Chapter 5

Cumulative Impacts

In addition to analyzing direct and indirect impacts, the Washington State Environmental Policy Act (SEPA) requires an environmental impact statement (EIS) to consider the cumulative impacts of a proposed action, including alternatives to the proposed action and any identified connected actions (Washington Administrative Code [WAC] 197-11-792). Cumulative impacts are the summation of impacts to a resource resulting from the incremental impact of an action (proposed action or alternative) including connected actions when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes those actions. When impacts of an action are viewed individually they may appear minor but when considered collectively (cumulatively) with the impacts of other actions, especially over a period of time, they can be significant (40 Code of Federal Regulations [CFR] 1508.7).

Direct, Indirect, and Cumulative Impacts

Direct Effects—Direct effects are caused by a proposed action and occur at the same time and place. *Examples: removing vegetation, disturbing wildlife*.

Indirect Effects—Indirect effects are caused by a proposed action but occur later in time or are farther removed in distance but are still reasonably likely to occur. *Examples: increased traffic congestion, changes in the local or regional economy and employment*.

Cumulative Effects—Cumulative effects are additive or interactive effects that would result from the incremental impact of a proposed action when added to past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. *Examples: increased soil erosion along the banks of the Columbia River from vessels associated with the Proposed Action in combination with vessels bound for other Columbia River terminals.*

As with the Project impact analysis conducted in Chapter 3, the cumulative effects analysis can help identify new alternatives or lead to reevaluating/modifying existing alternatives, and is essential to developing appropriate mitigation and monitoring. Information about a proposal's impacts from a cumulative effects perspective can be used by decision makers to view the significance of impacts, require mitigation, choose between alternatives, and/or deny the proposal.

This chapter describes the analytic method used to assess cumulative impacts; identifies specific projects and actions identified for the analysis; and describes potential cumulative impacts from the Proposed Action when combined with these projects and actions by environmental resource.

5.1 ANALYSIS OF CUMULATIVE IMPACTS

This cumulative impact analysis provides a broad assessment of impacts associated with implementing the proposed Project and No Action Alternative by considering a wide array of past activities, new and ongoing or proposed projects, and programs in the Project area and vicinity. The interactions between the proposed Project in combination with past, present, and reasonably foreseeable future actions are identified to assess adverse or beneficial cumulative impacts.

Council on Environmental Quality (CEQ) guidance states "A critical principle states that cumulative effects analysis should be conducted within the context of resource, ecosystem, and human community thresholds – levels of stress beyond which the desired condition degrades. The magnitude and extent of

the effect on a resource depends on whether the cumulative effects exceed the capacity of the resource to sustain itself and remain productive." There may also be situations where the capacity of the resource to sustain itself and remain productive has already been exceeded (e.g., listed species of plants and animals and the habitats that support them). It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful (CEQ 1997).

Cumulative impacts have the potential to occur based on proximity of the proposed Project to other actions and the combined effects that would take place during the same timeframe. Cumulative impacts also have the potential to occur from the transportation of crude oil to the proposed Facility by rail and from the proposed Facility by vessel in combination with other projects that use the same rail system or navigable waterways.

The methodology for evaluating cumulative impacts associated with the Proposed Action consisted of four steps:

1. Identification of spatial boundaries
2. Identification of temporal boundaries
3. Identification of projects and actions within established spatial and temporal boundaries and the resources they could potentially cumulatively impact
4. Evaluation of the effects of the Proposed Action on affected resources when considered in combination with identified projects and actions

These steps are discussed in Sections 5.1.1 through 5.1.4.

5.1.1 Identification of Spatial Boundaries

The spatial boundaries for the cumulative impacts analysis include the geographic area directly and indirectly affected or influenced by the proposed Project and No Action Alternative. The geographic area is consistent with the resources of the natural and human environment that could reasonably be affected by the proposed Project and No Action Alternative. For example, the geographic area over which impacts to air resources (related to the airshed) are considered is different than the geographic area considered for transportation (the local road system). The proposed Project would affect areas in proximity to Facility features and operations, including an area around the proposed Facility site, and rail systems and navigable waters associated with transport of crude to and from the site. When considering the effects of past, present, and reasonably foreseeable future actions in combination with the effects of the proposed Project, connected actions, and No Action Alternative, the spatial boundaries may be expanded.

5.1.2 Identification of Temporal Boundaries

The temporal boundaries establish the time span over which cumulative impacts of the Proposed Action and existing and future projects or actions are evaluated. The time span is defined by the duration of the direct and indirect impacts of the proposed Project. The temporal scope was established based on the timeframe of the proposed Project including construction, operations, and decommissioning. The proposed Facility's operational lifetime is assumed to be 20 years. Permitting and construction prior to operations and decommissioning and restoration after operations cease could add several years to the duration of direct and indirect impacts of the proposed Project.

5.1.3 Identification of Projects and Actions for the Cumulative Impacts Analysis

Existing and reasonably foreseeable future actions within a 3-mile radius of the proposed Project were identified to address potential cumulative impacts in the vicinity of the proposed Facility. A 3-mile radius was chosen as the distance within which localized effects from the proposed Project have the potential to combine with other projects and actions to create cumulative impacts. Additional future actions that may contribute other rail or vessel traffic on the same rail system or navigable waterways as the proposed Project were identified in Washington and Oregon so that the cumulative effects of rail and vessel traffic to resources can be analyzed. The Washington and Oregon spatial boundary was chosen to focus the analysis of cumulative impacts to a meaningful area. Projects or actions that occur outside of these states could also contribute additional rail traffic to the overall US rail system, but an analysis of such projects would not result in useful information for this Washington-based project. Rail and vessel transportation are dynamic systems with constantly moving freight and passenger trains and vessels that change from season to season and from year to year.

Projects and actions included in this cumulative impacts analysis include present operations, and future projects that have been announced, are in permitting, or have been permitted. Projecting the likelihood of new projects and programs that have not been announced was not undertaken in this evaluation because such projections would be speculative and such projects or programs cannot be evaluated without information on the types of actions that could occur. The identification of future projects, actions and trends involves some uncertainty, as does the assessment of the intensity, magnitude, and duration of impacts now and in the future. The cumulative impacts analysis is designed to explore the range of potential cumulative impacts while recognizing that uncertainty.

Past actions in proximity to the Port of Vancouver (Port) include human settlement, urbanization, and commercial and industrial activities that have taken place since the early 1800s. Past actions in proximity to the proposed Project and the connected actions have been accounted for by describing the existing characteristics of each resource in the description of the affected environment for the Proposed Action. The effects of the Proposed Action and the connected actions have been stated in the context of existing environmental conditions.

Present and future actions that could interact with the proposed Project and No Action Alternative were identified during the environmental analysis of the Project for the specific resource areas. To identify these actions, a general literature search was conducted and many sources were reviewed. Tables 5-1 and 5-2 provide a summary of potential projects and actions in close proximity to the Proposed Action (Table 5-1) or that could contribute additional rail and/or vessel traffic (Table 5-2) which, in combination with the Proposed Action, could result in cumulative impacts. Figures 5-1 and 5-2 illustrate the locations of these projects and actions in relation to the proposed Project.

An initial screening of the projects identified in the cumulative impacts analysis was performed for environmental resources. Each project identified in Tables 5-1 and 5-2 was considered with respect to its potential cumulative impacts to each environmental resource based on the available information. The environmental resources that could potentially be impacted by the projects were identified and added to Tables 5-1 and 5-2. Then, the relevant projects were evaluated and an analysis of potential cumulative impacts to each environmental resource was provided. The results of these analyses are provided in Sections 5.2 through 5.17.

Table 5-1. Projects and Actions Identified in Close Proximity to the Proposed Action

Action	Description	Status	Potential Cumulatively Impacted Resources
Bike Paths on Lower River Road	The Port was awarded two Federal Transportation Alternatives Program grants to design and build pedestrian and bike paths to connect western industrial properties to downtown. (Port of Vancouver 2013a)	Ongoing	Air Quality; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Transportation
Bulk Potash Handling Facility	The Port has proposed to lease approximately 50 acres of land to the BHP Billiton Group for the operation of a bulk potash handling facility at the Port's Terminal 5. The project would receive bulk quantities of potash via freight rail, temporarily store the potash, and then convey the potash to shiploaders located at a new marine facility at Terminal 5 for export. The project includes the construction of new rail infrastructure, a storage building, rail dumper building, administration building, and dock and ship loaders to handle approximately 8 million tons of potash exports per year. Vessels would range in size from 20,000 DWT to 60,000 DWT, which equates to approximately 133 to 400 vessels that would transit the Columbia River per year, or approximately 2.5 to 7.5 vessels per week. Although the BHP Billiton Group has received permits for the project, the company has not begun construction and has allowed the agreement with the Port to lapse. (BergerABAM 2011a, b; Anchor QEA, LLC 2011; Hoyle 2014)	Permitted; project suspended	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Transportation; Socioeconomics
Centennial Industrial Park	Centennial Industrial Park includes more than 100 acres of light industrial property located south of Vancouver Lake and north of NW Lower River Road (SR 501). The Port is currently seeking new business developments on 58 acres for industry, advanced manufacturing, or supply chain support. An additional 50 acres are available for expansion. Ground improvements and road and utility infrastructure have been constructed at the 58-acre site. (Port of Vancouver 2012a, 2014a)	Permitted; under construction	Air Quality; Water Resources; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Transportation; Socioeconomics
Channel and Berth Maintenance Dredging	Maintenance dredging and berth deepening at Port facilities along the Columbia River, including Berths 13 and 14, is ongoing under existing and future approvals from local, state, and federal agencies. Dredging occurs as necessary on an up-to-annual basis. In addition, the USACE conducts maintenance dredging of the navigation channel and anchorages as necessary. The dredging program varies by year. (USACE 2014)	Permitted and ongoing	Earth Resources; Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
CPU Electrical Substation	CPU will construct a new electrical substation on a portion of the JWC site on Harborside Drive in Vancouver. The project involves the construction of a power transformation (115-kV to 12.47-kV) substation, access driveway, and aboveground and underground connections to adjacent power facilities. (Port of Vancouver 2012b)	Permitted	Air Quality; Terrestrial Vegetation; Terrestrial Wildlife; Public Services and Utilities

Table 5-1. Projects and Actions Identified in Close Proximity to the Proposed Action

Action	Description	Status	Potential Cumulatively Impacted Resources
Columbia Gateway	Columbia Gateway is a 1,100-acre site located downstream of the existing Port terminals, which the Port acquired for long-term development. The initial plan for development includes 534 acres of industrial-zoned property, of which 350 to 400 acres would be for marine terminals (auto and grain/bulk cargoes), 31 acres would be for existing environmental mitigation, and 541 acres would be for future environmental mitigation. (BST Associates 2010)	Future development	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Transportation; Public Services and Utilities; Socioeconomics
Columbia River Wetland Mitigation Bank	The Columbia River Wetland Mitigation Bank is a 154-acre parcel of land located on the Port's Parcel 6. This mitigation bank has created 25.5 acres of new wetland and improves another 78 acres. Wetland credits can be purchased from Habitat Bank NW. (Port of Vancouver 2015a)	Operating	Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation
Gateway Avenue Grade Separation Project	Constructed in 2013, the Gateway Avenue Grade Separation project is an overpass that separates vehicular traffic from train traffic below. The overpass eases congestion and allows safe and efficient movement within the Terminal 5 area. (Port of Vancouver 2013b)	Completed	Air Quality; Noise; Visual Resources/Aesthetics; Recreation; Transportation
NGL Terminals LLC, Vancouver Terminal	NGL's Vancouver Supply Terminal transfers liquefied petroleum gas from railcars to trucks for delivery. The facility comprised six railcar offloading stations, two 80,000-gallon propane storage tanks, one 74,000-gallon butane storage tank, and two truck loading lanes. NGL submitted an application to the SWCAA requesting approval to install a third tank to handle butane.	Permitted; not yet constructed	Air Quality; Energy and Natural Resources; Noise; Public Services and Utilities
NuStar Terminals Conversions to Crude Oil	NuStar Energy LP (NuStar) owns and operates two bulk tank terminals in Vancouver that are connected by an underground pipeline; the main terminal is approximately 2.5 kilometers (1.6 miles) from Terminal 5 at the Port, and an annex terminal is located approximately 3 kilometers (1.9 miles) north of the main terminal. NuStar has proposed to convert existing bulk liquid storage and transfer equipment at the main and annex terminals to crude oil service. Crude oil would be received via railcar and shipped via ship/barge using the existing marine loading rack. The facility would have a maximum yearly throughput of 246,792,000 gallons (5,876,000 bbl) of crude oil (SWCAA 2014). The system would have the capacity to receive 2 trains per day with 16 railcars in each train (City of Vancouver 2014a) but would likely receive one unit train of 110 railcars every 5 days (SWCAA 2014). NuStar states the proposed project would not increase potential rail traffic to the site due to its displacement of existing operations and would not add a significant number of vessel trips in comparison to existing traffic levels but does not specify the number of vessels that would accommodate the proposed project (SWCAA 2014).	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Transportation; Public Services and Utilities; Socioeconomics

Table 5-1. Projects and Actions Identified in Close Proximity to the Proposed Action

Action	Description	Status	Potential Cumulatively Impacted Resources
Port of Vancouver Trail Project	The Port of Vancouver Trail Project would extend and connect two existing segments of a multiuse trail along SR 501's southern edge, from the westernmost existing multiuse trail (Gateway Avenue/Parcel 1A trail) east to St. Francis Lane. The proposed project consists of two trail extensions and associated landscaping, totaling approximately 0.83 mile. (Port of Vancouver 2014b)	Permitted	Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Socioeconomics
Vancouver Rail Bypass and West 39th Street Bridge	WSDOT has proposed to construct a rail bypass to reduce freight and passenger congestion and increase safety. Construction is scheduled to continue through Spring 2016. A new vehicle/pedestrian/bicycle bridge over the railroad tracks at the West 39th Street crossing was constructed in 2010. (WSDOT 2014a)	Permitted; components complete and under construction	Air Quality; Noise; Visual Resources/Aesthetics; Recreation; Transportation
Vancouver Waterfront Development Project	The City of Vancouver approved a Master Plan in fall 2009 for the construction of a new mixed-use development located on 33 acres between the Interstate 5 and railroad bridges over the Columbia River and the BNSF mainline/Port lead and the Columbia River. The approved plan includes a maximum of 3,300 residential units and approximately 1 million square feet of office space for restaurants, specialty shops and services, and a 160-key hotel. Infrastructure construction started in spring 2014 and building construction is to commence in spring 2015. The entire development is scheduled to be completed by spring 2016. (City of Vancouver 2014b; Columbia Waterfront, LLC 2014)	Master Plan approved; under construction; some permits must still be obtained	Air Quality; Water Resources; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Transportation; Socioeconomics
WVFA Project	The WVFA Project is a series of project elements to be implemented over a number of years, many of which have already been completed, to improve rail movement and alleviate rail traffic delays within the Port and along the BNSF and Union Pacific mainlines that connect to the larger state and national rail network. Project elements that have been completed include relocation of Port utilities, a stormwater treatment pond, and some rail tracks; building of grain unit train storage tracks; realignment of access road and construction of an overpass; and construction and expansion of loop tracks. Project elements that are under construction or would occur in the future include construction of a new rail entrance to the Port; relocation of a bulk unloading facility; and construction of new rail tracks including an additional yard track and unit train tracks (Port of Vancouver 2014c, d). WVFA Project 3, completed in June 2010, constructed 35,000 feet of new rail track in a loop with associated yard tracks, to allow unit trains up to 7,500 feet in length to be handled within the Port's internal rail complex. WVFA Project 21, completed in 2013, constructed 2,450 feet of new track and relocated 6,300 feet of existing track to handle unit trains up to 8,400 feet in length. (Port of Vancouver 2014e)	Various components permitted, completed, under construction, or slated for future	Earth Resources; Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Transportation; Public Services and Utilities; Socioeconomics

Table 5-1. Projects and Actions Identified in Close Proximity to the Proposed Action

Action	Description	Status	Potential Cumulatively Impacted Resources
Port of Vancouver Comprehensive Scheme of Harbor Improvements and Industrial Development	In October 2014, the Port proposed to amend its Comprehensive Scheme of Harbor Improvements and Industrial Development. Projects included under this scheme are widely diverse, ranging in size, purpose, and nature, are generally unrelated to each other, and occur on a multitude of sites and parcels. The largest of these projects are included as separate entries in this table. (Port of Vancouver 2014f, g)	In permitting; ongoing	Earth Resources; Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Energy and Natural Resources; Environmental Health; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Transportation; Public Services and Utilities; Socioeconomics
Redevelopment of Terminal 1	Red Lion Hotel Corporation, in partnership with the Port and Columbia Waterfront LLC, is working to build a new Red Lion Hotel on Terminal 1, which would reconfigure the terminal and remove the 4,557-square-foot Centennial Center. Construction is projected to begin in 2015. Further development on Terminal 1 is expected to include blend retail, open space, and commercial space. (*The Columbian* 2014, Port of Vancouver 2014h)	Ongoing	Air Quality; Energy and Natural Resources; Noise; Land and Shoreline Use; Visual Resources/Aesthetics; Recreation; Transportation; Public Services and Utilities; Socioeconomics

bbl = barrels, BNSF = Burlington Northern Santa Fe, CPU = Clark Public Utilities, DWT = deadweight tonnage, JWC = Clark County Jail Work Center, Port = Port of Vancouver, SWCAA = Southwest Clean Air Agency, USACE = US Army Corps of Engineers, WSDOT = Washington State Department of Transportation, WFVA = West Vancouver Freight Access

Table 5-2. Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon

Action	Description	Status	Potential Cumulatively Impacted Resources
Arc Logistics Portland Terminal	Arc Logistics Partners LP has acquired the lease of the Portland Terminal, an existing rail/marine facility adjacent to the Willamette River in Portland, Oregon. The 39-acre site has 84 tanks with a total storage capacity of 1,466,000 bbl and is capable of receiving, storing, and delivering heavy and refined petroleum products. Products are received and/or delivered via railroad, waterways (up to Panamax size vessels), and a truck loading rack. (Arc Logistics Partners 2014)	Existing/acquired	Transportation
BP Rail Logistics Project	A rail logistics facility to serve the BP Cherry Point refinery in Whatcom County, Washington, was constructed and began operation in December 2014. The facility is composed of a 10,200-linear-foot rail loop interconnected to the BNSF Custer Spur to transfer crude oil between railcars and the refinery. The facility is permitted to receive one unit train per day. The project included clearing and grading and installation and construction of associated infrastructure improvements associated with the rail track loop with load transfer facility, personnel operations shelter, parking and access, including inspections and security roads, pipe racks and utility tie-ins, stormwater facilities, security features, and visual screening measures. (Whatcom County 2012)	Existing	Transportation
Burnaby Refinery and Rail Facility	Chevron Canada operates the Burnaby Refinery on the shores of Burrard Inlet near Vancouver, Canada. Crude oil is supplied to the refinery from northern British Columbia, Alberta, and Saskatchewan mainly via pipeline, with supplemental deliveries coming by rail and truck. The crude oil supplied by rail consists of small trains of 8 to 10 railcars per day to deliver about 6,500 bbl (273,000 gallons) a day to the refinery. (Chevron Canada 2015, CBC News 2013)	Existing	Transportation
Crude-by-Rail East Gate	Shell Puget Sound Refinery has proposed to construct a rail spur and crude oil unloading/loading facilities near Anacortes, Skagit County, Washington. The facility would receive one unit train per day, up to a maximum of six unit trains per week (approximately 612 incoming fully loaded oil cars and 612 outgoing empty tank cars on a weekly basis). The proposed rail spur would connect to the existing BNSF mainline. The rail facility would consist of approximately 8,000 feet of unloading tracks with a concrete unloading pad, approximately 1,300 feet of track for temporary storage of railcars that are taken out of service for repair and maintenance, and about 7,200 feet of train-staging track. (Rizzo 2013)	In permitting	Transportation
Gateway Pacific Terminal	Pacific International Terminals, Inc. has proposed building a deepwater marine terminal at Cherry Point in Whatcom County, Washington. The project would handle import and export of up to 54 million metric tons per year of dry bulk commodities, including, but not limited to, coal, grain products, potash, and calcined petroleum coke. The project area would encompass approximately 1,500 acres with development occurring on approximately 334 acres. The proposed Gateway Pacific Terminal includes two materials handling and storage areas and a wharf and access trestle. In a related project, BNSF has proposed to modify rail facilities adjacent to the terminal site, including installation of receiving/departure tracks west of the BNSF mainline and developing a second track along the approximately 6-mile Custer Spur to the proposed terminal site. (Gateway Pacific Terminal EIS 2012)	In permitting	Transportation

Table 5-2. Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon

Action	Description	Status	Potential Cumulatively Impacted Resources
Global Partners Clatskanie Terminal	Global Partners LP currently owns a crude oil and ethanol facility at the Port Westward Industrial Park near Clatskanie, Columbia County, Oregon. The site is located on land leased under a long-term agreement from the Port of St. Helens. The facility is currently permitted to receive and transload 50,000,000 gallons (1,190,476 bbl) of crude oil per year. The company intends to increase crude oil and/or ethanol storage and loading to as much as 1,839,600,000 gallons (43,800,000 bbl) per year, which requires a new permit. Crude oil and/or ethanol would be received by rail, transferred to storage tanks, and then dispensed to marine vessels. Proposed new project facilities include four storage tanks, two railcar unloading tanks, and an oxidizer unit (Global Partners LP 2013, ODEQ 2013). This amount of oil would require approximately 12 unit trains per week, each carrying approximately 70,000 bbl (2,940,000 gallons) of oil, and between 1 and 2.5 vessels per week (or between 52 and 130 vessels per year).	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
Grays Harbor Rail Terminal Project	Grays Harbor Rail Terminal, LLC has proposed a new bulk liquids rail logistics facility at the Port of Grays Harbor, Washington. The facility would handle up to 50,000 bbl (2,100,000 gallons) per day of crude oil with one 120-car unit train delivery about every 2 days, or approximately 3.5 unit trains per week. Ship transits would range from 45 to 60 per year depending on vessel size. (US Development Group 2013)	In permitting	Transportation
Haven Energy Export Terminal	Haven Energy Terminals, LLC has proposed to construct and operate a propane and butane export terminal at Longview, Washington. Propane and butane would be transported by rail, refrigerated, stored, and loaded onto vessels (Haven Energy 2014a). At full capacity, the facility would receive approximately 20 trains per month (or approximately 4.6 unit trains per week) and two to three vessels per month (24 to 36 vessels per year) (Haven Energy 2014b). The Port of Longview commissioners rejected the proposed project on March 11, 2015 (*The Columbian* 2015).	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
Imperium Bulk Liquid Terminal Facility Project	Imperium Terminal Services, LLC proposes to expand its existing bulk liquid storage terminal at the Port of Grays Harbor, Washington, to include construction of a tank farm to allow for the receipt, storage, and transfer of biofuels, biofuel feedstocks, petroleum products, and renewable fuels. Up to nine storage tanks would be constructed on the site of Imperium's existing bulk storage tanks, each with a capacity of 80,000 bbl (3,360,000 gallons) for a project total storage capacity of up to 720,000 bbl (30,240,000 gallons). The existing rail facility would be expanded by constructing approximately 6,100 feet of track in multiple new rail spurs onsite in connection with the existing rail line, and expanding the existing railyard. Terminal operations are estimated to consist of two unit trains per day, one loaded and one empty. Each unit train would consist of an average of 105 tank cars. The company estimates that the terminal operations would consist of up to 200 vessels or barges a year (400 entry and departure transits). (Plaza 2013)	In permitting	Transportation

Table 5-2. Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon

Action	Description	Status	Potential Cumulatively Impacted Resources
Kalama Manufacturing & Marine Export Facility	Northwest Innovation Works has proposed to construct and operate a methanol production plant at the Port of Kalama, Washington. The plant would manufacture methanol from natural gas. Natural gas would be received by a new pipeline, processed into methanol onsite, and exported by marine vessel (Port of Kalama 2014, Northwest Innovation Works 2014). The proposed project would produce about 10,000 metric tons of methanol each day. Since oceangoing chemical tankers range from 5,000 to 35,000 DWT, it is estimated that between approximately 2 and 14 vessels per week (104 to 728 vessels per year) would be required.	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
March Point Crude Oil Unit Train Unloading Facility	Tesoro has recently constructed a crude oil unit train unloading facility near Anacortes, Washington, to provide feedstock to the Tesoro refinery on March Point. The refinery has a total crude oil capacity of 120,000 bbl (5,040,000 gallons) per day. The unit train unloading facility has the capability to unload two, 100-car unit trains per 24-hour period, or approximately 3.5 unit trains per week. (Ecology 2014, Tesoro 2014, Wilson & Company 2015)	Existing	Transportation
Millennium Bulk Terminals Longview Coal Export Terminal	Millennium Bulk Terminals Longview, LLC proposes to construct a coal export terminal on an existing industrial site in Longview, Washington. The proposed project would cover approximately 100 acres of the 416-acre site and would consist of rail unloading, storage, reclaiming, and loading vessels with coal. The project is proposed to be constructed in two phases—Stage 1 would have a capacity of 25 million metric tons of coal per year, and Stage 2 would bring the capacity to 44 million metric tons of coal per year. The project includes upland facilities, rail improvements, three docks (totaling 5.37 acres), and dredging of 385,000 cubic yards from 48 acres of river (Grette 2012). The project would generate 16 train trips per day and 140 ship transits in the Columbia River a month (1,680 vessels per year). (Millennium Bulk Terminals Longview EIS 2013)	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
Oregon LNG Project	Oregon LNG has proposed a liquefied natural gas peak-shaving, liquefaction, and export facility near the Columbia River mouth, on the Skipanon Peninsula in Warrenton, Oregon, and an associated 86-mile natural gas pipeline to be routed through Clatsop, Tillamook, and Columbia counties in Oregon, from Washington. The project includes a marine loading terminal, two full-containment 160,000-cubic-meter LNG storage tanks, and facilities to support ship berthing and cargo loading. The bidirectional facility (having both import and export capabilities) would produce up to 9 million metric tons of liquefied natural gas per year and up to 125 vessel trips per year. (ODEQ 2014, Oregon LNG 2014)	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
Phillips 66 Crude Unloading Rail Project	Phillips 66 is constructing a railcar crude oil unloading facility along existing rail infrastructure at its refinery near Ferndale, Washington. This project includes four approximately 1,800-linear-foot rail unloading tracks, one storage track (500 feet long), one runaround track (2,500 feet long), and siding track for empty backhaul train staging (7,000 feet long) to allow the transfer of crude oil between railcars and the refinery. The refinery has a throughput capacity of 75,000 bbl (3,150,000 gallons) per day. The project would add up to one unit train every other day (or approximately 3.5 unit trains per week), on average on an annual basis, to the existing rail traffic on the BNSF Custer Spur. (Ecology 2014a, Whatcom County 2013)	Permitted; under construction	Transportation

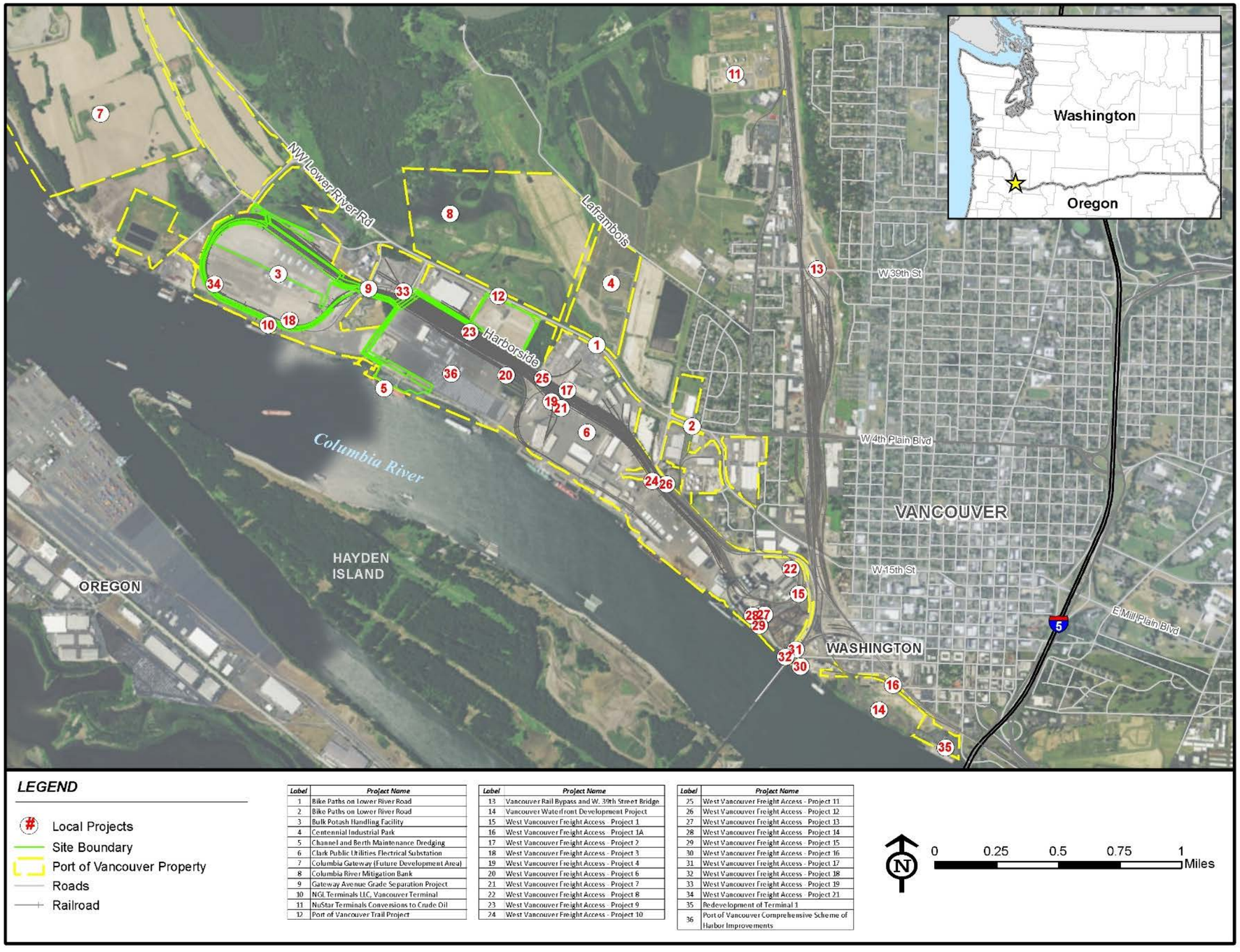
Table 5-2. Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon

Action	Description	Status	Potential Cumulatively Impacted Resources
Port Westward Methanol Export Facility	Northwest Innovation Works is proposing to construct a methanol production plant at the Port of St. Helens Port Westward Industrial Park north of Clatskanie, Oregon. The proposed project would produce about 10,000 metric tons of methanol each day. Since oceangoing chemical tankers range from 5,000 to 35,000 DWT, it is estimated that between approximately 2 and 14 vessels per week (104 to 728 vessels per year) would be required. Permitting has not started as of the date of publication of this Draft EIS. (Northwest Innovation Works 2014)	Announced	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
Targa Sound Terminal	Targa Sound Terminal, LLC operates a petroleum products terminal in Tacoma, Washington. Products handled include diesel, biodiesel, ethanol, asphalt, industrial fuel, bunker fuel, crude oil, and propane. Products are moved by truck, rail, and marine vessel. The facility has the capacity to transport approximately 75,000 bbl of crude oil per day and currently receives approximately 3.5 unit trains per week. (Ecology 2014a; Targa 2015)	Existing	Transportation
Morrow Pacific Project	Ambre Energy has proposed to construct and operate a coal terminal facility at the Port of Morrow near Boardman, Oregon. Coal would be shipped by rail from Intermountain states to the Port of Morrow, where it would be transferred to an enclosed storage facility and loaded onto covered barges through an enclosed conveyor. The coal would then be shipped down the Columbia River to the Port of St. Helens' Port Westward Industrial Park where enclosed transloaders would transfer the coal onto covered oceangoing Panamax-size vessels. Initially, one 4-barge tow per day would move down the Columbia River, shipping 3.5 million metric tons of coal per year. At full capacity, barge tows would increase to 2 per day with expected shipment of 8 million metric tons per year. That would translate to an initial weekly amount of approximately 5 trains to Port of Morrow, 5.5 loaded barge tows from Port of Morrow to Port Westward, and 1 Panamax ship to Asia per week. At full capacity, this amount would increase to 11 trains, 12 loaded barge tows, and 3 Panamax vessels per week (or 156 vessels per year). (Ambre Energy 2014)	In permitting	Air Quality; Water Resources; Terrestrial Vegetation; Terrestrial Wildlife; Aquatic Resources; Environmental Health; Noise; Visual Resources/Aesthetics; Recreation; Historic and Cultural Resources; Transportation
US Oil Refinery and Rail Facility	US Oil & Refining Co., purchased by TrailStone Group in 2014, operates a refinery with current crude capacity of 39,000 bbl per day at the Port of Tacoma, Washington. The refinery receives crude oil by vessel at the dock and rail stations and distributes refined petroleum products by truck, train, and marine vessel. The refinery currently has 64 stations receiving oil with construction planned for an additional 48. Approximately 1.75 unit trains depart the facility per week. (Ecology 2014a, US Oil and Refining Co. 2015, Oil & Gas Journal 2014)	Existing	Transportation
Westway Terminal Expansion Project	Westway Terminal Company, LLC proposes to expand its existing bulk liquid storage terminal at the Port of Grays Harbor, Washington, to allow for the receipt of crude oil unit trains, storage of crude oil, and outbound shipment of crude oil by vessel and/or barge from the Port of Grays Harbor. The new tanks would each have a capacity of 200,000 bbl (8,400,000 gallons) for a project total storage capacity of 800,000 bbl (33,600,000 gallons). The existing rail facility on the site would be expanded from 2 short spurs with a total of 18 loading/unloading spots to 4 longer spurs with a total of 76 loading/unloading spots. The terminal is estimated to receive 9,600,000 bbl (403,200,000 gallons) of oil per year, equivalent to 1 unit train (120 railcars) every 3 days, or approximately 2.3 unit trains per week. The company estimates 60 vessels or barges a year for shipment of the crude oil. (Shoemake 2014)	In permitting	Transportation

Table 5-2. Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon

Action	Description	Status	Potential Cumulatively Impacted Resources
Tacoma Manufacturing & Marine Export Facility	Northwest Innovation Works has proposed to construct and operate a methanol production plant at the Port of Tacoma, Washington. The plant would manufacture methanol from natural gas. Natural gas would be received by a new pipeline, processed into methanol onsite, and exported by marine vessel. (Port of Tacoma 2015a, Northwest Innovation Works 2014)	Proposed	Transportation
Puget Sound Energy LNG Project	Puget Sound Energy has proposed a liquefied natural gas facility at the Port of Tacoma, Washington. The LNG receiving facility would be located on a 30-acre site and provide natural gas to residents, commercial customers, and marine vessels. It is projected to be completed by 2018. (Puget Sound Energy 2015)	Proposed	Transportation
Portland Bulk Terminals	Canpotex, through its wholly owned subsidiary Portland Bulk Terminals, LLC, operates a potash export facility at the Port of Portland's marine Terminal 5. The company announced plans to invest in new equipment, storage, and infrastructure to improve the efficiency of its ship-loading operations. The planned expansion would enable shorter turnaround times for trains and vessels servicing the facility. (Canpotex 2014)	Announced	Transportation

bbl = barrels, BNSF = Burlington Northern Santa Fe, DWT = deadweight tonnage, Ecology = Washington State Department of Ecology, EIS = environmental impact statement, ODEQ = Oregon Department of Environmental Quality, Port = Port of Vancouver



Label	Project Name
1	Bike Paths on Lower River Road
2	Bike Paths on Lower River Road
3	Bulk Potash Handling Facility
4	Centennial Industrial Park
5	Channel and Berth Maintenance Dredging
6	Clark Public Utilities Electrical Substation
7	Columbia Gateway (Future Development Area)
8	Columbia River Mitigation Bank
9	Gateway Avenue Grade Separation Project
10	NGL Terminals LLC, Vancouver Terminal
11	NuStar Terminals Conversions to Crude Oil
12	Port of Vancouver Trail Project

Label	Project Name
13	Vancouver Rail Bypass and W. 39th Street Bridge
14	Vancouver Waterfront Development Project
15	West Vancouver Freight Access - Project 1
16	West Vancouver Freight Access - Project 1A
17	West Vancouver Freight Access - Project 2
18	West Vancouver Freight Access - Project 3
19	West Vancouver Freight Access - Project 4
20	West Vancouver Freight Access - Project 6
21	West Vancouver Freight Access - Project 7
22	West Vancouver Freight Access - Project 8
23	West Vancouver Freight Access - Project 9
24	West Vancouver Freight Access - Project 10

Label	Project Name
25	West Vancouver Freight Access - Project 11
26	West Vancouver Freight Access - Project 12
27	West Vancouver Freight Access - Project 13
28	West Vancouver Freight Access - Project 14
29	West Vancouver Freight Access - Project 15
30	West Vancouver Freight Access - Project 16
31	West Vancouver Freight Access - Project 17
32	West Vancouver Freight Access - Project 18
33	West Vancouver Freight Access - Project 19
34	West Vancouver Freight Access - Project 21
35	Redevelopment of Terminal 1
36	Port of Vancouver Comprehensive Scheme of Harbor Improvements

Figure 5-1. Locations of Projects and Actions in Close Proximity to the Proposed Action Considered in the Cumulative Impacts Analysis

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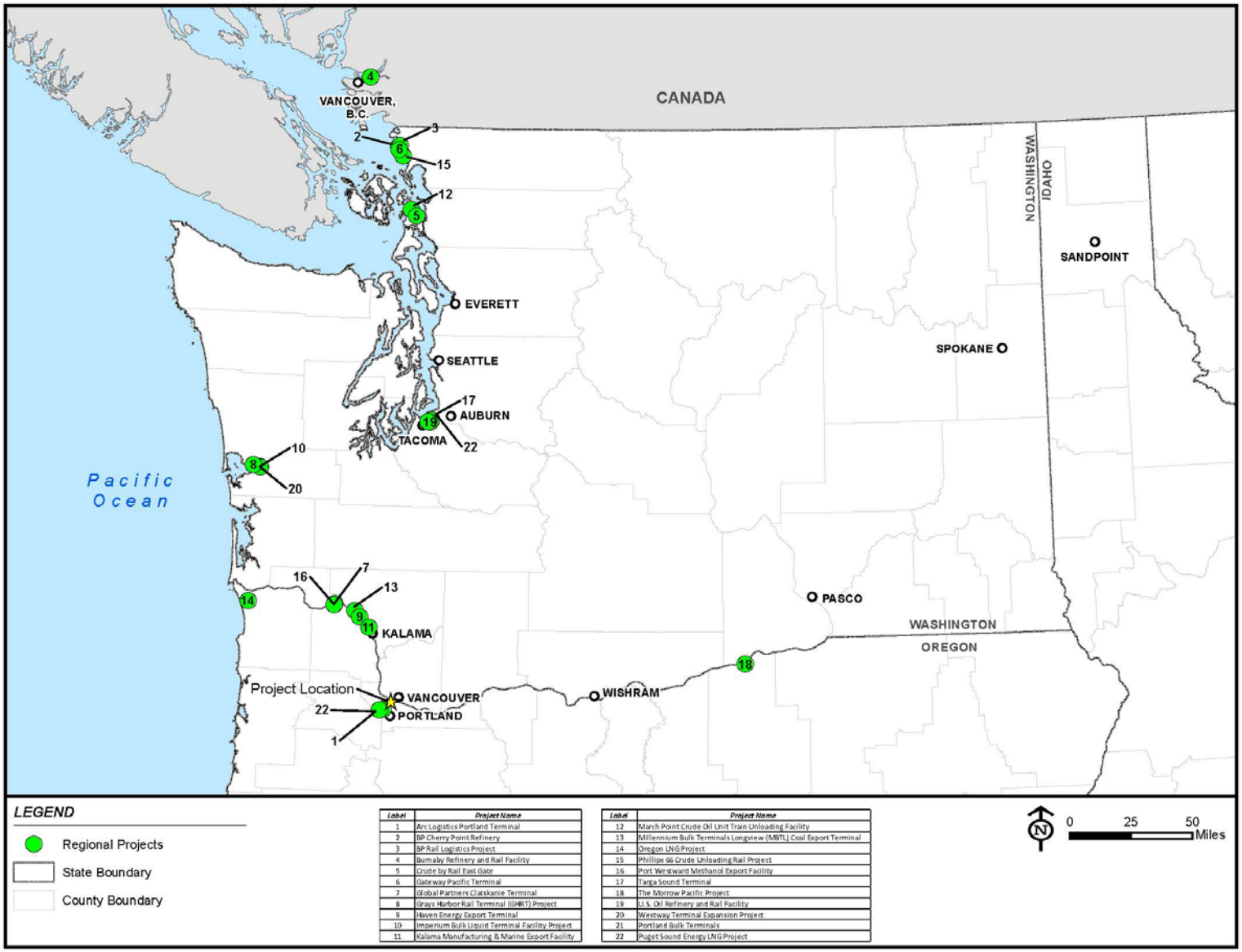

Label	Project Name
1	Arc Logistics Portland Terminal
2	BP Cherry Point Refinery
3	BP Rail Logistics Project
4	Burnaby Refinery and Rail Facility
5	Crude by Rail East Gate
6	Gateway Pacific Terminal
7	Global Partners Clatskanie Terminal
8	Grays Harbor Rail Terminal (GHRT) Project
9	Haven Energy Export Terminal
10	Imperium Bulk Liquid Terminal Facility Project
11	Kalama Manufacturing & Marine Export Facility

Label	Project Name
12	March Point Crude Oil Unit Train Unloading Facility
13	Millennium Bulk Terminals Longview (MBTL) Coal Export Terminal
14	Oregon LNG Project
15	Phillips 66 Crude Unloading Rail Project
16	Port Westward Methanol Export Facility
17	Targa Sound Terminal
18	The Morrow Pacific Project
19	U.S. Oil Refinery and Rail Facility
20	Westway Terminal Expansion Project
21	Portland Bulk Terminals
22	Puget Sound Energy LNG Project

Figure 5-2. Locations of Projects and Actions with Additional Rail and/or Vessel Traffic in Washington and Oregon Considered in the Cumulative Impacts Analysis

Note: An enlarged version of this figure is available in Appendix P.11.

Cumulative impacts could occur from projects that are in close proximity to the Proposed Action (i.e., projects at the Port) and from projects that would contribute additional rail or vessel traffic in the same geographic locations as the Proposed Action. In addition to considering the identified projects and actions, the cumulative impacts assessment also considers identifiable trends. Trends data can be used to establish the baseline for the affected environment more accurately (i.e., by incorporating variation over time); evaluate the significance of effects relative to historical degradation (i.e., by helping to estimate how close the resource is to a threshold of degradation); and to predict the effects of the action (i.e., by using the model of cause and effects established by past actions) (CEQ 1997). Further information regarding Port and rail and vessel traffic including identifiable trends is provided below.

5.1.3.1 Port of Vancouver

The Port was established as a publicly owned and managed port district in 1912 with the jurisdiction to lease Port-owned property to private operators. Citizens of Clark County, Washington, elect three Port commissioners to 6-year terms, giving them the responsibility of setting policy for the Port as a public agency. The Port currently has five terminals on 2,127 acres and more than 600 acres available for future development (Port of Vancouver 2015c). Several tenants are currently leasing from the Port, including shipping services, industrial manufacturers and recyclers, wholesalers, and commodity import/export facilities handling dry bulk, liquid bulk, auto, and agricultural commodities.

The Port is currently operating under a strategic plan that outlines a mission to maximize marine and industrial business development and improve their multimodal transportation access (Port of Vancouver 2014i). Current projects at the site include the ongoing West Vancouver Freight Access (WVFA) Project to improve onsite rail access and the development of a 100-acre light industrial property. The projects and actions at the Port that were considered in the assessment of cumulative impacts are presented in Table 5-2.

5.1.3.2 Rail Traffic in Washington State

Approximately 3,157 miles of railroad track and 28 railroads operate in the state of Washington. The two primary railroads operating in Washington are Burlington Northern Santa Fe (BNSF) and Union Pacific Class I railroads, which operate 2,165 miles of track in the state. BNSF's mainline corridors accommodate a variety of train and commodity types through Washington, including international container trains, domestic intermodal trains, manifest (mixed cargo) trains, and bulk unit trains of coal, grain, and crude oil. Crude oil trains operate through the state to serve existing facilities in Tacoma (US Oil and Refining Co.), Fidalgo (Tesoro), Cherry Point (British Petroleum), and Point Westward (Global Partners) (Washington State Department of Ecology [Ecology] 2015).

According to the *Washington State Rail Plan* (Washington State Department of Transportation [WSDOT] 2014a), the state's rail infrastructure has adequate capacity to meet current demands. The most highly used corridor is BNSF's Spokane to Pasco segment, which operates at 87 percent of practical capacity (WSDOT 2014b). A report sponsored by Washington Public Ports Association and WSDOT estimates that rail lines along the Lower Columbia River in Washington are projected to carry 43.0 to 74.9 million tons of cargo by 2030 under their moderate and high-growth forecasts (Pacific Northwest Rail Coalition 2011).

Ecology (2015) noted in the *Washington State 2014 Marine and Rail Oil Transportation Study* that Washington BNSF mainline corridor capacity and operating protocols are continually being challenged with the rapid development of crude-by-rail trains carrying shale oil originating in the Bakken formation of North Dakota and Montana and destined for West Coast refineries and oil transfer facilities (current and proposed). As a consequence, BNSF introduced a train operations protocol change in 2012 to enhance use of existing capacity by a directional running agreement using Stampede Pass for eastbound

empty bulk trains, and BNSF is aggressively pursuing infrastructure expansion projects along the entire Northern Corridor (the railroad lines that span the northern United States between the Pacific Northwest and Chicago, and reaching key southern points in Canada). Growth in trains carrying crude oil is expected over the next 5 to 10 years as a result of the expansion of shale oil extraction in the Bakken formation and planned oil transfer facility developments in Washington (Ecology 2015).

Table 5-2 presents the projects and actions that have the potential to add trains to the Class I railroads in Washington. The total number of trains that would be added to the system if all of these projects were to be permitted and operated is approximately 155 unit trains or 310 one-way train trips per week.

Without any improvements to operations and infrastructure, WSDOT estimates that population growth and market demand will exceed the current state rail capacity by the year 2035 (WSDOT 2014a). The rail system in Washington is expected to handle more than 260 million tons of cargo by 2035, representing a compound annual growth rate of 3.4 percent for all commodities carried on the rail system since 2010. The *Washington State Rail Plan* also suggests that the rapid growth in the transport of bulk commodities in unit trains (including crude and coal) could produce demand exceeding current capacity sooner than 2035. The Class I railroads (BNSF and Union Pacific) and other stakeholders are expected to address capacity issues as they emerge (WSDOT 2014a). BNSF is currently investing $900 million in terminal, line, and intermodal expansion and efficiency projects, including bridge, double track, and multiple siding improvement projects in Washington and an additional 66 miles of second main track on the busiest segments of their Northern Corridor (BNSF 2015).

5.1.3.3 Vessel Traffic on the Columbia River

The Columbia River is the largest river in the Pacific Northwest with a navigation channel maintained to a depth of 43 feet and a width of 600 feet. The distance between the mouth and the Ports of Portland and Vancouver is 106 nautical miles. The Columbia River Channel Improvements project, completed in 2010, was a collaborative effort between the US Army Corps of Engineers (USACE) and the Lower Columbia River Ports of Portland, Vancouver, Kalama, Longview, and Woodland. The project deepened the Columbia River navigation channel to 43 feet to accommodate the current fleet of international bulk cargo and container vessels and improved the condition of the Columbia River estuary through the completion of environmental mitigation and restoration projects. The 43-foot depth and stern buoy installations at designated anchorages has allowed greater use of the river by Panamax-size bulk vessels. The number of these larger vessels has increased in recent years, while the number of smaller Handysize vessels is decreasing. The average age of vessels using the Columbia River is also decreasing due to the large number of new vessels that have replaced older vessels (Ecology 2015).

Marine commerce on the Columbia River includes cargo barges, passenger cruise ships, tour boats, commercial fishing charter boats, the Wahkiakum Cathlamet-Westport auto ferry, dredges, tugs, and launch-service boats. Recreational and tribal fishing boat activity is heavy at various locations during open fishing seasons (Ecology 2015). The Columbia River currently supports the movement of nearly 60 million tons of cargo annually along the Columbia Region. In terms of annual vessel transits, the busiest ports on the Columbia River are Portland, Oregon, Longview, Washington, Vancouver, Washington, Kalama, Washington, and Astoria, Oregon, as shown in Table 5-3.

Table 5-3. Recent Vessel Call Data for Largest Columbia River System Ports

Columbia River Vessel Activity by Port		
Annual Vessel Transits	2012	2011
Portland, OR	978	1,095
Longview, WA	324	230
Vancouver, WA	281	386
Kalama, WA	254	263
Astoria, OR	33	37

Source: Merchants Exchange of Portland, Oregon 2012

The volume of cargo shipped on the Lower Columbia River between 2003 and 2011 ranged from between 46,138,220 tons in 2009 to 58,228,290 in 2007 (Table 5-4). Grains and oilseeds were the predominant commodities, accounting for between 41 and 51 percent of the total cargo shipped between 2003 and 2011. Wood (including wood chips) and petroleum (diesel, jet fuel, asphalt, and gasoline) are also significant commodity groups; between 2003 and 2011, petroleum shipments have declined while the amount of wood and wood chips has increased. Petroleum has declined from a high of 8.2 million tons in 2006 to 4.4 million tons in 2011. Together, the three commodity groups of grain, wood, and petroleum account for approximately two-thirds of the cargo shipped to and from Lower Columbia River ports. Commodities constituting the remaining one-third of total cargo include sand and gravel, fertilizer, chemicals, cement, iron and steel products, and machinery.

Data from Columbia River Pilots include information on commercial vessels and large articulated tug barge (ATB) combinations that use a pilot. Table 5-5 shows the number of annual inbound trips for vessels or ATBs using a Columbia River Pilot boarding the vessel at Astoria for the years 1995 through 2013. It shows a general decline in the number of commercial deep-draft vessels using a pilot over the 18-year period, from 2,046 inbound trips in 1995 to 1,457 inbound trips in 2013. One of the main reasons for the decline in vessel traffic on the Columbia River has been the increased use of larger vessels requiring fewer smaller ones to carry a similar amount of cargo. The data from the Columbia River Pilots closely match the data provided in the Ecology *Washington State 2014 Marine and Rail Oil Transportation Study*. For example, for the year 2013, Ecology (2015) reports 1,454 transits of deep-draft vessels as opposed to 1,457 transits reported by the Columbia River Pilots. Transits by vessel type in 2013 as reported by Ecology (2015) were:

- Cargo and Passenger: 1,293
- Tankers: 63
- Tank Barges: 874
- ATBs: 201

Future changes to the vessel traffic in the Columbia River were addressed in the *Washington State 2014 Marine and Rail Oil Transportation Study* (Ecology 2015) and include the following:

- More ships may travel through the river, though they could generally be newer with safer, more environmentally friendly engineering systems.

- More stern buoy installations at anchorages will enable more Panamax-size bulkers (70,000-ton, 740-feet length) to replace some of the smaller Handysize bulkers (30- to 40,000-ton, 650-feet length).
- The average age of vessels could continue to drop, as older ships are scrapped and new builds come online.
- More bulk ships are expected to call, and more could be the larger Panamax size.
- More tank ships and ATBs may transit, many of them due to crude-by-rail transport.
- The additional bulk ships may generate more bunkerings but tank ships probably will not bunker in the Columbia River due to their regular trade to California and Puget Sound.
- More vessels could be at anchorages, causing crowding and potential swing-related groundings[1] or collisions during low-water periods.
- The backlog of vessels awaiting transit following bar closure may increase, due to weather and limited anchorages, and periods of high traffic may occur at the bar after it is reopened.
- The volume of oil and liquid chemical products being transported may increase, including more crude transport and persistent oil with higher pollution-damage potential.

Information from Table 5-2 on the projects and actions that have the potential to add vessels to the Columbia River system was used to calculate the total number of vessels that could be added to the system in the event that all of these projects were to be permitted and operated. Including adding the 365 vessels per year from the Proposed Action, the total potential number of vessels that could be added to the Columbia River is between approximately 2,610 and 3,948 vessel trips per year. When this amount is added to the 2013 total (approximately 1,457 vessel trips), between 4,067 and 5,405 deep-draft vessels per year could travel through the Columbia River. This amount would significantly exceed the recent historical high of 2,086 vessel trips that occurred in 2000. Note that not all of these projects may be permitted or constructed. Under the No Action Alternative, the number of vessels that would be added to the Columbia River system would be less than this, but would still substantially exceed the recent historical high.

An increase in vessels on the Columbia River may cause crowding at anchorages and potential swing-related groundings or collisions during low-water periods. The backlog of vessels awaiting transit following bar closure, due to weather and limited anchorages, may increase, and periods of high traffic may occur at the bar after it is reopened. High traffic volumes may increase the risk of an accident and potential oil outflow since a greater number of vessels would be using the Columbia River system. However, the additional vessels could generally be newer, with safer and more environmentally friendly engineering systems. In addition, all vessels that transport crude oil would be double-hulled as required by the Oil Pollution Act of 1990, which would provide a greater level of protection against releases of oil in the event of an accident than single-hulled vessels. Further analysis of the cumulative impacts to vessel traffic is provided in Section 5.15.

1 Swing-related groundings occur when a vessel is anchored and swings with the movements of water, usually at low-water periods, causing the vessel to ground.

Table 5-4. Volume of Cargo Shipped on Lower Columbia River between 2003 and 2011

Columbia River Ports Cargo Tonnage by Commodity									
Year	Total Cargo Tons	Grain and Oilseeds (Soybeans)	% of Annual Total	Wood and Chips	% of Annual Total	Petroleum and Petro Products	% of Annual Total	Other Cargo	% of Annual Total
2011	54,261,533	26,524,142	48.9%	5,853,999	10.8%	4,443,813	8.2%	17,439,579	32.1%
2010	54,538,280	27,712,689	50.8%	4,656,206	8.5%	5,539,875	10.2%	16,629,510	30.5%
2009	46,138,220	23,610,785	51.2%	3,281,064	7.1%	5,808,558	12.6%	13,437,813	29.1%
2008	54,890,397	25,447,673	46.4%	3,579,278	6.5%	5,585,638	10.2%	20,277,808	36.9%
2007	58,228,290	25,748,524	44.2%	3,501,270	6.0%	8,011,905	13.8%	20,966,591	36.0%
2006	52,329,255	21,436,509	41.0%	3,461,176	6.6%	8,206,735	15.7%	19,224,835	36.7%
2005	51,472,208	22,098,891	42.9%	3,688,606	7.2%	7,587,679	14.7%	18,097,032	35.2%
2004	53,656,479	24,221,789	45.1%	3,550,084	6.6%	7,709,182	14.4%	18,175,424	33.9%
2003	47,389,242	19,553,434	41.3%	3,476,918	7.3%	7,673,591	16.2%	16,685,299	35.2%

Source: USACE 2011

Table 5-5. Annual Inbound Trips Using a Pilot

Year	Columbia River Pilots Number of Inbound Piloted Vessels
2013	1,457
2012	1,474
2011	1,450
2010	1,558
2009	1,404
2008	1,804
2007	1,894
2006	1,767
2005	1,634
2004	1,701
2003	1,720
2002	1,738
2001	1,974
2000	2,086
1999	2,075
1998	1,972
1997	2,010
1996	1,964
1995	2,046

Source: BergerABAM 2014

5.1.4 Evaluation of Cumulative Effects

The known or predicted impacts of projects and actions identified within the spatial and temporal boundaries of the proposed Project and No Action Alternative are combined with the direct and indirect impacts of the proposed Project and No Action Alternative to identify potential future cumulative impacts to a given environmental resource. The analysis of cumulative impacts to environmental resources is included in Sections 5.2 through 5.17 and uses the same impact criteria (negligible, minor, moderate, and major) described in Chapters 3 and 4 of this EIS.

5.2 EARTH RESOURCES

5.2.1 Proposed Facility

The proposed Facility would result in localized and minor impacts to earth resources including a localized increase in soil erosion susceptibility in upland and river environments. Other foreseeable future projects that could contribute to cumulative earth resource impacts would be those that would occur at the Port. Cumulative impacts could occur from increased soil erosion onsite that results in additional dust emissions or sediment particles in stormwater runoff. However, erosion potential of soils would be

minimized through the implementation of erosion and sedimentation best management practices (BMPs) for the proposed Facility and for the other identified projects and actions, resulting in limited cumulative impacts.

Soil at the Port could become contaminated by releases of oil, vehicle fuels, solvents, thinners, paints, antifreeze, coatings and sealants, or other hazardous materials from proposed Project activities or other existing or future actions. However, activities at the Port are not anticipated to cumulatively contaminate soil resources due to BMPs and minimization measures that would be required to reduce the potential for release of hazardous materials.

Soils in portions of the proposed Facility site have been contaminated in the past by various aluminum smelting and fabrication operations. It is possible that construction or decommissioning activities could disturb existing contaminants in the soil through grading operations or disruption or removal of capping systems, both from the proposed Facility and from other past, present, and future actions. However, areas containing potential soil contaminants would be addressed in construction or decommissioning plans, and procedures would be established to minimize the potential for groundwater impacts, including restrictions on work in those portions of the site, minimizing or controlling grading to prevent ponding water that would promote leaching, using temporary covers over disturbed areas, and controlling tracking of contaminants from one portion of the site to another.

The proposed Facility and other existing and future actions include changes in site topography. Most areas of the site have been graded, filled, and generally modified from their original state over the past several decades, and the slight modifications that would occur are anticipated to result in minor cumulative impacts.

5.2.2 Rail Transportation

Soil contamination is a potential cumulative impact from railcars traveling along the rail corridor associated with the Proposed Action and existing and foreseeable future actions, due to leaks of crude oil, diesel fuel, and lubricants. However, regular, thorough inspection of all trains using the rail routes would prevent such leaks from accumulating, and all railcars would be required to meet leak prevention and detection standards, resulting in minor cumulative soil contamination impacts.

5.2.3 Vessel Transportation

Increased vessel traffic from the Proposed Action and existing and foreseeable future actions has the potential to increase riverbank erosion caused by vessel wakes. The Columbia River is already subject to existing wakes from current vessel traffic, as well as waves generated by wind and tidal forces. The additional wakes caused by Project vessels could lead to a minor cumulative impact of increased soil erosion along the banks of the Columbia River. Vessel-induced mobilization, resuspension, and transport of streambed material are possible throughout the Lower Columbia River, which is a dynamic sand-bed system that has experienced historical aggradation in many subreaches (Simenstad et al. 2011). Areas vulnerable to bank erosion would include reaches with actively migrating channel margins and some of the more confined valley sections, though these are not extensive. Overall, there are limited areas in which wake-induced erosion could occur along the Columbia River, because much of the shoreline has been strengthened by riprap and other armoring. Existing rock and vegetation, as well as engineered structures, protect the riverbank along the Port and much of the Columbia River, which would prevent or reduce cumulative impacts from increased vessel traffic on the Columbia River. The rate of wake-induced bank erosion would depend on the number and sizes of vessels using the Columbia River. New vessel traffic on the Columbia River from vessels associated with the Proposed Action in addition to that associated with existing and future actions represents an increase from the commercial deep-draft vessel traffic levels of recent years. The cumulative increase in vessel traffic could range from slightly higher

than the historical high to well beyond that level, which would likely result in increased wake-induced bank erosion in some areas of the Columbia River. The potential for soil erosion would be limited to the lower approximately 33 miles of the river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The cumulative increase in deep-draft vessel traffic and associated increase in vessel wakes could have a minor to moderate impact to erosion, primarily in the Columbia River estuary. Section 3.6.5 includes mitigation measures to reduce the potential for wake stranding of aquatic species, which would also reduce the rate of erosion from wake-induced effects described herein.

5.3 AIR QUALITY

5.3.1 Proposed Facility

Calculated construction and operations emissions generated by the proposed Facility show that criteria pollutant emissions including hazardous air pollutants (HAPs) and toxic air pollutants (TAPs) would not exceed any of the comparative thresholds, and construction and operations would not be anticipated to produce significant air quality impacts in the study area for the proposed Facility (as described in Section 3.0). A cumulative impact for air quality could occur in the event that existing or future actions were constructed or operated at the same time as and within 1,000 feet of the proposed Facility, with impacts potentially greater the closer they are to the Facility since pollutants disperse in air. Identified projects and actions within 1,000 feet of proposed Facility construction areas include the Bulk Potash Handling Facility, Gateway Avenue Grade Separation Project, Port of Vancouver Trail Project, and Bike Paths on Lower River Road. The Bulk Potash Handling Facility is unlikely to be constructed at the same time as the proposed Facility since the project has been suspended, and construction of the Gateway Avenue Grade Separation Project has been completed, so neither of these would contribute to cumulative air quality impacts during the Facility life. Construction of the trail and bike path projects could result in some minimal increases in air pollutants and odors from construction equipment and materials, including diesel-powered engines, and placement of gravel and asphalt. However, air pollutants related to these projects are anticipated to be temporary—for the duration of construction—and would result in low contributions to air quality impacts. As such, minor cumulative impacts to air quality are expected from construction and operation of the proposed Facility in combination with other existing or future actions.

5.3.2 Rail Transportation

Locomotive emissions associated with the Proposed Action when added to emissions from existing and future actions would contribute to air pollution in areas through which the rail routes pass. The amount of air pollution is not anticipated to be substantial since railroad locomotives represent a relatively small amount of total statewide emissions, contributing about 5 percent of the statewide nitrogen oxide (NOx) emissions compared with 57 percent for onroad mobiles sources, and less than 1 percent of the particulate matter 2.5 ($PM_{2.5}$) emissions compared with about 23 percent for residential wood burning (Ecology 2014b). In the event that an increased number of locomotives pass through a nonattainment area, even a small increase in emissions would exacerbate a decrease in air quality.

The rail routes to and from the proposed Facility site would pass through several air quality nonattainment and maintenance areas outside of Washington, including the Sandpoint particulate matter 10 (PM_{10}) nonattainment area in Idaho and the Whitefish PM_{10} nonattainment area in Montana. Increases in rail traffic from the Proposed Action in combination with additional trains associated with existing and future actions could be assumed to represent an increase in air emissions in these areas. However, the locomotives would be temporary emission sources, moving through any given area in a short period of time. In addition, the US Environmental Protection Agency (EPA) requirements for increasingly stringent

emission standards and locomotive idle reduction technology would be expected to reduce NOx, volatile organic compound (VOC), and PM emissions and significantly reduce smoke emissions and exhaust odors (EPA 2013a). These measures will reduce future emissions compared with both past and present locomotive emissions. As such, emissions from locomotives associated with the Proposed Action in combination with existing and future train traffic could result in minor increases in cumulative impacts to air quality in these areas.

Rail traffic associated with the Proposed Action in combination with existing and future train traffic would likely increase gate downtimes and associated vehicular delays. In urban areas and during peak commuting periods, the number of highway vehicles idling while delayed at the crossing could be substantial and result in minor to moderate localized increases in emissions, whereas in more rural areas, fewer vehicles would likely be waiting, resulting in negligible to minor increases in emissions. The mitigation measures identified in Section 3.14.5 to reduce vehicular delays from gate downtime at at-grade crossings would also reduce emissions from idling vehicles.

5.3.3 Vessel Transportation

Large vessel engine emission specifications are set based on International Maritime Organization (IMO) requirements. The IMO controls pollution from vessels through the MARPOL Convention; it sets limits on NOx and sulfur oxide emissions from ship exhausts and prohibits deliberate emissions of ozone-depleting substances. In March 2010, the IMO accepted a proposal from EPA to designate waters off the North American coasts as an Emission Control Area, in which stringent international emission standards apply to vessels. For this area, the effective date of the first-phase fuel sulfur standard was 2012, and the second phase begins in 2015. Beginning in 2016, NOx after-treatment requirements become applicable. By 2020, emissions from vessels operating in the North American Emission Control Area are expected to be reduced by 23 percent for NOx, 74 percent for $PM_{2.5}$, and 86 percent for sulfur oxides from predicted levels in 2020 absent the Emission Control Area (EPA 2010). The vessels that would transit the Columbia River as a result of proposed Facility operations as well as those associated with present and future actions would be required to comply with the IMO standards, and as a result, NOx, sulfur oxide, and $PM_{2.5}$ emissions would decrease over time. The air quality emissions associated with potentially substantial increases in vessel traffic as a result of the Proposed Action in combination with present and future actions would be somewhat offset by the emissions reductions associated with the IMO standards. Consequently, the result would likely be minor cumulative increases in air emissions from vessels.

5.4 WATER RESOURCES

5.4.1 Proposed Facility

Potential cumulative impacts to surface water include turbidity, sediment, and pollutants entering waterways from stormwater runoff during construction of the proposed Facility and other existing and future actions at the Port. Construction activities would be sequenced and controlled to limit the potential for erosion and sediment transport, including the establishment of BMPs before clearing, excavation, and grading, clearing and grading small portions of the site at a time, and stabilizing all nonactive disturbed areas in accordance with individual permits. In addition, stormwater discharges from the Port would be governed by individual permits that would reduce this potential, including Stormwater Pollution Prevent Plans (SWPPPs) that would be developed for new facilities constructed at the Port. The SWPPPs would identify erosion, sediment, and stormwater controls to reduce the potential for violations of the Port's discharge limits.

Short-term disturbance of the riverbed would occur during dock modifications, which, combined with ongoing permitted channel and berth maintenance dredging and other new marine facilities such as that

proposed for the Bulk Potash Handling Facility or Columbia Gateway projects, has the potential to result in a cumulative increase in localized and temporary turbidity. However, these two projects are unlikely to be constructed at the same time as the proposed Facility since the Bulk Potash Handling Facility project has been suspended, and the Columbia Gateway project is a future proposed development that has not begun the permitting process. In the event that dredging is carried out in other areas close to Terminal 5 at the Port or that other marine terminals are constructed during the same time period, localized and temporary increases in turbidity within surface waters could occur.

Soils in portions of the Facility site have been contaminated in the past by various aluminum smelting and fabrication operations. It is possible that construction or decommissioning activities could disturb existing contaminants in the soil through grading operations or disruption or removal of capping systems, both from the proposed Facility and from other past, present, and reasonably foreseeable future actions. Disturbances could result in contaminants entering stormwater and waterways or groundwater. Construction activities such as excavation and site grading near capped areas could temporarily disrupt surface-water drainage patterns or impact ongoing/previous remediation activities. However, site-specific measures to minimize the disturbance of existing capped or contaminated areas would be developed for the proposed Facility and other future projects, resulting in minor cumulative impacts to water resources from disturbance of previously contaminated areas.

Minimal pollutant discharges could occur from spills and leaks of petroleum products and lubricants, such as from fueling construction vehicles and equipment, from the proposed Facility and from other past, present, and future actions. Pollutant discharges could reach surface water and groundwater directly or through stormwater runoff. However, construction BMPs would be put in place to reduce these effects including staging equipment when not in use in a specified area, using duck ponds/catch basins below equipment staged, and regular monitoring and inspections of equipment for leaks. Cumulative impacts to water quality from small spills and leaks of hazardous materials from the proposed Facility in combination with other developments at the Port would be minor.

No wetlands are present on the proposed Facility site and buffers for the adjoining wetlands do not extend onsite, so cumulative impacts from the proposed Facility in combination with other past, present, and reasonably foreseeable future actions are not anticipated.

5.4.2 Rail Transportation

Increased rail operations from the Proposed Action and other past, present, and future actions could contribute to the accumulation and transportation of hazardous materials including caked-on grease on tracks and creosote discharge from old railroad ties. Drips and leaks, or the discharge of residual range organics, that occur in transit associated with increased rail traffic overall could cause minor cumulative impacts to groundwater, although more stringent regulations to prevent leaks from railcars, such as press release #FRA 04-15 requiring railroad tank car owners to replace unapproved valves currently installed in some tank cars (Federal Railroad Administration 2015) may offset this cumulative impact.

5.4.3 Vessel Transportation

Increased vessel traffic associated with the Proposed Action and existing and future actions has the potential to increase erosion caused by vessel wakes, which could increase turbidity and cause localized water quality effects. The Columbia River is subject to existing vessel wakes from current vessel traffic as well as waves generated by wind and tidal forces. Areas vulnerable to bank erosion include portions of the streambank along the Port and the northern side of Hayden Island, which contain unprotected native sediments. Increases in turbidity and local redistribution of sediment within the channel bed and/or to active channel bars and floodplain surfaces associated with additional vessel transits in the Lower Columbia River from vessels associated with the Proposed Action and existing and future actions have

the potential to alter the river channel, its hydrology, and water quality relative to baseline conditions, depending on the number and size of vessels that would be added to the system. However, areas in which wake-induced erosion could occur along the Columbia River are limited since much of the bank has been strengthened by riprap and other armoring. Existing rock and vegetation, as well as engineered structures, protect the riverbank along the Port and much of the Columbia River and would reduce cumulative impacts from increased vessel traffic on the Columbia River. The rate of wake-induced bank erosion would depend on the number and sizes of vessels using the Columbia River. New vessel traffic on the Columbia River from vessels associated with the Proposed Action in addition to that associated with existing and foreseeable future actions represents an increase from the commercial deep-draft vessel traffic levels of recent years. The cumulative increase in vessel traffic could range from slightly higher than the historical high to well beyond that level. The cumulative effect on bank erosion is spatially limited but could be substantial in local, vulnerable locations in the lower approximately 33 miles of the river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Water quality impacts from vessels associated with the Proposed Action and existing and future actions may result in minor to moderate cumulative impacts. The mitigation measures identified in Section 3.6.5 to reduce the potential for wake stranding of aquatic species would also reduce the water quality effects from wake-induced erosion.

Sediment contamination with polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers (PBDEs) exists in the Lower Columbia River, and the vessel traffic associated with the Proposed Action in combination with that of other past, present, and reasonably foreseeable future actions could cumulatively increase the concentration of these contaminants in the water column. The rate of concentration of contaminants would depend on the number and sizes of vessels that would be used within the Columbia River, and could result in a minor cumulative impact.

5.5 TERRESTRIAL VEGETATION

5.5.1 Proposed Facility

Cumulative impacts to terrestrial vegetation could occur as a result of vegetation removal resulting from construction of the proposed Facility and past, present, and reasonably foreseeable future actions that have resulted in or would result in the loss of vegetation communities. An area with less than 0.07 acre of upland cottonwood stands containing a total of about 273 trees currently exists at the proposed Facility site. Removal of approximately 246 of these trees has been permitted for construction of the Clark Public Utilities (CPU) Electrical Substation, and the proposed Facility would result in the removal of approximately an additional nine trees (one-third of the remaining 27 trees). The Applicant would plant about 2.2 acres of landscape plantings with a minimum of eight tree units to mitigate for the loss of vegetation cover, including the cottonwood trees. Although young new trees would not directly replicate existing mature trees, the amount of vegetation that would be replaced (2.2 acres) is considerably more than the amount that would be removed (0.07 acres). As such the combined removal of approximately 255 black cottonwood trees from the Proposed Action in combination with existing and future actions constitutes a minor cumulative impact to terrestrial vegetation at the Port.

Construction and operations equipment used for the proposed Facility and existing and future actions could disperse noxious weed seeds, which tend to first colonize newly disturbed ground. Most disturbed areas for the proposed Facility would be revegetated or would contain buildings or impervious surfaces, and although the gravel railbed and other gravel surfaces could provide suitable growing conditions for noxious weeds, BMPs are in place to control their spread. Under current law, landowners are responsible for eradicating Class A weeds. It is assumed that future actions would also implement a noxious weed

control plan during construction of projects. The spread of Class A noxious weeds is generally localized and controlled and is considered to be a minor cumulative impact.

5.5.2 Rail Transportation

Increased rail operations associated with the Proposed Action and past, present, and reasonably foreseeable future actions could contribute to increased volumes of leaks of small quantities of grease, oil, and fuel along the rail lines. Small spills and leaks would be expected to remain on the gravel railbed and potentially within adjacent soils, and could affect vegetation in close proximity to rail lines. Increased rail traffic associated with the Proposed Action in combination with past, present, and future actions could also facilitate the rate at which noxious weeds are dispersed along the rail line. The increase in rail traffic with associated small spills and leaks and facilitated movements of noxious weeds and invasive plants could contribute to moderate, long-term cumulative impacts to vegetation communities along rail lines.

5.5.3 Vessel Transportation

An increase in vessels transiting the Columbia River associated with the proposed Facility and existing and foreseeable future actions would cumulatively create more vessel wakes, which have the potential to impact riparian vegetation directly through breakage, swamping, and erosion and indirectly through altered patterns of erosion and deposition and spread of aquatic invasive plants. Wakes can redistribute fine sediment that can smother aquatic vegetation, but can also provide substrate for colonization of emergent wetland plants. Vessel wakes are most likely to affect shoreline vegetation communities at or near water level. Although the existing shoreline is exposed to vessel wakes and wind-driven waves, the expected cumulative increase in wave energy from vessels associated with the proposed Facility and existing and foreseeable future actions would likely create additional impacts of wakes on shoreline vegetation. New vessel traffic on the Columbia River from vessels associated with the Proposed Action in addition to that associated existing and foreseeable future actions represents an increase from the commercial deep-draft vessel traffic levels of recent years. The cumulative increase in vessel traffic could range from slightly higher than the historical high to well beyond that level, which would likely result in increased wake effects to vegetation primarily within the 16 percent of the lower river where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The cumulative increase in deep-draft vessel traffic and associated increase in vessel wakes could contribute to moderate, long-term impacts to shoreline vegetation from wake-induced shoreline erosion and potential spread of invasive wetland and riparian plants. The mitigation measures identified in Section 3.6.5 to reduce the potential for wake stranding of aquatic species would also reduce impacts to shoreline vegetation from wake-induced shoreline erosion.

5.6 TERRESTRIAL WILDLIFE

5.6.1 Proposed Facility

Cumulative impacts to terrestrial wildlife could occur as a result of habitat removal resulting from construction of the proposed Facility and past, present, and reasonably foreseeable future actions. The combined removal of approximately 255 black cottonwood trees in the Westside Lowland Conifer-Hardwood Forest habitat that would occur from the Proposed Action and the CPU Electrical Substation project constitutes a cumulative impact to wildlife habitat structure including removal of tree canopy, shrub understory, and ground cover that could provide shelter, perching, and potential nesting or burrow sites for birds, squirrels, and small- to medium-sized mammals, as well as vegetation and insects for forage. The Applicant would plant about 2.2 acres of landscape planting with a minimum of eight tree

units to mitigate for the loss of vegetation cover including the cottonwood trees. This planting would provide habitat typical of urban areas and could provide perching and foraging habitat for migratory birds. Although young new trees would not directly replicate the habitat structure of existing mature trees, the amount of vegetation that would be replaced (2.2 acres) is considerably more than the amount that would be removed (0.07 acres) and the trees would mature with time. As such the combined removal of approximately 255 black cottonwood trees from the Proposed Action in combination with existing and future actions constitutes a minor cumulative impact to terrestrial wildlife habitat at the Port.

Construction equipment and vehicles associated with the proposed Facility and existing and future actions could run over amphibians, reptiles, and small mammals, but the minor impacts would be site-specific and are not expected to contribute to cumulative impacts. Most vehicles and equipment would be moving at slow speeds within construction sites and few animals are likely to collide with vehicles.

Noise generated during Facility construction could reach wildlife habitats in the Columbia River Wetland Mitigation Bank and the Vancouver Lake Wildlife Area. If other projects were to be constructed during the same timeframe and in close proximity to the Proposed Action, noise levels in these areas could increase, causing avoidance of these areas by some sensitive species, particularly nesting and migrating birds. Operational noise would not be expected to cause wildlife displacement from habitats near existing Port operations because the area is currently used for industrial purposes with associated noise, and noise increases from the proposed Facility would be within ambient conditions.

New lights installed for the proposed Facility and from existing and future actions could cause localized light and glare impacts to adjacent wildlife habitats, reducing nocturnal habitat suitability. Light pollution from existing and future actions in the immediate area, such as the Bulk Potash Handling Facility, Gateway Avenue Grade Separation Project, or NuStar Terminals Conversions to Crude Oil Project could extend the area of impact for light and glare when added to the lighted area under the Proposed Action. The Bulk Potash Handling Facility is unlikely to be constructed at the same time as the proposed Facility since the project has been suspended, and construction of the Gateway Avenue Separation Project has been completed, so neither of them would contribute additional light and glare. However, the NuStar Terminals Conversions to Crude Oil Project, which is currently in permitting, could contribute to cumulative light and glare impacts in the general vicinity and could, thus, reduce nocturnal habitat suitability in this area.

Both native and invasive wildlife that are adapted to urban and industrial areas and human activity have the potential to create problems for the proposed Facility and for other existing and future projects. Such wildlife include bats, coyotes, raccoons, opossums, skunks, rats, and various birds. These animals could use newly constructed facilities as roosts, nests, or dens, and/or could be attracted by garbage that is not appropriately contained. Impacts related to problem wildlife would generally be location-specific and are anticipated to become a minor cumulative impact.

5.6.2 Rail Transportation

Increased rail operations associated with the Proposed Action and existing and future actions could cause cumulative impacts to terrestrial wildlife through reduced habitat suitability and incremental increases in barrier effects and collision mortality. Wildlife that would most likely be affected by these impacts include deer, elk, and bears. A cumulative increase in collision mortality risk could also occur for predators, including bald and golden eagles, wolves, and wolverines, who may scavenge on rail-killed deer, elk, and moose, especially during fall and winter (Wells et al. 1999). The incremental increase in rail traffic associated with the Proposed Action and existing and future actions would likely contribute a moderate increase in wildlife collision mortality. Mitigation measures are identified in Section 3.5.5 to address this impact.

Wildlife habitats within the rail corridor could be affected by leaks of small quantities of grease, oil, and fuel along the railways. However, these small spills and leaks would be expected to generally remain on the railbed and would not likely reach vegetated habitats. While most contamination would remain within the railbed, precipitation may transport some contaminates into nearby waters where they may result in reduced productivity and potential increases in deformities in amphibians. Reptiles such as snakes and lizards may be exposed to contaminants if they use the railbed for basking. The incremental increase in rail traffic associated with the Proposed Action and existing and future actions would likely contribute a minor impact to wildlife found in close proximity to rail lines.

5.6.3 Vessel Transportation

An increase in deep-draft vessels transiting the Columbia River associated with the Proposed Action and existing and foreseeable future actions would contribute to cumulative increases in wake effects, wake and vessel disturbance, and potential injury or mortality from vessel strikes. Wildlife that use shoreline habitats, including amphibians, small mammals, and shorebirds, could experience some cumulative increases in shoreline erosion and periodic disturbance as vessel wakes collide with the shoreline, resulting in some habitat alteration. The degree of shoreline erosion would be subject to shoreline substrate and vegetation cover, shoreline exposure, and the size, draft, and speed of the vessel producing the wake. The incremental increase in vessels associated with the Proposed Action and existing and foreseeable future actions would likely contribute a minor increase in habitat alteration.

Waterfowl and seabirds using open-water habitats are the most likely to be disturbed by vessel traffic, although waterbirds using the area would be habituated to existing and routine vessel traffic. Waterfowl and seabirds sometimes collide with vessels, both when in motion and when anchored; such collisions are most likely to occur at night or during poor visibility due to poor weather, when birds may be attracted by vessel lights. Although disturbance to these birds may occur from vessels associated with the Proposed Action and existing and future actions, all commercial vessels would transit through the vessel corridor within designated shipping lanes, and waterfowl and seabirds using the area would be habituated to routine vessel traffic in this area. Therefore, impacts to waterfowl and seabirds from an increase in vessel transportation would be expected to be minor.

5.7 AQUATIC RESOURCES

5.7.1 Proposed Facility

Cumulative effects from construction and operation of the proposed Facility and past, present, and reasonably foreseeable future actions on aquatic habitat and species could include habitat alteration, decrease in habitat access, reduction of water quality, and underwater noise disturbances.

Aquatic habitat at the proposed Facility site has been altered in the past from its original state by industrial developments including marine terminals and berthing structures. Aquatic habitats would be further altered, either temporarily or permanently, through the addition of temporary or permanent structures, from removal of existing structures, or from additional shade or lighting created under the proposed Facility and from future projects. For instance, installation of temporary structures such as support piles would temporarily affect water quality in the vicinity of the piles and the expansion of overwater structures would modify habitat, increasing daytime shading and night lighting of the nearshore habitats in the vicinity. However, these habitat impacts would be localized and minor and are not expected to result in cumulative impacts to aquatic habitats or species.

Ongoing permitted channel and berth maintenance dredging and other new marine facilities such as the proposed Bulk Potash Handling Facility or Columbia Gateway projects would increase the potential for

water quality degradation. If dredging is carried out in areas close to Terminal 5 at the Port or other marine terminals are constructed during the same time period the proposed Facility would be constructed, localized and temporary decreases in water quality could occur from suspended sediment mobilized during in-water construction activities or from accidental releases of small amounts of hazardous materials. However, it is unlikely that any of the projects and actions identified in Table 5-1 would contribute cumulative impacts to water quality since none of these projects are expected to occur at the same time as the proposed Facility. Ongoing channel and maintenance dredging would not likely occur near the proposed Facility during modification of Berths 13 and 14 under the Proposed Action due to the presence of construction equipment in the area, the Bulk Potash Handling Facility project has been suspended, and the Columbia Gateway project is a future proposed development that has not initiated the permitting process.

Fish and marine mammals in the Port vicinity would be exposed to underwater noise disturbances from pile driving and work boat/barge movements under the Proposed Action. It would be unlikely that any of the projects and actions identified in Table 5-1 would contribute to cumulative impacts of noise exposure since they do not involve in-water work or construction activities during the same time as the proposed Facility.

5.7.2 Rail Transportation

Increased rail operations associated with the Proposed Action and past, present, and future actions could contribute to the accumulation and transportation of residual range petroleum hydrocarbons including caked-on grease on tracks and creosote discharge from old railroad ties. However, it is unlikely that these materials would disperse outside of the immediate rail tracks and that they would enter waterways in sufficient quantities to cause more than minor cumulative adverse impacts to surface water and associated impacts to fish and invertebrates.

5.7.3 Vessel Transportation

The increase in deep-draft vessel traffic associated with the Proposed Action and existing and foreseeable future actions could cumulatively impact aquatic habitat and species through increased vessel wakes, wake stranding, noise disturbances, increased entrainment of aquatic organisms, and vessel disturbance and strikes.

Vessel wakes have the potential to impact riparian and wetland vegetation communities, which could affect juvenile fish that use this habitat for foraging and resting. The increase in vessel wakes from increases in deep-draft vessels associated with the Proposed Action, and existing and future actions, could have adverse impacts to aquatic habitats and salmon, groundfish, and pelagic essential fish habitat (EFH) as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats, resulting in a moderate to major long-term change to the resource. Mitigation for this impact has been identified in Section 3.6.5.

Wake stranding[2] resulting from deep-draft vessels along the Lower Columbia River below Vancouver is an issue of ongoing active management concern (E2 Consulting Engineers, Inc. 2012). Susceptibility of juvenile salmonids (and by extension other fish present in the vessel corridor) to wake stranding from

2 Wake stranding is when aquatic species are lifted by a wave onto a shoreline and are stranded.

deep-draft vessel wakes may occur in approximately 33 miles (16 percent) of the Columbia River where shorelines with beaches close to the channel are not shielded from wave action and have beach slopes less than 10 percent. Localized reductions of existing vegetation, prey, and overall EFH function could also occur from wakes during vessel transit. Wake effects would be the greatest as vessels pass through the Columbia River estuary and its associated habitats including tidal wetlands, shallow water, and tidal flats. The habitat types in these areas serve as important nursery grounds for juvenile fish and contain some of the highest quality, unarmored shallow-water shoreline habitat that is of great importance to numerous aquatic species and associated fisheries. The increase in deep-draft vessel traffic and associated increase in vessel wakes could reduce the vegetation communities in these areas, resulting in a moderate to major long-term change to the resource, indirectly affecting fish species that rely on these habitats to complete their life cycle. A substantial increase in vessel traffic associated with the Proposed Action and existing and foreseeable future actions could have significant wake-stranding effects to juvenile salmonids and other fish species, constituting a moderate to major cumulative impact. Mitigation for this impact has been identified in Section 3.6.5.

Underwater noise would be generated by vessels associated with the Proposed Action and existing and foreseeable future actions as they transit through the Columbia River and the Pacific Ocean, which could disturb fish, marine mammals, or turtles. Vessel movements in the Columbia River would occur within existing designated shipping lanes, which are characterized as having high levels of use by both commercial and recreational vessels. Vessels associated with the Proposed Action and existing and future actions traveling through the freshwater and marine portions of the vessel corridor would likely cause low-frequency transitory peaks to background noise levels. On occasions when fish, marine mammals, or sea turtles are present in proximity to a vessel in transit, the duration of noise exposure would be limited to the brief period when the vessel is nearby. It is not likely that an increase in vessels transiting through the marine portion of the vessel corridor would add a significant level of noise due to the high volume of existing marine traffic and large area in which vessels can travel, resulting in minor impacts. In the event that a significant increase in vessel traffic occurs within the confines of the Columbia River, noise levels from transiting vessels could increase ambient noise levels in this area, resulting in minor to moderate impacts.

Entrainment of aquatic lava and eggs would likely increase as a result of increased vessel numbers associated with the Proposed Action and existing and future actions transiting the Columbia River. Impacts to fish eggs, larval fish, and pelagic larval invertebrates from entrainment include physical stress due to pressure changes, or abrasions or mortality from contact with screens and pump impellers. Vessels currently travel regularly up and down the Columbia River, and entrainment impacts to eggs and larval fish and invertebrates are ongoing. Vessels associated with the Proposed Action in addition to those associated with existing and future actions would increase the potential for entrainment and may result in a minor to moderate additional impact to the reproduction, population size, or distribution of fish species present in the vessel corridor.

Increased traffic associated with the Proposed Action and existing, and future actions in the vessel corridor could result in vessel strikes or disturbances to pinnipeds (e.g., seals and sea lions). While vessel strikes are unlikely for pinnipeds as they are typically vigilant and able to avoid collisions, increased disturbance of pinnipeds from an increase in vessel traffic in the Columbia River could result in behavioral effects such as changes in foraging behavior. A large increase in vessel traffic in the Columbia River as a result of implementation of the Proposed Action in combination with existing and future actions could cumulatively lead to increased disturbance to pinnipeds, resulting in minor impacts.

Vessel traffic associated with the Proposed Action, and existing and future actions, transiting the marine portion of the vessel corridor could strike or disturb cetaceans (e.g., whales and porpoises) or leatherback turtles. Cetaceans are vulnerable to collisions with all vessel types, sizes, and classes, but a review of the

National Marine Fisheries Service's Large Whale Ship Strike Database (Jensen and Silber 2004) found no instances of ship-struck cetaceans in the study area for vessel transportation (as defined in Section 3.0) between 1975 and 2002. Vessels and tugboats associated with the Proposed Action and existing and future actions would proceed in a predictable straight path to their destinations at relatively low speeds and are likely to be detected and avoided by cetaceans and leatherback turtles. Vessel traffic associated with the Proposed Action and existing and future actions is not anticipated to increase the occurrence of vessel strikes in the marine portion of the vessel corridor, resulting in negligible impacts.

5.8 ENERGY AND NATURAL RESOURCES

5.8.1 Proposed Facility

The amount of electricity consumed by the proposed Facility would be similar to other medium-sized industrial construction projects and would not be significant in terms of overall regional supply. The projects and actions identified as part of this cumulative impacts analysis include industrial, residential, and retail developments (Table 5-1), which would require electricity for construction and operations. Each new project would need to obtain electricity from a local supplier such as CPU. If existing and future actions require electricity beyond the current infrastructure in the future, it is assumed that new substations and other infrastructure would be added to the system. A CPU substation is planned for construction at the Port and could be completed approximately 1 year after the Port and CPU commit to building the new substation (Blaufus, pers. comm., 2015) and when all required permits have been obtained. The need for electricity for the proposed Facility in combination with other existing and future projects is assumed to be fulfilled by the new CPU substation, resulting in no cumulative impacts to electricity at the Port.

Gasoline and diesel fuel are used to power portable generators, construction vehicles, and other equipment required for development and operation of the proposed Facility and other existing and future projects. The quantity of transportation-related petroleum products consumed by the proposed Facility would be similar to other medium-sized industrial projects and would not be significant in terms of overall regional supply. The industrial, residential, and retail development projects and actions (Table 5-1) would require gasoline and diesel fuel for construction and operations, which is readily available throughout the United States. The consumption of gasoline and diesel fuel for the proposed Facility in combination with existing and future actions would not result in a significant cumulative impact.

Natural gas would be used to power boilers for the proposed Facility and would be obtained from NW Natural. Natural gas could also be required for other existing and future facilities. Natural gas use for the proposed Facility would represent approximately 0.4 percent of NW Natural's industrially based consumption at the Vancouver hub, 0.04 percent of industrially based consumption systemwide, and 0.0015 percent of all firm consumption (excluding transportation-related) systemwide. NW Natural has current projects underway to bolster the distribution system capacity in Clark County and would likely have adequate resources to accommodate the other projects and actions identified in Table 5-1. Natural gas requirements for the proposed Facility in combination with existing and foreseeable future projects would not likely affect other users or locally available natural gas supplies and, as such, are not identified as a cumulative impact.

Mineral and earth resources such as steel, gravel, and concrete would be required for development of the proposed Facility and other foreseeable future projects. The resources available within Clark County would be sufficient to meet the Facility's needs, but for other future projects, additional resources could be required. Mineral and earth resources are readily available throughout the United States and the need for mineral and earth resources is, therefore, identified as a minor cumulative impact.

The proposed Facility and other projects and actions (Table 5-2) would handle small to large shipments of US- and Canada-derived crude oil for delivery to refineries on the US West Coast but are not likely to impact the North American or global supply and demand for refined petroleum products.

5.8.2 Rail Transportation

The fuel consumed by trains associated with the Proposed Action and existing and foreseeable future train traffic would not likely impact the availability of fuel for other uses since diesel fuel is readily available throughout the United States. In addition, locomotive fuel economy is expected to improve in the future as a result of various regulatory programs requiring retiring or rebuilding of older engines.

5.8.3 Vessel Transportation

The fuel consumed by vessels associated with the Proposed Action and existing and foreseeable future train traffic would not likely impact the availability of fuel for other uses since diesel and bunker fuel is readily available. In addition, EPA regulations designed to reduce marine engine air pollutant emissions would also have beneficial effects on fuel consumption, and fuel economy would also likely improve as a result of retiring or rebuilding older vessel engines.

5.9 ENVIRONMENTAL HEALTH

5.9.1 Proposed Facility

Risks to workers during construction of the proposed Facility and other foreseeable future actions would be similar to those from typical construction activities for similar sizes and types of projects and would be minimized by implementation of Project-specific construction safety plans, employee emergency plans, and fire prevention plans. Other future facilities that could be built and operated would each have specific safety hazards to workers and the public and could require different construction or operational safety plans depending on the facility. Handling of hazardous materials during construction and operation of each future project and handling of previously contaminated material at the Port would include following appropriate hazardous materials handling procedures, BMPs, and requirements imposed by environmental covenants, minimizing the risk of contaminated material to workers and the public.

Vandalism and threats to homeland security are not expected to increase from the proposed Facility in combination with existing and reasonably foreseeable future actions. Access to the proposed Facility and other potentially hazardous facilities would likely be limited to facility personnel only, which would reduce the potential for public safety impacts.

Overall, risks to workers and the public from construction and operation of the proposed Facility in combination with other existing and reasonably foreseeable future actions are expected to result in negligible cumulative impacts or increases in the rate of injury or fatality to workers or the public.

5.9.2 Rail Transportation

Workers involved in operating trains on the Port rail infrastructure for the Proposed Action and existing and future projects using the same infrastructure would be exposed to slow-moving rail traffic. Few accidents involving trains occur to workers (less than 2 percent in 2013) (Washington UTC 2014). Therefore, these cumulative effects of rail transportation on the health of workers would be minor.

A train derailment could have impacts to workers and the public depending on the specific circumstances of the event and could include injuries or fatalities. Accidents and fatalities currently occur along rail

corridors throughout the United States from trespassing and from at-grade crossing conflicts with pedestrians and motorists. The additional rail traffic associated with the Proposed Action in combination with existing and foreseeable future actions has the potential to increase the rate of accidents and fatalities to pedestrian trespass or motorists at at-grade crossings along the rail corridor since a greater number of trains would mean a greater number of potential conflicts. In addition, as discussed in Section 3.8, some at-grade crossings along the rail corridor may currently have elevated safety risks that would increase with additional train traffic. Therefore, cumulative impacts to environmental health from rail transportation are expected to be minor for many crossings but may be moderate for crossings with existing elevated safety risks. In the event of an accident, impacts to environmental health could be minor to major, depending on the unique circumstances of the event. Mitigation measures are identified in Section 3.8.5 to address this impact.

5.9.3 Vessel Transportation

Impacts to environmental health from transportation of crude oil by vessel could include vessel collisions, which can have impacts to workers and the public depending on the specific circumstances of the event, including injuries or fatalities. The additional vessel traffic associated with the Proposed Action in combination with existing and foreseeable future actions has the potential to increase the rate of vessel collisions along the vessel corridor. However, all large cargo vessels would use a vessel pilot service to enter, transit, and exit the Columbia River, whereby the vessels would be under the control of trained and licensed mariners. Vessel traffic on the Columbia River is monitored through the Lower Columbia Vessel Traffic Information System (VTIS), which is used by pilots, vessel and tug operators, the USACE, and the US Coast Guard (USCG) to collectively monitor vessel traffic, manage anchorages, and maintain awareness of current conditions. Vessel communications along the Columbia River follow conventional protocols set by the USCG and local authorities. These vessel operations and requirements would reduce the cumulative increased risk of vessel collisions and associated potential for accidents in the Columbia River, resulting in minor cumulative impacts overall. In the event of an accident, impacts to environmental health could be minor to major, depending on the unique circumstances of the event.

5.10 NOISE

5.10.1 Proposed Facility

During the construction phase of the proposed Facility, noise from construction activities could add to the noise in the immediate vicinity. In the event that other future actions are constructed in the same timeframe and in close proximity, noise levels at the Port could increase. Sensitive receptors, including the Clark County Jail Work Center (JWC), Fruit Valley residential neighborhood, and other tenants of the Port could experience increased levels of noise. Noise emissions from locations farther removed from the Port would be lower due to the natural attenuation of sound with increasing distance. It is anticipated that elevated construction noise levels would be temporary and intermittent and would likely occur only during daytime hours. If pile driving occurs for the proposed Facility at the same time and near another future action, for example for development of a marine terminal for the Bulk Potash Handling Facility or Columbia Gateway projects, elevated noise levels in both in-water and upland areas could occur. Cumulative increases in vibration could also be experienced by nearby receptors. However, these two projects are unlikely to be constructed at the same time as the proposed Facility since the Bulk Potash Handling Facility project has been suspended, and the Columbia Gateway project is a future proposed development that has not initiated the permitting process.

Sound levels for operations were modeled for the proposed Facility and are not expected to result in significant noise impacts at any sensitive receivers near the site when added to existing sound levels. Sound levels from future actions have not been modeled, but none of the projects identified in Table 5-1

are anticipated to create greater operational noise levels than the proposed Facility, so additional noise at lower levels would not cumulatively increase the overall level at the site (see Section 3.9 for a discussion of noise analyses). Operational noise from the proposed Facility in combination with past, present, and reasonably foreseeable future actions would be expected to result in minor cumulative noise impacts.

5.10.2 Rail Transportation

Increases in rail traffic associated with the Proposed Action and existing and foreseeable future train traffic would likely result in increases in train-related noise and vibration at locations throughout Washington including noise from locomotives, railcars, and at-grade crossing horns, and vibration from locomotives and railcars. Numerous trains currently travel on the rail mainlines, and noise and vibration from trains are already affecting receptors near the rail lines. Noise from an increase in the use of train horns heard by nearby receptors could increase, although this noise would be temporary, until the horn is stopped or the train passes by. Cumulative, temporary noise impacts from trains associated with the Proposed Action in combination with existing and foreseeable future train traffic are anticipated to be minor.

Existing vibration-sensitive uses (e.g., research facilities, recording studios) within 600 feet of the rail line and residences or other sleeping areas within 200 feet of the rail line are already affected by train-related vibrations. According to Federal Transit Administration (FTA) vibration impact criteria, a doubling of train events would be required to cause a significant vibration impact in a heavily used rail corridor (i.e., two trains traveling through the same area at the same time). Since two trains can only travel through the same area in the presence of double lines and for a very short period of time, the potential for cumulative vibration impacts is low, resulting in minor cumulative impacts.

5.10.3 Vessel Transportation

An increase in vessel trips in the Columbia River and along the Washington coast from vessels associated with the Proposed Action in combination with existing and foreseeable future vessel traffic could result in an increase in vessel-related noise (mostly transmitted by vessel engines) at receptors near these shipping routes. Receptors include transportation uses, including two- and four-lane highways and local roads; existing rail corridors; agricultural uses; industrial and light industrial uses; recreational uses; and residential uses. At any location along the vessel corridor, noise resulting from transiting vessels may or may not be perceptible depending on the receptor's sensitivity and other noise sources affecting the landscape. It is likely that recreational watercraft users present on the Columbia River in the vicinity of ship operations would be the most sensitive to increases in vessel noise since they would be located nearest to the vessels. Existing noise emissions from vessel traffic are already part of the noise background, although the increase in vessels from the Proposed Action in combination with future vessel traffic could be substantial in the future, depending on which projects are constructed and operated. Operational noise from the Proposed Action in combination with existing and foreseeable future actions is expected to result in cumulative noise impacts to recreational watercraft users and other nearby receptors.

5.11 LAND AND SHORELINE USE

5.11.1 Proposed Facility

Cumulative impacts to land and shoreline uses could occur if the proposed Facility and past, present, and reasonably foreseeable future actions were inconsistent with the policies of local land use plans and/or applicable regulations. It is assumed that the foreseeable future actions that could be constructed at the Port would be consistent and in compliance with such plans and regulations, resulting in no cumulative impacts to land and shoreline use.

During construction of the proposed Facility and future actions, the potential would exist for construction-related traffic to result in some temporary cumulative impacts to businesses and facilities in the vicinity. These impacts would be temporary, occurring during the period of construction, and minor because of the nature of existing traffic associated with Port operations. Such impacts would not likely be sufficient to cause any change to existing land uses or development. Each future action would be required to go through its own permitting process, which would address potential land use impacts.

During operations, the proposed Facility and future actions would be developed on land designated for industrial, residential, or commercial activities, which would not change the existing land uses or land use activities and development patterns.

5.11.2 Rail Transportation

Land use plans along the rail corridor include recognition of the existing rail infrastructure, which would not be altered by the Proposed Action or existing or future train traffic. To date, no specific BNSF-proposed physical improvements have been identified that would address rail segments likely to be used by unit trains traveling to and from the proposed Facility with existing or anticipated high utilization. Thus no cumulative impacts to land uses have been identified.

Use of the existing rail lines could affect the operation of existing at-grade rail crossings, and the additional train traffic associated with the Proposed Action in combination with future actions would likely result in an increase in community disruptions from gate downtime and resulting vehicle delays. Development around rail lines has occurred and many locations along the rail line, especially those in populated areas, have available grade-separated crossings. Some of the identified foreseeable future actions include improvements to the rail system to alleviate delays in both rail traffic and public access through rail lines. For example, the City of Vancouver's Waterfront Access Project, which began construction in January 2011, includes reconstruction of part of the BNSF main rail line, closure of some at-grade rail crossings, and new signal installations, all of which are anticipated to improve efficiency and safety of rail traffic in Vancouver. Also, the WVFA Project is an ongoing effort undertaken by the Port to improve mainline freight rail access and mobility (Port of Vancouver 2015b). The identified future actions in this cumulative impacts analysis are expected to result in positive community impacts along the rail line through rail line and crossing improvements.

5.11.3 Vessel Transportation

Operation of the Proposed Action, in combination with existing and foreseeable future actions, would result in additional vessels using the Columbia River navigation channel. However, the navigation channel and adjacent land uses are existing uses that are not anticipated to change as a result of this additional vessel traffic.

5.12 VISUAL RESOURCES/AESTHETICS

5.12.1 Proposed Facility

During construction of the proposed Facility and foreseeable future actions, temporary changes to the visual setting near the construction areas would occur from the presence of construction workers and equipment, and from the storage of materials. However, the future actions identified in Table 5-1 that would be constructed near the proposed Facility would be within the industrialized Port, resulting in no cumulative impacts to existing visual characteristics. The proposed Facility and most identified existing and future actions would be constructed and operated in an area with existing industrial development and activity, so the visual impacts of additional industrial facilities would create little contrast to the

surrounding area. Some of the foreseeable future actions could be seen as improvements to the current landscape, including the Vancouver Waterfront Development Project and Redevelopment of Terminal 1, which would result in beneficial cumulative impacts.

Additional light and glare from the proposed Facility in combination with past, present, and reasonably foreseeable future actions would make additional contributions to overall ambient light levels in the immediate vicinity and would constitute a minor cumulative visual impact because neighboring properties share similar land uses, hours of operation, and security requirements, and light penetration to areas farther afield would be masked by landforms.

5.12.2 Rail Transportation

The additional trains associated with the Proposed Action and existing and foreseeable future projects would be visible along the rail corridor, and visual impacts would be greatest in highly scenic areas such as the Columbia River Gorge, where the increased number of trains would be visible from scenic viewpoints and recreation areas. Since trains are currently part of the visual setting of areas along the rail corridor, an increase in the number of trains, and in the frequency and the length of time trains would be running and in view, would not add a new type of visual impact to the existing rail corridor, resulting in minor cumulative visual impacts.

5.12.3 Vessel Transportation

The additional vessels associated with the Proposed Action and existing and foreseeable future projects would be visible along the Columbia River and Washington coast. Since vessels are currently part of the visual setting of the area, the impact from the additional vessels to visual resources would be an increase in the frequency and the length of time viewers see vessel traffic, resulting in minor cumulative visual impacts.

5.13 RECREATION

5.13.1 Proposed Facility

The construction of the proposed Facility and some of the future industrial projects identified (Table 5-1) are not anticipated to have impacts to current or planned park and recreation areas since these developments would occur within industrial-designated lands zoned for high-intensity development that are not designated for or used for recreational purposes. Some of the actions identified in this cumulative impacts analysis would benefit recreational users in the vicinity. For instance, the Bike Paths on Lower River Road project would create pedestrian and bike paths to connect western industrial properties to downtown, and the Port of Vancouver Trail Project consists of two trail extensions and associated landscaping totaling approximately 0.83 mile. Overall, upland recreational use is expected to see beneficial cumulative impacts from the proposed Facility in combination with reasonably foreseeable future actions.

Modification and construction of marine terminals associated with the proposed Facility and future actions such as the Bulk Potash Handling Facility or Columbia Gateway projects would add to congestion in the Columbia River adjacent to these marine terminals; however, it is unlikely that these projects would contribute to cumulative impacts as they would not be constructed at the same time as the proposed Facility. The Bulk Potash Handling Facility project has been suspended, and the Columbia Gateway project is a future proposed development that has not begun the permitting process. However, in the event that dredging were to be carried out in areas close to Terminal 5 at the Port or other marine terminals were

to be constructed during the same time period, localized and temporary minor cumulative impacts to recreational boaters could occur.

Noise and visual impacts could be expected to hunters and other recreationists in some recreation areas in close proximity to the Port, such as Shillapoo Wildlife Area, from impact pile driving and other construction work for the proposed Facility. The hunting season for waterfowl and pheasant partially overlaps with the approved agency in-water work window. If construction for some of the future projects occurs within the same time period and in close proximity to the Facility, minor cumulative noise and visual impacts to recreationists could occur.

5.13.2 Rail Transportation

The additional trains associated with the Proposed Action and existing and foreseeable future projects could result in minor cumulative impacts to users of the existing recreational facilities and recreational activities near the rail lines from exposure to increased noise and visual effects. Some potential for recreational access delays at at-grade crossings could occur from the overall increase in trains since some recreational sites are accessed by existing at-grade crossings. For example, Wintler Park in the City of Vancouver is accessed from SE Beach Drive via an existing at-grade crossing of the rail corridor. Overall, 20 recreation areas within the rail corridor study area are expected to experience rail delays from additional trains associated with the Proposed Action and existing and foreseeable future actions. However, the average delay per vehicle/train is anticipated to be 2.54 minutes, which is considered a minor impact to recreational sites in the rail corridor study area.

5.13.3 Vessel Transportation

Recreational watercraft users present on the Columbia River in the vicinity of vessel operations could experience increases in vessel noise and visual impacts. Existing noise emissions and visual impacts from vessel traffic are already part of the background environment, although the increase in vessels from the Proposed Action in combination with existing and foreseeable future vessel traffic could be substantial in the future, depending on which projects are constructed and operated. The cumulative increase in vessel traffic could range from slightly higher than the historical high to well beyond that level, which could result in minor to moderate noise and visual impacts to recreational watercraft users. Mitigation measures identified in Section 3.12.5 would address these impacts.

Seasonal commercial/recreational fishing vessel conflicts occur in certain areas within the Columbia River. The additional vessels associated with the Proposed Action and existing and foreseeable future actions would likely require recreational vessels to give way more often to such vessels, which could reduce the fishing experience for some users during narrow fishing seasons. As such, the cumulative impact from these additional vessels would be minor to moderate. Mitigation measures identified in Section 3.12.5 could partly mitigate this impact.

5.14 HISTORIC AND CULTURAL RESOURCES

5.14.1 Proposed Facility

No impacts would occur to historic or cultural resources because the proposed Facility site has no known recorded archaeological or historic resources, or usual and accustomed (U&A) lands. In the event that cultural resources are impacted by present and reasonably foreseeable future actions, these impacts would not be cumulative to those from the proposed Facility.

5.14.2 Rail Transportation

The additional trains associated with the Proposed Action and foreseeable future actions would increase the frequency and duration of visual interruptions and dust, which could alter the setting of cultural resources. Many of the historic resources in the rail corridor study area are bridges, tunnels, and other features of the rail system, and increased use of the rail facilities could degrade the resources, necessitating more frequent repairs and limitations on use during repairs. Other impacts include limitations on access to historic and cultural resources during gate closures, which would increase with additional trains using the system. However, since trains are currently part of the setting of cultural resources along the rail corridor, these cumulative impacts are anticipated to be minor.

U&A fishing and hunting areas for several treaty tribes are located near the inbound rail route. These could be impacted by an increase in the number of trains traveling through these areas, which may temporarily impede access to U&A areas, although no at-grade crossings exist near tribal reservation lands along the inbound rail corridor. Impacts to wildlife from train collisions would not likely reduce populations of species that are hunted or caught by tribes. Cumulative impacts to U&A areas from trains associated with the Proposed Action, and existing and foreseeable future actions are anticipated to be minor.

5.14.3 Vessel Transportation

Increased vessel traffic associated with the Proposed Action and existing and foreseeable future actions could increase erosion caused by vessel wakes, which could increase shoreline erosion, causing added degradation and destruction to some archaeological resources located along the shoreline in addition to that which has occurred in the past. However, areas where wake-induced erosion could occur along the Columbia River are limited since existing rock and vegetation, as well as engineered structures, protect the riverbank along the Port and much of the Columbia River, which would reduce such cumulative impacts. The rate of wake-induced bank erosion would depend on the number and sizes of vessels using the Columbia River, and it is identified as a potential moderate to major cumulative impact. Mitigation measures identified in Section 3.6.5 to reduce wake-stranding impacts to aquatic species would also reduce wake-induced bank erosion effects to cultural resources.

Increased vessel traffic associated with the Proposed Action and existing and foreseeable future actions could also include more frequent noise and additional dust impacts to historic resources from increased vessel emissions. However, since vessel traffic is part of the existing setting of historic resources, these cumulative impacts are anticipated to be minor.

U&A fishing and hunting areas for treaty tribes lie within the vessel corridor, which is currently used for vessel traffic. Tribal fishing vessels are required to give way to larger cargo vessels. The increase in vessel traffic associated with the Proposed Action in combination with existing and foreseeable future actions would likely require tribal fishing vessels to give way more often to larger cargo vessels, which may temporarily impede access to U&A areas. The degree of impact would depend on the number of vessels that would use the Columbia River system and the location and timing of tribal fishing activities. Impacts to aquatic species from vessel wakes have the potential to reduce localized populations of important tribal fish species such as salmon, particularly during vulnerable conditions such as extremely high temperatures. Cumulative impacts to U&A areas from a large increase in vessels could be moderate. Mitigation measures identified in Section 3.12.5 could partially mitigate these potential impacts.

5.15 TRANSPORTATION

5.15.1 Proposed Facility

Vehicle traffic generated during the construction phase (i.e., construction workers and delivery trucks) and the operations phase (i.e., employee commuting trips) of the proposed Facility would increase the volume/capacity (v/c) ratio at most intersections but would not cause the applicable performance standard (i.e., level of service [LOS] or v/c) to be exceeded. Other foreseeable future actions that could use the same roads during construction as the proposed Facility (Figure 5-1) include the Bulk Potash Handling Facility, Gateway Avenue Grade Separation Project, Port of Vancouver Trail Project, and Bike Paths on Lower River Road projects, which could contribute to additional traffic generated by construction or operations workers. However, none of these future actions are likely to result in substantial changes in levels of service or increase the v/c ratio for the following reasons: the Bulk Potash Handling Facility is unlikely to be constructed at the same time as the proposed Facility since the project has been suspended, construction of the Gateway Avenue Grade Separation Project has been completed, and construction of the trail and bike path projects would not involve a large number of workers. Therefore, minor cumulative impacts to roadways are anticipated for construction or operation of the proposed Facility in combination with reasonably foreseeable future actions.

At the Port, numerous WVFA projects have been completed, are under construction, or would occur in the future, including construction of a new rail entrance to the Port, relocation of a bulk unloading facility, and construction of new rail tracks including an additional yard track and unit train tracks. Construction of these projects (some of which are included as onsite connected actions to the Proposed Action and analyzed in Chapter 3 of this Draft EIS), in combination with construction of the new rail loops (tracks 4106 and 4107), could result in temporary disruptions to rail service within the Port during construction. However, the goal of these WVFA projects is to improve rail movement and alleviate rail traffic delays within the Port and along the BNSF and Union Pacific mainlines. The long-term benefits from completion of the WVFA projects are considered to be a beneficial cumulative impact for rail service within the Port when combined with rail infrastructure improvements for the proposed Facility.

During construction of the proposed Facility, a number of work boats would be used including barges and tugboats, which would mix with marine traffic in the Columbia River. In the event that boats are used to develop future projects in similar locations, such as the Bulk Potash Handling Facility or Columbia Gateway projects, it could result in temporary river traffic increases in the Port vicinity and could contribute to congestion along a portion of the river adjacent to the proposed Facility site. However, these two projects are unlikely to be constructed at the same time as the proposed Facility since the Bulk Potash Handling Facility project has been suspended, and the Columbia Gateway project is a future proposed development that has not initiated the permitting process.

During Facility operation, the movement of tanker vessels and docking assist tugs would contribute to marine traffic near the proposed Facility, which could contribute cumulative impacts in the presence of other vessels from other future actions such as ongoing permitted channel and berth maintenance dredging. In the event that dredging were carried out close to Terminal 5 at the Port during Facility operations, which is likely, localized and temporary increases in river traffic is expected in the area immediately adjacent to Berths 13 and 14 at Terminal 5. However, the vessels that would call at the proposed Facility marine terminal would only use the navigational channel in proximity to these areas for short periods of time, so cumulative impacts to river traffic from operation of the proposed Facility in combination with existing and foreseeable future actions are expected to be temporary and minor at the location of the marine terminal.

5.15.2 Rail Transportation

An increase in rail traffic resulting from the Proposed Action in combination with existing and foreseeable future actions would increase the overall use of rail facilities and would likely reach or exceed capacity in some areas. In instances where demand approaches or exceeds capacity, a rail operator could implement various operational and/or physical improvements to minimize congestion on the rail network. Operational improvements include changing train scheduling and/or routing, and physical improvements include measures to increase capacity such as additional sidings or segments of double-track. In addition, the Class I railroads (BNSF and Union Pacific) and other key stakeholders are expected to address capacity issues as they emerge (WSDOT 2014a). BNSF is currently investing $900 million in terminal, line, and intermodal expansion and efficiency projects, including bridge, double-track, and multiple siding improvement projects in Washington, and an additional 66 miles of second main track on the busiest segments of their Northern Corridor (BNSF 2015). The increase in rail transportation from the Proposed Action in combination with existing and foreseeable future actions could have a moderate to major cumulative impact to rail transportation in the future if adequate operational and/or physical improvements to minimize congestion are not implemented. Impacts include increased rail congestion, which could impact other users of the rail system, such as grain farmers, resulting in delays in moving their goods to market or delays to passenger trains. Mitigation measures identified in Section 3.14.5 address this impact.

The Proposed Action and existing and foreseeable future train traffic in combination would result in cumulative increases in vehicular delays at roadway-railroad at-grade crossings due to increases in gate downtimes, which would be worse during peak commuting times, particularly in urban areas. Rail transportation associated with the Proposed Action would increase gate downtime delay by between 13 and 17 percent, and future train traffic could further increase gate downtime. The three locations in Cheney identified by WSDOT as being operationally sensitive to significant increases in train traffic would likely experience increased cumulative effects from increased rail transportation. The cumulative impact of increased rail operations on gate downtime delay is anticipated to be major. Section 3.14.5 identifies mitigation measures to address these impacts.

5.15.3 Vessel Transportation

The Proposed Action in combination with vessel traffic associated with existing and foreseeable future actions would increase the number of deep-draft vessels using the Columbia River navigation channel from the baseline of 1,457 deep-draft vessel transits in 2013 to an unknown number in the future. The number of vessels that could use the Columbia River navigation channel would depend on which projects are permitted, constructed, and operated. The total number of vessels that could be added to the Columbia River including baseline traffic (2013) and vessel traffic associated with the Proposed Action and future actions is between approximately 4,067 and 5,405 vessels per year. This amount would significantly exceed the recent historical high of 2,086 vessel trips that occurred in 2000. Increased traffic from vessels associated with the Proposed Action, in addition to that associated with existing and foreseeable future actions, would result in an increased demand for pilot resources and in the ability to accommodate all demands from vessel traffic. However, the pilots indicate that the number of available pilots and current vessel management systems are sufficient to handle the anticipated growth (WorleyParsons 2014).

Increased traffic from vessels associated with the Proposed Action in addition to those associated with existing and foreseeable future actions could also result in increased demand for tug assist services. Shaver Transportation Company would provide docking services for vessels associated with the Proposed Action and has indicated that the projected traffic increase from the Proposed Action could be absorbed into the fleet it currently maintains; in addition, it is currently adding an additional tug (WorleyParsons 2014). However, it is not known if tug services for other vessels associated with future actions would be

adequate. It is anticipated that new tugs would be added to existing fleets to maintain an appropriate level of service for future needs.

New vessel traffic on the Columbia River from vessels associated with the Proposed Action in addition to those associated with existing and foreseeable future actions represents an increase from the commercial deep-draft vessel traffic levels of recent years. The cumulative increase in vessel traffic could range from slightly higher than the historical high to well beyond that level, which would result in traffic congestion within the river in the event that this level reaches the capacity of the river system, unless system improvements or operational adjustments are made to respond to the increased traffic. Vessel traffic congestion could result in delays for some vessel traffic using the system.

5.16 PUBLIC SERVICES AND UTILITIES

5.16.1 Proposed Facility

The proposed Facility's demand for water supply, wastewater, police protection, natural gas, communications, and solid waste services, in combination with the additional needs for these services for the projects and actions identified in Table 5-1, is not anticipated to exceed the capacity of providers of these services. Risks to workers and the public from Facility construction and operation (see Section 5.9) in combination with other existing and future actions are expected to result in negligible cumulative impacts or increases in demand for medical, fire protection, and emergency services. CPU does not currently have the ability to serve an electricity load increase at the Port from the proposed Facility and foreseeable future projects. However, a new CPU substation is planned and permitted for construction in the JWC vicinity to serve multiple customers at the Port.

5.16.2 Rail Transportation

Trains associated with the Proposed Action in combination with trains associated with existing and foreseeable future actions could result in delays to emergency response vehicles at at-grade crossings from increased gate downtimes. These delays would occur in areas with no alternative routes to at-grade crossings such as Bingen, White Salmon, and Vancouver, which could increase the potential for harm to human health and property.

5.16.3 Vessel Transportation

Vessel operations do not typically require the provision of public services, and no impacts to public services or utilities are anticipated for vessel transportation from the Proposed Action foreseeable future actions.

5.17 SOCIOECONOMICS

5.17.1 Proposed Facility

Direct annual employment from the proposed Facility is projected to be 616 full-time jobs each year over the 2017 to 2030 timeframe with associated income of $67 million in 2017, rising annually to $88 million in 2030. Some of the identified future actions would involve employment for construction only, such as the Port of Vancouver Trail Project and Bike Paths on Lower River Road, while other existing and future actions would involve employment for both construction and operations, such as the Vancouver Waterfront Development Project, which is currently under construction and includes office space for restaurants, specialty shops and services, and a 160-key hotel, eventually providing employment for a range of occupations. Also, substantial indirect and induced employment would occur from the proposed

Facility in combination with past, present, and reasonably foreseeable future actions, leading to increased beneficial cumulative impacts for socioeconomics.

It is expected that essentially all employment for the proposed Facility would come from the Portland-Vancouver Metropolitan Statistical Area (see Section 3.16.3.1), and related housing impacts would be negligible. It is anticipated that long-term housing requirements for existing and future projects would not be substantial since these would be constructed and operated at different times and would involve various occupations. Existing and future projects with large construction requirements could require additional housing above the needs of the proposed Facility, such as the NuStar Terminals Conversions to Crude Oil project, but this housing would likely be for limited duration.

Tax revenues would be generated from construction and operation of the proposed Facility and past, present, and reasonably foreseeable future actions. Payments to state and local government would include sales tax, business and occupation tax, property tax, and other taxes. The amount of tax paid would depend on future projects being constructed and operated, but would add to the taxes generated by the proposed Facility. The generation of tax revenue is identified as a beneficial cumulative impact from the proposed Facility in combination with past, present, and reasonably foreseeable future actions.

No disproportionate impacts are anticipated for environmental justice populations from the proposed Facility. In the event that environmental justice populations are impacted by existing and future actions, these impacts would not be cumulative to those of the proposed Facility.

5.17.2 Rail Transportation

Minor cumulative impacts from increased rail traffic associated with the Proposed Action and existing and foreseeable future actions would occur for employment and income, housing, government revenue, or property values. However, rail traffic delay costs from congestion and increased gate downtimes are expected to be a moderate cumulative effect of increased trains associated with the Proposed Action and existing and foreseeable future actions. Mitigation measures identified in Section 3.14.5 address this impact.

No disproportionate impacts are anticipated for environmental justice populations for air quality, environmental health, noise, or visual resources that would result from an increase in trains. However, an increase in trains associated with the Proposed Action in combination with those associated with existing and foreseeable future actions would increase gate downtime delay, resulting in impacts to transportation resources. This increase would result in disproportionate effects on environmental justice populations.

5.17.3 Vessel Transportation

Increased vessel traffic associated with the Proposed Action in combination with existing and foreseeable future actions would not likely result in cumulative impacts to employment and income, housing, government revenue, and property values. However, the cumulative increase in vessel traffic could range from slightly higher than the historical high to well beyond that level, which may result in traffic congestion within the river in the event that this level reaches the capacity of the river system, unless system improvements or operational adjustments are made to respond to the increased traffic. Vessel traffic congestion could result in delays and have economic impacts to other transportation system uses in the short and long term. Vessel traffic delays could affect business activity by increasing costs for labor, fuel, and capital.

No disproportionate impacts are anticipated for environmental justice populations from air quality, environmental health, noise, or visual resources resulting from vessels that would be associated with the Proposed Action, and existing and foreseeable future actions.

5.18 GREENHOUSE GASES AND CLIMATE CHANGE

Construction and operation of the proposed Facility, including the related actions of transporting the crude oil from its source to the proposed Facility and from the proposed Facility to receiving refineries would contribute to global greenhouse gas (GHG) emissions. In addition, activities indirectly related to the proposed Facility (e.g., crude oil extraction, refining, and product end use combustion) would also contribute to global GHG emissions. Although it is likely that the crude oil that would be transported through the proposed Facility would replace existing supplies and as such not constitute an increase in global GHG emissions, the amount of GHGs that would be emitted from the full life-cycle of crude oil use has been quantified for the 360,000 barrels (bbl) per day of crude oil that would be transported through the proposed Facility. A discussion of the potential destinations and resulting contributions to global GHG emissions is also provided.

5.18.1 Life-Cycle GHG Analysis

A life-cycle analysis for GHG can be referred to as a "cradle-to-grave" analysis. The cradle refers to the extraction of raw materials from the earth and the grave represents the combustion of the fuel in a vehicle or aircraft. The US Department of Energy (DOE) National Energy Technology Laboratory (NETL) developed a baseline for the life-cycle GHG emissions using the following five stages (NETL 2008):

- Life-Cycle Stage #1: Raw Material Acquisition
  - Boundary includes extraction of raw feedstocks (e.g., crude oil) from the earth and any partial processing of the raw materials that may occur
  - Feedstocks include foreign and domestic crude oil, natural gas liquids, unfinished oils, and unconventional hydrocarbons (e.g., oil sands)
- Life-Cycle Stage #2: Raw Material Transport
  - Boundary begins at the end of extraction/processing of the raw materials and ends at the entrance to the petroleum refineries
  - Feedstocks are transported from both domestic and foreign sources to US and foreign refineries
- Life-Cycle Stage #3: Liquid Fuels Production/Refining
  - Boundary starts at the entrance of the petroleum refinery with the receipt of crude oil (and other feedstock inputs) and ends at the entrance to the petroleum pipeline used to transport the liquid fuels to the bulk fuel storage depot
  - Petroleum refinery operations are both foreign and domestic
  - Emissions associated with acquisition and production of indirect fuel inputs such as purchased power and steam, purchased fuels such as natural gas and coal, and fuels produced in the refinery and subsequently consumed therein are included in this stage
  - Emissions associated with onsite and offsite hydrogen production are included in this stage, including emissions associated with raw material acquisition for hydrogen plant feedstock and fuel
  - Production of oxygenates is excluded from the analysis (NETL 2008)

- Life-Cycle Stage #4: Product Transportation and Refueling
  - Boundary starts at the exit of the petroleum refinery and ends with dispensing the fuel into the vehicle/aircraft
  - Boundary includes the operation of the bulk fuel storage depot for gasoline and diesel and the airport fuel storage tanks
  - Boundary includes the operation of liquid fuel tanker trucks used to transfer the gasoline/diesel from the depot to the vehicle fueling stations and the transport of jet fuel from the airport fuel storage tanks to the aircraft by a refueling truck
- Life-Cycle Stage #5: Vehicle/Aircraft Operation
  - Boundary starts at the vehicle/aircraft fuel tank and ends with the combustion of the liquid fuel

The DOE NETL study (2008) determined life-cycle GHG emissions from conventional petroleum-based fuels (gasoline, diesel, kerosene-based jet fuel) sold or distributed in the United States in the year 2005. The study was based on a weighted average of fuels produced in the United States plus fuels imported into the United States and minus fuels produced in the United States but exported to other countries for use. The crude oil mix fed to American refineries included in the study is identified in Table 5-6. This crude oil mix was used to describe the type of crude oil that would be used at refineries receiving crude oil from the proposed Facility, since it accounted for over 90 percent of the total American crude input in 2005. Refineries on the US West Coast currently obtain crude oil primarily from Alaska and California, and through imports. While likely somewhat different than the California-only crude oil mix, the national average is used in this analysis to approximate the existing California refinery crude oil mix.

Table 5-6. Sources of Crude Oil Used at US Petroleum Refineries in 2005

US Crude Oil Source	Percent of Refinery Crude
US Crude Oil	33.8%
Canada Crude Oil	10.7%
Canada Oil Sands	
Mexico Crude Oil	10.2%
Saudi Arabia Crude Oil	9.4%
Venezuela Crude Oil	8.1%
Nigeria Crude Oil	7.1%
Iraq Crude Oil	3.4%
Angola Crude Oil	3.0%
Ecuador Crude Oil	1.8%
Algeria Crude Oil	1.5%
Kuwait Crude Oil	1.5%
Total	90.5%

Source: National Energy Technology Laboratory 2008

The resulting GHG emissions for the five life-cycle stages for gasoline, diesel, and kerosene-based jet fuel are presented in Table 5-7. GHG emissions are presented in units of kilograms (kg) of carbon dioxide equivalent (CO_2e) per bbl consumed. Because carbon dioxide (CO_2) is the reference gas for climate change, measures of non-CO_2 GHGs are converted into CO_2e. CO_2e means the number of metric tons of CO_2 emissions with the same global warming potential (GWP) as 1 metric ton of another GHG. GWPs are calculated and are a measure of the total energy that a gas absorbs over a particular period of time (usually 100 years) compared to CO_2 (EPA 2013b). As an example, methane (CH_4), which is a common GHG, is widely represented as having a 100-year GWP of 25 (i.e., for the same weight, the comparative impact of CH_4 on climate change is 25 times greater than CO_2 over a 100-year period).

As indicated by the study results, combustion of fuel in vehicles (life-cycle stage #5) accounts for 80 percent of the total GHG emissions of gasoline and diesel (NETL 2008).

Table 5-7. Life-Cycle GHG Emissions for Liquid Fuels Production of US Crude Oil Average (kg CO_2e/bbl consumed)

	Life-Cycle Stage #1: Raw Material Extraction	Life-Cycle Stage #2: Raw Material Transport	Life-Cycle Stage #3: Liquid Fuels Production/ Refining	Life-Cycle Stage #4: Product Transportation and Refueling	Life-Cycle Stage #5: Vehicle/ Aircraft Operation	Life-Cycle Total
Gasoline						
Total	35.8	7.0	47.9	5.3	375	471
CO_2	23.9	6.9	46.2	5.2	367	449
CH_4 (CO_2e)	11.7	0.1	1.4	0.1	0.6	13.9
N_2O (CO_2e)	0.2	0.0	0.2	0.0	7.3	7.8
Diesel						
Total	36.6	7.3	52.6	4.8	422	524
CO_2	24.6	7.1	50.8	4.7	422	509
CH_4 (CO_2e)	11.8	0.1	1.6	0.1	0.0	13.6
N_2O (CO_2e)	0.2	0.0	0.2	0.0	0.3	0.8
Jet Fuel						
Total	35.3	7.0	31.6	5.2	407	486
CO_2	23.8	6.9	30.5	5.1	403	470
CH_4 (CO_2e)	11.4	0.1	0.9	0.1	0.1	12.6
N_2O (CO_2e)	0.2	0.0	0.1	0.0	3.3	3.7

Source: National Energy Technology Laboratory 2008

bbl = barrels, CO_2 = carbon dioxide, CO_2e = carbon dioxide equivalent, CH_4 = methane, GHG = greenhouse gas, N_2O = nitrogen dioxide

According to the US Energy Information Administration (EIA), 1 bbl of crude oil (42 gallons) yielded 44.9 gallons of refined products in 2013, including 18.9 gallons of gasoline, 12.4 gallons of diesel, and 4.0 gallons of jet fuel (EIA 2015). Although refinery yields of individual products vary from month to month as refiners focus operations to meet demand for different products and to maximize profits, this average breakout was used to quantify potential production and consumption of gasoline, diesel, and kerosene-based jet fuel for refineries that would receive crude oil from the proposed Facility.

Consequently, the proposed 360,000 bbl per day of crude oil would equate to 162,000 bbl of gasoline, 106,200 bbl of diesel, and 34,200 bbl of jet fuel.

Table 5-8 converts the GHG emissions for the five life-cycle stages into units of metric tons per year based on the three main petroleum products produced by 360,000 bbl per day of crude oil.

Table 5-8. Life-Cycle GHG Emissions for Liquid Fuels Production of 360,000 bbl Per Day Crude Oil (metric-ton CO_2e/year)

Fuel Type	Life-Cycle Stage #1: Raw Material Extraction	Life-Cycle Stage #2: Raw Material Transport	Life-Cycle Stage #3: Liquid Fuels Production	Life-Cycle Stage #4: Product Transportation and Refueling	Life-Cycle Stage #5: Vehicle/ Aircraft Operation	Life-Cycle Total
Gasoline	2,116,854	413,910	2,832,327	313,389	22,173,750	27,850,230
Diesel	1,418,726	282,970	2,038,934	186,062	16,357,986	20,284,678
Jet Fuel	440,650	87,381	394,463	64,912	5,080,581	6,067,986
Total	3,976,230	784,261	5,265,724	564,363	43,612,317	54,202,894

Sources: National Energy Technology Laboratory 2008, US Energy Information Administration 2015

bbl = barrels, CO_2e = carbon dioxide equivalent, GHG = greenhouse gas

Results indicate that the total life-cycle GHG emissions from activities directly and indirectly related to the proposed Facility are approximately 54 million metric tons per year of CO_2e. This would include GHG emissions estimates from operation of the proposed Facility and from transportation of the crude oil to and from the proposed Facility using trains and vessels (see Section 3.2):

- Onsite operation of the proposed Facility: 312,046 CO_2e/year (Tables 3.2-12)
- Offsite transport of crude oil for the proposed Facility using rail and vessel and onsite mobile source operation: 200,304 CO_2e/year (Table 3.2-12)

In 2013, US GHG emissions totaled 6,673 million metric tons of CO_2e (EPA 2014a). In 2010, estimated worldwide GHG emissions from human activities totaled nearly 46 billion metric tons of CO_2e (EPA 2014b). Consequently, the direct and indirect GHG emissions related to the proposed Facility would represent approximately 0.8 percent of the US total and 0.1 percent of the worldwide GHG emissions. This does not mean, however, that there would be a 0.8 percent increase in US or 0.1 percent increase to worldwide GHG emissions, since some portion or potentially all of the crude oil transported through the proposed Facility would replace existing supplies.

US GHGs emissions in 2013 were 9 percent below the 2005 level of 7,350 million metric tons of CO_2e (EPA 2014a). In 2009, President Obama made a commitment to reducing US GHG emissions to approximately 17 percent below 2005 levels by 2020 by implementing the following (President's Climate Action Plan 2013):

- Deploying Clean Energy (Cutting carbon pollution from power plants; Promoting American leadership in renewable energy; Unlocking long-term investment in clean energy innovation)
- Building a 21st Century Transportation Sector (Increasing fuel economy standards; Developing and deploying advanced transportation technologies)
- Cutting Energy Waste in Homes, Businesses, and Factories (Reducing energy bills for American families and businesses)

- Reducing Other GHG Emissions (Curbing emissions of hydrofluorocarbons; Reducing methane emissions; Preserving the role of forests in mitigating climate change)
- Leading at the Federal Level (Leading in clean energy; Federal government leadership in energy efficiency)

Taking into account the reduced US GHG emission target, the direct and indirect GHG emissions related to the proposed Facility would represent approximately 0.9 percent of the US total GHG emissions.

Crude oil transported from the Canadian oil sands is often referred to as dilbit. The in-place crude oil within the oil sands is in the form of bitumen, a semisolid, highly viscous form of naturally occurring petroleum. Dilbit is bitumen blended with a diluent, usually a natural gas liquid such as condensate (e.g., propane, butane), to create a somewhat "lighter" product and to reduce viscosity for transportation. The life-cycle GHG emissions associated with Canadian oil sands (i.e., bitumen) is approximately 17 percent greater than the 2005 US crude oil blend for gasoline production, 7 percent greater than for diesel production, and 9 percent greater than for jet fuel production, as indicated in Table 5-9 (NETL 2008, 2009). Note that the GHG emissions do not account for the fact that condensate is blended with bitumen to form dilbit. Since condensate has a lower GHG intensity than bitumen, the per-bbl GHG emissions from dilbit would be less than the per-bbl emissions from bitumen (NETL 2008, 2009).

Table 5-9. Comparison of Life-Cycle GHG Emissions for Liquid Fuels Production of US Crude Oil Average and Canadian Oil Sands (kg CO_2e/bbl consumed)

Fuel Type	Life-Cycle Stage #1: Raw Material Extraction	Life-Cycle Stage #2: Raw Material Transport	Life-Cycle Stage #3: Liquid Fuels Production	Life-Cycle Stage #4: Product Transportation and Refueling	Life-Cycle Stage #5: Vehicle/ Aircraft Operation	Life-Cycle Total	Difference from 2005 US Average
Gasoline							
2005 US Average	35.8	7.0	47.9	5.3	375	471	0%
Canadian Oil Sands	105.2	4.9	59.2	4.9	375	549	16.6%
Diesel							
2005 US Average	36.6	7.3	52.6	4.8	422	524	0%
Canadian Oil Sands	104.7	5.0	72.8	4.4	375	562	7.2%
Jet Fuel							
2005 US Average	35.3	7.0	31.6	5.2	407	486	0%
Canadian Oil Sands	105.1	4.7	41.3	4.7	375	531	9.2%

Sources: National Energy Technology Laboratory 2008, 2009

GHG = greenhouse gas, kgCO_2e/bbl = kilograms carbon dioxide equivalent per barrel

Using the unlikely scenario that all crude oil handled at the proposed Facility would be sourced from Canadian oil sands (i.e., bitumen), Table 5-10 calculates the worst-case GHG emissions for the five life-cycle stages in units of metric tons per year based on the three main petroleum products that would ultimately be refined from the 360,000 bbl per day.

Table 5-10. Life-Cycle GHG Emissions for Liquid Fuels Production of 360,000 bbl per Day Canadian Oil Sands (metric-ton CO_2e/year)

Fuel Type	Life-Cycle Stage #1: Raw Material Extraction	Life-Cycle Stage #2: Raw Material Transport	Life-Cycle Stage #3: Liquid Fuels Production	Life-Cycle Stage #4: Product Transportation and Refueling	Life-Cycle Stage #5: Vehicle/Aircraft Operation	Life-Cycle Total
Gasoline	6,219,175	289,264	3,500,094	289,264	22,173,750	32,471,547
Diesel	4,059,571	192,295	2,820,334	170,929	14,536,125	21,779,255
Jet Fuel	1,312,250	58,757	515,760	58,757	4,681,125	6,626,650
Total	11,590,997	540,317	6,836,188	518,951	41,391,000	60,877,453

Sources: National Energy Technology Laboratory 2008, 2009, US Energy Information Administration 2015

bbl = barrels, GHG = greenhouse gas, CO_2e = carbon dioxide equivalent

Results indicate that the total life-cycle GHG emissions from activities directly and indirectly related to the proposed Facility would be approximately 61 million metric tons per year of CO_2e. This represents a 12.3 percent increase over the life-cycle GHG emissions of the 2005 US average crude oil mix. Consequently, the direct and indirect GHG emissions related to the proposed Facility would represent approximately 0.9 percent of the US total (or 1.0 percent of the reduced 2020 US GHG emissions target) and 0.1 percent of the worldwide GHG emissions. Again, this does not indicate that there would be a 0.9 percent increase in US or 0.1 percent increase to worldwide GHG emissions since some or all of the crude oil transported through the proposed Facility would replace existing supplies.

While the proposed Facility does not include construction, retrofit, or operation of any refineries that could receive crude oil transported through the proposed Facility, refinery operations could contribute to increased cumulative impacts to GHGs and associated climate change if changes in the type or quantity of refinery emissions occurred in the future as a result of refining crude oil transported through the proposed Facility. Such changes could occur if the proposed Facility generated construction of a new refinery, caused expansions of capacity in existing refineries, induced existing refineries to add new downstream processing units (such as cokers or fluid catalytic converters), or induced refineries to process a different crude oil (e.g., crude oils with different sulfur contents or API gravities).[3] The potential changes to operations in refineries on the West Coast of the United States is discussed below. Although the Applicant has stated that the crude oil transported through the proposed Facility would be received at US West Coast refineries, a discussion of the potential for export is provided herein.

3 API gravity is a measure of how dense an oil is compared to water. An API gravity >10 indicates a crude oil is lighter than water and will float, and an API gravity <10 indicates it will sink in water.

5.18.2 Refineries within Petroleum Administration for Defense Districts

During World War II, the War Department (now the Department of Defense) delineated five "Petroleum Administration for Defense Districts" (PADDs) to administer and facilitate oil allocation across the United States. At that time, refineries in each of the five PADDs processed crude oil and distributed petroleum products for use in their districts. Currently, a network of crude oil and petroleum product pipelines interlinks the five PADDs, making them interdependent (Andrews et al. 2010).

The five designated PADDs and the primary sources of crude oil supplied to the refineries within each PADD are as follows (Figure 5-3):

- PADD 1 (East Coast) refineries process crude oil shipped from all over the world
- PADD 2 (Midwest) refineries process crude oil produced and moved by pipeline from Canada and PADD 3 as well as production from the Rocky Mountain states
- PADD 3 (Gulf Coast), the largest refining region, obtains crude oil from the Gulf Coast outer continental shelf, Mexico, Venezuela, and the rest of the world
- PADD 4 (Rocky Mountains) refineries source crude oil from Canada, PADD 3, and from the Rocky Mountain states
- PADD 5 (West Coast) currently obtains crude oil primarily from Alaska (by tanker) and California, and through imports

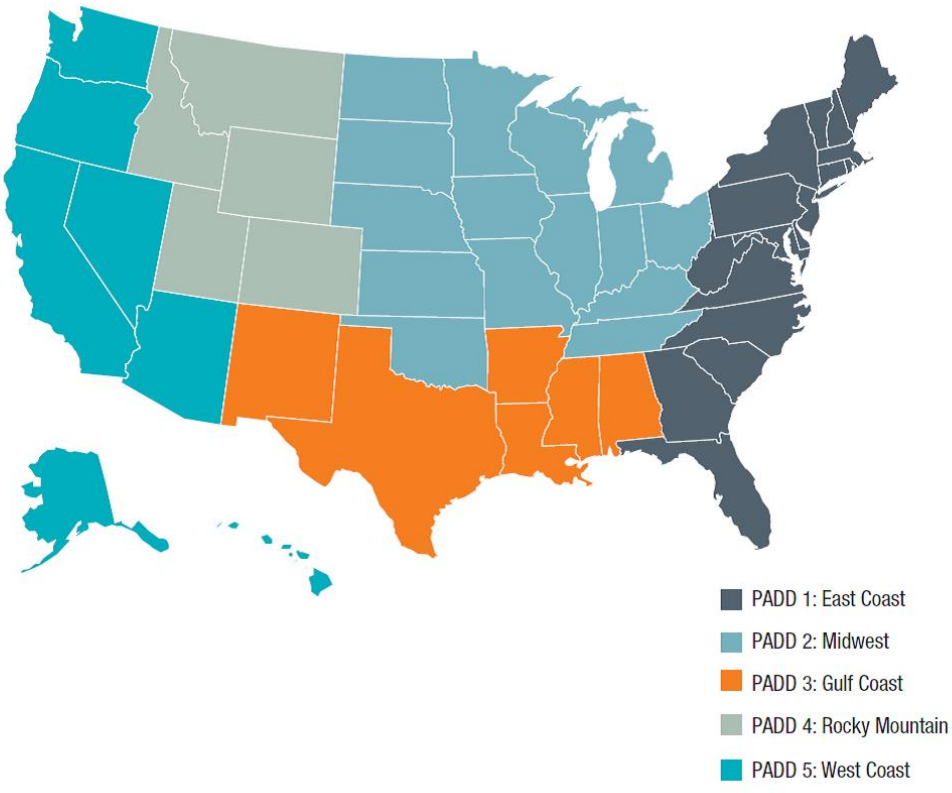

Figure 5-3. Petroleum Administration for Defense Districts

Source: Energy Information Administration 2012

The Applicant has stated that the proposed Facility would supply approximately 360,000 bbl per day to refineries located in PADD 5. PADD 5 has 30 operating refineries with a capacity to refine up to 3.1 million bbl per day of crude oil. Approximately 66 percent of this refining capacity occurs at refineries with coking capacity. The actual average refining throughput at these refineries has been approximately 2.6 million bbl per day since 2010 (Energy Global 2015). PADD 5 runs have the lowest API gravity in the country, averaging 28.4 in 2014, due to a large amount of crude oil sourced from California. California has an abundant supply of crude oil and is one of the top producers of crude oil in the nation, accounting for more than 7 percent of total US production (EIA 2014). A system of crude oil pipelines connects the state's oil production to state refineries. The API gravity of two of the most important California crude streams are API gravity 12.6° for Kern River and API gravity 19.4° for Wilmington (Croft and Patzek 2009).

In addition to refining crude oil sourced from California, PADD 5 refineries also process large volumes of Alaskan and foreign crude oil. The largest refineries in PADD 5, particularly in California, are highly sophisticated and are capable of processing a wide variety of crude oil types. Crude oil production in California and Alaska has declined, and PADD 5 refineries have become increasingly dependent on foreign imports to meet refinery needs. Refineries use other domestic crudes including Alaska North Slope (API gravity 31.4°) and Bakken (API gravity 36-44°) crude oils (ExxonMobil 2015, North Dakota Petroleum Council 2012). The region refines roughly equal amounts of domestic and imported crude oil, but declining Alaskan production has been offset by crude receipts by rail from PADD 2 (Energy Global 2015, Hydrocarbon Processing 2015).

In recent years, US refineries have sourced more crude oil from the United States and Canada than in the past, and this trend is expected to continue. US refinery sourcing has been significantly impacted by increased shale oil volumes from the Bakken shale play in North Dakota and from the Eagle Ford and Permian basins in Texas. Crude oil from these areas has been used by US East Coast and Gulf Coast refineries in PADD 1 and PADD 3 and transported via rail, tanker, barge, and pipeline. Crude oil from these areas has replaced imported crudes. Light sweet domestic crude oils are also beginning to infiltrate US West Coast refineries. Crude oils produced in the Eagle Ford and Bakken formations are generally lighter than domestic and foreign light crude oils, and the large quantity of shale oil being produced in the United States is anticipated to lead to greater use of shale oil over heavier crudes, leading to an overall "lightening" of the crude feedstock slate and changes in product yields in most PADDs (Hydrocarbon Processing 2015). Refiners are anticipated to add more than 500 million bbl per day of new refining capacity by 2020 to capitalize on the increasing supply of US shale oil and on growing distillate demand. Most of the new investment will be in refineries in PADDs 2 and 3 (Hydrocarbon Processing 2015).

Refineries blend individual feedstock streams to generate an optimized crude oil blend prior to initiating the refining process. The blends are optimized based on the types of crude oil stored at the refinery and available for blending, specific refinery configuration, processing equipment, and desired end product mix. For example, blending Canadian derived dilbit crude oil with the Bakken crude oil would create a feed blend for refining that would be similar to Alaskan North Slope crude oils that have generally been used in PADD 5 refineries. Regardless of the types of oil, the refineries currently optimize the blend prior to refining and their future blends would likely be similar. California, the United States' largest gasoline market, has been importing more crude by rail from Canada in recent years. Heavy materials are required to fill secondary processing units (i.e., delayed cokers). US West Coast refineries are developing projects to bring in more oil by rail from Canada and the US Midwest to displace expensive foreign supplies (Hydrocarbon Processing 2015).

5.18.3 Potential PADD 5 Refinery Changes

Refinery operations could contribute to global GHG emissions and associated climate change if changes in the type or quantity of refinery emissions were to occur in the future as a direct result of refining crude oil transported through the proposed Facility. Such changes could occur if the proposed Facility induced expansion or modification of an existing refinery, or construction of a new refinery in PADD 5.

A new refinery has not been constructed on the West Coast of the United States in 25 years. However, one energy company, Riverside Refining LLC, is considering proposing a new refinery in Oregon or Washington, which would have a capacity of 30,000 bbl per day and produce a mix of diesel, gasoline, and jet fuel primarily for regional use (Oregon Public Broadcasting 2015, Reuters 2015). Roughly 10 trains per month would transport sweet light crude from the Bakken oil fields of North Dakota to the refinery. Once refined, motor vehicle fuel and other petroleum-based products would be transported by water. The City of Longview is one potential location for the new refinery. However, at the time of preparation of this Draft EIS, no permit application has been submitted for such a project.

Proposed or planned refinery expansions and upgrades in PADD 5 include:

- Chevron Richmond Refinery, Richmond, California – upgrades are proposed to allow refining of heavier crude oil
- Paramount Petroleum Bakersfield, Bakersfield, California – new rail infrastructure is proposed to receive shipments of light crudes from North Dakota's Bakken shale and other mid-continent locations
- Phillips 66 Santa Maria Refinery, Santa Maria, California – an extension of the existing rail track on refinery property is proposed to enable rail delivery of up to five 80-railcar trains carrying North American crude oil per week
- Tesoro Corporation Anacortes Refinery, Anacortes, Washington – upgrades are planned to produce reduced-sulfur gasoline while running the refinery more efficiently, and to build a new facility to produce "mixed xylenes," a complex hydrocarbon that can be extracted from crude oil and that is used as a solvent and in plastics manufacturing
- Shell Puget Sound Refinery, Anacortes, Washington – new rail infrastructure is proposed to be able to receive six 102-railcar trains per week to deliver Bakken crude from North Dakota

None of these proposed expansions/modifications involve increasing the volume of crude oil to be refined and none have yet been successfully permitted, so it is not known if any or all of the proposed expansions would occur. Regardless, three of the above five refinery expansions/modifications involve creating new rail infrastructure that would allow these refineries to obtain domestically produced crude oil from locations other than the proposed Facility. However, even if these proposed expansions are permitted, they would likely occur regardless of whether the Proposed Action is constructed and operated. There is no indication that the availability of oil transported via the proposed Facility would directly result in specific expansions of existing refineries or development of new refineries. Crude oil delivered to refineries in PADD 5 would likely replace domestic crude oil supplies or supplant existing supplies from overseas. Thus, most GHG emissions indirectly related to the proposed Facility would already be accounted for within the total GHG emitted from existing refineries. However, a discussion of export of crude oil transported through the proposed Facility is provided in Section 5.18.4.

5.18.4 Potential for Export of Crude Oil

The Applicant would receive the proposed Facility's customers' crude oil by rail, unload and temporarily store that crude oil in onsite storage tanks, and then load the crude oil onto vessels chartered by those customers. However, there is a possibility that customers using the proposed Facility would be able to export oil produced in the United States or Canada.

Generally, the exportation of crude oil produced domestically is prohibited, although under a number of exemptions and circumstances crude oil exports are allowed. For example, the President has authority to allow certain crude oil exports if an exemption is determined to be in the national interest. The President's national interest determination must, at a minimum, consider (1) whether the export will diminish the quantity or quality of petroleum available in the United States, (2) the results of an environmental review, and (3) whether the export might cause sustained material oil supply shortages or significantly increase oil prices above world market levels (Brown et al. 2014). At the current time, given the dramatic increase in discovered oil reserves within the United States, there are ongoing industry and congressional initiatives to consider repealing the crude oil export ban. In the event that the crude oil export ban is lifted, there is a potential that crude oil transported through the proposed Facility could be exported to foreign markets. However, it is not possible to quantify the amount.

Canadian sourced crude oil is not limited by the US ban on exports, although a license to re-export foreign crude is required. Rules that prohibit mixing nonexportable domestic oil with foreign grades can deter energy traders from re-exporting crude oil (Reuters 2014). However, there remains a possibility that re-export of Canadian sourced crude oil transported through the Proposed facility could occur. However, it is not possible to calculate the specific quantities that could be re-exported.

If export of US domestic or Canadian crude oil from the proposed Facility induced new refinery construction or expansion/modification of an existing refinery in the destination country, the amount of GHGs emitted during the refining process and during product combustion could be incremental to existing levels.

5.18.5 Summary

If crude oil that would be transported through the proposed Facility did not replace existing supplies, but rather induced new facilities, whether in the United States or abroad, the GHG emissions from refining and end use of this crude oil could be additive to global GHG emissions with associated additional contributions to climate change. In the unlikely event that all crude oil that would be transported through the proposed Facility is processed in new or expanded refineries, whether within the United States or abroad, the throughput would account for an approximately 0.1 percent increase in global GHG emissions per year, regardless of whether the oil comes from North Dakota or Canada. Although Canadian dilbit emits more GHG in the extraction process, the final percentage increase remains 0.1 percent of global emissions. It seems more likely, however, that some or all of the crude oil that would be transported through the proposed Facility would replace existing sources of crude oil received at refineries on the West Coast, primarily in PADD 5. In this case, the GHG emissions from refineries that receive crude oil transported through the proposed Facility would not contribute to an incremental increase in global GHG emissions and would already be accounted for in existing GHG emissions.

5.19 RISK OF ACCIDENTS

5.19.1 Proposed Facility

The Proposed Action includes Facility element designs, operational procedures, and risk reduction/minimization measures to reduce the risk of crude oil spills and related potential for fire and explosion. The Washington Energy Facility Site Evaluation Council (EFSEC) has identified additional mitigation measures to further reduce the potential for accidents resulting from seismic events at the proposed Facility site (see Section 3.1.5). It is important to note, however, that the risk of an accident is never completely eliminated irrespective of design and construction used at a site. The risk analyses carried out for the Proposed Action find that the possibility for a crude oil spill, fire, or explosion at the proposed Facility is very low. The likelihood of an oil spill, fire, or explosion from another existing or future action within a similar timeframe and location as the Proposed Action is highly unlikely.

5.19.2 Rail Transportation

An increase in the number of trains transporting crude oil associated with the Proposed Action and existing and foreseeable future actions could result in an increased risk of derailment, in turn causing an increased risk of spills, fires, or explosions simply because more trains would be transporting crude oil. Potential impacts to environmental resources from different sized scenarios for crude oil spills, fires, or explosions along the rail corridor are provided in Chapter 4. Impacts in the event of an accident could range from minor to major, depending on the unique incident. Mitigation measures are identified in Section 4.9 of this EIS to reduce the potential for a rail accident. See Section 4.7 for a discussion of the types of impacts that could occur to resources from a rail accident.

5.19.3 Vessel Transportation

An increase in the number of vessels transporting crude oil associated with the Proposed Action and existing and future actions would likely result in an increased risk of accident, in turn causing an increased risk of spills, fires, or explosions since a greater number of vessels would carry crude oil through the Columbia River. Although crude oil is currently being transported out of the Columbia River, for example via ATBs from a terminal near Clatskanie, Oregon, bound for Washington or California (Ecology 2015), the volume of crude oil that would be transported via vessels associated with the proposed Facility would exceed current levels. As noted in Section 4.3.7, the current Maritime Fire and Safety Association spill contingency plan is not designed to address spills greater than 300,000 bbl, and is primarily focused on addressing spills of refined petroleum products rather than crude oil. The new vessel traffic associated with the proposed Facility presents a new challenge on the Columbia River that has not been planned for to date. Mitigation measures are identified in Section 4.9 of this EIS to address this.

Potential impacts to environmental resources from different sized scenarios for crude oil spills, fires, or explosions along the vessel corridor are provided in Chapter 4. The types of impacts that would occur to environmental resources from a crude oil spill from any vessel, regardless of whether it was associated with the proposed Facility or with different project, would be similar. For this cumulative impacts assessment, it is recognized that a greater number of vessels traveling through the Columbia River would likely increase the frequency of accidents and oil release. Impacts in the event of an accident and oil spill could range from minor to major, depending on the amount of oil released and the subsequent cleanup actions. See Section 4.7 for a discussion of the types of impacts that could occur to resources from a crude oil spill in the Columbia River.