3.14 Water Quality and Hydrology

Communities depend on a reliable supply of clean water for domestic use, agriculture, industry, and recreation. Fish and many wildlife species depend on clean water habitats to live. In urban areas, pollutants that wash off roadways during storms contribute to poor water quality in rivers and streams. Pollutants from roadways typically include fuel, oil, grease, and other automotive fluids; heavy metals such as copper and zinc; and small particles from erosion or road sanding which can temporarily make waterways more turbid (cloudy). The design and placement of roadways and stormwater systems can affect how stormwater is treated and released into the environment.

Placing structures such as bridge piers or roadways in a waterway or its floodplain may increase the height of floods during storm events. Although an individual road or structure may be small in relationship to the volume of a waterway, collectively, all roads, structures, and other developments constructed along a river can have a dramatic effect on the severity of floods. For this reason, construction in streams and rivers or in their floodplains is strictly regulated, and must take into account any incremental contribution toward worsening flood conditions on the waterway.

What is the difference between water quality and hydrology?

In this FEIS, hydrology refers to the flow of water—its volume, where it drains, and how quickly the flow rate changes in a storm. Water quality refers to the characteristics of the water—its temperature and oxygen levels, how clear it is, and whether it contains pollutants.

This section examines the potential effects of the CRC project alternatives on both water quality and hydrology, and relates these potential effects to the existing conditions in the waterways and surrounding areas. A comparison of impacts from the LPA and DEIS alternatives is summarized in Exhibit 3.14-4. A more detailed description of the impacts of the DEIS alternatives on water quality and hydrology is in the DEIS starting on page 3-377. Groundwater and aquifers are discussed in greater detail in Section 3.17, Geology and Soils of this FEIS.

This section also discusses a conceptual stormwater treatment design for the LPA that has been developed for analysis purposes and to advance discussions with agencies on regulatory approvals. This design meets regulatory criteria. Agency coordination will continue through the development of the final stormwater design, to be completed as part of future permitting.

This section addresses impacts in the main project area, at the Ruby Junction Maintenance Facility, the Steel Bridge, and at casting and staging areas. See Chapter 2 for a map of these areas. More detailed and technical discussions of the information presented in this section can be found in the CRC Water Quality and Hydrology Technical Report, included as an electronic appendix to this FEIS, and the CRC Stormwater Management Memorandum, included as an appendix to the Water Quality and Hydrology Technical Report.

3.14.1 New Information Developed Since the Draft EIS

Since publication of the DEIS, additional information has been gathered and analyzed in order to better assess and avoid adverse effects. The additional information includes:

- The preparation of a Troutdale Sole Source Aquifer (TSSA) report that confirms previous assumptions about existing conditions and potential project impacts. For further information in regards to potential effects of the project on the TSSA, refer to Section 3.17 (Geology and Soils). The TSSA report is also included as Appendix E of the Hazardous Materials Technical Report.
- More information on existing conditions, developed through field work, research, and agency coordination.

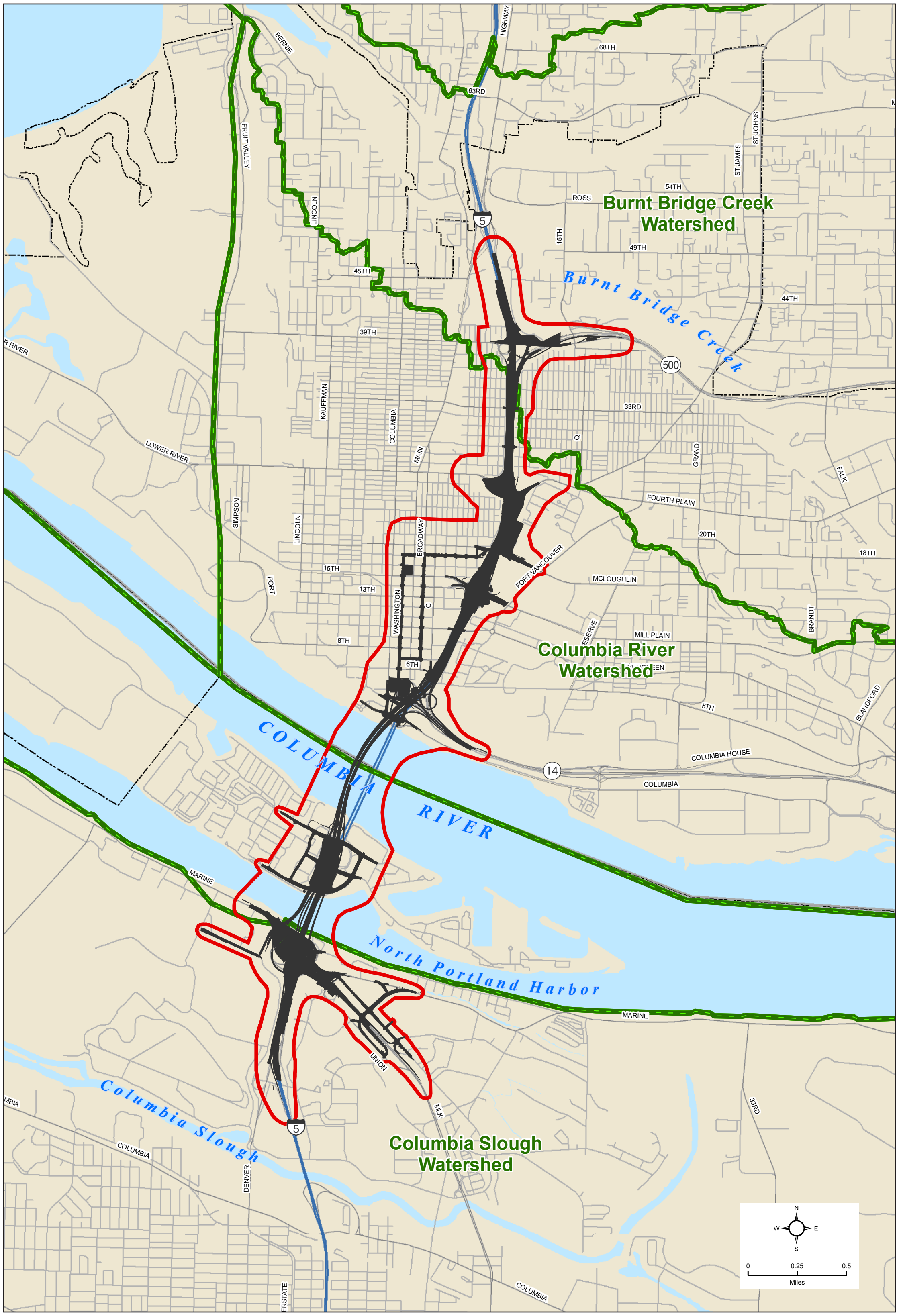
In addition to new information developed since the DEIS, the FEIS includes refinements in design, impacts and mitigation measures. Where new information or design changes could potentially create new significant environmental impacts not previously evaluated in the DEIS, or could be meaningful to the decision-making process, this information and these changes were applied to all alternatives, as appropriate. However, most of the new information did not warrant updating analysis of the non-preferred alternatives because it would not meaningfully change the impacts, would not result in new significant impacts, and would not change other factors that led to the choice of the LPA. Therefore, most of the refinements were applied only to the LPA. As allowed under Section 6002 of SAFETEA-LU [23 USC 139(f)(4)(D)], to facilitate development of mitigation measures and compliance with other environmental laws, the project has developed the LPA to a higher level of detail than the other alternatives. This detail has allowed the project to develop more specific mitigation measures and to facilitate compliance with other environmental laws and regulations, such as Section 4(f) of the DOT Act, Section 106 of the National Historic Preservation Act, Section 7 of the Endangered Species Act, and Section 404 of the Clean Water Act. FTA and FHWA prepared NEPA re-evaluations and a documented categorical exclusion (DCE) to analyze changes in the project and project impacts that have occurred since the DEIS. Both agencies concluded from these evaluations that these changes and new information would not result in any new significant environmental impacts that were not previously considered in the DEIS. These changes in impacts are described in the re-evaluations and DCE included in Appendix O of this FEIS. Relevant refinements in information, design, impacts and mitigation are described in the following text, including a revised conceptual stormwater treatment design.

3.14.2 Existing Conditions

The surface water features studied for the CRC project are determined by the potential for water quality and hydrology impacts to these features from the project. Four major surface water features may receive stormwater runoff from the LPA: the Columbia Slough, the Columbia River (which includes the North Portland Harbor), Burnt Bridge Creek, and Fairview Creek. For the surface water features located in the main project area, their locations and designated watersheds are identified in Exhibit 3.14-1.

Exhibit 3.14-1

Main Project Area Watersheds and Water Features



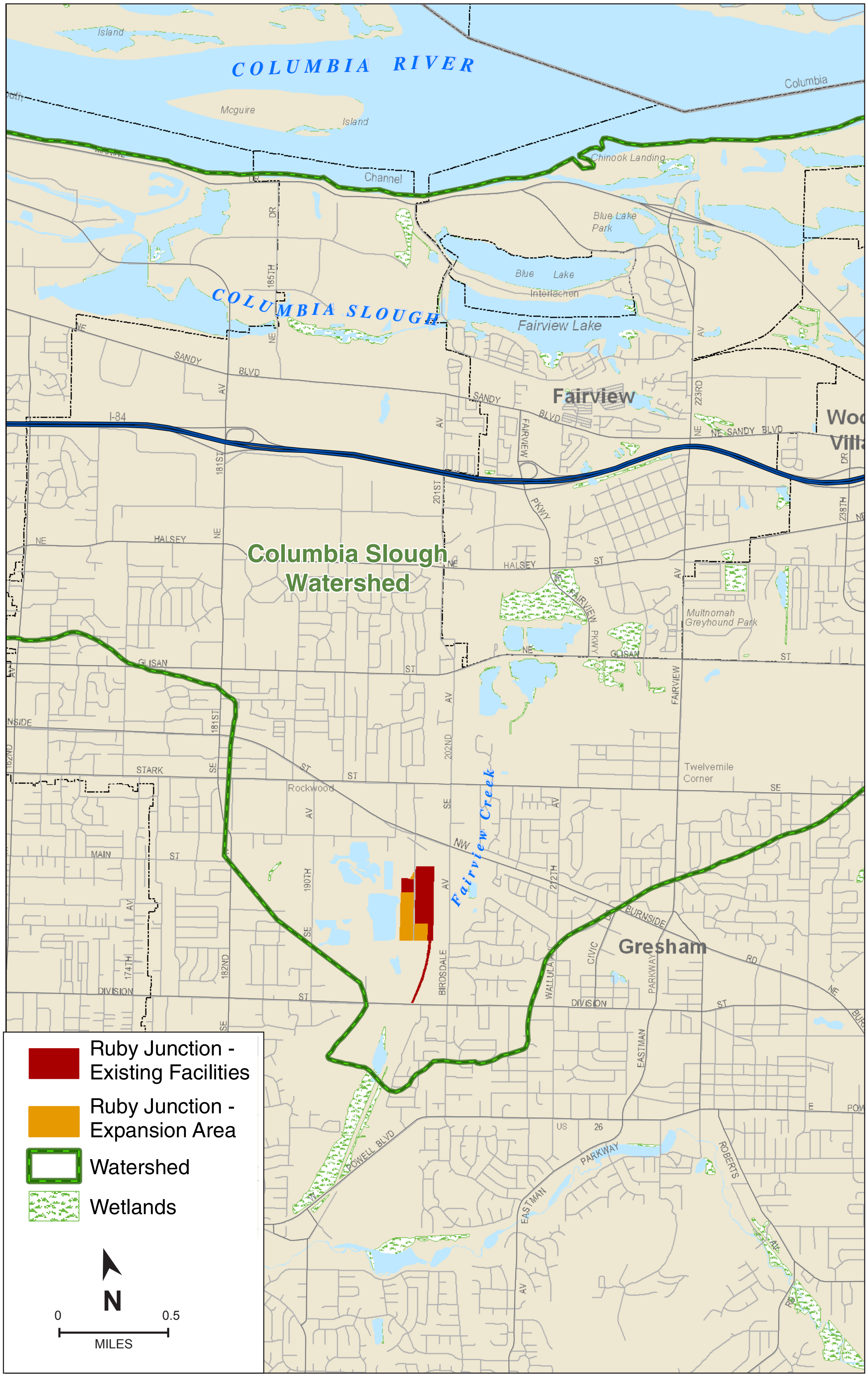
Dimensions are approximate.

Main Project Area

Project Footprint

Watershed

Exhibit 3.14-2
Ruby Junction Maintenance Facility and Fairview Creek



Dimensions are approximate.

TriMet's Ruby Junction Maintenance Facility is located in Gresham, Oregon, outside the main project area. Under the LPA and in collaboration with the Portland-Milwaukie Light Rail Project, this facility would be expanded by approximately 10.5 acres over several phases of construction. Portions of 3 of the 15 parcels that would be added to the facility are located within the 100-year floodplain of Fairview Creek. Exhibit 3.14-2 shows the location of the Ruby Junction Maintenance Facility and its expansion area, Fairview Creek, and the creek's designated watershed.

States are required to monitor and regulate water quality in their rivers and streams under Section 303(d) of the federal Clean Water Act. If a water body fails to meet the water quality standards for one or more pollutants, as determined by the state, that water body is "303(d)-listed." Under this law, states also develop action plans to address water quality concerns, including setting Total Maximum Daily Loads (TMDLs) for particular pollutants in a waterway. Exhibit 3.14-3 lists the 303(d)-listed waterways that may be affected by the CRC project, and identifies the water quality standards they do not currently meet. Exhibit 3.14-3 also shows the TMDLs that have been established for these waterways.

What is a watershed?

A watershed is an area of land from which all water under or on that area drains to the same place, generally, the same water body. Watersheds vary in shape and size, as determined by topography and geology, and can cross county, state, or even national boundaries.

Exhibit 3.14-3

Water Quality-Limited Waterways Within the Project Area

Waterway	303(d) Listing Factors	Established TMDLs
Columbia Slough	Toxics (lead, iron, manganese) Temperature	Toxics (lead, PCBs, DDE/DDT, dieldrin, dioxin) Eutrophication (pH, dissolved oxygen, phosphorus, and chlorophyll a) Bacteria
Columbia River (includes North Portland Harbor)	**In Oregon:** Toxics (PCBs, PAHs, DDT/DDE, arsenic) Eutrophication (dissolved oxygen) Temperature **In Washington:** Toxics (PCBs) Eutrophication (dissolved oxygen) Temperature	Dioxin Total Dissolved Gas
Burnt Bridge Creek	Eutrophication (dissolved oxygen) Bacteria Temperature	None
Fairview Creek	E. coli Fecal Coliform	Toxics (lead, PCBs, DDE/DDT, dieldrin, dioxin) Eutrophication (pH, dissolved oxygen, phosphorus, and chlorophyll a) Bacteria Temperature

The Federal Emergency Management Agency (FEMA)-designated floodplains located within the main project area and near the Ruby Junction Maintenance Facility include the Columbia Slough, the Columbia River (including North Portland Harbor), Burnt Bridge Creek, and Fairview Creek. These floodplains are confined to the immediate vicinity of these rivers and streams. In general, within the project area, the Columbia Slough and Columbia River are confined by man-made levees, while Burnt Bridge Creek and Fairview Creek are confined by natural topography.

The following discussions describe existing water quality and stormwater conditions of these potentially affected water bodies and watersheds.

Columbia Slough

The Columbia Slough is a slow-moving, low-gradient drainage channel extending nearly 19 miles from Fairview Lake in the east to the Willamette River in the west. The slough is divided into upper, middle, and lower reaches. Water levels in the upper and middle sloughs are managed with pumps, small dams, and levees to support surface water withdrawals, flood control, and recreation. These management devices minimize the impacts of pollutants in the water by diluting them.

The I-5 crossing of the Columbia Slough is in a highly urbanized area. Riparian habitat along the slough has been largely replaced by buildings and paved surfaces. Riparian areas along the slough are generally not adequate to provide shade, bank stabilization, sediment control, pollution control, or streamflow moderation. The predominant land use around the slough in the project vicinity is light industrial, with some residential. The Columbia Slough connects to the Willamette River approximately 6.5 miles west of the project area, within a mile of the confluence of the Columbia and Willamette Rivers.

There are approximately 42.8 acres of pollutant-generating impervious surfaces (PGIS) and 1.6 acres of non-PGIS in the Columbia Slough's contributing impervious area (CIA). Stormwater runoff from about 3 acres of PGIS is dispersed and infiltrated rather than being discharged to the slough. For the portions of the future project footprint that currently drain to the Columbia Slough, pump station operations provide the only flow control measures. Existing stormwater treatment within the Columbia Slough watershed and the project's CIA is limited to a stormwater outfall to the Schmeer Slough. Stormwater treatment at the Schmeer Slough consists of a manhole sediment trap serving approximately 6 acres of existing PGIS. As discussed in the CRC Water Quality and Hydrology Technical Report, included as an electronic appendix to this FEIS, this facility is not considered to provide water quality treatment.

What are pollutant generating impervious surfaces (PGIS)?

These are surfaces that do not absorb water and to which contaminants may adhere, so that when stormwater strikes the surface, it runs off to a nearby surface, carrying some of these contaminants with it. If the water runs off to soil, these contaminants can enter the soil, causing harmful effects. In addition, PGIS are often warmer than the surrounding surfaces, and runoff from these surfaces that enters nearby rivers or lakes can raise water temperatures, causing harmful effects. Examples of PGIS include highways, parking lots, and sidewalks. For example, brake pad wear from highway traffic can deposit copper, known to have harmful effects on fish, on the road surface, and this copper can be carried by runoff into nearby streams.

Contributing impervious area (CIA)

For this project, a CIA consists of all impervious surfaces within the strict project limits and impervious surfaces outside the project limits that drain or are conveyed to the project area.

Columbia River and North Portland Harbor

The I-5 bridges are located at river mile (RM) 106 of the Columbia River. The Columbia River is highly constrained within the main project area by existing levees and landform. In addition, 10 bridge footings are currently located below the river's ordinary high water level (OHW), and these also constrict the river. A flood control levee runs along the south bank of the North Portland Harbor and forms a boundary between the adjacent neighborhoods and the harbor. Within the main project area, riparian habitat quality along both the north and south banks of the Columbia River is poor. Sandy beaches created by dredge disposal are also present along the Lower Columbia River. Shoreline erosion rates are likely slower than they were historically due to flow regulation and river bank protection. The river channel is deeper and narrower than historical conditions as well (USACE 2001).

North Portland Harbor is a large side channel of the Columbia River located between North Portland and the southern bank of Hayden Island. The channel branches off the Columbia River approximately 2 river miles upstream (east) of the existing bridge site, and flows approximately 5 river miles downstream (west) before rejoining the mainstem Columbia River. Piers and moorages line the majority of North Portland Harbor's shore within the main project area.

The Oregon side of the Columbia River, within the CIA, includes approximately 59.4 acres of PGIS, 3 acres of non-PGIS, and no existing stormwater treatment. Within the CIA, on the Washington side of the Columbia River, there are 120.7 acres of PGIS and 12.2 acres of non-PGIS. There is also no existing stormwater treatment, with the exception of approximately 3 acres of PGIS along SR 14 that is dispersed and infiltrated. On both sides of the river, including the North Portland Harbor, stormwater runoff from the existing bridge structures discharges directly to the water surface or ground below.

Burnt Bridge Creek

Burnt Bridge Creek is a small tributary to the lower Columbia River. It originates in an area east of Vancouver, Washington, near NE 162nd Avenue, and flows west (roughly paralleling SR 500 for approximately 5 out of its approximately 13 miles) to its outlet at Vancouver Lake. The lake then drains into the Lower Columbia River via Lake River.

The I-5 corridor is located in the vicinity of RM 2 of Burnt Bridge Creek. Burnt Bridge Creek enters the project area in Vancouver, east of 15th Avenue near Leverich Park and northeast of the I-5/SR 500 interchange. In the park area, the creek has substantial overhead cover from large-diameter trees and shrubs in some areas, and sparse cover by widely spaced large-diameter trees in areas maintained by park staff. In the more open areas within the park, the banks are highly eroded (WDFW/MHCC 1999).

From Leverich Park, the Burnt Bridge Creek channel passes under Leverich Park Way through a concrete culvert and onto Vancouver city property adjacent to I-5. The channel bank is artificially stabilized for approximately 100 feet, after which it continues north, parallel to I-5 and Leverich Park Way, through a silt-dominated channel.

Within this watershed, the CIA includes approximately 16.2 acres of PGIS and 0.3 acre of non-PGIS. In contrast to other watersheds in the main project area, stormwater runoff from the entire PGIS within Burnt Bridge Creek's CIA currently receives some level of stormwater treatment. Runoff from approximately 14.5 acres of PGIS and 0.2 acre of non-PGIS within the project footprint is conveyed to an infiltration pond at the Main Street interchange, and 1.7 acres is conveyed to a wet pond north of SR 500.

Fairview Creek

Fairview Creek is a 5-mile-long urban stream that originates in a wetland near Grant Butte in Gresham and drains to Fairview Lake, a tributary to the eastern portion of the Columbia Slough. Historically, the creek had flowed directly into the Columbia River. The present course of Fairview Creek was established when its waters were diverted into an artificial channel that drains into the Columbia Slough, which is a tributary of the Willamette River. The artificial channel travels through a heavily urbanized area, including residential neighborhoods, then crosses under multiple roadways through culverts.

What is stormwater infiltration?

Stormwater infiltration is the process by which stormwater sinks into the soil, becoming groundwater that, in turn, feeds rivers and lakes. Groundwater is also frequently pumped for household, industrial, agricultural, or municipal uses. Stormwater infiltration can occur naturally, where soil conditions and geography allow, or at artificially created stormwater infiltration facilities. Stormwater that runs off of impervious surfaces such as highways and parking lots can contain contaminants harmful to the environment. In addition, this runoff is often warmer than nearby water, and allowing it to enter rivers or lakes untreated can raise water temperatures, potentially causing harmful effects. Channeling stormwater into stormwater infiltration facilities is one way in which stormwater can be treated and cooled before it enters surface water bodies.

The Ruby Junction Maintenance Facility has 16.8 acres of PGIS. Runoff from the southwest portion of the existing Ruby Junction Maintenance Facility currently drains to Fairview Creek through a stormwater filtration system and wet pond. This portion of the site includes a paint and body shop and a parking lot. Stormwater from the rest of the existing facility is infiltrated through the use of dry wells, ultimately recharging the groundwater aquifer and contributing to flows in water bodies in the Columbia Slough watershed.

Further detail on the existing conditions of these surface water features is included in the CRC Water Quality and Hydrology Technical Report, included as an electronic appendix to this FEIS. Groundwater and aquifers are discussed in greater detail in Section 3.17 of this FEIS.

3.14.3 Long-term Effects

Water Quality

The differences in long-term effects on water quality between the LPA and the No-Build Alternative are substantial. Although the total amount of PGIS would slightly increase for the LPA, the amount of untreated impervious surface would drop dramatically compared to existing conditions and the No-Build Alternative. Under the LPA, stormwater runoff from all existing, new or reconstructed impervious surface area within the CIA would be treated, while stormwater runoff from most of the existing PGIS does not currently undergo stormwater treatment. As a result, within the CIA, the LPA would decrease the PGIS contributing untreated runoff to rivers and streams by 219 acres.

Exhibit 3.14-4 compares the water quality impacts, according to pollutant loading estimates, of the LPA to the other build and No-Build alternatives. As shown, total suspended solids and other pollutants entering the project waterways would decrease substantially in the main project area as a result of the construction of the LPA. However, while the Columbia Slough drainage would experience a decrease in other pollutants, under the LPA Options A and B, it may experience a slight increase in dissolved copper (0.01 to 0.02 pounds per year, respectively). For surface waters overall, the highway phasing options provide similar but slightly better water quality improvements relative to the full LPA options, including a reduction in dissolved copper in the Columbia Slough relative to the No-Build Alternative. The project is affecting pollutant loading in two ways. The project will treat stormwater from existing pollutant generating impervious surfaces that were previously untreated. As a result, overall water quality improves with the project. Also, the pollutant loading model assumes, even with treatment, that stormwater from additional new pollutant generating impervious surfaces increases the amount of pollutants in surface waters. Because the highway phasing options have less new impervious surface than the full LPA, but still provide treatment for a great deal of existing impervious surfaces, the model suggests it has less pollutant loading than the Full Build.

As noted in Exhibit 3.14-4, the conceptual stormwater treatment design used in the DEIS to analyze Alternatives 2 through 5 was updated for this FEIS, and since publication of the DEIS a more precise understanding of the project footprint and stormwater basins has been developed. If Alternatives 2 through 5 were reanalyzed using the updated stormwater design, they would provide water quality improvements similar to the LPA.

For the LPA, stormwater runoff from all impervious areas in the Ruby Junction Maintenance Facility expansion area would be infiltrated to groundwater. The infiltration techniques would comply with the City of Gresham stormwater management requirements. Therefore, the water quality of Fairview Creek would not be adversely impacted by any of the LPA alternatives.

Modifications to the Steel Bridge would allow MAX trains a maximum speed of 15 mph on the bridge, thus improving the speed of all MAX lines crossing the bridge. The work needed to increase the speed limits over the Steel Bridge lift spans would include grinding the transit rails within the track bed, installing a vibration pad, stiffening support brackets, and traffic signal adjustments. Only the grinding of the rail could potentially impact water quality. However, standard practices for shielding the work area and containing and collecting all work area generated waste would prevent materials from spreading onto the bridge and being transported into the Willamette River via stormwater runoff. Therefore, no water quality impacts are anticipated due to the Steel Bridge modifications.

Exhibit 3.14-4

Annual Pollutant Load Estimates for the LPA and Other Project Alternatives

Environmental Metric	Locally Preferred Alternative[a]		No-Build	Alt 2: Repl Crossing with BRT	Alt 3: Repl Crossing with LRT	Alt 4: Suppl Crossing with BRT	Alt 5: Suppl Crossing with LRT
	LPA Option A	LPA Option B					
Approximate total PGIS area (acres)	267 (256)	267 (257)	239	247	246	232	231
Approximate untreated PGIS area (acres)	0	Same as Option A	219	38	38	35	35
Total Suspended Solids (lbs/year)	14,062 (13,578)	14,124 (13,640)	168,103	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]
Dissolved copper (lbs/year)	5	Same as Option A	9	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]
Dissolved zinc (lbs/year)	22	Same as Option A	68	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]	Similar to LPA[b]

a Text in parentheses indicates impacts if the LPA Option A or B is constructed with highway phasing.

b The pollutant loading estimates for Alternatives 2 through 5, as reported in Section 3.16 of the DEIS, were not updated for the FEIS. The conceptual stormwater treatment design used in the DEIS was updated for the LPA analysis for this FEIS; since publication of the DEIS, more precise understandings of the project footprint and stormwater basins have been developed. If Alternatives 2, 3, 4 and 5 were reanalyzed, all the build alternatives, including the LPA, would perform similarly.

Stormwater

As mentioned above, the LPA includes an updated conceptual stormwater treatment design for the project corridor. This design includes a number of stormwater treatment facilities and infiltration facilities to reduce pollutants (including sediment and metals) entering waterways. The design also provides flow control for stormwater runoff discharged to Burnt Bridge and Fairview Creeks; flow control is not required for discharges to the Columbia Slough, North Portland Harbor, or the Columbia River.

The proposed project, not including TriMet's Ruby Junction Maintenance Facility, would increase the total impervious (PGIS and non-PGIS) area by approximately

42 acres. Unmitigated, this could reduce infiltration rates and increase the amount of pollutants in stormwater. However, although impervious area would increase under the LPA, untreated PGIS would be eliminated. Relative to the No-Build Alternative, the LPA reduces untreated PGIS from 219 acres to zero (0) acres.

At present, the project area provides treatment, in the form of infiltration, for only 21 acres of existing PGIS. The completed project would provide treatment not only for the new PGIS, but also for runoff from existing PGIS within the project footprint that does not currently receive treatment and for runoff that drains onto the project footprint within the project CIA. Including areas where stormwater is infiltrated, LPA Options A and B would result in a net increase of the amount of PGIS receiving treatment by approximately 250 acres relative to the No-Build Alternative. This scenario represents treatment of nearly nine times the area of PGIS that would be added as part of the LPA. Stormwater runoff would either be infiltrated or treated in compliance with current standards before being discharged to project area water features.

At the TriMet Ruby Junction Maintenance Facility, no new structures are planned to be constructed in the floodplain of Fairview Creek, but some PGIS would be added and some would be replaced outside the floodplain. There would be a net gain of 0.7 acre of PGIS. All of the existing PGIS onsite (16.8 acres) is currently infiltrated and all PGIS would continue to be infiltrated following construction.

Traffic models projected to the year 2030 indicate that the LPA would substantially decrease traffic congestion within the project corridor. Decreasing traffic congestion on the I-5 and North Portland Harbor bridges and associated roadways would decrease idling and brake pad wear and may consequently reduce the amount of copper and other traffic-related pollutants currently carried by corridor stormwater runoff. Potential reductions associated with decreased congestion resulting from the LPA are not included in the pollutant load analysis shown in Exhibit 3.14-4.

LPA Option B would not differ from LPA Option A in its proposed stormwater treatment facilities; however, Option B includes 0.3 acre more PGIS in the Columbia Slough watershed and 0.4 acre more PGIS in the Columbia River watershed on the Oregon side than Option A. Because highway phasing would postpone some project improvements, the biofiltration swale proposed south of Victory Boulevard and west of I-5 and one proposed bioretention pond adjacent to the SR 500 interchange would also be postponed.

Hydrology

Two key elements of hydrology were analyzed for the FEIS: floodplains and increases in stormwater runoff. When analyzing hydrologic impacts, it is important to study all impervious surfaces, not just PGIS, as even those impervious surfaces that are unlikely to impact water quality can still impact the flow of water.

The installation of piers within the Columbia River and North Portland Harbor would encroach upon the Columbia River's 100-year floodplain. However this would result in little, if any, increase in flooding risks, given the relatively small size of the bridge piers compared to the size of the Columbia

River. New roads within the project area would either be elevated above the floodplain or would avoid floodplains altogether. Construction activities would occur, but no structures would be placed, within the 100-year floodplain of Fairview Creek at the Ruby Junction Maintenance Facility.

Exhibit 3.14-5 shows the project's new and rebuilt impervious surfaces by project element and watershed. An overall increase in impervious surfaces within the project area is likely to result in increased stormwater runoff rates and volumes. Without mitigation, this could affect the hydrology of project waterways. The Columbia River and Columbia Slough are large water bodies and the project-related increase in stormwater quantity would not result in a measurable increase of flows in these surface waters. Burnt Bridge Creek and Fairview Creek are smaller water bodies and more prone to be affected by increased stormwater quantity resulting from increased impervious surfaces. However, at Burnt Bridge Creek, engineered water quality facilities would be designed to reduce the rate of runoff from the project to pre-development conditions. At Fairview Creek, stormwater from all new impervious surfaces would be infiltrated.

Exhibit 3.14-5

New and Rebuilt Impervious Surfaces (acres) by Project Element and Watershed

Project Element	Columbia Slough	Columbia River South	Columbia River North	Burnt Bridge Creek	Fairview Creek (Ruby Junction)	Project Element Total Impervious Surface Area
Highway structures	10.8	19.4	20.7	0.8	0.0	**51.7**
Highway pavement (incl. tunnels)	31.1	21.4[a]	54.6	9.5	0.0	**116.6**
Transit guideway, platforms, and associated roadway	0.1	0.2	16.7	0.0	0.0	**17.0**
Transit maintenance facilities	0.0	0.0	0.0	0.0	5.4	**5.4**
Transit structures	0.0	2.8	0.8	0.0	0.0	**3.6**
Park and ride structures	0.0	0.0	5.0	0.0	0.0	**5.0**
Sidewalks and bike-pedestrian paths (incl. those on transit structures)	4.3	7.4	13.3	0.7	0.0	**25.7**
Total New and Rebuilt Impervious Surfaces by Watershed	**46.3**	**51.2**	**111.1**	**11.0**	**5.4**	**225.0**

a This does not include 10 acres of post-project TOD assumed in the Stormwater Management Memorandum adjacent to the Hayden Island Light Rail Transit station. The Stormwater Management Memorandum is an appendix of the CRC Water Quality and Hydrology Technical Report.

With LPA Option B, the proposed local multimodal bridge over North Portland Harbor would carry only light rail transit and bicycles and pedestrians; it would not include traffic lanes, and vehicle movements between the Oregon mainland and Hayden Island would instead be accommodated by highway ramps adjacent to the I-5 mainline. This would result in slight PGIS increases, relative to LPA Option A, of 0.3 acre in the Columbia Slough watershed and 0.4 acre in the Columbia River watershed in Oregon.

Both LPA options with highway phasing include 10.7 fewer acres of PGIS than their Full Build counterparts. Under each highway phasing option, the flyover ramp between eastbound Marine Drive and northbound I-5 would not be constructed initially. In addition, the ramp between Marine Drive and southbound I-5 would be terminated north of Victory Boulevard. These changes would reduce the PGIS within the Columbia Slough watershed by about 5.5 acres. Also, with highway phasing, improvements to 39th Street as well as the connections between westbound SR 500 and northbound I-5 and between southbound I-5 and eastbound SR 500 would be postponed. In addition, there would be no improvements to I-5 itself north of 39th Street. Phasing of this highway construction would postpone the construction of approximately 5.2 acres of CIA, all of which lies within the Burnt Bridge Creek watershed.

Executive Order 11988 and local and state regulations require more detailed analysis of floodplain impacts, including a no-rise analysis, prior to project approval. At this time, preliminary calculations indicate that no floodway impacts are expected to occur as a result of construction. Therefore, floodway mitigation is not anticipated. However, further analysis will be completed when a more detailed design of bridge piers is available and prior to permitting. In addition to flood rise analysis, project-related alterations to the U.S. Army Corps of Engineers' (USACE) levee system will require federal review and authorization.

Indirect Effects

The LPA would support development and redevelopment of property adjacent to or near light rail stations on Hayden Island and in downtown Vancouver, consistent with local municipal planning efforts. The impacts to the built and natural environment resulting from these changes to property are considered the long-term indirect effects of the LPA. Development and redevelopment, including removal or renovation of existing in-water structure and near-shore development, would comply with the relevant laws, regulations, policies, and code in force at the time of the action. The development and redevelopment would likely trigger the need to upgrade existing infrastructure to comply with existing stormwater treatment regulations. Local regulations require the avoidance and minimization of impacts to protected resources. These resources include shorelines, wetlands, streambanks, and their buffers, resources that are often most important to juvenile salmonids and their habitat. However, as the project would comply with all relevant regulations, impacts to existing resources would be negligible.

Although the project is anticipated to facilitate and expedite TOD construction on Hayden Island and in downtown Vancouver, the LPA could induce small amounts of development to occur at other locations as well. However, to the extent such development occurs, it would have to be consistent with local municipal planning efforts, as well as the laws, regulations, policies, and codes that manage impacts to water quality and hydrology. As such, even with some additional unanticipated development effect, impacts to resources should remain negligible.

3.14.4 Temporary Effects

Temporary effects are those that would occur during construction of the LPA and that would likely cease once construction is finished. No CRC-related construction would occur if the No-Build Alternative is chosen, so no temporary effects are considered for that option. Temporary effects have been divided into on-site construction and off-site construction effects. On-site refers to construction-related activities within the main project area and at the Ruby Junction Maintenance Facility. Off-site refers to construction activities that would take place at major project casting and staging areas.

To comply with the federal Endangered Species Act (ESA), the CRC project team consulted with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS). The consultation, now complete, resulted in the identification of measures to protect salmon from water quality impacts during construction as well as during project operations. The CRC project team will prepare applications for dredging and fill activities under Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers (USACE), and will seek water quality certification under Section 401 of the Clean Water Act, administered by DEQ and the Washington Department of Ecology (Ecology).

National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Discharge Permits would regulate the discharge of stormwater from on-site and off-site construction sites. These permits include discharge water quality standards, runoff monitoring requirements, and provision for preparing a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would contain all the elements of a Temporary Erosion and Sediment Control Plan (TESCP) and Spill Prevention Control and Countermeasures Plan (SPCCP). These are described in further detail in the CRC Water Quality and Hydrology Technical Report, included as an electronic appendix to this FEIS.

As part of securing the NPDES permits, the CRC project team will develop these plans to control construction-related risks from erosion, sedimentation, or accidental spills. Construction will not begin until these plans are approved by the appropriate agencies, which include the DEQ, Ecology, City of Portland, City of Vancouver, and City of Gresham. Plans will specifically address spill prevention and in-water construction work and could include specific water quality targets, with penalties if these targets are not met. There may be special runoff control requirements to address the 303(d) listings of each of the waterways in the project area.

The temporary impacts associated with specific types of construction activity are discussed in greater detail below. It is important to note that state and local regulations require use of mitigation measures to ensure that long-term water quality and hydrology impacts associated with project construction and operation would be avoided, and any unavoidable impacts minimized and mitigated. The LPA would not be constructed until state, federal, and local agencies approve the proposed impact minimization and mitigation methods.

On-site Construction

IN-WATER WORK

In-water construction of bridge piers could move sediments from the riverbed and suspend them in the river, which would increase turbidity. In-water work includes the use of barges and work bridges in the Columbia River and North Portland Harbor, equipment that would be temporarily anchored to the riverbed. Temporary cofferdams would also be installed, but would not be dewatered, for the piers nearest the shoreline, where the water is shallow.

Turbidity caused by any activity inside the cofferdams (including installation of permanent shafts as well as temporary piles) would be contained within the cofferdams. (See Exhibit 3.14-6 for a cofferdam example.) Sediment would be disturbed during the installation and removal of the cofferdams. During the demolition of the existing structures, riverbed sediment would be disturbed when the timber piles of the I-5 bridges are cut off below the mudline.

What are cofferdams?

A cofferdam is a temporary, watertight enclosure used to isolate work areas from surrounding waters. The CRC project could require cofferdams to isolate work areas in the Columbia River where new bridge pier foundations are constructed near shore or where existing ones are removed.

Exhibit 3.14-6
Cofferdam Example

Source: CalTrans 2007.

There are no known records of contaminated sediments in the Columbia River portion of the project area. Therefore, there is very little risk that in-water work in the Columbia River would resuspend contaminated sediments. Contaminated sediments have been identified in the North Portland Harbor, but they are likely outside of the project footprint. If there is potential that in-water work could disturb these sediments, they would be analyzed in accordance with regulatory criteria, and if necessary, removed from the river and disposed of properly. Removed sediments may be disposed of in a permitted upland disposal site, if required.

Potential sources of toxic contaminants associated with in-water work include refueling track-mounted equipment located on the barges or work bridges, lead-based paint from the existing bridges, turbidity and concrete debris from wire-saw-cut concrete during demolition, green concrete (concrete that has not fully cured) associated with bridge construction, potential spills from construction equipment, and materials accidentally entering the Columbia River and North Portland Harbor during over-water work. Full containment of fuel, other hazardous materials, and green concrete would be required to prevent these materials from entering the Columbia River and North Portland Harbor, in accordance with project specifications.

BELOW-GRADE CONSTRUCTION

On land, construction activities occurring below-grade may require the removal of groundwater through pumping, a process known as dewatering. Therefore, constructing roads, transit lines, and other infrastructure below the surrounding surface can alter groundwater conditions. If there are nearby hazardous materials sites, dewatering can increase the likelihood of contaminants migrating through the groundwater and into surface waters. The following elements of the LPA are relatively close to high ranking potential hazardous materials sites and near-surface groundwaters, and work at these sites would require below-grade construction techniques:

- Marine Drive Interchange
- North Portland Harbor Bridges
- Hayden Island Interchange
- Columbia River Crossing
- SR 14 Interchange

Left unmitigated, construction of these elements could result in moderate risks for the migration of existing contamination, potentially affecting both ground and surface water quality. Sites with existing soil or groundwater contamination near construction areas will be further studied and tested before any groundwater pumping occurs, in order to avoid causing such contamination to spread.

In addition to existing contamination, the installation of shafts and piles below ground includes the risk of introducing new contamination, for example from green concrete, into groundwater.

Further discussion of contamination issues associated with below-grade construction is included in the CRC Hazardous Materials Technical Report, included as an electronic appendix to this FEIS.

GROUND DISTURBANCE

Without proper management, land-based construction activities may have temporary adverse effects on water quality in nearby water bodies. Construction involves ground disturbances which can increase soil erosion substantially, especially for construction activities along river or stream banks. The LPA would involve ground disturbance near North Portland Harbor, the Columbia River, near Burnt Bridge Creek, and near Fairview Creek. If runoff contains extra sediment from erosion, waterways can become turbid (cloudy) and can build up excessive sediment deposits. Runoff and soil erosion can also transport pre-existing hazardous materials and construction related hazardous materials into water bodies, some of which may dissolve in water or are water-transportable. Section 3.16, Ecosystems, discusses the harmful effects of turbidity and hazardous materials to fish. Topography in the project area is generally flat, except near Burnt Bridge Creek. As discussed in Section 3.17, Geology and Soils, roadway construction of the I-5/SR 500 interchange (for all alternatives) would disturb steep slopes near the creek.

Exhibit 3.14-7 summarizes the areas that could be disturbed during construction, by watershed. The table includes all areas within the LPA right-of-way as well as near Fairview Creek, but does not include potential areas of construction in or over water or additional land that could be required outside the right-of-way for casting or staging.

Exhibit 3.14-7
Areas of Potential Disturbance During Construction

Watershed	Potential Area of Temporary Disturbance
Columbia Slough	105 acres
Columbia River - Oregon	70 acres
Columbia River - Washington State	170 acres
Burnt Bridge Creek	55 acres
Fairview Creek	15 acres

Off-site Staging and Casting

Constructing the river crossing would require at least one large site to stage equipment and materials, and may also need a large site for use as a casting yard for fabricating segments of the new bridges. The potential sites for staging and bridge assembly/casting areas include the Port of Vancouver Parcel 1A, the Red Lion at the Quay, the vacant Thunderbird Hotel site on Hayden Island, The Port of Vancouver Alcoa/Evergreen West site, and the Sundial site. Each of these sites is adjacent to the Columbia River. The existing conditions on these sites range from a developed and paved port terminal to a currently undeveloped site. Staging and casting/assembly site activities may increase stormwater runoff over existing conditions and may increase pollutant levels in the runoff. However, any staging and/or casting site would be required to meet all applicable stormwater requirements. All necessary permits would be secured prior to site development and operations for any major staging or casting yard.

3.14.5 Mitigation or Compensation

A flood-rise analysis will be conducted during final design, when the bridge design is further advanced, to precisely calculate the impact that piers in the water would have on flood elevation, in accordance with local and state regulations and Executive Order 11988, Floodplain Management. Pending the formal hydraulic analysis, it is not possible to conclusively state that zero flood-rise will occur. However, given available information, it is reasonable to assume that formal hydraulic analysis will conclude that there would be no flood-rise, or if analysis indicates that any rise would occur, it would be very small. One factor reducing the risk of flood-rise is that, despite the LPA increasing impervious surface area by approximately 42 acres, the LPA's conceptual stormwater design increases the amount of impervious surface area receiving infiltration by 91 acres, thus resulting in a net reduction in runoff. Should flood-rise be projected or the existing floodplain be otherwise negatively impacted, mitigation would be identified to negate the impacts. Specific mitigation measures, if necessary, would be determined in coordination with federal, state, and local regulatory agencies, but could include balanced cut and fill, map revisions, and/or bridge pier volume reduction or design revision.

Re-vegetation of construction easements and other temporarily disturbed areas would occur after construction is completed. All disturbed riparian vegetation would be replanted with species native to the geographic region. A 5-year monitoring plan for re-vegetated areas would be implemented to ensure 100 percent survival of vegetation by stem count at the end of 1 year and 80 percent survival by stem count at the end of the 5-year monitoring period. If these success criteria were not met by the end of the 5-year period, adaptive management would be implemented to ensure the revegetation of the site. For additional details, see ODOT Standard Specifications 01040.00 to 01040.90 and/or WSDOT Standard Specification 8-01.3(2)F.

To mitigate the effect of pollutants in runoff from additional impervious surface area, the CRC project team has prepared a conceptual stormwater management design. The design was prepared to meet the requirements of ODOT and WSDOT for those portions of the project along I-5. These requirements are described in the 2006 ODOT Hydraulics Manual, 2010 WSDOT Hydraulics Manual, and 2008 WSDOT Highway Runoff Manual. The Cities of Portland and Vancouver regulations, found in the 2008 City of Portland Stormwater Management Manual and 2005 Stormwater Management Manual for Western Washington, respectively, will be implemented for those portions of the project along City-managed roads. The design for the Ruby Junction Maintenance Facility (as discussed in Section 3.14.3) would comply with the City of Gresham stormwater management requirements found in the 2006 City of Gresham Stormwater Management Plan.

The conceptual stormwater management design prepared for the FEIS analysis includes gravity pipe drainage systems with pumping in a few discrete areas. The drainage systems would collect and convey runoff from the new bridges, transit guideway, and road improvements. Stormwater treatment facilities would reduce total suspended solids (TSS), particulates, and dissolved metals to the maximum feasible extent before runoff reaches surface waters.

After consultation with and agreement from WSDOT and State of Washington regulatory agencies, the project has adopted ODOT's technical memorandum on stormwater quality (ODOT 2009c) on a project-wide basis to provide a standard approach to determining types of water quality facilities that would provide adequate protection to listed species. The memorandum is the result of a collaborative effort by ODOT, FHWA, and the following natural resource agencies: NMFS, DEQ, USFWS, EPA, and the Oregon Department of Fish and Wildlife (ODFW). The decision to use this approach on the CRC project has been endorsed by WSDOT and Ecology.

Based on the ODOT technical memorandum, some or all of the following water quality BMPs will be included in the CRC project (these BMPs are effective in reducing sediments, particulates and dissolved metals—pollutants of concern for ESA-listed species observed in the waterbodies to which stormwater will be discharged):

- **Bioretention ponds** are infiltration ponds that use an engineered (amended) soil mix to remove pollutants as runoff infiltrates through this material and into underlying soils.
- **Constructed treatment wetlands** are shallow, permanent, vegetated ponds that function like natural wetlands. They remove pollutants through such means as sedimentation, sorption, microbial activity, and uptake by plants.

What is sorption?

Sorption refers to a combination of two separate processes—absorption and adsorption—occurring at the same time. Absorption is the process by which one material is incorporated into material of a different state; for example, a dry sponge absorbs water. Adsorption is the process by which one substance adheres to—sticks to—the surface of another. For example, in certain air filtering systems, dust and other particulate matter adsorbs to the surface of the filter. When contaminated water infiltrates soil, the soil both absorbs the water and adsorbs certain pollutants.

- **Soil-amended biofiltration swales** are channels with mild slopes and shallow depths of flow. The channels are dry between storm events and are typically grassed. They treat runoff by filtration and sorption as runoff flows through the vegetated surface and amended soils.
- **Soil-amended filter strips** are intended to treat sheet runoff from an adjacent roadway surface. Similar to biofiltration swales, filter strips treat runoff by filtration and sorption as runoff flows through the vegetated surface and amended soils.
- **Bioslopes**, like filter strips, are intended to treat sheet runoff from an adjacent roadway surface. Bioslopes are also known as ecology embankments. The percolating runoff flows through a special mixture of materials, which promotes the adsorption of pollutants.
- **Proprietary systems**, such as catch basins with built-in cartridge filters, are designed to filter pollutants out of stormwater through straining, adsorption, and chemical transformation. These systems are known for their ability to consistently remove fine-grain suspended solids.

Exhibit 3.14-8 shows the location of stormwater treatment facilities that are included in the conceptual stormwater design for the LPA.

This conceptual stormwater design was also discussed in the Biological Assessment (BA) prepared for the ESA compliance, and is consistent with the terms and conditions included in the project's Biological Opinion (BO) (see Appendix N of this FEIS). The design of the stormwater collection and treatment system will be further developed, refined, and finalized after the ROD as part of the final project design.

Exhibit 3.14-8

Stormwater Management Facility Locations

Dimensions are approximate.

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