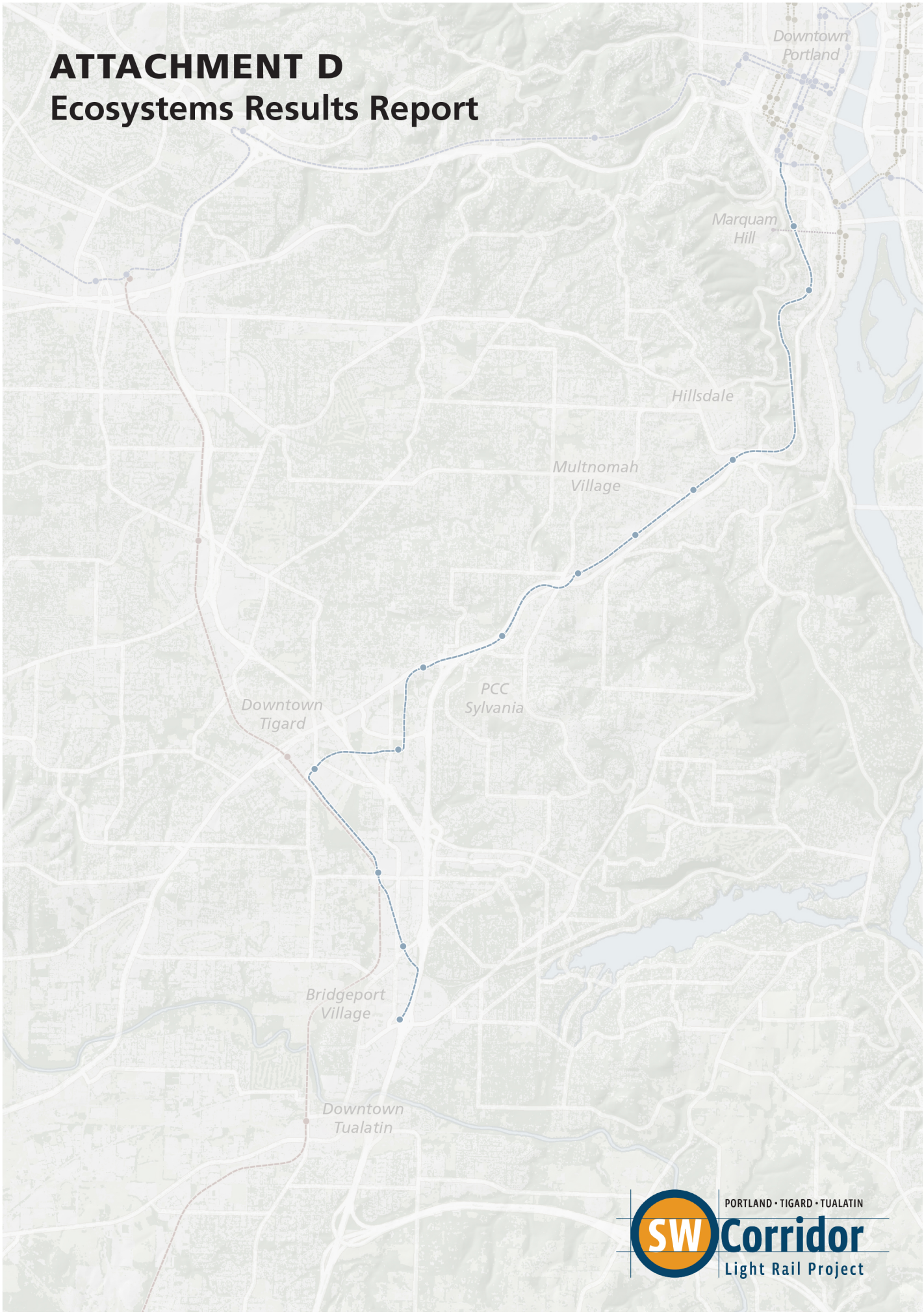
ATTACHMENT D
Ecosystems Results Report



PORTLAND • TIGARD • TUALATIN
SW Corridor
Light Rail Project

Southwest Corridor Light Rail Project
Final Environmental Impact Statement

Attachment D:
Ecosystems Results Report

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1. INTRODUCTION

This Ecosystems Results Report discusses the aquatic species and habitat, vegetation, wetlands, terrestrial wildlife species and habitat, and other biological resources that may be affected by the Southwest Corridor Light Rail Project (the Project). The Project would be subject to federal, state and local regulations concerning potential impacts to biological resources. This ecosystems analysis provides information for the Final Environmental Impact Statement (EIS) prepared in compliance with the National Environmental Policy Act of 1969 (NEPA). This analysis also assumes compliance with the conditions common to permits for large transportation projects. With regard to impact estimation, for example, the analysis assumes that Best Management Practices (BMPs) would be implemented, resulting in a degree of avoidance and minimization of impact.

Ecosystems exist at varying scales within the area affected by the Project. Smaller systems are contained within larger ones. Both natural and human factors can affect ecosystems, and ecosystem health can affect the quality of human life.

This Ecosystems Results Report supports Section 4.9 of the Southwest Corridor Light Rail Project Final EIS, which identifies the potential impacts of the Preferred Alternative, its associated elements, and mitigation. Analysis of the impacts of the Southwest Corridor Light Rail Project Draft EIS alternatives, which is included in Section 4.9 of the Draft EIS, is incorporated by reference. Information on the Draft EIS alternatives is provided in tabular form and discussed in the text of this report to the extent that it provides clarification on the impacts of the Preferred Alternative. Methods for evaluating the existing conditions and potential impacts to ecosystem resources are discussed in the text below where applicable.

1.1. Regulatory Environment

Construction of the Project would be subject to federal, state and local regulations concerning impacts to biological resources, including NEPA. One goal of conducting this ecosystems analysis is to prepare NEPA documentation that can support the environmental review of other agencies' permit decisions for the Project following the issuance of the Record of Decision (ROD) by the Federal Transit Administration (FTA). The principal regulations, ordinances and permit actions that could apply to implementation of the Preferred Alternative are summarized in Table 1.1-1 Many of the processes identified below would be addressed in detail during the design and permitting phase.

Table 1.1-1. Summary of Potential Natural Resource Permit Requirements *(multipage table)*

Regulation/Permit	Responsible Agency	Documentation or Processes Required	Regulated Resources
Federal			
National Environmental Policy Act (NEPA)	Federal Transit Administration (FTA)	NEPA EIS addressing natural resource conditions, impacts and mitigation	Human and natural environment, and related social and economic effects
Clean Water Act (CWA) Section 404 Individual Permit	U.S. Army Corps of Engineers (USACE)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan	Waters of the U.S., including wetlands

Table 1.1-1. Summary of Potential Natural Resource Permit Requirements *(multipage table)*

Regulation/Permit	Responsible Agency	Documentation or Processes Required	Regulated Resources
Federal Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation Management Act	National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS)	Biological Assessment addressing project impacts to listed species, species proposed for listing and candidate species No effect documentation for those ESA-listed species that are not affected	Vegetation, wildlife, fisheries
Fish and Wildlife Coordination Act	USFWS, NMFS and Oregon Department of Fish and Wildlife (ODFW)	Agency consultation; identify impacts to fish and wildlife resources; recommend mitigation	Vegetation, wildlife, fisheries
Migratory Bird Treaty Act	USFWS	Identify impacts to migratory birds; avoid destruction of active nests or eggs, and killing of individuals	Wildlife
Bald and Golden Eagle Protection Act	USFWS	Identify bald eagle nesting habitats; agency consultation	Wildlife
State			
Oregon Removal-Fill Permit	Oregon Department of State Lands (DSL)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan	Waters of the state, including wetlands
Oregon State ESA	ODFW and Oregon Department of Agriculture (ODA)	Identify project impact to state-listed and candidate species not currently listed under federal ESA	Vegetation, wildlife, fisheries
CWA Section 401 Water Quality Certification	Oregon Department of Environmental Quality (DEQ) (Delegated authority for federal law)	Assess project compliance with state water quality standards; implement mitigation measures	Rivers, streams, other bodies of water (Waters of the U.S.)
Fish Passage Law	ODFW	Agency consultation; identify crossed streams with native migratory fish; implement passage at identified streams	Native migratory fish
Local			
Environmental Overlay Zone	City of Portland	Identify adverse impacts; mitigation plan; impact evaluation/ alternatives analysis	Rivers, streams, wetlands and floodplains, vegetation, wildlife and fisheries
Portland City Code, Title 11: Trees	City of Portland	Identify and mitigate trees to be removed	Trees
Stormwater Management Plan	City of Portland	Manage impervious surface runoff and discharge points	Rivers, streams, wetlands
City of Tigard Sensitive Lands	City of Tigard	Identify adverse impacts; mitigation plan	Vegetation, wildlife, fisheries
Tigard Municipal Code, Title 8: Urban Forestry	City of Tigard	Identify and mitigate trees to be removed	Trees
City of Tualatin Natural Resource Overlay Zone	City of Tualatin	Protect natural resources and areas of public value	Vegetation, wildlife, fisheries
Clean Water Services Sensitive Areas	Clean Water Services	Sensitive areas pre-screening, delineation report; natural resource assessment report	Sensitive natural areas and vegetated corridors

1.1.1. Federal Regulations

In addition to NEPA, the primary federal natural resource regulatory approvals that would be required include the Endangered Species Act (ESA) Section 7 process and the Clean Water Act (CWA) Section 404 permit. The federal ESA Section 7 process must be initiated when a federal action, such as funding or permitting, that could affect a species listed or proposed for listing under the federal ESA is undertaken.

Section 7 of the ESA requires consultation by the lead federal agency with the National Marine Fisheries Service (NMFS) and/or U.S. Fish and Wildlife Service (USFWS). Additionally, an analysis of effects on Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation Management Act is required. The Project has initiated consultation with NMFS under the federal ESA and the Magnuson-Stevens Fishery Conservation Management Act based on the identification of the NEPA preferred alternative. A biological assessment (BA) has been prepared that addresses fish species potentially affected by the Preferred Alternative.

Section 404 of the CWA regulates the discharge of dredged or fill materials into "waters of the U.S." (waters), which includes rivers, streams, wetlands and some ditches. Applicants for Section 404 permits must demonstrate that all wetland and water impacts have been avoided to the extent practicable and that unavoidable impacts are offset through compensatory mitigation. An alternatives analysis would be required if the Project's impacts trigger an Individual Permit rather than a Nationwide Permit. That analysis would be completed after the NEPA process is completed. The alternatives analyses in the Draft EIS and Final EIS have addressed the CWA issues to the extent practicable.

In Oregon, permit applications for impacts to jurisdictional wetlands and waters require a combination of federal and state agency approvals. A Joint Permit Application is jointly filed with the U.S. Army Corps of Engineers (USACE) (Section 404 permit) and the Oregon Department of State Lands (DSL) (Oregon Removal-Fill permit). Before a Section 404 permit can be approved, the USACE needs to receive reviews and approvals through the following combination of federal and state agency approvals:

- ESA review by USFWS and/or NMFS
- coordination with state and federal fish and wildlife agencies
- CWA 401 Water Quality Certification from the Oregon Department of Environmental Quality (DEQ)
- Section 106 Compliance from the State Historic Preservation Office (SHPO)

1.1.2. State Regulations

In Oregon, the principal state regulations for biological resources are the CWA Section 401 Water Quality Certification (the USEPA delegated authority to the state), the Oregon Removal-Fill Law, the Oregon Fish Passage Law and the Oregon ESA (see Table 1.1-1).

A Section 404 permit application for wetland and waters impacts triggers review for a Section 401 Water Quality Certification through DEQ. Approval of a post-construction stormwater management plan to address impacts from stormwater to waters and aquatic receptors is necessary before the issuance of a Water Quality Certification.

The Oregon Removal-Fill Law requires a permit for any removal or fill activities within Essential Salmonid Habitat (ESH) or of 50 cubic yards or more in any other water of the state (including wetlands). As mentioned, this permit application would be filed jointly with USACE through the federal CWA Section 404 permitting process. DSL review of the joint application would also include consultation with the Oregon Department of Fish and Wildlife (ODFW), DEQ, the Department of Land Conservation and Development (DLCD), Washington County, the City of Portland, the City of Tigard and the City of Tualatin.

The Oregon Fish Passage Law requires that passage for fish be maintained or restored in streams with current or historical presence of native migratory fish. ODFW reviews fish passage designs.

The Oregon ESA gives ODFW and the Oregon Department of Agriculture (ODA) responsibility and jurisdiction over state-listed threatened and endangered species. Federal ESA Section 7 consultation with USFWS and NMFS supersedes consultation with ODFW for federally listed fish and wildlife species and with ODA for federally listed plant species. Section 3 of this report presents lists of the state-listed and federally listed threatened, endangered and sensitive species potentially occurring within the project corridor. These lists may be refined during the design and permitting phases, but they will continue to include mainstem Willamette River and Columbia River fish species potentially affected by stormwater runoff.

1.1.3. Local Regulations

Under Oregon land use regulations, local and state jurisdictions are required to compile inventories of wetland and other natural areas and protect the highest-ranking inventoried sites. Within the project corridor, this protection is provided by local regulations as discussed below.

The local jurisdictions' environmental zones, sensitive lands overlay zones, and other locally identified regulated areas and resources are generally intended to provide protection for natural resource values that provide benefit to the public. Such areas include sites that meet the standards of Statewide Planning Goal 5 for open space, scenic or natural values. In general, the overlay zones are intended to allow development in situations where adverse impacts from the development can be avoided or mitigated. The regulations of these ordinances provide guidelines for, among other things, identifying, protecting and mitigating impacts and managing important natural resources. Each jurisdiction has its own process for assessment and approval of development projects in the vicinity of sensitive ecosystem resources. The processes generally include an assessment of existing conditions, analysis of potential impacts from a project, and documentation of actions taken to avoid, minimize or compensate for impacts to the resources.

Permit approvals from local jurisdictions would include those related to the following areas:

- City of Portland Environmental Overlay Zone
- City of Tigard Sensitive Land Overlay Zone
- City of Tualatin Natural Resources Overlay Zone
- Clean Water Services (CWS) Sensitive Areas and Vegetated Corridors

In addition, each jurisdiction has its own urban forestry or tree code, which governs tree removal and related mitigation, as well as local requirements for stormwater management and treatment.

2. STUDY AREA

The boundary of the study area for direct effects is complex, because it is based on project elements and extends 50 feet from the edge of construction for the Preferred Alternative alignment and stations, the Hunziker Operations and Maintenance (O&M) Facility, the Marquam Hill Connection, and the related transportation improvements. Rivers, streams, wetlands, floodplains, forested areas and riparian corridors are present within the study area for ecosystem resources.

Table 2.1-1 below summarizes the area in acres for the study area for ecosystem resources. The overall study area size for the Preferred Alternative alignment, stations, all other related elements footprints and buffers is 481.5 acres (392.8 acres for the Upper Boones Ferry Terminus Option), compared to a range of approximately 380.8 to 477.8 acres for the Draft EIS alignment alternatives. The construction footprint and buffer for the Marquam Hill Connection is 5.1 acres under the Preferred Alternative, compared to a range between 4.2 and 6.0 acres for the Draft EIS alignment alternatives. The Hunziker O&M Facility construction footprint and buffer total 29.0 acres under the Preferred Alternative, while the study area for the O&M facilities options in the Draft EIS ranges between approximately 11.8 and 22.3 acres in size. The Draft EIS study area did not include the related transportation improvements.

Table 2.1-1. Footprint and Buffer Areas by Project Element

Segment	Construction Footprint Area (acres)	50-Foot Buffer Area (acres)	Total Study Area (acres)[1]
Light Rail Investment			
Segment A alignment and stations	62.9	41.0	103.9
Segment B alignment and stations	117.2	67.4	184.6
Segment C alignment and stations – Preferred Alternative	93.5	65.3	158.9
Segment C alignment and stations – Upper Boones Ferry Terminus Option	34.7	35.5	70.2
Marquam Hill Connection	3.3	1.8	5.1
Hunziker O&M Facility	24.1	4.9	29.0
Related Transportation Improvements			
Ross Island Bridgehead Reconfiguration	30.2	18.7	49.0
Station access improvements	130.2	203.5	333.7
TOTALS			
Preferred Alternative	301.0	180.4	481.5
Upper Boones Ferry Terminus Option[2]	242.2	150.6	392.8
Hall Terminus Option	216.0	134.3	350.3
Full Project (Preferred Alternative + all Related Transportation Improvements)	461.4	402.6	864.1
Draft EIS Alternatives (Range)			
Segment A alignment alternatives	54.9 to 64.9	40.6 to 48.1	95.5 to 113.0
Segment B alignment alternatives	85.8 to 100.6	74.9 to 100.6	160.7 to 201.2
Segment C alignment alternatives	49.5 to 61.0	59.4 to 74.3	108.9 to 135.3
Marquam Hill connection options	1.4 to 2.6	2.8 to 3.4	4.2 to 6.0
O&M facility options	7.7 to 17.4	3.8 to 4.9	11.5 to 22.3

[1] Due to rounding, some totals might not correspond with the sum of the separate values.

[2] The construction footprint, buffer and study area for the Hall Terminus Option are smaller than those of the Upper Boones Ferry Terminus Option.

An expanded analysis area is used to address indirect, downstream impacts to fish that may be affected by stormwater quality and hydrologic modifications. These fish include those listed under the federal ESA and the Magnuson-Stevens Fishery Conservation and Management Act. For the ESA consultation, the analysis area extends to the mouth of the Columbia River at the Pacific Ocean because of the potential indirect effects on those species.

The study area for wildlife species is 0.25 mile from the edge of construction. Ground-truthing was conducted both where imprecise spatial data suggested further investigation was necessary and where access was available.

3. AFFECTED ENVIRONMENT

Much of the study area is along existing transportation corridors with adjacent urbanized land uses. These land uses include commercial and residential buildings, schools, roads, sidewalks, railways and other infrastructure. The remainder of the study area consists of forested lands and undeveloped areas adjacent to the northern portion of SW Barbur Boulevard and within road and railway rights of way. Specific habitats and ecosystem resources that exist in the study area are described below.

3.1. Aquatic Habitat

The study area is within the following four subwatersheds, also called the 12-digit Hydrologic Unit Code [HUC12] areas, which is the finest detail mapped in the region. These four subwatersheds are located in two subbasins:

- Willamette River subwatershed – HUC 170900120202 (Lower Willamette subbasin)
- Oswego Creek-Willamette River subwatershed – HUC 170900120104 (Lower Willamette subbasin)
- Fanno Creek subwatershed – HUC 170900100502 (Tualatin River subbasin)
- Saum Creek-Tualatin River subwatershed – HUC 170900100504 (Tualatin River subbasin).

Segments A and B under the Preferred Alternative cross the same watercourses within the same reaches as the Draft EIS alignment alternatives. Segment C under the Preferred Alternative crosses the same watercourses within the same reaches as Draft EIS Alternative C2. The watercourses are mapped in a dataset available from Metro's Regional Land Information Service (RLIS) (Metro, 2020). Based on mapping, the majority of these streams currently flow under the Preferred Alternative alignment within pipes or culverts. The Preferred Alternative includes four crossings of two named streams (three over Red Rock Creek and one over Ball Creek). Streams that run through pipes or culverts have been previously impacted by development and are largely paved over within the study area (see Figure 3.1-1, Figure 3.1-2 and Figure 3.1-3). Within the study area, there is minimal natural habitat associated with these streams.

Of the watercourses located within the study area, only a few are named in RLIS (Stephens Creek, Tryon Creek, Ball Creek and Red Rock Creek). Several others have local names, but those names are not in the datasets. Red Rock Creek is the largest stream that flows mainly on the surface in the study area. When names are not available, the latitude-longitude identification number (LLID), which is a unique 13-digit code, is used to identify streams.

Figure 3.1-1. Ecosystem Resources: Segment A

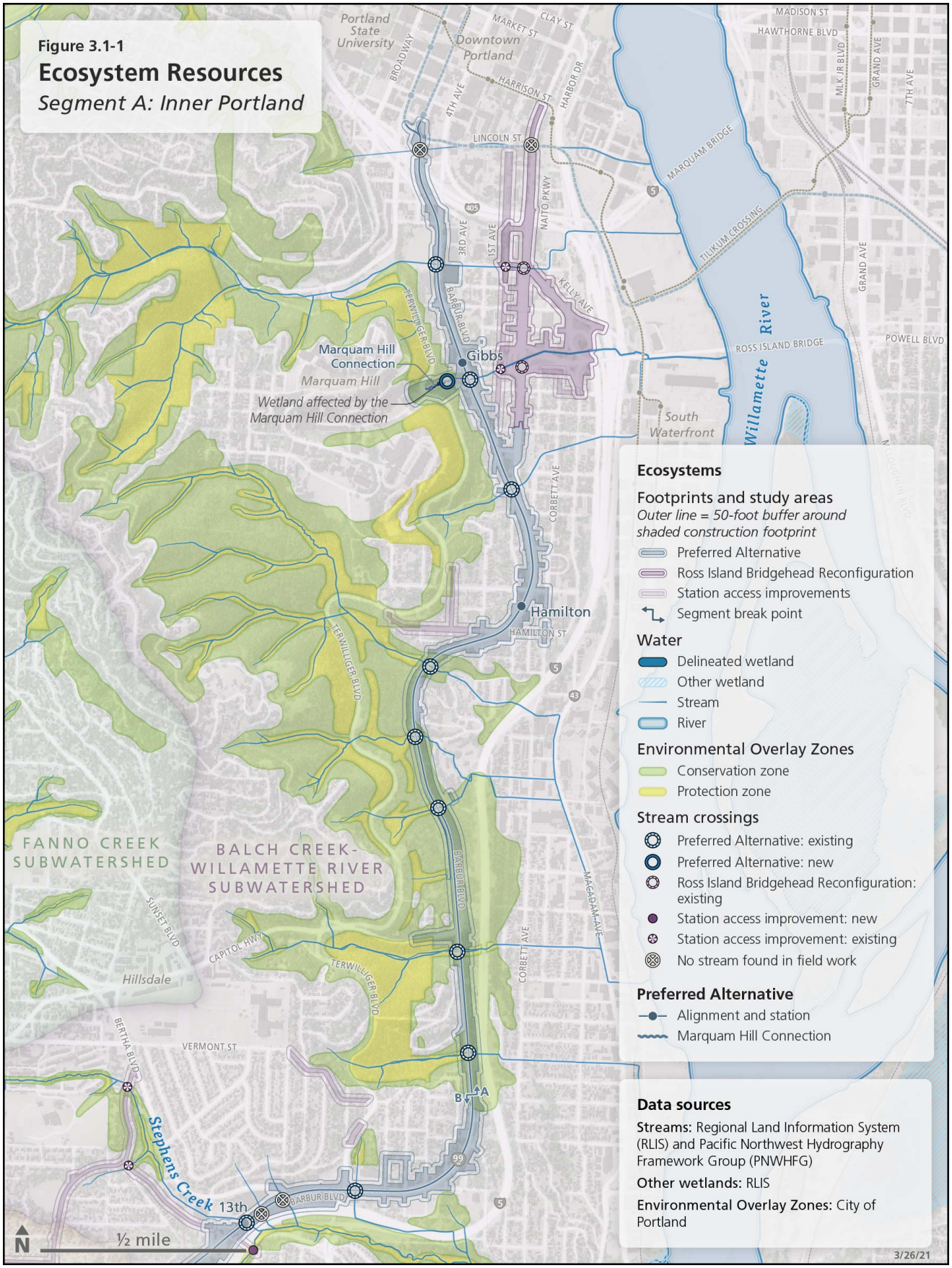


Figure 3.1-2. Ecosystem Resources: Segment B

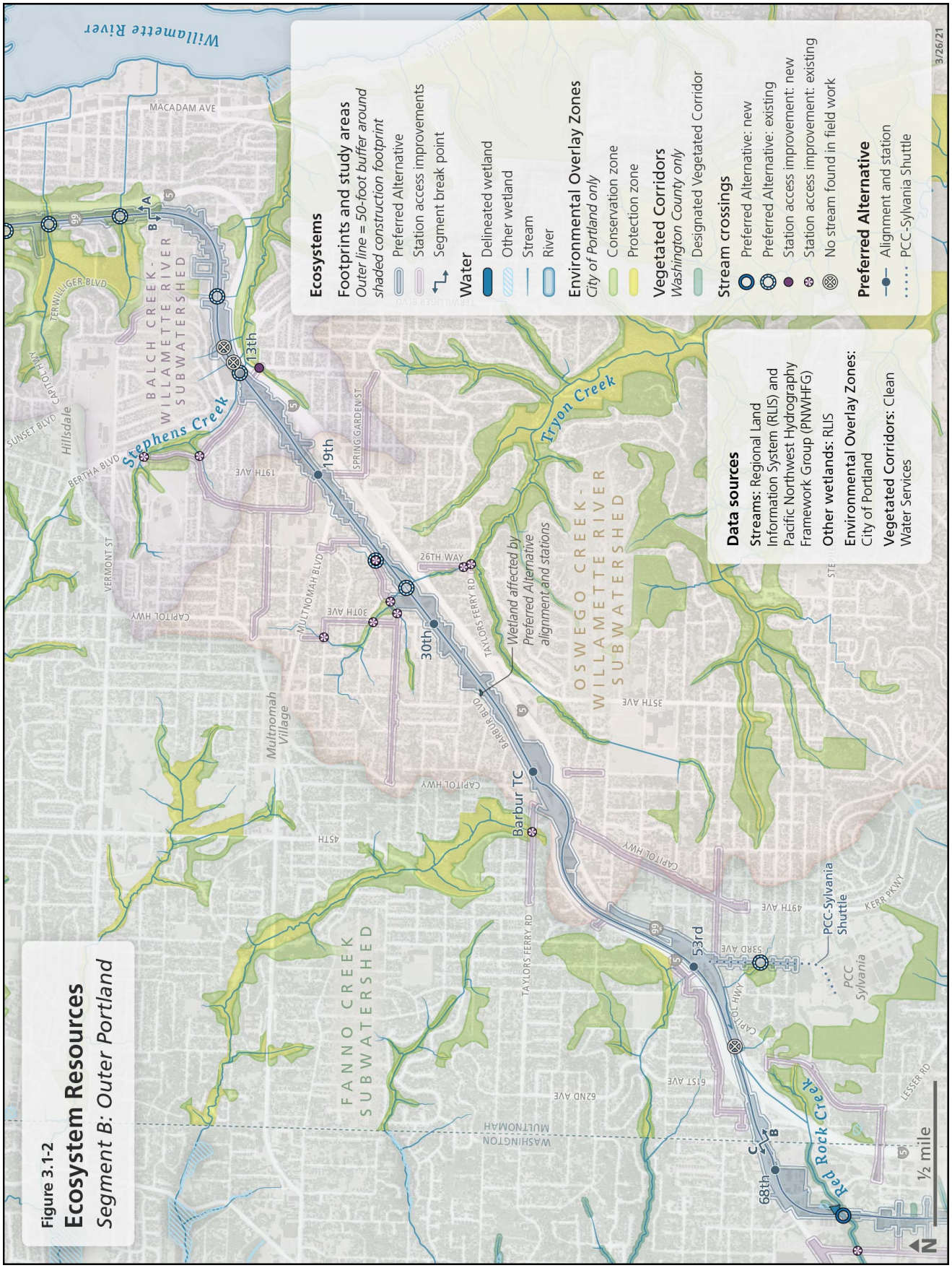


Figure 3.1-3. Ecosystem Resources: Segment C

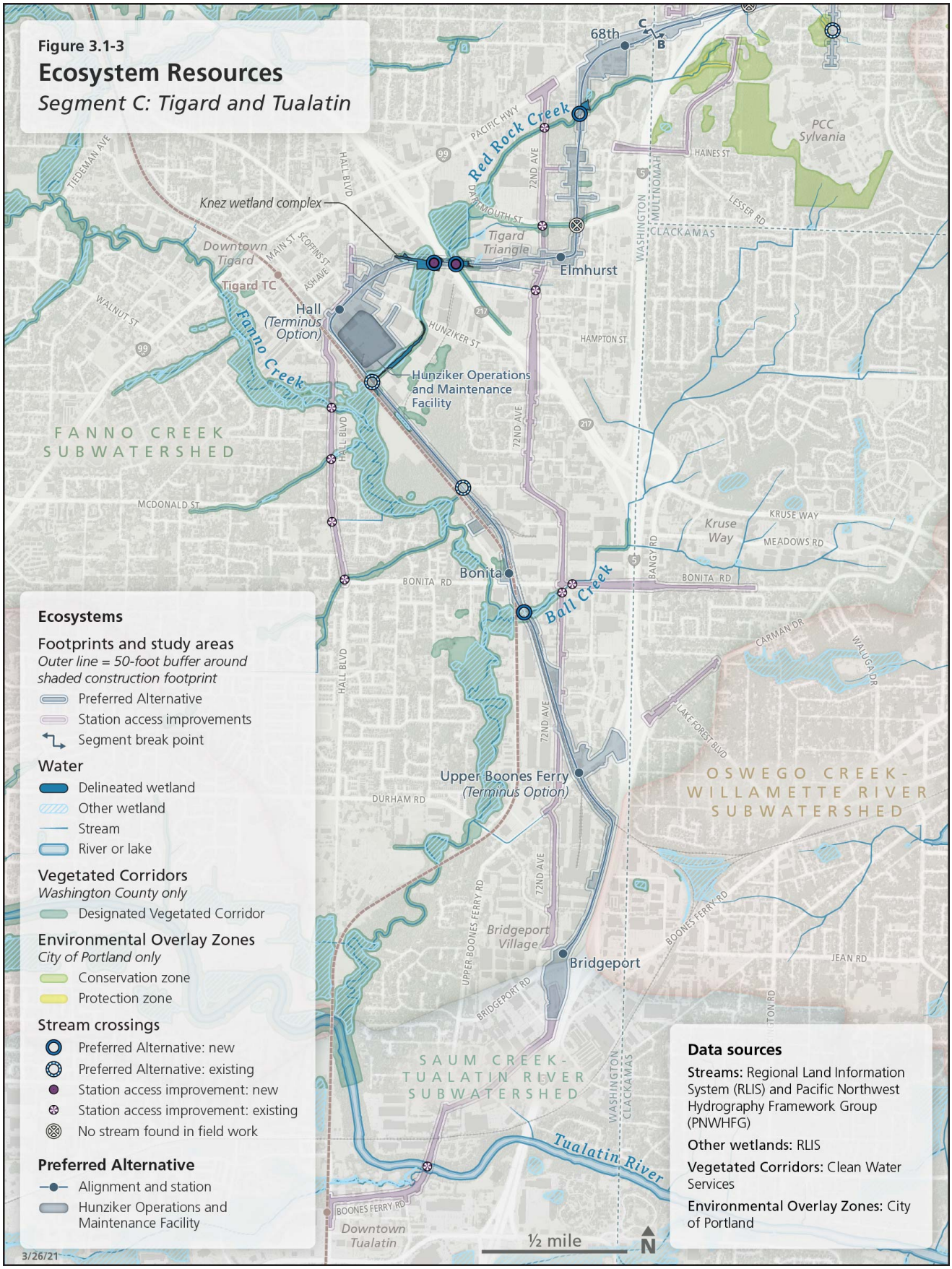


Table 3.1-1 provides a summary of the streams present within the study area, the data source of the stream name/LLID and location, whether the mapped stream passes under the Preferred Alternative alignment on the surface or is piped, and the stream's location within subwatersheds (HUC12) and project segments. Because the RLIS stream data are more detailed and were updated more recently, RLIS was used as the primary source of information on mapped streams, while PNWHFG was used only as a supplemental source. PNWHFG included three streams that were not in the RLIS database. These streams were not found during field investigation but are retained in the table for informational purposes.

Most of the streams are small and flow through pipes under the footprint and buffers of the Preferred Alternative alignment and stations. The few surface waters include Red Rock Creek and Ball Creek, as well as a small number of their tributaries. None of these streams have a free and open connection to streams that are known to support anadromous fish, such as Fanno Creek and the Willamette River. Small numbers of resident and anadromous fish might occur in portions of the study area in streams such as Red Rock Creek and Ball Creek under certain circumstances.

Table 3.1-1. Mapped Streams within the Preferred Alternative Ecosystems Study Area

Name/LLID	Source[1]	Status	Subwatershed (HUC12)
Segment A: Inner Portland			
1226684455094	PNWHFG	Piped, not found during field work	Willamette River
1226675455059	RLIS	Piped	Willamette River
1226653455017	RLIS	Piped (two crossings)	Willamette River
1226714455006	RLIS	Piped	Willamette River
1226780454885	RLIS	Piped	Willamette River
1226783454858/1226817454846 (branched)	RLIS	Piped	Willamette River
1226690454806	RLIS	Surface to pipe	Willamette River
1226662454766	RLIS	Piped	Willamette River
Segment B: Outer Portland			
1226790454686	RLIS	Piped	Willamette River
1226865454699	PNWHFG	Piped, not found during field work	Willamette River
1226876454698	PNWHFG	Piped, not found during field work	Willamette River
1226667454690 (Stephens Creek)	RLIS	Piped	Willamette River
1227048454606	RLIS	Piped	Oswego Creek-Willamette River
1227019454579 (Tryon Creek)/ 1226557454227	RLIS	Piped	Oswego Creek-Willamette River
1227422454406	RLIS	Piped	Fanno Creek
1227375454443	RLIS	Piped, not found during field investigation	Fanno Creek
Segment C: Tigard and Tualatin			
1227626454239 (Red Rock Creek)	RLIS	Piped and surface at various intervals (three crossings)	Fanno Creek
1227575454326	RLIS	Piped, not found during field work	Fanno Creek
1227575454314	RLIS	Surface	Fanno Creek
1227534454137 (Ball Creek)	RLIS	Surface	Fanno Creek

[1] RLIS was used as the primary source of mapped stream data. PNWHFG data were used only if there was no corresponding stream in the RLIS data. Surface streams were also investigated as part of field reviews.

3.2. Aquatic Species

Several databases were queried for potential presence of sensitive species in the study area, including the Oregon Biodiversity Information Center (ORBIC) database, publicly available data from the USFWS Information, Planning, and Consultation System (IPaC), USFWS's Species by County Reports, and ODFW's Centralized Oregon Mapping Products and Analysis Support System (COMPASS). The database searches revealed the presence within the expanded analysis area (action area), but not within the direct effect study area, of eight species of fish listed under the federal or state ESA, or as federal species of concern or state sensitive. Of these, five species are salmon and steelhead, and are represented by seven evolutionarily significant units (ESUs) or distinct population segments (DPSs) (see Table 3.2-1). Because of the potential effects of stormwater runoff from the study area, additional species that will be addressed in the federal ESA consultation process include those ESUs/DPSs listed by NMFS that utilize the Lower Columbia River for migration and rearing, including those originating in the Upper Willamette River, Snake River, Upper Columbia River and Middle Columbia River sub-basins. Appendix L to the Final EIS, Biological Opinion, contains the ESA consultation documentation that discusses these species, their habitats, and potential impacts in more detail.

Table 3.2-1. Fish Species Recorded as Potentially Present in the Vicinity of the Project *(multipage table)*

	Federal Status			State Status					County[1]			
Scientific Name **Common Name**	Listed Threatened	Species of Concern[2]	Critical Habitat[3]	Listed Endangered	Sensitive[4]	Sensitive Critical[5]	ORBIC[6]	IPaC[7]	Multnomah	Clackamas	Washington	COMPASS[8]
Acipenser medirostris												
Green sturgeon	●		●		●		●					
Entosphenus tridentata												
Pacific lamprey		●			●		●					
Oncorhynchus clarki												
Coastal cutthroat trout Lower Columbia River ESU					●							●
Oncorhynchus keta												
Chum salmon Columbia River ESU	●		●			●						
Oncorhynchus kisutch												
Coho salmon Lower Columbia River ESU	●		●	●			●					●
Oncorhynchus mykiss												
Steelhead Lower Columbia River DPS	●		●			●	●					●
Steelhead Upper Willamette River DPS	●		●				●					●
Oncorhynchus tshawytscha												
Chinook salmon Lower Columbia River ESU	●		●			●	●					●
Chinook salmon Upper Willamette River ESU	●		●			●	●					●

Table 3.2-1. Fish Species Recorded as Potentially Present in the Vicinity of the Project *(multipage table)*

	Federal Status			State Status					County[1]			
Scientific Name **Common Name**	Listed Threatened	Species of Concern[2]	Critical Habitat[3]	Listed Endangered	Sensitive[4]	Sensitive Critical[5]	ORBIC[6]	IPaC[7]	Multnomah	Clackamas	Washington	COMPASS[8]
Salvelinus confluentus												
Bull trout	●				●				●	●		
Thaleichthys pacificus												
Pacific eulachon	●		●									

Sources and Notes:

[1] USFWS Species by County, available at: https://www.fws.gov/endangered/ (2020a).

[2] Taxa that were previously Category 1 (C1) or Category 2 (C2) candidates for which further information is needed to warrant listing as threatened or endangered.

[3] Critical Habitat has been designated for this species.

[4] Taxa that are facing one or more threats to their populations and/or habitats.

[5] Taxa that are of particular conservation concern.

[5] Oregon Biodiversity Information Center (ORBIC), 2017.

[6] USFWS Information for Planning and Consultation (IPaC), 2020b.

[7] ODFW Centralized Oregon Mapping Products and Analysis Support System (COMPASS), 2020.

Note: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit; N/A = Not Applicable.

Federal Status – U.S. Fish and Wildlife Service and National Marine Fisheries Service

State Status – Oregon Department of Fish and Wildlife

The species listed in Table 3.2-1 occur in the expanded analysis area of the Fanno Creek, Willamette River and Columbia River drainages, downstream of the study area. Anadromous fish are likely not present within the more limited project study area itself due to long-standing natural and artificial barriers, although small numbers of resident fish may occur in portions of the study area in streams such as Red Rock Creek and Ball Creek. ODFW (2009) conducted fish presence surveys in several streams in the vicinity of the Project alignments. Within Segment A, ODFW found 17 total species in the lowest reach of Stephens Creek (LLID 1226667454690). The Stephens Creek reach that was sampled was downstream of a culvert under Highway 43 (SW Macadam Avenue), which presents a passage barrier of unknown status for fish. An additional 2,500-foot culvert is in place from approximately 400 feet downstream of where the stream crosses under Interstate 5 (I-5) to where it daylights (returns to the surface) near SW Bertha Boulevard.

Within Segment B, the Preferred Alternative would cross the upper reaches of Tryon Creek (LLID 1226557454227 in the RLIS dataset). The stream under the alignment is piped through a 54-inch-wide, 590-foot-long culvert. The stream appears to flow at the surface for the remainder of its course (with the exception of several culverts) before flowing through Tryon Creek State Park and discharging to the Willamette River approximately 3.6 miles downstream of the Preferred Alternative alignment. Several anadromous fish species are known to occur in the lower reaches of Tryon Creek, but not within the study area. Coho salmon and steelhead are recorded as being present up to Tryon Creek's crossing of SW Maplecrest Drive, approximately 4,500 linear feet southeast of the alignment (ODFW, 2009). Farther south along Segment B, ODFW found no fish in Woods Creek (LLID 1227615454726), which is adjacent to the light rail alignment near SW Capitol Highway (ODFW, 2009).

No studies have been published regarding migratory or resident fish presence within the study area in Segment C. Given the number and lengths of culverts between the Preferred Alternative alignment and

Fanno Creek (the closest fish-bearing stream), the presence of anadromous and/or migratory fish near the alignment is unlikely, but it is possible that small numbers of resident fish may inhabit portions of Red Rock Creek and Ball Creek.

No streams within the study area are known to support anadromous fish; however, further investigation would need to occur to ensure compliance with the Oregon Fish Passage Law. Any new or revised structures over streams with current or historical presence of native migratory fish would need to be designed to meet fish passage criteria.

Impacts to floodplains can affect aquatic habitats and fish through changes in vegetation, off-channel refuge and hydrology. Table 3.2-2 shows the area of mapped 100-year floodplains intersecting the Preferred Alternative study area compared to the Draft EIS alignment alternatives (see also Figure 3.2-1). No mapped 100-year floodplains are located within Segments A and B of the study area. Within Segment C, approximately 2.8 acres of mapped 100-year floodplains occur within the construction footprint and an additional 3.0 acres of wetlands occur within the buffer. Approximately 3.5 acres of 100-year floodplains are located within the Hunziker O&M Facility overall footprint and an additional 1.0 acre is located within the buffer. However, O&M structures would likely not be constructed in the floodplain. Additional detail regarding floodplains is contained in Section 4.10, Water Resources, of the Final EIS.

Table 3.2-2. Mapped 100-Year Floodplains within Footprint and Buffer Areas

	Mapped 100-Year Floodplains in Construction Footprint	Mapped 100-Year Floodplains in 50-Foot Buffer	Mapped 100-Year Floodplains (total)
Preferred Alternative			
Segment A alignment and stations	0.0	0.0	0.0
Segment B alignment and stations	0.0	0.0	0.0
Segment C alignment and stations	2.8	3.0	5.8
Marquam Hill Connection	0.0	0.0	0.0
Hunziker O&M Facility[1]	3.5	1.0	4.5
Related Transportation Improvements			
Ross Island Bridgehead Reconfiguration	0.0	0.0	0.0
Station access improvements[2]	5.6	9.4	14.9
TOTALS			
Preferred Alternative	6.5	4.1	10.7
Upper Boones Ferry Terminus Option[3]	6.5	4.1	10.7
Full Project[4]	12.1	13.4	25.5
Draft EIS Alternatives (Range)			
Draft EIS alignment alternatives[5]	0.6 to 9.7	1.5 to 5.1	2.1 to 14.8

[1] While the footprint for the Hunziker O&M Facility encompasses portions of the 100-year floodplain, O&M structures would be outside of the floodplain boundary.

[2] Station access improvement footprints are defined by the extent of the current right of way where improvements will be made. Buffers of 50 feet have been added to this footprint.

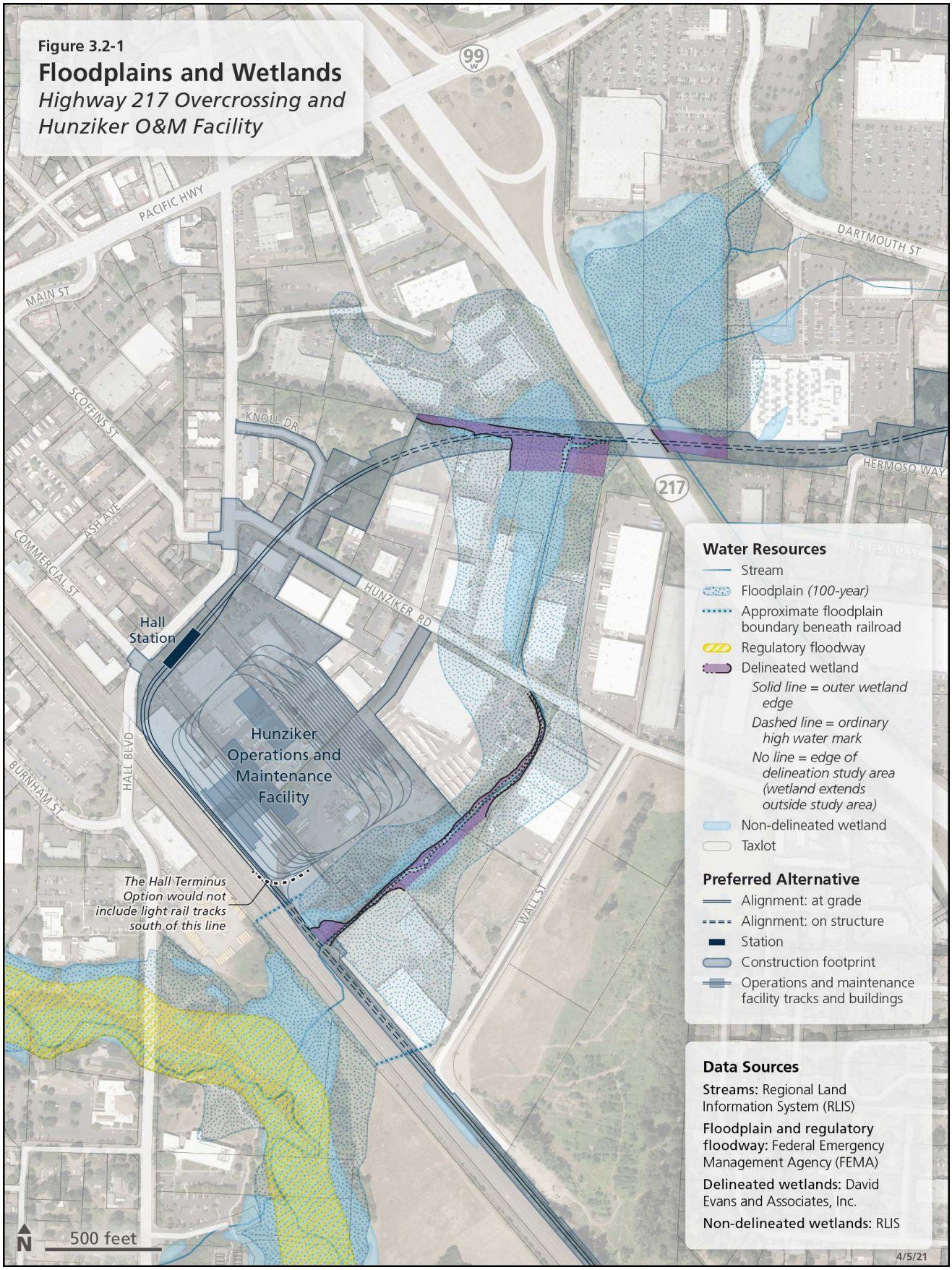
[3] Numbers presented are for the Upper Boones Ferry Terminus Option; the Hall Terminus option would avoid floodplain impacts south of the Hunziker O&M Facility.

[4] Full Project impacts include overlaps between the Preferred Alternative and station access improvements and buffers.

[5] Draft EIS analysis did not include the related transportation improvements.

Note: EIS = Environmental Impact Statement; O&M = Operations and Maintenance.

Figure 3.2-1. Floodplains and Wetlands: Highway 217 Overcrossing and Hunziker O&M Facility



3.3. Vegetation and Wildlife Species and Habitat

3.3.1. Vegetation

The habitat mapping within Segments A and B under the Preferred Alternative, shown in Figure 3.1-1 and Figure 3.1-2, is derived from the City of Portland Bureau of Planning & Sustainability vegetation mapping project, which began in 2004. It emerged from a Geographic Information Systems (GIS) model intended to produce a relatively fine-scale inventory of landscape features that contribute to riparian and upland natural resource values and functions. The mapping project methods are described in the summary document prepared by the City of Portland (2011).

As shown in Table 3.3-1, the City of Portland maps the greatest amount of acreage of forest within Segment A, both in the construction footprint and the associated buffers. This forest habitat occurs on slopes adjacent to SW Barbur Boulevard in the southern half of the segment. The northernmost portion of Segment A consists of heavily developed and urbanized areas with relatively little vegetation present.

The Preferred Alternative alignment and stations in Segment A contain approximately 19.9 acres of mapped forest within the construction footprint and approximately 12.9 acres within the buffers. Mapped woodland habitat occupies approximately 3.6 acres of the construction footprint in Segment A and 2.3 acres within the buffers. Mapped shrublands occupy approximately 0.4 acre within the construction footprint in Segment A and approximately 0.5 acre within the buffers. Approximately 0.9 acre of mapped herbaceous cover occurs within the construction footprint in Segment A and an additional 0.6 acre occurs within the buffers. The total amount of mapped vegetation classes within the construction footprint and buffers in Segment A is approximately 41.2 acres, compared to a range between 37.4 and 39.6 acres for the Draft EIS alignment alternatives.

Much of the area west of Segment A has been identified by the Portland Parks and Recreation as a portion of the Westside Wildlife Corridor (City of Portland 2020). This corridor is the forested spine of the West Hills and is identified as a local target area for linking Forest Park to Tryon Creek, buffering existing natural areas, and providing neighborhood access to trails, among other criteria (City of Portland 2020). This corridor does not convey any additional regulations or protections that are not already afforded by local land use regulations.

The Preferred Alternative alignment and stations in Segment B contain approximately 5.2 acres of mapped forest within the construction footprint and approximately 2.7 acres within the buffers. Approximately 5.2 acres of mapped woodland habitat occur within the construction footprint in Segment B and approximately 2.6 acres occur within the buffers. Less than 0.01 acre of shrubland is mapped within the construction footprint and buffer of Segment B. Approximately 6.6 acres of mapped herbaceous cover occur within the construction footprint in Segment B and an additional 2.3 acres are within the buffers. The total amount of mapped vegetation classes within the construction footprint and buffers in Segment B is approximately 24.6 acres, compared to a range of 26.0 to 31.1 acres for the Draft EIS alignment alternatives.

Given the scale of the effort, the City of Portland (2011) vegetation layer provides relatively precise habitat mapping, which was used to calculate impacts. Although small inaccuracies were noted in the field (such as new developments where habitat was previously mapped), they were generally minor. For example, tree canopies overhanging roads, and even developed areas without tree canopy cover, are frequently included

in the mapping when viewed closely. Since these inaccuracies tended to overestimate rather than underestimate impacts, the mapping information was used for the purposes of the Final EIS reporting. While field observations and surveys were conducted, they do not cover all of the Project area and are not as comprehensive as the mapped resources. More detailed surveys were conducted based on identification of the Preferred Alternative, but were limited by property access restrictions in this urbanized corridor, where property owners needed to consent before field work could be conducted. In many cases, property owners did not respond or denied requests, particularly after the onset of COVID-19.

Within Segment C, the majority of the study area consists of developed land cover with more localized areas of forest and other types of vegetative cover. The Cities of Tigard and Tualatin do not have vegetation mapping resources analogous to the City of Portland vegetation layer. Therefore, to quantify the study area, vegetated land cover types within Segment C were characterized via use of CWS's mapped vegetated corridors and review of available desktop tools, such as Google Earth and the City of Tigard's urban forestry GIS layers.

Table 3.3-1. Area in Acres of Vegetation Classes Identified by City of Portland (2011) Present within Segments A and B

	Forest (Footprint / Buffer)	Herbaceous (Footprint / Buffer)	Shrubland (Footprint / Buffer)	Woodland (Footprint / Buffer)	Total of All Classes (Footprint / Buffer)
Preferred Alternative					
Segment A alignment and stations	19.9 / 12.9	0.9 / 0.6	0.4 / 0.5	3.6 / 2.3	24.8 / 16.3
Segment B alignment and stations	5.2 / 2.7	6.6 / 2.3	0 / <0.01	5.2 / 2.6	17.0 / 7.6
Marquam Hill Connection	1.2 / 1.1	0 / 0	0 / 0	0 / 0	1.2 / 1.1
PCC-Sylvania Shuttle	0.5 / 1.5	0 / 0	0 / 0	0.1 / 0	0.6 / 1.5
Light Rail Investment: Total					
Preferred Alternative and terminus options	26.8 / 18.2	7.5 / 2.9	0.4 / 0.5	8.9 / 4.9	43.6 / 26.5
Related Transportation Improvements					
Ross Island Bridgehead Reconfiguration	0.2 / 0.5	1.4 / 0.3	0 / 0	1.7 / 2.1	3.3 / 2.9
Station access improvements[1]	7.1 / 10.2	0.4 / 1.9	0.0 / 0.2	3.3 / 6.4	10.8 / 18.7
Full Project[2]					
Preferred Alternative + all related transportation improvements	34.1 / 28.9	9.3 / 5.1	0.4 / 0.7	13.9 / 13.4	57.7 / 48.1

[1] Footprints of the station access improvements are defined by the extent of the current right of way where improvements will be made. Fifty-foot buffers have been added to this footprint.

[2] Impacts shown for the full Project include overlapping areas between the Preferred Alternative and station access improvements and buffers (i.e., totals include double-counting).

While the vegetation classes provide an indication of the potential impacts to different wildlife habitat and vegetation types present in Segments A and B, the local development regulations require compliance with the standards governing Environmental Zones (E-zones). Within Segment A, the total acreage of E-zone area within the construction footprint for the Preferred Alternative alignment, stations, and Marquam Hill Connection is 28.8 acres. E-zone areas within construction buffers total approximately 14.7 acres. Most of these E-zone areas are associated with the forested area along SW Barbur Boulevard.

Within Segment B, total acreage of E-zone areas within the construction footprint for the Preferred Alternative alignment and stations is 1.0 acre, and within construction buffers is approximately 1.3 acres. Like Segment A, most of these areas are associated with the forested area along SW Barbur Boulevard.

Segment C is in the cities of Tigard and Tualatin, where the City of Portland E-zone designations do not apply; however, CWS does designate and regulate vegetated riparian corridors, which come with protections similar to those afforded by E-zones in Portland. Designated vegetated corridors are regulated by Chapter 3 of the CWS Design and Construction Standards (CWS, 2017). These corridors are located mainly around surface waters, as shown on Figure 3.1-3.

Within Segment C, the majority of the study area consists of developed land cover. Developed land cover includes commercial and residential buildings, schools, roads, sidewalks, railways and other infrastructure. The remainder of the study area consists of several undeveloped areas primarily within road and railway rights of way; the riparian corridor of Red Rock Creek, Fanno Creek and others, including several wetlands; park areas adjacent to creeks; and undeveloped lots. Mapped vegetated corridors within the construction footprint total approximately 8.0 acres (see Table 3.3-2). Mapped vegetated corridors within the construction buffers total approximately 5.9 acres. Most of these corridors are associated with the forested areas along Red Rock Creek and Fanno Creek. In addition, approximately 2.4 acres of vegetated corridors are within the construction footprint of the Hunziker O&M Facility and 1.0 acres are located within the buffer. Approximately 2.0 acres of vegetated corridors are within the construction footprint for the Segment C station access improvements, while an additional 5.5 acres are located within the buffers.

Table 3.3-2. Environmental Zones and Vegetated Corridors within the Study Area

Project Element	Acres of E-Zones[1] *(City of Portland)*			Acres of Vegetated Corridor *(City of Tigard)*		
	Construction Footprint	50-Foot Buffer	Study Area Total	Construction Footprint	50-Foot Buffer	Study Area Total
Light Rail Investment: Individual Elements						
Segment A alignment and stations	27.1 (25.7 C/1.4 P)[1]	13.4 (12.3 C/1.1 P)	40.5	0.0	0.0	0.0
Segment B alignment and stations	1.0 (1.0 C/0.0 P)	1.3 (1.2 C/0.1P)	2.3	0.0	0.0	0.0
Segment C alignment and stations	0.0	0.0	0.0	7.9	5.9	13.8
Marquam Hill Connection	1.7 (1.7 C/0.0 P)	1.4 (1.3 C/0.1P)	3.1	0.0	0.0	0.0
PCC-Sylvania Shuttle	0.0	0.0	0.0	0.0	0.0	0.0
Hunziker O&M Facility	0.0	0.0	0.0	2.4	1.0	3.4
Light Rail Investment: Total						
Preferred Alternative	29.8	16.1	45.9	10.3	6.9	17.2
Upper Boones Ferry Terminus Option	29.8	16.1	45.9	10.3	6.9	17.2
Hall Terminus Option	29.8	16.1	45.9	7.9	5.9	13.8
Related Transportation Improvements						
Ross Island Bridgehead Reconfiguration	0.0	0.0	0.0	0.0	0.0	0.0
Station access improvements[2]	1.7	6.2	7.9	2.0	5.5	7.5
Full Project[3]						
Preferred Alternative + all related transportation improvements	31.5	22.3	53.8	12.3	12.4	24.7

Note: O&M = operations and maintenance.

[1] Portland E-zones are designated as "Conservation" or "Protection." The breakout is provided in the table for Segments A and B.

[2] Station access improvement footprints are defined by the extent of the current right of way where improvements will be made.

[2] Impacts shown for the full Project include overlapping areas between the Preferred Alternative and station access improvements and buffers (i.e., totals include double-counting).

Within Segment C, the City of Tigard also designates and regulates Sensitive Lands, per Chapter 18.510 of the Tigard Community Development Code. Sensitive lands generally encompass lands potentially unsuitable for development because of their location within:

1. The special flood hazard area or 1996 flood inundation line, whichever is greater;
2. Natural drainageways;
3. Wetland areas that are regulated by the other agencies including the U.S. Army Corps of Engineers and the Department of State Lands, or are designated as significant wetland on the City of Tigard Wetland and Stream Corridors Map;
4. Steep slopes of 25 percent or greater and unstable ground; and
5. Significant fish and wildlife habitat areas designated on the City of Tigard Significant Habitat Areas Map.

Within the Tigard portion of Segment C, the total area represented by designated sensitive lands as shown in Table 3.3-3 below overlaps in large part with the CWS vegetated corridors, floodplains, and wetlands described in other sections of this report. In addition to these areas the total acreage of sensitive lands includes significant fish and wildlife habitat areas and areas of steep slopes. The Tigard Community Development Code places additional development restrictions on designated sensitive lands that are specific to the City of Tigard, beyond those protections already afforded by other federal, state, and local regulations. These restrictions require an amendment to the Tigard Comprehensive Plan in order for development to take place on sensitive lands. Mapped sensitive lands within the Segment C construction footprint total approximately 15.6 acres (see Table 3.2-3). Mapped sensitive lands within the construction buffers total approximately 14.1 acres. In addition, approximately 5.6 acres of sensitive lands are within the construction footprint of the Hunziker O&M Facility and 1.2 acres are located within the buffer. Approximately 11.0 acres of sensitive lands are within the construction footprint for the Segment C station access improvements, while an additional 21.0 acres are located within the buffers. Most of these areas are coextensive with areas of wetlands, floodplains, and designated vegetated corridors described above.

Table 3.3-3. Sensitive Lands in Segment C (Tigard)

	City of Tigard Sensitive Lands in Footprint (acres)	City of Tigard Sensitive Lands in 50-Foot Buffer (acres)	Total City of Tigard Sensitive Lands (acres)
Preferred Alternative			
Segment C alignment and stations	15.6	14.1	29.7
Hunziker O&M Facility	5.6	1.2	6.8
Related Transportation Improvements			
Station access improvements[1]	11.0	21.0	32.0
TOTALS			
Preferred Alternative	21.2	15.1	36.3
Upper Boones Ferry Terminus Option[2]	20.0	14.9	34.9
Full Project[3]	32.2	36.1	68.3
Draft EIS Alternatives			
Draft EIS alignment alternatives[4]	N/A	N/A	N/A

[1] Station access improvement footprints are defined by the extent of the current right of way where improvements will be made. Buffers of 50 feet have been added to this footprint.

[2] The Hall Terminus Option would impact a smaller acreage of City of Tigard sensitive lands than the Upper Boones Ferry Terminus Option.

[3] Full Project impacts include overlaps between the Preferred Alternative and station access improvements and buffers.

[4] Draft EIS analysis did not include potential impacts to City of Tigard sensitive lands.

In all three segments, the Preferred Alternative alignment crosses areas of forest that are governed by local tree codes. Tree removal would be required for construction of the Project. All three cities within the study area regulate tree removal based on size (measured in diameter at breast height, or DBH), location and condition, and prescribe specific mitigation options for tree removal. Mitigation can be accomplished through on-site or off-site replacement of trees, which is not always done on a one-to-one basis but is typically based on a ratio determined by the trees' size, location and condition. Where direct replacement of trees is not feasible, mitigation can also be accomplished through contributions to the appropriate urban forestry fund, dependent upon the city where the tree removal impacts take place.

Most of the large areas of contiguous forest are located along SW Barbur Boulevard in Segments A and B. In December 2019, David Evans and Associates, Inc. (DEA) conducted a preliminary assessment of the number of trees that could potentially be impacted by construction of the Preferred Alternative. Two primary methods were used to estimate tree numbers: (1) counting trees using available desktop resources and (2) using previous tree field surveys to generate a tree-per-acre number to be applied to adjacent, similar forested areas. A complete tree survey conducted by DEA for a portion of the Project along SW Barbur Boulevard in early 2019 was used to calculate tree number and size per acre within similar adjacent forest areas, yielding a count of approximately 68 trees per acre. This per-acre number was applied directly to acreage within adjacent forest to estimate a total number of trees within the SW Barbur Boulevard portion of Segments A and B. The number of trees in Segment C was estimated entirely using desktop resources.

A preliminary accounting of the number of trees within the Preferred Alternative footprint and 50-foot buffers, along with their respective size classes, is shown in Table 3.3-4. This number will be further refined through additional tree surveys that will be required to support tree plans, which will be conducted during the later design and permitting phases of the Project.

Table 3.3-4. Estimated Number of Trees within the Study Area by Size Class: Preferred Alternative

Segment	Tree Size Class	Construction Footprint	50-Foot Buffer	Study Area Total
Segment A: Inner Portland				
North of SW Hamilton St.	Small (6-12" DBH)	210	180	390
	Medium (12-24" DBH)	360	140	500
	Large (>24" DBH)	100	50	150
South of SW Hamilton St.	Small (6-12" DBH)	630	390	1,020
	Medium (12-24" DBH)	480	310	790
	Large (>24" DBH)	120	70	190
Segment B: Outer Portland				
North of Barbur Transit Center	Small (6-12" DBH)	400	160	560
	Medium (12-24" DBH)	330	130	460
	Large (>24" DBH)	70	20	80
South of Barbur Transit Center	Small (6-12" DBH)	180	120	300
	Medium (12-24" DBH)	460	170	630
	Large (>24" DBH)	30	40	70
Segment C: Tigard and Tualatin				
Tigard	Small (6-12" DBH)	580	170	750
	Medium (12-24" DBH)	530	160	690
	Large (>24" DBH)	140	70	210
Tualatin	Small (6-12" DBH)	20	10	30
	Medium (12-24" DBH)	0	0	0
	Large (>24" DBH)	0	0	0
Total (all size classes)				
Segment A	All (>6" DBH)	1,900	1,140	3,040
Segment B	All (>6" DBH)	1,470	640	2,110
Segment C	All (>6" DBH)	1,270	410	1,680
PROJECT TOTAL: Full Corridor	All (>6" DBH)	4,640	2,190	6,830

Note: DBH = diameter at breast height.

3.3.2. Listed and Sensitive Terrestrial Species

Wildlife species within the study area for this analysis include mollusks, insects, amphibians, reptiles, birds and mammals. Plant species include grasses, forbs, shrubs and trees.

Database searches for non-fish (terrestrial) species listed under federal or state processes as threatened, endangered or sensitive revealed the presence of 8 species of plants, 14 species of birds, 5 mammals, 2 reptiles, 1 amphibian, 1 insect and 1 mollusk (invertebrate) (see Table 3.3-5). As in the fish database queries, not all of the species identified in the databases are likely to occur within the study area.

Table 3.3-5. Listed/Sensitive Terrestrial Species *(multipage table)*

Common Name *(Scientific Name)*	Federal Status					State Status							County[3]			
	Listed Endangered	Listed Threatened	Candidate[5]	Species of Concern[6]	Critical Habitat[7]	Listed Endangered	Listed Threatened	Candidate	Sensitive[8]	Sensitive Critical[9]	ORBIC[1]	IPaC[2]	Multnomah	Clackamas	Washington	COMPASS[4]
Plants																
Golden paintbrush *(Castilleja levisecta)*		●				●							●	●	●	
White rock larkspur *(Delphinium leucophaeum)*				●												●
Water howellia *(Howellia aquatilis)*		●										●		●		
Bradshaw's lomatium (desert-parsley) *(Lomatium bradshawii)*	●					●						●				
Kincaid's lupine *(Lupinus sulphureus* ssp. *kincaidii)*		●			●		●					●	●		●	
Willamette daisy *(Erigeron decumbens* var. *decumbens)*	●				●	●						●	●	●		
Whitebark pine *(Pinus albicaulis)*			●											●		
Nelson's checkermallow *(Sidalcea nelsoniana)*		●					●					●	●	●	●	
Oregon sullivantia *(Sullivantia oregana)*				●				●			●					
Birds																
Marbled murrelet (*Brachyramphus marmoratus)*		●			●		●						●	●	●	
Common nighthawk *(Chordeiles minor)*										●						●
Olive-sided flycatcher *(Contopus cooperi)*				●					●							●
Willow flycatcher *(Empidonax traillii)*				●						●						●
Harlequin duck *(Histrionicus histrionicus)*				●					●							●
Lewis's woodpecker *(Melanerpes lewis)*				●												●

Table 3.3-5. Listed/Sensitive Terrestrial Species *(multipage table)*

Common Name *(Scientific Name)*	Federal Status					State Status					ORBIC[1]	IPaC[2]	County[3]			COMPASS[4]
	Listed Endangered	Listed Threatened	Candidate[5]	Species of Concern[6]	Critical Habitat[7]	Listed Endangered	Listed Threatened	Candidate	Sensitive[8]	Sensitive Critical[9]			Multnomah	Clackamas	Washington	
Oregon vesper sparrow *(Pooecetes gramineus affinis)*				●						●						●
Chipping sparrow *(Spizella passerina)*									●							●
Yellow-billed cuckoo *(Coccyzus americanus)*		●			●							●	●	●	●	
Streaked horned lark *(Eremophila alpestris strigata)*		●			●					●		●	●	●	●	
American peregrine falcon *(Falco peregrinus anatum)*									●		●					●
Bald eagle *(Haliaeetus leucocephalus)*											●					
Purple martin *(Progne subis)*				●						●	●					●
Northern spotted owl *(Strix occidentalis caurina)*		●			●		●					●	●	●	●	●
Mammals																
Pallid bat *(Antrozous pallidus)*				●												●
Townsend's big-eared bat *(Corynorhinus townsendii)*				●						●	●					●
Red tree vole (*Arborimus longicaudus)*			●						●				●		●	
North American wolverine *(Gulo gulo luscus)*							●						●	●		
Columbian white-tailed deer (*Odocoileus virginianus leucurus)*		●								●			●			
Reptiles																
Western pond turtle *(Actinemys marmorata)*				●						●	●					●
Western painted turtle *(Chrysemys picta)*										●	●					●
Amphibians																
Oregon slender salamander *(Batrachoseps wrighti)*				●					●		●					
Insects																
Fender's blue butterfly *(Icaricia icarioides fenderi)*	●				●						●				●	
Invertebrates																
California floater (mussel) (*Anodonta californiensis)*				●							●					

Sources and Notes:

[1] Oregon Biodiversity Information Center (ORBIC), 2017.

[2] USFWS Information for Planning and Consultation (IPaC), 2020b.

[3] USFWS Species by County, available at: https://www.fws.gov/endangered/ (2020a).

[4] ODFW Centralized Oregon Mapping Products and Analysis Support System (COMPASS), 2020.

[5] Taxa for which the U.S. Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

[6] Taxa that were previously Category 1 (C1) or Category 2 (C2) candidates for which further information is needed to warrant listing as threatened or endangered.

[7] Critical Habitat has been designated for this species.

[8] Taxa that are facing one or more threats to their populations and/or habitats within the Willamette Valley or Coast Range ecoregions.

[9] Taxa that are of particular conservation concern within the Willamette Valley or Coast Range ecoregions.

Federal Status – U.S. Fish and Wildlife Service and National Marine Fisheries Service

State Status – Oregon Department of Fish and Wildlife and Oregon Department of Agriculture

Note: N/A = Not Applicable.

The presence of wildlife or plant species listed as threatened or endangered under the federal ESA within Segments A and B is not likely. A few state-sensitive bird and mammal species could inhabit the forested areas along SW Barbur Boulevard. The presence of wildlife species listed as threatened or endangered under the federal ESA within Segment C is not likely; however, the plant species Nelson's checkermallow has been planted in the Knez Wetland in the past. Based on surveys, no individuals are presumed to have survived (see the discussion under the Wetlands section below). State-sensitive bird, mammal and reptile species, including purple martin (*Progne subis*), Townsend's big-eared bat (*Corynorhinus townsendii*) and western pond turtle (*Actinemys marmorata*), likely inhabit the vegetated and wetland areas along Red Rock Creek.

In addition to the threatened, endangered and sensitive species, over 100 other species are likely to occur within the vicinity of the Project (Csuti et al., 1997). At least 20 species of amphibians and reptiles potentially occur within the study area and surrounding habitat areas, including native and non-native species. Among these species are the northwestern salamander (*Ambystoma gracile*), northern red-legged frog (*Rana aurora*), western painted turtle, northwestern pond turtle (*Actinemys marmorata*), and northern alligator lizard (*Elgaria coerulea*). Bird species are the most diverse group of vertebrates that occur in urban areas. Notable bird species in the area include the great blue heron (*Ardea herodias*), red-tailed hawk (*Buteo jamaicensis*), bald eagle and osprey (*Pandion haliaetus*). Mammals that occur in the vicinity of the Project include Virginia opossum (*Didelphis virginiana*), black-tailed deer (*Odocoileus hemionus*), eastern cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), several bat species (*Myotis* spp. and *Corynorhinus* spp.), fox squirrel (*Sciurus niger*), native mice (*Peromyscus* spp.) and vole (*Microtus* spp.) species, house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*). Muskrat (*Ondatra zibethicus*), non-native nutria (*Myocastor coypus*), beaver (*Castor canadensis*) and river otter (*Lontra canadensis*) occur in the Tualatin River and its tributaries, including Fanno Creek and Red Rock Creek (Csuti et al., 1997).

3.4. Wetlands

The presence of wetlands within the study area was initially assessed using the best available data, which include three distinct but often overlapping datasets: National Wetlands Inventory (NWI), RLIS and City of Tigard Local Wetlands Inventory (LWI). See Figure 3.2-1 for mapped wetlands in Segment C. Both the NWI and RLIS datasets cover all segments, but RLIS maps more acreage of wetlands for the area covered. The LWI for the City of Tigard was completed in 1997 (COT, 1997), and portions of it appear to be included in the RLIS data. As part of the Final EIS and to support Clean Water Act Section 404 and related permitting processes, the project completed a *Wetland Delineation Report* (Attachment E to the Final EIS), which has

more detailed survey information on specific wetlands, focused on those that have the potential to be impacted by the project, based on preliminary design information.

Of these layers, the RLIS (Metro, 2017) data was considered the most comprehensive, because the "layer is based on the 1998 National Wetlands Inventory, finished and in-progress local wetland inventories conducted by local jurisdictions, and information/documentation collected during the development of Metro's Title 13 Nature in Neighborhoods program." However, the RLIS data does not include ponds or riverine type wetlands. Furthermore, it was not possible to obtain the wetland type (e.g., emergent, scrub-shrub, forested, ponds and riverine) from the RLIS data. Therefore, to be as comprehensive as possible given the existing data, this section discusses the extent of wetlands from all three sources—NWI, RLIS and City of Tigard LWI.

Field visits were conducted on May 17 and June 5 and 6, 2017, to improve the accuracy of the mapping. Additional surveys were conducted on April 25, June 6 and 7, and July 11, 2019 as well as on January 17, 2020. Together, these efforts resulted in enough detailed information to prepare a wetland delineation report for those areas where access was granted. For those areas without approved access, the resulting mapping accuracy is useful for the Final EIS impact analysis but might not be accurate enough to be used for permitting purposes. Small wetlands discovered in the field (and not included in RLIS) were mapped, and boundaries of wetlands that were noticeably different from mapped wetlands (such as those adjacent to the Costco building in Tigard) were mapped using a combination of Global Positioning System (GPS) data and field observations marked on aerial photos.

In an effort to capture the area of riverine wetlands, the area of NWI wetlands for the Preferred Alternative and related transportation improvements is presented in Table 3.4-1. Segments A and B contain few mapped wetland resources, totaling approximately 0.1 acre. Segment C contains approximately 2.5 acres of wetland resources for the Preferred Alternative.

Table 3.4-1. Approximate Area of Wetland Types in National Wetlands Inventory (USFWS, 2020c)

	Freshwater Emergent Wetland (Footprint / Buffer) (acres)	Freshwater Forested / Shrub Wetland (Footprint / Buffer) (acres)	Freshwater Pond (Footprint / Buffer) (acres)	Riverine (Footprint / Buffer) (acres)	Grand Total (Footprint / Buffer) (acres)
Preferred Alternative					
Segment A alignment and stations	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.1 / 0.1	0.1 / 0.1
Segment B alignment and stations	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
Segment C alignment and stations	0.1 / 0.0	0.5 / 0.4	1.1 / 0.6	0.2 / 0.1	1.8 / 1.1
Marquam Hill Connection	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
Hunziker O&M Facility	0.0 / 0.0	0.2 / 0.0	0.4 / 0.1	0.0 / 0.0	0.7 / 0.2
Related Transportation Improvements					
Ross Island Bridgehead Reconfiguration	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0
Station access improvements[1]	0.1 / 0.2	0.1 / 0.3	0.1 / 0.9	0.8 / 1.2	1.0 / 2.5
TOTAL					
Preferred Alternative	0.1 / 0.0	0.7 / 0.4	1.5 / 0.7	0.3 / 0.2	2.6 / 1.4
Full Project[2]	0.2 / 0.2	0.8 / 0.7	1.5 / 1.6	1.1 / 1.4	3.6 / 3.9

[1] Footprints of the station access improvements are defined by the extent of the current right of way where improvements will be made. Fifty-foot buffers have been added to this footprint.

[2] Impacts from the full Project include overlaps between the Preferred Alternative and the station access improvements and buffers.

The RLIS dataset showed no wetlands within Segments A and B; however, a previously unmapped, field-delineated wetland approximately 0.2 acre in area lies within the construction footprint for the Marquam Hill Connection. Table 3.4-2 shows the areas of RLIS-mapped wetlands within Segment C, which total approximately 7.5 acres.

Table 3.4-2. Approximate Area of Mapped RLIS-Identified Wetlands (Segment C)

	Footprint Area (acres)	Buffer Area (acres)	Total Area (acres)
Preferred Alternative			
Segment C alignment and stations	2.3	1.7	4.0
Hunziker O&M Facility	1.1	0.5	1.6
Related Transportation Improvements			
Station access improvements[1]	0.2	1.6	1.8
TOTAL			
Preferred Alternative	3.5	2.2	5.7
Full Project[2]	3.7	3.8	7.5

[1] Footprints for station access improvements are defined by the extent of the current right of way where improvements will be made. Fifty-foot buffers have been added to this footprint.

[2] Impacts from the full Project include overlaps between the Preferred Alternative and station access improvements and buffers.

Table 3.4-3 below summarizes the mapped wetlands identified in the City of Tigard LWI as significant (Fishman Environmental Services, 1997) and additional wetlands identified in City of Tigard data as jurisdictional (COT, 2020).

Table 3.4-3. Approximate Area of Mapped LWI-Identified Wetlands (Segment C)

Alternative/ Option	Wetland Status/Type Footprint		Wetland Status/Type Buffer	
	Jurisdictional (acres)	Significant (acres)	Jurisdictional (acres)	Significant (acres)
Preferred Alternative				
Segment C alignment and stations	0.1	2.3	0.1	1.8
Hunziker O&M Facility	0.0	1.2	0.0	0.5
Related Transportation Improvements				
Station access improvements[1]	0.0	0.1	0.1	0.1
TOTAL				
Preferred Alternative	0.1	3.3	0.1	1.9
Full Project[2]	0.1	3.4	0.1	2.0

[1] Footprints for station access improvements are defined by the extent of the current right of way where improvements will be made. Fifty-foot buffers have been added to this footprint.

[2] Impacts from the full Project include overlaps between the Preferred Alternative and station access improvements and buffers.

Segment C contains by far the greatest amount of wetland resources. These wetland resources are associated with streams such as Red Rock Creek, Ball Creek and Fanno Creek in generally flat areas near Tigard. The portions of these wetlands near the Project are generally surrounded and confined by development.

Historically, the area associated with Red Rock Creek was part of a larger wetland. The historical "Red Rock Creek Wetland" was probably more than 25 acres in size and contained a mix of forested, shrub, emergent

and open water wetland types. The construction of Oregon Highway 217 (Highway 217) severed the wetland into two portions: a 6.7-acre wetland/pond complex on the southwest side of the highway that contains the Knez Wetland and a 15-acre wetland area on the northeast side of the highway, referred to here as the "Costco Wetlands." The two wetlands are still hydrologically connected by Red Rock Creek, which passes under the highway in a culvert. Both wetlands are mapped by the NWI and RLIS as wetland, but the boundaries have been adjusted somewhat based on site visits and aerial photos.

The Knez Wetland, a 1.87-acre site, contains a relatively high-quality, remnant Willamette Valley wet prairie plant community. According to the wetland site's management plan, The Wetlands Conservancy (TWC) supported protection of the wetland in comments submitted to regulatory agencies during the Knez Building Materials, Inc. wetlands permitting process in 1991. Upon approval of the permit in 1992, Knez Building Materials, Inc. donated the property to the City of Tigard in 1992. TWC assisted the city in site management, and in 1994 the property was donated to TWC by the city (TWC, 2006).

Parametrix and DEA project team representatives met with a representative of TWC (Megan Garvey) on May 17, 2017. She described TWC's efforts to establish listed plant species in the remnant prairie portion of the property. She stated that Nelson's checker-mallow was planted several years ago, but the fluctuating water levels (as a result of beaver dams as well as water inputs from outside the site) have made it difficult to control weeds and maintain the populations, and it is currently unknown whether the species persists at the site. She also mentioned that placement of a water control device known as a "beaver deceiver" could make water levels more predictable and improve conditions for the adjacent landowners, whose parking lots occasionally flood during high water. Based on the conversation with TWC, surveys of the Knez Wetland and the immediate surrounding area were conducted in order to determine the presence of Nelson's checkermallow, but no individuals were identified. Additionally, surveys found that the habitat is not currently suitable for the presence of Nelson's checkermallow because of the density of invasive reed canarygrass (*Phalaris arundinacea*). Red Rock Creek flows south along the eastern edge of the Knez Wetland site and then continues south through a narrow strip of land that ends at SW Hunziker Street. The wetland extends onto adjacent properties to the north, west and east of TWC's parcel and contains additional wetland prairie, a hydrologically connected 1.3-acre stormwater detention pond and a short unnamed tributary of Red Rock Creek that enters the site from the northwest. The total area of the wetland/pond complex is approximately 6.7 acres, with about 4.4 acres in wetland prairie.

4. LONG-TERM IMPACTS

4.1. Long-Term Impacts of the No-Build Alternative

The No-Build Alternative would not include any of the proposed changes to the transportation system in the corridor. Impacts would be limited to activities and conditions that already exist.

The potential ecosystem impacts from the No-Build Alternative are relatively few. Untreated stormwater runoff would continue to flow from impervious surfaces that the Preferred Alternative would otherwise upgrade. Stormwater from over 81 acres of impervious surface within Segments B and C would continue to flow untreated for water quality and water quantity to project area streams. The stormwater runoff from the existing impervious surfaces would continue to cause pollutants such petroleum, copper, zinc, *E. coli* and suspended sediments to affect streams and aquatic organisms downstream of the project.

4.2. Long-Term Impacts of the Project

The Preferred Alternative alignment and stations in Segments A and B are largely in developed areas, with the exception of the forested area along SW Barbur Boulevard. Segment C does not traverse any large contiguous areas of ecosystem resources, but the Preferred Alternative would potentially affect these resources in localized areas.

The station access improvements generally involve localized improvements such as new sidewalks and bike lanes and crossings that are primarily adjacent to roadways. Impacts from the station access improvements overall would be similar in character to those described for the Preferred Alternative alignment and stations. However, because they would predominantly be located in previously disturbed and/or developed areas, impacts from the station access improvements to contiguous, high-quality ecosystem resources are expected to be relatively few. Additionally, upgraded facilities that would be part of these improvements would typically include stormwater runoff treatment and management, which would benefit ecosystems.

Direct long-term impacts could occur where the Project crosses streams, removes vegetation or fills wetlands. Impacts could result from the guideway, station footprints, roadway improvements, stormwater facilities, station access improvements and other ancillary features.

Riparian habitat could experience permanent impacts where guideways span areas of riparian vegetation. Construction of elevated guideways above vegetation would reduce the amount of water the vegetation receives from precipitation. In some areas, vegetation cleared from beneath elevated guideways might not grow back. Because elevated guideway structures would be relatively narrow, shading impacts on riparian vegetation would be limited in most areas, although some impacts would result from both shading and water interception. Herbaceous plants and shrubs are generally able to grow beneath narrow guideways that are at least 15 feet above the ground (Sound Transit, 2011). Based on the nature and location of construction buffer impacts, as well as the current condition of the corridor itself, no substantial degradation of riparian functions (e.g., fish and wildlife habitat, food chain support or water temperature maintenance) or processes is likely to result from Project-related clearing under the Preferred Alternative.

Long-term impacts to streams could be caused by increases in the amount of impervious surface in the study area, which can increase stormwater runoff rates, volumes and pollutant loads. These impacts, in turn, can lead to higher peak flows and degrade water quality in streams. New impervious areas would

include new tracks and guideways, stations, the station access improvements, O&M facility infrastructure and roads. To minimize the potential impacts of increased impervious surface, stormwater detention and treatment facilities would be constructed as part of the Project. The amount of area treated would be sufficient to offset any increase in impervious surface area to meet local standards. Based on the construction of these detention and treatment facilities and implementation of BMPs, peak flows would not be expected to increase in any of the streams in the study area as a result of the Project; moreover, base flows would be expected to remain similar to current conditions. Stormwater from all Project-related impervious surface would receive appropriate flow control where required. In addition, pollutant-generating impervious surfaces associated with the Project would receive water quality treatment where applicable, thereby resulting in long-term improvements to water quality compared to the existing conditions. Appendix L to the Final EIS contains the ESA consultation documentation that provides highly detailed stormwater management information and analysis as it relates to ecosystem resources.

The effects on vegetation and wildlife habitat from construction of the Project would vary, depending on the land cover type within the limits of project clearing. The effects on the developed cover type, for example, would be minimal. Little or no vegetation is present in areas that are already developed; therefore, the replacement of existing developed cover with guideways or other facilities would constitute a minimal change in the characteristics of such areas or their ability to support wildlife.

Project construction could cause changes in habitat quality within the forest, woodland, shrubland and herbaceous cover types within Segments A and B, and within wetlands, riparian areas and vegetated corridors within Segment C. In these cover types, replacement of existing vegetation with project features would represent a loss of structural and biotic diversity associated with the variety of plant and wildlife species previously present in the cleared areas. In areas with herbaceous and shrub vegetation, the potential for adverse effects would vary with site-specific conditions. For example, areas dominated by dense growth of invasive species (e.g., Himalayan blackberry [*Rubus armeniacus*]) typically do not support diverse and abundant communities of vegetation and wildlife. Conversely, areas with more native species would be expected to support a greater number and variety of species.

Construction of project features would have a greater likelihood of reducing the habitat quality of forest and woodland areas than that of other cover types. Clearing of trees, snags and understory vegetation would cause the loss of nesting and foraging sites for many species of birds, as well as a reduction in the availability of hiding cover for small mammals. The introduction of cleared areas through patches of contiguous forest cover would result in the fragmentation of forested habitat. By increasing the amount of edge habitat (where sensitive wildlife species are less protected from weather extremes and are more susceptible to predation from species that are adapted to open habitats), fragmentation compounds the effects of habitat loss by reducing the quality of the remaining habitat.

Invasive plants rapidly colonize disturbed sites such as construction areas. They prevent native species from becoming re-established following ground disturbance, spread into undisturbed areas where they can affect habitat value on adjacent lands, and generally provide relatively poor wildlife habitat or forage. Several of the BMPs that would be implemented during project construction are intended to avoid, reduce and control new infestations of noxious weeds. Consistent and successful application of these measures would reduce potential habitat disturbance and improve existing habitats that are already disturbed.

Despite the implementation of BMPs, it is likely that some especially invasive weeds could become established in some areas that are disturbed during construction. However, the Project could also improve

conditions in portions of the study area where existing weeds such as Himalayan blackberry, reed canarygrass or Japanese knotweed (*Fallopia japonica*) dominate vegetated areas. Because of project construction, such areas would either be replaced with project features or they would be disturbed and replanted with native species, in which case the Project could increase the potential for re-establishment of native vegetation.

Wetland impacts could be associated with fill for permanent bridge bents and other project elements. Direct impacts could decrease the functions and values of the impacted wetlands, interrupt existing hydrological regimes and permanently remove wetland vegetation.

Further discussion of these potential impacts, by segment and ecosystem element, are discussed below.

4.2.1. Segment A: Inner Portland

Segment A traverses several piped streams and the forested area along SW Barbur Boulevard. In addition, one small wetland, approximately 0.2 acre in area, is within the construction footprint for the Marquam Hill Connection. As a result of the lack of natural resources in this segment, most of the impacts in Segment A would be associated with tree removal.

Aquatic Species and Habitat

Direct impacts to fish are not anticipated within Segment A, because no fish-bearing streams are located within the study area in this segment. Direct impacts to streams would likely be insignificant, because most of the streams in Segment A currently traverse the alignment through pipes or culverts that drain into the City of Portland's combined sewer system. Some of these streams still contain remnant surface flow and/or surface connections upstream of the alignment. Amphibians and invertebrates might still be present in these area, and could be impacted by the removal of riparian vegetation and hydrological changes. Many streams that would be crossed by the Preferred Alternative already flow through pipes or culverts, have been previously impacted by development, and are not expected to be additionally impacted by the Project.

Indirect impacts could occur as a result of changes to hydrology and riparian buffers. No impacts to mapped 100-year floodplains would occur within Segment A.

Vegetation and Wildlife Species and Habitat

As shown in Table 3.3-1, the City of Portland (2011) maps the greatest amount of forested acreage within Segment A, both in the construction footprint and the associated buffers. This forest habitat occurs on slopes adjacent to SW Barbur Boulevard in the southern half of the segment. The northern half of Segment A consists of heavily developed and urbanized areas with relatively less vegetation present. Within Segment A, the impacts to the four mapped vegetation classes include approximately 19.9 acres of forest within the construction footprint, 3.6 acres of woodland, 0.4 acre of shrubland and 0.9 acre of herbaceous cover. Approximately 12.9 acres of forest lie within the construction buffers, along with 2.3 acres of woodland, 0.5 acre of shrubland and 0.6 acre of herbaceous cover. The total amount of mapped vegetation classes within the Segment A alignment and stations footprint is 24.8 acres (16.3 acres within the buffers).

Within Segment A, total acreage of potential impacts to the City of Portland's conservation E-zones from the construction footprint is 25.7 acres (see Table 3.3-2). Potential impacts to conservation E-zones within the

buffers total 12.3 acres. The acreage of potential impacts to protection E-zones is 1.4 acres within the Segment A construction footprint and 1.1 acres within the buffer. Most of these impacts are associated with the forested area along SW Barbur Boulevard.

For the Marquam Hill Connection, impacts to vegetation would encompass 1.2 acres within the construction footprint and 1.1 acres within the buffer. The forest vegetation class would be the only class to be impacted. Potential impacts to E-zones would total 1.7 acres of conservation E-zone within the construction footprint and 1.3 acres within the buffer. There would be no potential impacts to the protection E-zone within the construction footprint, while potential impacts to protection E-zone within the buffer would total 0.1 acre.

As noted in Section 3.3, the presence of threatened or endangered wildlife or plant species within Segment A is not likely. However, sensitive bird and mammal species could inhabit the forested areas along SW Barbur Boulevard. Trees and vegetation within the construction footprint of the Preferred Alternative alignment, stations and station access improvements would be completely removed. Overall, up to approximately 3,035 trees could be removed within Segment A, although it is unlikely that all trees within the 50-foot buffer would be removed. Therefore, this number could potentially decrease by a substantial amount. The forested area along SW Barbur Boulevard adjoins approximately 400 acres of additional contiguous forested habitat, approximately 350 acres of which are designated as parks and protected from future development. The impact would therefore be minimal in the context of the remaining forested habitat in the surrounding area. Additionally, most of the wildlife species residing in this area of Segment A are mobile, and it is anticipated they would be able to move away from the area of construction disturbance to other available forested habitat nearby. Tree removal would have a negative impact on wildlife species, but the impact would be minimal in the context of the remaining habitat in the area.

Overall, impacts to vegetation and wildlife species from the Segment A alignment and stations and Marquam Hill Connection would be noticeable but not significant.

Wetlands

Within Segment A, RLIS data shows no wetlands, but according to NWI data, small riverine wetlands are present. Data reviews and limited site visits support the accuracy of the presence of these small riverine wetlands that are found along small unnamed tributaries leading from forested slopes west of Segment A. These streams are then piped under SW Barbur Boulevard, I-5 and developed areas in Southwest Portland. These streams are listed in Table 3.1-1. As noted below, about 0.2 acre of impacts to mapped NWI wetland areas could occur in Segment A in the vicinity of the Marquam Hill Connection. In addition, impacts to unmapped, small riverine wetlands are possible, which could slightly increase total wetland impacts. A comprehensive delineation of wetlands would be completed during the design and permitting phase of the Project.

No palustrine or emergent wetlands are mapped within the Marquam Hill Connection area; however, a field-delineated palustrine emergent wetland approximately 0.2 acre in area lies within the construction footprint. Additional impacts to smaller, undiscovered wetlands are possible, but they would be limited.

Overall, the level of potential wetland impacts in Segment A would be considered minor.

Threatened and Endangered Species

No threatened or endangered species, or other sensitive species, are likely to be present within Segment A. Impacts to ESA-listed fish from stormwater runoff are possible but are not confined to this segment. The construction of stormwater treatment facilities could also provide improvements in the long term by enhancing water quality where no stormwater treatment currently exists. Sensitive bird and mammal species could inhabit the forested areas along SW Barbur Boulevard. Removal of trees would have a negative impact on these species; as noted above, the impact would be minimal in the context of the remaining habitat in the area associated with Terwilliger Parkway, Marquam Nature Park and other city parks.

4.2.2. Segment B: Outer Portland

Segment B traverses several piped streams and a portion of the forested area along SW Barbur Boulevard, as well as mostly developed areas. As such, the impacts from Segment B are associated mainly with tree removal in the northern and southern extents of the segment.

Aquatic Species and Habitat

Direct impacts to fish are not anticipated within Segment B, because no fish-bearing streams are located within the study area in this segment. Direct impacts to streams would likely be insignificant, because most of the streams within Segment B pass underneath the alignment through pipes or culverts that have not been proposed for replacement as part of the Project. In the streams that contain remnant surface flow and/or maintain surface connections to other streams, amphibians and invertebrates might still be present, and could be impacted by vegetation removal or hydrologic changes. Indirect impacts could occur as a result of changes to hydrology and riparian buffers. No impacts to mapped 100-year floodplains would occur within Segment B.

Vegetation and Wildlife Species and Habitat

Vegetation acreage that would be impacted in Segment B is approximately 80 percent that of Segment A, with a higher proportion of herbaceous and woodland cover and a lower proportion of forested cover (see Table 3.3-1). The central portion of the segment consists of heavily developed and urbanized areas with little vegetation present. Within the construction footprint in Segment B, the potential impacts to the four mapped vegetation classes would include approximately 5.2 acres of forest, 5.2 acres of woodland and 6.6 acres of herbaceous cover. Within the construction buffer in Segment B, impacts would affect approximately 2.7 acres of forest, 2.6 acres of woodland and 2.3 acres of herbaceous cover. Less than 0.01 acre of shrubland habitat is located within Segment B. The total amount of mapped vegetation classes within the construction footprint in Segment B is 17.0 acres, and within the buffer it is approximately 7.6 acres.

In Segment B, impacts to conservation E-zones within the construction footprint would total approximately 0.9 acre. Impacts to conservation E-zones within buffers would total approximately 0.5 acre. Most of these impacts are associated with the forested area along SW Barbur Boulevard in the northern portion of Segment B. Only 0.1 acre of construction buffer would be within the protection E-zone in Segment B.

As noted in Section 3.3, the presence of threatened or endangered wildlife or plant species within Segment B is not likely. However, sensitive bird and mammal species could inhabit the forested areas along

SW Barbur Boulevard. Trees and vegetation within the construction footprint of the Preferred Alternative alignment, stations and station access improvements would be completely removed. Overall, up to approximately 2,094 trees could be removed within Segment B, although it is unlikely that all trees within the 50-foot buffer would be removed. Therefore, this number could potentially decrease by a substantial amount. The forested area along SW Barbur Boulevard adjoins approximately 400 acres of additional contiguous forested habitat, approximately 350 acres of which are designated as parks and protected from future development. The impact would therefore be minimal in the context of the remaining forested habitat in the surrounding area. Additionally, most of the wildlife species residing in this area of Segment B are mobile, and it is anticipated they would be able to move away from the area of construction disturbance to other available forested habitat nearby. Tree removal would have a negative impact on wildlife species, but the impact would be minimal in the context of the remaining habitat in the area. Overall, impacts to vegetation and wildlife species within Segment B would not be significant.

Wetlands

Similar to Segment A, wetland resources impacted in Segment B are limited to small areas consisting of forested/shrub and riverine wetlands found along streams. A small wetland, unmapped in RLIS but mapped by NWI, was found at SW 35th Avenue and SW Barbur Boulevard. Although it appears to be a shrub wetland based on characteristics observed during the field visit, it is identified by NWI as riverine. Impacts to this wetland would total less than 0.2 acre. Additional impacts to a small swale downstream and across Barbur Boulevard from this wetland could total up to 0.1 acre. Access to both of these sites was not granted. Impacts to a mapped forested/shrub wetland could occur along the upper portion of Red Rock Creek as it intersects I-5 near SW Barbur Boulevard. Potential impacts to this wetland would be less than 0.2 acre. Based on the above information, up to 0.5 acre of potential permanent impact to likely wetlands are possible within Segment B. Overall, the level of potential impacts to wetlands in Segment B is considered insignificant.

Threatened and Endangered Species

No threatened, endangered or sensitive species are likely to be present within Segment B. Impacts to ESA-listed fish from stormwater runoff are possible, but these impacts would not be confined to Segment B. The construction of stormwater treatment facilities could also provide improvements in the long term by enhancing water quality where no stormwater treatment currently exists. Sensitive bird and mammal species could inhabit the forested areas along SW Barbur Boulevard. Removal of trees would have a negative impact on these species, but as noted above, the impact would be minimal in the context of the remaining habitat in the area associated with Terwilliger Parkway, Marquam Nature Park and other city parks.

4.2.3. Segment C: Tigard and Tualatin

Within Segment C, the majority of the study area consists of developed land cover. Developed land cover includes commercial and residential buildings, schools, roads, sidewalks, railways and other infrastructure. The remainder of the study area consists of several undeveloped areas primarily within road and railway rights of way; the riparian corridor of Red Rock Creek, Fanno Creek and other streams; and park areas adjacent to creeks. Segment C traverses several piped and open streams and wetlands near Highway 217, as well as mostly developed areas. As such, most of the impacts from Segment C are associated with wetland impacts.

Aquatic Species and Habitat

No direct impacts to anadromous fish and their habitat from in-water work are anticipated in Segment C as part of the Project, because the Preferred Alternative alignment would completely span the surface-flowing streams that it crosses (one crossing of Ball Creek and three crossings of Red Rock Creek). Impacts to other aquatic species, including turtles, amphibians and invertebrates, are possible within Red Rock Creek and Ball Creek, because potential habitat is present adjacent to those streams. In Segment C, potential impacts to mapped 100-year floodplains within construction footprints would total approximately 2.8 acres and within buffers would total approximately 3.0 acres. However, only portions of the crossing of the Knez Wetlands would likely involve structures within floodplains.

Vegetation and Wildlife Species and Habitat

Because much of Segment C is urbanized and developed, it contains less area of mapped vegetation than Segments A and B. Within Segment C, potential impacts to mapped City of Tigard/CWS vegetated corridors within the construction footprint would be approximately 7.9 acres. Impacts to vegetated corridors within construction buffers would be approximately 5.9 acres. Most of these impacts are associated with the forested areas along Red Rock Creek and Ball Creek. Vegetated corridors require mitigation and restoration through CWS's Design and Construction Standards.

Impacts of the Preferred Alternative on mapped City of Tigard Sensitive Lands within the Segment C construction footprint would be approximately 15.6 acres. Impacts to City of Tigard Sensitive Lands within construction buffers would be approximately 14.1 acres. These impacts would largely be coextensive with the wetland, floodplain and vegetated corridor impacts discussed above. Impacts to City of Tigard Sensitive Lands from development of infrastructure such as that associated with the Project are generally not allowed. Any impacts to City of Tigard Sensitive Lands would require an amendment to the Tigard Comprehensive Plan.

Trees and vegetation within the construction footprint of the Preferred Alternative alignment, stations and station access improvements would be completely removed. Overall, up to approximately 1,679 trees could be removed within Segment C, although it is unlikely that all trees within the 50-foot buffer would be removed. Therefore, this number could potentially decrease by a substantial amount. Potential impacts would be further refined during tree surveys, which would be required as part of the Project's permitting process.

Sensitive bird, mammal and reptile species, including purple martin, Townsend's big-eared bat and western pond turtle, likely inhabit the vegetated and wetland areas along Red Rock Creek. Removal of trees and modification of wetland and pond areas would have a negative impact on these species, but potential impacts to forested habitat would be limited to a maximum of 4.8 total acres in Segment C (2.2 acres within the construction footprint and 2.6 acres within the 50-foot buffer), because Segment C largely traverses urbanized, developed areas. Several large areas of contiguous forested and wetland habitat exist within a mile or less of the Segment C alignment, including 48-acre Dirksen Nature Park, 30-acre Fanno Creek Park and 79-acre Cook Park. The anticipated impacts to sensitive wildlife species habitat would therefore be minimal in the context of the remaining habitat in the surrounding area, and the Preferred Alternative would not be expected to affect these species on a population level. Overall, potential impacts to vegetation and wildlife species within Segment C would be minimal.

Wetlands

Potential impacts to wetlands in Segment C are based on wetland delineation information collected in support of the Project, where available. In areas that could not be accessed for delineations, the City of Tigard's LWI mapping results are used. The potential impact within the construction footprint and in the 50-foot buffer are shown separately in Table 3.4-1 and Table 3.4-2 to illustrate the potential level of direct impacts from construction compared to what was analyzed (the study area). Because bridges and viaducts would largely span stream and wetland crossings, the total area of potential permanent and temporary impacts would be far less than the totals shown in Table 3.4-1 through Table 3.4-3 and would include only the footprint of permanent bridge bents. Additionally, it would be possible to avoid some of the direct temporary impacts within the construction footprint by using pile-supported work platforms during construction. The Preferred Alternative would be likely to permanently impact a total of approximately 0.8 acre of wetlands within Segment C. Approximately 0.05 acre of this total would consist of impacts to the Knez Wetland in the vicinity of the Highway 217 overcrossing. The remainder of the impact would consist of fill of several delineated low-quality wetlands along the existing railroad alignment. Overall, potential impacts to wetlands within Segment C would be considered minimal.

Threatened and Endangered Species

No threatened or endangered fish or wildlife species have the potential to be present within this segment, except for one federally listed plant, Nelson's checkermallow, which was planted within the Knez Wetland complex as part of a past restoration effort. Anecdotal information suggests that the initial plantings did not survive (M. Garvey, pers. comm., 2017). Surveys of the Knez Wetland and the immediate surrounding area were conducted in order to determine the presence of Nelson's checkermallow, but no individuals were identified. Additionally, surveys found that the habitat is not currently suitable for the presence of Nelson's checkermallow because of the density of invasive reed canarygrass. As a result, it is presumed that this species is not present within Segment C. Impacts to ESA-listed fish from stormwater runoff is possible, but such potential impacts are not confined to this segment. The construction of stormwater treatment facilities would also provide improvements in the long term by enhancing water quality and stormwater detention where no stormwater treatment currently exists.

4.2.4. Hunziker O&M Facility

Red Rock Creek flows to the southeast of the Hunziker O&M Facility. Red Rock Creek is not known to provide habitat for anadromous fish, but indirect impacts to the stream could occur from vegetation removal during construction and operation of the facility. These impacts would include removal of shading and temporary changes to water quality. Approximately 3.5 acres of potential impacts to mapped floodplains would be possible at the Hunziker O&M Facility. Up to an additional 1.0 acre of impacts could take place within the buffer. Impacts to floodplains could affect stream hydrology, but it is unlikely that most of the floodplains at the facility would be directly impacted.

The O&M facility is located in an area of existing development; therefore, vegetation is mapped entirely as Grass/Open Area, with no forested vegetation present. The site appears to have a fringe of non-native, invasive vegetation, such as Himalayan blackberry, present between the stream and the proposed construction footprint. During development, this vegetation would likely be impacted, but it is not considered to provide quality habitat for any wildlife species. Any areas of vegetation removal would be

replanted with native species, in which case the Project could increase the potential for re-establishment of native vegetation and improved habitat quality.

Direct impacts to mapped City of Tigard Sensitive Lands could occur as a result of the construction of the Hunziker O&M Facility. Mapped City of Tigard Sensitive Lands within the construction footprint are approximately 5.6 acres, while mapped City of Tigard Sensitive Lands within construction buffers total approximately 1.2 acres. Direct impacts to wetlands could occur as a result of the construction of the Hunziker O&M Facility. Delineated wetland impacts would total up to 0.4 acre of impact within the construction footprint and 0.6 acre within the buffer

4.2.5. Related Transportation Improvements

Related transportation improvements include the station access improvement options and the Ross Island Bridgehead Reconfiguration. The station access improvements are currently anticipated to be funded separately from the light rail project and constructed by others at a later date. As a result, detailed design information for the station access improvements is unavailable, and potential ecosystem impacts are described in terms of the maximum extent of each ecosystem resource present within the construction footprint and buffers for these improvements. As design refinements progress, the area of potential impacts from the station access improvements is expected to decrease substantially and would likely represent minimal additional impacts beyond those described for the Preferred Alternative alignment and stations. Generally, the station access improvements are not expected to impact large areas of contiguous high-quality ecosystem resources, because these project components would be developed largely within and immediately adjacent to previously developed and/or disturbed areas.

Similarly, the Ross Island Bridgehead Reconfiguration is expected to be funded separately and constructed by others. This project component includes reconfiguring roadways and ramps at the west end of the Ross Island Bridge in a previously developed area with few ecosystem resources present. As a result, although design refinements are expected to better define the potential ecosystem impacts from this project component, the overall impacts are anticipated to be negligible.

Aquatic Habitat and Species

Station access improvements would have potential impacts similar in character to those described above for the Preferred Alternative alignment and stations. No direct impacts to fish and habitat are anticipated due to the projects not requiring in-water work, although other aquatic species, such as amphibians and invertebrates, might be affected by riparian vegetation removal and hydrologic changes in those streams that still contain surface connections to other streams.

Direct impacts to fish and fish habitat are not anticipated at the Ross Island Bridgehead, because there are no streams that contain fish within the vicinity. The two mapped streams flowing through this area are piped into a culvert upstream of the Ross Island Bridgehead and flow beneath the area through culverts. Other aquatic species would thus not be affected, because this project component would not result in impacts to hydrology or riparian habitat quality. In addition, all stormwater generated in this area flows to the City of Portland combined sewer system; the Ross Island Bridgehead Reconfiguration is therefore not anticipated to result in indirect impacts to fish from stormwater runoff.

Vegetation and Wildlife Habitat and Species

Within Segments A and B, the maximum extent of impacts to mapped E-zones from the station access improvements would include 6.9 acres of impacts to E-zone conservation areas (1.6 acres within the construction footprint and 5.3 acres within the buffers) and approximately 1.1 acres of impacts to E-zone protection areas (0.1 acre within the construction footprint and 1.0 acre within the buffers). Most of the E-zone area impacts would be associated with the forested area along SW Barbur Boulevard. Trees and vegetation within the construction footprint of the station access improvements would be completely removed. In Segment C, station access improvements could potentially impact a maximum of up to 2.0 acres of vegetated corridors within the construction footprint and up to 5.5 acres within the buffers. Station access improvements could potentially impact a maximum of up to 11.0 acres of City of Tigard Sensitive Lands within the construction footprint and up to approximately 21.0 acres within the buffer. Impacts to vegetation and wildlife habitat and species from the station access improvements would be similar in character to those described above for the Preferred Alternative alignment and stations above. The station access improvements would be constructed to meet local jurisdiction requirements, and while some vegetation would be removed, these impacts would be mitigated to meet local standards.

Sensitive bird and mammal species might inhabit the forested areas along SW Barbur Boulevard. Removal of trees to construct the station access improvements could have a negative impact on these species. However, similar to the potential impacts to forested habitat described for the Preferred Alternative alignment and stations in Segments A and B above, the impacts would be minimal in the context of the remaining forested habitat in the surrounding area associated with Terwilliger Parkway, Marquam Nature Park and other parks. Additionally, most of the wildlife species residing in these areas are mobile, and it is anticipated they would be able to move away from the area of construction disturbance to other available forested habitat nearby. In Segment C, potential impacts to sensitive species and their habitat would be similar to those described above for the Preferred Alternative alignment and stations. These potential impacts would be localized and limited in extent, occurring in locations such as the vegetated and wetland areas along Red Rock Creek, and as a whole would be expected to add minimally to the impacts from the Preferred Alternative alignment and stations. Indirect impacts to downstream fish and habitat from stormwater runoff would be unlikely, because increased stormwater treatment resulting from construction of the station access improvements would minimize potential impacts and could provide a net benefit to water quality in the long term.

Impacts to vegetation and wildlife habitat and species from the Ross Island Bridgehead Reconfiguration are expected to be negligible because of the heavily developed nature of this area and the fragmentation of existing vegetated habitat. No E-zones are present within the construction footprint or buffer for this project component. Although the City of Portland Natural Resources Inventory data maps 0.2 acre of forest within the construction footprint (0.5 acre within the buffer) and 1.7 acres of woodland within the construction footprint (2.1 acres within the buffer), this area does not provide important habitat for wildlife species. Furthermore, it is anticipated that the amount of forest or woodland vegetation that would require removal would be far less than the amount inventoried by the Natural Resources Inventory, likely amounting to only a small number of individual trees. These impacts would be mitigated to meet local standards as necessary.

Wetlands

Approximately 0.16 acre of mapped wetlands is located within the construction footprint for the station access improvements, and approximately 1.6 acres are located within the buffer. Potential wetland impacts related to the station access improvements would be concentrated primarily within Segment C. As with the potential wetland impacts described for Segment C above, the total area of potential direct permanent and temporary impacts is expected to be substantially less than the total acreage of mapped wetlands within the construction footprint and buffer. The amount of potential wetland impacts will be refined as design refinements progress. Overall, the level of potential impacts to wetlands from the station access improvements is expected to be minimal.

No mapped wetland areas are present within the construction footprint or buffer for the Ross Island Bridgehead Reconfiguration. As a result, no wetland impacts are expected from construction of this project component,

Threatened and Endangered Species

No threatened or endangered species are likely to be present within the area of the Ross Island Bridgehead Reconfiguration. Indirect impacts to downstream fish and habitat from stormwater runoff would also be unlikely, because stormwater from this area flows to the City of Portland's combined sewer system. Additionally, increased stormwater treatment resulting from construction of these improvements could provide a net benefit to water quality in the long term.

4.2.6. Terminus Options

Impacts associated with the terminus options would be smaller than those with the Preferred Alternative, because the terminus options would construct a portion of the Preferred Alternative, and would thus disturb and displace less habitat and have less impact on natural areas. For example, the terminus options would add slightly less additional impervious (paved) surface and therefore would contribute to a smaller incremental increase in runoff. The Hall Terminus Option would avoid impacts associated with the crossings of streams and floodplains south of the Hunziker O&M Facility, including Red Rock Creek and Ball Creek.

5. CONSTRUCTION IMPACTS

Construction impacts discussed in this section are generally short-term and temporary.

5.1. Construction Impacts of the No-Build Alternative

As stated above, existing conditions characterize the No-Build Alternative, which would not include any of the Project's proposed changes to the transportation system in the corridor. Consequently, the No-Build Alternative would not include construction over the length of the corridor and, therefore, would avoid, or have fewer short-term impacts to, ecosystem resources.

5.2. Construction Impacts of the Project

Temporary disturbance to vegetation would occur during construction as a result of direct vegetation removal and potential soil compaction. Dust from construction also has the potential to adversely impact surrounding vegetation through settlement of dust on leaf surfaces, thereby reducing photosynthetic efficiency. Temporary impacts to vegetation would be minimized by limiting construction staging and access corridors to the minimum size practicable and siting such areas in already disturbed areas where possible. Temporarily disturbed areas would be revegetated with native plant species, where feasible, and restored to pre-project conditions or better. Silt fencing and other erosion control methods would be utilized to minimize the potential short-term impacts to adjacent vegetation. A return to pre-construction conditions would depend in part on the re-establishment of vegetation, however, and would not occur immediately. Herbaceous vegetation and some fast-growing shrubs would require two to five years to return to pre-project conditions. Areas of mature forest would require several decades.

Short-term impacts could include visual and auditory disturbance, and removal of vegetation during construction. Any birds protected by the Migratory Bird Treaty Act that are nesting in areas cleared or graded during construction could be adversely affected. These impacts could be avoided by several methods, including scheduling the clearing activity for the non-nesting season, conducting surveys to determine occupancy before construction or excluding birds from nesting on structures.

In addition, noise, lights and other disturbance from construction could negatively affect breeding, foraging and dispersal of both common and protected terrestrial wildlife that might avoid loud machinery, and migratory birds that might no longer rest or feed near the construction areas. Lights used for night work could disturb nocturnal animals such as owls or bats, or disrupt night-migrating birds.

Temporary impacts to jurisdictional wetlands would occur in the wetlands associated with Red Rock Creek at the Knez Wetland and those wetlands adjacent to Ball Creek. Temporary, pile-supported work platforms would be used in the construction of the guideway bridges. Up to 550 piles would be used within the Knez Wetland. Work platforms would be approximately 30 feet wide with extensions up to 70 feet wide at bridge bent locations. The temporary works would be in place for up to 12 months. The Hunziker O&M facility bridge and the Ball Creek crossing would involve similar techniques and would have approximately 100 piles each. Temporary wetland impacts would include approximately 750 square feet of direct impacts due to disturbance of soils and vegetation at the work platform pile locations, as well as approximately 1.0 acre of indirect impacts due to shading of existing vegetation by the work platforms. The locations of the temporary impacts would be restored to pre-project conditions after construction.

No appreciable temporary construction effects are anticipated outside of the construction area, primarily because impact minimization measures, pollution control measures, sediment and erosion control, and stormwater management would be implemented. Construction of the Preferred Alternative would not involve any in-stream work; therefore, no direct effects to fish or other aquatic species would result, and mitigation would not be required.

6. INDIRECT AND CUMULATIVE IMPACTS

6.1. Indirect Impacts

The majority of the corridor is already developed, and station area transit-oriented developments would have limited indirect effects on ecosystems, because they would largely occur in already developed lands. There would be indirect beneficial effects to ecosystems from improved stormwater treatment for water quality and water quantity associated with the Project. Minor indirect adverse effects to biological species would occur during very heavy precipitation events when stormwater management facilities exceed capacity, but effects would still be less than existing conditions.

6.1.1. Changes in Stormwater Treatment

As in much of the region, many of the existing facilities within the study area either do not have any stormwater runoff treatment facilities or have facilities that are not up to standards or are undersized. With construction of light rail, stormwater management facilities could be implemented to meet local requirements of the City of Portland, the City of Tigard or CWS, and these new or upgraded facilities would indirectly improve ecosystems function compared to existing conditions. See Appendix L of this Final EIS for more information.

6.1.2. Waterways and Floodplains

Potential impacts to floodplains could affect aquatic habitats and fish. There are no mapped 100-year floodplains within Segments A and B of the ecosystems study area, but there are within Segment C. Additional details on floodplains are included in Section 4.10, Water Resources, of the Final EIS.

As discussed above, indirect permanent impacts would result from shading of vegetation and water bodies at bridge crossings. Herbaceous plants and shrubs are generally able to grow beneath narrow guideways that are at least 15 feet above the ground (Sound Transit, 2011). Based on the nature and location of the anticipated construction buffer impacts, as well as the current condition of the corridor itself, no substantial degradation of riparian functions (e.g., fish and wildlife habitat, food chain support or water temperature maintenance) is expected.

6.1.3. Wildlife Crossings

With the construction of retaining walls along SW Barbur Boulevard, terrestrial animal crossings would likely be hindered. Anecdotal evidence suggests that a small herd of deer, and occasionally elk, inhabit the forested area between SW Hamilton Street and SW Terwilliger Boulevard. Individual deer occasionally cross SW Barbur Boulevard; however, barriers to crossings in areas where collisions could occur, such as the retaining walls that would be a part of the Preferred Alternative, would be a benefit. Crossing of SW Barbur Boulevard would still be possible through the Newberry Street and Vermont Street trestle bridges.

6.1.4. Terrestrial Disturbance

Both noise and human activity have been demonstrated to displace wildlife from occupied habitats, interfere with the ability of birds to hear territorial songs, interfere with mating and alarm calls of amphibians and small mammals, and interfere with raptor foraging activities. The ecosystems study area is

within or immediately adjacent to developed areas for nearly its entire length. Wildlife that use habitats adjacent to the Preferred Alternative alignment and stations are generally accustomed to some level of human activity and noise. Impacts would be related to likely increases in noise levels and the frequency and types of human activities. Section 4.11, Noise and Vibration, of the Final EIS contains more information on the anticipated noise impacts associated with the Project. Based on the limited amount of area that would be affected under the Preferred Alternative, such effects would not be expected to cause changes in the regional populations of any wildlife species.

6.2. Cumulative Impacts

No cumulative ecosystem impacts were identified. Developments, as well as other transportation projects, would generally not adversely affect ecosystem resources, because they are proposed in areas that are largely urbanized. Further, other projects or land use actions would be subject to regulatory review and/or permitting, which would trigger measures to avoid, minimize or mitigate impacts on ecosystem resources, including streams and wetlands. Such processes would also result in compensatory mitigation for any unavoidable impacts to streams or stream buffers, wetlands or wetland buffers.

7. COMPARISON TO IMPACTS OF THE DRAFT EIS LIGHT RAIL ALTERNATIVES

Table 7-1 provides a comparison between the ecosystems impacts of the Draft EIS light rail alternatives and the Preferred Alternative. The differences in impacts are explained below.

Table 7-1. Comparison of Ecosystems Impacts Between the Draft EIS and Final EIS

	City of Portland E-Zone Conservation Areas (acres)		City of Portland E-Zone Protection Areas (acres)		City of Tigard Vegetated Corridors (acres)		Permanent Wetland Impacts (acres)
	Construction Footprint	50-foot Buffer	Construction Footprint	50-foot Buffer	Construction Footprint	50-foot Buffer	Estimated Impact
Draft EIS							
Full-corridor project range[1]	19.9–20.5	14.3–14.7	1.0–1.5	1.4–1.7	3.3–6.0	4.0–7.8	1.3-1.6
Final EIS							
Preferred Alternative	28.5	14.8	1.4	1.3	10.3	6.9	1.3[2]

Note: EIS: Environmental Impact Statement.

[1] The full-corridor project range is defined as the range representing the lowest and highest possible sum of impacts from a composite of one alignment alternative within each segment, a Marquam Hill connection option, a PCC-Sylvania shuttle option and an O&M facility option.

[2] Wetland impacts include those impacts that are likely to occur and are based on the potential for minimizing impacts through use of bridges, bents and reduced abutments.

The Draft EIS used a draft footprint plus a 50-foot buffer to account for likely changes in the designs and construction activities such as staging and access as designs progressed. This Final EIS uses refined designs that include proposed staging and access areas within its construction footprint. A 50-foot buffer is still included to account for any potential changes in the design or in case of field-modified changes as a result of site-specific issues. Therefore, the comparison of impacts between the Draft EIS and Final EIS do not necessarily use the same levels of information but do represent likely maximum impacts overall.

Impacts from the Preferred Alternative on ecosystem resources would be generally within the range of potential impacts anticipated for the Draft EIS light rail alternatives, with the exception of impacts to wetlands. Impacts to E-zone area may appear to be higher for the construction footprints, but the Final EIS construction footprint is similar to the Draft EIS footprint and the 50-foot buffer. Therefore, combined Draft EIS footprint and buffer impacts to E-zones of approximately 37 to 38 acres compare favorably to the Final EIS footprint impacts of 29.4 acres. A similar situation with Tigard vegetated corridors also occurs, with a Draft EIS footprint and buffer impact of approximately 8 to 17 acres and a Final EIS footprint impact of 10.3 acres.

The study area for the Preferred Alternative construction footprint and buffer would contain more mapped wetlands than the range of wetland acreages shown in the Draft EIS. However, avoidance measures incorporated into the design of the Preferred Alternative have allowed the permanent impacts to wetlands of approximately 1.3 acres to remain within the Draft EIS impact estimated range of 1.3 to 1.6 acres. For example, most of the wetlands within the construction footprint in Segment C are in the Knez Wetland and would be spanned by light rail structures; thus they would not be affected directly and permanently except by bridge supports. The remaining impacts would occur along the existing railroad alignment. Additionally, potential wetland impacts from construction of the Hunziker O&M Facility under the Preferred Alternative would be less than anticipated in the Draft EIS due to changes in the design of the facility to remain outside of the floodplain.

Impacts from the Preferred Alternative on all other ecosystem resources would be within the range of potential impacts anticipated under the Draft EIS alternatives.

8. POTENTIAL MITIGATION MEASURES

In accordance with local, state and federal regulations and Executive Order 11990, the Project would avoid and minimize impacts to ecosystem resources, including wetlands, waters and vegetation, to the extent practicable during the construction of the Project.

8.1. Short-Term Mitigation

During construction, BMPs would be used to avoid impacts to wetlands, waters and other jurisdictional resources from erosion, spills, damage to vegetation or disruption of hydrology. Standard specifications and special provisions would direct contractors to avoid and minimize impacts. In addition, standard terms and conditions of approvals from local, state and federal regulatory agencies have been incorporated into the preliminary designs that are analyzed in this Final EIS. Areas of temporary work platforms would be restored through removal of work platforms and support piles as well as through revegetation to meet necessary permit conditions. Areas of temporary vegetation disturbance would be restored with native vegetation. The project team would work collaboratively with local, state and federal permitting agencies to determine appropriate site-specific impact avoidance and minimization measures during the permitting phase of the Project.

8.2. Long-Term Mitigation

Impacts to trees and vegetated corridors would be avoided to the greatest extent practicable outside of the area of direct disturbance associated with construction activities. Trees within the construction footprint would need to be completely removed. Each of the three cities that the Preferred Alternative would traverse has different preservation and planting requirements that prescribe the measures to be taken in order to mitigate for tree removal, based on tree size, condition, location and other factors. Mitigation for impacts to trees and vegetated corridors would be addressed through coordination with the applicable city government or local agency under the applicable ordinance, based on the location of the impact. Tree removal could be mitigated through on-site replacement of trees that are removed (where possible), replacement via planting of trees in an off-site location or payment to the applicable urban forestry fund. Tree plans that outline proposed mitigation would be required as part of the development permitting process. Tree plans would be based on detailed tree surveys that would be conducted in support of development permit applications.

Impacts to E-zones within the City of Portland and to sensitive lands and vegetated corridors would be avoided to the extent practicable. City of Portland land use code stipulates that development meet E-zone requirements under Chapter 33.430. When the development standards cannot be met, an environmental review process is required. Given the likely impacts to both conservation and preservation areas within E-zones, an environmental review would likely be required for local permitting. Likely mitigation would consist of on-site planting, off-site planting and site restoration, and potentially funding for City-led planting in the affected watersheds.

Impacts to sensitive lands within the City of Tigard would require compliance with Chapter 18.510. If development standards cannot be met, a sensitive lands review and approval process would be required. Effects from the Preferred Alternative might also require a comprehensive plan amendment and an environmental, social, economic and energy consequences analysis.

Compensatory mitigation for direct impacts to wetlands is regulated by federal, state and local jurisdictions as described in Section 1.2 of this report, and would typically require restoring or enhancing degraded wetland areas or establishing new wetlands nearby to compensate for functions lost or degraded by those impacts.

Compensatory mitigation for unavoidable impacts to wetlands would be addressed either through purchase of credits through an approved mitigation bank, payment to an approved in-lieu fee program, or preparation and implementation of a compensatory wetland mitigation plan as part of the CWA Section 404 permitting process. If permittee-responsible compensatory mitigation is required for wetland impacts, it would typically require on-site or off-site enhancement or restoration of existing degraded wetland areas, or creation of new wetlands nearby to compensate for functions lost or degraded by those impacts.

Within Segments A and B, potential compensatory mitigation for wetland impacts could include on-site or off-site enhancement or restoration of existing wetlands, or creation of new wetlands. The selection of these sites would depend on the area needed for mitigation, current and future ownership of potential mitigation sites, and site characteristics. Mitigation sites would be selected based on soil types and topographic position that would increase the likelihood of successful restoration or establishment of wetland conditions.

Within Segment C, where wetland impacts occur, compensatory mitigation could consist of purchasing credits through an approved mitigation bank or an in-lieu fee program. In addition, impacts to the existing Knez Wetland could be mitigated through enhancement or restoration of the existing wetland complex or purchase of adjacent parcels for the benefit of protecting the existing wetland complex. It could also be possible to improve habitat for plant species listed as threatened under the federal ESA through improvements to hydrology and vegetation.

Table 8.2-1 summarizes the potential mitigation measures that would address long-term and short-term impacts to ecosystem resources.

Table 8.2-1. Mitigation Measures for Impacts to Ecosystem Resources *(multipage table)*

Time Period	Impact Type	Preferred Alternative and Terminus Options	Related Transportation Improvements
Long and short Term	Impacts to threatened or endangered species	TriMet would adhere to mitigation requirements stipulated in the Biological Opinion issued by the National Marine Fisheries Service, attached as Appendix L of this Final EIS.	None required beyond those required by applicable regulations and permitting requirements.
Long term	Unavoidable impacts to wetlands and waters from fill, vegetation removal or disruption of hydrology	TriMet would mitigate unavoidable impacts to wetlands and waters consistent with state and federal regulations.	Project sponsors would mitigate unavoidable impacts to wetlands and waters consistent with state and federal regulations.
Long term	Removal of vegetation, including trees, within the construction footprint or the buffer area	TriMet would coordinate with consulting tribes to offer opportunities to harvest culturally significant native plants before construction. TriMet would mitigate tree removal through coordination with the applicable city government or local agency under the applicable ordinance, based on location of the impact.	Project sponsors would mitigate tree removal through coordination with the applicable city government or local agency under the applicable ordinance, based on the location of the impact.
Long term	Unavoidable impacts to E-zones and sensitive lands	TriMet would design the Marquam Hill Connection to provide wildlife passage below and minimize light spillover to vegetated areas below.	Project sponsors would likely address unavoidable impacts to areas with E-zones within the City of Portland and sensitive lands overlays within the City of Tigard

Table 8.2-1. Mitigation Measures for Impacts to Ecosystem Resources *(multipage table)*

Time Period	Impact Type	Preferred Alternative and Terminus Options	Related Transportation Improvements
		TriMet would likely address unavoidable impacts to areas with E-zones within the City of Portland and sensitive lands overlays within the City of Tigard through on-site or off-site mitigation. An environmental review process would likely be required for E-zone impacts. A sensitive lands approval, in addition to a comprehensive plan amendment and environmental, social, economic and energy consequences analysis, could be required.	through on-site or off-site mitigation. An environmental review process would likely be required for E-zone impacts. A sensitive lands approval, in addition to a comprehensive plan amendment and environmental, social, economic and energy consequences analysis, could be required.
Long term	Impacts to wildlife associated with the Marquam Hill Connection	TriMet would work with the City of Portland/Portland Parks and Recreation to develop design details for the Marquam Hill Connection to minimize impacts to wildlife, including bird-friendly cabs and elevator headhouse, with an elevator guideway span clearance designed to accommodate wildlife passage, which while minimizing impacts to views.	N/A
Short term	Impacts to wetlands and waters from erosion, spills and vegetation damage or disruption of hydrology	During construction activities that are taking place in proximity to wetlands and waters, TriMet would use best management practices to avoid erosion, spills, vegetation damage or disruption of hydrology. Standard specifications and special provisions would direct contractors to avoid and minimize impacts.	During construction activities that are taking place in proximity to wetlands and waters, project sponsors would use best management practices to avoid erosion, spills, vegetation damage or disruption of hydrology. Standard specifications and special provisions would direct contractors to avoid and minimize impacts.
Short term	Impacts to wetlands from temporary work platform piles and decking	TriMet would restore disturbed sites to pre-project conditions.	None required. No impacts from related transportation improvements are anticipated.

Note: DSL = Oregon Department of State Lands.

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