lower Columbia River environment. Levees and river embankments were constructed in the early 1900s on both sides of the river, which isolated the majority of the floodplain from all but the highest flows. As the floodplain experienced increased development, elaborate pumping operations were implemented on the Oregon side to prevent overbank flow. Today, pumps run 9 to 10 months a year, and continuously 24 hours every day during the winter rainy period, resulting in over a billion gallons pumped per day by UFSWQD #1. Dams constructed in the mainstem Columbia River have effectively regulated flows, starting with completion of the Bonneville Dam in 1938.

The temporal frame of reference for the natural environment "past" will generally be from the broad changes that began in the 1800s. The temporal frame of reference for the "future" will generally be through 2045, which is the planning horizon for the regional transportation model, and the year to which impacts can be reliably identified (either quantitively or qualitatively) without speculation. Long-term cumulative effects that can be non-speculatively predicted extending beyond the 2045 planning horizon that are related to project life cycle will be considered qualitatively.

For a discussion of temporary cumulative effects on the natural environment, see Chapter 6.

4.1 Ecosystems

Please see the Ecosystems Technical Report for additional information.

4.1.1 Program Effects

This section addresses general ecosystem resources as well as aquatic and terrestrial Species of Interest (SOI).[30]. Ecosystem resources within and around the study area include fish, wildlife, plants, and their habitats. Examples of aquatic and terrestrial SOI include those species listed under the federal Endangered Species Act (ESA), species with other federal regulatory protections (such as marine mammals, bald eagles, and migratory birds), species with special state regulatory status in either Oregon or Washington, and other species that consulting tribes have identified as warranting particular focus.

4.1.1.1 No-Build Alternative

The No-Build Alternative would continue to contribute to an adverse effect on ecosystem resources due to the lack of stormwater treatment, resulting in roadway pollutants entering water bodies that provide aquatic habitat for aquatic species, and disturbance of wildlife during intermittent maintenance activities (for example, maintenance activities would generate temporarily elevated noise levels, temporary lighting, localized vegetation removal and trimming, and direct disturbance or displacement of individuals). Earthquakes are unpredictable and could occur at any time or not occur at all during the time frame of this analysis. The No-Build Alternative would not change existing and ongoing ecosystem conditions unless a catastrophic event, such as a major earthquake, were to occur affecting fish and wildlife species in both the immediate vicinity of the Interstate Bridge and downstream. At the time of an earthquake event fish and wildlife in the immediate vicinity of the Interstate Bridge could be injured or killed, if struck, by falling debris. Fallen debris would diminish habitat suitability at the site by displacing benthic habitat and could contribute chemical contaminants to the water, reducing water quality that could affect aquatic species and habitats downstream of the Interstate Bridge.

Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on fish, wildlife, and vegetation (identified below) would continue under the No-Build Alternative, though any impacts from those actions would be subject to applicable regulatory requirements. Untreated stormwater from approximately 157 acres of CIA within the study area would continue to be discharged into wetlands and waters, negatively affecting the natural habitats and species within them. Increased development, traffic volumes, and congestion from other actions could increase pollutant discharge to wetlands and waters from the untreated surfaces of the No-Build Alternative, including 6PPD-quinone.

[30] SOI is not a specific category of governmental or nongovernmental organization-designated species but refers to native species identified through tribal, local, state, and federal coordination as locally important due to their regulatory status, rarity, and/or special habitat considerations.

4.1.1.2 Modified LPA

Construction of the Modified LPA would result in temporary impacts (e.g., increased noise, turbidity, overwater shading) to sensitive aquatic and terrestrial species and their habitats. To reduce the potential for construction impacts to fish and wildlife species and their habitats, the installation and removal of all temporary work bridges, platforms, and piers would be conducted consistent with BMPs described in the Ecosystems Technical Report and required construction permits.

Long-term effects on ecosystem resources would include impacts and benefits to both aquatic and terrestrial species and habitats. Piers and shaft caps associated with the new Columbia River bridges would displace benthic habitats and introduce new overwater shading that would have potential effects on aquatic habitat function for fish and wildlife. The Modified LPA would create new impervious surfaces, which would generate stormwater runoff from roadways, but would also provide water quality treatment for both new and existing impervious surfaces. The Modified LPA would add approximately 33 acres of contributing impervious area (CIA) but would treat or infiltrate 207 acres of CIA, including approximately 156 acres of existing CIA that is currently untreated. This represents treatment of nearly six times the area of net new CIA associated with the Modified LPA. The updated stormwater management and treatment would reduce runoff pollution into waterways and better protect aquatic habitat and aquatic species in the Columbia River compared to the No-Build Alternative.

The Modified LPA would also result in the permanent loss of small quantities of sensitive terrestrial habitats, including riparian buffers, trees, wetlands, and wetland buffers. In general, these habitats are suitable for a variety of wildlife species, including 18 amphibian species (e.g., Pacific treefrogs), 15 reptile species (e.g., western pond turtles), 154 bird species (e.g., woodpeckers, owls, songbirds, and waterfowl), and 69 mammal species (e.g., elk, cougars, coyotes, and bobcats). Not all of these species are present within the study area.

Applicable federal, state, and local regulatory frameworks require mitigation that includes avoidance and minimization of impacts, and compensatory mitigation to achieve “no net loss” of ecosystem resource functions. Such compensatory mitigation must fully offset the impacts of the Modified LPA and achieve this “no net loss” standard. The IBR Program uses two functional assessment tools to evaluate habitat functions and values both prior to and following construction activities. These tools are a Habitat Equivalency Analysis and the Stream Function Assessment Method. Results from the functional assessment tools support the determination of mitigation requirements for natural resource impacts from the construction. Both the Stream Function Assessment Method and Habitat Equivalency Analysis are used for compliance with Section 404 of the Clean Water Act to inform compensatory mitigation decisions for the USACE, as well as for state and local regulatory agencies (e.g., Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Oregon Department of State Lands, Ecology, the City of Portland, and the City of Vancouver).

Compensatory mitigation for unavoidable impacts on aquatic and terrestrial habitats and species in Washington is anticipated to be provided through the purchase of credits from the proposed Wapato Valley Mitigation and Conservation Bank. Compensatory mitigation for unavoidable impacts to wetlands, and aquatic and terrestrial habitats and species in Oregon, is anticipated to be partially compensated through the purchase of advance mitigation credits at ODOT’s proposed Columbia

Bottomlands Advance Mitigation/Conservation Site, and partially through the purchase and protection under conservation easement of a site on West Hayden Island.

Operation of the Modified LPA would also result in disturbance of fish and wildlife during intermittent bridge and highway maintenance activities, which would be similar to those that occur under the No-Build Alternative.

Indirect effects to aquatic and terrestrial species and their habitat could result from continued land use development, such as transit-oriented development around light-rail stations. However, future development would comply with local land use plans and requirements, such as providing stormwater treatment and replanting of trees.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

4.1.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Native Americans lived in the region for more than 10,000 years before the arrival of Euro-American settlers. However, the human population in the region was low compared to Euro-American settlement (Aikens and Melvin 2006; Ames et al. 1998). Since approximately the mid-1800s, human population growth and development have gradually displaced and reduced the quality and quantity of aquatic and terrestrial habitats.

Historically, many activities, including deforestation, urbanization, dams for hydroelectricity, irrigation and flood control, hatchery operations, and overfishing have contributed to a loss of habitat and a reduction in fish and wildlife species. These past actions have made significant changes to the health and capacity of the region's ecosystem. Changes associated with increasing urbanization, industrialization, and agricultural development have exposed fish and wildlife along the lower Columbia River to an increasing variety of contaminants (Nilsen and Morace 2014). Increases in impervious roadway surfaces and vehicles in the watershed have increased pollutants in waterbodies that have affected aquatic species.

Although natural habitats in the area are generally small and fragmented compared to their historic conditions, these areas do provide habitat for a variety of plants, birds, terrestrial wildlife, and fish, including both common species and species with special regulatory status. Many SOI are subject to additional legal protections (e.g., the ESA) requiring evaluation and mitigation for impacts caused by present and future actions. Compliance with relevant federal, state and local laws, regulations, policies, and codes would help minimize or mitigate effects on SOI and their habitats. However, even if a project has a net beneficial impact on these species, many would continue to face threats to their continued long-term survival.

Effects from past actions on these ecosystem resources are summarized below.

4.1.2.1 Botanical Resources

Most natural habitat for botanical resources within the study area has been lost or highly degraded through human development, land use conversion, and introduction of invasive species and noxious weeds. Based on data from land surveys for the General Land Office between 1851 and 1895, it is estimated that combined riparian/wetland forest and wetlands/wet prairie habitat in the Portland Urban Growth Boundary area has declined from approximately 8% of the total vegetation cover historically to less than 2% currently—an overall decrease of 75% of wetland cover type (Christy et al. 1993; Metro 2010). Comparable data are not available for historical vegetation cover in the Vancouver area. However, given the close geographical proximity and the similar land use history, relative losses of wetland vegetation types in the Vancouver portion of the study area are likely to be consistent with those across the river in Portland. In general, natural habitat for botanical resources within the study area occurs primarily within wetlands, riparian buffers, and other protected open spaces. Invasive plants and noxious weeds are also ubiquitous throughout many of the vegetated spaces within the study area.

4.1.2.2 Terrestrial Resources

Terrestrial resources include terrestrial mammals, birds, amphibians, and reptiles. The wildlife species originally inhabiting the general area included numerous amphibian species (e.g., Pacific treefrog [*Pseudacris regilla*]); reptile species (e.g., western pond turtles [*Actinemys marmorata*]); bird species (e.g., songbirds, waterfowl); and mammal species (e.g., elk [*Cervus canadensis*], cougar [*Puma concolor*]). 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 the study area unsuitable as habitat for many species of native mammals, birds, amphibians, reptiles, and other wildlife that were once common.

Some species that once occurred, such as the grizzly bear (*Ursus arctos*), California condor (*Gymnogyps californianus*), and gray wolf (*Canis lupus*), have been completely extirpated. Other species, such as the streaked horned lark (*Eremophila alpestris strigata*), are still present, but their abundance and distribution have declined to the point of requiring regulatory protection. Still other native species continue to occur, but in smaller and more fragmented populations than occurred historically. Other species have adapted to the change in habitat conditions, persisting or even benefiting from the changes (e.g., raccoons [*Procyon lotor*], coyote), and red-tailed hawks [*Buteo jamaicensis*]).

4.1.2.3 Aquatic Resources

The term “aquatic resources” refers primarily to surface waters (rivers and streams) and the species that these habitats support (fish, marine mammals, and other aquatic organisms). Many aquatic species have been significantly affected by the cumulative impacts of human activities in the Columbia River Basin, such as projects that have increased impervious surfaces (e.g., the original construction of I-5), leading to an increase in pollutants reaching receiving waterbodies.

Contaminants present in roadway runoff, even when released in small amounts, can result in toxic levels to fish and wildlife (EPA 2020). Environmental exposure to polychlorinated biphenyls and other

human-made compounds can cause liver damage, disruption of neurodevelopment, reproductive problems, and some forms of cancer in salmon. These adverse effects can be passed down through generations and create cascading consequences for aquatic species and habitat in the Columbia River.

Juvenile salmon are one indicator species by which to track ecosystem changes over time. Salmon have historically been widespread throughout the Columbia River Basin and contribute to the overall health of its freshwater ecosystems over their life cycle (EPA 2020). The Columbia River historically supported salmon and steelhead runs that numbered between 10 and 16 million adults annually (CRC 2011a). Since 1900, the abundance and distribution of Chinook, coho, sockeye, chum, and steelhead in the Columbia River Basin have declined. Beginning with Snake River sockeye in 1991, many of these runs have been listed under the ESA as threatened or endangered and have been closely monitored and managed.

The natural abundance of most of the listed salmonids has increased since the mid-1990s but remains well below recovery targets. Diminishing risk from harvest and hatchery production together with relatively productive marine and freshwater conditions supported high adult returns for many stocks in the early 2010s. However, unusual environmental conditions, such as warming ocean temperatures and marine heat waves, have led to dramatic population changes since 2015 (Ford 2022). Some populations are hitting record high abundances while others drop to new lows. Three species are discussed below and illustrate trends that are typical for most of the listed salmonids in the Columbia River. All three species occur in the lower Columbia River Basin, the middle Columbia River Basin, and the Snake River Basin, and although they each migrate through the mainstem of the Columbia River, their habitat use, distribution, and ecology within the Columbia River Basin are distinct.

Columbia River chum (*Oncorhynchus keta*) runs numbered in the hundreds of thousands of adults in 1900, and at times approached a million per year (Good 2005). By the early 1950s, these populations began to decline due to habitat degradation and high harvest rates. Over the last 50 years, the total number of chum salmon returning to the Columbia River has averaged a few thousand per year over a restricted portion of the former range (NMFS 2013). Due to their small size, juvenile migrating chum are especially vulnerable to changing conditions in the lower river and estuary. Per the most recent 5-year status review, despite improvements in some populations, most Columbia River chum remain at a moderate to high risk of extinction (NMFS 2022).

Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*) runs numbered approximately 100,000 returning adults before 1960, with some historical estimates surpassing 300,000 (NMFS 2020). By 2005, the run had decreased to approximately 20,000 fish. The most recent review indicates that the status of MCR steelhead has not significantly improved since its final listing determination in 2006 (NMFS 2022). The population remains threatened and at a moderate to high risk of extinction.

Snake River sockeye (*Oncorhynchus nerka*) runs numbered 45,000 to 55,000 returning adults in 1900. This run has a very limited spawning distribution, making it especially vulnerable to threats. By 1991, the population group was reduced to one extant population at Redfish Lake with about 10 fish returning per year (NMFS 2015). Snake River sockeye runs have increased since the early 1990s due to various factors, including improved downstream and ocean survivals and increases in hatchery juvenile production. Yet, numbers crashed in 2015 and have remained low. The most recent status

review shows slight improvements over the past five years due to changes in hydropower operations and habitat restoration throughout the Columbia River mainstem (NMFS 2022). Despite these incremental improvements, the report determined that Snake River sockeye remain at a high risk of extinction.

Pacific lamprey (*Entosphenus tridentatus*) were historically widespread along the West Coast; however, their abundance has declined and their distribution has contracted (USFWS 2019). They are culturally important to Indigenous people throughout their range and play a vital role in the ecosystem as food for mammals, fish and birds, nutrient cycling, and storage (USFWS 2019). The mainstem Columbia River and North Portland Harbor are used as a migration corridor for returning adult lamprey, but the species faces similar challenges as salmon and steelhead, such as hydroelectric obstructions to passage, habitat loss and degradation, and contamination. As a result of precipitous declines in the region, Pacific lamprey are listed as a federal species of concern.

4.1.2.4 Present and Reasonably Foreseeable Future Actions

Past actions on aquatic and terrestrial SOI have resulted in the same effects as non-SOI fish, wildlife and vegetation, including deforestation, urbanization, and dams for hydroelectricity, that have resulted in loss of habitat and reduction in the populations of SOI. Although regulations have been implemented to protect SOI, present and reasonably foreseeable future actions include development that would continue to affect SOI and their habitat.

Substantive legislation to protect natural resources began in the 1960s and has since expanded. Current and reasonably foreseeable future projects in the study area, such as USACE PMLS, Flood Safe Columbia River, Terminal 1, Cascade Renewable Transmission Project, Renaissance Boardwalk, dredging, and maintenance of existing waterfront structures, could include activities that would impact aquatic or terrestrial species and their habitats. Projects involving these types of activities are subject to federal, state, and/or local permits that require a mitigation sequencing process consisting of avoidance, minimization, and mitigation to reduce effects on species and their habitats. For example, the Terminal 1 project would include water quality protection measures such as a temporary erosion and sediment control plan to avoid or minimize potential adverse effects of the in-water work (demolition of the existing dock, slope repair and regrading, placement of fish mix, and dock replacement) on water quality and the aquatic environment (Port of Vancouver USA n.d.).

Other current and reasonably foreseeable future projects along the Columbia River may increase the amount of impervious surfaces within the study area, increasing the quantity of stormwater runoff into the Columbia River and potentially affecting aquatic habitat function. Of the reasonably foreseeable future actions, only the USACE PMLS project is identified as increasing impervious surfaces (by less than 1 acre); the remaining projects (including Renaissance Boardwalk, Waterfront Gateway, and Expo Center) are located in areas that currently consist primarily of impervious surfaces and redevelopment may ultimately improve runoff if it includes stormwater detention and treatment. Future projects, including development that is not yet identified, would be required to provide stormwater quality and quantity treatment consistent with applicable stormwater regulations, thereby reducing the risk of potential effects on water quality. Because requirements typically include treatment for existing untreated impervious surfaces, future projects may have a net beneficial effect on water quality compared to conditions today (as with the Modified LPA). Projects are also legally

required to avoid, minimize, and mitigate impacts to fish and wildlife to achieve no net loss in habitat function. While these projects could contribute to cumulative effects on fish and wildlife species, each project would not be constructed simultaneously, helping to distribute potential effects over time.

Planned restoration in the study area includes cleanup at the Portland Harbor Superfund Site and smaller projects along Burnt Bridge Creek in Vancouver and the Columbia River Slough in Portland (EPA n.d.; Ecology n.d. (a); Lee and Stamberger 2018). The Burnt Bridge Creek Partnership implements a water cleanup plan that includes recommendations such as water quality monitoring, BMPs for stormwater, improving the maintenance and development of septic systems and wastewater, riparian restoration, improving groundwater and streamflow, and public education and outreach. Objectives identified for the Columbia River Slough restoration project include continuing and expanding restoration and habitat enhancement projects in the watershed, continuing and expanding the slough trash cleanup program, strengthening stormwater management through green infrastructure and partnership, and engaging in land use planning processes and decisions.

Compliance with the relevant laws, regulations, policies, and codes in force at the time of such development would help minimize or mitigate the effects of such actions on resources that are important to aquatic and terrestrial species and their habitats. However, even if a given project has a net beneficial impact on these species, many of them would continue to face threats to their continued long-term survival.

Federal agencies have developed a Basinwide Salmon Recovery Strategy aimed at recovering the threatened and endangered salmon and steelhead species in the Columbia River Basin, most of which travel through the study area. The recovery strategy includes changes in habitat, hydropower, hatcheries, and harvest—all factors that will have the greatest impact on species survival.

Recent research has also indicated that climate change has affected and will continue to affect species and to modify fish and wildlife habitat in the Pacific Northwest in multiple ways, including increased temperatures and decreases in snowpack (May et al. 2018). In August 2021, the U.S. Environmental Protection Agency 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). This TMDL documented that water temperature impairments are widespread, primarily due to the cumulative effects of climate change and dam impoundments. Changes include less snowfall due to warmer temperatures that, in turn, decreases snowpack and changes the flow timing, including peak flow levels, of streams and rivers, as well as an overall increase in water temperatures. It is important to note that river dams on the Columbia and Snake Rivers would manage flows in the study area, such that the flow extremes in the Columbia River would be moderated where the river flows through the study area.

4.1.3 Conclusions

Past actions, such as deforestation, urbanization, and construction of dams for hydroelectricity, have resulted in loss of habitat and reduction in fish and wildlife species. Although regulations have been implemented to protect species and their habitat, present actions include development that would continue to affect species and their habitat. Reasonably foreseeable future actions, such as the PMLS

project and the Cascade Renewable Transmission Project, which both involve extensive over-, near-, and in-water work, would also affect species and their habitat in the ecosystems study area.

The No-Build Alternative would contribute to adverse cumulative effects on ecosystem resources, particularly aquatic habitat and aquatic species, from continued untreated stormwater runoff from I-5 and disturbance of fish and wildlife during intermittent bridge and highway maintenance activities. The Modified LPA would displace some benthic habitat for aquatic species, and result in new overwater shading from shaft caps, in the Columbia River; however, the Modified LPA would also provide water quality treatment that would improve aquatic habitat.

Under the No-Build Alternative, cumulative effects on fish, wildlife, and vegetation would continue to be driven by past, present, and reasonably foreseeable actions; continue to contribute untreated stormwater runoff from I-5; and cause intermittent disturbance of fish and wildlife. Some future actions would remove or disrupt habitat, while others would provide better stormwater management and treatment, continuing existing cumulative conditions.

Under the No-Build Alternative, cumulative effects driven by past, present, and reasonably foreseeable actions would continue on aquatic and terrestrial SOI. Some future actions would remove or disrupt SOI habitat, while others would provide better stormwater management and treatment, continuing existing cumulative conditions.

Compared to the No-Build Alternative, the cumulative effects on fish, wildlife, and vegetation from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be incrementally more beneficial because of compensatory mitigation and additional stormwater treatment.

Compared to the No-Build Alternative, the cumulative effects on aquatic and terrestrial SOI from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be incrementally more adverse because of in-water habitat disturbance and incrementally more beneficial from compensatory mitigation and additional stormwater treatment.

4.2 Geology and Groundwater

Please see the Geology and Groundwater Technical Report for additional information.

4.2.1 Program Effects

The study area consists of soils with high relative earthquake hazard rating, susceptible to severe ground shaking and liquefaction during a major seismic event.

4.2.1.1 No-Build Alternative

The No-Build Alternative would not include the construction of new Columbia River bridges and other improvements built to current seismic safety standards. Therefore, the No-Build Alternative would leave I-5 vulnerable to earthquakes and other geologic hazards that would have an adverse cumulative effect with other structures that have not been built to current seismic standards.

Earthquakes are unpredictable and could occur at any time or not occur at all during the time frame of this analysis. In addition, with the No-Build Alternative, stormwater would continue to run off untreated, which would continue contributing to an adverse cumulative effect on groundwater from pollutants in the runoff. The identified reasonably foreseeable future actions in the study area that could contribute to cumulative effects on geological and hydrogeologic conditions would continue under the No-Build Alternative, subject to applicable regulatory requirements for water quality and current seismic design standards.

4.2.1.2 Modified LPA

The Modified LPA would construct new Columbia River bridges and other I-5 structures to current seismic design standards that would substantially improve the region's resiliency to withstand a major seismic event. In Portland, the Modified LPA includes structures and fill placed in the vicinity of the existing or planned levee sections, which could induce longer-term settling of soils that may cause a reduction in the overflow elevations for the levees. Structure foundation elements that penetrate the levees could compromise the ability of the levee to retain water and increase seepage. The IBR Program would design foundation elements that would penetrate levee elements or affect the stability of the levees to current standards and would coordinate with the USACE and UFSWQD to protect levee elements.

In areas on both sides of the Columbia River, Hayden Island, and throughout the study area, the placement of construction fill, retaining walls, or other structures for the Modified LPA could result in non-seismic soil settling (which occurs in loose, soft soil material). The potential for non-seismic settling would be evaluated by site-specific geotechnical investigations conducted in accordance with applicable regulations and building codes set forth by the City of Portland, the City of Vancouver, WSDOT, and ODOT and addressed as a part of the geotechnical design for the Modified LPA.

The Modified LPA would expose approximately 415 acres of near-surface soils to potential erosion from excavation, fill, clearing, and grading during construction. Impacts to geology and geologic hazards (such as steep slopes, soil erosion, and landslides) would be mitigated and avoided to the extent feasible by the Modified LPA. Construction on steep slopes would be minimized, and the roadway design would include retaining walls or other stabilization techniques to reduce the potential for soil erosion and slope failure hazards. Landslides are not known to occur within the study area, and the Modified LPA would address the risks of increased scour that could result from potential landslides upstream caused by a major Cascadia Subduction Zone event. No long-term effects on geologic hazards are anticipated in the Ruby Junction Light-Rail OMF expansion area.

The Modified LPA would have beneficial effects on groundwater quality, including for the Troutdale Sole Source Aquifer, through stormwater facilities that would manage stormwater volume and flow rates and treat stormwater runoff to reduce pollutants.

Concrete construction may require more aggregate than is available through local suppliers. The construction contractor may need to transport construction material to the site from several suitable source areas throughout the region.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

4.2.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Contaminants from historical commercial and industrial activities in both Vancouver and Portland have resulted in diminishing groundwater quality. Past activities in the study area that have affected geological conditions and groundwater include settlement and development of the region, clearing of native vegetation, filling of lowland areas, grading of slopes, and construction in earthquake-prone areas. Current development projects, including roads, bridges, and buildings, are being constructed under updated codes that require additional protection against earthquakes and measures to limit adverse effects in sensitive zones (such as landslide-prone areas).

More recent development, such as the mixed-use buildings along the Vancouver waterfront, was constructed to current design standards and should withstand a major seismic event. However, in some cases, future actions, such as the Waterfront Gateway, levee system improvements, and the Renaissance Boardwalk, may include development and regrading that could lead to soil erosion, even with erosion control practices in place. These and other reasonably foreseeable future actions would also be constructed to current seismic standards and would contribute to the beneficial cumulative effect of improved resiliency throughout the study area. Past actions such as the Vanport Flood, the siting of the Hayden Island Landfill, and industrial activities along the Columbia River have also resulted in contamination of groundwater. Updated construction codes help protect groundwater sources from present and future actions that could further contaminate groundwater. Several soil and groundwater remediation actions have helped and will continue to help reduce existing contaminants in groundwater.

4.2.3 Conclusions

Past actions that have affected geological and groundwater conditions include regional development that has graded slopes and occurred in earthquake-prone areas and commercial and industrial activities that have resulted in groundwater contamination. Present actions in the study area are required to meet current, stricter standards for water quality, erosion control, and seismic safety. Reasonably foreseeable future actions, including new construction and redevelopment of existing sites, would continue to bring buildings and infrastructure throughout the study area up to current seismic design standards and comply with regulatory requirements related to discharges into groundwater.

Earthquakes are unpredictable and could occur at any time or not occur during the time frame of this analysis. The No-Build Alternative would not include the construction of new Columbia River bridges or other structures, leaving I-5 vulnerable to earthquakes and other geologic hazards, and stormwater runoff that enters into groundwater would remain untreated. The Modified LPA would improve the seismic resiliency of the Columbia River bridges and other I-5 structures and would treat stormwater runoff within the CIA that enters into groundwater.

Under the No-Build Alternative, cumulative effects on geology and groundwater would continue to be driven by past, present, and reasonably foreseeable actions. Without improvements to I-5 and related infrastructure, the infrastructure would continue to deteriorate, increasing vulnerability to seismic damage, and untreated stormwater would continue to infiltrate groundwater, continuing existing adverse cumulative conditions.

Compared to the No-Build Alternative, the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would have beneficial cumulative effects on geology and groundwater due to improved seismic resiliency of structures in the I-5 corridor and the treatment of stormwater that enters into groundwater.

4.3 Water Quality and Hydrology

Please see the Water Quality and Hydrology Technical Report for additional information.

4.3.1 Program Effects

4.3.1.1 No-Build Alternative

Under the No-Build Alternative, most of the existing impervious surface area along roadways in the primary study area (including the Interstate Bridge) would remain untreated, which would allow for the continued release of stormwater with degraded quality into the study area's receiving waters. However, with no way to quantify future emissions or other pollutants, such as 6PPD-quinone (a byproduct of tire dust that is toxic to salmonids), and for the purposes of the present analysis, it is assumed that the No-Build Alternative would maintain existing water quality conditions and would not result in long-term changes (either increased or decreased impacts). As noted above, there are approximately 180 acres of CIA in the study area, and stormwater runoff from over 80% of the CIA (approximately 157 acres) is untreated. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on water quality and hydrology (identified below) would continue under the No-Build Alternative, though impacts from those actions would be subject to applicable regulatory requirements.

4.3.1.2 Modified LPA

Under the Modified LPA, construction activities, such as construction of the new bridges and removal of the existing bridges and staging and casting/assembly site activities, can impact hydrology and surface water quality by disturbing the beds and banks of waterbodies, increasing the potential for erosion and accidental material discharges, and removing shading vegetation. During construction the Modified LPA would use cofferdams at some pier complexes to isolate the work area from active flow in the Columbia River and contain waste material and sediments. The hydrologic effect of these temporary structures is expected to be minor due to the width of the Columbia River and the regulation of river flows by upstream dams. In addition, all reasonable precautions would be taken to avoid and minimize water quality impacts during construction, through the use of BMPs specified in the Temporary Erosion and Sediment Control Plans and Spill Prevention, Control, and Countermeasures Plans that would be developed for all necessary National Pollutant Discharge Elimination System permits.

Long-term, an overall increase in impervious surfaces within the study area could result in increased stormwater runoff rates and volumes. However, the Columbia River and Columbia Slough are large, tidally influenced waterbodies, and the Modified LPA -related increase in stormwater quantity would not result in a measurable increase of flows in these surface waters. Burnt Bridge Creek and Fairview Creek are smaller waterbodies and more prone to be affected by increased stormwater quantity resulting from increased impervious surfaces. However, the Modified LPA includes stormwater facilities that would provide flow control that would control the amount and velocity of stormwater discharging into a receiving water, as required by federal and state agencies.

A preliminary hydraulic study was prepared for the Program and is appended to the Water Quality and Hydrology Technical Report. No rise in base flood elevation is anticipated for the future construction package. During the final design phase, this preliminary assessment would be confirmed with the hydraulic analysis once design concepts progress to a sufficient level of detail. If the hydraulic analysis shows a resulting rise in the base flood elevation, mitigation would be explored (see the Water Quality and Hydrology Technical Report for additional details).

The Modified LPA would provide stormwater treatment (in accordance with current standards) for new and currently untreated resurfaced roadways within the project footprint, including the new Columbia River and North Portland Harbor bridges. This would result in a net improvement for water quality by reducing pollutants discharged to the Columbia Slough, Columbia River, North Portland Harbor, Burnt Bridge Creek, and Fairview Creek.

Indirect effects to water quality and hydrology could result from continued land use development, such as transit-oriented development around light-rail stations. However, future development would comply with local land use plans and requirements, such as development within the floodplain and stormwater treatment.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

4.3.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Historic land use changes and increasing urbanization have decreased the amount of natural areas and the natural flow of water bodies in the study area. Over the past 150 years, historic off-channel areas have been filled, rechanneled, diverted, and otherwise developed for agricultural and urban use. Flood-control measures have been implemented that affect the hydrology of the entire lower Columbia River. Levees and river embankments were constructed in the early 1900s on both sides of the Columbia River, which isolated the majority of the floodplain from all but the highest flows. Development of the hydropower system on the Columbia River has also significantly influenced peak seasonal flows in the river, as well as their velocity and timing. The channelization of the watershed, combined with the development of the hydropower system, dramatically altered the historic hydrologic regime.

The enactment of environmental laws beginning in the 1960s (such as the Clean Water Act) and a recent decrease in upstream heavy industrial activities have addressed many known contamination sources and improved water quality in the Columbia River and Columbia Slough. In July 2005, a ROD was issued for the Columbia Slough Sediment Program, developed by DEQ and the City of Portland to remediate widespread sediment contamination by dredging "hot spots," which could be sources of waterbody contamination through groundwater, and long-term monitoring to ensure the program's effectiveness (DEQ 2005, BES 2006). However, most of the water bodies within the study area are "303(d)-listed," meaning they fail to meet the water quality standards for one or more pollutants under the Clean Water Act.

Projected population and employment growth will continue to increase urbanization and the geographic extent of development. Most of the immediate study area is already developed, so future projects would mostly consist of redevelopment and would be subject to current regulations, which are more stringent and generally result in a reduction in stormwater runoff and associated pollutants. The USACE PMLS and Flood Safe Columbia River would temporarily affect water quality due to construction activities, as well as an increase in impervious surface in the Columbia Slough watershed; however, the USACE has determined that these effects would be minor due to minimization measures and the limited area of impervious surface (approximately 0.5 acres) (USACE and CCDD 2021).

Future hydrologic projects in the study area include maintenance of the existing drainage system as well as the levee system improvements proposed by the USACE and the UFSWQD. These projects would maintain and improve the flood-control systems in the study area.

Most present and reasonably foreseeable future projects would improve water quality and hydrology in the study area as new development is held to stricter standards for stormwater management and treatment than past actions. The redevelopment of the Expo Center and Waterfront Gateway properties, for example, would likely improve runoff from these sites, which are mostly impervious surfaces at present. While individual actions are required to mitigate and treat their stormwater runoff, increased development could still lead to an increase in pollutant discharges to local water bodies as a result of increased congestion and traffic on existing roads that lack sufficient treatment.

There are several reasonably foreseeable future projects that specifically seek to improve water quality, including restoration activities along Burnt Bridge Creek in Vancouver and the Columbia Slough in Portland (Ecology n.d. (a); Lee and Stamberger 2018). In addition, cleanup of the Portland Harbor Superfund Site will improve water quality in the Willamette River (which flows into the Columbia River downstream of the Interstate Bridge). Increased scrutiny by regulatory agencies on chemicals at much lower levels than current standards is occurring and may result in new standards. Current treatment systems and regulations do not fully address these likely new standards. However, even with new treatment systems, increased development may still lead to impaired water quality in some locations. At a larger scale, the U.S. and Canada are developing a modernized Columbia River Treaty regime.

4.3.3 Conclusions

Hydrological function in the study area has been heavily influenced by past development, hydropower projects, and flood-control projects. Past development has also increased impervious surfaces and

the number of pollutant sources in the study area, including industrial sites and vehicles, leading to many of the waterbodies failing to meet water quality standards under the Clean Water Act. Because recent, present, and reasonably foreseeable future actions are subject to stricter regulatory standards for pollutants and hydrological effects, it is anticipated that water quality would continue to improve in the study area and hydrological effects would continue to be managed by existing and planned hydropower and flood-control projects. It is assumed that existing water quality conditions would be maintained under the No-Build Alternative (see Section 3.14 of the NEPA/SEPA Final SEIS).

The No-Build Alternative would continue release of pollutants and untreated runoff from past development, contributing to adverse cumulative effects. It also would not contribute to beneficial cumulative effects created by the stricter standards that apply to reasonably foreseeable future actions.

Under the No-Build Alternative, cumulative effects on water quality and hydrology would continue to be driven by past, present, and reasonably foreseeable actions. More stringent treatment of stormwater runoff would continue to be required for new actions, although there would be no project contribution. Adverse cumulative effects from the release of untreated runoff would also continue.

Compared to the No-Build Alternative, the cumulative effects on water quality and hydrology from the Modified LPA and past, present, and reasonably foreseeable future actions would be incrementally more beneficial due to improved stormwater treatment within the CIA.

4.4 Wetlands and Other Waters

Please see the Wetlands and Other Waters Technical Report for additional information.

4.4.1 Program Effects

4.4.1.1 No-Build Alternative

The No-Build Alternative would not result in the filling of a wetland or reduction of a wetland buffer within the study area due to Modified LPA activities. Untreated stormwater from over 156 acres of CIA within the study area would continue to be discharged into wetlands and other waters. Increased development, traffic volumes, and congestion could increase pollutant discharge to wetlands and waters, including 6PPD-quinone. The No-Build Alternative could also result in cumulatively increased impervious surface from development that would continue to occur along roadways in the study area. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on wetlands and other waters (identified below) would continue under the No-Build Alternative, although impacts from those actions would be required to meet applicable regulatory requirements for no net loss of functions or value.

4.4.1.2 Modified LPA

The long-term effects on wetlands and other waters resulting from the Modified LPA include decreased vegetated wetland buffer areas, increased impervious surface areas, and placement of fill and other alterations of waters of the states and the U.S.

The Modified LPA would impact approximately 0.25 acres of five wetlands in the Columbia Slough watershed. The Modified LPA would impact the buffers of eight wetlands in the study area, totaling approximately 5.7 acres, which would adversely affect wetland functions. In addition, the Modified LPA would increase the area of impervious surface in the vicinity of wetlands and decrease the distance between wetlands and roadway traffic, which could have an indirect effect on wetlands through the potential for increased stormwater flow and pollutants to wetlands. However, the Modified LPA would also provide stormwater facilities that would treat stormwater runoff for both new and existing impervious surfaces, which would improve water quality flowing into wetlands. In addition, the double-deck fixed-span configuration would result in a net restoration of approximately 0.13 acres of waterway in the Columbia River and North Portland Harbor and the single-level fixed-span configuration would result in a net restoration of approximately 0.16 acres in those waterbodies, both due to the smaller footprint of the replacement structures compared to the existing Interstate Bridge. The single-level movable-span configuration would result in a small net loss (less than 0.1 acres) due to its larger in-water footprint compared to the existing Interstate Bridge.

The Modified LPA would include permanent bridge piers in the Columbia River and North Portland Harbor to support the replacement bridges. While the replacement bridges have a smaller in-water footprint than the existing bridges, the Modified LPA would temporarily increase the area of piers by 0.29 acres over existing conditions, as the original bridges would remain in place until the replacement bridges are functional. Demolition of the existing bridge piers would remove 1.04 acres from the in-water footprint, resulting in a net restoration of approximately 0.13 acres of benthic habitat.

The Modified LPA would be designed to avoid, minimize, rectify, and reduce impacts to natural resources to the extent practicable. Mitigation for wetland fill is regulated by federal, state, and local jurisdictions and would typically require purchasing credits from an agency-approved mitigation site or completing on-site or off-site mitigation to compensate for lost or degraded wetland functions. Fill of the Vanport wetland by the Modified LPA would require increased mitigation ratios because it is an existing wetland mitigation site. Unavoidable Modified LPA impacts to wetlands and other waters would be offset through one or more compensatory mitigation projects, which are currently being developed in coordination with federal, state, and local regulatory agencies, tribes, and community members. With mitigation, it is anticipated that the Modified LPA would result in a net beneficial effect on quality and ecological function of wetlands and waters. The net reduction of fill in the Columbia River and improved stormwater treatment would improve the current functions of wetlands and waters, helping to mitigate some past actions

The compensatory mitigation plan would be developed during the permitting phase of the project, and full implementation of this plan would be a condition of the applicable permits of the agencies with jurisdiction (i.e., Section 10/404 permit and Section 401 certifications, among others), and the mitigation would comply fully with all applicable permit terms and conditions.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

4.4.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Urbanization and land use changes have led to a decrease in the acreage of wetlands in the study area since the 1800s, which is consistent with state and national trends (Morlan et al. 2010). Oregon and Washington lost an estimated 38% and 31% (respectively) of their wetlands between the 1780s and 1980s (Dahl 1990). The advent of stricter federal and state protections in the 1970s–1990s reduced the annual wetland loss in the Willamette Valley but did not stop the loss of wetlands (Morlan et al. 2010).

Since 1958 (the base year of I-5 construction), some wetland restoration has occurred near the southern portion of the study area. The Port of Portland completed a wetland restoration project at the 90-acre Vanport wetlands parcel, located immediately west of the existing highway and light-rail line (maintenance of the site is ongoing). Other historic wetlands east of the highway, in the Delta Park area and on Hayden Island, have experienced increased development, draining, or filling since 1964. Located just south of the study area, the Lombard to Delta Park project affected a relatively small area of wetland habitat and natural areas.

Continued growth throughout the region will affect portions of the study area. Local, state, and federal regulations require protection of wetlands and jurisdictional waters, slowing the destruction of these habitats and mandating replacement of their functions.

The following reasonably foreseeable future actions in the study area that could contribute to cumulative effects on wetlands and other waters have been identified:

- Planned restoration activities near Burnt Bridge Creek, the Columbia Slough, Vanpot, and the Smith and Bybee Wetlands Natural Area, which would improve wetland functions.
- The PMLS project, which is estimated to result in the loss of approximately 0.5 acres of wetlands that would be mitigated through compensatory mitigation (e.g., the purchase of credits from a wetland mitigation bank) (USACE and CCDD 2021). Mitigation would be required to completely offset any loss of functions or value, and USACE issued a Finding of No Significant Impact in 2022.
- The Renaissance Boardwalk mixed-use development, which has been proposed near the Columbia River in Vancouver. While more detailed information is not yet available for this project, impacts to the shoreline would have to meet Washington state requirements for no net loss of functions or value.
- Future dredging projects, such as the potential deepening of the navigation channel by USACE, would disturb sediment in the Columbia River waterway. USACE and affected ports are conducting environmental reviews for a Dredged Material Management Plan for the lower Columbia River, which would document effects on wetlands and waters as well as proposed mitigation. However, these environmental reviews are not yet complete, so specific

information regarding the potential impacts from the dredging project are not known at this time.

- The Cascade Renewable Transmission Project, which would install an underwater cable at the bottom of the Columbia River. This project would involve disturbing the river bottom sediment to create an approximately 24-inch trench for the cable and temporarily disturb 40 square feet of wetlands (Cascade Renewable Transmission2025).

- The Oregon Department of State Lands recorded a net loss of wetlands (from actions requiring a permit) over the past decade in Oregon (approximately 45 acres), though there was a net gain between 2020 and 2024 (approximately 47 acres). Based on the data, statewide wetland gains and losses are highly variable year to year (ranging from a net loss of 42 acres to a net gain of 60 acres). While all recorded wetland losses are compensated, this is often achieved through the purchase of credits from mitigation banks or in-lieu fee programs, and wetland enhancement and preservation are not counted as wetland gains as they do not result in gains in wetland acres (Pelton 2024). Similar data for Washington state were not located. USACE, Ecology, and some Washington jurisdictions (including the City of Vancouver) encourage the use of mitigation banks and in-lieu fee programs over on-site mitigation because they can offer greater assurance for mitigation (Hruby et al. 2009; USACE and EPA 2008). Therefore, a loss of wetlands can be reliably offset in another location within the watershed without a loss of overall value and function.

4.4.3 Conclusions

Past actions, including construction of I-5 and the existing Interstate Bridge, led to a decline in the amount and function of wetlands and other waters. Present actions are required to adhere to more stringent regulations, with the current requirements being no net loss in wetland function and value and treating stormwater runoff from roadways. Reasonably foreseeable future actions in the study area that affect wetlands and other waters would also be required to comply with regulations to achieve no net loss of wetland function or value and treat stormwater.

While the No-Build Alternative would not result in filling of wetlands or other waters, it would not improve wetland functions, and untreated stormwater would continue to be discharged into wetlands and other waters. The Modified LPA would result in the fill of some wetlands, but it would provide mitigation to improve the current value and functions of wetlands and would improve stormwater treatment.

Under the No-Build Alternative, cumulative effects on wetlands and other waters caused by past, present, and reasonably foreseeable future actions would continue. Although stormwater pollution from these actions would persist, reasonably foreseeable future actions would be required to provide more stringent stormwater treatment for water that flows into wetlands and other waters.

Compared to the No-Build Alternative, the cumulative effects on wetlands and other waters from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be incrementally more beneficial due to improved stormwater treatment within the CIA and mitigation to replace lost functions and values of fill placed in wetlands and waters.

Under the No-Build Alternative, cumulative effects on wetlands and other waters caused by past, present, and reasonably foreseeable future actions would continue. Although stormwater pollution from these actions would persist, reasonably foreseeable future actions would be required to provide more stringent stormwater treatment for water that flows into wetlands and other waters.

Compared to the No-Build Alternative, the cumulative effects on wetlands and other waters from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be incrementally more beneficial due to improved stormwater treatment within the CIA and mitigation to replace lost functions and values of fill placed in wetlands and waters.

5. CULTURAL AND RECREATIONAL ENVIRONMENT CUMULATIVE EFFECTS

Resources categorized as cultural and recreational environment include archaeological sites (below ground), the historic built environment (HBE) (above ground), and parks and recreation areas. Many (but not all) of these resources are regulated by Section 4(f) of the U.S. Department of Transportation Act of 1966, Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (23 CFR Part 774 and 16 U.S.C. §§ 470 et seq., respectively), Section 6(f) of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601-4 et seq. and Public Law 88-578, 78 Stat 897), and the Federal Lands to Parks (FLP) program.

The analysis examines the cumulative effects resulting from the Modified LPA in conjunction with other past, present, and reasonably foreseeable future actions. Issues considered include past effects on cultural resources in the study area, including loss of historic resources due to development and past effects on archaeological sites. The IBR Program team will conduct the analysis in consultation with the Washington Department of Archaeology and Historic Preservation, Oregon State Historic Preservation Office, consulting tribes, and other consulting partners.

5.1 Archaeological Sites

Please see the Archaeology Technical Report for additional information.

5.1.1 Program Effects

Archaeological sites are physical remnants of past human activity, including items left behind by past peoples (i.e., artifacts) and physical modification to the landscape (i.e., features). For the IBR Program analysis, this includes sites protected under Section 106 of the NHPA. The I-5 corridor within the area of potential effects (APE)[31] is a zone of intense past construction involving earthmoving on a massive scale, apart from land on the east side of I-5 in the Vancouver National Historic Reserve (VNHR), which generally has not been subject to construction disturbance. Although the region and general Program area are known to have been used by Native Americans, no archaeological evidence of precontact Native American occupation has been identified to date on the Oregon shore of the Columbia River within or near the APE. Potential reasons for this include: 1) the APE represents a very narrow transect across the Columbia River floodplain; 2) evidence of Native American occupation and activity may be present, but over time it has been buried by natural flood deposits and/or introduced fill deposits associated with 20th-century development, and 3) previous archaeological surveys have been mostly

[31] In the implementing regulations for NHPA Section 106 at 36 CFR 800.16(d), the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alteration in the character or use of historic properties, if any such properties exist." APE is analogous to "study area," which is the term commonly used for other resources. The APE for the IBR Program is shown in Figure 3.8-1 in the NEPA/SEPA Final SEIS.

limited to inspection of the existing ground surface and/or shallow probing. Dozens of archaeological sites have been recorded on the Washington shore of the Columbia River within or near the APE.

There are 35 archaeological sites within or directly adjacent to the APE (all located in Washington), including 15 sites that are listed in, or are eligible for listing in the National Register of Historic Places (NRHP) and one as-yet unevaluated resource.

5.1.1.1 No-Build Alternative

The No-Build Alternative would not affect archaeological sites in the APE as no ground disturbance would occur, and therefore it would not contribute to a cumulative effect. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on archaeological sites would continue under the No-Build Alternative, though any impacts from those actions would be subject to regulatory requirements for the protection of archaeological sites.

5.1.1.2 Modified LPA

Construction-related physical ground disturbance is anticipated to be the primary source of potential permanent and temporary direct effects to archaeological sites. An example of an adverse effect would include physical destruction of or damage to all or part of the archaeological site. Excavations during construction of the Modified LPA could directly affect the eligible archaeological sites. As discussed in the Archaeology Technical Report, 15 archaeological sites are located within the Washington portion of the APE; of these 15 sites, 11 are within the Modified LPA footprint and have the potential to be impacted by construction-related physical ground disturbance based on the anticipated nature and extent of ground disturbance associated with the Modified LPA. The remaining four resources are located within the APE but are outside of the Modified LPA footprint and therefore would not be disturbed by its construction. Archaeological and geoarchaeological studies performed in support of the CRC project highlight the potential for encountering as-yet -undocumented archaeological sites in previously unsurveyed areas and in deeply buried contexts at specific locations across the APE.

FTA and FHWA, in consultation with WSDOT, ODOT, Washington Department of Archaeology and Historic Preservation, Oregon State Historic Preservation Office, the consulting tribes, and other consulting parties, have resolved adverse effects on historic properties through execution of a Section 106 PA. The PA identifies parties responsible for complying with elements of the agreement and outlines mitigation measures and archaeological treatment. While archaeological studies were previously performed for the CRC project, additional studies are in progress to verify known archaeological resource presence and dimensions, and to identify unrecorded terrestrial and marine archaeological sites. Further studies will be performed through phased identification as allowed under Section 106 of NHPA (36 CFR 800.14(b)(2)) as stipulated in the Section 106 PA.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

5.1.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

At the time of European American contact, the shores of the lower Columbia River in the vicinity of the APE were inhabited by Native peoples, with numerous villages located along the river between the outer coast and what is now referred to as The Dalles, as well as several ethnographically named places in the vicinity of the study area. Extensive development has occurred on both shores of the Columbia River in the past 200 years.

Since the late 19th century, diking, draining, dredging, and filling along the shores have altered the banks of the Columbia River, possibly damaging archaeological sites, or encapsulating them under fill. Intensive residential, commercial, and transportation development over the past 160 years has had major impacts on the cultural landscape in the I-5 corridor and vicinity. In particular, the construction of I-5 and SR 14 affected the archaeology of the Hudson's Bay Company/Kanaka Village/U.S. Army presence in Vancouver.

The earliest Euro-American settlement and development in the city of Vancouver occurred in the mid-1800s in the area immediately west of modern-day I-5. Historic Sanborn insurance maps indicate that the city of Vancouver had begun to spread north of 20th Street by 1907 and had reached 41st Street by 1949, indicating a moderate to high likelihood of encountering buried historical archaeological deposits associated with residences and businesses dating to the early 20th-century settlement of Clark County. While the development of Vancouver formed the historic part of the archaeological record, the construction of each road, house, and trash pit potentially destroyed or disturbed evidence of Native American sites in the area.

While not every parcel is likely to contain significant archaeological resources, recent archaeological investigations demonstrate the potential for encountering archaeological resources associated with early residences, businesses, and industries in this portion of Vancouver. Based on the results of these projects, there is reason to believe that abundant and well-preserved archaeological resources are present beneath the older portions of Vancouver.

It is likely that 20th-century development along the I-5 corridor altered near-surface evidence of Native American occupancy and use of the area. However, geoarchaeological and geomorphological investigations in Oregon indicate that deep alluvial soils have the potential to contain evidence of the archaeological record as well as important paleoenvironmental data (CRC 2011c).

Recent transportation projects in the area of these resources include the Land Bridge pedestrian overpass and Interpretive Trail over SR 14, and the Vancouver Barracks, West Reserve Area, and other improvements planned for the VNHR. Based on a review of available literature on the reasonably foreseeable future actions, none of the actions are known to affect a recorded archaeological site within the APE. However, given the prevalence of unrecorded sites and the anticipated need for ground disturbance for future projects, there is the potential for the identified reasonably foreseeable future actions to affect archaeological sites, which could be preserved, recovered, disturbed, or destroyed. The environmental assessment for the USACE levee system improvements acknowledges that these improvements could disturb or destroy known or unknown archaeological resources (USACE and CCDD 2021). Ground disturbance associated with any of the reasonably foreseeable future

actions, as well as other development in the area may affect archaeological sites. Current local, state, and federal cultural resources laws and regulations that protect archaeological sites reduce the likelihood of destruction, but cannot completely prevent it.

5.1.3 Conclusions

The No-Build Alternative would not contribute to cumulative effects on archaeological sites, as no ground disturbance would occur; however, it would not change the overall trends in disturbance to archaeological sites from other past, present, and future actions. Although local, state, and federal regulations are in place to protect archaeological sites, ground disturbance during construction of the Modified LPA and other reasonably foreseeable future actions may result in adverse effects on known or unknown sites.

Under the No-Build Alternative, cumulative effects on archaeological sites would continue to be driven by past, present, and reasonably foreseeable actions. An ongoing pattern of large-scale ground disturbance in the study area would continue the existing adverse cumulative conditions, although the No-Build Alternative would not contribute to these conditions.

The cumulative effects on archaeological sites from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would also continue to be adverse due to a pattern of large-scale ground disturbance in the study area, with the incremental addition of ground disturbance due to construction of the Modified LPA. However, the cumulative effects would not be additional or greater than the adverse effects on archaeological sites identified through the Section 106 process (because that process considers the cumulative effects of the Modified LPA in the finding of effect). No separate cumulative adverse effects on archaeological sites would occur for properties that are not identified as adversely affected through the Section 106 consultation process.

5.2 Historic Built Environment

Please see the Historic Built Environment Technical Report for additional information.

5.2.1 Program Effects

HBE resources include buildings, objects, structures, sites, or districts (NPS 1997). For the IBR Program analysis, an HBE resource was considered if it is listed in the NRHP or is eligible for the NRHP. The IBR Program cultural resources review identified 33 historic properties in the APE constructed prior to 1982 that are listed in the NRHP or considered eligible for listing in the NRHP. Of these, eight properties are located in Oregon, 22 are in Washington, and three span the Columbia River between Oregon and Washington (the northbound and southbound I-5 bridges and the lower Columbia River Federal Navigation Historic District).

Potential effects that the IBR Program cultural resources team members evaluated include those described in 36 CFR 800.5: physical destruction and removal; alteration; change in use or setting; and the introduction of visual, atmospheric, or audible elements. Effects including the neglect of a

property and the transfer, lease, or sale of a property out of federal ownership or control are not anticipated for the Modified LPA.

5.2.1.1 No-Build Alternative

The No-Build Alternative would retain the existing infrastructure, and the existing Interstate Bridge would continue to operate as it does today. The No-Build Alternative would have no direct or indirect impacts on the character-defining features or integrity of the HBE properties and, therefore, no cumulative effects. A seismic event could adversely affect the two historic bridge spans. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on the HBE (identified below) would continue under the No-Build Alternative, though any impacts from those actions would be subject to regulatory requirements for the protection of historic sites and features.

5.2.1.2 Modified LPA

The Modified LPA is being designed to avoid direct effects on many HBE resources and minimize impacts that cannot be avoided. However, activities proposed for the Modified LPA would result in adverse effects, as defined under 36 CFR Part 800.5, on 12 HBE properties, including demolition of the northbound and southbound Interstate Bridge. The Normandy Apartments would also be adversely affected under the I-5 westward shift west design option. The Modified LPA's incremental impact to the loss of the area's historic fabric is relatively small compared to the combined effects of past projects and developments. The Modified LPA would primarily occur within the existing I-5 right of way and would only minimally widen the existing visual divide and introduce some new retaining walls and potential new sound walls. Other changes include affecting the historic features or settings of various resources. There are some differences in effects on historic properties across the design options, but no design option would completely avoid adverse impacts, and therefore all would contribute to adverse cumulative effects.

5.2.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Cumulative impacts to HBE resources have occurred over years of settlement and development patterns in the IBR APE in Oregon and Washington. Construction and operation of I-5 and the Interstate Bridge transformed both Hayden Island and Vancouver. The first bridge was completed in 1917 and the second bridge structure was built in 1958. Construction of the highway involved the removal of several buildings that had been constructed during the early history of Vancouver, and the highway created a substantial barrier between eastern and western portions of the historic community. The 1917 bridge is listed on the NRHP in both Oregon and Washington, and the 1958 bridge span has been determined eligible.

Several other substantial projects and developments have affected the HBE in the APE, including:

- Significant population growth from 1950 to the present in Portland, Vancouver, and surrounding areas, which has put a high demand on housing in historic neighborhoods,

causing new development both adjoining and within the historic sections of town, and ultimately diminishing the integrity of historic neighborhoods.

- Significant population growth (see above), which has attracted urban and industrial development in the study area, changing the use and nature of the open space along the river and causing the displacement and alteration of some historic buildings.
- The completion of I-5 through Vancouver in 1954, which resulted in the demolition of large sections of the city's historic neighborhoods to access the 1917 bridge to Portland.
- Construction of the parallel bridge in 1958 (southbound), which accommodated increased traffic flow on the new highway, resulting in increased interstate traffic and commerce.
- The loss of businesses in downtown Vancouver from competition with shopping malls built at Jantzen Beach in Portland and the Vancouver Mall in the 1970s.
- Construction of the Aeon Apartments and redevelopment of Providence Academy in downtown Vancouver, which removed several derelict historic structures and introduced contemporary architecture directly adjacent to the Academy/House of Providence, which is listed on the NRHP.

Based on a review of available literature on the reasonably foreseeable future actions, several of the identified reasonably foreseeable future actions are anticipated to affect known historic resources, namely redevelopment of the Expo Center, which is recommended as eligible for listing on the NRHP, and the USACE levee system improvements, which would affect contributing resources in the Columbia Slough Drainage Districts Historic District (note that the Modified LPA would have no adverse effect on this district). It is also likely that reasonably foreseeable future actions could alter the context and setting of historic resources, and ongoing development in the area consistent with adopted land use plans may affect historic resources, ranging from demolition, preservation and restoration, to changes in the historic setting.

In addition, historic properties that are currently vacant or underutilized may be lost through deterioration because of their current state of disrepair and the high cost of adapting them for reuse.

5.2.3 Conclusions

HBE resources in the APE in Oregon and Washington are reflective of the growth and development in the region, particularly trading in the 18th and 19th centuries and the introduction of wartime industries during the 20th century. Despite substantial development over the past decade, many historic resources and districts remain in the study area. Ongoing development has led to an incremental loss of the area's historic fabric, and this would continue into the future as more development and redevelopment occur. The No-Build Alternative would not directly contribute to cumulative effects on the HBE; however, it also would not change the overall past, present, and reasonably foreseeable future trends of HBE properties being affected by other transportation and land redevelopment actions. While the Modified LPA and all reasonably foreseeable future actions would need to meet regulatory requirements to preserve historic resources, the actions would still contribute to changes in the context and setting of those resources over time by introducing modern architecture and increasing urban density.

Under the No-Build Alternative, cumulative effects on HBE would continue to be driven by past, present, and reasonably foreseeable actions. Other such actions would continue to have specific impacts to HBE resources and changes in the surrounding historic setting, although no project contribution would occur.

When combined with past, present, and reasonably foreseeable future actions, the Modified LPA would also continue adverse cumulative effects due to specific impacts to HBE resources as identified through the Section 106 process and cause incremental changes in the surrounding historic setting. However, the cumulative effects would not be additional to or greater than the adverse effects on HBE resources identified through the Section 106 process (because that process considers the cumulative effects of the Modified LPA in the finding of effect). No separate cumulative adverse effects on HBE resources would occur for properties that are not identified as adversely affected through the Section 106 consultation process.

5.3 Parks and Recreation Areas

Please see the Parks and Recreation Technical Report for additional information.

5.3.1 Program Effects

The parks and recreation resources analysis considers cumulative effects of actions beginning in the 1950s, with the construction of I-5.

5.3.1.1 No-Build Alternative

The No-Build Alternative would not require the conversion of parks and recreation resources to transportation use. Access to these resources would continue to be hindered by limited public transit service and substandard active transportation facilities. Earthquakes are unpredictable and could occur at any time or not occur at all during the time frame of this analysis. Without seismic upgrades to the Interstate Bridge, a major earthquake could collapse or seriously damage one or both bridges, temporarily limiting access to parks and recreation resources. Other reasonably foreseeable future actions in the study area that could contribute to cumulative effects on parks and recreation (identified below) would continue under the No-Build Alternative.

5.3.1.2 Modified LPA

The Modified LPA would improve access to regional recreational resources in Portland and Vancouver, including Portland International Raceway, East Delta Park, and VNHR. Notably, it would improve access and connections to the Portland Expo Center, which would support Metro's plans to redevelop the site into a sports and cultural complex. The Modified LPA would also improve access to the Vancouver waterfront and connect parks on both the east and west sides of the bridges, which would restore the once-connected waterfront that was bifurcated by the existing bridge.

The Modified LPA would not result in long-term direct effects on Waterfront Park, beyond the changes in eastern and southern views from the new Columbia River bridges, while the Columbia River

Renaissance Trail, Discovery Historic Loop Trail, and Marine Drive Multi-use Trail would be realigned beneath the existing and new Columbia River bridges.

Parkland acquisitions would be required for the Modified LPA, with approximately 1.3 acres acquired in total. Permanent acquisitions would be required from the Fort Vancouver National Historic Site, Old Apple Tree Park, Marshall Community Center and Park, and Kiggins Bowl. Some acquisitions would affect lands protected by Section 4(f) and/or Section 6(f) (see NEPA/SEPA SEIS Chapter 4 for the Section 4(f) evaluation and NEPA/SEPA SEIS Section 3.21 for a discussion of Section 6(f) properties). The IBR Program would work with the Cities of Portland and Vancouver to identify potential mitigation measures for loss of parkland and other impacts.

Last, the Modified LPA would not adversely affect the planned Bridgeton Trail connection near the Marine Drive interchange.

While there are some changes in direct and indirect impacts and/or benefits associated with the design options, these differences would not affect the conclusion (below) regarding cumulative effects.

5.3.2 Effects from Past, Present, and Reasonably Foreseeable Future Actions

Park and trail development efforts in the region have been ongoing. These efforts would be continued and are supported by current plans and programs. The impacts listed above are small in the context of local park resources and are balanced by recent investments in parks and trails elsewhere in the area (e.g., the Vancouver Waterfront Trail, open space at The Waterfront Vancouver and Terminal 1). Some of the parks and recreation facilities are regulated and protected by Section 4(f) of the U.S. Department of Transportation Act and/or Section 6(f) of the Land and Water Conservation Fund Act. These protections, along with state and local goals to increase access to recreation facilities, have led to an increase in acreages of parks and recreation facilities in both Vancouver and Portland over the past decade (City of Vancouver 2021; City of Portland 2022).

Recent projects that have added or expanded recreation facilities include public open space at the Vancouver waterfront and a new amphitheater at Terminal 1, both of which are connected by new segments of the Renaissance Trail. Planned park and trail development at the Portland waterfront, Hayden Island, the VNHR, and Kiggins Bowl would expand the provision of park and recreation facilities to the public. Other development could result in loss of parkland, but no reasonably foreseeable projects have been identified that are anticipated to reduce park or recreation facilities, and the extent of a potential loss is currently not known. Parks in the study area that received Land and Water Conservation Fund grant dollars are regulated by Section 6(f) protections and may only be converted out of parkland use with replacement. Several of the foreseeable future projects would create new parks and recreation facilities, including a new sports and cultural complex at Expo Center, 2 acres of public space at Waterfront Gateway, and public spaces and trails proposed as part of Terminal 1 and Renaissance Boardwalk. Planned extensions or improvements to the trail systems in Portland and Vancouver will connect many of the new recreation facilities.

5.3.3 Conclusions

While some past actions reduced recreational areas because of their conversion to other uses, recent projects (such as The Waterfront Vancouver and Terminal 1) have typically increased the number of recreation and park resources. Present actions include routine maintenance of parks and recreational facilities. Parks and recreation sites in the study area would continue to be expanded and improved by reasonably foreseeable future actions (such as Waterfront Gateway and Renaissance Boardwalk).

The No-Build Alternative would not contribute to cumulative effects as access to parks and recreation resources would remain as-is, and there would be no change to existing resources. However, other reasonably foreseeable future actions would continue to result in net expansions and improved access to parks and recreation facilities. The Modified LPA would improve connectivity between existing and planned facilities through new and improved active transportation facilities.

Under the No-Build Alternative, cumulative effects on parks and recreation would continue to be driven by past, present, and reasonably foreseeable actions. The number and size of parks and recreation facilities would increase, continuing existing beneficial cumulative conditions, but the No-Build Alternative would have no effect on this trend.
The cumulative effects on parks and recreation from the Modified LPA, combined with past, present, and reasonably foreseeable future actions, would be a net incrementally beneficial effect through additional access and connections to parks and recreation sites.

6. TEMPORARY CUMULATIVE EFFECTS

Cumulative effects during construction may result when simultaneous or sequential construction projects have an additive effect to the temporary effects resulting from construction of the Modified LPA, demolition (including the removal of existing bridges), and associated activities of the proposed improvements. Simultaneous or sequential construction projects can increase congestion, cause temporary delays and disruptions to local residents and businesses, create more temporary employment opportunities, cause community and natural resource impacts, and require additional public and private spending. Temporary cumulative effects on the community may occur due to local traffic congestion and rerouting, as well as noise and air quality impacts, where construction under the Modified LPA overlaps with the construction of other projects in the area. The highest potential for such impacts is likely to be near the bridge landing in Vancouver and on Hayden Island, where other large projects are anticipated and where construction duration and intensity under the Modified LPA are likely to be high. Construction projects that may contribute to these effects when combined with the Modified LPA include (but are not limited to):

- The Waterfront Vancouver
- Terminal 1
- Renaissance Boardwalk
- Waterfront Gateway Project
- Levee system improvements
- Portland Expo Center (Expo Future)
- Cascade Renewable Transmission Project
- I-5 Rose Quarter Improvement Project
- 29th and 33rd Streets Safety and Mobility Project
- Cleanup of the Portland Harbor Superfund Site

These projects have, or would have, their own traffic control plans, but some may influence the travel routes of commuters and freight and could place more traffic in the study area. Likewise, some of the projects are on planned haul routes and could influence the delivery of supplies and materials to the job sites for the Modified LPA. As more detailed plans are developed, traffic control plans would need to be developed with consideration of these projects and their timelines. Mitigation plans, including traffic control plans and business assistance, would reduce the negative consequences of construction, while the employment demands would result in positive economic outcomes for the region.

Other likely or potential construction projects in the vicinity are described in the Land Use Technical Report.

Construction activities associated with the Modified LPA have the potential to cause economic impacts by temporarily blocking visibility and access to businesses, causing traffic delays, and rerouting traffic on detours that increase travel times and make access to some locations difficult.

Access restrictions or difficulties may divert customers and clients, hamper deliveries, and complicate the provision of emergency services. However, most traffic movements would remain open throughout the construction stages of the Modified LPA.

Construction of the Modified LPA could also result in increased employment and spending in the study area during construction. The extent of these effects depends on the source of project funding and the makeup of work crews used during construction. Federal or State funds that are new to a region can have a measurable economic effect on employment and income gains resulting from project construction. The federal government and the States of Oregon and Washington would provide the funds for the Modified LPA, resulting in some income and job benefits that would otherwise not occur.

The Modified LPA is likely to have the following effects on marine commerce:

- The duration of in-water construction is projected to be periodic over 4years. Several other projects will require in-water work that may occur at the same time, including Renaissance Boardwalk, the levee system improvements, and the Cascade Renewable Transmission Project.
- The lift span channel would be closed for a two-month period. This channel is one of three channels available to marine commerce; during construction, efforts would be made to keep at least one channel open at all times.
- The 300-foot channel is expected to be closed for a three-month period; after this, there could be room for selected river traffic, but it would be on a case-by-case basis and require coordination to maintain safe and effective working conditions. This channel is one of three channels available to marine commerce, and efforts would be made during construction to keep at least one channel open at all times.
- Marine commerce may need an extra tow to help maneuvering during construction, which would carry an extra cost.
- Temporary river travel restrictions are anticipated under the Modified LPA as barges are used to ferry materials to and from work sites.

The VNC restrictions during construction would prevent the dredge *Yaquina* from navigating above the Interstate Bridge to conduct yearly maintenance dredging, and portions of the river could shoal and reduce the ability of vessels to navigate the federal navigation channel or could require reduced loads and vessel drafts. Modifications to the *Yaquina*, such as converting the fixed mast to a lowerable mast, use of alternative vessels, or changing dredging methods, would be undertaken to fulfill the USACE's navigation missions during these time periods, per discussions with USACE.

In addition to marine commerce, overlapping in-water work can also create temporary cumulative effects on fish and wildlife. For each project, most of the construction impacts would be localized to the extent that the extent and magnitude of any cumulative effects from other projects would be minimal. Other projects in the area, such as the two levee improvement projects and the Cascade Renewable Transmission Project, could directly impact the same waters or wetlands or regulated habitats that the Modified LPA would affect. Potential temporary water quality impacts include turbidity due to sediment disturbance associated with in-water work, toxic contamination due to disturbance of hazardous sediments during in-water work, and toxic contamination due to accidental

equipment leaks or spills in the vicinity of waterways in the study area. Additional short-term effects on aquatic resources could include harassment and non-lethal disturbance from in-water work; injury or disturbance due to hydroacoustic impacts associated with pile driving and fish handling; increased risk of predation due to in-water shading during construction; and potential mortality associated with hydroacoustic impacts and fish handling.

However, cumulative effects related to construction activities would only be expected to occur if such activities were being conducted simultaneously and near construction being conducted for the Modified LPA. Temporary cumulative effects to aquatic habitats may include underwater noise from pile driving, physical benthic impacts, and shading from temporary in-water and overwater structures. Any project that requires substantial in-water construction work would require federal approvals for work within the river, and would therefore need to undergo Section 7 ESA consultation. With regards to pile driving noise, the Section 7 consultation process would require such a project to account for its own hydroacoustic impacts and would require development of avoidance and minimization measures to minimize these impacts. To minimize impacts to aquatic species and their habitats, certain work below the ordinary high-water mark of the Columbia River and North Portland Harbor would be restricted to defined timing restrictions, referred to here as the in-water work window. The USACE, National Oceanic and Atmospheric Administration Fisheries Service, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife all can recommend and/or require restrictions on the timing of in-water work during their regulatory review processes. For these reasons, it is unlikely that any project conducted concurrently with Modified LPA –related construction would result in a cumulative adverse effect related to underwater noise or other construction impacts.

Upland ground-disturbing activities (including clearing, grubbing, and excavation) have the potential to cause erosion, which in turn may introduce sediment into adjacent water bodies. However, future projects would require project-specific erosion and sediment control plans, which would reduce the potential for upland construction to cause turbidity in the Columbia River.

If construction of future projects does occur simultaneously with Modified LPA –related construction, adverse cumulative effects would be temporary and minimized through construction coordination with ODOT, WSDOT, and other agencies.

7. REFERENCES

AASHTO (American Association of State Highway Transportation Officials). 2016. Practitioner's Handbook. Available at <https://wsdot.wa.gov/sites/default/files/2021-10/ENV-NSEPA_AASHTOCummHndbk.pdf>. Accessed March 28, 2023.

Aikens, C. Melvin. 2006. Paleo-Indians: West. In Environment, Origins, and Population, D.H. Ubelaker, ed. pp. 194–207. Handbook of North American Indians, Vol. 3, W. C. Sturtevant, general ed., Smithsonian Institution, Washington, DC.

American Medical Association. 1994. Effects of Electric and Magnetic Fields, Report of the Council on Scientific Affairs to the American Medical Association, United States, December 1994.

Ames, Kenneth M., Don E. Dumond, Jerry R. Galm, and Rick Minor. 1998. Prehistory of the Southern Plateau. In Plateau, edited by Deward E. Walker, pp. 103–119. Handbook of North American Indians, Vol. 12, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

BES (Bureau of Environmental Services, City of Portland). 2006. Columbia Slough Sediment Program Watershed Action Plan. Available at <https://www.deq.state.or.us/Webdocs/Controls/Output/PdfHandler.ashx?p=0a83f925-05c5-4cd3-9864-131add5dc8f0pdf&s=FINAL%20Watershed%20Action%20Plan%20Oct_2006_w_maps.pdf>. Accessed February 10, 2023.

Cambridge Systematics. 2015. Port of Portland Commodity Flow Forecast. Prepared for the Port of Portland. March 2015. Available at <https://popcdn.azureedge.net/pdfs/Trade_Trans_Studies_LCR_Cmdty_Flw_Rpt.pdf>. Accessed October 2002.

Campbell, Will. 2021a. Former Safeway on Hayden Island Being Demolished; Flooring Store to Be Built. The Columbian. April 2, 2021. Available at <https://www.columbian.com/news/2021/apr/02/former-safeway-on-hayden-island-being-demolished/>. Accessed November 1, 2021.

Campbell, Will. 2021b. More Apartments Joining the Waterfront Vancouver. The Columbian. April 10, 2021. Available at <https://thewaterfrontvancouverusa.com/wp-content/uploads/2021/05/The-Columbian-More-Apartments-Joining-The-Waterfront-Vancouver-4-10-21.pdf>. Accessed November 2, 2021.

Cascade Renewable Transmission. No date. Cascade Renewable Transmission Project. Available at <www.cascaderenewable.com/>. Accessed July 30, 2024.

Cascade Renewable Transmission. 2025. Draft Application for Site Certification, Cascade Renewable Transmission, The Dalles to Portland. September 2025. Available at <https://efsec.wa.gov/document-search>. Accessed December 9, 2025.

Christy, J., E.R. Alverson, M.P. Dougherty, and S.C. Kolar. 1993. Historical vegetation for Oregon. 1993. Oregon Natural Heritage Program, The Nature Conservancy of Oregon.

City of Portland. 2019. Historical Context of Racist Planning – A History of How Planning Segregated Portland. Available at https://www.portland.gov/sites/default/files/2019-12/portlandracistplanninghistoryreport.pdf>. Accessed November 2, 2021.

City of Portland. 2022. Level of Service Guidance, Developed Parks and Natural Areas. Available at <http://www.portland.gov/parks/documens/level-service-parks-and-natural-areas-report/download. Accessed July 31, 2024>.

City of Portland Fire and Rescue. 2022. Portland Fire and Rescue Annual Performance Report Fiscal Year 2021-2022. Available at <https://www.portland.gov/fire/about-portland-fire-rescue>. Accessed July 31, 2024.

City of Portland Police Bureau. 2022. Dispatched Calls Dashboard. Available at <https://www.portland.gov/police/open-data/police-dispatched-calls>. Accessed July 31, 2024.

City of Vancouver. 2021. 2022-2032 Vancouver Parks, Recreation And Cultural Services Comprehensive Plan. Available at <https://www.cityofvancouver.us/government/department/parks-recreation-and-cultural-services/2022-2031-parks-recreation-cultural-services-comprehensive-plan/>. Accessed July 31, 2024.

City of Vancouver. 2023. City of Vancouver Fire & EMS 2023 Annual Report. Available at <https://www.cityofvancouver.us/departments/fire-department/>. Accessed July 31, 2024.

City of Vancouver. Not dated. Waterfront Gateway. Available at <https://www.cityofvancouver.us/business/planning-development-and-zoning/long-range-planning/plans-projects/waterfront-gateway/>. Accessed April 27, 2026.

CRC (Columbia River Crossing). 2011a. Cumulative Effects Technical Report. Available at: <https://www.wsdot.wa.gov/accountability/ssb5806/environmental-process-and-permitting.htm>. Accessed August 1, 2023.

CRC. 2011b. Interstate 5 Columbia River Crossing Project Final Environmental Impact Statement and Final Section 4(f) Evaluation. Available at: <https://www.wsdot.wa.gov/accountability/ssb5806/environmental-process-and-permitting.htm>. Accessed January 12, 2023.

CRC. 2011c. Historic Built Environment Technical Report. Available at: <https://www.wsdot.wa.gov/accountability/ssb5806/environmental-process-and-permitting.htm>. Accessed March 17, 2023.

Dahl, Thomas. 1990. Wetlands Losses in the United States – 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington. D.C.

DEQ (Oregon Department of Environmental Quality). 2005. Record of Decision, Remedial Action Approach for Columbia Slough Sediment, Portland, Oregon. Available at

<https://www.deq.state.or.us/Webdocs/Controls/Output/PdfHandler.ashx?p=17b16a0b-ef61-4256-bae1-e6fb1993eaebpdf&s=CSloughROD2005scan.pdf>. Accessed October 12, 2022.

DEQ. 2021. Oregon Air Quality Monitoring Annual Report: 2020. Available at <https://www.oregon.gov/deq/aq/Documents/2020AQMonitoringReport.pdf>. Accessed February 3, 2022.

Ecology (Washington Department of Ecology). No date (a). Burnt Bridge Creek Partnership for clean water. Available at < https://www.ezview.wa.gov/site/alias__1962/37697/burnt_bridge_creek_partnership.aspx>. Accessed September 26, 2023.

Ecology. No date (b). Improving air quality in overburdened communities. Available at <https://ecology.wa.gov/air-climate/climate-commitment-act/overburdened-communities>. Accessed May 18, 2026.

Ecology. 2025. Washington State Environmental Policy Act (SEPA) Handbook. Available at <https://apps.ecology.wa.gov/publications/SummaryPages/2506009.html>. Accessed December 2, 2025.

EPA (U.S. Environmental Protection Agency). 2024. Sources of Greenhouse Gas Emissions. Available at <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions> Accessed August 5, 2024.

EPA. 2021. Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. August 13, 2021.

EPA. No date. Portland Harbor, Portland, Oregon, Cleanup Activities. Available at <https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=1002155#bkground>. Accessed September 26, 2023.

FHWA (Federal Highway Administration). 2016. Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Available at <https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/>. Accessed January 31, 2022.

Ford, Michael J. (editor) 2022. Biological Viability Assessment Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest. Available at <https://repository.library.noaa.gov/view/noaa/34363#tabs-2>. Accessed July 18, 2023.

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-66, 598 p. Accessed August 1, 2023.

Hruby, T., K. Harper, and St. Stanley. 2009. Selecting Wetland Mitigation Sites Using a Watershed Approach. Ecology Publication #09-06-032. December 2009. Available at <https://apps.ecology.wa.gov/publications/documents/0906032.pdf>. Accessed August 5, 2024.

Hunden Partners. 2024. Expo Future Project Update. Metro / MERC Joint Session. December 10, 2024. Available at <https://www.oregonmetro.gov/sites/default/files/2024/12/13/Expo-Future-preferred-scenario-20241210.pdf. Accessed February 26, 2025.

IBR (Interstate Bridge Replacement Program). 2023. Level 2 Toll Traffic and Revenue Study. Available at <https://www.interstatebridge.org/media/sh2lube2/ibr_level-2_tr_report_final_remediated.pdf>. Accessed December 22, 2025.

IBR. 2025a. "Detailed Bridge Lift Data 2007 – 2025."

IBR. 2025b. Navigation Impact Report. Available at < https://www.interstatebridge.org/media/r2ileauk/revisednir_ibrprogram_october2025_withtransmittalletter.pdf>. Accessed May 8, 2026.

Kramer, George, M.S., HP Senior Preservation Specialist. May 2004. The Interstate Highway System in Oregon: A Historic Overview. Prepared for the Oregon Department of Transportation Salem, Oregon. Prepared by Heritage Research Associates, Inc. Eugene, Oregon.

Lee, Matthew and Jamie Stamberger. 2018. Columbia Slough Watershed Council Five Year Stewardship Action Plan 2018–2023.

May, C., C. Luce, J. Casola, M. Chang, J. Cuhaciyan, M. Dalton, S. Lowe, G. Morishima, P. Mote, A. Petersen, G. Roesch-McNally, and E. York. 2018. Northwest. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II (Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart, eds.). U.S. Global Change Research Program, Washington, DC, USA, pp. 1036–1100. DOI: 10.7930/NCA4.2018.CH24.

Metro (Oregon Metro). 2010. Metro. 2010. Wildlife corridors and permeability: A literature review. Available at < https://www.oregonmetro.gov/sites/default/files/2019/08/22/wildlife-corridors-and-permeability-report-April-2010.pdf >. Accessed August 2, 2023.

Metro. 2018. Regional Transportation Plan. December 2018. Available at <https://www.oregonmetro.gov/regional-transportation-plan>. Accessed March 28, 2023.

Metro (Oregon Metro). Not dated. Expo Future. Available at <https://www.oregonmetro.gov/projects/expo-future> Accessed April 27, 2026.

Morlan, J.C., E.F. Blok, J. Miner, and W.N. Kirchner, 2010. Wetland and Land Use Change in the Willamette Valley, Oregon: 1994 to 2005. U.S. Fish and Wildlife Service, Portland, Oregon, and Oregon Department of State Lands, Salem, Oregon.

NIEHS (National Institute of Environmental Health Services). 1999. NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. National Institute of Environmental Health Services, National Institutes of Health. NIH Publication No. 99-4493.

Nilsen, E. and Morace, J., 2014. Foodweb transfer, sediment transport, and biological impacts of emerging and legacy organic contaminants in the lower Columbia River, Oregon and Washington, USA: USGS Contaminants and Habitat (ConHab) Project. Science of the Total

Environment, 484, pp.319-321. Available at <https://www.sciencedirect.com/science/article/pii/S004896971300911X>. Accessed August 1, 2023.

NMFS (National Marine Fisheries Service). 2013. ESA recovery plan for Lower Columbia River Coho salmon, Lower Columbia River Chinook salmon, Columbia River Chum salmon, and Lower Columbia River steelhead. Available at <https://repository.library.noaa.gov/view/noaa/16002>. Accessed July 17, 2023.

NMFS. 2015. ESA recovery plan for Snake River sockeye salmon (Oncorhynchus nerka). Available at < https://repository.library.noaa.gov/view/noaa/16001>. Accessed July 17, 2023.

NMFS. 2020. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Continued Operation and Maintenance of the Columbia River System. Available at <https://repository.library.noaa.gov/view/noaa/26460>. Accessed July 17, 2023.

NMFS. 2022. 2022 5-Year Review: Summary & Evaluation of Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, Lower Columbia River Coho Salmon, and Lower Columbia River Steelhead. Available at <https://repository.library.noaa.gov/view/noaa/16002>. Accessed July 17, 2023.

NPCC (Northwest Power and Conservation Council). 2010. Columbia River History: Bridges. Available at <http://www.nwcouncil.org/history/Bridges.asp>. Accessed January 14, 2011.

NPS (National Park Service). 1997. How to Apply the National Register Criteria for Evaluation. Published 1990, revised 1991, 1995, and 1997. Available <https://www.nps.gov/subjects/nationalregister/upload/NRB-15_web508.pdf> Accessed September 28, 2023.

ODOT (Oregon Department of Transportation). 1999. Oregon Highway Plan. Available at <https://www.oregon.gov/odot/Planning/Documents/OHP.pdf>. Accessed November 1, 2021.

ODOT. 2020. NEPA Environmental Impact Statement Annotated Template. Available at <https://www.oregon.gov/odot/engineering/technical-guidance/pages/ge10-01d.aspx>. Accessed May 13, 2026.

Pelton, M. 2024. Personal Communication of July 26, 2024. Public Records Coordinator. Oregon Department of State Lands.

Portland Floating Homes. 2023. Portland Floating Homes market Report, June 2023. Available at < https://statics.teams.cdn.office.net/evergreen-assets/safelinks/1/atp-safelinks.html>. Accessed August 1, 2024.

Port of Vancouver USA. Not dated. Exemption - Port of Vancouver Terminal 1 Dock/Pier Replacement Application to the City of Vancouver. February 15, 2023.

RTC (Southwest Washington Regional Transportation Council). 2019. Regional Transportation Plan for Clark County. March 2019. Available at <https://www.rtc.wa.gov/programs/rtp/clark/> Accessed March 28, 2023.

USACE (U.S. Army Corps of Engineers). Not dated. Columbia River Treaty. Available at <https://www.nwd.usace.army.mil/crwm/columbia-river-treaty/>. Accessed March 17, 2025.

USACE and CCDD (U.S. Army Corps of Engineers and Columbia Corridor Drainage Districts Joint Contracting Authority). 2021. Portland Metro Levee System Final Integrated Feasibility Report and Environmental Assessment. June 2021.

USACE and EPA (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency). 2008. Compensatory Mitigation for Losses of Aquatic Resources: Final Rule. (73 Federal Register 70, 19594-19705) April 10, 2008. 33 CFR Parts 325 and 332 40 CFR Part 230.

USCB (U.S. Census Bureau). 2000. Decennial Census 2000. Table P53 (Median Household Income) and H63 (Median Gross Rent).

USCB. 2010. Decennial Census 2010. Table P1 (Race).

USCB. 2020. Decennial Census 2020. Table P1 (Race).

USCB. 2021. 2017–2021 American Community Survey. Table B19013 (Median Household Income) and B25064 (Median Gross Rent).

USCG (U.S. Coast Guard). 2022. Preliminary Navigation Clearance Determination for the Interstate Bridge Replacement Program. Letter to Thomas D. Goldstein, PE, IBR Program Oversight Manager, FHWA, from B. J. Harris, Chief, Waterways Management Branch, Coast Guard District 13. June 17. Available at <https://www.interstatebridge.org/media/fi2b3xei/ibr_next_steps_bridge_permitting_june2022_remediated.pdf>. Accessed September 25, 2023.

USCG. 2026. Preliminary Navigation Clearance Determination for the Interstate Bridge Replacement Program. Letter to Carley Francis, Interim IBR Program Administrator, IBR Program, from Brian L Dunn, Chief, Office of Bridge Programs. January 16, 2026. Available at <https://www.interstatebridge.org/media/2ildjsdp/ibrp_pncd_2026.pdf>. Accessed January 16, 2026.

USFWS (U.S. Fish and Wildlife Service). 2019. Pacific Lamprey (*Entosphenus tridentatus*) Assessment. 283 pp. Available at <https://www.pacificlamprey.org/wp-content/uploads/2022/02/Pacific-Lamprey-Entosphenus-tridentatus-Assessment-%E2%80%93-2018-Revision.pdf>. Accessed March 21, 2023.

WSDOT. 2026. Environmental Manual, Chapter 412: NEPA reasonably foreseeable effects and SEPA cumulative impacts. Available at <https://wsdot.wa.gov/publications/manuals/fulltext/m31-11/412.pdf>. Accessed May 18, 2026.