

MILLENNIUM **Bulk Terminals—Longview**

EIS Environmental Impact Statement

State Environmental Policy Act Final Environmental Impact Statement

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DEPARTMENT OF ECOLOGY State of Washington

Volume III.b

Natural Environment Technical Reports

Geology and Soils

Surface Water and Floodplains

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Water Quality

Vegetation

Fish

Wildlife

Energy and Natural Resources

MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA GEOLOGY AND SOILS TECHNICAL REPORT

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Acronyms and Abbreviations

Applicant	Millennium Bulk Terminals—Longview, LLC
BMP	best management practice
BNSF	BNSF Railway Company
CRD	Columbia River Datum
CSZ	Cascadia Subduction Zone
Ecology	Washington State Department of Ecology
g	gravity
LVSW	Longview Switching Company
PGA	peak ground acceleration
Reynolds facility	Reynolds Metals Company facility
UP	United Pacific Railroad
USGS	U.S. Geological Survey

Chapter 1
Introduction

This technical report assesses the potential geology and soil impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and the No-Action Alternative. For the purposes of this assessment, geology and soils refers to items such as earthquakes and site constraints that may affect project engineering and design. This report describes the regulatory setting, establishes the methods for assessing potential geology and soil impacts, presents the existing geologic and soil conditions in the study area, and assesses the potential for impacts on geology and soils.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east

in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

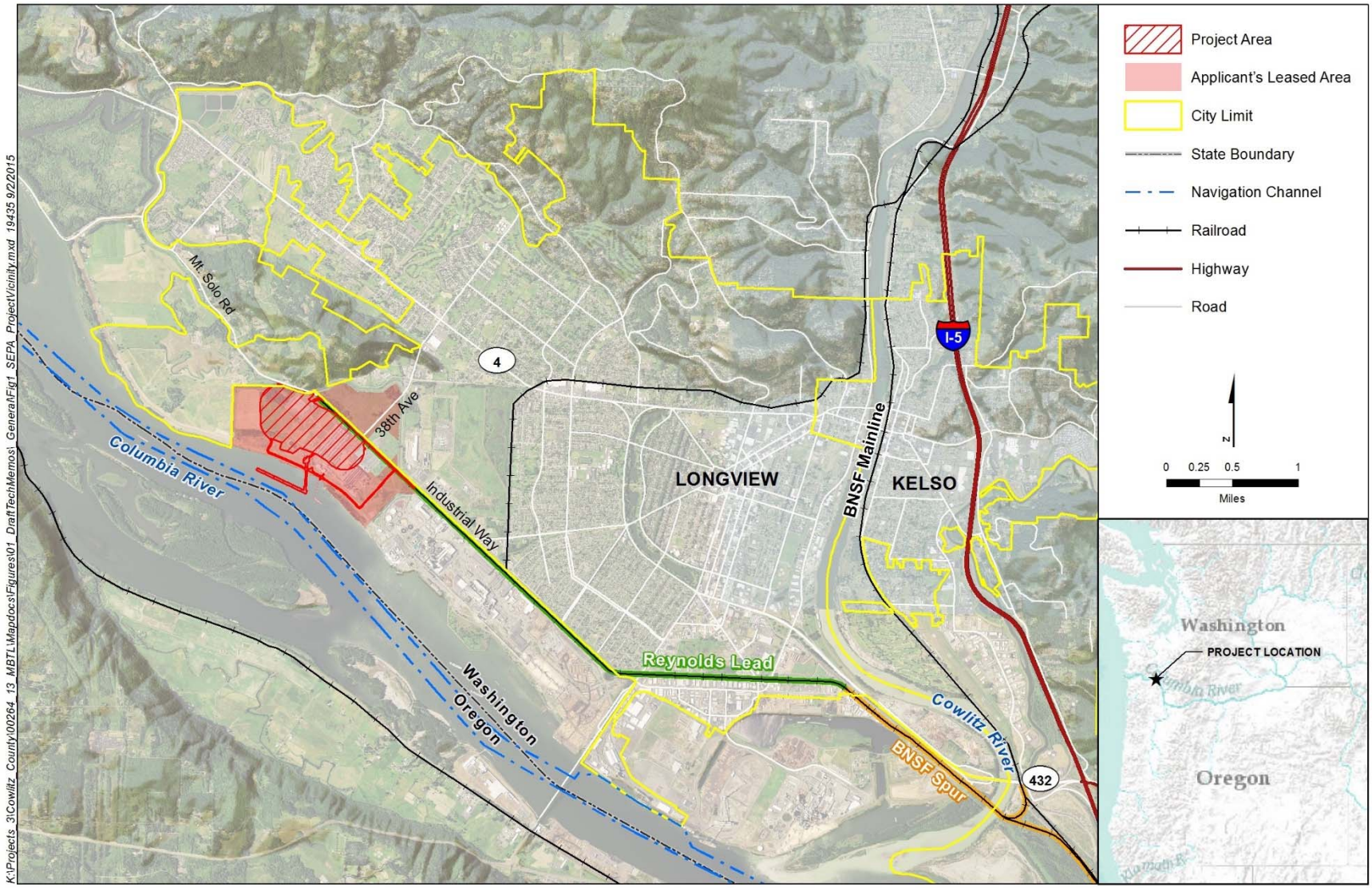
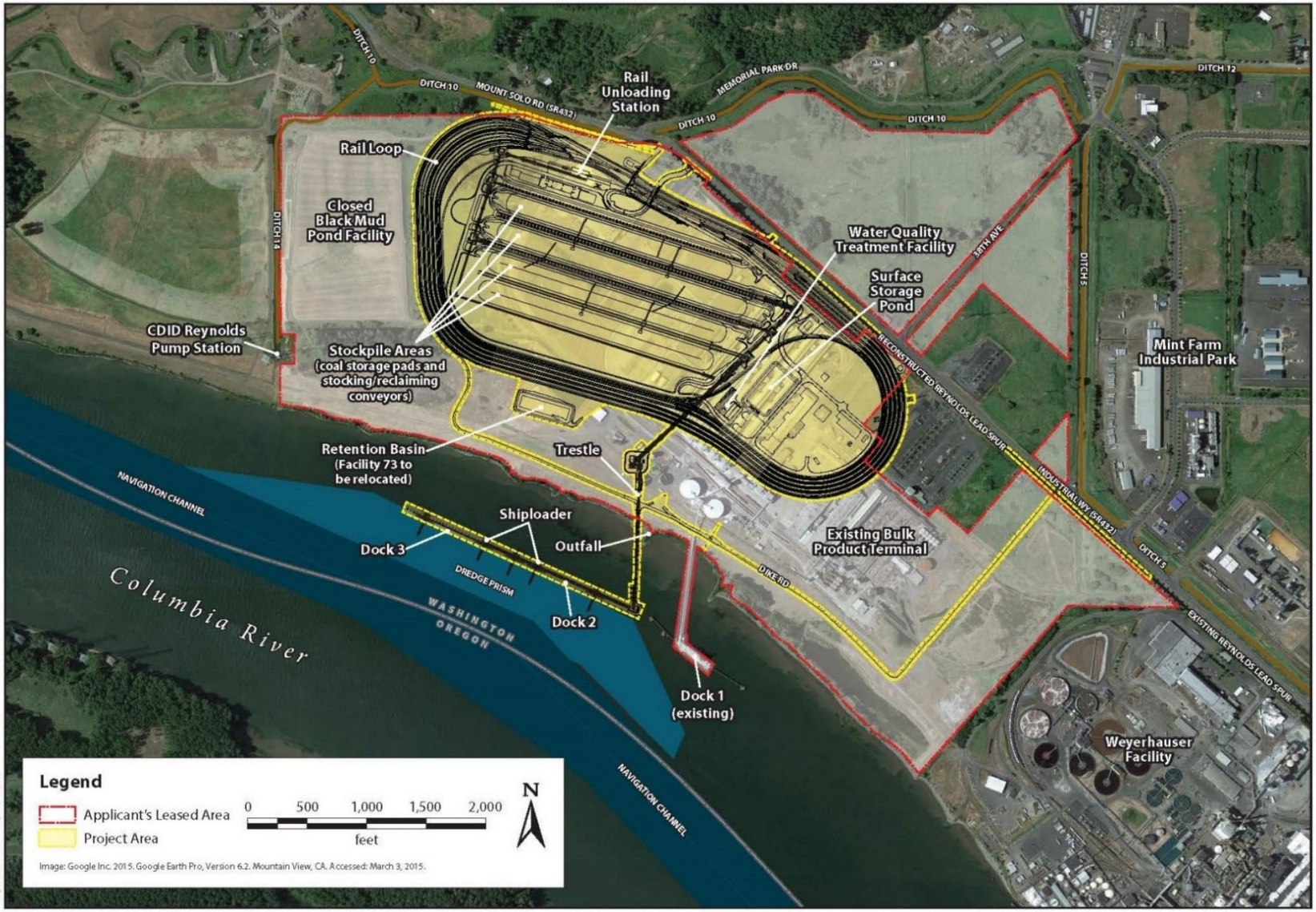


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

Different jurisdictions are responsible for the regulation of geology and soils. These jurisdictions and their regulations, statutes, and guidance that apply to geology and soils are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidance for Geology and Soils

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental impacts. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Clean Water Act Section 402 Permit for Stormwater Discharges Associated with Construction Activities	Primarily deals with water quality but includes eroded soil that is potentially delivered offsite via water runoff. Mandates that certain types of construction activity (and operations) comply with the EPA NPDES program. The EPA has delegated Ecology as the authority for the NPDES program in Washington State. Includes development of a stormwater pollution prevention plan.

Regulation, Statute, Guideline	Description
State	
Washington State Environmental Policy Act (RCW 43.21c)	SEPA directs state and local agencies to consider environmental impacts (cumulative, short-term, long-term, direct, and indirect), alternatives, and mitigation before committing to an action. SEPA gives agencies the authority to condition or deny a proposal based on the agency's adopted SEPA policies and environmental impacts identified in a SEPA document (RCW 43.21C.060, WAC 197-11-660).
Local	
Cowlitz County SEPA Regulations	Cowlitz County has adopted and incorporated rules pertaining to the integration of policies and procedures as required under SEPA (RCW 43.21C.120).
Cowlitz County Critical Areas Protection Ordinance (CCC 19.15)	Designates geologically hazardous areas (including seismic, volcanic, erosion, and landslide hazards) and defines performance standards and specific requirements for development within these areas.
Cowlitz County Grading (16.35)	Grading plan requirement and standards including the protection of water quality from adverse impacts of erosion and sedimentation.
Cowlitz County Building Code (16.05)	Cowlitz County has adopted the 2012 International Building and Residential Codes.

Notes: NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; USC = United States Code; RCW = Revised Code of Washington; SEPA = Washington State Environmental Policy Act; EPA = U.S. Environmental Protection Agency; NPDES = National Pollutant Discharge Elimination System; Ecology = Washington State Department of Ecology; CCC = Cowlitz County Code

1.3 Study Area

The study area for geology and soils is the project area. Additionally, the study area includes the broader geologic environment that can influence the project areas. These broader geologic influences include earthquakes (seismicity) and their associated impacts (e.g., ground shaking) as well as tsunamis (large earthquake-generated waves that can affect coastal zones and may extend some distance up large rivers) or off-site landslides that might reach the sites.

Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to geology and soils.

2.1 Methods

This section describes the methods used to characterize the existing conditions and assess the potential impacts on geology and soils.

2.1.1 Data Sources

Information with respect to geology and soils was collected through review of information and reports provided by the Applicant, Washington State Department of Natural Resources Division of Geology and Earth Resources materials, U.S. Geological Survey (USGS) maps and reports, U.S. Department of Agriculture Natural Resources Conservation Service soil information, and geological and soil literature. Additionally, a site visit conducted on January 29, 2014 provided an overview of existing conditions at the project areas.

The following sources of information were used to evaluate the characteristics of geology and soils in the study area.

- USGS National Seismic Hazard Maps and associated report (U.S. Geologic Survey 2013).
- Cascadia Region Earthquake Workgroup (2013) report on the Cascadia Subduction Zone (CSZ) earthquakes.
- USGS reports on Washington State volcanic hazards (various).
- USGS reports on Columbia River liquefaction associated with CSZ earthquakes (various).
- Washington State Department of Natural Resources Division of Geology and Earth Resources geologic mapping and geologic hazards of the Longview area (various).
- Natural Resources Conservation Service soil mapping (2013).
- Geotechnical engineering reports and geotechnical engineering data reports prepared for the project area (GRI 2011, 2012).
- Professional workshop and refereed scientific journal materials on tsunamis in the Columbia River.
- Permit application and other materials prepared by the Applicant.
    - Washington State Joint Aquatic Resources Permit Application.
    - Cowlitz County Shoreline and Shoreline Conditional Use Application.
    - Applicant's Purpose and Need.
    - Geology and soil reports prepared for the project areas (URS Corporation 2014).

2.1.2 Impact Analysis

The analysis of impacts related to geology and soils considered the following elements.

- Regional and site characteristics (bedrock, unconsolidated sediment, and soil characteristics) and their influence on site or structure stability through soil erosion, landslides, and settling.
- Potential ground shaking and ground settling due to earthquakes and the stability of the underlying materials.
- The potential for impacts related to volcanic hazards and tsunamis.

2.2 Existing Conditions

The existing environmental conditions related to geology and soils in the study area are described below. Broader geologic context is provided as a foundation for the site-specific analysis.

2.2.1 Local and Site Geology

The project area for the Proposed Action is located on the north shore of the Columbia River approximately 5 miles downstream of the confluence of the Cowlitz and Columbia Rivers at approximately river mile 63 on the Columbia River. The project area is approximately 16 feet Columbia River Datum (CRD). The site is underlain by river and floodplain deposits and the surface is fairly level. Levees were constructed along the riverside of the project area (Figure 3) in approximately 1920, and the site has been industrialized since the 1940s (Anchor QEA 2011). The adjacent Columbia River navigation channel is approximately 43 feet deep at low tide (-43 feet CRD; National Oceanic and Atmospheric Administration Chart 18524) and from 28 to 42 feet deep at low tide at the location of the proposed docks (Dock 2 and Dock 3) (Millennium Bulk Terminals—Longview 2010). Although the project area is fairly level, steeper slopes descend into drainage ditches in the northern part of the project area and to the Columbia River on the south side of the project area and an on-site constructed pond. No unique geologic physical features occur at the project area.

While the physical attributes and location of the project area are dominated by their presence in the lower Columbia River valley, geologically they are within the broadly north to south–oriented physiographic-geologic province of the Puget Sound Lowland–Portland Basin–Willamette Valley lowland (Washington State Department of Natural Resources 2014a). In the Longview-Kelso area, this lowland area is quite narrow compared to the Puget Sound and Portland Basin–Willamette Valley portions to the north and south, respectively. The Longview-Kelso area is sometimes referred to locally as the Longview-Kelso basin (GRI 2012; URS Corporation 2014).

Figure 3. Levees Adjacent to the Proposed Action



The regional geology is dominated by events related to the eastward movement of the Juan de Fuca tectonic plate against the North American plate (Evarts et al. 2009; Parsons et al. 2005). The Juan de Fuca plate plunges (or forms a subduction zone) progressively deeper as it moves east beneath the North American plate. This movement compresses the rocks above it thereby producing both uplift and down dropping (troughs or basins). This area is also referred to as the CSZ. Additionally, as the Juan de Fuca plate melts at depth, the associated magma (lava) rises to the surface forming the Cascade volcanic range. Consequently, the three major geologic zones from west to east are the Coast Range forearc, the Puget Sound–Portland Basin–Willamette Basin forearc trough (encompassing the project area) and the Cascade Range volcanic arc (Evarts et al. 2009).

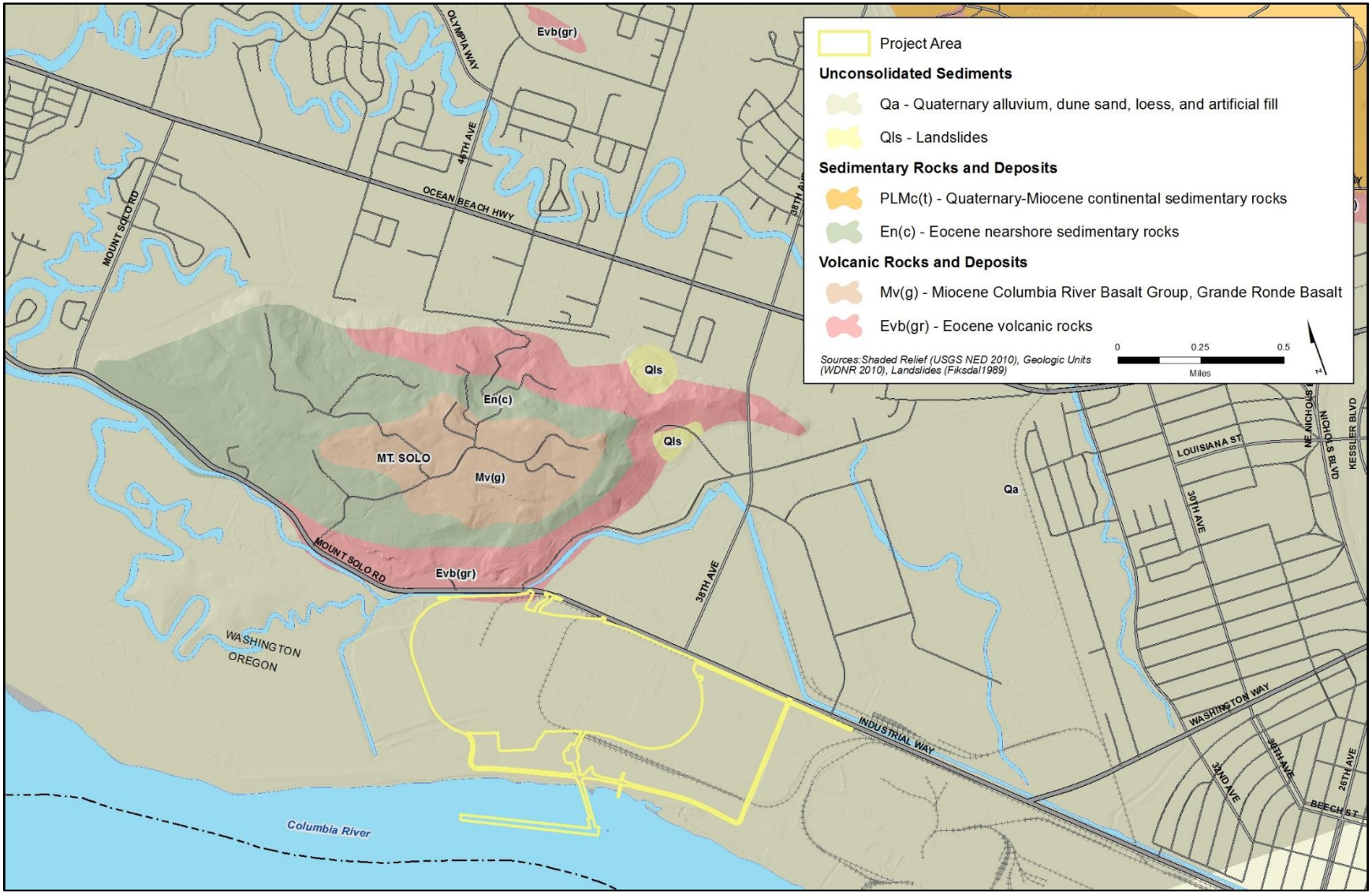
The project area is underlain by late Pleistocene and Holocene alluvial (river) deposits to a depth of more than 300 feet below sea level. However, bedrock is exposed at several places near the project area, including Mount Solo to the immediate north of the project area (Figure 4); Mount Coffin approximately 0.5 mile upstream of the project area (Washington State Department of Natural Resources2014b), and within the Columbia River where shallowly submerged bedrock has required excavation for channel maintenance at Longview just upstream of the Lewis and Clark Bridge (State Route 433) (Garmire 2012). Bedrock uplands also occur to the south across the Columbia River, to the northwest and north of the project area, and to the east of the project area across the Cowlitz River.

Three bedrock geologic units are exposed on Mount Solo (Figure 4). The bedrock at its central portion is mapped as Miocene age basalt (lava) flows of the Columbia River Basalt Group or Grande Ronde Basalt (Washington State Department of Natural Resources 2014b). This basalt is surrounded by Eocene age nearshore sedimentary rocks of sandstone and siltstone. The outermost bedrock is mapped as Eocene age volcanic rocks (basalt flows). At the study area scale landslides are also mapped along the slopes of Mount Solo (see *Landslides and Slope Stability*, below, for a more detailed discussion).

The low-lying area along the Columbia River is mapped as Quaternary alluvium, dune sand, loess (windblown silt), and artificial fill. Near the project area, the immediately underlying material is predominantly alluvium (i.e., river deposits of gravel, sand, and silt of Pleistocene to Holocene age) as well as artificial fill.

During Quaternary glaciations (between approximately 2 million to 10,000 years ago) sea level was more than 330 feet lower than present. During that time, the Columbia River incised to a similar depth of approximately 330 feet below current sea level at Longview (Baker et al. 2010; Peterson et al. 2013). Peterson et al. (2013: Figures 3 and 5) constructed cross-sections derived from boreholes in and near the project area. These cross-sections show, from the surface downward, about 20 feet of mud overlying sand or muddy sand/sandy mud from depths of approximately 20 feet to 160 feet, underlain in turn, by other sands, some muds, and Pleistocene gravel to a depth of approximately 330 feet (Peterson et al. 2013: Figure 5). The cross-section shows Mazama volcanic ash (derived from the explosion of Mount Mazama which created Crater Lake, Oregon) at approximately 45 to 60 feet below sea level. Mazama ash is approximately 7,700 years old (Peterson et al. 2013). Borings at the project area (GRI 2012:5) encountered volcanic ash between elevations -57.5 and -68 feet below mean sea level that ranged from 2 to 7 feet in thickness. Water wells at the project area reach almost 300 feet below ground depth, although there is a maximum reported depth of 410 feet (Anchor Environmental 2007: Figure 6-2; Anchor QEA 2013: Plate 4-2).

Figure 4. Local and Site Geology



In the late Pleistocene, a glacial dam forming massive Lake Missoula in Montana collapsed several times sending cataclysmic flows across the Columbia Plateau and down the Columbia River. In the Portland, Oregon, area these flows were more than 360 feet above present sea level and deposited sand banks at approximately 120 to 210 feet above present sea level (Peterson et al. 2013). These floods also deposited deep gravels and sands within the Columbia River valley. These deep gravels and sands underlie the project area at approximate depths of 120 feet and greater (Peterson et al. 2013: Figure 3). Regionally and locally, these deep floods also deposited fine-grained silts in the upper, slackwater parts of the flow. These floods extended up the Cowlitz River and deposited silts that are now found on the flanks of the adjacent hills at Castle Rock and near the confluence of the Cowlitz and Toutle Rivers (Chan et al. 2007).

Based on the elevations of the silts at Castle Rock and in the Toutle River valley (Chan et al. 2007), the Lake Missoula flood levels would have reached at least 175 to 200 feet above sea level in the Mount Solo vicinity and would have scoured it at least to these elevations. No fine-grained silt deposits associated with these floods are reported on Mount Solo (Wegmann 2006).

2.2.1.1 Subsurface Conditions

General subsurface conditions are described above under *Local and Site Geology*. Because the materials beneath the project area are derived from river and floodplain sedimentation (including the contemporary development of wetlands on these surfaces), geotechnical boreholes show sediments consisting of upper silty fill overlying loose to dense sands with varying silt and clay content, silts with sand content, and interbedded organic silt and peat (Anchor Environmental 2007; Anchor QEA 2011; GRI 2012; URS Corporation 2014). Based on geotechnical borings, groundwater begins at between 3 to 20 feet below the ground surface, so most sediments have varying amounts of water content (Anchor QEA 2011, 2013; GRI 2012; URS Corporation 2014). Field index properties done on geotechnical borings indicate that the surface and near-surface sediments are soft or loose (URS Corporation 2014). All of these properties indicate the potential for some amount of settlement under the loads (or weight) imposed by building and other structures. Consolidation tests indicate the potential for large settlement and the need for long periods for primary and secondary consolidation of these underlying materials (URS Corporation 2014). This consolidation would minimize the potential for settlement under constructed structure loading.

Because of saturated sandy conditions at depth, liquefaction could occur during and after an earthquake. Geotechnical reports prepared for a previously proposed asphalt plant on the site identifies the potential for post-earthquake liquefaction settlement of 7 to 16 inches (GeoEngineers, Inc. 2007) and 12 to 16 inches (Shannon and Wilson, Inc. 2008).

A variety of geotechnical data has been collected at the project area (Anchor QEA 2011, 2013). Anchor QEA (2011) also summarizes earlier geotechnical borings and appends those data reports and geotechnical reports. The Anchor QEA (2011, 2013) data have been collected to assist with project design, but a geotechnical analysis and report using these recent data have not been prepared.

2.2.1.2 Landslides and Slope Stability

No landslides are identified for the project area in local slope instability reports or on-site investigations (Figure 5) (Fiksdal 1989; Wegmann 2006; Anchor Environmental 2007; GRI 2011, 2012). The project area is also flat and therefore has a low likelihood of landslides. The City of Longview (2006) Comprehensive Plan identifies steep slopes that lead from the flat, low-lying surfaces of the alluvium into the adjacent Columbia River; however, there is no indication of excessive erosion along these banks. Much of the shoreline has been armored with large riprap and angular rock along the length of the levee near the project area and along the Columbia River. The levee and shoreline armoring disconnect the river from its floodplain and protect the levee system from erosion.

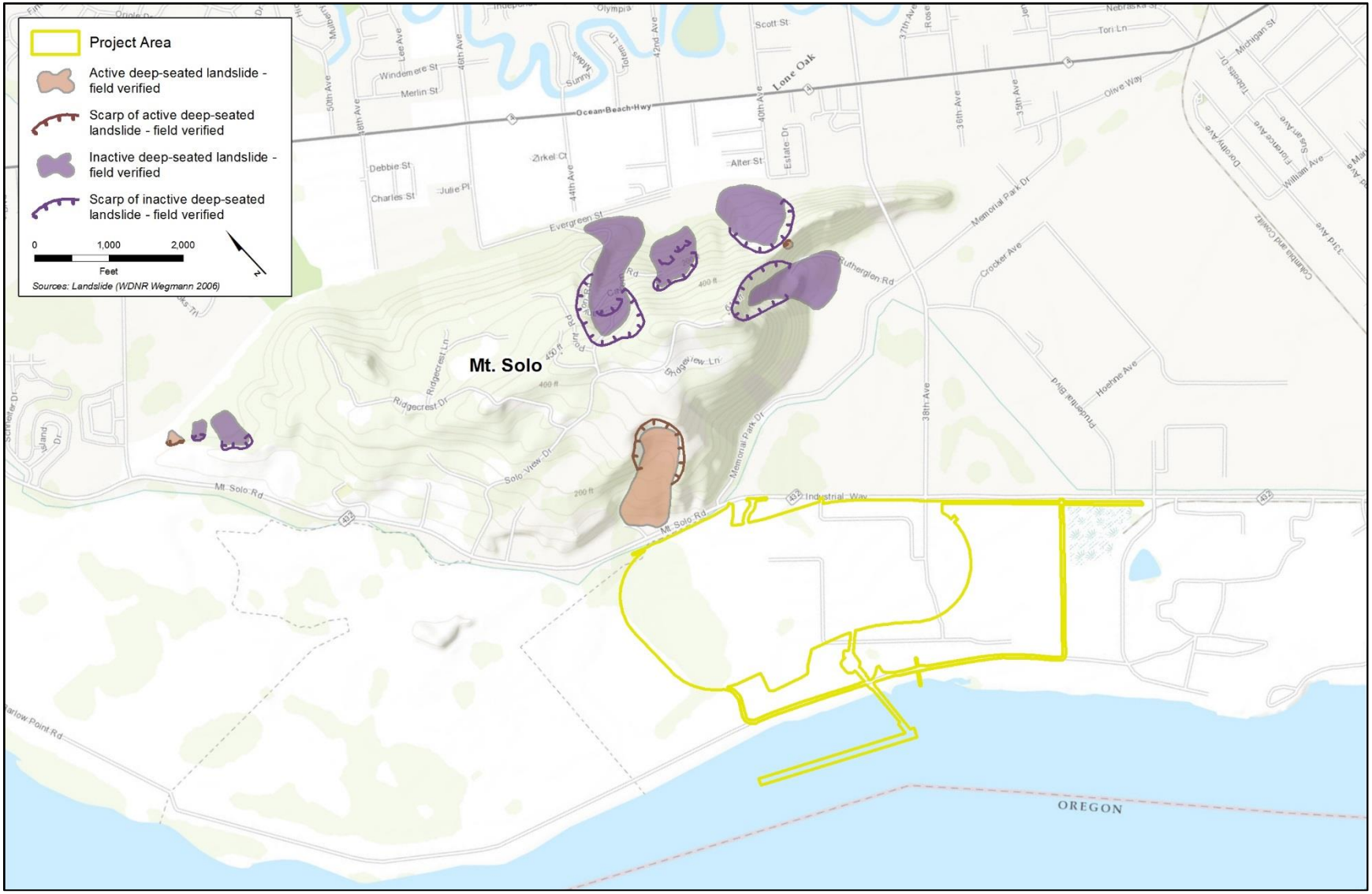
Landslides have been identified on Mount Solo. Fiksdal (1989) identified two landslide areas on easternmost Mount Solo, one on the north side and one on the south side (Figure 5). More detailed mapping by Wegmann (2006) identified multiple landslides around Mount Solo (Figure 5). Wegmann (2006) also identified whether the features were inactive or active. One active landslide is relevant to the project area. The approximately 16-acre active landslide is located on the south slope of Mount Solo (Figure 5), about 200 feet from the northwest corner of the project area. This landslide is formed in sedimentary bedrock overlain by basalt flows (Wegmann 2006). It is oriented toward the southwest. The landslide toe (bottom) is just west of the intersection of Industrial Way and Memorial Park Drive on the north side of the road. Its active nature is identified by the presence of ground cracks, exposed and disrupted soil, and disrupted trees (Wegmann 2006). Landslides may also be caused, or existing landslides may be reactivated, by strong ground shaking from earthquakes.

2.2.2 Seismicity

As described by URS Corporation (2014: Figures 2, 3, and 4) and by the Washington State Department of Natural Resources (2014b), Pacific Northwest earthquake origins are from one of four possible geologic events: interplate movement on the coastal CSZ, intraplate movement within the subducting Juan de Fuca tectonic plate that is sinking beneath the North American tectonic plate, shallow crustal movements within the North American tectonic plate, and movements beneath Cascade volcanoes (magma- or fault-related).

Although no great earthquakes (magnitude 8.0 to 9.0 or higher) have occurred on the CSZ during the historical record, reconstructions from the geologic record indicate that more than 10 great earthquakes have occurred in Oregon and Washington over the last 5,000 years (Cascadia Region Earthquake Workgroup 2013; URS Corporation 2014). Recurrence intervals for these earthquakes are approximately 250 to 900 years. These earthquakes result from fault rupture over most of the CSZ from northern California to southern British Columbia (Cascadia Region Earthquake Workgroup 2013) and cause substantial ground shaking and tsunamis. The last CSZ earthquake occurred in 1700 (Atwater 1994; Jacoby et al. 1997).

Figure 5. Landslides in the Project Vicinity



Based on the historical record, intraplate movements are considered capable of generating earthquakes as large as magnitude 7.5 (URS Corporation 2014). These earthquakes generally do not have faults that reach the ground surface and their recurrence interval is not known. Example intraplate earthquakes include the following: 1949 Olympia 7.1 magnitude, 1965 Seattle 6.5 magnitude and 2001 Nisqually 6.8 magnitude. These earthquakes did not cause substantial damage in the Longview area (Noson et al. 1988; Washington State Department of Natural Resources 2001; Washington State Seismic Safety Committee 2012; URS Corporation 2014).

Shallow crustal earthquakes are widespread geographically and based on geologic data and historical records in the Pacific Northwest, these movements are capable of producing earthquakes greater than magnitude 6.0 and perhaps as high as magnitude 7.0 to 7.5 (URS Corporation 2014). The 1872 North Cascade (Lake Chelan, Washington, area) magnitude 6.5 to 7.0 earthquake is considered the largest historical shallow crustal earthquake (Bakun et al. 2002; URS Corporation 2014). Shallow crustal faults in southwestern Washington and northwestern Oregon have the potential to generate magnitude 6.0 and greater earthquakes (Wong et al. 2000; Lidke et al. 2003; Personius et al. 2003; URS Corporation 2014).

Volcanic earthquakes occur beneath the Cascade volcanoes, which are approximately 30 miles or greater to the east of the project area. These earthquakes can be associated with the movement of magma or from faults such as that within the Mount St. Helens seismic zone (which may also be considered shallow crustal earthquakes). The largest recorded earthquake beneath Cascade volcanoes was a magnitude 5.1 earthquake in 1981 (U.S. Geological Survey 2013).

2.2.2.1 Surface Fault Rupture

No recognized crustal faults are active or potentially active in the immediate vicinity of the project area (Lidke et al. 2003; Personius et al. 2003; Barnett et al. 2009; Czajkowski and Bowman 2014.). The closest Holocene age (the last 10,000 years) faults are the Portland Hills and Frontal Fault–Lacamas Lake Faults approximately 40 miles to the southeast near Portland, Oregon (Wong et al. 2000; URS Corporation 2014), and the Mount St. Helens Seismic Zone to the east and offshore faults to the west, both of which are approximately 60 miles away.

2.2.2.2 Strong Ground Shaking

URS Corporation (2014: Table 1) compiled a list of the largest known earthquakes felt in Washington derived from Noson et al. (1988) and from the Pacific Northwest Seismic Network (www.pnsn.org/ and www.pnsn.org/earthquakes/historic-catalog). Between 1872 and 2014, these earthquakes ranged in instrumental magnitude from 7.3 to 5.0 for all of Washington (URS Corporation 2014: Table 1). Large earthquakes that would have affected the Longview area occur primarily in the Puget Sound area and Portland, Oregon, vicinity. They range in instrumental magnitude from 5.0 to 7.1 (URS Corporation 2014: Table 1). Large or CSZ earthquakes would cause severe ground shaking in the Longview area including the project area.

Earthquake magnitude provides a specific measure with which to compare the energy released by different events. However, earthquake magnitude does not provide a direct measure of shaking at a given site because that movement decreases with distance from the earthquake site. The distance from the earthquake also includes the depth within the Earth at which the earthquake actually occurred. For example, ground shaking from the 2001 Nisqually earthquake (magnitude 6.8) was

not particularly violent since it occurred at 30 miles depth. The location directly above it was 30 miles away (Palmer et al. 2004).

The USGS National Seismic Hazard Maps determine earthquake ground motions for various probability levels that are applied in seismic provisions of building codes. These values are derived by evaluating all the potential earthquakes (along with their locations, depths, and probabilities) that could affect an area. The maps show probabilistic peak ground motion as peak ground acceleration (PGA) expressed as a multiplier of the force of gravity (g). That is, the ground and overlying structures are accelerated from no motion at all to a peak motion value. This acceleration causes shaking and stress on structures. The USGS (2014) map depicting 2% probability of PGA exceedance over 50 years shows the Longview area within the 0.4 to 0.5 g contour (Petersen et al. 2014). A PGA in the range of 0.34 to 0.65 g is perceived as severe shaking and could cause moderate to heavy damage, depending on the duration of the event, the types of underlying materials, and the structural integrity of affected buildings or structures (Petersen et al. 2014).

Ground shaking is also stronger in areas of soft soils or unconsolidated deposits such as sand and silt. The Site Class Map of Cowlitz County, Washington, characterizes the project area as site class E, which has the softest soil conditions and highest level of potential ground shaking (Palmer et al. 2004). As noted by the Cascadia Region Earthquake Workgroup (2013:11), one ground shaking–liquefaction hazard is underwater landslides that could disrupt Columbia River shipping channels.

One component of geotechnical analysis reports is to integrate the regional data with detailed, site-specific data to calculate ground shaking and other effects (such as liquefaction, see next section) for a particular location and type of construction. These reports use the regional earthquake and PGA data from the USGS National Seismic Hazard Maps and integrate it with bedrock, surficial sediment properties, and groundwater conditions derived from site-specific boreholes. Laboratory data on the characteristics of borehole samples and calculations are then used to derive the site-specific ground shaking, liquefaction and other parameters.

2.2.2.3 Secondary Seismic Hazards: Liquefaction and Subsidence

Liquefaction occurs when a saturated or partially saturated soil loses its strength and acts like a fluid due to applied stress such as earthquake shaking. The project area is subject to liquefaction and subsidence during ground shaking. The Liquefaction Susceptibility Map of Cowlitz County, Washington, characterizes the area as having high liquefaction susceptibility (Palmer et al. 2004). As noted above, the area is underlain by hundreds of feet of gravel, sand, silt, and organic layers. The sandy layers can liquefy during strong ground shaking. When liquefied these layers can flow like a liquid and/or lose consistency and no longer support the ground above them. The layers may flow laterally or be injected vertically, depending on the strength and weakness of adjacent layers or whether the liquefying layer can exit the ground (e.g., by flowing out of an adjacent slope or into a river channel). If close to the surface, the flowing materials may be ejected at the surface (vent) forming one or more sand volcanoes. The loss of support for overlying layers may also result in them subsiding and moving laterally. These changes continue until the liquefied layer deliquefies.

The geologic record provides evidence of liquefaction susceptibility along the Columbia River. One of the data sets that provided information on the 1700 CSZ great earthquake was surface venting of liquefied layers. Several of these layers were dated by tree-ring analyses of trees affected by the sediment ejection or trees that began growing on the new ground (Atwater 1994; Jacoby et al. 1997). Atwater (1994) record such liquefaction events at Marsh, Brush, Price, Hunting, and Wallace

Islands within the lower Columbia River. The Wallace Island site is between river miles 47.5 and 50 approximately 13 miles from the project area.

One geotechnical investigation at the project area indicated that post-liquefaction settlement varies with location and earthquake magnitude but is estimated at 7 to 16 inches for a CSZ earthquake of magnitude 7.4 and a PGA of 0.24 g (GeoEngineers, Inc. 2007). Another geotechnical investigation estimated similar liquefaction-induced settlement of 12 to 16 inches for a magnitude 8.3 CSZ earthquake with a PGA of 0.26 g (Shannon and Wilson, Inc. 2008). These estimates were for a previously proposed asphalt plant at the site.

2.2.3 Volcanic Hazards

The primary volcanic hazard at Longview is from airborne fragments, ash fall, and lahars (volcanic mudflows) reaching, and continuing down, the Columbia River.

2.2.3.1 Volcanic Eruption and Ash Fall

Active volcanoes occur within the Cascade Range to the east of Longview. The active volcanoes nearest the area are Mount St. Helens (approximately 40 miles to the east), Mount Adams (approximately 70 miles to the east), and Mount Hood (approximately 80 miles to the southeast). The project area is not within the Cowlitz County–designated volcanic flowage hazard zone 1 (i.e., within a 5-mile radius of volcanic activity).

As noted by URS Corporation (2014), ash fall of more than 0.4 to 2 inches would disrupt transportation and operation of certain facilities. USGS estimates the annual probability of ash fall exceeding 4 inches at Longview to be between 0.01 and 0.02% or between 1 in 10,000 to 1 in 5,000 (Wolfe and Pierson 1995).

2.2.3.2 Lahars and Sedimentation

Lahars associated with the 1980 Mount St. Helens eruption flowed down the Toutle River to the Cowlitz River and reached the Columbia River at approximately the Lewis and Clark Bridge (SR 433) (Haini 1983). Lahars derived from the south flank of Mount Rainier in the upper Cowlitz River are unlikely to reach the lower Cowlitz River (Cakir and Walsh 2012). The Longview vicinity is not within the Cowlitz County–designated volcanic flowage hazard zone 3, which requires an evacuation and emergency management plan. That requirement only applies to areas upstream of the North Fork Toutle River sediment retention structure.

Upstream on the Columbia River, lahars have been documented along the Sandy River draining from Mount Hood in Oregon (Pierson et al. 2009). These sites are approximately 55 miles upstream of Longview. Lahars from Mount Adams could reach the Columbia River via the White Salmon River; its confluence with the Columbia River is more than 100 river miles upstream from Longview.

2.2.4 Mine Hazard Areas

Mine hazard areas in Cowlitz County are primarily associated with historical coal mining and areas underlain by or affected by the mine workings such as adits, tunnels, drifts, or airshafts. No bedrock with coal occurs along the Columbia River near Longview. The nearest historical coal mines are in the Coal Creek drainage approximately 7 miles northwest of Mount Solo and 5 miles northeast of Mount Solo on the east side of the Cowlitz River (Culver 1919; Vonheeder 1977). Based on a review

of topographic maps and geologic reports (Culver 1919; Vonheeder 1977; Norman et al. 2001), no other mines have been documented near Mount Solo or the adjacent Columbia River deposits. Consequently, the issue is not discussed further.

2.2.5 Tsunamis

Washington and Oregon tsunamis could result from CSZ earthquakes along their coastline or similar major earthquakes in areas such as southern Alaska, Japan, or Indonesia. Tsunami hazard and evacuation maps for Washington and Oregon only extend up the Columbia River to a point just east of Astoria, Oregon (approximately 50 miles downstream of the project area at river mile 15) (Walsh et al. 2000; Washington State Department of Natural Resources 2010; Oregon Department of Geology and Mineral Industries 2012). Therefore, these maps are not applicable to the Longview area.

Based on previous work, Tolkova (2013) reviewed five documented historical tsunamis and their penetration up the Columbia River (August 23, 1872; November 4, 1952; May 23, 1960; March 28, 1964 [great Alaskan tsunami]; and March 11, 2011 [East Japan tsunami]). Instrumentally recorded tsunamis reach as far as Portland, Oregon, although with relatively small magnitude (i.e., wave height and energy). For example, the 1964 great Alaskan tsunami had a 0.3-meter (approximately 1-foot) height at Beaver (river mile 53). The 2011 East Japan tsunami registered a wave height between 0.001 to 0.004 meters (approximately 0.04 inches to 0.16 inches) at Longview (river mile 65.7). Tsunami wave height and penetration also vary with tide level with less height and penetration during a falling tide and greater wave height and penetration during rising tides (Tolkova 2013).

Evaluation of tsunami penetration up the Columbia River occurred at a Workshop on Tsunami Hydrodynamics in a Large River held at Oregon State University, Corvallis, in 2011 (http://isec.nacse.org/workshop/2011_orst/) and subsequently summarized by Yeh et al. (2012). These evaluations indicate that as a tsunami enters the river valley it is transformed into a long period (i.e., longer time between wave peaks), small amplitude (i.e., small height) wave (Yeh et al. 2012; Tolkova 2013). Modeling indicates that although the wave would advance to Portland at approximately river mile 107, its height would be quickly reduced upon entering the river because of energy dissipation (Yeh et al. 2012). For example, a numerical simulation indicated that a tsunami height of 5.6 meters (18 feet) at the Columbia River mouth would decrease to 1.5 meters (4.9 feet) at river mile 18 (Astoria), to 0.2 meter (0.65 foot or less than 8 inches) at Longview (river mile 65.7), and to 0.04 meter (0.13 foot or approximately 5 inches) at river mile 107 (Portland) (Yeh et al. 2012).

2.2.6 Sea Level Rise

Future sea level change in the vicinity of the Columbia River mouth is expected to be between -3 centimeters and +48 centimeters (approximately -1.2 inches and +18.9 inches) by 2050 and 10 to 143 centimeters (approximately 4 inches to 56 inches) by 2100 (National Research Council 2012). The range of values is based on consideration of several influences on sea level rise including tectonism (incorporation of tectonic uplift is the reason for the -3 centimeter value noted above) (National Research Council 2012). Considering the low gradient of the lower Columbia River, the maximum expected rise at Longview would be similar to the coastal sea level rise projections at the mouth of the Columbia River. The project area is behind Columbia River levees of approximately 36 feet CRD, as noted in the SEPA Surface Water and Floodplains Technical Report (ICF 2017a), and

since this is higher than the potential sea level rise, there would not be any impacts on soils on the project area or increased risk of erosion. Consequently, the issue is not discussed further.

2.2.7 Soils

Cowlitz County soils have been mapped by the Natural Resource Conservation Service[1]. Figure 6 shows the naturally occurring soils mapped at the project area. Excluding water, five soil units are mapped at the project area. These soil units and some of their relevant characteristics are presented in Table 2. All of these soil units reflect the alluvial (river deposit) origin of the soil parent material and are relatively fine-grained. The soil textures range from gravelly sandy loam (Arents, Map Unit Number 5), to loamy fine sand, to silt loam, to silty clay loam. These soils map units also reflect the low-gradient nature of these river deposits with map unit slopes from 0 to 8%. These map units reflect the soil characteristics throughout each soil's range in Washington (and Oregon) and the slopes along this landscape position, which are very flat (near zero), except adjacent to drainage ditches, ponds, and the Columbia River.

The project area is dominated by Caples silt loam (Map Unit Number 17) and the Maytown silt loam (Map Unit Number 127) (Figure 6; Table 2). A small area is mapped as Snohomish silty clay loam. The Pilchuck loamy fine sand (Map Unit Number 160) and the Arents (Map Unit Number 5) map units are narrow and parallel the Columbia River shoreline. With respect to the project area boundary, these soils are only encountered along the narrow trestle extension that leads to the dock within the Columbia River.

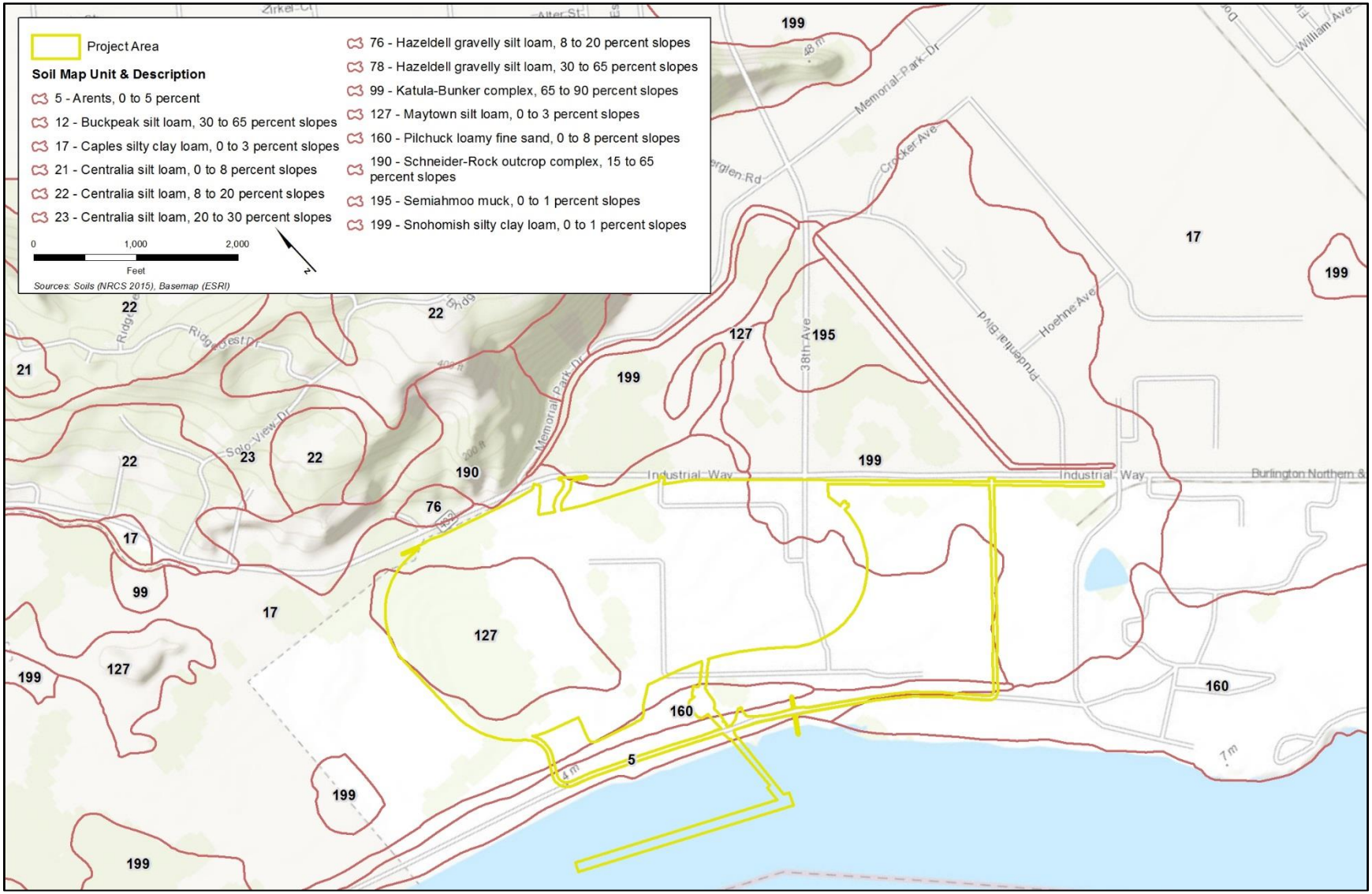
The erosion hazard is characterized as slight for all soils reflecting the low landscape gradient. The K factor indicates a soils susceptibility to sheet and rill erosion. The higher the soil's K factor the higher its erosion potential. Based on the K factor, the Caples silty clay loam (Map Unit Number 17), the Maytown silt loam (Map Unit 127), and Snohomish silty clay loam (Map Unit Number 199) have a higher erosion hazard under bare soil conditions. These soils have a low susceptibility to wind erosion.

The site soils are all moderate with respect to their potential for corrosion of concrete. Their uncoated steel corrosion potential ranges from low (Pilchuck loam fine sand), to moderate (Arents), to high (Caples silty clay loam, Maytown silt loam, and Snohomish silty clay loam). Several standard engineering measures address concrete and steel corrosion such as improving drainage and replacing native soil with fill (Washington State Department of Transportation 2014).

A soil's linear extensibility is a measure of its potential to expand during wetting and, conversely, to contract during drying. The more a soil expands the more potential it has to affect overlying materials such as structure foundations. The values in Table 2 are provided as a percent expansion and a descriptive classification (class). The soil expansion classes for the project area range from low (Arents, Pilchuck loamy fine sand), to moderate (Maytown silt loam, Snohomish silty clay loam), to high (Caples silty clay loam).

[1] http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Figure 6. Soil Types in the Project Vicinity



The above discussion addresses the naturally occurring soils at the project area. The project area has been an industrial site since the 1940s and has had various amounts of surface disturbance (grading, digging for new foundations, asphalt road placement with underlying gravel base) and fill material placement. Consequently, site-specific surface soil materials may vary from the Natural Resource Conservation Service mapping. Geotechnical data reports for the project area indicate varying distributions of fill materials particularly under existing structures. This fill material includes sand, silt, mixed silt and sand, large gravel, and crushed rock (Anchor QEA 2011; GRI 2011, 2012).

Table 2. Soils and Soil Properties at the Project Area

Map Unit Number[a]	Soil Map Unit Name	Drainage Class	K Factor[b]	Erosion Hazard	Corrosion of Concrete[c]	Corrosion of Uncoated Steel[d]	Linear Extensibility /Class
5	Arents, 0 to 5% slopes	Moderately well drained	0.28	Slight	Moderate	Moderate	1.5%/Low
17	Caples silty clay loam, 0 to 3% slopes	Somewhat poorly drained	0.43	Slight	Moderate	High	7.0%/High
127	Maytown silt loam, 0 to 3% slopes	Moderately well drained	0.49	Slight	Moderate	High	3.6%/ Moderate
160	Pilchuck loamy fine sand, 0 to 8% slope	Not defined	0.20	Slight	Moderate	Low	1.5%/Low
199	Snohomish silty clay loam, 0 to 1% slopes	Poorly drained	0.37	Slight	Moderate	High	4.5%/ Moderate
263	Water	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

[a] Soil Map Units are shown on Figure 6.

[b] Higher K factor values indicate greater potential for erosion: K factor values below 0.13 have low erosion potential; values 0.13 to 0.26 have medium erosion potential; values greater than 0.26 have high erosion potential.

[b] The potential for concrete corrosion increases decreasing water and soil acidity and increases in sodium, magnesium sulfate, and sodium chloride.

[c] The potential for corrosion of uncoated steel increases with soil water saturation, greater water acidity and conductivity.

Source: Natural Resource Conservation Service 2013

N/A = not applicable

Chapter 3
Impacts

This chapter describes the impacts on geology and soils that would result from construction and operation of the Proposed Action or ongoing activities of the No-Action Alternative.

Construction impacts include potential impacts such as soil erosion that could be delivered off site to streams adversely affecting water quality. Operational impacts include the potential adverse impacts of the geological and soil environment on the project. Examples of these impacts are earthquakes, landslides, or tsunamis that could damage the export terminal after its construction. Seismic-related impacts are important primarily after project construction. Therefore, these impacts are discussed under Section 3.1.3, *Operations: Direct Impacts*.

3.1 Proposed Action

The following construction activities could affect geology and soils.

- Ground disturbance associated with construction of the export terminal
- Preloading of the coal stockpile areas

The following operations activities could affect geology and soils.

- Exposure of people and structures to potential effects from catastrophic events

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

Result in Land Enlargement, Affect a Unique Physical Feature, or Cause Substantial Soil Erosion

Construction of the Proposed Action would not result in the enlargement of land area by placing fill in the Columbia River or by causing sedimentation in the Columbia River. There are no unique physical features at the project area that would be affected by the Proposed Action. Although steep slopes locally occur along drainage ditches and the Columbia River banks, there are no indications of instability and project activities are not expected to cause instability at these locations.

Construction of the Proposed Action would affect approximately 190 acres of land and involve such ground-disturbing activities as grading, railroad construction, excavation for foundations, and road construction. Additionally, approximately 2.1 million cubic yards of material would be imported and used for preloading, or compressing soils onsite for the stockpile areas, as well as approximately 130,000 cubic yards of ballast rock for rail infrastructure and rail-related structures. Approximately 2.5 million cubic yards of material would be moved around the project area during the compression of on-site soils.

As discussed in Section 2.2.7, *Soils,* and shown in Table 2, although the soils in the project area have a moderate to high potential for erosion (i.e., moderate to high K factor), the on-site soils

have a slight erosion hazard, primarily because of the site's flat gradient. However, since construction would occur over a period of several years, large areas of bare soil could be exposed for varying periods. Soil erosion could occur during periods of rainfall and would have the potential for off-site transport of eroded soil materials to waterways such as the Columbia River and adjacent ditches. Additionally, imported preload and rail ballast materials would be obtained from a commercial supplier. Wind erosion potential is limited because of the precipitation levels that occur at the site, and proposed dust suppression during construction to control wind erosion of, but could occur during summer dry periods. Dust from coal stockpiles is addressed in the SEPA Air Quality Technical Report (ICF 2017b). When build out is complete, the project area would be approximately 90% impervious surfaces, which would reduce soil erosion potential to near zero.

Dredging related to the construction of Docks 2 and 3 would be managed under the Section 401 Water Quality Certification. This could involve approval of flow-lane disposal of dredge material, which would avoid impacts on uplands. The Applicant could, if approved, also dispose of dredge materials in upland portions of the project area for preloading the stockpile area. Placement of this dredge material in the stockpile area would compact the underlying soil (see *Affect Project Structures from Soil Materials Underlying the Site*, below, for more information). This in-water activity is discussed in the SEPA Water Quality Technical Report (ICF 2017c) and SEPA Surface Water and Floodplains Technical Report (ICF 2017a).

Affect Project Structures from Soil Materials Underlying the Site

As discussed in Section 2.2.7, *Soils*, and shown in Table 2, the on-site soils have moderate potential to corrode concrete, low to high potential to corrode steel, and have an expansion-contraction (wet-dry) class of low to high. A variety of standard engineering measures address concrete and steel corrosion such as improving drainage and replacing native soil with fill (Washington State Department of Transportation 2014).

The sediments underlying the project area are relatively fine-grained and water-saturated, and the water table is near the ground surface. These characteristics make the sediments susceptible to compaction from the weight of overlying materials and structures. This susceptibility is primarily of concern for the coal stockpile areas on the project area, because the coal's weight would cause compaction of the underlying sediment (estimated at approximately 8 to 10 feet), which would result in relatively substantial settlement of these underlying sediments. Compaction would be a lesser concern for other project components, because they involve much less weight.

Compaction and settlement of underlying sediments in the coal stockpile areas are addressed in the project design through preloading. Preloading involves import of material to compact the underlying soil to improve their load-bearing capacity. Approximately 2.1 million cubic yards of material would be imported into the coal stockpile areas (Millennium Bulk Terminals–Longview 2013) in stages over a period of up to 7 years.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on geology and soil because construction impacts are immediate and no construction impacts would occur later in time or farther removed in distance than the direct impacts.

3.1.3 Operations: Direct Impacts

Operation of the Proposed Action could expose people or structures to potential effects involving catastrophic events such as; rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure (i.e., liquefaction), landslides, and tsunamis. Thus, potential effects from these types of catastrophic events were evaluated.

3.1.3.1 Surface Faults

No known earthquake faults at the project area reach the ground surface. Therefore, no ground surface ruptures could directly damage structures or buildings at the project area.

3.1.3.2 Ground Shaking

The Longview area, including the project area, could be subject to strong ground shaking from earthquakes. The USGS National Seismic Hazard Map shows that there is a 2% probability of an earthquake with a PGA of 0.4 g to 0.5 g, occurring over 50 years (Petersen et al. 2014). As a generalization, this means that in any 50-year period, there is a 2% chance that an earthquake could occur that would result in severe shaking. This amount of shaking could directly damage proposed structures and buildings including those with human occupancy (one maintenance building and one administration building).

3.1.3.3 Seismic-Related Ground Failure, Including Liquefaction

The project area could be subject to liquefaction during strong ground shaking. Palmer et al. (2004) characterize the area as having high liquefaction susceptibility. Geotechnical investigation of the area for a previously proposed asphalt plant indicated that post-liquefaction settlement varies with earthquake location and earthquake magnitude but is estimated at 7 to 16 inches for a magnitude 7.4 CSZ earthquake with a PGA of 0.24 g (GeoEngineers, Inc. 2007). Shannon and Wilson, Inc. (2008) estimated similar liquefaction-induced settlement of 12 to 16 inches for a magnitude 8.3 CSZ earthquake with a PGA of 0.26 g for the previously proposed asphalt plant. Ground settling of this amount could damage proposed structures and buildings. These previous geotechnical studies used the earthquake magnitudes and PGAs recognized at the time of their preparation and did not address coal stockpiles. The Proposed Action would comply with the adopted International Building Code (per Cowlitz County Code [CCC] 16.05) and Cowlitz County Grading Ordinance (CCC 16.35). Preloading of the stockpile area would expel groundwater and consolidate soils in the immediate vicinity of the coal stockpile areas, which would reduce the susceptibility of the soils to liquefaction. This would also be likely to reduce the potential for damage to proposed structures that occur in the immediate vicinity of the preloading area. Preparation of a geotechnical report would identify the specific soil conditions pre- and post-project construction, and would inform project design and construction techniques to reduce potential impacts based on the risk of liquefaction.

3.1.3.4 Landslides

There are no existing landslides at the project area. Strong ground shaking associated with earthquakes would have minimal potential to cause new landslides at the project area, because the site is level and there is only about 40 feet of elevation difference between the site surface and the adjacent Columbia River bottom.

The project area is near the active deep-seated landslide on the south flank of Mount Solo, but it is located more than 50 feet from the its edge, which is the minimum distance required by the Cowlitz County Critical Areas Ordinance for landslide hazards. Additionally, because the project is at the toe (bottom) of the landslide, and is physically isolated from it, no actions taken at the project area would increase the risk that the landslide would be reactivated. However, as with all landslides, periods of prolonged and intense rainfall (including multiyear periods) or earthquake-caused ground shaking could activate this landslide. The extent to which any such movement would be translated to the toe of the slide or the extent to which the toe might extend to the southwest towards the project area is uncertain.

3.1.3.5 Tsunamis

Large earthquakes in the Pacific Ocean or on the CSZ could cause a tsunami, which could affect the coastal zone of Washington and Oregon. Large tsunamis have been detected as far up the Columbia River as Portland, Oregon, as described in Section 2.2.5, *Tsunamis*. Modeling calculations found that an 18-foot-high tsunami at the Columbia River mouth decreased to less than 8 inches at Longview (Yeh et al. 2012). Tsunami levels at the project area would be similar and would not affect the project area structures or operation including ships at the docks.

3.1.4 Operations: Indirect Impacts

No indirect impacts on geology or soils have been identified.

3.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the export terminal. Ongoing operations in the project area would continue and additional storage and transfer activities might occur on the using existing buildings. However, these activities would not require new permits and would not affect the geology and soils in the project area beyond their current conditions.

Chapter 4
Required Permits

The Proposed Action would require the following permits related to geology and soils.

- A fill and grade permit and/or a building permit would be required from Cowlitz County to ensure that final design and construction follow the County and engineering requirements.
- Cowlitz County Critical Areas permit to address compliance with the County's Critical Areas Ordinance related to the presence and protection of Critical Aquifer Recharge Areas located on site.
- A Construction Stormwater Permit would be required from Washington State Department of Ecology (Ecology) to address erosion control and water quality during construction.
- An Industrial Stormwater Permit would be required from Ecology to address erosion control and water quality during operations. The permit and Stormwater Pollution Prevention Plan control adverse impacts through the application of best management practices. These are defined as schedules of activities, prohibitions of practices, maintenance procedures, and structural and managerial practices that, when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts on waters of Washington State. The types of best management practices are source control, treatment, and flow control.

The following permit requirements would be required for construction of the Proposed Action.

- A qualified geologist or engineer would monitor the fill placement during construction and conduct appropriate field tests to verify proper compaction of the fill soils.
- Preliminary plans have identified the need to preload the site for construction. A site-specific preloading plan would be developed prior to initiating construction by the project geotechnical engineer working with the project civil and structural engineers. The plan would include measures to maintain proper site drainage, collection, and treatment of water generated, volumes, and sources of fill sources, and staging of fills, setbacks from existing structures. The plan would also consider the short-term and long-term impacts on adjacent structures and features, including but not limited to railroads, existing streets and utility connections, utilities, drainage features, landfills, existing hazardous materials, and buildings.
- Visual inspection would be conducted following abnormal seismic activity. These inspections would document whether the seismic activity has resulted in significant changes to the surface conditions.
- Best management practices would minimize the potential for erosion. A stormwater pollution prevention plan would be required and implemented. Clearing, excavation, and grading would be limited to the areas necessary for construction, and would not be completed far in advance of terminal construction.
- BMP C107: Construction Road/Parking Area Stabilization. Roads, parking areas, and other on-site vehicle transportation routes would be stabilized to reduce erosion caused by construction traffic or runoff.

Chapter 5
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MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA SURFACE WATER AND FLOODPLAINS TECHNICAL REPORT

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Acronyms and Abbreviations

Applicant	Millennium Bulk Terminals—Longview, LLC
BNSF	BNSF Railway Company
CCC	Cowlitz County Code
CDID	Consolidated Diking Improvement District
CEQ	Council on Environmental Quality
CFR	Code of Federal REgulations
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRD	Columbia River Datum
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
LVSW	Longview Switching Company
MSL	Mean Sea Level
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD29	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metals Company facility
SEPA	State Environmental Policy Act
SWMP	stormwater management plan
UP	Union Pacific Railroad
USC	United States Code
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WRIAs	Water Resource Inventory Areas

Chapter 1
Introduction

This technical report assesses the potential surface water and floodplains impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, surface water and floodplains refers to on-site drainage, the Consolidated Diking Improvement District (CDID) #1, the Columbia River, and the Columbia River and Cowlitz River floodplain. This report describes the regulatory setting, establishes the methods for assessing potential surface water and floodplains impacts, presents the historical and current surface water and floodplain conditions in the study area, and assesses the potential for impacts on surface water and floodplains.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP, and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the

east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

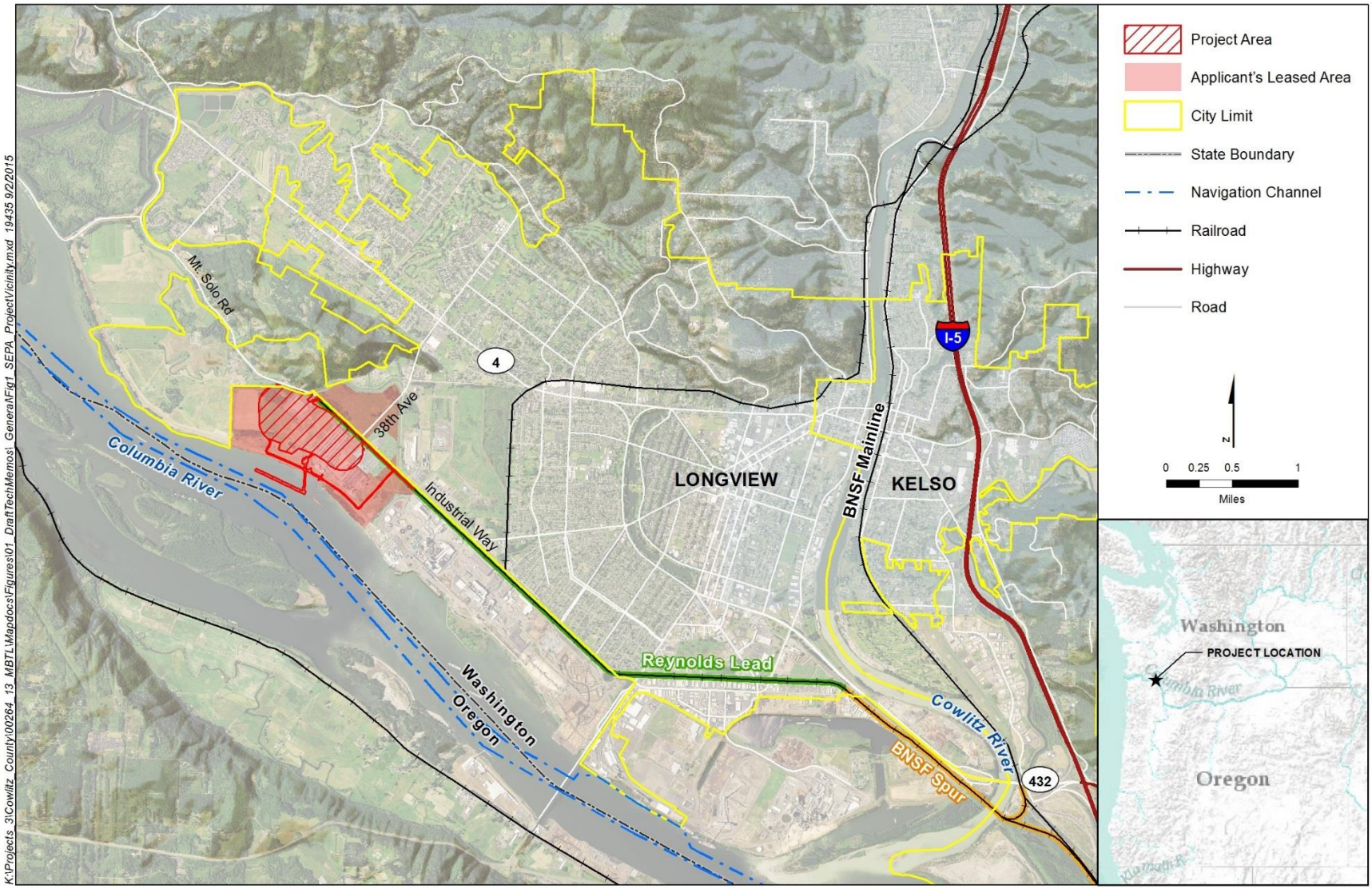
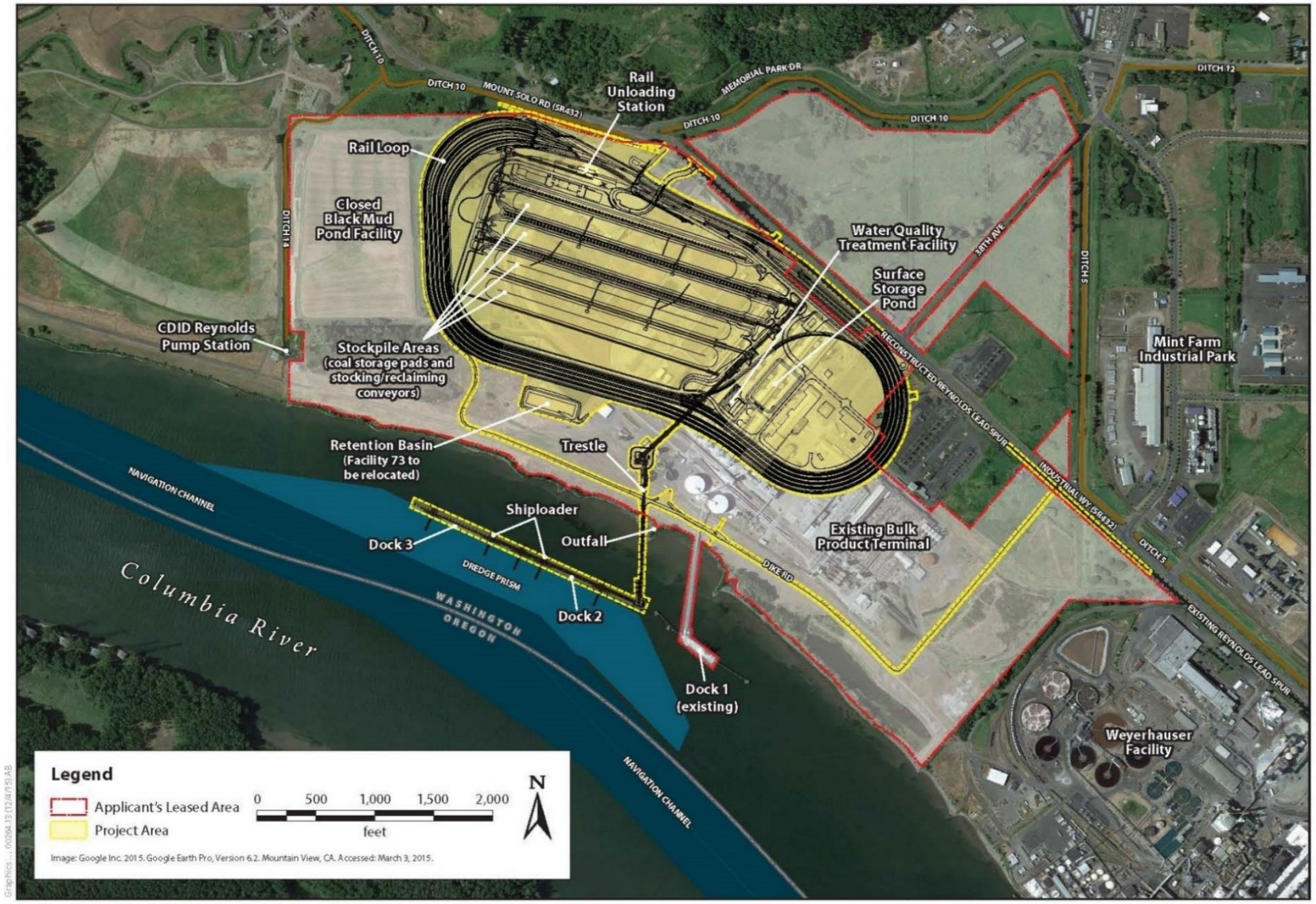


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

Federal, state, and local regulations, statutes, and guidelines require the review of the possible environmental impacts of the Proposed Action, including potential impacts on surface water and floodplains. The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential aesthetic impacts are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Floodplains

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
U.S. Army Corps of Engineers NEPA Environmental Regulations (33 CFR 230)	Provides guidance for implementing the procedural provisions of NEPA for the Corps. It supplements CEQ regulations 40 CFR 1500–1508.
Rivers and Harbors Act of 1899	Authorizes the Corps to protect commerce in navigable streams and waterways of the United States by regulating various activities in such waters. Section 10 (33 USC 403) specifically regulates construction, excavation, or deposition of materials into, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters.
Clean Water Act (33 USC 1251 *et seq*.)	Establishes the basic structure for EPA to regulate discharges of pollutants into the waters of the United States and regulating quality standards for surface water.

Regulation, Statute, Guideline	Description
Section 404 of the Clean Water Act	Regulates the placement of dredged or fill material into waters of the United States, including special aquatic sites such as sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes. EPA is the agency responsible for enforcing this act.
Section 401 of the Clean Water Act	Requires that a water quality certification be obtained from Ecology for any activity that requires a federal permit or license to discharge any pollutant into a water of the United States. This certification attests that the state has reasonable assurance that the proposed activity would meet state water quality standards.
Sections 301 and 402 of the Clean Water Act	Section 301 prohibits the discharge of any pollutant to a water of the United States without a permit. Section 402 (33 USC 1342) establishes the NPDES permitting program, (40 CFR 122). The NPDES permitting program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Authorized by the Clean Water Act.
National Flood Insurance Act of 1968	Established the NFIP, a federal floodplain management program designed to reduce future flood losses nationwide through the implementation of community-enforced building and zoning ordinances in return for the provision of affordable, federally backed flood insurance to property owners. FEMA is the agency responsible for enforcing the National Flood Insurance Act.
Executive Order 11990, Protection of Wetlands	Applies to all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. EPA is the agency responsible for enforcing this Executive Order.
Executive Order 11988, Floodplain Management	Requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative (42 FR 26951). FEMA is the agency responsible for enforcing this Executive Order.
State	
Washington State Environmental Policy Act (197-11 WAC, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to ensure that waters of the state are protected and fully utilized for the greatest benefit. Ecology is the agency responsible for enforcing the Water Resources Act.

Regulation, Statute, Guideline	Description
Water Pollution Control (RCW 90.48)	Policy to maintain the purity of waters of the state consistent with public health and public enjoyment, as well as propagation and protection of wildlife and industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state.
Water Quality Standard for Surface Waters of the State of Washington (173-201A WAC)	Establishes water quality standards for surface waters of the state of Washington.
National Pollutant Discharge Elimination System Permit Program (WAC 173-220)	Establishes state individual permit program for discharge of pollutants and other wastes and materials to surface waters of the state.
Shoreline Management Act (RCW 90.58)	Regulates and manages the use, environmental protection, and public access of the state's shorelines. The Shoreline Management Act (RCW 90.58) was passed by the Washington State Legislature in 1971 and adopted in 1972. Ecology is the agency responsible for enforcing the Shoreline Management Act.
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Stormwater Drainage Ordinance (CCC 16.22)	The Cowlitz County Stormwater Drainage Ordinance is a requirement of the NPDES Phase II Municipal Stormwater Permit issued to Cowlitz County by Ecology. The permit requires Cowlitz County to reduce stormwater runoff and pollution in unincorporated areas of Cowlitz County adjacent to the City of Longview and City of Kelso. The Proposed Action would not be within the area affected by the NPDES Phase II Municipal Stormwater Permit.
Cowlitz County Phase II Municipal Stormwater Management Plan (CCC 19.22)	Requires Cowlitz County to develop a SWMP. The SWMP must incorporate best management practices to reduce the discharge of pollutants from the regulated area to the maximum extent practicable to protect water quality. Cowlitz County is responsible for enforcing the SWMP.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Requires Cowlitz County, in compliance with the Growth Management Act, to adopt development regulations based upon the best available science that assure the protection of critical areas such as wetlands, aquifer recharge areas, geologically hazardous areas, fish and wildlife habitat, and frequently flooded areas. Cowlitz County is responsible for enforcing this ordinance.
Cowlitz County Shoreline Master Program (CCC 19.20)	Requires Cowlitz County to provide for the enhancement of shorelines and protection against adverse effects to vegetation, wildlife, and waters of the state and their aquatic life.
Cowlitz County Floodplain Ordinance (CCC 16.25)	Requires Cowlitz County to implement the Washington State Flood Control Zone permit program to regulate floodplain development. Cowlitz County adopted a revised floodplain ordinance and revised FIRM in December 2015.

Regulation, Statute, Guideline	Description
Notes: USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; CEQ = Council on Environmental Quality; EPA = U.S. Environmental Protection Agency; Corps = U.S. Army Corps of Engineers; Ecology = Washington State Department of Ecology; NPDES = National Pollutant Discharge Elimination System; NFIP = National Flood Insurance Program; FEMA = Federal Emergency Management Agency; WAC = Washington Administrative Code; RCW = Revised Code of Washington; CCC = Cowlitz County Code SEPA = State Environmental Policy Act; City = City of Longview; SWMP = stormwater management plan; FIRM = Flood Insurance Rate Map	

1.3 Study Area

The study area for direct impacts of the Proposed Action on surface waters is the Columbia River and stormwater drainage ditches within the project area for the Proposed Action. The study area for indirect impacts on surface water encompasses the CDID #1 stormwater system drainage ditches adjacent to the project area and the Columbia River downstream 1 mile from the project area. Figure 3 shows the study area for surface water for the Proposed Action.

The study area for direct impacts on floodplains is the project area for the Proposed Action. The study area for indirect impacts on floodplains is the project area and surrounding 500-year floodplain on the north side of the Columbia River near the project area. Figure 4 shows the study area for floodplains.

Figure 3. Surface Water Study Area

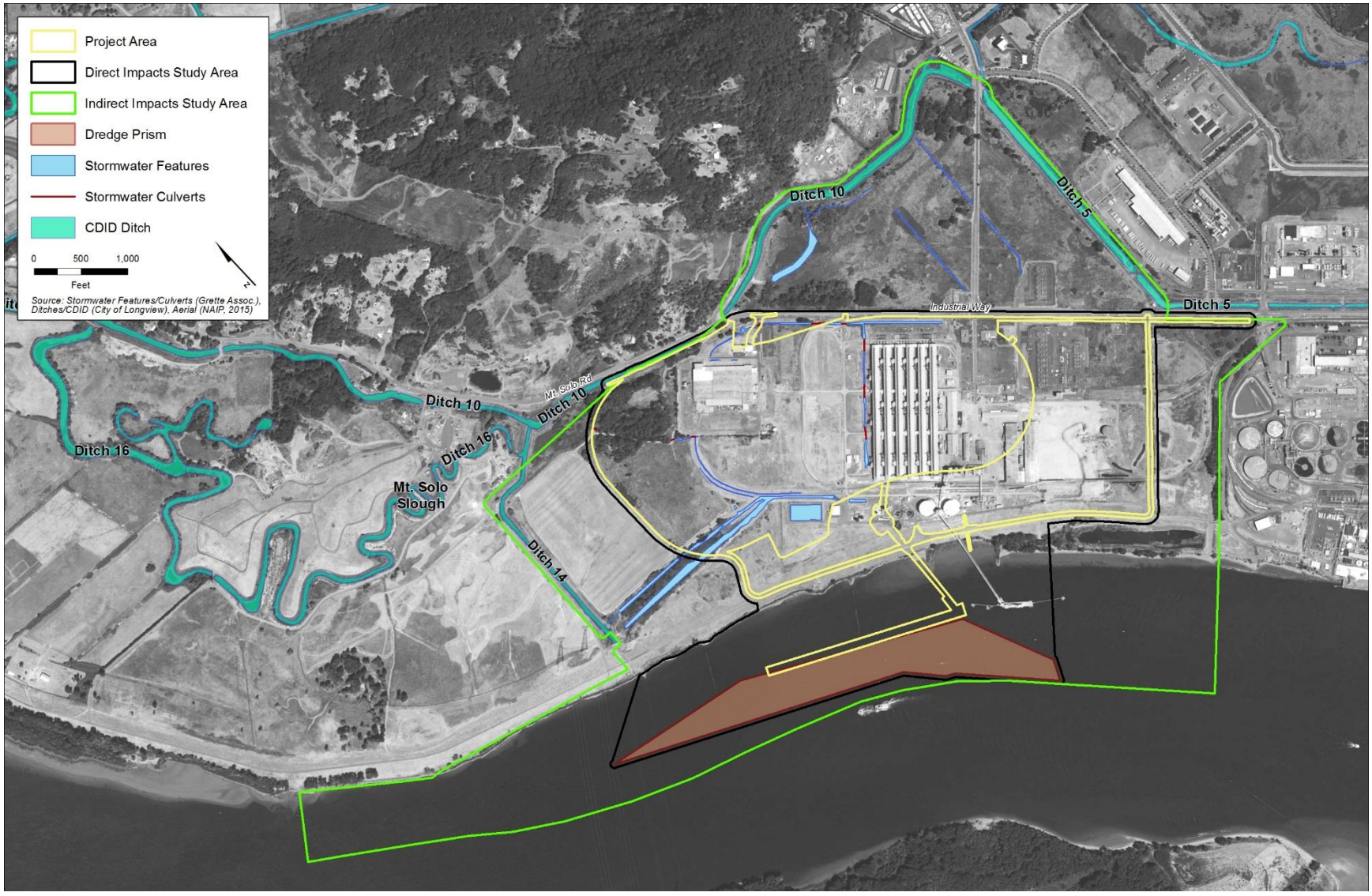
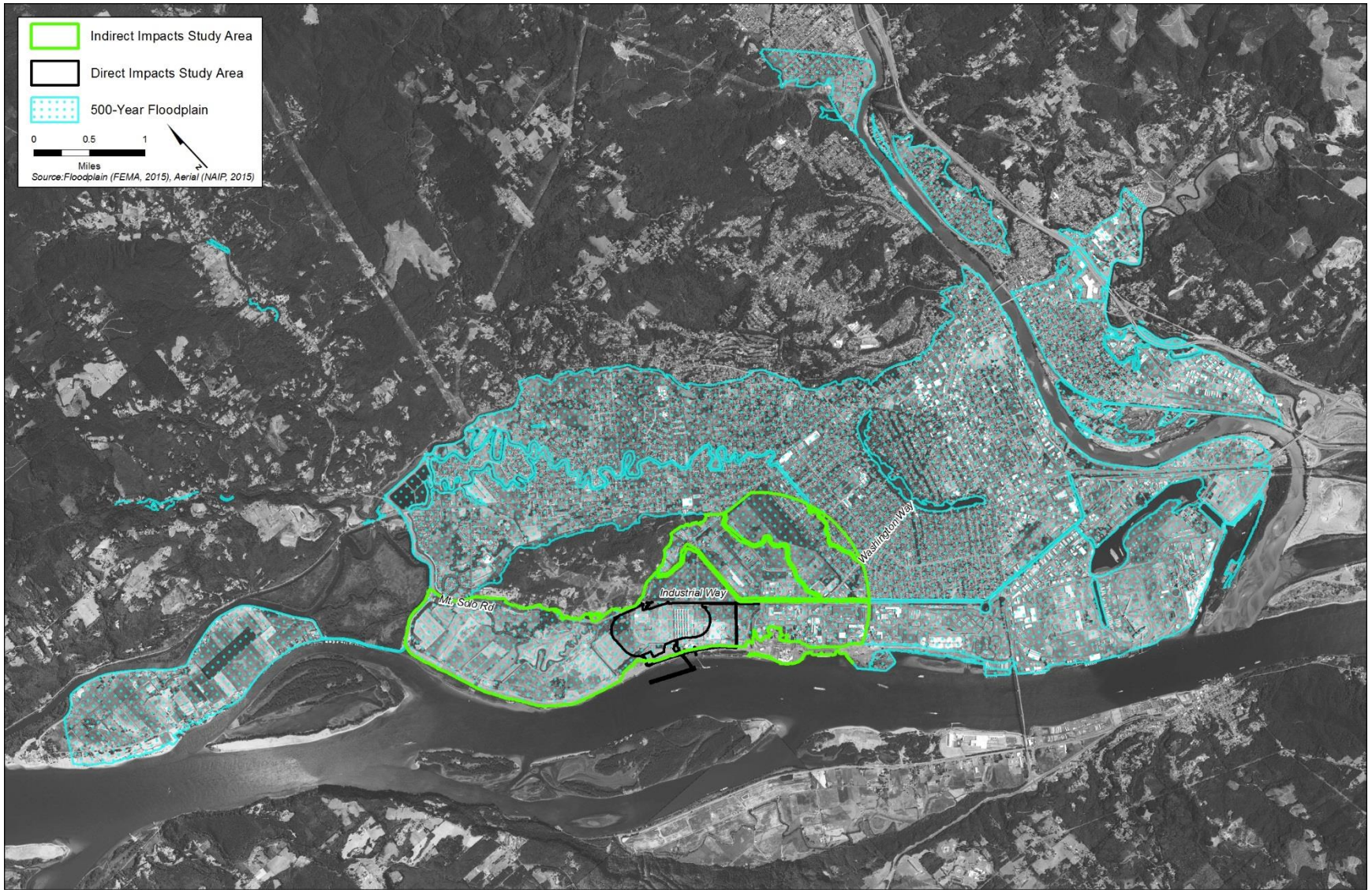


Figure 4. Floodplain Study Area



Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to surface water and floodplains.

2.1 Methods

This section describes the methods used to characterize the existing conditions and assess the potential impacts of the Proposed Action and No-Action Alternative on surface water and floodplains.

The existing conditions related to surface waters and floodplains in the study area and the evaluation of the potential effects of the proposed action are based on various reports and other pertinent literature (Section 2.1.1, *Data Sources*). No field surveys were conducted to prepare this report. The *Engineering Report for NPDES Application Millennium Bulk Terminals—Longview, LLC* (Anchor QEA 2011) was used to establish baseline conditions for on-site surface water conditions. Designations from the Washington State Department of Ecology (Ecology) and the Oregon Department of Environmental Quality were reviewed to establish environmental baseline conditions for the Columbia River. The impact analysis involved evaluating the potential changes the proposed project could have on surface waters and floodplains.

2.1.1 Data Sources

The following sources of information were used to characterize the study area.

- *Engineering Report for NPDES Application Millennium Bulk Terminals—Longview, LLC* (Anchor QEA 2011).
- *Engineering Report Update for NPDES Application Millennium Bulk Terminals—Longview, LLC* (Anchor QEA 2014).
- CDID #1 website.
- *Columbia River Basin: State of the River Report for Toxics* (U.S. Environmental Protection Agency 2009).
- *Diminishing Returns: Salmon Declines and Pesticides* (Ewing 1999).
- *Millennium Coal Export Terminal Longview, Washington: Permanent Impacts to Aquatic Habitat* (Grette Associates, LLC 2014).
- *Columbia River Estuary ESA Recovery Module for Salmon and Steelhead* (National Marine Fisheries Service 2011).
- Columbia River Estuary Operational Forecast System website.
- *Designated Beneficial Uses Mainstem Columbia River 340-41-0101* (Oregon Department of Environmental Quality 2003).

- *303(d)/305(b) Integrated Water Quality Assessment Report* (Oregon Department of Environmental Quality 2012).
- *Millennium Coal Export Terminal Longview, Washington: Water Resource Report Supplemental* (URS Corporation 2014a).
- *Millennium Coal Export Terminal Longview, Washington. Affected Environment Analysis – Water Resources* (URS Corporation 2014b).
- *Millennium Coal Export Terminal Longview, Washington: Water Collection and Drainage Package*. (URS Corporation 2014c).
- *Millennium Coal Export Terminal Longview, Washington: Water Management Plan* (URS Corporation 2014d).
- *Millennium Coal Export Terminal Longview, Washington: Water Balance Calculation* (URS Corporation 2014e).
- U.S. Geological Survey (USGS) water-quality data, Columbia River Estuary, 2004–2005 (U.S. Geological Survey 2005).
- USGS water-quality data, Columbia River at The Dalles, Oregon, 2012 (USGS 14105700).
- *Stormwater Management Manual for Western Washington* (Washington State Department of Ecology 2012).
- Columbia River facts and maps website (Washington State Department of Ecology 2014a).
- Grays-Elochoman, Cowlitz River Basins Water Resource Management Programs (Washington State Department of Ecology 2014b).
- Other literature, as cited in the text.

2.1.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative on surface waters and floodplains. This impact analysis evaluates how surface water conditions could affect the project area.

Potential surface water and floodplain impacts have been evaluated with respect to how the Proposed Action and No-Action Alternative could affect certain parameters such as changes to surface water drainage, surface water discharge, and floodplain connectivity. The assessment of impacts is also based on regulatory controls and the assumption that the Proposed Action would include the following element.

- An individual and construction National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges and for stormwater improvements.

For the purpose of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

2.2 Existing Conditions

The existing environmental conditions related to floodplains in the study area are described below.

In general, the project area is protected by a robust levee system operated and maintained by CDID #1. CDID #1 also operates and maintains a series of ditches and pump stations that receive surface water and shallow groundwater inflow that originates on the project area, as well as other adjacent areas and Longview. In addition, the Applicant now operates and maintains independent stormwater and facility process water treatment and conveyance facilities for the project area. Ultimately, all of these waters are discharged to the Columbia River as groundwater, surface water, or treated stormwater discharge.

The project area is located in the right-bank floodplain of the Columbia River near river mile 63 near Longview (Figure 4). The project area is generally protected from Columbia River flooding by a levee that was originally constructed in the 1920s and then improved in 1949. Project area topography is relatively flat.

2.2.1 Columbia River

The Columbia River basin comprises 260,000 square miles from its headwaters in British Columbia, Canada, to its mouth in Astoria, Oregon, bordering Washington and Oregon. The basin includes parts of seven states, 13 federally recognized Native American reservations, and one Canadian province; 19% of the watershed is in Washington. The average annual flow for the Columbia River at Beaver Army Terminal near Quincy, Oregon,[1] is approximately 236,600 cubic feet per second (cfs) (1 cfs = 448.8 gallons per minute). The river's annual discharge rate fluctuates with precipitation and ranges from 63,600 cfs in a low water year to 864,000 cfs in a high water year (U.S. Geological Survey 2014).

The Columbia River, downstream from the U.S.-Canadian border has been identified as a flow-exempt water body, which is to say that it is exempt from flow control requirements associated with the detention/retention and discharge of stormwater. However, water quality criteria must still be met for all stormwater discharges.

Dam construction began in the early 20th century for flood control and power production. Today, a major dam is located on average every 72 miles in the Columbia River watershed (Bonneville Power Administration 2001). After dams were constructed along the river, the flow regime of the river changed substantially. Records kept since 1878 show that flows were much higher in the spring and lower in winter before dam construction. In addition, the velocity of the water moving down the river was significantly greater before dam construction began in the 1930s. In 1917, Washington adopted a water code to help manage water allocations from surface water bodies in the state, including the Columbia River.

Since the water code was adopted, the state has allocated 768 surface water and 1,379 groundwater rights on the mainstem Columbia River. These Columbia River water users have the right to take approximately 13,000 cfs in instantaneous withdrawals from April through October, when most crops are grown in the basin. The total annual withdrawal from the mainstem Columbia River

[1] Approximately 12 river miles downstream of the project area.

during the growing season is about 4.7 million acre-feet of water (1 acre-foot = 325,851 gallons, enough water to cover 1 square acre of land to a depth of 12 inches).

The Bureau of Land Management is the single largest water user on the mainstem Columbia River and is allocated about two-thirds of the water from the river. Ecology has allocated 768 surface water and 1,379 groundwater rights on the mainstem Columbia River (Washington State Department of Ecology 2014a).

The lower Columbia River is tidally influenced by the Pacific Ocean from Astoria to Bonneville Dam, located upstream of Portland (Bonneville Power Administration 2001). Tidal fluctuations are diurnal, meaning there are two high tides and two low tides in each 24-hour tidal cycle. Tidal ranges vary along the lower Columbia River with a mean range of 3.78 feet at Longview (Table 2).

Table 2. Tidal Station 9440422—Longview

Established	March 23, 1985
Present Installation	March 22, 2002
Mean Tidal Range	3.78 feet

Source: National Oceanic and Atmospheric Administration 2014.

The Columbia River experiences seasonal variation in flow from year to year depending on snow mass in the upper watershed. To account for this variability and provide a basis for navigation, in 1911 the U.S. Army Corps of Engineers (Corps) established a unique low-water datum on the Columbia River. The datum references the lowest recorded water level at that time, from Portland, Oregon, on October 6, 1886. This recorded water level became the "zero" of the gage operating there at that time and it has never been changed. This datum is called the Columbia River Datum (CRD).

CRD is primarily maintained by the Corps' Portland District and is tied to National Geodetic Vertical Datum of 1929 (NGVD29). Elevations of CRD are held at benchmarks along the river basin, and tide gages can be set to these elevations during survey operations. Shortly after the establishment of NGVD29, geodetic ties were made at all possible benchmarks where a tie to CRD existed. The presence of a geodetic tie at a CRD benchmark allows a reference point to which tidal datums can be leveled. For recent hydrographic and photogrammetric surveys, the relationships between CRD, NGVD29, North American Vertical Datum of 1988 (NAVD88), and tidal datums were reconciled at all installed subordinate tide gages and provided to the Office of Coast Survey and National Geodetic Survey (National Oceanic and Atmospheric Administration 2014).

All tidal datums are above CRD for the entire river, in keeping with the original premise of the low water reference datum. Trends of Mean Sea Level (MSL) reveal a slight downward slope from the entrance to upstream. There is a notable drop in MSL near Longview, between the sections of the system under basin influence and those under river influence. The differences between high water tidal datums and low water tidal datums also change drastically near Longview, with a much larger difference occurring in the estuary entrance than the upper reaches of the river basin (National Oceanic and Atmospheric Administration 2014). This is important to consider when reviewing tidal data upstream and downstream of Longview. Table 3 includes the current reported tidal heights at Longview. Data is presented in CRD, but the comparison to NAVD88 can also be determined.

Table 3. Tidal Heights at Tidal Station 9440422—Longview

Description	Acronym	Height (feet CRD)
Mean Higher High Water	MHHW	6.991
Mean High Water	MHW	6.512
Mean Tide Level	MTL	4.623
Mean Sea Level	MSL	4.475
Mean Low Water	MLW	2.736
Mean Lower Low Water	MLLW	2.382
Columbia River Datum	CRD	0.000
North American Vertical Datum 1988	NAVD88	-2.487

Source: National Oceanic and Atmospheric Administration 2014

CRD is a Corps nontidal datum defined at distinct river miles relative to NAVD88, and is used as chart datum above river mile 23 on the Columbia River. Datums are computed using observations from the low river stages of the year, generally August through October, due to the masking of the tidal signal from strong seasonal river runoff during other times of the year. Depending on river flow, water levels can be significantly higher than Columbia River datums.

NAVD88 and NGVD29 are fixed geodetic datums whose elevation relationships to local MSL and other tidal datums may not be consistent from one location to another. It is not uncommon for datums to become confused and elevations in waterways, especially tidal elevations, to be misrepresented or misreported with errors of several feet. For clarity, the definitions of the most common datums that could be encountered over the course of this analysis are provided below.

- **Mean Sea Level.** MSL is a tidal datum determined over a 19-year National Tidal Datum Epoch. The tidal epoch is based on the lunar cycle and requires an adjustment to all tidal gages each 19-year period. MSL pertains to local MSL and should not be confused with the fixed datum of NGVD29, often casually referred to as "Sea Level Datum" or NAVD88.
- **NGVD29**. NGVD29 is a fixed datum adopted as a national standard geodetic reference for heights but is now considered superseded. NGVD29 is sometimes referred to as Sea Level Datum of 1929 or as MSL on some early issues of Geological Survey Topographic Quads. NGVD29 was originally derived from surveys based on 26 tidal stations (21 in the coastal United States and 5 in coastal Canada), hence the confusion with the name.
- **NAVD88**. NAVD88 is a fixed datum and replaces NGVD29 as the national standard geodetic reference for heights. It is derived from a simultaneous, least squares,[2] and minimum constraint adjustment of Canadian/Mexican/United States leveling observations. Local MSL observed at Father Point/Rimouski, Canada, was held fixed as the single initial constraint. While the conversion between NAVD88 and NGVD29 varies at all locations except for Father Point/Rimouski, Canada, that at all other locations NAVD88 is lower than NGVD 29 and should, therefore, be reported with a larger elevation.

[2] A mathematical procedure for finding the best-fitting curve to a given set of points by minimizing the sum of the squares of the offsets (the residuals) of the points from the curve.

2.2.2 Water Resource Inventory Area 25

A watershed generally has a topographic boundary that defines an area draining to a single point of interest. Precipitation falling on a ridgeline of a mountain would drain into one watershed or the other depending on which side of the ridge the rain falls. Ecology and other state natural resources agencies have divided Washington State into 62 Water Resource Inventory Areas (WRIAs) to delineate and manage the state's major watersheds. The project area is located in the WRIA 25–Grays/Elochoman Basin.

2.2.3 Consolidated Diking Improvement District #1

Other than the Columbia River levee, the project area for the Proposed Action is surrounded and protected by the levees, ditches, and pump stations of CDID #1. CDID #1 consists of 19 miles of levees; over 35 miles of sloughs, ditches, and drains for flood protection; a stormwater collection and routing system; and seven pump stations for removing and discharging stormwater to receiving waters outside of the levee system, such as the Columbia River. The combined capacity of the seven pump stations (19 pumps across these stations) is 700,000 gallons per minute. These pump stations are instrumental in removing stormwater and preventing local and area-wide flooding. The need for this pumping capacity is apparent when considering 1 inch of rain falling on the 16,000-acre watershed is equivalent to 434-million gallons of water. Removal of 4.8 inches of rain deposited during a 1986 storm required 54 hours of continuous pumping. These components work together to keep the local community dry. Information presented below is available on the CDID #1 website (Consolidated Diking Improvement District No. 1 2014).

In 1923, six separate diking districts were merged to form CDID #1. CDID #1 worked with the Corps to raise the levees in 1949. The facilities described below are in the project area and are currently operated and maintained by CDID #1.

2.2.3.1 Columbia River Levee

The CDID#1 levee system can be divided into three major segments, but the project area is primarily protected by the Columbia River levee. This levee protects the project area from flooding along the Columbia River and from related backwater elevations in Coal Creek Slough. It extends from the main pump station and office complex around the western edge of Longview and unincorporated portions of Cowlitz County, up the Columbia River to its confluence with the Cowlitz River. The levee is a mixture of well-defined rural levees and overbuilt sections associated with urbanized levees through industrial areas.

Vegetation on the levees is controlled through system-wide mowing, typically occurring at the beginning and middle of the growing season. The tops of all levees are maintained with a drivable surface for vehicle access. Regular patrols identify issues that could affect access for maintenance or emergency purposes such as unwanted vegetation, illegal dumping, abandoned vehicles, and unauthorized structures.

In addition to ongoing inspections conducted by CDID #1 personnel, CDID #1 participates in two inspection programs overseen by the Corps. These programs, identified below, ensure that the operations and maintenance work undertaken by CDID #1 is in conformance with applicable federal standards.

- **Rehabilitation and Inspection Program, ER 500-1-1.** Conducted annually, this routine inspection takes approximately 1 day, which involves driving the levee system to assess whether the flood control works would continue to provide the intended degree of flood protection and determine if the maintenance program is adequate.
- **Periodic Inspection, National Levee Safety Program Act of 2007.** Conducted every 5 years, this is a more thorough review of all levee and stormwater removal systems. The inspection is conducted entirely on foot, takes approximately 4 days to complete, and consists of a large multidisciplinary team of engineers.

2.2.3.2 Pump Stations

CDID #1 operates seven pumping stations with 19 pumps. The combined water capacity of these pumps is 700,000 gallons per minute. These pump stations are located throughout the greater Longview area and are instrumental in removing stormwater and preventing local and area-wide flooding. The two pumps of primary interest in the project vicinity are the Reynolds Pump Station and the Industrial Way Pump Station.

- **Reynolds Pump Station**. The Reynolds Pump Station is located at the terminus of Ditch 14; this pump station draws water from Ditch 10 and pumps directly to the Columbia River. Total pumping capacity is 80,000 gallons per minute.
- **Industrial Way Pump Station**. The Industrial Way Pump Station is located adjacent to Ditch 5 and Industrial Way. It has a pumping capacity of 90,000 gallons per minute and pumps water a distance of nearly 0.5 mile, where it discharges to the Columbia River through the levee at the east end of the project area.

To provide additional safeguards against system failure and oversight of individual pump stations, CDID #1 maintains a radio-operated Supervisory Control and Data Acquisition system. This system performs real-time tracking of water-surface elevations, operational status, and alarm conditions for each facility and provides a visual readout to staff at the CDID #1 office, maintenance office, and main pump station. This system enables CDID #1 staff to respond quickly to issues that need attention and logs data that could be useful for troubleshooting system failures if they occur.

2.2.3.3 Sloughs, Ditches, and Drains

CDID #1 maintains approximately 35 miles of sloughs, ditches and drains that collect and convey stormwater to the CDID #1 pump stations. There are 15 numbered ditches and 31 numbered drains, together with cutoff sloughs and one bypass ditch. The drainage ditch system is composed of a combination of human-made ditches and altered natural channels. Longview is built on a natural floodplain and the levees—which prevent the river flood waters from inundating the city—also prevents stormwater, which falls behind the levees from escaping.

The ditches have a dual function, acting as a conveyance system to transport stormwater to the pumping stations and as a storage reservoir for intense rainfalls exceeding the capacity of the pumps. The Columbia River is the ultimate destination of the drainage water.

The sloughs, ditches, and drains are maintained on a regular rotational basis. Maintenance work involves cleaning ditches of mud and debris, clearing and removing vegetation and mowing on the banks and areas above water level, and repairing ditch banks that have eroded or slumped. The majority of ditches and drains are accessible by vehicle along at least one bank, and maintenance is

performed using excavation equipment (backhoe, track hoe, etc.) with the removed material being applied to the drainage way bank or placed in a dump truck and hauled to an approved disposal site. Some submerged vegetation is treated chemically. These treatments are contracted to a State of Washington-certified contractor for performing this type of work and are performed in compliance with local, state, and federal laws governing such operations.

Below is a description of the CDID #1 ditches that are on or adjacent to the project area.

- **Ditch 5.** Ditch 5 borders the eastern edge of Parcel 10213 and extends toward the south from 38th Avenue to the Industrial Way Pump Station along Industrial Way, which pumps water to the Columbia River via an underground pipeline. A second branch of Ditch 5 extends from the pump station toward the southeast along the north side of Industrial Way down to Washington Way. It connects with other drainage ditches (Ditch 1 and Ditch 3) and conveys flow to the pump station.
- **Ditch 10.** North of Industrial Way, Ditch 10 forms the northern boundary of Parcel 10213 and extends toward the west from 38th Avenue. It continues toward the west, crosses under Industrial Way through a culvert, and extends toward the northwest, eventually connecting to other segments of the drainage system including Ditch 14 and Ditch 16. Ditch 14 conveys flow to the south to the Reynolds Pump Station, which discharges to the Columbia River through and underground pipeline. South of Industrial Way, Ditch 10 is located offsite to the north of the former cable plant and remnant forested area. Ditch 10 intersects with Ditch 14 just north of the closed Black Mud Pond facility.
- **Ditch 14.** Ditch 14 is located along the western boundary of the project area and consists of a trapezoidal-shaped drainage ditch that receives flow from Ditch 10 and Ditch 16 and other privately owned ditches located on site (e.g., Cable Plant Ditch) and off site. During high water events, it conveys flow toward the south to Reynolds Pump Station, which pumps water under the Columbia River levee.

2.2.4 On-Site Drainage

Stormwater and shallow groundwater drainage for the project area is controlled by a system of ditches, pump stations, treatment facilities, and outfalls. All of these facilities operate under a single NPDES permit. As shown in Figure 5, all of the project area drainage is either held onsite and evaporates, discharged to CDID #1 ditches that eventually flow to the Columbia River, or treated and discharged through Outfall 002A to the Columbia River. Table 4 lists the drainage basins in the project area.

Figure 5. Existing Site Drainage System

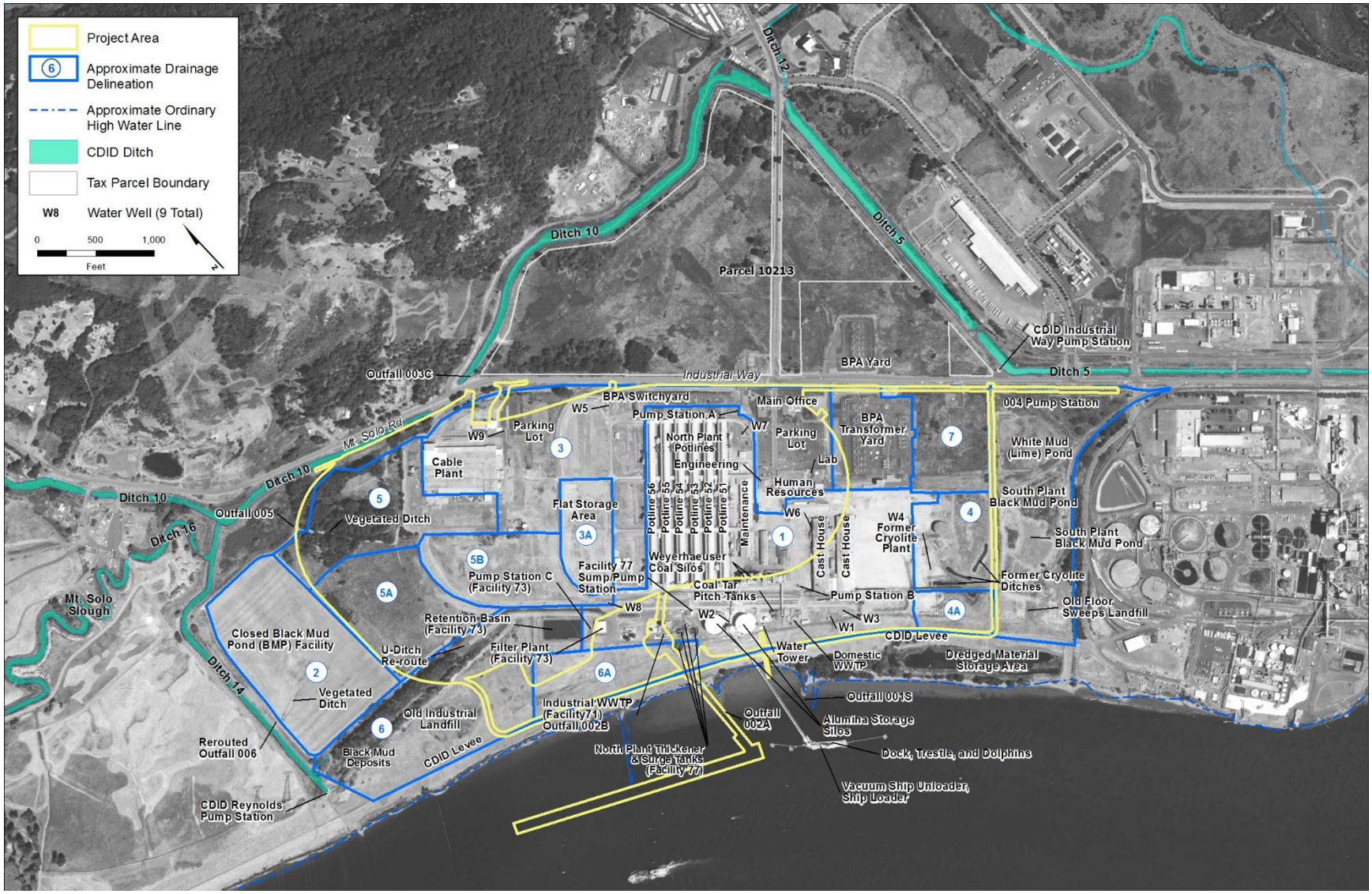


Table 4. Existing Drainage Basins in the Project Area

Area	Description
1	Stormwater runoff gravity drains to Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
2	Stormwater runoff gravity drains to a vegetated conveyance swale and is pumped into the U-Ditch, where it drains to Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A as designed. Larger runoff events may overflow the sump and discharge into CDID Ditch 14 through Rerouted Outfall 006.
3	Stormwater runoff ponds locally and/or gravity drains to a vegetated ditch and is discharged through Outfall 003C into CDID Ditch 10.
3A	Stormwater runoff ponds locally and infiltrates/evaporates and/or is pumped to the U-Ditch, where it drains to Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
4	Stormwater runoff gravity drains to ditches and is pumped via Pump Station 004 to Facility 77, where it is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
4A	Stormwater runoff ponds locally and infiltrates/evaporates.
5	Stormwater runoff from improved areas ponds locally and infiltrates/evaporates; runoff from the larger events may gravity drain to a vegetated ditch and discharge through Outfall 005 to CDID Ditch 14. Stormwater runoff from unimproved areas may gravity drain towards the vegetated ditch.
5A	Stormwater runoff ponds locally and infiltrates/evaporates.
5B	Stormwater runoff ponds locally and infiltrates/evaporates.
6	Stormwater runoff ponds locally and infiltrates/evaporates. Larger runoff events may sheet flow to the U-Ditch, which discharges to Facility 77, and is then pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
6A	Stormwater runoff ponds locally and infiltrates/evaporates. Stormwater runoff from unimproved areas may gravity drain toward the vegetated ditch.
7	Stormwater runoff ponds locally and infiltrates/evaporates.

The following is a brief description of the on-site drainage components of the project area.

- **Sheetflow and infiltration.** Subbasin 4A, 5, 5A, 5B, 6A, and 7 receive sheet flow from storm events where it subsequently infiltrates or evaporates.
- **Columbia River discharge.** Subbasins 1, 2, 3A, 4, and 6 are conveyed via pumped systems or gravity to Facility 73 where they are treated and then discharged to the Columbia River via Outfall 002A.
- **CDID #1 discharge.** Subbasin 3 flows through a vegetated ditch that discharges to Ditch 10 through Outfall 003C. During larger storm events, overflow from Subbasin 2 and Subbasin 5 (both described above) can discharge to the CDID #1 ditch system. Subbasin 2 overflows would discharge to Ditch 14 through Outfall 006. This is a designed overflow system and it is equipped with a high-flow alarm to alert staff when it is activated. Subbasin 5 flows can enter a vegetated ditch that discharges to Ditch 10 through Outfall 005. Ultimately, all CDID #1 ditch flows discharge to the Columbia River.
- **Drainage features on Parcel 10213.** These features include three vegetated ditches, two unvegetated ditches, and a shallow stormwater pond. Two of the vegetated ditches run north-

south across the two larger portions of Parcel 10213 (Figure 5). They are narrow and linear and convey stormwater to a culvert approximately 16 inches in diameter located on the north end of these ditches, which then empties into CDID Ditch 10. The third vegetated ditch consists of three segments of linear vegetated ditches adjacent to Industrial Way. These three ditch segments are connected by two culverts that are beneath the site's access roads. This feature likely collects stormwater from Industrial Way and adjacent areas and conveys it to CDID Ditch 10.

One unvegetated ditch runs parallel to Ditch 10 and consists of two sections of a narrow ditch that was likely constructed to intercept shallow groundwater affecting agricultural use of the site. This unvegetated ditch is several feet deep, near vertical along its sides, and is bisected by one of the vegetated ditches that runs parallel across the site; however, there is no surface hydrology connection between these two ditches. The other unvegetated ditch serves as the outlet channel for the stormwater pond. This ditch is located at the northeast end of the stormwater pond and conveys excess stormwater from the pond to CDID Ditch 10 through a 16-inch culvert. All six features are privately owned and are not managed by CDID #1.

- **Off-site privately owned ditch.** This ditch is located near the northwest corner of the former Reynolds Metals Plant. It conveys flow into Ditch 14 at a point just north of the closed Black Mud Pond facility.

Outfall 002A

Outfall 002A is a 30-inch outfall to the Columbia River that discharges treated water received from Facility 73 (the site's stormwater treatment system) and treated wastewater from Facility 71 (the site's wastewater treatment system). Typical flow rates through the outfall are currently less than 2,000 gallons per minute and there is a maximum flow rate of 14,000 gallons per minute.

2.2.4.1 Columbia River and Cowlitz River Floodplain

The project area is located in the right bank floodplain of the Columbia River approximately 5 miles downstream of the confluence of the Cowlitz River and the Columbia River (Figure 1). The Columbia River, from the U.S.-Canadian border downstream, has been identified as a flow-exempt water body, which is to say that it is exempt from flow control requirements associated with the detention/retention and discharge of stormwater. However, water quality criteria must still be met for all stormwater discharges.

Longview and Kelso were developed on the floodplain of the Columbia River and Cowlitz River. The majority of the project area is behind the Columbia River levee that is operated and maintained by CDID #1. The average elevation of the project area is 13.9 feet NAVD88 (16.4 feet CRD), and the levee averages 33.9 feet NAVD (36.4 feet CRD) (Anchor QEA 2014). The portion of the project area waterward of the Columbia River levee is in the floodway of the Columbia River. Construction and operational changes associated with the proposed docks and trestle would occur on the river side of the existing levee system, where the floodplain is constrained by the levee alignment.

CDID #1 operates the slough, ditch, and drain system several feet lower than the low-flow elevation of the Columbia River throughout the year. This strategy provides necessary stormwater storage capacity and allows the pump system to maximize the flood control potential of the levee's interior drainage. The combined capacity of the seven CDID #1 pump stations (19 pumps across these stations) is 700,000 gallons per minute. These pump stations are instrumental in removing stormwater and preventing local and area-wide flooding. The need for this pumping capacity is

apparent when considering 1 inch of rain falling on the 16,000-acre watershed is equivalent to 434-million gallons of water. For example, during a 1986 storm event, removal of 4.8 inches of rain deposited required 54 hours of continuous pumping.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) maps the project area landward of the CDID #1 levee as Zone X (Federal Emergency Management Agency 2015). Zone X is described by FEMA as follows.

> Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

The current FIRM delineates the project area in "medium shading" and maps the current levee that protects the site.

Flooding at the project area is expected to be minimal under existing conditions. The following events could cause flooding.

- Pump station failures
- Precipitation events that exceed pumping capacity
- Levee failure
- Levee overtopping

The portions of the project area located waterward of the levee (i.e., trestle and docks) are within the floodway. The project area improvements would need to consider the flood inundation limits and velocities for this condition.

Chapter 3
Impacts

This chapter describes the impacts on surface water and floodplains that would result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued.

The Applicant identified the following best management practice to be implemented as part of the project, which was considered when evaluating potential impacts of the Proposed Action.

- BMP C107: Construction Road/Parking Area Stabilization - roads, parking areas, and other onsite vehicle transportation routes would be stabilized to reduce erosion caused by construction traffic or runoff.

The following constructions activities could affect surface water and floodplains.

- Disturbance of surface soils during construction of the coal export terminal
- Redirection of drainage and sheet flow during construction
- Removal of vegetation from leveed floodplain

The following operations activities could affect surface water and floodplains.

- Use of water from rainfall runoff and on-site wells for dust suppression, washdown water, and fire-protection systems
- Redirection of stormwater via a new pump station

3.1 Proposed Action

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would take place in areas of the Columbia River and landward in a Zone B flood zone, an area within the floodplain that is protected from the base flood by a system of levees.

The following constructions activities at the project area could affect surface water and floodplains.

- Preparing the project area and preloading the coal stockpile areas.
- Regrading the project area to drain toward specific collection areas.
- Constructing the rail loop.
- Installing coal processing equipment (unloading facilities, transfer towers, conveyors).

- Constructing offices, maintenance buildings, and other structures.
- Constructing water-management and storage facilities.
- Construction of Docks 2 and 3 and Removal of Existing Pile Dikes.

The following direct impacts on surface water and floodplains could occur as a result of construction activities for the Proposed Action.

Alter Drainage from Heavy Equipment and Staging Areas

Placement of heavy equipment, including but not limited to excavators, pile-driving equipment, forklifts, and rail-track-laying equipment, and establishment of on-site staging areas could redirect sheet flow and potentially lead to localized flooding on- or offsite. Redirection of sheet flow has the potential to create rivulet and/or gully flow across bare soil, which could result in erosion and introduce sediment to the surrounding drainage channels and basins. Introduction of increased sediment loads to the drainage system could change the sediment deposition and transport characteristics of that system, resulting in potential changes in downstream channel morphology, including a reduction in channel sinuosity and storage, increased channel gradient, and reduced pool depth. This could result in the need for additional channel maintenance. However, this is unlikely because erosion and sediment control best management practices and requirements of the NPDES construction permit that would be obtained for the project, would avoid and minimize potential impacts during construction and all measures would be monitored to ensure effectiveness. Weekly inspection and inspection within 24 hours of a rain event would be required under the NPDES Construction Stormwater permit. The inspections must be performed by a Certified Erosion and Sediment Control Lead.

Decrease Floodplain Floodwater Retention

Site preparation would require clearing vegetation within a Zone B flood zone. However, because the project area is protected by levees, it does not currently function as a floodplain. Vegetation that would be removed from the project area does not currently contribute the Columbia River floodplains ability to retain or absorb floodwaters. Activities that occur landward of the levee would not modify conditions in the Columbia River. Thus no decrease in the ability of the Columbia River to retain floodwaters within the floodplain would result from the project.

Construction of Docks 2 and 3 and Removal of Existing Pile Dikes

The Columbia River would be permanently altered and benthic (i.e., river bottom) habitat removed by the placement of piles. A total of 610 of the 630 36-inch-diameter steel piles required for the trestle and docks would be placed below the ordinary high water mark, permanently removing an area equivalent to 0.10 acre (4,312 square feet) of benthic habitat. The majority of this habitat is located in the Delivered Water Zone (Grette 2014a). The placement of piles would displace benthic habitat, and the areas within each pile footprint would cease to contribute toward primary or secondary productivity. Individual pile footprints are relatively small (7.07 square feet) and are spaced throughout the dock and trestle footprint.

Creosote-treated piles would be removed from the deepest portions of two existing timber pile dikes (Figure 6). Approximately 225 linear feet of the dikes would be removed (approximately 125 feet from the western pile dike and approximately 100 feet from the eastern pile dike).

Removal of creosote-treated piles would result in a temporary increase in turbidity and would temporarily affect benthic habitat. Turbidity would be localized and short-term and the benthic habitat affected would recover relatively quickly. Benthic invertebrates typically recolonize disturbed areas within 30–45 days following disturbance. Overall, however, the removal of creosote-treated woodpiles from the Columbia River would be a beneficial impact, as any remaining creosote in those piles would be removed from the aquatic environment. Refer to the SEPA Fish Technical Report (ICF 2017b) for further information.

Use Water for Construction

Construction of the Proposed Action would use water from rainfall runoff and on-site groundwater wells for dust suppression, washdown water, and fire-protection systems. This would be regulated under the NPDES Construction Stormwater Permit. Rainfall would be collected and treated and either stored for reuse in a detention pond to be constructed as part of the Proposed Action, or discharged to the Columbia River through the existing Outfall 002A. If stormwater is collected and used for industrial beneficial use (such as dust control), a Water Rights Permit would be required in accordance with RCW 90.03. The Proposed Action would not withdraw water from the Columbia River or other surface waters in the study area to meet construction water demands. Thus, no impacts on surface water and floodplains are anticipated related to water needs or use during construction.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on surface waters or floodplains because construction of the coal export terminal would be limited to the project area.

3.1.3 Operations: Direct Impacts

The following direct impacts on surface water and floodplains could occur as a result of operations of the Proposed Action.

Use Water for Operations

Operation of the Proposed Action would use water from rainfall runoff and on-site groundwater wells for dust suppression, washdown water, and fire-protection systems. Rainfall would be collected and treated and either stored in a detention pond to be constructed as part of the project, or discharged to the Columbia River through the existing Outfall 002A. The Proposed Action would not withdrawal water from the Columbia River or other surface waters in the study area to meet operations water demands. Thus, no impacts on surface water and floodplains are anticipated related to water needs or use during operations.

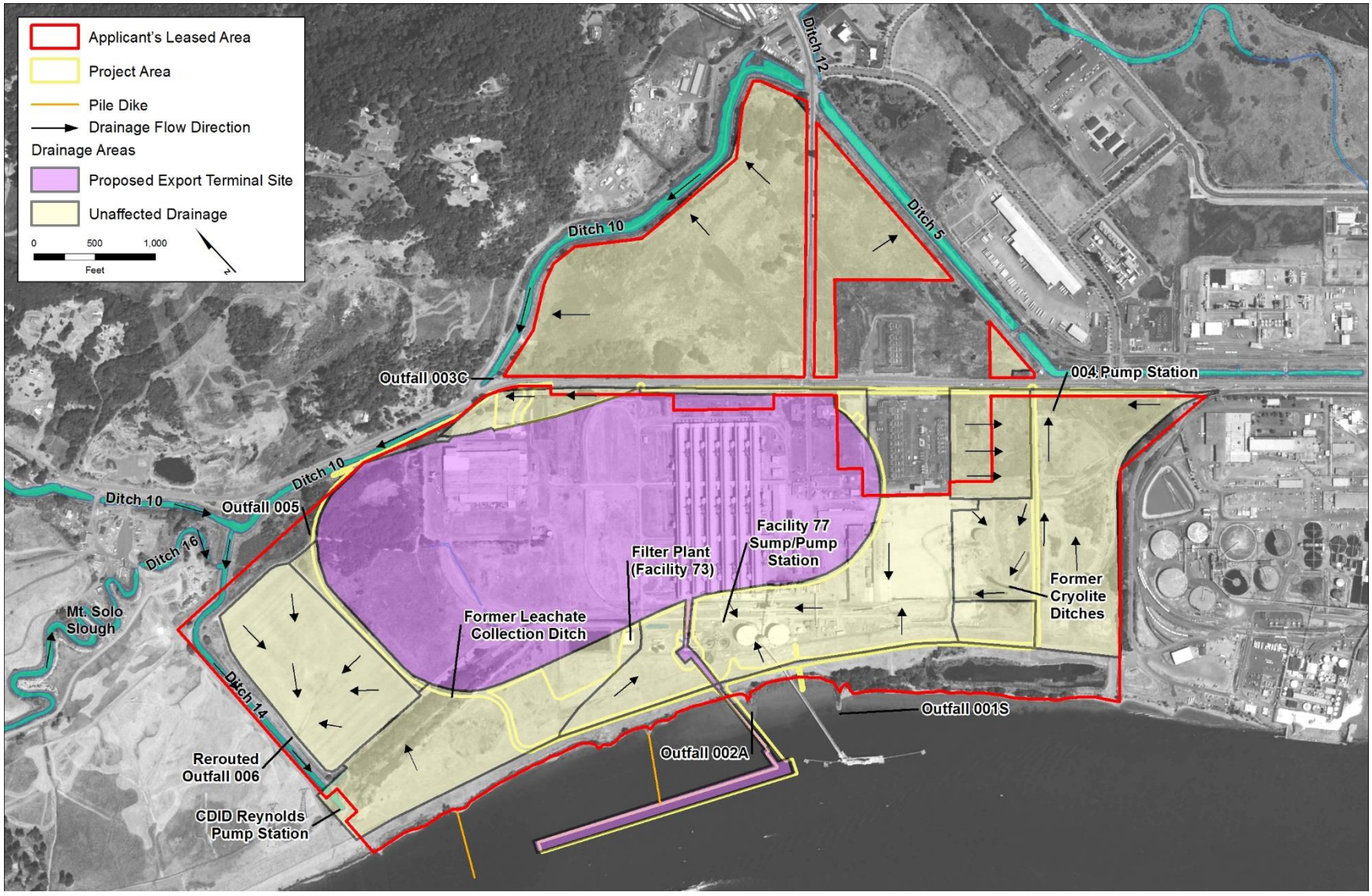
Alter Water Collection and Discharge

Currently, stormwater runoff at the project area is managed by infiltration or evaporation and by a complex stormwater collection and treatment system (Facilities 77 and 73); in conformance with the Applicant's existing NPDES permit (WA-000008-6). The NPDES system includes 12 stormwater basins and five outfalls that the Applicant manages under its NPDES permit, which discharge to the Columbia River. The existing stormwater collection and treatment system configuration would not adequately serve the needs of the future condition

resulting from the Proposed Action. The Applicant would develop a water management system, including capture of stormwater from the project area, separated and isolated from the existing stormwater management system. Information on stormwater is included in the SEPA Water Quality Technical Report (ICF 2017a).

If stormwater is collected and used for industrial beneficial use (such as dust control), a water right permit would be required in accordance with RCW 90.03. The water management system would collect all stormwater and surface water (washdown water) from the stockpile areas, rail loop, office areas, the dock, and other paved/impervious surface areas at the project area and direct these waters to a series of vegetated ditches and ponds, then to a collection basin or sump (Figure 6). Similar to existing conditions, collected water would be pumped to an existing on-site treatment facility consisting of settling pond(s) with flocculent addition to promote settling as needed. Chemical treatments must be identified as part of the NPDES permit process. Treated water would be pumped to a surface storage pond for reuse in support of operations, or, if storage is not necessary the excess treated water would be discharged to the Columbia River via outfall 002A in accordance with the NPDES permit limits. The surface storage pond would have an approximate capacity of 3.6 million gallons to store water for reuse. The capacity of the pond would include a reserve of 0.36 million gallon maintained at all times for fire suppression. The stored water would be available for reuse for dust suppression, washdown and cleanup, and fire suppression. Water for dust suppression would be applied on the main stockpiles, within unloading and conveyance systems, and at the dock. Excess water from dust suppression and washdown would be collected, treated, and stored for reuse.

Figure 6. Proposed Drainage Plan



The proposed changes in water management for each basin are summarized in Table 5.

Table 5. Summary of Proposed Changes to Stormwater Collection and Discharge by Basin

Basin	Existing Collection and Discharge	Proposed Collection and Discharge
1	Collection: Collected from facility collection piping, pumps and ditches, directed to Sump/Pump Station (Facility 77), routed through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	Approximately 48% of this area (32 acres) would be absorbed into the project area. Stormwater generated in Basin 1 contained within the project area would be collected, treated, and reused; excess would be directed to the Proposed Action treatment system for discharge to the Columbia River under the NPDES permit.
	Discharge: Basin 1 gravity flows to Facility 77 and is then routed through Facility 73 for treatment and eventual discharge to the Columbia River via Outfall 002A.	Excess from the project area would be collected and treated within the project area, then routed to a new internal outfall (monitored under a separate NPDES permit). The outfall would tie in to the existing Facility 77 sump, and all waters from the Applicant would go through Facility 73. The Applicant's existing discharge line from Facility 73 would continue to discharge to the Columbia River through the existing Outfall 002A. The remaining areas of Basin 1 outside of the project area would continue to gravity flow to Facility 77 and be routed through Facility 73 for treatment and eventual discharge to the Columbia River via Outfall 002A.
2	Collection: Collected from the top of the cap of the closed Black Mud Pond facility into a sump where it is routed through a pump station to drainage ditches that gravity flow into Facility 77, routed through Facility 73 for treatment and then discharged to Columbia River through Outfall 002A. During heavy storm events, stormwater from the cap may overflow Outfall 006 Sump/Pump Station and flow to Ditch 14.	The Proposed Action would not modify Basin 2.
	Discharge: From the sump, it is routed through a pump station to drainage ditches that gravity flow into Facility 77, routed through Facility 73 for treatment and then discharged to Columbia River through Outfall 002A. During heavy storm events, stormwater from the cap may overflow Outfall 006 Sump/Pump Station and flow to Ditch #14.	The drainage routing for Basin 2 would remain the same as its existing condition.

Basin	Existing Collection and Discharge	Proposed Collection and Discharge
3	Collection: Stormwater generated in Basin 3 ponds locally and/or drains to a vegetated ditch located along the northeastern boundary of the site, adjacent to Industrial Way. The vegetated ditch discharges by gravity drainage to Ditch 10.	The Proposed Action would occupy approximately 85% of Basin 3 (21.8 acres). Runoff in Basin 3 in the project area would be collected, treated, and reused.
	Discharge: Stormwater discharges by gravity to Ditch 10, located at the north edge of the basin and south of Industrial Way.	Excess would be directed to the Proposed Action's treatment system for discharge under NPDES permit through Facility 77 to Facility 73, and then to Outfall 002A. Runoff in Basin 3 outside of the Proposed Action would continue to gravity flow and discharge to Ditch 10.
3A	Collection: Collected from facility pumps, directed to Sump/Pump Station (Facility 77) routed through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	The Proposed Action would occupy 100% of Basin 3A. Runoff in Basin 3A in the project area would be collected, treated, and reused.
	Discharge: Directed to Sump/Pump Station (Facility 77) routed through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	Excess would be directed to the Proposed Action treatment system for discharge under the NPDES permit through Facility 77 to Facility 73, and then through Outfall 002A.
4	Collection: Collected and routed to Facility 77.	The Proposed Action would not occupy areas of Basin 4.
	Discharge: From Facility 77, pumped through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	The drainage routing for Basin 4 would remain the same as its existing condition.
4A	Collection: Allowed to pond and evaporate or infiltrate into the soil.	The Proposed Action would not occupy areas of Basin 4A.
	Discharge: Allowed to pond and evaporate or infiltrate into the soil.	The drainage routing for Basin 4A would remain the same as its existing condition.
5	Collection: Collected by gravity to Ditch 14.	The Proposed Action would occupy 93% of Basin 5.
	Discharge: Stormwater discharges by gravity to the Ditch 14, located at the north edge of the basin and south of Industrial Way.	Runoff in Basin 5 within the Proposed Action would be collected, treated, and reused. Excess would be directed to the Proposed Action's treatment system for discharge under CET NPDES permit through Facility 77 to Facility 73, and then to Outfall 002A. Runoff in Basin 5 outside of the Proposed Action would continue to discharge by gravity to CDID Ditch #14.
5A	Collection: Allowed to pond and evaporate or infiltrate into the soil.	The Proposed Action would occupy 91% of Basin 5A.

Basin	Existing Collection and Discharge	Proposed Collection and Discharge
	Discharge: Allowed to pond and evaporate or infiltrate into the soil.	Runoff in Basin 5A within the Proposed Action would be collected, treated, and reused. Excess would be directed to the Proposed Action treatment system for discharge under the NPDES permit through Facility 77 to Facility 73, and then to Outfall 00 Proposed Action 2A. Runoff in Basin 5A outside of the Proposed Action would continue to be allowed to pond and evaporate or infiltrate into the soil.
5B	Collection: Allowed to pond and evaporate or infiltrate into the soil.	The Proposed Action would occupy 100% of Basin 5B.
	Discharge: Allowed to pond and evaporate or infiltrate into the soil.	Runoff in Basin 5B within the project area would be collected, treated, and reused. Excess would be directed to the Proposed Action treatment system for discharge under the NPDES permit through Facility 77 to Facility 73, and then to Outfall 002A.
6	Collection: Allowed to pond and evaporate or infiltrate into the soil. Stormwater sheet flows from this area and is collected in the U-Ditch located to the south of the former plant's water treatment system and is conveyed to the collection sump at Facility 77, then pumped through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	The Proposed Action would occupy approximately 25% of Basin 6. Runoff in Basin 6 within the project area would be collected, treated, and reused.
	Discharge: From Facility 77, stormwater is then pumped through Facility 73 treatment facility and then discharged to Columbia River through Outfall 002A.	Excess would be directed to the Proposed Action treatment system for discharge under the NPDES permit through Facility 77 to Facility 73, and then to Outfall 002A. Runoff in Basin 6 outside of the project area would continue to gravity flow and discharge to Facility 77 would be routed through Facility 73 for treatment, and discharge to the Columbia River via Outfall 002A.
6A	Collection: Allowed to pond and evaporate or infiltrate into the soil.	The project area would occupy approximately 3% of Basin 6A. The settling pond of Facility 73 would eventually be relocated from Basin 6 into Basin 6A as an indirect impact of the Proposed Action.
	Discharge: Allowed to pond and evaporate or infiltrate into the soil.	Runoff in Basin 6A outside of the project area would continue to be allowed to pond and evaporate or infiltrate into the soil.
7	Collection: Allowed to pond and evaporate or infiltrate into the soil.	The project area would not occupy areas of Basin 7.
	Discharge: Allowed to pond and evaporate or infiltrate into the soil.	The drainage routing for Basin 7 would remain the same as its existing condition.

The proposed reuse of stormwater and surface water would alter the rate and volume of discharge from the project area. Table 6 summarizes the proposed changes in runoff volume and

velocity for each basin shown in Figure 5. The proposed water collection and drainage system would reduce the annual runoff volume and 50-year peak discharge from each basin affected by operations of the Proposed Action.

This reduction would decrease the potential for on-site flooding during heavy rain and result in a potentially beneficial impact on the existing water treatment infrastructure by increasing available treatment capacity.

Table 6. Proposed Changes to Water Collection and Discharge in Volume and Rate of Discharge

Basin	Area (acres)	% Reduced by Proposed Action	Existing Avg. Annual Runoff Ac-ft (MGY)	Proposed Avg. Annual Runoff Ac-ft (MGY)	Existing Peak Runoff Discharge[a] (cfs)	Proposed Peak Runoff Discharge[a] (cfs)
1	88.7	48	284 (92.5)	147 (48.0)	44.7	23.2
2	33.1	0	52 (16.9)	52 (16.9)	5.5	5.5
3	64.2	85	165 (53.8)	24 (8.0)	24.5	3.6
3A	9.4	100	18 (5.9)	0	2.7	0.0
4	52.3	0	92 (30.0)	92 (30.0)	10.4	10.4
4A	5.6	0	13 (4.2)	13 (4.2)	2.0	2.0
5	25.1	93	55 (18.0)	4 (1.2)	8.1	0.6
5A	21.4	91	32 (10.4)	3 (1.0)	3.3	0.3
5B	17.3	100	28 (9.1)	0	3.0	0.0
6	40.5	25	64 (20.9)	48 (15.6)	6.9	5.2
6A	12.9	3	20 (6.5)	19.5 (6.4)	2.2	2.1
7	14.1	0	22 (7.2)	22 (7.2)	2.3	2.3

[a] Volume provided for 50-year storm.
Avg = average; Ac-ft = acre-feet; MGY = million gallons per year; cfs = cubic feet per second

Discharge Less Water to CDID #1 Ditches

Basins 2, 3, and 5 of the existing water management system at the project area currently discharge to CDID #1 drainage ditches. Once constructed, most of the project area would no longer drain to the CDID ditches. The exception being a portion of the access overpass and frontage improvements, which would continue to drain to the ditches. All stormwater and excess dust suppression water within the footprint of the project area would be collected, conveyed, treated, and either stored onsite for reuse or discharged to the Columbia River. The ditches would remain as they are today. Therefore, no negative impacts on the CDID #1 ditches would occur under the Proposed Action. However, less water would be discharged to the ditches from the project area. As discussed below, this could have a beneficial indirect impact on the CDID ditches.

Instigate Flooding from Interior Drainage System Failure

A new pump station and 18-inch outfall line is proposed to convey stormwater from the project area to the existing Facility 77 sump, and then all waters from the project area would go through Facility 73.

Failure of the interior drainage pumps could result in flooding onsite for Basin 3A. However, redundancy would be built into the system to avoid flooding associated with pump failure, i.e., interior drainage pumps would have backup systems. Thus, the potential that both systems would fail simultaneously would be unlikely.

3.1.4 Operations: Indirect Impacts

Modifications to the existing on-site water management system would be unlikely to have any measurable impact on the Columbia River. The Columbia River is one receiving water with a mean annual discharge of 171.4 million acre-feet per year (55.85 trillion gallons per year).[3] The proposed changes to the volume and velocity of surface water discharged to the Columbia River associated with the Proposed Action would be negligible within the Columbia River. Annual discharge to the river is estimated to decrease from 276 to 138.5 million gallons per year, which would equate to a decrease in average annual flow in the Columbia River of 0.0000025 ($2.5 * 10^{-6}$ %). A decrease in flow of this magnitude would essentially be undetectable in the lower Columbia River.

The CDID #1 ditches are much smaller than the Columbia River; therefore, changes to the volume of surface water discharged from the project area could potentially have a measurable effect on the capacity of the ditches. However, the proposed changes would reduce flow to the ditches from 88 to 26.3 million gallons per year. This could be beneficial to the ditches because there would be additional capacity for drainage. As mentioned above, under existing conditions, the combined capacity of the CDID #1 pump stations is 700,000 gallons per minute. These pump stations are instrumental in removing stormwater and preventing local and area-wide flooding. The need for this pumping capacity is apparent when considering 1 inch of rain falling on the 16,000-acre watershed is equivalent to 434 million gallons of water. Removal of 4.8 inches of rain deposited during a 1986 storm required 54 hours of continuous pumping. Thus, any reduction in discharge to the CDID ditch system could provide a benefit during significant rain events.

3.2 No-Action Alternative

Under the No Action Alternative, the Applicant would not construct the coal export terminal and impacts on surface waters and floodplains related to construction of the Proposed Action would not occur. The Applicant would continue with current and future increased operations in the project area. The project area could be developed for other industrial uses including an expanded bulk product terminal or other industrial uses.

No activities that would require a Corps permit or shoreline permit would occur as part of the No-Action Alternative; thus, no impacts on surface waters of floodplains would occur. New construction, demolition, or related activities to develop the project area into an expanded bulk terminal could occur on previously developed upland portions of the project area.

Additionally, the quantity of impervious surface could change but drainage patterns would be similar to existing conditions. Any new or expanded industrial uses that could substantially alter drainage patterns would trigger a new NPDES permit or modification to the permitting process.

[3] USGS Station 14246900 Columbia River at Beaver Army Terminal, near Quincy, Oregon: Average Discharge for Period of Record, 23 years (water years 1969, 1992–2013).

Impacts related to being located in a Zone B flood zone would be similar to those stated for the Proposed Action.

Chapter 4
Required Permits

The Proposed Action would require the following Cowlitz County permits related to surface water and floodplains.

- **Shoreline Substantial Development Permit.** The Proposed Action would result in new development in the shoreline area regulated by the Washington State Shoreline Management Act and *Cowlitz County Shoreline Master Program* (Cowlitz County 2012). Therefore, this alternative would require a shoreline substantial development permit. This permit is administered by the Cowlitz County Department of Building and Planning.
- **Critical Areas Permit.** The Proposed Action would result in development in designated critical areas because the project area contains a frequently flooded area, an erosion hazard area, and a critical aquifer recharge area. Therefore, this alternative would require a critical areas permit from the Cowlitz County Department of Building and Planning.
- **Floodplain Permit—Cowlitz County Building and Planning.** A floodplain permit would be required from Cowlitz County to address development in any areas designated as Frequently Flooded Areas.
- **Clean Water Act Section 401—Washington State Department of Ecology**. An individual water quality certification from Ecology under Section 401 of the Clean Water Act would be required for construction of the Proposed Action.
- **NPDES Construction Stormwater Permit.** A Construction Stormwater Permit would be required from Ecology to address erosion control and water quality during construction. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued.
- **NPDES Industrial Stormwater Permit—Washington State Department of Ecology**. An Industrial Stormwater Permit would be required from Ecology for discharge of industrial use water during operations. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued.
- **Water Rights—Washington State Department of Ecology.** If stormwater is collected and reused for beneficial industrial reuse, a Water Right Permit would be required in accordance with RCW 90.03.
- **Hydraulic Project Approval—Washington Department of Fish and Wildlife.** The Proposed Action would require a hydraulic project approval from the Washington Department of Fish and Wildlife because project elements would affect the Columbia River.

- **Clean Water Act Authorization, Section 404—U.S. Army Corps of Engineers.** Construction and operation of the Proposed Action would affect waters of the United States, including wetlands. Department of Army authorization by standard individual permit would be required.
- **Rivers and Harbors Act—U.S. Army Corps of Engineers.** Construction and operation of the Proposed Action would affect navigable waters of the United States (i.e., the Columbia River). The Rivers and Harbors Act authorizes the Corps to protect commerce in navigable streams and waterways of the United States by regulating certain activities in such waters. Section 10 of the RHA (33 U 403) specifically regulates construction, excavation, or deposition of materials into, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters.

The following measures were identified by the Applicant as measures that would be implemented during construction and/or operations. These measures are assumed conditions or requirements of permits identified above that would be issued for the project, and thus are described here. These measures were considered when evaluated the potential impacts of the project:

- Based on site grading and drainage areas, five water quality ponds (wetponds) will treat runoff based on Ecology requirements. In general, the ponds are sized for treatment of the volume and flow from the water quality design storm event (72% of the 2-year storm). Additional storage will be provided within the coal storage area so that the runoff is always treated within the stockyard area, even for larger storm events. The ponds are designed to provide settlement as the water passes through. Subsequently, water released from these ponds will be conveyed downstream to the existing pump station outfall 002A that discharges into the Columbia River via an existing 30-inch steel pressure line. The ponds that treat runoff from the coal stockyard will harvest water for circulation around the site for multiple uses, including dust control measures.

  The Ecology criteria will be used as the basis of design, which utilizes the Western Washington Hydrology Model computer simulation for facility sizing. Because of the flat nature of the site, some surface ponding will occur in both the yard areas and open conveyance systems. The piped conveyance systems will be sloped at .50% minimum.

- Additional water storage would be provided within the coal storage area in the event of a larger storm event. Water volumes exceeding the demands for reuse would be discharged offsite via the existing outfall 002A into the Columbia River. Water released offsite would be treated and would meet the requirements of Ecology and required discharge permits.

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MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA GROUNDWATER TECHNICAL REPORT

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Acronyms and Abbreviations

AFY	acre-feet per year
Applicant	Millennium Bulk Terminals—Longview, LLC
BMP	best management practice
BNSF	BNSF Railway
CCC	Cowlitz County Code
CDID	Consolidated Diking and Improvement District
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
cPAH	carcinogenic PAHs
CRB	Columbia River basalt
CVI	Chinook Ventures Inc.
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
LMC	Longview Municipal Code
gpm	gallons per minute
MCL	maximum contaminant level
MTCA	Model Toxics Control Act
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Reynolds facility	Reynolds Metals Company facility
RCW	Revised Code of Washington
RI/FS	Remedial Investigation/Feasibility Study
SEPA	Washington State Environmental Policy Act
SPL	spent potliner
TPH	total petroleum hydrocarbons
UP	Union Pacific Railroad
USC	United States Code
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

Chapter 1
Introduction

This technical report assesses the potential groundwater impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, groundwater refers to subsurface waters held in soils or interstitial spaces of rocks of the project area. This report describes the regulatory setting, establishes the methods for assessing potential groundwater impacts, presents historical and current groundwater conditions in the study area, and assesses the potential for impacts on groundwater.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

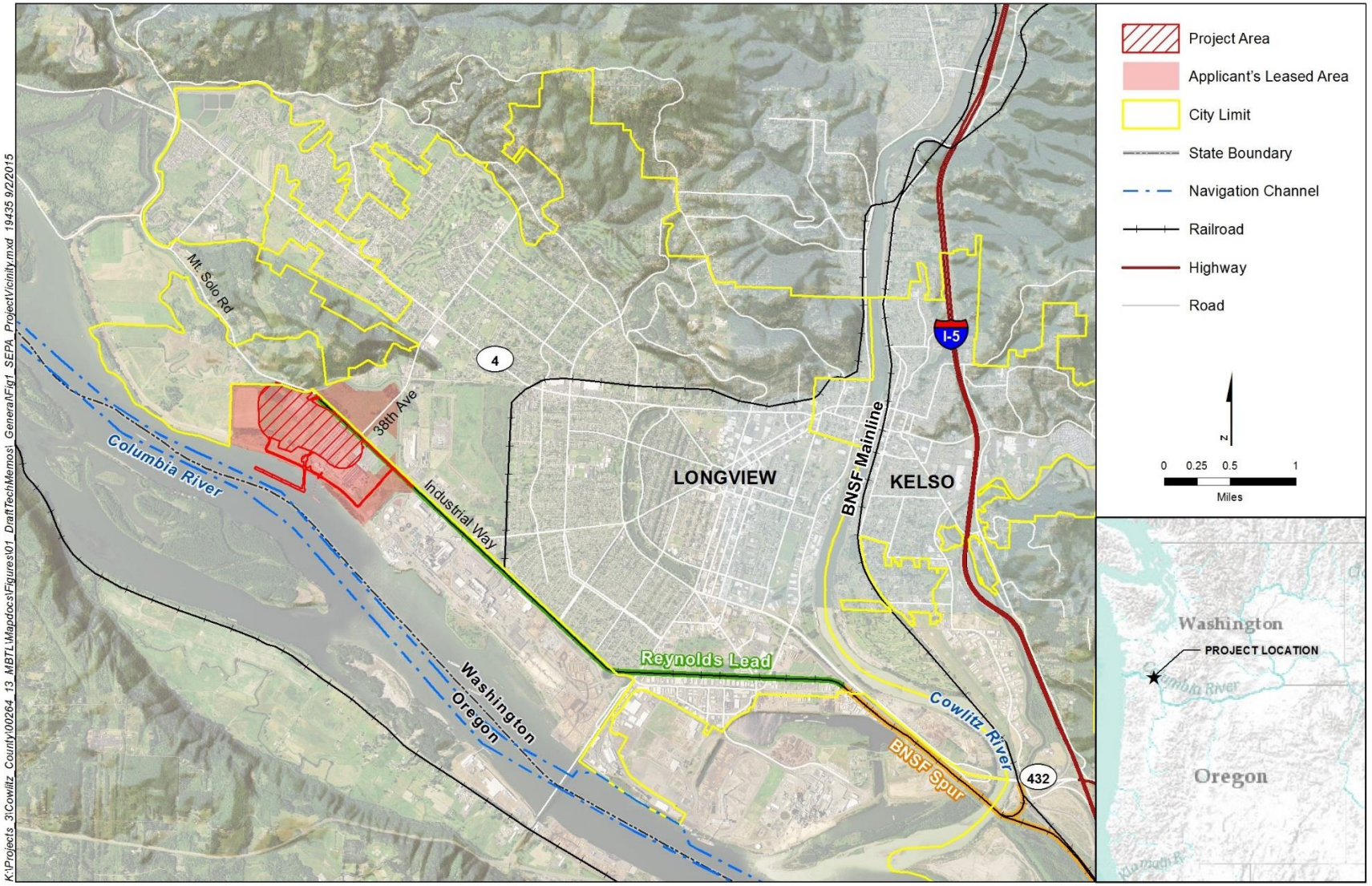
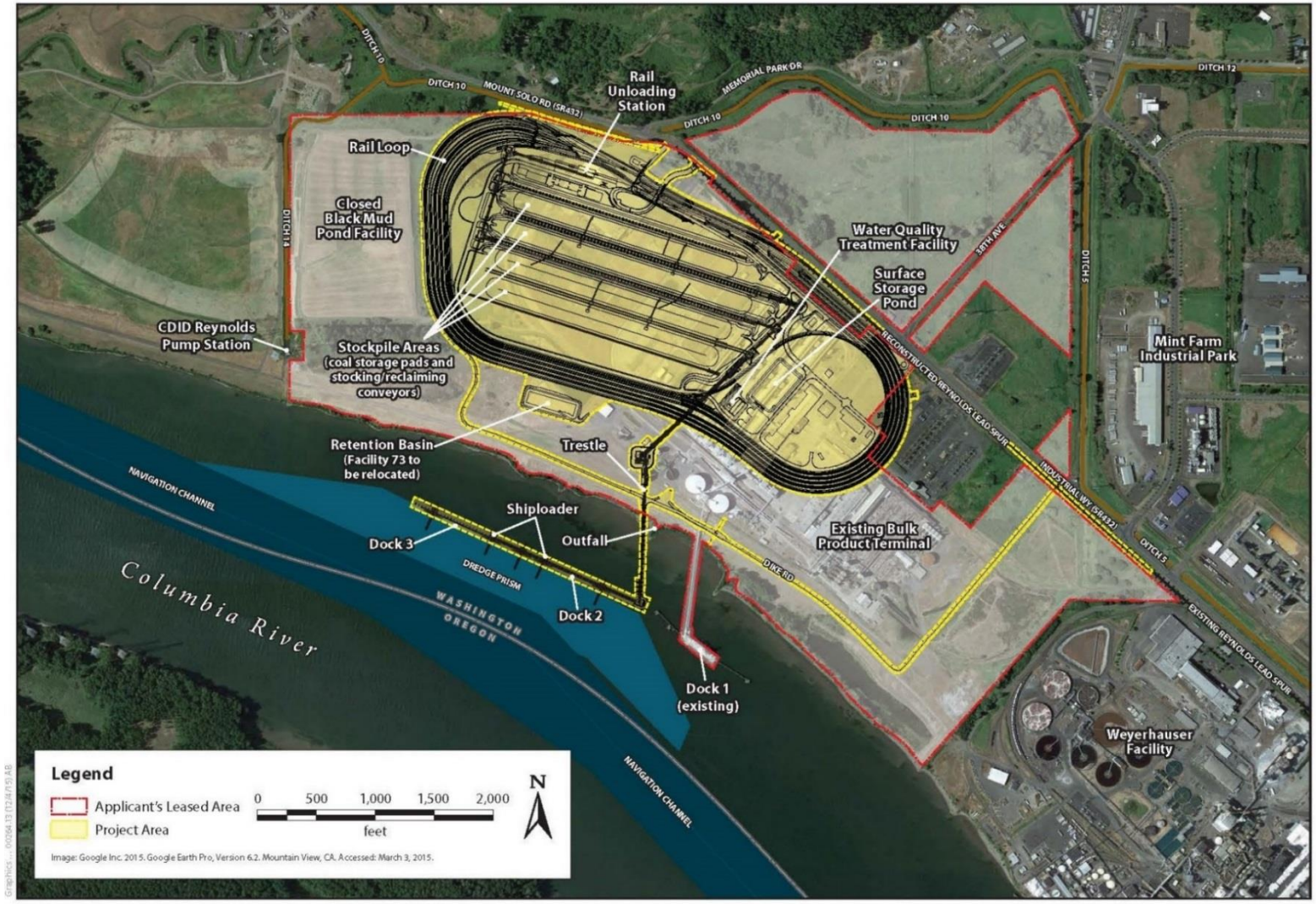


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

Various jurisdictions have responsibility for the protection and regulation of groundwater. These jurisdictions and the regulations, statutes, and guidelines that apply to groundwater are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Groundwater

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Clean Water Act (33 USC 1251, *et seq*.)	Establishes the basic structure for regulating discharges of pollutants into waters of the United States and regulating quality standards for surface waters but not groundwater.
Safe Drinking Water Act	Requires the protection of groundwater and groundwater sources used for drinking water. Also, requires every state to develop a wellhead protection program.
National Pollutant Discharge Elimination System Permit	Authorized by the Clean Water Act, the permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Surface water in the study area interacts with groundwater.

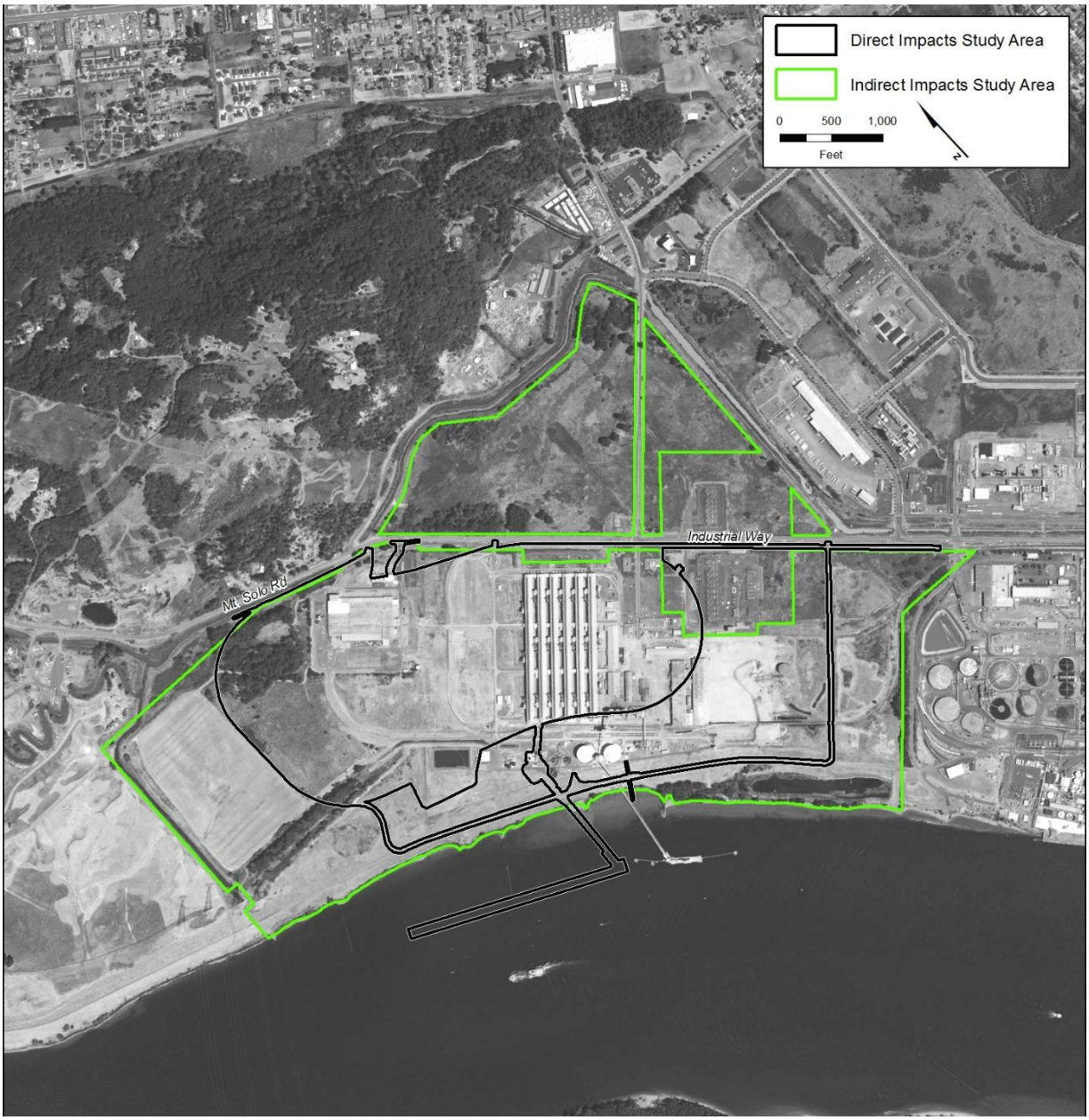
Regulation, Statute, Guideline	Description
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Water Code (RCW 90.03)	Establishes rules for regulating and controlling water rights, and defines beneficial uses.
Regulation of Public Groundwaters (RCW 90.44)	Regulates and controls groundwater. Extends application of surface water statutes (90.03 RCW) to groundwater.
Water Quality Standards for Groundwaters of the State of Washington (WAC-173-200)	Groundwater standards intended to preserve a level of quality for groundwater capable of meeting current state and federal safe drinking water standards.
Drinking Water/Source Water Protection (RCW 43.20.050)	Requires that the Washington State Department of Health assure safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors.
Model Toxics Control Act (RCW 70.105D)	Requires potentially liable persons to assume responsibility for cleaning up contaminated sites.
State Water Pollution Control Law (RCW 90.48)	Grants Ecology the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland water, salt waters, watercourses, and other surface and groundwater in the state.
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to insure that waters of the state are protected and fully utilized for the greatest benefit.
Washington State Oil and Hazardous Substance Spill Prevention and Response (90.56 RCW)	Requires notification of releases of hazardous substances and establishes procedures for response and cleanup
Model Toxic Control Act Cleanup Regulations (173-340 WAC).	Establishes procedures for investigation and site cleanup actions. Requires potentially liable persons to assume responsibility for cleaning up contaminated sites
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Designates critical areas and development regulations to assure the conservation of such areas in accordance with best available science.
Cowlitz County Critical Aquifer Recharge Area (CCC 19.15.160)	Designates critical areas and development regulations to assure the conservation of such areas in accordance with best available science.
Longview Water Supply Protection Ordinance (LMC 17.100)	Establishes a Wellhead Protection Program to minimize the risk of groundwater contamination.

NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; USC = United States Code; RCW = Revised Code of Washington; SEPA = Washington State Environmental Policy Act; WAC = Washington Administrative Code; EPA = U.S. Environmental Protection Agency; Ecology = Washington State Department of Ecology, CCC = Cowlitz County Code; LMC = Longview Municipal Code

1.3 Study Area

The study area for direct impacts on groundwater is the project area for the Proposed Action. The study area for indirect impacts is the 540-acre Applicant's leased area (Figure 3).

Figure 3. Groundwater Study Area



Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to groundwater resources.

2.1 Methods

This section describes the methods used to characterize the existing conditions and assess the potential impacts related to hazardous material under the Proposed Action and No-Action Alternative.

2.1.1 Data Sources

The following sources of information were used to characterize and evaluate groundwater conditions in the study area.

- *Remedial Investigation Report* (Anchor Environmental, LLC 2007).
- *Former Reynolds Metals Reduction Plant—Longview, Draft Remedial Investigation and Feasibility Study* (Anchor QEA 2014a).
- *Millennium Coal Export Terminal Longview, Washington, Water Resources Report* (URS Corporation 2014a).
- *Millennium Coal Export Terminal Longview, Washington, Water Resource Report* (URS Corporation 2014b).
- *Millennium Coal Export Terminal Longview, Washington, Surface Water Memorandum* (URS Corporation 2014c).
- *Millennium Coal Export Terminal Longview, Washington Surface Water Memorandum, Second Supplement to Water Resource Report Water Collection and Drainage* (URS Corporation 2014d).
- City of Longview, Mint Farm Regional Water Treatment Plant, Preliminary Design Report, Part 2A, Hydrogeologic Characterization, March 2010).
- Other scientific literature as cited in the text.

2.1.2 Impact Analysis

This impact analysis evaluates the changes the Proposed Action and No-Action Alternative could have on existing groundwater conditions and how existing groundwater conditions could affect the project area. Although the indirect impact study area includes the extent of the Applicant's leased area, impacts on groundwater were determined to be limited to the project area and along the rail line that accesses the project area within the watershed. For direct impacts, the analysis assumes best management practices were incorporated into the project design, operations of the facility, and during construction.

Potential groundwater impacts have been evaluated with respect to several general parameters, including groundwater discharge and recharge, groundwater quality, and groundwater withdrawal and how the Proposed Action and No-Action Alternative may affect these parameters. The assessment of impacts is also based on regulatory controls and the assumption that the Proposed Action would include the following actions and authorizations.

- National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit and Industrial Stormwater Permit for stormwater discharges.
- Remediation of any existing soil and groundwater contamination in the project area prior to and concurrently with project construction.
- Long-term monitoring as part of the remediation of the existing groundwater contamination to verify remedy effectiveness and natural attenuation of groundwater contamination.

2.2 Existing Conditions

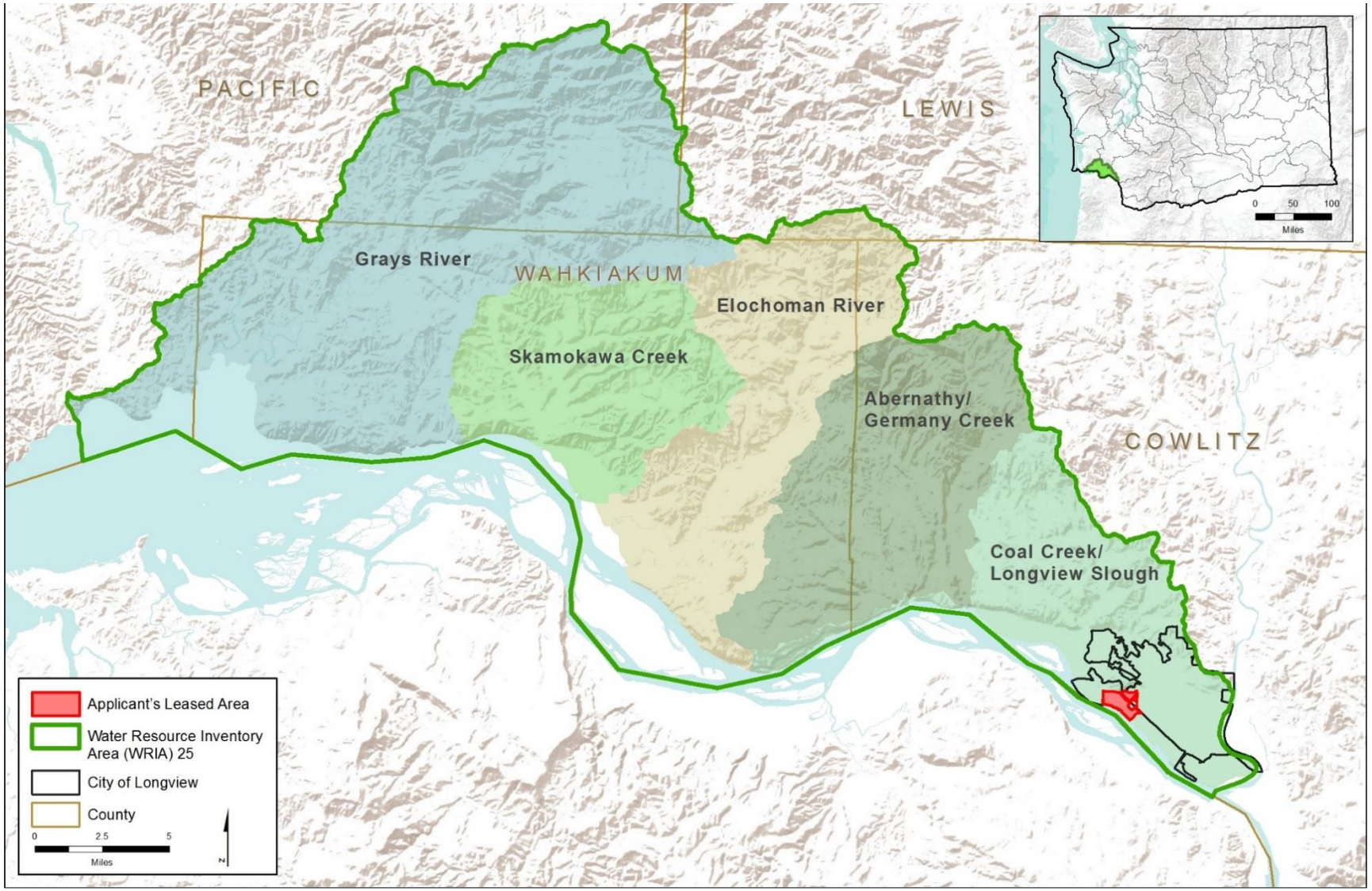
The existing conditions related to groundwater in the study area are described below.

Groundwater can be described as water that is collected or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks. Groundwater largely originates from rain or melting snow and ice, and is the source of water for aquifers, springs, and wells (Washington State Department of Ecology 2014a). An aquifer is the underground soil or rock through which groundwater can easily move. The amount of groundwater that can flow through soil or rock depends on the size and connectivity of the spaces in the soil or rock. Aquifers that consist of gravel, sand, sandstone, or fractured rock such as limestone are made of materials that are permeable (or porous) and allow water to flow through. Aquifers that contain materials such as clay or shale have many small pores that are not well connected and are considered impermeable with restricted groundwater flow (U.S. Geological Survey 2001). An unconfined aquifer is recharged directly by infiltration of precipitation or surface water (e.g., rivers). Confined aquifers are overlain by low-permeability material that limits the vertical flow of water into or out of the aquifer. Landowners access groundwater from wells that tap into an aquifer. Most groundwater is better protected from quick contamination than surface water, depending on a contaminant's ability to permeate the overlying soils or rock.

2.2.1 Regional Setting

The direct and indirect impact study areas are within Water Resource Inventory Area (WRIA) 25, also known as the Grays-Elochoman watershed. This watershed encompasses approximately 296,000 acres and is defined by five subbasins: Grays River, Skamokawa Creek, Elochoman River, Abernathy/Germany Creek, and the Coal Creek/Longview Slough. Figure 4 depicts the Grays-Elochoman watershed, the five subbasins, and the project area within the Coal Creek/Longview Slough subbasin.

Figure 4. Watershed Map



The principal hydrogeological units that yield the largest quantities of groundwater to wells within WRIA 25 are the unconsolidated sediments (Alluvium Unit) that occur in the valleys of the Cowlitz and Grays river systems and along the Columbia River (HDR and EES 2006). This unit consists of unconsolidated to poorly consolidated Quaternary-age sand, gravel, and silt that form undissected terrace deposits and floodplain deposits within major river and stream valleys. The thickness of this unit is highly variable, commonly ranging from less than 5 feet to more than 100 feet (Lower Columbia Fish Recovery Board 2001).

Other water-bearing units present in this watershed include tertiary continental sedimentary rocks and the Columbia River basalt (CRB) group. The tertiary continental sedimentary rocks are composed of mainly moderately to well-indurated fluvial (river/stream deposits) sediments, consisting of sandstone, conglomerates, and siltstones, volcaniclastic sediments, and minor paldual (swamp/marsh) and lacustrine (lake) deposits. The tertiary continental sedimentary rocks occur in the eastern portion of the watershed and can reach more than 2,000 feet thick. The CRB group represents the distal portions of a series of continental flood basalt flows that emanated from linear vent systems in northeastern Oregon, southeastern Washington, and western Idaho between approximately 6 and 17 million years ago. The total thickness of this group is highly variable, ranging from 50 feet to more than 400 feet (Lower Columbia Fish Recovery Board 2001).

2.2.1.1 Coal Creek/Longview Slough Subbasin

The project area is in the Coal Creek/Longview Slough subbasin. The principal aquifers mapped in this subbasin are the alluvium and the CRB group. The alluvial aquifer is most extensive in the lower elevations of the subbasin, along streams and their tributaries. The sediments that compose the alluvial aquifer are generally highly permeable. Groundwater in the alluvial aquifer is generally unconfined. Production wells, which produce groundwater for human consumption, are screened in the alluvial aquifer and generally have high yields (to greater than 1,000 gallons per minute [gpm]). The alluvial aquifer is recharged in part by the Columbia and Cowlitz Rivers and tributaries such as Coal Creek (Lower Columbia Fish Recovery Board 2001).

The CRB group is present in the higher elevations of the Coal Creek subbasin. This aquifer is recharged by precipitation, seasonal gains from rivers and streams, and inflow from deeper bedrock aquifers. The number of wells completed in aquifers in the CRB group is unknown; however, groundwater use values presented in the *WRIA 25/26 Grays-Elochoman and Cowlitz Watershed Planning Documents Level 1 Assessment* indicate that significant water withdrawal from the basalt water-bearing zones is not currently occurring. The bulk of the groundwater withdrawal in the Coal Creek/Longview Slough subbasin is currently occurring from the alluvial aquifers where most of the population resides (Lower Columbia Fish Recovery Board 2001).

2.2.2 Local Setting

The project area is located on the northeast shore of the Columbia River. The project area is within the Longview-Kelso basin, a topographic and structural depression formed by the Cascadia subduction zone (Anchor 2013 in URS Corporation 2014a). The Longview-Kelso basin is composed of unconsolidated alluvium (silt, fine-grained sand, and clay) underlain by alluvium (coarse-grained sand and gravel). Groundwater resources in the study area include an upper alluvium aquifer (i.e., shallow groundwater) and a deeper confined aquifer from which industries, small farms, and domestic well users withdraw groundwater. Shallow groundwater is hydraulically connected with the Columbia River. Preliminary hydrogeologic investigations conducted for the City of Longview

indicate that shallow, unconfined groundwater does not significantly contribute to the deeper aquifer as the lower aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014b). The project area is not considered a significant source of groundwater recharge by infiltration because of the low recharge rates of the soil in the study area (URS Corporation 2014c).

2.2.2.1 Shallow Aquifer

Groundwater in the shallow aquifer is found at depths less than 5 feet below the ground surface (bgs) (Anchor QEA 2014a). Groundwater flow in the shallow aquifer in the study area is complex because of the competing influences of the Consolidated Diking and Improvement District (CDID) #1 system, and to a lesser extent, the tidally influenced Columbia River (Anchor QEA 2014a). Groundwater and stormwater discharged to the CDID #1 ditches are actively pumped from the ditches by the CDID #1 to maintain surface-water levels below those in the Columbia River. Water from the CDID #1 is discharged to the Columbia River. A CDID #1 pump station is located near the southwest corner of the project area boundary (Figure 2).

2.2.2.2 Deep Aquifer

The deep aquifer is located at an approximate depth of 200 bgs, with sand coarsening to gravel to a depth of 400 feet bgs (Anchor QEA 2014a). The deep aquifer in the study area is a source of drinking water for the Mint Farm Regional Water Treatment Plant, which provides municipal water to the City of Longview. The City of Longview conducted a pumping test at a production well for the Mint Farm Regional Water Treatment Plant, located approximately 6,000 feet east of the eastern boundary of the Applicant's leased area (Figure 2), to characterize the deep aquifer. The test results indicate that the Columbia River recharges the deep aquifer at the Mint Farm site and suggest similar recharge of the deep aquifer in the project area. Overall, recharge to the deep aquifer in the project area is expected to be primarily driven by deeper aquifers below the Columbia River and insignificantly from shallow, unconfined aquifers (Anchor QEA 2014b). Discharge from the deep aquifer is from seepage back to the Columbia River, direct discharge to the shallow aquifer, and pumpage from wells (URS Corporation 2014b).

2.2.2.3 Columbia River

The Columbia River flows along the entire south/southwest boundary of both project area and water levels fluctuate with the tides. The mean annual flow of the Columbia River, measured at the Beaver Army Terminal at river mile 53.8 near Quincy, Oregon, is approximately 236,000 cubic feet per second. The river's annual discharge rate fluctuates with precipitation, snowmelt, and reservoir releases, ranging from 63,600 cubic feet per second in a low water year to 864,000 cubic feet per second in a high water year (U.S. Geological Survey 2014). Tributaries to the Columbia River basin are primarily snow-fed (i.e., precipitation falls mainly as snow). These tributaries typically have low winter flows and strong spring and summer peak flows with snowmelt. This concentrates about 60% of the natural runoff to the Columbia River during May, June, and July (URS Corporation 2014b). Tidal influences on groundwater tend to propagate farthest in the coarse-grained deep aquifer and to a much lesser degree within the shallow aquifer (Anchor QEA 2014a).

2.2.2.4 CDID #1 Ditch System

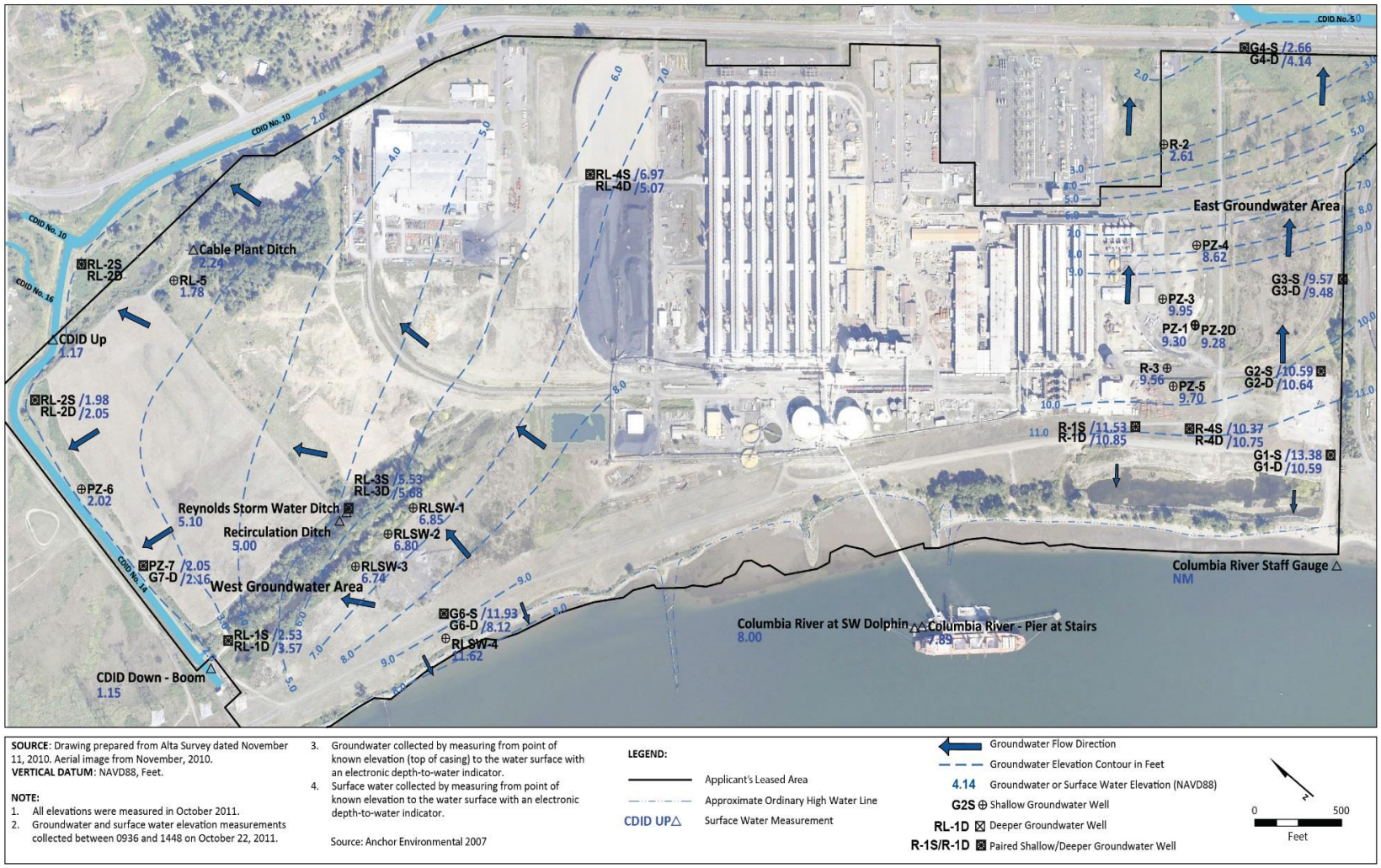
The CDID #1 is a secondary permittee on the Cowlitz County/Kelso/Longview Municipal NPDES permit. The CDID #1 system is a series of levees and ditches. It consists of approximately 35 miles of drainage ditches for the purpose of flood protection from external flooding (rivers), internal flooding (storm drainage runoff), and flooding from lands adjacent to the levee system (groundwater). Additionally, the U.S. Army Corps of Engineers (Corps) constructed a CDID #1 flood control levee in the 1920s along the Columbia River shoreline at the southern boundary of the project area, referred to as the Columbia River levee (Figure 2). This levee is part of the larger network of levees designed to protect properties in the Longview area from Columbia River flooding (Anchor QEA 2014a).

The CDID #1 system surrounding and including the project area was developed to control local flooding and depress the groundwater elevation in lower elevation areas (including the project area) near the Columbia River. Specifically, the system was designed to protect life, property, and the environment from external flooding and internal flooding (flooding due to storm runoff from lands adjacent to and inside the levee system). Water levels in the CDID #1 ditches are maintained below the water surface elevation of the Columbia River, which subsequently influences groundwater flow direction in the shallow aquifer. The CDID #1 ditch system and the higher water surface elevation of the Columbia River cause groundwater to flow away from the river (to the north, east, and west) and toward the CDID #1 ditches (Anchor QEA 2014a), with one localized exception. Groundwater flow south of the axis of the Columbia River levee is toward the Columbia River (Anchor Environmental 2007). Groundwater that discharges into the CDID #1 ditches and stormwater that is collected in the CDID #1 ditches are actively pumped by the CDID #1 system to the Columbia River through a network of pump stations and valves to maintain water levels below the level of the Columbia River. Some groundwater from the deep aquifer may be discharged into the CDID #1 ditches because an upward vertical gradient also exists in areas near the ditches, causing groundwater in the deep aquifer to move upward into the shallow aquifer (Anchor Environmental 2007).

2.2.2.5 Project Area

As discussed above, the project area is located on the northeast shore of the Columbia River. At the project area, groundwater movement in the shallow aquifer is relatively slow. Groundwater in the shallow aquifer flows north from the Columbia River levee then proceeds northwest toward the regional CDID #1 ditch system (Figure 5) (Anchor Environmental 2007). In areas farther from the CDID #1 ditches, shallow groundwater, fed by precipitation, moves downward into the deep aquifer. In areas near the CDID #1 ditch system, groundwater in the deep aquifer moves upward into the shallow aquifer. The levee recharges the shallow groundwater to the north, while the Columbia River recharges the groundwater south of the levee. Discharge of the shallow aquifer occurs from seepage back to the Columbia River, CDID #1 ditch system extraction, evapotranspiration, and pumping from shallow wells (URS Corporation 2014a)..

Figure 5. Groundwater Gradients and Flow Direction



SOURCE: Drawing prepared from Alta Survey dated November 11, 2010. Aerial image from November, 2010.
VERTICAL DATUM: NAVD88, Feet.

NOTE:
1. All elevations were measured in October 2011.
2. Groundwater and surface water elevation measurements collected between 0936 and 1448 on October 22, 2011.
3. Groundwater collected by measuring from point of known elevation (top of casing) to the water surface with an electronic depth-to-water indicator.
4. Surface water collected by measuring from point of known elevation to the water surface with an electronic depth-to-water indicator.

Source: Anchor Environmental 2007

LEGEND:
- Applicant's Leased Area
- Approximate Ordinary High Water Line
- CDID UP△ Surface Water Measurement
- Groundwater Flow Direction
- Groundwater Elevation Contour in Feet
- 4.14 Groundwater or Surface Water Elevation (NAVD88)
- G2S ⊕ Shallow Groundwater Well
- RL-1D ⊠ Deeper Groundwater Well
- R-1S/R-1D ⊠ Paired Shallow/Deeper Groundwater Well

0 500 Feet

Drainage Basins and Stormwater System

The on-site drainage system collects, treats, and discharges stormwater under the Applicant's Individual Industrial NDPES Permit WA-000008-6 for the existing bulk product terminal. Stormwater is collected from 12 drainage basins and is discharged as treated stormwater to CDID #1 ditches and the Columbia River via four outfalls. A fifth outfall, Outfall 004, has been closed since 1991. The major collection and treatment systems, drainage basins, outfalls, and discharge locations currently managed under the NPDES program are described in more detail in the following sections, based on the *Millennium Coal Export Terminal Longview, Washington Surface Water Memorandum* (URS Corporation 2014c), and shown on Figures 6 and 7.

Basins 1 and 3a

Waters collected from Basins 1 and 3a (approximately 89 and 9 acres, respectively) are collected from facility pumps and ditches and directed to the Facility 77 Sump/Pump Station. An average of approximately 99 million gallons per year of stormwater from Basins 1 and 3a is routed into Facility 77, treated through Facility 73, and then pumped through Outfall 002A to the Columbia River.

Basin 2

Basin 2 (approximately 40 acres) collects stormwater runoff from the top of the cap of the closed Black Mud Pond facility into a sump, where it is routed through a pump station to drainage ditches that gravity flow via the U-Ditch into Facility 77. Approximately 17 million gallons per year (97% of the stormwater runoff from Basin 2) are routed into Facility 77. During heavy storm events, stormwater from off the closed Black Mud Pond facility cap may overflow the Outfall 006 Sump/Pump Station and flow to CDID Ditch 14. No discharge has been observed through Outfall 006 since the sump/pump station was installed in 2012. Waters collected at Facility 77 are directed to Facility 73 for treatment and then discharged to the Columbia River through Outfall 002A.

Basins 3 and 5

Stormwater generated in Basins 3 and 5 (27 acres and 62 acres, respectively) discharge by gravity drainage to the CDID Ditches 10 and 14, respectively. Ditches 10 and 14 are located at the north and west edges of the Applicant's leased area, respectively. An average of approximately 72 million gallons per year of stormwater flows to the CDID #1 ditches from these areas.

Basin 4

Waters collected from the cryolite area ditches (see *Cryolite Area Ditches* below) are directed to a pump and sent to Facility 71 (Industrial Wastewater Treatment Plant) for treatment. Treated water exiting Facility 71 is then discharged through internal Outfall 002B to Facility 77 where it is comingled with other waters and routed to treatment at Facility 73, eventually discharging to the Columbia River via Outfall 002A.

Stormwater runoff generated in Basin 4, other than in the cryolite area ditches, drains to gravity ditches that convey the flows to Pump Station 004, which discharges to Facility 77. An average of approximately 30 million gallons per year of stormwater from Basin 4 is collected and eventually discharges to the Columbia River via Outfall 002A.

Figure 6. Water Management System in the Project Area

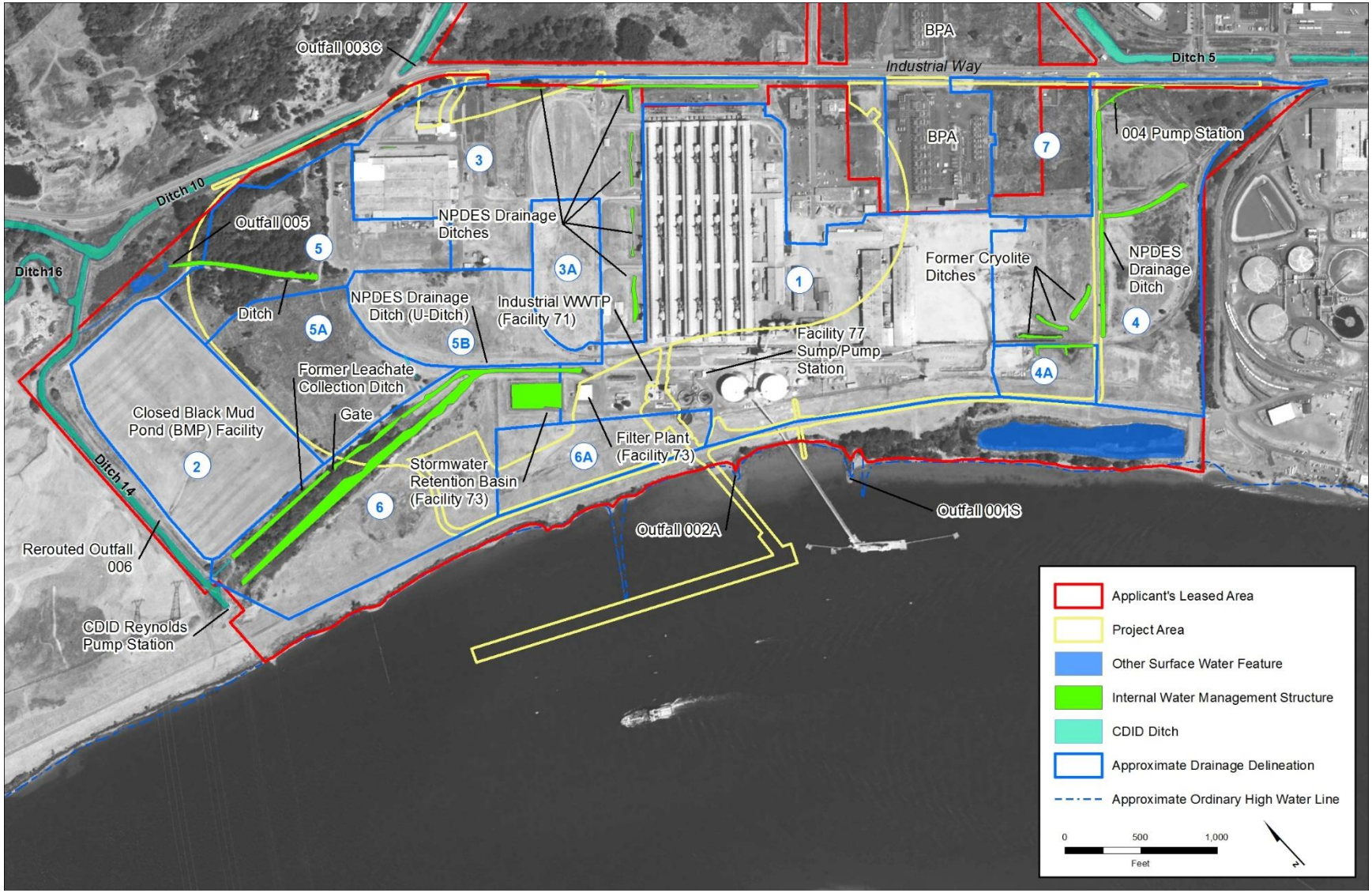
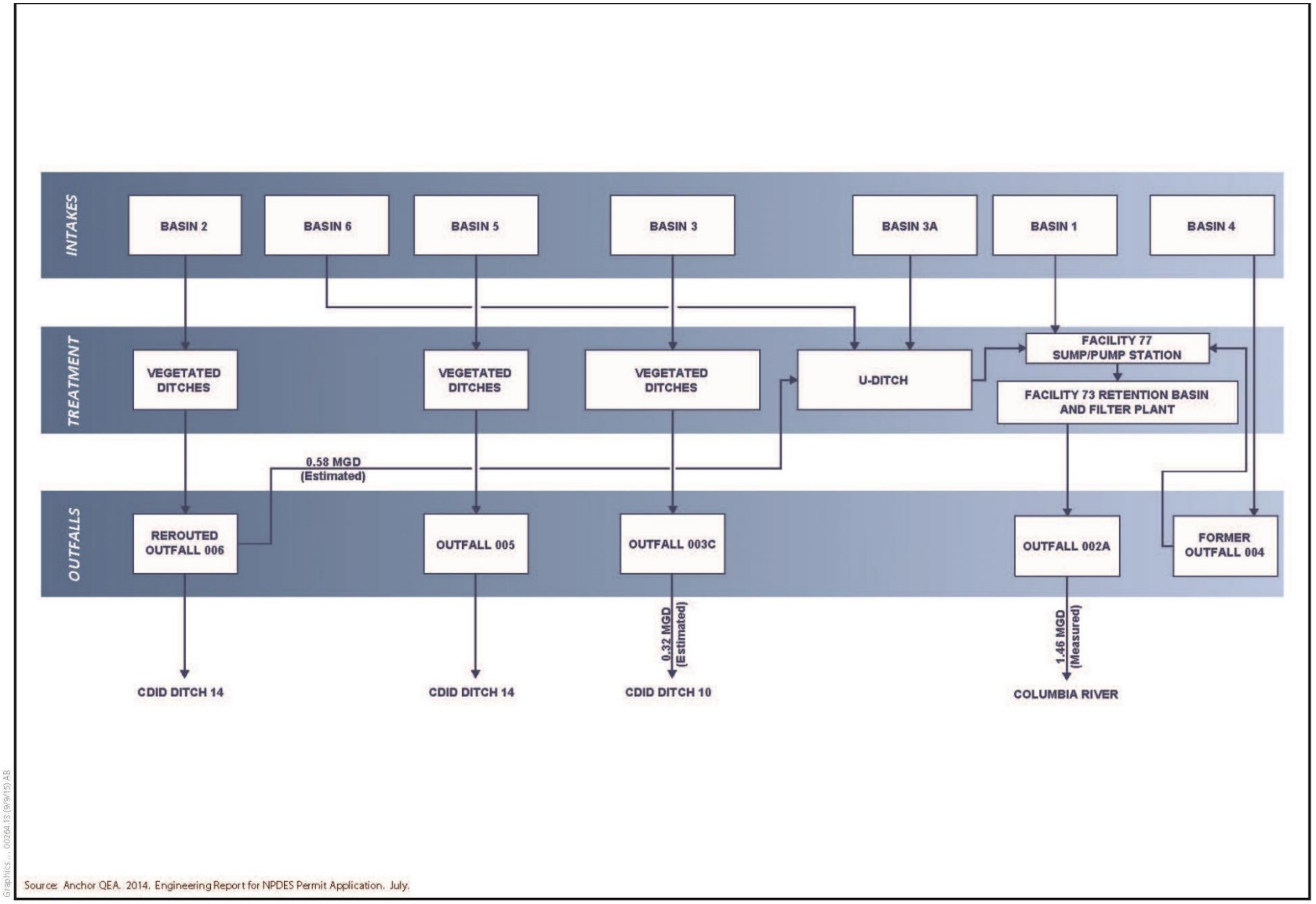


Figure 7. Schematic of Stormwater Flow in the Project Area



Basins 4A, 5A, 5B, 6A, and 7

Stormwater from Basins 4A, 5A, 5B, 6A, and 7 may pond in these areas and then evaporate or infiltrate into the soil. These basins represent a combined area of approximately 71 acres and generate approximately 37 million gallons per year of stormwater.

Basin 6

Minor amounts of stormwater from Basin 6 may pond locally and evaporate or infiltrate into the soil. During storm events, stormwater from Basin 6 (an area of approximately 40 acres), is collected in the U-Ditch and conveyed to the Facility 77 Sump/Pump Station. Approximately 21 million gallons per year of stormwater from Basin 6 are conveyed to Facility 77. Process water and stormwater collected at Facility 77 is treated through Facility 73 and then discharges to the Columbia River through Outfall 002A.

Facility 71

Facility 71, installed in 1988, is the site's industrial wastewater treatment system.[1] Treated wastewater from Facility 71 is discharged through Internal Outfall 002B to the Facility 77 Sump/Pump Station and is then comingled with the other waters, treated through Facility 73, and discharged through Outfall OO2A to the Columbia River.

Facility 73 (Stormwater Treatment System)

Facility 73, the stormwater treatment system, is used to achieve water quality standards required by the existing NPDES permit (WA-000008-6). Facility 73 is located in the southwest portion of the Applicant's leased area and consists of a 1.98-million-gallon retention basin (Figure 6), oil and grease removal, multi-media filters, and a discharge pump station (Pump Station C). The retention basin is sized to handle flows up to 6,000 gpm (8.64 million gallons per day). The retention basin is equipped with an oil and grease removal system. Flows exiting the retention basin are discharged through a 20-inch line to Pump Station C. Pump Station C includes three alternating pumps with a combined discharge capacity of 6,000 gpm under peak flow conditions. Pump Station C pumps the water through an 18-inch line where an in-line turbidity monitor located downstream measures the outgoing water's turbidity. If the turbidity reading is below the turbidity set point, the water in the 18-inch line discharges into the 30-inch Outfall 002A line and then to the Columbia River. If the turbidity reading is above the turbidity set point, a solenoid valve routes the water through multimedia filters before tying back into the 18-inch line for discharge to the Outfall 002A line.

Facility 77 (Sump and Pump Station)

Facility 77 is a large central collection sump and pump station that is the primary stormwater discharge point for the majority of all basins within the southern property of the Applicant's leased area (except for Basins 3 and 5). Facility 77 is outfitted with four operating pumps with varying capacities of up to 2,700 gpm each. The pumps at Facility 77 previously discharged directly to the Columbia River through Outfall 002A; however, since the mid-1990s flows collected at Facility 77 are pumped through a 16-inch line to the stormwater treatment system (Facility 73) before being discharged through Outfall 002A.

[1] Facility 71 was destroyed in a fire in June 2011 and reconstructed in February 2012.

Outfall 002A

Outfall 002A is a 30-inch outfall to the Columbia River that discharges the water it receives from Facility 73. As described above, treated wastewater from Facility 71 is discharged through Internal Outfall 002B to Facility 77 and is then comingled with the other waters and treated through Facility 73. The average amount of stormwater runoff generated by the basins discharging to Outfall 002A is 166.3 million gallons per year. The combined average flow to the Columbia River through Outfall 002A is 1.46 million gallons per day or 532.9 million gallons per year.

Outfall 003C

Outfall 003C drains through a 2,500-linear foot vegetated conveyance ditch to CDID Ditch 10.

Former Outfall 004

Former Outfall 004 was rerouted to Facility 77 with the installation of Pump Station 004, and the outfall was closed in 1991. From Facility 77, the water is routed to Facility 73 for treatment and then discharged to the Columbia River through Outfall 002A.

Outfall 005

Outfall 005 drains to CDID Ditch 14. Stormwater runoff from improved areas ponds locally and infiltrates or evaporates. Runoff from larger events may gravity drain to a vegetated ditch and discharge to CDID Ditch 14.

Rerouted Outfall 006

Outfall 006 was created after the current NPDES permit was issued in 1990 and is not described in NPDES permit WA-000008-6. Outfall 006 has been in multiple NPDES renewal applications submitted to the Washington State Department of Ecology (Ecology) since the Outfall was created. Treatment occurs through stormwater passing through the vegetated conveyance swale. Stormwater flows from Outfall 006 are routed to the U-Ditch and then to Facility 77 where the stormwater is pumped to Facility 73 for treatment and then discharged to the Columbia River through Outfall 002A. Treated stormwater runoff from events larger than the 6-month, 24-hour storm may overflow the Outfall 006 Sump/Pump Station and discharge directly into CDID Ditch 14.

Cryolite Area Ditches

Additionally, a series of ditches, referred to as cryolite area ditches, which are not part of the CDID #1 or NPDES system, is located on the east side of the Applicant's leased area (Figure 6). These ditches were constructed to control stormwater and perched shallow groundwater. Although the ditches used to discharge into the CDID #1 system, they are now isolated from it; water from these ditches is pumped via Pump Station 004 (Anchor Environmental 2007) to Facility 77 where it is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.

2.2.3 Groundwater Quality

Groundwater data in WRIA 25 are extremely fragmented and exist for only a few localized areas near Kelso and Longview (Lower Columbia Fish Recovery Board 2001).

2.2.3.1 Regional

Alluvial (Shallow) Aquifers

According to the Lower Columbia Fish Recovery Board (2001), chemical quality of groundwater ranges from excellent to poor in the alluvium units. Shallow wells near streams and rivers typically have excellent water quality, while deeper wells and/or wells located farther from streams and rivers often produce groundwater of lower quality. The problem constituents are typically iron, manganese, and total dissolved solids found at levels that produce undesirable aesthetic/cosmetic (taste, odor, color, discoloration) effects, but do not necessarily pose health risks (Lower Columbia Fish Recovery Board 2001). The source of these elevated constituents is assumed to arise from bedrock groundwater recharge to the alluvial aquifer and/or long residence time for groundwater within the alluvial aquifer, which allows leaching of these constituents from the sediment that hosts the aquifer.

Another groundwater quality problem associated with alluvial aquifers in this area is the potential presence of phenol compounds. These phenol compounds are produced by the decomposition of vegetative materials because of dewatering volcanic lahars/debris flows[2].

Tertiary Continental Sedimentary Rock Unit

Limited data exist on the chemical quality of groundwater from the formations found in this aquifer unit. The available data suggest that the chemical quality is often poor. The problem constituents are typically iron and manganese found at levels that produce undesirable aesthetic/cosmetic (taste, odor, color, discoloration) effects, but do not necessarily pose health risks. Similar to the alluvium unit, the likely source of these elevated constituents is due to groundwater from older bedrock units that is entering this aquifer and/or long residence time for groundwater within this aquifer, which would allow leaching of these constituents from the sediment that hosts the aquifer (Lower Columbia Fish Recovery Board 2001).

Columbia River Basalt Group

No data on the chemical quality of groundwater from the Columbia Basin Basalt Group were available at the time of preparation of this document. However, the flood basalt flows of this group often serve as good aquifers capable of producing groundwater of typically good chemical quality (Lower Columbia Fish Recovery Board 2001).

2.2.3.2 Local

Kennedy/Jenks Consultants (2010) completed a water quality and environmental risk assessment as part of the preliminary design report for the Mint Farm Regional Water Treatment Plant. The risk assessment included sampling and water quality analysis of the groundwater from the deeper aquifer of six wells. This study found no chemicals in the groundwater above their respective human health screening levels. Kennedy/Jenks Consultants (2012a) repeated the water quality analysis

[2] Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano and/or river valleys. As lahars move downstream form a volcano, their size, speed, and amount of water and rock debris/mudflow is constantly changing as it deposits rocks, boulders, and vegetation across the river valley it enters (USGS 2013).

from the same wells in November 2012 and found manganese and iron at levels above the Washington State Department of Health secondary water quality standards and arsenic in one of the wells but at levels below thresholds established by the U.S. Environmental Protection Agency (EPA) for drinking water quality standards). These levels were found to be naturally occurring and are characteristic of the regional water supply aquifer (Anchor QEA 2014a). Groundwater gradients and monitoring well locations are shown in Figures 8 and 9.

Project Area

Historical and Existing Sources of Groundwater Contamination

Industrial use of the Applicant's leased area began in 1941 with the development of the aluminum production operations by Reynolds Metals Company. The manufacturing capabilities were expanded in the 1960s and the operations focused primarily on aluminum production. Historical operations in the Applicant's leased area included aluminum production facilities, cable plant operations, cryolite recovery plant operations, and industrial landfills. Figure 10 shows the facilities in the Applicant's leased area. The SEPA Hazardous Materials Technical Report describes the history of contamination in the Applicant's leased area (ICF 2017a).

Aluminum Production Facilities

Initial industrial operations in the Applicant's leased area began with the Reynolds Metals aluminum reduction plant in 1941. The plant is located in the eastern portion of the Applicant's leased area (referred to as South Plant) and was used for aluminum smelting and casting operations (Figure 10). In 1967, Reynolds developed the North Plant in the center of the Applicant's leased area for additional aluminum production (Anchor QEA 2014a).

Smelter operations required an extensive dry-materials handling system for raw materials. Raw materials included alumina ore, petroleum coke, coal tar pitch, anthracite coal, cryolite, and aluminum fluoride. Liquid coal tar was unloaded by rail and transferred into storage tanks, which connected to the greenmill by distribution lines. At the greenmill, pitch (which contains polycyclic aromatic hydrocarbons [PAHs]) was used as a raw material for anode and cathode construction. Pitch was also placed on the ground near the rail unloading area (Anchor Environmental 2007). Smelter operations in the Applicant's leased area have been associated with elevated concentrations of fluoride in soils or solid media (Anchor QEA 2014a). Figure 10 shows the location of the aluminum manufacturing facilities: North Plant and South Plant lie within the project area, while the pitch tanks and unloading area lie near the southern boundary of the project area.

Former Cable Plant Operations

The cable plant, constructed in the late 1960s, was located west of the aluminum production facilities and within the project area boundary (Figure 10). The cable plant produced electrical cable products, including aluminum wire, rods, and insulated (polyethylene and polyvinyl) low- and medium-voltage cable. It received molten aluminum from the aluminum production facilities and processed it in three furnaces: a continuous ingot caster, a rolling mill, and wire drawers. Ancillary structures associated with the cable plant included office buildings, a parking lot, and a sanitary wastewater treatment plant.

Figure 8. Shallow Aquifer Groundwater Gradients and Monitoring Well Locations

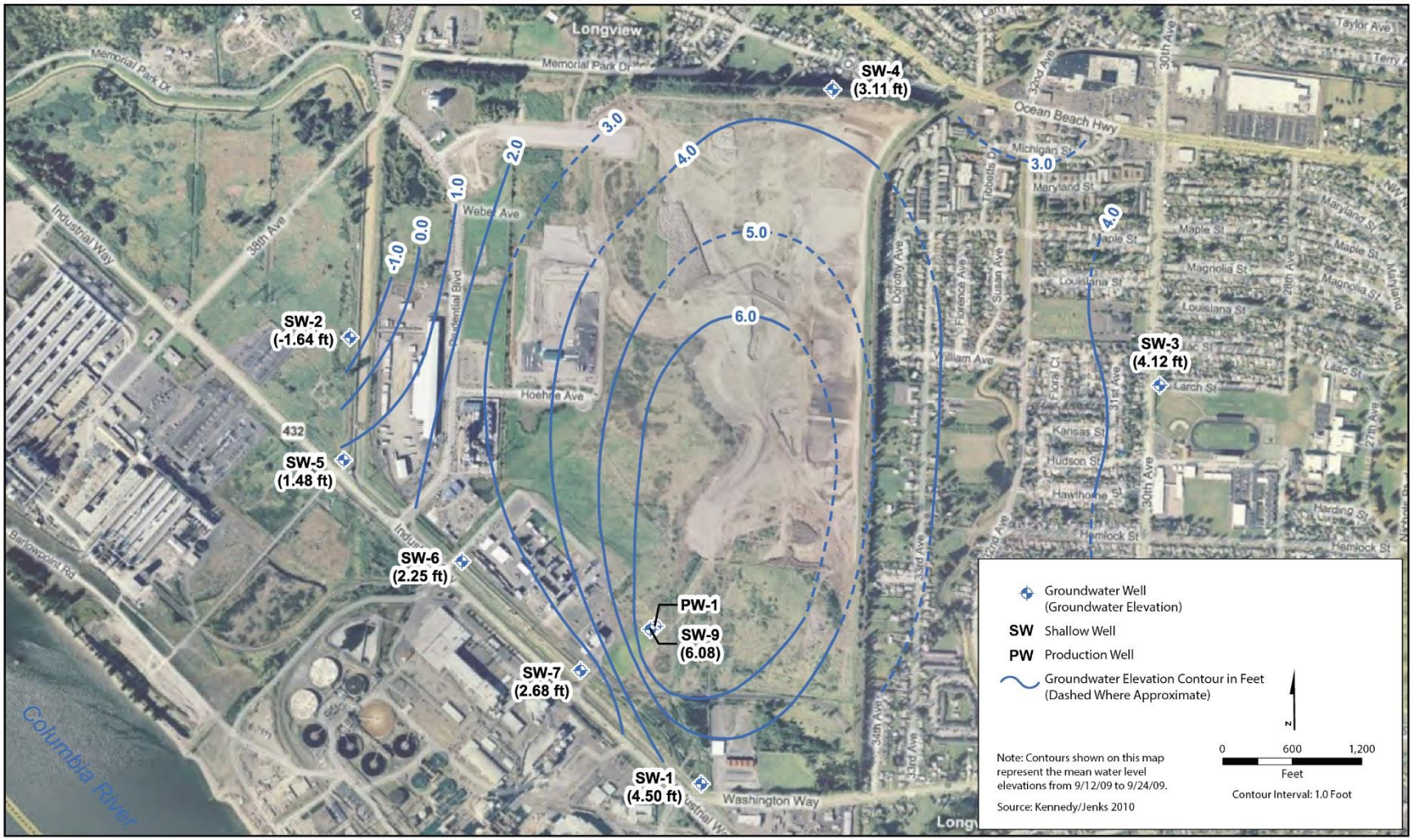


Figure 9. Deep Aquifer Groundwater Gradients and Monitoring Well Locations



Figure 10. Former and Existing Facilities in the Applicant's Leased Area



Cryolite Recovery Plant

The cryolite recovery plant was constructed in 1953 in the South Plant area (Figure 10). The plant was used as a spent potliner (SPL) recovery and recycling facility for the Reynolds facility and other northwest aluminum reduction plants. SPL is a byproduct of the aluminum manufacturing process. It contains fluoride and PAH compounds and, potentially, varying levels of cyanide. The cryolite recovery plant also recovered reusable fluoride compounds, called underflow solids that were eventually used to control air emissions that occurred during the aluminum manufacturing process. The underflow solids were collected in clarifiers (a type of tank) at two unspecified locations in the Applicant's leased area (Anchor Environmental 2007).

The cryolite recovery process involved multiple steps, resulting in a "black mud," which was disposed of in several fill deposits in the Applicant's leased area. The process also required lime to produce the sodium hydroxide solution. After the 1970s, the spent lime facility was combined and managed with the residual carbon facility.

With the increase in regulatory requirements associated with SPL stockpiling and handling in the 1980s, Reynolds began to bury and cover the stockpiled SPL and install groundwater monitoring wells to address concerns regarding potential impacts on groundwater in the area (Anchor QEA 2014a).

In May 1990, the cryolite recovery plant ceased operation. The SPL generated during aluminum manufacturing was removed and shipped to permitted treatment, storage, and disposal facilities. The cryolite recovery plant facilities were removed in May 1990; the area where they once sat is now vacant (Anchor Environmental 2007). No deposits of SPL are known to remain in the Applicant's leased area (Anchor QEA 2014a).

Residual carbon was generated during the cryolite recovery process. Residual carbon typically includes calcium carbonate, alumina, carbon, fluoride compounds, sodium, iron, and sulfate (URS Corporation 2014b). Test results revealed that shallow groundwater at the former location of the cryolite recovery plant contained fluoride-containing solid media and fluoride and alkalinity releases because of the cryolite plant's operations (URS Corporation 2014b). Additional investigations, findings, and cleanup of the residual carbon deposits are discussed below (*Remedial Actions* and *Remedial Investigation Findings*).

Industrial Landfills

Three historical landfills are located in the Applicant's leased area, outside the project area boundary

- Floor sweeps landfill (Landfill 1) is located east of the former cryolite recovery plant.
- The old industrial landfill (Landfill 2) is located on the southwest side of the former Reynolds facility.
- The construction debris landfill (Landfill 3) is located between the Columbia River levee and the Columbia River.

Landfill 1 received dry materials gathered from floors in the potlines, including alumina, bath, cryolite, and aluminum fluoride. By the mid-1970s, Landfill 1 was no longer in use and Landfill 2 began operation. Landfill 2 accepted scrap coke, ore, cryolite, aluminum fluoride, bath, brick, concrete, and debris from miscellaneous maintenance activities. Landfill 3 contains concrete debris and other plant wastes, similar to Landfill 2. Use of these landfills ceased in the 1980s prior to

implementation of more restrictive regulations. The landfills are still present in the Applicant's leased area; additional investigations, findings, and cleanup are discussed below (*Remedial Actions* and *Remedial Investigation Findings*). Figure 10 shows the locations of the cryolite recovery plant and the three landfills.

Historical Uses after Closure of the Reynolds Facility

In 2000, Alcoa purchased Reynolds Metals Company, which became a wholly owned subsidiary. As part of this transaction, Reynolds was required to divest of its facility on the Applicant's leased area. It sold the facility to Longview Aluminum in 2001 but retained ownership of the land. Longview Aluminum immediately ceased aluminum production operations, and the facility has not produced aluminum since 2001.

In December 2004, Chinook Ventures Inc. (CVI) purchased the Applicant's leased area assets from a bankruptcy trustee, which took over operations after Longview Aluminum declared bankruptcy in 2003. CVI entered into a long-term ground lease with Reynolds that ran until September 2005 when ownership of the land transferred from Reynolds to Northwest Alloys, both of which are wholly owned subsidiaries of Alcoa.

CVI was sole operator of the facility and associated Northwest Alloys–owned properties between 2004 and 2011. CVI operated a terminal for the import, handling, and export of dry bulk materials, such as alumina, coal, green petroleum coke, cement, fly ash, slag, and other materials. During this time, CVI also decommissioned the majority of the facilities associated with aluminum manufacturing operations and recycled materials from smelters, which were being decommissioned throughout the northwest region. These activities included the removal and disposal or recycling of alumina, electrolyte bath, coal, and carbon products.

On January 11, 2011, CVI sold its Applicant's leased area assets to the Applicant, which has subsequently removed most of the structures constructed by CVI and has continued facility decommissioning, removal, and cleanup activities.

Remedial Action (Cleanup) Process

In January 2015 a remedial investigation/feasibility study (RI/FS) (Anchor QEA 2014a) was prepared per the requirements of the Washington State Model Toxics Control Act (MTCA), which is implemented by Ecology. Under the MTCA, the RI/FS included two parts: completion of the investigation of potential contaminants in the Applicant's leased area and evaluation of the potential options for cleanup. The selection of a final cleanup action occurs in a separate step and will be documented in an MTCA Cleanup Action Plan.[3]

Prior to preparation of the RI/FS, an initial site assessment was performed by Ecology, which reviewed available data and established the agency's priority ranking for the site investigation and cleanup. During this phase, Ecology ranked the former site as a 5, the lowest priority on its five-point scale.

[3] According to Ecology (2014b), a draft MTCA Cleanup Action Plan was completed for the Reynolds Metals Aluminum Smelter in 2015. The comment period on this action ended on March 18, 2016. Ecology is currently working to finalize the MTCA Cleanup Action Plan and Consent Decree for the cleanup of contamination from former aluminum smelting operations at the site.

Since completion of the initial assessment and site ranking, a number of investigations and cleanup actions have been completed in coordination with Ecology. The previously completed cleanup actions prior to preparation of the RI/FS have resolved cleanup issues for a number of areas within the Applicant's leased area. Extensive quantities of materials have been appropriately reused, recycled, or disposed of at permitted facilities. These actions have improved safety of the Applicant's leased area and helped to return the property to productive reuse.

After Ecology reviewed information from the previous investigation, cleanup, and closure activities, it defined focus areas for further evaluation and defined specific data gaps and testing requirements to be addressed in the RI/FS. Figure 11 shows the locations of the resulting testing that was implemented as part of the RI/FS. The RI/FS included multiple phases of investigation activity, the scope of which was developed and approved by Ecology (Anchor QEA 2014a).

Final cleanup decisions are to be specified in an MTCA Cleanup Action Plan. Design and implementation of the cleanup action will be performed after finalization of the plan and court approval of the consent decree. Long-term management to monitor and/or clean up persistent water quality issues will be addressed in the MTCA Cleanup Action Plan.

The RI/FS provides a detailed description of cleanup and remedial actions conducted in the Applicant's leased area (Anchor QEA 2014a). Figure 12 shows the locations of previous cleanup and removal activities and remedial investigation focus areas.

Remedial Investigation Findings

The following sections summarize the RI/FS (Anchor QEA 2014a).

Screening Levels

The groundwater contained in the fill soil and shallow silt/clay/soils of the upper alluvium or shallow aquifer in the Applicant's leased area is not used as a source for drinking water. Furthermore, the fine-grained texture and low hydraulic conductivities of the upper alluvium, in conjunction with the upward groundwater gradients between the lower water supply shallow aquifer and the upper alluvium, severely limit the potential for this shallow groundwater to affect potential sources of drinking water. Regardless, the RI/FS screening levels included consideration of regulatory requirements applicable to groundwater that is used as a drinking water source and include the following.

- **MTCA Method A Groundwater Cleanup Levels**. These levels consider risks associated with ingestion of drinking water.
- **State Drinking Water Maximum Contaminant Levels**. These levels assume drinking water as the highest beneficial use of groundwater and are typically more stringent than the national drinking water standards.
- **Natural Background**: MTCA regulations consider background chemical concentrations as part of data screening and development of cleanup levels for groundwater.

Table 2 shows the RI/FS screening levels for groundwater for the relevant chemicals of concern discussed below. This table lists the relevant chemicals of concern discussed below in *Source Areas and Chemicals of Concern*. For a list of all parameters tested in the Applicant's leased area, refer to the RI/FS (Anchor QEA 2014a).

Figure 11. Remedial Investigation Testing Locations (Geologic, Hydrogeologic, and Geochemical) in the Applicant's Leased Area

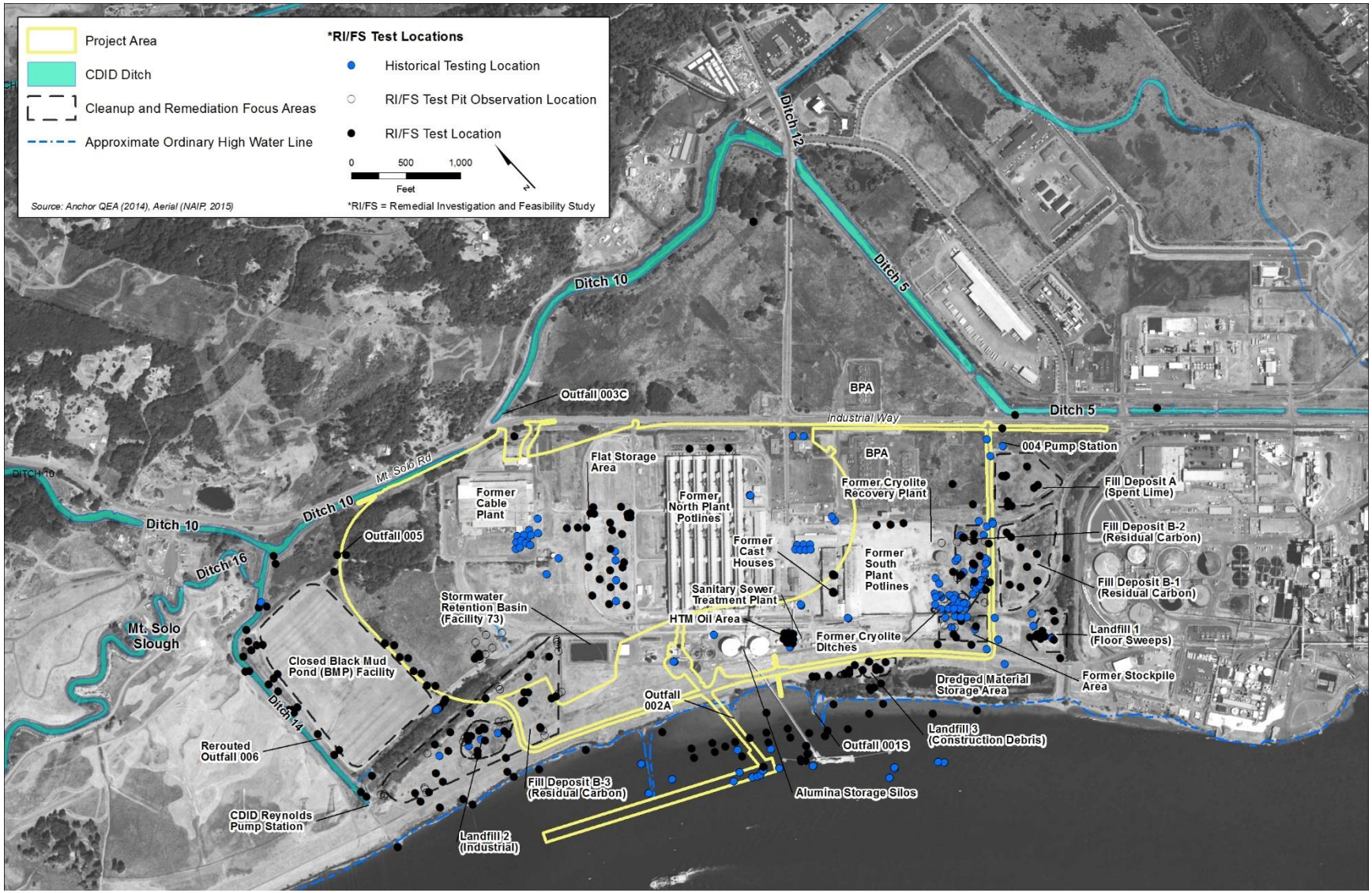


Figure 12. Previous Cleanup, Removal Areas, and Remedial Investigation Areas in the Applicant's Leased Area

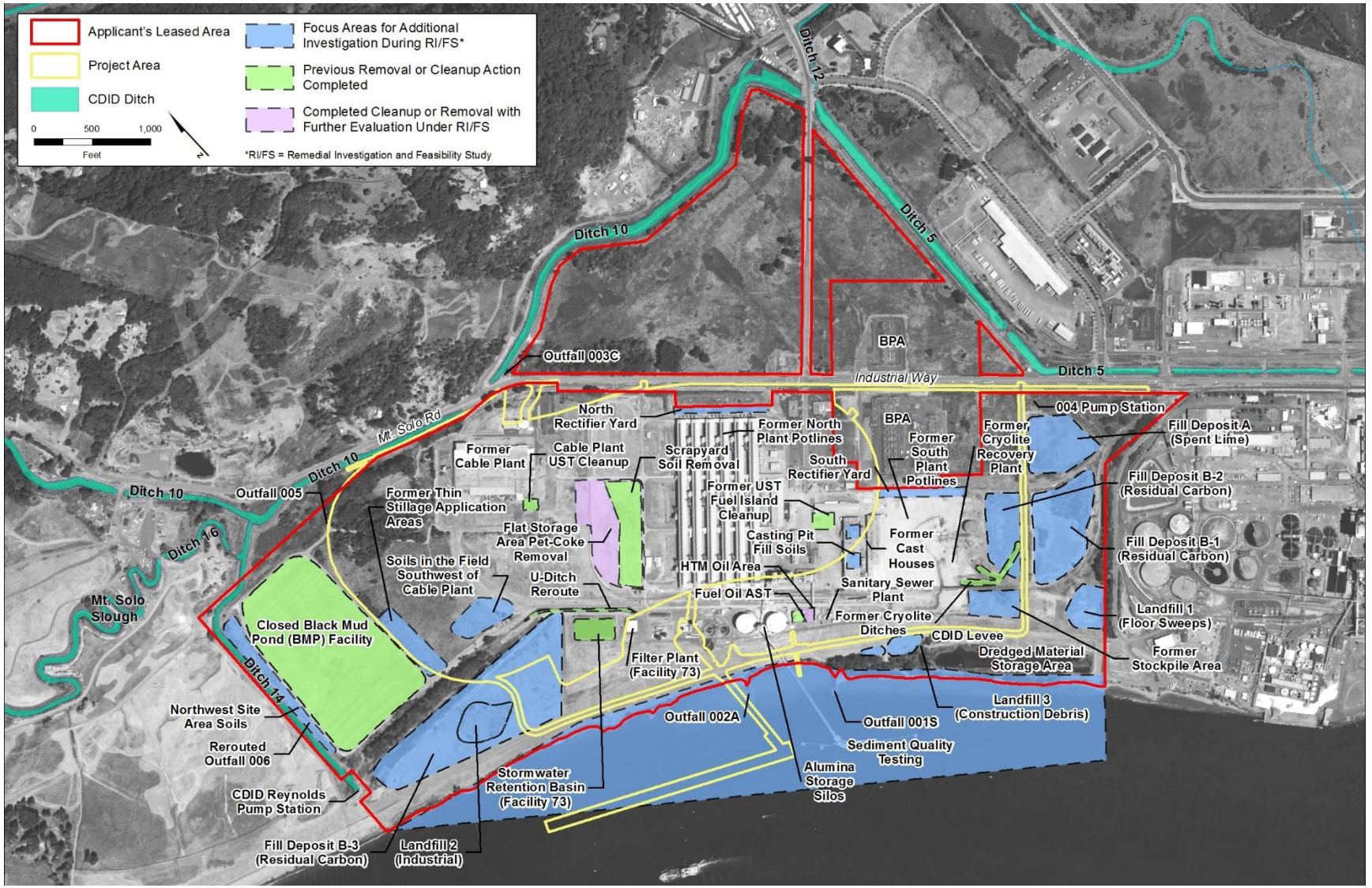


Table 2. Screening Levels for Groundwater

Parameter	Screening Level	Unit[a,b]	ARAR[c,d]
Cyanide	0.2	mg/L	MCL
Fluoride	4.0	mg/L	MCL
Total cPAHs	0.1	µg/L	MTCA Method A
Total PCB Aroclors	0.1	µg/L	MTCA Method A
TPH-Diesel	500	µg/L	MTCA Method A

[a] mg/L = milligrams per liter
[b] µg/L = micrograms per liter
[c] ARAR = Applicable, Relevant, and/or Appropriate Requirement.
[d] MCL = State Drinking Water Maximum Contaminant Level

Source Areas and Chemicals of Concern

Testing of groundwater was conducted over a series of multiple sampling events primarily occurring in September and October 2006, July 2011, October 2011, and October 2012 and primarily outside the boundaries of the project area (Anchor QEA 2014a). Specific testing parameters varied by sampling event and were consistent with Ecology testing requirements defined in the RI/FS Work Plan and Addenda (Anchor QEA 2014a).

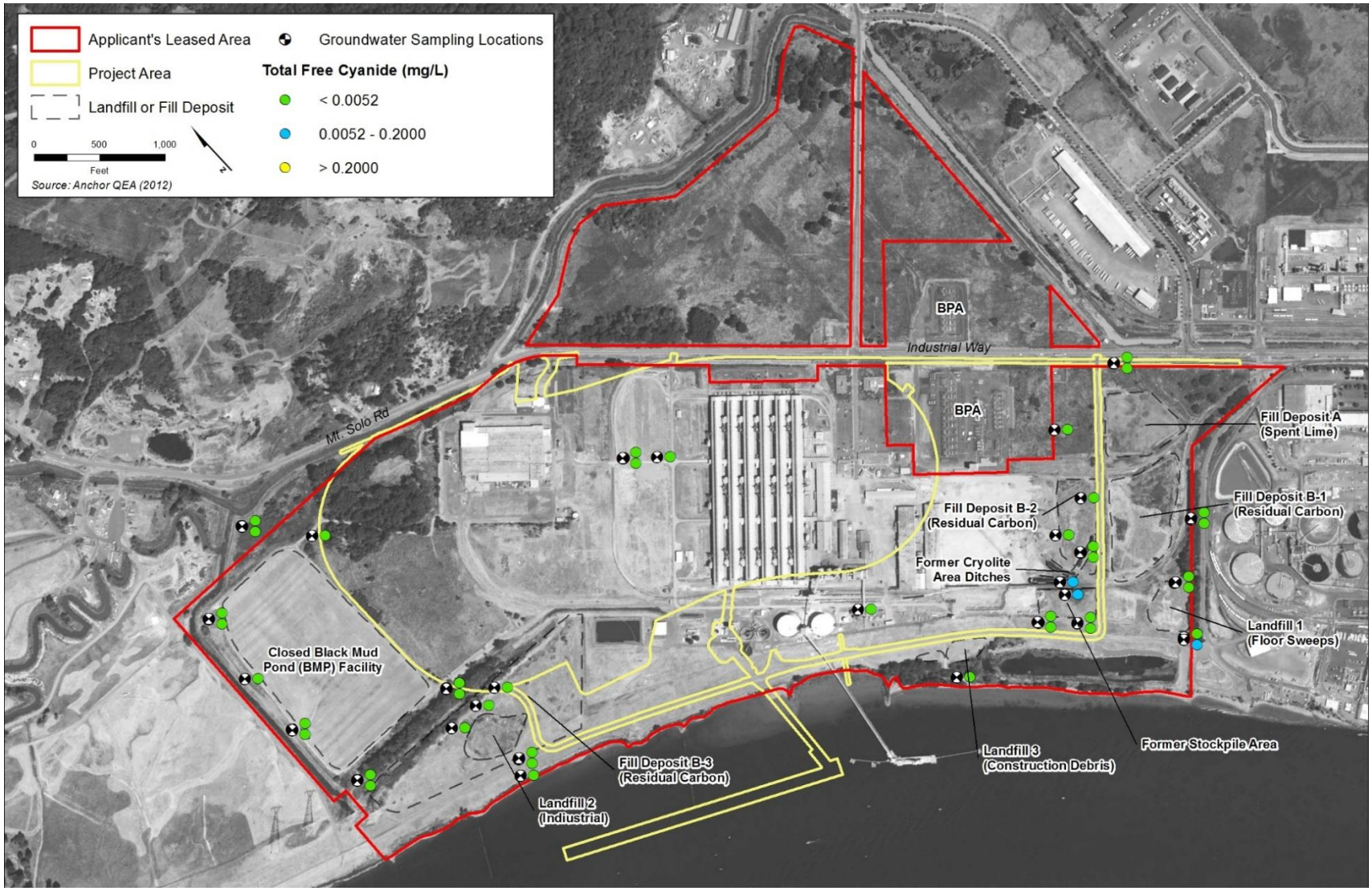
Cyanide

Groundwater cyanide concentrations in the study area are very low and have been decreasing over time. None of the groundwater samples collected in the western portion of the study area near the closed Black Mud Pond facility and Fill Deposit B-3 exceeded the groundwater maximum contaminant level (MCL) for free cyanide. As shown on Figure 13, 2012 free cyanide concentrations in all samples taken in the western portion of the Applicant's leased area were below the groundwater screening level of 0.2 milligrams per liter.

Groundwater cyanide concentrations in samples collected in the eastern portion of the Applicant's leased area have also been decreasing over time. One of the groundwater samples (located near the Former Stockpile Area in the southeast corner of the project area) slightly exceeded the groundwater MCL in 2006, but concentrations decreased significantly by the 2011 and 2012 sampling events. As shown on Figure 13, the 2012 free cyanide[4] concentrations in most of the eastern portion of the Applicant's leased area were below the groundwater screening level.

[4] Free cyanide refers to the sum of hydrogen cyanide (HCN) and cyanide ion (CN-) in a sample. Free cyanide is bioavailable and toxic to organisms in aquatic environments.

Figure 13. 2012 Groundwater Testing Results in the Applicant's Leased Area—Total Free Cyanide



Fluoride

Groundwater fluoride concentrations in most of the Applicant's leased area are below the groundwater screening levels. The exceptions are the shallow groundwater located in or immediately adjacent to the landfills and fill deposits (Anchor QEA 2014a). Data from the most recent sample event in 2012 for fluoride are summarized on Figure 14. Green data symbols represent groundwater fluoride concentrations that are below thresholds established for the drinking water MCL.

In the western portion of the Applicant's leased area, the highest concentrations of fluoride are measured in wells located in Fill Deposit B-3 and adjacent to Landfill 2 (industrial landfill), and in the wells located immediately downgradient of the closed Black Mud Pond facility.

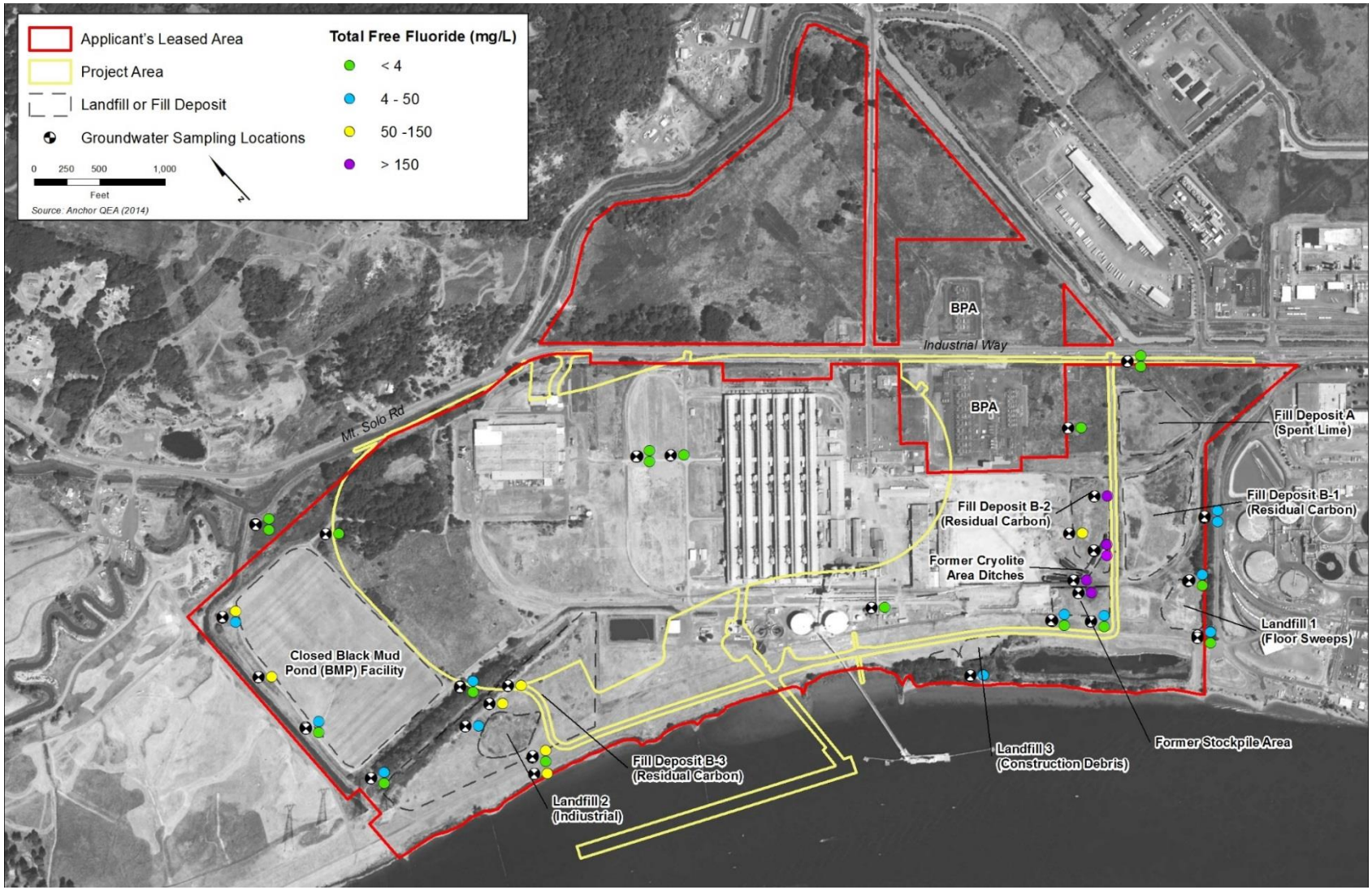
In the eastern portion of the Applicant's leased area outside of the project area boundary, groundwater monitoring data show that fluoride concentrations attenuate rapidly with distance from the fill and landfill deposits (Anchor QEA 2014a), which are summarized as follows.

- **Fill Deposit A (spent lime) and B-1 (residual carbon).** Groundwater fluoride concentrations immediately downgradient of these deposits comply with the groundwater MCL. This is more than 10-fold to 20-fold lower than the fluoride concentrations measured in the fill deposits.
- **Landfill 1 (floor sweeps).** Two well pairs are located immediately adjacent to this landfill (less than 10 feet from the landfill contents). In both well pairs, the deeper groundwater samples comply with the groundwater fluoride concentration MCL, and the fluoride concentration in the shallower groundwater samples slightly exceed the MCL.
- **Fill Deposit B-2 (residual carbon).** The highest groundwater fluoride concentrations in the Applicant's leased area are located in Fill Deposit B-2, located just east of the former cryolite recovery plant. The groundwater wells in this area are located in the fill deposit and immediately adjacent to the former stockpile area and the cryolite area ditches. Groundwater in this area has elevated alkalinity, which enhances fluoride solubility. In contrast, the groundwater fluoride concentrations immediately downgradient of this deposit are consistently below the MCL, showing that fluoride in this area is relatively immobile.

In consideration with other RI/FS monitoring data, the groundwater data for fluoride concentrations demonstrate that the closure of the closed Black Mud Pond facility has been effective, and that the elevated fluoride concentrations present in shallow groundwater adjacent to the other landfill and fill deposits are localized and relatively immobile. The higher concentrations of fluoride present within Fill Deposit B-2 appear to be a function of the fill deposits and the geochemical properties of this area, including the elevated alkalinity of groundwater (Anchor QEA 2014a).

Groundwater fluoride concentrations attenuate rapidly with depth and with distance laterally from these landfills and fill deposits. This has been observed in all parts of the Applicant's leased area, including the areas near Fill Deposit B-2. Surface water monitoring demonstrates that the fluoride present in the shallow groundwater is not affecting water quality in the adjacent CDID Ditches 10, 5, or 14 (Anchor QEA 2014a).

Figure 14. 2012 Groundwater Testing Results in the Applicant's Leased Area—Total Free Fluoride



Carcinogenic Polycyclic Aromatic Hydrocarbons

At the request of Ecology, groundwater samples from selected locations were analyzed for PAHs. Figure 15 shows the maximum concentration of carcinogenic PAHs (cPAH)[5] measured during each of the sampling events (2007, 2011, and 2012). None of the measured cPAH concentrations from the western portion of the Applicant's leased area exceeds groundwater screening levels. In the eastern portion of the Applicant's leased area, and outside the project area boundaries, cPAH concentrations during the 2012 sampling events were below the groundwater screening levels in all locations except for the wells located immediately within or adjacent to fill deposits. These three localized areas (purple circles on Figure 15) include wells located immediately adjacent to Landfill 1 and Fill Deposit B-2. The cPAH concentrations in wells located farther downgradient were less than the groundwater screening level and the surface water screening level.

Polychlorinated Biphenyls

As part of the RI/FS testing program, Ecology required testing for polychlorinated biphenyls (PCBs) in groundwater at wells located immediately downgradient of the landfills and fill deposits. No PCBs were detected in any of the groundwater samples analyzed (Anchor QEA 2014a).

Heavy Metals

Sampling for heavy metals in groundwater was performed during 2011 and 2012 at selected locations identified by Ecology. Test findings indicate that groundwater heavy metals concentrations are below applicable screening levels.

Volatile Organic Compounds

No volatile organic compounds were detected in any of the groundwater samples analyzed.

Total Petroleum Hydrocarbons

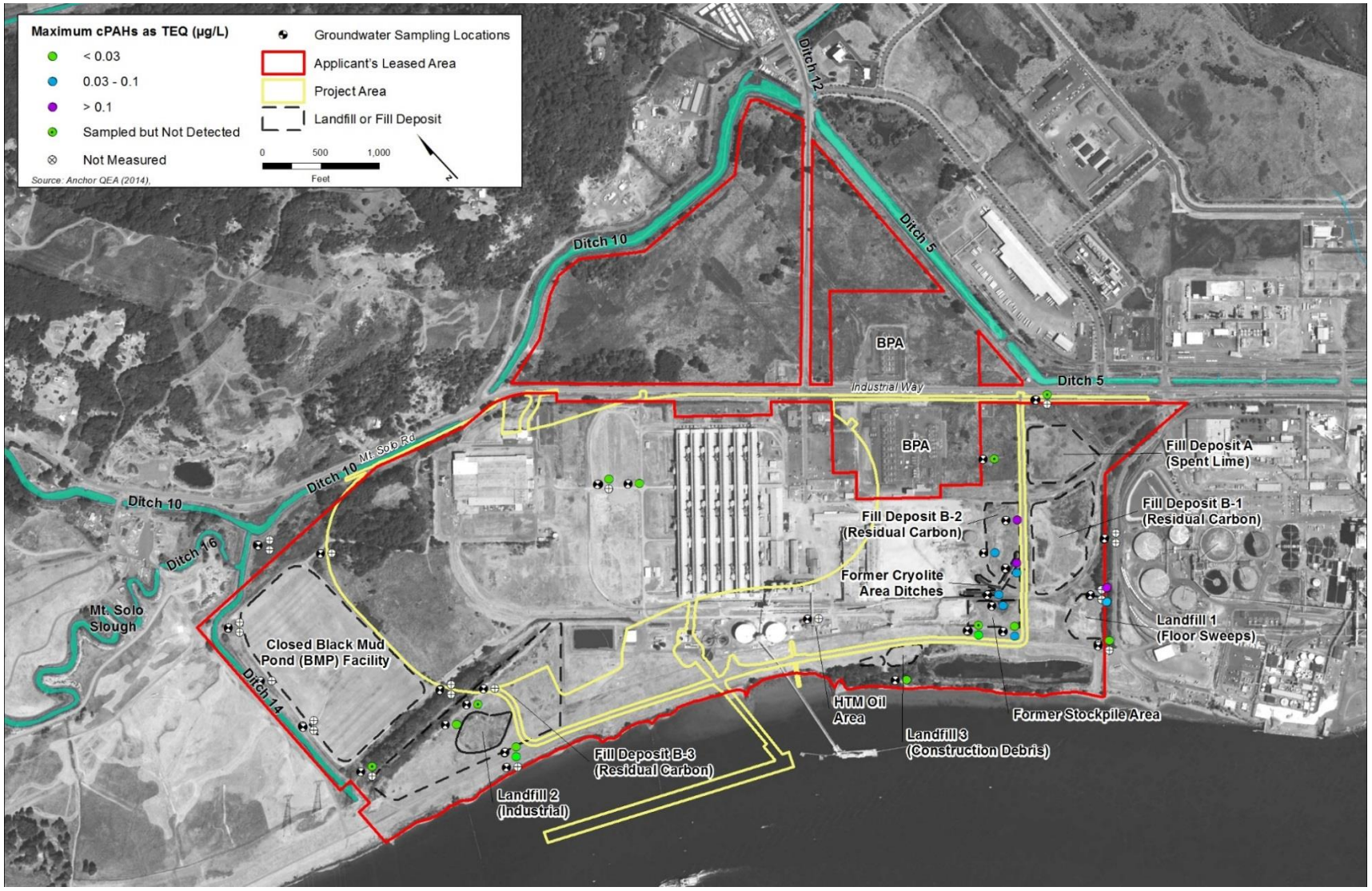
The RI/FS testing program included analysis for total petroleum hydrocarbons (TPHs) in the HTM Oil Area. All samples collected were below groundwater screening levels.

Distribution and Movement of Chemicals of Concern

As discussed above, the fluoride and cyanide levels found in the shallow groundwater within or immediately adjacent to Landfills 1, 2 and 3 have limited mobility and are not affecting downgradient groundwater or surface water quality (Anchor QEA 2014a). Groundwater contamination by fluoride and cyanide could occur during leaching when soils or solid media come into contact with the groundwater. However, the upward hydraulic gradients in the shallow aquifer cause dispersion of fluoride and cyanide and prevent migration into the north-south groundwater flows. This subsequently protects groundwater, surface water, and the Columbia River and limits fluoride and cyanide from traveling to the CDID #1 ditches. Fluoride and cyanide concentrations have been decreasing over time, since the closure of the Reynolds facility. Thus, it is unlikely that fluoride and cyanide in the Applicant's leased area affect the surrounding groundwater (Anchor QEA 2014a).

[5] cPAHs were used in the RI/FS because they have the most stringent screening levels.

Figure 15. 2007–2012 Groundwater Testing Results in the Applicant's Leased Area—Total cPAHs as Toxic Equivalents



Final Cleanup Actions

A MTCA Cleanup Action Plan for the project area and the Applicant's leased area would be protective of human health and the environment, meet state cleanup standards, and comply with other applicable state and federal laws. Cleanup standards would be consistent with the current and anticipated future land use, which will be based on industrial criteria. Ecology's comment period on the draft MTCA Cleanup Action Plan ended March 18, 2016, and issuance of a final plan is pending. Although a final plan has not been determined, this section discusses the site-specific cleanup action requirements applicable to all the cleanup alternatives.

Table 3 shows the proposed cleanup levels, remediation levels, and conditional points of compliance for groundwater to be implemented as part of the MTCA Cleanup Action Plan (Anchor QEA 2014a). Cleanup levels were based on MTCA equations or Applicable or Relevant and Appropriate Requirements to protect groundwater resources for the highest beneficial use (i.e., drinking water) (Anchor QEA 2014a).

Table 3. Groundwater Cleanup Standards

Chemical of Potential Concern	Groundwater Cleanup Level	Protection Basis	Point of Compliance
Fluoride (dissolved)	4 mg/L	State Drinking Water MCL	Conditional point of compliance at property line and groundwater-ditch boundary
Free cyanide (dissolved)	200 µg/L	State Drinking Water MCL	Wells adjacent to where remedial action will occur
cPAHs	0.1 µg/L	MTCA Method A Standard Value	
TPH-D	500 µg/L	MTCA Method A Standard Value	
TPH-O	500 µg/L	MTCA Method A Standard Value	

Source: Anchor QEA 2014a
TPH-D = total petroleum hydrocarbon – diesel
TPH-O = total petroleum hydrocarbon – oil

2.2.4 Water Supply

The following discussion provides a summary of the water supply for the Proposed Action.

2.2.4.1 Regional

Communities in WRIA 25 rely upon a variety of systems to meet their needs for domestic, commercial, industrial, and agricultural water supply. These systems include large municipal systems, small public water systems, individual domestic wells, and wells and diversions owned by self-supplied industrial and agricultural users. In general, water needs throughout WRIA 25 are met by a combination of both surface and groundwater supplies (HDR and EES 2006). Note that the proposed project will not withdraw any water from the Columbia River. All water supply needs will be met through existing on-site groundwater wells and above ground water storage facilities.

2.2.4.2 City of Longview

The Mint Farm Regional Water Treatment Plant began operation in January 2013 and replaced the Longview water treatment plant (which was located on the shore of the Cowlitz River and treated surface water drawn from the Cowlitz River for municipal water use). The Mint Farm plant is located in the Mint Farm Industrial Park, approximately 6,000 feet east of the project area. While the direct impacts study area does not extend to the Mint Farm Regional Water Treatment Plant, the indirect impact study area includes the treatment plant, and both the direct and indirect impact study areas include the treatment plant's Wellhead Protection Area (i.e., the 5-year Wellhead Protection Plan Source Area).The wellhead protection area is based on the extent of the Columbia River recharge of the deep aquifer flows according to the hydrological investigations performed for the Mint Farm Regional Treatment Plant. Groundwater is tapped from wells in the Mint Farm Industrial Park. The water treatment plant consists of four high-capacity (4,000 gpm) groundwater wells (and associated treatment infrastructure) and supplies the City of Longview and the Beacon Hill Water and Sewer District with municipal water.

The treatment plant ultimately may have as many as six groundwater production wells at the Mint Farm Industrial Park, although the current operation includes four well casings and four well pumps, each capable of pumping approximately 4,000 gpm. Groundwater modeling conducted to evaluate the sustainability of long-term pumping from the wellfield, which draws from the deep aquifer, calculated approximately 6 feet of drawdown to meet the City's 50-year maximum daily demand. Test pumping of a production well showed no drawdown impact 60 feet or more away from the well. The source of water to the wellfield was found to be the Columbia River (Kennedy/Jenks 2010). A water rights permit has been issued for the treatment plant, which has an instantaneous maximum withdrawal rate of 28,250 gpm and a maximum annual withdrawal rate of 13,500 acre-feet per year (AFY) (Permit No. G2-30521, priority date June 8, 2009).

Under a Water Service Agreement, the three water purveyors in the Longview/Kelso urban area (City of Longview, Cowlitz County Public Utility District No. 1, and the City of Kelso) have a long-term arrangement whereby the three agencies can share each other's facilities when necessary. This agreement provides backup resources in case of emergency, natural disaster, and for scheduled maintenance outages (City of Longview 2006).

2.2.4.3 Project Area

The project area landowner, Northwest Alloys, currently holds several water rights to extract groundwater from the deep aquifer (Kennedy/Jenks 2012b). Water use in Washington State is subject to the "first in time, first in right" clause, historically established by western water law and adopted into Washington State law (Revised Code of Washington [RCW] 90.44.050). A senior right cannot be impaired by a junior right. Seniority is established by the date an application was filed for a permitted or certificated water right (priority date) or the date that water was first put to beneficial use in the case of claims and exempt groundwater withdrawals. The Columbia River basin is not closed to new water rights, surface or hydraulically connected groundwater, in this reach. When the Reynolds facility was initially developed in 1941, Reynolds was responsible for developing nine water supply wells. In 1945, the state groundwater code was enacted, which required a water right permit or certificate, unless the user was exempt from state permitting requirements. Three of the water rights claims were acquired in 1941, prior to the 1945 requirements; therefore, these claims are not accompanied with a certificate. Details of the water rights claims and certificates, along with the instantaneous and annual withdrawal amounts are

provided in Table 4. The Applicant has a ground lease with Northwest Alloys that includes use of water rights. When issued, the total instantaneous withdrawal volume allowance under these water rights was 23,150 gpm and the total annual withdrawal allowance was 31,367 AFY (Table 4). It is estimated the Applicant has an existing demand of 1.53 million gallons per day or approximately 1,063 gpm (Chaney pers. comm.). This is well within the volume of the water rights that were issued in 1941, 1966, and 1967.[6] However, water rights relinquish back to Washington State if water rights are not used for 5 consecutive years without good cause (RCW 19.14.160). If the historical water rights have been relinquished, new water rights would need to be applied for by the Applicant or Northwest Alloys under the normal regulatory process.

Table 4. Northwest Alloys' Water Rights Claims and Certificates

		Withdrawal		
Record Number	**Certificate Number**	**Instantaneous (gallons per minute)**	**Annual (acre-feet/year)**	**Priority Date**
Claims				
G2-006572CL	-	2,500	2,340	1941
G2-006573CL	-	2,500	2,340	1941
G2-006574CL	-	2,500	1,614	1941
Certificates				
G2-*02244CWRIS	01571	2,500	4,033	1966
G2-*08309CWRIS	06184	2,500	4,000	1966
G2-*08310CWRIS	06185	2,500	4,000	1966
G2-*08367CWRIS	06186	3,000	4,800	1966
G2-*08368CWRIS	06187	3,000	4,800	1966
G2-*09127CWRIS	06427	2,150	3,440	1967
	Total	**23,150**	**31,367**	

Source: URS Corporation 2014d.

2.2.4.4 Private Wells

Local industries, small farms, and domestic well users withdraw groundwater from private wells near the project area. These include the Weyerhaeuser Timber Company and many small farms and exempt domestic well users. The groundwater permit exemption allows certain users of small quantities of groundwater (most commonly, single residential well owners) to construct wells and develop their water supplies without obtaining a water right permit from Ecology (RCW 90.44.050). Any user whose water use that exceeds the exemption limits must apply for and obtain a water right permit before water use is allowed.

A review of Ecology's online Water Rights Tracking System indicated 31 water rights applications were pending in WRIA 25. However, none of these applications was located in the Sections and Townships bordering the project area (Washington State Department of Ecology 2015).

[6] The Applicant is responsible for maintaining water rights. The technical report did not verify whether water rights are current.

2.2.4.5 Wellhead Protection Areas and Sanitary Control Areas

The Safe Drinking Water Act requires every state to develop a wellhead protection program. The Washington State Department of Health administers the wellhead protection program in Washington State.

Most public water supply wells are located in or near communities. Washington's wellhead protection requirements are designed to prevent contamination of groundwater used for drinking water. A wellhead protection area is the surface and subsurface area around a well or wellfield that a community or water system manages to protect groundwater-based drinking water supplies from contamination.

In Washington, wellhead protection areas are based on horizontal time-of-travel rates for groundwater. Depending on the rate of travel, the wellhead protection area is broken into management zones that correspond to an established time-of-travel rate for water within the aquifer. Each of the management zones represents an interval between the time a particle of water is introduced at the zone boundary and its eventual arrival at the well. These zones create an early warning system that gives a public water system time to respond to a contaminant moving within an aquifer before it arrives at the water supply well. A typical wellhead protection area has four or five management zones (Washington State Department of Health 2010).

- Sanitary control area
- Primary zones, based on 1-, 5-, and 10-year time-of-travel rates
- Buffer zone (if necessary)

The management zones are described in more detail below (Washington State Department of Health 2010).

Sanitary Control Area

The sanitary control area is the area immediately around the wellhead. This area should be tightly controlled to minimize any direct contamination at the wellhead. The purpose of this area is to reduce the possibility of surface flows reaching the wellhead and traveling down the well casing. All public water systems are encouraged to enclose wells in a well house and secure them in a fenced area to help protect individual wells from direct introduction of contaminants.

Zone 1

Zone 1 is based on the 1-year horizontal time-of-travel for groundwater. The purpose of Zone 1 is to protect the drinking water supply from viral, microbial, and direct chemical contamination. Literature suggests that bacteria and viruses survive less than 1 year in groundwater Because of Zone 1's proximity to the sanitary control area, it includes an additional 6-month time-of-travel boundary.

Zone 2

Zone 2 is based on the 5-year time-of-travel for groundwater. The purpose of Zone 2 is to control potential impacts on groundwater from chemical contaminants. The primary difference between potential contaminant sources in Zones 1 and 2 is the time available to respond to a release. A release in Zone 2 presents a less acute crisis than a release in Zone 1. All potential contaminant

sources within Zone 2 must be identified and managed in a manner that facilitates pollution prevention and risk reduction. Zone 2 also provides information that local planners use to site future high-risk and medium-risk potential contamination sources.

Zone 3

Zone 3 is based on the 10-year time-of-travel for groundwater. Zone 3 is the outer boundary of the wellhead protection area if a Buffer Zone is not present. In Zone 3, potential high- and medium-risk contaminant sources receive increased regulatory oversight and technical assistance, with emphasis on pollution prevention and risk reduction. This allows the community to plan and site future high-risk and medium-risk contamination sources outside the wellhead protection area. It is also used to educate the industry, public, and others regarding drinking water and potential sources of contamination.

Buffer Zone

The buffer zone, if present, is an area of added protection, which helps compensate for error when calculating the time-of-travel boundaries for Zones 1 through 3.The primary goal of the Buffer Zone is to provide information to planners on activities or facilities outside Zone 3 that could release contaminants into the wellhead protection area.

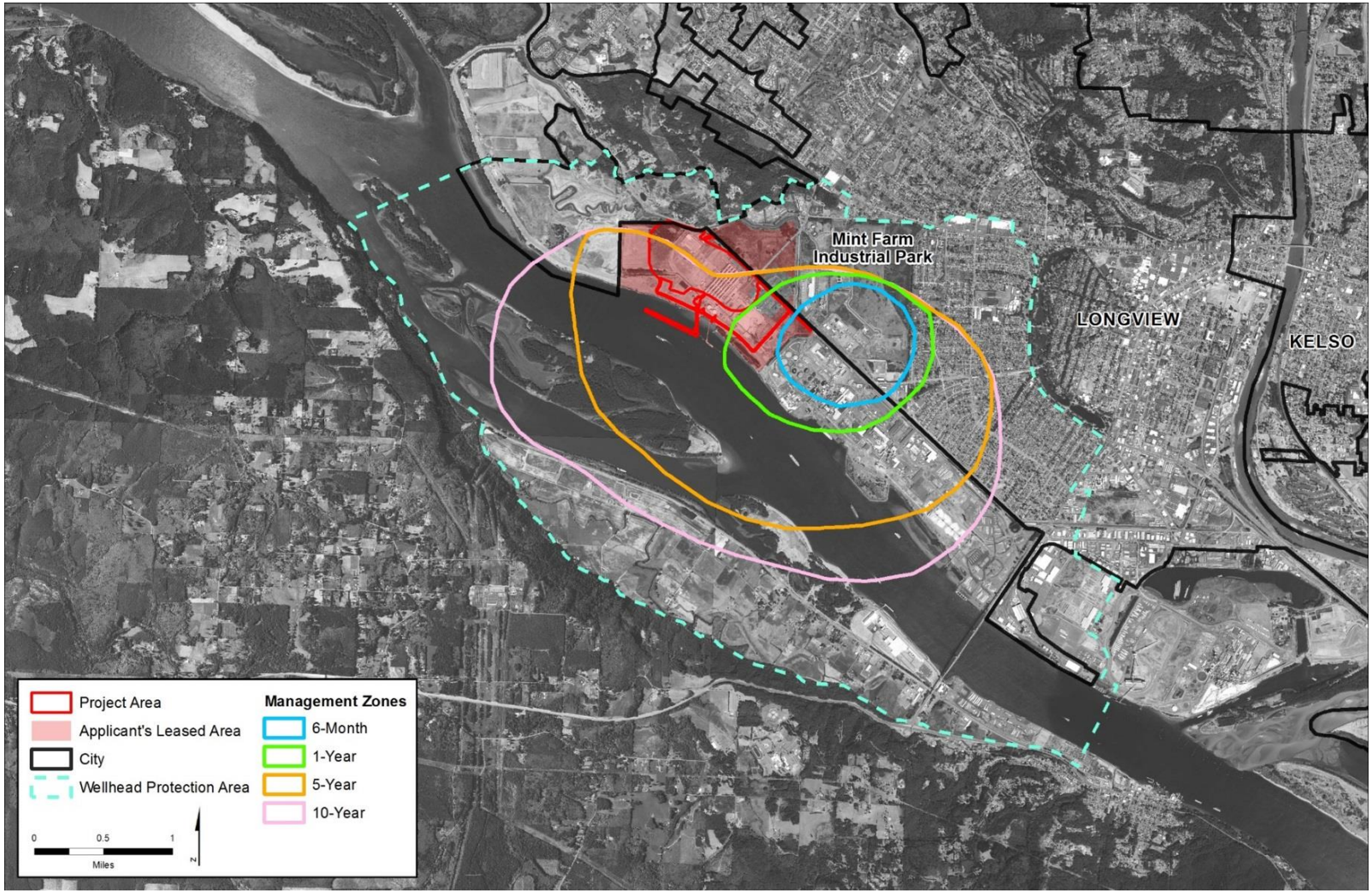
The Washington State Department of Health administers the Wellhead Protection Program, while other state agencies, such as Ecology and the Department of Agriculture, integrate wellhead protection into their programs. Local agencies, such as planning and health departments, play a major role by helping water systems protect their community's drinking water supply and coordinating wellhead protection measures.

2.2.4.6 City of Longview Wellhead Protection Areas

As discussed above, two distinct groundwater systems are present at the city's wellfield: a shallow aquifer and a deep aquifer. A confining unit consisting of clay and silt ranging in thickness from approximately 100 to 200 feet separates the two systems below the project area. The confining unit becomes appreciably thinner beyond the project area, to the north and east near residential areas. Groundwater modeling indicates the source for the deep aquifer is the Columbia River, with a travel time to the wellfield of between 2 and 35 years (Kennedy/Jenks Consultants 2012b). The Columbia River is within approximately 300 feet of the project area's southern boundary.

In 2012, the City of Longview approved its Wellhead Protection Program and established the wellhead protection area, which encompasses and extends beyond the management zones (Figure 15). As shown in Figure 16, the southeast portion of the project area is within Zone 1 (1-year); most of the project area is within Zones 2 and 3 (5- and 10-year, respectively).

Figure 16. City of Longview Wellhead Protection Area



Chapter 3
Impacts

This chapter describes the impacts on groundwater that could result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

The Applicant identified the following design features and best management practices to be implemented as part of the project, and to be considered when evaluating potential impacts of the Proposed Action.

- The pads and berms would be made of low-permeability engineered material. The use of low-permeability engineered materials for formation of the pads and berms would control water from entering subsurface soil or groundwater.
- All wastewater and stormwater generated on site and potentially discharged from the site would be evaluated and characterized, and then the specific language and type of NPDES permit would be determined and issued to ensure that water quality standards are met.

3.1 Proposed Action

Potential impacts on groundwater from the Proposed Action are described below. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area are defined and the type of NPDES permit would be determined and issued.

The following construction activities could affect groundwater.

- Disturbance of surface soils during construction.
- Release of hazardous and non-hazardous materials during construction.
- Disturbance of previously contaminated sites.
- Use of groundwater for dust control.

The following operations activities could affect groundwater.

- Alteration of surface runoff patterns.
- Use of groundwater for dust control, equipment washdown, and cleanup.
- The water would then be pumped to a surface storage pond. The surface storage pond would have an approximate capacity of 3.6 million gallons and would be used to store the water for reuse. The capacity of the pond would include a reserve of 0.36 million gallons for fire suppression.

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

Affect Groundwater Recharge during Construction

Construction of the Proposed Action would involve preloading and installation of vertical wick drains that would direct groundwater from the shallow aquifer upward toward the surface during pre-loading, where it would discharge. Ground-disturbing activities (excavations, grading, filling, trenching, backfilling, and compaction) could temporarily disrupt the existing drainage and groundwater recharge patterns in the study area. However, as described above, the major sources of groundwater recharge in the project area are the Columbia River, the regional CDID #1 ditch system, and the NPDES ditch system. The study area is not considered a major source of groundwater recharge of the deep aquifer through infiltration as the majority of stormwater runoff is managed by the existing NPDES stormwater collection and treatment system with nominal infiltration and evaporation. Therefore, construction of the Proposed Action would not be expected to have a measurable impact on groundwater recharge patterns of the deep aquifer.

The shallow aquifer in the project area is only minimally recharged by stormwater through surface infiltration due to the low recharge rates of soils in the study area (URS Corporation 2014c). During construction, impervious surfaces would be sloped to convey stormwater to collection sumps. The collected stormwater would then be conveyed to water collection facilities and discharged through a monitored internal outfall to existing facilities in the project area for treatment prior to discharge to the Columbia River (Outfall 002A). Therefore, drainage and groundwater recharge patterns are expected to be similar to those of the existing conditions, with runoff directed to collection and treatment facilities and minimal infiltration to groundwater. Construction of the Proposed Action would be expected to reduce groundwater in the shallow aquifer slightly but would have no measurable impact on groundwater recharge patterns. For more information on the project construction NPDES permit, see the SEPA Water Quality Technical Report (ICF 2017b).

Degrade Groundwater Quality during Construction

Any construction-related contaminant released on the ground could infiltrate and temporarily degrade groundwater quality if the contaminant were to reach groundwater. This would be a concern primarily for the shallow aquifer and not the deep aquifer because there is a confining, impervious soil unit consisting of clay and silt that separates the two aquifer systems, and the deep aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014a) rather than surface infiltration. Poured concrete, cement, mortars, and other cement- or lime-containing construction material could alter the pH of stormwater, which could infiltrate into the ground and affect the shallow aquifer water quality. Petrochemicals could also be released through leaks and accidental spills, which could infiltrate into the ground and potentially reach groundwater. However, the likelihood of a large contaminant spill would be low with implementation of the best management practices that will be required as part of the NPDES Construction Stormwater Permit. In addition, cleanup efforts would begin immediately after a contaminant release, to prevent large amounts of contaminant from reaching groundwater and impairing water quality. Further, the majority of stormwater generated during construction would be collected and treated in compliance with the project construction NPDES permit prior to discharge. For more information on the project construction NPDES permit, see the SEPA Water Quality Technical Report (ICF 2017b). The existing water treatment plant (Facility 73) is anticipated to be adequate to handle the water generated during construction, including removing contaminants and sediment loads from stormwater prior to discharge. By

using prevention measures and best management practices, construction is not expected to degrade groundwater because of a contaminant release and no long-term impacts are anticipated. In addition, construction of the coal export terminal would adhere to the best management practices proposed by the Applicant as to avoid and minimize potential impacts on surface and groundwater resources. Best management practices would include, but not be limited to, the following actions.

- BMP C153: Material delivery, storage, and containment would be used to prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage, including the following.
  - Storage of on-site hazardous materials would be minimized to the extent feasible.
  - Materials would be stored in a designated area, and secondary containment would be installed where needed.
  - Refueling would occur in designated areas with appropriate spill control measures.
- BMP C154: A concrete washout area would be constructed near the entrance to the project area to prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, or performing on-site washout in a designated area to prevent pollutants from entering surface waters or ground water.

Site preparation activities would involve preloading and installation of vertical wick drains to aid in the consolidation of low consistency silt and low-density sand. Wick drains would direct groundwater from the shallow aquifer upward toward the surface during pre-loading, where it would discharge. Water discharged from the wick drains would be captured, tested for contaminants, and properly managed. If allowable it would be treated prior to discharge to any surface waters. These activities could take place adjacent to areas where known groundwater contamination exists and the contaminated groundwater could penetrate these areas. However, the permeability of the earth materials affected by preloading would be relatively low and thus would not be particularly susceptible to the infiltration of contaminated groundwater. By adhering to best management practices, construction is not expected to result in groundwater degradation because of preloading and vertical wick drains, and no long-term impacts are anticipated.

In addition, as described in the SEPA Hazardous Materials Technical Report (ICF 2017a), construction of the Proposed Action could encounter previously contaminated areas currently identified in the MTCA Cleanup Action Plan, which could degrade groundwater quality. However, with the exception of two small areas—the eastern corner of the Flat Storage Area and the northeastern portion of Fill Deposit B-3 (Figure 11)—cleanup actions are mandated as part of the MTCA Cleanup Action Plan within the project area. For the Flat Storage Area and Fill Deposit B-3, construction and remediation activities would be coordinated to prevent spread of contamination or environmental impacts. Also, as mentioned in Section 2.2.3.5, *Project Area*, fluoride and cyanide levels found in shallow groundwater have limited mobility and are not affecting downgradient groundwater or surface water quality. Furthermore, the MTCA Cleanup Action Plan would include minimum thresholds for cleanup, which would be protective of the environment, comply with applicable state and federal laws, and provide for future compliance monitoring. Therefore, construction of the Proposed Action would not result in groundwater degradation because of disturbing previously contaminated areas.

Construction of the Proposed Action is not expected to affect the wellfield at the Mint Farm Industrial Park, which is located upgradient and approximately 1.14 miles (6,000 feet) away from the project area. However, the project area is located within Zone 2 of the Mint Farm Industrial Park's wellhead protection and sanitary control areas (Figure 16). The wellfield draws water from the deep aquifer, which is protected by a confining, impervious soil unit consisting of clay and silt that separates the two aquifer systems, and the deep aquifer is primarily recharged by deeper aquifers below the Columbia River. So it would be unlikely that contaminants from a spill would reach the groundwater withdrawn by the wellfield.

Affect Groundwater Supply during Construction

Construction of the Proposed Action would require groundwater from on-site wells for dust suppression. The maximum amount of water that would be used for dust suppression is estimated to be 40,000 gallons per day (44.8 AFY). Combined with demand from existing activities in the project area of 1,994 AFY, the total demand for groundwater during construction would be approximately 2,039 AFY. As stated previously, Northwest Alloys holds water rights that originally authorized extraction from on-site wells of approximately 23,150 gpm or 31,367 AFY. Verification of the amount of Northwest Alloys' water rights will occur outside of the environmental review process. Water demand for construction-related activities and existing operations would together represent approximately 6.5% of the original Northwest Alloy's groundwater extraction rights, which would be an increase of approximately 2% over current groundwater extraction.

A production well from the new Mint Farm Regional Water Treatment Plant was tested by the City of Longview to characterize the deeper confined aquifer. The subsurface conditions within the Mint Farm site are similar to those expected at the Applicant's 540-acre leased area. The production well was drilled to a depth of 385 feet below ground surface and is located approximately 6,000 feet southeast of the Applicant's leased area. The constant rate pumping tests results from this well calculated that the transmissivity values of the aquifer ranged from 3.3 million to 4.5 million gallons per day, per foot, while the hydraulic conductivity values from recovery water level data ranged from 20,000 to 28,000 gallons per day, per foot (2,600 to 3,600 feet per day). The study observed a recharge influent of the Columbia River on the deep aquifer at the production well; this became apparent after approximately 1.5 days of pumping, when drawdown curves became virtually flat (Kennedy/Jenks 2010 in URS 2014). The Mint Farm Regional Water Treatment Plant has water rights for an instantaneous maximum withdrawal rate of 28,250 gallons per minute and a maximum annual withdrawal rate of 13,500 AFY (Permit No. G2-30521, priority date June 8, 2009) (URS 2014). In 2011, the projected average daily demand was 6.7 million gallons per day with a maximum daily demand of 14.06 million gallons per day.

Construction and existing water demand would represent approximately 6.5% of the Applicant's groundwater extraction rights. Construction of the Proposed Action is expected to have negligible impacts on groundwater supply, based on the Mint Farm constant rate pumping test results and when compared to existing groundwater use.

Excavation activities could intersect groundwater in low-lying areas, which could result in temporary fluctuations in shallow groundwater in the immediate area. Dewatering effluent would be pumped to temporary containment tanks for settling, where it would be tested for pollutants before being discharged to receiving waters. If pollutants are encountered during

testing, dewatering would be suspended and Ecology would be notified. Contaminated water would be treated before being discharged to receiving waters.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on groundwater because construction would be limited to the project area and would not occur later in time or be farther removed than the direct impacts.

3.1.3 Operations: Direct Impacts

Operation of the Proposed Action would result in the following direct impacts.

Affect Groundwater Recharge during Operations

Operation of the facility could permanently reduce infiltration due to soil compaction and new impermeable surfaces, such as coal stockpile pads, roads, or buildings.[7] The project area would occupy some of the existing drainage basins in the project area (Figure 6), effectively eliminating a portion of the runoff presently handled under the Applicant's existing NPDES Industrial Stormwater Permit. The Applicant would be required to obtain a separate NPDES Industrial Stormwater Permit for a separate system of stormwater collection and discharge. However, the project area is not an important source of groundwater recharge due to relatively impermeable soils (URS Corporation 2014c). In addition, runoff is currently collected in a ditch system and operating the proposed terminal would not substantively change these conditions; the primary source of shallow groundwater recharge in the project area would continue to be the Columbia River, and the direction and volume of groundwater recharge from the Columbia River is expected to be relatively constant. Under the Proposed Action, the Applicant would be required to obtain a separate NPDES permit and would develop a separate system of stormwater collection and discharge regulated by this permit. Excess water from the project area would be collected and treated on the project area, then routed to a new internal outfall that would be monitored under the new NPDES permit. The outfall would tie into the existing Facility 77 sump, and all waters from the project area would go through Facility 73 for water quality treatment. The existing discharge line from Facility 73 would continue to discharge to the Columbia River through the existing Outfall 002A. Therefore, operation of the Proposed Action is not expected to change substantially the groundwater recharge patterns associated with surface waters on the site. Overall, operation of the terminal under the Proposed Action is not expected to change substantially the shallow groundwater recharge volumes or patterns in the project area.

Operations would not be expected to affect groundwater recharge for the deep aquifer because the deep aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014a).

[7] The project area covers 190 acres, which is currently mostly developed with impervious surfaces. During operations, all of the project area is considered impervious for water management.

Degrade Groundwater Quality during Operations

Contaminants and coal dust generated during operations could degrade groundwater quality if contaminated runoff were to infiltrate into the ground and reach groundwater. However, as described under *Affect Groundwater Recharge during Operations*, the project area is not considered a significant source of groundwater recharge through infiltration because of the low recharge rates of the soil characteristics in the study area (URS Corporation 2014c), limiting contaminant movement into the ground. In addition, runoff from the study area, and contaminants in that runoff, would be directed to on-site drainage systems, treated, and possibly reused on site, or discharged in accordance with an NPDES Industrial Stormwater Permit for the export terminal. The water reused on site would be brought to Washington State Class A Reclaimed Water standards (URS Corporation 2014c). Excess water not reused on site would be further treated and tested prior to being routed to outfalls regulated by an NPDES permit and finally discharged to the Columbia River. Discharge of water to the Columbia River during project operations would mostly occur during the rainy season (fall through spring) when excess surface water is more likely to be generated on site.

As discussed in the SEPA Water Quality Technical Report (ICF 2017b), the following best management practices would be part of the Proposed Action design to maximize the protection of surface-water quality (and thus groundwater via infiltration).

- Enclosed conveyor galleries.
- Enclosed rotary unloader building and transfer towers.
- Washdown collection sumps for settlement of sediment.
- Regular cleanout and maintenance of washdown collection sumps.
- Containment around refueling, fuel storage, chemicals, and hazardous materials.
- Oil/water separators on drainage systems and vehicle washdown pad.
- Requirement that all employees and contractors receive training, appropriate to their work activities, in the best management practices.
- Design of docks to contain spillage, with rainfall runoff and washdown water contained and pumped to the upland water treatment facilities.
- Design of systems to collect and treat all runoff and washdown water for on-site reuse (dust suppression, washdown water or fire system needs) or discharge off site.

Because collected waters would be treated before reuse or discharge to the Columbia River and would be unlikely to infiltrate, groundwater quality is not expected to be affected by operation of the Proposed Action.

The potential for coal dust to affect groundwater would be relatively low because of the low permeability of the soil in the study area, the propensity for soil to filter out coal dust suspended in water, and treatment of on-site stormwater runoff. Coal dust would not likely meet groundwater.

The potential for toxic constituents of coal to reach groundwater is also relatively low. Toxic constituents of coal include cPAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, mineral impurities in the coals and environmental conditions, determine whether these compounds can be leached

from the coal. The potential risk for exposure to toxic chemicals contained in coal would be relatively low because these chemicals tend to be bound in the matrix structure and are not quickly or easily leached. See the SEPA Water Quality Technical Report (ICF 2017b) and the SEPA Coal Technical Report (ICF 2017c) for more information, including characteristics of Powder River and Uinta Basin coal.

In summary, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs, trace metals) would be relatively low, because these chemicals tend to be bound in the matrix structure and not quickly or easily leached. Further, particles would likely be transported downstream by the flow of the river and either carried out to sea or distributed over a sufficiently broad area as not to be problematic. See the SEPA Water Quality Technical Report (ICF 2017b) and the SEPA Coal Technical Report (ICF 2017c) for more information. In addition, operation of the Proposed Action is not expected to encounter or disturb previously contaminated areas addressed by the MTCA Cleanup Action Plan. Operation of the Proposed Action would occur concurrently with environmental remediation and monitoring as required in the final MTCA Cleanup Action Plan for the former Reynolds facility, as described in the SEPA Hazardous Materials Technical Report (ICF 2017a). If contaminated areas are encountered, remediation activities would be carried out in accordance with relevant regulations and coordinated to avoid exposure to the environment. Furthermore, the impact of the cleanup activities would result in bringing previously contaminated groundwater to levels that are protective of human health and the environment, thereby reducing the potential for exposure for sensitive receptors.

Affect Groundwater Supply during Operations

Process water uses would include dust control, equipment washdown, and cleanup. Water for dust suppression would be applied on the main stockpiles, within unloading and conveying systems, and at the docks. Excess water from dust suppression and washdown would be collected for reuse. Process water supply would come from two sources: the on-site water management system during the wet season and on-site groundwater wells during the dry season.

The on-site water management system would provide process water in the following ways.

- Stormwater and surface water (washdown water) would be collected from the stockpile areas, rail loop, office areas, docks, and other paved surfaces in the project area and directed to a series of vegetated ditches and ponds, then to a collection basin or sump.
- The collected water would be pumped to an on-site treatment facility consisting of retention pond(s) with flocculent added to promote settling as required.
- The water would then be pumped to a surface storage pond. The surface storage pond would have an approximate capacity of 3.6 million gallons and would be used to store the water for reuse. The capacity of the pond would include a reserve of 0.36 MG for fire suppression.

Approximately 1,200 gpm of water during the wet season and 2,000 gpm during the dry season (approximately 2,034 AFY) would normally be required for dust suppression. On-site groundwater wells would provide approximately 635 gpm (1,025 AFY) to maintain minimum water levels in the storage pond to meet process water demands during the dry season. Water from the storage pond could also be used for the fire hydrant, sprinklers, and deluge systems,

watering of landscaping, and other nonrecyclable uses. Northwest Alloys holds water rights that originally authorized extraction of 23,150 gpm up to a total volume of 31,367 AFY. Verification of those water rights will occur outside of the environmental review process. Combined with the groundwater demand from existing activities in the study area (approximately 1,994 AFY), operation of the Proposed Action would require approximately 3,019 AFY of water, an increase of approximately 51% over existing groundwater demands. The total demand accounts for less than 10% of the maximum pumping limit allowed under original water rights. Therefore, operation of the Proposed Action would have a negligible impact on groundwater supply. The Applicant would ensure that water rights are current before withdrawing any water for construction or operations; water rights would be maintained for ongoing groundwater use during operation of the Proposed Action. If stormwater is collected and used for a beneficial use, a water right permit would be required in accordance with RCW 90.03.

3.1.4 Operations: Indirect Impacts

Operation of the Proposed Action would result in the following indirect impact on groundwater related to facility operations in the direct impact study area and increased rail traffic (up to 240 unit trains[8] arriving and departing per month) on the BNSF Spur and Reynolds Lead in the direct and indirect impact study areas.

Degrade Groundwater Quality during Operations

Operation of the Proposed Action is not expected to affect groundwater at the wellfield at the Mint Farm Industrial Park because the wellfield draws water from the deep aquifer and, as previously mentioned, there is a confining impervious layer of clay and silt separating the two aquifers. Therefore, it would be unlikely that contaminants from a spill during operations would reach the groundwater aquifers tapped by the wellfield The majority of the study area is located within Zone 2 of the Mint Farm Industrial Park's wellhead protection and sanitary control areas (Figure 16). Although it would be highly unlikely a contaminant would reach the deep aquifer, should a spill or contaminant release occur during operations, cleanup would occur rapidly. In addition, surface water generated on the study area would be collected and reused on site or treated before being discharged to the Columbia River, further minimizing the potential for contaminants to infiltrate into groundwater.

Degrade Groundwater Quality Because of a Train Collision or Derailment

Spills of fuel or other potentially hazardous materials (i.e., lubricants, hydraulic fluids) could occur along the rail spur if rail cars were to collide or derail within the study area. Similar to day-to-day rail operations, any materials released to the ground because of a fuel spill could degrade groundwater quality. As discussed in the SEPA Hazardous Materials Technical Report (ICF 2017a), if a release of hazardous materials or fuel spill were to occur, the rail operator would implement emergency response and cleanup actions as required by Occupational Safety and Health Administration rules (29 Code of Federal Regulations [CFR] 1910.120), the Washington State Oil and Hazardous Substance Spill Prevention and Response regulations (90.56 RCW), and the MTCA Cleanup Regulations (Chapter 173-340 Washington Administrative Code [WAC]). In addition, Federal Railroad Administration accident reporting requirements (49

[8] A unit train consists of approximately 125 rail cars and three to four locomotives.

CFR 225) include measures to prevent the potential for a spill of fuel or other potentially hazardous materials from affecting groundwater quality, through quick response, containment, and cleanup. A spill or release of hazardous materials or fuels would not be expected to affect groundwater.

3.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the coal export terminal and would continue with current operations in the Applicant's leased area. The project area could be developed for other industrial uses including an expanded bulk product terminal or other industrial uses that would not require a permit from the Corps (i.e., would not affect waters of the U.S.). Because existing industrial import and export activities would be expanded, potential impacts on water quality of groundwater would be similar to those described for the Proposed Action with respect to potential oils and grease spills from equipment or other raw materials shipped from the terminal. An NPDES Industrial Stormwater Permit would be required to regulate stormwater discharges to the Columbia River. This would maintain water quality of groundwater.

Any new or expanded industrial uses would trigger a new NPDES or modified permit. Upland buildings could be demolished and replaced for new industrial uses. Ground disturbance would not result in any impacts on waters of the United States and would not require a permit from the Corps. Any new impervious surface area would generate stormwater, but all stormwater would be collected and treated to meet state and federal water quality requirements prior to discharge to the Columbia River. Groundwater recharge in the study area is primarily from the Columbia River; thus, maintaining water quality in the Columbia River would be expected to maintain water quality of groundwater within the study area.

Chapter 4
Required Permits

The Proposed Action would require the following permits related to groundwater.

- A Cowlitz County Critical Areas permit would be required to address compliance with the County's Critical Areas Ordinance related to the presence and protection of Critical Aquifer Recharge Areas located on site.
- Clean Water Act Section 401 Water Quality Certification would be required to ensure construction and operation impacts on groundwater quality would not violate state water quality standards.
- An NPDES Construction Stormwater Permit would be required for any new stormwater discharges during construction of the Proposed Action. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by Washington State. Once the water to be discharged has been accurately evaluated and characterized, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued.
- An NPDES Industrial Stormwater Permit would be required for stormwater discharges related to operation of the Proposed Action. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by Washington State. Once the water to be discharged has been accurately evaluated and characterized, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued.
- The Applicant would ensure that the original water rights are valid and in good standing prior to using those rights. If the water rights are valid, it is the Applicant's or Northwest Alloy's responsibility to maintain those water rights in good standing. If these water rights are partially or fully relinquished, the Applicant must apply for and obtain the necessary water rights for legal beneficial use of water at the project area. If stormwater is collected and reused for a beneficial use, a water right permit would be required in accordance with RCW 90.03.

Chapter 5
References

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MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA WATER QUALITY TECHNICAL REPORT

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Acronyms and Abbreviations

Applicant	Millennium Bulk Terminals—Longview, LLC
BNSF	BNSF Railway Company
CCC	Cowlitz County Code
CDID	Consolidated Diking and Improvement District
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRD	Columbia River Datum
DDE 4,4	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FNU	formazin nephelometric units
g/cm^3	grams per cubic meter
g/L	grams per liter
g/m^2/year	grams per square meter per year
LVSW	Longview Switching Company
mg/L	milligrams per liter
NPDES	National Pollution Discharge Elimination System
OAR	Oregon Administrative Rules
Oregon DEQ	Oregon Department of Environmental Quality
ORS	Oregon Revised Statutes
PAH	polyaromatic hydrocarbon
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metals Company facility
SEPA	Washington State Environmental Policy Act
SWMP	stormwater management plan
SWPPP	stormwater pollution prevention plan
TCDD	tetrachlorodibenzo-p-dioxin
TEEC	trace elements of environmental concern
TMDL	total maximum daily load
UP	Union Pacific
USC	United States Code
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resources Inventory Area

Chapter 1
Introduction

This technical report assesses the potential water quality impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, water quality refers to the overall quality of the water resources of the project area and study area. This report describes the regulatory setting, establishes the methods for assessing potential water quality impacts, presents the historical and current water quality conditions in the study area, and assesses potential impacts on water quality.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP, and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

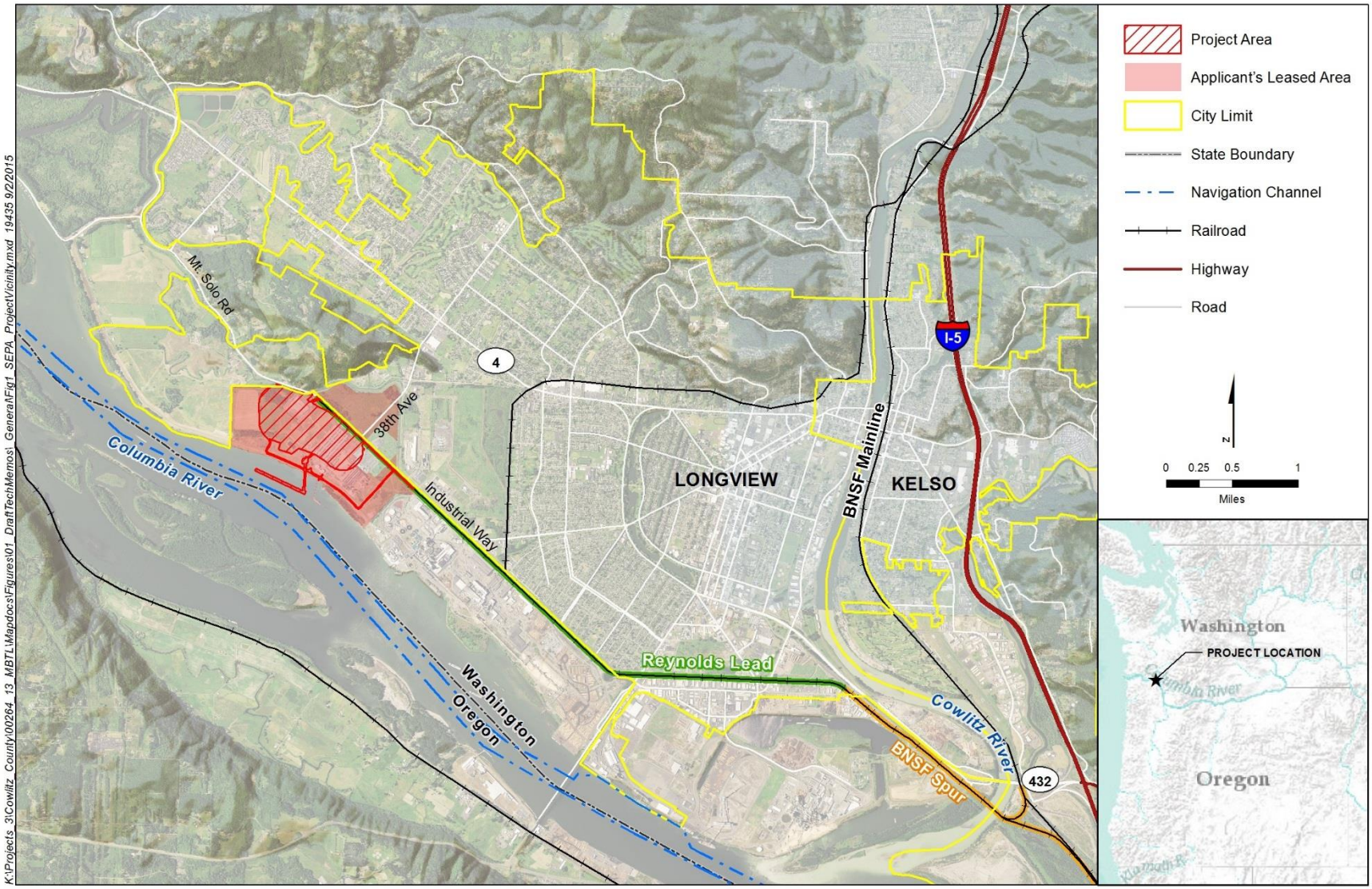
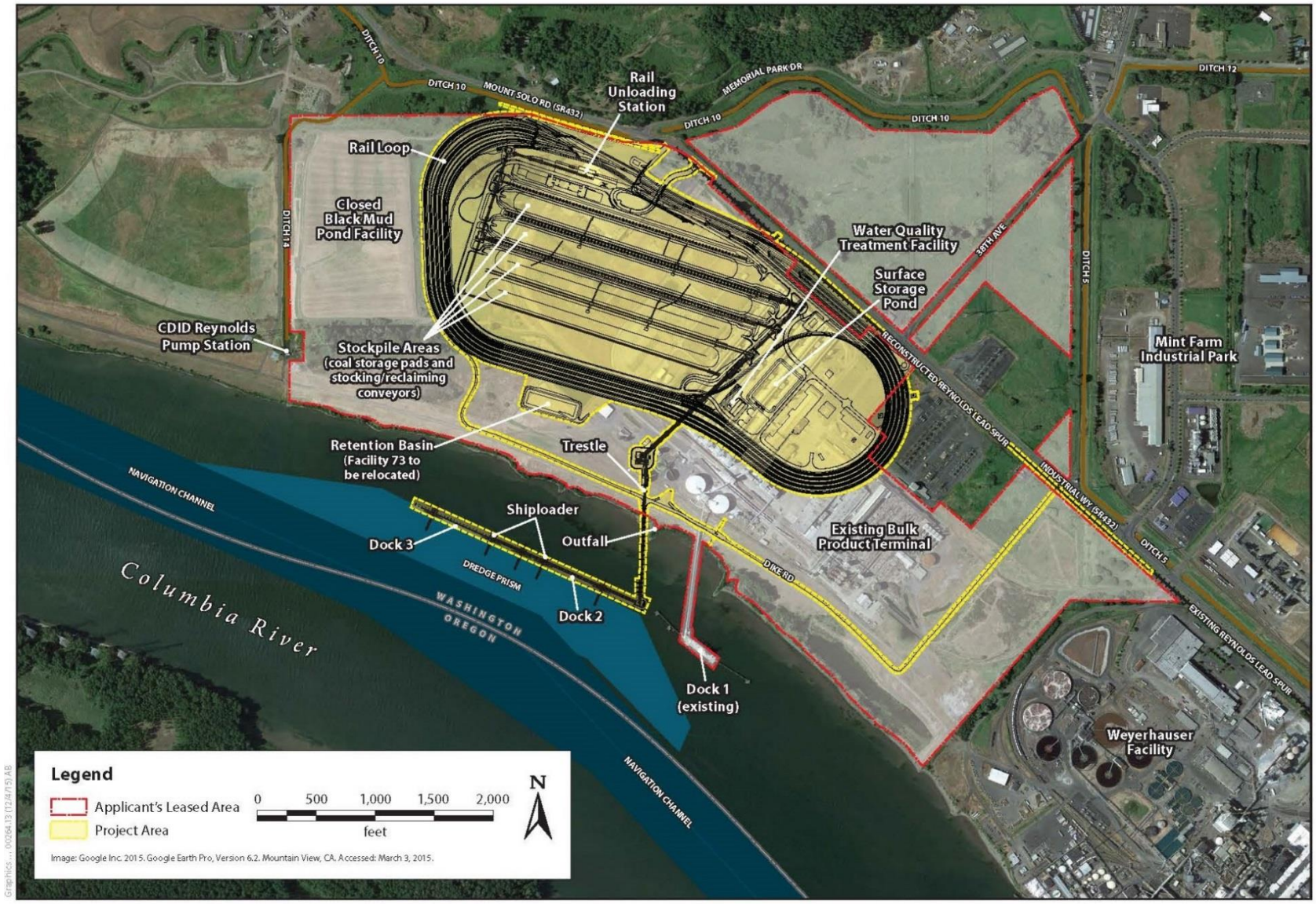


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

Different jurisdictions are responsible for the regulation of water quality. These jurisdictions and their regulations, statutes, and guidance that apply to water quality are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Water Quality

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 et seq.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Clean Water Act (33 USC 1251 *et seq*.)	Authorizes EPA to establish the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
Safe Drinking Water Act (42 USC 300f *et seq*.)	Requires the protection of groundwater and groundwater sources used for drinking water. Also, requires every state to develop a wellhead protection program. EPA is the responsible agency.
National Pollutant Discharge Elimination System Permit (40 CFR 122)	Controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Authorized by the Clean Water Act. EPA is the responsible agency but typically delegates authority to state resource agencies.

Regulation, Statute, Guideline	Description
National Pollutant Discharge Elimination System Vessel Permit	Regulates incidental discharges from the normal operation of vessels. These incidental discharges include, but are not limited to, ballast water, bilgewater, graywater (e.g., water from sinks, showers), and antifoulant paints (and their leachate). Such discharges, if not adequately controlled, may result in negative environmental impacts via the addition of traditional pollutants or, in some cases, by contributing to the spread of aquatic invasive species. Authorized by the Clean Water Act. EPA is the responsible agency.
Ballast Water Management (33 CFR 151)	Establishes ballast discharge standards and vessel requirements to meet those ballast discharge standards. The U.S. Coast Guard is the responsible agency. Such discharges, if not adequately controlled by these regulatory requirements, may result in the spread of organisms that may adversely affect the environment.
Washington State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Clean Water Act Section 401 Water Quality Certification	Ecology issues Section 401 Water Quality Certification for activities that may result in any discharge into waters of the state to ensure compliance with state water quality standards and other aquatic resources protection requirements under Ecology's authority as outlined in the federal Clean Water Act.
Drinking Water/Source Water Protection (RCW 43.20.050)	Ensures safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors. Ecology is the responsible agency.
Model Toxics Control Act (RCW 70.105D)	Requires potentially liable persons to assume responsibility for cleaning up contaminated sites. Ecology is the responsible agency.
State Water Pollution Control Law (RCW 90.48)	Provides Ecology with the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland water, salt waters, watercourses, and other surface and groundwater in the state.
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to ensure that waters of the state are protected and fully used for the greatest benefit. Ecology is the responsible agency.
Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A)	Establishes water quality standards for surface waters of Washington State. Ecology is the responsible agency.
Ballast Water Management (RCW 77.120)	Governs discharge of ballast water into waters of the state. Includes reporting and testing requirements. WDFW is the responsible agency.
National Pollutant Discharge Elimination System Permit Program (WAC 173-220)	Establishes state individual permit program for discharge of pollutants and other wastes and materials to surface waters of the state.
Model Toxics Control Act—Cleanup Regulation (WAC 173-340-300)	Requires reporting of hazardous substance releases if they may constitute a threat to human health or the environment.
Sediment Management Standards (WAC 173-204)	Establishes administrative procedural requirements and criteria to identify, screen, evaluate, prioritize, and clean up contaminated surface sediment sites.

Regulation, Statute, Guideline	Description
Washington State Oil and Hazardous Substance Spill Prevention and Response (RCW 90.56)	Requires notification of releases of hazardous substances and establishes procedures for response and cleanup
Oregon State	
Treatment Requirements and Performance Standards for Surface Water, Groundwater Under Direct Influence of Surface Water, and Groundwater (OAR 333-061-0032)	Establishes water quality standards for groundwater to meet current state and federal safe drinking water standards. Oregon DEQ is the responsible agency.
Oregon Drinking Water Quality Act (ORS 448.119 to 448.285; 454.235; and 454.255)	Ensures safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors. Oregon DEQ is the responsible agency.
Water Quality Standards: Beneficial Uses, Policies, And Criteria for Oregon Oregon State Legislature: Turbidity Rule (OAR 340-041-0036)	Establishes the following turbidity standard: No more than a 10% cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity-causing activity. However, limited-duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied. Oregon DEQ is the responsible agency.
Local	
Cowlitz County SEPA Regulations (Cowlitz County Code 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Stormwater Ordinance (CCC 16.22)	Establishes minimum standards to guide and advise all who make use of, contribute to, or alter the surface waters and stormwater drainage systems in Cowlitz County.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Requires Cowlitz County to designate critical areas such as wetlands, aquifer recharge areas, geologically hazardous areas, fish and wildlife habitat, and frequently flooded areas; and adopt development regulations to ensure the protection of such areas.
City of Longview Stormwater Ordinance	Establishes methods for controlling the introduction of runoff and pollutants into the municipal storm drain system (MS4) in order to comply with requirements of the Western Washington Phase II Municipal Stormwater NPDES Construction Stormwater Permit process.
Cowlitz County Phase II Municipal Stormwater Management Plan	Requires the Cowlitz County to develop a SWMP and update it at lease annually. The SWMP incorporates best management practices to reduce the discharge of pollutants from the regulated area to the maximum extent practicable in order to protect water quality.

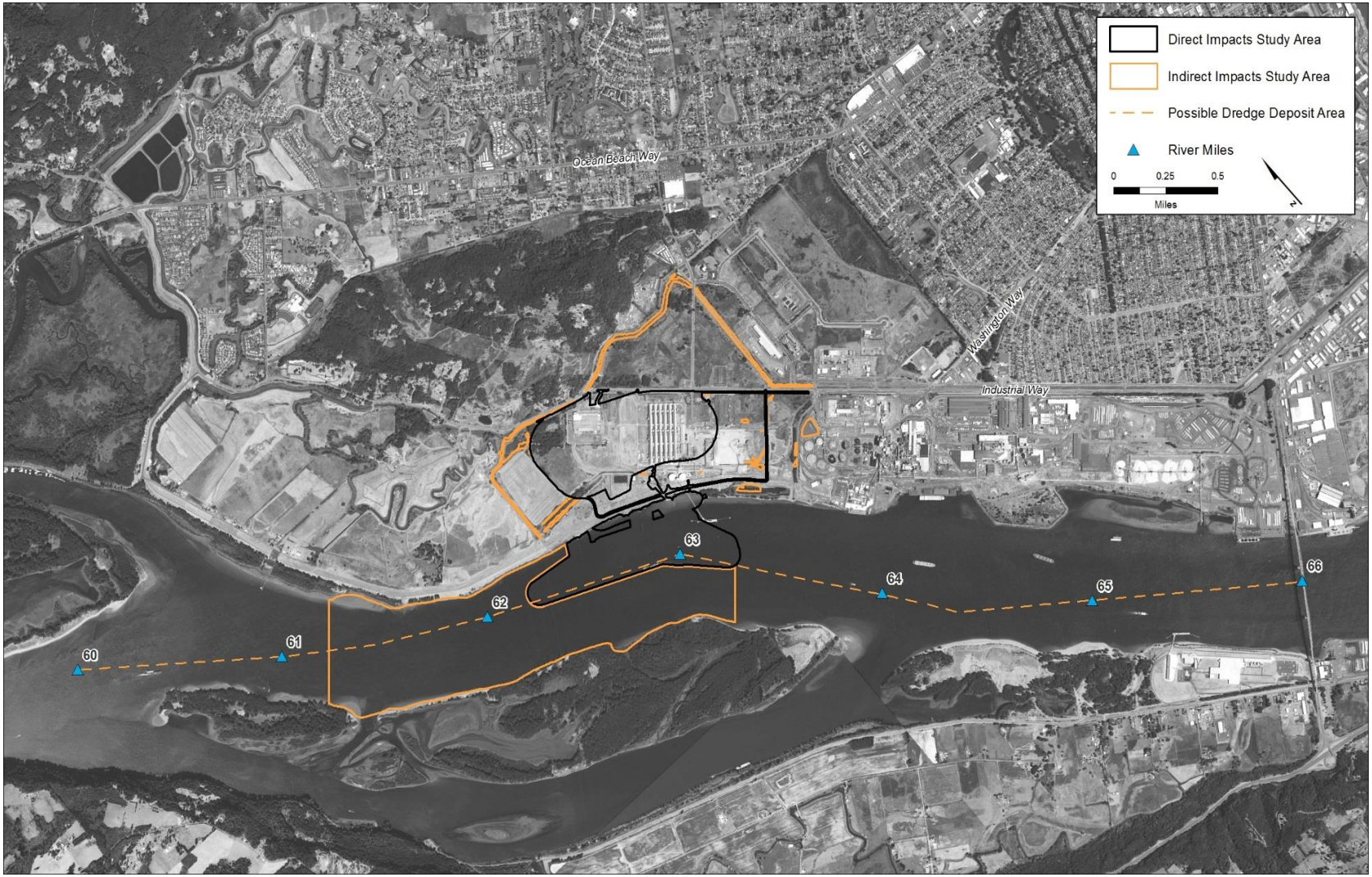
Notes:
USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; Corps = U.S. Army Corps of Regulations; CEQ = Council on Environmental Quality; EPA = U.S. Environmental Policy Act; NPDES = National Pollutant Discharge Elimination System; WAC = Washington Administrative Code; Ecology = Washington State Department of Ecology; RCW = Revised Code of Washington; Oregon DEQ = Oregon Department of Environmental Quality; ORS = Oregon Revised Statutes; NTU = nephelometric turbidity units; WDFW = Washington Department of Fish and Wildlife; OAR = Oregon Administrative Rules; CCC = Cowlitz County Code; SWMP = stormwater management plan

1.3 Study Area

The study area for direct impacts of the Proposed Action on water quality is the project area and an area extending 300 feet from the project area into the Columbia River (Figure 3). This portion of the study area accommodates the analysis of in-water construction and dredging impacts on water quality and sediment quality associated with suspended sediment and elevated turbidity. The study area also incorporates potential in-river dredged material disposal sites and an area extending 300 feet downstream of each disposal site. This portion of the study area accommodates the analysis of sediment disposal impacts. Dredged material is expected to be suitable for flow-lane disposal in the deepwater areas of the Columbia River in the project vicinity.

For indirect impacts, the study area includes the project area, Consolidated Diking and Improvement District (CDID) #1 stormwater system drainage ditches adjacent to the project area, the Columbia River up to 1 mile downstream of the project area, and potential in-river dredged material disposal sites plus an area extending 300 feet downstream of each disposal site. This study area is based on the potential of the Proposed Action to affect water quality in water bodies downstream of the project area.

Figure 3. Water Quality Study Area



Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to water quality.

2.1 Methods

This section describes the methods used to characterize the existing conditions and assess the potential impacts of the Proposed Action and No-Action Alternative on water quality.

2.1.1 Data Sources

The following sources of information were used to evaluate the characteristics of the study area.

- Anchor QEA. 2011. *Engineering Report for NPDES Application Millennium Bulk Terminals.* Longview, WA. September 2011. Established the baseline water conditions for each project area.
- U.S. Environmental Protection Agency (EPA). 2009. *Columbia River Basin: State of the River Report for Toxics.* EPA 910-R-08-004.
- Ewing, Richard. 1999. *Diminishing Returns: Salmon Declines and Pesticides.* Available: http://www.pcffa.org/salpest.pdf. Accessed: October 20, 2014.
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- Grette Associates, LLC. 2014b. *Millennium Coal Export Terminal Longview, Washington: Docks 2 and 3 and Associated Trestle Direct Effects of Construction.* September 2014.
- Grette Associates, LLC. 2014c. *Millennium Coal Export Terminal Longview, Washington: Bulk Product Terminal Wetland and Stormwater Ditch Delineation Report – Parcel 61953. September 2014.*
- National Marine Fisheries Service. 2011. *Columbia River Estuary ESA Recovery Module for Salmon and Steelhead.* Portland, OR. January 2011.
- Oregon Department of Environmental Quality (Oregon DEQ). 2003. *Designated Beneficial Uses Mainstem Columbia River (340-41-0101)*.
- Oregon DEQ. 2012. *303(d)/305(b) Integrated Water Quality Assessment Report.* Established the baseline water conditions for the Columbia River.
- Oregon State Marine Board. 2012. *Best Management Practices (BMP) White Paper for Recreational Boating Facility Construction and Replacement.*
- URS Corporation. 2014a. *Millennium Coal Export Terminal Longview, Washington. Affected Environment Analysis – Water Resources*. January.
- Washington State Department of Ecology (Ecology). 2014. *Stormwater Management Manual for Western Washington.* Publication No. 14-10-055. Olympia, WA. Established the baseline water conditions for the Columbia River.

- Washington Department of Natural Resources. 2008. *Creosote Cleanup of Puget Sounds and its Beach*. Sedro-Woolley, WA.

2.1.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative on water quality. Potential impacts on the quality of groundwater are described in more detail in the SEPA Groundwater Technical Report (ICF 2017a).

Impacts are based on how the Proposed Action and No-Action Alternative would consume and discharge water and affect water quality relative to existing conditions and assuming compliance with all laws and regulations regarding water quality and sediment quality permits. For the purposes of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year). For direct impacts, the analysis assumes best management practices, as required by permits, are incorporated into the design, construction, and operations of the Proposed Action.

The impact assessment assumes that the Proposed Action would include the following elements.

- Compliance with new state water quality standards.
- An individual National Pollution Discharge Elimination System (NPDES) Construction Stormwater Permit for stormwater discharges.
- Remediation of any existing soil and groundwater contamination in the project area prior to and concurrently with project construction.
- Long-term monitoring as part of the remediation of the existing groundwater contamination to verify remedy effectiveness and natural attenuation of groundwater contamination.
- Water management would include the collection, conveyance, treatment, and reuse of water. Any water discharged to adjacent waters would be treated prior to discharge.
- Verification of water rights.

2.2 Existing Conditions

The existing environmental conditions related to water quality in the study area are described below.

The project area for the Proposed Action is located along the north shore of the Columbia River and lies in CDID #1.[1] The project area is generally flat at an elevation of +5 to +12 feet above the Columbia River Datum (CRD) and is drained by a system of ditches to the Columbia River following treatment and to CDID #1 ditches. Discharges to the Columbia River and CDID #1 ditches (Ditches 10 and 14) are monitored as part of the existing NPDES permit.

[1] CDID #1 is a special purpose district pursuant to Chapter 85.15 of the Revised Code of Washington (RCW). CDID #1 was formed in 1923 as a consolidation of seven smaller diking and drainage districts in the area. (http://cdid1.org/)

2.2.1 Project Area Characteristics

The water quality characteristics of the project area are described below.

2.2.1.1 Drainage

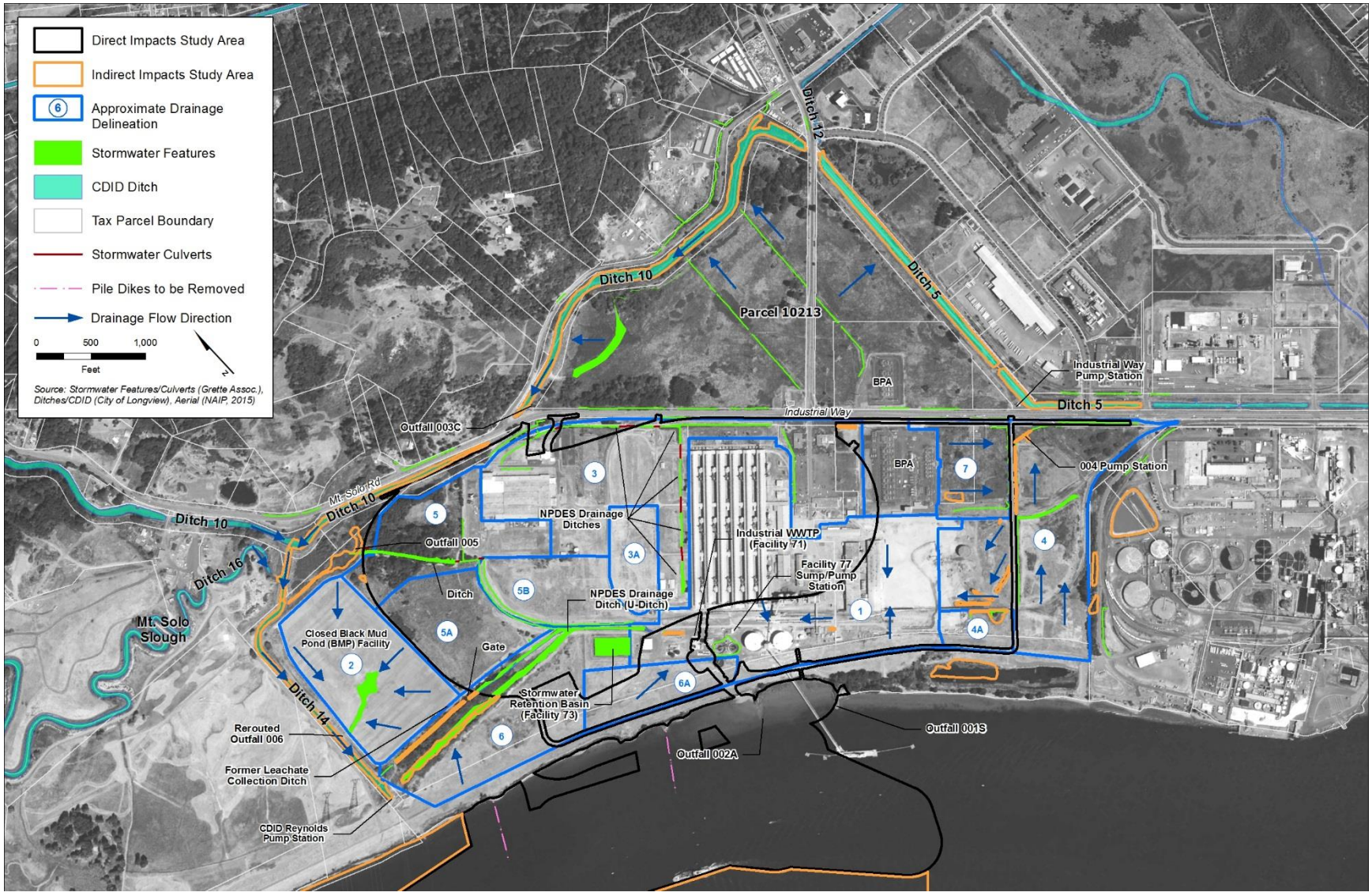
Stormwater and shallow groundwater drainage for the Applicant's leased area is controlled by a system of ditches, pump stations, treatment facilities, and outfalls. As shown in Figure 4, all of these facilities operate under a single NPDES industrial permit. All of the Applicant's leased area drainage is either held onsite and evaporates, discharged to surrounding CDID #1 ditches (Ditches 10 and 14) that eventually flow to the Columbia River, or is collected, treated, and discharged through Outfall 002A to the Columbia River.

The following is a brief description of drainage components within the Applicant's leased area.

- **Sheet flow and infiltration.** Subbasin 4A, 5, 5A, 5B, 6A, and 7 receive sheet flow from storm events, which subsequently infiltrates or evaporates.
- **Columbia River discharge.** Subbasins 1, 2, 3A, 4, and 6 are conveyed via pumped systems or gravity to Facility 73, where they are treated and then discharged to the Columbia River via Outfall 002A.
- **CDID #1 discharge.** Subbasin 3 flows through a vegetated ditch that discharges to CDID Ditch 10 through Outfall 003C. During larger storm events, overflow from Subbasin 2 and Subbasin 5 can discharge to the CDID #1 ditch system. Subbasin 2 overflows would discharge to CDID Ditch14 through Outfall 006. This is a designed overflow system and it is equipped with a high flow alarm to alert staff when it is activated. Subbasin 5 flows can enter a vegetated ditch that discharges to CDID Ditch 10 through Outfall 005. Ultimately, all CDID #1 ditch flows discharge to the Columbia River.
- **Drainage features on Parcel 10213**. These features include three vegetated ditches, two unvegetated ditches, and a shallow depression that may collect stormwater. Two of the vegetated ditches run north-south across the two larger portions of Parcel 10213. They are narrow and linear and convey stormwater to a culvert approximately 16 inches in diameter located at the north end of these ditches which then empties into CDID Ditch 10. The third vegetated ditch consists of three segments of linear vegetated ditches adjacent to Industrial Way. These three ditches are connected by two culverts that are beneath the site's access roads. This feature likely collects stormwater from Industrial Way and adjacent areas and conveys it to CDID Ditch 10.

  One unvegetated ditch runs parallel to CDID Ditch 10 and consists of two sections of a narrow ditch that was likely constructed to intercept shallow groundwater affecting agricultural use of the site. This unvegetated ditch is several feet deep, nearly vertical along its sides, and is bisected by one of the vegetated ditches that runs parallel across the site; however, there is no surface hydrology connection between these two ditches. The other unvegetated ditch serves as the outlet channel for the stormwater pond. This ditch is located at the northeast end of the stormwater pond and conveys excess stormwater from the pond to CDID Ditch 10 through a 16-inch culvert. All six features are privately owned and are not managed by CDID #1.

Figure 4. Drainage Features



2.2.1.2 Consolidated Diking and Improvement District # 1

CDID #1 is a secondary permittee on the Cowlitz County/Kelso/Longview Municipal NPDES permit. The CDID #1 system is a system of levees that contain approximately 35 miles of drainage ditches that protect from external flooding (rivers), internal flooding (storm drainage runoff), and flooding from lands adjacent to the levee system (groundwater). The project area lies within the areas served by the CDID #1 series of levees and ditches, which protect the area from flooding.

Water of CDID Ditches 5, 10, and 14 in the study area was tested in 2006, 2011, and 2012 to determine levels of cyanide and fluoride. These contaminants are associated with the activities that occurred during operations associated with the former Reynolds Metals Company facility (Reynolds facility). Total suspended solids were also tested. The results showed that water quality standards were met and there were no water quality exceedances or violations of established Washington State water quality standards (Anchor QEA 2014). The entire CDID #1 ditch system discharges to the Columbia River.

2.2.1.3 Columbia River

The Columbia River flows along the southwest boundary of the Applicant's leased rea. This part of the river is fresh water but tidally influenced. Ecology has established instream flow requirements for several locations on the Columbia River. Instream flows are specific streamflow levels that are regulated to protect fish, wildlife, recreation, aesthetics, water quality, and navigation (Washington State Department of Ecology 2014a). The project area is located at approximately river mile 63, where instream flow requirements have not been established. The mean annual flow of the Columbia River, measured at the Beaver Army Terminal near Quincy, Oregon (river mile 53.8) is approximately 236,000 cubic feet per second (cfs). The river's annual discharge rate fluctuates with precipitation, snowmelt, and reservoir releases. Flows range from 63,600 cfs to 864,000 cfs depending on conditions in the watershed (U.S. Geological Survey 2014). The Columbia River's annual cycle is driven by snowmelt and the general climate of the Pacific Northwest, which produces high flows during the spring snowmelt period and low flows during the late summer and early fall. The river's flow, however, is highly managed through the operations of the many hydroelectric and irrigation dams that exist throughout the basin. The average annual discharge ranges from about 120,000 cfs during a low water year to about 260,000 cfs during a high water year (Washington State Department of Ecology 2016a).

Surface water quality in the Columbia River is influenced by geology (mineral content of rocks and sediments), point and nonpoint contaminant sources, groundwater that discharges to surface water, and the natural flow regime. In 2009, the U.S. Environmental Protection Agency (EPA) listed the Columbia River in Washington's Water Resources Inventory Area (WRIA) 25 (which includes the project area) on the federal Clean Water Act Section 303(d) List as exceeding water quality criteria for certain parameters. Portions of the Columbia River within WRIA 25 are listed as a Category 4a for total dissolved gas and dioxin. If a water body is listed as Category 4a, it indicates that the water has identified pollution problems and that an approved total maximum daily load (TMDL) limit is actively being implemented for the listed water quality parameters.

EPA implemented a strategic plan in 2009 to restore and protect the Columbia River basin by preventing water pollution and improving and protecting water quality and ecosystems in the Columbia River basin to reduce risks to human health and the environment.

The strategic targets for 2014 were as follows (URS Corporation 2014).

- Protect, enhance, or restore 19,000 acres of wetland and upland habitat in the Lower Columbia River watershed.
- Clean up 85 acres of known highly contaminated sediments.
- Demonstrate a 10% reduction in the mean concentration of certain contaminants of concern found in water and fish tissue.

2.2.1.4 Water Quality Characteristics and Criteria

Water quality characteristics and criteria are described below.

Designated Beneficial Uses

Designated beneficial uses for a water body, as established in the Clean Water Act, are used to design protective water quality criteria, to assess the general health of surface waters, and to establish thresholds for future permit limits. Table 2 provides a list of the beneficial uses for the Columbia River as defined by Ecology and the Oregon DEQ. A designated beneficial use provides a water body's assessed function or utility, and if a water body fails to meet the established water quality standards (see *Water Quality Impairments*), the water body's designated use can be adversely affected.

Table 2. Beneficial Uses for the Columbia River

Washington State Department of Ecology[a]	Oregon Department of Environmental Quality[b]
Domestic water supply	Public domestic water supply; private domestic water supply
Industrial water supply	Industrial water supply
Agricultural water supply	Irrigation
Stock water supply	Livestock watering
Spawning/rearing uses for aquatic life	Fish and aquatic life
Harvesting	Fishing; wildlife and hunting
Boating	Boating
Primary contact for recreation uses	Water contact recreation
Commerce/navigation	Commercial navigation & transportation
Aesthetics	Aesthetic quality

Notes:

[a] Washington State Department of Ecology (2012) approved uses for the Columbia River from its mouth to river mile 309.3

[b] Oregon Department of Environmental Quality (2003) approved uses for the Columbia River from its mouth to river mile 86 (2003)

Anticipated Designated Beneficial Uses for Proposed Action

Weyerhaeuser Longview, which is located at river mile 63.5, discharges wastewater from two treatment plants into the Columbia River. Weyerhaeuser's NPDES Permit WA0000124 (Weyerhaeuser 2014) included designated beneficial uses. Because of the proximity of the Weyerhaeuser Longview facility to the project area it is anticipated that the uses and criteria established for Weyerhaeuser may be applicable to the project area. The Weyerhaeuser uses and associated water quality criteria are provided below in Tables 3 and 4.

Table 3. Freshwater Aquatic Life Uses (Weyerhaeuser Longview)

Salmonid Spawning, Rearing, and Migration	
Parameter	**Water Quality Criteria**
Temperature Criteria – Highest 1-DAD MAX	• 1-day maximum (1-DMax) of 20.0 °C • When natural conditions exceed 1-DMax, no temperature increase will raise the receiving water temperature by greater than 0.3 °C
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	To exceed 90 percent saturation
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Total Dissolved Gas Criteria	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
pH Criteria	The pH must measure within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

Table 4. Recreational Uses (Weyerhaeuser Longview)

Parameter/Use	Water Quality Criteria
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL

In addition to the designated beneficial uses listed in Tables 3 and 4, water supply uses established for Weyerhaeuser include domestic, agricultural, industrial, and stock watering and miscellaneous freshwater uses include wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

Water Quality Impairments

The Columbia River faces water quality issues that endanger the health of important habitats found throughout the basin. Land use practices have increased the level of nutrients and pesticides and water temperature and instream structures such as dams and irrigation impoundments have affected water quality by inhibiting mixing, introducing dissolved gases, and trapping contaminated sediments. Industrial, municipal, and agricultural practices have introduced toxic contaminants from point and nonpoint sources (U.S. Geological Survey 2005).

Portions of the Columbia River are considered impaired for a number of water quality factors, according to the U.S. Environmental Protection Agency (EPA)-approved 303(d) lists for Washington and Oregon. Table 5 shows the 303(d)-listed impairments for water quality factors in the study area. The State of Washington recently finalized its 2012 water quality assessment and 303(d) list of impaired waters. According to this 303(d) list, in the study area the Washington State portion of the Columbia River is impaired (Category 5) for water temperature and bacteria (Washington State Department of Ecology 2016b). In addition, Ditch 5 in the study area is listed as impaired for

dissolved oxygen. Oregon has listed the Columbia River in the study area as impaired for arsenic, dichlorodiphenyldichloroethylene (DDE 4,4), and polychlorinated biphenyls (PCBs).

Sediment sampling from within, adjacent to, and upstream of the Project area (to approximately river mile 68, has demonstrated that in deepwater areas of the Columbia River, sediments are typically composed of silty sands with a low proportion of fines and very low total organic carbon. Further, sediments sampled from deepwater areas near the proposed export terminal have consistently met suitability requirements for flow lane disposal or beneficial use in the Columbia River (Grette 2014b: Appendix B). Sediment testing performed by the Applicant in the project area has revealed no exceedance of sediment-management standards at any nearshore or offshore location, except for in a localized area immediately adjacent to the existing Outfall 002A. Testing criteria were exceeded at one location downstream of the outfall, but criteria for human health protection were not exceeded (Anchor QEA 2014 in Grette 2014b: Appendix B). The distribution of contamination was limited in area and depth to an isolated layer 6 inches thick, and the contamination source was identified as an historical discharge and not the result of an ongoing release (Grette 2014b: Appendix B). The affected sediment was removed and backfilled in November 2016.

Table 5. 303(d)-Listed Impairments for Surface Waters in the Study Area

Parameter	Washington	Oregon[c]	
	Columbia River	Ditch 5	Columbia River
Arsenic	-	-	5
Bacteria	5[a]	-	-
DDE 4,4	-	-	5
Dioxin (2,3,7,8-TCDD)	-	-	4A[b]
Dioxin	4A[b]	-	-
Dissolved Oxygen	-	5	-
PCB	-	-	5
Temperature	5		
Total dissolved gas	-	-	4A[b]

Notes:

[a] Category 5 waters are impaired 303(d) waters, which means water quality standards have been violated for one or more pollutants and a TMDL or other water quality improvement is required.

[b] Category 4A listing indicates a TMDL has been developed and is actively being implemented.

[c] Oregon 2012 303(d) list is pending approval from EPA. The 2010 effective list for this segment of the Columbia River is the same as the 2014 list that is pending approval by EPA.

Sources: Washington State Department of Ecology 2016b; Oregon Department of Environmental Quality 2012

DDE = Dichlorodiphenyldichloroethylene; TCDD = Tetrachlorodibenzo-p-dioxin; PCB = polychlorinated biphenyl; EPA = U.S. Environmental Protection Agency

The water quality impairments in the study area result from a variety of practices throughout the Columbia River basin that degrade water quality, primarily human activities. Elevated water temperatures, increased nutrient loading, reduced dissolved oxygen, and increases in toxic contaminants in the basin pose risks to fish and wildlife, as well as to people. Sources of these contaminants include agricultural practices, urban and industrial practices, riparian practices, and climate change (National Marine Fisheries Service 2011). A summary of the water quality conditions of the greater Columbia River as a result of the basin-wide activities are described in the following sections.

Baseline Water Quality Conditions

General baseline conditions for the broader Columbia River basin and Lower Columbia River and Estuary near the project are described below, followed by a discussion of specific water quality attributes. These attributes are discussed quantitatively where feasible and qualitatively otherwise.

Columbia River Basin

A significant focus has been placed on toxics reduction in the Columbia River basin. While many contaminants are found in the Columbia River basin, four main contaminants are found throughout the basin at levels that could adversely affect people, fish, and wildlife: mercury dichlorodiphenyltrichloroethane (DDT) and its breakdown products, PCBs, and polybrominated diphenyl ether (PBDE) flame retardants. Other contaminants found in the basin include radionuclides, lead, pesticides, industrial chemicals, and newly emerging contaminants such as pharmaceuticals (U.S. Environmental Protection Agency 2009).

Lower Columbia River and Estuary near the Project Area

The lower Columbia River and Estuary is the 235-kilometer reach from the Bonneville Dam downstream to the Pacific Ocean. Monitoring results have shown high levels of contaminants such as PCBs, polyaromatic hydrocarbons (PAHs), DDT, and PBDEs in juvenile salmon tissue, water, and sediment. Studies have shown that flame-retardants and endocrine-disrupting compounds in water, sediment, fish, and osprey eggs increase downstream from Skamania to Longview (Lower Columbia Estuary Partnership 2015). Arsenic is most frequently detected metal in the lower Columbia.

Trace metals such as aluminum, iron, and manganese are predominantly transported in the suspended phase, whereas arsenic, barium, chromium, and copper are transported in the dissolved phase. Highest water temperatures in the lower Columbia generally occur in August where daily mean water temperatures often exceed 20^0C. Data collected on September 11, 2015 at river mile 53, near the Beaver Army Terminal, indicated an oxygen saturation of 85.5% (9.17 milligrams per liter [mg/l]), temperature of 20.03^0C, and turbidity of 1.61 nephelometric turbidity units (NTUs). For contrast, data collected just below the Bonneville Dam at river mile 145 indicated an oxygen saturation of 97.9% (10.5 mg/l), temperature of 20.07^0C, and turbidity of 2.27 NTUs (Center for Coastal Margin Observation and Prediction 2016).

On a more localized basis near the project area, the following average values were recorded in the lower Columbia: oxygen saturation of 73.62% (7.9 mg/l), temperature of 20.96^0C, and turbidity of 9.9 NTUs (Weyerhaeuser NPDES 0000124).

Water Quality Attributes

Water Clarity

Water clarity refers to the amount of light that can penetrate water. Water clarity is an important parameter for assessing baseline water quality because lower clarity increases water temperatures, reducing the water's capacity to hold dissolved oxygen; and adversely affects photosynthesis, reducing the production of dissolved oxygen. Suspended sediment can clog the gills of fish and reduce their resistance to disease, cause lower growth rates, and affect egg and larval development. While both suspended sediment concentration and turbidity are common metrics of water clarity, turbidity data are available from a nearby U.S. Geological Survey (USGS) station and are used to characterize baseline conditions.

Background levels of turbidity in the Columbia River vary by season and weather patterns. USGS provisional data from the 2014 water year, collected at Beaver Army Terminal near Quincy, Oregon, reported elevated turbidity[2] (U.S. Geological Survey 2015) that was generally higher than during the 2007 water year, when water clarity was rated as poor (U.S. Environmental Protection Agency 2007). However, elevated turbidity levels or poor water clarity in rivers such as the Columbia River are a natural condition that occurs during storm events and periods of high seasonal runoff and does not necessarily mean the water quality conditions are poor.

Biological Indicators

EPA, in collaboration with the Lower Columbia Estuary Partnership, reported the following additional parameters in 2007 (U.S. Environmental Protection Agency 2007).

- **Dissolved nitrogen and phosphorus:** 100% of the estuarine area was rated *good* for dissolved nitrogen while 70% of the estuarine area was rated *fair* for dissolved phosphorus.
- **Chlorophyll *a*:** 29% of the estuarine area was rated *fair* for this indicator, with the remaining 71% of the area rated *good*.
- **Dissolved oxygen:** 99% of the estuarine area was rated *good* for this indicator.
- **Sediment quality:** 89% of the estuary as a whole was rated *good* while 11% was rated *poor*. The sediment quality index is rated based on three component indicators: sediment toxicity, sediment contaminants, and sediment total organic carbon. The estuarine area rated *poor* exceeded thresholds for one or more of these indicators.

Temperature

Water temperature is an important parameter for assessing baseline water quality. The Columbia River is impounded at many locations. These impoundments contribute to elevated water temperature by ponding water and increasing exposure to solar radiation. Although EPA and the Lower Columbia Estuary Partnership did not rate the Columbia River Estuary with respect to water temperature, because water temperature affects the water's capacity for dissolved oxygen, if dissolved oxygen levels are considered good, water temperatures are also fairly good.

Chemical Indicators

USGS conducted a survey of water quality in the Columbia River estuary with data from 2004 and 2005. Major findings of this study are as follows (U.S. Geological Survey 2005).

- The median copper concentration was 1.0 microgram per liter, a level shown to have inhibitory effects on juvenile coho salmon.
- Of the 173 pesticides and degradation products analyzed, 29 were detected at least once, oftentimes with two or more products occurring in a sample together. Fourteen samples with multiple products were detected (no concentrations were provided).
- Of the 54 wastewater products analyzed, eight were detected at least once, usually at trace levels. The known endocrine disruptor, bisphenol A, was detected.

[2] The USGS data presented is defined as "Turbidity, water, unfiltered, monochrome near infra-red LED light, 780-900 nm, detection angle 90 +-2.5 degrees, formazin nephelometric units (FNU)."

- Of the 24 pharmaceuticals analyzed, acetaminophen, a common analgesic, and diphenhydramine, a widely used antihistamine, were detected. This is an indicator of human sources of water contamination, likely from wastewater treatment plant effluent.
- During the seasonal samplings of suspended sediment at all four sites, no organochlorine compounds or PAHs were detected.

Wetlands

Wetlands provide multiple ecological functions including water purification, flood protection, shoreline stabilization, groundwater recharge, and streamflow maintenance. They can also provide fish and wildlife habitat, recreational opportunities, and aesthetics benefits.

Several wetlands occur in the Applicant's leased area. Ecology requires that all wetlands be rated on three functions: water quality, hydrology, and habitat based on site potential, landscape position, and value of each function. The rating system uses the combined function shores to categorize wetlands. Ecology's wetland categories are summarized in Table 6.

Table 6. Ecology's Wetland Categories Based on Functions

Wetland Category	Total Score for Functions	Category Description
Category I	≥ 70	1. Represent a unique or rare wetland type; or 2. Are more sensitive to disturbance than most wetlands; or 3. Are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or 4. Provide a high level of functions.
Category II	51-69	1. Difficult but not impossible to replace, and 2. Provide a high level of some functions.
Category III	30-50	1. Provide a moderate level of functions, 2. Can often be adequately replaced with a well-planned mitigation project, and 3. Interdunal wetlands between 0.1 and 1 acre in size.
Category IV	< 30	1. Often heavily disturbed, 2. May provide some level of functions, and 3. Should be able to replace, and in some cases be able to improve.

Notes:
Source: Washington State Department of Ecology 2014b.

Based on Ecology's rating system, the wetlands in the project area scored between 20 to 46, indicating that wetlands in the project area are rated as Category III and IV and provide low to moderate water quality functions, low hydrologic functions, and low to moderate habitat functions (Grette Associates 2014d). Additional information on wetlands is described in the SEPA Vegetation Technical Report (ICF 2017b).

Practices that Degrade Water Quality

Human activity has degraded water quality in the Columbia River estuary. Higher water temperatures, increased nutrient loading, reduced dissolved oxygen, and increases in toxic contaminants pose risks to fish and wildlife, as well as people. Sources of these contaminants include agricultural practices, urban and industrial practices, and riparian practices (National

Marine Fisheries Service 2011). Refer to the SEPA Fish Technical Report (ICF 2017c) for information regarding fish and potential impacts on fish and fish habitat.

Agricultural Practices

Agricultural practices contribute nutrients (i.e., nitrogen and phosphorus), sediment, and organic compounds (e.g., pesticides) and trace metals to runoff (U.S. Environmental Protection Agency 2014). Increased nutrient loads have been found to result in increased phytoplankton concentrations, increased turbidity, and depressed dissolved oxygen levels, especially in areas with lower flows and warmer water temperatures (Fenn et al. 2003). Increased sediment loads into surface waters can cause potential adverse impacts on aquatic resources. Common sediment impacts include deposition and scouring that can smother or dislodge benthic organisms; effects of turbidity (suspended sediment) which can affect aquatic organisms (e.g. clogging fish gills), alter water temperatures (by absorbing and scattering sunlight), and reduce light penetration which alters primary productivity and affects plants' ability to photosynthesize; and sediment binding to chemicals that can have toxic effects on organisms.

Banned pesticides, including DDT, persist in the environment and pesticides currently in use continue to run off into the estuary (Ewing 1999). The pesticides atrazine, simazine, metolachlor, *S*-ethyl dipropylcarbamothioate, dimethyl tetrachloroterephthalate, and diuron are present at sites throughout the Columbia River estuary, often in combination (U.S. Environmental Protection Agency 2009). Pesticides have the potential to harm benthic invertebrates, fish, amphibians, and various stream microbes.

Trace metals can affect aquatic organisms depending on the metal, the species, and the environment in which it is deposited. Excessive concentrations of some metals can lead to dysfunction of the endocrine system, reproduction, and growth. Moreover, those metals that can be accumulated in tissues and organs may adversely affect cellular functions by interacting with enzymes, which can lead to disturbances of growth, reproduction, the immune system, and metabolism (Jakimska et al 2011).

Urban and Industrial Practices

Pollutants sources that affect water quality are separated into two groups, *point sources* and *nonpoint sources*. Point sources are easily identified by a concentrated outlet to a receiving water, where the origin of flow is single known source (e.g., municipal wastewater treatment plant). Nonpoint sources contribute from a variety of locations in a given area. Eventually, nonpoint sources can be concentrated through a single outlet to a receiving water, but each source is not known or difficult to determine (e.g., lawn fertilizer from one or many unknown homes within a watershed).

The Columbia River from Bonneville Dam to the estuary is the most urbanized stretch in the entire basin. Over 100 point sources discharge directly into this stretch, including chemical plants, hydroelectric facilities, pulp and paper mills, municipal wastewater treatment plants, and seafood processors (Ewing 1999).

The largest point source discharger in the Columbia River basin is Portland's wastewater treatment plant (approximately 40 miles upstream of the project area). Nutrient loads from the plant account for 2 to 3% of the annual in-stream nutrient loads at the Beaver Army Terminal water quality sampling site in Quincy, Oregon, downstream of the project area. Another major source of aquatic pollution is the effluent from existing pulp and paper mills, which is highly toxic and contains

dioxins and chlorinated phenols. (Ewing 1999). Pulp mill effluent is generally high in organic content and contains pollutants such as absorbable organic halide, toxic dyes, bleaching agents, salts, acids, and alkalis. Heavy metals such as cadmium, copper, zinc, chromium are often also present (Oberrecht 2014). Effluents from these point sources are regulated under NPDES permits and violations can incur enforcement actions and fines.

Riparian Practices

Shoreline modifications, timber harvest, and agricultural activities in riparian zones and residential, commercial, and industrial development along the Columbia River have resulted in a significant loss of riparian habitat function in the area (Ewing 1999). Healthy riparian habitat conditions (connected, forested riparian zones) may help to regulate water temperatures (depending on the size of the stream and the extent of shading) and contribute to aquatic habitat conditions and complexity (woody debris, bank stability, allochthonous inputs). In the study area, riparian habitat conditions the functions provided by riparian habitat are degraded. (Ewing 1999).

Chapter 3
Impacts

This chapter describes the impacts on water quality that would result from construction and operation of the Proposed Action or the ongoing activities under the No-Action Alternative.

All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area are defined and the type of NPDES permit would be determined and issued.

3.1 Proposed Action

This section describes the potential impacts that could occur in the study area as a result of construction and operation of the Proposed Action.

The following construction activities could affect water quality.

- Ground disturbance associated with construction.
- Delivering, handling, and storing construction materials and waste.
- Using heavy construction equipment.
- In- and above-water work and dredging activities and disposal.
- Demolishing existing structures.
- Preloading ground for coal stockpiles.

The following operations activities could affect water quality.

- Coal spills from rail unloading and vessel loading.
- Transport of airborne fugitive coal dust from stockpiles or rail cars.
- Operating and maintaining heavy equipment and machinery.
- Maintenance dredging and disposal.
- Unloading of 8 trains a day.
- Loading of 70 ships a month.

The Applicant has identified the following design features and best management practices to be implemented as part of the Proposed Action. These were considered when evaluating potential impacts of the Proposed Action. These would be evaluated during the NPDES permit process.

- **BMP C200: Interceptor Dike and Swale**. A ridge of compacted soil, or a ridge with an upslope swale, would be provided at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. The dike and/or swale would be used to intercept the runoff from unprotected areas and direct it to areas where erosion can be

controlled. This would be used to prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

- The pads and berms would be made of low-permeability engineered material. The use of low permeability engineered materials for formation of the pads and berms would control water from entering subsurface soil or groundwater.
- The stockyard and berms would be graded to allow the water to drain and be collected for treatment and reuse.
- Drainage systems would be designed such that runoff within the project area would be collected for treatment before reuse or discharge. The following best management practices would be part of the coal export terminal's design to maximize the availability of water for reuse.
    - Enclosed conveyor galleries.
    - Enclosed rotary unloader building and transfer towers.
    - Washdown collection sumps for settlement of sediment.
    - Regular cleanout and maintenance of washdown collection sumps.
    - Containment around refueling, fuel storage, chemicals, and hazardous materials.
    - Oil/water separators on drainage systems and vehicle washdown pad.
    - Requirement that all employees and contractors receive training, appropriate to their work activities, in the site best management practices.
    - Design of docks to contain spillage, with rainfall runoff and washdown water contained and pumped to the upland water treatment facilities.
    - Design of system to collect and treat all runoff and washdown water for either reuse for onsite (dust suppression, washdown water, or fire system's needs) or discharged off site.
    - The wharf area would be sealed to capture the washdown water and stormwater runoff, preventing it from flowing to the River without treatment.
- Stormwater, sediment, and erosion control best management practices would be installed in accordance with the Stormwater Management Manual for Western Washington and Cowlitz County. Water quality management would be performed in accordance with the requirements of the NPDES Construction and Industrial Stormwater Permits. The site's stormwater pollution prevention plan (SWPPP) would provide details of the site best management practices.
    - Drainage systems would be designed such that runoff within the construction site would be collected and treated as necessary before reuse or discharge.
    - The treatment facility could treat surface runoff and process/construction waters with capacity to store the water for reuse.
- **BMP C153: Material Delivery, Storage, and Containment.** Material delivery, storage, and containment best management practices would be used to prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage.
    - Storage of hazardous materials on site would be minimized to the extent feasible.

- Materials would be stored in a designated area, and secondary containment would be installed where needed.
- Refueling would occur in designated areas with appropriate spill control measures.

- Typical construction best management practices for working over, in, and near water would be applied, including checking equipment for leaks and other problems that could result in discharge of petroleum-based products, hydraulic fluid, or other material to the Columbia River.
- **BMP C154: Concrete Washout Area.** Concrete waste and washout waters would be either carried out off site or disposed of in a designated facility on site designed to contain the waste and washout water.
- Based on site grading and drainage areas, five water quality ponds (wetponds) would treat runoff based on Ecology's requirements. In general, the ponds would be sized for treatment of the volume and flow from the water quality design storm event (72% of the 2-year storm). Additional storage would be provided within the coal storage area so that the runoff is always treated within the stockyard area, even for larger storm events. The ponds would be designed to provide settlement as the water passes through. Subsequently, water released from these ponds would be conveyed downstream to the existing pump station outfall 002A that discharges into the Columbia River via an existing 30-inch steel pressure line. The ponds that would treat runoff from the coal stockyard would harvest water for circulation around the site for multiple uses, including dust control measures. Ecology's criteria would be used as the basis of design, which uses the Western Washington Hydrology Model computer simulation for facility sizing. Because of the flat nature of the site, some surface ponding would occur in both the yard areas and open conveyance systems. The piped conveyance systems would be sloped at 0.50% minimum.
  - The surface drainage system and features would be designed and constructed in accordance with the *Stormwater Management Manual for Western Washington.*
- The water treatment facility would be designed to treat all surface runoff and process water with capacity to store the water for reuse. Treatment would be as required to meet reuse quality or Ecology's requirements for offsite discharge.
- Additional water storage would be provided in the coal storage area in the event of a larger storm event. Water volumes exceeding the demands for reuse would be discharged off site via the existing outfall 002A into the Columbia River. Water released off site would be treated and would meet the requirements of Ecology and required discharge permits.
- The water system would be designed and constructed in accordance with or consideration of the latest edition of the following standards, where applicable.
  - International Building Code.
  - National Fire Protection Association.
  - Washington State Department of Ecology Stormwater Design Manual
  - U.S. Department of Health—Occupational Safety and Health Standards.
  - Washington State Department of Health.
  - In the event of conflict between codes and technical specification, the requirements would be reviewed and a decision made on the action to be implemented with agency of jurisdiction.

- Where possible, pile extraction equipment would be kept out of the water to avoid "pinching" pile below the water line to minimize creosote release during extraction.
- Piles would be removed slowly to minimize sediment disturbance and turbidity in the water column.
- Prior to pile extraction, the operator would "wake up" [3] the pile to break the friction between the pile and substrate to minimize sediment disturbance. During pile removal and pile driving, a containment boom would be placed around the perimeter of the work area to capture wood debris and other materials released into the waters as a result of construction activities. All accumulated debris would be collected and disposed of upland at an approved disposal site. Absorbent pads would be deployed should any sheen be observed.
- The work surface on barge deck or pier would include a containment basin for pile and any sediment removed during pulling. Any sediment collected in the containment basin would be disposed of at an appropriate upland facility, as would all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- Upon removal from substrate the pile would be moved expeditiously from the water into the containment basin. The pile would not be shaken, hosed-off, stripped or scraped off, left hanging to drip or any other action intended to clean or remove adhering material from the pile.
- Project construction would limit the impact of turbidity to a defined temporary area of mixing and would otherwise comply with Washington Administrative Code (WAC) 173-201A.
- All dredged material would be contained within a barge prior to disposal; dredged material would not be stockpiled on the riverbed.
- The contractor would remove any floating oil, sheen, or debris within the work area as necessary to prevent loss of materials from the site. The Contractor would be responsible for retrieval of any floating oil, sheen, or debris from the work area and any damages resulting from the loss.
- Flow lane disposal would occur using a bottom-dump barge or hopper dredge. These systems release material below the surface, minimizing surface turbidity.
- For work adjacent to water, proper erosion control measures would be installed prior to any clearing, grading, demolition, or construction activities to prevent the uncontrolled discharge of turbid water or sediments into waters of the state. Erosion-control structures or devices would be regularly maintained and inspected to ensure their proper functioning throughout this project.
- Project construction would be completed in compliance with Washington State Water Quality Standards WAC 173-201A, including but not limited to prohibitions on discharge of oil, fuel, or chemicals into state waters, property maintenance of equipment to prevent spills, and appropriate spill response including corrective actions and reporting as outlined in permits and authorizations (Clean Water Act Section 404, Rivers and Harbors Act Section 10, , Hydraulic Project Approval, Clean Water Act Section 401 Water Quality Certification).
- The contractor would have a spill containment kit, including oil-absorbent materials, on site to be used in the event of a spill or if any oil product is observed in the water.

[3] "Waking up" the pile consists of vibration of the pile to break the skin friction bond between the pile and soil. This allows the pile to be extracted without pulling out a large block of soil.

- All fuel and chemicals would be kept, stored, handled, and used in a fashion, which assure no opportunity for entry of such fuel and chemicals into the water.
- The contractor would use tarps or other containment methods when cutting, drilling, or performing over-water construction that might generate a discharge to prevent debris, sawdust, concrete and asphalt rubble, and other materials from entering the water.
- No land-based construction equipment would enter any shoreline body of water except as authorized.
- Equipment would have properly functioning mufflers, engine-intake silencers, and engine closures according to federal standards; the contractor would inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks to prevent spills into the surface water.

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

Construction projects in Washington State that include clearing, grading, and excavating activities that disturb 1 acre or more and discharge stormwater to surface waters of the state are required to obtain an NPDES Construction Stormwater Permit from Ecology. Prior to issuance of permits, sites with known contaminated soils or groundwater are required to provide a list of contaminants with concentrations, depths found and boring locations shown on a map with an overlay of where excavation or construction may occur. Additional alternative best management practices may be necessary based on the contaminants and treatment of contaminated construction stormwater. The state permit requires the preparation of a temporary erosion and sediment control plan,[4] a SWPPP and best management practices to avoid and minimize the risk of erosion. Guidance for the design and implementation of these best management practices would be sourced from the *2012 Stormwater Management Manual for Western Washington* (Washington State Department of Ecology 2014a), including but not limited to those developed by the Applicant. The selected best management practices would represent the best available technology that is economically achievable and the best conventional pollutant control technology to reduce pollutants. Best management practices would include a wide variety of measures to reduce pollutants in stormwater and other nonpoint source runoff. Construction practices would include measures to avoid and minimize erosion of soils associated with land disturbance and subsequent discharge of sediment-laden stormwater to adjacent surface waters. The Applicant-developed measures were considered when evaluating the potential direct impacts associated with construction.

Temporarily Discharges Increase Surface Water Turbidity Because of Upland Soil Disturbance

Construction of the Proposed Action would include ground-disturbing activities that would expose soils and generate soil stockpiles. Rain could erode soils and carry it to adjacent waterways, such as the Columbia River and CDID #1 ditches, and temporarily increase turbidity.

Although background turbidity in the Columbia River may change by orders of magnitude following storm events, if increased turbidity is sustained for several days it could affect surface

[4] Temporary erosion and sediment control plans are developed and implemented to comply with SWPPP, discharge sampling and reporting requirements in the NPDES Construction Stormwater Permit, issued by Ecology.

water quality through interference with photosynthesis, oxygen exchange, and the respiration, growth, and reproduction of aquatic species. The potential for erosion during most ground-disturbing activities is considered low because the project area is relatively level and appropriate erosion and sediment control measures would be required by regulatory agencies through the NPDES Construction Stormwater Permit, thus reducing the potential for impacts on water quality.

The CDID #1 ditches collect water from roads, parking lots, yards, and other land uses that contribute to elevated turbidity levels and pollutants that are discharged to the Columbia River. Both Ecology and Oregon DEQ have standards for turbidity increases from construction (Section 1.2, *Regulatory Setting*). These include the Water Quality Standards for Surface Waters of the State of Washington; Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon; and Oregon State Legislature: Turbidity Rule. Runoff from the project area would be required to meet the terms and conditions of all permits issued for the Proposed Action; thus, during construction, the Proposed Action would be expected to maintain water quality conditions in the receiving waters, but could even provide some improvement to the quality of water discharged from the site to the CDID #1 ditches. Overall, the construction activities associated with the Proposed Action would not be expected to cause a measurable impact on water clarity, water quality, or biological indicators, nor would they affect designated beneficial uses.

The Applicant has identified the following design features and best management practices to be implemented as part of the Proposed Action, which were considered when evaluating potential impacts of temporary discharges to surface waters. Some of the best management practices that would be used through the adaptive management process and would be evaluated during the NPDES process.

- **BMP C105: Stabilized Construction Entrance/Exit.** Installed and maintained through the duration of demolition, site preparation, preloading, and construction.
- **BMP C106:** Wheel Wash. Installed and used at the entrance of the project area to prevent sediment from being tracked off site.
- **BMP C107:** Construction Road/Parking Area Stabilization. Roads, parking areas, and other on-site vehicle transportation routes would be stabilized to reduce erosion caused by construction traffic or runoff.
- **BMP C140:** Dust Control. Used to prevent wind transport of dust from disturbed soil surfaces. Either water or polyacrylamide would be used prevent soil erosion.
- **BMP C153:** Material Delivery, Storage, and Containment. Used to prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage.
    - Storage of hazardous materials onsite would be minimized to the extent feasible.
    - Materials would be stored in a designated area, and secondary containment would be installed where needed.
    - Refueling would occur in designated areas with appropriate spill control measures.
- **BMP C154:** Concrete Washout Area. Constructed near the entrance to the project area to prevent or reduce the discharge of pollutants to stormwater from concrete waste by

conducting washout off site, or performing on-site washout in a designated area to prevent pollutants from entering surface waters or groundwater.

- **BMP C162:** Scheduling. Would reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.
- **BMP C200: Interceptor Dike and Swale.** A ridge of compacted soil or a ridge with an upslope swale would be provided at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. The dike or swale would be used to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This would be used to prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.
- **BMP C203: Water Bars.** A small ditch or ridge of material would be constructed diagonally across roads as needed to prevent gullying.
- **BMP C207: Check Dams.** Constructed to reduce the velocity of concentrated flow and dissipate energy at the check dam.
- **BMP C209: Outlet Protection.** Prevent scour at conveyance outlets and minimize the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.
- **BMP C220: Storm Drain Inlet Protection.** Installed at several locations across the project area to prevent coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.
- **BMP C233: Silt Fence.** Constructed around the entire project area to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.
- **BMP C241: Temporary Sediment Pond(s).** Designed and constructed to remove sediment from runoff originating from disturbed areas of the project area.

Implementation of BMP C241: Temporary Sediment Pond would result in the creation of water quality ponds (wetponds) based on the proposed site grading and drainage areas. These wetponds would be sized to treat the volume and flow from a water quality design storm event (72% of the 2-year storm). Additional storage would be provided within the coal storage area such that the runoff would always be treated within the stockpile area, even for larger storm events.

These wetponds are part of Facility 73 and would be designed to provide sufficient capacity for sediment settlement as the stormwater flows through the ponds during construction. Weekly inspection and inspection within 24 hours of a rain event would be required under the NPDES Construction Stormwater Permit. The inspections would be performed by a Certified Erosion and Sediment Control Lead. In the event that the wetponds reach their capacity, existing wetponds would be expanded or additional wetponds would be constructed sufficient to handle the amount of stormwater and sediment generated. Oil and grease components would be removed by mechanical skimmer. If treatment through the wet ponds is insufficient, filtration treatment would further remove suspended solids, associated particulate metals, and oil and grease. Filtration is initiated when effluent is greater than 15 NTUs for 20 minutes; otherwise, if stormwater is below 15 NTUs following settling, the filtration plant is bypassed. Subsequently,

treated water would be conveyed downstream to the existing pump station outfall 002A that discharges into the Columbia River via an existing 30-inch steel pressure line or harvested for circulation around the site for multiple uses, including dust control measures.

CDID #1 ditches are used for controlling floods, removing stormwater from areas that are protected behind levees, and conveying and discharging that stormwater to the Columbia River. The CDID #1 ditches collect water from roads, parking lots, yards, and other land uses that contribute to elevated turbidity levels and pollutants that are discharged in the Columbia River. Because runoff from the project area would be required to meet the terms and conditions of all permits issued for the Proposed Action, construction may provide some improvement to the quality of water that is discharged from the site to the CDID #1 ditches.

Overall, the construction activities associated with Proposed Action would not be expected to cause a measurable impact on water clarity, water quality, or biological indicators; nor would construction affect designated beneficial uses.

Temporarily Release Contaminants Associated with Equipment and Material Use

The delivery, handling, and storage of construction materials and waste, as well as the use of heavy construction equipment could provide sources for stormwater contamination. Use and maintenance of heavy equipment could result in leaks or spills of vehicle fluids (i.e., fuel, lubricants, hydraulic fluid) on exposed parts of the equipment or onto the ground, where it could enter nearby surface water bodies through surface runoff. Constituents in vehicle fluids such as fuel, oil, hydraulic fluid, and grease can be acutely toxic to aquatic organisms and could degrade water quality and bioaccumulate in the environment. Chemicals typically used during construction including paints, solvents, and cleaning agents, which could also enter ground and surface waters through infiltration and stormwater runoff if such substances are spilled or exposed to precipitation. These substances can also be toxic to aquatic organisms and can degrade water quality. Construction waste such as metal, welding waste (e.g., scrap electrodes, slag, flux), and uncured concrete could be a potential source of pollution to water resources. Waste metals and welding wastes contain heavy metals and other chemicals and uncured concrete has a high pH, all of which can degrade water quality and be harmful to aquatic organisms (Washington State Department of Ecology 2014a). Additionally, staging areas or building sites can be sources of pollution because of the use of paints, solvents, cleaning agents, and metals during construction. Impacts associated with metals in stormwater include bioaccumulation and toxicity to aquatic organisms and contamination of drinking supplies.

Development and implementation of a site-specific construction SWPPP that includes best management practices for material handling and construction waste management would reduce the potential for water quality impacts from these sources. The following typical SWPPP best management practices would help prevent releases to surface waters.

- All fuel and chemicals would be stored and handled properly to ensure no opportunity for entry into the water.
- No land-based construction equipment would enter any shoreline body of water except as authorized.
- Equipment would have properly functioning engine closures (i.e., hydraulic, fuel, lubricant reservoirs) according to federal standards; the contractor would inspect fuel hoses, oil or

fuel transfer valves, and fittings on a regular basis for drips or leaks to prevent spills into the surface water.

- The contractor would have a spill containment kit on site, including oil-absorbent materials, to be used in the event of a spill or if any oil product is observed in the water.

Furthermore, the spill response time would be relatively quick and proper spill response equipment would be labeled and available. Quantities of hazardous materials would during construction typically be fewer than 50 gallons), and response time would be relatively quick on site. A fuel truck would visit the site as needed during operations. The frequency would vary based on usage and could range from once or twice per day, to once or twice per week. The trucks would have a capacity of 3,000 to 4,000 gallons. A spill could have potential impacts on water quality if the spill were to reach surface waters, which could affect aquatic species and habitats. A spill within the project area would be contained, conveyed, and treated within the proposed stormwater system (i.e., material spilled within the project area would be contained and would not be discharged to surface waters outside the project area).

Construction activities would involve preloading and installing vertical wick drains to aid in the consolidation of low-consistency silt and low-density sand (i.e., unconsolidated materials). Wick drains would direct groundwater from the shallow aquifer upward toward the surface during preloading, where the water would discharge. Water discharged from the wick drains would be captured, tested for contaminants, and treated prior to discharge to any surface waters. Although water discharged from the wick drains is not anticipated to be contaminated, it would be tested to ensure any contaminated water is not discharged, and no impact on water quality is anticipated. See the SEPA Groundwater Technical Report (ICF 2017a) for additional information regarding water discharged from wick drains.

Temporarily Mobilize Pollutants or Increase Turbidity from In-Water Work and Dredging

Construction of the Proposed Action would require dredging an estimated 500,000 cubic yards of sediment from the river to provide site access from the Columbia River navigation channel and berthing at Docks 2 and 3. The work necessary to construct the approach trestle and Docks 2 and 3 would require in-water work that could resuspend pollutants and sediment and increase turbidity.

Dredging would permanently deepen a 48-acre area, all of which is in deep water (at least -20 feet) to a target depth of -43 feet CRD with a 2-foot overdredge allowance. The deepening would require dredging of up to approximately 16 feet (vertically) of sediment. It is anticipated that the sediment within the dredge prism[5] for Docks 2 and 3 would be deemed suitable for flow-lane disposal or beneficial use in the Columbia River. Dredging would be conducted using a barge-mounted mechanical clamshell dredge with material loaded into a bottom-dump barge for transport to an approved dredge material disposal site once the barge is full. Dredging could also be conducted using a hydraulic dredge. These methods do not require dewatering. The dredging permit would require testing the sediment and determining suitability for flow lane disposal.

Dredged material would be suitable for flow-lane disposal or beneficial use in the Columbia River based on recent sediment sampling that suggests that sediments from the deepwater

[5] Total volume, typically trapezoidal in shape of the channel bottom to be removed by the dredging process.

areas of the Columbia River are composed of silty sands with a low proportion of fines and low total organic carbon (Grette Associates 2014e). The Sediment Evaluation Framework for the Pacific Northwest was developed by EPA and the U.S. Army Corps of Engineers (Corps) as a toolbox for determining the proper disposal method for dredge material including flow-lane disposal. This framework is designed to allow for project-specific concerns and can adapt to projects of any size. Generally, the framework outlines the level of detail required for the sediment characterization study to determine the presence or extent of contamination based on initial sampling. If flow lane disposal is approved, the disposal area for dredged materials would require approximately 80 to 110 acres, based on recent flow-lane disposal for disposing of material from the adjacent Dock 1 (Grette Associates 2014a). However, the actual acreage of the disposal site would be determined by the permitting agencies. Recent authorizations for flow-lane disposal of dredged materials in the Columbia River near the project area were generally in or adjacent to the navigation channel between approximately river mile 60 and 66) (Grette Associates 2014c).

Dredging and in-water work would result in temporary increases in suspended sediment and turbidity. Sediment sampling from within, adjacent to, and upstream of the project area has demonstrated that in deepwater areas of the Columbia River, sediments are typically composed of silty sands with a low proportion of fines (e.g., silt or mud) and very low total organic carbon. Further, sediments sampled from deepwater areas near the project area have consistently met suitability requirements for flow-lane disposal or beneficial use in the Columbia River (Grette Associates 2014c). Thus, it is anticipated that sediment within the dredge prism for Docks 2 and 3 would be deemed suitable for flow-lane disposal or beneficial use in the Columbia River. However, prior to obtaining a dredging permit, the Applicant would conduct site-specific sediment sampling to characterize the proposed dredge material and ensure compliance with the Dredged Materials Management Plan (Grette Associates 2014c).

Standard best management practices for working in aquatic areas would be followed to maintain acceptable water-quality conditions, including but not limited to maintaining appropriate standards for construction-related turbidity (including during active dredging and flow-lane disposal, if used), minimizing the risks of unintended discharges of materials such as fuel or hydraulic fluid, and managing construction debris. In addition, typical construction best management practices for working over, in, and near water would be applied, including checking equipment for leaks and other problems that could result in discharge of petroleum-based products, hydraulic fluid, or other material to the Columbia River. The following best management practices are related to in-water work and apply during the construction period.

- The contractor would use tarps or other containment methods when cutting, drilling, or performing over-water construction that might generate a discharge to prevent debris, sawdust, concrete and asphalt rubble, and other materials from entering the water.
- The contractor would to retrieve any floating debris generated during construction using a skiff and a net. Debris would be disposed of at an appropriate upland facility. If necessary, a floating boom would be installed to collect any floated debris generated during in-water operations.

Construction of the approach trestle and Docks 2 and 3 would require construction activities both in-water and over-water and waterward of the ordinary high water line, which is 11.1 feet CRD. The Applicant currently anticipates the in-water work will require up to 2 years (over two approved in-water work windows) to complete Docks 2 and 3 and the associated trestlework,

depending on permit restrictions. In-water work windows would avoid and minimize impacts on various natural resources, most notably federally protected fish species, as described in the SEPA Fish Technical Report (ICF 2017c). In-water construction would primarily involve dredging, pile driving and removal of pile dikes and would use barge-based equipment and purpose-built vessels, although some work would likely be supported from land. A total of 610 of the 630 36-inch diameter steel piles required for the trestle and docks would be placed below the ordinary high water mark, permanently removing an area equivalent to 0.10 acre (4,312 square feet) of river bottom. The construction would also remove 225 feet of the deepest portion of timber pile dikes (Grette Associates 2014a). Piles would be driven and removed via vibratory methods. Piles would be driven and removed using vibratory methods. Vibratory methods are likely to result in localized, short-term resuspension of sediment but to a lesser extent than would be caused by impact methods. Vibration methods reduce friction between the pile and substrate to avoid disturbing large amounts of sediment (Oregon State Marine Board 2012).

According to hydrodynamics modeling from Grette (2014a), strong down-current flow is evident by erosional scour marks along the dredge cut. Therefore, sediments disturbed during dredging activities would be expected to move downstream. However, initial sediment physical and chemical characterization at the project area shows sediments are typically silty sands with low proportions of fines and organic material, thus reducing the potential to increase turbidity as compared to silty mud or sediments with high concentrations of organic material. Therefore, the period of increased turbidity at the project area is anticipated to be relatively short as sandy particles settle out of suspension more quickly than fine-grained materials. Furthermore, the vast majority construction would occur at relatively deep (less than 20 feet CRD) locations, which also reduces the potential for sediment disturbance during vessel maneuvering (Grette 2014a).

The remobilization of nutrients would be temporary and not likely in quantities large enough to cause algal blooms due to the river's continual flow. Furthermore, dissolved oxygen depletion during dredging is not typically a concern in the Columbia River because of the sandy characterization of river sediments. Any in-water construction impacts would be highly localized and confined within the area around the in-water work.

The following best management practices would avoid and minimize potential impacts from pile removal and installation activities.

- The contractor would remove piles slowly to minimize sediment disturbance and turbidity in the water column.
- Prior to pile extraction the contractor would "wake up the pile to break the friction between the pile and substrate to minimize sediment disturbance.

Another potential water quality impact from in-water work is the possibility for creosote releases resulting from the removal of existing creosote-treated timber piles associated with two pile dikes. Creosote is a wood preservative that has been used for over a century to treat wood, including piles. Creosote is composed of more than 300 chemicals, including PAHs. PAHs at sufficient levels have been shown to be fatal to marine life (Washington Department of Natural Resources 2008). The removal of creosote-treated piling would result in temporary suspension of sediments and a potential long-term increase in the exposure of creosote in the study area. Over the long-term, the source of creosote would be removed or capped by the

sediment falling into the hole left by the extracted pile. The concentration of creosote in the sediment would decrease, water quality would improve, and the pathway of exposure for fish through contamination of prey would be reduced. The exposure of creosote would be caused by the removal of piles that have been buried in an anoxic zone that leaves the creosote highly volatile when re-exposed to water. This creosote could be suspended in the water column and contaminate the adjacent sediments. Additionally, droplets of previously unexposed creosote could be released from the piling into the surrounding sediments because the droplets are heavier than water. To minimize this impact, the contractor would follow the following standard best management practices for removal of creosote-treated wooden piles.

- **Pile removal.** If possible, the contractor would use vibratory extraction, the preferred method of pile removal. A major creosote release to the environment could occur if equipment (bucket, steel cable, vibratory hammer) pinches the creosoted piling below the water line. Therefore, the contractor would keep the extraction equipment out of the water to the extent practicable to remove the piling. Cutting would be necessary if the pile were to break off at or near the riverbed, which means it could not be removed without excavation. Pile cutoff would be an acceptable alternative if vibratory extraction or pulling were not feasible. The piling would be cut 2 feet below the riverbed, and the subsequent hole would be filled and capped with clean sand.
- **Disposal of creosote-treated piling, sediment, and construction residue.** The contractor would place the pulled pile in a containment basin to capture any adhering sediment immediately after the pile is removed. Containment basins typically have continuous sidewalls and controls as necessary (e.g., straw bales, oil absorbent boom, plastic sheeting) to contain all removed materials and prevent re-entry into the water. The type and location (e.g., barge, land) of the containment basin would be determined when the contractor's work plan is developed. Cut-up piling, sediments, construction residue, and plastic sheeting from the containment basin would be packed into a container and disposed of at a facility in compliance with federal and state regulations.

Above-water work would include installing pile-supported elements of the dock structures and coal-handling infrastructure and equipment. Some concrete components (such as the dock decking, crane rail supports, and pile caps) would need to be cast in place. Appropriate techniques and best management practices, such as the use of a bib, would avoid and minimize the potential for wet or uncured concrete to come in contact with the Columbia River.

Materials handling infrastructure and equipment such as shiploaders and conveyors would be delivered by barge and off-loaded by crane directly to the docks and trestle. Barges would not offload materials or equipment to any area below the ordinary high water mark of the Columbia River. As much as practicable, infrastructure would be prefabricated so that above-water work would largely consist of installation and assembly.

Impacts on water quality from in- and over-water work would be addressed in the Water Quality Monitoring and Protection Plan to be prepared by the Applicant and approved by Ecology. Impacts on water quality from dredging would be minimized with the implementation of a dredging and disposal quality control plan in compliance with the dredged material management program as required by State agencies (Ecology and Washington State Department of Natural Resources) and federal agencies (the Corps and EPA). Dredging and disposal activities would be assessed and evaluated in the dredged material management program based on

established policies and guidelines. The *Dredged Material Management Program User Manual* provides technical and policy guidance on the preparation of the quality control plan.

The quality control plan would include dredging methods and procedures to minimize water quality impacts, disposal protocols (whether upland or in-water), a water quality monitoring plan, and contingencies for water quality exceedances. Adhering to the plan would avoid and minimize impacts, ensuring potential impacts are temporary and localized in nature. No long-term changes in the baseline conditions within the study area would be expected to occur.

Temporarily Introduce Hazardous or Toxic Materials from Demolition Activities

Demolition of the existing structures in the project area (i.e., cable plant building, potline buildings, and small ancillary structures) has the potential to affect water quality by disturbing soil or building parts and debris that may contain hazardous or toxic materials. The existing structures are primarily made from steel, aluminum, concrete, and wood and may contain asbestos and lead. As discussed in the SEPA Hazardous Materials Technical Report (ICF 2017d), a survey of each existing on-site structure has identified if asbestos or lead is present. In addition to disturbing soil, demolition of the existing buildings would result in a significant amount of debris that may contain hazardous materials such as asbestos or lead. Demolition of buildings with concrete components would also generate concrete dust.

Concrete dust from demolition produces a strong alkaline solution that can drastically increase pH and cause chemical burns to fish, insects, and plants. If concrete dust is not properly contained during demolition, it can run off in stormwater and cause substantial harm to aquatic environments and organisms.

This impact would be minimized by the collection and removal of all concrete and other structural debris and the collection and treatment of all stormwater from the site prior to discharge to surface waters. The implementation of best management practices in compliance with the NPDES Construction Stormwater Permit that would be obtained for the Proposed Action would reduce the potential for demolition-related pollutants to enter and contaminate surface waters. Overall, the demolition activities associated with the Proposed Action would not be expected to cause a measurable impact on water quality or biological indicators, nor would they affect designated beneficial uses.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on water quality because construction impacts would be limited to the project area and not occur later in time or farther removed in distance than the direct impacts.

3.1.3 Operations: Direct Impacts

Operation of the Proposed Action would result in the following direct impacts.

Although most operations impacts would be as described below, relatively large-scale coal spills could occur in the study area. The trains proposed to bring coal to the project area would hold approximately 122 tons per car and there would be 125 cars per train (8 loaded trains and 8 empty trains per day). The Panamax shipping vessels, with an average capacity of 65,000 deadweight tonnage would be used to transfer the coal to its final destination (Maritime Connector 2015). A

large-scale coal spill could affect a variety of local and regional water resources for extended periods. Refer to the SEPA Rail Transportation Technical Report, the SEPA Vessel Transportation Technical Report, and the SEPA Coal Technical Report (ICF 2017e, 2017f, 2017g) for more discussion of potential spills.

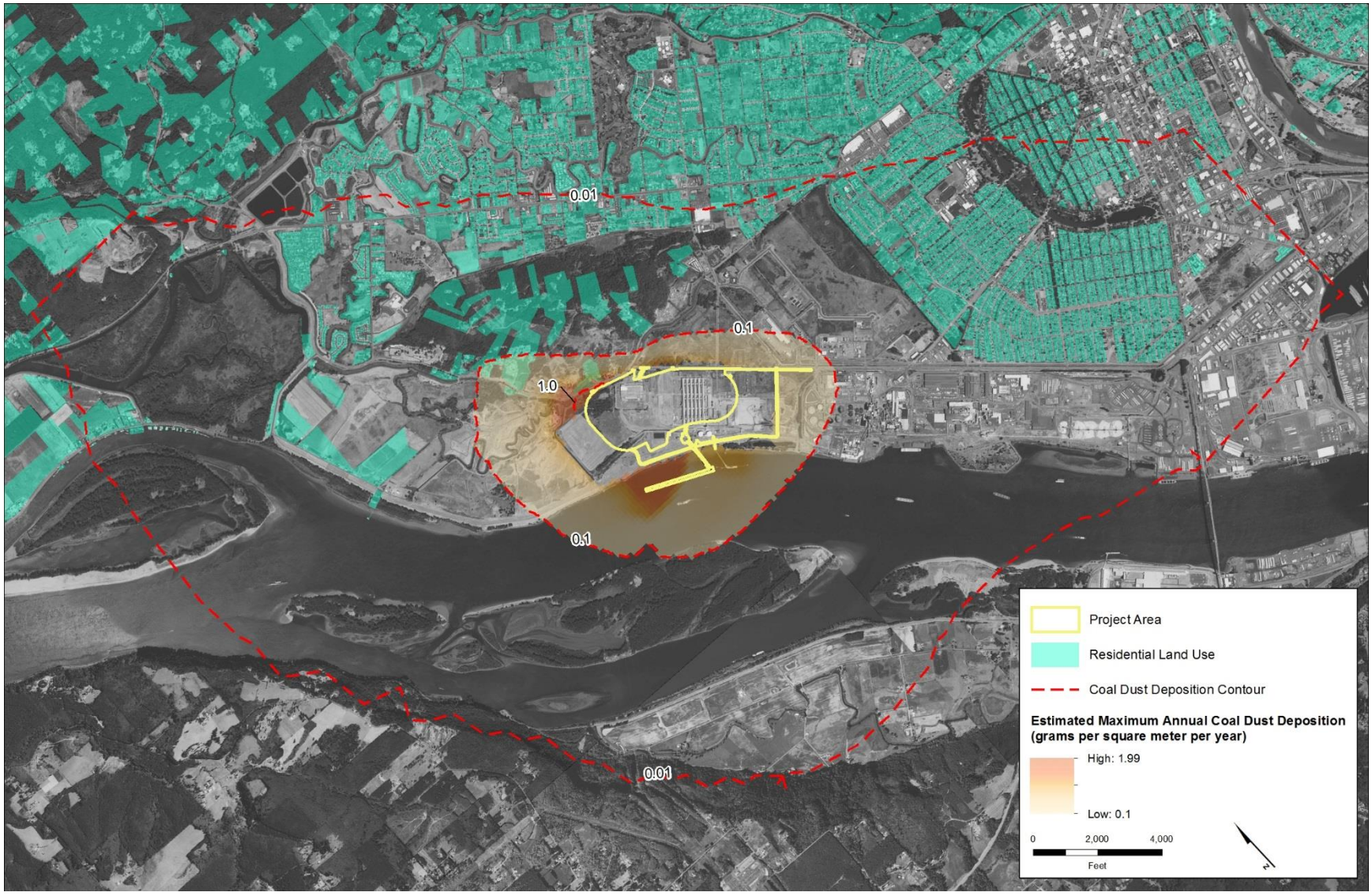
Introduce Contaminants from Coal Spills and Coal Dust

Coal and coal dust could enter the Columbia River directly or through the surrounding drainage channels from spills during loading or unloading or through airborne transport of coal dust during operations. The extent of average annual coal dust deposition was modeled and mapped (Figure 5). Coal dust is anticipated to deposit a maximum of 0.40 gram per square meter per month (g/m^2/month) adjacent to the project area. This amount of deposition is well below the benchmark for dust nuisance impacts (2.0 g/m^2/month), which is defined as the level of dust deposition that affects the aesthetics, look, or cleanliness of surfaces. Annually, coal dust is anticipated to deposit a maximum of 1.99 grams per square meter per year (g/m^2/year) adjacent to the proposed export terminal, including at Docks 2 and 3 in the Columbia River. Additional information on these deposition levels is provided in the SEPA Coal Technical Report (ICF 2017g). The spatial extent of the maximum annual coal dust deposition near the project area is shown in Figure 5.

At sufficient quantities, coal and coal dust in marine and estuarine environments have similar adverse effects as elevated levels of suspended sediments on water quality (Ahrens and Morrisey 2005). During periods of lower flow, a smaller amount of coal dust could have a greater impact on water quality. Impacts include increased turbidity, which can interfere with photosynthesis and increase water temperatures (Ahrens and Morrisey 2005). Coal and coal dust in the water column can also affect marine organisms through abrasion of tissue, smothering and clogging of respiratory and feeding organs (Ahrens and Morrisey 2005). However, at a maximum deposition rate of 1.99 g/m^2/year adjacent to the project area, and at the minimum flow[6] recorded over the 23-year period of record for 1 day, coal dust deposition directly into the river assumed to be an area of approximately 3 million square meters (1.16 square miles) in the study area would result in a change in suspended sediment concentration of less than 1 part per 10 billion (7.5e-05 mg/L). This change would not be measureable and is not anticipated to increase turbidity or increase water temperature, or affect marine organism functions (e.g. respiration, feeding).

[6] The minimum recorded flow at the Columbia at Beaver Army Terminal, Quincy, OR is 65,600 cfs (1969 to 2014).

Figure 5. 3-Year Annual Average Coal Dust Deposition



Coal and coal dust captured in water runoff (e.g., from precipitation that falls on the stockpile areas and water used for dust suppression) would be collected in the stockpile pads (low-permeability surfaces allowing minimal infiltration), conveyed in an enclosed stormwater system, and treated at Facility 73 in settling ponds before being discharged from the site. Some settled coal dust from the project area could discharge to the Columbia River through CDID #1. If coal dust from the project area accumulated without being disturbed throughout the dry season (assumed 120 days), the anticipated change in suspended sediment concentration in the Columbia River in the study area for the minimum recorded flow over 1 day would be approximately 0.0192 mg/L. This change would not be measureable and likely would not increase turbidity or water temperature, or affect marine organism functions (e.g. respiration, feeding).

The Proposed Action would employ dust suppression systems throughout the coal export terminal, including the tandem rotary dumpers, all conveyors, stockpile pads, surge binds, transfer towers, and trestle. Approximately one-third of the conveyor belts would be closed, as would the shiploaders, to limit the release of coal dust. The dust suppression system would employ sprayers and foggers to capture coal dust. Dust suppression water would be collected and conveyed through the stormwater collection, conveyance, and treatment system. Once treated, the water would be reused or, if not needed (if sufficient water is stored in the on-site water storage pond), discharged to the Columbia River. All water discharged to the Columbia River would be required to meet specific water quality standards outlined in the NPDES permit prior to discharge. If stormwater is collected and used for industrial beneficial use (such as dust control), a Water Rights Permit would be required in accordance with RCW 90.03.

Coal contains trace amounts of toxic elements. Coal has a heterogeneous chemical composition; therefore, specific impacts related to the toxic contaminants of coal are highly dependent on coal composition and source (Ahrens and Morrisey 2005). The majority of coal transloaded at the proposed coal export terminal is expected to be mined in the Powder River Basin, with lesser amounts sourced from the Uinta Basin in Utah and Colorado. Trace elements of environmental concern (TEEC) in Powder River Basin and Uinta Basin coal include antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, and uranium. These elements are generally low in coals from both of these basins compared to other mining regions, although exact concentrations are not reported (U.S. Geological Survey 2007). Table 7 presents the average concentrations of each TEEC sampled in parts per million. However, at a maximum coal dust deposition rate of 1.99 g/m^2/year adjacent to the project area and at the minimum flow recorded over the 23-year period of record for 1 day, TEEC deposition directly into the Columbia River[7] would result in unmeasurable changes in concentration for each of the elements of concern on the order of $1x10^{-13}$ to $1x10^{-15}$ grams per liter (g/L). If coal dust from the project area accumulated without being disturbed throughout the dry season (assumed to be 120 days), the anticipated change in TEEC concentration for the minimum recorded flow over one day would be on the order of $1x10^{-10}$ to $1x10^{-12}$ g/L. Again, this change would not be measureable and is not anticipated to affect human health or marine organism functions (respiration, feeding).

Toxic constituents of coal include PAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, along with mineral

[7] Assumed to be an area of approximately 3 million square meters (1.16 square miles) in the study area

impurities in the coal and environmental conditions, determine whether these compounds can be leached from the coal. Some PAHs are known to be toxic to aquatic animals and humans.

Metals and PAHs could also leach from coal to the pore water of sediments. However, the low aqueous extractability and bioavailability of the contaminants minimizes the potentially toxic effects. One review of coal dust's chemical composition (U.S. Geological Survey 2007) suggests that the risk of exposure to concentrations of toxic materials (e.g., PAHs and trace metals) from coal are low because the concentrations are low and the chemicals bound to coal are not easily leached. Another study by Rust et al. (2004) found virtually no desorption of any PAH in coal and that the bioavailability of coal-derived PAHs usually was too low to be measured. Furthermore, the type of coal anticipated to be exported from the coal export terminal is alkaline, low in sulfur, and low in trace metals. The conditions to produce concentrations in pore waters are not present in a dynamic riverine environment. This would further support the view of Ahrens and Morrisey (2005) that the bioavailability of such toxins would likely be low.

In summary, coal dust from project operations is not expected to have a demonstrable effect on water quality. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals) would be relatively low as these chemicals tend to be bound in the matrix structure and not quickly or easily leached. Further, particles would likely be transported downstream by the flow of the river and either carried out to sea or distributed over a sufficiently broad area that a measurable increase in concentrations of a toxic chemical in the Columbia River would be unlikely. The annual deposition of coal dust could be as high as 1.99 g/m^2/year adjacent to the project area. However, because toxic chemicals in coal dust tend to be bound to the matrix structure of the coal and are not quickly or easily leached, they would likely not result in a significant increase in chemical indicators in the Columbia River and would likely not cause a measurable impact on water quality or biological indicators nor would they affect designated beneficial uses.

An evaluation of a potential coal spill as well as potential impacts associated with coal dust are described in the SEPA Coal Technical Report (ICF 2017g).

Because the rate of coal dust deposition is so low, it is likely unmeasurable and the concentration of TEEC are considered low. Therefore, impacts of dispersed coal, coal dust, and coal dust constituents on water quality are anticipated to be low.

Table 7. Average Concentration of Trace Elements in Wyodak and Big George Coal Beds, Powder River Basin, Wyoming and Miscellaneous Uinta Basin Coal Beds in Colorado Plateau

Trace Element of Environmental Concern	Average Concentration in Sampled Coal (ppm)	
	Powder River Basin	Uinta Basin
Antimony	0.10	0.7
Arsenic	1.43	2.2
Beryllium	0.18	1.5
Cadmium	0.06	0.1
Chromium	2.63	6.1
Cobalt	1.93	2.0
Lead	1.26	13.9
Manganese	10.05	28.2
Nickel	1.58	4.5
Selenium	0.57	1.4
Uranium	0.46	1.8

Sources: U.S. Geological Survey 2007, Pierce and Dennen 2009
ppm = parts per million

As part of operations, any stormwater runoff from the storage and stockpile areas would be collected and conveyed to water quality treatment facilities. Stormwater would be treated prior to discharge to surface waters to avoid and minimize water quality degradation. Approximately 4,900 linear feet of the 16,100 linear feet of conveyor belts would be enclosed, as would the shiploaders to limit the potential for coal or coal dust to affect water quality.

Rail cars carrying coal would be treated with topping agents or surfactants to the surface of loaded coal to control dust. These agents generally consist of glue (polyvinyl acetate), alkyl alcohol, guar gum, or vegetable oils mixed with water. These chemicals could enter the Columbia River directly from spills during loading or unloading; however, they are nontoxic and would not introduce pollutants of concern (Agency for Toxic Substances and Disease Registry 1992).

Introduce Contaminants from Maintenance Operations

Potential contaminants, including diesel fuel, oils, grease, and other fluids would be required for the operation and maintenance of heavy equipment and machinery used to transport, store, move, and load coal at the coal export terminal. Normal operations and maintenance activities at the project area would not result in a direct discharge of pollutants or process water into surface water or groundwater. Most operation-related impacts would result from inadvertent spills of potentially hazardous materials such as petroleum products (fuel, lubricants, and hydraulic fluids) or industrial solvents either directly into surface waters or in locations where they could be transported and discharged to surface water or groundwater. These potential releases would be relatively small (less than 50 gallons) and limited in their extent and duration (localized and short-term). The designated areas for these activities would mostly be covered and curbed. Runoff from these areas would be contained and treated and largely stored and reused. Furthermore, potential releases of petroleum products required to maintain and operate heavy equipment and machinery would be limited to small drips and would be cleaned and disposed of at an approved facility. Additionally, locomotives have a fuel capacity of 5,000 gallons and could potentially release fuel during operations. Fuel trucks would visit the site as required during operations. The frequency would vary based on usage and could range from once or twice per

day to once or twice per week. Fuel trucks typically have a 3,000- to 4,000-gallon capacity. A spill in the project area would be contained, conveyed, and treated in the proposed stormwater system and would not be discharged to surface waters outside the project area. A spill would be responded to under federal and state laws. The Applicant would be required to manage contaminated stormwater in accordance with the requirements of the NPDES Industrial Stormwater Permit and would avoid and minimize impacts to water quality.

Maintenance dredging for Docks 2 and 3 would be expected to occur every few years or as needed following extreme-flow and sediment-deposition events. Maintenance dredging impacts on water quality would be similar to those discussed for dredging during construction but to a lesser degree because maintenance dredging volumes would be smaller than the initial dredging action during construction based on the estimated accretion rates described below. Preparation and implementation of a dredging and disposal quality control plan, discussed above for construction dredging, would also be employed for maintenance dredging. Similarly to construction-related dredging activities, no long-term changes in the baseline conditions in the study area would be expected to persist because of maintenance dredging. A dredging plan, as discussed for construction dredging, would be prepared for each maintenance dredging event.

Cargo vessels calling at Docks 2 and 3 would require the use of two tugboats to assist with docking and undocking, as described EIS Chapter 5, Section 5.4, *Vessel Transportation*. Once a vessel powers down in preparation for docking, it generally does not engage its main propeller; there are specific conditions (e.g., especially strong currents) or circumstances (e.g., if the vessel requires a quick adjustment) under which the vessel may briefly engage the propeller, but these are not the norm (Gill pers. comm.). Thus, typical cargo vessel operations would not be expected to cause propeller wash-related scour of the side slopes or bottom of the dredge prism. Propeller wash from tugboats would be nearer to the surface and would, thus, have less potential to result in scour or erosion of bottom sediments within the dredge prism.

The following factors would further reduced the likelihood of temporary, localized increases in turbidity from propeller wash. The berthing basin would be dredged to a depth to accommodate the largest vessels calling at Docks 2 and 3, the dredge prism would tie into the navigation channel, Docks 2 and 3 would be parallel to the navigation channel, the slopes would be dredged at a 3:1 (horizontal to vertical) slope, and the sediment would comprise the coarse sediment substrates typical of the mainstem Columbia River.

Sediment accretion in the proposed dredge prism would most likely occur because of bedload transport due to river currents local scour, and sediment redistribution resulting from propeller wash. Hydrodynamic modeling and sediment transport analysis was conducted for the proposed Docks 2 and 3 berthing/navigation basin. Sedimentation is complex in a newly dredged basin. Specific morphologic data are unavailable for the proposed new dredging basin; therefore the rate of accretion can only be estimated. Based on current accretion estimates, a rough estimate for annual accretion height is 0.16 feet (0.07 to 0.26 feet range) and annual accretion volume is 11,675 cubic yards (ranging from 4,670 to 23,350 cubic yards). Maintenance dredging would likely be required on a multiyear basis or following occasions with extreme flow events. Small-scale maintenance dredging could be needed more frequently, especially in the early years following the initial dredging work when higher than normal accretion is more likely (WorleyParsons 2012).

Introduce Contaminants from Stormwater Runoff

Stormwater would be managed in accordance with the requirements of an NPDES Industrial Stormwater Permit for the water management facilities of the coal export terminal. Contaminants such as oil and grease, coal dust, and other chemicals could accumulate on the ground and facility surfaces and become constituents of site stormwater. All stormwater runoff would be collected for treatment before reuse or discharge to the Columbia River. If stormwater is collected and reused for a beneficial industrial use, a water right permit would be required in accordance with Revised Code of Washington (RCW) 90.03.

Coal particulates would be removed from stormwater by allowing the coal dust to settle out in stormwater ponds. The coal dust would be removed from the stormwater ponds and placed back in the coal stockpile area during regular maintenance of the stormwater ponds. Other solids accumulated in the treatment systems not acceptable for reuse would be periodically collected and disposed of at an appropriate off-site disposal site.

As shown in Table 5, the Columbia River is listed as impaired for a number of pollutants. Some of these pollutants may be introduced from stormwater runoff from the project area, but the NPDES Industrial Stormwater Permit would require that all water quality standards are met prior to stormwater discharge to the Columbia River. The following pollutants were detected during monitoring of existing outfalls that would drain the project area: arsenic, fecal coliform (indicator bacteria), and dioxin (Anchor QEA 2014). These pollutants would be expected to continue to be introduced because of the Proposed Action, although maximum reported outfall concentrations for these pollutants fall below established water quality standards.

Continued discharges at existing levels would not cause a measureable increase in chemical indicators in the Columbia River and would not cause a measurable impact on water quality or biological indicators, nor would they affect designated beneficial uses. Any changes in concentrations of these pollutants that may occur during operations would be addressed under the NPDES Industrial Stormwater Permit to ensure water quality standards continue to be met post discharge to the Columbia River.

3.1.4 Operations: Indirect Impacts

Operation of the Proposed Action would result in the following indirect impacts on water quality, which could arise as a result of the increase in vessel and rail traffic could result in indirect impacts on water quality in the Columbia River.

Introduce Contaminants from Coal Spills and Coal Dust

Potential impacts related to introducing contaminants from coal spills and coal dust during rail and vessel transport would be the same as those described in Section 3.1.3, *Operations: Direct Impacts*.

Introduce Contaminants from Maintenance and Operations

Potential impacts related to introducing contaminants from maintenance and operations during rail and vessel transport would be the same as those described in Section 3.1.3, *Operations: Direct Impacts*.

Introduce Contaminants from Shipping Vessels or Rail Transport

Coal would be transported to the coal export terminal via rail, then loaded onto vessels and transported as directed by the purchasers or owners of the coal to its final destination overseas. Water quality could be indirectly affected as a result of transportation of coal within the study area. These impacts are summarized below. Details regarding an operations oil spill while vessels are at dock and bunkering or as a result of a vessel collision are available in the SEPA Vessel Transportation Technical Report (ICF 2017f). Details regarding a release of hazardous materials during rail operations and accidental collision or derailment are discussed in the SEPA Hazardous Materials Technical Report (ICF 2017d) Details regarding coal spills from vessels and rail are available in the SEPA Coal Technical Report (ICF 2017g).

- **Propeller wash.** Propeller wash increases the potential for scour and erosion of the sides and bottom of the navigation channel, and thus could cause temporary, localized increase in turbidity. During transit of the Columbia River to and from Docks 2 and 3, the large propellers on cargo vessels would create turbulence close to the river bottom that could erode bottom sediments. The propeller wash from tugboats transiting to and from Docks 2 and 3 to assist cargo vessels would be nearer the surface and would, thus, have less potential to result in scour or erosion of bottom sediments.

  Counihan et al. (2014) surveyed sediment contaminants in several reaches of the lower Columbia River (including a reach adjacent to the study area) and found that contaminant presence and concentrations in the deeper parts of the river channel, which includes the navigation channel, are lower than other areas of the river channel. The Columbia River navigation channel is routinely dredged, and the study found that the deepest parts of the river channel have erosional deposition patterns where flows are the greatest, sediment transport is high, and coarser sediments are found. These coarser sediments require more energy to mobilize and become suspended. Areas closer to the shoreline were found to be depositional areas with higher amounts of fine sediments, which were found to correlate with the higher presence and concentration of contaminants compared to the deeper erosional areas with coarse sediments. These sediments outside of the navigation channel would be unlikely to be affected by vessels transiting within the navigation channel. Therefore, it is unlikely that contaminant resuspension would be an issue given the low potential for turbidity from vessel movements in the study area and lower occurrence and concentrations of contaminants in the navigation channel.

- **Ballast water.** Ballast water could contain materials that degrade surface waters. Common contaminants include invasive marine plants and animals, bacteria, and pathogens that could result in harm or displace native aquatic species. However, the likelihood of such occurrences is considered low because Proposed Action-related vessels would be required to adhere to the state and federal regulations that control discharge and water quality of ballast water. Oversight of federal ballast water regulations is provided by the U.S. Coast Guard and EPA, and Washington State regulations are administered by the Washington Department of Fish and Wildlife (WDFW). Specifically, Proposed Action-related vessels would be required to implement one of the following ballast water management methods per U.S. Coast Guard ballast discharge regulations (33 CFR 151.2025): install a ballast water management system, use only water from a U.S. public water system, not discharge ballast water, or discharge ballast to a facility onshore or to another vessel for treatment. Regardless of the ballast water management option selected by vessel operators, all ballast

water discharge must meet the U.S. Coast Guard ballast discharge standards (33 CFR 151.2030) and EPA NPDES Vessel General Permit standards. In addition, the Washington State ballast discharge regulations (RCW 77.120.040) include reporting, monitoring, and sampling requirements of ballast water, and all vessels must submit nonindigenous species ballast water-monitoring data. WDFW may also board and inspect vessels under WAC 220-150-033 without advance notice to provide technical assistance, assess compliance, and enforce the requirements of Washington State ballast water management program laws and regulations. All vessel operators would be required to comply with federal and state ballast regulations or risk penalties for violations. Table 8 identifies the U.S. Coast Guard ballast water treatment standards.

In addition, the U.S. Coast Guard sets forth its reporting and recordkeeping requirements in 33 USC 151.2060 and 151.2070 which include the maintenance of written records for 2 years and available upon request.

Table 8. U.S. Coast Guard Ballast Water Treatment Standards

Organism Size Class	Biological Discharge Standards
Organisms greater than 50 µm in minimum dimension	< 10 viable organisms/cubic meter
Organisms less than 50 µm and greater than or equal to 10 µm in minimum dimension	< 10 viable organisms/mL
Indicator organisms must not exceed	
• Toxicogenic *Vibrio cholera* (Serotypes 01 and 0139):	< 1 cfu/100 mL or <1 cfu/gram wet weight zoo plankton samples
• *Escherichia coli*	< 250 cfu/100 mL
• Intestinal enterococci	< 100 cfu/100 mL

Source: Grette Associates 2014f33 CFR 151.2030
µm = micrometer; mL = milliliter; cfu = colony-forming unit
Note: The EPA ballast water treatment standards under the NPDES Vessel General Permit is the same as the U.S. Coast Guard standards.

- **Spills from vessel.** Coal and fuel spills could occur if the cargo tanks on a vessel are ruptured during such events as a grounding or collision. A grounding is when the vessel makes contact with a seabed or channel bottom. The potential for a vessel rupture incident is low. The SEPA Vessel Transportation Technical Report (ICF 2017f) evaluates the risk of vessel-related incidents. The SEPA Hazardous Materials Technical Report (ICF 2017d) discusses actions to be taken for emergency response and cleanup. A spill from a vessel could have significant impacts on water quality based on the location, quantity, and response actions taken. The SEPA Coal Technical Report (ICF 2017g) provides a general evaluation of potential impacts associated with a spill.
- **Day-to-day rail operations.** Day-to-day rail operations could release contaminants to stormwater, including coal dust, metals, hydraulic and brake fluid, oil, and grease from track lubrication. Stormwater would be collected and treated prior to reuse or discharge. Stormwater water would be treated to meet the water quality criteria defined within the NPDES permit that would be issued for the Proposed Action, which would reduce the potential impact
- **Spill from collision or derailment of train.** Fuel or hazardous material spills could occur if trains or rail cars collide or derail. As discussed in the SEPA Hazardous Materials Technical Report (ICF 2017d), if a release of hazardous materials were to occur, the rail operator

would implement emergency response and cleanup actions as required by the Federal Railroad Administration requirements and state law, including Washington State regulations under RCW 90.56. The SEPA Hazardous Materials Technical Report (ICF 2017d) also discusses actions to be taken for emergency response and cleanup. Spills of coal from a rail car could affect water quality based on the location, quantity spilled, and response actions taken. Details regarding coal spills from vessels and rail are available in the SEPA Coal Technical Report (ICF 2017g). A spill from a train could affect water quality. While temporary degradation of water quality conditions could result from a spill or release of hazardous materials, it would be expected that cleanup actions would reduce the magnitude of the spill such that no long-term degradation of water quality conditions persisted.

3.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the Proposed Action. Current operations would continue and the existing bulk product terminal would be expanded. Because existing industrial import and export activities would be expanded, impacts on water quality would be similar to those described for the Proposed Action with respect to potential oils and grease spills from equipment or other raw materials shipped from the coal export terminal. The existing NPDES permit would remain in place, maintaining the water quality of existing stormwater discharges. Maintenance dredging at Dock 1 would continue in accordance with a future maintenance-dredging permit, with dredging occurring every 2 to 3 years.

Any new or expanded industrial uses would trigger a new or modified NPDES permit. Upland buildings could be demolished and replaced for new industrial uses. Ground disturbance would not result in any impacts on waters of the United States and would not require a permit from the Corps. Any new impervious surface area would generate stormwater, but all stormwater would be collected and treated to meet state and federal water quality requirements prior to discharge to the Columbia River.

Chapter 4
Required Permits

The Proposed Action would require compliance with the following permits related to water quality.

- **NPDES Construction Permit.** The construction of the Proposed Action would result in an area of ground disturbance greater than 1 acre and would require a construction stormwater permit. As part of the NPDES permit process, stormwater and wastewater generated on the site will be evaluated and characterized, then the specific language and type of NDPES permit will be determined. This permit is administered by Ecology.
- **NPDES Industrial Stormwater Permit.** The Proposed Action would result in industrial activities such as the operation of transportation facility or bulk station and coal export terminal and would require an industrial stormwater permit. All wastewater and stormwater generated in the project area and potentially discharged from the project area after treatment would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area would be defined and the type of NPDES permit would be determined and issued. This permit is administered by Ecology.
- **Water Rights—Washington State Department of Ecology.** The Applicant would need to ensure that its original water rights are current prior to using those rights. If the Applicant's water rights are current, the Applicant must maintain those water rights. If the Applicant's water rights are partially or fully relinquished, the Applicant must apply for and obtain the necessary water rights. If stormwater is collected and reused for a beneficial use, a Water Right Permit would be required in accordance with RCW 90.03.
- **Clean Water Act Section 404—U.S. Army Corps of Engineers.** Construction of the Proposed Action would require Department of Army authorization from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.
- **Clean Water Act Section 401—Washington State Department of Ecology**. An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act would be required for construction of the Proposed Action.
- **Rivers and Harbors Act—U.S. Army Corps of Engineers.** Construction of the Proposed Action would require Department of Army authorization from the U.S. Army Corps of Engineers under Section 10 of the Rivers and Harbors Act. The Rivers and Harbors Act authorizes the Corps to protect commerce in navigable streams and waterways of the United States by regulating various activities in such waters. Section 10 of the act (33 USC 403) specifically regulates construction, excavation, or deposition of materials in, over, or under navigable waters, and any work that would affect the course, location, condition, or capacity of those waters.
- **Hydraulic Project Approval—Washington Department of Fish and Wildlife.** The Proposed Action would require a Hydraulic Project Approval from the Washington Department of Fish and Wildlife because project elements would affect and cross the shoreline of the Columbia River. The approval would consider impacts on riparian and shoreline/bank vegetation in issuance and conditions of the permit, including for the installation of the proposed docks and piles, as well as for Proposed Action-related dredging activities and other project related in-water work.

Chapter 5
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MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA VEGETATION TECHNICAL REPORT

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Acronyms and Abbreviations

Applicant	Millennium Bulk Terminals—Longview, LLC
BNSF	BNSF Railway Company
BPA	Bonneville Power Administration
CCC	Cowlitz County Code
CDID	Consolidated Diking Improvement District
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CRD	Columbia River Datum
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
g/m^2/year	grams per square meter per year
HGM	hydrogeomorphic code
IPaC	Information, Planning, and Conservation
LVSW	Longview Switching Company
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
PEM	palustrine emergent
PFO	palustrine forested
PSS	palustrine scrub-shrub
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metals Company facility
SEPA	Washington State Environmental Policy Act
UP	Union Pacific Railroad
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources

Chapter 1
Introduction

This technical report assesses the potential vegetation impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, vegetation refers to vascular plants[1] growing in upland and wetland areas; it does not include mosses, liverworts, or algae or vegetation growing submerged in the water (aquatic vegetation). This report describes the regulatory setting, establishes the methods for assessing potential vegetation impacts, presents the historical and current vegetation conditions in the study area, and assesses the potential for impacts on vegetation.

Both upland and wetland vegetation are described in this technical report; however, wetlands as a specific resource are also discussed in the multiple wetland delineation reports prepared by Grette Associates.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the

[1] Vascular plants include those plants that have tissues for conducting or transferring water and minerals throughout the plant.

Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

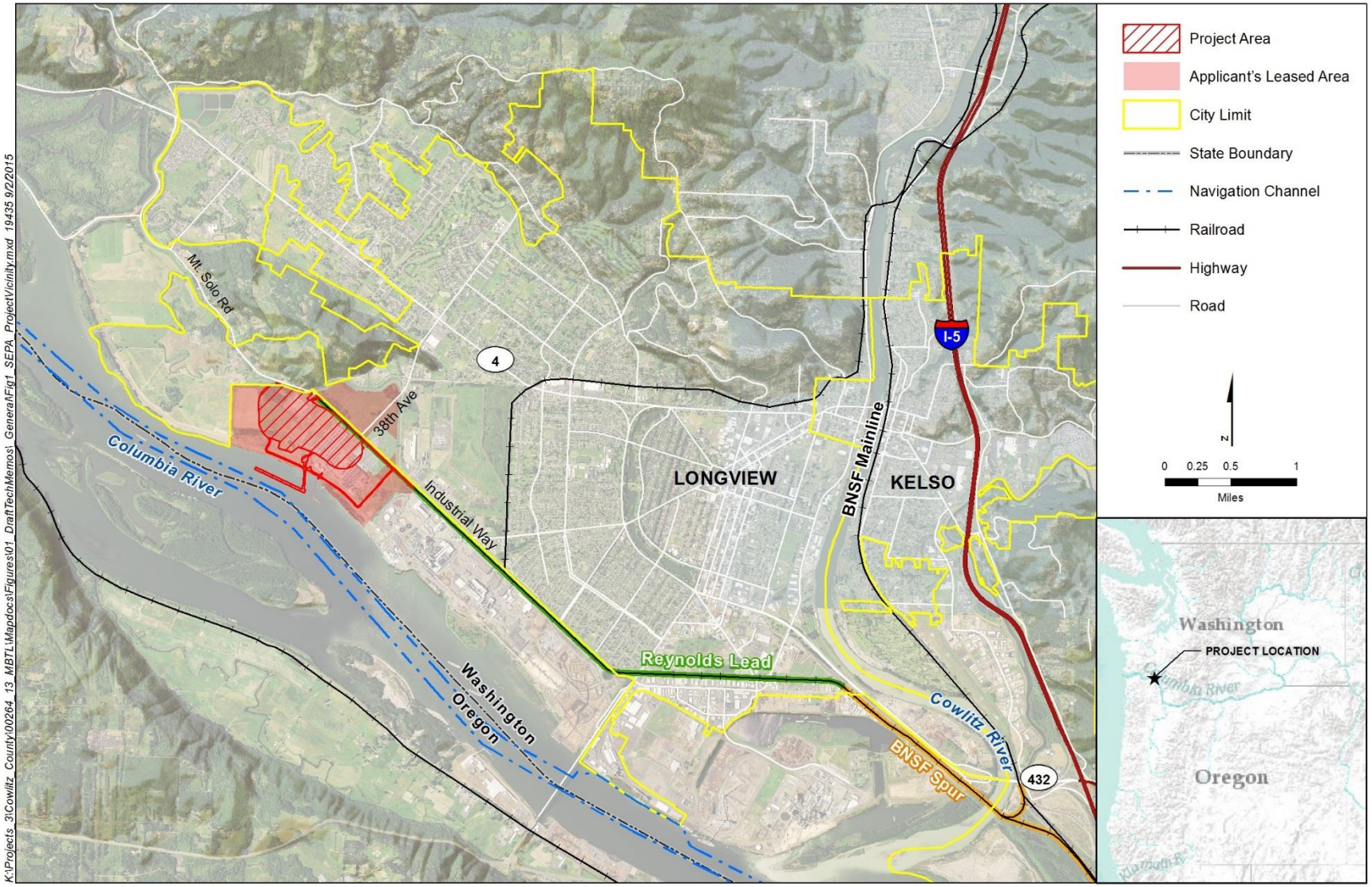
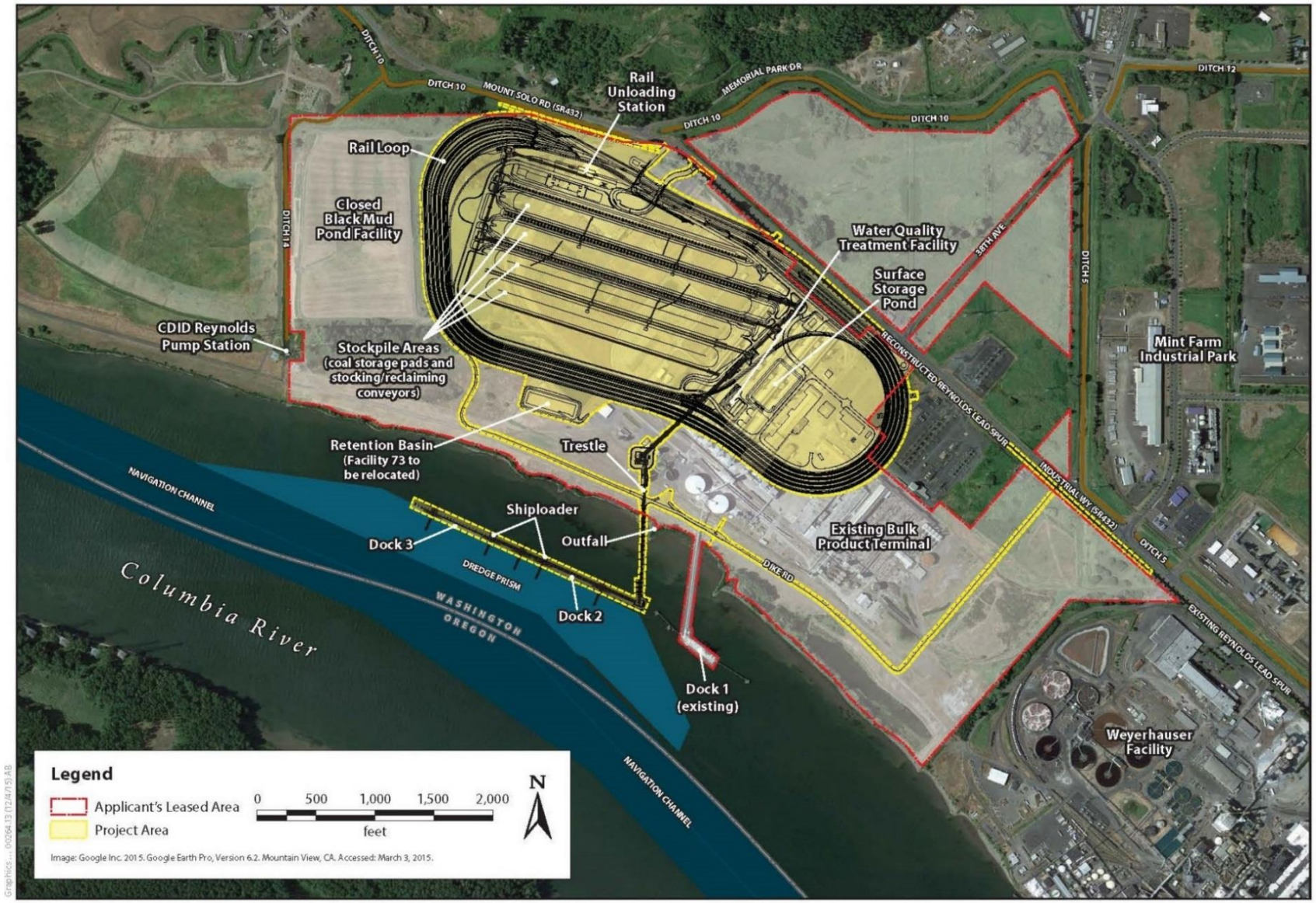


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

Vegetation in general is not a regulated feature of the environment. However, impacts on certain vegetation types or communities are addressed as a component of other regulations, statutes, or guidance focused on a regulated feature (e.g., wetlands), a component of habitat for wildlife, or an environmental element of concern (e.g., noxious weeds). See the SEPA Wildlife Technical Report (ICF 2017a) and reports prepared by the Applicant (Section 2.1.1, *Data Sources*) for further information. In addition, federally listed endangered or threatened species of plants are regulated under the Endangered Species Act, and some species or vegetation communities are protected at a local or state level. For example, the presence of certain types of wetland vegetation (e.g., old growth forest, estuarine wetlands, bogs) can change the regulatory classification of a wetland. Similarly, some jurisdictions have provisions in their critical areas or land development codes that regulate impacts on significant trees (e.g., native coniferous species over a particular size threshold) and on vegetation located within a stream or wetland buffer.

The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential impacts on vegetation are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidance for Vegetation

Regulation, Statute, Guidance	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
U.S. Army Corps of Engineers NEPA Environmental Regulations (33 CFR 230)	Provides guidance for implementing the procedural provisions of NEPA for the Corps. It supplements CEQ regulations (40 CFR 1500–1508).
Clean Water Act (33 USC 1251, *et seq*.)	Authorizes EPA to establish the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Regulates activities in streams, wetlands, and other aquatic resources, including integral vegetated components.
Endangered Species Act (16 USC 1531-1544)	Provides for the conservation of species listed as threatened or endangered and the habitat upon which they depend. Section 7 of the ESA requires federal agencies to consult with USFWS and/or NMFS to ensure a federal action is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of designated critical habitat.
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Washington State Growth Management Act (RCW 36.70A)	Defines a variety of critical areas, which are designated and regulated at the local level under city and county critical areas ordinances.
Washington State Shoreline Management Act (90.58 RCW)	Requires cities and counties (through their Shoreline Master Programs) to protect shoreline natural resources against adverse impacts.
State Water Pollution Control Act (RCW90.48)	Provides Ecology with the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland water, salt waters, watercourses, and other surface and groundwater in the state.
Washington Natural Resource Damage Assessment (RCW 90.56.370)	Holds parties responsible for spilling oil into state waters liable for damages resulting from injuries to public resources.
Oil Spill Natural Resource Damage Assessment (WAC 173-183)	Establishes procedures for convening a resource damage assessment committee and screening resource damages resulting from oil spills to determine which damage assessment to use. Provides for determining damages in cases where the compensation schedule is selected as the applicable damage assessment method.

Regulation, Statute, Guidance	Description
Washington Natural Area Preserves Act	Establishes the Washington Natural Heritage Program to identify candidates for natural areas designated to preserve special-status plant species and regionally important or unique plant communities. Authorizes the program to track plant species and high-quality natural ecosystems in the state and to designate plants with a state status as threatened, sensitive, or endangered. WDNR is the implementing agency.
Washington State Noxious Weed Control Act (RCW 17.10, WAC 16-750)	Establishes noxious weed control boards, which designate certain plant species as Class A, B, or C noxious weeds. Authorizes the management, control, and/or elimination of noxious weed populations in the state.
Washington State Hydraulic Code (RCW 77.55, WAC 220-110)	Considers effects on riparian and shoreline or bank vegetation in issuance and conditions of a hydraulic project approval for construction projects or activities in or near state waters. WDFW is the implementing agency.
Clean Water Act Section 401 Water Quality Certification	Ensures compliance with state water quality standards and other aquatic resources protection requirements under Ecology's authority as outlined in the federal Clean Water Act.
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Critical Areas Protection Ordinance (19.15)	Requires Cowlitz County to designate critical areas, including vegetation in wetlands and their buffers.
City of Longview Critical Areas Ordinance (17.10.140)	Regulates activities within and adjacent to critical areas including vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas.

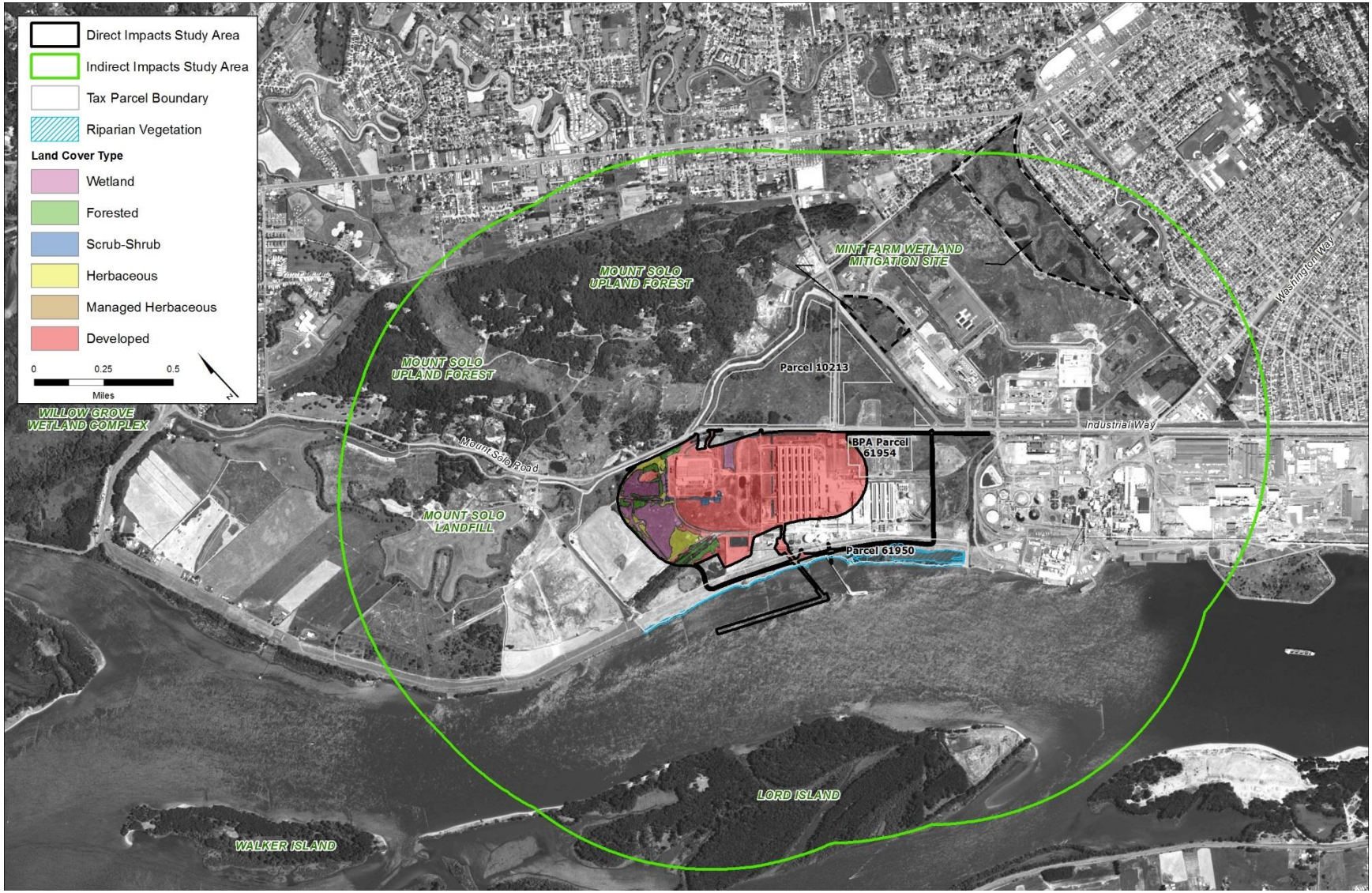
USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; CEQ = Council on Environmental Quality; EPA = U.S. Environmental Protection Agency; ESA = federal Endangered Species Act; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; WAC = Washington Administrative Code; RCW = Revised Code of Washington; Ecology = Washington State Department of Ecology; WDNR = Washington State Department of Natural Resources; WDFW = Washington State Department of Fish and Wildlife; SEPA = State Environmental Policy Act; CCC = Cowlitz County Code

1.3 Study Areas

The 212-acre study area for direct impacts on vegetation is the 190-acre project area plus additional elements (access roads, docks, and rail line) (Figure 3). The indirect impact study area is the area within 1 mile of the project area, for a total of 4,401 acres (Figure 3). This area considers the extent to which potential coal dust deposition could affect vegetation during operations. Vegetation indirect impact study areas were also established for vessel and rail traffic associated with the Proposed Action. These include the Lower Columbia River for potential impacts on shoreline vegetation from Proposed Action-related vessels transiting the Columbia River and rail routes for potential impacts of a coal spill from Proposed Action-related trains in Cowlitz County.

Wetland vegetation is also covered in this technical report; however, wetlands as a resource are discussed in the multiple wetland delineation reports prepared by Grette Associates. The direct impact study area for wetlands is the same as for vegetation, but the wetland indirect impact study area is limited to those wetlands that extend outside of the direct impact study area and are partially affected by the Proposed Action because of ongoing effects after construction.

Figure 3. Vegetation Study Area



Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to vegetation.

2.1 Methods

This section describes the sources of information and methods used to characterize the existing conditions and assess the potential impacts of the Proposed Action and No-Action Alternative on vegetation.

2.1.1 Data Sources

The following sources of information were used to evaluate the study area.

- Two reconnaissance level site visits conducted by ICF biologists on April 8 and December 11, 2014.
- A series of historical aerial photos from various years and months between 1994 and 2014 accessed through Google Earth Professional, a 2010 aerial photo provided by ESRI, and a 2012 aerial photo from the North Agriculture Imagery Program.
- Reports prepared by Grette Associates and provided by the Applicant as part of the permit application materials.
    - *Coal Export Terminal Wetland and Stormwater Ditch Delineation Report–Parcel 619530400 and associated appendices including Appendix F: Noxious Weeds and Sensitive Plants* (Grette Associates 2014a).
    - *Bulk Product Terminal Shoreline Wetland Delineation Report–Parcel 61950* (Grette Associates 2014b).
    - *Bulk Product Terminal, Wetland and Stormwater Ditch Reconnaissance Report–Parcel 10213* (Grette Associates 2014c).
    - *Bulk Product Terminal Wetland and Stormwater Ditch Delineation Report–Parcel 61953* (Grette Associates 2014d).
    - *Affected Environment Biological Resources, Addendum Upland Habitat Survey–MBTL Lease Areas* (Grette Associates 2014e).
    - *Affected Environment Biological Resources Report* (Grette Associates 2014f).
    - *Off-Site Alternative – Barlow Point Upland Habitat Survey* (Grette 2014g).
    - *Off-Site Alternative – Barlow Point Shoreline Habitat Inventory* (Grette 2014h).
    - *Off-Site Alternative – Barlow Point Wetland Reconnaissance Report* (Grette 2014i).

- The results of a January 30, 2015, U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) system online database search to determine federally listed endangered or threatened plant species under the jurisdiction of USFWS.
- 2011 National Land Cover Database (Homer et al. 2015) to describe land cover classes in the indirect impact study area.
- Washington State Department of Fish and Wildlife (WDFW) Priority Habitat and Species spatial data provided by WDFW on May 5, 2014, for the 5-mile radius study area surrounding the project area.
- The Washington State Department of Natural Resources (WDNR) Natural Heritage Program Information System (Washington State Department of Natural Resources 2015) list of known occurrences of rare plants in Cowlitz County, Washington, and details regarding their occurrence, habitat, and range.
- A limited literature search for information relative to threatened and endangered species.
- Comments received from interested parties during the scoping period relative to vegetation and wildlife, as summarized in the Scoping Reports (ICF 2014a, 2014b).
- Other literature, as cited in the text.

2.1.2 Vegetation Cover Type Mapping

Vegetation cover type mapping in the direct impact study area was accomplished by initially identifying the major land classification categories present using recent and historical aerial photographs, and the information gathered from the references cited in Section 2.1.1, *Data Sources*. Five categories were identified: developed lands, uplands, wetlands, and open water (Section 2.2.1.4, *Land Cover Classifications and Vegetation Cover Types*). Each of these categories was further broken out into different cover types based on the dominant vegetation form (e.g., herbs, shrubs, trees) present. Preliminary boundaries of each cover type were sketched on a recent aerial photograph of the study area using ArcGIS. Wetland cover types were mapped on the same aerial photo by overlaying the wetland boundaries previously identified (Grette Associates 2014a, b, c, d, i). Cover types in the direct impact study area were organized and named using land cover classifications similar to those used in the National Land Cover Database (Multi-Resolution Land Characteristics Consortium 2011) and the USFWS *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

Mapped vegetation cover types across the majority of the direct impact study area were checked by ICF biologists during reconnaissance-level site visits on April 8 and December 11, 2014. Visual observations of the vegetation present in adjacent areas and along Industrial Way, Mt. Solo Road, and Memorial Park Drive were made during the December 2014 site visit. Where necessary, cover type boundary mapping was adjusted based on field observations. The typical plant species observed in each cover type were recorded and compared with information on the historical vegetation of the Columbia River floodplain to gauge the level of disturbance present across the study area and the potential to support native vegetation communities.

Land cover types in the indirect impact study area (within 1 mile of the project area) are based on the 2011 National Land Cover Database GIS data (Homer et al. 2015); land cover classifications described in this data consist of open water, developed, forest, shrub, herbaceous, barren land,

agriculture (planted/cultivated and hay/pasture), and wetlands. Definitions of these land cover classifications can be found in Homer et al. (2015).

2.1.3 Impact Analysis

The following methods were used to evaluate potential impacts of the Proposed Action and No-Action Alternative on vegetation. Direct impacts on vegetation from the clearing of land to construct the coal export terminal and associated infrastructure were determined by overlaying the direct impact study area on the vegetation cover type map. All cover types that fell within the direct impact study area were considered permanent impacts, because they would be removed during construction and replaced with gravel pads, stockpiles, railroad tracks, buildings, pavement, and other project features. Approximate acreage of each cover type that would be affected by these activities was calculated and expressed as a percentage of the total cover types affected within the study area. Potential impacts on vegetation in the indirect impact study area were qualitatively discussed by identifying the potential impact mechanism (i.e., how the impact would occur), describing the potential effects, and by assessing the likelihood of its occurrence after implementation of the proposed construction mitigation measures.

Direct and indirect impacts from operations were qualitatively described, including the impact mechanism, potential effects, duration (i.e., temporary or permanent), and likelihood of occurrence.

For the purposes of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

2.2 Existing Conditions

The existing environmental conditions related to vegetation in the study area are described below.

2.2.1 Regional Context

This section provides general information on the vegetation known to be present in this region, the special-status species known to occur in Cowlitz County, and the noxious weeds typically found in this area. The land cover classifications and vegetation cover types present in the indirect impact study area, within 1 mile of the project area, are described.

2.2.1.1 Historical Vegetation

The project area is located in the Western Hemlock (*Tsuga heterophylla*) Forested Zone of the Coast Range physiographic province (Franklin and Dyrness 1988:6, 44–45). The portion of this zone that contains the project area is characterized by a wet, mild, maritime climate, with a mean average temperature of 46 to 48°F. Annual precipitation averages between 59 and 118 inches per year, with most of it falling in the fall and winter. Most of this zone was historically covered by coniferous forests dominated by Douglas-fir (*Pseudotsuga menziesii*), western hemlock, and western redcedar (*Thuja plicata*). While forests composed of these species are still the primary land cover, most of these areas have been logged or burned (or both) during the last 150 to 175 years (Franklin and Dyrness 1988:71) and many now exist as managed timberlands. Deciduous trees are relatively uncommon in these forests and occur primarily in disturbed area, riparian zones, and floodplains.

Dominant trees in such areas commonly include black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), Oregon ash (*Fraxinus latifolia*), big-leaf maple (*Acer macrophyllum*), and red alder (*Alnus rubra*).

Prior to historic development, the floodplain of the lower Columbia River near the project area was characterized by deciduous riparian forest and riverine wetlands, emergent wet meadows, and complex mosaics of intertidal marshes and tidal forested wetlands. A 1993 natural area inventory for the Lower Columbia classified the areas around Longview as historically being a mixture of freshwater tidelands that transitioned to overflow plains as you moved further upstream (Christy and Putera 1993:12–13). The wettest tidelands were primarily occupied by freshwater marshes dominated by species such as three-square rush (*Schoenoplectus americanus* formerly *Scirpus americanus*) and Lyngby's sedge (*Carex lyngbyei*), while slightly higher sites were occupied by shrub swamps of red-osier dogwood (*Cornus sericea* formerly *C. stolonifera*), Pacific willow (*Salix lucida* var. *lasiandra*), and Sitka willow (*Salix sitchensis*). Stands of Oregon ash and black cottonwood were also common on natural levees along tidal streams. In nontidal areas, the wettest sites were dominated by creeping spikerush (*Eleocharis palustris*) in the shallows along the river, Columbia River willow (*Salix fluviatilis*) on sandy banks and sandbars, and Pacific willow along channels and around overflow lakes. Oregon ash frequently occurred in association with stinging nettle (*Urtica dioica*) on higher sites that were protected natural levees, and with black cottonwood, red-osier dogwood, snowberry (*Symphoricarpos albus*), and stinging nettle on higher banks and on the tops of natural levees. Plant communities that once occurred in this area that are now extremely rare or extirpated include Columbian sedge (*Carex aperta*) marsh, tufted hairgrass (*Deschampsis cespitosa*) prairie, and Oregon white oak (*Quercus garryana*) savanna. (Christy and Putera 1993)

European colonization and establishment of the City of Longview in 1923 modified the floodplain, particularly with the establishment of the Consolidated Diking Improvement District (CDID) #1 Columbia River flood control levee in the 1920s. This levee, which extends along the shoreline near the project area, effectively disconnected the floodplain from the river and resulted in the loss of intertidal habitats along the shoreline. Floodplain vegetation was further modified by the hydroregulation (i.e., construction and management of hydroelectric dams) of the Columbia River system and the urbanization of the watershed (Johnson 2010). The construction of multiple stormwater drainage ditches by both CDID #1 and private entities also altered the hydrologic regime and vegetation of these areas, as did the development of the floodplain for industrial, agricultural, residential, and recreational uses.

2.2.1.2 Special-Status Plant Species

The WDNR National Heritage Program database was queried for records of rare plant occurrences in Cowlitz County. As shown in Table 2, 15 species with some type of federal or state status were returned from this query (Washington Department of Natural Resources 2015). None of these species has been recorded in the project area. The nearest record of occurrence of one of these plants relative to the project area is for a documented siting of the obligate wetland species Columbia water-meal (*Wolffia columbiana*) approximately 1.5 miles northwest of the project area for the Proposed Action (Washington Department of Natural Resources 2015) and outside of the study area. Table 3 provides a summary of the typical elevation, habitat, and geographic range for each of these species, as well as an assessment of their potential to occur on the project area based on the presence or absence of suitable habitat.

Table 2. List of Known Occurrences of Threatened, Endangered, Sensitive, and Rare Plants in Cowlitz County, Washington

Scientific Name	Common Name	Federal Status[a]	State Status[b]	Historical Record[c]
Agoseris elata	Tall agoseris	--	S	C
Buxbaumia viridis	Buxbaumia moss	--	R1	C
Cimicifuga elata	Tall bugbane	SC	S	H
Corydalis aquae-gelidae	Clackamas corydalis	SC	S	C
Erythronium revolutum	Pink fawn-lily	--	S	C
Euonymus occidentalis var. *occidentalis*	Western wahoo	--	S	C
Isoetes nuttallii	Nuttall's quillwort	--	S	C
Physostegia parviflora	Western false dragonhead	--	R1	H
Poa laxiflora	Loose-flowered bluegrass	--	S	C
Poa nervosa	Wheeler's bluegrass	--	S	C
Salix sessilifolia	Soft-leaved willow	--	S	C
Sidalcea nelsoniana	Nelson's checker-mallow	LT	E	C
Tetraphis geniculata	Tetraphis moss	--	R1	C
Utricularia gibba	Humped bladderwort	--	R1	C
Wolffia columbiana	Columbia water-meal	--	R1	C

[a] Federal status under the Endangered Species Act:
LT = Listed Threatened (likely to become endangered)
SC = Species of Concern. An unofficial status, the species appears to be in jeopardy, but insufficient information to support listing.

[b] State status of plant species is determined by the Washington Natural Heritage Program. Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness.
E = Endangered. In danger of becoming extinct or extirpated from Washington.
S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
R1 = Review group 1. Of potential concern but needs more fieldwork to assign another rank.

[c] Historical Record refers to when the occurrence was documented:
C = Most recent sightings after 1977.
H = Most recent sighting before 1977.

Source: Washington Department of Natural Resources 2014

Table 3. Elevation, Habitat, and Geographic Range of Listed Threatened, Endangered, Sensitive, and Rare Plants in Cowlitz County, Washington

Scientific Name	Common Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Agoseris elata	Tall agoseris	500 to 7,800 feet	Found in meadows, prairies, open woods, and exposed rocky ridges. Occurs in areas with little to no canopy cover and assumed to be shade intolerant.	Throughout California, Oregon, and Washington.	Documented within northeastern part of Cowlitz County. Not likely to occur in the project area due to elevation.
Buxbaumia viridis	Buxbaumia moss	Low to subalpine elevations	Found in coniferous forests on very well-rotted logs and peaty soil and humus.	Western North America including the western portion of Washington.	Documented in east-central portion of Cowlitz County. Not likely to occur in the project area due to lack of suitable coniferous habitat.
Cimicifuga elata	Tall bugbane	100 to 2,800 feet, with majority below 700 feet	Occurs in or along margins of mixed mature or old growth forests, including mesic coniferous or mixed coniferous-deciduous stands. Frequently found on north or east-facing slopes.	Southwestern British Columbia to southern Oregon, west of Cascade range.	Documented in western portion of Cowlitz County in areas along the Columbia River. Not likely to occur in the project area due to lack of appropriate forest habitat.
Corydalis aquae-gelidae	Clackamas corydalis	1,250 to 4,200 feet	Occurs in or near cold flowing water, including seeps and small streams; often occurring in stream channels. Moist shady woods in western hemlock (*Tsuga heterophylla*) and silver fir (*Abies amabilis*) zones. Prefers intermediate levels of overstory canopy closure.	Regionally endemic in Washington State and in Clackamas and Multnomah Counties in Oregon.	Documented in eastern portion of Cowlitz County. Not likely to occur in the project area due to elevation and lack of suitable habitat.
Erythronium revolutum	Pink fawn-lily	100 to 600 feet	Occurs in high-precipitation areas within 100 km of the coast; in moist soil in open or moderately shaded forests that provide full light at	Pacific coast region from southern British Columbia to northwestern California.	Documented in northwestern portion of Cowlitz County. Not likely to occur in the project area due to lack of suitable coniferous forest habitat.

Scientific Name	Common Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
			ground level. Habitats in Washington include swampy western redcedar (Thuja plicata)-lodgepole pine (*Pinus contorta*) forests, Sitka spruce (*Picea sitchensis*) woods on consolidated sand dunes, Sitka spruce-western hemlock forests, and shaded river bottoms.		
Euonymus occidentalis var. *occidentalis*	Western wahoo	20 to 600 feet	Occurs in moist woods and forested areas on west side of Cascades. Often found in shaded draws, riparian areas, and ravines. Sometimes found in grassy areas with scattered trees. In Washington, it typically occurs on fine sandy loam, silty loam, and silty clay loams.	British Columbia, western Washington and Oregon, south to central California	Documented in west-central portion of Cowlitz County, potentially near the project area. Appropriate habitat could occur on and near both project area.
Isoetes nuttallii	Nuttall's quillwort	200 to 345 feet	Terrestrial species found in seasonally wet ground, seepages, temporary streams, and mud near vernal pools.	Southeast Vancouver Island, British Columbia to southern California	Documented in west-central portion of Cowlitz County, potentially near the project area. Not likely to occur in the project area due to elevation.

Scientific Name	Common Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Physostegia parviflora	Western false dragonhead	None provided.	Occurs along shores of streams and lakes, marshes, and other low, wet places in the valleys and foothills (Herbarium, Burke Museum of Natural History and Culture 2014).	East of the Cascade summits, British Columbia south through Washington to the Columbia Gorge, then west to Portland, Oregon; east to Idaho and North Dakota. (Herbarium, Burke Museum of Natural History and Culture 2014)	Most recent documentation in Cowlitz County is prior to 1977. Appropriate habitat could occur on and near the project area.
Poa laxiflora	Loose-flowered bluegrass	50 to 3,700 feet	Found on moss covered rocks and logs, along streams and rivers, and on edges of wet meadows in moist shady woods.	Coastal Alaska, British Columbia, western Washington, and western Oregon	Documented in northwestern portion of Cowlitz County. Appropriate habitat could occur on or near the project area.
Poa nervosa	Wheeler's bluegrass	10 to 800 feet	Found in low-elevation wet habitats west of the Cascade crest in forest openings with minimal canopy cover, mossy rock outcrops, cliff crevices, and occasionally talus. Sites are often sparsely vegetated with little soil development.	Endemic from Vancouver Island, British Columbia, to northwest Oregon	Documented in west-central portion of Cowlitz County, potentially near the project area. Unlikely to occur in the project area due to lack of preferred habitat elements.
Salix sessilifolia	Soft-leaved willow	None provided	Found in wet lowland habitats, including silty or sandy riverbanks, riparian forests, dredge spoils, sandy beaches, and at the upper edge of an intertidal zone.	Southern British Columbia to northern California	Documented in northern portion of Cowlitz County. Appropriate habitat could occur on or near the project area.
Sidalcea nelsoniana	Nelson's checker-mallow	None provided	Found in low-elevation meadows, prairie, or grassland, along fencerows, streams, and roadsides,	Regionally endemic of Benton County, Oregon, north to Lewis County, Washington, and from	Documented within northwestern portion of Cowlitz County. Appropriate habitat could occur on or near the project area.

Scientific Name	Common Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
			drainage swales, and edges of plowed fields adjacent to wooded areas.	central Linn County, Oregon to just west of the crest of the Coast Range.	
Tetraphis geniculata	Tetraphis moss	Sea level to subalpine elevations.	Occurs on the cut or broken ends or lower half of large decay class rotten logs or stumps, and occasionally on peaty banks in moist coniferous forests.	From Alaska and British Columbia through western Washington and select sites in Oregon.	Not documented in Cowlitz County. Not likely to occur in the project area due to lack of suitable coniferous habitat with logs and stumps.
Utricularia gibba	Humped bladderwort	160 to 490 feet	Occurs in lakes and lake edges and in muddy disturbed sites in the lowland zone.	Southern British Columbia south to California.	Documented in the northern portion of Cowlitz County. Not likely to occur in the project area due to elevation.
Wolffia columbiana	Columbia water-meal	10 to 250 feet	Found in freshwater lakes, ponds, and slow streams.	From California to British Columbia, east to Quebec, and south to Florida, excluding the interior southwestern states.	Occurs within 1.5 miles of the project area; could occur in ponded habitats on or near the project area.

Source: Unless noted otherwise, this information came from the Washington State Department of Natural Resources, Washington Natural Heritage Program plant species fact sheets; available at: http://www1.dnr.wa.gov/nhp/refdesk/lists/plantsxco/cowlitz.html

As indicated in Table 3, of the 15 special-status species known to occur in Cowlitz County, six were identified by ICF as potentially occurring in the project area, based on the presence of potentially suitable habitat in the species range. These include Nelson's checker-mallow, western wahoo, western false dragonhead, loose-flowered bluegrass, soft-leaved willow, and Columbia water-meal. Appendix A, *Descriptions of Special-Status Plant Species with Potential to Occur in the Project Area,* provides descriptions of these species.

2.2.1.3 Noxious Weeds

Special-status plants can also include species designated as noxious weeds by the Washington State Weed Control Board under Washington State's noxious weed law (Revised Code of Washington 17.10). Noxious weeds are nonnative plants that have been designated as undesirable plants by federal and state laws. Noxious weeds can displace native species; decrease plant species diversity; degrade habitat for rare species and wildlife; decrease productivity of farms, rangelands, and forests; create unattractive areas dominated by a single species; and/or impair full use of the landscape by wildlife and humans. As weed infestations spread, private landowners and public land managers spend increasing amounts of money, time, and resources conducting weed control activities.

Washington Administrative Code (WAC) 16-750 establishes the list of noxious weeds and defines three classes of noxious weeds (A, B, and C), as defined below in Table 4. These classes indicate the level of concern based on the threat to natural systems and current degree of distribution in the area and specify mandatory control and prevention measures associated with each class. Local noxious weed control boards adopt lists specific to their areas, typically at a county level.

Table 4. Washington State Noxious Weed Classification

Class	Definition
A	Nonnative species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. Eradication of Class A plants is required by law.
B	Nonnative species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.
C	Noxious weeds that are typically widespread in Washington or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired. Other counties could choose to provide education or technical consultation.

Source: Washington State Noxious Weed Control Board 2015

The Washington State Noxious Weed Control Board maintains the state's official list of noxious weeds (Appendix B, *State Noxious Weed List*) that landowners could be required to control. Local noxious weed boards use the statewide list and classifications to identify noxious weed problems in their jurisdictions and to implement and prioritize control efforts. Cowlitz County's Noxious Weed Control Board maintains a county-specific noxious weed list (Appendix C, *Cowlitz County Noxious Weed List*) and assigns their own control priorities based on the distribution of these weeds in their jurisdiction.

The project area supports plant species regulated as noxious weeds. None of the species designated for Cowlitz County as Class A noxious weeds have been observed in the project area. Six species documented in or within 1 mile of the project area are listed as Class B noxious weeds, a classification assigned to plants considered a priority for weed control to prevent new infestations and to contain existing populations: indigobush (*Amorpha fruticosa*), Scotch broom (*Cytisus scouparius*), Policeman's helmet (*Impatiens glandulifera*), Eurasian watermilfoil (*Myriophyllum spicatum*), parrotfeather (*Myriophyllum aquaticum*), and water primrose (*Ludwigia hexapetala*). Eight species documented in the project area or within 1 mile are listed as Class C noxious weeds, a classification assigned to widespread weeds: Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), English ivy (*Hedera helix*), yellowflag iris (*Iris pseudacorus*), reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus armeniacus*), common tansy (*Tanacetum vulgare*),and nonnative cattail (*Typha angustifolia*). Appendix D, *Descriptions of Noxious Weeds with Potential to Occur in the Project Areas*, provides descriptions of these species.

2.2.1.4 Land Cover Classifications and Vegetation Cover Types

Land cover classifications and vegetation cover types found in the project area are briefly described in the following sections along with the typical plant species observed in them. A discussion of the location and distribution of these cover types is provided in Section 2.2.2, *Study Area*.

Developed Land

Developed land includes those areas where the majority of the vegetation has been removed and replaced with pavement, buildings, or other types of infrastructure. One vegetation cover type (disturbed) was identified in the project area.

Disturbed

Scattered vegetation is occasionally present in this community and typically consists of various nonnative grasses, forbs, and shrubs including colonial bentgrass (*Agrostis capillaris*), Kentucky bluegrass (*Poa palustris*), reed canarygrass, Canada thistle, bull thistle, common mullein (*Verbascum thapsus*), Scotch broom, and Himalayan blackberry.

Uplands

The upland land cover category includes undeveloped vegetated areas that do not exhibit wetland characteristics. The following upland vegetation cover types are present in the project area.

Forested Uplands

The forested upland cover type includes areas where trees greater than 16 feet in height provide greater than 20% canopy cover (Multi-Resolution Land Characteristic Consortium 2011). Trees commonly found in this cover type include black cottonwood, red alder, Oregon ash, and Pacific willow in floodplain areas and Douglas-fir, big-leaf maple, and red alder in off-site areas. Planted rows of Sitka spruce (*Picea sitchensis*) along roadways and ditches are also present. Understory shrubs typically include Himalayan blackberry, trailing blackberry (*Rubus ursinus*), red elderberry (*Sambucus racemosa*), red-osier dogwood, and occasionally Pacific crabapple (*Malus fusca*) and cascara (*Rhamnus purshiana*). Reed canarygrass is typically the dominant plant in the understory, with bedstraw (*Galium aparine*), stinging nettle, Canada thistle, and climbing nightshade (*Solanum dulcamara*) are also common.

Scrub-Shrub Uplands

The scrub-shrub upland cover type includes areas with greater than 20% canopy cover of shrubs or small trees that are less than 16 feet in height (Multi-Resolution Land Characteristic Consortium 2011). Like forested uplands, this cover type typically occurs in isolated patches surrounded by previously disturbed or developed lands. It is also commonly found in association with wetlands and drainage ditches. Dominant species are similar to those found in forested uplands including young black cottonwood, red alder, various willows, red-osier dogwood, and red elderberry. Himalayan blackberry is also common in more disturbed areas, as is Scotch broom.

Unmanaged Herbaceous Uplands

The unmanaged herbaceous upland cover type includes those areas dominated by native and nonnative grasses and forbs that are not maintained or managed (e.g., mowed) on a regular basis. Dominant vegetation in these areas is primarily reed canarygrass. Other common species include perennial ryegrass (*Lolium perenne*), colonial bentgrass, haired bentgrass (*Agrostis scabra*), Kentucky bluegrass, fowl bluegrass (*Poa palustris*), orchard grass (*Dactylis glomerata*), short-awn foxtail (*Alopecurus aequalis*), western bittercress (*Cardamine occidentalis*), common horsetail (*Equisetum arvense*), soft rush (*Juncus effusus*), Queen Anne's lace (*Daucus carota*), velvetgrass (*Holcus lanatus*), hairy cat's ear (*Hypochaeris radicata*), English plantain (*Plantago lanceolata*), Canada thistle, bull thistle, black medic (*Medicago lupulina*), red clover (*Trifolium pratense*), and American vetch (*Vicia americana*).

Managed Herbaceous Uplands

The managed herbaceous upland cover type is a subset of the herbaceous upland cover type and includes herbaceous areas that are regularly managed by mowing, grazing, or other activities. Dominant vegetation in these areas is nonnative grasses, with some scattered native and nonnative forbs. Species are the same as described above for the herbaceous upland cover type. Shrubs are typically lacking in these areas.

Wetlands

The wetland category includes areas that exhibit the three diagnostic wetland characteristics required by state and federal wetland delineation manuals: hydrophytic vegetation, hydric soils, and wetland hydrology characteristics.

Forested Wetlands

The forested wetland cover type includes palustrine forested (PFO) wetland areas where trees 16 feet in height or higher provide greater than 20% or more canopy cover (Multi-Resolution Land Characteristic Consortium 2011). Dominant vegetation in this cover type includes black cottonwood, Pacific willow, red alder, and Oregon ash, over a shrub layer that includes such species as salmonberry (*Rubus spectabilis*), Himalayan blackberry, other willows, red-osier dogwood, and red elderberry. Scattered Sweetbriar rose (*Rosa eglanteria*) and Douglas spiraea (*Spiraea douglasii*) shrubs are occasionally present. The understory of most of the forested wetland community is dominated by reed canarygrass. Soft rush, fowl bluegrass, and stinging nettle are also common.

Scrub-Shrub Wetlands

The scrub-shrub wetland cover type includes palustrine scrub-shrub (PSS) wetland areas where shrubs or small (less than 16 feet in height) trees provide greater than 20% canopy cover (Multi-Resolution Land Characteristic Consortium 2011). Scrub-shrub wetlands are typically dominated by red osier dogwood, Douglas spiraea, Himalayan blackberry, Hooker's willow (*Salix hookeriana*), Pacific willow, Sitka willow, and saplings of red alder, Oregon ash, black cottonwood, Columbia River willow, Nootka rose (*Rosa nutkana*), creeping buttercup (*Ranunculus repens*), and slough sedge (*Carex obnupta*). The understory of such areas is often dominated by reed canarygrass, with narrowleaf cattail (*Typha angustifolia*) common in wetter areas.

Herbaceous Wetlands

Herbaceous or palustrine emergent (PEM) wetlands are found in the floodplain of the Columbia River, often along drainage ditches and in areas that were previously disturbed by agriculture and past borrow activities. Most are dominated by a near monoculture of reed canarygrass, with soft rush and narrow-leaf cattail commonly present in wetter areas. Other species noted in herbaceous wetlands include English plantain, curly dock (*Rumex crispus*), common plantain, slough sedge, and giant horsetail (*Equisetum telmateia*). Various willows, red elderberry, Himalayan blackberry, and Canada thistle are often present around their edges where herbaceous wetlands transition into uplands.

The managed herbaceous wetland cover type represents a subset of the herbaceous wetlands identified by Grette in their multiple wetland reports (Grette Associates 2014a, b, c, d, i). This cover type includes those herbaceous wetlands that exhibit evidence of regular management by mowing. These areas are typically dominated by reed canarygrass.

Riparian Lands

The riparian land cover category includes those areas located along the shoreline of the Columbia River between the ordinary high water mark (OHWM) and the top of the CDID levee. It includes the vegetation growing in the active channel margin and riparian zones identified by Grette in their upland and shoreline habitat inventories (Grette Associates 2014e, g, h). Vegetation in these areas interacts directly with the Columbia River, with growth and habitat function heavily influenced by river flows, the rise and fall of water levels, and the erosion and deposition of materials along the shoreline. For the purposes of this analysis, riparian vegetation communities are limited to uplands located in the riparian zone; therefore, riparian lands are reported as part of the upland land cover class. Wetlands located in the riparian zone are included in the wetland vegetation community mapping and discussed under those sections.

Riparian Forests

The riparian forest cover type includes upland areas that have greater than 30% canopy cover of trees 20 feet in height or higher growing along the shoreline of the Columbia River, between the OHWM and the levee. This cover type is found growing within both sandy substrates and amongst riprap and other types of shoreline armoring (i.e., Reno mattress[2]). Dominant vegetation typically includes black cottonwood, Oregon ash, Himalayan blackberry, Scotch broom, Scouler's willow,

[2] Reno mattress is a type of gabion, a wire cage or basket filled with rock that is used for river bank and scour protection, where the depth of the basket is less than its width and length, creating a permeable, flexible 'mattress'.

Hooker's willow, Columbia River willow, Sitka willow, red-osier dogwood, and false indigo bush (*Amorpha fruticosa*). Big-leaf maple, Pacific crabapple, and Douglas hawthorn (*Crataegus douglasii*) are also present in some areas. Underlying herbaceous vegetation typically includes reed canarygrass along with various other grasses and forbs include various bromes (*Bromus* spp.), velvetgrass, red clover, Canada thistle, gumweed (*Grindelia* sp.), poverty rush (*Juncus tenuis*), and stinging nettle, among others.

Riparian Scrub-Shrub

The riparian scrub-shrub cover type includes upland areas that have greater than 30% canopy cover of shrubs or small trees (less than 20 feet in height) growing along the shoreline of the Columbia River, between the OHWM and the levee. It is found in substrates similar to the forest vegetation community and contains similar species.

Riparian Herbaceous

The riparian herbaceous cover type is generally dominated by mown grasses and weeds including reed canarygrass, velvet grass, common horsetail, and English plantain. It is only found in the project area. It occurs in scattered areas that are too small to be seen on the vegetation cover type figures.

Open Water

The open water land cover category includes the various surface and stormwater ditches and ponds that are present in the project area. It is described in more detail in the SEPA Surface Water and Floodplains Technical Report (ICF 2017b). Species present in these fringe areas typically include reed canarygrass, cattails, creeping spikerush, yellowflag iris, and slough sedge.

2.2.2 Study Area

The following sections describe the existing conditions in the study area relative to vegetation.

2.2.2.1 General Description of Project Area

The 212 acre direct impact study area lies within the 540-acre site currently leased by the Applicant; the lease area includes Parcels 10213, 61950, 61953, and 619530400, as well as two parcels that are currently owned by Bonneville Power Administration (BPA) (Parcels 6195303 and 61954) (Figure 4). Parcel 10213 is located on the north side of Industrial Way (i.e. outside of the direct impact study area) and Parcels 61950, 61953, 6195303, 619530400, and 61954 are located on the south side of Industrial Way. Parcel 10213 is undeveloped; Parcels 619530400, 6195303, and 61953 contain the former Reynolds Metals Aluminum Reduction Plant; Parcel 61950 contains the CDID levee and Columbia River shoreline; and Parcels 6195303 and 61954 are primarily occupied by electrical substations/switchyards. The export terminal would be constructed on portions of Parcels 619530400, 6195303, 61950, and 61954. These parcels are within the direct impact study area and include two parcels of the former Reynolds Metals Aluminum Reduction Plant, a shoreline parcel, and two parcels that are currently owned by BPA.

Figure 4. Features in the Project Area



Parcel 10213

Parcel 10213 is located on the north side of Industrial Way, between the roadway and segments of CDID Ditch 5 and CDID Ditch 10 (Figure 4). It is broken into three portions by 38th Avenue and Parcel 1021401, which contains a part of the BPA Longview Substation. The largest portion is the northern part, which is bounded by Ditch 10 on the north, 38th Avenue on the southeast, and Industrial Way on the southwest. The next largest part is the central portion, an arrow-shaped section that is bounded by 38th Avenue on the northwest, Ditch 5 on the east, and Parcel 1021401 on the south. The third portion is a small, triangular section on the southeast end that is bounded by Industrial Way to the southwest, Parcel 1021401 to the northwest, and Ditch 5 to the east.

With the exception of a former commercial office building at the corner of Industrial Way and 38th Avenue, an overgrown softball field along the north side of 38th Avenue, and multiple transmission lines supported on both wooden pole structures and steel towers, Parcel 10213 is undeveloped. It primarily consists of former agricultural land that is now dominated by a near monoculture of reed canarygrass, with a few areas of trees and shrubs in various locations around its perimeter (Appendix E, *Site Photographs*, Photos 1 and 2).

Surface-water features on or adjacent to Parcel 10213 include CDID Ditch 5 and Ditch 10, and six unnamed privately owned drainage features (Figure 4). These features are described in the SEPA Surface Water and Floodplains Technical Report (ICF 2017b)

Parcels 619530400 and 61953 (Former Reynolds facility)

Parcels 619530400 and 61953 are located on the south side of Industrial Way and contain the former Reynolds Metals Company Aluminum Reduction Plant (Figure 4). Roughly half of this site is devoid of vegetation having been previously developed as large industrial buildings, parking lots, storage areas, disposal sites, stormwater ponds, interior roads, and railroad tracks. Moving northwest to southeast across the central portion of the site, major structures and facilities remaining include the Cable Plant, outdoor storage area, North Plant Potlines, various maintenance and administrative buildings, coal storage silos, cast houses, and remnant portions of the South Plant Potlines and Cryolite Recovery Plant (Figure 4). Structures bordering the landward side of the CDID levee include the Stormwater Retention Basin and Filter Plant (Facility 73), Wastewater Treatment Facility, alumina storage silos, coal tar pitch tanks, and the sanitary sewer treatment plant. The alumina and coal storage silos, associated conveyors and transloading facilities, and Dock 1 are used by the Applicant for their existing bulk terminal operations. Aside from these structures, the administrative offices, and a few maintenance areas, the remainder of the facility is currently unused. Many of the former plant buildings and other infrastructure is in the process of being demolished.

Surface-water features on or adjacent to these parcels include two drainage ditches managed by CDID #1 (Ditch 10 and Ditch 14); an off-site, privately owned ditch; the U-Ditch, Interception Ditch, Cryolite Recovery Ditches, and various stormwater conveyance ditches. These features are described in the SEPA Surface Water and Floodplains Technical Report (ICF 2017b).

Parcel 61950

Parcel 61950 includes the shoreline of the Applicant's leased area and the levee, which runs along the entire length of the Applicant's leased area along the Columbia River (Figure 4). The top of the

levee lies at an elevation of +30 feet Columbia River Datum (CRD) (Grette Associates 2014e). It is topped by a paved road (Dike Road) along its length, with its riverward and landward faces maintained in grass cover by regular mowing (Appendix E, Photo 37), consistent with U.S. Army Corps of Engineers (Corps) standards for vegetation maintenance on flood control levees.

The project area is located approximately 30 miles upstream of the extent of tidal salinity in the river. The portion of the project area that includes the nearshore zone of the Columbia River is thus characterized as tidal freshwater habitat. The tidal amplitude—the difference between mean lower low water and mean higher high water—is 4.6 feet, creating a daily rise and fall of water levels along the shoreline of approximately 2.3 feet (on average) around the average water level (Grette Associates 2014e). The shoreline along the project area is characterized by a narrow, steep sloping sandy beach, with scattered areas of woody debris and herbaceous, scrub-shrub, and forested vegetation (Appendix E, Photos 32 through 38). Two rock groins and two wooden pile dikes extend out into the river from the shoreline along the Applicant's leased area boundary. Existing facilities located in the river and riparian zone include Dock 1, a trestle-supported access ramp, and an overhead conveyor that extends across the levee and shoreline to the shiploader on Dock 1. The area around Dock 1 and navigation channel in the river are both actively maintained by regular maintenance dredging.

A linear ponded area is located at the southeastern corner of the Applicant's leased area between the river and the CDID levee (Figure 4; Appendix E, Photos 39 and 40). This area was previously used by the Corps as a dredged material disposal site for spoils from routine maintenance dredging of the Columbia River Federal Navigation Channel. Past excavation of the dredged sands from this site by the previous site tenant created a large pond that is separated from the river by a steep shoreline berm. This berm is primarily covered with invasive vegetation such as Scotch broom and Himalayan blackberry on the pond side, and by native willows and black cottonwood trees which overhang the shoreline on the river side.

Parcels 6195303 and 61954

Parcels 6195303 and 61954 (Figure 4) are owned and maintained by BPA. Parcel 6195303 is 2.31 acres in size and currently consists of a fenced-in gravel pad that is partially vegetated with scattered weedy grasses and forbs. Parcel 61954 is located near the center of the project area, between Industrial Way and the South Plant Potlines. It is approximately 22 acres in size and primarily occupied by paved areas and a large electrical substation, which is part of the Longview Substation. The southeastern quarter of this parcel consists of an herbaceous wetland field that contains several high-voltage transmission lines supported on wooden pole structures and metal towers (Appendix E, Photos 41 and 42). Part of a smaller electrical substation owned by the Cowlitz County Public Utilities Department is also present on this and the adjacent parcel (Parcel 61953).

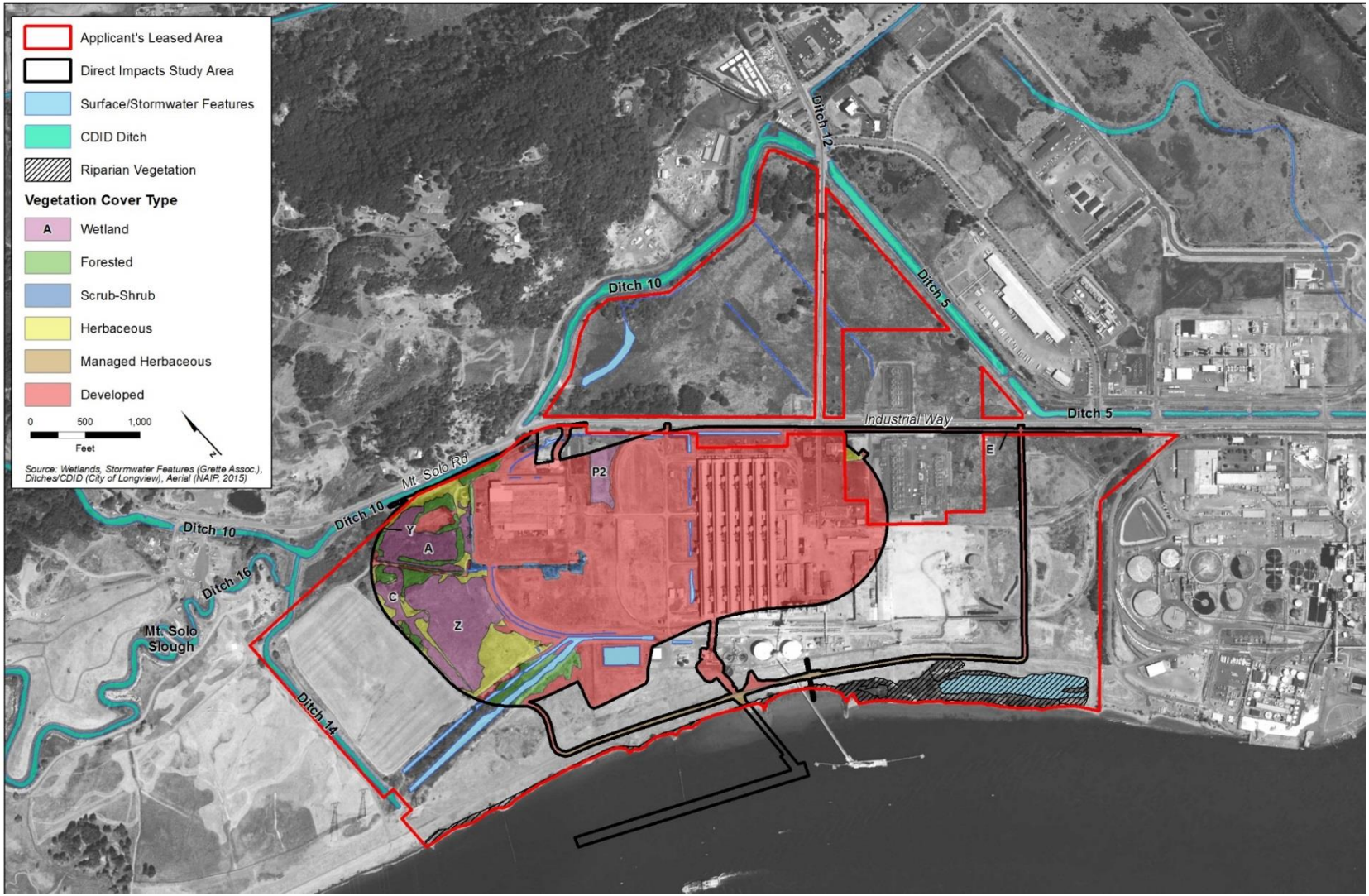
Both of these parcels are accessible from Industrial Way and from internal roads in the Applicant's leased area (Figure 4). Surface-water features are limited to a stormwater conveyance ditch located between Parcel 6195303 and the Reynolds Lead.

2.2.2.2 Land Cover Classification and Vegetation Cover Types in the Direct Impact Study Area

Figure 5 shows land cover classifications and vegetation cover types identified in the direct impact study area. The most dominant land cover class is developed lands, which accounts for 71% of the

direct impact study area. This is followed by the upland, wetland, and open water land cover classes. The following sections provide the general locations and descriptions of each of these communities in the direct impact study area.

Figure 5. Existing Land Cover Classes and Vegetation Cover Types in the Direct Impact Study Area



Developed Lands

Approximately 151.14 acres of the direct impact study area (71%) were identified as developed lands. These lands comprise only one vegetation cover type: disturbed (Figure 5; Appendix E, Photos 7 through 9, 12, 20 through 22, 28, and 29). Widely scattered patches of invasive shrubs such as Himalayan blackberry and Scotch broom occur on higher mounds, and around derelict structures and pieces of equipment. Developed lands include all of the areas previously developed for the former Reynolds facility and the BPA and Cowlitz County Public Utility District substations.

Uplands

Approximately 26.26 acres of the direct impact study area (12%) were identified as uplands. Of the four upland cover types present, herbaceous upland cover type was the most prevalent, followed by forested upland, managed herbaceous, and scrub-shrub upland.

Unmanaged Herbaceous Upland

Approximately 10.88 acres of the direct impact study area (5.0%) were identified as unmanaged herbaceous uplands. These areas occur on the former Reynolds facility and BPA Parcel 61954 (Figure 5).

Unmanaged herbaceous uplands in the direct impact study area occur along CDID Ditch 10 to the northwest of the former Cable Plant; in the former borrow area to the east of the closed Black Mud Pond facility (Appendix E, Photo 14); and along the Reynolds Lead (Figure 5). These areas are primarily dominated by reed canarygrass.

Unmanaged herbaceous uplands on BPA Parcel 61954 are located in a transmission line easement to the northwest of the Longview Substation (Figure 5). This area is dominated by reed canarygrass, scotch broom, and bentgrass, as well as Himalayan blackberry.

Forested Uplands

Approximately 8.90 acres of the direct impact study area (4%) were identified as forested upland.

Forested uplands occurs around Wetlands A, C, and Y (described in *Wetlands* below) between the closed Black Mud Pond facility and the former Cable Plant and along the U-Ditch and Interceptor Ditch (Figure 5). Some of these areas are shown in Photos 15 through 17 and 23 through 26 (Appendix E). Dominant trees in the uplands adjacent to Wetlands A, C, and Y include black cottonwood, some Pacific willow, and Oregon ash. Common shrubs include Himalayan blackberry, red elderberry, and sweetbriar rose, with black cottonwood and Oregon ash saplings also present. Dominant trees in the forested corridor along the U-Ditch and Interceptor Ditch include black cottonwood, red alder, and some Oregon ash along the ditch banks. Himalayan blackberry is the most common plant in the shrub layer, but has been recently cleared from some areas on the western end of the U-Ditch. Red osier-dogwood is also common. Several types and sizes of down wood are present in this forested corridor, as are various snags. Reed canarygrass is common in the herbaceous layer in all of these forested upland areas.

Forested upland in the direct impact study area includes a small area (0.05 acre) of forest in the riparian zone along the Columbia River between the ordinary high water mark (OHWM) and the top of the CDID #1 levee.

Managed Herbaceous Uplands

Approximately 4.37 acres of the direct impact study area (2.0%) were identified as managed herbaceous upland cover type. As shown in Figure 5, managed herbaceous upland land cover occurs on the CDID #1 levee, lawns around the administrative and maintenance buildings, and caps of the closed Black Mud Pond facility (Appendix E, Photos 10 and 11). All of these areas are dominated by grasses and forbs that are regularly mown. Species present include reed canarygrass, haired bentgrass, colonial bentgrass, American plantain, orchard grass, short-awn foxtail, western bittercress, blue wildrye (*Elymus glaucus*), common horsetail, Queen Anne's lace, scouring rush (*Equisetum hyemale*), bedstraw, velvetgrass, perennial ryegrass, Kentucky bluegrass, and American vetch could also be present.

Scrub-Shrub Uplands

Approximately 2.11 acres of the direct impact study area (1%) were identified as scrub-shrub upland.

As shown in Figure 5, scrub-shrub uplands on the former Reynolds facility occur around the former Cable Plant (Appendix E, Photo 22) and to the north of the closed Black Mud Pond facility around Wetland Y (Appendix E, Photos 18 and 19). Common species in these areas include young black cottonwood, willows, and Himalayan blackberry. Reed canarygrass is also common in the herbaceous layer.

Wetlands

Approximately 26.93 acres (11%) of the direct impact study area were identified as wetland (Table 5, Figure 6). The most prevalent wetland type present is herbaceous wetlands, followed by forested wetlands, and scrub-shrub wetlands. As described in Section 2.1.1, *Data Sources*, wetland mapping was based on the wetland delineation and determination studies previously conducted by Grette Associates.

Table 5 provides a summary of the wetlands identified in the direct impact study area during the Grette Associates determinations and delineations. Additional wetlands outside the direct and indirect impact study areas were delineated in the Applicant's leased area. These wetlands are shown in Table 6 and Figure 6.

Table 5. Wetlands Identified in the Direct Impact Study Area

Wetland	Location (Parcel)	Cowardin Classification[a]	HGM Classification[b]	Category[c]	Area (acres)
A	619530400	PFO	Depressional	III	6.28
C	619530400	PEM/PFO	Depressional	III	3.38
Y	619530400	PEM/PSS	Depressional	III	3.40
Z	619530400	PEM	Depressional	III	11.22
P2	619530400	PEM	Depressional	IV	2.65
Total					**26.93**

Wetland	Location (Parcel)	Cowardin Classification[a]	HGM Classification[b]	Category[c]	Area (acres)

[a] Cowardin classification per Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Values include: PFO = palustrine forested; PSS = palustrine scrub-shrub; and PEM = palustrine emergent

[b] Hydrogeomorphic (HGM) classification per the Washington State Wetland Rating System for Western Washington (Hruby 2006).

[c] Wetland category determined by Grette Associates using the Washington State Wetland Rating System for Western Washington (Hruby 2006).

Source: Grette Associates 2014a, b, c, d.

Table 6. Wetlands Outside the Study Areas in the Applicant's Leased Area

Wetland	Location (Parcel)	Cowardin Classification[a]	HGM Classification[b]	Category[c]	Area (acres)[d]
D	61953	PEM/PSS	Depressional	III	5.43
E	61953, 61954	PEM	Depressional	III	9.46
F	61953	PEM	Depressional	III	0.45
G	61953	PSS	Depressional	III	2.60
H	61953	PEM	Depressional	III	0.24
X	61950	PSS	Riverine	III	0.44
AS1	10213	PEM	Depressional	III	8.86
AS2	10213	PEM	Depressional	IV	0.94
AS3	10213	PEM	Depressional	IV	0.12
AS4	10213	PEM	Depressional	III	0.02
NW1	10213	PEM	Depressional	III	1.38
NW2	10213	PEM	Depressional	III	0.50
NW3	10213	PFO	Depressional	IV	0.19
NW4	10213	PSS/PFO	Depressional	IV	0.05
NE1	10213	PEM	Depressional	III	29.48
LW1[e]	10213	PEM/PFO/PSS	Depressional	III	-
LW2[e]	10213	PFO	Depressional	III	-
LW3[e]	10213	PFO	Depressional	III	-
Total					**60.16**

Notes:

[a] Cowardin classification per Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Values include PFO = palustrine forested; PSS = palustrine scrub-shrub; and PEM = palustrine emergent

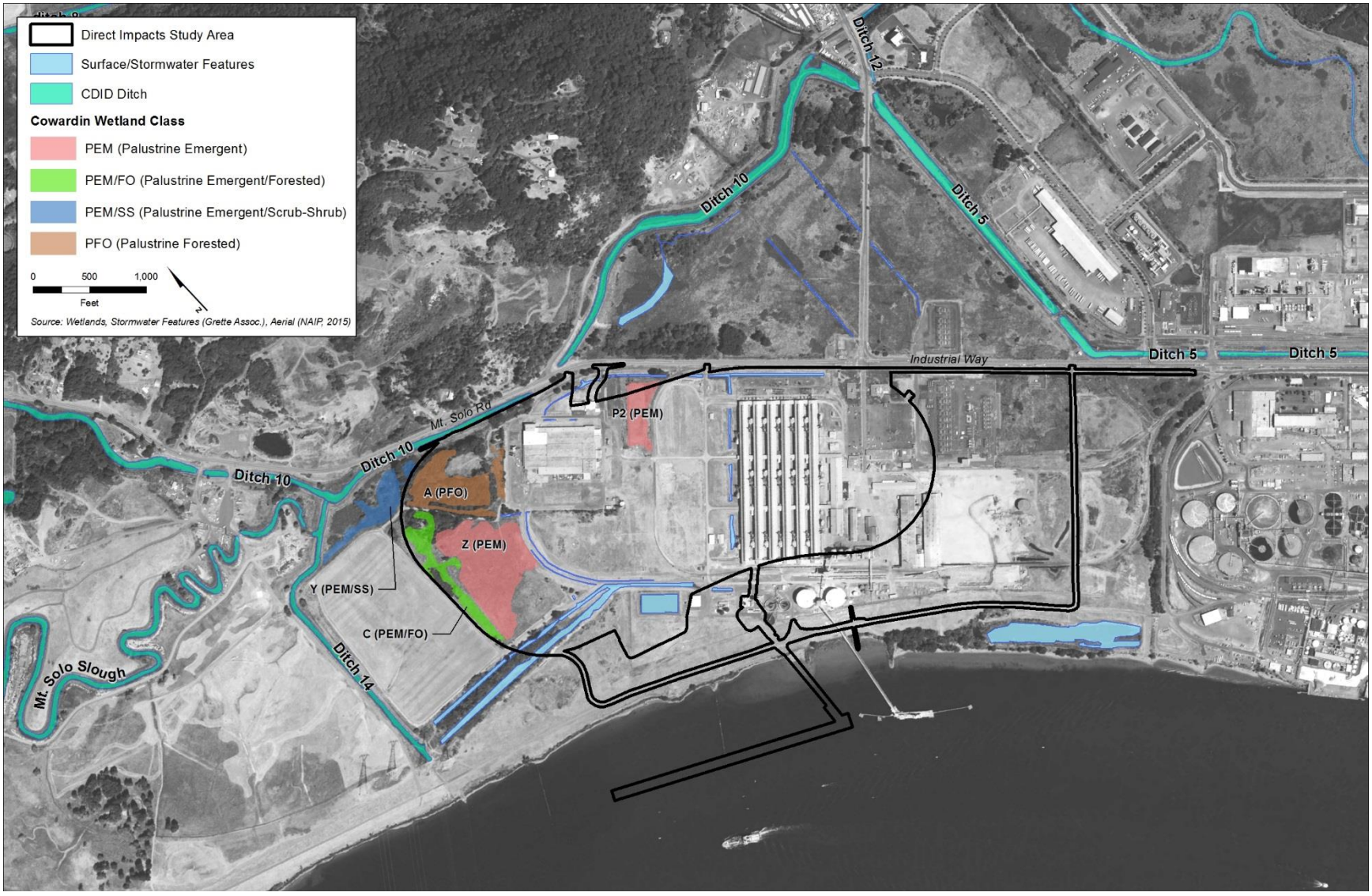
[b] Hydrogeomorphic (HGM) classification per the Washington State Wetland Rating System for Western Washington (Hruby 2006).

[c] Wetland category determined by Grette Associates using the Washington State Wetland Rating System for Western Washington (Hruby 2006).

[d] Acreages as reported by Grette Associates 2014 a, b, c.

[e] These wetlands correspond to the three areas on Parcel 10213 that Grette Associates identified as *likely wetland* areas. Grette Associates did not report acreages for these areas.

Figure 6. Existing Wetlands in the Direct Impact Study Area



Forested Wetlands

Approximately 6.28 acres of the direct impact study area were identified as forested wetland and includes all of Wetland A (Table 5, Figure 6).

This wetland is depressional and is supported primarily by high groundwater and direct precipitation. Common plant species observed in the forested wetlands include a predominately native overstory of black cottonwood (*Populus balsamifera*), Pacific willow (*Salix lucida*), red alder (*Alnus rubra*), and Oregon ash (*Fraxinus latifolia*) trees, overlying a shrub layer dominated by salmonberry (*Rubus spectabilis*) and nonnative Himalayan blackberry (*Rubus armeniacus*). Reed canarygrass (*Phalaris arundinacea*), an invasive grass, is the common herbaceous plant (Appendix E, Photos 15 through 17).

Emergent/Forested Wetlands

Approximately 3.38 acres of emergent/forested wetland occur in the study area and includes all of Wetland C (Figure 6). This wetland is depressional and is supported primarily by high groundwater and direct precipitation. The emergent portion of the wetland is dominated by reed canarygrass. Common plant species observed in the forested portion include a predominately native overstory of black cottonwood (*Populus balsamifera*), Pacific willow (*Salix lucida*), red alder (*Alnus rubra*), and Oregon ash (*Fraxinus latifolia*) trees, overlying a shrub layer dominated by salmonberry (*Rubus spectabilis*) and nonnative Himalayan blackberry (*Rubus armeniacus*).

Emergent/Scrub-Shrub Wetlands

Approximately 3.40 acres of emergent/scrub-shrub wetland occur in the study area and includes all of Wetland Y. Wetland Y is north of the closed Black Mud Pond facility and is the only wetland in the direct impact study area that extends outside of the direct impact study area (Figure 6). This wetland is depressional and is supported primarily by high groundwater and direct precipitation. The scrub-shrub component is dominated by Himalayan blackberry, red osier dogwood (*Cornus sericea*), Douglas spirea (*Spiraea douglasii*), and narrowleaf cattail (*Typha angustifolia*). The emergent component is dominated by reed canarygrass and an unidentified bryophyte; some nonnative narrowleaf cattail is also present.

Emergent Wetlands

Approximately 13.87 acres of emergent wetland occur in the study area and includes all of Wetlands Z and P2 (Figure 6). These wetlands are depressional and are supported primarily by high groundwater and direct precipitation. Wetland Z is dominated by reed canarygrass and soft rush (*Juncus effusus*) and contains several brush piles left over from past clearing activities. Wetland P2 is also dominated by reed canarygrass and soft rush.

Open Water

Approximately 10.78 acres of the direct impact study area (5%) are open water areas, including the Columbia River and various ditches and ponds (Appendix E, Photos 2, 16, 23 through 31, 39, and 40). The ditches and ponds are artificially created features; with the exception of the Columbia River, no natural streams or drainages are present in the direct impact study area.

Aquatic Vegetation

Aquatic vegetation was not assessed or quantified in the aquatic portions of the study area during either the Grette Associates studies or the ICF field visits. Grette Associates (2014e) states that curly pondweed (*Potamogeton crispus*) was observed at approximately -1 foot CRD downstream of Dock 1 during a period of high visibility. The report states it is possible that the gently sloping portion of the shallow water habitat area between the east and west pile dikes near the project area could support a narrow band of sparse aquatic vegetation in the upper most elevations where increased light penetration and reduced river velocity are present, relative to the deeper portions of the river in this area.

Indirect Impact Study Area Vegetation Communities

Table 7 summarizes the areas and percent cover of land cover classes in the indirect impact study area within 1 mile of the project area. Approximately 70% of the indirect impact study area is occupied by developed lands, open water (primarily the Columbia River) and agricultural lands; the remaining 30 percent consists of forest, shrub, herbaceous, wetlands, and barren lands.

Table 7. Land Cover in the Indirect Impact Study Area

Land Cover Classification	Area in Indirect Impact Study Area (acres)	Percent Cover in Indirect Impact Study Area
Developed	1631	37
Forest	347	8
Shrub	106	2
Herbaceous	62	2
Agriculture	573	13
Wetlands	719	16
Open water	880	20
Barren land	83	2
TOTAL	4401	100

Source: National Land Cover Data Base 2011 (Homer et al 2015)

Land use adjacent to the direct impact study area is described in detail in the SEPA Land and Shoreline Use Technical Report (ICF 2017c). In general, land use north of the direct impact study area includes a mix of undeveloped forested areas, rural residences, and lands previously disturbed by various industrial and agricultural activities. Land to the east and southeast is primarily developed for marine industrial and commercial uses and include the Mint Farm Industrial Park and the Weyerhaeuser wood/paper products facility. Land to the northwest includes undeveloped properties that were previously disturbed by agriculture and other recreational activities (project area for the Off-Site Alternative) and a closed construction debris/nonhazardous industrial waste landfill (Mount Solo Landfill). A mix of smaller rural-residential, small-scale industrial, and agricultural sites are also present in this area.

Land cover in the indirect impact study area immediately surrounding the direct impact study area is similar to what is described for the direct impact study area, mostly consisting of developed areas, managed/unmanaged herbaceous areas, wetlands, and open water of the Columbia River. Riparian lands are found predominantly along the Columbia River between the ordinary high water mark

(OHWM) and the top of the CDID #1 levee, and include vegetation growing adjacent to the active channel margin in riparian zones identified in the previous upland and shoreline habitat inventories (Grette Associates 2014e, 2014g, 2014h). These riparian lands consist of three vegetated types – forest, scrub-shrub, and herbaceous.

- **Riparian forest.** Riparian forest- extends in a band of varying width along most of the shoreline, with the widest areas found on the southern portion of the shoreline near the previous dredged material storage area. Dominant vegetation in this cover type includes 12- to 16-inch-diameter black cottonwood and various willow trees, underlain by a mixture of native shrubs such as red osier dogwood and invasive shrubs such as Himalayan blackberry and Scotch broom (Appendix E, Photos 32 through 36 and 38). Scattered accumulations of large woody material are present in these areas.
- **Riparian scrub-shrub.** Riparian scrub-shrub contains similar species as riparian forest. Two scrub-shrub riparian areas are found on Parcel 61950, between the Columbia River and the levee. These areas are dominated by black cottonwood saplings, various willow, and nonnative vegetation including Himalayan blackberry and Scotch broom (Appendix E, Photos 32 and 42). Native and nonnative herbaceous species are also present.
- **Riparian herbaceous.** Riparian herbaceous areas are generally dominated by grasses and weeds including reed canarygrass, velvet grass, common horsetail, and broadleaf plantain (*Plantago major*). These sparse patches of emergent vegetation occur under the existing Dock 1 conveyor and trestle, and on the sandy flats between the OHWM and the approximate elevation of mean higher high water (Appendix E, Photos 36 and 37).

The following areas in the indirect impact study area contain higher-quality vegetation communities and generally represent contiguous forest and other intact vegetation communities.

- **Mount Solo upland forest.** Mount Solo is a forested ridge that lies to the north of the project area (Appendix E, Photos 18, 20, 22, and 23). It is covered with a large area (approximately 505 acres) of native forest intermixed with rural residential areas and some light industrial uses. Vegetation observable from Mt. Solo Road and Memorial Park Drive includes Douglas fir (*Pseudotsuga menziesii*), big leaf maple, red alder, and western hemlock. Other native tree, shrub, and herbaceous species are likely present. This area is the largest inland forested area in the indirect study area and likely provides habitat for a variety of wildlife species.
- **Mint Farm wetland mitigation sites.** Two compensatory wetland mitigation sites for the Mint Farm Industrial Park are located to the east of the project area, in or within 1mile of the project area. These sites were constructed by the City of Longview in the late 1990s and early 2000s under federal and state permits as compensation for the authorized placement of fill material into wetlands and wetland ditches to construct a light industrial park. The Phase I mitigation site is 4.28 acres in size and has developed into a complex of forested, scrub-shrub and emergent wetlands; the Phase II mitigation site is 67 acres in size and includes a mixture of emergent (PEM), scrub-shrub (PSS), and forested (PFO) wetlands intermixed with forested uplands. ICF was unable to determine the current quality and species composition of these areas; however, it is likely that they contain a higher percentage of native vegetation and provide enhanced wetland and habitat functions over other, disturbed wetlands, uplands, and developed areas in the vicinity.
- **Lord Island.** Lord Island is located in the Columbia River near the project area. It consists of a 234-acre island that was previously used for dredge material disposal. It is densely forested and

bisected by various high-flow channels that support tidal marshes and shallow habitat areas. Vegetation on the island is largely native. Lord Island provides significant wildlife values including habitat for bald eagles and significant numbers of wintering waterfowl (Oregon Wetlands Joint Venture 1994:20).

2.2.2.3 Special-Status Species

Of the 15 special-status plant species known to occur in Cowlitz County (Table 3), six were identified by ICF as potentially occurring in the direct impact project area. These include Nelson's checker-mallow, western wahoo, western false dragonhead, loose-flowered bluegrass, soft-leaved willow, and Columbia water-meal. Botanical surveys for these species have not been conducted in the project area or vicinity. Based on the typical habitat description, soil type, and associated plant species presented in Table 3, ICF identified potential habitats in the project area that could support these species. Approximate blooming times are provided and typically correspond with the best timeframe for field surveys.

- **Western wahoo**. Potential habitat for western wahoo could exist in and around the forested wetlands (Wetlands A and Y) between the closed Black Mud Pond facility and the former Cable Plant. Grette Associates (2014a) states that presence of suitable habitat for this species in the project area is unlikely because the site is largely constructed from dredge spoils and is not associated with a remnant oak savannah or high-quality forest. Western wahoo blooms between May to June (Washington Department of Natural Resources 2015).
- **Western false dragonhead.** Potential habitat for western false dragonhead could occur in and around the forested wetlands (Wetlands A and Y) between the closed Black Mud Pond facility and the former Cable Plant, along the bank of CDID Ditches 10 and 14, and in other low, wet places in the project area. Western false dragonhead blooms between July and September (Herbarium, Burke Museum of Natural History and Culture 2014).
- **Loose-flowered bluegrass.** Potential habitat for loose-flowered bluegrass exists in the forested wetland and emergent/scrub-shrub wetlands (Wetlands C and Z) located between the closed Black Mud Pond facility and the former Cable Plant. Such habitat could also occur along CDID Ditch 10, Ditch 14, and along the U-Ditch and Interception Ditch. Loose-flowered bluegrass flower between from late May through June (Washington Department of Natural Resources 2015).
- **Soft-leaved willow.** Potential habitat for soft-leaved willow occurs along the Columbia River, in and around the Dredged Material Storage Area, and possibly in the wetlands (Wetland A, C, Z, and Y) located between the closed Black Mud Pond facility and the former Cable Plant. Soft-leave willow flowers from May to June (Washington Department of Natural Resources 2015).
- **Nelson's checker-mallow.** Given its regional distribution, documented occurrence within Cowlitz County, and association with semi disturbed habitats and species; Nelson's checker-mallow could occur in the project area. Potential occurrence locations include the outer edges of the project area in relatively undisturbed habitats along Industrial Way, adjacent to the CDID and privately owned ditches that fringe the northern edge of the project area, and/or adjacent to Wetlands A and Y in the northern portion of the area. Nelson's checker-mallow typically blooms between May and September (Washington Department of Natural Resources 2015).
- **Columbia water-meal.** Given its regional distribution, documented occurrence within 1.5 miles of the project area, and its known association with ponded habitats and more common species

such as duckweed, this species could occur in the pond at the Dredged Material Storage Area and in the ditches maintained by CDID #1 and private entities. Bloom time of Columbia water-meal in Washington is unknown but not necessary for identification (Washington Department of Natural Resources 2015).

2.2.2.4 Noxious weeds

Table 8 presents the noxious weed species identified in the project area during various site investigations. The project area supports plant species regulated as noxious weeds under the law. Fourteen noxious weed species have been documented in the project area (Table 7) (Cowlitz County Noxious Weed Control Board 2015; Washington State Noxious Weed Control Board 2015).

Table 8. Noxious Weeds Identified in the Project Area

Noxious Weed Species			Classification		State/County Priority Weed for Control[e]
Common Name	Scientific Name	Location Observed[a, b, c]	State[d]	Cowlitz County[e]	
Indigobush	*Amorpha fruticosa*	Riparian[b]	B	B	Yes/No
Scotch broom	*Cytisus scoparius*	W/U[a, b]	B	B	No/Yes
Policeman's helmet	*Impatiens glandulifera*	W/U[a]	B	B	Yes/Yes
Eurasian water milfoil	*Myriophyllum spicatum*	W/OW[a]	B	B	Yes/No
Parrotfeather	*Myriophyllum aquaticum*	W/OW[a]	B	B	No/No
Water primrose	*Ludwigia hexapetala*	D[c]	B	B	No/No
Canada thistle	*Cirsium arvense*	W/U[a, b]	C	C	No/Yes
Bull thistle	*Cirsium vulgare*	W/U[a, b]	C	C	No/No
English ivy	*Hedera helix*	W/U[a, b]	C	C	No/No
Yellowflag iris	*Iris pseudacorus*	W/D[b]	C	C	No/No
Reed canarygrass	*Phalaris arundinacea*	W/U[a, b]	C	Not listed	No/No
Himalayan blackberry	*Rubus armeniacus*	U[a, b]	C	C	No/No
Common tansy	*Tanacetum vulgare*	U[a]	C	C	No/Yes
Nonnative cattail	*Typha* spp.	W[a, b]	C	C	No/No

[a] Observations made by Grette Associates, as presented in *Appendix F: Noxious Weeds and Sensitive Plants* in Grette Associates 2014a. Location values: W = wetland; U = upland; D = Ditches; OW = open water

[b] Observations made by ICF during site investigations in April and December 2014

[c] Observations by Washington State Noxious Weed Control Board (2015)

[d] State noxious weed classification based on Washington State Noxious Weed Control Board 2015 Noxious Weed List

[e] Noxious weed classification and priority for weed control (state and county level) based on Proposed 2015 Cowlitz County Noxious Weed List (Cowlitz County Noxious Weed Control Board 2015)

None of the species designated as Class A noxious weeds by the Cowlitz County Noxious Weed Control Board have been observed in or within 1 mile of the project area. Six species documented in the project area are listed Class B noxious weeds, a classification assigned to plants considered a priority for weed control to prevent new infestations and to contain existing populations.

- **Indigobush.** Indigobush was observed by ICF in the riparian plant community along the western shoreline of the project area, near the outlet of CDID #1's Reynolds Pump Station. It likely occurs along other portions of the shoreline of the project area.
- **Scotch broom.** As noted by Grette Associates (2014a) and ICF during the 2014 field reconnaissance, Scotch broom is present in scattered patches throughout the project area in disturbed uplands including the former Outdoor Storage Area, north end of U-Ditch, along the outer edges of Wetland Z, throughout Landfill 2 (Industrial Landfill), Fill Deposit A (White Mud Pond), Fill Deposits B-1 and B-2 (Eastern Black Mud Ponds), portions of Fill Deposit B-3 (Black Mud Deposits), and along the berm around the Dredged Material Storage Area (Figure 4).
- **Policeman's helmet.** Policeman's helmet was listed as being present in the project area by Grette Associates (2014a), but no specific locations for this species were provided. Based on documented habitat preferences and site conditions, policeman's helmet could be present in the understory/herbaceous layer of Wetlands A and Y.
- **Eurasian watermilfoil and parrotfeather.** Both of these species were identified by Grette Associates (2014a) as being present in or within 1 mile of the project area. However, no specific location for where these species were observed was provided. These aquatic species typically occur in permanently ponded areas. Given their habitat requirements, they could occur in CDID Ditch 4, 10, and 14, and possibly in part of the Dredged Material Storage Area pond.
- **Water primrose (*Ludwigia hexapetala*).** Water primrose has been identified by as occurring in drainage ditches within the CDID # 1. Water primrose is typically found creeping along the shoreline, floating on the water surface, or growing upright. It is possible that water primrose could occur in CDID Ditches 4, 10 and 14, and possibly the Dredged Material Storage Area pond.

Eight species present in this study area are listed Class C noxious weeds, a classification assigned to weeds that are not typically considered a priority for weed control because they are already widespread throughout the state.

- **Canada thistle and bull thistle.** Both of these species are listed as being present in the project area by Grette Associates (2014a) and recorded in the uplands of Parcel 10213 and former Reynolds facility (Grette Associates 2014e). Canada thistle was also observed by ICF in Wetland Z during the December 2014 site visit.
- **English ivy.** English ivy was identified by Grette Associates (2014a) as being present in the project area; however, they did not state where it was observed. Given its habitat preferences, it could be present in Wetland A, as well as in scattered forested areas along Industrial Way and Memorial Park Drive in Parcel 10213.
- **Yellowflag iris.** Yellowflag iris was observed by ICF along the edges of the U-Ditch and Interception Ditch during the December 2014 site visit. Grette Associates (2014b) also recorded it in Wetland X along the shoreline of the Columbia River.
- **Reed canarygrass and Himalayan blackberry.** Both of these species are present in disturbed areas, uplands, and wetlands throughout the project area, including in Wetlands A, C, and Z, as well as along the shoreline of the river, and within the herbaceous wetland and upland areas north of Industrial Way (Grette Associates 2014c). Reed canarygrass is a dominant understory species in forested Wetland A and is a dominate species in emergent Wetlands P2, C, Y, and Z (Grette Associates 2014a). Blackberry occurs in scattered areas throughout the project area, particularly along the U-Ditch/Interception Ditch, off the southeast corner of the former Cable

Plant, along the margins of various stormwater conveyance features, along the south side of Industrial Way, and along the Reynolds Lead (Grette Associates 2014a).

- **Common tansy.** Grette Associates (2014a) lists this species as present in the project area but does not indicate where this species was observed.
- **Nonnative cattail.** Nonnative cattails were recorded within Wetland Y (Grette Associates 2014a) and are a dominate species in Wetland E and in the stormwater conveyance features of the far eastern end of the project area (Grette Associates 2014d); cattails were also observed at the eastern end of the Dredged Material Storage Area pond at the southeastern end of the project area, as well as at the eastern end of the U-Ditch and in a shallow ponded area off the southeast corner of the former Cable Plant.

Chapter 3
Impacts

This chapter describes the potential direct and indirect impacts on vegetation that could result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

Construction and operation of the coal export terminal would cause both direct and indirect impacts on vegetation. Direct impacts could result from activities that directly disturb or damage vegetation including such actions as the removal of vegetation during clearing and grading and the physical and chemical management of vegetation and noxious weeds as part of routine maintenance. Indirect impacts are those induced by construction or operation of the coal export terminal that occur later in time or farther removed from the project area but are still reasonably foreseeable. Examples include the future spread of noxious weeds into adjacent areas from the construction site and the associated changes in plant communities over time that could result from this activity. For the purposes of this analysis, no indirect impacts on vegetation would result from construction activities. Operation-related vegetation impacts that occur on site are regarded as direct impacts, while those that occur off site are considered indirect impacts.

The duration of potential impacts on vegetation was also considered. Permanent impacts would modify vegetation cover types to such a degree that they would not return to their preconstruction state for the life of the Proposed Action. While construction would temporarily disturb vegetation cover types, the implementation of best management practices, project design components, regulatory requirements, or an on-site vegetation management plan would facilitate re-establishment of vegetation cover types similar to preproject conditions after construction is completed.

The Applicant identified the following design features and best management practices to be implemented as part of the Proposed Action. These were considered when evaluating potential impacts of the Proposed Action.

- The Applicant would surface unpaved areas to control soil erosion by wind and water to support pedestrians and light vehicles (including four-wheel drive vehicles) and to repress undesirable vegetation.
- The Applicant would implement best management practices and the following project components (and related activities) to avoid and minimize potential impacts associated with coal dust.
    - Conveyors would be:
        - Enclosed (except for stockyard and shiploader conveyors).
        - Monitored for general status and washed down regularly.
        - Cleaned using high-pressure water in the collection and containment areas, including belts.
    - Transfer points would be:
        - Enclosed in transfer towers.

- Equipped with soft-flow transfer chutes, inlet and outlet curtains and side skirts, and water spray systems.
- Cleaned using high-pressure water as part of regular washdowns of underbelt plating, and water collection and containment system.

○ Rail car unloaders would be:

- Located in an enclosed building.
- Cleaned with dry fog and water spray systems to control dust.

○ Stockpiles would be:

- Sprayed via a spray system controlled by local and remote weather stations.
- Managed via a controlled dropper from the stackers to manage height of piles.
- Cleaned along conveyor berms and sealed roadways.

○ Shiploading equipment would be:

- Equipped with an enclosed loading spout and shiploader boom.
- Discharged below-deck of vessel.
- Cleaned and washed by high-pressure water.
- Washed; washdown water would be captured and contained.

3.1 Proposed Action

Potential impacts on vegetation from the Proposed Action are described below.

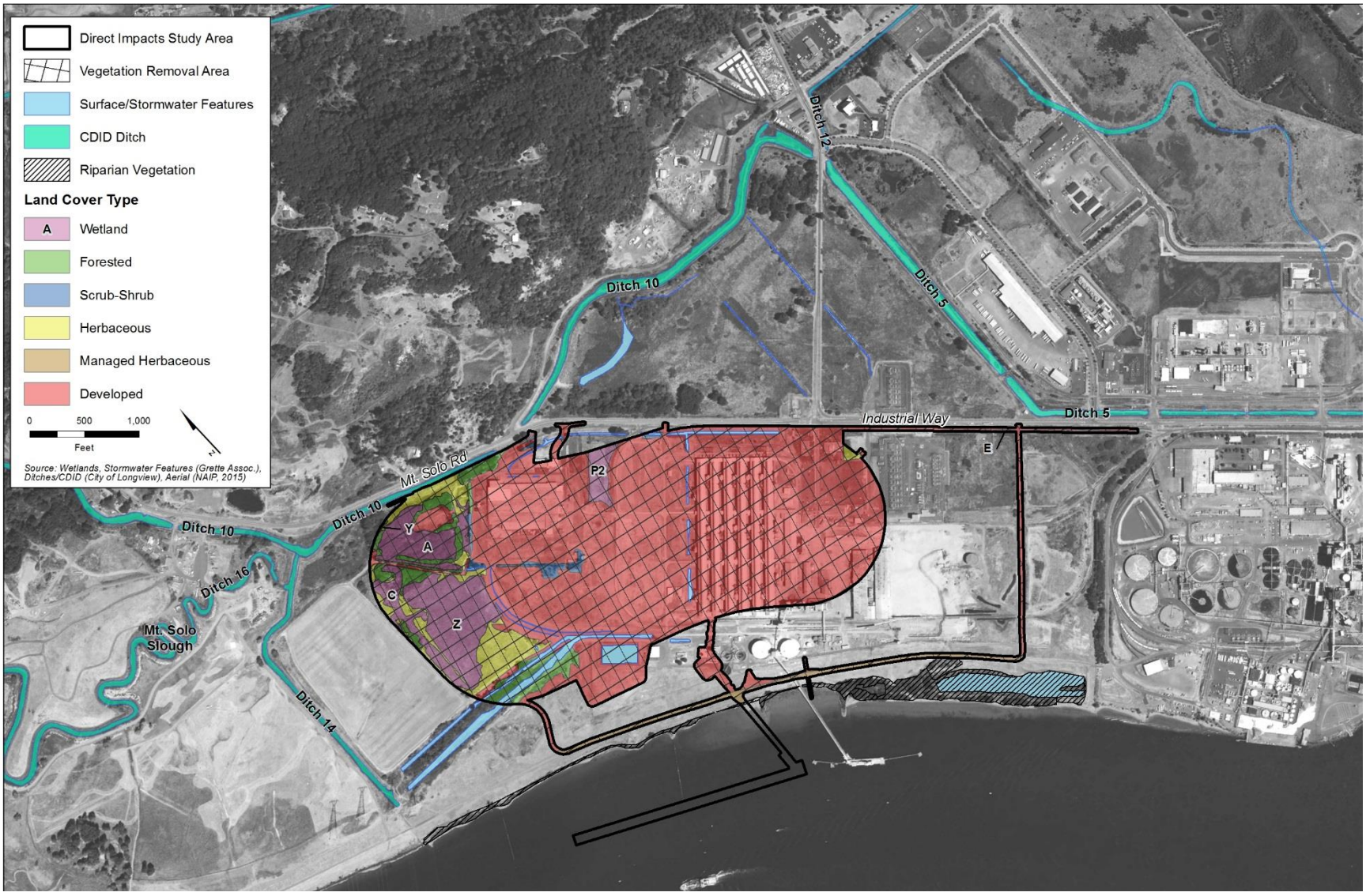
3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

Permanently Remove Vegetation

Construction of the Proposed Action would require removal of vegetation (Figure 7). Clearing and grading would permanently alter or remove approximately 212 acres of land cover types from the direct impact study area (Table 9). The majority (71%) of the total impact would occur in areas occupied by the disturbed cover type (i.e., areas with existing structures or scattered grasses and weeds in and around the developed portions of the project area). These areas of disturbed vegetation are early successional and weedy areas that generally do not support native plant species or provide suitable wildlife habitat.

Figure 7. Impacts on Existing Land Cover Classes and Vegetation Cover Types in the Direct Impact Study Area



Under the Proposed Action, approximately 26.26 acres of upland vegetation or 12% of the total upland vegetation within the project area would be removed (Table 9). Herbaceous upland vegetation surrounding Wetlands A, C, and Z make up the majority of this acreage. These herbaceous upland areas are generally dominated by reed canarygrass. Approximately one-third of the upland forest in the project area would be removed. The majority of the 8.90 acres of upland forest impacts would occur to the upland forested areas surrounding Wetland A and the upland forested areas surrounding the interception ditch and stormwater conveyance feature SC11. These areas are dominated by native trees, primarily black cottonwood, red alder, Oregon ash, and Pacific willow trees, with an understory of mixed native and invasive shrubs dominated by red elderberry, sweetbriar rose, and Himalayan blackberry. The impacts would occur as a result of construction of the rail loop, stockpile pads, and a series of stacking and reclaim conveyors.

Approximately 0.05 acre of upland forest impact consists of riparian forest. These impacts would occur as a result of construction of the trestle conveyor that connects the surge bin to Docks 2 and 3, and would include the removal or trimming of black cottonwood and willow trees, and understory shrubs such as red-osier dogwood and Himalayan blackberry.

Table 9. Permanent Direct Impacts by Land Cover and Vegetation Cover Type in the Project Area

Land Cover Category	Vegetation Cover Type	Impacts (Acres)[b]	Percentage of Cover Type[c]
Developed land			
	Developed land total	**151.14**	**71**
Upland	Forested	8.90	4
	Scrub-shrub	2.11	1
	Herbaceous	10.88	5
	Managed herbaceous	4.37	2
	Upland total	**26.26**	**12**
Wetlands[a]	PFO	6.28	3
	PEM/PFO	3.38	2
	PEM	13.87	7
	PEM/PSS	0.57	0
	Wetlands total	**24.10**	12
Open water	**Open water total**	**10.78[d]**	**5**
Total		**212.28**	**100**

Notes:

[a] Cowardin classification per Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Values include PFO = palustrine forested; PSS = palustrine scrub-shrub; PEM = palustrine emergent

[b] These are direct impacts on vegetation in the 212-acre project area, which includes the 190 acre terminal plus additional elements (e.g. access roads, docks, and rail line).

[c] This column represents the percent of cover type in the direct impact study area affected by construction.

[d] Approximate open water area within footprint of project area. Includes area of docks and trestle over the open water of the Columbia River. For details on permanent impacts to open water habitat see SEPA Wildlife Technical Report (ICF 2017a).

Affect Special-Status Plants

Although no special-status plant species have been recorded in the project area, potentially suitable habitat is present. Should any special-status plant species occur in the project area, they could be permanently removed as a result of project construction depending on the location of the plant. As mentioned previously, six special-status plant species were identified as potentially occurring in the study area for direct impacts, based on the presence of potentially suitable habitat. These plant species are Nelson's checker-mallow, western wahoo, western false dragonhead, loose-flowered bluegrass, soft-leaved willow, and Columbia water-meal. The spatial extent of any impact on special-status plants cannot be quantified until a special-status plant survey is conducted. Such surveys would be required mitigation. These surveys would occur during the appropriate time of year, prior to any Proposed Action-related construction activities beginning. If special-status plants are identified by the survey, the impact would be mitigated through Cowlitz County's Critical Areas Ordinance mitigation requirements for special-status plants (CCC 19.15.170).

Temporarily Disturb Adjacent Vegetation during Construction

Construction activities could temporarily affect vegetation adjacent to the project area, including wetland and riparian vegetation, through vehicle usage, material storage and stockpiling, and ground disturbance. Construction and staging activities in the direct impact study area could result in the crushing and burying of adjacent vegetation and compaction of soil by construction equipment and material staging. Such impacts are not likely to alter the vegetation in these areas permanently, as the areas would likely revegetate with similar species following completion of construction. Ground disturbance related to these activities could also increase the opportunity for stormwater runoff to carry sediments, spilled vehicle fluids, or other construction materials into areas outside of the project area, potentially affecting the health and vigor of the vegetation in these areas. Depending on the extent, duration, and content of this runoff, vegetation could be affected through interference with photosynthesis, respiration, growth, and/or reproduction. Dust from construction activities could also affect vegetation by collecting on leaves and other plant surfaces, potentially inhibiting photosynthesis and other plant functions. Depending on the material used and the best management practices employed, the 35-foot-high preload material piles could provide an area for invasive plant species, including noxious weeds, to colonize temporarily. Such conditions would provide a seed source that could be readily dispersed into adjacent areas by wind and runoff, increasing the potential for invasive species and noxious weeds to spread and displace native vegetation.

The potential for temporary construction impacts on vegetation would be minimized by adhering to permit conditions, such as those required by the National Pollutant Discharge Elimination System Construction Stormwater Permit from Washington State Department of Ecology (Ecology) and the Fill and Grade Permit, Critical Areas, Shoreline Development, and Floodplain Development permits issued by Cowlitz County. Compliance with these permits would require implementation of the Stormwater Drainage Control Plan, Temporary Erosion and Sedimentation Control Plan, and other relevant best management practices to reduce the potential for soil erosion during construction and related impacts on water quality or adjacent vegetated areas. This would also require developing and implementing a Spill Prevention, Control, and Countermeasures Plan and a site-specific Construction Stormwater Pollution Prevention Plan that includes best management practices for equipment and material handling and construction waste management. Implementation of the measures outlined in these plans

would reduce the potential for temporary construction impacts on vegetation from construction equipment and materials usage.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on vegetation because construction impacts would be limited to the project area, and would not occur later in time or further removed in distance than the direct impacts.

3.1.3 Operations: Direct Impacts

Direct impacts on vegetation from operation of the Proposed Action would likely be limited to the continued existence and possible colonization by noxious weeds around (and outside) the periphery of the project area, impacts from vessel loading and transport along rail tracks, and control of vegetation under the conveyor and along the rail tracks and rail loop.

Operation of the Proposed Action would result in the following direct impacts.

Result in Colonization by Noxious Weeds

Because the project area would be mostly developed, colonization of the project area by native plants would not likely occur during operations. Invasive plant species, including several of the noxious weed species already present in and around the project area, are generally adapted to colonize highly disturbed areas, such as the periphery and other portions of the project area. Reed canarygrass, Himalayan blackberry, Canadian and/or bull thistle, and Scotch broom are the noxious weed species most likely to occur in and around the project area. These species are already present on the project area and are common in adjacent areas, and would likely continue to persist during operations. Areas along rail tracks, along stacking conveyors, and between tracks of the rail loop would be most likely to support such noxious weed species in scattered patches.

Disturb Vegetation As a Result of Rail Transport and Vessel Loading in the Project Area

Operation of the Proposed Action could disturb upland, wetland, and riparian vegetation along the railroad tracks entering the project area and along the shoreline of the Columbia River, as well as scattered areas of aquatic vegetation that could be present in the shallow waters of the Columbia River near the site. Such impacts could occur as the result of potential spills of coal or other materials or fluids associated with operation of the machinery and equipment associated with the trains and rail cars, the coal export terminal's conveyor and stockpiling systems, the mobile equipment used to maintain the facilities, and the shiploaders. Direct impacts on aquatic vegetation along the shoreline of the Columbia River cannot be quantified until an aquatic vegetation survey(s) is conducted and occurrence of aquatic vegetation is determined.

Impacts on water quality associated with the routine movement of coal across the shoreline zone and along the shiploaders into vessels at the docks could also affect vegetation along or in receiving waters. However, stormwater runoff would be collected at the project area and treated to remove potential contaminants associated with the operations and maintenance activities (e.g., coal, diesel fuel, oil, hydraulic fuel, antifreeze, tire, and brake dust, exhaust particulates) prior to discharge to the Columbia River. Best management practices and mitigation to reduce

potential water quality impacts are detailed in the SEPA Water Quality Technical Report (ICF 2017d).

Although hazardous materials spills or leaks could occur as the result of human error or minor equipment failure, the potential for these to occur and affect the environment would be minimized by appropriate training and the implementation of prevention and control measures. Best management practices and mitigation to reduce potential impacts from spills and leaks are detailed in the SEPA Hazardous Materials Technical Report (ICF 2017e), the SEPA Vessel Transportation Technical Report (ICF 2017f) and the SEPA Rail Transportation Technical Report (ICF 2017g). Specifically, prior to the commencement of operations, all personnel would be trained in proper operating and spill-prevention procedures. Specific prevention and response actions would be described in the coal export terminal's spill prevention, control, and countermeasure plan. All conveyors and loading equipment would be regularly inspected and promptly repaired as necessary. During loading operations, the dock would be constantly attended to by the terminal operator who would have the ability to stop a transfer immediately if a spill or leak occurred from the conveyors, shiploaders, or other equipment. If a spill occurs, it must be reported and cleanup actions taken. Depending on the spill, a natural resource damage assessment could be required under WAC 173-183, Oil Spill Natural Resource Damage Assessment.

Affect Vegetation during Maintenance of Vegetation under Conveyor to Docks 2 and 3

Vegetation maintenance during operation of the Proposed Action could affect riparian trees and tall shrubs beneath and adjacent to the conveyor that would be used to transport coal from the storage facility to the shiploaders on Docks 2 and 3. Trees and tall shrubs in the approximately 45- to 50-foot-wide area beneath and around the trestle and conveyor would likely be regularly trimmed and/or removed to ensure that branches and leaves do not interfere with the operation of the conveyor. This maintenance would limit the height of trees and the aerial spread of shrubs that develop in this location, slightly reducing the ability of the site's shoreline to provide organic material to the river, shade the upper beach and shoreline, and provide native foraging, resting, and perching opportunities for passerine birds. This area is small, however, relative to the total length of vegetated shoreline.

Affect Vegetation during Maintenance of Vegetation along Rail Tracks and Rail Loop

Routine vegetation maintenance during operation of the Proposed Action could affect both upland and wetland vegetation along the perimeter road and rail tracks entering the project area and along the rail loop used to stage trains within the site. Trees and tall shrubs within approximately 25 feet of either side of the perimeter road surrounding the tracks would likely be trimmed to ensure branches and leaves do not interfere with the movement of the rail cars into and through the site. Similarly, any vegetation that colonizes the interior of the site along the rail loop would likely also be removed, controlled, or trimmed to eliminate any interference with the movement of the rail cars, equipment, or personnel. This maintenance would result in artificial stunting of tree and shrub species in these areas; it would not measurably reduce the functions of native plant communities, however, because it would be confined to the outermost edges of such communities.

Affect Special-Status Plants

Any special-status plants that occur in areas along the periphery of the project area, along the rail tracks and rail loop, or under the conveyor would be affected by operation of the coal export terminal in the same manner as described above. The potential for and spatial extent of any such impact cannot be quantified until a special-status plant survey(s) is conducted and occurrence of special-status species is determined.

Cause Release of Coal from a Spill

Direct impacts resulting from a coal spill during coal handling at the coal export terminal would likely be negligible because the amount of coal that could be spilled would be expected to be relatively small due to the contained nature and features of the terminal and safety mechanisms to stop operations of coal moving equipment. It is anticipated that a small spill could be cleaned up quickly by hand using hand tools or small, mechanized equipment so as to not stop or delay routine terminal operations. Also, impacts would be negligible because of the absence of vegetation in the project area and the contained nature and features of the terminal (e.g., fully enclosed belt conveyors, transfer towers, and shiploaders).

Coal spilled into terrestrial environments could affect vegetation. Herbaceous vegetation would be more susceptible to damage and smothering from a coal spill compared to more rigid, woody vegetation like shrubs and trees, which could be better able to withstand the weight and force of a coal spill, depending on the magnitude of the spill. The magnitude of potential impacts would depend on the size (volume) and extent (area) of the coal spill. The physical impact of coal spilled on vegetation would range from minor plant damage to complete loss of vegetation. Some plant species could be more sensitive to coal than other species. Coal dust associated with a coal spill could also cover vegetation, resulting in reduced light penetration and photosynthesis, which could lead to reduced vegetation density and plant diversity. The magnitude of a coal dust impact would depend on duration of exposure, tolerance of vegetation, and aggressiveness of nonnative species. Cleanup of coal spilled during operations could further affect vegetation by either removing or further damaging vegetation because of ground disturbance related to cleanup activities. Any coal remaining on the ground after a cleanup effort could leach chemicals from exposure to rain, which could damage or kill vegetation. However, if this were to occur, the impact area would generally be highly localized, limited to the extent of the spill, and unlikely to disrupt the overall plant community in the project area.

3.1.4 Operations: Indirect Impacts

Operation of the Proposed Action would result in the following indirect impacts.

Deposit Coal Dust on Vegetation

Under the Proposed Action, the movement of coal into and around the project area, creation of large stockpiles of coal within the project area, and use of open conveyors to move coal within the project area and onto vessels, create the potential for coal particles and fugitive coal dust to be generated. For example, coal dust deposition was noted within 8 months of the start of coal stockpiling in areas adjacent to and downwind of coal stockpiles associated with a Portland General Electric coal-fired power plant near Boardman, Oregon (approximately 158 miles southeast and across the Columbia River from the project area Proposed Action) (Spencer and

Tinnin 1997:476). Similarly, air quality sampling conducted by concerned citizens in Seward, Alaska, downwind of the Seward Coal Loading Facility, indicated that the air samples collected on windy days while coal was being loaded or unloaded at the facility were highly enriched with total carbon in the form of particulate matter. Most of the total carbon in the air samples was organic carbon, indicating the presence of coal dust in the air (Zimmer 2014:4–10). Similarly, coal concentration in estuarine sediments doubled from 1.8 to 3.6% in the uppermost 2 to 3 centimeters of sediment within about 3 square kilometers of the Roberts Bank coal loading terminal in British Columbia, Canada, between 1975 and 1999 (Johnson and Bustin 2006:67).

Although concerns regarding coal dust are commonly articulated relative to air quality and human health concerns, wind-born coal dust can also deposit on vegetation, soils, and sediments. The potential extent and deposition rate of coal dust particles less than 75 microns diameter was modeled as part of the analysis conducted relative to air quality; see the SEPA Air Quality Technical Report (ICF 2017h) for additional details.

Based on this modeling, the highest rate of coal dust deposition would be expected in the area adjacent to the project area, but smaller particles would also be expected to deposit in a zone extending around and downwind of the project area. Deposition rates could range from 1.99 grams per square meter per year (g/m^2/year) closest to the project area, gradually declining to less than 0.01 g/m^2/year approximately 2.4 miles from the project area.

The zone of deposition includes the coniferous forest vegetation on the hills adjacent to the northern extent of the project area, as well as the riparian vegetation along the shoreline of the river. Deposition rates of less than 0.1 g/m^2/year are projected to occur over the forested communities on Lord Island within the Columbia River just east of the project area, with declining concentrations across the island and to the south and west toward Walker Island.

The effects of dust (arising from a variety of sources) on vegetation vary depending on dust load, climatic conditions, and the physical characteristics of the vegetation. Effects can be physical, such as blocked stomata which alters gas diffusion into/out of the leaves, causing reduced respiration (smothering of leaves) or increased transpiration (water loss), alteration in leaf surface reflectance and light absorption potential, and increased in leaf temperature due to optical properties of the dust including its particle size and color (Chaston and Doley 2006:42–44, Doley 2006:38–41; Farmer 1993:63–66). Such effects can be complex. Experimental manipulation of desert soil dust deposition on the leaves of the endangered Lane Mountain milk-vetch (*Astragalus jaegerianus*), a Mohave desert perennial affected by U.S. Army training center vehicular traffic, showed a decrease in average shoot growth but an increase in seasonal net photosynthesis (Wijayratne et. al. 2009:84–86). Increased leaf temperature caused increased photosynthesis early in the growing season but ultimately resulted in reduced shoot growth as seasonal air temperatures increased.

Research conducted in the more arid climates of eastern Oregon investigated species composition and plant growth of vegetation growing on and off a plume of coal dust, which had deposited adjacent to a coal yard holding area for the Portland General Electric power plant near Boardman, Oregon. Coal dust deposition was correlated with increases in soil temperature and moisture holding capacity; accumulation of iron, copper, zinc, lead, and sulfates; and lower soil pH (Spencer 2001:847–848). While studies did not find significant differences in total plant biomass within and outside of the dust deposition plume, significantly lower frequency of

occurrence and lower percent cover of lichens in areas within the coal dust plume was documented (Spencer 2001:847–848; Spencer and Tinnin 1997:479).

It is not known whether the climatic conditions in the area where these studies occurred are directly applicable to the climatic conditions in the study area. Neither the specific mechanisms of effect nor a threshold for potential physical or biological effects of coal dust deposition has been studied and/or identified relative to the climate and native vegetation of the Columbia River Gorge or the study area. Similarly, no studies identify the deposition rate or particle size at which impacts on native Pacific Northwest tree, shrub, or herbaceous plants would occur. Given the number and variety of environmental, climatic and plant factors affecting the deposition of dust (Doley 2006:36), information regarding foliage density, leaf dimensions and characteristics, as well as particle size distribution, dust color and climatic conditions would likely be needed to determine the level of dust deposition that could affect vegetation or plant functions.

The movement of coal by rail could generate coal particles and fugitive coal dust, which could be deposited on vegetation, soil, and sediments in the study area. Coal transported by vessel would be in enclosed cargo holds and is not likely to result in deposition of coal on vegetation along the vessel route in the Columbia River.

Cause Erosion of Vegetation due to Vessel Wakes during Operations

Operation of the Proposed Action could result in indirect impacts on vegetation along the shoreline of the Columbia River related to increased vessel traffic and associated vessel wakes and sediment erosion.

There could be an increase in the potential for impacts on vegetation associated with vessel wakes compared with existing conditions. Approximately six vessels per year currently deliver alumina over Dock 1 to the existing bulk product terminal. Operation of the Proposed Action at maximum throughput would result in the loading and movement to and from the coal export terminal of 70 vessels per month (80% Panamax size; 20% Handymax size) at Docks 2 and 3 or 1,680 vessel transits a year.

Shoreline erosion is both a natural process as well as a human-caused process that removes sediments from the shoreline. It is caused by a number of factors, including storms, wave action, and wind. The removal of shoreline sediment can remove the substrate in which vegetation grows, eventually leading to loss of plants. Although erosion does naturally occur, it can be increased by vessel wakes, which can intensify the impacts and/or rate of the erosion process. In riverine environments the wave periods of vessels are longer compared to waves generated by wind. Riverbank vegetation is naturally adapted to shorter periods of wind waves, but not to longer periods, which may be present in vessel wakes. Long-period waves are a new erosion mechanism to which the riverbank vegetation may be susceptible (Macfarlane and Cox 2004 in Gourlay 2011). While vessel wakes and associated shoreline erosion of the Columbia River currently result from existing vessel traffic, operation of the terminal would increase vessel traffic and potentially increase or intensify the extent and/or rate of shoreline erosion and subsequent loss of shoreline vegetation.

Increased vessel traffic in the Columbia River has the potential to increase vessel wakes, which could cause an increase in shoreline erosion and possibly affect vegetation. The average number of annual vessel transits in the Columbia River over a 5-year period (2010–2014) is approximately 3,358 (ICF 2017e). With operation of the Proposed Action at maximum

throughput and projected growth in other commercial vessel traffic, annual transits are expected to increase up to 7,342 by 2024–2027 when the coal export terminal becomes operational and up to 8,672 moving beyond 2028. The potential for vessel wake impacts on vegetation along the shoreline in the immediate vicinity of the project area is limited due to the slope of the shoreline and the general lack of aquatic vegetation near the docks. Additionally, Proposed Action-related vessels maneuvering near the docks would be moving slowly as they prepare to dock, and likely not putting out a wake sufficient to cause shoreline erosion. However, there could be a potential for such impacts on the thin strip of shoreline vegetation along the northern end of Lord Island from large wakes, and/or wakes oriented perpendicular to the main navigation channel and docks, such as those that can occur when tugs are oriented perpendicular to the shoreline as they push vessels into position at docks. However, the impact on shoreline vegetation associated with vessel wakes cannot be quantified or measurably attributed to potential Proposed Action-related vessels.

The actual extent, location, and magnitude of shoreline erosion impacts is influenced by the complex interaction of multiple factors that affect when, where, and with what intensity vessel wakes would interact with the shorelines of the river. Such factors can include vessel design, hull shape, vessel weight and speed, angle of travel relative to the shoreline, proximity to the shoreline, currents and waves, tidal stage, and water depth (Jonason 1993:29–30; MARCOM 2003). The potential for shoreline erosion can also be influenced by the slope and physical character of the shoreline (i.e., soil susceptibility to erosion), as well as the amount and type of vegetation that occurs along the shoreline.

Disturb Vegetation as a Result of Rail Transport and Vessel Operations

Operation of the Proposed Action could indirectly affect vegetation along the rail tracks entering the project area and along the shoreline of the Columbia River within the study area, as well as scattered areas of aquatic vegetation that could be present in the shallow waters of the Columbia River in the study area. Such impacts could occur as the result of potential spills of coal or other potentially hazardous materials or fluids associated with operation of the machinery and equipment associated with the Proposed Action as well as with operation of the trains and vessel transporting coal to and from the project area.

Although spills or leaks could occur as the result of human error or minor equipment failure, the potential for these to occur and affect the environment would be minimized by appropriate training and the implementation of prevention and control measures. Prevention and response actions would be described in the coal export terminal's spill prevention, control, and countermeasure plan. Specifically, prior to the commencement of operations, all personnel would be trained in proper operating and spill-prevention procedures. All conveyors and loading equipment would be regularly inspected and promptly repaired as necessary. During loading operations, the dock would be constantly attended to by the terminal operator who would have the ability to stop a transfer immediately if a spill or leak occurred from the conveyors, shiploaders, or other equipment. If a spill were to occur, it would be reported and cleanup actions would be taken. Depending on the spill (i.e., material and quantity of material spilled), a natural resource damage assessment could be required under WAC 173-183, Oil Spill Natural Resource Damage Assessment. Refer to the SEPA Hazardous Materials Technical Report (ICF 2017e), SEPA Vessel Transportation Technical Report (ICF 2017f) and SEPA Rail Transportation Technical Report (ICF 2017g) for further details.

Affect Special-Status Plants

Any special-status plants that occur in areas along the along the rail tracks entering the project area, along the shoreline of the Columbia River, or in any area receiving coal dust deposition could be indirectly affected by operation of the coal export terminal in the same manner as described above. The potential for and spatial extent of any such impact cannot be quantified until a special-status plant survey(s) is conducted and occurrence of special-status species is determined.

Cause a Spill of Coal during Rail Transport

The magnitude of the potential indirect impact from a coal spill on terrestrial environments would be similar to those described previously and would depend on the location of the spill, the volume of the spill, and success of efforts to contain and clean up the spill, none of which can be predicted.

The potential impact of a coal spill from a Proposed Action-related train is directly related to the probability of a Proposed Action-related train incident occurring. Draft EIS Section 5.2, *Rail Safety*, estimates the number of Proposed Action-related train incidents that could occur during coal transport within Cowlitz County and Washington. The predicted number of incidents of loaded trains related to the Proposed Action is approximately one every 2 years in Cowlitz County or five per year in Washington.

Not every incident of a loaded coal train would necessarily result in a rail car derailment or a coal spill. A train incident could involve one or multiple rail cars, and could include derailment in certain circumstances. The size and speed of the train and the terrain at the location of an incident would influence whether the incident resulted in a coal spill that could have impacts on vegetation. A broad range of spill sizes from a partial rail car to multiple rail cars could occur because of a Proposed Action-related train incident.

Additionally, containment and cleanup efforts for coal spills from a rail incident factor into the potential impact on vegetation and the environment. It is expected that coal spills in the terrestrial and built environments would be easier to contain and clean up than spills occurring in an aquatic environment. Spills occurring on land could have a quicker response time and cleanup in some locations due to their visibility and access for cleanup equipment, as compared to spills into aquatic environments. Cleanup of spills in the terrestrial environment could affect vegetation and require restoration.

Potential physical and chemical effects of a coal release in terrestrial environments would be the same or similar to those described above under *Operations: Direct Impacts*.

3.2 No-Action Alternative

Under the No-Action Alternative, impacts on vegetation related to construction and operation of the coal export terminal would not occur. The Applicant would continue to operate the existing bulk product terminal and could develop the project area for another use.

If the project area is developed for another use, these activities would not trigger a Clean Water Act permit, a new waste discharge permit, or shoreline permit; thus, no impacts on wetland vegetation

or riparian vegetation within the shoreline zone would occur. Continued industrial use of the project area would likely result in the redevelopment of the largely developed upland areas of the project area. New construction, demolition, and activities related to this development could result in impacts on the areas of disturbed vegetation (i.e., scattered grasses and weeds) that are present throughout the developed portions of the site.

Although construction of the coal export terminal would not occur, it is assumed that growth in the region would continue, which would allow continued operations in the project area within the 20-year analysis period (2018 to 2038). Cleanup activities, relative to past industrial uses, would continue to occur. This could result in impacts on developed areas and associated disturbed vegetation in a similar manner as described for the Proposed Action.

Chapter 4
Required Permits

The Proposed Action would require the following permits related to vegetation.

- **Clean Water Act Section 404 Permit and Rivers and Harbors Act Section 10 Permit.** The Corps must issue a Section 404 Permit for all work in waters of the United States and a Section 10 permit for all work within navigation waters. The Proposed Action would affect wetlands (waters of the United States) and would require work within the Columbia River (navigable waters). Therefore, it would require both a Clean Water Act Section 404 permit and a Rivers and Harbors Act Section 10 Permit.
- **Local Critical Areas and Construction Permits.** The Proposed Action would require local permits related to clearing and grading of the project area and relative to impacts on regulated critical areas. Cowlitz County would require an application for planning clearance, a fill and grade permit, a shoreline permit and would review the Proposed Action for consistency with the County's critical areas ordinance.
- **Clean Water Act Section 401 Water Quality Certification—Washington State Department of Ecology.** An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act and a National Pollution Discharge Elimination System permit under Section 402 of the Clean Water Act would also be required for the Proposed Action.

The Applicant will implement proposed best management practices that minimize the potential for erosion, including a stormwater pollution prevention plan. The Applicant will complete these activities far in advance of construction.

Chapter 5
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Appendix A

Special-Status Species with Potential to Occur in the Project Area

- **Western wahoo (*Euonymus occidentalis var. occidentalis*)**. Western wahoo is a deciduous, opposite-leaved shrub that grows up to 6 to 15 feet in height. It has a straggling or sometimes climbing growth form, with hairless branches that have narrow, parallel, longitudinal ridges. Flowers are greenish- and purplish-mottled to purplish red. Flowering typically occurs between May and June. Fruits are a 3-lobed capsule with a reddish-orange seed coat. Western wahoo does not have a federal status but is considered to be a *sensitive* species by Washington State.



Photo source: http://www.northbanknow.com/2014/07/save-western-wahoo/ [*permission pending*]

  Western wahoo typically grows in moist woods and forested areas on the west side of the Cascades, often in shaded draws, riparian areas and ravines and sometimes in grassy areas with scattered trees. In Washington, it typically grows in fine sandy loams, silty loams, and silty clay loams. Associated plant species include Oregon white oak (*Quercus garryana*), Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), big-leaf maple (*Acer macrophyllum*), red alder, vine maple (*Acer circinatum*), service berry (*Amelanchier alnifolia*), salmonberry, and sword fern (*Polystichum munitum*). Occurrence records indicate that this species has been previously recorded near the Columbia River in the general vicinity of Longview.

- **Western false dragonhead (*Physostegia parviflora*)**. Western false dragonhead is a perennial herb that grows approximately 8 to 12 inches tall. It blooms between July and September, with lavender-purple flowers occurring in a close-flowered, elongate, terminal raceme. Leaves are stem-borne, opposite and linear-oblong, with serrate or nearly entire leaf margins. (Herbarium, Burke Museum of Natural History and Culture 2014). Western false dragonhead has no federal status but is considered a *Review Group 1* species by Washington State. Such species are considered to be of potential concern, but in need of more field work to more definitively assign it a status under the Washington Natural Heritage Program.



Photo source: Clarence A. Rechenthin, hosted by the USDA-NRCS PLANTS Database: http://plants.usda.gov/java/largeImage?imageID=phpa10_001_ahp.tif

  Western false dragonhead is known to occur along the shores of streams and lakes, marshes, and other low, wet places in the valleys and foothills (Herbarium, Burke Museum of Natural History and Culture 2014). It was last documented in Cowlitz County prior to 1977.

- **Loose-flowered bluegrass (*Poa laxiflora*).** Loose-flowered bluegrass is a perennial grass with creeping rhizomes that typically grows in single stalks between 3 and 4 feet in height. Stems and sheaths are rough to the touch when pulling upward. Leaf blades are flat, loosely arranged, and strongly roughened on both sides, with abruptly prow-like tips. Flowers are borne in an open loose panicle, with widely spreading branches. Loose-flowered bluegrass flowers from late May through June. This species has no federal status under but is considered to be a *sensitive* species by Washington State.



Photo source: Mary Clay Stensvold, hosted by the USDA-NRCS PLANTS Database: http://plants.usda.gov/java/usageGuidelines?imageID=pola3_002_ahp.tif

  In the Pacific Northwest, loose-flowered bluegrass is commonly found on moss covered rocks and logs, along streams and rivers, and on edges of wet meadows in moist shady woods. Associated species include red alder, red elderberry, buttercup (*Ranunculus uncinatus*), sword fern, monkeyflower (*Mimulus dentatus*), little-leaf miner's lettuce (*Montia parvifolia*), reed canarygrass, and other grasses. Documented occurrence in Cowlitz County is in the northwestern portion of the county in the general vicinity of Longview.

- **Soft-leaved willow (*Salix sessilifolia*)**. Soft-leaved willow grows as a shrub or small tree that varies in height between 6 and 24 feet tall. Its leaves, young twigs, and capsules are copiously covered with long, soft, loose, unmated hairs, which become less apparent as the plant ages. Leaf blades are lance-shaped to oblong, with widely spaced teeth along the margins. Flowering typically occurs between May and June. Soft-leaved willow has no federal status but is considered to be a *sensitive* species by Washington State.


Photo source: Stephen Laymon, Bureau of Land Management - http://www.blm.gov/ca/st/en/fo/bakersfield/Programs/atwell_island/atwellplantlist/salix_sessilifolia.html

  Soft-leaved willow typically occurs in wet lowland habitats, including silty or sandy riverbanks, riparian forests, dredge spoils, sandy beaches, and at the upper edge of an intertidal zone. Documented occurrence in Cowlitz County is limited to the northern portion of the county; however, this species has been found along the Columbia River in multiple locations in adjacent Wahkiakum County.

- **Nelson's checker-mallow (*Sidalcea nelsoniana*)**. Nelson's checker-mallow is a perennial herb that grows from 16 to 40 inches in height. Flowers are pinkish-lavender in color and are borne on a spike-like raceme. Flowering occurs in mid-May to September. Nelson's checker-mallow is listed as *threatened* by the federal government and *endangered* by Washington State.

  Photo source: United States Fish and Wildlife Service: http://www.fws.gov/oregonfwo/Species/Data/NelsonsCheckerMallow/

  Nelson's checker-mallow is known to occur in two populations in Washington—one in Cowlitz County and one in Lewis County. It is a regionally endemic species and is rare throughout its range from Benton County, Oregon north to Lewis County, Washington, and from central Linn County, Oregon to just west of the crest of the Coast Range. The known habitat of Nelson's checker-mallow includes low-elevation meadows, prairie or grassland habitats, along fencerows, streams, and roadsides, drainage swales, and edges of plowed fields adjacent to woodland areas (Table 2). Standing water is present in some sites. It is associated with wetland species such as western buttercup (*Ranunculus occidentalis*), sedges (*Carex* spp.), and common rush (*Juncus effusus*), as well as drier species such as tall fescue (*Schedonorus pratensis*), velvetgrass (*Holcus lanatus*), and oxeye daisy (*Leucanthemum vulgare*).

- **Columbia water-meal (*Wolffia Columbiana*)**. Columbia water-meal is a tiny, perennial aquatic plant that floats just below the water surface in colonies in freshwater lakes, ponds, and slow-moving streams. It consists of a transparent green spherical plant body that lacks roots, definite leaves, or stems. Bloom time in Washington is unknown. Columbia water-meal has no federal status but is considered a *Review Group 1* species by Washington State.

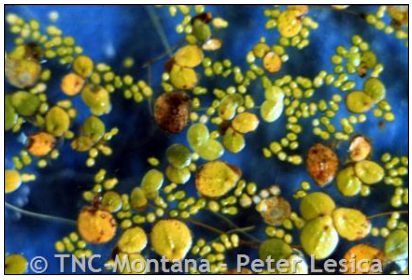
  

  Photo source: http://fieldguide.mt.gov/detail_PMLEM03030.aspx [*permission pending*]

  Columbia water-meal is found in association with common duckweed (*Lemna minor*) in freshwater lakes, ponds and slow streams. It has been found in Clark, Cowlitz, and Wahkiakum Counties in Washington, but is known from fewer than five occurrences across the state.

Appendix B

State Noxious Weeds List

Class A Weeds: Nonnative species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. **Eradication of all Class A plants is required by law.**

Class B Weeds: Nonnative species presently limited to portions of the State. Species are **designated** for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal. **Please contact your County Noxious Weed Control Coordinator to learn which species are designated in your area.**

Class C Weeds: Noxious weeds that are typically widespread in WA or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired. Other counties may choose to provide education or technical consultation.

Class A Weeds
Eradication is required

common crupina	*Crupina vulgaris*
cordgrass, common	*Spartina anglica*
cordgrass, dense-flowered	*Spartina densiflora*
cordgrass, saltmeadow	*Spartina patens*
cordgrass, smooth	*Spartina alterniflora*
dyer's woad	*Isatis tinctoria*
eggleaf spurge	*Euphorbia oblongata*
false brome	*Brachypodium sylvaticum*
floating primrose-willow	*Ludwigia peploides*
flowering rush	*Butomus umbellatus*
French broom	*Genista monspessulana*
garlic mustard	*Alliaria petiolata*
giant hogweed	*Heracleum mantegazzianum*
goatsrue	*Galega officinalis*
hydrilla	*Hydrilla verticillata*
Johnsongrass	*Sorghum halepense*
knapweed, bighead	*Centaurea macrocephala*
knapweed, Vochin	*Centaurea nigrescens*
kudzu	*Pueraria montana* var. *lobata*
meadow clary	*Salvia pratensis*
oriental clematis	*Clematis orientalis*
purple starthistle	*Centaurea calcitrapa*
Ravenna grass	*Saccharum ravennae*
reed sweetgrass	*Glyceria maxima*
ricefield bulrush	*Schoenoplectus mucronatus*
sage, clary	*Salvia sclarea*
sage, Mediterranean	*Salvia aethiopis*
shiny geranium	*Geranium lucidum*
silverleaf nightshade	*Solanum elaeagnifolium*
Spanish broom	*Spartium junceum*
spurge flax	*Thymelaea passerina*
Syrian beancaper	*Zygophyllum fabago*
Texas blueweed	*Helianthus ciliaris*
thistle, Italian	*Carduus pycnocephalus*
thistle, milk	*Silybum marianum*
thistle, slenderflower	*Carduus tenuiflorus*
variable-leaf milfoil	*Myriophyllum heterophyllum*
wild four-o'clock	*Mirabilis nyctaginea*

Class B Weeds

blueweed	*Echium vulgare*
Brazilian elodea	*Egeria densa*
bugloss, annual	*Anchusa arvensis*
bugloss, common	*Anchusa officinalis*
butterfly bush	*Buddleja davidii*
camelthorn	*Alhagi maurorum*
common fennel, (except bulbing fennel)	*Foeniculum vulgare* (except *F. vulgare var. azoricum)*
common reed (nonnative genotypes only)	*Phragmites australis*
Dalmatian toadflax	*Linaria dalmatica* ssp. *dalmatica*
Eurasian watermilfoil	*Myriophyllum spicatum*
fanwort	*Cabomba caroliniana*
gorse	*Ulex europaeus*
grass-leaved arrowhead	*Sagittaria graminea*
hairy willowherb	*Epilobium hirsutum*
hawkweed, oxtongue	*Picris hieracioides*
hawkweed, orange	*Hieracium aurantiacum*
hawkweeds: All nonnative species and hybrids of the meadow subgenus	*Hieracium,* subgenus *Pilosella*
hawkweeds: All nonnative species and hybrids of the wall subgenus	*Hieracium,* subgenus *Hieracium*
herb-Robert	*Geranium robertianum*
hoary alyssum	*Berteroa incana*
houndstongue	*Cynoglossum officinale*
indigobush	*Amorpha fruticosa*
knapweed, black	*Centaurea nigra*
knapweed, brown	*Centaurea jacea*
knapweed, diffuse	*Centaurea diffusa*
knapweed, meadow	*Centaurea x moncktonii*
knapweed, Russian	*Acroptilon repens*
knapweed, spotted	*Centaurea stoebe*
knotweed, Bohemian	*Polygonum x bohemicum*
knotweed, giant	*Polygonum sachalinense*
knotweed, Himalayan	*Polygonum polystachyum*
knotweed, Japanese	*Polygonum cuspidatum*
kochia	*Kochia scoparia*
lesser celandine	*Ficaria verna*
loosestrife, garden	*Lysimachia vulgaris*
loosestrife, purple	*Lythrum salicaria*
loosestrife, wand	*Lythrum virgatum*
parrotfeather	*Myriophyllum aquaticum*
perennial pepperweed	*Lepidium latifolium*
poison hemlock	*Conium maculatum*
policeman's helmet	*Impatiens glandulifera*
puncturevine	*Tribulus terrestris*
rush skeletonweed	*Chondrilla juncea*
saltcedar	*Tamarix ramosissima*
Scotch broom	*Cytisus scoparius*
spurge laurel	*Daphne laureola*
spurge, leafy	*Euphorbia esula*
spurge, myrtle	*Euphorbia myrsinites*
sulfur cinquefoil	*Potentilla recta*
tansy ragwort	*Senecio jacobaea*
thistle, musk	*Carduus nutans*
thistle, plumeless	*Carduus acanthoides*
thistle, Scotch	*Onopordum acanthium*
velvetleaf	*Abutilon theophrasti*
water primrose	*Ludwigia hexapetala*
white bryony	*Bryonia alba*
wild chervil	*Anthriscus sylvestris*
yellow archangel	*Lamiastrum galeobdolon*
yellow floatingheart	*Nymphoides peltata*
yellow nutsedge	*Cyperus esculentus*
yellow starthistle	*Centaurea solstitialis*

Class C Weeds

absinth wormwood	*Artemisia absinthium*
Austrian fieldcress	*Rorippa austriaca*
babysbreath	*Gypsophila paniculata*
black henbane	*Hyoscyamus niger*
blackgrass	*Alopecurus myosuroides*
buffalobur	*Solanum rostratum*
cereal rye	*Secale cereale*
common barberry	*Berberis vulgaris*
common catsear	*Hypochaeris radicata*
common groundsel	*Senecio vulgaris*
common St. Johnswort	*Hypericum perforatum*
common tansy	*Tanacetum vulgare*
common teasel	*Dipsacus fullonum*
curlyleaf pondweed	*Potamogeton crispus*
English ivy - four cultivars only	*Hedera helix* 'Baltica', 'Pittsburgh', and 'Star'; *H. hibernica* 'Hibernica'
evergreen blackberry	*Rubus laciniatus*
field bindweed	*Convolvulus arvensis*
fragrant waterlily	*Nymphaea odorata*
hairy whitetop	*Lepidium appelianum*
Himalayan blackberry	*Rubus armeniacus*
hoary cress	*Lepidium draba*
Italian arum	*Arum italicum*
Japanese eelgrass	*Zostera japonica*
jointed goatgrass	*Aegilops cylindrica*
jubata grass	*Cortaderia jubata*
lawnweed	*Soliva sessilis*
lepyrodiclis	*Lepyrodiclis holosteoides*
longspine sandbur	*Cenchrus longispinus*
nonnative cattail species and hybrids	*Typha* spp.
old man's beard	*Clematis vitalba*
oxeye daisy	*Leucanthemum vulgare*
pampas grass	*Cortaderia selloana*
perennial sowthistle	*Sonchus arvensis* ssp. *arvensis*
reed canarygrass	*Phalaris arundinacea*
Russian olive	*Elaeagnus angustifolia*
scentless mayweed	*Matricaria perforata*
smoothseed alfalfa dodder	*Cuscuta approximata*
spikeweed	*Hemizonia pungens*
spiny cocklebur	*Xanthium spinosum*
Swainsonpea	*Sphaerophysa salsula*
thistle, bull	*Cirsium vulgare*
thistle, Canada	*Cirsium arvense*
tree-of-heaven	*Ailanthus altissima*
white cockle	*Silene latifolia* ssp. *alba*
wild carrot (except where commercially grown)	*Daucus carota*
yellowflag iris	*Iris pseudacorus*
yellow toadflax	*Linaria vulgaris*

Noxious Weeds are non-native plants introduced to Washington State that can be highly destructive, competitive, and difficult to control. These plants invade our croplands, rangeland, forests, parks, rivers, lakes, wetlands, and estuaries causing both ecological and economical damage that affects us all. Noxious weeds can:

- Lower crop yields
- Reduce forage quality
- Destroy plant and animal habitat
- Displace native plants
- Reduce recreational opportunities (*e.g.*, fishing, hunting, swimming and hiking)
- Clog waterways
- Decrease land values
- Increase erosion and wildfire risk
- And some are toxic to humans and livestock

Please help protect Washington's economy and environment from noxious weeds!

To help protect the State's resources and economy, the Washington State Noxious Weed Control Board adopts a State Noxious Weed List each year (WAC 16-750). This list groups weeds into three major classes – A, B, and C – based on the distribution of each species and the seriousness of the threat they pose to Washington State. This classification system is designed to:

- Prevent small infestations from expanding by eradicating them when they are first detected
- Restrict already established weed populations to regions of the state where they occur and prevent their movement to un-infested areas
- Allow flexibility of weed control at the local level for weeds that are already widespread.

WEED'EM OUT

NOXIOUS WEEDS DAMAGE OUR RESOURCES

To learn more about noxious weeds and noxious weed control in Washington State, please contact:

WA State Noxious Weed Control Board
P.O. Box 42560
Olympia, WA 98504-2560
(360) 725-5764

Email: noxiousweeds@agr.wa.gov

Website: http://www.nwcb.wa.gov

Or

WA State Department of Agriculture
21 North First Avenue #103
Yakima, WA 98902
(509) 249-6973

Or

Your local County Noxious Weed Control Board

County Noxious Weed Control Board contact information can be found on our website's homepage by clicking on the box 'County Links'.

2015

Washington State Noxious Weed List



Ravenna grass (*Saccharum ravennae*) a new Class A noxious weed for 2015

List arranged alphabetically by:

COMMON NAME

Appendix C

Cowlitz County Noxious Weeds List

Class A Weeds : Non-native species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. Eradication of all Class A plants is required by law.

Class B Weeds: Non-native species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal. Please contact your County Noxious Weed Control Coordinator to learn which species are designated in your area.

Class C Weeds: These are noxious weeds typically widespread in WA State or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired. Other counties may choose to provide education or technical consultation.

*Class A Weeds
Eradication is required

common crupina	*Crupina vulgaris*
cordgrass, common	*Spartina anglica*
cordgrass, dense-flowered	*Spartina densiflora*
cordgrass, saltmeadow	*Spartina patens*
cordgrass, smooth	*Spartina alterniflora*
dyer's woad	*Isatis tinctoria*
eggleaf spurge	*Euphorbia oblongata*
false brome	*Brachypodium sylvaticum*
floating primrose-willow	*Ludwigia peploides*
flowering rush	*Butomus umbellatus*
French broom	*Genista monspessulana*
garlic mustard	*Alliaria petiolata*
giant hogweed	*Heracleum mantegazzianum*
goatsrue	*Galega officinalis*
hydrilla	*Hydrilla verticillata*
Johnsongrass	*Sorghum halepense*
knapweed, bighead	*Centaurea macrocephala*
knapweed, Vochin	*Centaurea nigrescens*
kudzu	*Pueraria montana* var. *lobata*
meadow clary	*Salvia pratensis*
oriental clematis	*Clematis orientalis*
ravenna grass	*Saccharum ravennae*
purple starthistle	*Centaurea calcitrapa*
reed sweetgrass	*Glyceria maxima*
ricefield bulrush	*Schoenoplectus mucronatus*
sage, clary	*Salvia sclarea*
sage, Mediterranean	*Salvia aethiopis*
silverleaf nightshade	*Solanum elaeagnifolium*
Spanish broom	*Spartium junceum*
spurge flax	*Thymelaea passerina*
Syrian beancaper	*Zygophyllum fabago*
Texas blueweed	*Helianthus ciliaris*
thistle, Italian	*Carduus pycnocephalus*
thistle, milk	*Silybum marianum*
thistle, slenderflower	*Carduus tenuiflorus*
variable-leaf milfoil	*Myriophyllum heterophyllum*
wild four-o'clock	*Mirabilis nyctaginea*

Class B Weeds

*blueweed	*Echium vulgare*
*Brazilian elodea	*Egeria densa*
*bugloss, annual	*Anchusa arvensis*
*bugloss, common	*Anchusa officinalis*
*butterfly bush	*Buddleja davidii*
*camelthorn	*Alhagi maurorum*
*common fennel, (except bulbing fennel)	*Foeniculum vulgare* (except *F. vulgare var. azoricum*)
*common reed (nonnative genotypes only)	*Phragmites australis*
Dalmatian toadflax	*Linaria dalmatica* ssp *. dalmatica*
*Eurasian watermilfoil	*Myriophyllum spicatum*
*fanwort	*Cabomba caroliniana*
*gorse	*Ulex europaeus*
*grass-leaved arrowhead	*Sagittaria graminea*
*hairy willowherb	*Epilobium hirsutum*
*hawkweed, oxtongue	*Picris hieracioides*
*hawkweed, orange	*Hieracium aurantiacum*
*hawkweeds : All nonnative species and hybrids of the meadow subgenus	*Hieracium,* subgenus *Pilosella*
*hawkweeds : All nonnative species and hybrids of the wal subgenus	*Hieracium,* subgenus *Hieracium*
herb-Robert	*Geranium robertianum*
*hoary alyssum	*Berteroa incana*
*houndstongue	*Cynoglossum officinale*
*indigobush	*Amorpha fruticosa*
*knapweed, black	*Centaurea nigra*
*knapweed, brown	*Centaurea jacea*
knapweed, diffuse	*Centaurea diffusa*
knapweed, meadow	*Centaurea x moncktonii*
*knapweed, Russian	*Acroptilon repens*
knapweed, spotted	*Centaurea stoebe*
knotweed, Bohemian	*Polygonum x bohemicum*
knotweed, giant	*Polygonum sachalinense*
*knotweed, Himalayan	*Polygonum polystachyum*
knotweed, Japanese	*Polygonum cuspidatum*
*kochia	*Kochia scoparia*
*lesser celandine	*Ficaria verna*
*loosestrife, garden	*Lysimachia vulgaris*
loosestrife, purple	*Lythrum salicaria*
*loosestrife, wand	*Lythrum virgatum*
parrotfeather	*Myriophyllum aquaticum*
perennial pepperweed	*Lepidium latifolium*
poison hemlock	*Conium maculatum*
*policeman 's helmet	*Impatiens glandulifera*
*puncturevine	*Tribulus terrestris*
*rush skeletonweed	*Chondrilla juncea*
*saltcedar	*Tamarix ramosissima*
Scotch broom	*Cytisus scoparius*
shiny geranium	*Geranium lucidum*
*spurge laurel	*Daphne laureola*
*spurge, leafy	*Euphorbia esula*
*spurge, myrtle	*Euphorbia myrsinites*
*sulfur cinquefoil	*Potentilla recta*
tansy ragwort	*Senecio jacobaea*
*thistle, musk	*Carduus nutans*
*thistle, plumeless	*Carduus acanthoides*
*thistle, Scotch	*Onopordum acanthium*
*velvetleaf	*Abutilon theophrasti*
water primrose	*Ludwigia hexapetala*
*white bryony	*Bryonia alba*
wild chervil	*Anthriscus sylvestris*
yellow archangel	*Lamiastrum galeobdolon*
*yellow floatingheart	*Nymphoides peltata*
*yellow nutsedge	*Cyperus esculentus*
*yellow starthistle	*Centaurea solstitialis*

Class C Weeds

buffalobur	*Solanum rostratum*
nonnative cattail species and hybrids	*Typha* spp.
common groundsel	*Senecio vulgaris*
common St. Johnswort	*Hypericum perforatum*
common tansy	*Tanacetum vulgare*
common teasel	*Dipsacus fullonum*
English ivy - four cultivars only	*Hedera helix* 'Baltica', 'Pittsburgh', and 'Star'; *H. hibernica*

PROPOSED

	'Hibernica'
evergreen blackberry	*Rubus laciniatus*
field bindweed	*Convolvulus arvensis*
Himalayan blackberry	*Rubus armeniacus*
Italian arum	*Arum italicum*
Jubata grass	*Cortaderia jubata*
old man's beard	*Clematis vitalba*
oxeye daisy	*Leucanthemum vulgare*
Pampas grass	*Cortaderia selloana*
Russian olive	*Elaeagnus angustifolia*
s centless mayweed	*Matricaria perforata*
spiny cocklebur	*Xanthium spinosum*
Swainsonpea	*Sphaerophysa salsula*
thistle, bull	*Cirsium vulgare*
thistle, Canada	*Cirsium arvense*
tree-of-heaven	*Ailanthus altissima*
white cockle	*Silene latifolia* ssp . *alba*
wild carrot (except where commercially grown)	*Daucus carota*
yellow flag iris	*Iris pseudacorus*
yellow toadflax	*Linaria vulgaris*

New additions to the 2015 List

Changes in class for 2015

*
State designated high priority for control and enforcement

Control required along transportation right-of -ways, near residential communities (fire danger), areas where plants create a significant impact to managed pastures or farmland.

Bold listings - documented plant species in Cowlitz Co.

Highlighted listings - County select class B and C high priority weeds for control and enforcement action.

PROPOSED

Noxious Weeds are non-native plants introduced to Washington State that can be highly destructive, competitive, and difficult to control. These plants invade our croplands, rangeland, forests, parks, rivers, lakes, wetlands, and estuaries causing both ecological and economical damage that affects us all. Noxious weeds can:

- Lower crop yields
- Reduce forage quality
- Destroy plant and animal habitat
- Displace native plants
- Reduce recreational opportunities (*e.g.*, fishing, hunting, swimming and hiking)
- Clog waterways
- Decrease land values
- Increase erosion and wildfire risk
- And some are toxic to humans and livestock

Please help protect Washington's economy and environment from noxious weeds!

To help protect the State's resources and economy, the Washington State Noxious Weed Control Board adopts a State Noxious Weed List each year (WAC 16-750). This list classifies weeds into three major classes – A, B, and C – based on the stage of invasion of each species and the seriousness of the threat they pose to Washington State. This classification system is designed to:

- Prevent small infestations from expanding by eradicating them when they are first detected
- Restrict already established weed populations to regions of the state where they occur and prevent their movement to un-infested areas
- Allow flexibility of weed control at the local level for weeds that are already widespread.

WEED'EM OUT
NOXIOUS WEEDS DAMAGE OUR RESOURCES

To learn more about noxious weeds and noxious weed control in Washington State, please contact:

Cowlitz County
Noxious Weed Control Board
207 Fourth Ave. N.
Kelso, WA 98628-4124
Tel. (360)577-3117
Email: noxiousweeds@co.cowlitz.wa.us
Website: http://co.cowlitz.wa.us

Or

WA State Noxious Weed Control Board
P.O. Box 42560
Olympia, WA 98504-2560
(360) 725-5764

Email: noxiousweeds@agr.wa.gov

Website: http://nwcb.wa.gov

Or

WA State Department of Agriculture
Natural Resource Building
P.O. Box 42560
1111 Washington St. SE
Olympia, WA 98504-2560
Tel. (360)902-1800

Website: http://agr.wa.gov

PROPOSED

20 15

Cowlitz County Noxious Weed List



Brigitte E.M. Daniel SBA (Beaconsfield 1959); Her work is held in the RHS Lindley Library, The National Gallery and Museum of Wales.

List arranged alphabetically by:
COMMON NAME

Appendix D

Noxious Weeds with Potential to Occur in the Project Area

- **Indigobush (*Amorpha fruticosa*).** Indigobush, also known as false indigobush and desert false indigo, is an introduced, leguminous shrub native to the southern United States and Atlantic coast. The shrub is typically three to ten feet in height, with showy purplish-blue, scented flowers that appear in upright spikes; it grows along streams and canyons, as well as in disturbed areas with infertile, dry and sandy soils (U.S. Department of Agriculture Plant Guide 2015). In Washington, indigobush has been documented along the Columbia River in Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat counties, as well as in the extreme southeastern corner of the state in Adams, Franklin, Whitman, Columbia, and Asotin counties (Herbarium, Burke Museum of Natural History and Culture 2015a).



Photo Source: Jennifer Anderson 2002, hosted by the USDA-NRCS PLANTS Database. Available: http://plants.usda.gov/java/largeImage?imageID=amfr_003_avp.tif

- **Scotch broom (*Cytisus scouparius*).** Scotch broom is an introduced, now widely distributed, tall shrub with showy yellow flowers that is native to Europe. It occurs throughout western Washington, especially in disturbed lowlands, along roadsides, in pastures, grasslands, and open areas of recent soil disturbance (Herbarium, Burke Museum of Natural History and Culture 2015b). It is able to fix nitrogen and is thus able to colonize poor soils.



Photo source: Danny S 2012 Available: http://en.wikipedia.org/wiki/Cytisus_scoparius

- **Policeman's helmet (*Impatiens glandulifera*)**. Policeman's helmet is an introduced annual herbaceous species, with large white to pink/red 'touch-me-not' flowers that was introduced into western Washington and British Columbia from Asia; it has been recorded in Whatcom, Skagit, Snohomish, King, Clallam and Pacific counties (Herbarium, Burke Museum of Natural History and Culture 2015c), as well as in Cowlitz county (Cowlitz County Noxious Weed Control Board 2015). It commonly invades the herbaceous layer in seasonally saturated wetlands.



Photo source: http://en.wikipedia.org/wiki/Policeman%27s_helmet

- **Eurasian watermilfoil (*Myriophyllum spicatum*)**. Eurasian watermilfoil is a perennial, submersed, aquatic plant with dissected leaves that forms dense mats in streams, lakes, ponds, quiet streams, and ditches. It is an ornamental aquatic plant native to Europe, Asia, and Northern Africa that escaped cultivation and is now widely distributed throughout Washington with records of occurrence in multiple counties including Cowlitz, Wahkiakum, and Skamania (Herbarium, Burke Museum of Natural History and Culture 2015d).



Photo source: Alison Fox, University of Florida, Bugwood.org. Available: http://www.invasive.org/weedcd/images/1536x1024/1624031.jpg [*permission pending*]

- P**arrotfeather (*Myriophyllum aquaticum*)**. Parrotfeather is a submerged aquatic plant with both emergent and submersed feather-like leaves. It is usually found on mud banks along the edges of freshwater ponds, streams, lakes, and canals. It is an escaped ornamental plant native to South America that is now found in several Washington counties on both sides of the Cascade Crest (Herbarium, Burke Museum of Natural History and Culture 2015e). In 2011, Cowlitz County was known to have one of the higher distributions of this species in the state (Washington State Department of Agriculture 2011a).



Photo source: André Karwath. 2005. Available: http://en.wikipedia.org/wiki/Myriophyllum_aquaticum

Eight species present in the study areas are listed as Class C noxious weeds, a classification assigned to weeds that are not typically considered a priority for weed control because they are already widespread throughout the state. Brief descriptions for each of these species are provided below.

- **Canada thistle (*Cirsium arvense*).** Canada thistle is an aggressive colony-forming perennial weed with a deep root system characterized by extensive horizontal spreading roots. It grows 2 to 5 feet tall and frequently occurs in cultivated fields, riparian areas, pastures, rangeland, forests, lawns, gardens, roadsides, and waste areas. Canada thistle is an introduced species native to Europe and Asia that is now widespread in Washington, inhabiting nearly every county in the state (Washington State Department of Agriculture 2011b).



Photo source: Al Schneider, hosted by the USDA-NRCS PLANTS Database. Available: http://plants.usda.gov/core/profile?symbol=ciar4 [permission pending]

- **Bull thistle (*Cirsium vulgare*)**. Bull thistle is a many-branched biennial herbaceous plant growing from 3 to 7 feet tall, with coarsely lobed leaves tipped with spines. It commonly occurs in disturbed areas including pastures, roadsides, hayfields, and ditch banks. Bull thistle is native to Europe, Asia, and Northern Africa but is now widespread in Washington, commonly occurring in most counties. As of 2011, distribution is Cowlitz was known to be less than other counties in the state (Washington State Department of Agriculture 2011c).



Photo source: ICF International. 2012.

- **English ivy (*Hedera helix*)**. English ivy is a highly invasive woody, evergreen vine native to most of Europe that has leathery broadly ovate to triangular leaves that can occur both in vine (juvenile) and shrub (adult) form. It spreads rapidly by vegetative stem growth, aggressively climbing on other plants and trees and outcompeting native vegetation. Adult plants can also spread by seed. English ivy is an introduced ornamental plant that is widely established in most counties in western Washington including Cowlitz, Wahkiakum, Clark, Skamania, and Lewis counties (Herbarium, Burke Museum of Natural History and Culture 2015f).



Photo source: ICF International. 2015.

- **Yellowflag iris (*Iris pseudacorus*).** Yellowflag iris is a large, introduced perennial iris native to North Africa and Europe. It is highly tolerant of low oxygen conditions in the soils with high levels of soluble organics; it is also very efficient at absorbing heavy metals. It forms dense clumps in shallow water and along the edges of rivers, ponds, and lakes, as well as in the understory of wetlands (U.S. Department of Agriculture Plant Guide 2015b). Yellowflag iris is widely distributed throughout western and central Washington including Cowlitz, Wahkiakum, and Skamania counties, among others (Herbarium, Burke Museum of Natural History and Culture 2015g).



Photo source: Robert H. Mohlenbrock, hosted by the USDA-NRCS PLANTS Database / USDA NRCS. 1995. Northeast wetland flora: Field office guide to plant species. Northeast National Technical Center, Chester. Available: http://plants.usda.gov/java/largeImage?imageID=irps_002_ahp.tif

- **Reed canarygrass (*Phalaris arundinacea*)**. Reed canarygrass is a rhizomatous, perennial, cool season grass native to Eurasia that spreads both by seed and creeping rhizomes. It is known to form dense, monotypic stands in wetlands but can also be found in roadside ditches, along river and streams, and in upland meadows. It is widely distributed throughout Washington and present in nearly every county in the state (Washington State Department of Agriculture 2011d).



Photo source: ICF International. 2012.

- **Himalayan blackberry (*Rubus armeniacus*).** Himalayan blackberry is rambling evergreen, perennial, wood shrub with stout stems that are armed with stiff, hooked thorns. It commonly grows in dense, often nearly impenetrable thickets in a variety of disturbed habitats including roadsides, field margins, riparian areas, and around the edges of both upland and wetland forests. Native to Asia, it is now widespread in western Washington, including Cowlitz, Lewis, and Skamania counties, among others (Washington State Department of Agriculture 2011e).



Photo source: Robin R. Buckallew, hosted by the USDA-NRCS PLANTS Database. Available: http://plants.usda.gov/java/largeImage?imageID=ruar9_001_ahp.jpg [*permission pending*]

- **Common tansy (*Tanacetum vulgare*).** Common tansy is an introduced aromatic, upright perennial herb with fern-like foliage and yellow flowers. It is common in open herbaceous areas on disturbed sites and can be found along roadsides, in waste areas, along stream banks, and in pastures. It was introduced from Europe and Asia and is now common throughout Washington including Cowlitz, Wahkiakum, Skamania, Clark, and Lewis counties, among others (Washington State Department of Agriculture 2011f).



Photo source: William S. Justice, hosted by the USDA-NRCS PLANTS Database. Available: http://plants.usda.gov/java/largeImage?imageID=tavu_1v.jpg [*permission pending*]

- **Nonnative cattail (*Typha angustifolia*) and Hybrids**. Cattails are a perennial emergent species that grow in fresh to slightly brackish wetlands. They are characterized by erect, linear, sheathed leaves that are thickened and spongy, with flowers borne in dense cylindrical spikes. They most commonly spread by rhizomes and frequently form dense monocultures in saturated soils and wetlands. "Nonnative cattail species and hybrids" are considered Class C noxious weeds in Cowlitz County (Cowlitz County Noxious Weed Control Board 2015) and include narrow-leaf cattail and similar species introduced from Europe and/or eastern North America. Nonnative cattails species are frequently found in marshes, wet meadows, lakeshores, pond margins, estuaries, ditches, bogs, and fens.



Photo source: Nelson DeBarros, hosted by the USDA-NRCS PLANTS Database Available: http://plants.usda.gov/java/largeImage?imageID=tyan_006_avp.tif [*permission pending*]

Appendix E

Site Photographs

Appendix E – Site Photographs

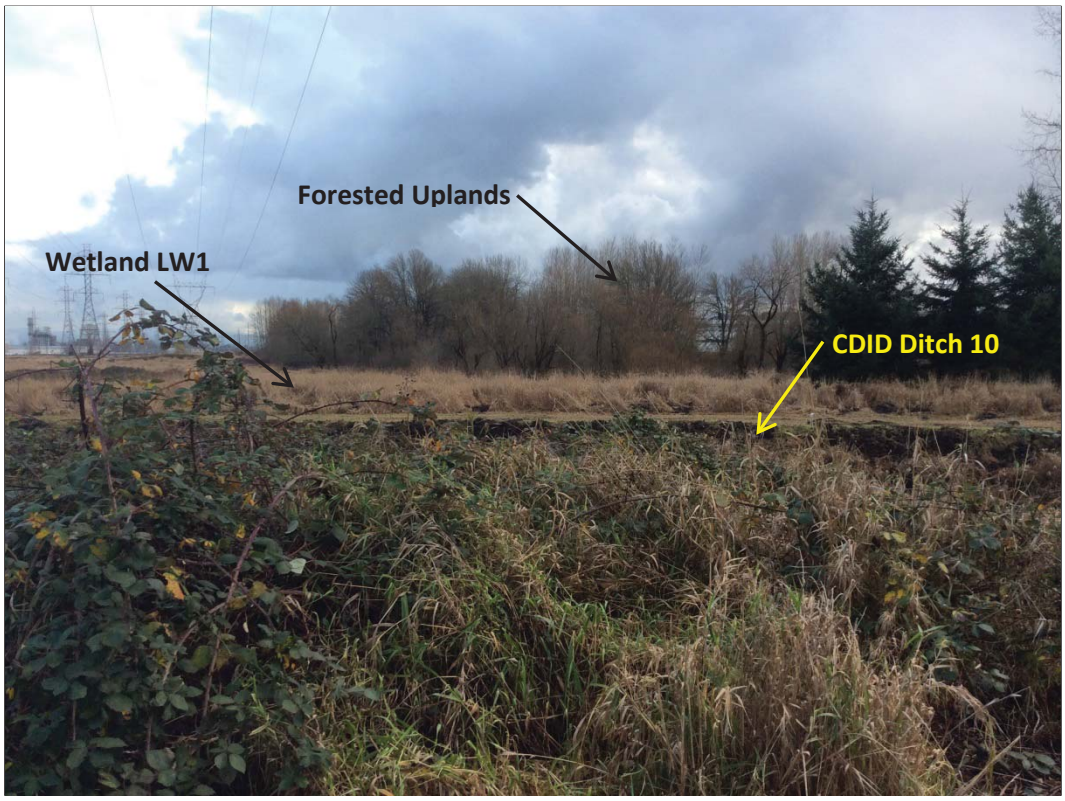


Photo 1. Photo shows typical vegetation present on Parcel 10213 of the MBTL Site including reed canarygrass and Himalayan blackberry growing in upland areas along CDID Ditch 10 and Memorial Park Drive, reed canarygrass in Wetland LW1, and forested uplands. (Photo Date: 12/12/2014)

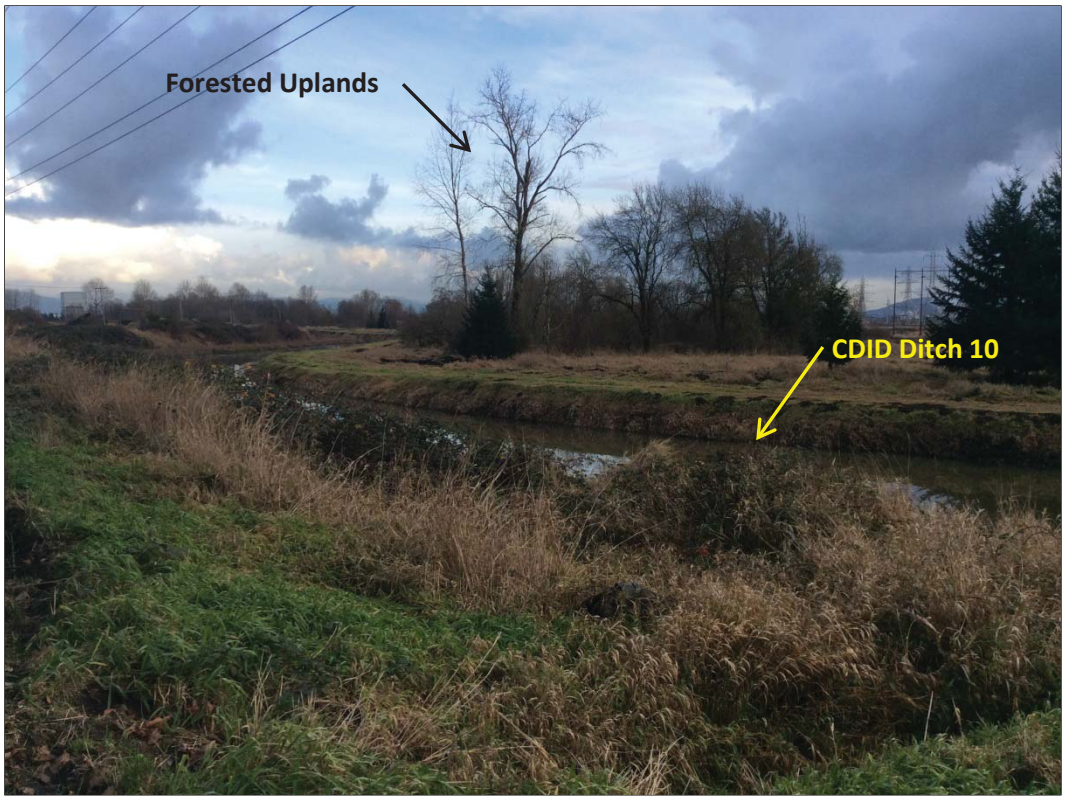


Photo 2. Photo shows typical vegetation on Parcel 10213 of the MBTL Site including reed canarygrass and Himalayan blackberry growing in upland areas around CDID Ditch 10 and forested upland areas. (Photo Date: 12/12/2014)

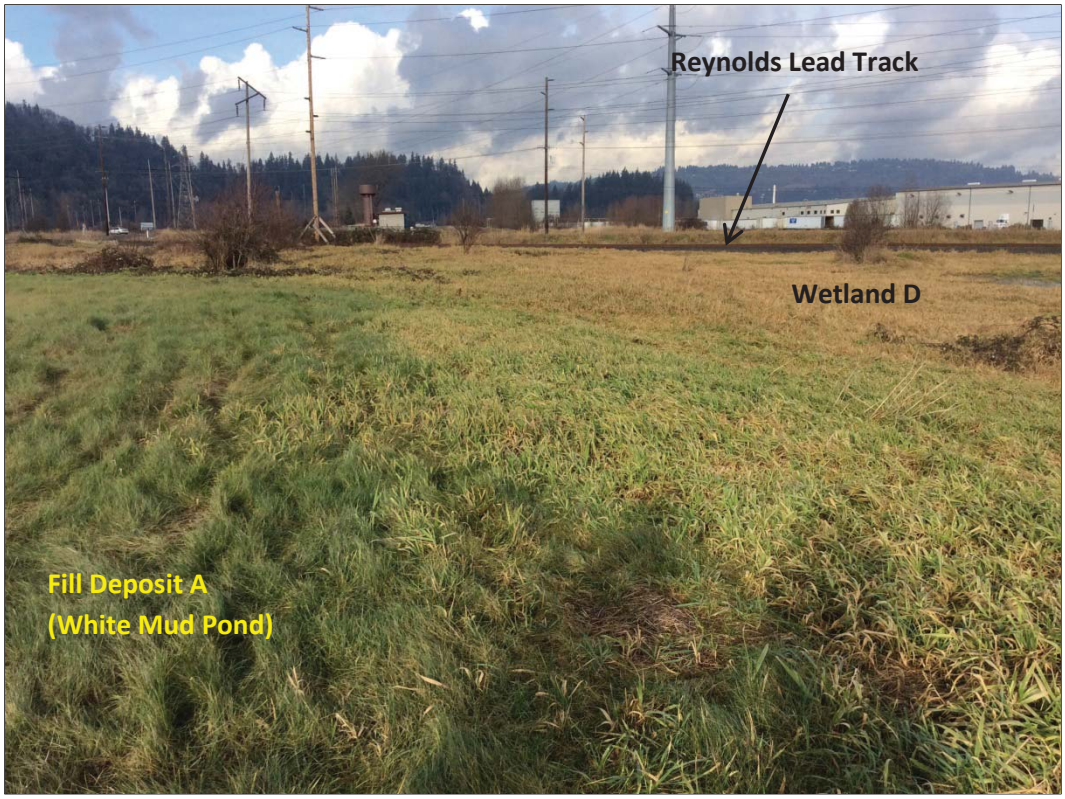


Photo 3. Photo shows herbaceous wetland vegetation cover type in Wetland D between Fill Deposit A (White Mud Pond) and Reynolds Lead Track on the MBTL site. (Photo Date: 12/12/2014)

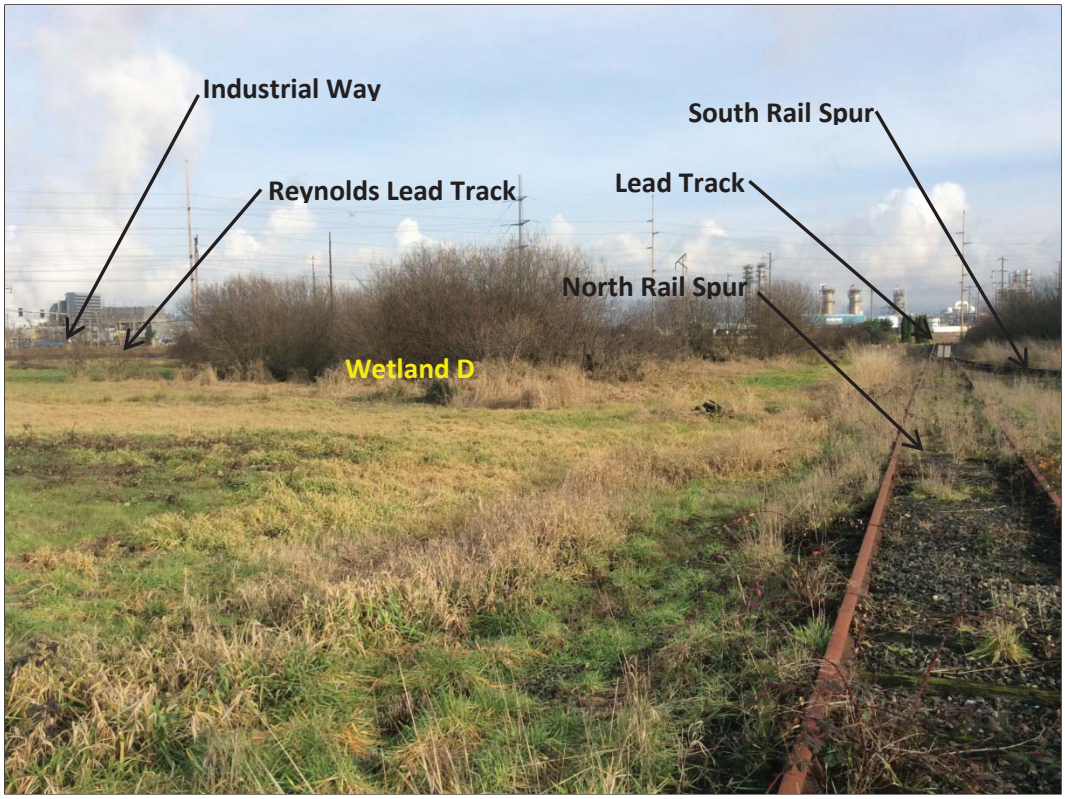


Photo 4. Photo shows scrub-shrub and herbaceous wetland vegetation cover types of Wetland D on the MBTL Site. (Photo Date: 12/12/2014)

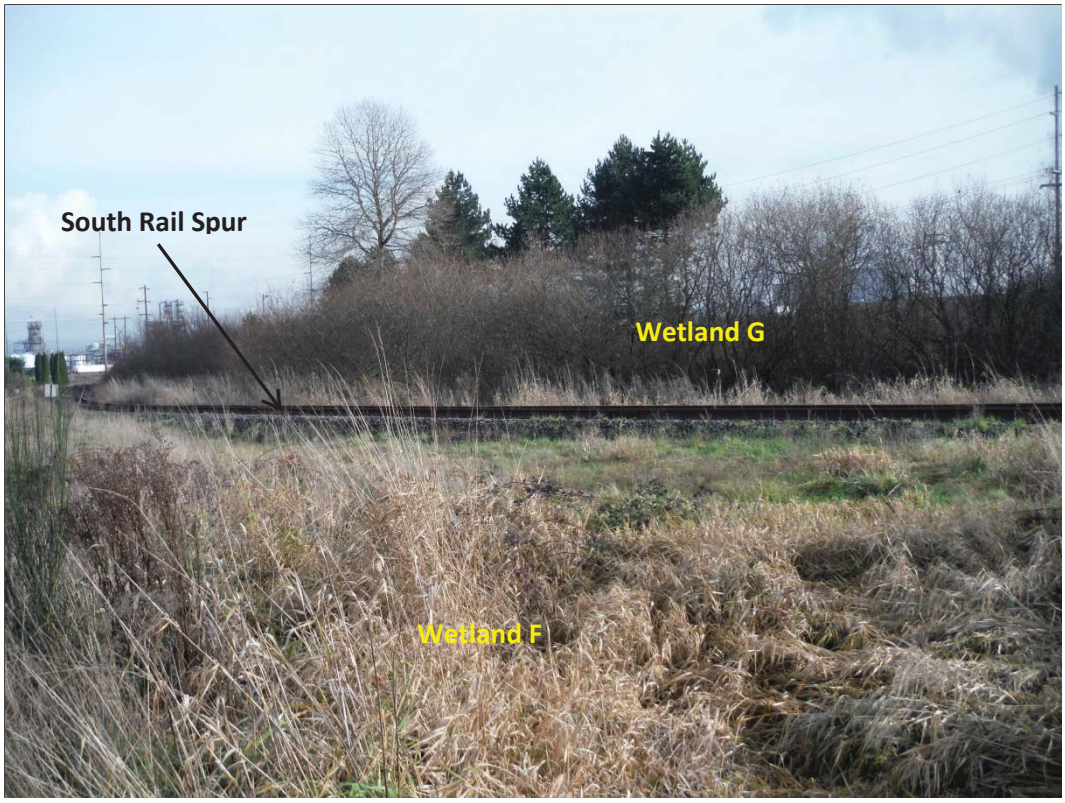


Photo 5. Photo shows herbaceous and scrub-shrub wetlands cover types in Wetlands F (foreground) and G (background) along the south rail spur on the MBTL Site. Wetland F is characterized as a disturbed wetland cover type. (Photo Date: 12/12/2014)



Photo 6. Photo shows typical herbaceous wetland vegetation cover type in Wetland F between the South Rail Spur and Fill Deposit B-1 (East Black Mud Pond) on the MBTL Site. Wetland F is characterized as a disturbed wetland cover type. (Photo Date: 12/12/2014)



Photo 7. Photo shows disturbed cover type around the railroad tracks that extend from the South Rail Spur through the transloading area. (Photo Date: 12/4/2013)



Photo 8. Photo shows typical vegetation present in Fill Deposit B-3 (Black Mud Deposits) area, which is located between the U-Ditch and CDID levee on the MBTL Site. Landfill #2 (Industrial Landfill) can be seen in the background. (Photo Date: 12/12/2014)



Photo 9. Photo shows typical disturbed vegetation cover type present on Landfill #2 (Industrial Landfill) and central portion of Fill Deposit B-3 (Black Mud Deposits) on the MBTL Site. (Photo Date: 12/12/2014)



Photo 10. Photo shows managed herbaceous vegetation growing on Closed BMP Facility on the MBTL Site. This area is regularly mown. (Photo Date: 12/12/2014)

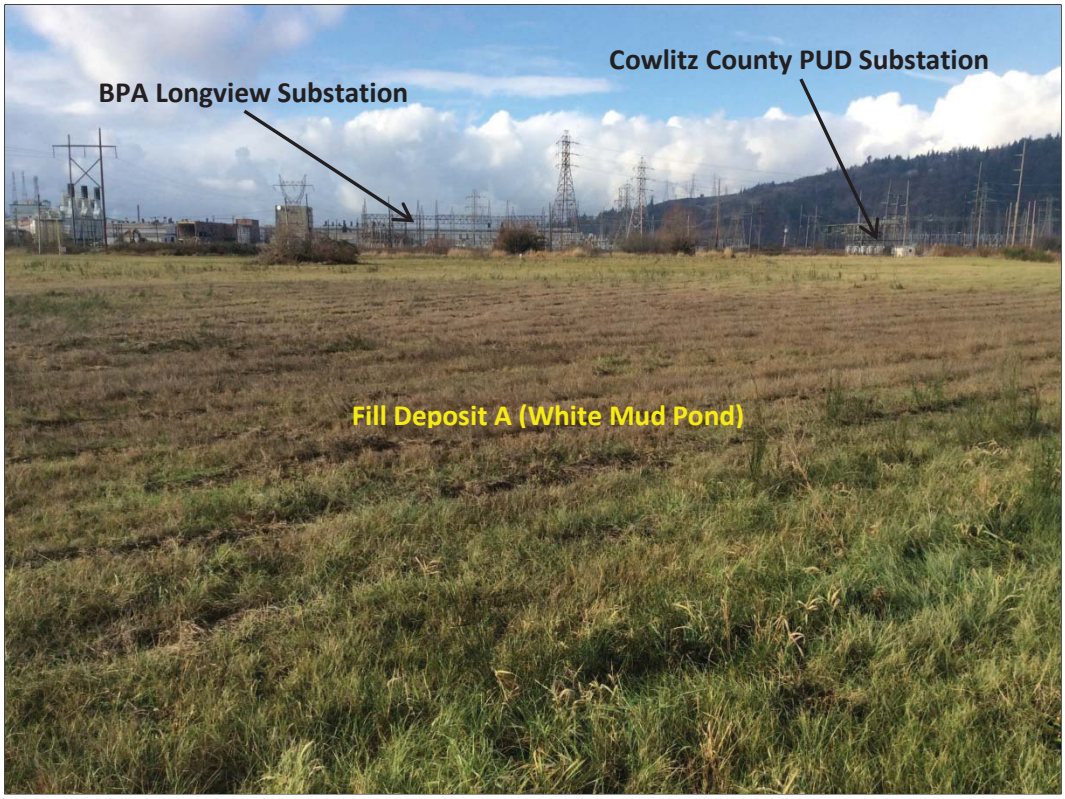


Photo 11. Photo shows typical managed vegetation cover type growing on Fill Deposit A (White Mud Pond) on the MBTL Site. (Photo Date: 12/12/2014)



Photo 12. Photo shows managed herbaceous vegetation cover type growing on Fill Deposit B-2 (Eastern Black Mud Pond) on the MBTL Site. (Photo Date: 4/8/2014)

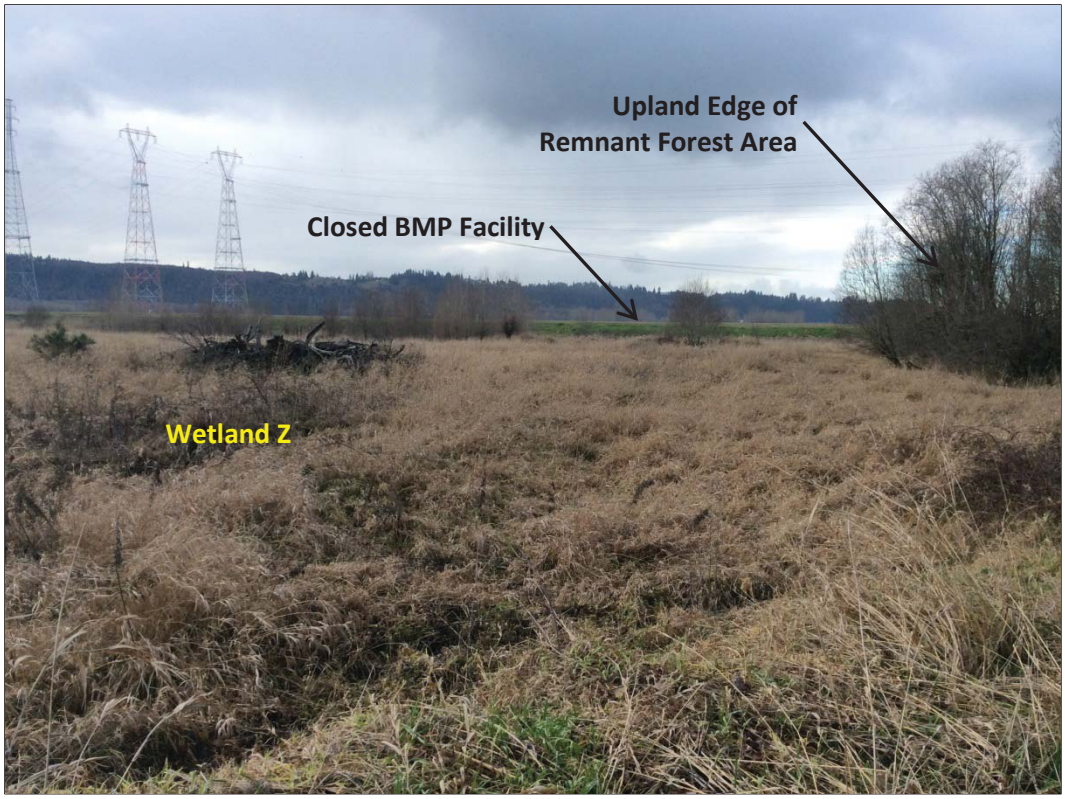


Photo 13. Photo shows typical conditions present in southern portion of the former Borrow Area located between Closed BMP Facility and Former Cable Plant on the MBTL Site. This area includes Wetland Z and a portion of Wetland C (not visible in photo), and is bordered by the upland edge of the Remnant Forest Area. (Photo Date: 12/12/2014)



Photo 14. Photo shows northern portion of Borrow Area, which contains the herbaceous portion of Wetland C, as well as adjacent uplands dominated by reed canarygrass and Himalayan blackberry in the foreground and between the wetland and the Closed BMP Facility. (Photo Date: 12/12/2014)



Photo 15. Photo shows typical conditions present in the Remnant Forest Area that lies between the Closed BMP Facility and Former Cable Plant on the Former Cable Plant on the MBTL Site. Most of this area consists of forested wetlands. (Photo Date: 12/12/2014)

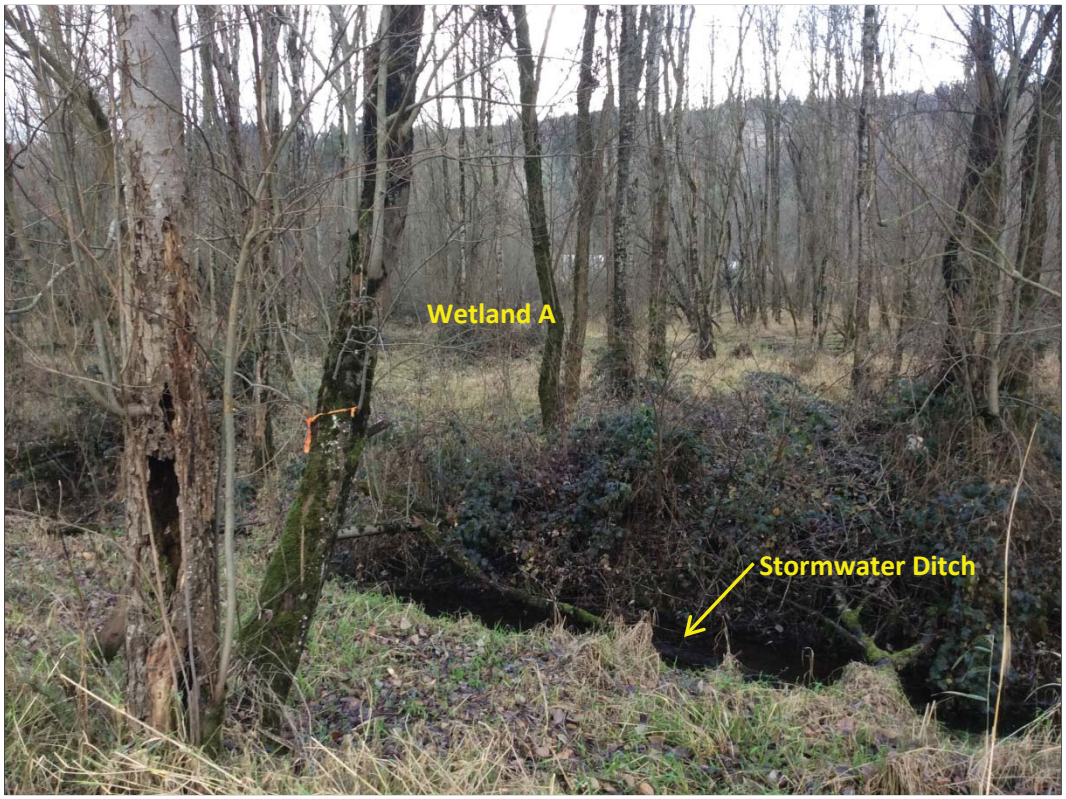


Photo 16. Photo shows Wetland A and a stormwater conveyance ditch in Remnant Forest Area on MBTL Site. (Photo Date: 12/12/2014)



Photo 17. Photo shows forested portion of Wetland C in the Remnant Forest Area on the MBTL Site. (Photo Date: 12/12/2014)

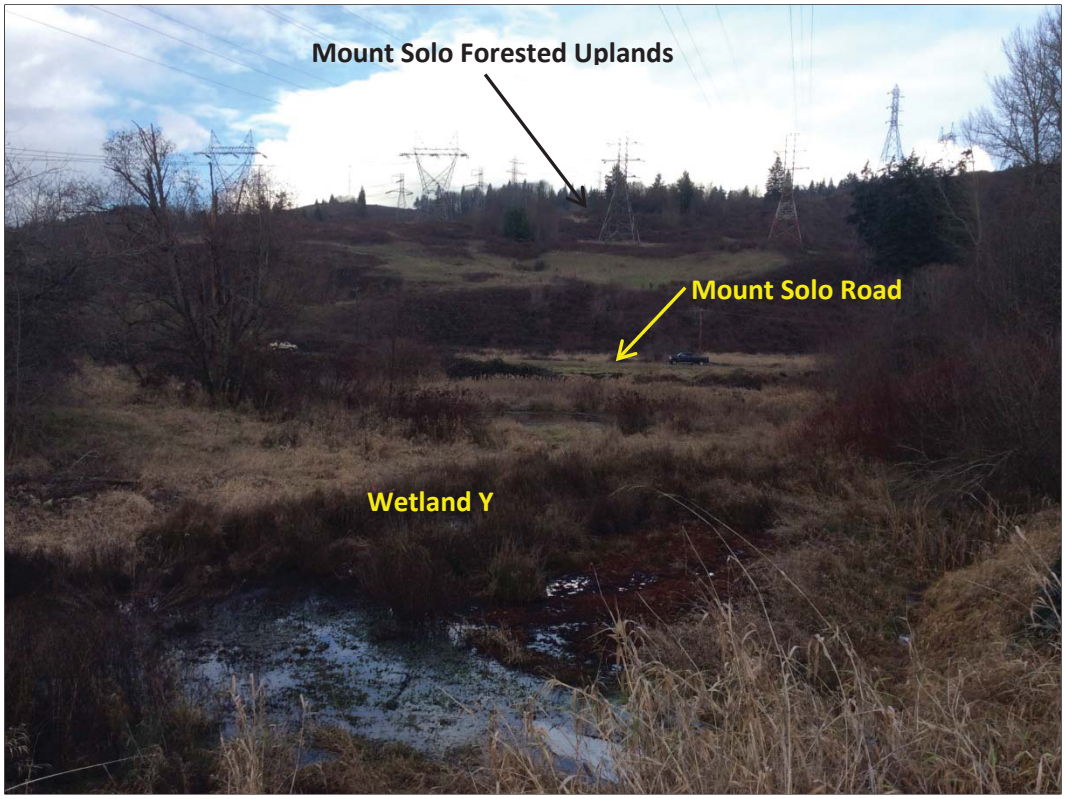


Photo 18. Photo shows the herbaceous and scrub-shrub areas of Wetland Y and surrounding upland vegetation on the MBTL Site. Some of the forested uplands on Mount Solo can be seen in the background on the other side of Mount Solo Road. (Photo Date: 12/12/2014)



Photo 19. Photo shows typical wetland and upland vegetation cover types present in and around Wetland Y on the MBTL Site. This wetland extends onto the Barlow Point Site. (Photo Date: 12/12/2014)

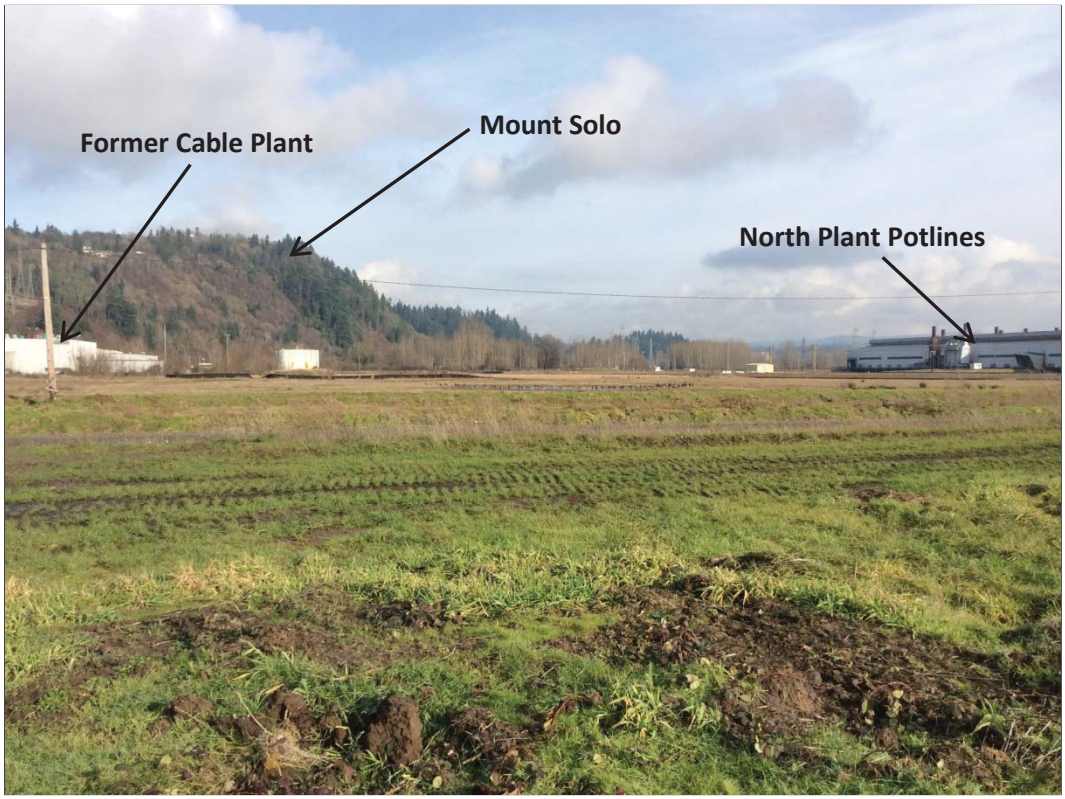


Photo 20. Photo shows typical disturbed vegetation cover type in southern portion of Outdoor Storage Area between the Cable Plant and North Plant Potlines on the MBTL Site. Upland forested areas on Mount Solo are visible in the background (Photo Date: 12/12/2014)



Photo 21. Photo shows typical disturbed vegetation cover type in central portion of Outdoor Storage Area between the Cable Plant and North Plant Potlines on the MBTL Site. (Photo Date: 4/8/2014)



Photo 22. Photo shows upland scrub-shrub cover type along the edge of the former Cable Plant parking lot on the MBTL Site. Parking lot and Cable Plant are classified as disturbed lands. Forested uplands on Mount Solo are visible in the background. (Photo Date: 12/12/2014)

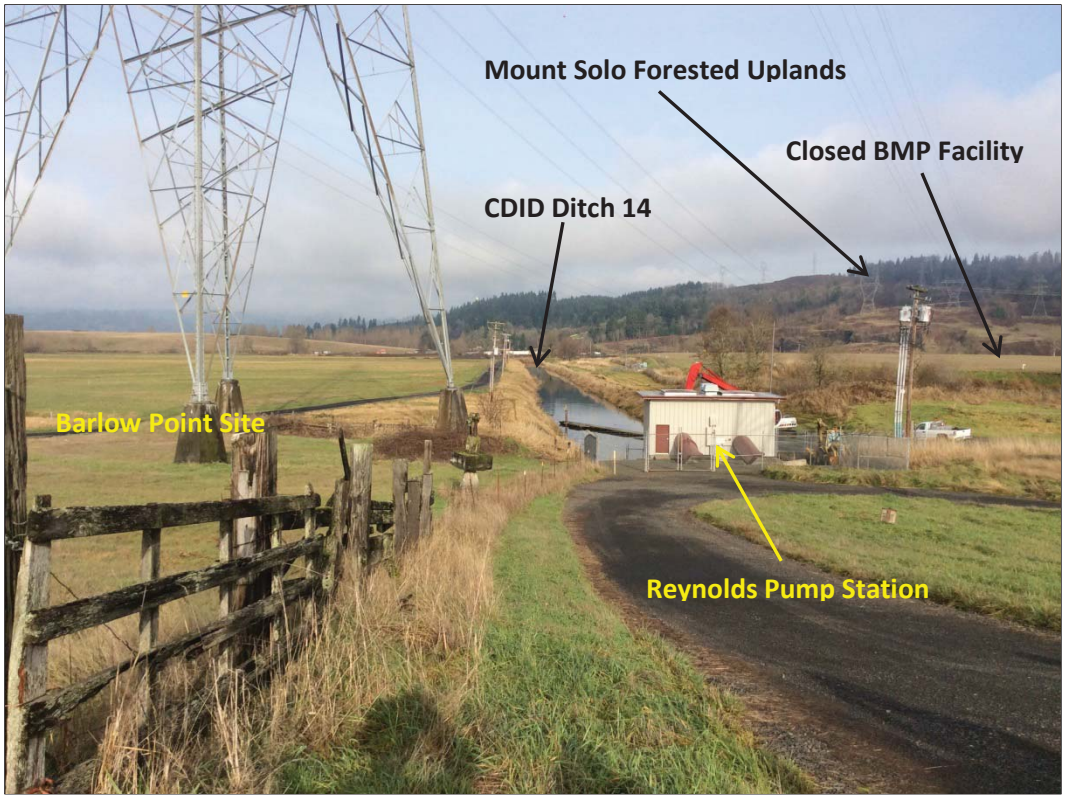


Photo 23. Photo shows CDID's Reynolds Pump Station and CDID Ditch 14 on the MBTL Site. Forested uplands of Mount Solo are visible in the background (Photo Date: 12/12/2014)



Photo 24. Photo shows typical forested upland vegetation along the south channel of the U-Ditch on the MBTL Site. (Photo Date: 12/12/2014)



Photo 25. Photo shows forested uplands adjacent to the north channel of the U-Ditch on the MBTL Site. The earthen embankment that separates the U-Ditch from the Interception Ditch is visible on the right. (Photo Date: 12/12/2014)



Photo 26. Photo shows forested uplands along the Interception Ditch, which lies to the south of the Closed BMP Facility on the MBTL Site. (Photo Date: 12/12/2014)



Photo 27. Photo shows typical vegetation present around the western end of the U-Ditch near the confluence of the north and south channels on the MBTL Site. (Photo Date: 12/12/2014)



Photo 28. Photo shows combined channel of the U-Ditch that flows to the stormwater treat facility on the MBTL Site. Adjacent areas are classified as the disturbed cover type (Photo Date: 12/12/2014)

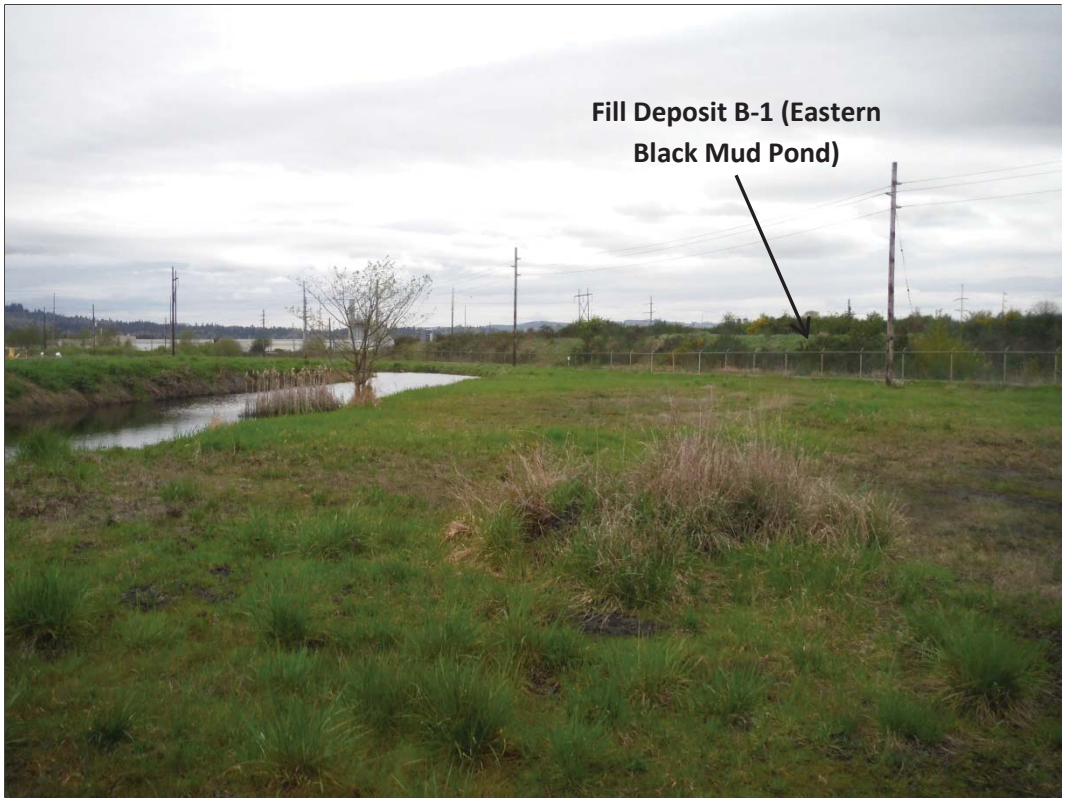


Photo 29. Photo shows typical disturbed vegetation cover type growing around one of the Cryolite Recovery Ditches on the MBTL site. Fill Deposit B-1 (Eastern Black Mud Pond) can be seen in background. (Photo Date: 4/8/2014)



Photo 30. Photo shows unnamed stormwater conveyance ditch to south of Cable Plant on MBTL Site. This ditch flows through Remnant Forest Area and into Wetland Y. (Photo Date: 12/12/2014)



Photo 31 Photo show vegetation in a roadside ditch between Fill Deposit A (White Mud Pond) and the eastern access road. This area is mapped as an herbaceous upland cover type. (Photo Date: 12/12/2014)



Photo 32. Photo shows typical conditions present along the southern shoreline of the MBTL Site including the scrub-shrub riparian cover type on the berm around the Dredged Material Disposal Area and a forested riparian area. (Photo Date: 12/12/2014)



Photo 33. Photo shows forested riparian cover type along southern portion of the MBTL Site shoreline. (Photo Date: 12/12/2014)



Photo 34. Photo shows typical managed herbaceous vegetation cover type growing on the river side of the CDID Columbia River Levee. Existing rock groin and pile dikes are also visible. (Photo Date: 12/12/2014)



Photo 35. Photo shows typical managed herbaceous vegetation cover type growing on the river side of the CDID Columbia River Levee downstream of the existing Dock 1 conveyor and trestle on the MBTL Site. Forested riparian areas are also shown. (Photo Date: 4/8/2014)

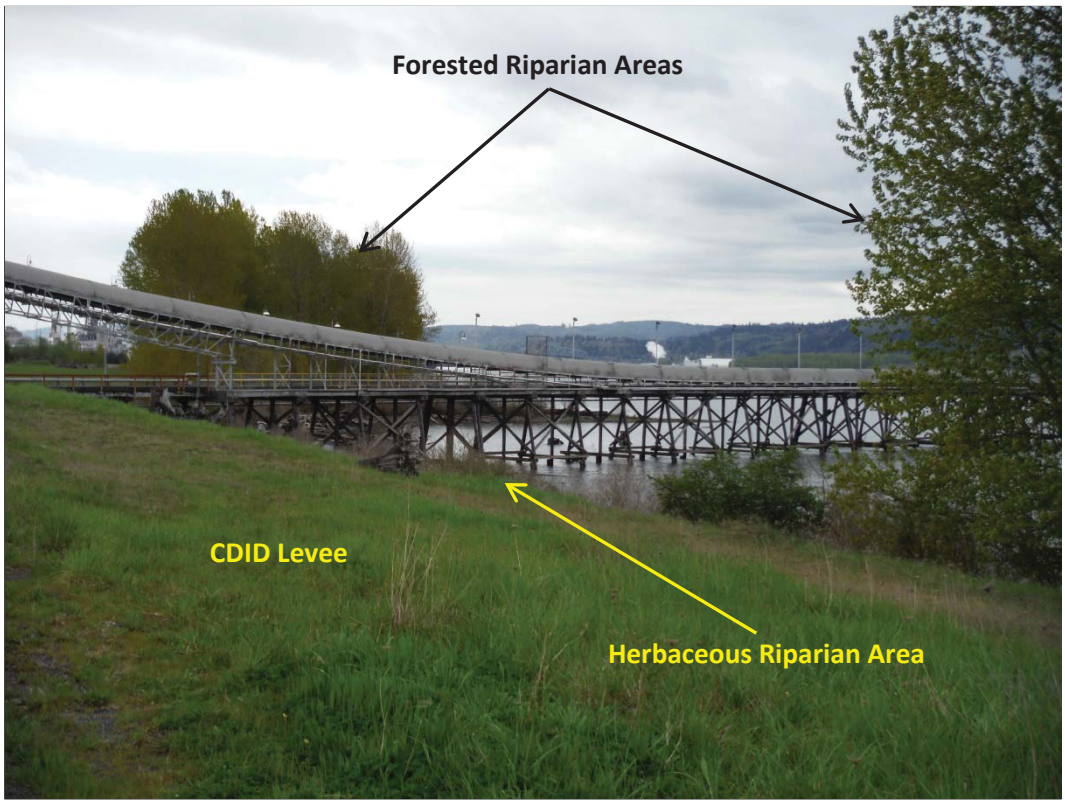


Photo 36. Photo shows typical managed herbaceous vegetation cover type growing on the river side of the CDID Columbia River Levee and in the vicinity of the existing Dock 1 conveyor and trestle on the MBTL Site. Forested riparian vegetation cover types are also shown (Photo Date: 4/8/2014)

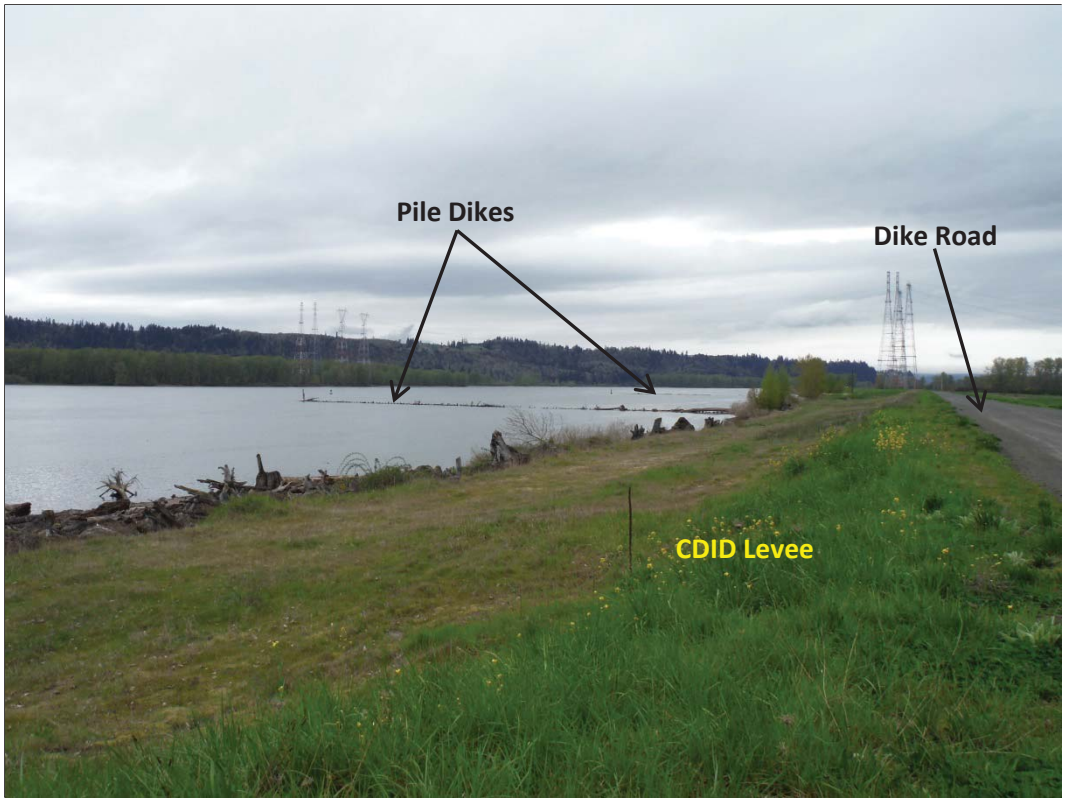


Photo 37. Photo shows typical managed herbaceous vegetation cover type growing on the river side of the CDID Columbia River Levee and herbaceous riparian area along shoreline. Existing pile dikes are also visible. (Photo Date: 4/8/2014)



Photo 38. Photo shows typical conditions present along the northern shoreline of the MBTL Site near the CDID Reynolds Pump Station outfall. (Photo Date: 12/12/2014)



Photo 39. Photo shows the typical conditions present in the Dredged Material Storage Area on the MBTL Site. (Photo Date: 12/12/2014)



Photo 40. Photo shows typical vegetation growing on the landward side of the berm around the Dredged Material Storage Area on the MBTL site. This area was classified as scrub-shrub riparian (Photo Date: 12/12/2014)



Photo 41. Photo shows typical herbaceous wetland vegetation cover type in the northern portion of Wetland E on Parcel 61954 of the MBTL Site (Photo Date: 12/12/2014)



Photo 42. Photo shows typical herbaceous wetland vegetation cover type in the southern portion of Wetland E on Parcel 61954 of the MBTL Site (Photo Date: 12/12/2014)

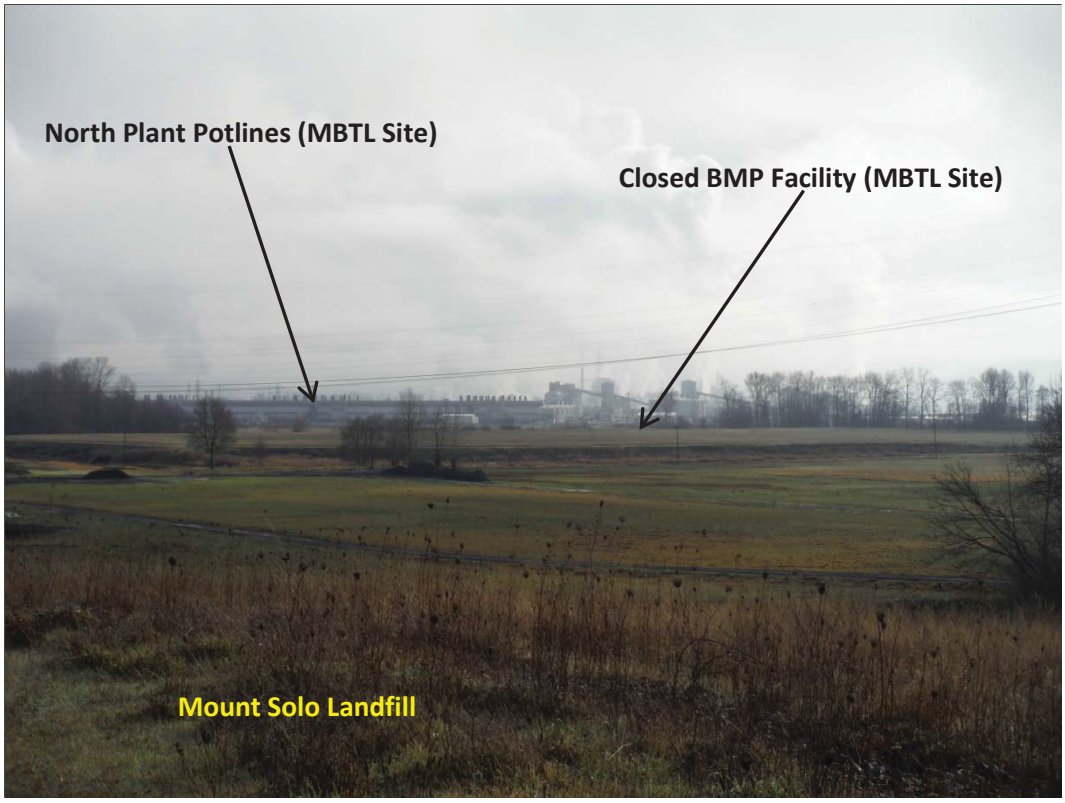


Photo 43. Photo shows disturbed, herbaceous upland, managed herbaceous upland, and herbaceous wetland cover types present in the southern portion of Barlow Point Site, as viewed from the Mount Solo Landfill. Wetlands 3 and 5 are present in the center of the photo but are not readily discernable. (Photo Date: 12/12/2014)



Photo 44. Photo shows disturbed, herbaceous upland, managed herbaceous upland, and herbaceous wetland cover types present in the southern portion of Barlow Point Site, as viewed from the Mount Solo Landfill. (Photo Date: 12/12/2014)

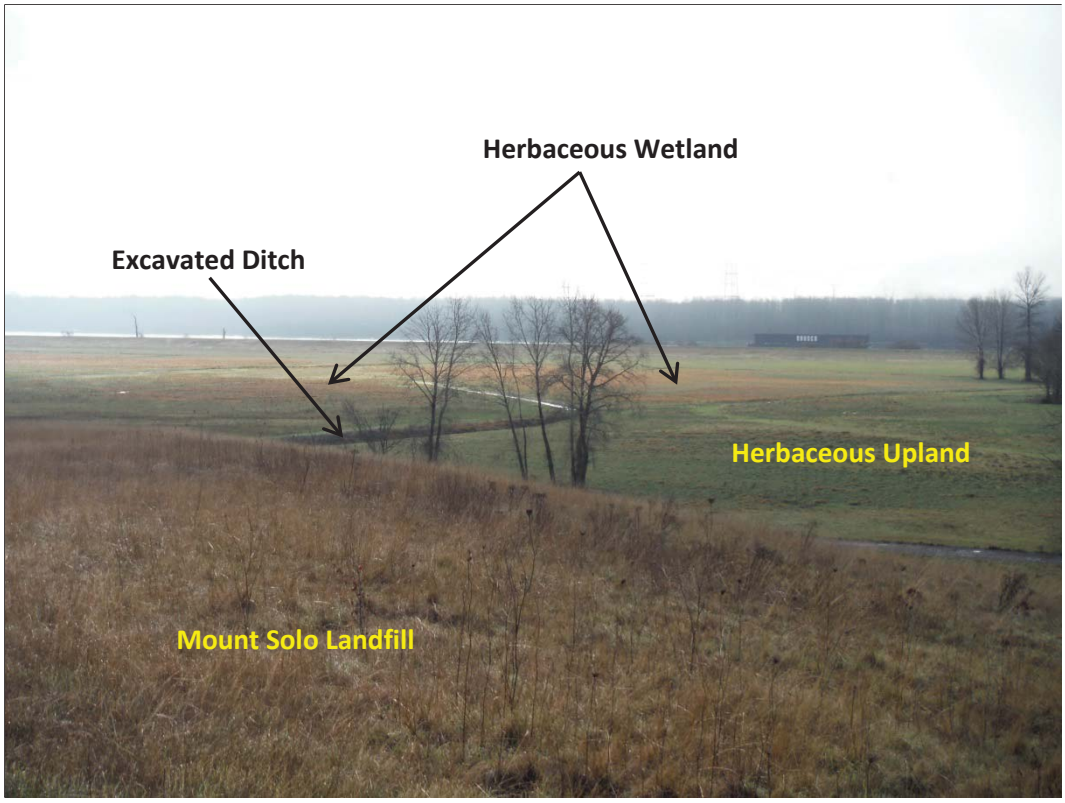


Photo 45. Photo shows disturbed, herbaceous upland, managed herbaceous upland, and herbaceous wetland cover types present in the southern portion of Barlow Point Site, as viewed from the Mount Solo Landfill. Wetland 4 is present on both sides of the excavated ditch. (Photo Date: 12/12/2014)

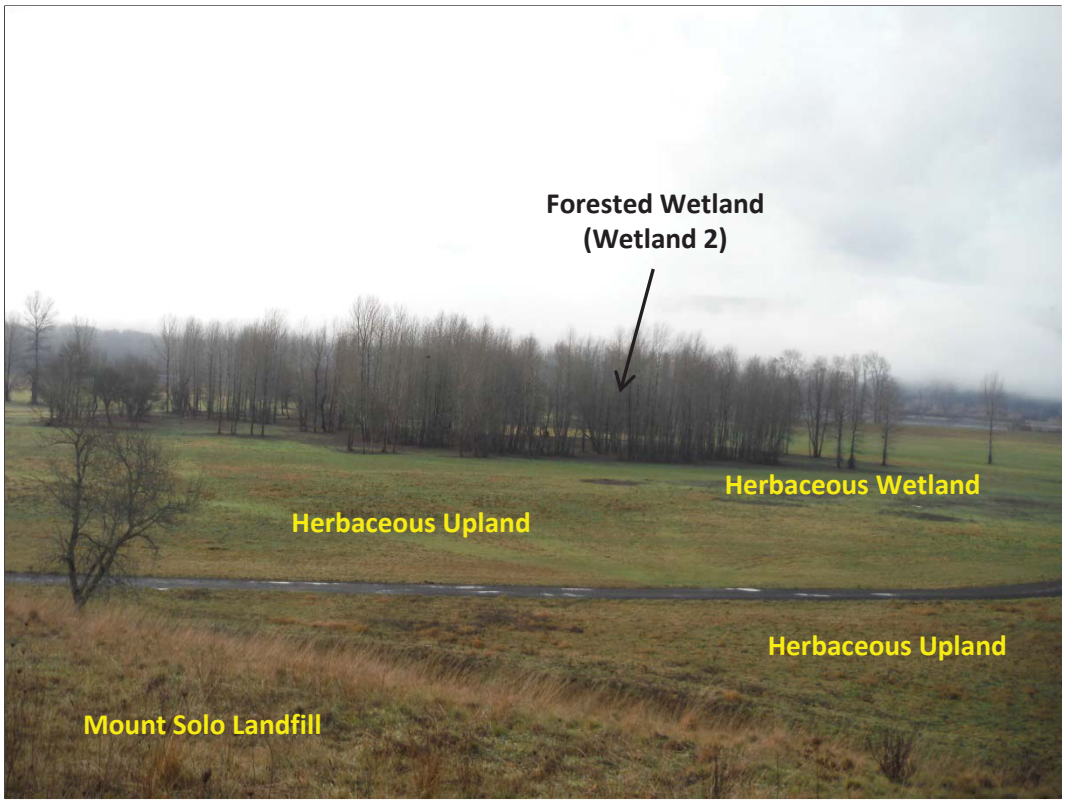


Photo 46. Photo shows multiple vegetation cover types present in the of central portion of Barlow Point Site including herbaceous upland and the herbaceous and forested wetland cover types in Wetland 2, as viewed from the Mount Solo Landfill. (Photo Date: 12/12/2014)

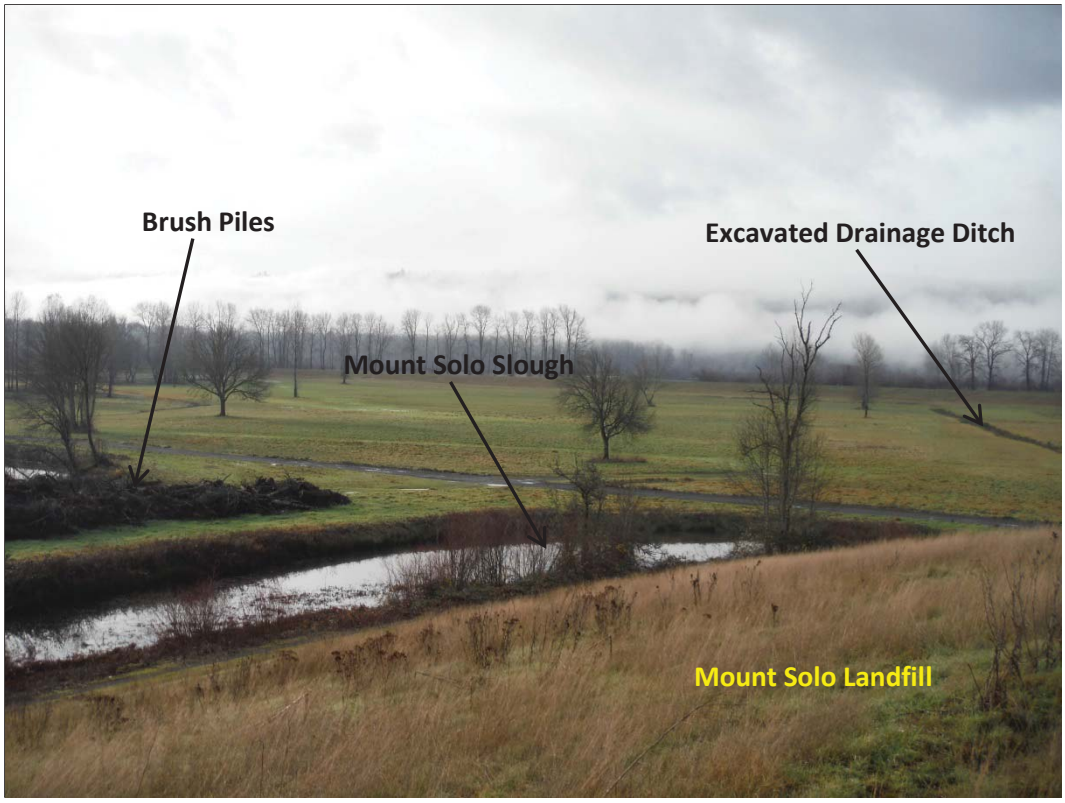


Photo 47. Photo shows typical herbaceous upland vegetation cover type of central portion of Barlow Point Site as viewed from the Mount Solo Landfill. Recently placed brush piles in the disturbed cover type, Mount Solo Slough, and an excavated drainage ditch are also shown. (Photo Date: 12/12/2014)

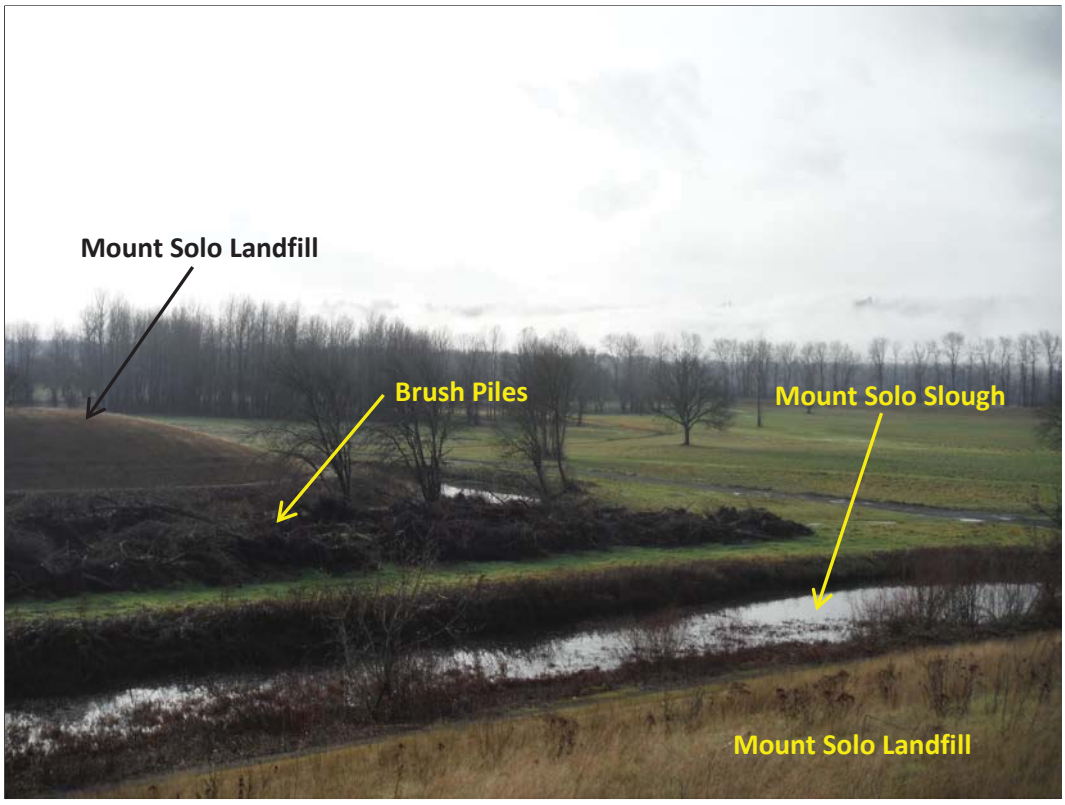


Photo 48. Photo shows recently placed brush piles in the disturbed cover type along Mount Solo Slough. (Photo Date: 12/12/2014)

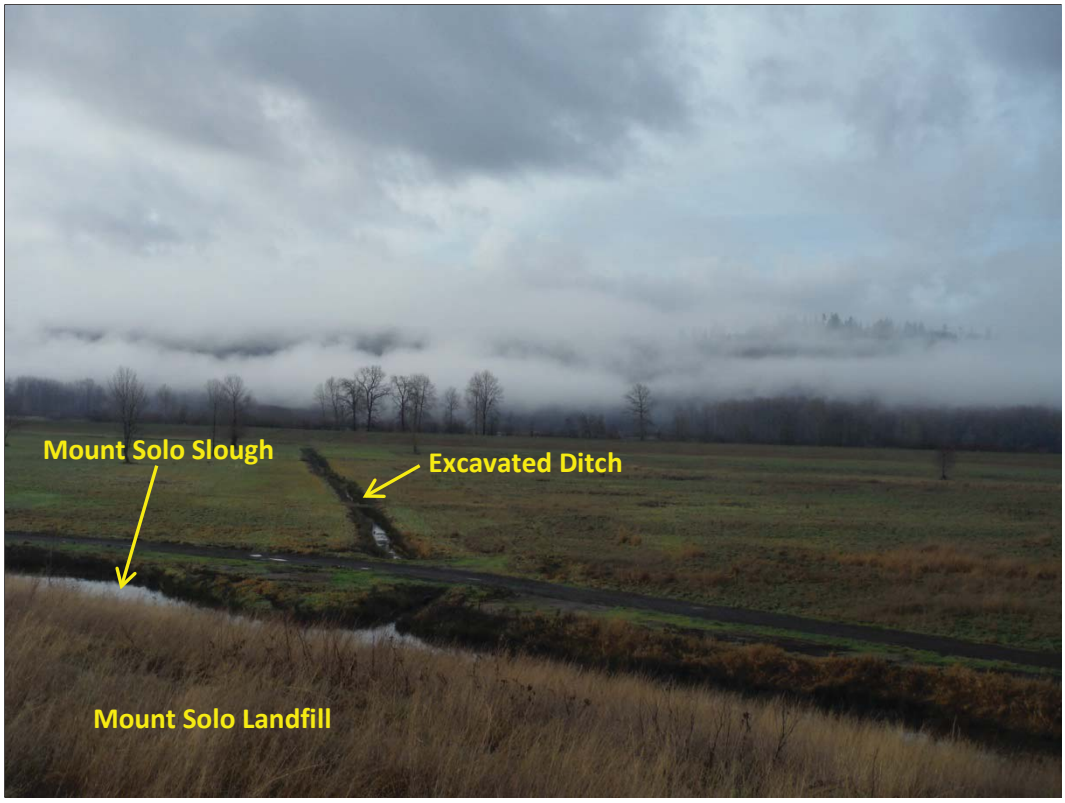


Photo 49. Photo shows herbaceous upland cover type present in the central portion of Barlow Point Site, as viewed from the Mount Solo Landfill. Excavated ditch draining to Mount Solo Slough is also shown. (Photo Date: 12/12/2014)

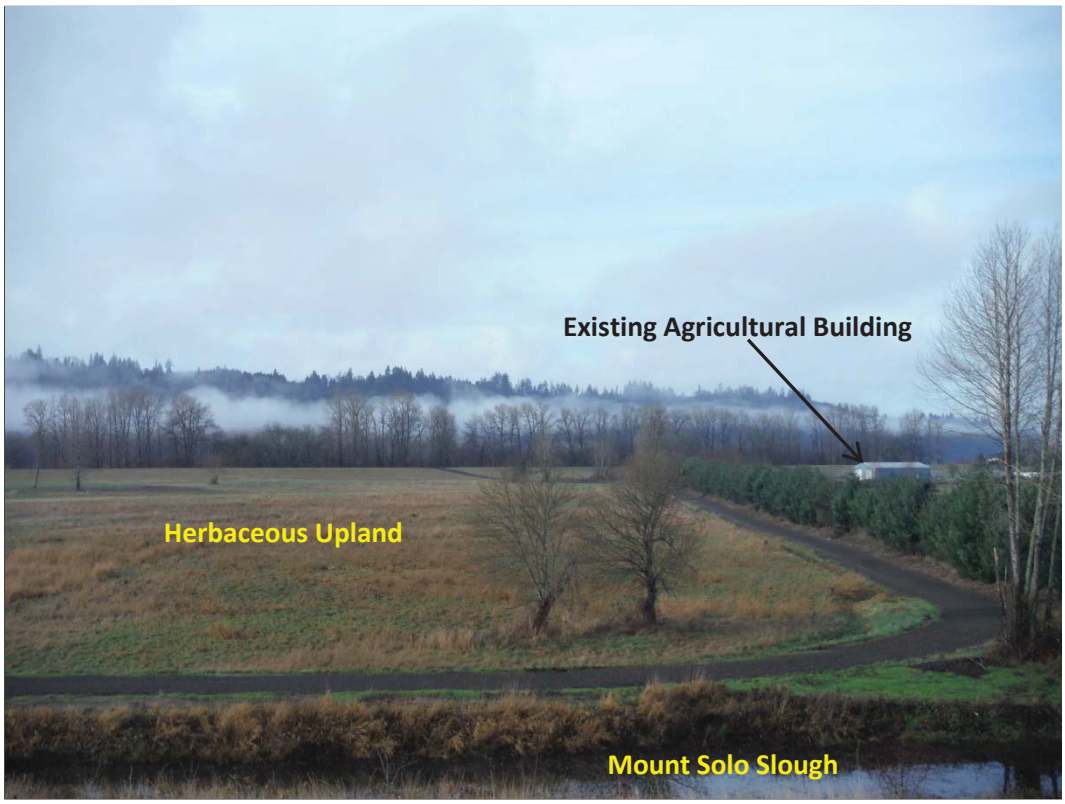


Photo 50. Photo shows herbaceous upland cover type present in the central portion of Barlow Point Site, as viewed from the Mount Solo Landfill. Existing agricultural building is shown on the right in an area classified as disturbed cover type. (Photo Date: 12/12/2014)

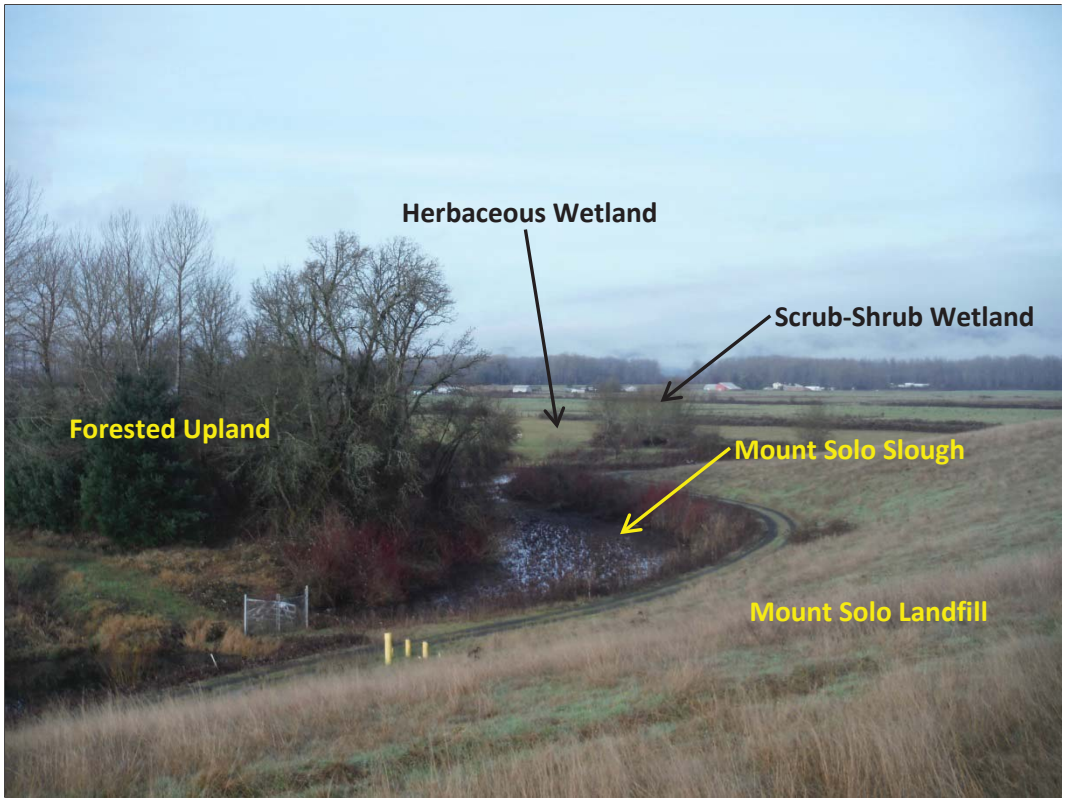


Photo 51. Photo shows northern portion of Barlow Point Site as viewed from the Mount Solo Landfill including herbaceous and scrub-shrub wetland cover types in Wetland 6. (Photo Date: 12/12/2014)

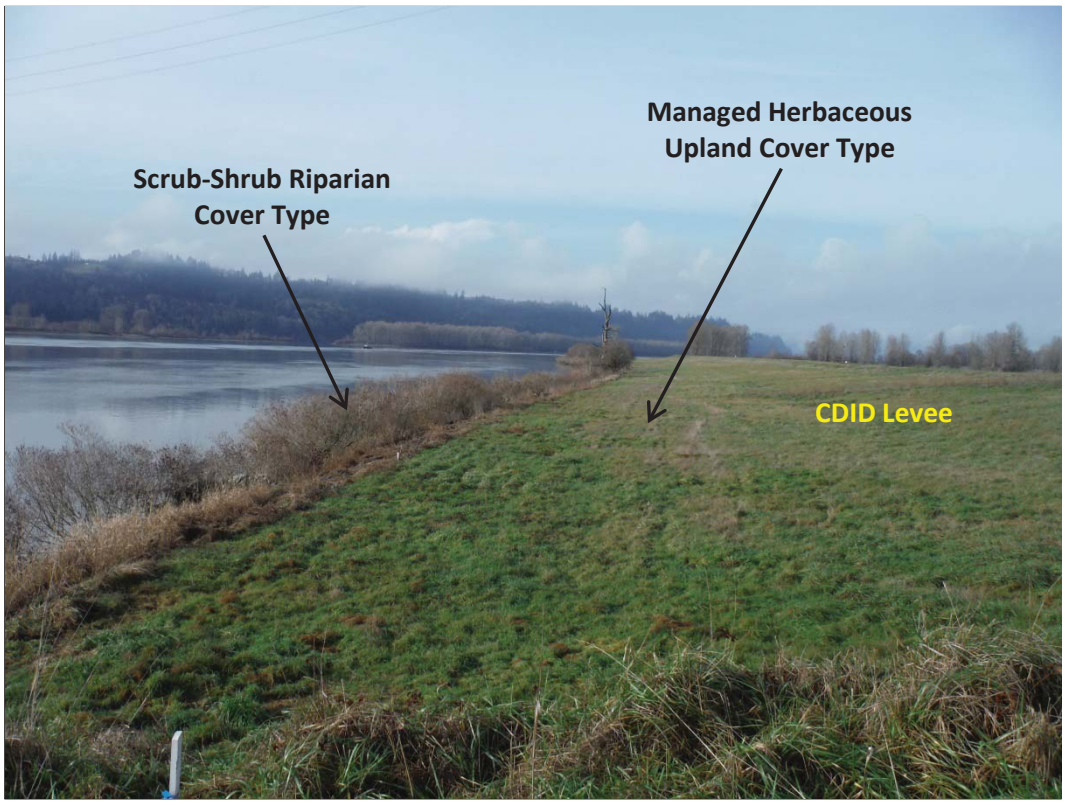


Photo 52. Photo shows typical managed herbaceous upland cover type growing on the river side of the CDID Columbia River Levee on the Barlow Point Site. A thin band of scrub-shrub riparian vegetation cover types is also shown (Photo Date: 12/12/2014)

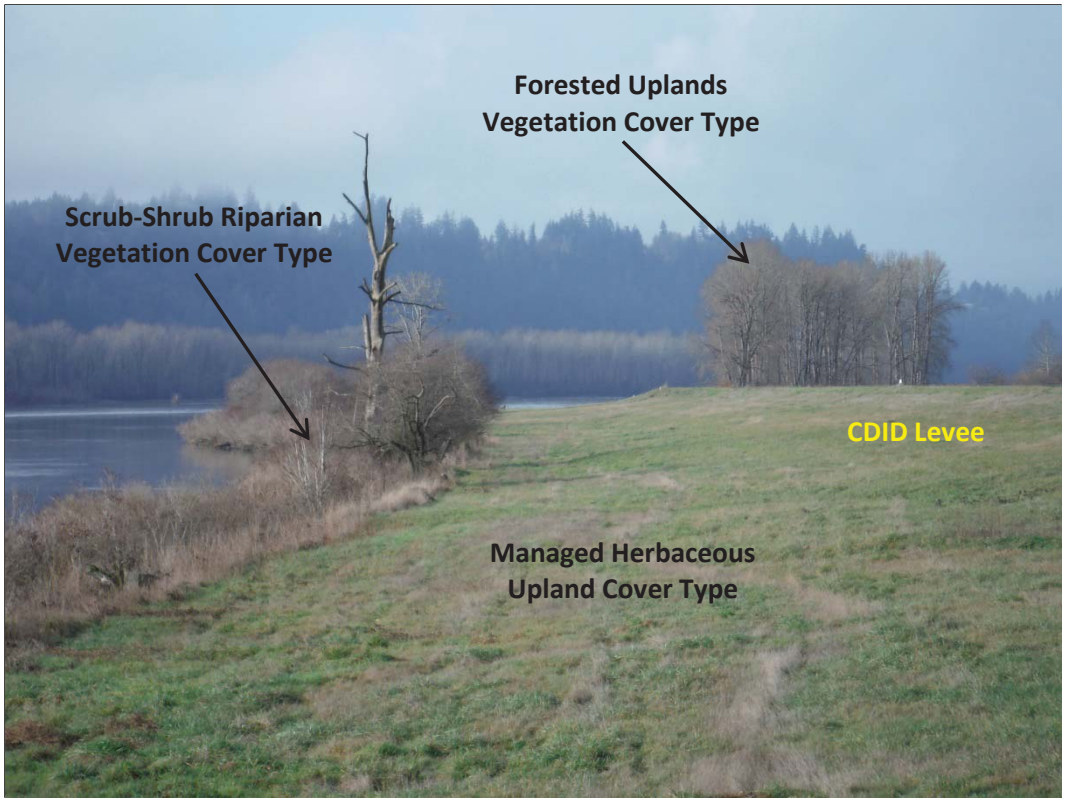


Photo 53. Photo shows typical managed herbaceous upland cover type growing on the river side of the CDID Columbia River Levee on the Barlow Point Site. The scrub-shrub riparian and forested upland cover types are also shown. (Photo Date: 12/12/2014)



Photo 54. Photo shows herbaceous and managed herbaceous upland cover types present in the southern portion of Barlow Point Site, as viewed from the MBTL Site. Wetlands 4 and 5 are present in the background but difficult to discern on the photo. (Photo Date: 12/12/2014)

MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA FISH TECHNICAL REPORT

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April 2017

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Acronyms and Abbreviations

ACM	Active Channel Margin
Applicant	Millennium Bulk Terminals—Longview, LLC
BNSF	BNSF Railway Company
CDID	Consolidated Diking Improvement District
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRC	Columbia River Crossing
CRD	Columbia River Datum
DART	Data Access in Real Time
dB	decibels
dB_{RMS}	decibel root-mean-squared
DPSs	Distinct Population Segments
dwt	dead weight tons
DWZ	Deep Water Zone
Ecology	Washington State Department of Ecology
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESUs	Evolutionary Significant Units
FR	Federal Register
g/m^2	grams per square meter
HEA	habitat equivalency analysis
HPA	hydraulic project approval
IPaC	Information, Planning, and Conservation
Management Agreement	2008-2017 United States v. Oregon Management Agreement
mg/L	milligrams per liter
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
OHW	ordinary high water
OHWM	ordinary high water mark

PAHs	polycyclic aromatic hydrocarbons
PCE	primary constituent element
PHS	Priority Habitats and Species
Port	Port of Longview
ppm	parts per million
PTS	permanent threshold shift
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metal Company facility
RMS	root mean square
SEL	sound exposure level
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SPL	sound pressure level
SWZ	Shallow Water Zone
TEEC	trace elements of environmental concern
TTS	temporary threshold shift
UP	Union Pacific Railroad
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

Chapter 1
Introduction

This technical report assesses the potential fish and fish habitat impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and the No-Action Alternative. For the purposes of this assessment, fish refers to the fish habitat conditions and the documented fish occurrences and fish likely to occur in the project area and surrounding area. This report describes the regulatory setting, establishes the methods for assessing potential fish and fish habitat impacts, presents the historical and current fish and fish habitat conditions in the study area, and assesses the potential for impacts on fish and fish habitat.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east

in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

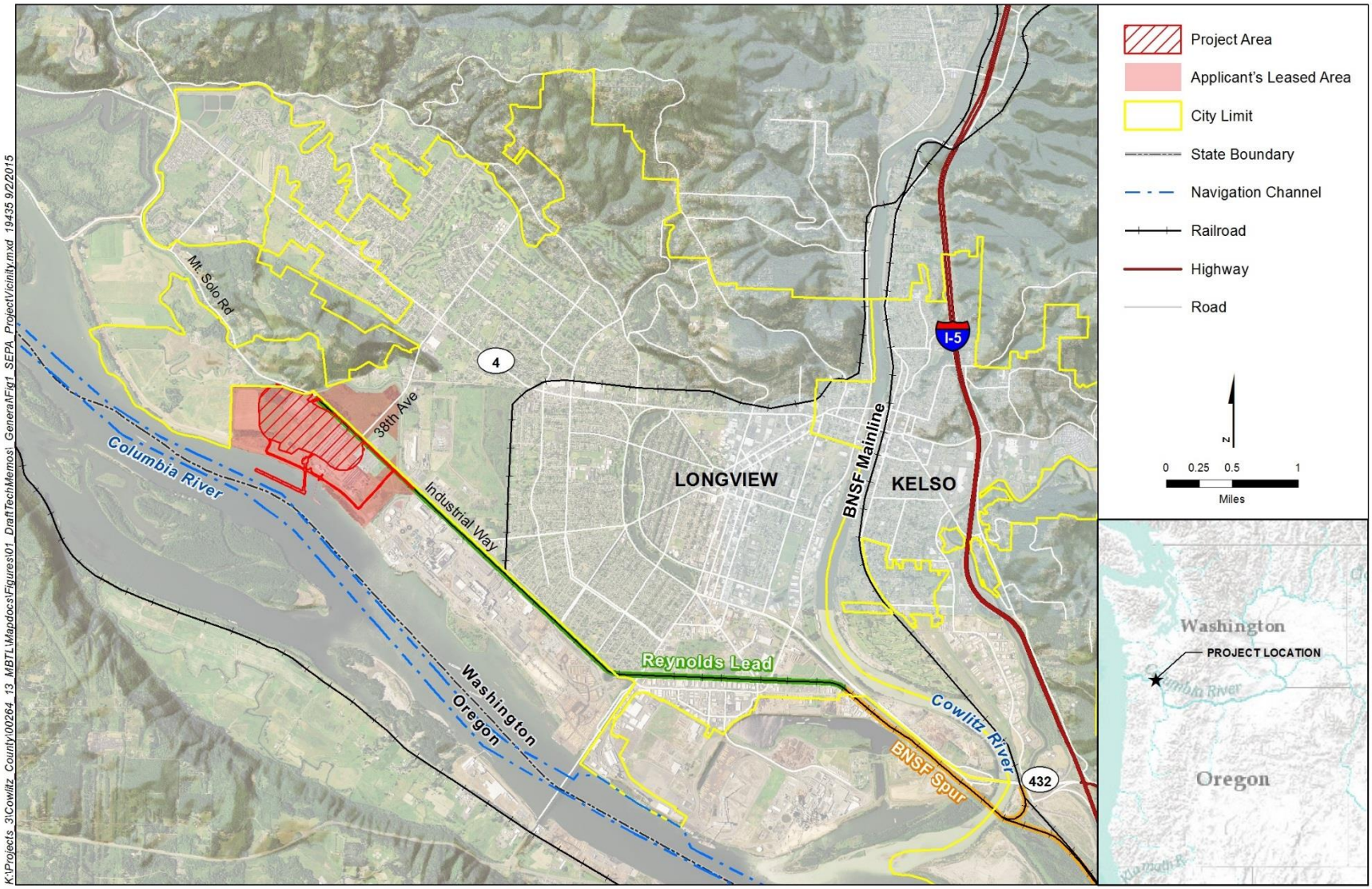
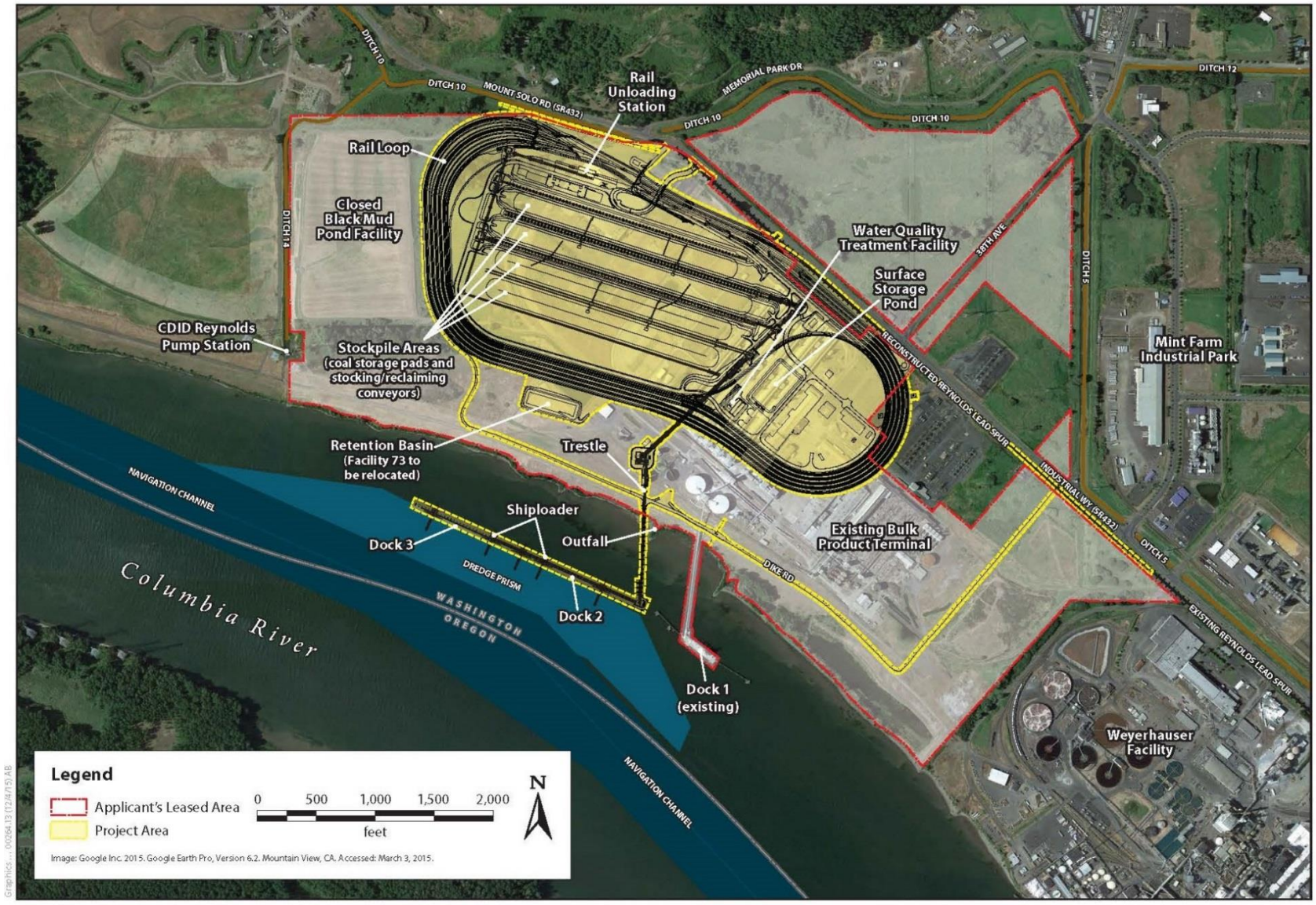


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential impacts on fish are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidance for Fish

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Endangered Species Act (16 USC 1531 *et seq*.)	Requires federal actions, such as issuing a permit under a federal regulation (e.g., NEPA, Clean Water Act, Clean Air Act) must undergo consultation with USFWS and/or NMFS to ensure the federal action is not likely to jeopardize the continued existence of any listed threatened or endangered animal species or result in the destruction or adverse modification of designated critical habitat. NMFS is responsible for managing, conserving, and protecting ESA-listed marine species. USFWS is responsible for terrestrial and freshwater species. Both NMFS and USFWS are responsible for designating critical habitat for ESA-listed species.

Regulation, Statute, Guideline	Description
Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267)	Requires fishery management councils to include descriptions of essential fish habitat and potential threats to essential fish habitat in all federal fishery management plans. Also requires federal agencies to consult with NMFS on activities that may adversely affect essential fish habitat.
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions
Washington State Growth Management Act (RCW 36.70A)	Defines a variety of critical areas, which are designated and regulated at the local level under city and county critical areas ordinances.
Washington State Shoreline Management Act (90.58 RCW)	Requires cities and counties (through their Shoreline Master Programs) to protect shoreline natural resources.
Washington State Hydraulic Code (WAC 220-660)	Under the Hydraulic Code, WDFW issues a hydraulic project approval for certain construction projects or activities in or near state waters. The hydraulic code was specifically designed to protect fish life.
Clean Water Act Section 401 Water Quality Certification	Ecology issues Section 401 Water Quality Certification for in-water construction activities to ensure compliance with state water quality standards and other aquatic resources protection requirements under Ecology's authority as outlined in the federal Clean Water Act.
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Regulates activities within and adjacent to critical areas.
Cowlitz County Shoreline Master Program (CCC 19.20)	Regulates development within shoreline jurisdiction, including the shores of the Columbia River, a Shoreline of Statewide Significance.

Notes:
NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; Corps = U.S. Army Corps of Engineers; CEQ = Council on Environmental Quality; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; ESA = Endangered Species Act; USC = United States Code; WAC = Washington Administrative Code; RCW = Revised Code of Washington; WDFW = Washington Department of Fish and Wildlife; Ecology = Washington State Department of Ecology; SEPA = State Environmental Policy Act; CCC = Cowlitz County Code

1.3 Study Area

The project area for the Proposed Action would be located 63 river miles (RM) upstream of the Pacific Ocean on the northern shoreline of the Columbia River Estuary in Cowlitz County, Washington. The study area accounts for the area where potential underwater noise impacts would likely extend. Underwater noise disturbance thresholds have been established by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) for fish, primarily salmonids, which occur in the Columbia River adjacent to the project area; therefore, these thresholds were used to help establish the study area relative to fish. The underwater noise study area includes the main channel of the Columbia River in which construction noise could disturb fish. It extends between the following approximate boundaries: downstream near the downstream end of

Walker Island (RM 60.4) on the Oregon side and Barlow Point (RM 61.6) on the Washington side, and upstream near the City of Rainier (RM 67.0) on the Oregon side and the Lewis and Clark Bridge (RM 66.0) on the Washington side (Grette 2014a) (Figure 3). This area extends a distance of approximately 3.92 miles upstream and downstream of the project area in the Columbia River (measured respectively, from the upstream and downstream extents of the proposed docks at the project area). The study area for direct impacts is based on the distances at which underwater noise is estimated to reach noise disturbance thresholds (i.e., 150 decibels [dB] root mean square[1] [RMS]) for fish from impact and vibratory pile driving (Grette 2014a).

At full build out, the Proposed Action would load 70 vessels (Panamax and/or Handymax) per month. Vessels of this size generate wakes, which in certain circumstances can strand fish on shallow sloping beaches. Therefore, the study area for indirect impacts from project-related vessel traffic extends from the project area downstream to the mouth of the Columbia River to accommodate an analysis of the potential effects of fish stranding (Figure 4). The study area for indirect impacts related to potential coal spills includes the rail routes for Proposed Action-related trains in Cowlitz County and Washington State that would be used to transport coal to the coal export terminal.

[1] Root mean square (RMS) is the square root of the energy divided by the impulse duration. This level is the mean square pressure level of the pulse.

Figure 3. Fish Direct Impacts Study Area

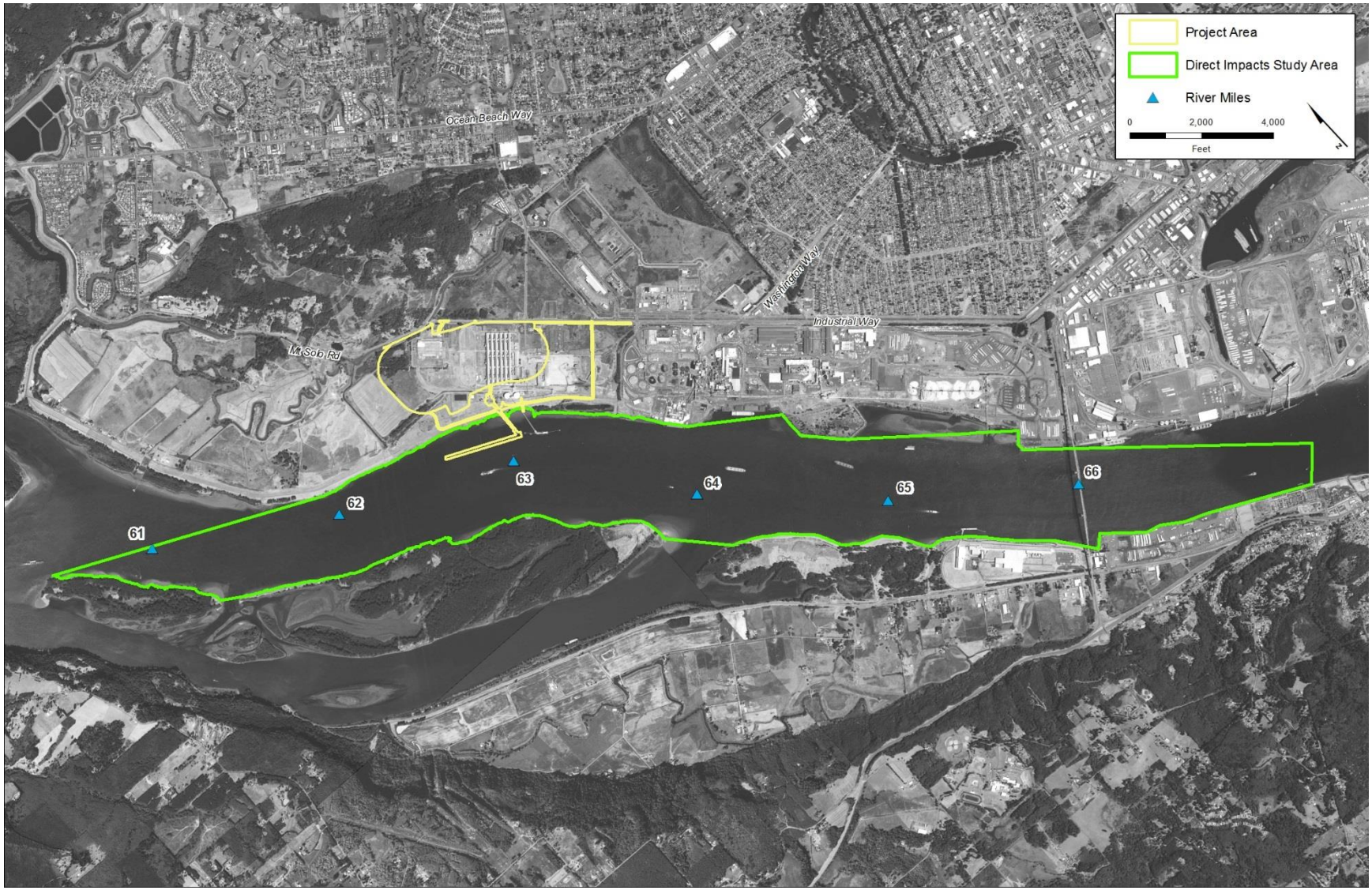
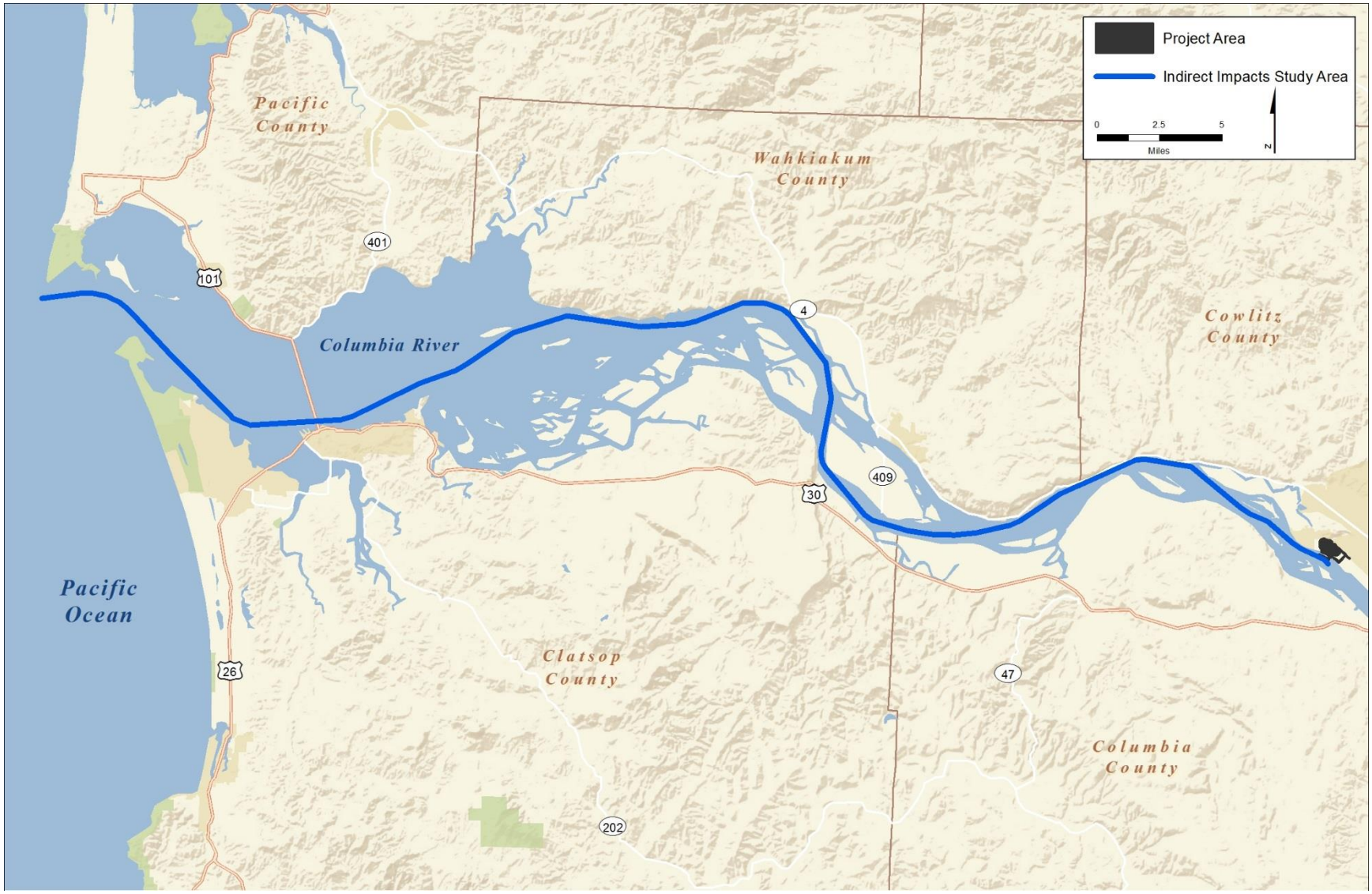


Figure 4. Fish Indirect Impacts Study Area



Chapter 2
Existing Conditions

This chapter describes the methods for assessing the existing conditions and determining impacts, and the existing conditions in the study areas as they pertain to fish and fish habitat.

2.1 Methods

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to fish and fish habitat. This assessment is based on ICF's review of information collected specifically for this technical report, as well as available information concerning fish and aquatic resources in the Columbia River. It specifically addresses existing aquatic and shoreline habitat conditions within the project areas, as well as areas adjacent to the project areas potentially affected directly and indirectly by construction and operation. This includes the shoreline and offshore areas associated with the proposed deepwater terminals, aquatic habitats subject to temporary impacts during construction, aquatic habitats affected by construction and maintenance dredging to create and maintain vessel access to the export terminal, and impacts of vessels transiting in the Columbia River between the project area and the mouth of the Columbia River.

2.1.1 Data Sources

The following sources were used to evaluate fish and fish habitat characteristics of the study area.

- One site visit conducted by ICF fish biologists on January 29, 2014.
- Reports prepared by Grette Associates for the Applicant as part of the permit application supporting materials.
    - Docks 2 and 3 and Associated Trestle Direct Effects of Construction (Grette 2014a).
    - Affected Environment Biological Resources. Technical Report and associated appendices (Grette 2014b).
    - Permanent Impacts to Aquatic Habitat (Grette 2014c).
    - Docks 2 and 3 and Associated Trestle Indirect Effects of Structures and Site Operations (Grette 2014d).
    - Docks 2 and 3 and Associated Trestle: Proposed Mitigation Measures to Minimize Construction and Long-Term Effects (Grette 2014e).
- National Oceanic and Atmospheric Administration (NOAA) Fisheries West Coast Region species list (2014a).
- NOAA Fisheries listing packages (2014a, b).
- USFWS (2014) Information, Planning, and Conservation (IPaC) system online database.
- Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) geographic information system data for the study area (2015a).

- Washington Department of Fish and Wildlife (2015b) SalmonScape data for the study area and vicinity.
- Washington State Department of Natural Resources, Natural Heritage Program, February 2014 database (accessed by ICF on April 7, 2014).
- Washington State Department of Ecology (Ecology) 303(d) /305(b) Integrated Report Viewer (accessed by ICF in December 2016).
- Fish Passage and Timing Data Columbia River Data Access in Real Time (DART), Columbia Basin Research, University of Washington (juvenile and adult fish passage) (Columbia River Basin 2013).
- Fish Passage Center. Query of adult passage at Bonneville Dam: graph with current year, last year, and 10-year average (Fish Passage Center 2014).
- Comments received from interested parties during the scoping period relative to fish and wildlife, as summarized in the SEPA Scoping Report (February 10, 2014).
- Other scientific literature and sources of technical information as cited in the text.

2.1.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative on fish and fish habitat. For the purposes of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

Potential impacts on fish and fish habitat were determined by considering the species that are likely to occur in the study area based on field surveys, site visits, the presence of suitable habitat and geographic range, and documented species occurrences and habitat conditions. For documented occurrences, focus was on fish species identified in the WDFW PHS database. The PHS program provides comprehensive information on important fish, wildlife, and habitat resources in Washington. It is the principal means by which WDFW provides fish, wildlife, and habitat information to public and private entities for planning purposes. In addition, the USFWS list of federally listed species in Cowlitz County and the NMFS West Coast Region species list of fish (which are also included in the PHS database) were also considered.

WDFW maintains a PHS geospatial database that maps likely locations of priority species occurrences and priority habitats. Priority species in the PHS program include fish and wildlife species classified under state law (Washington Administrative Code [WAC] 232-12-297) as threatened, endangered, or sensitive, as well as species that are candidates for such classification. Other PHS species include vulnerable aggregations of species or groups of animals that are susceptible to significant population declines due to their inclination to aggregate, and species of recreational, commercial, and/or tribal importance. The PHS database also includes state-monitored species, which are not considered special-status but are monitored for status and distribution trends. Geospatial PHS data containing mapped locations of priority species occurrences and priority habitats was obtained from WDFW (Washington Department of Fish and Wildlife 2015a). This PHS data was overlaid with the study area to determine presence of documented priority fish species and habitat occurrences.

A list of special-status fish species was compiled for the study area, consisting of those species federally listed as threatened, endangered, proposed, or candidate species, and fish species listed in the WDFW PHS database.

A list of federally listed fish species for Cowlitz County was generated from the USFWS IPaC online planning tool (U.S. Fish and Wildlife Service 2014).

A list of state priority species that occur in Cowlitz County was obtained from the WDFW PHS program website (Washington Department of Fish and Wildlife 2015a).

A list of federally protected fish and their habitat, including essential fish habitat, that could occur in the study area was also compiled from the NMFS (2015) West Coast Region website.

The impact analysis for fish habitat is quantitative; however, the impact analysis for fish species is qualitative because fish are generally mobile and their presence and abundance within the study area cannot be quantitatively predicted at any one location or time. In addition, a species reaction to an impact mechanism, such as construction-generated noise, can be different for each species given the variability in species' hearing frequencies, mobility, vision, and overall sensitivity (e.g., juvenile fish may be more sensitive and susceptible to potential impacts than adult fish). Therefore, impact mechanisms are identified and a qualitative impact discussion describes the potential effect an impact mechanism could have on species that may be in the study area during construction and operations.

2.2 Existing Conditions

The existing environmental conditions related to fish and fish habitat in the study areas are described in the following sections.

2.2.1 Project Area

The project area for the Proposed Action is located along the north side of the Columbia River at river mile 63, within unincorporated Cowlitz County and adjacent to the City of Longview.

The project area was once productive marsh and riparian floodplain habitat used by many species of fish for spawning, foraging, and rearing. It is now extensively modified for flood control, industrial development, and deep draft vessel traffic, and its value for fisheries is now primarily as a migratory corridor from upstream spawning areas to downstream rearing and foraging areas in the estuary and marine environments.

Adjacent lands to the north and west are largely undeveloped and are used for a combination of agricultural and recreation activities. Lands to the south and east are heavily industrialized and include a large Weyerhaeuser Lumber processing and export terminal and the Port of Longview (Port). The Port is a multipurpose deep-draft terminal encompassing 478 acres and over one mile of waterfront at river mile 66 on the Columbia River. The marine terminal includes nine berths handling bulk, break bulk, and cargoes for or from domestic barge and international (Panamax sized) ocean vessels. During 2010, the Port had 154 vessel calls, totaling 2.3 million metric tons of cargo (Port of Longview 2010). In 2012, this number increased to 225 vessel calls, reflecting the increased capacity provided by a new bulk export grain terminal capable of handling more than 8 million metric tons annually (Kulisch 2013).

In the 1920s, Consolidated Diking Improvement District (CDID) #1 constructed a levee along the Columbia River shoreline to protect Longview area properties from Columbia River flooding. In conjunction with the levees, the CDID also excavated a series of ditches to facilitate development of low-lying properties. These ditches, which lie north and west of the project area, drain both stormwater and shallow groundwater from properties within CDID #1. The ditch water is ultimately discharged to the Columbia River through pump stations. The topography of the 540-acre Applicant's leased area varies by location, although overall it is generally flat. Current topography on the property south of Industrial Way indicates the majority of the upland portion of the project area is in the range of elevation +5 to +12 feet above the Columbia River Datum (CRD).

This area is currently developed with a variety of facilities and structures associated with the Reynolds facility. Most of the approximately 540-acre Applicant's leased area that is located south of Industrial Way is paved with asphaltic concrete and Portland cement concrete pavements. The western portion of the Applicant's leased area extends into wooded areas and grass-covered fields.

2.2.2 Study Area

The hydrology of the region, as described in the SEPA Groundwater Technical Report (ICF 2017a) is characterized by two major aquifers: the upper alluvial aquifer (i.e., shallow groundwater) and a deeper confined aquifer. Shallow groundwater is present in the upper 75 to 100 feet of alluvium, and is in direct communication with the Columbia River. Multiple groundwater zones are present in the upper alluvial aquifer due to the interbedded nature of the alluvium. A deeper confined aquifer is present below approximately 300 feet below ground surface in coarser sands and gravels where production and supply wells draw groundwater. Both aquifers are in direct communication with the Columbia River.

The average annual rainfall recorded between 1931 and 2005 for Longview, Washington, is 46.17 inches. Approximately 44% of the total precipitation falls between November and January during winter storms. The average annual snowfall is just less than 5 inches. July and August are typically the two driest months of the year (Western Region Climate Center 2011, as cited in URS 2014).

The baseline conditions of the Lower Columbia River (Bonneville Dam to the Columbia River Mouth) and the study area are moderately to highly modified as a result of historical and ongoing human activities that have altered natural habitat conditions. The mainstem Columbia River environment is deeper than it was historically because of the deepening and periodic dredging of the shipping channel and the berthing areas in and adjacent to the proposed docks. The hydrologic regime and water temperature conditions have been altered by the operation of the Federal Columbia River Power System throughout the Columbia River Basin. Floodplain habitats have been disconnected from the riverine environment and in some cases eliminated. Finally, the shoreline and riparian environment has been substantially altered by extensive shoreline armoring and protection, construction of overwater structures, and development in adjacent upland and riparian zones. These modifications have eliminated and substantially altered habitat conditions and degraded habitat-forming processes, resulting in corresponding changes to the biological communities associated with these habitats. A more thorough discussion of the changes in the vegetation zones can be found in the SEPA Vegetation Technical Report (ICF 2017b).

By the mid-twentieth century a significant portion of the study area had been diked, dredged, and filled (Graves et al. 1995 in Johnson et al. 2003). Alteration of the natural hydrograph by the operation of upstream dams and reservoirs, surface water diversions, and other water uses have decreased seasonal and annual flow variability and altered the timing of the hydrograph peak discharge and base discharge. Peak spring flows are now smaller, begin earlier, and last longer than

they did historically. Winter flows are generally higher on average, but periodic peaks have been dampened or eliminated (Bottom et al. 2008). Overall, the average daily discharge in the Lower Columbia and the study area has decreased by approximately 16% relative to the historical norm (Bottom et al. 2008). The average annual flow for the Columbia River at Beaver Army Terminal near Quincy, Oregon, is approximately 236,600 cubic feet per second (cfs). The river's annual discharge rate fluctuates with precipitation and ranges from 63,600 cfs in a low water year to 864,000 cfs in a high water year (U.S. Geological Survey 2014). The change in flow conditions has altered estuarine dynamics in the study area. River flows can reverse direction during periods when river flows are low and incoming tides are large, and these reversal events now occur more frequently because the magnitude and timing of minimum flows has changed. Although the flow may reverse in response to tidal fluctuation, salt water does not intrude as far upstream as the study area and the water remains fresh through the tidal cycle. The study area can be considered a high-energy environment, characterized by strong currents, active bedload transport, and variable patterns of sediment of deposition and erosion (Grette 2014b).

Considerable effort has been expended to preserve, protect, enhance, and restore salmon habitat in the lower Columbia River subbasin, below Bonneville Dam. These efforts have included purchasing properties, working with private landowners and other interested parties to protect, enhance, and restore habitats in support of salmon recovery, as well as improving conditions for other aquatic and terrestrial wildlife. Appendix A, *Restoration Projects in the Lower Columbia River Subbasin*, lists these completed projects. A map of these projects is provided on the Lower Columbia Estuary Partnership website (www.estuarypartnership.org).

Key terms used in this section are defined in Table 2.

Table 2. Definitions of Key Terms

Term	Acronym	Definition
Active channel margin	ACM	The shoreline and nearshore edge habitat, extending from the OHWM (+11.1 feet) to 0 feet CRD
Columbia River Datum	CRD	The adopted fixed low water reference plane for the lower Columbia River.
Decibel	dB	A logarithmic unit used to express the ratio of two values of a physical quantity, often power or intensity.
Deep water zone	DWZ	The area extending waterward from the edge of the SWZ, approximately 450 feet ranging in depth from -20 feet CRD to -45 feet CRD. Water depths are based on an OHWM of +11.1 feet, CRD.
Distinct population segment	DPS	The smallest division of a taxonomic species permitted to be protected under the Endangered Species Act.
Essential fish habitat	EFH	Per the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, EFH includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.
Evolutionarily significant unit	ESU	A population of organisms that is considered distinct for purposes of conservation.
Peak	PEAK	The instantaneous maximum overpressure or underpressure observed during each pulse during pile driving.

Term	Acronym	Definition
Primary constituent element	PCE	A physical or biological feature essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species' historic geographic and ecological distribution.
Priority habitat and species	PHS	Program fulfilled by Washington Department of Fish and Wildlife to provide important fish, wildlife and habitat information to local governments, state and federal agencies, private landowners and consultants, and tribal biologists for land use planning purposes.
Root mean square	RMS	The square root sound of the energy divided by the impulse duration. Essentially, the average of the PEAK energy measured over time.
Shallow water zone	SWZ	The fully inundated near-shore zone extending from the edge of the ACM at 0 feet CRD out to -20 feet CRD.
Sound exposure level	SEL	A metric for acoustic events, often used as an indication of the energy dose.
Temporary threshold shift	TTS	Temporary shift in auditory threshold, such as temporary hearing loss.

2.2.2.1 Aquatic Habitat Types

The aquatic habitat in the study area is discussed in terms consistent with the habitat equivalency analysis (HEA) model, which provides a framework for describing habitat quality in the context of habitat availability and suitability as a function of water depth and physical attributes. The aquatic portion of the study area adjacent to the project area is composed of three broad habitat types (Grette 2014b): the Active Channel Margin (ACM), the Shallow Water Zone (SWZ), and the Deep Water Zone (DWZ). The riparian zone is also considered in terms of its interactions with aquatic habitats, as the riparian zone is the transition from aquatic to upland habitat. A cross-section of the aquatic habitat adjacent to the project area is provided in Figure 5, showing the maximum widths and typical depth profiles based on CRD, of each of these habitat types adjacent to the project area near the proposed docks. A plan view showing the extent of each habitat type is provided in Figure 6.

Riparian Zone

The discussion of the riparian zone here is focused on those elements relevant to aquatic habitat important to fish and fish habitat. The riparian zone includes lands less than 200 feet landward from ordinary high water (OHW) (+11.1 feet CRD) (Figures 5 and 6). Shoreline armoring and CDID dikes have contributed to what is typically low-complexity and artificially steepened upper shoreline with no floodplain connectivity in the downstream two-thirds of the vicinity of the proposed docks. Landward of the shoreline, most of the riparian area has been so heavily modified that there is little remaining function (Grette 2014b). There is a small area of intact riparian assemblage, immediately upstream of Dock 1; however, it consists primarily of nonnative and invasive species (ICF 2017b). There is little potential for a remnant area of riparian habitat to contribute biological material (e.g., leaf litter, woody material, and insects) to the aquatic areas, nor does it provide shade or other

physical function. In comparison to shoreline areas with intact riparian habitat, the HEA[2] model would rank shoreline habitat at a relatively lower value, especially when compared to similar areas with intact riparian habitat (e.g., Lord Island, immediately across the river) (Grette2014b). Lord Island also provided habitat for Columbia white-tailed deer. Refer to the SEPA Wildlife Technical Report (ICF 2017h) for further information regarding on Columbia white-tailed deer.

[2] HEA is a tool that can be used to estimate habitat gains and losses across a range of habitat types

Figure 5. Cross-Section of Shoreline Habitats Adjacent to the Project Area

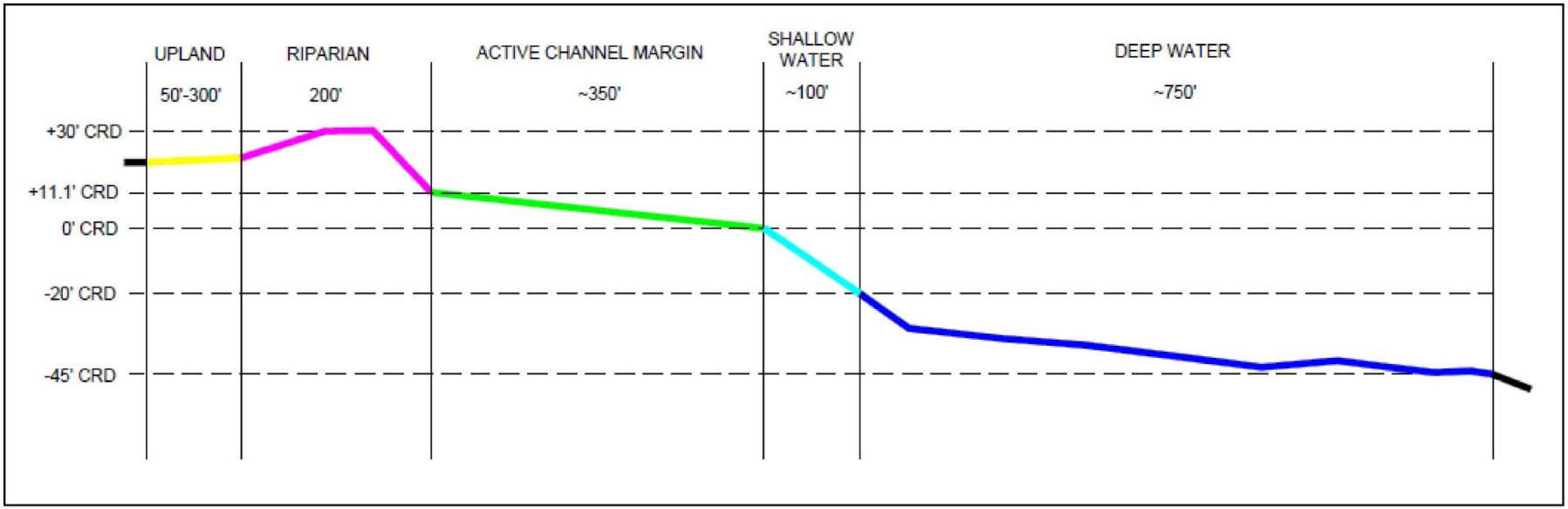
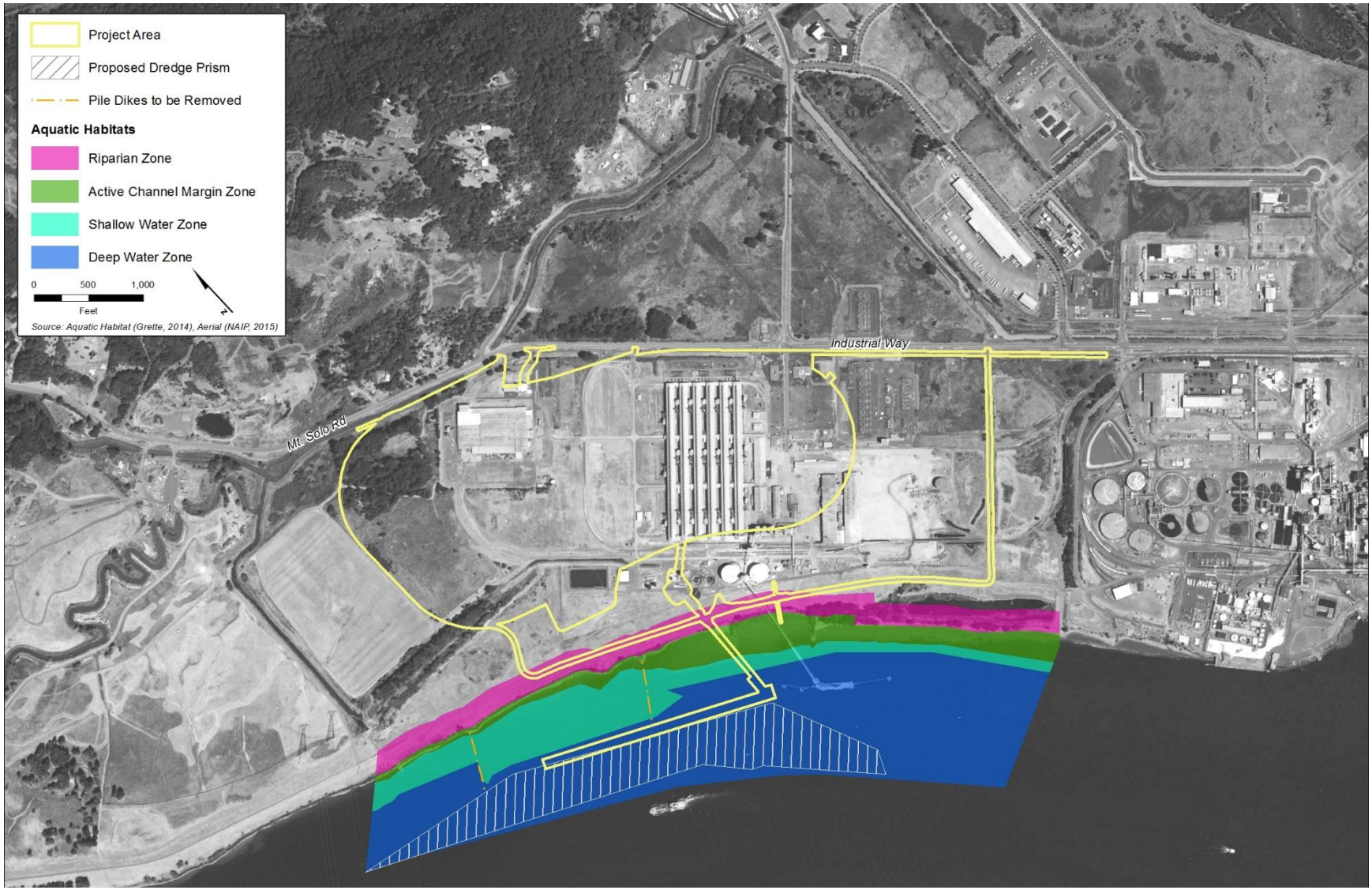


Figure 6. Aquatic Habitat Types Potentially Affected by the Proposed Action



Active Channel Margin

The ACM is defined as the shoreline and nearshore edge habitat, extending from the OHW line[3] (+11.1 feet CRD) to 0 feet CRD (Figures 5 and 6). For comparison purposes, the mean low water line is at approximately +2.7 feet CRD (National Oceanic and Atmospheric Administration 2013). Water levels in the ACM fluctuate continuously and portions are periodically dewatered because of tidal influence and river flow conditions, with the extent and duration of exposure dependent on site-specific topography. The ACM near the proposed docks covers approximately 25 acres and extends from 25 to 350 feet offshore. The shoreline portion of the ACM (less than 1.5 acres) is sparsely vegetated and consists of sandy substrate with little organic matter (Grette 2014b). Habitat functions in the ACM are strongly influenced by the condition of the shoreline and adjacent riparian zone. The shoreline in this area is highly modified by dikes and riprap armoring with scattered large woody debris.

Generally the ACM provides foraging and rearing habitat for juvenile salmonids, particularly those expressing a stream-type life history (National Marine Fisheries Service 2011). Steelhead trout (*Onchorhyncus mykiss*), lamprey, adult eulachon (*Thaleichthys pacificus*), and sturgeon are less likely to be found in the ACM because these species generally prefer deeper open water habitats (Carter et al. 2009, Gustafson et al. 2010, Independent Scientific Review Panel 2013). However, periodic occurrence of these species cannot be discounted. Larval and juvenile sturgeon may drift or move incidentally into inundated habitats in the ACM. Larval eulachon dispersal into the ACM is also probable.

Shallow Water Zone

The SWZ includes the fully inundated near-shore zone extending from the edge of the ACM at 0 feet CRD out to -20 feet CRD (Figures 5 and 6). The SWZ near the proposed docks covers approximately 34 acres extending from approximately 25 to 500 feet offshore. Bottom structure is primarily (90%) flat or shallow sloping substrate, with some moderate slopes out to depths of about -25 feet CRD, where the habitat becomes markedly steeper. Two pile dikes and one overwater dock extend into the SWZ and likely provide both cover and refuge for prey and predator species, but they are not likely to substantially inhibit migration past the project area. The substrate consists primarily of silty river sand with little organic matter (Grette Associates 2014b).

Deep Water Zone

The third major habitat type in the study area is the DWZ, which extends in depths beyond -20 feet CRD (Figures 7 and 8). The DWZ habitat type encompasses about 117 acres near the proposed docks, extending from the edge of the SWZ. At approximately 450 feet from the shore, this zone is about -20 feet deep CRD, extending to a maximum depth of -45 feet deep CRD approximately 1,200 feet from shore. The DWZ is used as an upstream migration corridor by adult salmonids returning to their spawning grounds and as a downstream corridor by juvenile salmonids of sufficient size to avoid predators and forage in open water. Steelhead are likely to be present periodically throughout the year in the DWZ as different summer and winter-run populations migrate through the area as juveniles and adults. Adult and subadult bull trout (*Salvelinus confluentus*) may also be found foraging in these deepwater habitats, particularly when eulachon, migrating juvenile salmonids, and other potential prey species are present in abundance. Eulachon (adults and larvae) are likely to be present during adult migration and larval dispersal. White sturgeon (*Acipenser transmontanus*)

[3] The OHW line is equivalent to the mean higher high water line in the tidally influenced Lower Columbia River

(adults, subadults, larvae, and juveniles) and green sturgeon (*Acipenser medirostris*) (adults and subadults) are likely to occur in the DWZ. Adult and juvenile lamprey may be present in the DWZ in the spring, summer, and fall during migration between freshwater and marine habitats (Table 3). There are a two pile dikes and one dock that extend into the DWZ. These structures are likely to influence but not inhibit the migration of juvenile salmonids, and they are likely to provide both resting and ambush habitats for predatory species including pikeminnow, bass, and piscivorous birds.

2.2.2.2 Columbia River Downstream of Project Area

The Columbia River estuary extends upstream from the mouth of the Columbia River to the Bonneville Dam (Simenstad et al. 2011). It has been considerably degraded from past use due to diking and filling and from water withdrawal for agricultural, municipal, and industrial purposes. The estuary is influenced by a number of physical structures (e.g., jetties, piles, pile dikes, bulkheads, revetments, and docks) that contribute to its overall degradation. Habitat-forming processes in the estuary have been altered by loss of upriver sediment input (now constrained behind upriver dams), changes in flow patterns that move sediments and modify landforms, and channel deepening and dredging. The near-elimination of overbank flood events and the separation of the river from its floodplain have altered the food web and reduced floodplain habitats of particular importance to ocean-type salmon runs (salmonids that typically rear for a shorter time in tributaries and a longer time in the estuary) (National Marine Fisheries Service 2011).

The estuary also is influenced by a number of physical structures (jetties, pilings, pile dikes, bulkheads, revetments, docks, etc.) that contribute to its overall degradation, but the extent of their impacts is poorly understood. Over-water and instream structures in the estuary number in the thousands and alter river circulation patterns, sediment deposition, and light penetration; they also form microhabitats that often benefit predators. In some cases, structures reduce juvenile access to low-velocity habitats (National Marine Fisheries Service 2011).

Habitat forming processes in the lower river and estuary have also been altered by loss of upstream sediment input (now constrained behind upriver dams), changes in flow patterns that move sediments and modify landforms, and channel deepening and dredging. The full impact of these changes is unknown. Some of the concerns about impacts on sediment transport and channel forming processes have been addressed by the use of instream dredge disposal alternatives and disposal methods to help sustain in-channel islands and shallow water habitats (National Marine Fisheries Service 2011). Stranding associated with existing ship wakes is an example of another threat to salmon and steelhead in the estuary. A study completed by ENTRIX (2008) identified 217 beach segments (out of 1,046 beach segments assessed) between the project area and the river mouth on which there is more than a minimal likelihood of fish stranding. Seventy of these sites occur in three clusters: Puget Island (RM 43–47), near Pt. Barlow (RM 61–62), and Walker and Lord Islands (RM 61–65) (Figure 7).

2.2.2.3 Focus Fish Species

This summary focuses primarily on fish species of special interest/concern, including federally and state-listed threatened and endangered species, and their designated critical habitat, as well as species of commercial, recreational, or cultural importance. Table 3 outlines the focus fish species, the status of the species (i.e., state and federal), habitat types these species typically occupy, and their seasonal occurrence in the study area. Existing conditions and habitat use by focus fish species are described by habitat type in the following sections and summarized in Table 3.

Table 3. Status of Focus Species and Seasonal Presences in the Study Area

Species, ESU/DPS	Federal Status[a]	Life Stage	Sept	Oct			Nov			Dec					
			A[b]	S[b]	D[b]	A	S	D	A	S	D	A	S	D
Chinook Salmon														
Snake River fall-run ESU	T	Adults			X[c]			…						
		Subyr		…[d]	…		…	…		…	…			
Lower Columbia River ESU	T	Adults			X			X						
		Yrlng												…
		Subyr		…	…		…	…		…	…	…		
Upper Willamette River ESU	T	Yrlng												…
		Subyr		…	…		…	…		…	…	…		
Coho Salmon														
Lower Columbia River ESU	T	Adults			X			X			X			X
		Subyr		…			…			…		…	…	
Chum Salmon														
Columbia River ESU	T	Adults						X			X			
		Subyr										…	…	
Steelhead Trout														
Snake River DPS	T	Adults			X			…						
Upper Columbia River DPS	T	Adults			X			…						
Middle Columbia River DPS	T	Adults			X			…[e]						
Lower Columbia River DPS	T	Adults			X			X			X			X
Bull Trout														
Columbia River DPS	T	Adults		…	…		…	…		…	…		…	…
Cutthroat Trout														
Columbia River DPS	NL	Adults/Juveniles		X	X		X	X		X	X		X	X
Green Sturgeon														
Southern DPS	T	Adults/Subadults		X	X		X	X						
Northern DPS	SOC	Adults		X	X		X	X						
		Subadults		X	X		X	X						
White Sturgeon														
Lower Columbia River		Adults		X	X		X	X		X	X		X	X

		Subadults	X	X		X	X		X	X	X	X
Eulachon												
Southern DPS	T	Adults							…	…	X	X
		Eggs/Larvae							…	…	X	X
Pacific & River Lamprey												
Multiple populations	NL	Adults	X	X		X	X					
		Ammoceotes	X	X		X	X		X	X	X	X

Notes:

[a] T denotes federally threatened (no Endangered in this table), "NL denotes Not Listed, SOC denotes Species of Concern.

[b] A, S, and D represent the HEA habitat categories of ACM, SWZ, and DWZ; see Grette (2014b) for additional information.

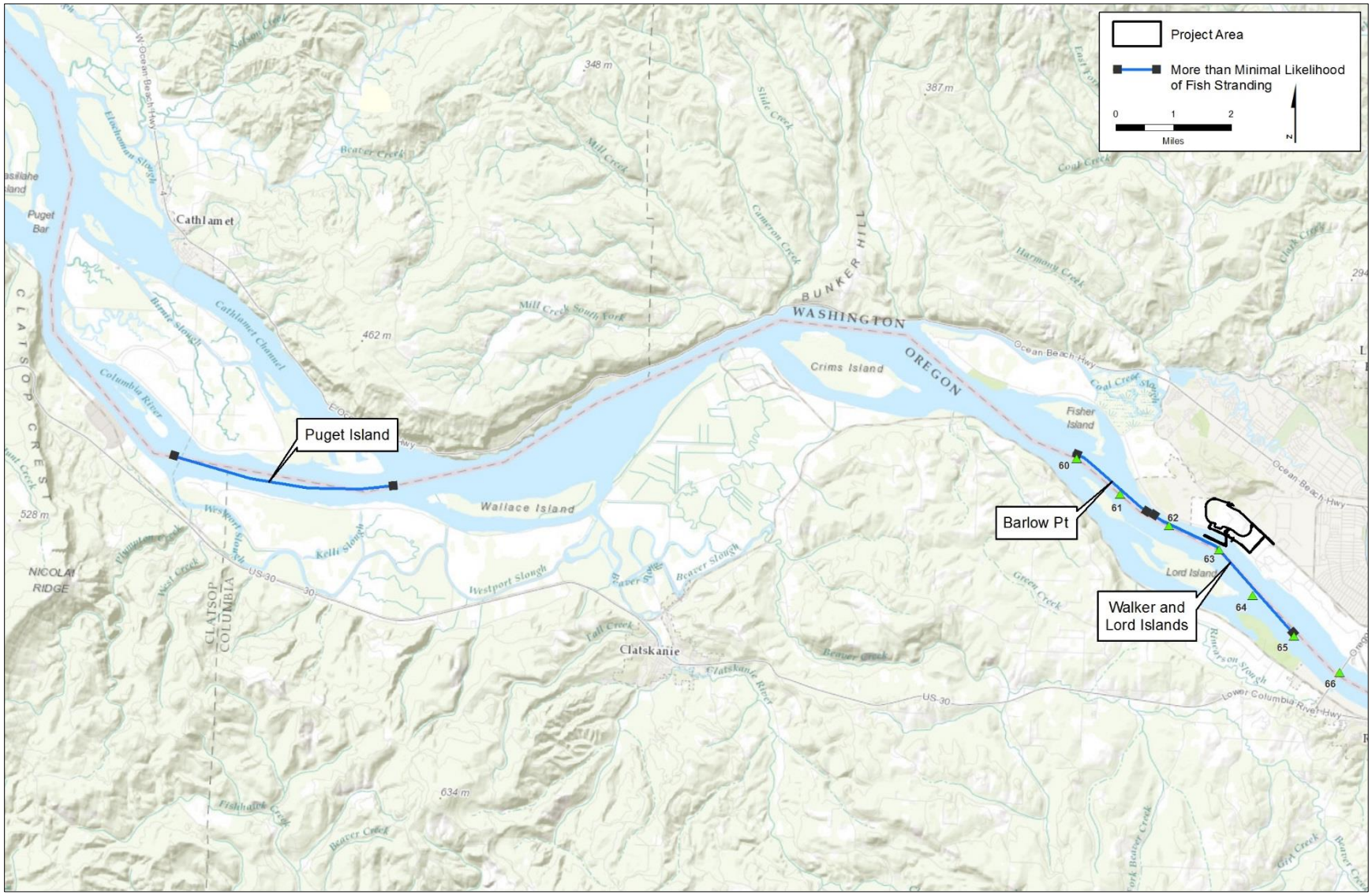
[c] X denotes expected or potential presence; see Grette Associates (2014c) for additional information.

[d] "..." denotes expected presence but low relative abundance; see Grette Associates (2014b) for additional information.

[e] The Middle Columbia River DPS includes a very small proportion of winter-run fish (Klickitat River, Fifteen-Mile Creek); because passage data at Bonneville Dam indicate that the vast majority of steelhead have passed the dam by early October, it is assumed that this includes winter steelhead spawning above it.

ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment; Subyr = subyearling; Yrlng = yearling.

Figure 7. Fish Stranding Sites



The study area provides habitat for a variety of anadromous and resident fish species found in the Columbia River. Anadromous salmonids occurring within the study area include the following species: Chinook (*Onchorhyncus tshawytscha)*, coho (*Onchorhyncus kisutch*), pink (*Onchorhyncus gorbuscha*), sockeye (*Onchorhyncus nerka*), and chum (*Onchorhyncus keta*) salmon; steelhead; bull trout; and coastal cutthroat trout (*Onchorhyncus clarkii clarkii*). Because of variable migration timing and duration of estuarine habitat use, one or more of these anadromous salmonid species are present in the Lower Columbia River throughout the year, as adults migrating upstream to spawning habitats, outmigrating juveniles, juveniles rearing in the estuary for extended periods, or, in the case of cutthroat trout and bull trout, as foraging subadults and adults. The study area also supports a variety of additional native and introduced fish species. Other anadromous or estuarine migrant species include green and white sturgeon, eulachon, shad (subfamily Alosinae), striped bass (*Morone saxatilis*), starry flounder (*Platichthys stellatus*), and Pacific lamprey (*Entosphenus tridentatus*) and river lamprey (*Lampetra ayresi*).

Resident freshwater fish expected to occur in the study area and vicinity include both coldwater (trout) and warmwater (bass, crappie, and bluegill [*Lepomis macrochirus*]) species, and locally migratory species (three spine sticklebacks (*Gasterosteus aculeatus*), peamouth chub [*Mylocheilus caurinus*]). Several resident fish species are predatory, feeding on a variety of small fish, including juvenile salmonids. These predators include the native northern pikeminnow (*Ptychocheilus oregonensis*), and introduced species such as walleye (*Sander vitreus*), crappie, and largemouth bass (*Micropterus salmoides*) and bass (*Micropterus dolomieui*).

Salmon and Trout

Eight threatened or endangered salmon Evolutionary Significant Units (ESUs), five threatened steelhead Distinct Population Segments (DPSs), one threatened bull trout DPS, and their designated critical habitats occur in the Lower Columbia River and the study area (Table 3) (Bottom et al. 2008, National Marine Fisheries Service 2011). In addition, essential fish habitat (EFH) has been designated for Chinook and coho salmon in the Lower Columbia River. The Columbia River estuary is used primarily as migratory and rearing habitat, and no salmonid spawning takes place in the study area. Adult anadromous salmonids travel through the estuary and lower river relatively quickly during their migration to upstream spawning grounds, remaining primarily in offshore deepwater habitats (Table 3 provides seasonal presence in the study area). In contrast, juvenile salmonids are present year round, use a wider variety of habitats, and exhibit more variable downstream migration speed, taking advantage of shallow water and ACM for foraging and seeking cover.

General salmon reproductive strategies can be divided into two groups: stream-rearing and ocean-rearing (noted in Table 3). Stream-rearing fish tend to spend extended periods, usually more than a year, rearing in fresh water before migrating to the ocean. Examples of stream-type fish are steelhead, coho, and spring-run Chinook salmon. In contrast, ocean-type juvenile salmonids tend to return to the ocean in the same year they were spawned. Examples of ocean-type fish are chum salmon, and fall-run Chinook salmon. These strategies affect how each population uses the estuary and how it may be affected by the Proposed Action. Because stream-type salmon spend more time rearing in their natal streams and associated rivers, they arrive in the estuary at a relatively larger size than ocean-type salmon and therefore use the estuary differently and are affected by different factors. For example, stream-type salmon arrive in the estuary as larger fish and generally use the estuary as a migration route rather than rearing habitat, and are affected mostly by predation and flow. Ocean-type salmon move into the estuary at a smaller size and use the estuary as rearing

habitat before entering the ocean. They are also affected by flow, but are more affected by habitat conditions in the estuary than are stream-type fish (Fresh et al. 2005). Salmonid occurrence by species and season are summarized in Table 3 (Bottom et al. 2008, Johnson et al. 2003, Fresh et al. 2005).

Habitat use and timing patterns of nonlisted salmon and steelhead populations are similar to the listed salmonid species (Table 3). Other salmonids, such as cutthroat trout, have complex life histories, consisting of both anadromous and resident populations that make extensive use of the lower river and estuary for foraging (Trotter 1989). Given the diverse run timing and life-history strategies exhibited by salmonids (Fresh et al. 2005) some life stage of salmon or trout could be present in the study area at any time. Salmon and steelhead use of the study area is described in the following sections by aquatic habitat type.

Designated critical habitat for federally protected salmonids in the study area consists of two primary constituent elements: migration corridors and estuarine areas. Migration corridors must be free of obstruction with healthy water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channel, and undercut banks to support juvenile and adult mobility and survival. Estuarine areas must be free of obstruction with water quality and salinity conditions to support juvenile and adult physiological transitions between fresh and saltwater with natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and with juvenile and adult forage, including aquatic invertebrates and fishes to support growth and maturation.

Additionally, the Columbia River is also EFH, as defined by the Magnuson-Stevens Fishery and Management Conservation Act for Chinook salmon and coho salmon. EFH for Pacific salmon is defined as those waters and substrate necessary to support salmon production, a long-term sustainable salmon fishery, and salmon contributions to a healthy ecosystem. To achieve that level of production, EFH must include those streams, lakes, ponds, wetlands and other currently viable water bodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho, and California. Thus, any discussion regarding the existing fish habitat conditions as well as potential impacts on fish habitat is applicable to EFH for Pacific salmon (i.e., Chinook salmon and coho salmon).

Active Channel Margin Use by Salmon and Steelhead

A fully functioning ACM provides natural cover, shoreline complexity, shade, submerged and overhanging large woody debris, logjams, and aquatic vegetation. All of these elements are identified in the primary constituent elements (PCEs) of critical habitat for Endangered Species Act (ESA)-listed salmon and steelhead, as well as bull trout (Grette 2014b). The ACM provides important habitat for juvenile salmon, with different species using different habitat types at different life stages. PCEs are defined as those physical and biological features of a landscape that a species needs to survive and reproduce. Table 3 identifies the salmon and steelhead species and season when individuals may be present in the ACM affected by the Proposed Action.

Use of the ACM varies both between and within species depending on locally specific adaptation for some life stages. Some salmonid species and populations rear in the lower river and estuary for extended periods (weeks to months) prior to entering the ocean; others spend very little time in the estuary and are unlikely to be present in the ACM for extended periods (Bottom et al. 2008, Johnson et al. 2003). Roegner and Sobocinski (2008) found that subyearling Chinook and chum salmon are

the most likely species to be found in the shallow nearshore habitats that compose the ACM. Juvenile chum salmon are abundant in shallow nearshore areas from March through May. Subyearling Chinook (likely ocean-type) are commonly found in the shallow margins of the ACM from March through July. Healthy ACM provides abundant macroinvertebrate forage and cover for protection from predation supporting increased growth, survival, and fitness. Information on use of the Columbia River estuary by the less abundant anadromous salmonid species (cutthroat and bull trout) and those species having life histories with limited freshwater rearing and migration (pink and chum salmon) is limited (Carter et al. 2009), although Carter et al. (2009) do report juvenile cutthroat trout use backwater and channel margin habitats during presmolt and smolt life stages in the Columbia River estuary. In contrast, steelhead and stream-type Chinook salmon are typically larger when they reach the estuary and are more likely to be found farther offshore in the SWZ or DWZ.

As stated above, the ACM near the proposed docks has been extensively modified. Consequently, it does not provide high-quality habitat for juvenile salmonids and other species that prefer shallow water habitats. These species are nonetheless likely to occur in the study area as they migrate downstream to better quality rearing in the lower river and estuary and/or during outmigration to the ocean (Table 3).

Shallow Water Zone Use by Salmon and Steelhead

The SWZ is used by adult salmon and steelhead as a migratory corridor and as foraging habitat by larger juveniles that are more capable swimmers in open water environments. Juvenile Chinook salmon, and sockeye salmon and steelhead smolts are typically found in deeper open water areas in the SWZ foraging on phytoplankton, invertebrates, and small fish (Bottom et al. 2008, Carter et al. 2009). Juvenile Chinook salmon are most commonly present from March through July but may be found in the SWZ during any month of the year. Juvenile coho salmon and steelhead are less likely to be found in the shallower areas but are abundant in deep water offshore habitats during their outmigration period (Roegner and Sobocinski 2008), indicating a likelihood of occurrence in the deeper areas of the SWZ.

Subyearling and yearling salmonids typically move offshore into the SWZ as temperatures increase in late spring and summer and as juveniles gain sufficient size to forage within the open water column (Carter et al. 2009). In general, survival and growth of juvenile salmonids is dependent upon habitats with ample food resources, resting areas (i.e., areas of slow current), refuge from predation, shoreline relief, side channels, and overhanging cover and banks. The SWZ near the proposed docks is made up of relatively high-energy habitat, with a sandy and silt bottom, and little organic matter, and is subject to erosion and deposition (National Marine Fisheries Service 2011). Consequently, this area is unlikely to provide substantial forage habitat for juvenile fish within the water column or along the bottom.

Generally, juvenile salmonids do not reside in specific habitats in the Lower Columbia River for extended periods, remaining in a given area for just a day or two before moving downstream to new suitable habitats (Bottom et al. 2008, Johnson et al. 2003). Carter et al. (2009) reported migration rates for tagged yearling and subyearling salmon of tens of kilometers per day. Given the simplicity of the shallow water habitat near the proposed docks and poor quality of the adjacent ACM, migratory fish are likely to move quickly through the area.

Deepwater Zone Use by Salmon and Steelhead

The DWZ zone provides a migratory corridor for adult salmon and steelhead and foraging and migratory habitat for larger juvenile Chinook salmon, coho salmon, and sockeye salmon and steelhead smolts pursuing phytoplankton, invertebrates, and small fish (Bottom et al. 2008, Carter et al. 2009, Roegner and Sobocinski 2008). Generally, juvenile salmonids do not reside in specific habitats in the Lower Columbia River for extended periods, remaining in a given area for just a day or two before moving downstream to new suitable habitats (Bottom et al. 2008, Johnson et al. 2003). Juvenile and adult salmon and steelhead are likely to be found in the DWZ during their respective migration and rearing periods (Table 3) as outmigrating salmonids (particularly stream type) tend to use deep water (Carter et al. 2009). The DWZ is also a dynamic environment, characterized by high flows and sediment transport. Sediment type is composed mostly of fine grain sands with little to no gravel or cobble for structure (Grette 2014b).

Bull Trout (Char)

Columbia River bull trout are listed as threatened, and there is one extant population in a subbasin that drains to the Lower Columbia River below Bonneville Dam; the Lewis River. Bull trout migrate to the mainstem Columbia River to rear, overwinter, or migrate to and from spawning areas. This indicates the possibility that more distant populations (e.g., Klickitat, Deschutes, Willamette) may migrate to and forage in the project vicinity or could in the future, but the extent to which different bull trout populations use the lower Columbia River is uncertain (Carter et al. 2009). The Lower Columbia Recovery Team considers the mainstem Columbia River to contain core habitat that may be important for full recovery of Columbia River bull trout (U.S. Fish and Wildlife Service 2002). Bull trout have occasionally been observed in the lower Columbia River as foraging or migrating adults and subadults, most likely originating from accessible lower Columbia River tributaries with extant bull trout populations. Subadults may occur in the study area throughout the year in shallow rearing habitats of the ACM and SWZ while adults are more likely to occur in the deeper areas of the SWZ and the DWZ (U.S. Army Corps of Engineers 2004b). However, bull trout are opportunistic predators and routinely move between aquatic habitat types in search of prey so they could be present anywhere in the study area during periods when they are likely to occur in the Lower Columbia River (Table 3).

Eulachon

Eulachon are small anadromous fish in the smelt family (*Osmeridae*), sometimes known as Columbia River smelt (among other names), that spawn in coastal rivers and migrate to the ocean to rear to adulthood. The historical range of this species extends from northern California to Bristol Bay, Alaska. NMFS has classified all extant eulachon populations from the southern end of the range in northern California to the Nass River in British Columbia (exclusive) as belonging to the Southern DPS of the species, and has listed this DPS as threatened under the ESA (*Federal Register* [FR], Volume 75, page 13012). Eulachon are a migratory anadromous species that spend the majority of their lives (2 to 5 years) in marine habitats but return to natal tributary rivers to spawn after reaching adulthood (75 FR 13012).

Eulachon reach sexual maturity and typically spawn in mid- to late-winter, spawning may also occur from November to April (Gustafson et al. 2010). Adults congregate in open water and scatter their fertilized eggs over a variety of substrates. The eggs are adhesive, remaining attached to the substrate through a relatively short incubation period lasting about two weeks at typical water

temperatures; eggs survive best in pea-sized gravel and coarse sandy substrates. The newly hatched larvae are captured by currents immediately after hatching and are transported rapidly downstream to estuarine and ocean habitats. Larvae that are dispersed into low current areas may remain in the estuary for weeks or months before growing into juveniles large enough to migrate to marine waters on their own. Most larvae are carried directly to the ocean where they rear to adulthood (Carter et al. 2009).

Prior to construction of dams in the Columbia River, eulachon may have migrated as far as Hood River to spawn. Currently eulachon migrate to the base of Bonneville Dam and spawn in the main river channel and many of the downstream tributaries, including the Grays, Elochoman, Kalama, Cowlitz, Lewis, and Sandy Rivers (Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife 2001). The Lower Columbia River up to Bonneville Dam and the lower reaches of those tributary streams that provide potential spawning habitats (i.e., Grays, Elochoman, Cowlitz, Kalama, Lewis, and Sandy Rivers) have been designated as critical habitat (76 FR 65324). Currently, the lower mainstem Columbia River and the Cowlitz River support the majority of eulachon production in the system (Gustafson et al. 2010). However, in years of relative abundance, spawning occurs broadly in the tidally influenced portions of the Columbia River and its tributaries (Grette 2014b). Adult migration in the Columbia River system is likely related to river temperature reaching 39.2°F and may begin in December, usually peaking in February and continuing through May (Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife 2001). In 2001, Howell et al. (2001) reported on spawning and distribution of larval eulachon, noting that, while spawning occurred widely in the mainstem and in tributaries as far upstream as the Sandy River (RM 120), the majority of the spawning likely occurred in the Cowlitz River and at a location just downstream of Barlow Point (RM 59.6). During the same spawning season, Romano et al. (2002) used artificial substrates to collect eulachon eggs as a way of identifying spawning sites in the main stem (based on the assumption that if eggs are collected spawning must have occurred nearby). They sampled locations between river mile 30 and river mile 85 near the mouth of the Lewis River. They collected the greatest number of eggs between river mile 56 and river mile 61 (Germany Creek to Barlow Point), and to a lesser extent river mile 67 through river mile 69 (mouth of the Cowlitz River to Cottonwood Island). Howell et al. (2001) took samples at several stations at seven fixed transects to assess the distribution of larvae across the river. They showed larvae were distributed nearer the Washington Shore at transects 7 downstream from Sandy River, and at transects 6 (downstream side of Lewis and Clark Bridge) and transect 5 downstream of Barlow Point. This likely reflects larvae moving downstream from spawning areas in the tributaries. Cross-channel distribution at transects farther downstream was more uniform, reflecting cross channel dispersion of larvae spawned in the tributaries and more intense mainstem spawning between Germany Creek and Barlow Point.

WDFW and the Oregon Department of Fish and Wildlife conducted plankton tows to sample for eulachon eggs and larvae between the Port of Longview above Barlow Point and the channel below the Cowlitz River mouth, including four sample sites offshore near the project area (Mallette 2014). Peak larval abundance occurred in mid-March during two of the three survey years and in late April/early May in the third year (Mallette 2014). As part of a related one-time sampling effort, eulachon eggs and larvae were documented in plankton tows at six sample sites (inshore and offshore) near the project area between river miles 62.8 and 64.0 in February 2012 (Mallette 2014: Report B). Eggs could be present from December through April; however, peak spawning season is usually in February or March. Larval eulachon, particularly from spawning aggregations in the Cowlitz River, likely pass through the study area as they are transported downriver. Further, it is

likely that at least limited spawning occurs in the mainstem Columbia River, as documented on the Oregon side of the Columbia River by Mallette (2014). Mallette (2014) found the greatest numbers of eulachon larvae in samples collected well downstream of the Lewis, Kalama, and Cowlitz Rivers and upstream of the Elochoman River (rivers with known eulachon spawning). While the relatively distance of sampling events to known spawning areas does not discount the possibility that larvae in samples may be the product of spawning in these tributaries, Mallette (2014) concluded that these findings highlight the potential for at least limited spawning in the mainstem Columbia River.

Adults deposit eggs in areas where the substrate consists of coarse sand/fine gravel (National Marine Fisheries Service 2010). Eggs are spherical and have a double membrane that, upon fertilization, peels back to form an adhesive peduncle (Howell et al. 2001). Eggs adhere to the surface of the substrate and incubate over a period of about 30 to 40 days, depending on temperature. Upon hatching, the larvae become part of the drift as (presumably) passive plankters and are rapidly transported out to sea (Howell et al. 2001). Larval fish, particularly from spawning aggregations in the Cowlitz River, are likely to pass through the study area as they are transported downstream. Eggs attached to large sand grains and pea-sized gravel may be disbursed from the spawning area flows in the Columbia River. The river channel in the study area is dynamic, with sand waves present in the area indicative of bedload movement. Given that incubation can be 30 to 40 days, there could be regular movement of eggs through the SWZ and DWZ of the study area conveyed by moving currents and bedload transport. Eggs could be present From December through April; however, peak of spawning season is usually in February or March.

Dredging in the Columbia River is identified as an activity of concern for eulachon conservation because this activity takes place in proximity to known and potential eulachon habitats. Dredging activities during the migratory and spawning period could entrain and kill adult fish, eggs, and larvae; bury and smother incubating eggs; or cause stress and disturbance that could contribute to decreased spawning success (National Marine Fisheries Service 2010).

Sturgeon

Both green and white sturgeon may be present in the deepwater component of the study area as adults and subadults. Two green sturgeon DPSs occur in in the Lower Columbia River. The northern DPS, currently listed as a federal species of concern, includes spawning populations from the Eel River in California to the Umpqua River in Oregon. The southern DPS, currently listed as threatened under the ESA, includes spawning populations from the Sacramento River basin. While this species does not spawn in the Columbia River or its tributaries, subadult and adult green sturgeon originating from all major spawning populations are known to use the Lower Columbia River and other coastal estuaries in Oregon and Washington for holding habitat in the summer and early fall (Adams et al. 2002, Lindley et al. 2011, Moser and Lindley 2007). Lindley et al. (2008 and 2011) investigated migration patterns of green sturgeon tagged with acoustic transmitters on their spawning grounds and in known nonspawning aggregation sites. They discovered that green sturgeon undertake long season migrations from spawning grounds to overwinter in marine waters off of the coast of Vancouver Island, British Columbia. In the late spring and summer green sturgeon enter and inhabit a number of estuarine and coastal sites, including the Columbia River estuary, Willapa Bay, Grays Harbor, and the estuaries of certain smaller rivers in Oregon, especially the Umpqua River estuary. Moser and Lindley (2007) suggested that growth opportunities for green sturgeon are higher in estuaries because they are warmer than shelf waters and food is abundant. Green sturgeon from different natal rivers use the Columbia River estuary from May through October (peak in July and August). The most prevalent tags reported by Lindley et al. (2011) were

from fish tagged in the Klamath and Rogue Rivers, but fish from the Sacramento River (southern DPS) were also present. Based on the size of green sturgeon and the number of tagged fish reported in the estuary, the Columbia River estuary appears to be an important component of foraging habitat for adult and juvenile green sturgeon belonging to the northern and southern DPSs.

Sturgeon are most commonly found in association with the bottom, where they feed on a mixture of aquatic insects and benthic (i.e., bottom-dwelling) invertebrates (Adams et al. 2002, Independent Scientific Review Panel 2013). Fish become a larger component of the diet as sturgeon increase in size. This species is known to spawn in the mainstem Columbia River in fast flowing waters near Bonneville Dam and in deepwater areas of the lower river (Independent Scientific Review Panel 2013, Parsley et al. 1993). Spawning lasts from 38 to 48 days extending from late April through early July during high runoff periods when water is turbid and turbulent. Adults are broadcast spawners, releasing their adhesive eggs over boulder and cobble substrate in areas with strong currents. Incubation lasts 7 to 14 days. Upon hatching the free-swimming embryos are broadly dispersed by currents as far as 100 miles downstream before settling. Post-settlement embryos seek out deep habitats with low light and large cobble or boulder substrates, remaining in cover for 20 to 25 days before they emerge as actively feeding larvae (Independent Scientific Review Panel 2013). The DWZ near the proposed docks does not provide suitable substrates for white sturgeon spawning or larval rearing so these life stages are unlikely to occur for extended periods in this area.

In contrast, juvenile white sturgeon are found throughout the Lower Columbia River and use a wide variety of habitats, including both main-channel and off-channel areas. They are most commonly found at depths greater than 33 feet (Independent Scientific Review Panel 2013). White sturgeon adults, sub adults, and young of the year are usually found at depths greater than 36 feet (McCabe and Tracy 1994), but habitat use can vary considerably. For example, Parsley et al. (2008) tracked the movement patterns of subadult and adult white sturgeon ranging from 20 to 48 inches in length in the Columbia River estuary and observed complex daily and seasonal patterns of habitat selection. Tagged sturgeon were readily observed in the study area in summer but virtually absent in winter. When present they exhibited diurnal movement patterns, occupying habitats deeper than 33 feet during the day and moving to shallower waters, sometimes less than 15 feet deep, at night. The tagged fish were broadly distributed across available suitable habitat, but individuals demonstrated strong site fidelity, restricting their daytime and nighttime movements to the same general area. The water depth preferences of white sturgeon indicate this species is most likely to be found in the DWZ, but individuals may also be present in the SWZ and, infrequently, in the ACM.

The white sturgeon population in the Columbia River downstream from Bonneville Dam has been among the most productive sturgeon populations in North America. Abundance and biomass have been estimated at 36.1 fish/acre and 88 pounds/acre, respectively (DeVore et al. 1995 cited in Independent Scientific Review Panel 2013). Current white sturgeon biomass in the unimpounded lower mainstem appears to be less than levels seen during pristine conditions before significant exploitation in the late 1800s (Jones et al. 2011). White sturgeon downstream from Bonneville Dam continue to range freely throughout the lower river mainstem, estuary, and marine habitats to take advantage of dynamic seasonal patterns of food availability. Individual growth, condition, and maturation values from the Lower Columbia River remain among the highest observed for white sturgeon range-wide. Habitat use of subadults and adults varies with habitat availability. Where habitat is relatively homogenous, such as in marine waters, estuaries, low gradient mainstem areas of the lower basin, and reservoirs, white sturgeon move frequently and range widely, presumably in search of scattered or mobile food resources. Many white sturgeon movement and migration patterns appear to be associated with feeding. Primary prey items appear to be the benthic

amphipod *Corophium salmonis* and the opossum shrimp *Neomysis mercedis* (Romano and Rien 2001). In the Lower Columbia River below Bonneville Dam, white sturgeon have been observed migrating upstream in the fall and downstream in the spring (Parsley et al. 2008). During early life stages, white sturgeon in the Lower Columbia River use a variety of habitats. Age-0 fish in the Lower Columbia River prefer deep (30–125 feet), low velocity areas where substrate particle sizes are small (e.g., sand; Parsley et al. 1993). Juvenile and subadult white sturgeon occupy a wide variety of depths (7–130 feet; Parsley et al. 1993 and 2008). Some juvenile white sturgeon preferentially used low velocity areas over sandy substrates at depths ranging from 7 to 190 feet in the Columbia River (Fisheries and Oceans Canada 2014), while others exhibited diel depth preferences Parsley et al. (2008). Given the abundance and mobility of white sturgeon in the Lower Columbia River, there likely would be some present during construction and operation of the Proposed Action.

Lamprey

Lamprey in general are a primitive anadromous fish species that spend their adult lives in the ocean but return to freshwater habitats for spawning and larval rearing. Two species, Pacific and river lamprey, are known to spawn in tributaries to the Columbia River and therefore migrate through the study area as adults and juveniles. Adults pass through the Lower Columbia River from March through October on their return migration to spawning tributaries (Columbia River Research 2014). Lamprey ascend rivers by swimming upstream briefly, then sucking to rocks, resting, and then proceeding.

Pacific lamprey populations may include mature adults that spawn within a few weeks of entering their spawning tributaries and immature adults that hold in freshwater overwinter and spawn between March and July the following spring (Clemens et al. 2013). Spawning takes place in the spring in low-gradient sections of water with gravel and sandy bottoms, when water temperatures are between 50 and 60°F. Females are very fecund, depositing between 10,000 and 100,000 extremely small eggs. Adults die within 3 to 36 days after spawning (Clemens et al. 2013).

The young (ammocoetes larvae) hatch in 2 to 3 weeks and are dispersed by currents to slack-water areas with soft substrates, where they settle in sediments, which are soft and rich in dead plant materials. They quickly burrow into the muddy bottom where they live for a period of 3 to 8 years as filter feeders consuming microscopic plants (mostly diatoms) and animals. As filter feeders, they are susceptible to pollutants in the water column and sediments, which originate from various sources such as urban and agricultural runoff. Because this species depends on muddy bottoms, backwater areas, and low gradient areas during its juvenile life stage, it is susceptible to loss or modification of wetlands, side channels, back eddies, and beaver ponds resulting from agricultural, forestry, or urban development practices or channelization for flood control. Late in the ammocoetes life stage, unknown factors trigger a metamorphosis, from which lamprey juveniles emerge. During high water periods, in late winter or early spring, the juveniles migrate to the ocean where they mature. During their ocean phase, Pacific lamprey are scavengers, predators, and/or parasites on larger animals such as salmon and marine mammals. They may undertake migrations in the Pacific Ocean, considerable distances from their natal river (Beamish 1980). After 2 to 4 years in the ocean they return to freshwater to spawn.

River lampreys are associated with large river systems such as the Fraser, Columbia, Klamath, Eel, and Sacramento Rivers. They exhibit a similar life history to the Pacific lamprey, including an ammocoete larval stage lasting 4 to 6 years. River lamprey ammocoetes also settle in slack water areas with muddy sediments and filter feed on microscopic organism (Moyle 2002). They differ

from Pacific lamprey in that they are smaller in size, a bit less fecund, with females laying between 12,000 and 37,000 eggs, and they are shorter lived. The length of adult life from the onset of metamorphosis until death following spawning is 2 years (Beamish 1980). The difference in longevity stems from their shorter ocean phase. River lamprey spend only 3 to 4 months in salt water, remaining close to the mouths of their natal rivers and foraging on smaller prey, such as herring and smelt (Beamish 1980).

The study area lacks suitable spawning substrates for either species. Therefore, adults are likely to be present only during upstream migration. Silver et al. (2007) and Jolley et al. (2012) investigated the presence and distribution of larval Pacific lamprey in the Willamette and Columbia Rivers. They found ammocoetes of several age classes in the Willamette River and at a few locations in the Columbia River. They observed anecdotally that larvae were more often found along underwater ledges at relatively steep drop-offs to deep water; and that shallow, flat, and sandy areas that appeared to present suitable habitat, were devoid of larvae. They speculate that those apparently suitable areas may have been dry during the summer months preceding the study because of lower regulated flows. They captured Pacific lamprey ammocoetes at two sites in the Columbia River near the mouth of the Cowlitz River. These ammocoetes were likely spawned in tributaries and either transported or migrated to the Columbia River. Their presence in the study area indicates the possibility that some ammocoetes could settle near the Proposed Action. The ACM and SWZ near the proposed docks generally lack the slack water environments required for ammocoete rearing, and the sediments in this area are mobile and lacking in the organic matter associated with suitable ammocoetes rearing habitat. The distribution of ammocoetes reported by Silver et al. (2007) indicates that ammocoetes may be transported through the area or migrate through the study area to suitable habitat downstream. Juvenile and adult lamprey may be present in the SWZ and DWZ during their respective migration periods (Table 3).

Nonfocus Fish

Other common native and introduced fish species are also expected to occur in the study area and are addressed more generically (Table 4). These are a mix of fish of interest because they are important food fish (harvested commercially and recreationally), game fish (harvested recreationally only), or on Washington's PHS list. Two of the species, mountain whitefish (*Prosopium williamsoni*) and leopard dace (*Rhinichthys falcutus*), are on Washington's PHS list as state candidate species. Both species are widely distributed in the Columbia and Fraser River basins. The other species in this group are important as commercial or recreational species. Most are abundant and widely distributed in the system, including several introduced species. Some are known predators of juvenile salmonid, such as largemouth bass, northern pikeminnow, smallmouth bass, striped bass, and walleye.

Table 4. Nonfocus Fish Species that Could Occur in the Study Area

Species	Reason for Interest	Native or Introduced
Channel catfish (*Ictalurus punctatus*)	WDFW game fish	I
Common carp (*Cyprinus carpio*)	WDFW food fish	I
Largemouth bass (*Micropterus salmoides*)	WDFW game fish	I
Leopard dace (*Rhinichthys falcutus*)	WDFW PHS	N
Mountain sucker (*Catostomus platyrhuchus*)	WDFW PHS, WDFW game fish	N
Mountain whitefish (*Prosopium williamsoni*)	WDFW game fish	N
Northern pikeminnow (*Ptychocheilus oregonensis*)	WDFW game fish	N
Peamouth (*Mylocheilus caurinus*)	WDFW game fish	N
Perch (family Percidae)	WDFW game fish	I
Shad (subfamily Alosinae)	WDFW food fish	I
Smallmouth bass (*Micropterus dolomieu*)	WDFW game fish	I
Suckers (family Catostomidae)	WDFW game fish	N
Sunfish (family Centrarchidae)	WDFW game fish	I
Striped bass (*Morone saxatilis*)	WDFW game fish	I
Walleye (*Sander vitreus*)	WDFW game fish	I

Notes:
Source: Grette 2014b.
WDFW = Washington Department of Fish and Wildlife; PHS = Priority Habitats and Species

2.2.2.4 Commercial, Tribal, and Recreational Fishing

Commercial, tribal, and recreational fisheries in the lower Columbia River are managed by the states of Washington and Oregon and tribes, subject to the terms of the 2008-2017 *United States v. Oregon* Management Agreement (Management Agreement). The Management Agreement establishes tribal harvest allocations and upholds the right of tribes to fish for salmon in their usual and accustomed fishing grounds. Commercial fisheries in these waters are managed under the Columbia River Compact, a congressionally mandated process that adopts seasons and rules for Columbia River commercial fisheries (National Marine Fisheries Service 2015). Tribal fish resources are discussed in the Final EIS (Volume I).

In Washington, commercial fishing seasons and rules are established by the Columbia River Compact, which comprises the Washington and Oregon Departments of Fish and Wildlife Directors, or their delegates, acting on behalf of the Oregon and Washington Fish and Wildlife Commission. The Columbia River Compact is charged by congressional and statutory authority to adopt seasons and rules for Columbia River commercial fishers. When addressing commercial seasons for salmon, steelhead and sturgeon, the Columbia River Compact must consider the effect of the commercial fishery on escapement, treaty rights, and sport fisheries, as well as the impact on species listed under the federal ESA. Although the Columbia River Compact has no authority to adopt sport fishing seasons or rules, it is their inherent responsibility to address the allocation of limited resources among users (National Marine Fisheries Service 2015).

In Washington State, recreational fishing seasons and rules are updated annually and presented in the Washington Sport Fishing Rules pamphlet. Sport fishing seasons are generally established from July 1 through June 30 of the following year. The pamphlet covers all fresh waters and marine

waters in Washington State, including the lower Columbia River, and establishes the seasons and rules for recreational fishing for finfish and shellfish/seaweed.

Commercial and recreational fishers primarily target hatchery-produced salmon and steelhead, as well as sturgeon and other game fish.

2.2.2.5 Sediment and Water Quality Conditions

Sediment conditions in the study area are generally uniform with slight variations between aquatic habitat types. ACM sediments are primarily sand mixed with silt, SWZ sediments are primarily sand, and DWZ sediments are primarily silt mixed with sand (Grette 2014b). Sediments within the dredge prism meet sediment disposal guidelines and are considered clean by the U.S. Army Corps of Engineers (Corps), U.S. Environmental Protection Agency (EPA), and Ecology (U.S. Army Corps of Engineers Dredged Material Management Office 2010 in Grette 2014b). Recent sediment characterization indicates less than 0.2% organic matter in deep areas and typically less than 0.3% in shallow areas. Eulachon eggs usually settle into coarse sands and gravels in relatively deep water, while the shallow and DWZs are largely made up of silty river sand and therefore not considered high quality habitat for eulachon eggs.

The Lower Columbia River is listed as a Washington State 303(d) impaired water and is classified by Ecology as a Category 5 polluted water for dissolved oxygen, temperature, bacteria, dieldrin, polychlorinated biphenyls, 2,3,7,8 TCDD, and 4,4,4 DDE (Washington State Department of Ecology 2016). At the project area, the Columbia River is listed as 303(d) impaired for bacteria and temperature. Over the years, downstream salinity patterns have changed, but intrusion and salinity in the study area are generally similar to historical patterns. Turbidity in the study area is variable based on a number of factors. For example, over 5 days of water quality monitoring for dredging, background levels (upstream from active dredging) ranged from the mid-20s to the mid-60s nephelometric turbidity units (NTUs) at all water depths (U.S. Army Corps of Engineers Dredged Material Management Office 2010 in Grette 2014b). Water temperature in the study area ranges from low 40s to low 70s (°F), which is slightly warmer than historical values (Bottom et al. 2008). Salmonids typically move from habitat areas as temperatures approach 66°F, and the study area habitat within the ACM and upper SWZ likely reaches this threshold and may become unsuitable for juveniles salmonids in the summer months. Refer to the SEPA Water Quality Technical Report (ICF 2017c) for further information regarding water quality conditions near the project area.

2.2.2.6 Fish Predators

Several bird, mammal, and fish species present in the Columbia River estuary are known to prey on one or more of the focus fish species. For example, cormorants and Caspian terns are significant avian predators that are known to target juvenile salmonids and eulachon. Osprey and bald eagles are also known fish predators, capable of taking both juvenile and smaller adult salmonids. Steller and California sea lions are primary predators on adult fish, including salmon, steelhead, and sturgeon in the Lower Columbia River (National Marine Fisheries Service 2013). However, the study area does not currently or historically support sea lion congregations, and it is unknown whether terns congregate in these areas (Jefferies et al. 2000). Native and nonnative fish species, including northern pikeminnow, smallmouth bass, and walleye, are known to be significant predators on juvenile fish and are capable of exploiting habitats present in the study area. Specifically, pikeminnow and smallmouth bass are known to associate with shoreline and channel modifications like riprap armoring, revetments, and pile dikes, which provide suitable holding habitat for lie-in-

wait predation (Pribyl et al. 2004). In contrast, walleye use deeper, open water habitats but they are also known to associate with artificial and natural structures when they are present (Pribyl et al. 2004). The existing dock, pile dikes, and other shoreline and channel modifications are likely to provide suitable habitat for these predatory fish species.

2.2.2.7 Fish Stranding

A growing body of evidence indicates that juvenile salmon and other fish are at risk of stranding on wide, gently sloping beaches because of wakes generated by deep draft vessel passage (Bauersfeld 1977; Hinton and Emmett 1994; Pearson et al. 2006;, ENTRIX 2008). Depending on the slope and breadth of a beach, wakes from passing vessels can travel a considerable distance, carrying fish and depositing them on the beach where they are susceptible to stress, suffocation, and predation.

Pearson et al. (2006) published the most detailed study of Columbia River fish stranding completed to date. They evaluated stranding at three sites in the Lower Columbia River: Sauvie Island, Barlow Point (adjacent to the project area), and County Line Park. The sites were chosen because prior work had established them as sites with high risk of stranding (Bauersfield 1977). Pearson et al. (2006) observed 126 vessel passages, 46 of which caused stranding. They also measured numerous site variables such as fish density (measured via beach seining), site topography, river stage, current velocity, tidal stage, tidal height, and a variety of vessel variables including direction of movement, velocity, ship type, ship size, and displacement. From the study, certain sites appear to be more susceptible to stranding than others. For example, the highest occurrence of stranding was at Barlow Point, where 53% of the observed passages resulted in stranding. Stranding occurred less frequently at Sauvie Island (37% of the observed passages resulted in stranding) and County Line Park (15% of observed passages resulted in stranding) (Pearson et al. 2006). The Proposed Action would add 1,680 vessel transits to the Columbia River at full buildout (840 vessels transiting to and from the project area), which would introduce additional permanent risk of fish stranding in the Columbia River. It should be noted, however, that Barlow Point is directly downstream from the project area. Vessels would be slowing as they approach the docks and accelerating as they leave the docks, which could reduce the size of vessel wakes. Other sites downstream of Barlow Point would be susceptible to increased risk of fish stranding because of the vessels associated with the Proposed Action.

Chapter 3
Impacts

This chapter describes the impacts on fish and fish habitat that would result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

3.1 Proposed Action

The Applicant has identified the following design features and best management practices to be implemented as part of the Proposed Action. These were considered when evaluating potential impacts of the Proposed Action. Some or all of these measures may be terms and conditions of permits that would be issued for the project, should the project be permitted.

- The Applicant would design the trestle to be long and narrow, and at a height above the OHWM to minimize shading in the shallow water zone. From shore, the trestle would measure 24 feet in width for 700 feet, and 51 feet in width for the final 150 feet. The top of the deck would be +22 feet CRD and the bottom of the deck +19.5 feet CRD. Therefore, the bottom of the deck would be more than 8 feet above OHW. This design would minimize overall impacts in shallow water, including impacts on habitat connectivity along the shoreline.
- The Applicant would locate Docks 2 and 3 entirely in deepwater habitat to distance the structure and terminal activities from shallow water areas.
- The Applicant would install pile caps on all project-related piling to minimize perching/roosting opportunities for piscivorous birds on the trestle and docks.
- The Applicant would locate the berthing area at water depths of at least -20 feet CRD to avoid habitat conversion from shallow to deepwater during dredging.
- The Applicant would locate the berthing area in deepwater closer to the navigation channel to minimize the scope of future maintenance dredging.
- The Applicant would direct project lighting downward or at structures, and would incorporate shielding to avoid spillage of light into aquatic areas.
- The Applicant would include a pinpoint light source at the end of the shiploading boom, aimed straight down into the ship hold area to avoid a broader beam that could cause light spillage.
- The Applicant would remove the piles slowly to minimize sediment disturbance and turbidity in the water column.
- Prior to pile extraction, the Applicant would break the friction between the pile and substrate to minimize sediment disturbance.
- The Applicant would conduct impact pile-driving using a confined bubble curtain or similar sound attenuation system capable of achieving approximately 9 dB of sound attenuation.
- During pile removal and pile driving, the Applicant would place a containment boom around the perimeter of the work area to capture wood debris and other materials released into the waters

as a result of construction activities. The Applicant would collect all accumulated debris and dispose of it upland at an approved disposal site. The Applicant would deploy absorbent pads should any sheen be observed.

- The Applicant would provide a containment basin on the work surface on the barge deck or pier for piles and any sediment removed during pulling. The Applicant would dispose of any sediment collected in the containment basin at an appropriate upland facility, as with all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- Upon removal from substrate, the Applicant would move the pile expeditiously from the water into the containment basin. The Applicant would not shake, hose, strip, or scrape the pile, nor leave it hanging to drip or any other action intended to clean or remove adhering material from the pile.
- The Applicant would limit the impact of turbidity to a defined mixing zone and otherwise comply with WAC 173-201A.
- The Applicant would not stockpile dredged material on the river bottom surface.
- The Applicant would contain all dredged material in a barge prior to flow lane disposal; dredged material would not be stockpiled on the riverbed.
- During hydraulic dredging, the Applicant would not operate hydraulic pumps unless the dredge intake is within 3 feet of the bottom.
- The Applicant would remove any floating oil, sheen, or debris within the work area as necessary to prevent loss of materials from the site. The Applicant would be responsible for retrieval of any floating oil, sheen, or debris from the work area and any damages resulting from the loss.
- The Applicant would dispose materials to the flow lane using a bottom-dump barge or hopper dredge. These systems release material below the surface, minimizing surface turbidity.
- The Applicant would have a spill containment kit, including oil-absorbent materials, on site to be used in the event of a spill or if any oil product is observed in the water.
- The Applicant would not allow barges to ground out during construction.
- The Applicant would be required to retrieve any floating debris generated during construction using a skiff and a net. The Applicant would dispose of debris at an appropriate upland facility. If necessary, the Applicant would install a floating boom to collect any floated debris generated during in-water operations.
- The Applicant would not allow land-based construction equipment to enter any shoreline body of water except as authorized.
- The Applicant would store, handle, and use all fuel and chemicals in a fashion to ensure that they do not enter the water.

The following construction activities could affect fish.

- Permanent removal or temporary alteration of fish habitat and prey resources from dredging and pile installation.
- Noise impacts associated with pile driving.

- Shading of aquatic habitat from docks, construction equipment, and construction vessels.
- Spills and leaks from equipment or storage of potentially hazardous materials (i.e., fuel, hydraulic fluids, lubricants or other chemicals)

The following operation activities could affect fish or fish habitat.

- Shading of aquatic habitat from docks and vessels.
- Spills and leaks of potentially hazardous materials associated with operations (i.e., fuel, hydraulic fluids, lubricants, or other chemicals).
- Vessel-generated noise.
- Vessel-generated wakes resulting in fish stranding.
- Loss or impairment of fish and benthic habitat during maintenance dredging.
- Loss or impairment of fish and benthic habitat from coal dust deposition in aquatic environments.

Potential impacts on fish and fish habitat from the Proposed Action are described below.

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would occur on currently developed and disturbed lands and within the Columbia River. Potential construction impacts on fish and fish habitat would include permanent removal or temporary alteration of habitat, elevated underwater noise associated with pile driving, temporary overwater shading, and spills and leaks of hazardous material.

Temporarily Alter or Permanently Remove Aquatic Habitat

Construction would result in the alteration and removal of aquatic habitat in the Columbia River adjacent to the project area. Riparian vegetation at the project area is sparse and riparian habitat conditions are degraded. Project construction would not result in measurable impacts on riparian vegetation or habitat conditions at the project area.

Habitat in the Columbia River would be permanently altered and removed by the placement of piles. A total of 610 of the 630 36-inch-diameter steel piles required for the trestle and docks would be placed below the OHW mark (Millennium Bulk Terminals–Longview 2016), permanently removing an area equivalent to 0.10 acre (4,312 square feet) of benthic habitat. The majority of this habitat is located in DWZ (Grette 2014a). The placement of piles would displace benthic habitat, and the areas within each pile footprint would cease to contribute toward primary or secondary productivity. Individual pile footprints are relatively small (7.07 square feet) and are spaced throughout the dock and trestle footprint. Benthic, epibenthic (i.e. living at the water-substrate interface), or infaunal (i.e., beneath the surface of the river floor) organisms within the pile footprint at the time of pile driving would likely perish.

Creosote-treated piles would be removed from the deepest portions of two existing timber pile dikes. In total, approximately 225 lineal feet of the dikes would be removed. Overall, the removal of creosote-treated woodpiles from the Columbia River would be a beneficial impact, as any remaining creosote in those piles would be removed from the aquatic environment. However,

removal of the piles could potentially result in temporary increases in suspended sediments, short-term contamination of water, and long-term contamination of sediments from creosote released during extraction. Creosote contains a mixture 200 to 250 compounds, with primary components composed of polycyclic aromatic hydrocarbons (PAHs) (Brooks 1995), which are known to be toxic to aquatic organisms including invertebrates and fish and can cause sublethal and lethal effects (Eisler 1987, Brooks 1995).

Creosote and associated chemicals are known to bioconcentrate in many aquatic invertebrates (Eisler 1987, Brooks 1995). This could expose higher trophic level species such as fish to creosote/PAH compounds through the food chain. Many vertebrates, including fish, however, metabolize PAHs and excrete them, reducing the potential risk to higher trophic level species (National Marine Fisheries Service 2009).

Most of the components of creosote are heavier than water and sink in the water column. PAHs from creosote accumulate in sediments and are likely to persist and degrade at the site of pile removal or wherever they settle after suspension (National Marine Fisheries Service 2009). However, PAHs from sediment are less bioavailable to aquatic species and thus these organisms are not likely to bioaccumulate PAHs from sediments (Brooks 1995).

Over the long term, the source of creosote would be removed or capped by the sediment falling into the hole left by the extracted pile. Water quality would improve over time; the concentration of creosote in the sediment would be expected to decrease, and the potential pathway of exposure for wildlife through contamination of prey would be reduced.

The in-water work windows would be defined by the permits that may be issued for the construction of the project. The in-water work windows presented here are consistent with WAC 220-110-206, which was repealed effective July 1, 2015 by Washington State Rule 15-02-029. No new in-water work windows have been defined and the project-specific in-water work periods would be defined during permitting. Dredging is proposed between August 1 and December 31, per the recently repealed WAC 220-110-206) and would permanently alter a 48-acre area of benthic habitat in the DWZ (below -20 feet CRD) by removing approximately 500,000 cubic yards of benthic sediment to achieve a water depth of -43 feet CRD, with a 2-foot overdredge allowance. Within the proposed dredge prism (i.e., extent of the area to be dredged), the amount of deepening would vary based on existing depths, from no removal up to approximately 16 feet of removal. The majority of the area of the proposed dredge prism is at or below a depth of -31 feet CRD. Hydrodynamic modeling and sediment transport analysis performed by WorleyParson (2012) evaluated the potential effects that could result from dredging, sediment deposition, and maintenance dredging. Overall, WorleyParsons (2012) found that the accretion rate would be approximately 12,000 cubic yards per year within the dredge prism; however accretion rates could fluctuate significantly year-over-year based on flow conditions. Maintenance dredging would likely only be required on a multiyear basis, or following special extreme flow events (WorleyParsons 2012). The preferred method for disposing of dredge material is flow-lane disposal so those sediments are not removed from the river, but remain in the river and are transported and deposited in areas where they can provide habitat for benthic species and benthic dependent species. Thus dredged materials are expected to be disposed of within the flow lane, adjacent to the navigation channel, allowing these sediments to support the downstream sediment transport system (Grette 2014a, 2014c). This area would be located within an area of approximately 80 to 110 acres between approximately river mile 60 and river mile 66. However, it could be that some or all of the dredged materials

could be used for preloading of the stockpile pads and then disposed of at an appropriate off-site upland facility. Specific disposal methods for dredged materials would be determined during permitting and federal ESA Section 7 consultation.

Much of the scientific literature evaluating the effects of turbidity on fish is discussed in relation to turbidity concentrations associated with dredging. The dredging that would occur for the Proposed Action would remove approximately 500,000 cubic yards of sediments, and temporary increases in turbidity associated with other related activities (e.g., pile driving and pile dike removal) would generally be lower than those associated with larger dredging activities (i.e., dredging of the navigation channel). Several studies indicate that suspended sediment concentrations occurring near dredging activity do not cause gill damage in salmonids. Servizi and Martens (1992) found that gill damage was absent in under yearling coho salmon exposed to concentrations of suspended sediments lower than 3,143 milligrams per liter (mg/L). A negligible risk of gill tissue damage is also expected for adult and subadult salmonids exposed to turbidity generated by dredging activities because salmonids in these life stages are generally more tolerant of elevated suspended sediment levels (Stober et al. 1981) and are generally able to avoid localized areas of elevated turbidity associated with construction activities.

Suspended sediments have been shown to cause stress in salmonids but at concentrations higher than those typically measured during dredging. Subyearling coho salmon exposed to suspended sediment concentrations above 2,000 mg/L were physiologically stressed as indicated by elevated blood plasma cortisol levels (Redding et al. 1987). Although turbidity may cause stress to salmonid species, studies by Redding et al. (1987) found that relatively high suspended sediment loads (2,000–2,500 mg/L) did not appear to be severely stressful to yearling salmon.

Although it is difficult to determine exactly how much of a temporary increase in turbidity would result from the covered activities, increases in suspended sediments are expected to be relatively short term, occurring during in-water construction activities and maintenance dredging. Thus, in-water construction and maintenance activities would not result in chronic sediment delivery to adjacent waters because sediments would be disturbed only during in-water work. Construction related dredging is proposed to occur from August 1 through December 31, when many fish species would be present within the study area (Table 3). Impacts on water quality from dredging would be minimized with the preparation and implementation of a dredging plan in compliance with the dredged material management program as required by state agencies (Ecology and Washington State Department of Natural Resources) and federal agencies (Corps and EPA). Adhering to a plan developed in compliance with the dredged material management program would minimize but not eliminate, water-quality impacts, ensuring that potential impacts are temporary and localized in nature. No long-term changes in the baseline conditions in the study area would be expected to occur. It is assumed that dredging would occur between 7:00 a.m. and 10:00 p.m., Monday through Friday, per the Cowlitz County Code Chapter 10.25, which restricts construction noise to these hours, unless the activity is authorized by a valid conditional use permit, a SEPA determination, or a permit approval condition.

Those fish that are present in the construction area when the effects are manifest are likely to avoid the area until the effects dissipate. Carlson et al (2001) observed out-migrating salmon smolts moving in-shore when encountering either a dredge or discharge plume before resuming

their prior distribution a short distance downstream. An evaluation of dredge disposal in the lower Columbia River found that white sturgeon may slightly shift habitat use toward disposal areas during disposal, possibly in response to prey items associated with dredged materials (Parsley et al. 2011). Hence, short-term, localized increases in turbidity associated with the Proposed Action dredging and dredge disposal activities would not likely result in significant physiological impacts on fish, their habitat, or their prey.

Behavioral effects related to increased turbidity are another consideration. Some of the documented behavioral effects of turbidity on fish include avoidance, disorientation, decreased reaction time, increased or decreased predation, and increased or decreased feeding activity. However, many fish species (especially estuarine species) have been documented to prefer higher levels of turbidity for cover from predators and for feeding strategies. For example, increased foraging rates for juvenile Chinook salmon were attributable to increase in cover provided by increased turbidity, while juvenile steelhead and coho salmon had reduced feeding activity and prey capture rates at relatively low turbidity levels. Juvenile Chinook salmon were also found to have reduced predator-avoidance recovery time after exposure to turbid water. (ECORP Consulting, Inc. 2009). Thus, while there may be some beneficial behavioral effects from increased turbidity, it is expected that for many of the focus fish species and native non-focus fish species behavior effects from increased turbidity would generally be negative.

The Proposed Action would permanently affect approximately 48 acres of benthic habitat due to dredging activities (i.e., removal of benthic habitat and benthic organisms) and construction of the docks (i.e., construction of new in-water structure and related shading of the aquatic environment). Water quality could be affected by coal dust. These potential impacts are discussed below. Other elements of these two PCEs, such as water quantity, natural cover, and salinity would not be impacted by the project.

Entrain Aquatic Organisms during Hydraulic Dredging

Fish, fish eggs, and fish larvae (i.e., eulachon eggs, lamprey ammocoetes) that occur within the dredge prism could become entrained during hydraulic dredging. It is assumed that adherence to the in-water work window for the Proposed Action, to be defined in permits issued for the Proposed Action, would be protective of the most vulnerable life-history stages for affected fish; however, some life-history stages could occur in the dredge prism year-round (i.e., lamprey ammocoetes). Thus, not all potential impacts associated with entrainment during hydraulic dredging would be avoided. Additionally, the in-water work window would not be defined until the Applicant obtains the necessary permits to construct the Proposed Action, and dredging would occur periodically over the life of the project. Proposed mitigation measures presented in the Final EIS (Volume I) would address impacts on all fish and life history stages.

The majority of benthic, epibenthic, and infaunal organisms within the proposed dredge prism would be removed and would perish during dredging. Recolonization by benthic, epibenthic, and infaunal organisms would be rapid, and disturbed habitats would return to reference conditions following recolonization by benthic organisms (McCabe et al. 1996). Typically, 30 to 45 days are required for benthic organisms to recolonize disturbed environments.

Increase Underwater Noise during Pile Driving

The following analysis is a summary of the Grette (2014a) evaluation of the potential impacts on fish from underwater noise generated during pile-driving activities. The Grette (2014a) analysis

was reviewed and evaluated by ICF, and the approach taken for the analysis is consistent with the current approach for evaluating the effects of underwater noise on fish, specifically underwater noise generated by pile-driving activities.

Docks 2 and 3 and their associated trestle would be supported by 630 36-inch steel piles, 610 of which would be installed in aquatic areas below OHW. The Dock 2 and 3 structures would be located completely within DWZ habitat (below -20 feet CRD) and would comprise the majority of the pile to be installed. Each pile would be installed using a vibratory driver until it meets practical resistance, at which point an impact pile driver would be used to proof the pile and complete installation to the necessary weight-bearing capacity.

Most piles would be installed to a depth approximately 140 to 165 feet below the mudline to provide the necessary resistance to support the overwater structures (i.e., Docks 2 and 3, the ship loaders, and conveyors) (Grette 2014a) The duration of vibratory and impact pile driving required to install each pile would be dependent upon the depth at which higher density materials (e.g., volcanic ash or dense sand and gravels) are encountered; shallower resistance would require less vibratory and more impact driving, while deeper resistance would require more vibratory and less impact driving.

Sound generated by impact pile driving has the potential to affect fish in several ways, ranging from alteration of behavior to physical injury or mortality, depending on the intensity and characteristics of the sound, the distance and location of the fish in the water column relative to the sound source, the size and mass of the fish, and the fish's anatomical characteristics (Hastings and Popper 2005). Refer to the SEPA Noise and Vibration Technical Report (ICF and Wilson Ihrig 2017) for further information regarding noise and vibration.

Both peak sound pressure level (SPL) and sound exposure level (SEL) can affect fish hearing through auditory tissue damage or temporary shifts in sensitivity to sounds (referred to as a temporary threshold shift [TTS]). Exposure to very loud noise or loud noise for extended periods may result in permanent reductions in sensitivity or permanent threshold shifts (PTS). Generally TTS would occur at lower levels than those resulting in auditory tissue damage, which result in PTS. The effects of hearing loss in fish may relate to the fish's reduced fitness, which may increase the vulnerability to predators and/or result in a reduced ability to locate prey, inability to communicate, or inability to sense their physical environment (Hastings and Popper 2005). Popper et al. (2005) found fish experiencing TTS were able to recover from varying levels of TTS, including substantial TTS, in less than 18 hours post exposure. Meyers and Corwin (2008) reported evidence that fish can replace or repair sensory hair cells that have been damaged in both the inner ear and lateral line, indicating that fish may be able to recover from PTS over a period of days to weeks.

In June 2008, NMFS, USFWS, the U.S. Federal Highway Administration, and several state transportation agencies agreed to interim criteria intended to protect fish from underwater noise generated by pile driving during bridge construction and retrofitting (Fisheries Hydroacoustic Working Group 2008). In general, the interim criteria establish thresholds for injury and behavioral effects from pile-driving generated underwater noise. There are three criteria for injury related to underwater noise: the first is based on peak pressure levels of 206

dB_{PEAK}[4] for impulse-type noise (e.g., pile driving), and the other two are based on accumulated sound exposure levels (i.e., sound energy integrated over time), the first of which is 187 dB cumulative $_{SEL}$ [5]for fish greater than or equal to 2 grams (e.g., most juvenile salmon and trout), and the other is 183 dB cumulative $_{SEL}$ for fish less than 2 grams (e.g., larval lamprey). Underwater noise levels of 150 decibels root-mean-squared (dB_{RMS}) may cause behavioral effects in fish species, such as startle response, disruption of feeding, or avoidance of an area. Depending on site-specific conditions, construction timing, duration, and other factors, exposure to these levels may cause behavioral changes that result in potential injury (Washington State Department of Transportation 2015). Potential adverse behavioral affects include interruption of foraging activities, avoidance of feeding or spawning areas, or movement away from cover, impaired predator avoidance (Washington State Department of Transportation 2015).

This analysis assumes that in-water pile driving would occur over two proposed construction seasons. In order to accomplish impact pile driving during limited work windows, multiple pile-driving rigs are expected to be in use simultaneously on the same day. The simultaneous use of multiple rigs may reduce the total duration of pile driving sound as some overlap in active driving may occur.

Considering the large number of piles to be driven, and the potential for multiple rigs to operate simultaneously, this analysis assumes that vibratory and/or impact pile driving may occur continuously during each working day of the Applicant-proposed in-water construction window (September 1 through December 31). Local Ordinance (Cowlitz County Code: Chapter 10.25) restricts construction noise to the hours of 7 a.m. to 10 p.m. unless the activity is authorized by a valid conditional use permit, a SEPA determination, or a permit approval condition. Various underwater reference noise values were reviewed, in order to select the appropriate noise values that would likely be generated by pile-driving activities. Of the various reference pile data available (ICF Jones & Stokes and Illingworth and Rodkin 2009, Washington State Department of Transportation 2015), sound levels from the Columbia River Crossing (CRC) 48-inch diameter steel test piling (David Evans Associates 2011) were selected as reference levels for the 36-inch-diameter steel piling proposed for the analysis. Although the pilings were larger for the CRC project, the proximity of the two sites and the similar conditions (i.e., depth, currents, and substrates) are expected to be more comparable than more distant locations such as Puget Sound or areas of California, where other reference data has been obtained for 36-inch-diameter steel piling (Grette 2014a).

Substrate characteristics between the CRC site and the project area are relatively similar, and pile driving conditions and underwater noise levels generated are anticipated to be similar. The greatest per-pile levels for each type of sound (i.e., single strike at 217 dB_{PEAK}, 201 dB_{RMS}, and 185 dB_{SEL}) were selected. These values are generally greater than reference values recorded for 36-inch-diameter piling at various other locations, and thus represent the potential worst-case for noise levels generated during pile driving (Grette 2014a).

Further, the hydroacoustic monitoring conducted for the CRC test pile also tested the efficacy of both confined and unconfined bubble curtains for attenuation of underwater noise from pile driving (David Evans Associates 2011). For 48-inch-diameter steel piling, both confined and

[4] dB_{PEAK} is the instantaneous maximum overpressure or underpressure observed during each pulse. When evaluating potential injury impacts on fish, peak sound pressure (dB_{PEAK}) is often used.

[5] dB cumulative SEL is a metric for acoustic events and is often used as an indication of the energy does. SEL is calculated by summing the cumulative pressure squared (p^2), integrating over time, and normalizing to 1 second.

unconfined bubble curtains consistently attenuated sound levels by 10 dB or more, measured at a distance of 33 feet from the source. At another Washington State Department of Transportation project completed downstream at Puget Island, the confined bubble curtain attenuated sound levels by 13 dB (measured at 43 feet) after on-site modifications (Washington State Department of Transportation 2010). Thus, the assumption that sound values would be attenuated by 9 dB during use of a confined bubble curtain in this analysis is considered realistic, achievable, and likely conservative (Grette 2014a).

Both the NMFS and the USFWS are concerned with potential impacts of elevated underwater noise levels during pile driving on federally protected fish species, such as salmonids, green sturgeon, and eulachon. NMFS and the USFWS have developed standard thresholds for disturbance/behavioral changes and injury (Table 5). Sound at or above these thresholds is evaluated on a site- and project-specific basis to determine whether potential impacts could occur, and whether any impacts on individuals resulting from underwater noise generated by pile driving could occur. Injury threshold values typically result from impact pile driving, as opposed to vibratory pile driving because sound- or pressure-related injuries, such as barotraumas, are thought to result from the rapid rise times and fluxes in over- versus under-pressure during a pile strike (Grette 2014a).

Table 5. Underwater Sound-Level Thresholds for Endangered Species Act-Listed Fish

Species	Effect Type	Threshold
All Listed Fish[a]	Injury, cumulative sound (fish ≥2 grams): onset of TTS (auditory response), with onset of auditory tissue damage and nonauditory tissue damage with increasing cumulative sound	$187dB_{SELcum}$
	Injury, cumulative sound (fish <2 grams): similar to above, onset of nonauditory tissue damage occurs at lower sound levels with smaller fish	$183dB_{SELcum}$
	Injury, single strike: onset of TTS and auditory tissue damage from single strike	$206dB_{PEAK}$
	Behavioral Disruption	$150dB_{RMS}$

Notes:

[a] Injury thresholds are based on interim criteria that were developed for salmonids based on data specific to hearing generalists with swim bladders (Carlson et al. 2007). NMFS also applied these thresholds to other listed fish with swim bladders (e.g., green sturgeon) and sometimes conservatively to fish without swim bladders (e.g., eulachon). Injury descriptions are based on information summarized in Carlson et al. (2007).

TTS = temporary threshold shift; dB = decibel; SEL = sound exposure level; cum = cumulative; RMS = root mean square.

Source: Grette 2014a.

It is standard practice to use the Practical Spreading Loss model to evaluate the potential effects of pile driving and determine the distance at which sound associated with pile driving would attenuate to specific levels (i.e., effect thresholds), except where cumulative sound is being considered.

The Practical Spreading Loss model is defined as:

$$TL = 15 * \text{Log} (R_1/R_2)$$

where:

TL = Transmission Loss, the difference between SPLs in dBs at distances R_1 and R_2; also $SPL_2 – SPL_1$

R_1 = distance at which transmission loss is estimated

R_2 = distance from source at which sound is known or measured (typically 10m)

In order to solve for R_1, the distance required for SPLs to attenuate to a desired level (e.g., threshold or ambient condition) based on reference SPLs at a known distance (R_2, typically at 10m), the terms are rearranged as follows:

$$R_1 = R_2 * 10^{(TL/15)}$$

In this case, the Practical Spreading Loss model was used to solve for R_1 in order to calculate distance to injury (single strike, 206 dB_{PEAK}) and distance to disturbance (150 dB_{RMS}) for federally protected fish during impact pile driving (Grette 2014a).

In addition to thresholds for single pile strikes, NMFS has established injury thresholds for fish based on cumulative sound exposure to account for the potential effects of impact pile driving over the course of a workday. Cumulative sound exposure is calculated using the NMFS Stationary Fish model (available at http://www.wsdot.wa.gov/Environmental/Biology/BA/BAguidance.htm#noise) (Grette 2014a).

The Stationary Fish model requires the number of pile strikes over an entire workday to determine the potential cumulative injury for fish based on dB_{SEL}. However, NMFS incorporated the concept of "effective quiet" into the model, which assumes that sound cannot accumulate and contribute toward cumulative injury below 150 dB_{SEL}. Because of this, one can calculate the maximum distance possible for cumulative injury independent of pile strikes. This can be accomplished either using the Practical Spreading Loss model to determine the distance required to attenuate sound at the source to 150 dB_{SEL}, or by iteratively increasing the pile strikes in the Stationary Fish model until it returns a consistent (rather than increasing) distance value because it is basing the calculation on effective quiet (Grette 2014a).

Rather than predicting daily pile strikes (which are anticipated to be highly variable), the Stationary Fish model was used to determine the distance to cumulative injury based on effective quiet. The maximum distance of potential cumulative effects occurred at approximately 5,000 strikes for fish greater than or equal to 2 grams (threshold 187dB_{SELcum}) and at approximately 2,000 strikes for fish less than 2 grams (threshold 183 dB_{SELcum}). This represents a distance of 1,775 feet for both size classes (Grette 2014a).

The model predicts that impacts on fish would not increase for more than approximately 2,000 pile strikes in a day for fish less than 2 grams or 5,000 pile strikes in a day for larger fish. This is because additional pile strikes do not result in additional cumulative energy. Furthermore, this predicted cumulative injury area is a liberal estimate (the largest possible) of the potential injury area for fish based on the stationary fish model. This conservative approach protects fish because, should fewer pile strikes occur on any given day, the area of potentially injurious sound would be smaller. Because there is no assumed upper limit on pile strikes, this approach includes scenarios where multiple pile-driving rigs are used simultaneously on a single day.

NMFS currently assumes a 12-hour recovery period where fish are not exposed to sound from pile driving in order to reset daily accumulated $_{SEL}$ calculations (Stadler and Woodbury 2009). As is standard practice, this analysis assumes that this 12-hour recovery period of nonexposure would occur between pile driving work periods (i.e., 12-hour pile driving days) (Grette 2014a).

Distances to Injury and Disturbance Thresholds

The results of the practical spreading loss and stationary fish models using the reference levels for injury and disturbance are summarized in Table 6. Noise attenuation and fish movement models predicted that underwater noise thresholds would be exceeded, resulting in injury or behavior impacts, at distances ranging from 45 feet (single sound strike) to 3.92 miles (cumulative sound). The specific distances and effects for listed fish are provided in Table 6. Because the number of pile strikes per day would be variable, it was assumed that a minimum of 5,000 strikes would occur. Increasing pile strikes beyond 5,000 would not affect the distance at which thresholds would be exceeded for all federally protected fish. Predicted noise reduction using confined or unconfined bubble curtains or similar attenuation devices would be at least 9 dB, based on observations at the Columbia River Crossing (David Evans Associates 2011) and at Puget Island (Washington State Department of Transportation 2010).

Table 6. Underwater Noise Thresholds and Distances to Threshold Levels

Species	Effect Type	Threshold	Distance to Effect Threshold[a]
All Federally Protected Fish	Injury, cumulative sound (≥2 grams)	187 dB_{SEL}	1,775 feet[b]
	Injury, cumulative sound (<2 grams)	183 dB_{SEL}	1,775 feet[b,c]
	Injury, single strike	206 dB_{PEAK}	45 feet[d]
	Behavior	150 dB_{RMS}	3.92 miles

[a] Impact Pile Driver Operation, 36-inch steel pile with 9 dB attenuation from use of confined bubble curtain.

[b] This represents the point at which the model for distance to threshold for cumulative sound no longer increases with increased pile strikes. For 187 dB_{SELcum} (fish ≥ 2 grams), this is at 5,003 strikes; for 187dB_{SELcum} (fish >2 grams), this is at 1,992 strikes. The concept of effective quiet makes the 1,775-foot distance applicable to both thresholds and therefore is applicable to fish both greater than and less than 2 grams.

[c] Given the Proposed Action location and adherence to the proposed in-water work window, most salmonids in the area during construction are assumed to be > 2 grams (187 dB_{SELcum} threshold), except possibly for very early subyearling chum salmon in December

[d] Because the distance to cumulative sound thresholds are greater than the distance to the single-strike sound threshold, this analysis follows the NMFS dual criteria guidance and moves forward solely considering the larger values.

Impact pile driving could occur from September 1 through December 31. To install 610 pilings in-water would require two years, based on the proposed in-water work window for impact pile driving. Pile driving would occur during working days, Monday through Friday. Each pile is expected to take between 20 and 120 minutes to set using an impact pile driver, depending on when the resistant layer is met during installation. The contractor would determine the sequencing of the pile driving and the overall number of driving rigs to be used; this analysis assumes that multiple pile-driving rigs may be used simultaneously. It is possible that impact pile driving could occur at any time, as permitted by Cowlitz County Code, during the proposed in-water work window for impact pile driving (September 1 through December 31), and that it could be continuous over some working days, particularly if multiple rigs are operating in areas of shallow practical resistance. However, given variable subsurface conditions, it is expected there would be days where periods of impact driving are shorter and/or intermittent throughout the workday. Pile-driving activities could affect federally protected salmon, steelhead and trout, eulachon and green sturgeon, as well as fish species that are not protected or listed.

3.1.1.1 Impacts on Salmon and Steelhead

Based on the proposed September 1 through December 31 in-water work window for impact pile driving, all life-history stages of the following ESUs/DPSs are expected to be absent from study area during this period:

- Snake River spring-/summer-run ESU Chinook salmon
- Upper Columbia River spring-run ESU Chinook salmon
- Snake River ESU sockeye salmon
- Upper Willamette River DPS steelhead

The potential for pile-driving activities to affect these species is considered negligible, and thus they are not considered further with respect to potential impacts from pile-driving activities.

Subadult and adult bull trout are occasionally observed within the Columbia River mainstem within the study area and could be present during any season. However, bull trout are expected to occur infrequently and in very low numbers relative to all other salmonids. The likelihood of bull trout presence at any given time is very low, and the potential for pile-driving activities to affect bull trout is considered negligible. According to USFWS (2002), bull trout in the Lower Columbia Recovery Unit could have migrated seasonally from tributaries downstream into the Columbia River to overwinter and feed. However, the extent to which bull trout in the Lower Columbia Recovery Unit currently use the mainstem Columbia River is unknown. Therefore, bull trout are not considered further with respect to potential impacts from pile-driving activities.

Federally protected adult and juvenile salmon and steelhead that could be present in the study area during the proposed in-water work windows include juvenile fish from five ESUs and adult fish from eight ESUs/DPSs, as summarized in Table 7.

Table 7. Summary of Salmonid ESUs/DPSs Potentially Present during the Impact Pile-Driving Proposed Work Window (September 1–December 31) by Life Stage, Month, and Habitat Zone

Species, ESU/DPS	Federal Status[a]	Life Stage	Sept			Oct			Nov			Dec		
			A[b]	S[b]	D[b]	A	S	D	A	S	D	A	S	D
Chinook Salmon														
Snake River fall-run ESU	T	Adults			X[c]			...						
		Subyr		...[d]	...		...	...		...	...			
Lower Columbia River ESU	T	Adults			X			X						
		Yrlng												...
		Subyr		...	...		...	...		...	...	...		
Upper Willamette River ESU	T	Yrlng												...
		Subyr		...	...		...	...		...	...	...		
Coho Salmon														
Lower Columbia River ESU	T	Adults			X			X			X			X
		Subyr		...			...			...		...	...	
Chum Salmon														
Columbia River ESU	T	Adults						X			X			
		Subyr										...	...	
Steelhead Trout														

Species, ESU/DPS	Federal Status[a]	Life Stage	Sept			Oct			Nov			Dec		
			A[b]	S[b]	D[b]	A	S	D	A	S	D	A	S	D
Snake River DPS	T	Adults			X			...						
Upper Columbia River DPS	T	Adults			X			...						
Middle Columbia River DPS	T	Adults			X			...[e]						
Lower Columbia River DPS	T	Adults			X			X			X			X

[a] "T" denotes federally threatened (no Endangered in this table).

[b] A, S, and D represent the HEA habitat categories of ACM, SWZ, and DWZ; see Grette (2014b) for additional information.

[c] "X" denotes expected presence; see Grette Associates (2014b) for additional information.

[d] "..." denotes expected presence but low relative abundance; see Grette Associates (2014b) for additional information.

[e] The Middle Columbia River DPS includes a very small proportion of winter-run fish (Klickitat River, Fifteen Mile Creek); because passage data at Bonneville Dam indicate that the vast majority of steelhead have passed the dam by early October, it is assumed that this includes winter steelhead spawning above it.

ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment; Subyr = subyearling; Yrlng = yearling.

Affect Juvenile Chinook Salmon Habitat Use and Timing

The majority of juvenile Chinook from all ESUs out-migrate through the study area during the spring and summer or early fall. However, a relatively small number of subyearlings from ocean-type ESUs may be present in the SWZ and DWZ during some or all of the September 1 to December 31 proposed work window for impact pile driving (Table 7). Overall habitat use and timing for juvenile Chinook salmon is summarized as follows (Grette 2014a).

- Juvenile Chinook salmon from the Snake River fall-run ESU exhibit multiple rearing strategies, but the majority of juveniles outmigrate as yearlings or large subyearlings during a well-defined period between late spring and early fall. These fish move through the tidal freshwater region at a large size and occur primarily in deeper water rather than the shallow margin.
- Juvenile Chinook salmon from the Upper Willamette River ESU exhibit multiple rearing strategies, but the majority of juveniles outmigrate as yearlings or large subyearlings during a well-defined period in late winter and spring. These fish move through the tidal freshwater region at a large size and occur primarily in deeper water rather than the shallow margin.
- Juvenile Chinook salmon from the Lower Columbia River ESU are associated with multiple runs and are thus associated with multiple rearing strategies. However, the majority of juveniles from this ESU outmigrate either as spring-run yearlings during the late winter and spring or as fall-run fry and fingerlings between the late winter and early summer. Any late-season fall-run subyearlings are expected to outmigrate through the tidal freshwater region at a large size and occur primarily in deeper water rather than the shallow margin.

Subyearling coho salmon from the Lower Columbia River ESU and subyearling chum salmon from the Columbia River ESU are expected to occur in the estuary during the proposed in-water work window; however, presence of individuals would represent low relative abundance in comparison to annual outmigration periods for each ESU. Subyearling coho salmon present in the estuary between September and December would represent individuals moving amongst

off-channel rearing areas. Any subyearling coho salmon present within the estuary are expected to overwinter in low-velocity tributaries or off-channel habitats prior to outmigrating the following spring as yearlings. Subyearling chum outmigrate soon after emergence and rear in the lower estuary. Any subyearling chum present in the river mainstem of the tidal freshwater region during the in-water work period would therefore be expected to move rapidly through the study area. Mainstem Columbia River habitats are considered to be used by juvenile salmon as a migratory corridor where presence in any given location is temporary and relatively short-term.

Cause Potential Injury to Juvenile Salmon

Because the distance to cumulative sound thresholds are greater than the distance to the single-strike sound threshold, this analysis follows the NMFS dual criteria guidance and moves forward solely considering the larger values. Sound above the potential cumulative injury threshold (183/187 dB_{SELcum}) may occur within 1,775 feet of impact pile driving (both upstream and downstream), for a maximum distance of 1.1 miles along the shoreline (1,775 feet upstream and downstream, along the 2,300-foot length of Docks 2 and 3 for a total distance 5,850 feet). This is approximately 0.44 square miles.

Approximately 21% (0.09 square mile) of this area is above -20 feet CRD, inclusive of the ACM and SWZ. This area provides relatively low-quality habitat for small (< 4 inches) subyearling salmon. Areas across the river and downstream provide greater (and more diverse) natural cover as well as floodplain connectivity, contributing to higher-quality critical habitat for rearing juvenile salmon.

Any subyearling salmon present in the 0.09-square-mile area during impact pile driving would be susceptible to sound-related injury due to cumulative exposure. The risk of injury for some individual smaller subyearling salmon is low based on relative abundance expected in the study area, but not discountable for the following salmon (in decreasing order of likelihood based on timing and relative abundance).

- Lower Columbia River Chinook salmon
- Upper Willamette River Chinook salmon
- Snake River fall-run Chinook salmon
- Lower Columbia River coho salmon
- Columbia River chum salmon

The mainstem Columbia River (Deep Water) comprises the remaining 79% of the aquatic area exposed to potentially injurious sound from impact pile driving. Any yearling or larger (> 4 inches) subyearling salmon present in this area would be susceptible to sound-related injury during pile driving due to cumulative exposure. The risk of injury for some individual yearling and larger subyearling salmon is low but not discountable for the following salmon (in decreasing order of likelihood based on timing and relative abundance).

- Lower Columbia River Chinook salmon (larger subyearlings and yearlings)
- Upper Willamette River Chinook salmon (larger subyearlings and yearlings)

- Snake River Fall-run Chinook salmon (larger subyearlings only)

It is possible that juvenile fish could leave areas of potentially injurious sound, either as an avoidance response or during the course of normal outmigration behavior, in which case they may not experience sufficient cumulative sound to cause injury.

Affect Adult Salmon Habitat Use and Timing

Adult from eight ESUs/DPSs of salmon and steelhead may migrate upstream through the study area within DWZ habitat during some or all of the proposed September 1–December 31 impact pile driving work window.

Adults from three of the eight ESUs/DPSs are expected to be in the Lower Columbia River each of the four months when pile-driving activities are anticipated to occur.

- Adult steelhead from the Lower Columbia River DPS migrate year-round (winter- and summer-run fish); therefore, individuals are expected to be present from September 1to December 31.
- Adult coho from the Lower Columbia River ESU could migrate through the tidal freshwater region from August through February and could be present from September 1 to December 31.
- Adult chum from the Columbia River ESU migrate through the tidal freshwater region during October and November, which is entirely within the September 1–December 31 period.
- Adults from the remaining five ESUs/DPSs are expected only in September and October.
- Lower Columbia River Chinook (fall-run component only)
- Snake River fall-run Chinook (in low abundance after September)
- Snake River steelhead (in low abundance after September)
- Upper Columbia River steelhead (in low abundance after September)
- Middle Columbia River steelhead (in low abundance after September)

Based on historical run-timing data from Bonneville Dam, 95% of adult Chinook and steelhead migrating upstream past the dam have done so by the end of the first week of October (inclusive of hatchery fish and nonlisted populations). For Chinook, typically 50% of adults have migrated past the Bonneville Dam by the end of August. For steelhead, that number is closer to 60%.

None of these ESUs/DPSs spawn in the mainstem of the river within the area of elevated sound (Table 6), adult salmonids do not forage in freshwater, and migrating fish are not expected to hold in this section of the river (versus holding near the confluence to a spawning tributary). Therefore, all migrating adult salmon and steelhead are expected to move quickly through the study area.

Migrating Chinook salmon in the Columbia River travel approximately 23 miles per day (median, from Keefer et al. 2004). Migrating steelhead in the Columbia River travel 19–25 miles per day in reaches not adjacent to spawning tributaries (English et al. 2006). Migration rates for

coho and chum specific to the Columbia River are not available, but surrogates can be used to estimate them. As reviewed in Sandercock (1991), upstream migration rates for coho may be 0.8–1.7 miles per hour, which results in approximately 9–20 miles per day assuming fish actually migrated 12 hours in each day (see Sandercock 1991). Chum salmon in the Yukon River averaged migration rates of 23 miles per day (Buklis and Barton 1984). In general, Chinook, chum, and steelhead would be expected to travel most swiftly through this section of the river (approximately 23 miles per day), with coho travelling somewhat slower (approximately 9–20 miles per day).

Overall, the proportion of adults from each of the eight ESUs/DPSs that could be present during some or all of the impact pile-driving period would move through the study area rapidly. No adult is expected to hold within or occupy the study area for an extended period.

Cause Potential Injury to Adult Salmon

Based on habitat use and timing, adult salmonids potentially migrating through the tidal freshwater region during the proposed September through December impact pile-driving work window would include all of the adults from the Columbia River chum salmon ESU, many of the adults from the fall-run component of the Lower Columbia River Chinook salmon ESU, many of the adults from the Lower Columbia River coho salmon ESU, and some of the adults from the Snake River, Upper Columbia River, Middle Columbia River, and Lower Columbia River steelhead DPSs. These fish would be actively migrating upstream at an estimated rate of 9–22 miles per day. The relative amounts (all, many, some) are based on the proportion of the total migration period that occurs within the impact pile-driving period (September through December) for each ESU/DPS (Grette 2014a).

Active pile driving would not occur continuously (all hours, all days) between September 1 and December 31; therefore, not all of the adults migrating upstream during this time would experience sound from pile driving. However, those adult salmon and steelhead that do migrate through the study area during active pile driving could experience potentially injurious sound. Assuming fish were to travel through the entire area (as opposed to avoiding portions of it) this distance traveled would be between 0.67 and 1.1 miles, depending on whether driving occurred at closely or widely spaced locations. Based on the migration speeds reviewed above, adult fish migrating upstream could pass through these areas in approximately 20 to 90 minutes. It is therefore not discountable that some adult salmonids from these ESUs/DPSs could be susceptible to sound-related injury while actively migrating through the study area, depending on the actual duration of sound exposure and proximity to pile driving for individual fish (Grette 2014a).

Current NMFS guidance is to apply the 187dB_{SELcum} injury threshold to all salmonids greater than 2 grams; however, this is an overly conservative approach (see Carlson et al. 2007). Carlson et al. (2007) conclude that for fish greater than 200 grams (applicable to all adult salmonids considered in this assessment), the threshold for nonauditory tissue injury (including injuries resulting from rapid oscillations in gas-filled spaces) is 213 dB_{SELcum}. The conservative approach used to model sound in this assessment predicts 214 dB_{SELcum} at 10 meters from pile driving. Therefore, because cumulative sound above 214 dB_{SELcum} would be limited to such a small area, it is extremely unlikely that adult fish would experience enough sound to result in injury to nonauditory tissues. However, adult fish could be susceptible to auditory injury (hair cell

damage) and hearing effects from TTS from cumulative sound exposure, should sufficient exposure occur (Grette 2014a).

Increase Potential Risk for Behavioral Effects on Salmon

As described in ICF Jones & Stokes and Illingworth and Rodkin (2009), 150 dB_{RMS} is a conservative threshold that is applied in most Biological Opinions to evaluate when impact pile driving/proofing could result in temporary behavioral responses in fish, which could in turn result in such effects as reduced predator avoidance and reduction in foraging efficiency. Also as described in ICF Jones & Stokes and Illingworth and Rodkin (2009), NMFS and USFWS do not provide scientific support for this threshold. Therefore, whether behavioral effects actually occur and then subsequently result in injury through behavioral changes or significant disruption of normal behavioral patterns must be evaluated on a project-specific basis dependent upon factors such as site characteristics, project details, and species life history and habitat use within the potential exposure area (Grette 2014a).

SPLs (not cumulative) may exceed the behavioral disturbance threshold of 150 dB_{RMS} up to 3.92 miles from the site during active pile driving. Underwater noise would only propagate into areas that are within line-of-site of the noise source; therefore, the area affected is less than 3.92 miles because islands and bends in the river prevent sound propagation beyond this distance. As mentioned previously, juvenile salmon from five ESUs and adult salmon and steelhead from eight ESUs/DPSs may migrate through the Columbia River adjacent to the project area during the impact pile-driving period (Table 6). However, juvenile and adult fish are expected to move through the study area relatively quickly as a function of active migratory behavior Grette 2014a).

Affect Nonlisted Salmon and Steelhead

Several nonlisted salmon ESUs and steelhead DPSs also migrate in the Columbia River through the study area and could be affected by pile-driving activities, similar to listed salmon and steelhead described previously. These include Chinook salmon from three ESUs (Deschutes River summer/fall-run, Middle Columbia River spring-run, and Upper Columbia River summer/fall-run), sockeye salmon from two ESUs (Okanogan River and Lake Wenatchee), as well as a number of artificial propagation programs (e.g., coho salmon re-introduction and/or hatchery programs established by member tribes of the Columbia River Inter-Tribal Fish Commission) (Grette 2014a).

During impact pile driving, adults and subyearlings from the Deschutes River summer-/fall-run and Upper Columbia River summer-/fall-run ESUs may be present in the study area, with timing and presence most similar to Snake River fall-run Chinook. Some adults are expected to be present in the study area during September, and adult migration through the area could continue into October. Subyearling fish may be present in very small numbers through November (Grette 2014a).

Presence, timing, and use of fish from artificial propagation programs are similar to listed ESUs by species and life-history types. Based on the timing and use summarized in Table 6, during impact pile driving, presence of some adults from these programs is expected; juveniles (subyearling and yearlings) are expected in relatively low numbers with variable timing and use by species and life history (Grette 2014a).

Based on similarities in presence, timing, and use, the analyses for listed salmonids can be generally applied to the nonlisted salmon and steelhead (Grette 2014a).

3.1.1.2 Impacts on Eulachon

The areas of potentially disturbing and injurious sound described previously for salmonids also can be applied to eulachon. However, because many of the cumulative injuries associated with underwater sound are related to the interaction between SPLs and a fish's swim bladder, the application of the cumulative injury threshold to eulachon is conservative (and therefore protective) as eulachon lack a swim bladder. As described above, the distances to thresholds are 1,775 feet for cumulative injury and 3.92 miles for disturbance. Impact driving would likely occur on most working days (Monday through Friday) within the proposed in-water work window (September 1–December 31). On some days impact driving may occur over most or even all of the day, but during much of the construction period, it would be for shorter durations and at times may be discontinuous (Grette 2014a).

Adult eulachon could arrive in the study area as early as November, although most adults would migrate through the study area later, coincident with peak spawn timing between February and March. Eggs from early spawners could be distributed from the tributaries downstream to portions of the study area where suitable incubation conditions occur (i.e., sand waves) shortly thereafter. Emergent larvae could be present in the study area as early as December. However, based on the timing of peak spawning, and because incubation occurs for one to two months, peak larval transport would not be expected until February or later (Grette 2014a).

Little information exists upon which to base assumptions about eulachon habitat use within the area of potentially elevated sound, such as preferential depths and migration behavior versus spawning for adults. Therefore, in order to present a conservative evaluation that is protective of the species, it is assumed that adult eulachon may be distributed anywhere throughout this area, and that not all adult fish are actively migrating through it. It is also assumed that eggs and incubating larvae, whether spawned in the area or delivered from upstream locations, may be distributed throughout areas where sand wave bed forms occur. As reviewed in Gustafson et al. (2010), larvae in the water column are quickly transported downstream and therefore are assumed to be moving with the current (Grette 2014a).

Cause Potential Injury to Eulachon

The area of potentially injurious sound is assumed the same as that delineated for salmon and steelhead (1,775 feet from pile-driving activities, which would include an area covering approximately 0.44 square mile). Any adult eulachon present during pile driving would be at risk of sound-related injury. Although the risk of injury to individual fish is low, based on relative abundance in the study area during pile-driving activities (Table 3), it is not discountable. Some fish may be moving through the area, reducing their risk of exposure to cumulative sound injury, or adult fish could leave and/or avoid areas of potentially injurious sound, as part of an avoidance response or during the course of normal behavior, in which case they may not experience sufficient cumulative sound to cause injury. However, some adult eulachon present in the area of impact may experience cumulative injury from pile driving in November and December. Nevertheless, based on the timing of adult returns to the Columbia River, this would probably be a very low number of fish relative to the entire annual eulachon run.

Eulachon eggs and larvae could experience sound that is potentially injurious for adult and juvenile fish, but based on the proposed timing for impact pile driving this would be an extremely low proportion of eggs and larvae produced in any given spawning year. Further, it is not appropriate to apply the same thresholds to larval fish and eggs. There is little information available on the effects of sound in general on fish eggs and larvae (Popper and Hastings 2009), and almost nothing specific to the effect of sound from pile driving (Bolle et al. 2012). As reviewed by Popper and Hastings (2009), there is some indication in the literature that sound (e.g., broadband noise) or sound pressure (e.g., blasts or even mechanical simulations such as drops) can affect egg, embryo, and larval survival and development. Because eulachon eggs adhere to sediments and therefore stay within or move slowly through areas of elevated sound, they may be more susceptible to prolonged exposure to cumulative sound from pile driving regardless of the distance at which injury may occur. Larvae are more likely to be transported quickly through areas of elevated sound, and may therefore be less susceptible to any cumulative effects. Common sole (*Solea solea*) larvae exposed to cumulative sound in excess of the standard injury threshold exhibited no increase in mortality (Bolle et al. 2012). The risk of injury generally applies to the earliest part of the run, and over a relatively small area of the potential incubation and migration area (Grette 2014a).

Increase Potential Risk for Behavioral Effects on Eulachon

Potentially disturbing sound from impact pile driving may extend up to 3.92 miles from the project area during active pile driving; this represents an approximately three square-mile area within which adult eulachon could be affected. As indicated previously, little is known about the behavioral effects of pile driving sound on fish, but it is possible that adult eulachon present in this area could be at greater risk of predation because of underwater sound generated during pile-driving activities. This risk is low but not discountable for adult eulachon (Grette 2014a).

Similar to injury thresholds, it is not appropriate to apply the behavioral threshold to larval eulachon, particularly given the paucity of information of the effects of sound in general, and from pile driving specifically. Should sound from impact pile driving affect these fish at any distance from the project area, active behavioral responses would not be expected based upon their small size and weak swimming behavior (Grette 2014a).

3.1.1.3 Impacts on Green and White Sturgeon

The areas of potentially disturbing and injurious sound described for salmonids can be applied to green and white sturgeon, which also have a swim bladder. Based on the calculations and assumptions described for salmonids, including the maximum pile strike assumptions in the cumulative sound model and use of an attenuation device, the distances to thresholds are 1,775 feet for cumulative injury and 3.92 miles for disturbance (Figure 4).

To minimize the potential for impacts on other fish, impact pile driving would occur between September 1 and December 31. Based on this timing, it is expected that some green sturgeon may be present in the Lower Columbia River during the early part of the work period but that numbers of fish would decline thereafter as they leave the estuary to winter in the Pacific Ocean. White sturgeon are expected to be present throughout the work period. When present in the Columbia River, green sturgeon are known to occur as far upstream as Bonneville Dam but are predominately present below river mile 37 (Adams et al. 2002). The project area is at river mile 63. Therefore, while some green sturgeon may be generally present within the area of potentially elevated sound, it is expected

that their number would be small. There is a relatively low likelihood of these fish being present in the area of potentially elevated sound during the summer, and that likelihood would further decline throughout the pile-driving period.

White sturgeon, on the other hand, are found throughout the lower Columbia River and are expected to be within the study area during pile driving activities.

Cause Potential Injury to Green and White Sturgeon Threshold

Green sturgeon have been observed swimming at speeds of 1.3–3.9 feet per second in tidal environments in the San Francisco Bay estuary (Kelly and Klimley 2012). White sturgeon are assumed to have similar swimming speeds as green sturgeon. Based on this swimming speed, Southern DPS green sturgeon and white sturgeon would pass through areas of potentially elevated sound within 20 and 75 minutes, depending on speed and distance, and some green and white sturgeon could be susceptible to sound-related injury while actively migrating through the study area. However, given the low number of green sturgeon expected to use areas upstream of the study area and the proposed timing for pile driving, this is expected to be a very low proportion of the Southern DPS green sturgeon using the Columbia River in any given year. White sturgeon are expected to be more abundant and would be likely to occur within the study area throughout the proposed timing for pile driving.

Application of the $187dB_{SELcum}$ injury threshold to fish > 200 grams is an overly conservative approach (see Carlson et al. 2007). As with salmonids, adult and subadult green and white sturgeon at this location would be expected to be > 200 grams and are expected to have a much higher threshold for nonauditory tissue injury. It is extremely unlikely that subadult or adult green and white sturgeon would experience cumulative sound sufficient to result in injury to nonauditory tissues. However, they could be susceptible to auditory injury (hair cell damage) and hearing effects from TTS from cumulative sound exposure, should sufficient exposure occur (Grette 2014a).

Increase Potential Risk of Behavioral Effects on Green and White Sturgeon

Potentially disturbing sound from impact pile driving may extend up to 3.92 miles from the project area. Adult or subadult Southern DPS green sturgeon may move downstream through this area, particularly early in the in-water work period. White sturgeon may occur within the study area and may be moving upstream or downstream. Using the same analysis of distances and swimming speeds, those fish would pass through the study area in less than one day but could experience potentially disturbing sound from pile driving during this migration period. However, the risk that individual adult and subadult green and white sturgeon would experience elevated sound and potentially be at greater risk of predation is considered low (Grette 2014a).

Mitigation measures address impacts on all fish caused by increased underwater noise during pile driving.

3.1.1.4 Impacts on Pacific Lamprey and River Lamprey

It is well documented that hydroacoustic impacts can be significant, causing injury or mortality, for fish with swim bladders. Lampreys do not have swim bladders and it is therefore difficult to determine the extent of this impact. Fish without swim bladders are thought to be at lower risk from

underwater noise than fishes with swim bladders (Hastings and Popper 2005 in Lord 2011). No thresholds for disturbance or injury have been established for such fish. Therefore, hydroacoustic impacts on lamprey should not be discounted, but they cannot be quantified or analyzed with any level of certainty (Lord 2011). Impacts on lampreys from project related pile driving would be expected to be less harmful than impacts on salmon and sturgeon and other fish species with swim bladders.

Increase Shading

Overwater structures (i.e., docks and large vessels) can increase shading to the aquatic environment beneath and adjacent to the structure, which can result in changes to productivity as well as fish behavior, predation, and migration. Barges necessary for construction of in-water elements of the Proposed Action would create temporary overwater structure, which would reduce the amount of light entering the water. This temporary reduction in light level is not anticipated to result in changes to aquatic habitat conditions and, therefore, would not change the ambient light in the environment.

Juvenile and subadult salmonids use the nearshore areas for feeding and rearing, and as a migratory corridor. As small individuals, they stay in shallow waters to avoid large fish predators found in deeper water. As these fish grow larger, they will feed on the forage fish, such as herring (family Clupeidae), sand lance (family Ammodytidae), and surf smelt (*Hypomesus pretiosus*), that spawn and rear in shallow intertidal areas.

The use of a barge or other similar large vessel could affect juvenile and subadult salmonid migration within the shallow water habitat areas. However, their use would primarily be during the in-water construction period (September 1–December 31) and would be mostly required for installation of support piling for Docks 2 and 3. Pile-driving activities would be expected to be much more disruptive to fish than the shading created by construction-related barges and vessels, and would likely affect migration and foraging opportunities within the study area to a greater extent (i.e., fish migrating within the study area would not be expected to be near construction barges during pile driving due to the elevated noise levels, thus fish would not be expected to be affected by shading associated with construction barges). Barges and similar large vessels may also be used for construction of Docks 2 and 3, which could occur outside of the proposed in-water window and thus could affect juvenile and subadult salmonid migration in the shallow-water habitat. However, specific timing and methods for construction of Docks 2 and 3 would be determined during permitting.

Result in Spills and Leaks

Construction activities would occur on land as well as in and over waters of the Columbia River. During all construction-related activities there is the potential risk of temporary water quality impacts resulting from the release of hazardous materials such as fuels, lubricants, hydraulic fluids, or other chemicals (SEPA Hazardous Materials Technical Report [ICF 2017d]). Overall, it is assumed that a spill would be less than 50 gallons because limited quantities of potentially hazardous materials would be stored and used during construction at the project area. These materials could enter surface waters of the Columbia River or drainage ditches near the project area. Such spills could affect aquatic habitat or fish that could be near the discharge point, resulting in potential toxic acute or subacute impacts that could affect the respiration, growth, or reproduction of the affected fish or other aquatic organisms. Over-water and in-water work

increases this risk as well as the potential for construction debris or materials to enter the Columbia River. The potential for these types of impacts would be avoided or greatly reduced given protective measures to guard against these risks, including: construction best management practices, avoidance and minimization measures, in-water work restrictions, and regulatory requirements, such as those associated with 401 Water Quality Certification. The SEPA Water Quality Technical Report (ICF 2017c) includes a detailed discussion on the potential risks to and impacts on water quality associated with the Proposed Action.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on fish because construction impacts are immediate and no construction impacts would occur later in time or farther removed in distance than the direct impacts.

3.1.3 Operations: Direct Impacts

Operations associated with the Proposed Action would occur on land and on dock and trestle structures in the Columbia River. Potential direct impacts related to operation of the Proposed Action are discussed below.

Increase Shading

Overwater structures (i.e., docks and large vessels) can increase shading to the aquatic environment beneath and adjacent to the structure, which can result in changes to productivity as well as fish behavior, predation, and migration. The trestle would result in approximately 0.3 acre of new overwater coverage in shallow-water areas above -20 feet CRD (SWZ), while Docks 2 and 3 and a portion of the trestle would result in 4.83 acres of new overwater coverage in DWZ habitat below -20 feet CRD. Vessels loaded at Docks 2 and 3 during project operations would further increase the shading beyond Docks 2 and 3 in DWZ habitat. At full build out, the Applicant anticipates serving 70 vessels per month; thus, it is expected that there would be two vessels at Docks 2 and 3 at all times. The worst case would be two Panamax vessels being loaded simultaneously. Panamax vessels are approximately 965 feet in length with a beam of 106 feet, for an overall area of 102,290 square feet (2.35 acres). Two Panamax ships would add 204,580 square feet (4.7 acres) of overwater surface area located over DWZ habitat, for a total of 9.83 acres being shaded. The study area encompasses approximately 1,300 acres, primarily DWZ habitat. Docks 2 and 3 as well as vessels being loaded at the docks would shade approximately 0.8%. As mentioned above, juvenile salmonids tend to migrate in SWZ habitat; thus, shading of DWZ habitat would likely affect juvenile salmonids to a lesser extent than adults or larger juveniles that tend to migrate in DWZ habitat. Overall, shading of DWZ habitat would be less likely to affect primary productivity, as primary productivity tends to be higher in SWZ habitat. Based on the location of Docks 2 and 3 over DWZ habitat and the relatively small area shaded in relation to the overall study area, the shading impact would be relatively low.

As reviewed in Carrasquero (2001), light attenuation from overwater structures in freshwater environments can lead to lowered primary productivity (phytoplankton and macrophyte producers). Reduced primary productivity, including reduced stock of algae and macrophytes, can in turn influence the epibenthic community on which other organisms depend. Reduction of primary productivity in DWZ habitat would not likely translate to reductions of epibenthic communities, which are more prevalent in SWZ habitat.

Light attenuation could affect fish migration, prey capture, and predation. Salmon fry are known to use darkness and turbidity for refuge. However, they tend to migrate along the edges of shadows rather than penetrate them (Simenstad et al. 1999). Studies in the northwest have documented this behavioral tendency to use shadow edges for cover during migration (Shreffler and Moursund 1999). The underwater light environment also affects the ability of fishes such as bass, to see and capture their prey, including juvenile salmonids. Foraging opportunities for juvenile fish are generally associated with SWZ habitat (areas above -20 feet CRD), which are expected to provide greater availability of benthic organisms as compared to DWZ habitat (areas below -20 feet CRD). Juvenile salmon primarily migrate in SWZ habitat, although larger juveniles do migrate in DWZ habitat. Juveniles migrating in DWZ habitat are likely migrating relatively quickly and not rearing for extended periods in any particular area. The trestle is the only structure that would generate shade in SWZ habitat. The potential shading created by the trestle would be relatively low because the trestle is elevated over the water surface elevation of the ordinary high water mark (OHWM) by approximately eight feet, allowing light to penetrate beneath the trestle, which would not be expected to have a measurable effect on primary productivity or fish behavior, migration, or predation in SWZ habitat.

The design and orientation of the trestle would further minimize the potential effects of shading. The elevation of the trestle combined with the relatively narrow width of the deck (24 feet), the height, and the width would allow some natural light to pass beneath the structure during all seasons. In addition, the north–south orientation of the trestle relative to the path of the sun overhead would reduce the amount of shading cast beneath it, as compared to if the structure were oriented east to west.

The docks and vessels would be located over the DWZ, but could provide shaded habitat for larger predatory fishes, such as bass, northern pikeminnow, as well as piscivorous birds (Carrasquero 2001). Support piling for the docks could also create flow shears (i.e. back-eddies), which could increase the potential predation of juvenile salmonids and other fish migrating or otherwise occurring within the SWZ and DWZ (Carrasquero 2001). The extent or magnitude to which an increase in overwater surface area may alter the predator-prey relationship at the project area is unknown, but it is assumed that the relationship would change and an increase in predation would be likely. The extent or magnitude to which an increase in overwater surface area could alter the predator-prey relationship in the study area is unknown, but it is assumed that the relationship would change and an increase in predation could occur where larger subyearling, yearling, or larger juvenile fish encounter the docks in the DWZ. This likely would likely not apply to smaller subyearling fish when encountering the trestle as they migrate within the ACM and SWZ.

In addition to shading, Proposed Action-related features such as support piling, docks, and trestle could provide suitable habitat for piscivorous birds. The level of activity on the docks and trestle would likely reduce the potential for birds to use such features as roosting habitat (Grette 2014e). As part of the proposed design, the Applicant would install pile caps on all Proposed Action-related piling to minimize perching and roosting opportunities for piscivorous birds on the trestle and docks. Thus, the Proposed Action would not be expected to result in a measurable increase in predation of fish by piscivorous birds.

Result in Spills or Leaks

Routine operations could result in spills or leaks at the project area from vehicles, trains, or equipment that could potentially affect water quality and the condition of aquatic habitat in the Columbia River and drainage ditches in the vicinity. Overall, it is assumed that a spill would be less than 50 gallons because limited quantities of potentially hazardous materials would be stored and used during operations at the project area. Refueling of vehicles during operations would occur off site at approved refueling stations, or fuel would be delivered to the project area by a refueling truck (capacity of 3,000 to 4,000 gallons). Refueling trucks are required to carry appropriate spill response equipment, and are thereby prepared to respond and reduce the potential risk and impacts associated with a fuel spill. Vessel bunkering (i.e., a vessel receiving fuel while at the dock) would not occur at the project area. Thus, the risk of spills from vessel transfers in the project area would not increase. Potential impacts on fish and fish habitat are similar to those described for construction leaks and spills in Section 3.1.1, *Construction: Direct Impacts* Appropriate training and implementation of prevention and control measures would guard against these risks, greatly reducing the potential for these types of impacts. Further information is contained in the SEPA Water Quality Technical Report (ICF 2017c) and SEPA Hazardous Materials Technical Report (ICF 2017d).

Spill Coal

Direct impacts on the natural environment from a coal spill during operations of the Proposed Action could occur; however, local, state, and federal permit processes would require features and site design that would be expected to reduce coal spills. Direct impacts resulting from a spill during coal handling at the coal export terminal would most likely be minor because the amount of coal that could be spilled would be relatively small. Also, impacts would be minor because of the absence of aquatic environments in the project area and the contained nature and design features of the terminal (e.g., enclosed belt conveyors over water, transfer towers, and shiploaders). Potential physical and chemical effects of a coal release on the aquatic environments that occur adjacent to the terminal are described below.

Aquatic environments could potentially be affected from a coal spill both physically and chemically. A coal spill could have physical effects on aquatic environments, including abrasion, smothering, diminished photosynthesis, alteration of sediment texture and stability, reduced availability of light, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The magnitude of these potential impacts would depend on the amount and size of coal particles suspended in the water, duration of coal exposure, and existing water clarity (Ahrens and Morrisey 2005). Therefore, the circumstances of a coal spill, the existing conditions of a particular aquatic environment (e.g., river shoreline, open water, pond, wetland), and the physical effects on aquatic organisms and habitat from a coal spill would vary. Similarly, cleanup of coal released into the aquatic environment could result in temporary impacts on habitat, such as smothering, altering sediment composition, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The recovery time required for aquatic resources would depend on the amount of coal spill and the extent and duration of clean-up efforts, as well as the environment in which the incident occurred. It is unlikely that coal handling in the upland portions of the coal export terminal would result in a spill of coal that would affect the Columbia River. This is unlikely because the rail loop and stockpile areas would be contained, and other areas adjacent to the coal export terminal are separated from the Columbia River by an existing levee, which would prevent coal from being conveyed from

upland areas adjacent to the rail loop to the Columbia River. Coal could be spilled during shiploading operations because of human error or equipment malfunction. However, such a spill would likely result in a limited release of coal into the environment due to safeguards to prevent such operational errors, such as start-up alarms, dock containment measures to contain spillage /rainfall/runoff, and enclosed shiploaders.

The chemical effects on fish, aquatic organisms, and habitats would depend on the circumstances of a coal spill and the existing conditions of a particular aquatic environment (e.g., shoreline, open water, pond, wetland). Some research suggests that physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005).

A recent coal train derailment and coal spill in Burnaby, British Columbia, in 2014, and subsequent cleanup and monitoring efforts provide some information about the potential impacts of coal spilled in the aquatic environment. Findings from spill response and cleanup found there were potentially minor impacts in the coal spill study area, and that these impacts were restricted to a localized area (Borealis Environmental Consulting 2015). Further information is provided under *Operations: Indirect Impacts.*

3.1.4 Operations: Indirect Impacts

Potential indirect impacts associated with proposed operations could occur as a result of vessel traffic in the Columbia River between the project area and the confluence with the Pacific Ocean. These potential impacts include fish stranding associated with vessel wakes. Periodic maintenance dredging could result in removal of benthic habitat and associated impacts on aquatic invertebrates. Also, coal dust could indirectly affect fish and fish habitat.

Cause Fish Stranding from Vessel Wakes

Ecology has monitored the number of vessel entries into the Columbia River of commercial cargo and passenger vessels of 300 gross tons or larger and tank vessels carrying oil products of all sizes since 1993. Over that period there has been about a 2% per year decline in the number of vessels crossing the Columbia River Bar (Figure 8). This is in part due the completion of the Columbia River Federal Navigation Channel Improvements Project, which dredged the Columbia River Ship Channel from near the entrance to the Port of Portland near river mile 106 to a depth of -43 feet CRD. This allowed the newer and larger Panamax and Handymax vessels to navigate the river and call at Columbia River ports, thereby reducing the number of smaller vessels navigating the Columbia River.

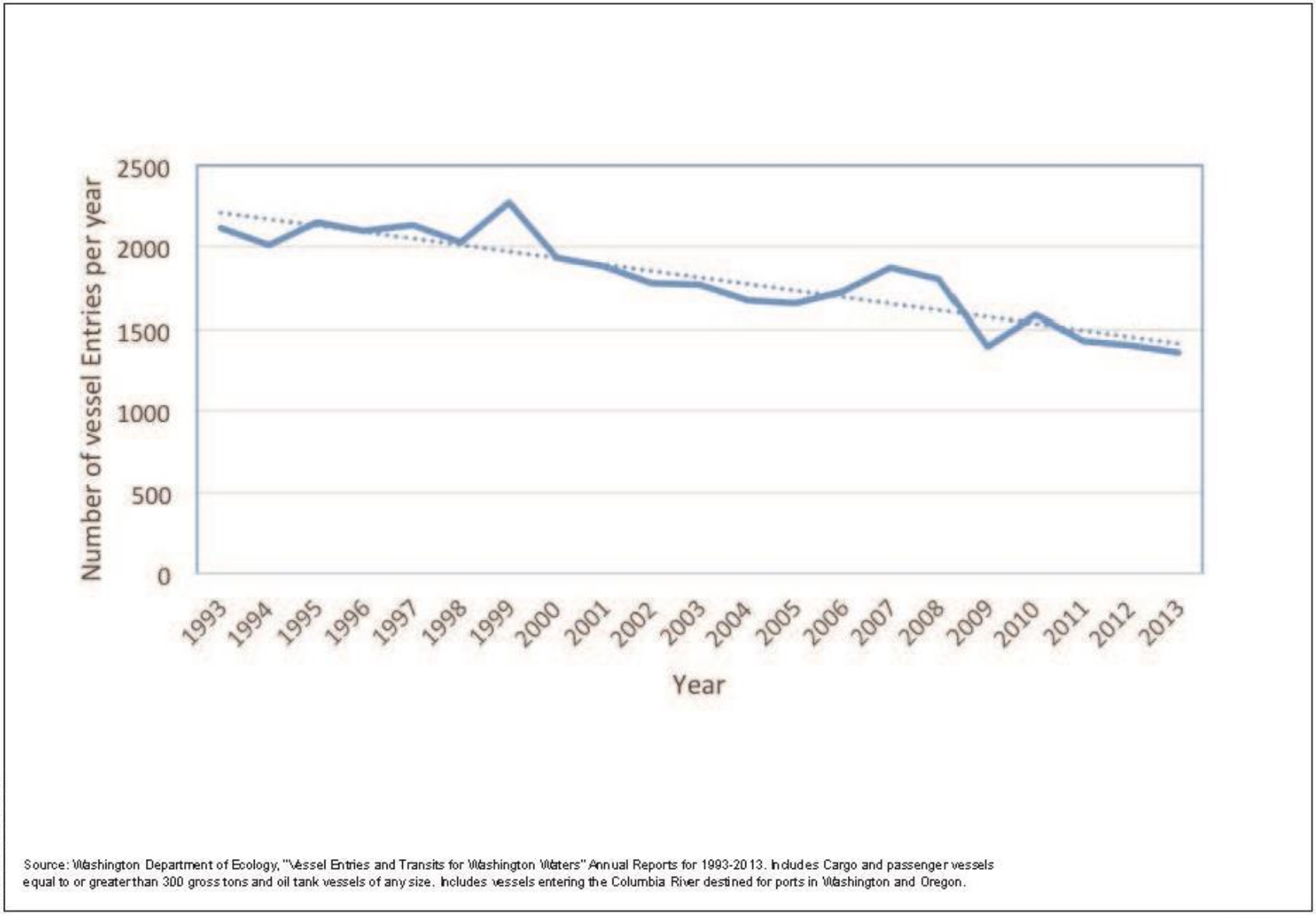
At full build out, the Proposed Action would have the capacity to serve up to 70 cargo vessels per month (840 vessels per year) with a throughput capacity of 44 million metric tons per year of coal. This would result in 1,680 vessel transits in the lower Columbia River (840 vessels each transiting to and from the project area).

The fleet serving the Proposed Action would consist of Panamax and Handymax vessels. Panamax vessels anticipated to use the export terminal average about 65,000 dead weight tons (dwt) and measure approximately 738 feet long by 105 feet wide with a draft of 43 feet. They are designed to fit snuggly but safely in the lock chambers of the Panama Canal. Handymax vessels are the workhorses of the dry bulk market. They are usually less than 60,000 dwt and measure approximately 490 to 655 feet long by 105 feet wide with a draft of 36 feet.

Depending on various factors such as the slope and breadth of a beach, river stage, tidal stage, depth of water vessels are transiting in, and vessel size and speed, wakes from passing vessels can travel a considerable distance. When these wakes meet the shoreline, they can carry fish and deposit them on the beach, potentially stranding them where they would be susceptible to stress, suffocation, and predation before they could return to the water.

Physical conditions affect the risk of fish stranding in the lower Columbia River caused by vessel wakes have been documented in several studies (Bauersfeld 1977; Hinton and Emmett 1994; Ackerman 2002; Pearson et al. 2006; Pearson and Skalski 2006). The physical conditions influencing the risk of fish stranding include gentle shoreline slopes (i.e., less than 5% slope), sandy substrate along the shoreline, confined river channel, proximity of the navigation channel to the shoreline, river tidal stage/elevation at the time of vessel passage, presence of a berm running parallel to the shoreline and shoreward of the 18-foot depth contour, and presence of shoreline features such as vegetation, riprap, bank faces, and debris.

Figure 8. Number of Vessels Entering the Columbia River per Year



Source: Washington Department of Ecology, "Vessel Entries and Transits for Washington Waters" Annual Reports for 1993-2013. Includes Cargo and passenger vessels equal to or greater than 300 gross tons and oil tank vessels of any size. Includes vessels entering the Columbia River destined for ports in Washington and Oregon.

Prior studies have evaluated the risk for stranding along different portions of the Columbia River (Pearson et al. 2008). Shorelines in the lower estuary (river miles 0 to 22) were determined to be too distant from the navigation channel to pose a stranding risk. Between river miles 22 and 104, approximately 33 of the 82 miles of shoreline pose a risk of fish stranding by ship wakes due to the shoreline being close to the navigation channel, not shielded from wave action, and having a beach slope of less than 10%. Of those 33 miles of shoreline approximately 8 miles have a high susceptibility for stranding based on the screening criteria (Pearson et al. 2008). Because Pearson's study considered only the physical conditions that contributed to the susceptibility of stranding along the shoreline in the lower Columbia River and not the abundance or distribution of fish, there was no attempt to quantify the potential extent of fish stranding in the lower Columbia River (Pearson et al. 2008).

The susceptibility of fish stranding by vessel wakes not only depends on physical conditions along the shoreline but also the presence of fish in the channel margins and nearshore areas adjacent to the shoreline. Subyearling Chinook salmon appear to be more susceptible to stranding, accounting for approximately 80% of the fish stranded by vessel wakes along the lower Columbia River (Hinton and Emmett 1994; Dawley et al. 1984; Pearson et al. 2006) while accounting for only 49% of fish captured in beach seine samples along the same shorelines (Pearson et al. 2006).

Studies indicate juvenile salmon and other fish are a/t risk of stranding on wide, gently sloping beaches because of wakes generated by deep draft vessel passage (Bauersfeld 1977; Hinton and Emmett 1994; Pearson et al. 2006; ENTRIX 2008).

In the lower Columbia River, the presence of fish in nearshore channel margin areas varies seasonally by species. However, fish are present year round in the lower Columbia River. Previous studies have found that fish also use different areas of the river, depending on age and life-history stage, and not all juvenile salmonids appear to be equally susceptible to stranding. The majority of strandings appear to affect subyearling Chinook salmon. Subyearling chum and coho salmon are also stranded but in much lower numbers than subyearling Chinook salmon. Other salmonids such as juvenile sockeye salmon, pink salmon, steelhead, yearling Chinook and coho salmon, do not appear to be as susceptible to vessel wake stranding based on their habitat use in the lower Columbia River (Grette Associates 2016). In general, subyearling Chinook salmon are present in the shallow river margin during winter, spring, and early summer but not during the late summer and fall. NMFS (2012) did not identify ship wake stranding from ship wakes as a limiting factor or threat to eulachon. Grette (2016) noted that "overall, eulachon are not expected to be susceptible or exposed to wake stranding risk in the lower Columbia River." This is supported by the fact that eulachon were not observed stranded or in beach seines conducted by Pearson et al. (2006, in Grette Associates 2016).

While the scientific literature generally acknowledges the connection between wakes generated by deep-draft vessels and fish stranding in the lower Columbia River, the literature has not identified methods to quantify the current level of stranding in the lower Columbia River, nor has a model been developed that could accurately predict the extent of stranding caused by deep-draft vessels in the lower Columbia River. Thus, while the Proposed Action would increase deep-draft vessel traffic in the lower Columbia River, which could contribute to an increase in fish stranding, it would be speculative to attempt to quantify fish stranding from vessels associated with the Proposed Action. SEPA Rules require the consideration of environmental

impacts that are likely, not merely speculative (WAC 197-11-060). In accordance with this requirement, the EIS discloses the potential for impacts related to fish stranding due to vessel wakes, but does not quantify the potential impact because the worst-case scenario cannot be developed with any reasonable certainty (WAC 197-11-080-3(a)). While vessel operations in the lower Columbia River are federally regulated, the Applicant has no authority to control or influence vessel operations, either directly or indirectly.

Cause Physical or Behavioral Responses to Vessel Noise

Vessels transit the Columbia River each year carrying oil, freight, and materials to and from ports along the river. Approximately 3,980 commercial vessel transits occurred on the Columbia River in 2014, including approximately 2,750 by cargo and passenger vessels larger than 300 gross tons (Washington State Department of Ecology 2015). Hemmera Envirochem et al. (2014) measured sound pressure levels of one Panamax-class vessel passing Victoria on Vancouver Island, Canada, at a speed of 11.1 knots. Sound pressure levels measured were approximately 155 dB_{RMS} at 67 meters, decreasing to less than 150 dB_{RMS} at approximately 110 meters. These source sound levels exceed identified thresholds for potential behavioral disturbance for fish and may cause avoidance or other behavioral responses (Fisheries Hydroacoustic Working Group 2008). Fish near transiting vessels could change behavior in response to the vessel noise but would not likely be injured.

Result in Further Impacts during Maintenance Dredging

Maintenance dredging would likely only be scheduled to occur on a multi-year basis or following extreme flow conditions; however, such dredging could be needed as frequently as every year to maintain required water depths at Docks 2 and 3 and to allow access from the docks to the navigation channel, especially in the years following the initial dredging work (WorleyParsons 2012). Maintenance dredging would require additional permitting, beyond any permits that may be issued to construct the project. It is assumed that flow lane disposal would be the preferred method for disposal of dredge material, provided the sediments were clean.

Sediment accretion in the proposed dredge prism would most likely occur as a result of bedload transport due to river currents, and local scour and sediment redistribution from propeller wash. Hydrodynamic modeling and sediment transport analysis was conducted for the proposed Docks 2 and 3 berthing/navigation basin. Sedimentation is complex in a newly dredged basin. Specific morphologic data is unavailable for the proposed new dredging basin; therefore, the rate of accretion can only be estimated roughly. Based on current accretion estimates, rough estimates for annual accretion height is approximately 0.16 foot (0.07–0.26 foot range), and annual accretion volume is approximately 11,675 cubic yards (4,670–23,350 cubic yard range) (WorleyParsons 2012). WAC 220-660-160 provides general design considerations for new terminals, to minimize impacts fish life that the project would generally comply with, whenever feasible.

Impacts on the benthic invertebrate community would be similar to those described for initial dredging associated with construction activities. Compared to the initial dredging effort, maintenance dredging would remove a relatively small amount of material, including benthic, epibenthic, and infaunal organisms, resulting in some mortality of invertebrate organisms and temporary disruption of benthic productivity. Habitat within the proposed dredge prism is in

DWZ habitat where benthic productivity is expected to be relatively low compared to shallow water habitats (McCabe et al. 1997).

Maintenance-related dredging activities could affect fish in a manner similar to the initial dredging associated with construction activities. Fish could potentially be affected by increased turbidity and noise associated with dredging activities (Todd et al. 2014). Turbidity would be elevated during maintenance dredging and impacts would be similar to those described above for construction under Section 3.1.1, *Construction: Direct Impacts*. Noise could potentially cause masking and behavioral changes in fish but is unlikely to cause auditory damage (Central Dredging Association 2011; Dickerson et al. 2001; Todd et al. 2014).

Generate Coal Dust

Coal dust and fugitive coal particles could be generated by the Proposed Action through the movement of coal into and around the project area and onto vessels. Coal dust could also become airborne from the large stockpiles that would be located in the project area.

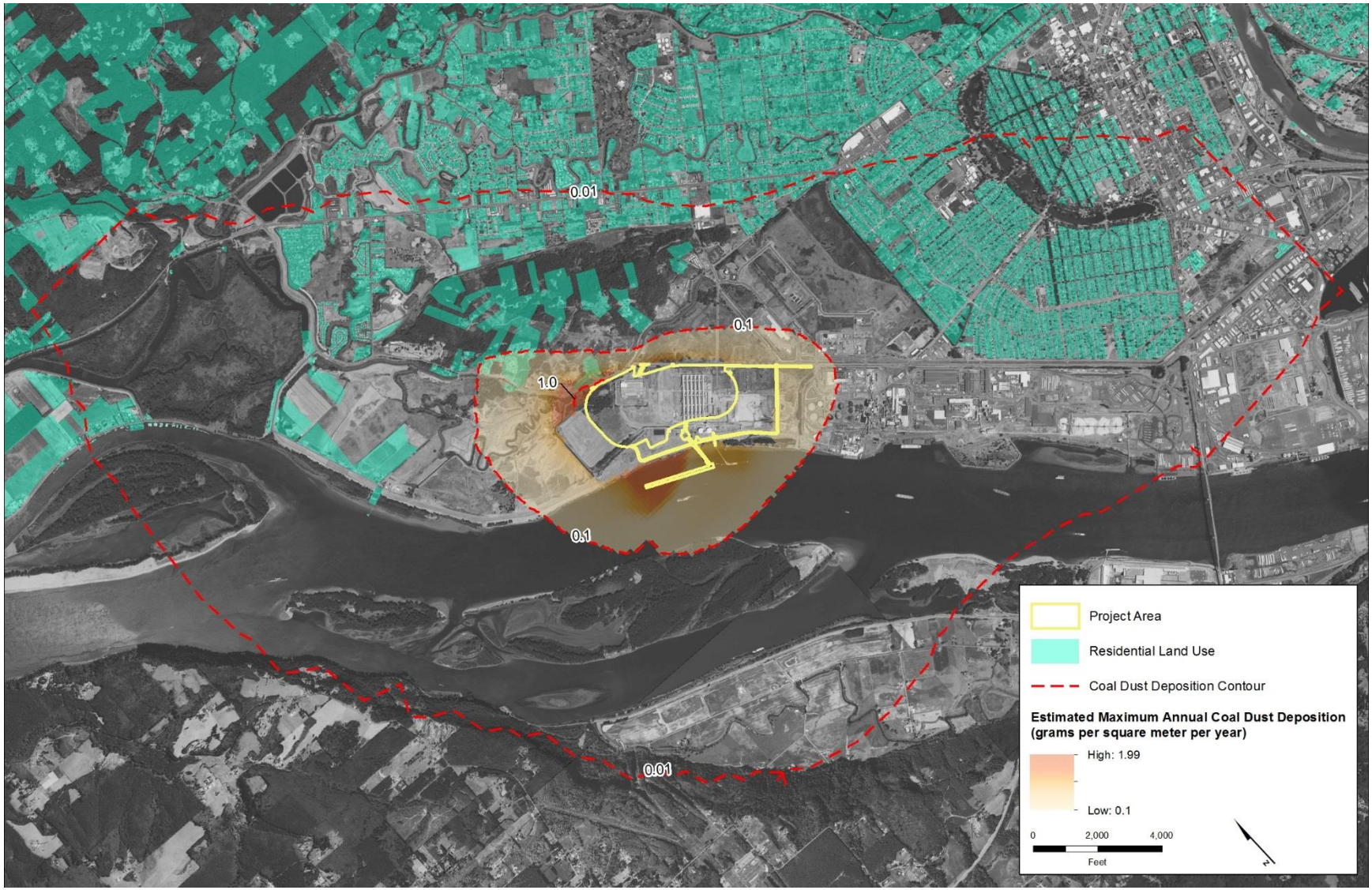
The potential extent and deposition rate of coal dust particles less than 75 microns was modeled as part of the analysis conducted relative to air quality and human health during the preparation of the Environmental Impact Statement (SEPA Air Quality Technical Report [ICF 2017e]) for additional details). Based on this modeling, the estimated maximum annual coal dust deposition at or beyond the project area would range from 1.99 grams per square meter per year (g/m^2) adjacent to the project area, to 0.01 g/m^2 per year approximately 2.4 miles from the project area, as described in the SEPA Coal Technical Report (ICF 2017f). Assuming a maximum deposition rate of 1.99 g/m^2 per year adjacent to the project area, and at the minimum flow[6] recorded over the 23-year period of record for 1 day, coal dust deposition directly into the river, assumed to be an area of approximately 3 million square meters (1.16 square miles) in the study area, would result in a change in suspended sediment concentration of less than 1 part per 10 billion (0.000075 mg/L).

Based on the models, the zone of deposition would extend primarily northwest of the project area and over the Columbia River, encompassing forested hills, riparian habitat along the shoreline, and extending across the Columbia River to Lord and Walker Islands. Deposition rates ranging from 0.4 g/m^2/year in the Columbia River adjacent to the project area to 0.1 g/m^2/year in the Columbia River at Lord Island (Figure 9), with declining concentrations moving away from the project area.

Although concerns regarding coal dust are commonly expressed relative to air quality and human health concerns, wind-born coal dust could potentially affect fish through physical or toxicological means. Ahrens and Morrisey (2005) conducted a literature review on the biological effects of unburnt coal in the marine environment. The following discussion is distilled from that review. Coal particles could affect aquatic wildlife in a manner comparable to any form of suspended particulates, such as tissue abrasion, smothering, obstruction, or damage to feeding or respiratory organs, and other effects resulting from reduced quantity or quality of light. Another potential manner in which coal could affect aquatic wildlife is through coal leachates. Unburnt coal can be a source of acidity, salinity, trace metals, hydrocarbons, chemical oxygen demand, and potentially macronutrients if they leach from the coal matrix into aquatic habitats.

[6] The minimum recorded flow at the Columbia at Beavery Army Terminal, Quincy, Oregon, is 65,600 cubic feet per second (1969 to 2014).

Figure 9. Modeled Average Annual Coal Dust Deposition



Toxic constituents of coal include PAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, the mineral impurities in the coal, and environmental conditions determine whether these compounds can be leached from the coal. Some PAHs are known to be toxic to aquatic animals and humans.

Metals and PAHs could also potentially leach from coal to the pore water of sediments and be ingested by benthic-feeding organisms, providing a mechanism for subsequent ingestion by other organisms throughout the food chain. However, the low aqueous extractability and bioavailability of the contaminants minimizes the potentially toxic effects (Ahrens and Morrisey 2005). The type of coal anticipated to be exported from the Proposed Action is alkaline, low in sulfur and trace metals. Furthermore, because the Columbia River is a dynamic riverine system the constituents of the coal dust would be distributed and diluted to even lower concentrations as they are transported downstream.

Coal has a heterogeneous chemical composition and specific impacts related to its toxic contaminants are highly dependent on the specific coal composition and source (Ahrens and Morrisey 2005). The majority of coal transported to and from the project area would be from the Powder River Basin. A 2007 U.S. Geological Survey (USGS) report investigated the quality of coal from the Powder River Basin, including the concentrations of trace elements of environmental concern, which include antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, and uranium. According to the study conducted by the USGS (2007), trace elements of environmental concern (TEEC) are generally low in the Powder River Basin coals in comparison to other mining regions, although exact concentrations were not known at the time of this report. Table 8 presents the average concentrations of each TEEC sampled in parts per million. However, at a maximum coal deposition rate of 1.99 g/m^2/year, a coal density of 0.83 grams per cubic centimeter, and at the minimum flow recorded over the 23-year period of record for one day, TEEC deposition directly into the river assumed to be an area of approximately 3,000,000 square meters would result in a change in concentration for each of the elements of concern on the order of $1x10^{-13}$ to $1x10^{-15}$ g/L.

Table 8. Average Concentration of Trace Elements in Wyodak and Big George Coal Beds, Powder River Basin, Wyoming

Trace Element of Environmental Concern	Average Concentration in Sampled Coal (ppm)
Antimony	0.10
Arsenic	1.43
Beryllium	0.18
Cadmium	0.06
Chromium	2.63
Cobalt	1.93
Lead	1.26
Manganese	10.05
Nickel	1.58
Selenium	0.57
Uranium	0.46

Source: U.S. Geological Survey 2007.
ppm = parts per million

If coal dust generated at the project area accumulated without being disturbed throughout the summer dry season (assuming 120 days duration), the anticipated change in TEEC concentration for the minimum recorded flow over one day would be on the order of $1x10^{-10}$ to $1x10^{-12}$ g/L. Again, this change would not be measureable and is not anticipated to affect human health or affect aquatic organism functions (i.e., respiration, feeding).

The concentration of PAHs in Power River basin coal was not investigated for this report because PAHs are only released during combustion. Because the rate of coal dust deposition is so low it is likely unmeasurable and the concentration of trace elements of environmental concern are considered low, impacts on water quality are anticipated to be low.

Research suggests that the bioavailability of contaminants in coal is limited, and that at levels of coal contamination at which estimates of bioavailable concentrations of contaminants might give cause for concern, the acute physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005). However, the variable chemical properties of coal could conceivably result in contaminant mobility and enhanced bioavailability in the aquatic environment. Coal can be a source of acidity, salinity, trace metals, PAHs), and chemical oxygen demand (a measure of organic pollutants found in water). Interactions between coal and water could alter pH and salinity, release trace metals and PAHs, and increase chemical oxygen demand. However, if and how much these alterations occur in the aquatic environment and whether the alterations are significant enough to be potentially toxic to aquatic organisms depends on many factors, including the type of coal, the relative amount of time the coal is exposed to water, dilution, and buffering.

In summary, fugitive coal dust from project operations is not expected to increase suspended solids in the Columbia River to the point that there would be a demonstrable effect on fish distribution, abundance, survival, or acute physical effects. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals), according to one study, would be relatively low because these chemicals tend to be bound in the matrix structure and not quickly or easily leached. Further, any coal particles would be transported downstream by the flow of the river and either carried out to sea or distributed over a broad area, further reducing the potential for adverse impacts on fish from suspended solids.

Affect Commercial and Recreational Fishing

Project-related increases in vessel traffic in the lower Columbia River and associated underwater noise could affect fishing in the study area. Increases in vessel traffic could cause behavioral responses, including quicker migration or avoidance of the navigation channel. The 70 large commercial vessels anticipated per month under the Proposed Action would be limited to the navigation channel. If adult fish targeted in commercial and recreational fishing were to alter behavior in response to underwater noise from vessels, they could avoid the navigation lanes or migrate quickly through them. Commercial and recreational fishing vessels in the navigational channel would be disrupted and need to move out of the navigation channel when large vessels are approaching or present. The Proposed Action would slightly affect commercial or recreational fishing access for fishing activities. The potential impacts of the Proposed Action on commercial and recreational fishing vessels are addressed in the SEPA Vessel Transportation Technical Report (ICF 2017g).

Coal Spill during Rail Transport

The potential indirect impacts of a coal spill during rail transport from a Proposed Action-related train are based on the likelihood of a Proposed Action-related train incident occurring and the consequences of an incident were it to occur. Final EIS Chapter 5, Section 5.2, *Rail Safety*, estimates the number of Proposed Action-related train incidents that could potentially occur during coal transport within Cowlitz County and Washington State. In Cowlitz County, the predicted number of loaded coal train incidents is approximately one every 2 years. The predicted number of loaded coal train incidents in Washington State is approximately five per year.

Not every incident of a loaded coal train would result in a rail car derailment or a coal spill. A train incident could involve one or multiple rail cars and could include derailment in certain circumstances. The size and speed of the train and the terrain at the location of the incident would influence whether the incident resulted in a coal spill that could affect fish. A broad range of spill sizes from a partial rail car to multiple rail cars could occur as a result of a Proposed Action-related train incident.

If an incident resulted in a coal spill, impacts on aquatic environments would depend on the location of the spill, the volume of the spill, and success of efforts to contain and clean up the spill. It is expected that coal spills in the terrestrial and built environments would be easier to contain and clean up than spills in an aquatic environment. Spills on land may have a quicker response time and cleanup in some locations due to their visibility and easier access for cleanup equipment, compared to spills into aquatic environments.

Research suggests that the bioavailability of contaminants in coal is limited, and that at levels of coal contamination at which estimates of bioavailable concentrations of contaminants might give cause for concern, the acute physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005). However, the variable chemical properties of coal could conceivably result in contaminant mobility and enhanced bioavailability in the aquatic environment. Coal can be a source of acidity, salinity, trace metals, PAHs, and chemical oxygen demand (a measure of organic pollutants found in water). Interactions between coal and water could alter pH and salinity, release trace metals and PAHs, and increase chemical oxygen demand. However, if and how much these alterations occur in the aquatic environment and whether the alterations are significant enough to be potentially toxic to aquatic organisms depends on many factors, including the type of coal, the relative amount of time the coal is exposed to water, dilution, and buffering.

The following summary of an aquatic impact assessment describes the derailment of a coal train in Burnaby, British Columbia in 2014, and subsequent cleanup and recovery of the spilled coal. Further information on the spill, efforts to recover the spilled coal, and monitoring results are provided here for context of the potential impacts of a coal spill from a train derailment.

On January 11, 2014, a Canadian Pacific train derailed in Burnaby, resulting in release of metallurgical[7] coal from three rail cars adjacent to and into Silver Creek, approximately 350 meters upstream of Burnaby Lake. Based on discussions with regulatory agencies, the rail company decided to follow a precautionary principle risk management approach, and remove

[7]The Proposed Action would handle subbituminous, or thermal coal from the Powder River Basin, which is different than metallurgical coal. Thermal coal is lower in carbon content and calorific value and higher in moisture.

the majority of the coal from the spill site. Coal was recovered between March 4 and April 2, 2014, using a vacuum-truck system and/or hand tools. Approximately 143 tons of mixed coal, organic matter, and mineral fines were removed.

The conclusions at the end of the monitoring completed as part of the aquatic impact assessment focused on four major elements: water quality, sediment quality, sediment and sediment leachate/porewater toxicity, and bioaccumulation potential. Monitoring locations were established upstream and downstream of coal recovery areas to provide a control/impact comparison. In situ and analytical water quality sampling was conducted between February 28 and April 1, 2014, prior to and during cleanup activities. Other monitoring efforts were completed on two dates, May 30/31 and April 2. (Borealis Environmental Consulting 2015).

The in situ water quality sampling between February 28 and April 1, 2014, focused on temperature, turbidity, conductivity, pH, dissolved oxygen, salinity, and oxidation-reduction potential. The analytical sampling program focused on the following parameters:

- Alkalinity
- Chloride
- Hardness
- Extractable Petroleum Hydrocarbons
- Nutrients (NH3, NO3, NO2, C)
- pH
- PAHs
- Sulfate
- Sulfide
- Total and dissolved metals
- Total and dissolved solids
- Total and suspended solids

Triton (2014, in Borealis Environmental Consulting 2015) compiled in situ and analytical data were compared with available Provincial and federal water quality guidelines for the protection of freshwater aquatic life. The resultant data indicated that sampled parameters were within applicable water quality guidelines, with some exceptions (e.g., that were not deemed to be spill related (CN 2014a, b, in Borealis Environmental Consulting 2015).

The intent of the monitoring for the aquatic impact assessment was to determine the potential agents of impact; where those impacts occur, whether chemicals in water and sediment occur at concentrations seemed to result in impacts, whether chemicals in water and sediment have adverse impacts on resident organisms, and whether those chemicals are taken up by organisms (bioaccumulation) over time.

For water quality, monitoring results indicated that water quality was deemed generally consistent with the British Columbia Ministry of Environment and/or the Canadian Council of Ministers of the Environment guidelines protective of aquatic life.

For sediment quality, site sediment concentrations of three metals (cadmium, copper, and nickel) and various PAHs (mainly downstream of the coal recovery area) exceeded both British Columbia and Canada freshwater sediment guidelines and background or reference area concentrations. The exceedance of site sediment concentrations of the three metals was only noted at one location, the Burnaby Lake reference site, which was located upstream of the spill area and not affected by the spill. No exceedances were noted in the exposed sites or the other reference location. These results support the assertion that the elevated levels of cadmium, copper, and nickel at the Burnaby Lake reference site must either be naturally occurring or originate from a source other than the coal spill.

Additional laboratory toxicity tests (of sediment samples) provided more specific information regarding the bioavailability of these parameters, and the potential for biological impacts. The bioaccumulation potential test results for invertebrates (i.e., represented by freshwater oligochaetes) conducted with Silver Creek/Burnaby Lake sediment samples, in comparison with both laboratory control samples and reference areas, indicate that PAHs present in specific, localized areas downstream of the derailment site have the slight potential to accumulate in benthic invertebrates resident in those areas. However, further mitigation of these sediments was not recommended, nor was additional study in the form of a Tier 2 assessment,[8] as it is not anticipated that higher tropic levels would experience any significant adverse effects, and there are unlikely to be impacts beyond the spatial extent assessed during the Aquatic Impact Assessment (i.e., downstream of the coal recovery area) (Borealis Environmental Consulting 2015).

For sediment and sediment porewater toxicity, test results for the fish, invertebrate, and algae tests conducted with Silver Creek/Burnaby Lake sediment samples in comparison with both laboratory control samples and reference areas indicate that samples were nontoxic to all species tested in most areas, with the exception of one monitoring site, at which samples yielded marginal but statistically significant effects on the survival of benthic macroinvertebrates (i.e., midges and amphipods). The results indicate that the sediments located approximately 160 meters downstream of the spill site have the potential to affect freshwater invertebrates, and that PAHs in sediments have a slight potential to bioaccumulate in benthic invertebrates. However, the results of the aquatic impact assessment indicate that, while there are potentially minor impacts restricted to a very small localized area, the coal in sediments post-recovery is of a low volume in relation to the volume of coal spilled and that these sediments should be left in place to undergo natural attenuation. Further mitigation of these sediments was not recommended (Borealis Environmental Consulting 2015).

3.2 No-Action Alternative

Under the No Action Alternative, the Applicant would not construct the Proposed Action. Current operations would continue, and the existing bulk product terminal would be expanded. Any expansion activities would not require a permit from the Corps or a shoreline permit; thus, no impacts on aquatic habitats would occur because of an expansion of the exiting bulk product terminal. New construction, demolition, or related activities to expand the bulk terminal could occur on previously developed upland portions of the project area. This could affect upland areas and habitats that do not provide suitable fish habitat.

It is assumed that growth in the region would continue, which would allow continued operation of the export terminal and the adjacent bulk terminal site within the 20-year analysis period (2018–2038). Cleanup activities, relative to past industrial uses, would continue to occur. This could affect developed areas and associated disturbed upland habitats. Vessel traffic is expected to continue and any fish disturbance or injury associated with vessel movements would continue at levels similar to

[8]The aquatic impact assessment included a Tier 1 assessment, which focused on risks to water and sediment quality, and resident aquatic biota in Silver Creek and Burnaby Lake. A Tier 2 assessment would have addressed any potential impacts on higher tropic levels (i.e., fish, birds, amphibians, reptiles) and aquatic habitats further downstream of Silver Creek and Burnaby Lake, but was not required or recommended.

current conditions; however, no additional measurable impact on fish or fish habitat would be expected to occur under the No Action Alternative because no in-water work would occur.

Chapter 4
Required Permits

The Proposed Action would require the following permits in relation to fish and fish habitat.

- **Shoreline Substantial Development and Conditional Use Permits**. Cowlitz County administers the Shoreline Management Act (SMA) through its Shoreline Management Master Program. The Proposed Action would have elements and impacts within SMA jurisdiction (CCC 19.20) and would thus require a Shoreline Substantial Development and Conditional Use permit from Cowlitz County and Ecology.

- **Critical Areas Permits**. The Proposed Action would require local permits related to impacts on regulated critical areas. CCC 19.15 regulates activities within and adjacent to critical areas and in so doing regulates fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and other sensitive areas. Cowlitz County would require an application for Planning Clearance, a Fill and Grade Permit, Building Permits, Shoreline Permit, Floodplain Permit, and Critical Area Permit, and would review the Environmental Impact Statements for consistency with the County's critical areas ordinance.

- **Construction and Development Permits—Cowlitz County.** The Proposed Action would require fill and grade permits (CCC 16.35) and construction permits (CCC 16.05) for clearing and grading and other ground disturbing activities, as well as construction of structures and facilities associated with the Proposed Action.

- **Clean Water Act Authorization.** Construction and implementation of the Proposed Action would result in impacts on waters of the United States, including wetlands. Because impacts would exceed 0.5 acre, Individual Authorization from the Corps under Section 404 of the Clean Water Act and appropriate compensatory mitigation for the acres and functions of the impacted wetlands would be required.

  An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act and a National Pollution Discharge Elimination System permit under Section 402 of the Clean Water Act would also be required for construction of the Proposed Action. Additional details regarding the permitting process related to the Clean Water Act can be found in the SEPA Water Quality Technical Report (ICF 2017c).

- **Hydraulic Project Approval.** The Proposed Action would require a hydraulic project approval (HPA) from the WDFW due to project elements that would affect and cross the shoreline of the Columbia River. The HPA would consider effects on riparian and shoreline/bank vegetation in issuance and conditions of the permit, including for the installation of the proposed docks and pilings, as well as for interior culverts or other crossings of drainage features.

Chapter 5
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Appendix A

Restoration Projects in the Lower Columbia River Subbasin

Appendix A
Restoration Projects in the Lower Columbia River Subbasin

Table A-1 provides a list of restoration projects in the lower Columbia River subbasin, below Bonneville Dam, that have been completed. This list was provided to the Cowlitz County and the Washington State Department of Ecology by the Columbia River Estuary Partnership. The list provides the project name, location, and acres of restoration. Further information on these projects can be found on the Columbia River Estuary Partnership website (www.estuarypartnership.org).

Table A-1. Lower Columbia River Subbasin Restoration Projects

	Locational Information		Acreage
Project Name	**Latitude**	**Longitude**	**Restored**
Hamilton Creek Chum Channel	45.639100	-121.979000	7
Alder Creek Fish Passage Restoration	45.831900	-122.954000	
Buckmire Slough	45.704300	-122.726000	65
Columbia Slough Confluence Habitat Enhancement	45.642500	-122.766000	20
Duncan Creek Dam Fish Passage Restoration	45.615800	-122.041000	
Duncan Creek Chum Channel Restoration	45.613100	-122.051000	
Honeyman Creek	45.791900	-122.855000	58
Horsetail Creek	45.591900	-122.075000	96
John R Palensky (Burlington Bottoms)	45.639000	-122.825000	275
Lewis River Riparian Enhancements, Cowlitz Tribe	45.869000	-122.732000	1
Lewis River East Fork (La Center Wetlands Floodplain Rest.)	45.858500	-122.670000	453
Lewis River East Fork Floodplain Restoration - Clark Co	45.844200	-122.653000	10
Lower Washougal Delta Habitat Complexing	45.585000	-122.390000	
Scappoose Bay Malarkey Ranch	45.802200	-122.848000	
Stephens Creek	45.468800	-122.670000	
Mirror Lake - Young Creek Culvert Removal	45.545400	-122.207000	30
Mirror Lake Restoration	45.543100	-122.240000	27
Multnomah & Wahkeena Creeks- Benson Lake Site	45.578100	-122.126000	9
Ramsey Wetland Complex Off-Channel Habitat Design and Restoration	45.627300	-122.762000	3
Sandy River Delta Riparian Forest Restoration, Multiple Phases	45.555800	-122.377000	367
Sandy River Dam Breach	45.554700	-122.378000	51
Sandy River Delta Revegetation - BPA	45.558700	-122.381000	40
Sandy River Delta Revegetation - COE	45.565500	-122.383000	110
Sauvie Island North Unit CREST/PC Trask	45.821500	-122.811000	308
Scappoose Bay Hogan Ranch	45.802000	-122.830000	10
Scappoose Bottomlands Restoration	45.783300	-122.867000	30
Steigerwald NWR	45.567200	-122.308000	
Thousand Acres, Sandy River Delta Restoration	45.546600	-122.350000	75
Woods Landing/Columbia Springs	45.599000	-122.540000	

Project Name	Locational Information		Acreage Restored
	Latitude	Longitude	
Lower Willamette River Riparian and Wetland Enhancement	45.465500	-122.668000	30
Multnomah Channel Natural Area - Metro Site	45.685300	-122.870000	72
Tryon Creek Off Channel Habitat Enhancement	45.422500	-122.659000	4
Smith & Bybee Lakes	45.615800	-122.728000	22
Abernathy Creek Riparian Restoration	46.197600	-123.161000	84
Abernathy Creek Tidal Restoration	46.193400	-123.167000	22
Barrett Slough	46.136900	-123.868000	
Big Creek	46.165800	-123.593000	3
Brownsmead/Blind Slough	46.214600	-123.529000	20
Chinook River Diversion Habitat Reconnection	46.269400	-123.929000	
Chinook River WDFW Conservation & Restoration	46.301300	-123.959000	420
Crazy Johnson Creek Conservation	46.374800	-123.548000	
Crims Island Acquisition & Restoration	46.173200	-123.141000	190
Grays Bay - Crooked Creek Conservation	46.294900	-123.670000	
Grays Bay - Crooked Creek 2 Conservation & Restoration	46.297800	-123.668000	
Grays Bay - Deep River. Svensen's Landing Acq. & Rest.	46.316200	-123.701000	155
Grays Bay - Deep River Confluence Acquisition & Restoration	46.308500	-123.718000	
Grays Bay - Devils Elbow Phase 1 Acquisition	46.313000	-123.669000	
Grays Bay - Devils Elbow Non-AA Acquisition & Rest - Johnson Farm	46.314900	-123.673000	88
Dibblee Point	46.113000	-122.991000	18
Lower Elochoman Tidal - Thomas Properties Acquisition & Restoration	46.224500	-123.389000	305
Fort Clatsop - Colewart Creek	46.128700	-123.879000	46
Fort Columbia	46.257200	-123.925000	96
Germany Creek Acquisition & Restoration	46.193500	-123.126000	7
Gnat Creek Tidal Wetlands Restoration	46.187400	-123.533000	20
Gorley Springs, Grays R.	46.368100	-123.551000	
Green Slough	46.133200	-123.873000	
Hanson Creek	46.145000	-123.867000	
Haven Island	46.116500	-123.808000	75
Integrated Pest Management	46.194100	-123.647000	
Johnson Slough	46.114400	-123.872000	
Julia Butler Hansen NWR - Mainland Unit tidegate modifications	46.257800	-123.430000	110
Julia Butler Hansen NWR - Tenasilahe Island Water Circulation	46.238700	-123.462000	92
CSR Acquisition & Restoration	45.991000	-122.863000	
Grays Bay - Kandoll Farm Conservation & Restoration	46.323900	-123.653000	183
Karlson Island Restoration	46.206600	-123.600000	314
Knappton Cove Acquisition	46.283600	-123.800000	438
Larson Slough	46.121300	-123.875000	

Project Name	Locational Information		Acreage Restored
	Latitude	Longitude	
Lewis & Clark River Dike Breaches	46.093900	-123.849000	25
South Tongue Point (Liberty Lane)	46.188700	-123.753000	10
Lord - Walker Islands	46.137300	-123.031000	335
Louisiana Swamp	46.116200	-123.278000	35
Lower Kalama Delta habitat complexing	46.037500	-122.870000	5
Skamakowa Creek - Dead Slough Restoration	46.278900	-123.454000	
Meglar Creek	46.249300	-123.863000	2
Grays Bay - Mill Road Conservation & Restoration	46.319400	-123.657000	55
Nelson Creek Riparian Enhancement	46.239700	-123.379000	
NOAA Marine Debris Crab Pot Recovery	46.254900	-123.980000	
Otter Point	46.136400	-123.876000	33
Perkins Creek Restoration and Enhancement	46.129800	-123.914000	1
Puget Island	46.159000	-123.368000	
Kerry Island Acquisition & Restoration	46.126000	-123.356000	88
Grays Bay - Seal Creek Slough Acquisition	46.324700	-123.666000	
Grays Bay - Secret River Acquisition	46.311900	-123.691000	
Skipanon Slough, 8th St Dam Tidegate Restoration	46.158800	-123.926000	
Vera Slough	46.164200	-123.890000	
Walker Island Conservation	46.145900	-123.047000	
Wallacut River	46.319100	-124.011000	46
Walluski River Kerr Property	46.130200	-123.780000	35
Walluski River North, Elliot property #1	46.135100	-123.781000	55
Warren Slough	46.188500	-123.584000	
Willow Grove Acquisition & Restoration	46.171900	-123.039000	
Wolf Bay Acquisition & Restoration	46.170500	-123.693000	
Youngs/ Walluski confluence	46.149600	-123.811000	
Abernathy Creek Habitat Rest. and Riparian Protection	46.211000	-123.150000	
Coal Creek Slough	46.182700	-123.071000	
Conyers Creek	46.100400	-123.201000	
Columbia Estuary Environmental Ed Program	46.232600	-123.387000	3
Sharnelle Fee Property	46.093500	-123.766000	50
Trestle Bay Jetty Breach	46.219700	-123.994000	628
Grays Bay - Doumit Property	46.309100	-123.677000	
Crooked Creek Upstream	46.294600	-123.654000	
Batwater Station	46.166400	-123.125000	26
Eagle Island, Cowlitz Tribe LWD placement	45.938100	-122.684000	5
Hardy Creek Spawning and Rearing Channel	45.632400	-121.998000	
Scappoose Confluence Restoration	45.768900	-122.874000	4
BES/COE Sec 1135 Columbia Slough Restoration	45.577800	-122.632000	2
Birnie Creek Una Road Fish Passage	46.204600	-123.381000	
Eagle Island Acquisition	45.932300	-122.695000	
Brooks Slough	46.258500	-123.416000	
Clark's Dismal Nitch	46.250900	-123.865000	

Project Name	Locational Information		Acreage Restored
	Latitude	Longitude	
Clatskanie Bottoms - NAWCA	46.133300	-123.331000	200
Deer Island	45.963700	-122.839000	350
Duck Creek Bridge & Fish Passage	46.250200	-123.317000	
Grays Bay - Deep River. Campbell Acquisition	46.322000	-123.700000	
Grays PUD Bar	46.357800	-123.570000	5
Harborton Wetlands	45.616000	-122.797000	
John Day River Marsh	46.161200	-123.725000	
Lewis and Clark NWR preservation	46.209800	-123.641000	
Lewis River Preserve	45.816900	-122.611000	125
Lockwood Creek Recovery Enhancement	45.851500	-122.653000	9
Mason Creek Rearing Pool/Chum Channel Creation	45.833100	-122.631000	
McCarthy Creek	45.653900	-122.850000	235
Nelson Creek Doumit Property Conservation	46.237100	-123.389000	
Port of Astoria Warrenton Airport Dike Breach	46.156900	-123.863000	30
Ridgefield NWR re-vegetation	45.797000	-122.760000	240
Round Lake	45.743200	-122.854000	100
Ryan Point	45.613400	-122.618000	
Sandy Island Conservation	46.006600	-122.863000	
Sauvie Island NAWCA: Racetrack/Gay Lakes, Mudhen/Footbridge units	45.740000	-122.784000	315
Sauvie Island North Unit DU Wetlands Project	45.826900	-122.804000	400
Ridgefield NWR Bachelor Island	45.824400	-122.777000	678
Shillapoo Wildlife Area	45.698900	-122.747000	80
Smith and Bybee Lakes Water Control Structure	45.614600	-122.736000	1600
Teal Slough	45.816600	-122.838000	69
Vanport Wetlands, Columbia Slough	45.601200	-122.687000	62
Westport Slough Levee Removal	46.127100	-123.243000	
Whitaker Ponds Natural Area, Columbia Slough	45.573600	-122.610000	12
Washougal Oaks Natural Area	45.568600	-122.276000	15
Kloppman LWD	45.944500	-123.041000	
Carcus Creek LWD	45.993900	-123.090000	
Clatskanie River Fish Passage Improvement	45.942300	-123.045000	
Lewis River North Fork RM 13.5	45.933700	-122.651000	6
Upper Elochoman Salmon Conservation Project	46.281600	-123.268000	
Lower Dean Creek Restoration	45.828100	-122.629000	4
Lockwood Creek Phase 3	45.855500	-122.635000	
Lockwood Creek Rest, Clark Pub Utilities	45.852600	-122.644000	6
Zmrhal/Rauth Coweeman Restoration	46.150200	-122.780000	4
Walters Stream Restoration	46.297200	-123.446000	2
Crosel Creek Acquisition	46.163400	-123.799000	
Blind Slough Swamp - Nature Conservancy Land	46.196600	-123.574000	
Gnat Creek North	46.190500	-123.533000	60
Grays River LWD Habitat Complexing	46.371700	-123.557000	
Kennedy property acquisition	45.981300	-122.867000	

Project Name	Locational Information		Acreage Restored
	Latitude	Longitude	
Pierce Island restoration	45.621400	-122.012000	8
Julia Butler Hansen NWR - Steamboat Slough	46.250100	-123.434000	68
Milton Creek Riparian Planting	45.861900	-122.869000	
Milton Creek LWD	45.917700	-122.942000	
Clatskanie RIver Floodplain Restoration	46.100300	-123.193000	23
Woodard Creek - Reach 1 Restoration	45.620700	-122.021000	1
Grays River Reach 2D Restoration	46.370300	-123.550000	4

MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA WILDLIFE TECHNICAL REPORT

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Acronyms and Abbreviations

ADD	auditory deterrence device
Applicant	Millennium Bulk Terminals—Longview, LLC
BA	biological assessment
BNSF	BNSF Railway Company
CDID	Consolidated Diking and Improvement District
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CRC	Columbia River Crossing
CRD	Columbia River Datum
dB	decibel
dB_{PEAK}	peak sound pressure
dB_{RMS}	decibel root mean square
dB_{SEL}	decibel sound exposure level
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
g/m^2/year	grams per square meter per year
GIS	geographic information system
Hz	Hertz
IHA	Incidental Harassment Authorization
IPaC	Information, Planning, and Conservation
kHz	kilohertz
LOA	Letter of Authorization
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
PAH	polycyclic aromatic hydrocarbon
PHS	Priority Habitat and Species
PTS	permanent threshold shift
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metals Company facility
SEL	sound exposure level
SEPA	Washington State Environmental Policy Act
SPLs	sound pressure levels
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

Chapter 1
Introduction

This technical report assesses the potential wildlife impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, wildlife refers to terrestrial and aquatic wildlife species other than fish. This report describes the regulatory setting, establishes the methods for assessing potential wildlife impacts, presents the historical and current wildlife conditions in the study area, and assesses potential impacts. Fish and their habitat are discussed in the Washington State Environmental Policy Act (SEPA) Fish Technical Report (ICF 2017a).

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP, and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the

east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

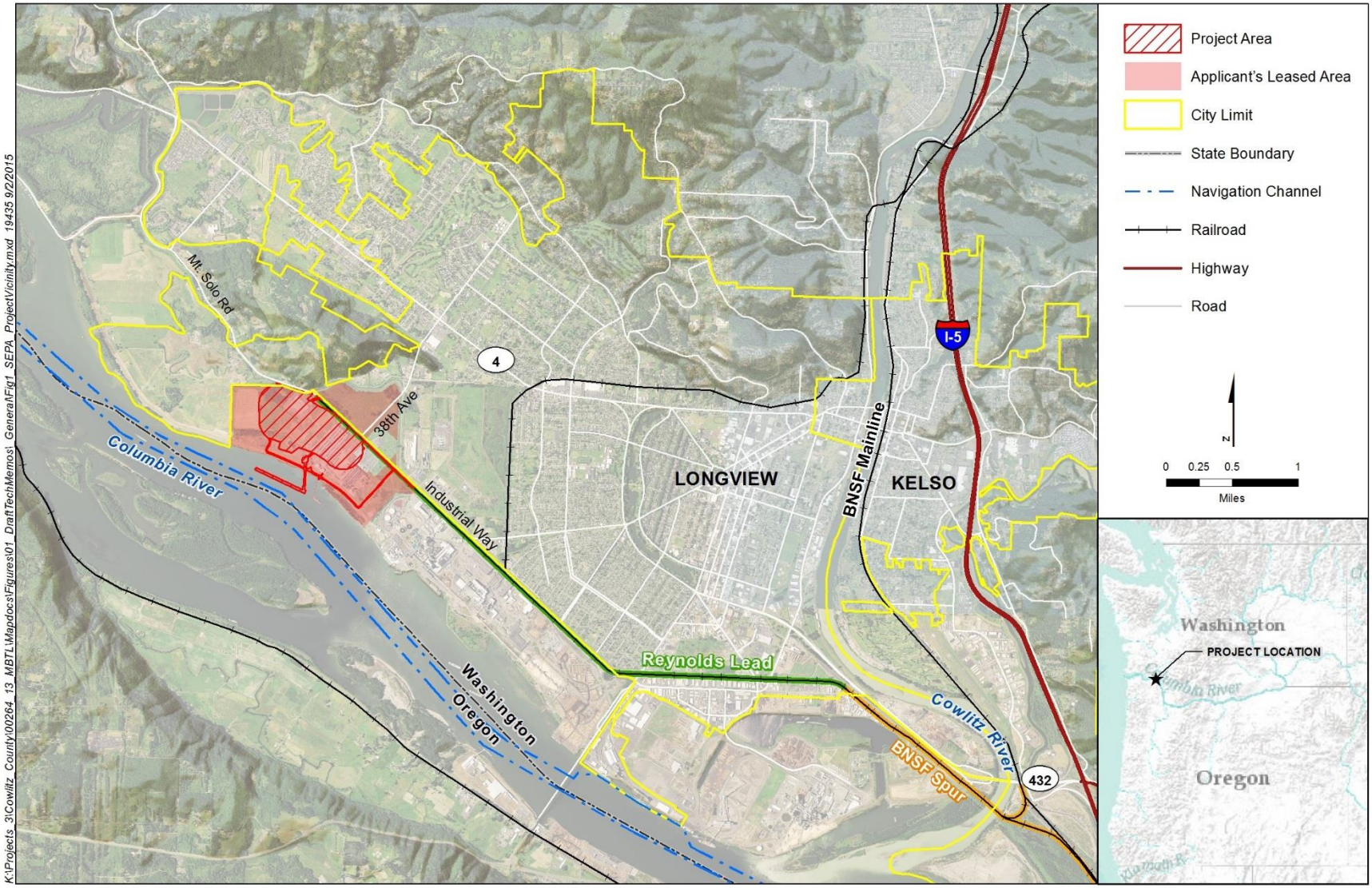
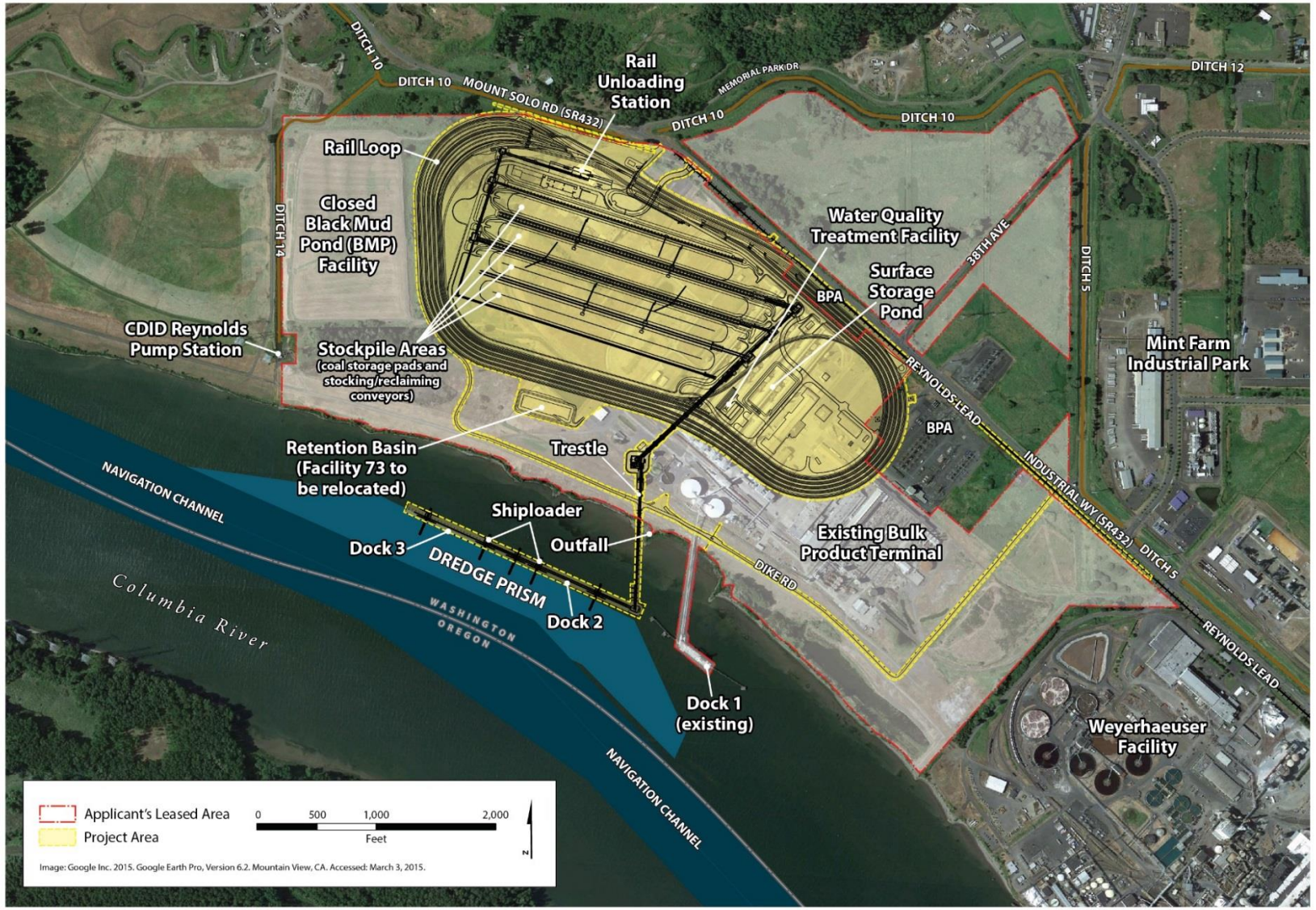


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential impacts on wildlife are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Wildlife

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 et seq.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Endangered Species Act Section 7	Requires federal actions, such as issuing a permit under a federal regulation (e.g., NEPA, Clean Water Act, Clean Air Act) to undergo consultation with USFWS and/or NMFS to ensure the federal action is not likely to jeopardize the continued existence of any listed threatened or endangered animal species or result in the destruction or adverse modification of designated critical habitat. NMFS is responsible for managing, conserving, and protecting ESA-listed marine species. USFWS is responsible for terrestrial and freshwater species. Both NMFS and USFWS are responsible for designating critical habitat for ESA-listed species.
Migratory Bird Treaty Act of 1918, as amended (16 USC 703–713)	Makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts,

Regulation, Statute, Guideline	Description
	nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. Under the regulatory authority of USFWS.
Bald and Golden Eagle Protection Act of 1940, as amended (16 USC 668–668c)	Prohibits the taking of bald eagles, including their parts, nests, or eggs without a permit issued by the USFWS, and provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle... [or any golden eagle], alive or dead, or any part, nest, or egg thereof."
Marine Mammal Protection Act of 1972, as amended (50 CFR 216)	Protects marine mammals from “take” without appropriate authorization, which is only granted under certain circumstances. NMFS and the USFWS enforce the MMPA. Animals under the jurisdiction of NMFS could be present within the study area. An Incidental Harassment Authorization or Letter of Authorization (specific authorization to be determined) could be required pursuant to the MMPA.
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Washington State Growth Management Act (RCW 36.70A)	Defines a variety of critical areas, which are designated and regulated at the local level under city and county critical areas ordinances.
Washington State Shoreline Management Act (90.58 RCW)	Requires cities and counties (through their Shoreline Master Programs) to protect shoreline natural resources.
Washington State Hydraulic Code (RCW 77.55)	Designed to protect fish life. The hydraulic project approval is administered by WDFW under the state hydraulic code.
Clean Water Act Section 401 Water Quality Certification	Issued for in-water construction to ensure compliance with state water quality standards and the protection of other aquatic resources under Ecology’s authority as outlined in the federal Clean Water Act.
Marinas and Terminals in Freshwater Areas (WAC 220-660-160)	Applies to constructing, maintaining, and repairing marinas and terminals in freshwater areas and provides provisions intended to address fish life concerns.
Local	
Cowlitz County SEPA Regulations (Cowlitz County Code 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Critical Areas Protection Ordinance (19.15)	Regulates activities within and adjacent to critical areas including fish and wildlife habitat conservation areas.
Cowlitz County Shoreline Master Program (19.20)	Regulates development in the shoreline zone, including the shoreline of the Columbia River, a Shoreline of Statewide Significance.

Regulation, Statute, Guideline	Description
City of Longview Shoreline Master Program (Ord. 3300)	Regulates development in the shoreline zone, including the shoreline of the Columbia River, a Shoreline of Statewide Significance. Adopted in September 2015.
City of Longview Critical Areas Ordinance(17.10)	Regulates activities within and adjacent to critical areas and in so doing regulates fish and wildlife habitat conservation areas.

Notes:
USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; Corps = U.S. Army Corps of Engineers; CEQ = Council on Environmental Quality; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act; WAC = Washington Administrative Code; RCW = Revised Code of Washington; WDFW = Washington Department of Fish and Wildlife; Ecology = Washington State Department of Ecology; SEPA = State Environmental Policy Act

1.3 Study Area

Three study areas have been identified for the wildlife analysis, described in the following sections.

1.3.1 Direct Impact Study Area: Terrestrial Species and Habitats

The study area for direct impacts on terrestrial species and habitats consists of the project area plus the area up to 0.5 mile beyond the project area (Figure 3). This distance accommodates noise and visual disturbance thresholds set by the U.S. Fish and Wildlife Service (USFWS) for some sensitive species (U.S. Fish and Wildlife Service 2006).

1.3.2 Direct Impact Study Area: Aquatic Species and Habitats

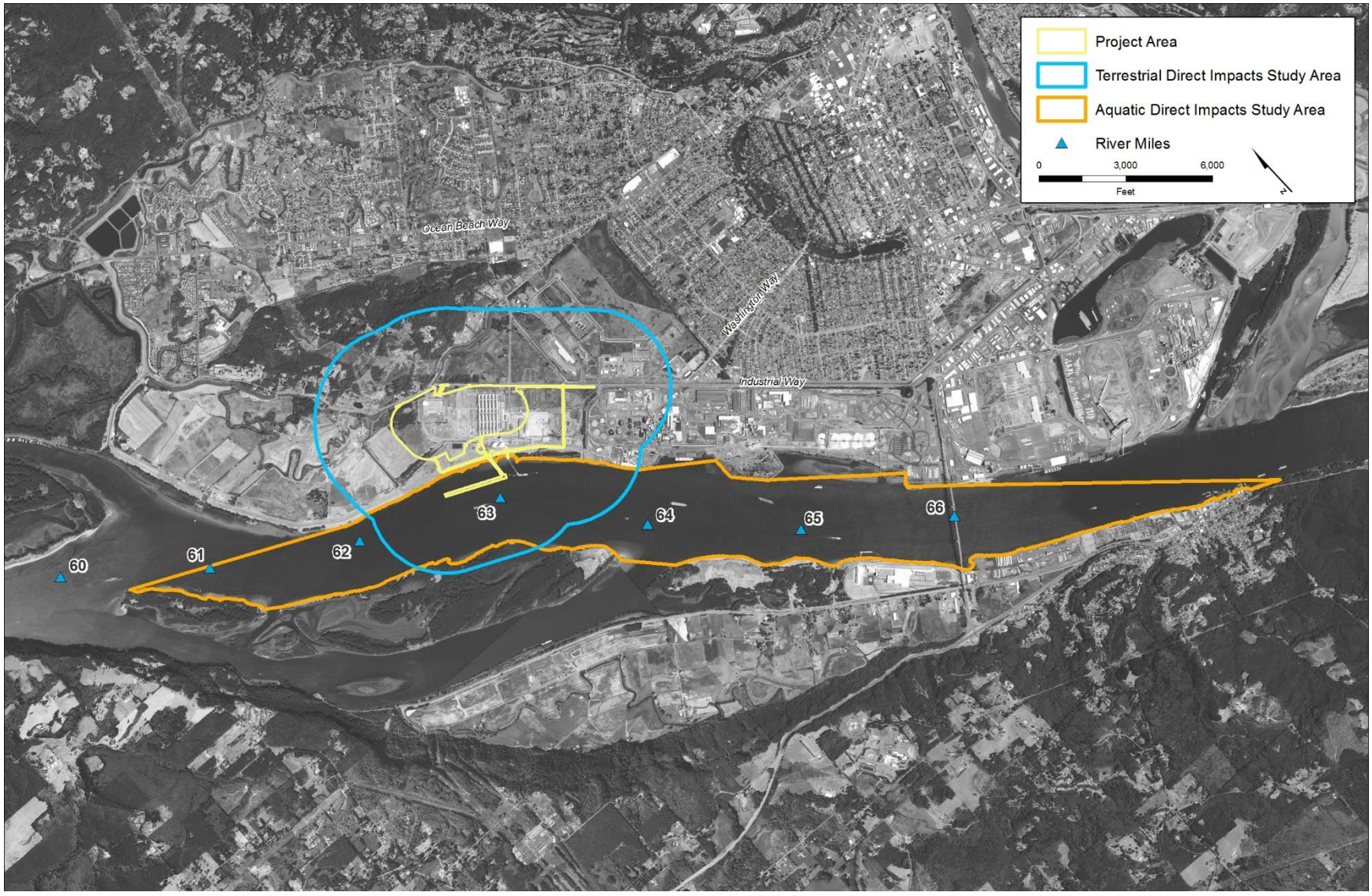
The study area for direct impacts on aquatic species and habitats includes the main channel of the Columbia River and extends 5.1 miles upstream and 2.1 miles downstream, measured, respectively, from the upstream and downstream extents of the proposed docks (Docks 2 and 3) at the project area (Figure 3). The aquatic study area is based on the distances where underwater noise is estimated to reach harassment levels. These distances represent the in-water line-of-site distances from the ends of the dock with respect to underwater noise.

The aquatic study area also includes the various surface and stormwater ditches, ponds, and wetlands found throughout the project area.

1.3.3 Indirect Impact Study Area: All Species and Habitats

The study area for indirect impacts on terrestrial species includes the rail corridors in Washington State that would be used by Proposed Action-related trains. This area accounts for potential coal spill and wildlife strike impacts. See the SEPA Rail Transportation Technical Report (ICF and Hellerworx 2017) for rail routes in Cowlitz County and Washington State). The study area for indirect impacts on aquatic species includes the Columbia River downstream from the project area to mouth of the river to account for potential impacts to marine mammals.

Figure 3. Study Area Boundaries



Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area for the Proposed Action as they pertain to wildlife.

2.1 Methods

This section describes the sources of information that were used to characterize the existing conditions and assess potential impacts of the Proposed Action and No-Action Alternative on wildlife and wildlife habitat.

2.1.1 Data Sources

The following data sources were used to define the existing conditions relevant to wildlife and wildlife habitat and to evaluate potential impacts of the Proposed Action and No-Action Alternative in the terrestrial and aquatic study areas.

- Two site visits to the project area conducted by ICF biologists on April 8, 2014, and December 12, 2014.
- One site visit to the Mount Solo Landfill, located adjacent to and north of the project area, was conducted by ICF biologists on December 12, 2014, to view the project area with binoculars from an elevated position. The site was also viewed with binoculars from the project area and from publicly accessible roads.
- Reports prepared by Grette Associates for the Applicant as part of the permit application materials.
    - *Docks 2 and 3 and Associated Trestle: Direct Effects of Construction Pile Driving and Marine Mammals* (Grette Associates 2014a).
    - *Wetland and Stormwater Ditch Delineation Report – Parcel 619530400* (Grette Associates 2014b).
    - *Bulk Product Terminal Shoreline Wetland Delineation Report – Parcel 61950* (Grette Associates 2014c).
    - *Wetland and Stormwater Ditch Delineation Report – Parcel* 61953 (Grette Associates 2014d).
    - *Bulk Product Terminal Wetland Stormwater Reconnaissance Report – Parcel 10213* (Grette Associates 2014e).
    - *Wetland Impact Report – Parcel 619530400* (Grette Associates 2014f).
    - *Permanent Impacts to Aquatic Habitat* (Grette Associates 2014g).
    - *Affected Environment Biological Resources. Technical Report* and associated appendices (Grette Associates 2014h).

- *Affected Environment Biological Resources. Addendum: Technical Memorandum: Streaked Horned Lark Surveys at Millennium Bulk Terminals* (Grette Associates 2014i).
- *Docks 2 and 3 and Associated Trestle: Proposed Mitigation Measures to Minimize Construction and Long-Term Effects* (Grette Associates 2014j).
- *Docks 2 and 3 and Associated Trestle Direct Effects of Construction* (Grette Associates 2014k).
- *Affected Environment Biological Resources. Addendum: Technical Memorandum: Docks 2 and 3 and Associated Trestle Effects of Construction and Terminal Operations on Streaked Horned Larks and Columbian White-Tailed Deer* (Grette Associates 2014l).

- National Marine Fisheries Service (NMFS) West Coast Region species list.
- National Oceanic Atmospheric Administration (2016) technical guidance for assessing the effects of underwater sounds on marine mammals.
- USFWS Information, Planning, and Conservation (IPaC) system online database (2015).
- Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) Statewide List and Distribution for Cowlitz County (Washington Department of Fish and Wildlife 2015a).
- WDFW interactive mapping for PHS spatial data provided by WDFW on May 5, 2014, for a 5-mile radius surrounding the project area.
- Washington State Department of Natural Resources online Herpetological Atlas spatial database (2015).
- Literature relative to threatened and endangered species.
- Comments received from interested parties during the project scoping period relative to wildlife, as summarized in the SEPA Scoping Report (February 10, 2014).

2.1.2 Impact Analysis

The impact analysis involved conducting a quantitative analysis of vegetated habitats at the project area and a qualitative analysis of wildlife species in the study areas. For the purpose of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative.

2.1.2.1 Vegetated Habitats

Direct impacts on habitat are based on the method outlined in the SEPA Vegetation Technical Report (ICF 2017b). Vegetation communities were identified, characterized, and mapped for both project area using recent and historic aerial photographs and the information gathered from the references cited in Section 2.1.1, *Impact Analysis*, of the SEPA Vegetation Technical Report. Mapped plant communities in the majority of the project area for the Proposed Action were checked by ICF biologists during the December 12, 2014 site visit. The vegetation types present in the project area were also verified by observing the project area, Mount Solo Landfill, and public roads through binoculars. Visual observations of the vegetation in the study area on adjacent, off-site areas and

along Industrial Way, Mt. Solo Road, and Memorial Park Drive were also documented during this site visit.

Once verified, vegetation communities were mapped on a recent aerial photograph using geographic information system (GIS) and overlain with the wetland boundaries delineated by Grette Associates (2014b, c, d, e, f). Direct impacts on vegetation from the clearing of land to construct the buildings and infrastructure of the Proposed Action were determined by overlaying the coal export terminal footprints on the vegetation maps using GIS. All vegetated areas that fell within the footprint were considered direct impacts.

2.1.2.2 Wildlife Species

Potential impacts on wildlife species were determined by considering species that are likely to occur in the study area based on field surveys, site visits, the presence of suitable habitat and geographic range, and documented species occurrences. For documented occurrences, the focus was on wildlife species identified in the WDFW PHS database. The PHS program provides comprehensive information on important fish, wildlife, and habitat resources in Washington. It is the principal means by which WDFW provides wildlife and habitat information to public and private entities for planning purposes. In addition, the USFWS list of federally listed species in Cowlitz County and the NMFS West Coast Region species list of marine mammals (most of which are also included in the PHS database) were also considered.

WDFW maintains a PHS geospatial database that maps locations of priority species occurrences and priority habitats. Priority species in the PHS program include wildlife species classified under state law (Washington Administrative Code [WAC] 232-12-297) as threatened, endangered, or sensitive, as well as species that are candidates for such classification. Other PHS species include vulnerable aggregations of species or groups of animals that are susceptible to significant population declines due to their inclination to aggregate, and species of recreational, commercial, or tribal importance. The PHS database also includes state-monitored species, which are not considered special-status, but are monitored for status and distribution trends. Geospatial PHS data containing mapped locations of priority species occurrences and priority habitats were obtained from WDFW (Washington Department of Fish and Wildlife 2014). These data were overlaid with the study area to determine presence of documented priority species and habitat occurrences.

- A list of special-status wildlife species was compiled for the study area, consisting of those species federally listed as threatened, endangered, proposed, or candidate species; wildlife species listed in the WDFW PHS database; and marine mammals.
- A list of federally listed wildlife species for Cowlitz County was generated from the USFWS iPAC online planning tool (U.S. Fish and Wildlife Service 2015).
- A list of state priority species that occur in Cowlitz County was obtained from the WDFW PHS program website (Washington Department of Fish and Wildlife 2013).
- A list of federally protected marine mammals that could occur in the study area was compiled from the NMFS (2015) West Coast Region website.

The impact analysis for wildlife habitat is quantitative; however, the impact analysis for wildlife species is qualitative because wildlife species are generally mobile and their presence in the study area cannot be predicted at any one location or time. In addition, a species' reaction to an impact mechanism, such as construction-generated noise, can be different for each species given the

variability in species' hearing frequencies, mobility, vision, and overall sensitivity (e.g., juveniles could be more sensitive and susceptible to potential impacts than older animals). Therefore, impact mechanisms are identified and a qualitative impact discussion describes the potential effect an impact mechanism could have on species that could be in the study area during construction and operations.

2.1.2.3 Assessing Noise and Visual Disturbance

An animal's response to sounds depends on various factors, including noise level and frequency, distance and event duration, equipment type and conditions, frequency of noisy events over time, slope, topography, weather conditions, previous exposure to similar noises, hearing sensitivity, reproductive status, time of day, behavior during the noise event, and an animal's location relative to the noise source (Delaney and Grubb 2003 in Washington State Department of Transportation 2015). As sound waves spread out from their source, their energy level decreases. This assessment considers potential impacts of terrestrial sound on wildlife and potential impacts of underwater sound on diving birds and marine mammals.

Terrestrial Noise and Visual Disturbance

USFWS has established terrestrial distance thresholds at which harassment[1] may occur for some sensitive species in Washington (U.S. Fish and Wildlife Service 2006) due to construction activity. Species for which USFWS has determined harassment distance thresholds include the bald eagle (*Haliaeetus leucocephalus*), marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), and Columbian white-tailed deer (*Odocoileus virginianus leucurus*). Table 2 presents distances from construction activity at which USFWS predicts these species may experience harassment (U.S. Fish and Wildlife Service 2006). Of these four sensitive species, the bald eagle can experience harassment from visual impacts as far as 0.5 mile from a construction site, the greatest distance of potential harassment of the four species. The remaining three species may experience harassment through either visual or noise disturbance at lesser distances. Therefore, using a conservative approach, the terrestrial study area for direct impacts extends 0.5 mile beyond the project area. While this distance is based on the bald eagle's sensitivity to noise and visual impacts, it is a reasonable proxy to use for terrestrial wildlife species in the absence of similar information for those species.

[1] *Harassment* under the Endangered Species Act is defined as actions that create the likelihood of injury to such an extent as to significantly disrupt normal behavior patterns, which include but are not limited to breeding, feeding, or sheltering (50 CFR 17.3).

Table 2. Harassment Distances for Federally Listed Species in Washington State

Species	Scientific Name	Activity and Harassment Distance
Bald eagle	*Haliaeetus leucocephalus*	Noise: 0.25 mile Visual: 0.5 mile
Marbled murrelet	*Brachyramphus marmoratus*	Pile driving: 180 feet Visual: 300 feet
Northern spotted owl	*Strix occidentalis caurina*	Pile driving: 180 feet
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	Noise: 0.25 mile

Source: U.S. Fish and Wildlife Service 2006

Underwater Noise Disturbance

For underwater impacts on marine mammals and diving birds due to sound, USFWS and NMFS have determined noise level thresholds that may result in behavioral changes or injury. The distance at which these thresholds would be reached is based on the practical spreading loss model as described by Thomsen et al. (2006).

Marine Mammal Underwater Noise Impact Thresholds

NMFS currently provides regulatory acoustic thresholds for assessing the effects of noise exposure on marine mammal hearing from impulsive (impact) and nonimpulsive (vibratory) pile driving or other noise sources (Table 3) (National Oceanic and Atmospheric Administration 2016). These thresholds represent peak and cumulative sound energy levels that may cause a permanent threshold shift (PTS), a physical injury that results in reduced hearing sensitivity, in the hearing of five functional hearing groups of marine mammals.

Table 3. Underwater Sound Level Effect Thresholds for Permanent Threshold Shift Auditory Injury to Marine Mammals

	Permanent Threshold Shift Onset Acoustic Thresholds (Received Level)	
Hearing Group	**Impulsive**	**Nonimpulsive**
Low-frequency cetaceans	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$:199 dB
Mid-frequency cetaceans	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-frequency cetaceans	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$:155 dB	$L_{E,HF,24h}$: 173 dB
Phocid pinnipeds (underwater)	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$:185 dB	$L_{E,PW,24h}$: 201 dB
Otariid pinnipeds (underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

Source: National Oceanic and Atmospheric Administration 2016

$L_{pk,flat}$ = Peak Sound Pressure Level (unweighted); $L_{E,24h}$ = Sound Exposure Level, Cumulative 24 hour; LF = Low Frequency; MF = Mid Frequency; HF = High Frequency; PW = Phocids in Water; OW = Otariids in Water

While the recent NMFS technical guidance on underwater noise impacts on marine mammals (National Oceanic and Atmospheric Administration 2016) provides guidance on injury impacts of noise on marine mammals, it does not provide revised guidance on noise impacts on behavior of marine mammals. Table 4 provides NMFS's interim sound threshold guidance for the potential onset of behavioral disturbance or harassment to marine mammals from nonimpulsive (vibratory) and impulsive (impact) pile driving.

Table 4. NMFS Underwater Sound Level Effect Thresholds for Behavioral Disturbance to Marine Mammals

Sound Source	Effect Threshold
Nonimpulsive	120 dB_{RMS}
Impulsive	160 dB_{RMS}

Source: National Oceanic and Atmospheric Administration Undated

dB_{RMS} = decibel root mean square

Because there is an extremely low probability of cetaceans (e.g. whales, and dolphins) using the study area, they are not assessed for underwater sound impacts of the Proposed Action. Pinnipeds (e.g., seals and sea lions) may be found in the aquatic study area during construction.

Diving Bird Underwater Noise Impact Thresholds

USFWS has established underwater noise level thresholds for behavioral change, auditory injury, and nonauditory injury (barotrauma) to the federally listed marbled murrelet (U.S. Fish and Wildlife Service 2011) (Table 5). The underwater effect threshold for behavioral disturbance is 150 decibels root mean square (dB_{RMS}); auditory injury is 202 decibels sound exposure level (dB_{SEL}); and nonauditory injury is 208 dB_{SEL}. Underwater noise below 150 dB_{SEL} does not cause injury and is recognized by USFWS as effectively quiet (Washington State Department of Transportation 2015).

While marbled murrelets are not found in the study area, the underwater noise thresholds provide some guidance on potential underwater noise impacts that could be useful for other diving birds in the study area. In the absence of any federal or state agency criteria for underwater noise impacts on diving birds, these marbled murrelet criteria were used to establish distances at which underwater noise due to impact pile driving may affect all diving birds in the aquatic study area. No vibratory pile-driving thresholds have been identified for marbled murrelet or other diving birds.

Table 5. USFWS Underwater Sound Level Effect Thresholds for Marbled Murrelets.

Effect Type	Effect Threshold
Behavioral disturbance	150 dB_{RMS}
Auditory injury	202 dB_{SEL}
Nonauditory injury (barotrauma)	208 dB_{SEL}

Source: U.S. Fish and Wildlife Service 2011
dB_{RMS} = decibel root mean square; dB_{SEL} = decibel sound exposure level

Underwater Noise Assessment Methods

The distance at which underwater noise is reduced to the noise level thresholds presented in Tables 3, 4 and 5 is calculated using the model currently preferred by USFWS and NMFS; the practical spreading loss model described by Thomsen et al. (2006). Up to four piles would be driven per day over an 8-hour period. Pile-driving duration and sound source levels measured during construction activities similar to those described for the Proposed Action (Table 6) provide the basis for calculating the distance at which construction-related noise no longer reaches the marine mammal and marbled murrelet noise impact thresholds. Sound attenuation devices would be used during impact pile driving and are predicted to reduce sound levels by up to 9 dB (Table 6) (Grette Associates 2014a). Attenuated sound levels are used in the calculation of the underwater distances at which murrelets and marine mammals may be affected. The calculated distances are presented in Section 3.1.1, *Construction: Direct Impacts*.

Table 6. Pile-Driving Duration (single pile) and Underwater Sound Source Levels (single strike) Used in Determining Acoustic Impacts

				Unattenuated[a]			Attenuated		
Pile-Driving Method	**Strikes**	**Minutes**	**Hours**	**dB_{peak}**	**dB_{RMS}**	**dB_{SEL}**	**dB_{peak}**	**dB_{RMS}**	**dB_{SEL}**
Vibratory driving	n/a	20	.3	n/a	181	n/a	n/a	n/a	n/a
Impact driving, per pile (including proofing if needed)	4030	120	2	217	201	185	208	192	176

Source: Grette Associates 2014a
Notes:
[a] All sound levels measures 10 meters from source
dB_{PEAK} = peak sound pressure; dB_{RMS} = decibel root mean square; dB_{SEL} = decibel sound exposure level

2.2 Existing Conditions

The existing environmental conditions related to wildlife in each study area are described below.

2.2.1 Terrestrial Habitat

Terrestrial habitats in the terrestrial direct impact study area are characterized by their main land cover classification and dominant form of vegetation and are described in the SEPA Vegetation Technical Report (ICF 2017b). Habitat types in the terrestrial direct impact study area include developed (disturbed), upland (forested, scrub-shrub, herbaceous, managed herbaceous, and riparian), and wetland (forested, scrub-shrub, and emergent).

Developed land includes areas where the majority of vegetation has been removed and replaced with pavement, buildings, or infrastructure associated with existing and historical industrial, agricultural, and recreational uses. Occasionally, scattered vegetation is present and typically consists of nonnative grasses, forbs, and shrubs. There is one vegetation type, disturbed, categorized in the developed areas.

Uplands include areas landward of the Columbia River levee with undeveloped vegetated areas that do not exhibit wetland characteristics. Vegetation within the uplands is categorized as forested, scrub-shrub, herbaceous, and managed herbaceous.

Wetlands include areas that exhibit the diagnostic wetland characteristics required by state and federal wetland delineation manuals (hydrophytic vegetation, hydric soils, and wetland hydrology). Wetland mapping and classifications were taken directly from the wetland delineation and determination work completed for the project area by Grette Associates (2014b, c, d, e,). Vegetation in the wetlands is categorized as forested, scrub-shrub, and emergent.

Riparian lands are uplands that include the areas along the shoreline of the Columbia River between the ordinary high water mark and the top of the Columbia River levee. Vegetation is categorized as forested, scrub-shrub, and herbaceous.

2.2.1.1 Project Area

The project area comprises a disturbed industrial site developed with roads and industrial buildings and relatively small and fragmented vegetated areas primarily in the western portion of the project area. Many of the surrounding areas are also highly disturbed. Of the undeveloped habitat areas on the project area, many are small and fragmented from other similar habitat patches. The largest contiguous areas of habitat are located on the west side of the project area and include an herbaceous wetland dominated by reed canarygrass and a forested wetland dominated by deciduous trees with an understory of shrubs and reed canarygrass. The highest quality habitat on the project area is a small forested area surrounding parallel drainage ditches, located in the southwest portion of the site. The habitat is characterized by deciduous trees along the banks of the ditches and abundant understory vegetation. In general, suitable wildlife habitat on the project area is degraded because of past industrial uses on the property. The patches of suitable habitat support foraging and cover for small to large mammals, foraging and nesting for birds, including waterfowl, raptors, and passerine birds, and foraging, breeding, and nesting for amphibians (Grette Associates 2014b, c, d, f).

2.2.1.2 Study Area

The project area for the Proposed Action is located along the north side of the Columbia River at river mile 63, within unincorporated Cowlitz County and adjacent to the City of Longview. In general, areas to the north-northeast and around to the southeast of the project area (in a clockwise direction) are already heavily developed by industrial, commercial, and residential land uses. These uses extend to the Cowlitz River and down along the Columbia River. Immediately upstream of the project area, the heavily developed shoreline lacks suitable habitat and wildlife species are not present. Because the project area is at the western edge of this development, wildlife dispersal or movement through the project area are unlikely because there is no suitable habitat in these developed areas for wildlife to disperse or move into. Existing conditions impede wildlife movement toward the City of Longview (upstream of the project area). Immediately downstream of the project area are uplands, wetlands, and riparian habitats, as well as disturbed areas. Habitat conditions for wildlife are less disturbed than in the project area. Immediately north of the project area is a triangular area of the Applicant's leased area bordered by Industrial Way to the south and Consolidated Diking Improvement District (CDID) #1 drainage ditches to the east and west. The habitat likely supports foraging and cover for small to large mammals (e.g., voles to deer); foraging and nesting for a variety of birds; and foraging, breeding, and refuge for amphibians and reptiles.

The terrestrial direct impact study area includes land both up- and down-stream of the project area, land north of Industrial Way, a strip of land between the project area and Columbia River, and a small portion of Lord Island (Figure 3). Upstream land is predominantly disturbed with heavy industrial development and wildlife is not present due to the lack of suitable habitat.

Predominant habitat types in the downstream portion of the terrestrial direct impact study area include disturbed areas, herbaceous and managed herbaceous upland habitats, herbaceous and managed herbaceous wetland habitats, and scrub-shrub or forested riparian habitat. Habitat support for wildlife is similar to that described for the project area and includes foraging and cover for small to large mammals, foraging and nesting for waterfowl, raptors, and passerine birds, and foraging, breeding, and nesting for amphibians.

North of Industrial Way, the landscape can be generally separated into three similar habitat areas that are separated by Consolidated Diking and Improvement District (CDID) #1 drainage ditches (Figure 3). To the northwest is Mount Solo, a forested ridge that is covered with a large area of contiguous native forest intermixed with rural residential areas and some light industrial uses. Smaller areas of scrub-shrub and managed herbaceous habitats are interspersed with the developed areas. Mount Solo is the largest contiguous forested upland habitat within 2 miles of the project area, and as such, is likely to support a greater diversity of wildlife—including small to large mammals, bird species (passerine, raptor, and owl), lizards, and snakes—than habitats on the project area.

Adjacent to the project area along the north side of Industrial Way is a triangular area bounded by CDID drainage ditches to the east and west. This area primarily contains herbaceous wetland habitat dominated by reed canarygrass. Other habitats, including forested and scrub-shrub wetlands and uplands (forested, scrub-shrub, and herbaceous) are small and isolated from other similar habitat types. A small portion of the site is disturbed. The habitat likely supports foraging and cover for small to large mammals; foraging and nesting for waterfowl, raptors, and passerine birds; and foraging, breeding, and refuge for amphibians and reptiles. Land to the east is largely disturbed by the Mint Farm Industrial Park, with few small areas of herbaceous or scrub-shrub habitat.

South of the project area, the terrestrial direct impact study area consists of a levee with managed herbaceous vegetation and riparian shoreline bordering the Columbia River. The riparian area is primarily forested and scrub-shrub habitat and likely provides foraging and cover for small and large mammals, foraging and nesting for passerine, waterfowl and raptor bird species, and foraging, breeding, and refuge for amphibians (Grette Associates 2014c).

A small portion of Lord Island is located in the terrestrial direct impact study area and is approximately 0.5 mile south of the project area. The island is located within the Columbia River and was previously used for dredged material disposal. Lord Island is primarily forested and connects downstream to Walker Island by a narrow band of sand. An embayment between the two islands contains a tidal marsh and shallows. This area provides foraging and resting habitat for waterfowl and has been previously documented as supporting significant numbers of wintering ducks and geese (Pacific Coast Joint Venture 1994). With the exception of several transmission towers, the island is undeveloped and contains wildlife habitat. Lord Island could support Columbia white tailed deer; however, no occurrences have been documented on the island (Washington Department of Fish and Wildlife 2014). Additional wildlife species supported by Lord Island include small mammals, birds (raptors and passerine), amphibians, and reptiles.

The study area for indirect impacts on terrestrial species and habitats along the rail corridors in Washington State consists of many habitat types, which broadly include lowland and montane forests, sagebrush prairie, and shrub-steppe. Various species of wildlife are associated with each of these terrestrial habitats.

2.2.2 Aquatic Habitat

The aquatic direct impact study area includes the Columbia River smaller areas of open water, including various surface and stormwater ditches and ponds, and wetlands throughout the project area created by the excavation of dredged materials in 2006. Ditches include those maintained by CDID #1 and privately owned stormwater ditches.

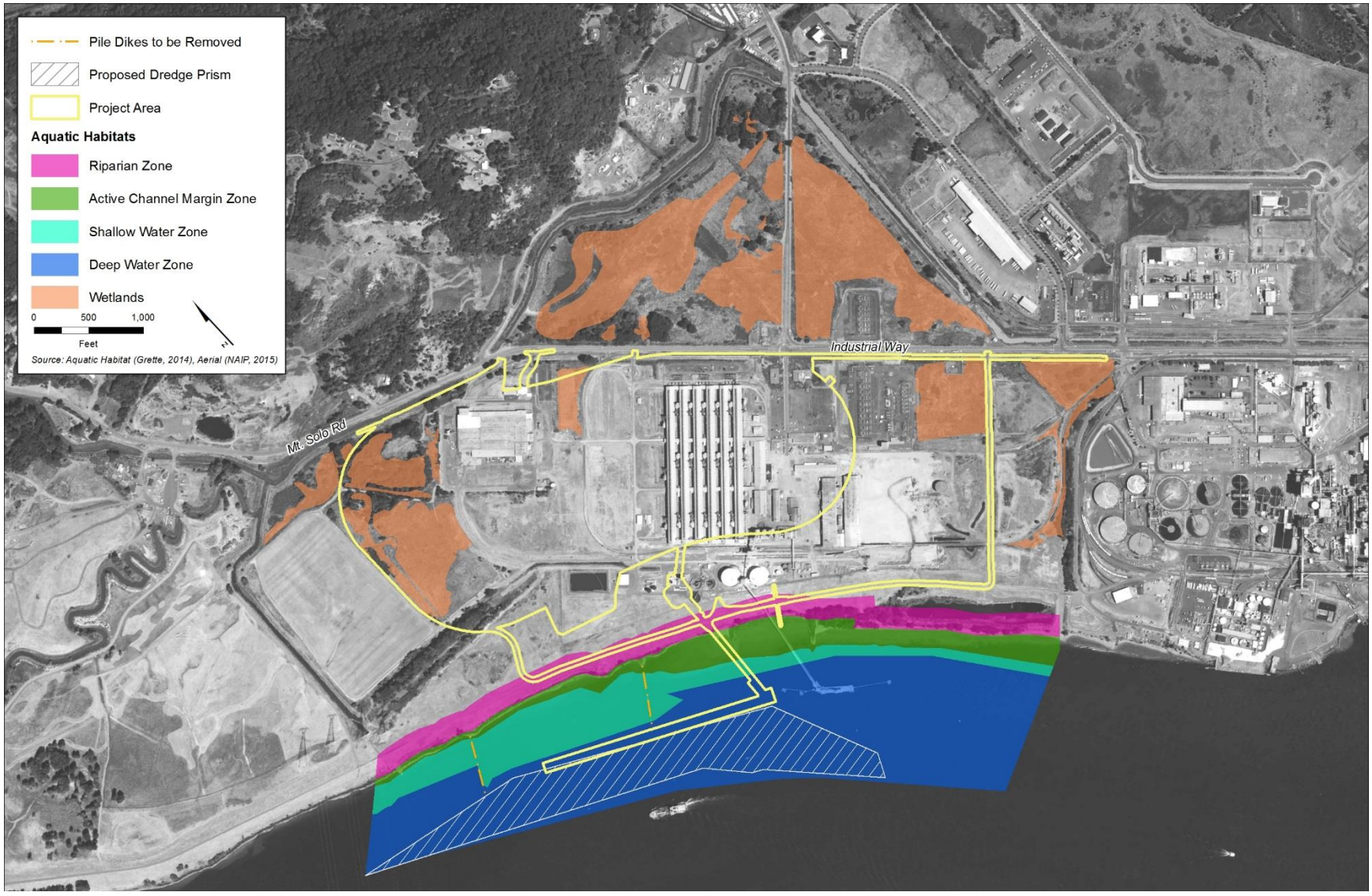
Aquatic habitat types in the Columbia River in the aquatic direct impact study area that could be affected by Proposed Action-related dredging and docks include the deepwater zone (deeper than -20 feet Columbia River Datum [CRD]), shallow-water zone (0 to -20 feet CRD), and the active channel margin (0 to +11.1 feet CRD) (Grette Associates 2014g).

The active channel margin includes the shoreline and nearshore edge habitat extending waterward from the ordinary high water mark of +11.1 feet CRD to 0 feet CRD. In general, the shoreline adjacent to the aquatic direct impact study area is sparsely vegetated and consists of sandy substrate with little organic matter (Grette Associates 2014h). The shoreline is highly modified by extensive dikes and riprap armoring with scattered large woody debris, bordered by the riparian zone.

The bottom structure of the shallow water zone consists primarily (90%) of flat or shallow sloping substrate, with some moderate slopes out to depths of about -20 feet CRD where the habitat becomes markedly steeper. There are two pile dikes and one overwater dock that extend into the shallow water zone (Figure 4). The substrates in the aquatic habitats consist primarily of silty river sand with little organic matter. Little to no aquatic vegetation is expected in the shallow water zone, however, sparse vegetation could exist in the upper elevations where light could penetrate, and flow is reduced. Conditions in the shallow-water portion of the in-water footprint are narrow and more

steeply sloped than the active channel margin and are, therefore, unlikely to support aquatic vegetation (Grette Associates 2014h).

Figure 4. Aquatic Habitats



Benthic habitats in the deepwater zone are subjected to strong currents and reduced light penetration. Aquatic vegetation is not expected to occur in the deepwater zone and these areas are generally associated with low productivity.

Aquatic habitats of the Columbia River support pinnipeds, fish, birds, and a variety of invertebrates, many of which serve as forage for fish and bird species. Fish are discussed in the SEPA Fish Technical Report (ICF 2017a). Smaller freshwater areas in the aquatic direct impact study area, such as ponds and ditches, could support common species of invertebrates and amphibians and could be used by small mammals and birds.

Habitat in the aquatic indirect impact study area includes the open water of the Columbia River from the project area to the river mouth that vessels use where marine mammals could be affected by vessel traffic. Marine mammals that may be found along the vessel route include sea lions and seals, as described below in Section 3.1.3, *Operations: Direct Impacts*. The aquatic habitats along the navigation channel are deepwater habitats that are regularly dredged to depths for safe vessel passage.

2.2.3 Wildlife

Wildlife species includes terrestrial and marine mammals, birds, reptiles, amphibians, and invertebrates, including species that are currently protected or proposed for protection under the federal Endangered Species Act (ESA) or other federal and state regulations. Fish are discussed in the SEPA Fish Technical Report (ICF 2017a).

Based on the data sources described in Section 2.1.1, *Data Sources*, wildlife species likely to be found in the direct terrestrial impact study area include common species of birds, rodents, amphibians, reptiles, and invertebrates. Larger and highly mobile species of mammals that are habituated to developed environments may also be present in the study area, including coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and deer (*Odocoileus* sp.).

Wildlife species likely to be found in the aquatic direct impact study areas include common species of birds (waterfowl, raptors, shorebirds, marine birds, and passerine birds), California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*), rodents, frogs, salamanders, snakes, lizards, and invertebrates.

Representative wildlife in the terrestrial indirect impact study area in Cowlitz County may include black-tailed deer, red fox, coyote, raccoon, striped skunk, beaver, Oregon and grey-tailed vole, red-tailed hawk, Cooper's hawk, Canada geese, mallard and northern pintail ducks, great blue heron, white-breasted nuthatch, chipping sparrow, and a variety of amphibians and reptiles (Commission for Environmental Cooperation 2011). A review of PHS data (Washington Department of Fish and Wildlife 2015a) for terrestrial habitats indicates small areas of oak woodlands in a few places along the rail line; species associated with this habitat include various woodpeckers, migrant birds, reptiles, invertebrates, and the western gray squirrel (Washington Department of Fish and Wildlife 1998). In addition, two osprey point locations are mapped within 300 feet of the rail line (Washington Department of Fish and Wildlife 2015a). No designated critical habitat for federally protected species under USFWS jurisdiction is mapped in the terrestrial environment near the rail line corridor(s) that would be used to transport coal in Cowlitz County. Beyond Cowlitz County, several ecoregions are found between the county and the Washington border, each with various representative wildlife species. These could include mule deer, pronghorn antelope, coyote, black-

tailed jackrabbit, ground squirrels, American kestrel, red-tailed hawk, western meadowlark, savanna sparrow, western diamondback rattlesnake, greater sage-grouse, sage sparrows, sage thrashers, pygmy rabbits, black-tailed deer, black bear, beaver, river otter, pileated woodpecker, northern goshawk, cougar, wolverine, yellow bellied marmot, bald and golden eagles, Cooper's hawk, and osprey, in addition to many other birds, mammals, reptiles, and insects (Commission for Environmental Cooperation 2011). The largest ecoregion has dry desert and steppe climates, marked by hot, dry summers and cold winters, and consists of shrub-steppe vegetation communities. Shrub-steppe communities can also support federally protected species, including the pygmy rabbit and Spalding's catchfly. WDFW considers shrub-steppe a priority habitat under the PHS program. PHS data (Washington Department of Fish and Wildlife 2015a) also indicate various priority habitats and species along the rail line study area beyond Cowlitz County, including talus slope and cliffs/bluffs habitats, bald eagle concentrations and breeding areas, and western pond turtle regular occurrence areas.

2.2.3.1 Site Visit Observations

During the December site visit, two Columbian black-tailed deer (*Odocoileus hemionus columbianus*) were observed in the forested wetland area (Wetland A) in the northwest portion of project area, and two nutrias (*Myocastor coypus*) were observed on the sloped bank of the CDID Ditch 10, on the north side of Industrial Way. Other signs of mammal presence were observed during both site visits, including several unidentified small mammal scats, a coyote scat along the dike road, a beaver (*Castor canadensis*)-chewed tree in the riparian habitat along the Columbia River, and an unidentified species of sea lion heard barking from the Columbia River channel.

Several common bird species were recorded in the terrestrial direct impact study area during the site visits, including red-winged blackbird (*Agelaius phoeniceus*), sparrows (*sp*.), robins (*Turdus migratoius*) and other songbirds, American coot (*Fulica Americana*), bufflehead (*Bucephala albeola*), mallards (*Anas platyrhnchos*) and other unidentified ducks, Canada geese (*Branta Canadensis*), cormorants (*sp*.), scaup (*sp*.), gulls (*sp*.), and great blue heron (*Ardea herodias*). A turkey vulture (*Cathartes aura*), red-tailed hawk, kestrel (*Falco sparverius*), and bald eagle (*Haliaeetus leucocephalus*) were observed flying overhead. During the December 2014 site visit, a small flock of Canada geese were observed grazing on wetland grasses in the project area, and several unoccupied raptor nests were observed in the forested habitat adjacent to the stormwater ditches on the southwest side of the project area and in an electrical tower near the west side of the dike road.

Grette Associates biologists conducted surveys for the federally threatened and state endangered streaked horned lark during the breeding season in 2013 (July 12, 2013) and 2014 (May 15, June 11, and July 10, 2014). The focus of these surveys was to detect the presence of streaked horned lark; however, other bird species were recorded during the surveys (Table 7). A few of the bird species recorded during these surveys are also special-status species, which are addressed in more detail in Section 2.2.3.2, *Special-Status Wildlife Species*. Surveys were conducted in all areas of suitable streaked horned lark breeding habitat on the west side of the project area and immediately adjacent land (Grette Associates 2014i). Streaked horned lark are discussed further in Section 2.2.3.2, *Special-Status Wildlife Species*.

Table 7. Bird Species Observed at Project Area during 2013–2014 Surveys

Common Name	Scientific Name
Osprey	*Pandion haliaetus*
Red-tailed hawk	*Buteo jamaicensis*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Great blue heron	*Ardea Herodias*
Canada goose	*Branta Canadensis*
Mallard	*Anas platyrhynchus*
Turkey vulture	*Cathartes aura*
Killdeer	*Charadrius vociferous*
Sandpiper	Scolopacidae
Common raven	*Corvus corax*
American crow	*Corvus brachyrhynchos*
Brewer's blackbird	*Euphagus cyanocephalus*
Red-winged blackbird	*Agelaius phoeniceus*
American robin	*Turdus migratorius*
European starling	*Sturnus vulgaris*
Lesser goldfinch	*Carduelis psaltria*
American goldfinch	*Spinus tristis*
Common yellowthroat	*Geothlypis trichas*
White-crowned sparrow	*Zonotrichia leucocephalus*
Savannah sparrow	*Passerculus sandwicensis*
Vesper sparrow	*Pooecetes gramineus*
Song sparrow	*Melospiza melodia*
Mourning dove	*Zenaida macroura*
Rock dove	*Columba livia*
Barn swallow	*Hirundo rustica*
Violet-green swallow	*Tachycineta thalassina*
Tree swallow	*Tachycineta bicolor*
Cliff swallow	*Petrochelidon pyrrhonota*
Western bluebird	*Sialia Mexicana*
Swainson's thrush	*Catharus ustulatus*
Purple martin	*Progne subis*
Black phoebe	*Sayornis nigricans*

Notes:
Source: Grette Associates 2014h, i

Three species of pinnipeds could be present in the aquatic study areas: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and Steller sea lion (*Eumetopias jubatus*) (Jeffries et al. 2000). Because these marine mammals are all protected under the MMPA, they are described in more detail in Section 2.2.3.2, *Special-Status Wildlife Species*. Various bird species, including waterfowl, raptors, and shorebirds are supported by habitats in the aquatic study areas. Freshwater insects and other invertebrate species (i.e., mollusks, crayfish) inhabit the upper layers of the

benthos and provide forage for many species of fish and birds. Fish and their habitats, are discussed in the SEPA Fish Technical Report (ICF 2017a).

2.2.3.2 Special-Status Wildlife Species

Special-status wildlife species are those listed as threatened, endangered, proposed, or candidate species under the ESA or listed as a WDFW priority species.

Table 8 provides a list of special-status wildlife species that are likely to occur in the terrestrial direct impact study area or aquatic study areas. Some of the PHS listings are not for individuals of a species (PHS Criteria 1) but for vulnerable aggregations (PHS Criteria 2) of individuals, such as Western Washington nonbreeding concentrations. The likelihood of each species or vulnerable aggregation occurring in the terrestrial or aquatic study areas is listed as either *Yes* (known to occur), *Possibly* (likely to occur due to presence of suitable habitat but not documented), or *Unlikely* (individuals could occur in the study area but vulnerable aggregations are not documented in the PHS database) (Washington Department of Fish and Wildlife 2014). A listing of *No* does not mean individuals of that species could not occur in the terrestrial direct impact study area or aquatic study areas, it only signifies there are no documented vulnerable aggregations (the potential for individuals to occur in the terrestrial or aquatic study areas is provided in parenthesis).

A complete list of all special status species that could occur in Cowlitz County is located in Appendix A, *Special-Status Wildlife Species in Cowlitz County,* including species that do not occur or are unlikely to occur in the terrestrial direct impact study area or aquatic study areas.

Table 8. Special-Status Wildlife Species that Could Occur in the Study Area

Wildlife Species	Potential for Occurrence[a]	Potential Habitat	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Mammals					
Columbian black-tailed deer (*Odocoileus hemionus columbianus*)	Yes	Species documented on project area. Limited habitat on project area. May use forested portions of terrestrial study area.	3	N/A	N/A
Columbian white-tailed deer (*Odocoilieus virginianus leucurus*)	Yes	Species documented on project area.[e] Limited forage and cover on project area. Suitable habitat available on Lord Island.	1	T	E
Harbor seal (*Phoca vitulina*)	Yes	Present in Columbia River	2	N/A	N/A
California sea lion (*Zalophus californianus*)	Yes	Present in Columbia River	2	N/A	N/A
Stellar Sea lion (*Eumetopias jubatus*)	Yes	Present in Columbia River	1, 2	SC	T

Wildlife Species	Potential for Occurrence[a]	Potential Habitat	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Birds					
Streaked horned lark (*Eremophila alpestris strigata*)	Possibly	Not documented during surveys on project area. Potential suitable habitat on Lord Island.	1	T	E
Bald eagle (*Haliaeetus leucocephalus*)	Yes	Forested wetlands could provide roosting habitat. Suitable habitat on Lord Island.	1	SC	S
Peregrine falcon (*Falco peregrinus*)	Possibly	Potential foraging habitat	1	SC	S
Barrows Goldeneye (*Bucephala islandica*)	Possibly (Nonbreeding Concentrations Unlikely)	Open water	2, 3	N/A	N/A
Common Goldeneye (*Bucephala clangula*)	Possibly (Nonbreeding concentrations Unlikely[f])	Open water	2, 3	N/A	N/A
Bufflehead (*Bucephala albeola*)	Yes (Nonbreeding Concentrations Unlikely[f])	Open water	2, 3	N/A	N/A
Waterfowl concentrations	Yes	Suitable habitat documented in terrestrial and aquatic study areas.	2, 3	N/A	N/A
Vaux's swift (*Chaetura vauxi*)	Possibly	No large snags for nesting or roosting identified on project area but possible in terrestrial study area.	1	N/A	C
Pileated woodpecker (*Dryocopus pileatus*)	Possibly	Possible in forested habitat.	1	N/A	C
Purple martin (*Progne subis*)	Yes	Species documented in terrestrial study area, possible foraging habitat.	1	N/A	C

Notes:

[a] Potential for individuals to occur based on multiple sources, including PHS data, scientific literature, and agency documents; Potential for vulnerable aggregations based on PHS data only.

[b] State PHS Species Criteria
1 – State-listed or candidate species
2 – Vulnerable aggregation
3 – commercial, recreational, or tribal importance

[c] Federal Status under the U.S. Endangered Species Act
E = Endangered
T = Threatened
SC = Species of Concern

[d] State Status
E = Endangered

Wildlife Species	Potential for Occurrence[a]	Potential Habitat	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
T = Threatened C = Candidate S = Sensitive					
[e] Grette Associates 2014h					
[f] Western Washington Nonbreeding Concentrations					
[g] Willapa Hills Audubon Society 2014					

Terrestrial Mammals

Columbian White-Tailed Deer (*Odocoilieus virginianus leucurus*)

The Columbia River population of the Columbian white-tailed deer is a federally threatened and state endangered species. The Columbia River population is one of only two extant populations in the United States. The other, in Douglas County Oregon, was delisted by USFWS in 2003, when population recovery goals were attained. The Columbia River population inhabits the Lower Columbia River floodplain and islands within the river channel. The current range of the Columbian white-tailed deer overlaps with the terrestrial direct impact study area, including Barlow Point and Fisher, Walker, and Lord Islands (Washington Department of Fish and Wildlife 2013). The current population is estimated at 582 deer (Washington Department of Fish and Wildlife 2013).

WDFW has identified specific locations along the Columbia River for recovery (Washington Department of Fish and Wildlife 2013) of this population based on the availability of secure habitat. The nearest recovery location to the project area is the upper estuary islands downstream of Longview (Figure 3), which includes Fisher, Hump, Lord, and Walker Islands (Washington Department of Fish and Wildlife 2013). Lord Island is approximately 0.5 mile from the project area and is visible from and directly across the Columbia River channel. Although 66 Columbian white-tailed deer have been translocated to these islands to date, WDFW estimates the population on these four islands totals only 10 deer (Washington Department of Fish and Wildlife 2013).

Historically, the Columbia River population has inhabited the river bottomlands, where riparian habitat dominated by Sitka spruce, alder, cottonwood, and willow provided a desirable mix of cover and forage (U.S. Fish and Wildlife Service 1983). The Columbia River floodplain has been drastically altered from historic times, with diking, road building, and conversion of forestlands to pasturelands among the most prominent changes. Although deer will forage in maintained pastures (U.S. Fish and Wildlife Service 1983), studies on the Julia Butler Hanson National Wildlife Refuge in the 1970s show that deer preferred to forage where vegetation was over 70 centimeters high and rarely foraged greater than 250 meters from woodland cover (U.S. Fish and Wildlife Service 1983).

Because of its proximity to the upper estuary islands and Barlow Point, portions of the terrestrial direct impact study area could be occupied by the upper estuary islands subpopulation of Columbia River Columbian white-tailed deer. On the project area, cover habitat is limited to the forested wetland in the northwest portion of the site. Industrial Way separates this forested patch from other cover habitat within the terrestrial direct impact study area located further north. Most of the "forage" habitat on the project area and within the terrestrial direct impact study area consists of managed herbaceous habitat, where mowed grasses are less than 70 centimeters high. In spite of this, Columbian white-tailed deer have been observed on the project area (Grette Associates 2014h).

While the project area does not provide optimal habitat conditions, the presence of white-tailed deer on the site has been documented. Occurrences within the terrestrial direct impact study area have been documented in the PHS database (Washington Department of Fish and Wildlife 2014).

Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*)

Unlike the endangered Columbian white-tailed deer that inhabit the river bottoms, Columbian black-tailed deer use upland slopes and closed-canopy coniferous forests. They require a mix of forest and openings for cover and forage, and browse on common shrubs and trees such as vine maple, red alder, and serviceberry (Washington Department of Fish and Wildlife 2014). Columbian black-tailed deer have been observed on the project area. The high level of human activity on the site, lack of well-distributed cover and forage areas, and general lack of preferred habitat (coniferous forest with brushy openings), indicate that the site could be used for travel, migration, and resting, but is not suitable for supporting a black-tailed deer population. The nearest black-tailed deer population documented by WDFW (as cited in Grette Associates 2014h) is 10 miles from the project area.

Birds

Streaked Horned Lark (*Eremophila alpestris strigata*)

The streaked horned lark is a federally threatened and state endangered species. The Pacific Northwest subspecies was once widespread throughout western Washington, Oregon, and British Columbia. Due primarily to habitat loss, this subspecies now breeds and winters over a fraction of its former range. USFWS estimated the overall population of streaked horned larks between 1,170 and 1,610 individuals, and listed the species as threatened on October 3, 2013 (U.S. Fish and Wildlife Service 2012, 2013).

The breeding range for this species historically ranged from southern British Columbia south through the Puget lowlands; Washington Coast; Lower Columbia River, Willamette, Rogue and Umpqua River valleys; and the Oregon Coast (U.S. Fish and Wildlife Service 2012). The streaked horned lark has been eliminated as a breeding species from at least half of that range. It is no longer found in southern British Columbia, the San Juan Islands, the northern Puget Trough, the Washington coast north of Grays Harbor, the Oregon coast, and the Rogue and Umpqua River valleys in Oregon (Pearson and Altman 2005; U.S. Fish and Wildlife Service 2012).

Historic breeding range consisted primarily of prairie and open coastal habitats (Pearson and Altman 2005). Over the past 150 years, prairie lands in Washington and Oregon have declined by 90% to 95% (U.S. Fish and Wildlife Service 2012). Streaked horned larks are now found nesting in both traditional and some nontraditional habitats, including agricultural fields, wetland mudflats, Christmas tree farms, gravel roads, airports, and dredge deposition sites in the Lower Columbia River (U.S. Fish and Wildlife Service 2012; Pearson and Altman 2005). Active establishment of territories and breeding occurs from late March until early August. During this time, streaked horned larks are susceptible to human activities that can jeopardize successful nesting. Human activities can disturb larks by causing them to become alert, fly, or directly destroy their nests. These activities include moving vehicles, gatherings of people and/or vehicles, fireworks, dog walking, flying model airplanes, construction activities, and mowing. Disruptive activities that keep larks away from their nests for more than one hour could result in nest abandonment. In general, activities occurring within approximately 100 feet (30 meters) are more likely to cause larks to flush than activities located farther away (Pearson and Altman 2005).

Streaked horned larks prefer wide-open spaces characterized by flat, treeless landscapes of 300 acres or more, sparse grass/forb vegetation, and few or no shrubs. They will use smaller habitat patches if there is an adjacent open landscape, such as agricultural fields or water (U.S. Fish and Wildlife Service 2012). In the Lower Columbia River, they were historically known to nest on sandy beaches and spits. Now, they can be found nesting on dredge spoil depositions, which provide the open expanses of bare ground preferred by this species. In the project area and the broader terrestrial direct impact study area, a few small areas containing potentially suitable habitat (low vegetative cover and no woody vegetation) are adjacent to the Columbia River: the closed Reynolds landfill and edges of roadbeds. These areas are regularly disturbed by maintenance (mowing) and operations (Grette Associates 2014h, 2014i).

Adult streaked horned larks feed mainly on grass and weed seeds, but could feed insects to their young (U.S. Fish and Wildlife Service 2012). They typically establish nests in areas of extensive bare ground next to a clump of bunchgrass (U.S. Fish and Wildlife Service 2012). Habitat within the terrestrial direct impact study area contains extensive areas of short (mowed) grass and forb vegetation, but relatively little bare ground and even less undisturbed vegetation as most of the grass/forb areas are maintained by mowing.

All critical habitat areas in the Lower Columbia River are downstream from the project area, with the exception of one area upriver. The closest designated critical habitat is on Crims Island, approximately 5 miles downstream of the project area. The only critical habitat upstream of the project area is on Sandy Island, Columbia County, Oregon at river mile 76, approximately 13 miles upriver (U.S. Fish and Wildlife Service 2012).

Grette Associates biologists conducted surveys for streaked horned larks in the project area during the breeding season in 2013 (July 12, 2013) and 2014 (May 15, June 11, and July 10, 2014). The surveys were conducted within the open, grassy areas that most closely resemble streaked horned lark habitat onsite. No streaked horned larks were observed during the surveys (Grette Associates 2014h, i). Standardized monitoring protocols were developed by WDFW for streaked horned larks, which require surveys on 3 separate days during the breeding season (Washington Department of Fish and Wildlife 2013).

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles nest and forage for fish along the Lower Columbia River. They build their nests in the tops of large trees, typically using the nests year after year. Nests could weigh up to 0.5 ton and span 10 feet in diameter (U.S. Fish and Wildlife Service 2007). There are no documented bald eagle nests in the terrestrial direct impact study area and no suitable nesting habitat exists on the project area. The nearest documented nest sites are located approximately 2 miles downstream and 4 miles upstream of the project area (Washington Department of Fish and Wildlife 2014). The terrestrial direct impact study area provides foraging habitat for this species. Bald eagles could perch in riparian vegetation or manmade structures over the water to forage for fish. Salmon and other fish within the Columbia River provide an important source of food for this species. Lord Island also provides suitable habitat that could be used by bald eagles (Pacific Coast Joint Venture 1994).

Bald eagles were observed soaring over the terrestrial direct impact study area during the April 8, 2014 site visit. Bald eagles were also observed in the terrestrial direct impact study area during the July 12, 2013 streaked horned lark surveys (Grette Associates 2014h).

Peregrine Falcon (*Falco peregrinus*)

Peregrine falcons nest on cliff ledges but also use tall manmade structures such as bridges, overpasses, buildings, and power plants (Oregon Department of Transportation undated). They prey primarily on other birds, including songbirds, shorebirds, ducks, pigeons, and starlings (Washington Department of Fish and Wildlife 2013). The nearest documented nest location is approximately 3 miles south of the project area (Washington Department of Fish and Wildlife 2014). A study of peregrines nesting in quarries in Ireland found that peregrines will use industrial areas if nesting requirements are met and sufficient prey is available (Moore et al. 1997). Peregrine falcons nesting within a few miles of the project area could use the study area for foraging.

Waterfowl

Nonbreeding concentrations of Barrows goldeneye (*Bucephala islandica*), common goldeneye (*B. clangula*), and bufflehead (*B. albeola*) are considered priority species (vulnerable aggregation) by WDFW. A few individual bufflehead were observed resting on open water (both in wetlands and on the Columbia River) in the terrestrial direct impact study area during the April 8, 2013 site visit. However, within the terrestrial direct impact study area there are no vulnerable concentrations of waterfowl documented by WDFW in the PHS database (Washington Department of Fish and Wildlife 2014). The nearest documented vulnerable concentration is located approximately 0.25 mile north of the terrestrial direct impact study area. Lord Island and adjoining Walker Island support waterfowl and suitable habitat is located just outside of the study area in the tidal marsh area between the islands south of the sand spit (Pacific Coast Joint Venture 1994). This area provides foraging and resting habitat for waterfowl and has been previously documented as supporting significant numbers of wintering ducks and geese (Pacific Coast Joint Venture 1994). Within the terrestrial direct impact study area (Figure 3), Lord Island is documented in the PHS database as supporting nesting Canada goose (Washington Department of Fish and Wildlife 2014).

Purple Martin (*Progne subis*)

The purple martin is a state-listed species of concern. Purple martins were observed on the project area during the streaked horned lark surveys in July 2013 (Grette Associates 2014h). Several nest sites are documented in the Coal Creek Slough, approximately 3 to 4 miles downstream of the study area (Washington Department of Fish and Wildlife 2014). Purple martin nest in natural cavities found in tree snags and crevices, as well as in artificial nest boxes and gourds provided by humans for this purpose (Washington Department of Fish and Wildlife 2014). Nesting habitat is unlikely on the project area; however, other forested areas in the terrestrial direct impact study area could contain this habitat. Purple martins forage for insects while in flight and individuals could occasionally use the terrestrial direct impact study area for this purpose. However, they are more likely to use areas such as Coal Creek Slough, where insect concentrations would be more abundant in herbaceous wetlands, forests, or marshes (Grette Associates 2014h).

Vaux's Swift (*Chaetura vauxi*)

The Vaux's swift is a state candidate species. They are summer (June to mid-August) residents in Washington, migrating north to Washington during the spring (April to late May) and south during the fall (mid-August to late September). They spend winters in central Mexico, Central America, and Venezuela. The species has a strong association with old-growth coniferous forests, using large hollowed-out trees and snags for nesting and roosting. They spend the majority of their day foraging in the air for flying insects over forests, grasslands, and aquatic habitats (Washington Department of

Fish and Wildlife 2013). There is no suitable nesting or roosting habitat on the project area; however, other forested areas in the terrestrial direct impact study area could contain suitable habitat. Vaux's swifts may fly through the terrestrial direct impact study area during migrations or while foraging. They are commonly observed at the Mint Farm (Willapa Hills Audubon Society 2014) east of the study area (Figure 3).

Pileated Woodpecker (*Dryocopus pileatus*)

Pileated woodpeckers inhabit mature deciduous or mixed deciduous-coniferous forests. They are also found in younger forests containing scattered, large, dead trees or decaying, downed wood, and in suburban areas containing large trees and woodland patches. Dead wood is an important component of their habitat, including snags, stumps, and downed logs. They forage for insects in the bark and use snags or dead branches of live trees for nesting (Cornell Lab of Ornithology 2015). There is no suitable nesting habitat in the project area. Limited foraging habit could be available in the forested areas onsite. Forested portions of the terrestrial direct impact study area could contain suitable habitat for nesting and foraging.

Marine Mammals

Pinnipeds

Three species of pinniped are found in the Lower Columbia River in the aquatic study areas: California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), and harbor seals (*Phoca vitulina*). Sea lions use the Lower Columbia River for foraging on fish and resting at haulout sites. Breeding areas (both mating rookeries and pupping sites) for California sea lions are located in California and Mexico. Only males are present in the Columbia River and primarily during the nonbreeding season, fall through spring (Jeffries et al. 2000). Steller sea lions in Washington come from rookeries in Oregon and British Columbia, but pupping sites have increased along the outer Washington Coast in recent years (Washington Department of Fish and Wildlife 2013). Breeding does not occur in the Columbia River, thus, Steller sea lions are primarily present during the nonbreeding season.

Since 2002, California and Steller sea lions have greatly increased in abundance below the Bonneville Dam, which is approximately 80 miles upstream of the study area. Migrating salmon and steelhead collect in a bottleneck below the dam, providing an abundant source of food for the sea lions (Washington Department of Fish and Wildlife 2013).

Sea lions use jetties, shoals, concrete slabs, rock rubble, marina floats, log booms, and other manmade structures as haulout sites along the Columbia River. Surveys conducted in the 1990s identified four haulout sites used by sea lions between the mouth of the Columbia River and its confluence with the Cowlitz River (Jeffries et al. 2000), which is approximately 4.5 miles upstream of the project area. There are no documented sea lion haulout sites in the aquatic direct impact study area, but individuals likely swim through the aquatic direct impact study area as they migrate up and down the Columbia River. The nearest California sea lion haulout site to the project area is near the mouth of the Cowlitz River (Washington Department of Fish and Wildlife 2014), approximately 1 mile upstream of the aquatic direct impact study area. The nearest Steller sea lion haulout site to the project area is approximately 48 miles downstream in the east mooring basin in Astoria, Oregon (Jeffries et al. 2000).

Harbor seals are the most numerous of the pinnipeds found in Washington waters. Like sea lions, they forage and rest along the Lower Columbia River, with dozens of haulout sites identified between the mouth of the river and the aquatic direct impact study area. Harbor seals use shoals, beaches, sandbars on islands, and the main shoreline as haulouts (Jeffries et al. 2000). There are no documented seal or sea lion haulout sites in the aquatic direct impact study area, but individuals swim through the aquatic direct impact study area as they migrate up and down the Columbia River. The nearest haulout site to the aquatic direct impact study area is approximately 1 mile upstream from the aquatic direct impact study area at Carroll Slough, near the confluence of the Columbia and Cowlitz Rivers (Washington Department of Fish and Wildlife 2014). Harbor seal breeding and pupping takes place in the Columbia River estuary and nursery areas are present downstream from the aquatic direct impact study area in Cathlamet Bay. Haulouts located further upriver are used primarily in the winter and spring (Jeffries et al. 2000).

Pinniped use and abundance in the aquatic direct impact study area is expected to vary seasonally as they transit between areas of known use at the mouth of the Columbia River, haulout sites upstream of the aquatic direct impact study area, and foraging areas farther upstream at the Bonneville Dam. For California sea lions, seasonal use is largely informed by the annual U.S. Army Corps of Engineers pinniped observation program at the Bonneville Dam during salmonid fish passage season (typically January through May, with some observations as early as August). This Corps program began in 2002 and is scheduled to end in 2016. California sea lions typically are not observed at the dam prior to January; they have been observed foraging below Bonneville Dam in very low numbers as early as August. Harbor seals are relatively rare at Bonneville Dam, but are known to haul out at a number of other locations upstream of the aquatic direct impact study area.

2.2.3.3 Rail and Vessel Corridors in Washington State

The indirect impact study area includes wildlife habitats along the railroad and vessel corridors in Washington State.

Rail Corridor

The BNSF main line rail corridor crosses diverse wildlife habitats in Washington State, including shrub-steppe, coniferous and deciduous forests, riparian forests, and agricultural lands. These habitats support a broad range of wildlife species, including reptiles, amphibians, small and large mammals, birds and insects. Several of these terrestrial wildlife species are listed as either threatened or endangered under the federal ESA. The existing conditions in the rail line study area are described for two areas: Cowlitz County and those portions of Washington State beyond Cowlitz County.

Cowlitz County

The terrestrial environment along the rail line includes a mix of natural habitats (forest, shrub, herbaceous upland), disturbed and developed areas (rural and urban areas), and agricultural areas. South of Longview and the confluence of the Cowlitz and Columbia Rivers, terrestrial vegetation and wildlife habitat conditions improve compared to the more industrial and urban character of the cities of Longview and Kelso. Here, there are some forested areas, wetlands, and ash mounds (associated with the eruption of Mount St. Helens in 1980 and subsequent dredging of the Cowlitz River to remove the mud and ash). South of the Kalama River near the town of Kalama, terrestrial conditions again revert to more industrial and urban land uses. From the town of Kalama south to

Martin Island, habitat conditions include areas of forests and wetland areas interspersed with rural development. From Martin Island south to the Cowlitz County-Clark County line, the BNSF rail corridor intersects primarily agricultural land and rural development, with the exception of the city of Woodland, which has some commercial, urban, and residential development.

Representative wildlife in the study area include black-tailed deer, red fox, coyote, raccoon, striped skunk, beaver, Oregon and grey-tailed vole, red-tailed hawk, Cooper's hawk, Canada geese, mallard and northern pintail ducks, great blue heron, white-breasted nuthatch, chipping sparrow, and a variety of amphibians and reptiles (Commission for Environmental Cooperation 2011). A review of PHS data (Washington Department of Fish and Wildlife 2015a) for terrestrial habitats indicates small areas of oak woodlands in a few places along the rail line. Species associated with this habitat include various woodpeckers, migrant birds, reptiles, invertebrates, and the western gray squirrel (Washington Department of Fish and Wildlife 1998). In addition, two osprey point locations are mapped within 300 feet of the rail line; no further information is provided (Washington Department of Fish and Wildlife 2015a). No designated critical habitat for federally protected species under the jurisdiction of USFWS is mapped in the terrestrial environment near the rail line corridor(s).

Washington State Beyond Cowlitz County

The vast majority of the rail study area beyond Cowlitz County is in the Columbia Plateau ecoregion (Commission for Environmental Cooperation 2011). This ecoregion has dry desert and steppe climates marked by hot, dry summers and cold winters, and consists of shrub-steppe vegetation communities. Vegetation is typically dominated by sagebrush, bitterbrush, bluebunch, needle-and thread, Idaho fescue, and Sandberg's bluegrass. Numerous annual and perennial flowers often grow in the spaces between the shrubs and bunchgrass. Shrub-steppe historically dominated the landscape of the ecoregion, but much of it has been degraded, fragmented, and isolated from other similar habitats due to conversion to croplands (Washington Department of Fish and Wildlife 2015b).

Representative wildlife of the Columbia Plateau include mule deer, pronghorn antelope (last reintroduced in 2011 at the Yakama Indian Reservation), coyote, black-tailed jackrabbit, ground squirrels, American kestrel, golden eagle, red-tailed hawk, western meadowlark, savanna sparrow, western diamondback rattlesnake, greater sage-grouse, sage sparrows, sage thrashers, and pygmy rabbits, in addition to many other birds, mammals, reptiles, and insects (Commission for Environmental Cooperation 2011 and Washington Department of Fish and Wildlife 2015b). Shrub-steppe communities can also support federally protected species, including the pygmy rabbit and Spalding's catchfly. The Washington Department of Fish and Wildlife also considers shrub-steppe a priority habitat under the PHS program.

The Cascades and Eastern Cascade Slopes and Foothills ecoregions make up a smaller area intersected by the rail study area and mostly coincide with Clark, Skamania, and Klickitat Counties. Typical vegetation in the Cascades ecoregion at lower elevations includes Douglas-fir, western hemlock, western red cedar, big leaf maple, and red alder; representative wildlife includes black-tailed deer, black bear, coyote, beaver, river otter, pileated woodpecker, and northern goshawk. Typical vegetation in the Eastern Cascades Slopes and Foothills ecoregion includes open forests of ponderosa pine and some lodgepole pine, with sagebrush and steppe vegetation at lower elevations. Representative wildlife species in this ecoregion include black bear, black-tailed deer, mule deer, cougar, wolverine, coyote, yellow-bellied marmot, bald and golden eagles, Cooper's hawk, and osprey (Commission for Environmental Cooperation 2011). PHS data (Washington Department of

Fish and Wildlife 2015a) indicate various priority habitats and species along the rail line study area, including talus slope and cliffs/bluffs habitats, bald eagle concentrations and breeding areas, and western pond turtle regular occurrence areas.

Vessel Corridor

Habitat in the aquatic indirect aquatic impact study area includes the open water of the Columbia River from the project area to the river mouth. Marine mammals that could be affected by vessel traffic along this route include sea lions and seals. The aquatic habitats along the navigation channel are deepwater habitats that are regularly dredged to depths for safe vessel passage.

Chapter 3
Impacts

This chapter describes the impacts on wildlife that would result from construction and operation of the Proposed Action or the ongoing activities of the No-Action Alternative.

The following design features and best management practices (BMPs) that the Applicant has documented would be part of the project and have been considered when evaluating potential impacts of the Proposed Action.

- The Applicant would design the trestle to be long and narrow and at a height above ordinary high water to minimize shading in shallow water areas. From shore, the trestle would measure 24 feet in width for 700 feet, and 51 feet in width for the final 150 feet. The top of the deck would be +22 feet CRD and the bottom of the deck +19.5 feet CRD. Therefore, the bottom of the deck would be more than 8 feet above ordinary high water. This design would minimize overall impacts in shallow water, including impacts on habitat connectivity along the shoreline.
- The Applicant would locate Docks 2 and 3 entirely in deepwater habitat to distance the structure and coal export terminal activities from shallow water areas.
- The Applicant would locate the berthing area at depths of at least -20 feet CRD to avoid habitat conversion from shallow to deep water during dredging.
- The Applicant would locate the berthing area in deep water closer to the navigation channel to minimize the scope of future maintenance dredging.
- The Applicant would direct project lighting downward or at structures, and would incorporate shielding to avoid spillage of light into aquatic areas.
- The Applicant would include a pinpoint light source at the end of the shiploading boom, aimed straight down into the ship hold area to avoid a broader beam that could cause light spillage.
- The Applicant would remove the piles slowly to minimize sediment disturbance and turbidity in the water column.
- Prior to pile extraction, the Applicant would break the friction between the pile and substrate to minimize sediment disturbance.

3.1 Proposed Action

The following construction activities could affect wildlife.

- Permanent removal of habitat and wildlife mortality in terrestrial and aquatic habitats associated with clearing and construction of the coal export terminal.
- Wildlife displacement and mortality associated with clearing and construction of the coal export terminal.
- Noise and visual impacts on terrestrial and aquatic wildlife associated with operation of construction equipment, general construction related noise and pile driving.
- Spills and leaks associated with construction equipment and materials.

The following operation activities could affect wildlife.

- Noise impacts on wildlife associated with operations such as train movements, transfer of coal, and general industrial operations.
- Spills and leaks from trains, vehicles, or equipment.
- Vessel strikes of marine mammals.
- Underwater vessel noise impacts on pinnipeds and diving birds.
- Removal of habitat during maintenance dredging impacting wildlife and habitat.
- Coal dust deposition affecting terrestrial, wetland, and aquatic habitats and wildlife.

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

3.1.1.1 Permanent Impacts on Terrestrial Habitat and Wildlife

Permanently Remove Habitat and Cause Associated Wildlife Mortality

Construction of the Proposed Action would result in the permanent loss of terrestrial wildlife habitat in the study area. The Proposed Action would remove 201.50 terrestrial acres of habitat during construction grading and clearing activities (Figure 5). The majority (151.14 acres) of these impacts would occur in previously developed lands in which industrial buildings, pavement, and infrastructure currently exist with scattered areas of vegetation surrounding the developed areas, or sparsely vegetated areas that previously served as material storage or disposal sites associated with past industrial uses of the property. In general, these lands provide degraded wildlife habitats that do not support wildlife. Patches of potentially suitable upland habitat in the undeveloped areas in the western portion of the project area could support foraging and cover for some wildlife, including the Columbian white-tailed deer.

Construction of the Proposed Action would result in the permanent loss of upland (26.26 acres) containing forested, herbaceous, managed herbaceous, and scrub-shrub vegetation and a small area (0.05 acre) of forested riparian habitat; and wetland (24.10 acres) habitats (Table 9). Animals inhabiting these areas could be displaced to other habitats outside of the project area and mortality of some less mobile individual species could occur. Highly mobile wildlife species, such as larger mammals and birds, would likely leave the terrestrial study area during construction activities. Some mortality of less mobile species could occur, such as burrowing mammals, reptiles, amphibians and insects. Typically, these species reproduce rapidly and any losses due to mortality would not be expected to affect the viability or fitness of the species at the population scale.

Figure 5. Existing Land and Vegetation Cover Types Affected during Construction

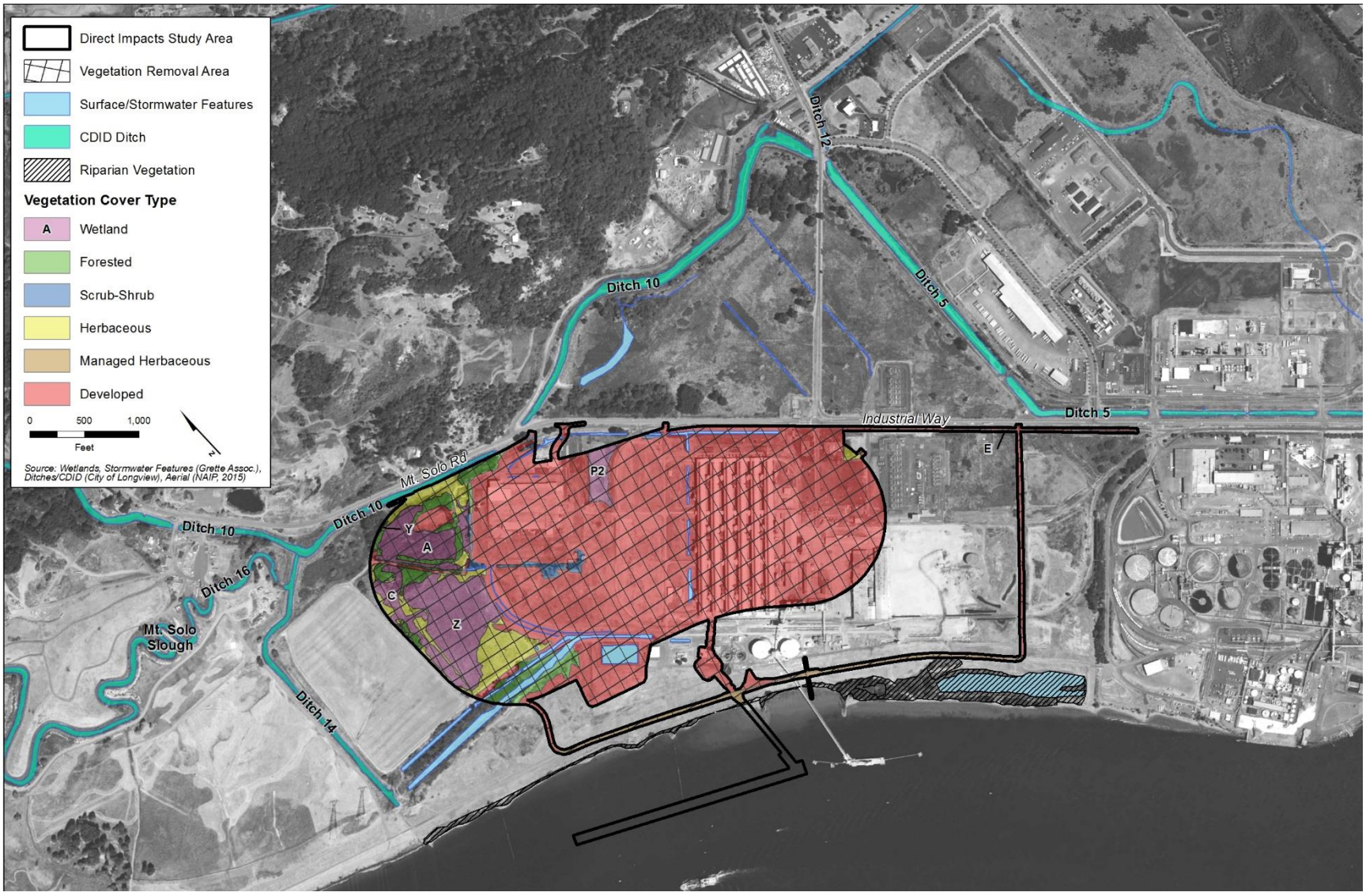


Table 9. Permanent Direct Impacts by Terrestrial Habitat Type in the Project Area

Land Cover Category	Vegetation Cover Type	Impacts in Project Area (Acres)[b]
Developed land	**Developed land total**	**151.14**
Upland	*Forested*	*8.90* [c]
	Scrub-shrub	*2.11*
	Herbaceous	*10.88*
	Managed herbaceous	*4.37*
	Upland total	**26.26**
Wetlands	**Wetlands total[a]**	**24.10**
Total		**201.50**

Notes:
[a] For a detailed discussion of wetland impacts refer to the SEPA Vegetation Technical Report.
[b] These are direct impacts on vegetation in the 212-acre project area, which includes the 190 acre terminal plus additional elements (e.g., access roads, docks, and rail line).
[c] Includes 0.05 acre of riparian forest.

3.1.1.2 Temporary Impacts on Terrestrial Habitat and Wildlife

Construction of the Proposed Action could temporarily affect wildlife habitat adjacent to the project area, including riparian vegetation along the shoreline of the Columbia River. Temporary disturbance could occur through soil disturbance, stockpiling, and erosion. These disturbances could temporarily increase total suspended sediments in the Columbia River and freshwater ditches on and adjacent to the project area. The potential for these types of impacts would be avoided or greatly reduced given protective measures to guard against these risks, including construction best management practices, avoidance and minimization measures, and regulatory requirements, such as those associated with 401 Water Quality Certification and hydraulic project approval that would be required for the Proposed Action. The SEPA Water Quality Technical Report (ICF 2017c) includes a detailed discussion on the potential impacts on water quality associated with Proposed Action.

Cause Wildlife Displacement or Mortality

Construction of the Proposed Action would be limited to the project area. Wildlife in the project area could be at risk of displacement and/or direct mortality during construction activities. Wildlife present in the indirect impact study area during construction could be displaced from increased human activity, elevated noise levels, and/or ground-disturbing activities. Wildlife could also be directly injured or killed due to a collision with construction vehicles or equipment, placement of construction materials on the ground, or ground disturbance such as preloading activities.

Approximately 75% or 151 acres of the terrestrial habitat in the project area is currently developed and wildlife would likely not be present in these areas due to the lack of suitable habitat, but wildlife could be present in the indirect impact study area. Areas around the project area could provide suitable habitat, although there are large areas where habitat has been degraded. The risk of displacement or mortality would be temporary, lasting for the duration of construction (approximately 6 years). Although construction could displace wildlife in the indirect impact study area, most wildlife species are mobile, and construction activities would be temporary. Less mobile species such as burrowing mammals, reptiles, amphibians, and

insects, may be more susceptible. Because these potential mortality impacts would only occur during construction and these species would be able to reproduce rapidly and in adjacent suitable habitats, the losses due to mortality would not be expected to affect the viability or fitness of the species on the population scale. The Proposed Action would be consistent with the general character and land uses of surrounding areas, particularly the shoreline in the study area. Other heavy industrial sites are located along the shoreline to the east of the project area. Overall, the potential displacement or mortality of wildlife during construction would not be expected to have a measurable affect to wildlife species at the population scale or in terms of overall population fitness.

Result in Construction Noise and Visual Impacts on Wildlife

Construction-related noise and human presence at the project area could affect wildlife in the aquatic and terrestrial study areas during construction activities. While wildlife in and around the terrestrial and aquatic study area are likely habituated to human activity and noise levels associated with industrial and developed areas, noise levels at the project area would increase above ambient levels for the duration of construction, especially during impact pile-driving activities associated with dock and trestle construction. Wildlife species exhibit different hearing ranges and all wildlife do not respond the same way to similar sound sources or levels. Even within a species, individuals do not necessarily respond the same way. Wildlife response to sounds depends on numerous complicated factors, including noise level, frequency, distance and event duration, equipment type and conditions, frequency of noise events over time, slope, topography, weather conditions, previous exposure to similar noises, hearing sensitivity, reproductive status, time of day, behavior during the noise event, and the animal's location relative to the noise source (Delaney and Grubb 2003 in Washington State Department of Transportation 2015). Therefore, an animal's reaction to elevated noise levels could range from mild disturbance with little or no reaction to escape behavior, which would displace individuals by forcing them to abandon the area of elevated noise levels, potentially resulting in significant impairment or disruption of normal behavioral patterns. Such displacement and disruption of behavior could reduce productivity and survival of individuals as the individual would likely expend more energy relocating to new suitable habitat, and would be less familiar with new habitat areas and at an increased risk of predation, potentially limiting survival of individual adults or offspring (e.g., abandoning young). These impacts would be exacerbated where there is no adjacent or nearby suitable habitat that is easily accessible. In addition, visible construction equipment, materials, and an increase in infrastructure could cause displacement because some species would avoid areas within the line-of-sight of construction equipment operations.

Dredging and the associated noise could affect birds, including streaked horned larks, during the nesting season. There are no studies that specifically identify noise level sensitivities of the streaked horned lark. Noise sensitivity studies have been conducted for the marbled murrelet. These studies found that marbled murrelets are very sensitive to underwater noise such as pile driving and prolonged terrestrial noise that lasts longer than 10 to 15 minutes (Mountain Loop Conservancy 2010). Little information is available on the impacts of noise on birds. Shorebird sensitivities are more closely related to those of sea lions because they spend most of their time above water and generally stay in the shallow water while hunting (Science Applications International Corporation 2011). Dredging related activities have been shown to generate noise

of 72 decibels in commercial or industrial areas (Epsilon Associates 2006). Terrestrial noise levels in this range could disturb birds but would not be expected to result in injury.

Additionally, construction-related noise impacts and the presence of construction equipment and materials would be temporary, lasting the estimated 6 years required for project construction. In addition, there is a lower density of development to the northwest of the study area where connectivity to other potentially suitable wildlife habitat exists, and where wildlife could relocate during and after construction. Given that the wildlife present in the study area are likely habituated to noise levels associated with industrial areas and are generally mobile, it is anticipated that construction-related noise would affect individuals of a species, but would not affect a species' whole population or the overall fitness of a population.

3.1.1.3 Aquatic Habitat and Wildlife Impacts

The following section describes potential impacts on aquatic habitat and wildlife.

Remove and Alter Aquatic Habitat and Impacts on Aquatic Wildlife

Construction of the Proposed Action would result in the physical alteration and removal of aquatic habitat in the Columbia River and open freshwater areas (e.g., ditches) located in the project area.

Construction of the Proposed Action would result in the permanent loss of approximately 5.17 acres of aquatic habitat (ditches and ponds) throughout the terrestrial habitats of the project area. These open areas of freshwater and wetlands support common species of amphibians and could be used by small mammals and birds. Mammals and birds are highly mobile species and are expected to leave the vicinity during construction activities. Some mortality of amphibians could occur; however, these species typically reproduce rapidly and any losses due to mortality would not be expected to affect the viability or fitness of the species' populations.

Habitat in the Columbia River would be permanently altered and removed by the placement of piles. Of the 630, 36-inch-diameter steel piles required for the trestle and docks, 610 would be placed below the ordinary high water mark, permanently removing an area equivalent to 0.10 acre (4,312 square feet) of benthic habitat. The majority of this habitat is located in deep water (Grette Associates 2014g). The placement of piles would displace benthic habitat and the areas within each pile footprint would cease to contribute toward primary or secondary productivity. Individual pile footprints would be relatively small (7.07 square feet) and would be spaced throughout the dock and trestle footprint.

Creosote-treated piles would be removed from the deepest portions of two existing timber pile dikes. The piles would be removed using vibratory extraction as feasible, or cut, pull and cap methods, depending on the condition of the piles (Grette Associates 2014k). In total, approximately 225 lineal feet of the levees would be removed. Overall, removing creosote-treated woodpiles from the Columbia River could result in an improvement in water quality, as most remaining creosote in those piles would be removed from the aquatic environment. However, removing the piles could result in temporary increases in suspended sediments, short-term water contamination, and long-term sediment contamination from creosote released during extraction. Creosote contains a mixture 200 to 250 compounds, with primary components composed of polycyclic aromatic hydrocarbons (PAHs) (Brooks 1997; National

Marine Fisheries Service 2009). PAHs are known to be toxic to aquatic organisms including invertebrates and fish and can cause sublethal and lethal effects (Eisler 1987; Brooks 1997).

Creosote and associated chemicals, particularly those that are water-soluble and that persist in the water column are known to bioconcentrate in many aquatic invertebrates (Eisler 1987; Brooks 1997). This could expose higher trophic level species such as fish, birds, and pinnipeds to creosote/PAH compounds through the food chain. Many vertebrates, including fish, however, metabolize PAHs and excrete them, reducing the potential risk to higher trophic-level species (Varanasi et al. 1989 in National Marine Fisheries Service 2009; Strauss 2006 in National Marine Fisheries Service 2009).

Most of the components of creosote are heavier than water and sink in the water column. PAHs from creosote accumulate in sediments and are likely to persist at the site of pile removal or wherever they settle until they degrade (National Marine Fisheries Service 2009). However, PAHs from sediment are less bioavailable to aquatic species and thus these organisms are not likely to bioaccumulate PAHs from sediments (Brooks 1997).

Over the long term, the source of creosote would be removed or capped by the sediment falling into the hole left by the extracted pile. Water quality would improve, the concentration of creosote in the sediment would be expected to decrease, and the potential pathway of exposure for wildlife through contamination of prey would be reduced.

Dredging would permanently alter a 48-acre area of deepwater habitat (below -20 feet CRD) by removing approximately 500,000 cubic yards of benthic sediment to achieve a depth of -43 feet CRD, with a 2-foot overdredge allowance. Within the proposed dredge prism (i.e., extent of dredged area) (Figure 2), the amount of deepening would vary based on existing depths, from no removal up to a depth of approximately 16 feet of removal. The majority of the area of the proposed dredge prism is at or below a depth of -31 feet CRD. It is anticipated that sediment within the dredge prism for Docks 2 and 3 would be deemed suitable for flow-lane disposal or beneficial use in the Columbia River based on past sediment sampling near the project area. However, prior to obtaining permits for the Proposed Action, including dredging permits, the Applicant would conduct site-specific sediment sampling to characterize the proposed dredge prism and ensure compliance with the Dredged Materials Management Plan (Grette Associates 2014g, j). This flow lane disposal area would likely be located within an area of approximately 80 to 110 acres between approximately river miles 60 and 66 (Figure 3).

The majority of benthic, epibenthic, and infaunal organisms are nonmotile or slow moving and become entrained during dredging. Benthic, epibenthic, and infaunal organisms in the proposed dredge prism above -43 feet CRD would be removed during dredging, likely resulting in mortality. These organisms often serve as prey for larger animal species. Most of the habitat in the proposed dredge prism is in deep water where benthic productivity is expected to be low relative to shallower habitat. Deep-water channels are subjected to higher water velocities, which periodically scour bottom sediments, limiting the standing crop of invertebrates and the buildup of detritus and fine materials that support these invertebrates (McCabe et al. 1997). Dredging activities are not typically associated with long-term reductions in the availability of prey resources and impacts on benthic productivity are expected to be temporary. Benthic organisms typically recolonize disturbed areas within 30 to 45 days. Disturbed habitats are

expected to return to reference conditions with rapid recolonization by benthic organisms (McCabe et al. 1996).

Dredging activities could affect pinnipeds. In *A Review of Impacts of Marine Dredging Activities on Marine Mammals*, Todd et al. (2014) states that potential direct impacts on marine mammals include collisions, turbidity, and noise. Collisions between dredging vessels and pinnipeds are possible but unlikely to occur given the slow speeds of dredging vessels. Information on turbidity is limited; however, existing research indicates that dredge-related turbidity is not likely to cause substantial impacts on pinnipeds since they often inhabit naturally turbid or dark environments and are likely to use senses in addition to their vision (Todd et al. 2014). Noise could cause masking and behavioral changes but is unlikely to cause auditory damage to pinnipeds (Todd et al. 2014). Dredging would be conducted using a clamshell dredger; however, a hydraulic dredger could also be used (Grette Associates 2014k). Sound pressure levels (SPLs) can vary widely, based on dredger type, operations stage, or environmental conditions (Todd et al. 2014). The operations stage is an important component of noise levels produced by a clamshell (grab) dredger. Dickerson et al. (2001) measured the entire clamshell dredge process at increasing distances from the dredge operation. The loudest measurement, 124 dB_{RMS}, was recorded at a distance of 518 feet from the dredge operation. This measurement is consistent with SPLs that could result in behavioral changes in pinnipeds, but likely would not cause auditory damage. Hydraulic dredges typically produce higher SPLs than clamshell dredges but these SPLs would be unlikely to reach levels that could cause auditory damage (Central Dredging Association 2011; Todd et al. 2014).

Result in Underwater Construction Noise Impacts on Pinnipeds

Potential impacts on pinnipeds in the Columbia River may occur due to underwater noise generated during in-water installation of the trestle and dock piles. Construction of the trestle and dock could include both vibratory pile driving for installation and impact pile driving for proofing. For purposes of this analysis, it is assumed that pile-driving activities would occur during approved in-water work windows. Based on in-water work windows established by NMFS, USFWS, and WDFW for the protection of other aquatic species, in-water pile installation could occur from September 1 to February 28 for vibratory pile driving and September 1 through December 31 for impact pile driving. Actual dates of pile-driving activities would be outlined in permits issued for the project from both the Corps and WDFW. Pile installation and the applicable work window(s) would be provisioned in the hydraulic project approval. Pile installation would occur over two in-water work window construction periods, due to the number of in-water piles required for the dock and trestle. To reduce underwater sound pressure levels from impact pile-driving operations, a confined bubble curtain system or similar noise attenuation technology would be used.

Whether or not in-water pile driving would affect pinnipeds depends on timing of pile driving and whether pinnipeds are in the aquatic study area during this time. Impact pile driving is proposed from September 1 through December 31, which would be prior to the beginning of seasonal use of the study area by California sea lions and harbor seals; it is unlikely that individuals would be present during impact pile driving. Steller sea lions have been observed at the Bonneville Dam from September through December, but in low numbers. Eleven individuals were observed from October through December 2011 (Stansell et al. 2012); no regular

observations were reported in October through December 2012. Therefore, individual Steller sea lions could be transiting through the aquatic study area during pile-driving activities.

Grette Associates (2014a) assessed the direct effects of in-water pile driving on marine mammals at the project area in its Millennium Coal Export Terminal Docks 2 and 3 and Associated Trestle: Direct Effects of Construction, Pile Driving and Marine Mammals report. Multiple sources were reviewed for comparable reference of underwater sounds levels during vibratory and impact installation of the 36-inch-diameter steel piles, including sound level data on pile installations compiled by the Washington State Department of Transportation (WSDOT), Caltrans, Port of Seattle, Port of Kalama, and the Columbia River Crossing (CRC) Test Pile Project. After reviewing all applicable information, sound levels from the CRC 48-inch-diameter test pile were selected as reference levels for the 36-inch-diameter steel pile proposed for the project area. While these piles are larger than those proposed, the proximity of the CRC site to the project area (less than 50 miles apart) and similar conditions are expected to be more comparable than more distance locations elsewhere in Washington and California. Using these reference levels provides for a liberal assessment of impacts due to sound (i.e., estimating at the high end for impact area), and therefore, presents a conservative evaluation that is protective of marine mammals because it considers relatively louder sounds, and therefore, larger potential impact areas than other reference values.

Cause an Injury to Pinnipeds from Impact Pile Driving

PTS auditory injury could affect Phocid pinnipeds (e.g., harbor seals) within 15,220 feet of active impact pile driving without sound attenuation in place. PTS auditory injury could affect Otariid pinnipeds (e.g., sea lions) within 1,109 feet of active impact pile driving without sound attenuation in place (Table 10). With implementation of a bubble curtain to attenuate noise levels during impact pile driving, sound would be reduced by at least 9 decibels at the source, which would decrease the distance to Phocid and Otariid PTS injury to 3,822 feet and 279 feet, respectively (Table 10). Because the Columbia River is approximately 3,281 feet wide at the point where pile driving would occur, and the aquatic impact study area extends 5.1 miles upstream of the project area and 2.1 miles downstream of the project area, pinnipeds could use a large area of the river in the aquatic impact study area to avoid exposure to underwater noise reaching PTS injury levels.

Based on the seasonal use patterns for California sea lion, Steller sea lion, and harbor seals in the study area and based on the proposed work window for in-water impact pile installation (September 1 through December 31), the presence of individual pinniped species during impact pile driving would be unlikely. In addition, the distances reported in Table 10 assume pinnipeds would be exposed to 8 hours of elevated noise during a day of pile driving. Given the adherence to in-water work windows, the use of bubble curtains to reduce noise and the potential impact distance, and the ability of pinnipeds to travel outside the area of elevated underwater noise thereby reducing the duration of their exposure, the three pinniped species that could be present are unlikely to experience PTS auditory injury.

Table 10. Distance from Impact Pile Driving to NMFS Underwater Sound Level Effect Thresholds for Injury to Marine Mammals

Hearing Group	Impulsive (impact: no attenuation)	Impulsive (impact: attenuation)
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat:}$ 218 dB at **30 feet** $L_{E,PW,24h:}$185 dB at **15,220**	$L_{pk,flat:}$ 218 dB at **7 feet** $L_{E,PW,24h:}$185 dB at **3,822 feet**
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat:}$ 232 dB at **3 feet** $L_{E,OW,24h:}$ 203 dB at **1,109 feet**	$L_{pk,flat:}$ 232 dB at **1 foot** $L_{E,OW,24h:}$ 203 dB at **279 feet**

dB = decibels

Cause a Behavioral Disturbance to Pinnipeds from Impact Pile Driving

Behavioral disturbance could affect both Phocid and Otariid pinnipeds up to 17,756 feet from impact pile-driving activities in the absence of sound attenuation devices. With implementation of a bubble curtain to attenuate noise levels during impact pile driving, sound levels would be reduced by 9 decibels at the source, which would decrease the distance to pinniped behavioral disturbance to 4,459 feet from pile-driving activities (Table 11).

Table 11. Distance from Impact Pile Driving to NMFS Underwater Sound Level Effect Thresholds for Behavioral Disturbance to Marine Mammals

Sound Source	Distance to Behavioral Disturbance (impact: no attenuation)	Distance to Behavioral Disturbance (impact: attenuation)
Impulsive	17,756 feet	4,459 feet

The NMFS 160 dB_{RMS} effect threshold for behavioral disturbance due to impulsive sound is a generalized threshold for use in analysis of potential effects on all marine mammals (cetaceans and pinnipeds) due to underwater noise. According to Southall et al. (2007), there is limited potential for pinnipeds exposed to multiple pulses between approximately 150 and 180 dB_{RMS} to respond with avoidance. The majority of individual documented behavioral responses at these levels are related to alert or orientation response, which could result in changes or interruption in feeding or diving, to cessation of vocalizations, to temporary displacement from habitat.

Based on the seasonal use patterns for California sea lion, Steller sea lion and harbor seals in the study area, presence of individuals of these species during impact pile driving would be unlikely. Steller sea lions are known to occur in the study are during the period when impact pile driving would occur, (September through December) but in very low numbers. In the event these pinnipeds pass through the study area during impact pile driving, they would be exposed to sound in excess of the behavioral disturbance threshold. However, it is so unlikely that California sea lions or harbor seals would be transiting through the area on their way to upstream locations such as haulouts or the Bonneville Dam that few, if any, individuals would be expected to experience sound in excess of the behavioral disturbance threshold. A relatively small number of Steller sea lions (likely less than 20 (Stansell et al 2010, 2012)) could experience sound in excess of the behavioral disturbance threshold.

The relatively few Steller sea lions that could experience pulsed sound above the behavioral disturbance threshold are not expected to exhibit behavioral changes. Based on an average

swim speed of approximately 3 meters per second (Stelle et al. 2000), a Steller sea lion would traverse the study area in approximately 30 minutes (assuming pile driving at any or all locations). Based on observations of swimming speeds in the Columbia River determined through telemetry, this speed could be somewhat high, particularly during upstream migration (Brown et al. 2011). However, even for speeds at the low end of those reported by Brown et al. (2011) (more than 1 meter per second), it is expected that the study area would be traversed in less than 2 hours. The lower-end estimates from Brown et al. (2011) are applicable to California sea lions and have been applied to harbor seals as well. For all three species, additional alert or orientation responses over the duration of the construction period would not be expected to impede transit through the area or otherwise significantly disrupt behavioral patterns. In the unlikely event a significant disruption of behavior were to occur to an individual during pile driving, effects could range from startle responses to changes or interruption in feeding or diving, to cessation of vocalizations, to temporary displacement from habitat.

Cause an Injury to Pinnipeds from Vibratory Pile Driving

PTS auditory injury could affect Phocid pinnipeds (e.g., harbor seals) within 331 feet of active vibratory pile driving. PTS auditory injury could affect Otariid pinnipeds (e.g., sea lions) within 23 feet of active vibratory pile driving (Table 12). Because the Columbia River is approximately 3,281 feet wide at the point where pile driving would occur, there would be a wide area of the river that pinnipeds could utilize in the aquatic impact study area and avoid exposure to the area where underwater noise reaching PTS injury levels may occur.

Based on the seasonal use patterns for California sea lions, Steller sea lions, and harbor seals in the study area and based on the proposed work window for in-water vibratory pile installation, the presence of individual pinniped species during vibratory pile driving would be unlikely. In addition, the distances reported in Table 12 assume pinnipeds would be exposed to 1.2 hours of elevated noise during a day of vibratory pile driving (four piles per day, 20 minutes per pile). Given the adherence to in-water work windows, the short impact distance, and the ability of pinnipeds to travel outside the area of elevated underwater noise, thereby reducing the duration of their exposure, the three pinniped species that could be present are unlikely to experience PTS auditory injury due to vibratory pile driving.

Table 12. Distance from Vibratory Pile Driving to NMFS Underwater Sound Level Effect Thresholds for Injury to Marine Mammals.

Hearing Group	Nonimpulsive (vibratory)
Phocid Pinnipeds (PW) (Underwater)	$L_{E,PW,24h}$: 201 dB at **331 feet**
Otariid Pinnipeds (OW) (Underwater)	$L_{E,OW,24h}$: 219 dB at **23 feet**

dB = decibels

Cause a Behavioral Disturbance to Pinnipeds from Vibratory Pile Driving

Behavioral disturbance could affect both Phocid and Otariid pinnipeds up to 5.1 miles upstream and 2.1 miles downstream from the project area from vibratory pile driving. These disturbance distances are defined by bends in the Columbia River that effectively intercept the underwater noise that would otherwise result in the disturbance area extending 72 miles. Sound travels in

straight lines, and can only travel up to the distances of these river bends. Therefore, behavioral disturbance from vibratory pile driving could only occur within this area (see Aquatic Direct Impact Study Area in Figure 3). Sound attenuation devices are not applicable to vibratory pile driving methods so no reduction in noise level is anticipated. Based on seasonal use patterns of the study area by pinnipeds and the proposed in-water work window for pile installation, pinnipeds are unlikely to be present during pile driving.

Vibratory pile driving could occur during much or all of each working day during the September 1 through February 28 in-water work window. The contractor would determine sequencing and the need for multiple pile-driving rigs. It is possible that vibratory pile driving could occur at any time during the approved in-water work window (September 1 through February 28), and it could be continuous during working days (Monday through Friday), particularly if multiple pile-driving rigs are operating. However, even considering multiple pile-driving rigs, given variable subsurface conditions there would be days where periods of vibratory pile driving would be shorter and/or discontinuous throughout the working day. Therefore, it is possible that some or all of the pinnipeds transiting through the study area would not experience behavioral disturbance from vibratory pile driving.

Aside from the vibratory pile-driving schedule and sequence of events during the in-water work window, individual California sea lions, Steller sea lions, and harbor seals are considered unlikely to be present during much of the vibratory pile-driving period, based on their typical occurrence and the in-water pile-driving construction timing. This would minimize the likelihood that individual pinnipeds would experience sound in excess of the 120 dB_{RMS} behavioral disturbance threshold for continuous pile-driving sound. However, some California sea lions and harbor seals are expected to pass through the study area during the latter part of the vibratory driving period (mid-January through February) on their way to upstream haulouts and the Bonneville Dam. Steller sea lions could pass through the study area throughout the vibratory pile-driving period, but in relatively small numbers (fewer than 20) prior to January 1, with increasing numbers possible thereafter.

NMFS applies the 120 dB_{RMS} behavioral disturbance threshold for continuous sound to all marine mammals. As noted in Southall et al. (2007), the 120 dB_{RMS} value is primarily based on data from two field studies observing the response of baleen whales (gray and bowhead whales) to continuous industrial sound (e.g., drilling or icebreaking). Southall et al. (2007) also states the effects of continuous sound exposures on pinnipeds are poorly understood, and existing data do not indicate strong behavioral responses to sounds between 90 and 140 dB_{RMS}. As such, the application of the 120 dB_{RMS} threshold for pinnipeds is considered a conservative analysis that is protective of the species.

The assertion that the 120 dB_{RMS} is considered conservative could be further supported by observed responses of sea lions, including Steller sea lions, to auditory deterrence devices (ADDs) employed at the Bonneville Dam (Stansell et al. 2010). The ADDs were installed in 2008 at most of the fishway entrances to deter pinniped foraging in these areas. Each ADD consisted of an Airmar decibel Plus II acoustic deterrent system emitting a 205 dB sound in the 15-kilohertz (kHz) frequency range, placed within the tailrace of the dam (Stansell et al. 2010). The ADDs are marketed as pinniped deterrents and are set to a frequency within the range of greatest hearing sensitivity for pinnipeds. Steller sea lion hearing sensitivity peaks between 1 and 16 kHz for males and between 16 and 25 kHz for females (Kastelein et al. 2005 in Grette

2014a). California sea lion hearing sensitivity peaks between 1 and 28 kHz with a peak at 16 kHz (Schusterman et al. 1972). Harbor seal hearing sensitivity peaks between approximately 10 and 40 kHz (Mohl 1968 in Richardson et al. 1995).

The ADDs were left on continuously for the entirety of the 2008 observation season (January through May), turned on or off randomly in 2009, and on or off for random 2-day periods in 2010 to mitigate against habituation (Stansell et al. 2010). According to observations, the ADDs had no detectable effect on sea lions when they were on continuously in 2008 or when they were randomly on or off in 2009 and 2010. Pinnipeds have been observed each year since 2008 swimming and foraging within 20 feet of the active ADDs, and many of the same individuals present in 2008 returned the following 2 years. Due to the ineffectiveness of the ADDs as deterrents at the Bonneville Dam, the investigators recommended discontinuing their use (Stansell et al. 2010).

The pinnipeds' reactions to the ADDs employed at Bonneville Dam illustrates that the environmental context plays a significant role on whether or not pinnipeds react to continuous noise. The noise from ADDs was well above both the documented pinniped hearing thresholds and the established threshold of potentially disturbing continuous sound. While the ADDs have been effectively used as a pinniped deterrent elsewhere, the acoustic deterrent was not enough to dissuade the animals from the abundant foraging opportunity at Bonneville Dam.

The results of the ADDs employed at Bonneville Dam strongly suggest that sea lions can habituate to high levels of continuous sound. Sound from vibratory pile driving is conservatively estimated to be 181 dB_{RMS} (170 dB_{RMS} could be more typical). The ADDs used at Bonneville Dam emitted sound at 205 decibels at the source (not specified as dB_{RMS}, dB_{SEL}) or decibels peak. However, since the ADDs emit continuous sound, dB_{RMS} should be a comparable metric). A modeled comparison of these sound levels determined that sound from vibratory pile driving is expected to be of comparable loudness to that emitted by the ADDs at Bonneville Dam. Other characteristics including frequencies could be different, but the ADDs targeted the most sensitive frequencies for pinnipeds and were still not effective deterrents at the Bonneville Dam.

California sea lions, Steller sea lions, and harbor seals would pass through the study area during the period proposed for vibratory pile driving with increasing numbers toward the end of the vibratory pile in-water work window. Individuals within 5.1 miles (26,928 feet) of vibratory pile driving upstream and 2.1 miles (11,088 feet) downstream of the project area would experience elevated sound levels. As discussed above, based on Southall et al. (2007), pinnipeds do not typically elicit strong behavioral responses to continuous sound between 90 and 140 dB_{RMS}. While not included in the detailed behavioral analysis, Southall et al. (2007) also discuss a number of studies that suggest a high tolerance of and/or limited behavioral changes by pinnipeds to sounds from underwater drilling, ADDs, and other continuous sources in the field. Stansell et al. (2012) observed that Steller sea lions did not avoid areas ensonified by ADDs and were observed foraging within 20 feet of the ADDs. Those ADDs emitted sound at levels comparable to what is expected during vibratory pile driving, and were frequency-specific to target peak sensitivity for pinniped hearing. Taken together, these findings suggest that a strong behavioral response such as absolute avoidance of the entire area of elevated sound is unlikely during vibratory pile driving, even with the relatively long time-period (September 1 through February 28) and daily duration proposed over the two in-water construction seasons. Even if an individual were to avoid the area of elevated sound initially, it would be expected to move

through the study area eventually, either once acclimated to the sound or once pile driving has ceased. Vibratory pile driving is not expected to affect the ability of, or the likelihood for, individual California sea lions, Steller sea lions, or harbor seals to transit through the study area or to reach other upstream areas and the Bonneville Dam.

Result in Underwater Noise Impacts on Diving Birds

Although hearing range and sensitivity have been measured in many terrestrial birds, little is known of diving bird hearing. Most published literature on bird hearing focuses on terrestrial birds and their ability to hear in air (U.S. Navy 2014). There is little published literature on hearing abilities of birds underwater, and the manner in which birds could use sound underwater is unclear (Dooling and Therrien 2012 in U.S. Navy 2014). In fact, there are no measurements of underwater hearing ability in any diving birds (Therrien et al. 2011 in U.S. Navy 2014). Diving birds may not hear as well underwater, compared to other (nonavian) terrestrial species, based on adaptations to protect their ears from pressure changes (Dooling and Therrien 2012 in U.S. Navy 2014).

Potential impacts on diving birds in the Columbia River are most likely to occur when underwater noise is generated during in-water installation of the trestle and dock piles. Specifically, impact pile driving would generate the loudest and most intense underwater noise during construction.

USFWS has provided underwater noise impact thresholds for impact pile driving for the federally listed marbled murrelet. While marbled murrelets are unlikely to be found in the study area, the underwater noise thresholds provide some guidance on potential underwater noise impacts that could be useful for other diving birds that could be in the study area.

USFWS recognizes a behavioral threshold of 150 dB_{RMS}, an auditory injury threshold of 202 dB_{SEL}, and a nonauditory injury (barotrauma) threshold of 208 dB_{SEL} (Table 13). Underwater noise below 150 dB_{SEL} does not cause injury (Washington State Department of Transportation 2015).

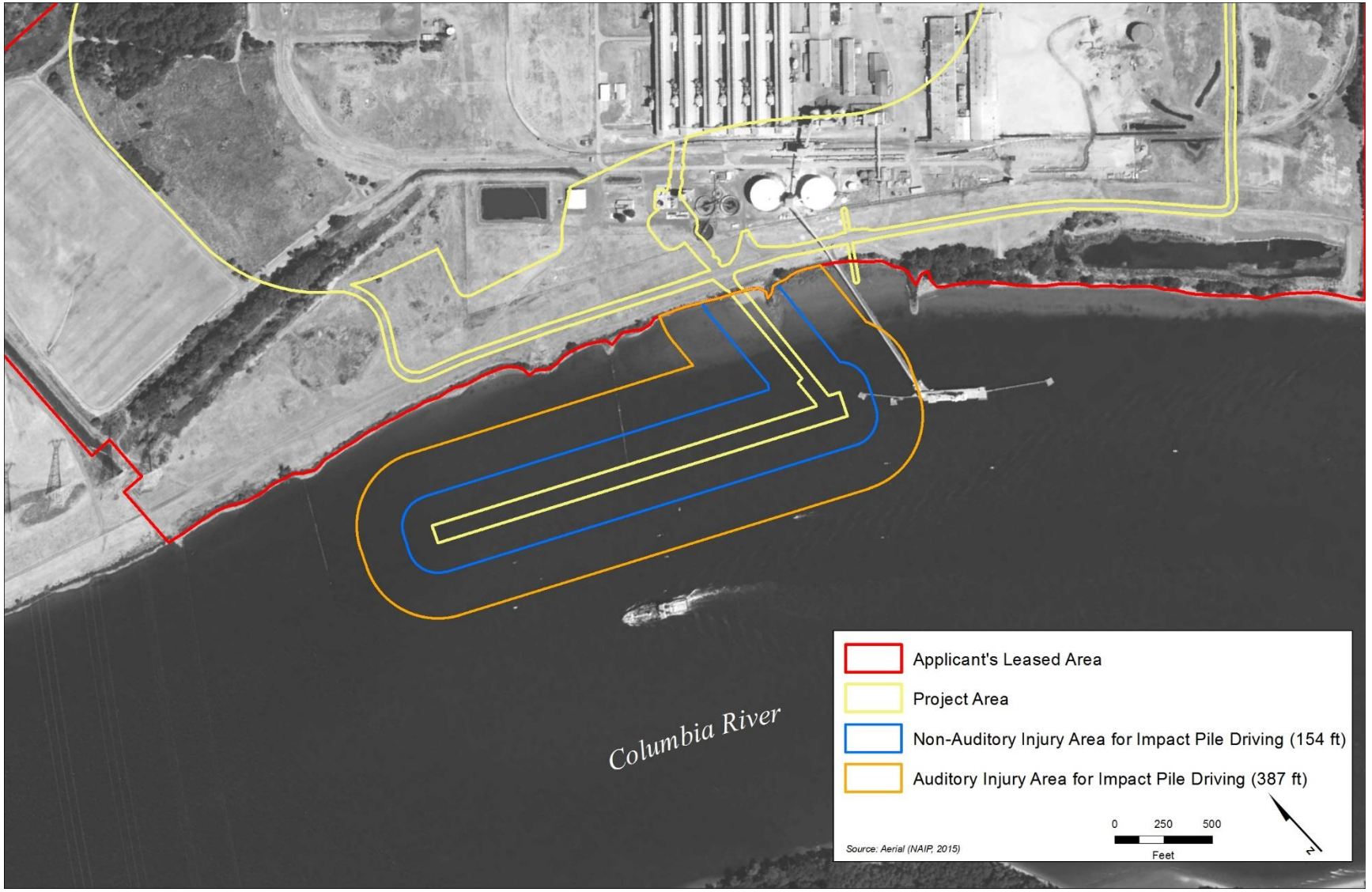
Based on noise levels provided in Table 5 and assuming noise attenuation devices will reduce sound source levels by 9 dB, marbled murrelet behavioral disturbance may occur at distances less than 20,701 feet, auditory injury may occur at distances less than 387 feet, and barotrauma injury may occur at distances less than 154 feet (Table 13, Figure 6).

Table 13. Distances to Potential Impact on Diving Birds from Impact Pile Driving.

Effect Type	Effect Distance
Behavioral disturbance	20,701 feet[a]
Auditory injury	387 feet
Nonauditory injury (barotrauma)	154 feet

[a] This distance is restricted to line-of-site downstream of the project area and would extend to only 11,088 feet (2.1 miles)

Figure 6. Potential Injury Impact Area for Diving Birds due to Impact Pile Driving



The reaction of a diving bird exposed to underwater noise levels above 150 dB_{RMS} (but below 202 dB_{SEL}) could range from mild disturbance to escape behavior. This would displace individuals by forcing them to abandon the area of elevated noise levels, potentially resulting in impairment or disruption of normal behavioral patterns. Such displacement and disruption of behavior could interrupt feeding and diving and reduce productivity and survival of individuals, as the individual would likely expend more energy relocating to a new area. However, pile-driving noise impacts would be temporary, occurring over 2 years and during the approved in-water work window. It is not anticipated that underwater impact pile-driving noise would affect the overall fitness of diving bird populations.

Result in Spills and Leaks

Construction activities would occur on land as well as in and over waters of the Columbia River. During all construction related activities there is the potential risk of temporary water quality impacts resulting from the release of hazardous materials such as fuels, lubricants, hydraulic fluids, or other construction-related chemicals. These materials could enter surface waters of the Columbia River or drainage ditches located near the project area. Such spills could affect aquatic habitat or wildlife, including pinnipeds, waterfowl, or terrestrial wildlife that could be near the discharge point, resulting in toxic acute or subacute impacts that could affect the respiration, growth, or reproduction of these species. Over-water and in-water work increases this risk as well as the potential for construction debris or materials to enter the Columbia River. The potential for these types of impacts would be avoided or greatly reduced given protective measures to guard against these risks, including: construction best management practices, avoidance and minimization measures, in-water work restrictions, and regulatory requirements, such as those associated with 401 Water Quality Certification and the spill prevention, control, and countermeasure plan. The SEPA Water Quality Technical Report (ICF 2017c) includes a detailed discussion on the potential impacts on water quality associated with the Proposed Action.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on wildlife or wildlife habitat because construction of the coal export terminal would be limited to the project area.

3.1.3 Operations: Direct Impacts

Operation of the Proposed Action would result in the following direct impacts.

Affect Wildlife as a Result of Noise

Operation of the Proposed Action could result in increased noise from movement of trains, transfer of coal from train to stockpile areas to vessels, and general industrial operations, which could affect wildlife in a manner similar to that described for construction noise. Increased operations noises could affect wildlife by causing disturbance or avoidance behaviors. Wildlife in the terrestrial study area are likely habituated to noise levels associated with industrial and developed areas, and operations noises associated with the Proposed Action are anticipated to be comparable to existing noises associated with the ongoing industrial operations in the study area. Given that the species present in the terrestrial study area are likely habituated to elevated

noise levels associated with industrial areas and are generally mobile, it is anticipated that operations noise associated with the Proposed Action would not have a measurable impact on wildlife species within the terrestrial study area.

Result in Spills and Leaks

Routine operations could result in spills or leaks at the project area from vehicles, trains, or equipment that could affect water quality and the condition of aquatic habitat in the Columbia River and drainage ditches located in the aquatic study area. Potential impacts on wildlife and wildlife habitat are similar to those described for construction leaks and spills. Personnel training, oil discharge prevention briefings, and implementation of prevention and control measures, as required under the Spill Prevention, Control and Countermeasure Regulation (40 CFR 112) would guard against these risks, greatly reducing the potential for these types of impacts. Further information is contained in the SEPA Water Quality Technical Report (ICF 2017c) and SEPA Hazardous Materials Technical Report (ICF 2017d).

Produce Coal Dust

Coal dust and fugitive coal particles could be generated during operation of the Proposed Action through the movement of coal onto the project area, around the project area, and onto vessels. Coal dust could also become airborne from the large stockpiles located in the site.

The potential extent and deposition rate of coal dust particles less than 75 microns in diameter was modeled as part of the analysis conducted relative to air quality, and human health during the preparation of the Environmental Impact Statement. See the SEPA Air Quality Technical Report for additional details (ICF 2017e). Based on the models, the highest rate of coal dust deposition would be expected in the immediate area surrounding the coal export terminal, but smaller particles would also be expected to deposit in a zone extending around and downwind of the terminal. Deposition rates could range from 1.99 grams per square meter per year (g/m^2/year) adjacent to the coal export terminal, gradually declining to less than 0.1 g/m^2/year within a few thousand feet from the terminal and 0.01 g/m^2/year approximately 2.4 miles from the terminal. Refer to the SEPA Coal Technical Report (ICF 2017f).

Based on the models, the zone of deposition would extend primarily northwest of the project area and over the Columbia River, encompassing forested hills, riparian habitat along the shoreline, and extending across the Columbia River to Lord and Walker islands. Deposition rates of less than 0.1 g/m^2/year are projected to occur over the forested habitats of Lord Island in the study area (Figure 3), with declining concentrations across the island and to the south and west toward Walker Island.

Although concerns regarding coal dust are commonly expressed relative to air quality and human health concerns, wind-born coal could affect wildlife through physical or toxicological means. In general, there is a paucity of peer-reviewed scientific literature examining the potential effects of coal dust on wildlife, in particular, on terrestrial wildlife. More research has been conducted on potential effects of coal dust on aquatic organisms. Potential physical effects of coal dust have been well documented; however, documentation on potential toxic effects on aquatic organisms is lacking.

Ahrens and Morrisey (2005) conducted a literature review on the biological effects of unburnt coal in the marine environment. The following discussion is distilled from that review. Coal

particles could affect aquatic wildlife in a manner comparable to any form of suspended particulates. Impacts could include tissue abrasion, smothering, obstruction or damage to feeding or respiratory organs, and other effects resulting from reduced quantity or quality of light. Another manner in which coal could affect aquatic wildlife is through coal leachates. Unburnt coal can be a source of acidity, salinity, trace metals, hydrocarbons, chemical oxygen demand, and potentially macronutrients if they leach from the coal matrix into aquatic habitats. Toxic constituents of coal include PAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, along with mineral impurities in the coal and environmental conditions determine whether these compounds can be leached from the coal. Some PAHs are known to be toxic to aquatic animals and humans.

Metals and PAHs could also leach from coal to the pore water of sediments and be ingested by benthic-feeding organisms, providing a mechanism for subsequent ingestion by other organisms throughout the food chain. However, the low aqueous extractability and bioavailability of the contaminants minimizes the potentially toxic effects. The coal anticipated to be exported from the coal export terminal is alkaline and low in sulfur and trace metals. The conditions to produce concentrations in pore waters are not present in a dynamic riverine environment. This would further support the view of Ahrens and Morrisey (2005) that the bioavailability of such toxins would likely be low.

In summary, fugitive coal dust from operation of the Proposed Action is not expected to increase suspended solids in the Columbia River to the point that there would be a demonstrable effect on aquatic wildlife and fish distribution, abundance, or survival. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals) would be relatively low as these chemicals tend to be bound in the matrix structure and not quickly or easily leached. Particles would likely be transported downstream and either carried out to sea or distributed over a sufficiently broad area as not to be problematic. Coal dust accumulation within the area is expected to be below the trigger level for sensitive areas, as indicated in the SEPA Coal Technical Report (ICF 2017f). Sensitive areas, as defined by New Zealand Trigger Levels referenced in the SEPA Coal Technical Report typically include areas with significant residential development. Over the long term, coal dust could accumulate in the terrestrial study area; however, predicting the extent to which wind and rain would further disperse coal dust is unknown. Refer to the SEPA Vegetation Technical Report for information related to coal dust impacts on vegetation (ICF 2017b).

Affect Wildlife from a Spill of Coal

Direct impacts on the natural environment from a coal spill during operation of the Proposed Action could occur. Direct impacts resulting from a spill during coal handling at the coal export terminal would likely be minor because the amount of coal that could be spilled would be relatively small. Also, impacts would be minor because of the absence of terrestrial and aquatic environments in the project area and the contained nature and design features of the terminal (e.g., enclosed over-water belt conveyors, transfer towers, and shiploaders). Potential physical and chemical effects of a coal release on the aquatic and terrestrial environments adjacent to the coal export terminal are described below.

A coal spill could have physical effects on aquatic environments, including abrasion, smothering, diminished photosynthesis, altered sediment texture and stability, reduced availability of light, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The

magnitude of these potential impacts would depend on the amount and size of coal particles suspended in the water, duration of coal exposure, and existing water clarity (Ahrens and Morrisey 2005). Therefore, the circumstances of a coal spill, the existing conditions of a particular aquatic environment (e.g., pond, stream, wetland), and the physical effects on aquatic organisms and habitat from a coal spill would vary. Similarly, cleanup of coal released into the aquatic environment could result in temporary impacts on habitat, such as smothering, altering sediment composition, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The recovery time required for aquatic resources would depend on the amount of coal spill and the extent and duration of cleanup efforts, as well as the environment in which the incident occurred. It is unlikely that coal handling in the upland portions of the coal export terminal would result in a spill of coal that would affect the Columbia River. This is unlikely because the rail loop and stockpile areas would be contained. Other areas adjacent to the coal export terminal are separated from the Columbia River by an existing levee, which would prevent coal from being conveyed from upland areas adjacent to the rail loop to the Columbia River. Coal could be spilled during shiploading operations because of human error or equipment malfunction. However, such a spill would likely result in a limited release of coal into the environment due to safeguards to prevent such operational errors, such as start-up alarms, dock containment measures to contain spillage/ rainfall/ runoff, and enclosed shiploaders.

The chemical effects on aquatic organisms and habitats would depend on the circumstances of a coal spill and the existing conditions of a particular aquatic environment (e.g., stream, lake, wetland). Some research suggests that physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005).

A coal train derailment and coal spill in Burnaby, British Columbia, in 2014, and subsequent cleanup and monitoring efforts provide some insight into the potential impacts of coal spilled in the aquatic environment. Findings from spill response and cleanup found there were potentially minor impacts in the coal spill study area, and that these impacts were restricted to a localized area (Borealis Environmental Consulting 2015).

3.1.4 Operations: Indirect Impacts

Impacts indirectly associated with proposed operation of the Proposed Action could occur as a result of project related vessel traffic in the Columbia River within the indirect impact study area. These impacts include vessel strikes and underwater vessel noise impacts on pinnipeds. Periodic maintenance dredging could result in removal of habitat and associated impacts on pinnipeds and aquatic invertebrates as well as noise impacts on birds. Coal dust could indirectly affect terrestrial and aquatic wildlife. The potential risk of a vessel related spill is discussed in the SEPA Vessel Transportation Technical Report (ICF 2017g) Operation of the Proposed Action would result in the following indirect impacts.

Result in Vessel Strike Impacts on Pinnipeds

Increased vessel traffic related to operations at the project area could increase the risk of vessel collisions with pinnipeds in the indirect impact study area. Most available research and literature on marine mammal vessel strikes is associated with vessel-whale collisions at sea. Compared to pinnipeds, whales are typically much larger, slower moving, and therefore, are assumed more vulnerable to vessel strikes. Vessel strikes on marine mammals are usually described as massive blunt force trauma (Geraci and Lounsbury 1993 in Horning and Mellish

2009), but are considered extremely rare for pinnipeds (Andersen et al. 2007 in Horning and Mellish 2009). The blunt force trauma that results from a marine mammal collision with a vessel can result in death or injury. Blunt force trauma to marine mammals can include, but are not limited to, bone fractures, organ damage, and internal hemorrhages (National Oceanic Atmospheric Administration 2008). There are cases in which small marine mammals survive strikes but sustain injuries and disfigurement to dorsal fins and other body parts (National Oceanic and Atmospheric Administration 2008); in Sarasota Bay, Wells and Scott (1997) (in National Oceanic Atmospheric Administration 2008) documented four cases of vessel strikes on bottlenose dolphins in which all four animals survived the strike.

Laist et al. (2001) examined collisions between vessels and whales by examining historical records and computerized stranding databases for evidence of vessel strikes, and concluded that larger vessels and higher vessel speeds can increase the risk of collisions. Even though pinnipeds are generally smaller and more agile than whales, it is reasonable to assume that vessel size and speed would also be a factor in the risk of collisions with pinnipeds. Laist et al. (2001) found that the most lethal and serious injuries to whales are caused by vessels 262 feet or longer, and by vessels traveling above 14 knots (16 miles per hour). Vessels accessing the project area would likely be larger than 262 feet, but typical transit speeds would be much less than 14 knots in the study area. Vessel speeds in the Columbia River are typically 12 knots, slowing to about 8 knots when passing moored vessels (ICF 2017g). In the indirect study area around the project area, the speed would likely be even slower as there would likely be a "no wake zone" around the vessel mooring area.

In summary, the potential for a pinniped strike with a vessel in the indirect study area would depend on many factors, including time of year, vessel type, vessel size, pinniped species, vessel location, vessel speed, and location of animal relative to vessel. The behavior of a pinniped in the path of an approaching vessel in the study area is uncertain, but it is likely that an individual would have the ability to avoid and swim away from the vessel. In addition, pinniped vessel strikes are rare; thousands of vessels transit the Columbia River every year. A small number of documented pinniped deaths are attributed to vessel strikes. For example, the *U.S. Pacific Marine Mammal Stock Assessments: 2015* (National Oceanic Atmospheric Administration 2016) for the Pacific Coast documented two harbor seals (Oregon/Washington Coast stock) killed by boats between 2007 and 2011 and 13 California sea lions killed by boats between 2008 and 2012. Pinnipeds in the Columbia River would also likely be habituated to existing Columbia River vessel traffic (estimated to be 3,185 vessels per year between 2021 and 2023), and vessel speed in the indirect impact study area would be less than 14 knots. Therefore, the potential risk for a vessel collision with a pinniped in the indirect study area would be low.

Result in Underwater Vessel Noise Impacts on Pinnipeds

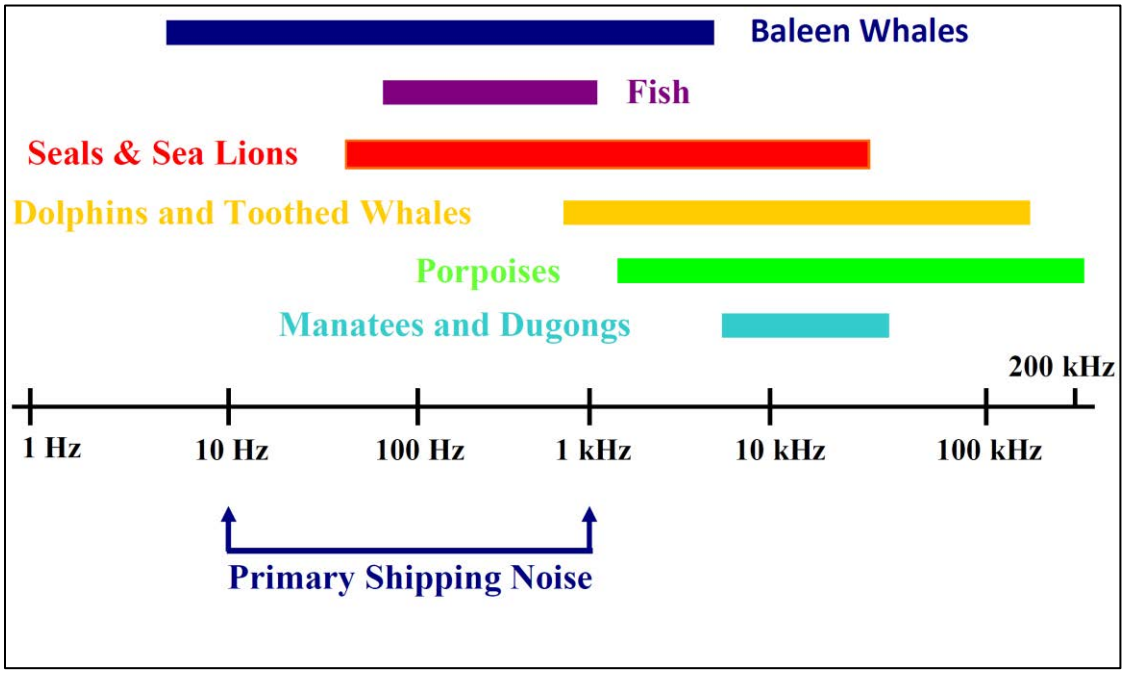
Increased vessel traffic related to operation of the Proposed Action contributes to underwater noise generated by existing ship traffic in the Columbia River. Ships generate noise primarily by propeller cavitation, propulsion machinery, hydraulic flow over the hull, and flexing of the hull (Marine Mammal Commission 2007). Studies in the Salish Sea have shown that the greater the ship size, the greater the underwater source level due to cavitation; however, tug vessels exhibit greater source noise levels underwater while performing activities such as berthing or accelerating a ship (Hemmera Envirochem Inc., SMRU Canada Ltd., and JASCO Applied Sciences (Canada) Ltd., 2014). While this information is from studies in the Salish Sea, noise levels from vessels would be similar in the Columbia River. Depending on the type of noise and ambient

noise conditions, underwater noise generated by vessels could affect marine mammals because they rely on sound as a means of communication, for finding food and mates, and for detecting predators. Increasing background noise levels could decrease communication ranges and modify behavior as well as induce stress responses (Wright 2008).

Operation of the Proposed Action at full build-out would result in approximately 840 additional vessel transits per year within the Columbia River compared to approximately 3,099 vessels that are estimated would transit the Lower Columbia River annually in 2028 (approximate timeframe for full build-out). With the project, total vessel transits per year would be approximately 3,939 (3,099 + 840). The 840 Proposed Action-related vessel traffic represents approximately 21% of the expected total vessel traffic volume in the Lower Columbia River per year. See the SEPA Vessel Transportation Technical Report for additional information on vessel traffic resulting from the Proposed Action (ICF 2017g).

Underwater noise frequencies associated with shipping vessels typically range between 10 Hertz (Hz) and 1 kHz (Wright 2008) (Chart 1), but most ships produce noise primarily in the low frequency range (up to 100 Hz) (Marine Mammal Commission 2007). Additionally, tugboats, the vessels that would be used to assist vessels in docking and departing the project area, typically produce less near-surface sounds than other vessels. This is not because they are quieter but because the propellers of a typical tugboat are recessed to protect the propeller from damage in case of grounding. With the propeller in this position, the sound rays from the propellers are blocked by the hull. Thus, the propeller noise cannot be heard ahead of the tug (University of Rhode Island 2015).

Chart 1. Frequency Relationship between Marine Animals Sounds and Sounds from Shipping



Source: Wright 2008.

As shown in Chart 1, several groups of marine animals hear sound within and outside of the primary shipping noise frequency range. Sea lions have been shown to be sensitive to a fairly wide range of mid frequencies (approximately 1 to 30 kHz) while seals are generally capable of

hearing across a wider range of low to mid sound frequencies (approximately 0.2 to 50 kHz) (National Oceanic and Atmospheric Administration 2005). Steller sea lion hearing sensitivity peaks between 1 kHz and 16 kHz for males and 16 kHz and 25 kHz for females (Kastelein et al. 2005 in Grette Associates 2014a); California sea lion hearing sensitivity peaks between 1 kHz and 28 kHz with a peak at 16 kHz (Schusterman et al. 1972 in Grette Associates 2014a); harbor seal hearing sensitivity peaks between approximately 10 kHz and 40 kHz (Mohl 1968 in Richardson et al. 1995 in Grette Associates 2014a). Comparing these pinnipeds' hearing frequency ranges with the shipping noise frequency range, underwater noise generated by ships in the study area would generally be outside of the peak sensitive hearing frequencies for Steller sea lion, California sea lion, and harbor seal; and potentially outside the full range of their sensitive hearing frequencies given that most ships produce noise primarily in the low frequency range (up to 100 Hz). In addition, pinnipeds that migrate through the study area would likely be habituated to ship noise because ship traffic on the Lower Columbia River is relatively frequent; between 2021 and 2023, it is estimated that a total of 3,185 vessels (this includes the estimated 840 vessels accessing the project area annually) would transit the Lower Columbia River annually (ICF 2017g). Marine mammals have adapted to varying levels of natural sound, and the adaptive mechanisms could allow them to function normally in the presence of many anthropogenic sounds. The unknown variable is when introduced sounds could exceed the adaptive capacity of marine mammals and thus pose a threat to individual animals or their populations (Marine Mammal Commission 2007).

In the event a pinniped were in the study area during the transit of a ship to or from the project area and if the underwater noise frequency of a particular ship were within the frequency range in which the pinniped is sensitive, there could be potential affects to the individual. Research has suggested that the primary auditory effect of vessel noise on marine animals is the masking of biologically significant sounds (National Oceanic and Atmospheric Administration 2005), which can affect communications between individuals. Complex behavioral responses to the same noise source can range from mild to severe and can vary among species and individuals, making it challenging to characterize impacts of shipping noise on marine mammal species (Ellison et al. 2012 in Joint Working Group on Vessel Strikes and Acoustic Impacts 2012). The effects of underwater noise exposure on marine organisms have been generally characterized by the following range of physical and behavioral responses (Richardson et al. 1995 in Bureau of Ocean Energy Management 2012), although it would not be anticipated that ship noise would cause all of these responses given the low frequency of underwater ship noise and the higher frequencies that Steller sea lion, California sea lion, and harbor seal are most sensitive. Additionally, it would be difficult to measure the effect that could be caused by the increase in vessel traffic associated with the project, as compared to the overall vessel traffic that would occur in the Columbia River.

- **Behavioral reactions.** Range from brief startle responses to changes or interruptions in feeding, diving, or respiratory patterns, to cessation of vocalizations, to temporary or permanent displacement from habitat.
- **Masking.** Reduction in ability to detect communication or other relevant sound signals due to elevated levels of background noise.
- **Temporary threshold shift.** Temporary, recoverable reduction in hearing sensitivity caused by exposure to sound.

- **Permanent threshold shift.** Permanent, irreversible reduction in hearing sensitivity due to damage or injury to ear structures caused by prolonged exposure to sound or temporary exposure to very intense sound.
- **Nonauditory physiological effects.** Effects of sound exposure on tissues in nonauditory systems either through direct exposure or because of changes in behavior (e.g., resonance of respiratory cavities or growth of gas bubbles in body fluids).

The effects of increased vessel noise associated with project related vessels on pinnipeds in the study area would depend on many factors, including vessel size and type, existing vessel traffic in Columbia River, ambient underwater noise, time of year, species of pinniped, vessel location, and location of animal relative to vessel and the intervening environment. Given that the peak hearing sensitivity frequencies of Steller sea lion, California sea lion, and harbor seal are generally outside of the noise frequencies generated by vessels and because these species would likely be habituated to existing Columbia River vessel generated noise levels, it is likely that any response to project related vessel noise would be relatively minimal, and could in fact be indistinguishable from the response of pinnipeds to Columbia River vessel traffic in general.

Remove Habitat during Maintenance Dredging and Cause Associated Impacts on Wildlife

Maintenance dredging would likely be required on a multiyear basis or following extreme flow conditions; however it could be needed as frequently as every year to maintain required depths at Docks 2 and 3 and to access the navigation channel, especially in the years following the initial dredging work (WorleyParsons 2012).

Sediment accretion in the proposed dredge prism would most likely occur because of bedload transport due to river currents, and local scour and sediment redistribution resulting from propeller wash. Hydrodynamic modeling and sediment transport analysis was conducted for the proposed Docks 2 and 3 berthing/navigation basin. Sedimentation is complex in a newly dredged basin. Specific morphologic data is unavailable for the proposed new dredging basin; therefore the rate of accretion can only be estimated roughly. Based on current accretion estimates, rough estimates for annual accretion height is approximately 0.16 feet (0.07 to 0.26 feet range) and annual accretion volume is approximately 11,675 yd^3 (4,670 to 23,350 y^3 range). Maintenance dredging would likely be required on a multiyear basis or following occasions with extreme flow events. Small scale maintenance dredging could be needed more frequently, especially in the early years following the initial dredging work when higher than normal accretion is more likely (WorleyParsons 2012).

Impacts on the benthic invertebrate community would be similar to those described for initial dredging associated with construction activities (Section 3.1.1, *Construction: Direct Impacts*). Compared to the initial dredging effort, maintenance dredging would remove a small amount of material, including benthic, epibenthic, and infaunal organisms, resulting in some mortality of invertebrate organisms and temporary disruption of benthic productivity. Habitat within the proposed dredge prism is in deep water where benthic productivity is expected to be low compared to shallow water habitats (McCabe et al. 1997). As mentioned in Section 3.1.1, *Construction: Direct Impacts*, benthic organisms typically recolonize disturbed areas in 30 to 45 days following disturbance. Thus, should dredging occur annually, it would not prevent recolonization of the benthic habitat.

Maintenance related dredging activities could affect pinnipeds in a similar manner as was described for initial dredging associated with construction activities in Section 3.1.1, *Construction: Direct Impacts*. Pinnipeds could be affected by colliding with dredging vessels, increased turbidity, and noise associated with dredging activities (Todd et al. 2014). Collisions between dredging vessels and pinnipeds are possible but unlikely to occur given the slow speeds of dredging vessels (Todd et al. 2014). Turbidity is unlikely to cause substantial impacts on pinnipeds since they often inhabit naturally turbid or dark environments and are likely to use other senses in addition to their vision to locate potential hazards and prey (Todd et al. 2014). Noise could cause masking and behavioral changes in pinnipeds but is unlikely to cause auditory damage (Central Dredging Association 2011; Dickerson et al. 2001; Todd et al. 2014).

Cause Noise Impacts from Maintenance Dredging

Potential noise impacts from maintenance dredging would be similar to those described for dredging in Section 3.1.1, *Construction: Direct Impacts*.

Spill Coal during Rail Transport

The magnitude of the potential indirect impact from a coal spill on the aquatic and terrestrial environments would be similar to those described in Section 3.1.3, *Operations: Direct Impacts*, and would depend on the location of the spill, the volume of the spill, and success of efforts to contain and clean up the spill, none of which can be predicted.

The potential impact of a coal spill from a Proposed Action-related train is directly related to the probability of a Proposed Action-related train incident occurring. In Cowlitz County, the predicted number of loaded coal train incidents is approximately one every 2 years. The predicted number of loaded coal train incidents in Washington State is approximately five per year.

Not every incident of a loaded coal train would necessarily result in a rail car derailment or a coal spill. A train incident could involve one or multiple rail cars and could include derailment in certain circumstances. The size and speed of the train and the terrain at the location of an incident would influence whether the incident resulted in a coal spill that could have impacts on wildlife. A broad range of spill sizes from a partial rail car to multiple rail cars could occur because of a Proposed Action-related train incident.

Additionally, containment and cleanup efforts for coal spills from a rail incident factor into the potential impact on the environment. It is expected that coal spills in the terrestrial and built environments would be easier to contain and clean up than spills in an aquatic environment. Spills on land could have a quicker response time and cleanup in some locations because they are more visible and accessible to cleanup equipment compared to spills into aquatic environments.

Potential physical and chemical effects of a coal release into aquatic and terrestrial environments would be the same or similar to those described in Section 3.1.3, *Operations: Direct Impacts*.

Interfere with Wildlife along Rail Corridors in Washington State

Increased rail traffic associated with the Proposed Action could result in an increase in train strikes of wildlife species along the rail corridor.

Dorsey (2011) found that some wildlife use railroads for movements, which could be considered a positive impact. Wildlife move on or along railroads while foraging, accessing critical resources (e.g., water), migrating, and dispersing. Wildlife move along railroads for three main reasons.

- Railroads are often aligned with high-quality habitats and natural movement corridors (e.g., valley bottoms and mountain passes).
- Foods (i.e., edge vegetation, carrion from strikes, and spilled agricultural grains) are available along rights-of-way or on the railbed.
- The flat rail bed provides an easily traversable route particularly where railroad beds could offer a relatively snow-free travel path.

However, Dorsey (2011) indicated that various factors are likely to contribute to the frequency of wildlife and rail interactions and the potential for train strikes and wildlife mortality. For example, train speed, rail alignment, and train volume as well as wildlife abundance, behavior, and habitat quality and use (i.e., migration or foraging) along rail corridors could individually, or in combination, affect the likelihood and frequency of train strikes of wildlife. The relative abundance of wildlife along a railroad could be the primary factor affecting strikes rates (Dorsey 2011), although Kusta et al. (2014) did not find abundance of roe deer in the Czech Republic and train strikes to be correlated. Dorsey (2011) cited several studies that have documented more herbivore than carnivore mortalities from train strikes, which reflects their relatively greater abundance in most landscapes. Although Dorsey (2011) points out that foods found on and along railroads could also be a factor affecting strikes by increasing the time wildlife spend directly on or adjacent to railroads. Foods found along railroads could consist of natural vegetation, carrion and agricultural products spilled from train cars.

Overall, the Proposed Action would increase the number of trains traveling through Washington State by approximately 16 trains per day at full build-out (8 loaded trains arriving and 8 empty trains leaving each day). This increase in train traffic through Washington State would increase the risk of wildlife strikes by trains.

3.2 No-Action Alternative

Under the No- Action Alternative, the Applicant would not construct the Proposed Action. Current operations would continue, and the existing bulk product terminal site would be expanded. However, any expansion would only include activities that would not require a permit from the U.S. Army Corps of Engineers or a shoreline permit; thus, no impacts on aquatic habitats would occur as a result of an expansion of the existing bulk product terminal. New construction, demolition, or related activities to expand the bulk terminal could occur on previously developed upland portions of the project area. This could affect upland areas and terrestrial habitats that provide suitable wildlife habitat. The specific extent cannot be determined, as the specific build-out is undefined for the No-Action Alternative.

It is assumed that growth in the region would continue, which would allow continued operation of the coal export terminal and the adjacent bulk terminal site within the 20-year analysis period (2018–2038). Cleanup activities, relative to past industrial uses, would continue to occur. This could affect developed areas and associated disturbed upland habitats. Vessel traffic volumes are expected

to continue and any aquatic wildlife disturbance or injury associated with vessel movements would continue at levels similar to current conditions; however, no additional measurable impact on aquatic wildlife or their habitat would be expected to occur under the No-Action Alternative because no in-water work would occur.

Chapter 4
Required Permits

The Proposed Action would require the following permits related to wildlife.

- **Endangered Species Act Consultation.** The Proposed Action could result in impacts on wildlife species or designated critical habitats protected under the ESA. In accordance with Section 7(a)(2) of the ESA, as amended, any action that requires federal authorization or funding, or is carried out by a federal agency must undergo consultation with the USFWS and/or NMFS to ensure the action is not likely to jeopardize the continued existence of any listed threatened or endangered animal species or result in the destruction or adverse modification of designated critical habitat. Since the proposed project could affect listed species, a Section 7 consultation with NMFS and USFWS is required under the ESA. A biological assessment (BA) would be prepared and submitted to the federal lead for consultation with NMFS and USFWS. NMFS and USFWS would issue biological opinions containing their conclusions on the effects of the Proposed Action on ESA-listed species and critical habitats.
- **Clean Water Act Authorization, Section 404.** Construction and implementation of the Proposed Action would result in impacts on waters of the United States, including wetlands. Because impacts would exceed 0.5 acre, Individual authorization from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and appropriate compensatory mitigation for the acres and functions of the impacted wetlands would be required.
- **Marine Mammal Protection Act.** The Proposed Action would require pile driving, which could result in harassment, or "take," of marine mammals protected under the MMPA of 1972, as amended. The most likely occurring marine mammals are sea lions and harbor seals. In accordance with the MMPA, either an Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA) would be required from NMFS, which could grant incidental "take" of small numbers of marine mammals under certain circumstances.
- **Local Critical Areas and Construction Permits.** The Proposed Action would also require local permits related to clearing and grading of the site and relative to impacts on regulated critical areas. Chapter 19.15 of the Cowlitz County Code regulates activities within and adjacent to critical areas and in so doing regulates vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas. Cowlitz County would issue a Fill and Grade Permit, and would review the proposed project for consistency with the County's critical areas ordinance.
- **Hydraulic Project Approval.** The Proposed Action would require a hydraulic project approval from WDFW because project elements would affect and cross the shoreline of the Columbia River. The hydraulic project approval would consider effects on riparian and shoreline or bank vegetation in issuance and conditions of the permit, including for the installation of the proposed docks and piles, as well as for interior culverts or other crossings of drainage features.
- **Clean Water Act, Section 401 Water Quality Certification.** The Proposed Action would result in the construction and operation of a coal export terminal that would discharge into the navigable waters and would require a Clean Water Act, Section 401 water quality certification. This certification is administered by Ecology

The following measures were identified by the Applicant as measures that would be implemented during construction and/or operations. These measures are assumed conditions or requirements of permits that would be issued for the Proposed Action. These measures were considered when evaluated the potential impacts.

- While the Applicant would plan to limit construction for an 8- to 10-hour day, 5 days per week, on occasion, dredging could occur 7 days per week to complete work within specific fish windows.
- The Applicant would limit the impact of turbidity to a defined mixing zone and would otherwise comply with WAC 173-201A.
- The Applicant would not stockpile dredged material on the river bottom surface.
- The Applicant would contain all dredged material in a barge prior to flow-lane disposal; dredged material would not be stockpiled on the riverbed.
- During hydraulic dredging, the Applicant would not operate the hydraulic pumps unless the dredge intake is within 3 feet of the bottom.
- The Applicant would remove any floating oil, sheen, or debris within the work area as necessary to prevent loss of materials from the site. The contractor would be responsible for retrieval of any floating oil, sheen, or debris from the work area and any damages resulting from the loss.
- For material being transported to flow-lane disposal sites, the Applicant would remove all debris (larger than 2 feet in any dimension) from the dredged sediment prior to disposal. Similar-sized debris floating in the dredging or disposal area would also be removed.
- The Applicant would dispose materials to the flow lane using a bottom-dump barge or hopper dredge. These systems release material below the surface, minimizing surface turbidity.
- The Applicant would limit all construction activities to daylight hours to ensure that construction noise levels would be controlled and within local and state noise limits.
- The Applicant would install and maintain a noise monitoring station at an appropriate location on or near the site boundary to create 24-hour per day noise record during construction. The measurements would be recorded and monitored on a real time basis, and the contractor would take actions to halt or alter construction activities that exceed noise levels.
- To reduce the sound along the rail line, the Applicant would work with the Longview Switching Company to convert both the Oregon Way and Industrial Way crossings to quiet crossings and would fund such improvements to the rail line as necessary to achieve this mitigation.
- The Applicant would plan construction for an 8- to 10-hour day, 5 days per week. On occasion, it could be necessary to work 6 or 7 days per week depending on the nature of the task. For example, dredging could occur 7 days per week to complete work within specific fish windows.
- The Applicant would use activity-specific work windows designed to minimize specific impact mechanisms that could affect individual species (or populations within those species) of concern. These proposed work windows would protect species of concern while providing feasible construction periods for the in-water portion of construction over a 2-year schedule.
- The Applicant would conduct impact pile driving using a confined bubble curtain or similar sound attenuation system capable of achieving approximately 9 decibels of sound attenuation.

- Where possible, the Applicant would keep extraction equipment out of the water to avoid "pinching" pile below the water line in order to minimize creosote release during extraction.
- During pile removal and pile driving, the Applicant would place a containment boom around the perimeter of the work area to capture wood debris and other materials released into the waters because of construction activities. The Applicant would collect all accumulated debris and dispose of it upland at an approved disposal site. The contractor would deploy absorbent pads should any sheen be observed.
- The Applicant would provide a containment basin on the work surface on the barge deck or pier for piles and any sediment removed during pulling. The Applicant would dispose of any sediment collected in the containment basin at an appropriate upland facility, as with all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- Upon removal from substrate, the Applicant would move the pile expeditiously from the water into the containment basin. The contractor would not shake, hose, strip, or scrape the pile, nor leave it hanging to drip or any other action intended to clean or remove adhering material from the pile.
- The Applicant would dispose of all piles removed at an appropriate upland facility.
- The Applicant would prepare a mitigation plan in coordination with the Corps, Ecology, and Cowlitz County to address impacts on wetlands and aquatic habitats. Mitigation actions could be implemented at one or several locations to ensure that a wide range of ecological functions is provided to offset identified, unavoidable impacts of the Proposed Action. The mitigation actions could include Applicant-sponsored mitigation actions or use of credits from existing or proposed mitigation banks

Chapter 5
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Appendix A

Special-Status Wildlife Species in Cowlitz County

Appendix A
Special-Status Wildlife Species in Cowlitz County

Table A-1. Special-Status Wildlife Species that Could Occur in Cowlitz County, Washington

Common Name	Scientific Name	Element of Concern	Potential for Occurrence in the Study Area	Potential for Habitat in the Study Area
Mammals				
Columbian black-tailed deer	*Odocoileus hemionus columbianus*	Individuals	Yes	Documented on the project area
Columbian white-tailed deer	*Odocoilieus virginianus leucurus*	Individuals	Yes	Documented on the project area[a]
Harbor seal (*Phoca vitulina*)	*Phoca vitulina*	Individuals	Yes	Present in Columbia River
California sea lion	*Zalophus californianus*	Individuals	Yes	Present in Columbia River
Stellar Sea lion	*Eumetopias jubatus*	Individuals	Yes	Present in Columbia River
Big brown bat	*Eptesicus fuscus*	Roosting concentrations	Unlikely	No suitable habitat identified
Myotis bats	*Myotis spp.*	Roosting concentrations	Unlikely	No suitable habitat identified
Pallid bat	*Antrozous pallidus*	Roosting concentrations	Unlikely	No suitable habitat identified
Townsends big-eared bat	*Corynorhinus townsendii*	Individuals	Unlikely	No suitable habitat identified
Fisher	*Martes pennant*	Individuals	No	No suitable habitat identified
Marten	*Martes Americana*	Individuals	No	No suitable habitat identified
Wolverine	*Gulo gulo*	Individuals	No	No suitable habitat identified
Elk	*Cervus elaphus*	Individuals	Unlikely	No suitable habitat identified
Birds				
Western grebe	*Aechmophorus occidentalis*	Individuals	Unlikely	Open water
Marbled murrelet	*Brachyramphus marmoratus*	Individuals	No	No suitable habitat identified
Yellow-billed cuckoo	*Coccyzus americanus*	Individuals	Unlikely, extremely rare	Very limited habitat

Common Name	Scientific Name	Element of Concern	Potential for Occurrence in the Study Area	Potential for Habitat in the Study Area
Streaked horned lark	*Eremophila alpestris strigata*	Individuals	Possibly	Not documented on project area; other areas of potential habitat in study area not surveyed
Great-blue heron	*Ardea herodias*	Breeding colony	No (individuals documented on project site)	No breeding habitat documented in study area
Cavity nesting ducks	N/A	Breeding areas	No	No breeding habitat documented in study area
Barrows Goldeneye	*Bucephala islandica*	Western Washington nonbreeding concentrations	Unlikely	Open water
Common Goldeneye	*Bucephala clangula*	Western Washington nonbreeding concentrations	Unlikely	Open water
Bufflehead	*Bucephala albeola*	Western Washington non-breeding concentrations	Unlikely	Open water
Harlequin duck	*Histrionicus histrionicus*	Breeding areas and regular concentrations in salt water	No	No open salt water; no suitable breeding habitat identified
Tundra swan	*Cygnus columbianus*	Regular concentrations	No	No suitable habitat identified
Trumpeter swan	*Cygnus buccinators*	Individuals	No	No suitable habitat identified
Waterfowl concentrations	N/A	Significant breeding areas, regular winter concentrations	Unlikely	Suitable habitat not likely to support large concentrations
Bald eagle	*Haliaeetus leucocephalus*	Breeding areas, communal roosts, regular concentrations	Possibly (individuals documented flying over the project area)	No breeding habitat identified; forested wetland could provide roosting habitat.
Golden eagle	*Aquila chrysaetos*	Breeding and foraging areas	Unlikely	Not found in lowland industrial areas
Northern goshawk	*Accipiter gentilis*	Breeding areas	No	No suitable habitat identified

Common Name	Scientific Name	Element of Concern	Potential for Occurrence in the Study Area	Potential for Habitat in the Study Area
Peregrine falcon	*Falco peregrinus*	Breeding areas; regular occurrences	Possibly	Potential foraging habitat
Sooty grouse	*Dendragapus fuliginosus*	Breeding areas; regular concentrations	No	No suitable habitat identified
Wild turkey	*Meleagris galiopavo*	Individuals	Unlikely	No suitable habitat identified
Sandhill Crane	*Grus Canadensis*	Breeding areas, regular concentrations, migration staging areas	Unlikely	No suitable habitat for breeding or congregating.
Plovers	Charadridae	Western Washington nonbreeding concentrations	Unlikely	Suitable habitat is limited
Waders/Sandpipers	Scolopacidae	Western Washington nonbreeding concentrations	Unlikely	Suitable habitat is limited
Phalaropes	Phalaropodidae	Western Washington nonbreeding concentrations	Unlikely	Suitable habitat is limited
Band-tailed pigeon	*Columba fasciata*	Regular concentrations, occupied mineral sites	No	No known habitat on the project area
Spotted owl	*Strix occidentalis*	Individuals	No	No suitable habitat on the project area
Vaux's swift	*Chaetura vauxi*	Breeding areas, communal roosts	Possibly	No large snags for breeding or roosting on the project site; known sightings at Mint Farm Industrial Park[b]
Pileated woodpecker	*Dryocopus pileatus*	Breeding areas	Unlikely (individuals possibly)	Breeding habitat component unlikely at the project area
Purple martin	*Progne subis*	Breeding and feeding areas	Yes	Species presence documented on the project area[a]
Slender-billed white-breasted nuthatch	*Sitta carolinensus*	Individuals	Unlikely	Lack of mature deciduous forest on the project area

Common Name	Scientific Name	Element of Concern	Potential for Occurrence in the Study Area	Potential for Habitat in the Study Area
Amphibians				
Western toad	*Bufo boreas*	Individuals	Unlikely, recently extirpated from local range	Species is uncommon; No large natural ponds for breeding on the project site and unlikely in study area
Dunn's salamander	*Plethodon dunii*	Individuals	No	No suitable habitat on the project area and unlikely in study area
Van Dyke's salamander	*Plethodon vandykii*	Individuals	No	No suitable habitat on the project area and unlikely in study area
Cascade torrent salamander	*Rhyacotriton cascadae*	Individuals	No	No suitable habitat on the project area and unlikely in study area
Larch mountain salamander	*Plethodon larselli*	Individuals	No	No suitable habitat on the project area and unlikely in study area
Reptiles				
Western pond turtle	*Actinemys marmorata*	Individuals	No	No suitable habitat on the project area and unlikely in study area

[a] Grette Associates 2014
[b] Willapa Hills Audubon Society 2014

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MILLENNIUM BULK TERMINALS—LONGVIEW SEPA ENVIRONMENTAL IMPACT STATEMENT

SEPA ENERGY AND NATURAL RESOURCES TECHNICAL REPORT

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Acronyms and Abbreviations

Applicant	Millennium Bulk Terminals—Longview, LLC
bgs	below the ground surface
BNSF	BNSF Railway Company
BPA	Bonneville Power Administration
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
City	City of Longview
Corps	U.S. Army Corps of Engineers
County	Cowlitz County
kV	kilovolt
kWh	kilowatt hour
MW	megawatt
MWH	megawatt hour
NEPA	National Environmental Policy Act
PUD	Public Utility District
RCW	Revised Code of Washington
Reynolds facility	Reynolds Metals Company facility
RWTP	Regional Water Treatment Plant
SEPA	Washington State Environmental Policy Act
UP	Union Pacific Railroad
USC	United States Code
WAC	Washington Administrative Code

Chapter 1
Introduction

This technical report assesses the potential energy and natural resources impacts of the proposed Millennium Bulk Terminals—Longview project (Proposed Action) and No-Action Alternative. For the purposes of this assessment, energy and natural resources refer to different energy types and sources that would be used during project construction and ongoing operations. This report describes the regulatory setting, establishes the methods for assessing potential energy and natural resources impacts, presents the historical and current energy and natural resources conditions in the study area, and assesses potential impacts.

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and UP, and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the

east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

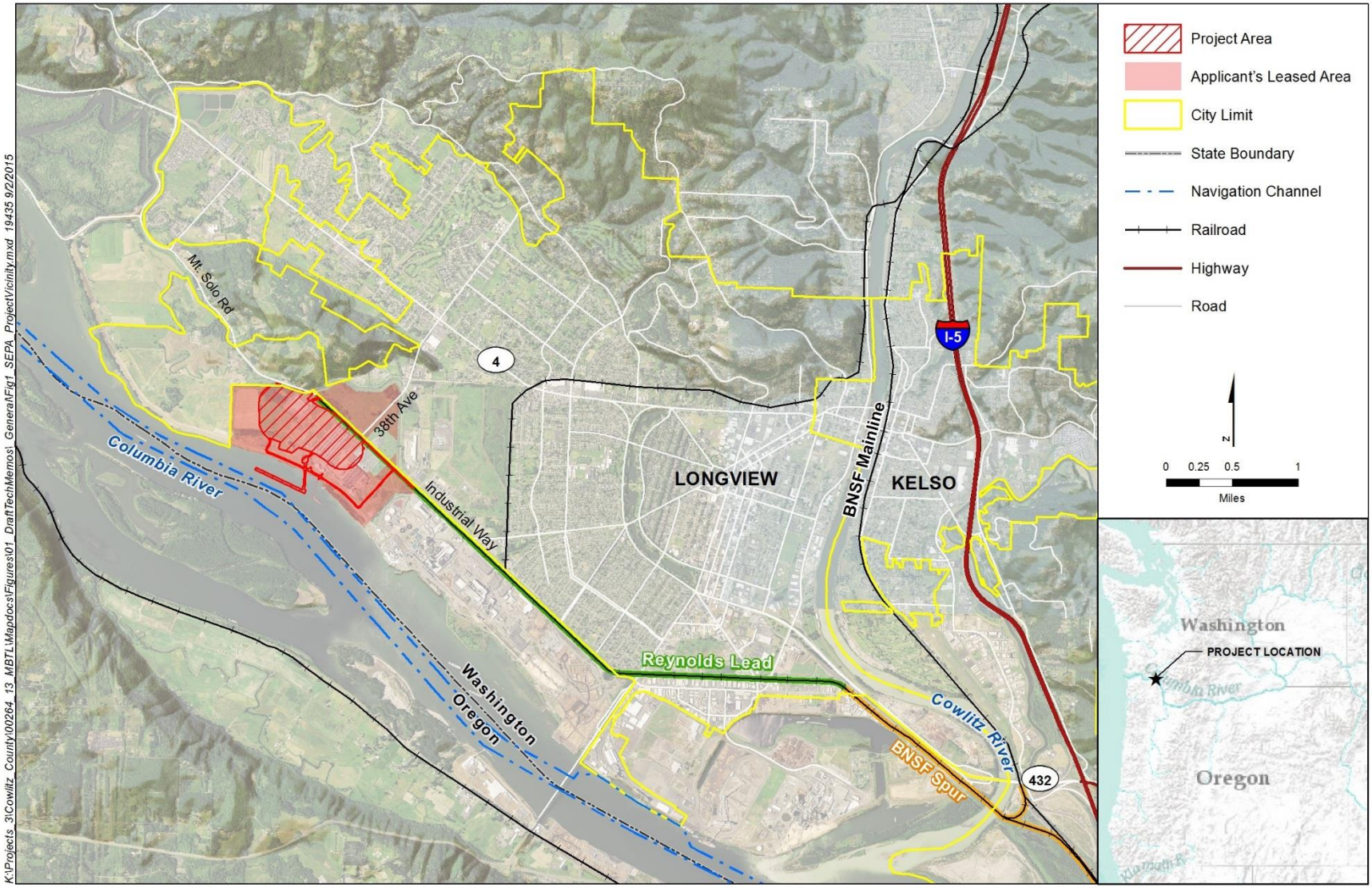
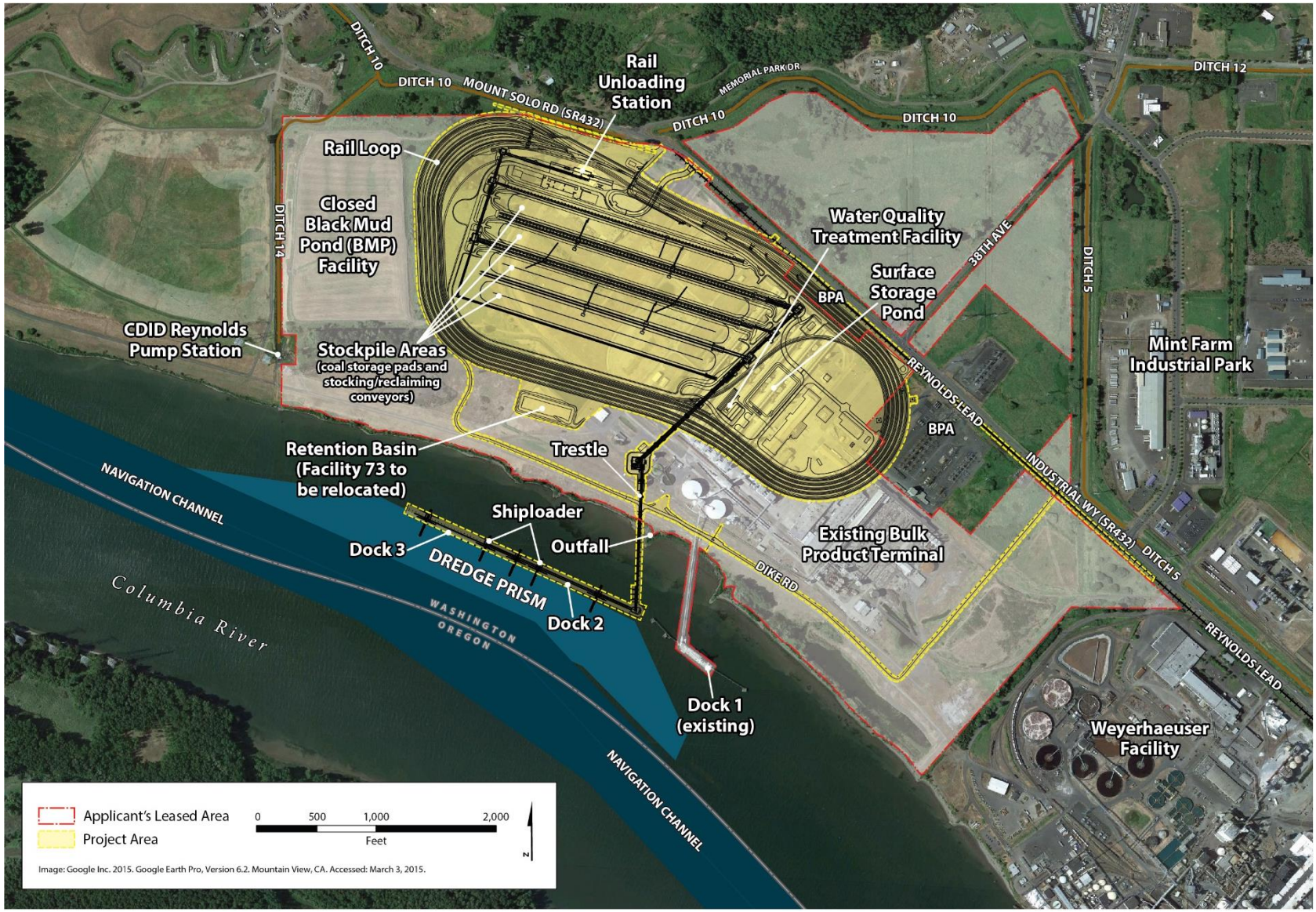


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential impacts on energy and natural resources are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Energy and Natural Resources

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Washington State Energy Code, Commercial Provisions (WAC 51-11C)	Regulates the design and construction of buildings for the use and conservation of energy over the life of each building.
Local	
Cowlitz County SEPA Regulations (CCC Code 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Comprehensive Plan	Provides a framework for the management of natural and energy resources within Cowlitz County.

Regulation, Statute, Guideline	Description
Cowlitz County Building Code (CCC 16.05)	Establishes standards for construction and the use of buildings and structures within unincorporated Cowlitz County. Requires conformance with the Washington State Energy Code, CCC 1605.130.

Notes:
USC = United States Code; NEPA = National Environmental Policy Act; CFR = Code of Federal Regulations; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SEPA = Washington State Environmental Policy Act; CCC = Cowlitz County Code

1.2.1 Study Area

The study area for direct impacts on energy and natural resources is the project area. For indirect impacts, the study area is the area within 0.25 mile of project area boundaries. When assessing the availability of energy and natural resources, the analysis considers those resources that are available regionally, beyond the 0.25-mile study area.

Chapter 2
Existing Conditions

This chapter explains the methods for assessing the existing conditions and determining impacts, and describes the existing conditions in the study area as they pertain to energy and natural resources.

2.1 Methods

This section describes the sources of information and methods used to characterize the existing conditions and assess the potential impacts of the Proposed Action and No-Action Alternative on energy and natural resources.

2.1.1 Data Sources

The following sources of information were used to evaluate the energy and natural resources characteristics of the study area.

- Cascade Natural Gas Website (http://www.cngc.com/utility-navigation/about-us).
- City of Longview Comprehensive Plan (http://wa-cowlitzcounty.civicplus.com/DocumentCenter/View/3160).
- Cowlitz Conservation District (http://scc.wa.gov/wp-content/uploads/2013/12/CowlitzLRP.pdf).
- Cowlitz County Comprehensive Plan (http://wa-cowlitzcounty.civicplus.com/DocumentCenter/View/3160).
- Cowlitz Public Utility District Annual Reports (http://cowlitzpud.org/annual_report.php).
- U.S. Energy Information Administration (http://www.eia.gov/state/?sid=WA#tabs-1).
- U.S. Mining Cowlitz County's Mines (http://www.us-mining.com/washington/cowlitz-county).

Information on existing energy sources and availability within the region was collected from documents made available by the respective energy providers. In addition, materials provided by the Applicant (URS Corporation 2014; Appendix A, *Additional Applicant-Provided Information*) were used to evaluate energy and natural resources.

2.1.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative on energy and natural resources. For the purposes of this analysis, construction

impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

Potential impacts on energy were evaluated based on the estimated amount of energy consumed during construction and operation of the Proposed Action and No-Action Alternative. Estimated hours of operation and types of fuel consumed were used in quantifying energy consumption.

Potential impacts on depletable natural resources from the Proposed Action and No-Action Alternative are estimated based on the proposed consumption of natural resources during construction.

For this analysis, a number of assumptions related to construction materials and transportation were made.

- Heavy construction materials, such as gravel, sand, concrete, and timber would be sourced locally to the extent possible.
- Quantities adequate to support the needs of the Proposed Action and No-Action Alternative are readily available in Cowlitz County.
- Long-distance transport of these materials would be undesirable due to associated transportation costs.
- Steel used in construction would be available from a combination of local (Cowlitz County) and regional (Washington and Oregon) sources.

Because there are no established federal, state, or local thresholds for the evaluation of energy-related impacts from construction or operations activities, the following methods were used to assess impacts of the Proposed Action and No-Action Alternative on energy and natural resources.

The following methods were used to evaluate construction impacts.

- Identified the energy types and natural resources that would be needed for construction.
- Analyzed the effect of the Proposed Action and No-Action Alternative on local fuel and natural resource availability during construction.
- Estimated the amount and source of materials and energy needed for project construction.

The following methods were used to evaluate operations impacts.

- Estimated energy use for the Proposed Action and No-Action Alternative.
- Analyzed the effect of energy consumed by the Proposed Action and No-Action Alternative on regional energy production and consumption.
- Identified energy and natural resources needed for operations.

2.2 Existing Conditions

The existing environmental conditions related to energy and natural resources in the study area are described below.

2.2.1.1 Energy

Local energy sources and current energy usage in the project area are described below.

Local Energy Sources

The project area is served by multiple local energy sources and providers, including electricity, natural gas, and diesel fuel facilities. The following subsections provide an overview of these local energy sources.

Electricity

Existing electricity energy sources in Cowlitz County include electricity provided by the Cowlitz Public Utility District (PUD) and high voltage transmission lines owned and operated by BPA.

Cowlitz PUD buys over 90% of its wholesale power from BPA. The majority of the BPA power comes from the Columbia River system hydroelectric projects. BPA also sells the output of the Columbia Generating System (nuclear plant) near Richland, Washington, and makes miscellaneous energy purchases on the open market. The remaining PUD power comes from its own 68.8 megawatt (MW) No. 2 Hydroelectric Project on the Lewis River near Cougar, Washington (Cowlitz Public Utility District 2015a).

According to the 2014 Cowlitz PUD Annual Report, the electric system provides service throughout Cowlitz County, which encompasses 1,144 square miles and approximately 49,000 customers. Cowlitz PUD is among the largest public utility districts in the state of Washington with total 2012 power sales of 5.14 million megawatt hours (MWH). Extreme weather and economic conditions are the primary influences on electricity sales (Cowlitz Public Utility District 2015a).

According to the 2014 Cowlitz PUD Integrated Resource Plan, it was estimated that, in 2015, Cowlitz PUD customers used 609 average MW and 821 peak MW. By 2040, a Cowlitz PUD customer will use an estimated 677 average MW and 934 peak MW (Cowlitz Public Utility District 2015b).

As depicted in Table 2, approximately 14% of Cowlitz PUD's power is sold to residential users. Residential usage was approximately 703 million kilowatt hours (kWh) in 2014. Approximately 8% of the power is sold to industrial users (22 companies or industries), using approximately 385 million kWh in 2014. Major Industrial users consume approximately 71% of the power, using approximately 3.6 billion kWh (Cowlitz Public Utility District 2015b).

Table 2. Cowlitz PUD Average Electrical Usage for 2014

Customer Type	Number of Customers	kWh	Percent of kWh
Residential	43,296	703,389,286	13.9
Sm. General Service	5,598	184,922,989	3.6
General Service	285	190,797,188	3.8
Large Industrial	22	385,324,314	7.6
Major Industrial/Direct Access	3	3,609,197,028	71.1
Street/Area Lighting and Other	12	3,279,000	0.1
Total	**49,216**	**5,076,909,805**	**100.00**

Source: Cowlitz Public Utility District 2015b
kWh = kilowatt hours

Natural Gas

Natural gas is not considered a utility that is essential to urban development but is an important alternative energy source that helps to reduce reliance on electricity. Cascade Natural Gas is the local provider of natural gas and serves more than 260,000 customers in 96 communities, 68 of which are in Washington and 28 in Oregon. The Cascade Natural Gas service area is concentrated in western and central Washington, and central and eastern Oregon. Interstate pipelines transmit Cascade's natural gas from production areas in the Rocky Mountains and western Canada (Cascade Natural Gas Company 2014).

Diesel Fuel

Local suppliers provide diesel fuel in the Longview-Kelso area. In Washington, approximately 88.36 million gallons of diesel fuel were sold annually to railroad-related uses in 2012 (U.S. Energy Information Administration 2014). This represents approximately 9% of total diesel sales for all uses in the state. The largest consumers were on-highway users, or motor vehicles, accounting for 62% of diesel sales, or approximately 618 million gallons, in Washington in 2012.

Tank vessels primarily use diesel or residual fuel oil. The fuel oil used by vessels is required to meet emission standards for nitrogen oxides, sulfur oxides and particulate matter while in the North American Emissions Control Area. Diesel fuel sales for vessel uses in Washington (excluding the military) totaled 80.5 million gallons in 2012, which accounted for 8.2% of the total diesel sales in the state (U.S. Energy Information Administration 2014). In 2013, the total prime supplier sales volume of fuel oil was 469.86 million gallons for Washington (U.S. Energy Information Administration 2014).

Project Area Energy Usage

Routine maintenance and site cleanup activities associated with the project area require the use of electricity, diesel fuel, and gasoline (URS Corporation 2014). The project area does not have solar or wind energy infrastructure to create solar or wind energy at the project area.

Cowlitz PUD provides electricity to the project area via overhead 230 kilovolt (kV) and 115 kV power lines along Industrial Way. Other power lines run perpendicular to the north end of the project area, where they converge with a BPA substation. The existing power configuration is sufficient for the current operations at the project area (URS Corporation 2014). The existing annual electricity use for the existing bulk product terminal area (outside the project area but within the Applicant's leased area) averages 20 MW based on the average electrical usages for 2014 (Appendix A, *Additional Applicant-Provided Information*).

In the project area, electricity is provided by Cowlitz PUD. Structures in the project area associated with the former Reynolds facility, such as warehouses, are currently not in use. Some electricity supplied by Cowlitz PUD is used for lighting, welding equipment, and computers and other office equipment in administrative buildings, but a majority of the energy used is from diesel- or gasoline-powered generators. Diesel fuel and gasoline are used in construction equipment. Gasoline and diesel used in the project area are provided by local fuel suppliers (Appendix A, *Additional Applicant-Provided Information*).

2.2.1.2 Natural Resources

Local natural resources are described below, followed by a discussion of the natural resources available in the project area.

Local Natural Resources

Renewable natural resources generally include water, solar, wind, open space (i.e., wildlife habitats, natural features, and recreation areas), sustenance fishing and harvesting, and wood-derived products from timberlands. Nonrenewable natural resources generally include materials mined from quarries such as sand, gravel, and soil; metals such as steel, aluminum, and iron; lime used to mix with sand and gravel for concrete; silica for glass; fossil fuels such as coal, petroleum, and natural gas; and unique natural features (URS Corporation 2014).

As late as 1998, forestlands covered 85% of Cowlitz County, and the economy in the early 1990s was centered on forestry and timber products (Cowlitz Conservation District 2008). Weyerhaeuser manufactures wood and paper products at a facility near the project area along the Columbia River. Many other wood supply companies are located in nearby Longview.

Groundwater resources in the area are an upper alluvium aquifer (i.e., shallow groundwater), and the deeper confined aquifer from which industries, small farms, and domestic well users withdraw groundwater. The shallow aquifer is at depths of 30 to 50 feet below the ground surface (bgs). The deeper aquifer is at depths of 240 to 400 feet bgs. The new Mint Farm Regional Water Treatment Plant (RWTP) operated by the Beacon Hill Water and Sewer District and located less than 1mile north of the project area, began withdrawing groundwater from the deep confined aquifer in January 2013 (URS Corporation 2014).

Numerous quarries and mines are located within Cowlitz County that provide crushed stone, sand, and gravel (U.S. Mining 2014). Mount Coffin, on the site of the Weyerhaeuser mill upstream from the project area, was dynamited for gravel and building stone (History Link 2014).

Project Area Natural Resources

The project area is zoned Heavy Manufacturing by Cowlitz County. No forest products are located within the 190-acre project area.

The project area landowner, Northwest Alloys, holds several historical water rights to extract groundwater from a deep aquifer. The Applicant has a ground lease with Northwest Alloys that includes use of water rights. For more information on local groundwater see the SEPA Groundwater Technical Report (ICF 2017a).

Based on lithologic logs for borings completed under the environmental characterization effort, the materials beneath the project area are composed of discontinuous and interbedded layers of sand, silt, and clay (Anchor QEA 2015).

Chapter 3
Impacts

This chapter describes the impacts on energy and natural resources that would result from construction and operation of the Proposed Action or the ongoing conditions under the No-Action Alternative. Impacts related to other resources are addressed in other technical reports:

- SEPA Air Quality Technical Report (ICF 2017b): Impacts on air quality.
- SEPA Geology and Soils (ICF 2017c): Impacts on geology and soils.
- SEPA Greenhouse Gas Technical Report (ICF 2017d): Impacts from greenhouse gas emissions (including rail and vessel transportation).
- SEPA Groundwater Technical Report (ICF 2017a): Impacts on groundwater.
- SEPA Surface Water and Floodplains Technical Report (ICF 2017e): Impacts on surface water and floodplains.
- SEPA Vegetation Technical Report (ICF 2017f): Impacts on vegetation.
- SEPA Water Quality Technical Report (ICF 2017g): Impacts on water quality and hydrology.

3.1 Proposed Action

Potential impacts on energy and natural resources from the Proposed Action are described below.

3.1.1 Construction: Direct Impacts

Construction of the Proposed Action would result in the following direct impacts.

Increase Energy Use

Construction-related energy uses would include the use of electricity, diesel fuel, gasoline, oil, and natural gas.

Electricity use for construction of the Proposed Action would come from the Cowlitz PUD Mint Farm substation. Minor electricity use would be required for equipment such as lighting and welding, and computers and other office equipment in a portable construction trailer. Because the majority of energy use for construction would likely be from diesel- or gasoline-powered generators, direct construction-related impacts on electricity would be short-term (URS Corporation 2014).

Heavy machinery would be operated to prepare foundations and footings for the construction of the coal export terminal, associated services, and utilities. Diesel fuel and gasoline would be used in most construction equipment such as cranes, wheel loaders, dozers, dump trucks, excavators, graders, rollers, compactors, drill rigs, pile driving equipment, portable ready-mix batch plant, ready-mix trucks, concrete pumps, elevated work platforms, forklifts, rail track laying equipment, water pumps, and other similar machinery (URS Corporation 2014).

Construction equipment would be refueled on site in a designated spill containment area.[1] A fuel truck would visit the project area as required. The frequency during construction would vary based on usage and activities and could range from a high of once or twice per day to a low of once or twice per week. Fuel trucks that would be used during construction would have a 3,000-gallon to 4,000-gallon capacity (Appendix A, *Additional Applicant-Provided Information*). A temporary increase in fuel usage would result from the need to transport employees and materials to the project area and to operate construction equipment.

Construction is anticipated to require on average approximately the following amounts of fuel (Appendix A, *Additional Applicant-Provided Information*).

- 500 gallons per month of gasoline.
- 50 gallons per month of oil.
- 5,000 gallons per week and 20,000 gallons per month of diesel.

The Proposed Action's demand for gasoline, oil, and diesel fuel would be a minor amount compared to the current regional demand for these fuels. Local fuel suppliers currently supply diesel to Weyerhaeuser, the logging industry, and several other local industrial users (Appendix A, *Additional Applicant-Provided Information*). Diesel fuel needs for construction of the Proposed Action would represent a minor amount of the total regional demand. This demand could be met by local suppliers.

Natural gas is piped to the project area. Natural gas would be used for minor purposes, including to heat water for showers and other sanitary uses, but not for industrial uses. To avoid disruption of natural gas supply, pipes would be located, properly marked, and avoided during construction (URS Corporation 2014). The demand for natural gas would be negligible compared to the regional natural gas demand, and no construction-related impacts are anticipated.

Increase the Use of Natural Resources

Natural resources that would be used on site for construction of the Proposed Action include water, gravel, fill dirt, steel, and wood. Groundwater available on site would be used during upland construction as necessary for dust suppression, requiring less than 40,000 gallons per day (URS Corporation 2014).

Approximately 2.1 million cubic yards of fill material would be imported to the project area to be used as preload material, and approximately 2.5 million cubic yards of material would be moved around the site during preload activities (URS Corporation 2014). Dredging would occur as part of the construction of the two docks (Docks 2 and 3), which would include removal of approximately 500,000 cubic yards of fill material. All regularly used roads accessing the buildings and facilities within the project area would be sealed with asphalt pavement, and other roads would be gravel (URS Corporation 2014). Any new impervious surface area would generate stormwater, but all stormwater would be collected and treated to meet state and federal water quality requirements prior to discharge to the Columbia River.

[1] The Applicant identified a list of best management practices from the *Ecology Stormwater Management Manual for Western Washington* (Washington State Department of Ecology 2012) that would be implemented during construction, including BMP C153, which addresses material delivery, storage, and containment. For more information, see the SEPA Water Quality Technical Report (ICF 2017g).

Rail loop construction would require importing and placing approximately 130,000 cubic yards of ballast rock for the rail foundations; placing railroad ties; laying steel rail lines; and installing signaling, switching equipment, and track lighting (URS Corporation 2014). The demand for cubic yards of gravel and fill dirt, steel needed for rail lines, and any wood resource needs during construction would not likely cause a noticeable impact on supplies in the area, which has many natural resource industries and associated suppliers.

3.1.2 Construction: Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on energy or natural resources.

3.1.3 Operations: Direct Impacts

Operation of the Proposed Action would result in the following direct impacts.

Increase Energy Use

Electricity, gasoline, oil, propane, and diesel fuel would be the primary energy types consumed in the project area. Electricity would be used to power the automated system used to unload coal, store coal, reclaim the coal from storage, and load the vessels. Specific types of equipment used for these processes include rail car unloading facilities, stacking conveyers, bucket wheel reclaimers, the belt conveyer system, and shiploaders (URS Corporation 2014).

The Applicant estimates terminal electricity usage during full operations would be approximately 6,624,000 kWh per year (Appendix A, *Additional Applicant-Provided Information*). Operations electricity requirements would be 20 to 25 MW per year (Appendix A). According to the Cowlitz PUD's Integrated Resource Plan, it is forecasted that in 2015, Cowlitz PUD's regional supply would use approximately 609 average MW and 821 peak MW. At full operation, energy use for the Proposed Action would represent an average of approximately 4% of the total electricity supplied to users in the Cowlitz PUD service area, and is anticipated to be met by existing regional supply because Cowlitz PUD currently has the capacity to meet the electricity demand from the Proposed Action.

Gasoline, propane, and diesel would be used to power vehicles and equipment used on site for standard operations and routine maintenance. Equipment would include wheel loaders, cranes, forklifts, trucks, welders, pumps, and other similar equipment (URS Corporation 2014).

Operations are anticipated to require on average approximately the following amounts of fuel (Appendix A, *Additional Applicant-Provided Information*).

- 100 gallons per month of gasoline.
- 75 gallons per month of oil.
- 200 gallons per week of diesel.

Operations fuel needs would be minor relative to the regional fuel demand and supply.

There are no specific plans to use biodiesel for maintenance vehicles; however, actual usage in the future would depend on local availability and compatibility with needed equipment (Appendix A, *Additional Applicant-Provided Information*).

Increase the Use of Natural Resources

Natural resources that would be used on site for operation of the Proposed Action would include water, gravel, fill dirt, and wood.

A water treatment facility would be designed to treat all surface runoff and process water with capacity to store the water for reuse. The use of stormwater in combination with a storage reservoir and on-site groundwater would be used for processing water and fire protection. All of the stormwater would be processed through the on-site water treatment facility prior to reuse. The proposed processed water uses include dust control, stockpile sprays, wash down, and clean-up (URS Corporation 2014).

Water would be used to control dust from operating conveyors, transfer points, rail car unloaders, stockpiling, and ship loading. Approximately 120 million gallons per year would be reused from on-site runoff during operations. Combined with the groundwater demand from existing activities in the project area (approximately 1,994 acre-feet per year), the total demand on groundwater supplies during operation of the Proposed Action would be approximately 3,019 acre-feet per year.[2] Water would be sourced from existing production wells within the existing water rights, and there would be no need for new wells. Water would be reused on site. The demand on other natural resources would not likely affect the local supplies.

Specific quantities and uses of gravel, fill dirt, and wood during operation of the Proposed Action are not known at this time. However, any increase in demand is not anticipated to be large enough to cause a noticeable impact on supplies in the area.

3.1.4 Operations: Indirect Impacts

Operation of the Proposed Action would result in the following indirect impacts.

Increase Energy Use

The Proposed Action would result in approximately 240 unit trains arriving and 240 unit trains departing each month. These rail traffic operations would increase rail locomotive fuel consumption in the study area compared to existing conditions and the No-Action Alternative.

The Proposed Action would result in approximately 1,680 vessel transits per year, compared to the No-Action Alternative, which would include 26 vessel transits per year (including existing, planned, and potential future activities). These vessel traffic operations would increase vessel fuel consumption in the study area compared to existing conditions and the No-Action Alternative.

The Proposed Action would require approximately 135 employees to operate the coal export terminal, which would generate approximately 270 trips per day, assuming two employee trips per day. These vehicle traffic operations would increase vehicle fuel consumption in the study area compared to existing conditions and the No-Action Alternative.

[2] This estimate does not account for any future projects that the Applicant could construct within the project area that could require groundwater pumping; however, since the Proposed Action combined with the existing demand would account for less than 10% of the maximum pumping limits, operation of the Proposed Action would have a negligible impact on groundwater supply.

During operations, a fuel truck would come to the project area as needed and would likely have a 3,000-gallon to 4,000-gallon capacity. Deliveries would be less frequent than in the construction phase. The frequency would vary based on usage and activities and could range from a high of once or twice per day to a low of once or twice per week (Appendix A, *Additional Applicant-Provided Information*).

Trains and vessels would not be fueled in the project area. Fuel consumption from employee and fuel truck trips would be a minor amount compared to the current demand for fuel in the study area, and could be met by the existing local and regional supply.

The design for the Proposed Action would not interfere with the potential for adjacent properties to implement solar and/or wind power because the design would not substantially shade adjacent properties or interfere with local wind patterns.

3.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the coal export terminal, and the existing use of energy and natural resources would continue. However, the Applicant could expand the existing bulk product terminal onto the project area. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations and federal and state permits. Potential impacts of the No-Action Alternative are described below.

Expanding the existing bulk product terminal would increase the demand for energy (natural gas, electricity, diesel fuel, and gasoline). Cowlitz PUD and Cascade Natural Gas have the capacity to meet the anticipated demand and local suppliers would be able to accommodate diesel and gasoline demand.

Expanding the existing bulk product terminal would increase the demand for natural resources. Use of natural resources would not cause a noticeable impact on supplies in the area, and demand for natural resources would not adversely affect the supply from local and regional service providers.

Chapter 4
Required Permits

The following permits would be required for the Proposed Action in relation to energy and natural resources.

The Proposed Action would require building and site development permits from the Cowlitz County Department of Building and Planning in relation to the use of energy and natural resources (such as electrical and mechanical permits).

Chapter 5
References

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ICF. 2016c. *Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement*. *SEPA Soils and Geology Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

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Appendix A

Additional Applicant-Provided Information

Appendix A
Additional Applicant-Provided Information

In addition to the Applicant-prepared reports,[1] the following information from the Applicant was used to document the energy and natural resource affected environment and assess potential energy and natural resource impacts of the alternatives.

Topic	Applicant-Provided Information
Diesel fuel usage during construction and operation	Diesel fuel needs for construction activities would average 5,000 gallons per week, with a minimum weekly usage of approximately 1,000 gallons and a maximum weekly usage of approximately 10,000 gallons. Local fuel suppliers currently supply diesel to Weyerhaeuser, Kapstone, the logging industry, Foster Farms, and other local industrial users. The Applicant's construction diesel fuel needs would be a minor amount relative to the total regional demand and supply.
Approximate gas, diesel, and oil required for construction and operations	Construction: • Gas: 500 gallons per month • Diesel: Average 5,000 gallons per week; 20,000 gallons per month • Oil: 50 gallons per month Operations: • Gas: 100 gallons per month • Diesel : 200 gallons per month • Oil: 75 gallons per month
Capacity of fuel trucks and refueling period	Construction equipment would be refueled on site in a designated area. A fuel truck would visit the site as required, and deliveries would be less frequent during operations than construction. The frequency would vary based on usage and activities and could range from a high of once or twice per day to a low of once or twice per week. Existing fuel trucks have a 3,600-gallon capacity. Future trucks would likely have a 3,000–4,000 gallon capacity.
Annual electricity requirements	The existing annual electricity use for the bulk product terminal averages 20 megawatts (based on the average electrical usages for 2014). Stage 1 power requirements are estimated at 10 to 15 megawatts; Stage 2 operation requirements are estimated at 20 to 25 megawatts.
Estimated annual electricity usage	Approximately 6,624,000 kilowatt hours per year for full operations

[1] Two reports prepared for the Applicant: (1) URS Corporation. 2014. *Millennium Coal Export Terminal—Longview, WA; Energy and Natural Resources Report*. August. Seattle, WA; and (2) URS Corporation. 2014. *Millennium Coal Export Terminal—Longview, WA; Off-Site Alternative – Barlow Point Appendix D, Energy and Natural Resources Report*. October. Seattle, WA.

Topic	Applicant-Provided Information
Construction energy conservation measures	Prior to the start of construction, a Waste Management Plan (WMP) will be prepared in coordination with Cowlitz County's Solid Waste Management Plan (Cowlitz County 2007). The WMP will include measures to avoid and minimize the generation of wastes and promote waste re-use and recycling, including: • Waste avoidance – practices will be developed that reduce the amount of waste on-site, via selective purchasing procedures and the use of bulk purchasing, where practicable • Material reuse – reuse of recyclable or reusable materials where practicable • Recycling – materials such as metals, oil, timber, plastics, glass and paper will be recycled where practicable • Energy Reduction – where feasible, construction vehicles will be turned off rather than left idling
Operation energy conservation measures	• Energy Efficient lighting • Lighting in unoccupied areas to be switched on only when needed and turned off by automatically • Energy efficiency in plant and equipment specification and selection, such as electric motors to have high power factors; conveyor drives to be "quiet drives," which require less power to operate; life cycle costs advantage of energy efficient components • Power factor correction equipment in substations • Conveyor idlers to specify rim drag to reduce conveyor start up power • Office equipment to revert to standby mode or switched off when not in use • Vehicle size to be matched to need of the task • Fuel efficiency to be a criteria in vehicle selection • Control and temperature settings on switch room and office air conditioning • Automatic shutdown of idle plant and equipment • Submetering of offices, workshops, conveyors stackers, reclaimers, and ship loaders to manage energy load. • Soft start of electric motors to minimize peak power demand
Maintenance vehicles that would use biodiesel	At this point, there are no specific plans to use biodiesel for maintenance vehicles. However, actual usage in the future would depend on local availability and compatibility with needed equipment.





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