Chapter 6
Cumulative Impacts

6.1 What are cumulative impacts?

Cumulative impacts are impacts that would result from the incremental addition of the proposed action to impacts from past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor, but collectively significant, actions that occur over time. The purpose of the cumulative impacts analysis is to ensure that decision-makers consider the full range of consequences for the proposed action, including the proposed action's incremental contribution to cumulative impacts on the environment.

This chapter describes the approach to conducting the cumulative impacts analysis, including what past, present, and reasonably foreseeable future projects are considered, and identifies the resource areas that are addressed in the analysis. It then describes cumulative impacts that could result from construction and operation of the proposed action, including potential risks associated with the handling, storage, and transport of crude oil. Lastly, this chapter presents any measures identified to mitigate the cumulative impacts of the proposed action and identifies any unavoidable and significant adverse cumulative impacts.

6.2 What is the study area and what resources were considered for the cumulative impacts analysis?

As discussed in the preceding chapters of this EIS, the potential for impacts related to the proposed action are considered in terms of the potential to affect resources in the study area, which generally includes the project site, Puget Sound & Pacific Railroad (PS&P) rail line, and Grays Harbor. The extended study area includes the area that could be affected by increased rail traffic from the source of crude oil to Centralia, Washington, and the areas that could be affected by increased vessel traffic from the mouth of Grays Harbor to the point of final delivery.

In general, the scope of the cumulative impacts analysis is limited to those resources where the proposed action could have significant impacts in combination with other past, present, and reasonably foreseeable and similar future actions. Based on the analyses in Chapter 3, *Affected Environment, Impacts, and Mitigation*, and Chapter 4, *Environmental Health and Safety*, the proposed action would affect the following resources in each study area and could contribute to cumulative impacts. The potential for cumulative impacts in the extended study area is addressed in Section 6.5.8, *Extended Study Area*.

- Section 6.5.1, *Air*
- Section 6.5.2, *Noise and Vibration*
- Section 6.5.3, *Tribal Resources*
- Section 6.5.4, *Rail Traffic*

- Section 6.5.5, *Vehicle Traffic and Safety*
- Section 6.5.6, *Vessel Traffic*
- Section 6.5.7, *Environmental Health and Safety* (related to incidents of oil spills, fires, and explosions)

6.3 What are the relevant regulations for the cumulative impacts analysis?

This cumulative impacts analysis is prepared in accordance with the Washington State Environmental Policy Act (SEPA) (Chapter 43.21C Revised Code of Washington [RCW]), the SEPA Rules (Chapter 197-11-060 Washington Administrative Code [WAC]), and the SEPA Handbook.

Additional guidance developed by the Council on Environmental Quality (CEQ) in the handbook entitled *Considering Cumulative Effects under the National Environmental Policy Act* (1997) was also considered where SEPA requirements are consistent with requirements of the National Environmental Policy Act (NEPA).

6.4 What methods were used to analyze cumulative impacts?

The resource-specific methods and assumptions described in the respective resource sections of Chapter 3*, Affected Environment, Impacts, and Mitigation*, Chapter 4*, Environmental Health and Safety,* and Chapter 5, *Extended Rail and Vessel Transport,* were used for the cumulative impacts analysis*.* The cumulative impact analysis took the following approach.

- Addressed the resources with the potential to be affected by the proposed action as discussed in Chapter 3, *Affected Environment, Impacts, and Mitigation*; Chapter 4, *Environmental Health and Safety*; and Chapter 5, *Extended Rail and Vessel Transport*.
- Considered other actions in relation to the geographic scope of the proposed action.
- Considered other actions in relation to the temporal period of the proposed action.
- Relied on the best available data at the time of the analysis.
- Reached conclusions based on known regulations at the time of the analysis.

The boundaries for the cumulative impacts analysis were based on the geographic location of the proposed action and are described for each resource area. The analysis considered regional influences and activities, and the projected lifespan of the proposed project activities. The geographic extent of the cumulative impacts analysis area is described for each resource in Section 6.5, *What cumulative impacts were identified?*

Where impacts were quantitatively evaluated, potential cumulative impacts were considered in 2017—the anticipated first year of operation—and in 2037 to account for future growth and development. The impacts identified in these years would apply to the lifetime of the proposed

action, and proposed mitigation measures are intended to apply for the lifetime of the proposed action.

This analysis considers the impacts on the environment resulting from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal, state, local) or person (private citizen, nongovernment organization, corporation) undertakes the other actions. This analysis considers other actions that could affect the human or natural environment similar to the proposed action and that could add to the impacts of the proposed action.

6.4.1 Past and Present Actions

The following past and present actions have contributed to the existing condition of resources in at the project site, in Grays Harbor, and along the PS&P rail line.

- **Prior industrial development at the Port of Grays Harbor (Port) and ongoing terminal operations.** The Port owns four deepwater marine terminal facilities and provides services including pilotage, ship assistance, line handling and terminal stevedoring, and onsite cargo storage. The Port's terminals are supported by large, paved, secured cargo yards, the Port's own on-dock rail system, and more than 104,000 square feet of on-dock covered storage. The marine terminal rail system includes more than 50,000 feet of rail looping through the marina terminal complex (WorleyParsons 2014). A network of local roads with some collector and arterial roads provides access to the Port's terminal facilities.
- **Prior development of transportation infrastructure (roadways and rail lines) and ongoing maintenance of that infrastructure.** The terminal rail system connects to the PS&P main line, owned by Genesee and Wyoming, Inc. The PS&P short line, Class III railroad, connects to the BNSF Railway Company (BNSF) main line, a Class I railroad, in Centralia. The PS&P rail line can also connect to the Union Pacific main line in Centralia (WorleyParsons 2014). The PS&P rail line was constructed between 1889 and 1896. It currently moves products and materials for 30 industries.
- **Prior development of infrastructure for harbor navigation and ongoing maintenance of that infrastructure**. Grays Harbor is a tidal estuary with jetties at the entrance. The two jetties were originally constructed from 1889 to 1913 for harbor navigation. Other aids to navigation include a deepwater navigation channel (Grays Harbor Navigation Channel), turning basins, and anchorage areas for shallow and deep-draft vessels (WorleyParsons 2014). The navigation channel, anchorage areas, and turning basins are maintained by the U.S. Army Corps of Engineers (USACE) through periodic maintenance dredging.

6.4.2 Ongoing and Reasonably Foreseeable Future Actions

Requests for information on any planned infrastructure or construction projects scheduled to occur between 2017 and 2037 were sent to the Cities of Oakville, McCleary, Elma, Montesano, Hoquiam, and Aberdeen. In addition, Thurston County, Lewis County, Grays Harbor County, including the Grays Harbor Council of Governments, Cowlitz-Wahkiakum Council of Governments, PS&P, the Port, the Quinault Indian Nation, and the Confederated Tribes of the Chehalis Reservation were also contacted. The following plans and elements were reviewed for this analysis.

- Cowlitz-Wahkiakum Council of Governments Metropolitan and Regional Transportation Improvement Programs 2015–2018 (August 2014)
- Grays Harbor Council of Governments 2013 Annual Report
- Cowlitz-Wahkiakum Council of Governments Fiscal Year 2013 Annual Report (July 1, 2012 to June 30, 2013); Southwest Washington Regional Transportation Planning Organization
- Washington State 2010–2013 Freight Rail Plan (December 2009)
- Cowlitz-Wahkiakum Council of Governments Metropolitan and Regional Transportation Plan 2009–2029 (November 2009)
- City of Hoquiam Comprehensive Land Use Plan (February 2009)
- Grays Harbor Council of Governments US 101 Regional Circulation Project – Final Report (January 2007)

Based on information gathered from the sources above, Table 6-1 lists future actions that could contribute to cumulative impacts on resources analyzed for the proposed action. The locations of these projects are show in Figure 6-1.

Figure 6-1. Cumulative Projects

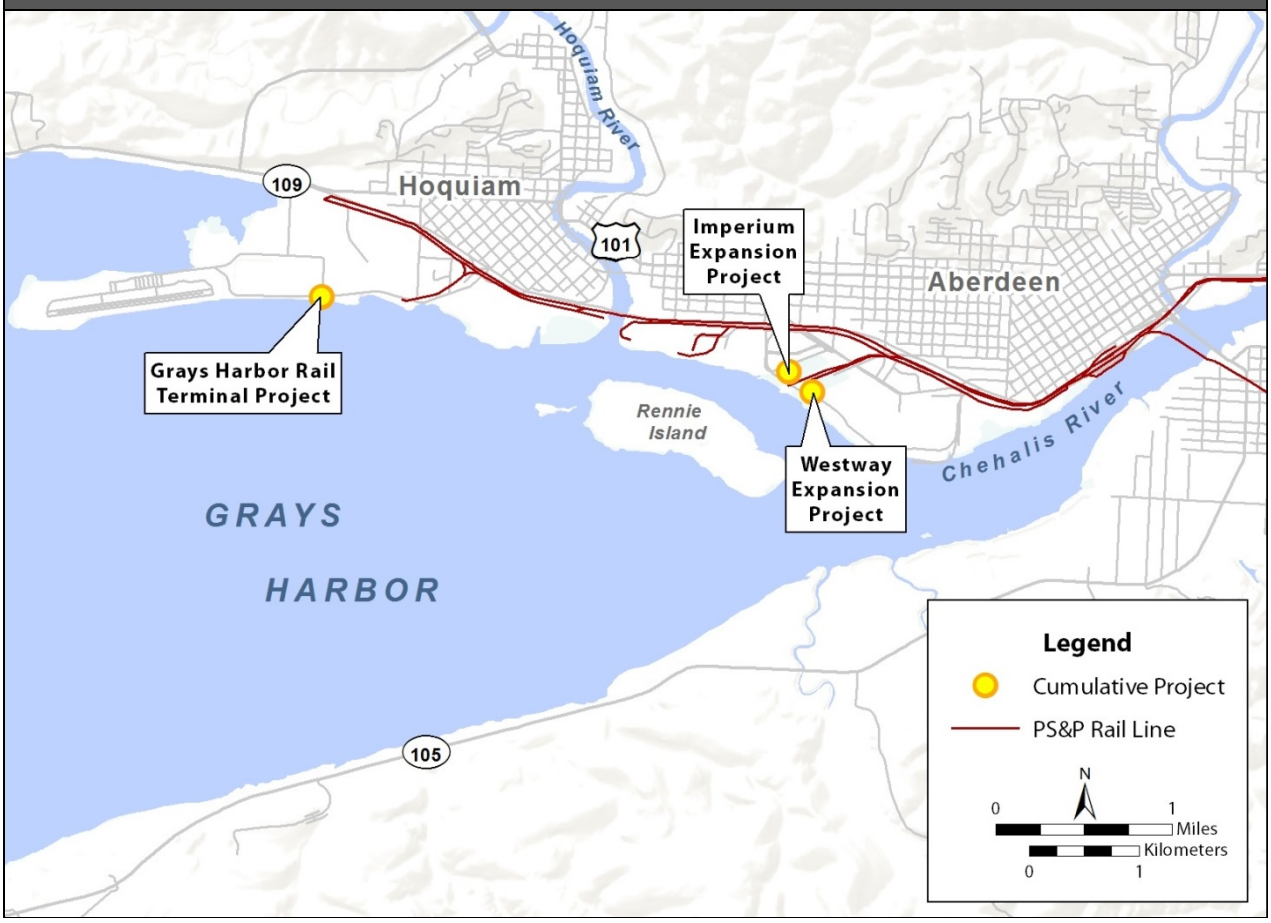

Table 6-1. Reasonably Foreseeable Future Actions Contributing to Cumulative Impacts

Project	Proponent	Location	Description	Contributing Activity	Schedule
Westway Expansion Project (proposed action)	Westway Terminal Company LLC	Port of Grays Harbor, Terminal 1	Westway Terminal Company LLC is proposing to expand the existing bulk liquids terminal to handle and store crude oil. The project would involve constructing additional storage tanks and expanding rail unloading capacity and vessel loading capacity on the site.	Proposed action would increase PS&P rail line traffic by 458 (loaded and unloaded) trips per year and vessel traffic in Grays Harbor by approximately 238 vessel trips per year.	Construction is anticipated to start in 2016 if permits are issued.
REG (formerly Imperium Terminal Services) Expansion Project	REG (formerly Imperium Terminal Services LLC)	Port of Grays Harbor, Terminal 1	REG is proposing[a] to expand the existing bulk liquids terminal to handle and store crude oil, ethanol, naphtha, gasoline, vacuum gas oil, jet fuel, no. 2 fuel oil, no. 6 fuel oil, kerosene, renewable jet fuel, renewable diesel, used cooking oil, and animal fat, in addition to currently permitted liquids, including biodiesel, petroleum diesel, vegetable oil, and methanol. The project would involve constructing additional storage tanks and expanding rail unloading capacity and vessel loading capacity on the site.	Proposed action would increase PS&P rail line traffic by 730 rail trips (loaded and unloaded) per year and vessel traffic in Grays Harbor by approximately 400 vessel trips per year.	Construction is anticipated to start in 2016 if permits are issued.
Grays Harbor Rail Terminal Project	USD Group LLC	Port of Grays Harbor, Terminal 3	USD Group LLC is proposing[c] to construct a new bulk liquids terminal to handle and store crude oil. The project would involve constructing additional storage tanks and expanding rail unloading capacity and vessel loading capacity on the site.	Proposed action would increase PS&P rail line traffic by 365 rail trips (loaded and unloaded) per year and vessel traffic in Grays Harbor by approximately 120 vessel trips per year.	Construction is anticipated to begin within the next 2 years if permits are issued.
Grays Harbor Navigation Improve-ment Project[a]	U.S. Army Corps of Engineers	Grays Harbor Navigation Channel	The project would deepen the navigation channel to 38 feet mean lower low water between the South reach and Cows Point reach.	Upon completion of channel deepening, the limiting design depth for the transit of large commercial vessels between the Bar Reach and Port terminals would be 38 feet mean lower low water.	Dredging for channel deepening is currently proposed to occur between 2016 and 2017.

Project	Proponent	Location	Description	Contributing Activity	Schedule

[a] Vessel traffic projections for the baseline and no-action alternative evaluated in this EIS assume the implementation of the Grays Harbor Navigation Improvement Project. Moreover, the channel capacity analysis in Chapter 3, Section 3.17, *Vessel Traffic*, and in Section 6.5.6, *Vessel Traffic*, considers the project's proposed increase in channel depth.

[b] The specifics of the REG Expansion Project are changing and have not been finalized. Therefore, the analysis of cumulative impacts retains the original proposed action considered in the Draft EIS. Based on information available at this time, the commodity types and volumes are anticipated to be less than assumed in the analysis.

[c] The proposal for the Grays Harbor Rail Terminal Project is no longer active; however, industrial growth is anticipated at this site between 2017 and 2037. Therefore, the analysis of cumulative impacts retains the original proposal considered in the Draft EIS. Future development would not include crude oil due to the revised zoning code.

Vessel traffic projections for the baseline and no-action alternative evaluated in this EIS assume the implementation of the Grays Harbor Navigation Improvement Project. Moreover, the channel capacity analysis in Chapter 3, Section 3.17, *Vessel Traffic*, and in Section 6.5.6, *Vessel Traffic*, considers the project's proposed increase in channel depth. For these reasons, the analysis of cumulative impacts focuses on those associated with construction and operation of the three projects proposed for development at the Port: the proposed action, the REG (formerly Imperium Terminal Services) Expansion Project (REG project), and Grays Harbor Rail Terminal Project. These three projects are referred to as the cumulative projects.[1]

Tables 6-2 and 6-3 summarize the rail and vessel traffic associated with the reasonably foreseeable future actions contributing to cumulative impacts of the cumulative projects.

Table 6-2. Rail Traffic for Reasonably Foreseeable Future Actions

	Rail Trips		
Project	**Daily**	**Weekly**	**Annual**
Proposed action	1.25	8.75	458
REG project	2	14	730
Grays Harbor Rail Terminal Project	1	7	365
Total Rail Trips	**4.25**	**29.75**	**1,553**

Table 6-3. Vessel Traffic for Reasonably Foreseeable Future Actions

	Vessel Calls			Vessel Trips		
Project	**Daily**	**Weekly**	**Annual**	**Daily**	**Weekly**	**Annual**
Proposed action	0.3	2.3	119	0.7	4.6	238
REG project	0.5	3.8	200	1.1	7.7	400
Grays Harbor Rail Terminal Project	0.2	1.2	60	0.3	2.3	120
Total Vessel Trips	**1.0**	**7.3**	**379**	**2.1**	**14.6**	**758**

6.5 What cumulative impacts were identified?

This section addresses the cumulative impacts on air, noise and vibration, tribal resources, rail traffic, vehicle traffic and safety, vessel traffic, and environmental health and safety that could result from the cumulative projects. This section also addresses potential cumulative impacts in the extended study area.

6.5.1 Air

This section discusses potential cumulative impacts on air that would result from construction and operation of the cumulative projects.

[1] As noted in Table 6-1, although the specifics of the REG project and Grays Harbor Rail Project are changing, growth at these properties between 2017 and 2037 is anticipated. Therefore, the analysis of cumulative impacts retains the original proposals considered in the Draft EIS. Based on information available at this time, the commodity types and volumes proposed by REG are anticipated to be less than assumed in the analysis.

6.5.1.1 Study Area

The cumulative impacts study area for air includes Grays Harbor County where emissions from onsite operations would occur and where the majority of emissions related to offsite rail transport on the PS&P rail line and vessel transport in Grays Harbor would occur. Possible greenhouse gas (GHG) emissions associated with operations, rail and vessel transport, and combustion are considered.

6.5.1.2 Cumulative Impacts

The following section describes the criteria pollutants, toxic air pollutants, and GHG emissions that could result from the construction and routine operation of the cumulative projects.

Criteria Pollutants

As presented in Chapter 3, Section 3.2, *Air*, air pollutants resulting from the proposed action are not anticipated to approach levels defined by the National Ambient Air Quality Standards (NAAQS). Although increased nitrogen oxide (NO_X) emissions during onsite operations of the proposed action would not exceed the NAAQS, the emissions are analyzed under a scenario where all cumulative projects perform activities at the same time.

The maximum cumulative nitrogen dioxide (NO_2) concentrations would occur if the following actions occurred simultaneously.

- The applicant is loading a vessel at the terminal while operating the vapor combustion unit at maximum capacity.
- REG is unloading crude oil from a unit train.
- USD Group LLC is loading crude oil at Terminal 3 and unloading a unit train.

Under these circumstances, the highest concentration of 1-hour NO_2 could occur resulting in an increase of NO_2 concentration that would slightly exceed the 1-hour NO_2 standard.[2] The 1-hour NO_2 standard is 188 micrograms per cubic meter of air (μg/m^3), and the total NO_2 concentration based on the above scenario is 190 μg/m^3 of air. A violation of the NO_2 standard would not likely occur for the following reasons.

- The standard requires that the 3-year average of NO_2 be exceeded.[3]
- The analysis conservatively assumed a high percentage of NO_2 converted.[4]

[2] The maximum 1-hour NO_2 modeled concentration from the combined total of all three facilities would be about 145 micrograms per cubic meter of air (μg/m^3) (81 μg/m^3 for the proposed action, 14 μg/m^3 for the REG project, and 50 μg/m^3 for the Grays Harbor Rail Terminal Project). Adding the maximum ambient 1-hour NO_2 background concentrations of 45 μg/m^3, the total concentration would be 190 μg/m^3. The 1-hour NO_2 standard under NAAQS is 188 μg/m^3.

[3] The standard requires that the 3-year average of the 98th percentile of the daily 1-hour maximum not be exceeded.

[4] The modeling conservatively assumed that 80% of the emitted NO_X is converted to NO_2. It is unlikely that this high percentage of emitted NO_X is converted to NO_2 over the short travel distances where the maximum concentration is predicted to occur.

- All of the mobile source activity as previously described would have to occur simultaneously during meteorological conditions that have the poorest dispersion conditions (i.e., very low wind speeds and a strong temperature inversion).
- The maximum 1-hour background concentration would need to occur simultaneously.

Additionally, incorporation of the mitigation described in Chapter 3, Section 3.2, *Air*, and Section 6.5.1.3, *Mitigation Measures*, would further reduce the risks of exceeding applicable air quality standards.

Toxic Air Pollutants

Air dispersion modeling of diesel particulate matter (DPM) was conducted using the U.S. Environmental Protection Agency (EPA) AERMOD dispersion model[5] for rail activities between Poynor Yard and the three project sites.

Figures 6-2 and 6-3 show the average increased inhalation cancer risk from DPM in 2017 and 2037[6] under cumulative conditions by illustrating the 10-per-million and 1-per-million risk levels. The air quality sensitive receptors[7] within these risk levels are also shown.

Under WAC 173-460, Controls of New Sources of Toxic Air Pollutants, Washington State Department of Ecology (Ecology) may recommend approval for a stationary source project that is likely to cause an exceedance of acceptable source impact levels for one or more toxic air pollutants if it is demonstrated that the increase in emissions of toxic air pollutants (such as DPM) would not likely result in an increased cancer risk of more than 10 in 1 million. However, this regulation only applies to stationary sources, not mobile sources such as rail locomotives. There are no local or state regulations for DPM emissions from mobile sources. For this reason, the 10-per-1-million risk level is not a threshold to determine significance of the impact. However, to provide context of the average increased inhalation cancer risk from DPM, the 10-per-million risk level is shown in Figures 6-2 and 6-3. For project-level impacts, EPA would typically urge action to mitigate the increased risk of exposure at the 100-per-million risk level. The maximum potential increase in risk from the project is well below this level of increase as shown in Figures 6-2 and 6-3.

The analysis indicates that if all cumulative projects are operating at maximum throughput, the 10-per-million-and-above risk level from rail operations would be limited to the project sites in 2017.

In 2017, the 1-per-million risk level from rail operations would extend from east of Poynor Yard to west of the REG project site. As shown in Figure 6-2, some residential land uses are within the 1-per-million risk level west and north of the PS&P rail line. Three sensitive receptors (West End Playfield, 28th Street Landing, and Viewing Tower) (Chapter 3, Section 3.2, *Air*) are also located within the 1-per-million risk level.

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[5] AERMOD is a dispersion model recommended by EPA for estimating the impact of industrial sources of emissions on ambient air quality.

[6] Years 2017 and 2037 were modeled to assess the risk from DPM emissions over time because locomotives that emit less DPM than in 2017 will be in operation by 2037. The analysis assumes maximum throughput capacity in 2017 and 2037.

[7] A facility or land use that houses or attracts members of the population who are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses.

By 2037, no 10-per-million risk levels are predicted (Figure 6-3). No residential areas would be above 1-per-million risk and the 28th Street Landing and Viewing Tower would be just below the 1-per-million risk level. The risks would be less compared to 2017 because the analysis considers that newer locomotives with improved control technologies would be used nearly exclusively by this time.

Figure 6-2. Average Cumulative Diesel Particulate Matter Inhalation Cancer Risk (2017)

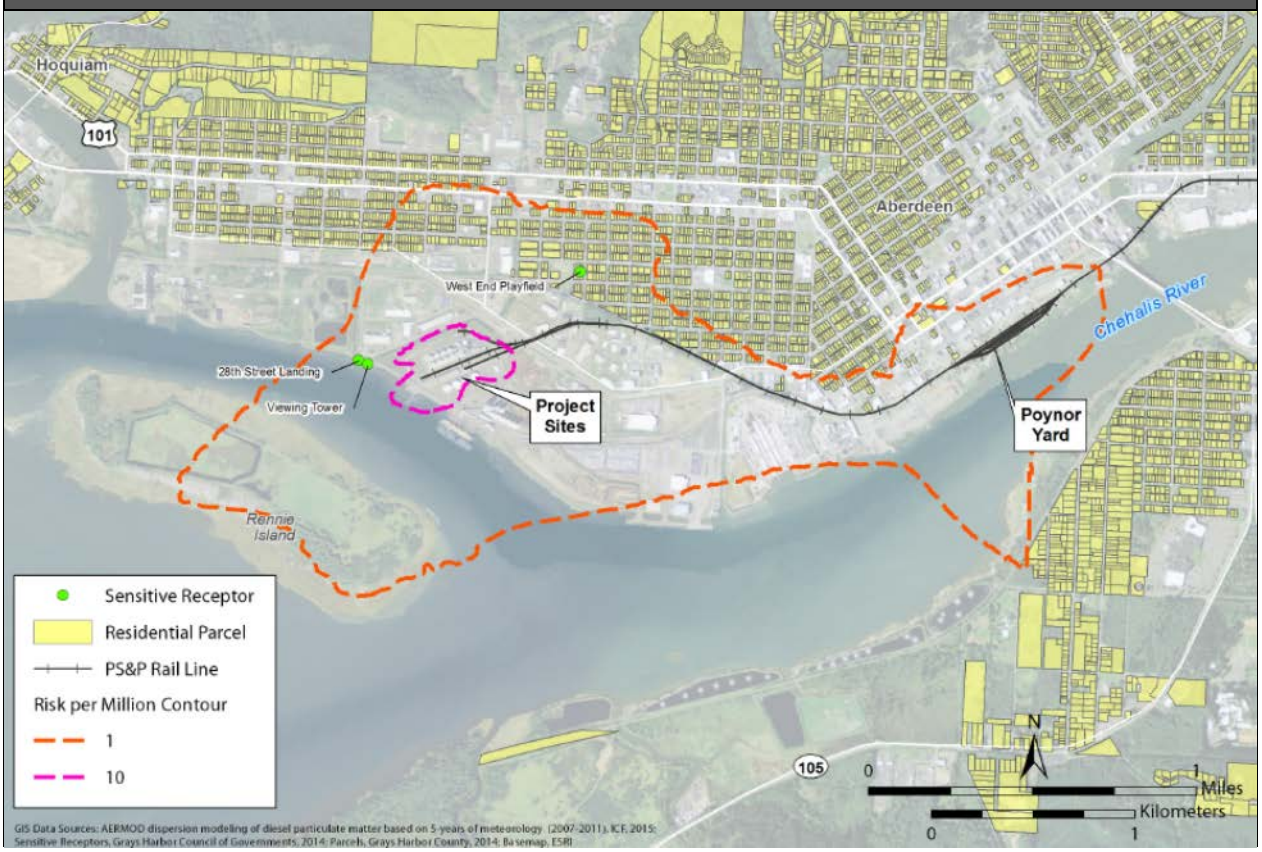
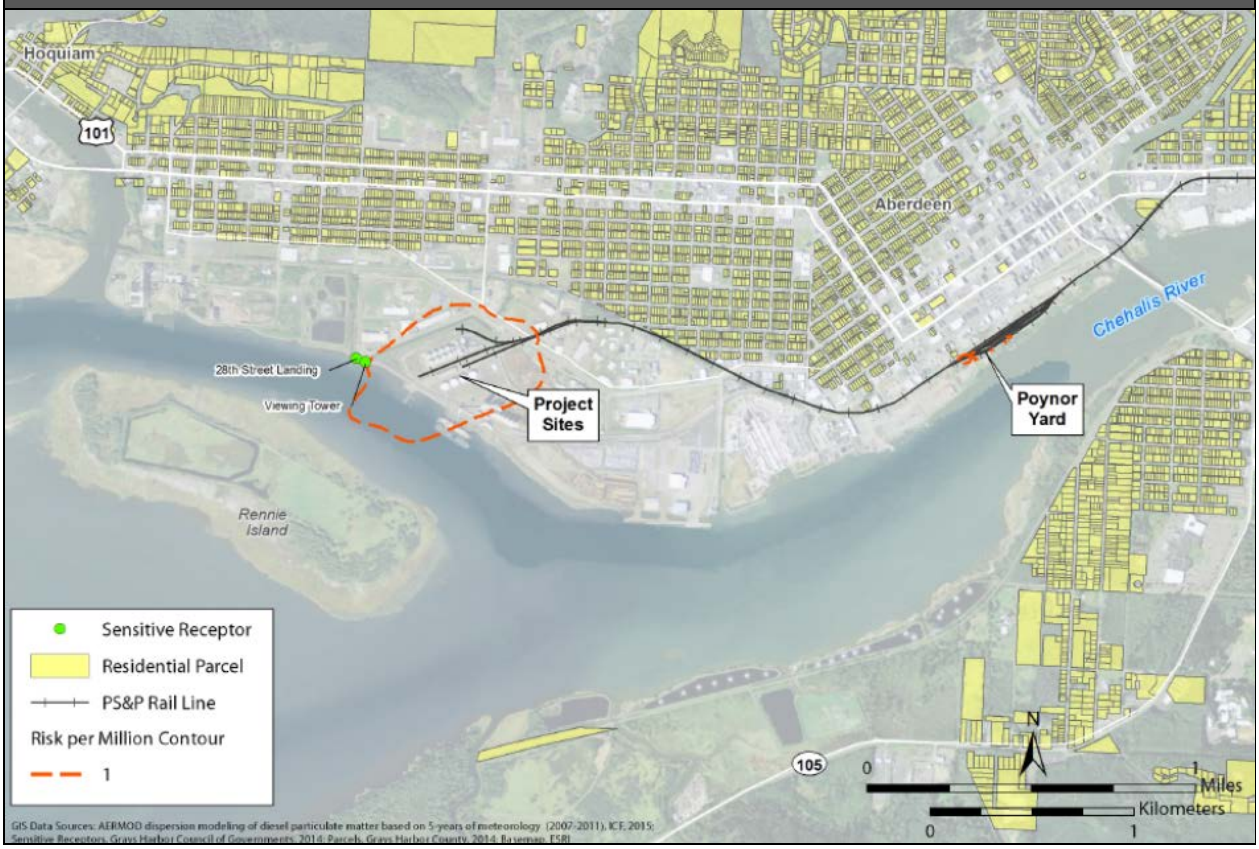


Figure 6-3. Average Cumulative Diesel Particulate Matter Inhalation Cancer Risk (2037)



Greenhouse Gas Emissions

Emission of GHGs would result from onsite operation of the cumulative projects. Other sources of GHG emissions that could be attributed to the cumulative projects are those from the extraction of crude oil, transport of the crude oil to and from the project site, and end use of the crude oil (e.g., combustion). These sources of GHG emissions are discussed below.

Crude Oil Production

Crude oil production (drilling) results in the emission of GHGs. If the cumulative projects were to induce production of crude oil or other bulk liquids,[8] GHG gas emissions for this activity could be deemed attributable to the proposed action. Based on the analysis presented in Appendix Q, *Crude Oil Market Analysis,* the proposed action would not likely affect oil production. Therefore, GHG emissions related to extraction activities are not quantified for the cumulative projects.

Onsite Operations and Offsite Transport

Onsite operation of the cumulative projects at maximum throughput would result in the emission of approximately 21,272 metric tons of carbon dioxide equivalent (CO_2e) each year from stationary sources (Table 6-4).

[8] The REG project proposes handling a variety of bulk liquids; however, for the purposes of the GHG analysis, it is assumed that maximum throughput is solely for crude oil.

Rail and vessel transport related to the cumulative projects would also result in GHG emissions. Based on the analysis presented in Appendix Q, *Crude Oil Market Analysis,* crude oil transloaded at the proposed facility is expected to be shipped to West Coast refineries. It is anticipated that much of this crude oil would replace crude oil that was previously transported to these refineries by other means. The *Washington Marine and Rail Oil Transportation Study* states the following (Washington State Department of Ecology 2014b):

> …historically, 90% of crude oil bound for Washington's refineries was delivered here by tank ship from Alaska or from other international sources of oil. Today pipeline and rail delivery of crude oil make up more than 30% of our imports, while vessel delivery is reduced to less than 70%. Crude oil transportation is rapidly shifting to delivery by rail and pipeline.

Table 6-4 presents estimates of GHG emissions from rail transport from the likely source, Williston Basin,[9] and vessel transport to the farthest likely destination, Port of Long Beach, California,[10] of maximum throughput of crude oil related to the cumulative projects.

Table 6-4. Annual Average Greenhouse Gas Emissions from Operations of the Cumulative Projects ($MTCO_2e$/year)

Source Type	Proposed Action	REG Project	Grays Harbor Rail Terminal Project	Total
Rail (Washington State)[a]	28,173	43,343	21,205	92,721
Rail (beyond Washington State)[b]	51,219	81,619	40,842	173,680
Marine vessels (Washington State)[c]	643	1,417	2,394	4,454
Marine vessels (beyond Washington State)[d]	39,161	65,817	36,025	141,003
Industrial sources (project site)	4,052[e]	6,634[f]	10,586[g]	21,272
Total	**123,248**	**198,830**	**111,052**	**433,130**

[a] Includes onsite rail emissions.
[b] Includes emissions from roundtrip rail transport between Washington State border and Enbridge, North Dakota.
[c] Includes emissions from vessels at the Terminal 1 dock.
[d] Includes emissions from vessel transport via from 3 nautical miles off the Washington coast to the Port of Long Beach, California.
[e] Trinity Consultants 2015a
[f] Trinity Consultants 2015b
[g] HDR Engineering, Inc. 2014
$MTCO_2e$ = metric tons of carbon dioxide equivalent

Table 6-5 presents estimates of GHG emissions related to transport of the equivalent volume of Alaska North Slope crude oil, which is expected to be offset by any crude oil transloaded under the cumulative projects. The emission estimates related to transport of Alaskan crude do not include emissions related to loading and movement of crude oil from the North Slope to Valdez; therefore, they are understated and conservative for the purposes of calculating offset emissions. Moreover, if crude oil transloaded through the proposed facility were to be transported to California refineries, it could replace crude oil from international sources.

[9] Enbridge, North Dakota, was used as the source point.
[10] Refer to Appendix Q, *Crude Oil Market Analysis,* for a discussion of why West Coast refineries are considered the most likely destination of crude oil transloaded through the proposed facility, despite the lifting of the ban on exports of U.S. crude oil.

Table 6-5. Estimated Annual Greenhouse Gas Emissions Related to Offset Vessel Transport of Alaskan Crude Oil (metric tons of CO_2e per year)

Vessel Transit[a]	Emissions
Proposed action	47,049
REG project	79,135
Grays Harbor Rail Terminal Project	43,326
Total	169,510

[a] Assumes 17 Suezmax vessels (195,000 deadweight tons). Loaded vessels traveling from Valdez, Alaska, to Long Beach, California, and returning empty. Does not include emissions from loaded vessels and movement of crude oil from North Slope to Valdez, Alaska.

Statewide GHG emissions related to the cumulative projects from onsite operations and offsite transport within the state would be 118,447 metric tons of CO_2e per year (Table 6-4). These statewide GHG emissions represent a 0.13% increase in 2011 related statewide GHG emissions[11] (Washington State Department of Ecology 2014a). The largest contribution of statewide GHG emissions would result from rail transport, which represents an increase of approximately 9.3% in the 2011 statewide GHG emissions from rail transport[12] (Washington State Department of Ecology 2014a). Future improvements in the efficiency of locomotives may decrease the total GHG emissions resulting from the cumulative projects.

RCW 70.235.020 sets the following GHG statutory reduction levels.

- By 2020, reductions to 1990 emission levels.
- By 2035, reductions to 25% below 1990 levels.
- By 2050, reductions to 50% below 1990 levels or 70% below Washington State's expected emissions that year.

In order to meet these reductions, Washington State must reduce emissions to 88.4 million metric tons per year by 2020, 66.3 million metric tons by 2035, and approximately 44.2 million metric tons by 2050. The statewide GHG emissions from the cumulative projects would represent approximately 0.26% of Washington State's statutory reductions of 44.2 million metric tons of CO_2e (half of the 1990 level) by 2050.

Adding emissions from rail and vessel transport related to the cumulative projects beyond Washington State (rail transport from the Williston Basin, North Dakota, to the state line, and vessel transport from state waters to Long Beach, California) would result in an additional 314,683 metric tons of CO_2e per year (Table 6-4). Onsite operations plus offsite transport of maximum throughput from crude oil source to refinery would total 433,130 metric tons of CO_2e per year. Considering offset emissions of 169,510 metric tons of CO_2e per year related to Alaskan crude oil, estimated net GHG emissions from the cumulative projects would be 263,620 metric tons of CO_2e per year.

In 2011, global emissions were estimated to be 43,372 million metric tons of CO_2e and U.S. emissions were estimated to be 6,550 million metric tons of CO_2e (World Resources Institute

[11] 2011 statewide GHG emissions from stationary industrial sources and rail and vessel transport were 91.7 million metric tons of CO_2e per year.
[12] 2011 statewide GHG emissions from stationary industrial sources and rail and vessel transport were 1 million metric tons of CO_2e per year.

2014). The estimated average annual net GHG emissions from the cumulative projects would represent approximately 0.0006 and 0.004% of these estimates, respectively.

In November 2014, the United States entered into a nonbinding agreement with China to reduce emissions 26 to 28% below 2005 levels (White House 2014). This national goal translates to annual emissions between 4,628 and 4,756 million metric tons by 2025. The estimated average annual net GHG emissions from the cumulative projects represents approximately 0.006% of these national targets.

According to the International Panel on Climate Change, cumulative GHG emissions should be limited to 1 trillion metric tons (total) by 2050 or the planet will exceed the 2°C warming threshold. Currently, GHGs emitted worldwide since the Industrial Age are estimated to be 592 billion metric tons (Oxford E-Research Center 2015). Cumulative worldwide emissions must be limited to 408 billion metric tons to meet the 2050 target. The estimated average annual net GHG emissions from the cumulative projects represent approximately 0.00006% of this limit.

Combustion

In addition to GHG emissions from onsite operations and offsite rail and vessel transport, the combustion of crude oil would also result in GHG emissions. To the extent that crude oil transloaded through the proposed facility would replace oil shipped to West Coast refineries by other means and from other sources (e.g., Alaska or international ports), combustion emissions would not be entirely additive. Crude oil may be refined into multiple other products that may or may not have substantial GHG emissions (e.g., asphalt is not combusted and is a crude oil product) and the end use would vary based on the product and market. Because crude oil can be broken down into a variety of products and their end use varies, the end-use combustion calculation, which assumes that all of the oil will be combusted, is conservative and likely overstates total GHG emissions. For purposes of disclosure, GHG emissions from the combustion of the maximum throughput of crude oil per year related to the cumulative projects were quantified using the emissions factors presented in Table 6-6.

Using EPA's average heat content of crude oil of 5.80 million British thermal units (Btu) per barrel (U.S. Environmental Protection Agency 2013) and the highest emissions factor[13] for the product likely to be handled by the facilities[14] listed in Table 6-6, the maximum amount of CO_2 emissions from end use of products shipped through the proposed facility in a given year is 28.1 million metric tons of CO_2 per year (proposed action is 7.8 million metric tons of CO_2 per year, REG project is 13.1 million metric tons of CO_2 per year, and Grays Harbor Rail Terminal Project is 7.2 million metric tons CO_2 per year).

[13] The emissions factor represents the number of kilograms of CO_2 that would be emitted for each million Btu of a given product.
[14] Kerosene has the highest emission factor but crude oil is expected to be the main product handled by all three facilities.

Table 6-6. Estimated CO_2 Emissions Factors for Oil Combustion

State or Condition	Products	CO_2 Emissions Factors (kg CO_2 per million Btu)
Refined	Gasoline	70.22
	Kerosene	75.20
	Naptha	68.02
	Jet fuels	72.22
	No. 2 fuel oil (diesel oil)	73.96
	No. 6 fuel oil (bunker oil)	75.10
	Vacuum gas oil	73.00 (Estimate)
Unrefined	Bakken crude oil[a]	73.96
	Diluted bitumen[b]	75.10
Non-Petroleum Fuels		
Pure (unblended)	Ethanol	68.44
Can be composed of 20–80% of plant-based fuel	Renewable jet fuel	72.22 (Estimate)
Can be composed of 20–80% of plant-based fuel	Renewable diesel	73.84
Variable composition	Used cooking oil/animal fat	71.06

Source: U.S. Environmental Protection Agency 2013.
[a] Emissions factor for no. 2 fuel oil was used for Bakken crude oil.
[b] Emissions factor for no. 6 residual fuel oil was used for diluted bitumen.
kg CO_2 per million Btu = kilograms of carbon dioxide per million British thermal units.

Regardless of the end-use emissions scenario, the cumulative projects would represent a very small segment of the crude oil market in the United States. In 2013, 7.45 million barrels of crude oil were produced in the United States, and 7.72 million barrels of crude oil were imported every day. Together, this equals 15.17 million barrels of crude oil supplied to the United States every day (U.S. Energy Information Administration 2015). The total amount of oil transported by the cumulative projects would be 176,110 barrels per day (Table 6-7) or 1.2% of the U.S. daily crude oil supply. Because of this small volume, the cumulative projects would not likely affect the crude oil market.

Table 6-7. Proposed Daily Throughput Compared to National Average—Cumulative Projects

Proposed Project	Daily throughput (barrels per day)	Daily US Crude Oil Supply (percent [%] of 15.17 million barrels per day)
Proposed action	48,918	0.3%
REG project (for all tanks)	82,192	0.5%
Grays Harbor Rail Terminal Project	45,000	0.3%
Total	**176,110**	**1.2%**

Climate Change

GHG emissions from the cumulative projects would contribute to global GHG emissions, which contribute to climate change. This section describes the projected impacts of climate change in the Pacific Northwest.

Earth's climate is primarily controlled by the balance of incoming energy from the sun and reflected energy from the Earth's surface. Heat and light from the sun is either reflected or absorbed by the Earth's surface and its atmosphere. GHGs (carbon dioxide, methane, nitrous oxide, water vapor, ozone, and hydrofluorocarbons) can trap outbound radiation in the Earth's atmosphere. GHGs are released through natural sources, such as CO_2 emitted from aerobic respiration or organic decomposition. GHGs are also released because of human activities, such as the combustion of fossil fuels, industrial processes, land use change, deforestation, agricultural production, solvent use, and waste management.

The *Intergovernmental Panel on Climate Change Fifth Assessment Report* states the warming of the global climate system is unequivocal, and each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. Additionally, from 1880 to 2012, the globally averaged, combined land and ocean surface temperature data show a warming of 0.85°C, or 1.5°F (Intergovernmental Panel on Climate Change 2013). This warming has coincided with increased concentrations of GHGs in the Earth's atmosphere.

The Intergovernmental Panel on Climate Change, the National Research Council, and the U.S. Global Change Research Program have concluded that it is extremely likely (a 95 to 100% chance) that global increases in atmospheric GHG concentrations and global temperatures are caused by human activities. Washington State's Climate Impacts Group has researched the potential impacts of climate change in the Pacific Northwest and concluded that there will be substantial impacts by the middle of the 21st century (Climate Impacts Group 2015). Changes to temperature, precipitation, and sea level are predicted (Mote et al. 2014). Observed and projected increases in temperatures, shifts in precipitation, and changes in flood patterns reflect regional patterns across Idaho, Oregon, and Washington. Changes in sea-level rise are localized to the Oregon and Washington coasts.

An increase in the overall temperature of the Earth causes large-scale changes throughout the Earth's climate system, including higher sea levels, changes in precipitation, and altered weather patterns (e.g., an increase in more extreme weather events). These changes affect the natural and built environment and humans.

Sea level rise can cause higher tides and storm surges, which result in early flooding in more low-lying areas. Stronger storms with heavier precipitation and higher wave conditions will increase the frequency and extent of flooding in many communities. Stronger storms combined with higher sea levels will result in higher coastal erosion rates and more damage to property and infrastructure in coastal communities (Washington State Department of Ecology 2016a).

Ocean acidification is also a result of increasing levels of CO_2. The Earth's oceans absorb excess CO_2 from the atmosphere, making seawater more acidic. More acidic waters threaten Washington State's shellfish industry and tribal resources and could affect the marine food web. Ocean acidity is increasing at a faster rate than predicted, and this increase may reduce the ability of oysters and other species to form shells (Washington State Blue Ribbon Panel on Ocean Acidification 2012).

Sea level rise can also lead to contaminated groundwater supplies as sea-water penetrates coastal aquifers and wells in low-lying communities (Washington State Department of Ecology 2016a).

Temperatures across the region increased by 1.3°F during the 1895 to 2011 period (Kunkel et al. 2013 in Mote et al. 2014). Temperatures are projected to continue increasing with average annual temperatures increasing 3.3 to 9.7°F[15] by the end of the century compared to the 1970 to 1999 period (Mote et al. 2014).

From 1895 to 2011, there has not been a statistically significant change in annual precipitation across the Northwest. However, the variability of annual precipitation has increased since 1976 compared to the previous 75 years (Kunkel et al. 2013 in Mote et al. 2014). Similarly, projected changes in precipitation are less certain with climate and various emissions futures resulting in a range of wetter and drier future conditions. Plausible futures range from an 11% decrease to a 12% increase in annual average precipitation by mid-century (Mote et al. 2014).[16] Seasonal shifts, such as a wetter spring and dryer summer, could be obscured by annual averages. An increase in heavy downpours may result in an increase in flood risk in rain-snow and rain-dominant basins (Mote et al. 2014), which could lead to greater flooding from the Chehalis, Humptulips, Wynoochee, and Wishkah Rivers because they originate in primarily rain-dominant basins.

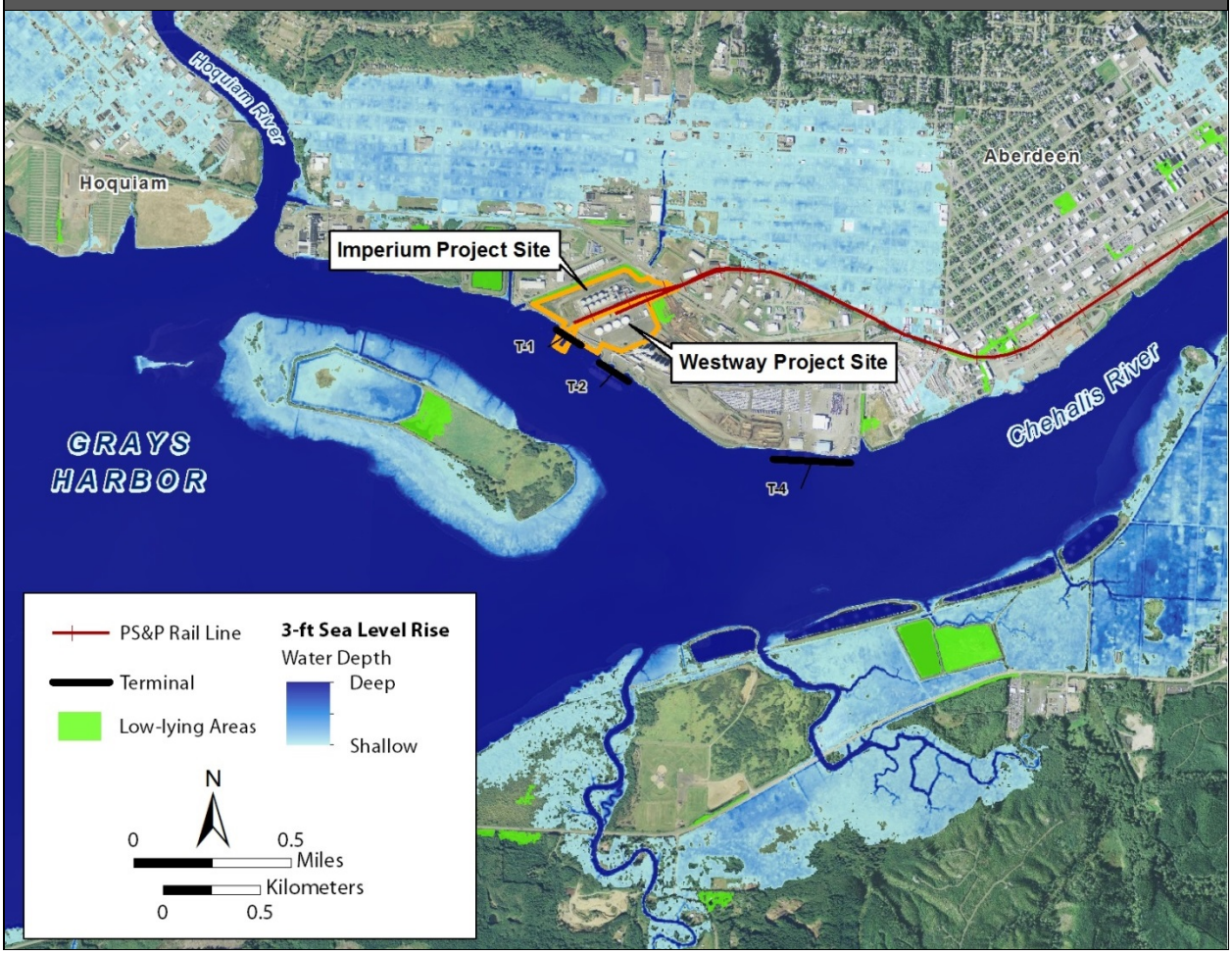
As global temperatures rise, the oceans warm and expand, and ice caps and glaciers melt. This causes sea levels to rise. Global sea level has risen about 7 inches during the 20th century and is projected to rise at a higher rate in the future (National Research Council 2012).

Sea level in the project vicinity in 2050 is expected to rise up to 48 centimeters (1.57 feet) (National Research Council 2012).[17] Adding 1.57 feet to the current mean sea level tide (4.51 feet), the high water from tides projected in 2050 would be up to 6.1 feet above mean sea level. Accounting for this increase in sea level, the project site, which has an average elevation of approximately 11 feet above mean sea level, would remain approximately 5 feet higher than the projected high tide level of 6.1 feet above mean sea level in 2050.

Intensifying coastal storms could increase the likelihood of more severe coastal flooding and erosion (Dalton et al. 2013). Based on the Sea Level Rise Viewer (National Oceanic and Atmospheric Administration 2015), a mapping tool that shows community-level impacts from coastal flooding or sea level rise at up to 6 feet above average high tides, flooding would not occur at the project site even at 3 feet of sea-level rise, which is nearly twice the amount predicted for 2050 (Figure 6-4).

[15] The range reflects changes projected under the lower (B1) and higher (A2) emissions scenarios, as defined by the Intergovernmental Panel on Climate Change *Special Report on Emissions Scenarios (SRES)*.
[16] Increase is relative to the 1970 to 1999 average and based on an ensemble of projections from 21 climate models and the low (B1) and high (A2) emissions scenarios.
[17] The National Research Council 2012 report provides a projection (a single estimate) and a range (high and low estimate) of projections for 2030, 2050, and 2100.

Figure 6-4. Flooding in the Study Area Based on 3 Feet of Sea-Level Rise



Source: National Ocean and Atmospheric Administration 2015

6.5.1.3 Mitigation Measures

Implementation of the applicant mitigation measure identified below would address potential exceedance of NO_X related to the cumulative impacts. Implementation of the applicant mitigation measures identified in Chapter 3, Section 3.2, *Air*, would also address cumulative impacts.

- In order to identify NO_X emissions if the proposed action, REG project, and Grays Harbor Rail Terminal Projects are approved, Westway, REG, and Grays Harbor Rail Terminal will ensure air-monitoring stations are installed to monitor the NO_2 emissions at or near the facility prior to the third proposed facility beginning operations. Air monitoring reports will be submitted to Olympic Region Clean Air Agency annually. If levels are observed to be approaching the NAAQS, then additional measures could be required in the agency's air permit.

6.5.1.4 Unavoidable and Significant Adverse Environmental Impacts

The cumulative projects would result in increased air emissions, most notably of NO_2 and DPM. Compliance with the applicable regulations along with implementation of the proposed mitigation measures described in Chapter 3, Section 3.2, *Air*, and above would reduce cumulative impacts on air quality. There would be no unavoidable and significant adverse cumulative

impacts. Cumulative impacts related to increased risk of incidents and related consequences are addressed in Section 6.5.7, *Environmental Health and Safety*.

6.5.2 Noise and Vibration

This section discusses potential cumulative impacts on noise that would result from construction and operation of the cumulative projects.

Based on the analysis in Chapter 3, Section 3.7, *Noise and Vibration*, the proposed action would have negligible onsite noise and vibration impacts from construction or routine operations at the project site and during vessel transport and vibration impacts from rail transport. The noise and vibration would be similar to levels generated by other industrial activities in the Port. For this reason, only the potential cumulative impacts on noise from rail operations are discussed in this section.

6.5.2.1 Study Area

The cumulative impacts study area for noise includes areas that could be affected by increased noise related to rail transport on the PS&P rail line.

6.5.2.2 Cumulative Impacts

The following section describes the noise impacts that could result from the routine operation of the cumulative projects.

The cumulative projects would increase train traffic on the PS&P rail line by 4.25 trips per day. Based on the Federal Railroad Administration (FRA)/Federal Transit Administration (FTA) guidance manual (FRA/FTA Manual) methods described in Chapter 3, Section 3.7, *Noise and Vibration*, the addition of proposed action trains to cumulative rail traffic would increase the average noise level along the PS&P rail line. Average noise level, or day-night sound level (L_{dn})[18] measures the average sound level over a 24-hour period (not single train passbys). Based on the FRA/FTA criteria, train noise with the cumulative projects would affect people farther from the rail line than under existing conditions.

Table 6-8 presents the number and general location of noise-sensitive receptors along the PS&P rail line that would be exposed to increased rail traffic noise (wayside and horn noise) from the cumulative projects. Approximately 78 receptors would be exposed to wayside noise increases that meet the FRA/FTA criteria for moderate impacts,[19] primarily in the Elma-Satsop area and the area between Montesano and Aberdeen. Approximately 10 receptors would be exposed to wayside noise increases that meet the FRA/FTA criteria for severe impacts,[20] all at PS&P rail line grade crossings[21] in Elma (North 11th Street, North 13th Street, and North 17th Street).

[18] This is a 24-hour average noise level (in A-weighted decibels [dBA]) with a 10-decibel upward adjustment of noise levels occurring at night. This adjustment is made to account for most individuals' increased sensitivity to noise at night.
[19] The change in the noise level would be noticeable to most people but may not be enough to cause strong adverse community reactions. For more information, see Section 3.7, *Noise and Vibration*.
[20] A significant percentage of people would be highly annoyed by the noise (Chapter 3, Section 3.7, *Noise and Vibration*).
[21] Throughout this chapter, *grade crossings* refer to at-grade crossings on the PS&P rail line.

Table 6-8. Estimated Counts of Sensitive Receptors Exposed to Increased Noise on the PS&P Rail Line—Cumulative Projects

Analysis Segment	Location	Grade Crossings[a]	Number of Grade Crossings	General Land Use Characteristics	Horn		Wayside	
					Moderate Impact[b]	Severe Impact[b]	Moderate Impact[b]	Severe Impact[b]
A	Centralia	1–8	8	Higher-density single family residential and commercial	143	0	0	0
B	Unincorporated Centralia, Rochester (south of US 12)	9–20	12	Single-family residential and commercial	47	15	1	0
C	Rochester (between US 12 and Littlerock Road SW)	21–24	4	Single-family residential and commercial	18	4	3	0
D	Rochester (west of Littlerock Road SW)	25–30	6	Single-family residential and commercial	23	5	0	0
E	Oakville	31–42	12	Lower-density single-family residential and commercial	41	3	0	0
F	Malone-Porter	43–54	12	Lower-density single-family residential	81	26	8	0
G	Elma-Satsop	55–72	18	Medium-density single-family residential	268	148	32	10
H	Montesano	73–84	12	Medium-density single-family residential	44	16	0	0
I	West of Montesano/east of Aberdeen	85–92	8	Medium-density single-family residential	45	27	34	0
J	Aberdeen	93–103	11	Single-family residential and commercial	46	9	0	0
Total					**756**	**253**	**78**	**10**

[a] See Chapter 3, Figure 3.7-2, for the location of grade crossings.
[b] As defined by FRA/FTA criteria (Chapter 3, Section 3.7, *Noise and Vibration*).

Increased noise would result from locomotive train horns sounding at grade crossings for public safety. Based on the analysis, noise exposure would occur near grade crossings along the PS&P rail line with the highest increases in the Elma-Satsop area. Approximately 756 receptors along the PS&P rail line would be exposed to increased noise from locomotive train horns that would meet the FRA/FTA criteria for moderate impacts at 83 grade crossings. These include the eight grade crossings in Centralia that have high levels of existing surface transportation noise exposure. Rail traffic noise from the cumulative projects would add to the existing high levels of noise exposure.

Approximately 253 additional receptors would be exposed to increased noise that would meet the FRA/FTA criteria for severe impacts. These receptors are near 51 grade crossings along the rail line, with a majority (approximately 148 receptors) in the Elma-Satsop area.

Table 6-9 illustrates the grade crossings exposed to the highest noise increases from train horn noise. For information on noise increases at all grade crossings, see Appendix G, *Noise Data*.

Table 6-9. Grade Crossings with the Most Sensitive Receptors Exposed to the Highest Noise Levels from Train Horns[a]

Grade Crossing[a]	Grade Crossing Description[b]	Location	Number of Receptors
55	North 2nd Streets	Elma	32
61	North 11th Street	Elma	24
62	North 13th Street	Elma	20
91	Private Crossing	Central Park	14
58	North 6th Street	Elma	14
85	Country Farm Road	Montesano	12
63	North 17th Street	Elma	10
65	Hurd Road	Satsop	10
60	North 10th Street	Elma	8
73	Old Monte Brady Road	Brady	6
45	Private Crossing	Malone-Porter	6
59	North 9th Street	Elma	6
57	North 5th Street	Elma	6

[a] Between one and four sensitive receptors would be exposed to the highest increase in train horn noise at 38 other grade crossings.
[b] See Chapter 3, Figure 3.7-2, for the location of grade crossings.

As described in Chapter 3, Section 3.7, *Noise and Vibration*, the relative impacts from exposure to increased noise would depend on the existing noise level. As the existing level of noise exposure increases, the additional noise exposure needed to cause a greater impact decreases. Potentially affected receptors would generally experience an average increase in noise exposure over the course of any given day. However, it is not possible to predict when trains would be traveling along the PS&P rail line. All trains would travel at the same speed as existing trains, and would continue to sound horns consistent with existing practices. Sensitive receptors along the PS&P rail line would experience train horn soundings more frequently from the additional 4.25 trips related to the cumulative projects.

6.5.2.3 Mitigation Measures

Implementation of the proposed mitigation measures identified in Chapter 3, Section 3.7, *Noise and Vibration* would also reduce cumulative impacts.

6.5.2.4 Unavoidable and Significant Adverse Environmental Impacts

The cumulative projects would result in increased noise along the PS&P rail line. This increased noise could result in impacts considered severe under FRA/FTA criteria. These impacts would occur at 55 crossings, affecting approximately 263 total receptors with up to approximately 32 receptors affected at any one grade crossing. Most of these impacts (253 of the 263 receptors affected) would result from train horn noise that is required for public safety; the other impacts would result from train wayside noise.

Local communities have the opportunity to work with FRA to apply for a quiet zone to limit train horn sounding. Mitigation identified in Chapter 3, Section 3.7, *Noise and Vibration*, would also reduce cumulative noise impacts. However, as long as train horns continue to sound for safety at the grade crossings listed in Table 6-9, the potential for exposure to severe impacts at these crossings would remain.

6.5.3 Tribal Resources

This section discusses potential cumulative impacts on tribal resources that would result from construction and operation of the cumulative projects.

6.5.3.1 Study Area

The cumulative impacts study area for tribal resources consists of tribal resources near the project sites that could be affected by construction and routine operations of the cumulative projects. The cumulative study area also includes tribal resources that could be affected during routine rail transport along the PS&P rail line and routine vessel transport through the Grays Harbor Navigation Channel.

6.5.3.2 Cumulative Impacts

The following sections describe the potential impacts on tribal resources that could result from the construction and routine operation of the cumulative projects. The potential for increased risks of larger spills and related environmental consequences are addressed in Chapter 4, *Environmental Health and Safety*.

Construction

As noted in Section Chapter 3, Section 3.12, *Tribal Resources*, the proposed action would be required to comply with water and air quality standards consistent with the permits described in Section 3.12. Therefore, construction of the proposed action would not likely result in the cumulatively substantial degradation of tribal resources.

Onsite Operations

As noted in Chapter 3, Section 3.12, *Tribal Resources*, the proposed action could affect tribal resources, including plants, wildlife, and fisheries, if operations were to degrade or limit access to resources used by the tribes.

As described in Chapter 3, *Affected Environment, Impacts, and Mitigation*, impacts on water, plants, and animals from routine operation of the proposed action are expected to remain low for the reasons noted in Sections 3.3, *Water*, 3.4, *Plants*, and 3.5, *Animals,* respectively. Specifically, required containment structures, stormwater treatment, and best management practices would minimize the potential for contaminated stormwater runoff to affect these resources. Because these factors would similarly apply to the cumulative projects, although the potential increase of small leaks and spills would be slightly greater than under the no-action alternative, the potential cumulative impacts on plants, wildlife, or fisheries from contaminated stormwater runoff are expected to remain low. Cumulative impacts from increased risk of oil spills, fires, and explosions that could affect tribal resources are addressed Section 6.5.7, *Environmental Health and Safety.*

As described in Chapter 3, Sections 3.3, *Water*, 3.4, *Plants*, and 3.5, *Animals*, leaks and spills of petrochemicals from routine operations and maintenance already pose risks at the existing site. The risks would increase under the cumulative projects because of increased facility operations. Although the potential increase of small leaks and spills would be slightly greater than under the no-action alternative, the potential impacts on plants, wildlife, or fisheries from contaminated stormwater runoff is expected to remain low. Cumulative impacts from increased risk of oil spills, fires, and explosions are addressed Section 6.5.7, *Environmental Health and Safety.*

As further noted in Section 3.12, *Tribal Resources*, onsite routine operations would involve vessel-loading activities that would increase the occupancy of the Terminal 1 berth, which is a usual and accustomed fishing area of the Quinault Indian Nation fishers. Currently, tribal fishers deploy gillnets and drift with the tide, taking turns sweeping through segments of Grays Harbor that typically extend as far as Cosmopolis to the Crossover Channel Reach of the navigation channel (Chapter 3, Figure 3.12-1). This area includes the portion of the navigation channel in front of the Terminal 1 berth. Depending on its size, a docked vessel would occupy approximately 20 to 25% of the width of the channel.[22] While a vessel is at berth, fishers cannot extend fishing nets as far and cannot access the areas nearest the dock structure where tribal fishers report that fish concentrate (Quinault Indian Nation 2015: Exhibit E). Lighting impacts from nighttime transfer operations may also affect fish behavior and harvest.

The most intensive fishing at the dock area is during the fall salmon management period from September to mid-November, when several fishing vessels may deploy drift gillnets near the Terminal 1 berth. Quinault Indian Nation fishers may also fish the area during other times of the year, deploying gillnets for winter steelhead, spring Chinook salmon, and white sturgeon in spring and summer.

Cumulative vessel calls to Terminal 1 at maximum throughput would occupy the berth a maximum of 363 days per year[23] (Section 6.5.6, *Vessel Traffic*). During periods of maximum catch for Chinook,

[22] The typical 550-class tank barge is approximately 600 feet long and a maximum of 78 feet wide and is assisted by a tug that is approximately 127 feet long and a maximum of 42 feet wide. A Panamax-class tanker has a maximum overall length of 950 feet and a maximum width of approximately 106 feet.
[23] Assumes all vessels are tank barges with a maximum 24-hour berth occupancy.

coho, or chum salmon, the fall fishery may be open 2 to 4 days per week. Assuming a 24-hour maximum berth occupancy and vessels evenly dispersed over the allowed harvest times, it is likely a vessel would be at the dock during a substantial portion of the fishery season. However, the potential of these vessels to affect treaty catch is dependent on how fish are distributed across the navigation channel relative to the remaining channel area available to treaty fishers.

Salmon concentrate next to the dock along Terminal 4 (Quinault Indian Nation 2015: Exhibit E); however, the navigation channel is narrower at Terminal 1 and salmon may be distributed differently at this location compared to the wider channel and adjacent shallow areas leading to the south channel at Terminal 4. Migration patterns of salmon in estuaries and rivers are complex. Hinch and Rand (2000) found evidence to suggest sockeye salmon were efficient at finding small reverse-flow vortices to increase swimming efficiencies during upstream migration. Generally upstream-migrating salmon avoid fast water by swimming near the shore and near the bottom (Quinn 2005:80). Hughes (2004) hypothesized that Chinook salmon migrate further from the bank than sockeye to avoid wave drag caused by swimming close to the surface in shallow waters. However, all species may distribute similarly in the dredged and tidally influenced navigation channel.

Depending on the specific circumstances of each interaction (e.g., chance of a vessel calling during an open tribal fishing season, time the vessel is at the dock, distribution of the fish, number of fishers on any given day), it is difficult to predict how much increased occupancy at Terminal 1 would affect the tribe's ability to meet the treaty allocation under their current practices. If vessels occupy the Terminal 1 berth up to 100% of the time during the fall fishery, Quinault Indian Nation fishers would not have the option to fish along the dock. Fishery openings in the fall are sometimes managed to harvest specific species within short windows of opportunity. Opportunities to relocate during intense fishing periods may be limited if the other areas are occupied by fishers. Additionally, gillnets used by fishers may be designed for one location and not appropriate for another location. Implementation of the mitigation described in Chapter 3, Section 3.12, *Tribal Resources,* to coordinate docking schedules and limit vessel time at the dock to avoid peak fishing openings could reduce potential impacts on treaty tribal fishing.

Docked vessels at other times of the year (i.e., winter, spring, and summer fishery openings) would likely have less impact because fewer fishers are participating in fish harvest. Fishers would, therefore, likely have more options to adjust their fishing efforts to other areas in Grays Harbor and the Chehalis River.

Rail Transport

As noted in Chapter 3, Section 3.12, *Tribal Resources*, the proposed action could affect tribal resources along the PS&P rail line if rail operations were to degrade or limit access to resources used by the tribes.

As described in Chapter 3, *Affected Environment, Impacts, and Mitigation,* impacts on water, plants, and animals from routine rail transport are expected to remain low for the reasons noted in Sections 3.3, *Water*, 3.4, *Plants*, and 3.5, *Animals.* Specifically, spills and leaks would be minimized through best management and good housekeeping practices. Any minor spills or leaks would most likely be contained within the underlying ballast rock. Because these factors would similarly apply to rail transport related to the cumulative projects, although the potential increase of small leaks and spills would be slightly greater than under the no-action alternative due to increased rail trips, the potential cumulative impacts on plants, wildlife, or fisheries from contaminated stormwater runoff

are expected to remain low. Cumulative impacts from increased risk of oil spills, fires, and explosions that could affect tribal resources are addressed Section 6.5.7, *Environmental Health and Safety.*

Increased rail traffic and the associated routine operations activities related to the cumulative projects—an additional 4.25 trips per day on average along the PS&P rail line to the baseline three trips per day—could affect animals along the PS&P rail line as the result of increased noise, potential for animal mortality (collisions with moving trains), and exposure to pollutants (spills). These impacts could, in turn, affect the number of animals available for take by hunters from the Quinault Indian Nation and Confederated Tribes of the Chehalis Reservation. These potential impacts on wildlife from increased rail traffic under the proposed action are addressed in detail in Chapter 3, Section 3.5, *Animals*.

Noise from additional trains would likely be imperceptible and would not likely affect species populations or fitness. Animals that feed on carrion, use the rail line as a movement corridor, or use habitats adjacent to the rail line could have an increased incidence of collision mortality. A potential secondary effect of animal collision mortality is the loss of any dependent offspring. While these animals may be habituated to the movement of existing trains, increased rail traffic under the cumulative projects is expected to proportionally increase animal mortality compared to the no-action alternative. This proportional increase in mortality is not likely to measurably alter species populations or fitness. Increased rail trips along the PS&P rail line related to the cumulative projects would increase average vehicle delay compared to the no-action alternative, which could affect access to tribal resources. However, as stated in Chapter 3, Section 3.12, *Tribal Resources*, for the majority of the PS&P grade crossings, the increase in crossing blockage time would not result in a substantial decline in vehicle delay compared to the no-action alternative because the potential to encounter a train at any crossing for the average vehicle would be low.

Cumulative risks of incidents are addressed in Section 6.5.7, *Environmental Health and Safety*.

Vessel Transport

As noted in Chapter 3, Section 3.12, *Tribal Resources*, the proposed action could affect tribal resources in Grays Harbor if vessel operations were to degrade or limit access to resources used by the tribes, including the plants and fisheries described in Section 3.12.

As described in Chapter 3, *Affected Environment, Impacts, and Mitigation,* impacts on water, plants, and animals from routine vessel transport are expected to remain low for the reasons noted in Sections 3.3, *Water*, 3.4, *Plants*, and 3.5, *Animals.* Specifically, spills and leaks would be minimized through best management and good housekeeping practices. Any minor spills or leaks would most likely be contained within confined areas of the vessel. Because these factors would similarly apply to vessel transport related to the cumulative projects, although the potential increase of small leaks and spills would be slightly greater than under the no-action alternative due to increased vessel trips, the potential cumulative impacts on plants, wildlife, or fisheries from contaminated stormwater runoff are expected to remain low. Cumulative impacts from increased risk of oil spills, fires, and explosions that could affect tribal resources are addressed Section 6.5.7, *Environmental Health and Safety.* As further noted in Section 3.12, vessel operations could disrupt access to usual and accustomed fishing areas if there are fishers in the navigation channel when a vessel is traveling to and from the project site. If the cumulative projects are approved, the number of vessels traveling

in the navigation channel through usual and accustomed fishing areas would increase further compared to the existing conditions.[24]

Operation of the cumulative projects at maximum throughput would result in a maximum additional 758 tank vessel trips[25] per year through the navigation channel. These vessel trips would be added to projected large commercial vessel[26] trips under the no-action alternative—between 324 and 422 trips[27] per year in 2017 and 2037, respectively, associated with ongoing operations at the Port terminals (Section 6.5.6, *Vessel Traffic*). Resulting total projected vessel trips would range from 1,082 in 2017 to 1,180 in 2037, when considering both the existing and the cumulative projects.

Because cumulative vessel traffic would be limited to the navigation channel (Chapter 3, Section 3.17, *Vessel Traffic*), impacts on tribal resources in Grays Harbor but outside the navigation channel are not expected. The cumulative projects would use Terminals 1 and 3, and would not affect drift and set-net gillnet fishers operating east of Terminal 1 and the turning basin, in the south channel near Markham, and in Area 2C (Chapter 3, Figure 3.17-5). Crab fishing grounds in Grays Harbor are outside of the navigation channel and access to those areas would not be affected by the increase in vessel traffic. Resources important to the Confederated Tribes of the Chehalis Reservation would also not be affected, because all tribal fishing occurs within the Chehalis Reservation.

Cumulative vessel trips would be most likely to conflict with tribal fishing during the fall salmon management period, when more fishers typically deploy drift gillnets in the navigation channel from the Crossover Channel Reach to the turning basin. During peak periods of the fall fishery, up to nine boats may be actively fishing this area and two to four fishers with nets deployed at one time (Quinault Indian Nation 2015:10). Increased vessel traffic would increase the chance that a vessel travelling through this area would disrupt tribal fishing.

As described in Section 3.17, *Vessel Traffic*, it takes approximately 2 hours for vessels to transit the navigation channel between the entrance buoy and Terminal 1. Favorable transit times for vessels related to the proposed action are close to high tide. Quinault Indian Nation fishers currently choose the high slack tide period for salmon drift gillnetting. Assuming the vessel is between the Crossover Channel Reach of the navigation channel and Terminal 1 for approximately half of the 2-hour transit time, including docking and undocking maneuvers, a vessel trip could disrupt fishing for a 1-hour period. The time Quinault Indian Nation fishers are not fishing to avoid a vessel would likely be longer to ensure adequate time to retrieve their nets, particularly if the nets are full of fish during peak fishing times.

Transiting vessels related to the cumulative projects would affect (limit) the timing, duration, and physical area that could be fished. Depending on the specific circumstances of the interaction, this could affect the volume of a day's catch. Depending on factors such as the time of day and number of other fishers, disruption could equate to lost fishing opportunities.

Although it is difficult to predict whether the increased vessel traffic would result in an overall inability to meet the tribe's seasonal quota, increased traffic would limit access to usual and

[24] As noted in Chapter 3, Section 3.16, *Vessel Traffic*, the analysis in this Draft EIS considers the potential growth in vessel traffic unrelated to the proposed action between 2017 and 2037. Projected traffic increases were based on growth rates used in the Grays Harbor Channel Deepening Project.
[25] A trip represents one-way travel.
[26] The term *large commercial vessel* refers collectively to tank and cargo vessels.
[27] Cumulative increase in trips does not reflect REG no-action vessels, because proposed action number is total for facility.

accustomed fishing areas with a greater potential to do so under cumulative conditions. Implementation of the mitigation described in Chapter 3, Section 3.12, *Tribal Resources*, to coordinate docking schedules and limit vessel transits during peak fishing seasons could reduce these potential impacts.

Increased vessel trips could also reduce access to the Quinault Indian Nation's ocean crab and marine fisheries by limiting the times when tribal fishers can cross the bar at the mouth of Grays Harbor and limiting access to the navigation channel, which tribal fishers prefer to use when transporting catch into the harbor. Although laden tank vessels are anticipated to transit out of the harbor during high tide, inbound vessels in ballast could transit the navigation channel at any time. To lessen the danger of hazardous conditions during incoming or outgoing tides, bar crossings are often timed during slack high or low tides. It is likely this disruption would not be substantial because smaller Quinault Indian Nation fishing vessels would be able to maneuver around and avoid the transiting tanker vessels.

Quinault Indian Nation fishers participating in the Dungeness crab fishery inside Grays Harbor would not be affected by cumulative vessel trips because they operate outside the navigation channel and monitor marine communications to avoid larger vessels when transiting to fishing grounds.

6.5.3.3 Mitigation Measures

Implementation of the applicant mitigation measures identified in Chapter 3, Section 3.12, *Tribal Resources*, would also reduce cumulative impacts.

6.5.3.4 Unavoidable and Significant Adverse Environmental Impacts

Implementation of the mitigation measures described in Chapter 3, Section 3.12 would reduce but may not completely eliminate impacts on tribal resources. Specifically, vessels related to the cumulative projects would travel through and dock in usual and accustomed fishing areas in Grays Harbor. Under current and future conditions, increased vessel activity could restrict access to tribal fishing areas in the navigation channel or at Terminal 1. This conflict is most likely during harvests of salmon, steelhead, and sturgeon. Because other factors besides vessel operations affect fishing opportunities, such as the number of fishers, fish distribution, timing, and duration of fish windows, the extent to which vessel operations related to the cumulative projects would affect tribal fishing is difficult to quantify. Cumulative impacts related to increased risk of incidents and related consequences are addressed in Section 6.5.7, *Environmental Health and Safety*.

6.5.4 Rail Traffic

This section discusses potential cumulative impacts on rail traffic that would result from construction and operation of the cumulative projects.

6.5.4.1 Study Area

The cumulative impacts study area for rail traffic consists of the PS&P rail line between Centralia and the project sites, including the PS&P junction with the BNSF main line in Centralia that could be affected during rail transport.

6.5.4.2 Cumulative Impacts

The following section describes the rail traffic, capacity, and grade-crossing occupancy impacts that could result from the routine operation of the cumulative projects. Cumulative impacts are not anticipated for construction of the cumulative projects.

Rail Traffic

Operation of the cumulative projects at maximum throughput would add 1,553 unit train trips per year (4.25 trips per day on average) along the PS&P rail line to the approximately 1,100 train trips per year (three trips per day on average) under the no-action alternative (Chapter 3, Section 3.15, *Rail Traffic*). Rail traffic from the cumulative projects at maximum throughput added to baseline rail traffic would equal approximately 7.35 trips[28] per day on the PS&P rail line. Table 6-10 summarizes the anticipated trips for the cumulative projects.

Table 6-10. Average Unit Train[a] Trips—Cumulative Projects

Project	Daily
Proposed action	1.25
REG project	2
Grays Harbor Rail Terminal Project	1
Existing traffic	3.1
Total	**7.35**

[a] Assumes 120-car unit trains (1.25 miles in length).

Capacity for Additional Trains

Based on simulation modeling (Chapter 3, Section 3.15, *Rail Traffic*), the PS&P rail line currently has the capacity to handle up to 12 trips per day, although, as with the existing traffic, delays along the rail line may occur. Current rail traffic along the PS&P rail line is approximately three trips per day. The addition of approximately 4.25 trips per day between Centralia and the project site can be accommodated without any improvements to the existing rail line.

Grade-Crossing Occupancy Times

Increased rail traffic along the PS&P rail line related to the cumulative projects would increase how often trains delay traffic at grade crossings (grade-crossing occupancy times).

The far-right column of Table 6-11 lists the average daily grade-crossing occupancy time at selected grade crossings between Centralia and east Aberdeen for all rail traffic (existing trains and trains from the cumulative projects) compared to the no-action alternative. These grade crossings are among those with the highest average daily traffic in the rail corridor (the other grade crossings are in Aberdeen).

[28] A trip represents one-way travel; in other words, an inbound trip and an outbound trip are counted as two trips.

Table 6-11. Average Daily Occupancy Time[a] for a Single Train at Selected Grade Crossings between Centralia and East Aberdeen—Cumulative Projects

Grade Crossing	Milepost	Location	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Tower Street (SR 507)	0.82	Centralia	26 minutes	1 hour 8 minutes
Pearl Street (SR 507)	0.89	Centralia	26 minutes	1 hour 8 minutes
West Reynolds Street	2.14	Centralia	17 minutes	53 minutes
Old Highway 99 SW	6.07	Unincorporated Thurston County	8 minutes	30 minutes
Monte Elma Road	51.98	Satsop	7 minutes	23minutes

[a] Occupancy times rounded to the nearest minute.
SR = State Route

As described in Chapter 3, Section 3.15, *Rail Traffic*, train occupancy times are most severe in Aberdeen due to switching operations related to Poynor Yard. Table 6-12 illustrates the maximum daily occupancy times for all trains (existing trains and trains from the cumulative projects) compared to the no-action alternative at selected grade crossings in Aberdeen.

Table 6-12. Maximum Daily Occupancy Time[a] for a Single Train at Selected Grade Crossings in Aberdeen—Cumulative Projects

Grade Crossing	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Fleet Street	37 minutes	45 minutes
East Heron Street	44 minutes	52 minutes
Port Industrial Road	9 minutes	58 minutes
West 1st Street	7 minutes	1 hour 7 minutes
Industrial Road	13 minutes	1 hour 17 minutes

[a] Occupancy times rounded to the nearest minute.

Unit train trips would increase the maximum train occupancy times for a single train at all grade crossings in Aberdeen. For example, the maximum train occupancy time at West 1st Street would increase by 1 hour. The increase in occupancy times at the grade crossings east of Poynor Yard would be from switching operations to build up departing trains at and east of Poynor Yard. The increase in train occupancy times at the grade crossings west of Poynor Yard would be from arriving trains and switching operations to break down trains at the west of Poynor Yard.

Unit train trips for the cumulative projects would also increase the frequency of trains occupying grade crossings in Aberdeen. Table 6-13 illustrates the average daily train occupancy time at selected grade crossing for all trains (existing trains and trains from the cumulative projects). Appendix L, *Vehicle Traffic Analysis*, provides the daily occupancy time at all grade crossings.

Table 6-13. Average Daily Train Occupancy Time[a] at Selected Grade Crossings

Grade Crossing	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Fleet Street	49 minutes	2 hours 38 minutes
East Heron Street	1 hour 10 minutes	3 hours 16 minutes
Port Industrial Road	14 minutes	1 hour 58 minutes
West 1st Street	17 minutes	2 hours 19 minutes
Industrial Road	43 minutes	3 hours 23 minutes

[a] Occupancy times rounded to the nearest minute.

The additional trains from the cumulative projects would substantially increase the average daily occupancy at grade crossings in Aberdeen. For example, the East Heron Street grade crossing is currently occupied on average 1 hour and 10 minutes daily from grain, auto, and mixed carload freight trains. With existing trains and additional trains from the cumulative projects, the East Heron Street crossing would be occupied on average 3 hours and 16 minutes daily. Section 6.5.5, *Vehicle Traffic and Safety*, presents potential impacts on vehicle delay from the cumulative projects.

6.5.4.3 Mitigation Measures

Impacts on rail traffic resulting from the construction and routine operation of the cumulative projects are considered low and would not necessitate mitigation beyond the minimum requirements specified by applicable laws and regulations. Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, presents mitigation measures for vehicle delay impacts at grade crossings. Chapter 4, *Environmental Health and Safety*, presents rail safety mitigation measures.

6.5.4.4 Unavoidable and Significant Adverse Environmental Impacts

The cumulative projects would result in an increase in rail traffic on the PS&P line; however, there would be sufficient capacity to accommodate this increase in rail traffic. There would be no unavoidable and significant adverse impacts on rail traffic related to the cumulative projects. Cumulative impacts on vehicle traffic and safety that could result from increased rail traffic are addressed in Section 6.5.5, *Vehicle Traffic and Safety*. Cumulative impacts related to increased risk of rail incidents and related consequences are addressed in Section 6.5.7, *Environmental Health and Safety*.

6.5.5 Vehicle Traffic and Safety

This section discusses potential cumulative impacts on vehicle traffic and safety that would result from construction and operation of the cumulative projects.

6.5.5.1 Study Area

The cumulative impacts study area for vehicle traffic and safety consists of the roadways and intersections near the project sites that could be affected by increased vehicle traffic from construction and operation of the cumulative projects. The study area also includes grade crossings between Hoquiam and Centralia that could be affected by increased rail traffic.

6.5.5.2 Cumulative Impacts

The following section describes the vehicle traffic and safety impacts that could result from the construction and routine operation of the cumulative projects.

Onsite Construction and Operations

Construction and operation of the cumulative projects would generate traffic to and from each project site during construction. The estimated daily construction vehicle trips generated for the proposed action and REG project are presented in Table 6-14. The Grays Harbor Rail Terminal project operations would also generate vehicle trips on area roadways. However, the project site is located at Terminal 3 approximately 3 miles to the west of the REG project and proposed action project sites. Any Grays Harbor Rail Terminal Project construction traffic in the Terminal 1 area including Industrial Road would have negligible impacts on vehicle delay.

Table 6-14. Estimated Daily Construction Vehicle Trips—Proposed Action and REG Project

Project	Estimated Number of Employees	Approximate Number of Vehicle Trips per Day
Proposed Action		
Phase 1	86	172
Phase 2	49	98
REG Project		
Phase 1	76	152
Phase 2	110	220

Up to approximately 196 construction workers could access the project sites (Phase 1 of the proposed action and Phase 2 of the REG project). This would generate approximately 392 construction vehicle trips each day, or approximately 7% of the average daily traffic on Industrial Road. This increase in traffic would be temporary and limited to the construction period. Construction vehicles would park at or near the project sites in the Port area and would not affect vehicle delay on Industrial Road.

After construction, approximately 160 trips would be generated daily at the project sites (approximately 100 trips with the proposed action and 60 trips with the REG project, assuming two trips per day per employee). This increase in employee vehicle trips would result in approximately 3% increase in average daily traffic on Industrial Road near the project sites. This increase is minimal compared to existing traffic conditions and would not result in a decrease to the level of service (LOS) designation on Industrial Road.

Rail

The following section describes vehicle traffic and safety impacts that could occur as a result of additional rail traffic from the cumulative projects.

Vehicle Delay

Rail traffic from the cumulative projects would increase the number of train trips on the PS&P rail line by an average of approximately 4.25 trips per day. Motorists, including emergency vehicle operators, would experience delays and an increase in vehicle delay at grade crossings.

Average Vehicle Delay

Increased rail traffic along the PS&P rail line related to the cumulative projects would increase average vehicle delay. However, for the majority of the PS&P rail line grade crossings, the increase in blockage time would not result in a decline in the LOS because the average daily traffic for a majority of grade crossings is low. Sixty of the 81 public grade crossings have average daily traffic of fewer than 900 vehicles.

The approximate total vehicle delay in 2017 in a 24-hour period for grade crossings between west of Centralia and east of Aberdeen would vary from approximately 19 to 56 minutes daily, depending on the grade crossing, compared to 7 to 17 minutes under the no-action alternative. Therefore, the total blockage time at grade crossings due to the cumulative project trains would increase by approximately 12 to 39 minutes in a 24-hour period. Even though there would be an increase in total daily vehicle delay, an increase in train trips on the PS&P rail line would not substantially increase the average vehicle delay at most PS&P rail line grade crossings compared to the no-action alternative. This is because vehicle traffic along most of the PS&P rail line is relatively low and the chance of a substantial number of vehicles encountering a train would remain relatively low. In other words, most individual drivers would not likely notice a substantial change in delay at grade crossings.

However, the total blockage time would be greater in Centralia and Aberdeen. As shown in Table 6-10 in Section 6.5.4, *Rail Traffic*, the Tower Street and Pearl Street grade crossings in Centralia would be blocked for approximately 1 hour and 8 minutes each day compared to 26 minutes under the no-action alternative. Aberdeen would also experience increases in delay as shown in Table 6-12. For example, the Port Industrial Road grade crossing would be blocked for 1 hour and 58 minutes compared to 14 minutes under the no-action alternative.

Table 6-15 summarizes the average vehicle delay in 2017 at the grade crossings with the highest average daily traffic.[29] Appendix L, *Vehicle Traffic Analysis*, provides the average vehicle delay at all grade crossings in 2017. Because these grade crossings have the highest average daily traffic, vehicles at these crossings have the highest probability to experience vehicle delay.

[29] See Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, for the methods used to determine average vehicle delay and corresponding LOS.

Table 6-15. Level of Service (Average Vehicle Delay) at Selected Grade Crossings (2017)

Grade Crossing	Milepost	Location	Approximate 2017 Average Daily Traffic	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Tower Street (SR 507)	0.82	Centralia	8,025	A	B
Pearl Street (SR 507)	0.89	Centralia	13,755	A	B
West Reynolds Street	2.14	Centralia	6,380	A	A
Old Highway 99 SW	6.07	Unincorporated Thurston County	10,160	A	A
Monte Elma Road	51.98	Satsop	4,770	A	A
Tyler Street	68.23	Aberdeen	4,050	B	F
South Chehalis Street	68.36	Aberdeen	4,905	C	F
Port Industrial Road	70.06	Aberdeen	17,845	A	D
West 1st Street	70.41	Aberdeen	4,625	A	E
Industrial Road	71.04	Aberdeen	5,795	B	F

SR = State Route

As shown in Table 6-15, grade crossings in Aberdeen (Olympic Gateway Plaza area and the Port of Grays Harbor area) would experience the most substantial increase in average vehicle delay with the addition of cumulative project trains on the PS&P rail line. All grade crossings that would operate at or below LOS D in 2017 are in Aberdeen. These grade crossings are in two general areas.

- **Olympic Gateway Plaza area.** As illustrated in Figure 6-5, average vehicle delay would worsen at the Olympic Gateway Plaza compared to the no-action alternative. As described in Chapter 3, Section 3.15, *Rail Traffic*, existing train-building activities at Poynor Yard require eastbound trains to extend across the Wishkah River bridge and block grade crossings in the Olympic Gateway Plaza area. The additional trains from the cumulative projects would lengthen the average vehicle delay at these grade crossings. LOS at the East Heron Street and Newell Street grade crossings, the western-most grade crossings in the Olympic Gateway Plaza area, would degrade from LOS D to LOS F. The grade crossings east of Newell Street at the Olympic Gateway Plaza area would degrade from LOS B or C to LOS E or F.
- **Port of Grays Harbor area.** As illustrated in Figure 6-6, the West 1st Street, North Maple Street, and Industrial Road grade crossings would operate at LOS E or F. These grade crossings would operate at LOS A or B under the no-action alternative. The Port Industrial Road and West 1st Street grade crossings would operate at LOS D.

Figure 6-5. 2017 Cumulative Vehicle Delay at Selected Grade Crossings East of Poynor Yard

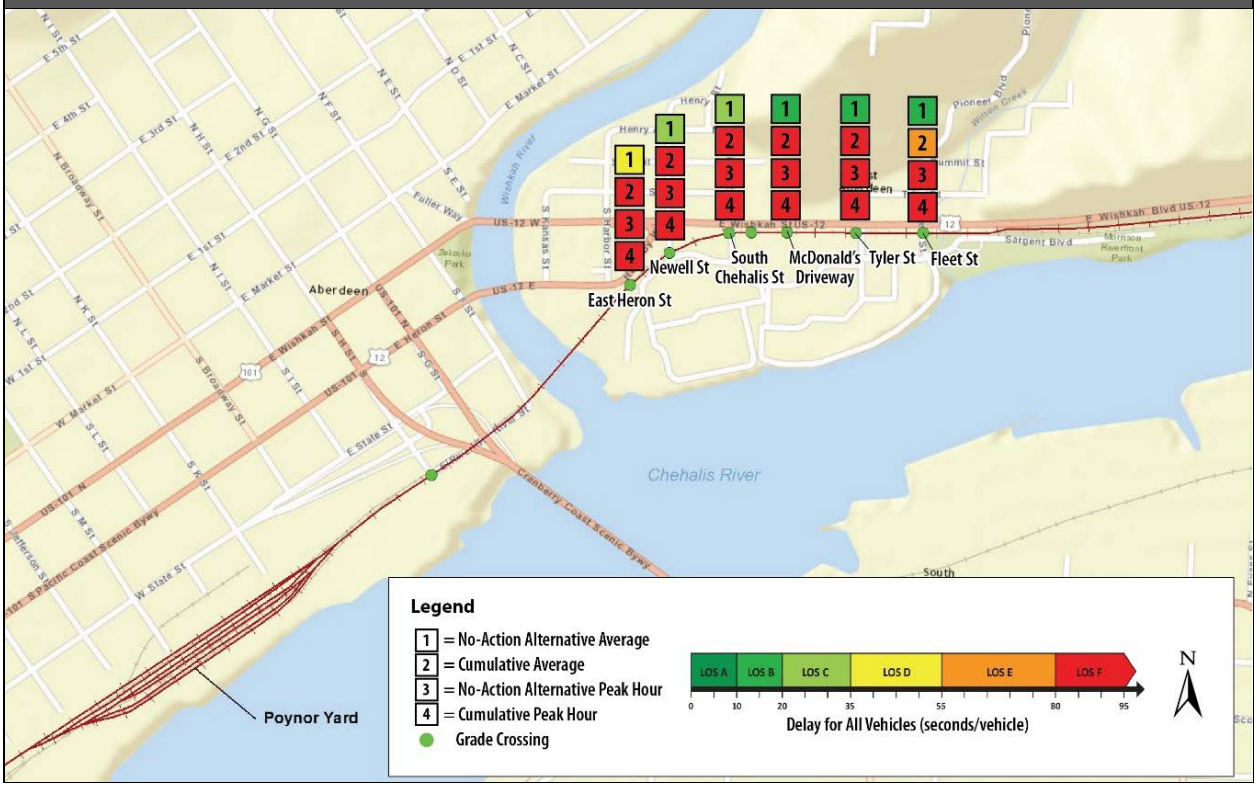
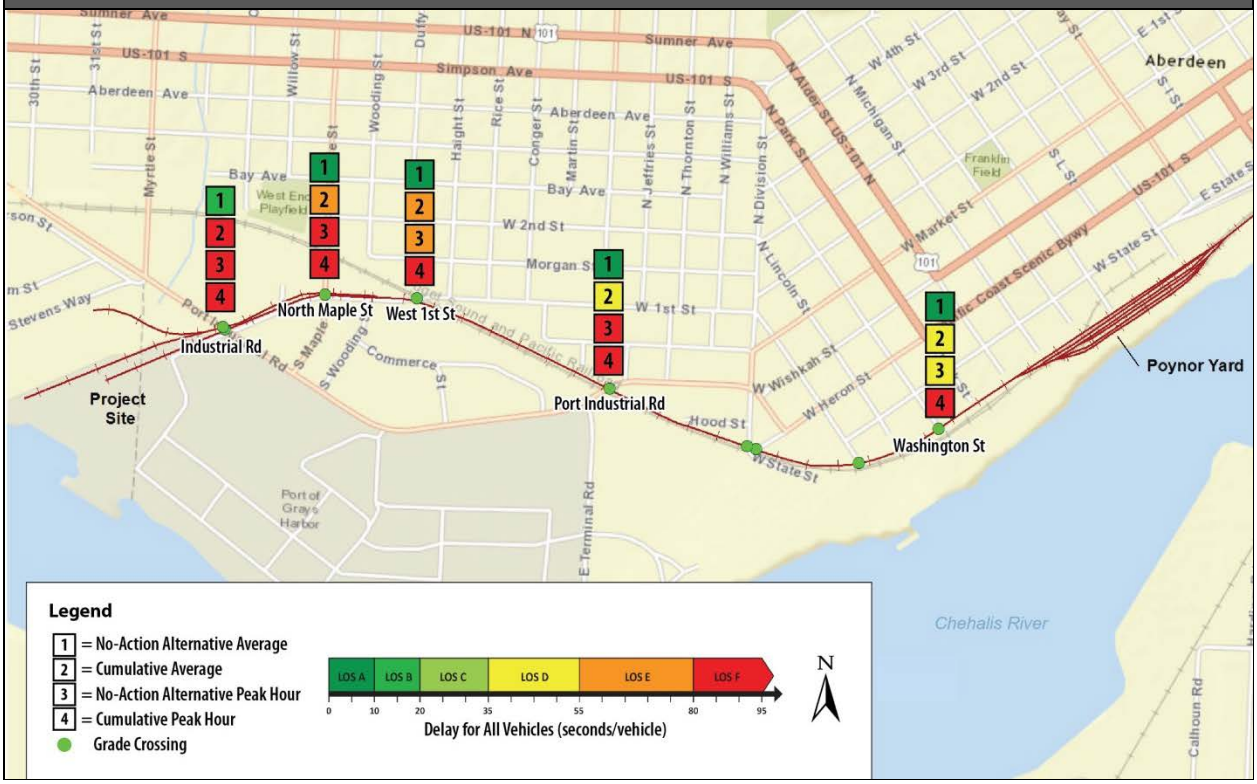


Figure 6-6. 2017 Cumulative Vehicle Delay at Selected PS&P Line Crossings West of Poynor Yard



As noted in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, this analysis represents a conservative analysis for the average vehicle in 2017 because the analysis is based on the following assumptions.

- **Maximum throughput.** The cumulative projects would begin full throughput operations of an average of 4.25 trips (maximum throughput) per day in 2017.
- **No trip diversion**. The vehicle delay analysis did not consider trip diversion (alternative routes for automobile traffic). Including trip diversion in the analysis would likely indicate shorter average vehicle delays at the Port area grade crossings because at some locations other routes would avoid crossing the PS&P rail line.
- **No planned rail infrastructure.** New infrastructure implemented in 2017 that could provide for increased train speeds (Chapter 3, Section 3.15, *Rail Traffic*) could reduce vehicle delay at grade crossings. Infrastructure improvements were not included in the analysis.
- **Most impactful switching operations for the REG project**. Switching operations for the REG project assumes that PS&P would deliver rail cars to the project site in the most cost- and time-efficient manner. This method would increase the time that REG project trains would block the grade crossing between Poynor Yard and the REG project site.

Because the population is forecasted to grow, vehicle traffic volumes at the grade crossings will increase over time. Table 6-16 summarizes the predicted average vehicle delay at the grade crossings with the highest average daily traffic in 2037. Appendix L, *Vehicle Traffic Analysis*, provides the average vehicle delay at all grade crossings in 2037. Because these grade crossings have the highest average daily traffic, vehicles at these grade crossings have the highest probability to experience vehicle delay at grade crossings.

Table 6-16. Level of Service (Average Vehicle Delay) at Selected Grade Crossings (2037)

Grade Crossing	Mile-post	Location	Approximate 2037 Average Daily Traffic	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Tower Street (SR 507)	0.82	Centralia	10,375	A	B
Pearl Street (SR 507)	0.89	Centralia	17,790	A	B
West Reynolds Street	2.14	Centralia	8,250	A	A
Old Highway 99 SW	6.07	Unincorporated Thurston County	13,135	A	A
Monte Elma Road	51.98	Satsop	6,170	A	A
Tyler Street	68.23	Aberdeen	5,235	A	D
South Chehalis Street	68.36	Aberdeen	6,345	B	D
Port Industrial Road	70.06	Aberdeen	23,075	A	E
West 1st Street	70.41	Aberdeen	5,980	A	E
Industrial Road	71.04	Aberdeen	7,495	B	F

SR = State Route

Similar to 2017 conditions, all grade crossings that would operate below LOS D in 2037 along at grade crossings are in Aberdeen.

- **Olympic Gateway Plaza area.** As described in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, the average vehicle delay would decrease between 2017 and 2037 in east Aberdeen (Olympic Gateway Plaza area) because of infrastructure improvements to the Wishkah River bridge that would allow speeds to increase from 5 up to 25 miles per hour. Trains would move through grade crossings faster, thereby reducing vehicle delay at east Aberdeen grade crossings. LOS would improve at all the grade crossings between South Chehalis Street and Fleet Street grade crossings with the increase in speeds. In addition, future roadway improvements could further improve congestion and improve LOS in the Port and surrounding area. For example, possible options to alleviate congestion along US Route 12 (US 12) in Aberdeen related to the East Aberdeen Mobility Project are under consideration, including the creation of grade-separated crossings; however, because a preferred alternative has not yet been determined and funding has not been identified, this project was not considered in transportation modeling.
- **Port of Grays Harbor area.** All grade crossings between Port Industrial Road and the proposed action and REG project sites would operate at LOS E or F indicating substantial delay for the average vehicle. Port Industrial Road would degrade from LOS D to E between 2017 and 2037 due to the forecasted traffic growth.

Peak Hour Vehicle Delay

To describe the greatest impacts that could occur under cumulative conditions, an analysis of vehicle delay during the peak traffic hour was completed. The peak traffic hour is the hour of the day when the highest number of vehicles travel study area roads. The peak hour vehicle delay assumes the longest train under cumulative conditions would operate during the peak hour. Because unit trains related to the cumulative projects would have the same number of rail cars and would be longer than existing trains, the cumulative vehicle delay would be the same as the proposed action, as presented in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*. Table 6-17 summarizes peak hour vehicle delay at the grade crossings with the highest average daily traffic.

Table 6-17. Level of Service (Peak Hour Vehicle Delay) at Selected Grade Crossings (2017)

Grade Crossing	Milepost	Location	No-Action Alternative	Cumulative Projects plus No-Action Alternative
Tower Street (SR 507)	0.82	Centralia	F	F
Pearl Street (SR 507)	0.89	Centralia	F	F
West Reynolds Street	2.14	Centralia	C	D
Old Highway 99 SW	6.07	Unincorporated Thurston County	C	D
Monte Elma Road	51.98	Satsop	A	B
Tyler Street	68.23	Aberdeen	F	F
South Chehalis Street	68.36	Aberdeen	F	F
Port Industrial Road	70.06	Aberdeen	F	F
West 1st Street	70.41	Aberdeen	E	F
Industrial Road	71.04	Aberdeen	F	F

SR = State Route

The peak hour vehicle delay would be most substantial in Centralia and Aberdeen. In Aberdeen, rail operations on the PS&P rail line are heavily influenced by activities related to Poynor Yard, as described in Section 6.5.4, *Rail Traffic*. Peak hour vehicle delay can be summarized as follows.

- Centralia: Similar to the no-action alternative, the Tower Street and Pearl Street grade crossings would operate at LOS F. The H Street grade crossing would operate at LOS E.
- Olympic Gateway Plaza area: Similar to the no-action alternative, all grade crossings would operate at LOS F (Figure 6-5).
- Port of Grays Harbor area: All grade crossings would operate at LOS F (Figure 6-6).

Therefore, in Aberdeen, the peak hour analysis concluded substantial vehicle delay, with all grade crossings operating at LOS F, from the eastern end of the Olympic Gateway Plaza (Fleet Street) to the Port of Grays Harbor area.

Queueing

Increases to existing traffic delays would occur with an average of 4.25 new rail trips on the PS&P rail line with the cumulative projects. Increased vehicle delay from trains blocking grade crossings would have secondary impacts on nearby intersections. As vehicles begin to queue while waiting for the grade crossing to open, increased roadway congestion can affect upstream intersections. Table 6-18 illustrates the grade crossings that would have queues exceeding available storage length in 2017, as well as the increase in the queue length in number of cars compared to the no-action alternative.

Table 6-18. Average Queue Lengths Exceeding Available Storage Capacity at Grade Crossings—Cumulative Projects (2017)

Grade Crossing	Queue Direction	Queue Location	Increase in Average Queue Length (Number of Cars)[a]
Centralia			
Tower Street (SR 507)	Northbound	SR 507 northbound couplet in central Centralia. Upstream affected intersection is 4th Street.	8
Pearl Street (SR 507)	Southbound	SR 507 southbound in central Centralia. Upstream affected intersection is 6th Street.	23
East Aberdeen/Olympic Gateway Plaza Area[b]			
Fleet Street	Northbound	Exit from Olympic Gateway Plaza at US 12.	8
Tyler Street	Northbound	Exit from Olympic Gateway Plaza at US 12.	9
Chehalis Street	Northbound	Exit from Olympic Gateway Plaza at US 12.	14
Newell Street[c]	Northbound	Exit from Olympic Gateway Plaza at US 12.	1
East Heron Street	Eastbound right-turn lane	Right-turn from US Route 12 eastbound to Olympic Gateway Plaza. Upstream affected intersection is South F Street.	15
Port of Grays Harbor Area[b]			
Port Industrial Road[c]	Eastbound and westbound	Adjacent to applicant's project site. Upstream affected intersection is South and Myrtle Street (Eastbound) and Maple Street (westbound).	25 (eastbound) 33 (westbound)
West 1st Street[c]	Eastbound and westbound	East of the project site and Port Industrial Road. Upstream affected intersection is Maple Street (eastbound) and Haight Street (westbound).	13 (eastbound) 17 (westbound)
Industrial Road[c]	Eastbound and westbound	Adjacent to applicant's project site in Port of Grays Harbor area.	35 (eastbound) 37 (westbound)

[a] Increase in average queue length compared to the no-action alternative. Assumes 20 feet per car. For example, the cumulative average queue length at Fleet Street would be 160 feet longer than the no-action alternative.
[b] Grade crossing location shown on Figures 6-5 and 6-6.
[c] Would not exceed available storage length under the no-action alternative. All other grade crossings exceed available storage length under the no-action alternative.
SR = State Route

Table 6-18 illustrates that, for average queue lengths at the Tower Street and Pearl Street grade crossings in central Centralia, five of the seven Olympic Gateway Plaza area grade crossings and three of the Port area grade crossings would be longer for cumulative conditions than for the no-action alternative. Three intersections would not exceed available storage length under the no-action alternative.

The queue lengths would be substantial at most intersections shown in Table 6-18. In the Port area, the queue lengths would result from switching operations between Poynor Yard and the proposed action and REG project sites, which would increase both the frequency and duration of blocked

grade crossings. Table 6-13 in Section 6.5.4, *Rail Traffic,* illustrates the average daily train occupancy time at selected grade crossings under cumulative conditions. This increase in the average daily train occupancy time would increase vehicle queue lengths.

In the Olympic Gateway Plaza area, queues at the grade crossings at the Olympic Gateway Plaza would extend into the plaza parking area, except at East Heron Street, where queues would extend onto US 12 eastbound. The grade crossing at East Heron Street conflicts with Olympic Gateway Plaza traffic traveling eastbound on US 12, and serves as a bottleneck. During an eastbound train event, the queue would extend past F Street (upstream intersection) on the west side of the Wishkah River. Similar to the vehicle delay analysis, the queuing analysis did not consider trip diversion. Including trip diversion in the analysis would likely indicate shorter average queue lengths at the Port area because there are other routes to avoid the grade crossings.

Average queue lengths in 2037 would increase compared to 2017 queue lengths due to the increase in traffic. Average queue lengths would also increase compared to no-action alternative conditions because of the blockage time associated with the cumulative project trains along the PS&P rail line. The grade crossings that would exceed the available storage length in 2037 would be the same as 2017 (Table 6-18). Appendix L, *Vehicle Traffic Analysis*, illustrates queue lengths at all study intersections. The following summarizes 2037 queue lengths.

- **Centralia.** Queue lengths at Pearl Street and Tower Street grade crossings in Centralia and the Port would grow by approximately 30% between 2017 and 2037.
- **Olympic Gateway Plaza area.** Queue lengths at grade crossings in the Olympic Gateway Plaza area in east Aberdeen would increase by approximately 10% between 2017 and 2037. The analysis assumed rail infrastructure improvements would improve train speeds in this area and reduce the amount of time trains occupy grade crossings in east Aberdeen by 2037.
- **Port of Grays Harbor area.** Queue lengths at the Port Industrial Road, West 1st Street, and Industrial Road grade crossings would increase by approximately 30% between 2017 and 2037.

Solutions being evaluated by ongoing regional planning efforts (such as the East Aberdeen Mobility Project) would alleviate some of the vehicle delay impacts related to the cumulative projects if such improvements are funded and implemented by 2037. Further regional efforts to evaluate the potential for additional storage capacity would also help to mitigate increased delay at those locations.

Vehicle Safety

Increased rail traffic related to the cumulative projects could increase the frequency of accidents along the PS&P rail line compared to the no-action alternative. The magnitude of the increase would be determined by the volume of train traffic and average daily traffic. The impacts on grade-crossing safety specific to each grade crossing for accidents involving trains and vehicles are summarized in Appendix L, *Vehicle Traffic Analysis.* This appendix provides the total predicted accident rate, predicted intervals between accidents, and the decrease in years between the predicted intervals in the analysis year (2017 or 2037) for all grade crossings along the PS&P rail line.

In 2017, the grade crossings that would have the shortest predicted intervals between accidents would be in Aberdeen because rail operations east of Poynor Yard (Olympic Gateway Plaza area) and west of Poynor Yard (the Port and surrounding area) would increase the frequency of train passbys at these grade crossings. As with vehicle delay, accident frequencies could improve by 2037

for some grade crossings if improvements such as grade-crossing protections are implemented. Additionally, although infrastructure improvements considered for the East Aberdeen Mobility Project were not included in the safety analysis, any improvements would likely lessen delay and improve safety at grade crossings in the Olympic Gateway Plaza area.

The *Railroad-Highway Grade Crossing Handbook–Revised Second Edition* (Federal Railroad Administration 2007) indicates that active devices with automatic gates should be considered when certain criteria are met. One criterion is if the expected accident frequency, as calculated by the U.S. Department of Transportation Accident Prediction formula, exceeds 0.075. As shown in Appendix L, *Vehicle Traffic Analysis*, no grade crossings would exceed this frequency using this formula. Therefore, using this threshold, the relative increase in the potential for accidents related to the proposed action would remain low.

Emergency Vehicle Access

As described in the vehicle delay analysis, average vehicle and peak hour delay would increase with the additional trains resulting from the cumulative projects. Because vehicle delay would increase, emergency vehicle delay would also increase at grade crossings. The following sections describe the impacts on emergency vehicle access, focused on the PS&P rail line between Centralia and Aberdeen, in Centralia, and in Aberdeen (Olympic Gateway Plaza and Port of Grays Harbor areas).

Between Centralia and Aberdeen

For the grade crossings between west Centralia and east Aberdeen, the average vehicle delay from rail traffic from the cumulative projects would increase compared to the no-action alternative. The cumulative projects would add an average of 4.25 unit train trips per day. The projected 2017 cumulative daily grade-crossing delay for all trains between west of Centralia and east of Aberdeen would be between approximately 19 and 56 minutes daily compared to between 7 and 17 minutes under the no-action alternative (Appendix L, *Vehicle Traffic Analysis*, provides daily grade crossing blockage times for all grade crossings). Therefore, the average delay at the grade crossings would increase 12 to 39 minutes in a 24-hour period from the additional trains from the cumulative projects.

These trains would affect emergency response times if an emergency vehicle were blocked at a grade crossing occupied by a train for one of the cumulative projects. The potential for the cumulative projects to affect emergency response would also depend on whether the dispatched emergency vehicle would need to cross the PS&P rail line and the availability of alternative routes if a train were to occupy the grade crossing at the time of the call. Because the frequency of train traffic on the PS&P rail line would increase, the probability of an increase in emergency response time at these grade crossings would also increase. This impact would occur when an emergency vehicle experienced a delay related to a train for the cumulative projects.

Centralia

The grade crossings in Centralia (BNSF main line to Reynolds Street crossing) are located in an urban area with a well-connected roadway network. The projected 2017 daily crossing time at grade crossings in Centralia would be 53 to 68 minutes compared to approximately 17 to 26 minutes under the no-action alternative. Because emergency response providers are located on both sides of the PS&P rail line, similar to existing conditions, emergency response calls could be dispatched to stations that would not be blocked at a grade crossing. Section3.16, *Vehicle Traffic and*

Safety, identifies proposed mitigation measures to reduce impacts on emergency response delay at grade crossings.

Aberdeen

Olympic Gateway Plaza Area (Aberdeen)

All grade crossings in the Olympic Gateway Plaza area (from East Heron Street to Fleet Street) are occupied for more than 35 minutes on average 3.9 times per week from eastbound grain and auto trains under the no-action alternative. Adding eastbound trains from the cumulative projects, these grade crossings would be occupied for more than 35 minutes on average 15.4 times per week.

Vehicle delays in the Olympic Gateway Plaza area are currently substantial because the six grade crossings at the plaza provide the only vehicular emergency access to and from the plaza and Morrison Riverfront Park, immediately east of the plaza. With all cumulative projects, emergency response vehicles would experience more frequent and longer delays to access the Olympic Gateway Plaza area because there is no alternate roadway access to the plaza. The communication and response procedures for providing emergency access to the Olympic Gateway Plaza area if a train is blocking all crossings, described in Chapter 3, Section 3.16, *Vehicle Traffic,* would also apply under the cumulative projects.

Port of Grays Harbor Area (Aberdeen)

Vehicular access west of Poynor Yard and south of the PS&P rail line would be completely blocked on the existing roadways during train transits for the cumulative projects. Emergency vehicle access blockage would be affected in two areas, described as follows.

- **Between Poynor Yard and East of Port Industrial Road.** West of Poynor Yard and east of Port Industrial Road are the Washington Street, Monroe Street, Heron Street, and Division Street grade crossings. These grade crossings would be blocked for approximately 24 minutes when a proposed action train arrives (average of 0.6 times per day), and 51 minutes when a REG project train arrives (average of 1.0 time per day), compared to between 4 and 8 minutes, depending on train type, under the no-action alternative. The alternative route described in Chapter 3, Section 3.16.5.2, *Proposed Action*, could provide access to the industrial land uses south of the PS&P rail line in this area. The proposed mitigation measures identified in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, would also reduce impacts on emergency response related to the cumulative projects.
- **Between Port Industrial Road and the project sites.** All land uses south of the PS&P rail line between the Port Industrial Road grade crossing and the proposed action project site, including Home Depot and the Port, would be blocked from lands north of the PS&P rail line for between approximately 10 minutes and 33 minutes when a proposed action train arrives (average of 0.6 times a day), and between 58 minutes and 1 hour 17 minutes when a REG project train arrives (average of 1.0 time a day). The Port Industrial Road grade crossing would be the first grade crossing that would open to provide vehicular access to this area. The Industrial Road grade crossing would the last grade crossing that would open to provide vehicular access to this area. This blockage of all grade crossings and the isolation of these land uses would substantially affect emergency response in this area. The alternative route described above could also provide access to these Port and commercial properties. The proposed mitigation measures identified in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, would also reduce impacts on emergency response related to the cumulative projects.

6.5.5.3 Mitigation Measures

Implementation of the proposed mitigation measures identified in Chapter 3, Section 3.16, *Vehicle Traffic and Safety*, would also reduce cumulative impacts.

6.5.5.4 Unavoidable and Significant Adverse Environmental Impacts

Implementation of the mitigation measures described in Section 3.16 could reduce impacts on vehicle traffic but average and peak hour vehicle delay at the following grade crossings would remain significant.

- Average hour: All six crossings in the Olympic Gateway Plaza area (Aberdeen) and three crossings (Industrial Road, North Maple Street, and West 1st Street in the Port area (Aberdeen).
- Peak hour: Washington Street in the Port area (Aberdeen).

Addressing vehicle delay at the grade crossings at the Olympic Gateway Plaza area and between Poynor Yard and the project site would require the participation of a broad group of stakeholders in coordination with ongoing regional transportation planning efforts. Ongoing regional transportation planning efforts such as the East Aberdeen Mobility Project could reduce vehicle delay impacts and improve safety conditions at the Olympic Gateway Plaza area. In addition, other regional transportation planning efforts to reduce vehicle delay (such as grade separation, early warning system, and grade-crossing protections) would also help to reduce vehicle delay.

6.5.6 Vessel Traffic

This section discusses potential cumulative impacts on vessel traffic that would result from construction and operation of the cumulative projects.

6.5.6.1 Study Area

The cumulative impacts study area for vessel traffic consists of the Terminal 1 berth and the entirety of Grays Harbor, including the navigation channel into and out of the harbor and travel corridors in state waters out to 3 nautical miles.

As described in Chapter 5, *Extended Rail and Vessel Transport,* the cumulative projects would not have a substantial impact on vessel traffic in the extended study area off the Washington coast. The impact of cumulative vessel traffic on environmental health from increased risk of incidents during vessel transport (e.g., vessel grounding or collision), and related consequences (e.g., oil spills from vessel tank ruptures) is described in Section 6.5.7, *Environmental Health and Safety.*

6.5.6.2 Cumulative Impacts

The following section describes the vessel traffic in Grays Harbor that could result from the construction and routine operation of the cumulative projects.

Construction

As noted in Chapter 3, Section 3.17, *Vessel Traffic*, construction of the proposed action is not anticipated to affect vessel operations because construction would be entirely contained on land and

not in water. This is also true of the cumulative projects. Therefore, the cumulative projects would not result in any cumulative impacts on vessel traffic.

Navigation Channel Capacity

Baseline cargo and tank vessel trips in Grays Harbor are projected to increase from 324 to 422 between 2017 and 2037 due to increased trade of commodities. The cumulative projects would add an additional 758 tank vessel trips carrying crude oil per year to baseline traffic, resulting in a forecast of 1,082 total cumulative trips in 2017 and 1,180 total cumulative trips in 2037 (Table 6-19) for all vessel types.[30]

Table 6-19. Cumulative Vessel Trips per Year—Cumulative Projects

	2017			2037		
Vessel Trips[a]	**Daily**	**Weekly**	**Annual**	**Daily**	**Weekly**	**Annual**
Baseline Conditions						
Cargo vessel	0.6	4.2	220	0.8	5.3	276
Cargo barge	0.2	1.4	72	0.3	1.8	92
Tank vessel[b]	0.1	0.6	32	0.1	1.0	54
Total Baseline Trips	0.9	6.2	324	1.2	8.1	422
Cumulative Projects						
Proposed action	0.7	4.9	238	0.7	4.6	238
REG project	1.1	7.7	400	1.1	7.7	400
Grays Harbor Rail Terminal Project	0.3	2.3	120	0.3	2.3	120
Total Cumulative Trips	2.1	14.6	758	2.1	14.6	758
Total Vessel Trips	**3.0**	**20.8**	**1,082**	**3.2**	**22.7**	**1,180**

[a] Vessel trips represent one-way trips.
[b] Numbers do not reflect REG no-action vessels, because proposed action number is total for facility.

The capacity analysis considered the number of navigable 2-hour windows available for vessels with different drafts and tidal elevations at the 2017 project depth of 38 feet mean lower low water.

Cargo barges transiting to the mouth of the Chehalis River or further inland are forecast to account for 72 trips per year (approximately 7% of total commercial vessel trips) at the Port in 2017 and 92 trips per year (8% of large commercial vessel trips) in 2037. These vessels are not considered deep-draft vessels. They have drafts between 0 and 17 feet, consistent with vessel data reported between 2008 and 2012 (Chapter 3, Section 3.17, *Vessel Traffic*).

The remaining trips under cumulative conditions would consist of tank and cargo vessels. It is anticipated that approximately half of the remaining vessel trips (either inbound or outbound trips) would be made by vessels in ballast. Vessels transiting in ballast would have a shallower draft (less than 27 feet) than when they are laden with cargo (U.S. Army Corps of Engineers 2014).

Based on these assumptions, approximately 53% of the total vessel trips (cumulative projects plus baseline) (577 in 2017 and 636 in 2037) would be made by vessels not considered to be deep draft,

[30] As noted in Chapter 3, Section 3.16, *Vessel Traffic*, projected traffic increases unrelated to the proposed action were based on growth rates used in the Grays Harbor Channel Deepening Project.

or vessels that draft less than 27 feet.[31] At the 2017 project depth of 38 feet mean lower low water, these vessels would be unconstrained by tidal elevations. The remaining 47% of all vessel trips (505 in 2017 and 544 in 2037) would be made by vessels with drafts between 27 and 39 feet.

Tank barges are most likely to call at Terminal 1 to load bulk liquids for the proposed action and REG project. The quantitative analysis in Chapter 3, Section 3.17, *Vessel Traffic*, assumes that the Crowley 550-Class articulated tug-barge or similar tank barges would be used. The analysis assumes that tank barges would be used, and thus considers the highest possible number of vessel trips. If larger-capacity tankers are used, the number of vessel trips would be reduced. For the Grays Harbor Rail Terminal Project, tankers are likely to call at Terminal 3 to load bulk liquids.

At the 2017 project depth of 38 feet mean lower low water, deep-draft vessels with drafts of 37 feet or less would have 1,627 navigable windows available each year, those with drafts of 38 feet would have 1,274 navigable windows and those with drafts of 39 feet or greater would have 904 navigable windows. Because the number of navigable windows available for transit of deep-draft vessels exceeds the total number of forecast laden vessel trips in 2017 or 2037 (505 in 2017 and 544 in 2037), the channel capacity would not be exceeded with the cumulative projects.

As described in Chapter 3, Section 3.17, *Vessel Traffic*, actual channel depths may vary considerably from project depths between maintenance dredging because sand and silt will accumulate in the channel. If the controlling depth of the navigation channel is reduced, the number of navigable windows at each tidal elevation threshold would be the same, but the maximum vessel draft possible at each tidal elevation would be reduced. Similar to current conditions, vessels with the greatest draft restriction would be given priority for transiting at the highest tidal elevations. Vessel operators may reduce the amount of cargo that is loaded to reduce the draft of the laden vessel and increase the transit opportunities. Given the flexibility of transiting at higher tidal elevations and/or reducing the cargo and draft of laden vessels, it is anticipated that vessel operators would be able to find navigable windows for the forecasted cumulative deep-draft vessel trips, even if the project depth of 38 feet mean lower low water is not maintained between dredging.

Berth Capacity at Terminal 1

As described in Chapter 3, Section 3.17, *Vessel Traffic*, assuming berth availability of 90%, the Terminal 1 berth would be available to receive vessels 328 days per year. Vessels are estimated to occupy the berth from 24 hours (tank barges) to 48 hours (tankers). The analysis assumed 100% tank barges for the cumulative projects, which results in a conservative estimate of the most days of berth occupancy. Vessel calls associated with the Grays Harbor Rail Terminal Project would call at Terminal 3 and would not affect the capacity of the Terminal 1 berth.

The cumulative tank barge calls would be 319 (119 for the proposed action and 200 for the REG project) and each would occupy the berth for 24 hours each, resulting in 319 days of berth occupancy. The baseline forecast[32] consists of 17 tankers, which would occupy the berth 34 days and 10 tank barges would occupy the berth for 10 days, for a total baseline forecast of 44 days without the cumulative projects. The total berth occupancy—baseline plus cumulative—would be 363 days per year. Although this exceeds the number of days that the Terminal 1 berth would be

[31] This percentage is slightly greater than 50% because cargo vessels have a shallower draft even when in ballast.
[32] Includes existing vessels (assumed tankers) and vessels related to projected growth between 2017 and 2037 (assumed 1 tanker and 10 barges).

available per year, it is based on conservative assumptions.[33] Moreover, if tankers replaced tank barges under the cumulative projects, berth occupancy could be as low as 318 days per year and there would be sufficient capacity.[34]

Other Capacity Constraints—Pilots and Tugs

State-Licensed Pilots

Grays Harbor is subject to compulsory Washington State pilotage for foreign vessels and U.S. vessels under enrollment and registered in foreign trade. All large commercial vessels engaged in foreign commerce would require Washington State pilots with Grays Harbor experience and knowledge (a requirement of their license and training). Domestic vessels on a coastwise voyage may enter and depart Grays Harbor under the control of a U.S. Coast Guard (federally) licensed captain.[35] However, many U.S. vessels calling at Washington State ports seek the assistance of a state-licensed pilot on a voluntary basis, or as a matter of company policy, even though it is not required by regulation.

The cumulative number of trips by large commercial vessels (cargo and tank vessels) is forecast to reach 1,082 trips in 2017 and 1,180 trips in 2037. The Port currently employs three state-licensed pilots, with two pilots to be on duty at any given time. If all cargo and tank vessels hired a state-licensed pilot to navigate to and from the Port, this would result in a maximum of 1,180 annual assignments, or approximately 393 annual assignments for each of the three state-licensed pilots currently employed by the Port.

Trips taken by state-licensed pilots in Grays Harbor are comparatively short (on average, 2 hours outbound or 2 hours inbound) and are limited to the navigation channel.[36] This would make it feasible for a pilot to take one vessel outbound and bring another inbound during a single high tide window if the volume of vessel traffic warranted this approach. Moreover, because Grays Harbor has a semidiurnal tidal cycle (with two high tides per day), there is more than one navigable window each day to pilot a vessel to or from the Port.

If needed to handle forecast growth, additional pilots could be trained. It takes approximately 9 months for a new pilot to obtain his/her first state license to handle smaller vessels and approximately 2.5 years to become fully qualified.

In accordance with WAC 363-116-065, Number of Pilots, the Puget Sound Board of Pilotage Commissioners regularly considers the number of pilots needed to optimize the operation of a safe, fully regulated, efficient, and competent pilotage service in the Grays Harbor pilotage district. The Port will continue to work with the Puget Sound Board of Pilotage Commissioners to forecast the number of vessels that would require a state-licensed pilot well in advance of anticipated increases, to allow for training and onboarding of additional pilots. If necessary, the Puget Sound Board of

[33] Maximum number of vessels (tank barges) and a full 24 hours at dock for each tank barge.
[34] A total of 86 (REG) tanker calls for 2 days each equaling 172 days added to a total of 51 (proposed action) tanker calls for 2 days each equaling 102 days added to the total baseline forecast of 44 days without the cumulative projects.
[35] Table 15.812(e)(2) in Title 46 Code of Federal Regulations requires (among other things) that the Master or Mate of a U.S. Inspected Tank Barge of 10,000 gross tons or less have 12 trips over the route to control the vessel in designated pilotage waters.
[36] In comparison, the Puget Sound pilots may spend up to 6 to 8 hours on one vessel and must debark in a completely different geographic area than where they started, adding travel time home to the assignment.

Pilotage Commissioners could support the Port by temporarily reassigning a qualified state-licensed pilot from Puget Sound to Grays Harbor (Larson pers. comm.).

Tugs

Brusco Tug & Barge has three harbor tugs stationed in Grays Harbor exclusively available for commercial vessel assistance in the harbor. During normal operations, two tugs (one at the bow and one at the stern) assist large commercial vessels (cargo and tank vessels) with docking and undocking maneuvers at the Port berths.

Tugs are also used to escort vessels through the harbor to reduce the potential for a vessel incident such as loss of steering or propulsion that could affect vessel traffic and pose a safety risk. Existing regulations do not require that vessels be accompanied by tugs through Grays Harbor. However, it is standard practice for large commercial vessels transiting Grays Harbor to use one or two tugs depending on the weather conditions and vessel-specific factors (e.g., the amount of vessel infrastructure above water, or steering or propulsion problems). With larger car carriers and big bulk cargo vessels a third tug may be used to assist with docking, undocking, or transiting when conditions warrant, such as when there are high winds (D'Angelo pers. comm.). Moreover, the Harbor Safety Plan for Grays Harbor has a *standard of care* (similar to a best management practice) that recommends tugs for all laden tank vessels carrying oil. The standards recommend the following practices, subject to pilot determination.

- At least one tug should meet an arriving laden tank vessel carrying oil at the Grays Harbor entrance and escort it to the Hoquiam River where two tugs will escort and assist the vessel during mooring procedures.
- At least one tug will accompany a departing laden tank vessel carrying oil from the terminal to the entrance of Grays Harbor.

Chapter 4, Section 4.6.3, *What mitigation measures would reduce impacts related to vessel transport?* includes proposed mitigation measures related to use of tugs through Grays Harbor to reduce potential risk of incident under the proposed action.

Including cumulative tank vessels at maximum throughput operation, large commercial vessel trips through Grays Harbor are forecast to reach 1,082 in 2017 and 1,180 in 2037, or approximately three vessel calls per day on average. A single vessel call includes an inbound and an outbound vessel transit, and it is assumed that the vessel is laden (and therefore, requires an escort) in only one direction. Based on the projected traffic levels and the fact that tugs can be moved between the Port terminals to assist with docking and undocking, the three tugs currently stationed in the harbor are adequate to support vessel operations at the Port under the cumulative projects.

Commercial (Nontreaty) Fishing

As noted in Chapter 3, Section 3.17, *Vessel Traffic*, the proposed action could result in increased disruption to commercial fishing in the navigation channel when a vessel is traveling to and from the project site or is docked at Terminal 1. This potential for disruption would increase with the cumulative projects. Vessel traffic in the navigation channel would increase from approximately one trip per day under baseline conditions to approximately three trips per day with the cumulative projects, and berth occupancy at Terminal 1 would increasing to 363 days per year. During periods of maximum catch for Chinook, coho, or chum salmon, the fall fishery may be open 2 to 4 days per week and for limited periods (e.g., 8:00 am to 12:00 noon). Approximately 15 to 20 boats participate

each year and total days the fishery is open is approximately 7 days (Scharpf pers. comm.). Commercial fisheries do not occur during other times of the year; therefore, vessel traffic at other times of the year does not affect commercial fisheries in Grays Harbor.

As noted in Chapter 3, Section 3.17, *Vessel Traffic*, assuming the vessel is traveling between the Crossover Channel Reach of the navigation channel and Terminal 1 for approximately half of the 2-hour transit time, including docking and undocking maneuvers, an individual vessel trip could disrupt fishing for a 1-hour period. When a vessel is traveling through the area, commercial fishers can either avoid the area entirely (fish elsewhere) or cut their drifts short (pull the nets in sooner) to avoid conflicts with vessels. Fishers would need to monitor radio communications for inbound and outbound vessel traffic and be prepared to retrieve fishing gear when a vessel is transiting the area.

On average, vessels related to the cumulative projects would also be at the dock more frequently, approximately 7 days per week compared to an average of 1 day per week under the no-action alternative. Depending on the specific circumstances of each interaction (e.g., chance of a vessel calling during an open fishing window, distribution of the fish, number of fishers on any given day), it is difficult to predict whether increased occupancy at Terminal 1 would substantially affect any single fisher's ability to reach their limit. If a vessel is at berth during the fall fishery, fishers would have the option to fish longer (complete more drifts) or to fish other preferred locations in Grays Harbor (such as other portions of the navigation channel, farther away from the shoreline or farther upstream), although opportunities to relocate during intense fishing periods may be limited if the other areas are occupied by fishers. Although it is difficult to predict whether the increased vessel traffic would result in an overall inability of a fisher to reach their limit, increased traffic would limit access to commercial fishing areas.

As noted in Chapter 3, Section 3.17.4.3, *Fishing and Recreational Vessels,* ocean-fishing vessels may use the navigation channel to transport their catch to the harbor. To lessen the danger of hazardous conditions during incoming or outgoing tides, bar crossings are often timed during slack high or low tides, whereas large commercial vessels tend to navigate through the channel when tidal elevations are more than 5 feet. Commercial fishers can navigate around larger vessels limited to the navigation channel to avoid potential impacts.

Implementation of the proposed mitigation measure in Chapter 3, Section 3.17, *Vessel Traffic*, to provide advance notice of arrivals and departures of vessels would also reduce cumulative impacts on commercial fishing.

6.5.6.3 Mitigation Measures

Implementation of the proposed mitigation measures in Chapter 3, Sections 3.17, *Vessel Traffic*, would also reduce cumulative impacts. Mitigation measures to address to risks related to vessel transport of crude oil in the study area are presented in Chapter 4, Section 4.6, *Environmental Health Risks—Vessel Transport*.

6.5.6.4 Unavoidable and Significant Adverse Environmental Impacts

Under existing fishing conditions, increased vessel traffic would cause a disruption when commercial fishers are in the navigation channel. This conflict is most likely during the fall harvest of salmon (Chinook, chum, and coho). Although vessel operations related to the cumulative projects are reasonably certain, it is not possible to determine how the proposed action could affect a

commercial fisher's daily catch because of other unpredictable factors (number of fishers, fish distribution, timing, and duration of fishing window on any given day of any given week).

Potential impacts related to increased risk of vessel incidents and related consequences are addressed in Section 6.5.7, *Environmental Health and Safety*.

6.5.7 Environmental Health and Safety

This section discusses potential cumulative impacts on environmental health and safety that would result from construction and operation of the cumulative projects.

6.5.7.1 Study Area

The cumulative impacts study area for environmental health and safety includes Grays Harbor, the 59 miles of PS&P rail line to the junction with the BNSF main line in Centralia, and the cumulative project sites. Within this area, the operations of interest include the storage and transfer (loading and unloading) of products for the cumulative projects and the associated rail and vessel movements, particularly for crude oil and bulk liquids.

6.5.7.2 Cumulative Impacts

This section describes the cumulative increases in risk that could result from the cumulative projects.

Risk management involves the systematic identification, evaluation, and control of impacts that may arise from uncertain future events such as oil spills, fires, explosions, toxic releases, or natural disasters. Assessing a risk to a particular resource requires identifying possible hazards, evaluating the frequency of adverse events and the magnitude of their consequences, and determining appropriate measures for prevention or mitigation. By anticipating the level of risk and the potential impacts, preventive and mitigation measures can be implemented to reduce the frequency of an event, the impacts, or both.

Because it is not possible to predict the timing or exact magnitude of an oil spill, this analysis focuses on spill scenarios, which are addressed in Appendix M, *Risk Assessment Technical Report*. Scenarios were developed for a range of potential incidents involving the terminal, unit trains, and vessels. Risks associated with the no-action alternative are discussed in Chapter 4, *Environmental Health and Safety,* Sections 4.4.1, 4.5.1, and 4.6.1, for terminal operations, rail transport, and vessel transport, respectively.

The analysis determined the likelihoods of the various scenarios for the activity levels of the cumulative projects. Scenarios included the following conditions.

- Incidents involving onsite handling and storage of crude oil and bulk materials at the cumulative project sites.
- Incidents involving trains transporting crude oil and bulk materials along the PS&P rail line.
- Incidents involving vessels transporting crude oil and bulk materials in Grays Harbor.

The scenarios considered various sizes of potential spills based on the activity (such as transport of or transferring oil) and size of tank, rail cars, and vessels. To simplify descriptions, spill scenarios are identified using the amount of material spilled (Table 6-20). Each scenario provides a

representative spill. Actual spills could be somewhat smaller or larger than the representative spill size. Additional information about each scenario is provided in Chapter 4, *Environmental Health and Safety.*

Table 6-20. Oil Spill Scenarios by Size Category

Size Category	Typical Scenario
Small	• Up to 2,100 gallons (50 barrels) spilled when transferring oil from rail cars or to vessels at the project site • Up to 1,000 gallons (24 barrels) spilled during a derailment along the PS&P rail line
Medium	• 50,400 gallons (1,200 barrels) spilled from pipeline or storage tank on site • 10,000 gallons (238 barrels) spilled when transferring oil from the facility to a vessel at the project site • 30,000 gallons (714 barrels or the contents of one full tank car) spilled during a derailment along the PS&P rail line
Large	• 8.4 million gallons (200,000 barrels or the contents of one full storage tank) spilled on site • 90,000 gallons (2,140 barrels or the contents of three full tank cars) spilled during a derailment along the PS&P rail line • 150,000 gallons (3,570 barrels or the contents of five full tank cars) spilled during a derailment along the PS&P rail line • 900,000 gallons (21,400 barrels or the contents of 30 full tank cars) spilled during a derailment along the PS&P rail line • 105,000 gallons (2,500 barrels) spilled into Grays Harbor from a vessel collision • 15.1 million gallons (360,000 barrels or the entire contents of a full tanker, including fuel) spilled into Grays Harbor during a vessel allision at harbor entrance

Using this information, the analysis first determined the likelihood that a spill would occur using the following methods. In general, the larger the spill, the less likely that the spill would occur.

- For spills at the terminals, operational information, such as the number of rail car unloadings, vessel loadings, and storage tanks in use, was combined with historical information on spills associated with these activities to determine the likelihood of spills.
- For spills along the PS&P rail line, the number of rail trips carrying crude oil was combined with historical information from the FRA on incidents on the PS&P rail line and across the country, as well as the numbers of cars derailed, the probability of spills for different types of rail cars, and the length of the rail route to determine the likelihood of spills.
- For spills during vessel transport, the number of vessel trips carrying crude oil was combined with historical information on vessel accidents and spill probabilities to determine the likelihood of spills.

The analysis looked at risks in 2017 and in 2037 for the proposed action.

Oil Spills

Onsite Risks

The cumulative projects would result in the potential for more frequent spills and the introduction of spilling crude oil, which is not handled today. The cumulative projects would result in an increase in the likelihood of a spill relative to the no-action alternative and to the proposed action alone, although the orders of magnitude are very similar. The release frequencies are summarized below.

- The **small rail-unloading spill scenario** (up to 2,100 gallons [50 barrels]) could occur once every 3 years. This amount is less than the unloading area containment that would be at least 30,000 gallons so the spill is expected to be contained on the facility.
- The **small vessel-loading spill scenario** (up to 2,100 gallons [50 barrels]) could occur once every 3 years. Much of this oil might be contained by booms and other mitigation measures.
- The **medium vessel-loading spill scenario** (represented by 10,000 gallons [238 barrels]) could occur once every 43 years. A small amount of the oil might be contained on the facility or vessel but the remaining oil could spill to water.
- The **medium pipeline or storage tank spill scenario** (represented by 50,400 gallons [1,200 barrels]) from the tanks or piping in the containment areas could occur once every 450 years. This amount is less than the containment area so the spill is expected to be contained on the facility under most circumstances.
- The **large storage tank spill scenario** (an extreme failure of any storage tank ranging between 3,360,000 to 8,400,000 gallons [80,000 to 200,000 barrels]) could occur once every 9,000 years. This could be caused by a construction or material failure, containment failure, or seismic or tsunami event. In some cases the oil would be caught in the containment area, but if there was major damage to the containment as well, the oil could spill to land or water.

Each proposed facility would operate independently, so cumulative impacts from facility operations alone are not likely. The facilities would cumulatively move and store more oil and bulk liquids increasing the potential for spills from the facilities. Spills could be from operations, during transfers, from catastrophic failure of tanks, or from piping.

Rail Risks

The increased number of rail trips related to the cumulative projects would increase the potential for more frequent spills and the possibility of spilling crude oil, as this material would be newly handled at the proposed facility. The cumulative projects would result in an increase in the likelihood of a spill relative to the no-action alternative or to the proposed action alone, although the orders of magnitude are very similar. The relative frequencies are summarized below.

- The **partial one rail car transport spill scenario** (up to 1,000 gallons [24 barrels]) could occur once in 29 years with current rail cars; with rail car improvements (80 FR 26643) this would extend to once in 31 years for 2037. Some amount of the spill would be contained in the ballast under the tracks but some amount could run out onto the ground in the immediate vicinity of the tracks. If the spill occurred over or near a waterway, some amount could spill into water.
- The **one rail car spill scenario** (roughly 30,000 gallons [714 barrels]) could occur once in 11 years with current rail cars; with rail car improvements, this would extend to once in 13 years.

- The **three rail car spill scenario** (roughly 90,000 gallons [2,140 barrels]) could occur once in 73 years with current rail cards; with rail car improvements, this would extent to once in 110 years.
- The **five rail car spill scenario** (roughly 150,000 gallons [3,570 barrels]) could occur once in 1,400 years with current rail cars; with rail car improvements, this would extend to once in 3,300 years.
- The **30 rail car spill scenario** (roughly 900,000 gallons [21,400 barrels]) could occur once in 22,000 years with current rail cars; with rail car improvements, this would extend to once in 44,000 years.

The cumulative impact of 7.5 trains per day could result in an increased potential for derailments or incidental releases of oil and hazardous substances, pollutants, and contaminants during transport or incidents. The risk of an oil spill from train operations typically relates to the risk of derailment. However, a derailment does not mean a spill will happen; a train can derail with no spill resulting.

Vessel Risks

The increased number of vessel trips related to the cumulative projects would increase the potential for more frequent spills and the possibility of spilling crude oil, compared to the other flammable materials currently handled. The cumulative projects would result in an increase in the likelihood of a spill relative to the no-action alternative and the proposed action alone, although the orders of magnitude are very similar. The relative frequencies are summarized below.

- The **large vessel collision spill scenario** (up to 105,000 gallons [2,500 barrels]) could occur once in 45 years.
- The **large vessel grounding spill scenario** (up to one vessel compartment of 1.2 million gallons [29,000 barrels]) could occur once in 128 years.
- The **large vessel allision spill scenario** (up to 15.1 million gallons [360,000 barrels]) could occur once 116 years.

Fires or Explosions

This section describes the likelihood of fires or explosions for the different release scenarios discussed in the preceding section.

Onsite Risks

A spill could cause a fire or explosion if there is an ignition source and combustible gases are present in a quantity that could ignite. The incident could cause sparking, which could ignite the spill. Many of the materials to be handled under the cumulative projects are flammable but they are generally in a liquid and not gaseous form. Typically, terminal activities resulting in a spill would have limited potential to result in ignition because terminals are designed with controls of potential ignition sources to reduce the chance of ignition. Liquid materials would pool on the ground with only limited vapor generation now that the Bakken crude oil has restrictions on its vapor pressure—particularly compared to other common materials like propane. Additional information regarding the risks of fire and explosions during rail transport is provided in Chapter 4, *Environmental Health and Safety*, and Appendix M, *Risk Assessment Technical Report*.

Rail Risks

The cumulative projects would result in an increased risk of fires or explosions compared to the no-action and proposed action alone. Explosions are most likely when a spill is ignited and the resulting fire impinges on another tank or rail car. As the material in these adjacent tanks or rail cars heat up, the pressure builds and may eventually burst the container. The extent of the damage depends on the exact configuration of the release and fire compared to the location of the other tanks or rail cars, any fire suppression capabilities, and the timing and nature of response actions. It also depends on the material: Bakken crude oil is more flammable than other heavier crude oils. The flammability of diluted bitumen varies based on the diluent (diluting agent) used.

Although fires or explosions can result from spills resulting from events like collisions and derailments, long-term historical data show that most spills do not result in fires or explosions. A fire or explosion would be less likely to occur than a spill. While there have been multiple recent derailments of trains on main lines that resulted in fires or explosions, the chance of an extreme derailment is very limited in the study area because of the slow speeds on the PS&P rail line, which are slower than typical mainline speeds. In general, large derailments from high-speed trains lead to releases from multiple rail cars. The energy involved in high-speed derailments and the resulting scatter of rail cars yield the greatest chance of a fire or explosion that affects other rail cars.

Additional information regarding the risks of fire and explosions during rail transport is provided in in Chapter 4, *Environmental Health and Safety,* and Appendix M, *Risk Assessment Technical Report*.

Vessel Risks

The cumulative projects would result in an increased risk of fires or explosions compared to the no-action and proposed action alone. Fires or explosions can occur as the result of spilled oil from vessels collisions and allisions, and less typically from groundings. A fire or explosion would be less likely to occur than a spill, i.e., in only a fraction of the spills. But some collisions and allisions might involve enough energy and sparking to cause ignition, and possibly an explosion if the vapors are sufficiently confined. In an even smaller fraction of accidents and releases, such fires/explosions could involve other compartments.

Information regarding the risks of fire and explosions during rail transport is provided in Chapter 4, *Environmental Health and Safety*, and Appendix M, *Risk Assessment Technical Report*.

Impacts on Resources

With the cumulative projects, the chance of an incident occurring would be cumulatively greater than compared to the proposed action alone. In the event of any one incident, the potential consequences are anticipated to be similar to those described in Chapter 4, *Environmental Health and Safety,* for the proposed action*.* As discussed in Chapter 4, Section 4.7, *Impacts on Resources*, the risks related to the scenarios analyzed in the risk assessment could result in adverse impacts on the following resources.

- **Water, plants, and animals.** Crude oil can degrade water quality and result in toxic exposure of plants and animals to harmful chemicals. Depending on the specific circumstances, exposure can cause tissue damage in plants and animals that can affect respiration, reproduction, and behavior. In extreme cases, exposure can result in death.
- **Tribal resources.** Harm to natural resources used by tribes for commercial, subsistence, or ceremonial purposes could result in adverse impacts on tribal resources.
- **Commercial fishing.** Impacts on fish and shellfish could affect the number available for harvest by commercial fishers in future years. This impact could last several years from residual amounts of oil persisting in the environment.
- **Aesthetics, recreation, and cultural resources.** Crude oil can cause aesthetic impacts by coating the environment and resulting in large areas of reduced vegetative growth. These impacts can disrupt recreational activities if areas affected by spills have to be closed to prevent harm of exposure to people or to conduct cleanup activities. Spilled oil can also cause damage to historic structures or other important cultural resources. Depending on the circumstances of the incident and the nature of the cleanup activities, ground disturbance during cleanup may also adversely affect archaeological resources.
- **Air.** Crude oil contains volatile vapors that, when released during a spill, may create flammable atmospheres or inhalation hazards. The toxicity of crude oil and the potential to adversely affect air quality depend mainly on the volatility of the constituents.
- **Human health.** Exposure to crude oil can adversely affect humans, primarily through exposure to harmful air pollutants. Depending on the circumstances of the incident, if people inhale crude oil vapors, they may suffer irritation to their respiratory systems, which can cause dizziness, rapid heat rate, headaches, confusion, nausea, and/or vomiting and possibly injury or death. Depending on the scale of the incident, the personal costs of these impacts could be severe and have long-lasting physical and emotional impacts on affected individuals and their families.
- **Public services.** Increased likelihood of an incident along with the new potential for spills, fires, or explosions related to crude oil handling, storage, and transport could result in the need for local emergency response services that exceed existing capacity. Disruption of local public services could also occur.

If a spill results in a fire or explosion, additional damage could occur, as listed in Chapter 4, Section 4.7, *Impacts on Resources*. The air pollutants of health concern are carbon monoxide, lead, nitrogen dioxide, particulate matter, sulfur dioxide, and polycyclic aromatic hydrocarbons. Inhalation of these byproducts can cause irritation of the respiratory system. Exposure may harm nasal passages and lungs and it may cause coughing, itching, and difficulty breathing. Depending on the circumstances of an incident, there is also the potential for injury and even death, either as a direct result of the event leading to the release or associated with emergency response and cleanup activities. The

personal costs of these impacts could be severe and have long-lasting physical and emotional impacts on affected individuals and their families.

Fires or explosions can also harm plants and animals. Depending on the extent of the damage, changes affecting community structure and function of ecosystems could occur. For example, if exposed to high, sustained temperatures, specific plant and animal communities could become more susceptible to other harm, such as increased risk of disease or predation. If individual species are adversely affected at a broader population level, the overall structure and function of the community could be altered. Harm to natural resources used by tribes for commercial, subsistence, or ceremonial purposes could also result in adverse impacts on tribal resources.

Similar to potential impacts associated with spills, damage caused by fires or explosions could adversely affect aesthetic resources, important historic structures, or recreational resources. This damage could be made worse due to cleanup activities.

6.5.7.3 Mitigation Measures

The mitigation measures listed in Chapter 4, *Environmental Health and Safety*, Sections 4.4.3, 4.5.3, and 4.6.3 would also help to reduce the proposed action's contribution to cumulative risks.

6.5.7.4 Unavoidable and Significant Adverse Environmental Impacts

Regulatory requirements for prevention of, preparedness for, and response to incidents involving the release of crude oil and mitigation measures to reduce impacts are detailed in Chapter 4, Section 4.2, *Applicable Regulations*. However, no mitigation measures would completely eliminate the possibility of a spill, fire, or explosion, nor would they completely eliminate the adverse consequences of a spill, fire, or explosion. Depending on the location of the incident, amount spilled, type of crude oil, and environmental conditions, such as the time of year, water flows, and weather conditions, the potential environmental impacts could be significant.

The following resources could experience significant impacts as described in Section 4.7, *Impacts on Resources*.

- Water
- Plants
- Animals
- Aesthetics
- Recreation
- Commercial fishing
- Cultural resources
- Tribal resources
- Public services
- Air
- Human health

6.5.8 Extended Rail and Vessel Transport

In addition to the impacts in the study area addressed in Chapters 3, *Affected Environment, Impacts, and Mitigation*, and 4, *Environmental Health and Safety*, impacts of the proposed action related to increased rail and vessel traffic in the extended study area are described in Chapter 5, *Extended Rail and Vessel Transport*. This section discusses potential cumulative impacts in the extended study area that would result from rail and vessel transport related to the cumulative projects.

6.5.8.1 Extended Study Area

The extended study area consists of specific rail and vessel transportation corridors that could be affected by the transport of crude oil to and from the project site. The rail corridor consists of the area along the BNSF main line from the Williston Basin in North Dakota[37] to Centralia, Washington, with a focus on Washington State. The vessel corridor consists of the vessel routes along the U.S. West Coast to the most likely destinations north to Puget Sound refineries and south to California refineries. Section 5.3, *What are the likely sources and destinations of crude oil?* describes the basis for these end points.

6.5.8.2 Cumulative Impacts

Rail Transport

Traffic

As described in Chapter 5, Section 5.5.1.1, *Traffic*, growth in rail traffic in the extended study area is expected to follow national trends as more freight transits through Midwestern states to coastal ports and population centers.

- Daily traffic on the BNSF Kootenai River Subdivision from Whitefish, Montana, to Spokane, Washington, is estimated to increase from 28 trips per day in 2012 to 70 trips per day in 2040, an increase of 133% (Idaho Department of Transportation 2013).
- The volume of freight shipped by rail through Montana is expected to increase from 54.1 million tons in 2002 to 79.3 million tons in 2035, an increase of 47% (Montana Department of Transportation 2010).

The cumulative projects would result in 4.25 unit train trips per day on average at maximum throughput operations. Table 6-21 present these trips as a percentage of 2015 traffic estimates and 2035 traffic projections for BNSF mainline routes expected to be used for crude oil trains in Washington State. As shown in the table, cumulative trips represent between 6.1 and 60.7% of 2015 traffic estimates along the assumed routes; along the assumed routes for loaded trains, cumulative trips represent between 6.1 and 12.5% of 2015 estimates. Cumulative trips represent between 3.4 and 32.7% of 2035 projections along the assumed routes; along the assumed routes for loaded trains, cumulative trips represent between 3.4 and 7.6% of 2035 estimates.

[37] The Williston Basin rail terminals are primarily in North Dakota but extend into Montana, South Dakota, and Saskatchewan, Canada.

Table 6-21. Proposed Action Rail Trips as Percentage of Existing and Projected Rail Trips in the Extended Study Area under the No-Action Alternative

Route Segment	Subdivision	Estimated 2015 Trips Per Day[a]	Cumulative Trips as a Percentage	Projected 2035 Trips per Day[b]	Cumulative Trips as a Percentage
Idaho/Washington State Line-Spokane	Spokane	70	6.1%	125	3.4%
Spokane-Pasco	Lakeside	39	10.9%	66	6.4%
Pasco-Vancouver	Fallbridge	34	12.5%	56	7.6%
Vancouver-Centralia	Seattle	50	8.5%	85	5.0%
Centralia-Auburnc	Seattle	50	8.5%	85	5.0%
Auburn-Yakima[c]	Stampede	7	60.7%	13	32.7%
Yakima-Pasco[c]	Yakima Valley	7	60.7%	13	32.7%

[a] Extrapolated to 2015.
[b] Numbers do not include crude oil unit trains or rail traffic related to coal export terminal proposals in Washington State.
[c] Assumed empty trains only.
Source: Washington State Department of Transportation 2014.

Potential Impacts

Continued increase in rail traffic along the BNSF main lines in the extended study area could affect rail capacity if BNSF does not take actions to address this growth. It is expected that BNSF will make the necessary investments or operating changes to accommodate the growth in rail traffic, but the timing of these actions is unknown.

In addition to potential impacts on rail capacity, increased routine rail traffic would incrementally add to currently occurring impacts on the natural and built environment, summarized as follows.

- Emission of ambient air pollutants and air toxics from train engine exhaust.
- Leaks and spills from engines and defective tank cars.
- Train noise, including wayside noise from passing trains and horn noise at grade crossings.
- Vehicle delay at at-grade crossings, including disruption to emergency vehicle response times.
- Impacts on tribal resources

The types of impacts would be similar to those described in the respective sections of Chapter 3, *Affected Environment, Impacts, and Mitigation*. While the actual impacts described in Chapter 3 are specific to rail transport along the PS&P rail line, they would also result from rail transport in the extended study area. However, the potential for impacts and their relative magnitude would depend on the existing conditions at specific locations and other factors.

When considered in combination, the cumulative projects are likely to increase the likelihood of rail incidents and related consequences (e.g., oil spills, fires, and explosions) in the extended study area compared to the no-action alternative and the proposed action alone. However, the potential consequences would remain similar in nature and magnitude to those that could occur under existing conditions and the no-action alternative. Chapter 4, Section 4.7, *Impacts on Resources,* describes the impacts that could result from an oil spill, fire, or explosion. These impacts are described in general terms, not specific to a particular size event or a specific location; therefore,

they can be generally applied to the extended study area. Depending on the specific location of a rail incident (e.g., proximity to population centers, sensitive resources), the type of material released, the volume of the release, and the potential for ignition (e.g., fire, explosion), impacts could be significant.

As discussed in Chapter 4, Section 4.2, *Applicable Regulations*, there is an extensive framework in place to prevent, prepare for, and respond to an incident involving the release of crude oil. However, as noted in Section 5.6.1.1, *Rail Transport*, there are gaps in geographic response planning within the extended study area and limited capacity exists to update and field test these plans. Additionally, there are existing gaps to plan, train, and equip local emergency service responders for crude oil incidents. Ongoing training is needed to prepare first responders who already face the risks of highly flammable crudes currently being shipped by rail (Washington State Department of Ecology 2015), such as would occur under the proposed action.

As noted in Chapter 4, Section 4.5, *Environmental Health Risks—Rail Transport*, there are ongoing broader efforts to address and improve the safety of crude oil transport by rail that would also help to offset potential increases in risk related to the cumulative projects.

Stakeholders include but are not limited to the local, tribal, and regional government agencies along the BNSF main lines, as well as the regulatory agencies, Washington State Department of Transportation, Washington Utilities and Transportation Committee, FRA, and Pipeline and Hazardous Materials Safety Administration. These stakeholders and agencies should continue coordination to identify solutions (operationally or for larger capital improvement projects) to address current and future concerns related to increased rail traffic, vehicle delay, and safety at grade crossings, and other concerns specific to each community. This could include infrastructure improvements such as grade separations, additional grade-crossing protections, grade-crossing closures, and roadway improvements.

Vessel Transport

The cumulative projects would result in 758 tank vessel trips[38] per year (approximately two trips per day on average) at maximum throughput. As described in Section 5.5.1.2, *Vessel Transport*, projections of vessel traffic cannot be quantified for the extended study area and, therefore, cumulative trips are compared to existing conditions.

Table 6-22 presents cumulative vessel trips as a percentage of existing large commercial vessel trips to selected West Coast destinations in the extended study area where cumulative vessels are likely to call. As shown in the table, cumulative vessel trips at maximum throughput operation represent 14.5% of existing large commercial vessel[39] traffic in Puget Sound, 12.8% of such traffic at larger ports accessed via San Francisco Bay, and 10.3% at Los Angeles area ports.[40]

[38] A trip represents one-way travel; in other words an inbound empty vessel trip and an outbound loaded vessel trip are counted as two trips.
[39] Based on vessels of more than 1,000 gross tons.
[40] The Ports of Los Angeles and Long Beach, which are adjacent to each other.

Table 6-22. Cumulative Vessel Trips as a Percentage of Existing Vessel Trips related to Select West Coast Destinations

Selected West Coast Destinations	Estimated Annual Trips 2015[a]	Proposed Action Trips as a Percentage
Washington		
Puget Sound	5,196	14.5%
California		
San Francisco Bay Area Ports	5,936	12.8%
Los Angeles–Long Beach Ports	7,376	10.3%

[a] Based on number of calls of vessels over 1,000 gross tons; a call is assumed to equal two trips (one inbound and one outbound).

Source: U.S. Maritime Administration 2015 (California ports); Washington State Department of Ecology 2016 (Puget Sound).

Potential Impacts

Vessel traffic related to the cumulative projects is anticipated to have a negligible impact on vessel traffic in the extended study area. However, continued growth of vessel traffic in the extended study area, as discussed in Chapter 5, Section 5.5.1.2, *No-Action Alternative*, would incrementally increase currently occurring impacts on the natural and built environment, summarized as follows.

- Emission of ambient air pollutants and air toxics from vessel engine exhaust.
- Water quality impacts from incidental leaks.
- Introduction of invasive species through ballast water exchanges.
- Impacts on aquatic species from increased underwater noise and vibration, vessel strikes, and increased wake and propeller wash.
- Impacts on tribal resources.

The types of impacts would be similar to those described in the respective sections of Chapter 3, *Affected Environment, Impacts, and Mitigation.* While the actual impacts described in Chapter 3 are specific to the study area (Grays Harbor and the marine nearshore environment), they can be generally applied to the extended study area. However, the potential for impacts and their relative magnitude would depend on the existing conditions at specific locations and other factors.

When considered in combination, the cumulative projects are likely to increase the chance of oil spills, fires, or explosions in the extended study area compared to the no-action alternative and the proposed action alone. However, the potential consequences would remain similar in nature and magnitude to those that could occur under existing conditions and the no-action alternative. Chapter 4, Section 4.7, *Impacts on Resources,* describes the impacts that could result from an oil spill, fire, or explosion. These impacts described in general terms, not specific to a particular size event or a specific location; therefore, they can be generally applied to the extended study area. Depending on the specific location of a vessel incident (e.g., proximity to population centers, sensitive resources), the type of material released, the volume of the release, and the potential for ignition (e.g., fire, explosion), impacts could be significant.

As noted in Section 5.4.3.2, *Existing Risks along the Vessel Routes*, there are existing preparedness and response gaps with respect to transport of crude oil by vessel. The need for updated and consistent geographic response planning and additional training and equipment for local emergency service responders would continue to be an issue of concern under the no-action alternative.

6.5.8.3 Unavoidable and Significant Adverse Environmental Impacts

Regulatory requirements for prevention of, preparedness for, and response to incidents involving the release of crude oil, and mitigation measures to reduce impacts are described in Chapter 4, *Environmental Health and Safety*. However, no mitigation measures would completely eliminate the possibility of a spill, fire, or explosion, nor would they completely eliminate the adverse consequences of a spill, fire, or explosion. Depending on the location of the incident, amount spilled, type of crude oil, and environmental conditions, such as the time of year, water flows, and weather conditions, the potential adverse environmental impacts could be significant.

The following resources could experience significant impacts as described in Chapter 4, Section 4.7, *Impacts on Resources*.

- Water
- Plants
- Animals
- Aesthetics
- Recreation
- Commercial fishing
- Cultural resources
- Tribal resources
- Public services
- Air
- Human health