Chapter 5
Extended Rail and Vessel Transport

Under the proposed action, crude oil would be transported to and from the project site by rail and vessel, respectively. Chapter 3, Affected Environment, Impacts, and Mitigation, and Chapter 4, Environmental Health and Safety, present analyses of potential impacts from onsite operation of the proposed action; transport of crude oil by rail along the Puget Sound & Pacific Railroad (PS&P) rail line between Centralia, Washington, and the project site; and transport of crude oil by vessel from the project site along the Grays Harbor Navigation Channel, out 3 nautical miles from the mouth of the harbor. This chapter addresses the transport of crude oil beyond these points, from the most likely source of crude oil to the likely destinations.

This chapter describes the following information.

- Extended study area.
- Likely sources and destinations for crude oil that would be transloaded and stored at the proposed facility, potential for the proposed action to affect (or induce) crude oil production at these sources, and likely effect of the lifting of the U.S. crude oil export ban.
- Routes, conditions, commodities, and existing and projected (where available) traffic volumes along the transportation routes in the extended study area.
- Potential impacts of routine transport and risk of oil spills, fires, and explosions under the no-action alternative and proposed action, considering existing and proposed emergency preparedness and response planning.
- Potential significant and unavoidable impacts.

5.1 What is the extended study area for rail and vessel transport?

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 Railway Company (BNSF) main line from the Williston Basin in North Dakota 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.

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1 The Williston Basin rail terminals are primarily in North Dakota but extend into Montana, South Dakota, and Saskatchewan, Canada.
5.2 How were impacts evaluated in the extended study area?

5.2.1 Information Sources

The following sources of information were used to define the existing conditions relevant to rail and vessel transportation and identify the potential impacts of the no-action alternative and the proposed action in the extended study area.

- Washington State Freight Mobility Plan (Washington State Department of Transportation 2014a).
- North Dakota State Rail Plan (North Dakota Department of Transportation 2007).
- 2010 Montana State Rail Plan (Montana Department of Transportation 2010).
- Idaho Statewide Rail Plan (Idaho Department of Transportation 2013).
- Vessel Calls in U.S. Ports, Selected Terminals and Lightering Areas (U.S. Maritime Administration 2015).

5.2.2 Impact Analysis

Rail transport was considered along the mainline BNSF routes between the likely source, Williston Basin, and Centralia, Washington (Section 5.3.1, Sources of Crude Oil). The routes considered are based on existing BNSF operations for loaded and unloaded crude oil trains. Infrastructure and operating information for these routes was based on the respective state rail plans identified above. No rail capacity or traffic projections were available between Williston Basin and the Washington state line. Rail capacity and existing and projected rail traffic for the BNSF mainline routes in Washington State are based on the Washington State rail plan (Washington State Department of Transportation 2014b). The rail plan provides estimates for 2010 and 2035. The 2010 estimates were extrapolated to 2015 to provide a 20-year interval between existing and projected conditions consistent with the rail analysis in the study area in Chapter 3, Section 3.15, Rail Traffic. Potential impacts on rail traffic are discussed based on comparing the unit train trips under the proposed action, 458 trips per year, to existing and projected rail trips along the assumed routes in Washington State.

Vessel transport was considered along the West Coast of the United States, north to the Puget Sound and south to California ports (Section 5.3.2, Destinations of Crude Oil). Existing vessel traffic was based on the information sources described above. Because no vessel traffic projections were
available, future vessel traffic was discussed qualitatively. Impacts on vessel traffic are discussed based on comparing the tank vessel trips under the proposed action, 238 trips per year, to existing trips of vessels of more than 1,000 gross tons that called at select West Coast destinations in 2015.

### 5.3 What are the likely sources and destinations of crude oil?

As described in Chapter 2, *Proposed Action and Alternatives*, crude oil would arrive at the proposed facility by unit train. It is expected to be Bakken crude oil from the Williston Basin, but could be diluted bitumen derived from oil sands in Alberta, Canada. The crude oil would be transported from the project site via tank vessel likely to West Coast refineries. This section explains the crude oil market driving these likely sources and destinations, the effect of recent policy changes related to the export of U.S. crude oil, other potential sources of crude oil, and the potential for the proposed action to induce crude oil production. Refer to Appendix Q, *Crude Oil Market Analysis*, for more information.

#### 5.3.1 Sources of Crude Oil

U.S. crude oil reserves are estimated at more than 36 billion barrels (U.S. Energy Administration 2013). U.S. crude oil production increased by 85% between 2006 and 2015 (U.S. Energy Administration 2015). This increase can be attributed primarily to the extraction of shale oil in Texas and crude oil from the Bakken formation. Extraction of Bakken crude oil increased by more than 11 times between 2003 and 2013—from 3.4 to 37.8 million gallons per day (Washington State Department of Ecology 2015). This increased production has led to increased shipments of these oils to refineries in Washington State, California, Illinois, Texas, Louisiana, and New Jersey via rail and vessel.

Current crude oil production from the Williston Basin is approximately 1.03 million barrels per day (North Dakota State Industrial Commission 2016). The capacity to move crude oil out of the basin via rail, pipelines, and trucks, referred to as takeaway capacity, is 1.83 million barrels per day, well above current production levels. Despite recent slowing of production due to the decline in oil prices that began in 2014, additional takeaway capacity has been planned for the coming years. Based on the analysis presented in Appendix Q, *Crude Oil Market Analysis*, because takeaway capacity is not constrained out of Williston Basin, the proposed action would not result in additional drilling or production of Bakken crude oil solely due to construction of the proposed facility.

Canadian crude oil production has increased by almost 75% over the past 10 years from 2.6 billion barrels per day in 2006 to 3.9 billion barrels per day in 2015 (National Energy Board of Canada 2016). It is reasonably likely that production will continue to grow slowly, but the rate of growth would depend on oil prices. Based on the analysis in Appendix Q, *Crude Oil Market Analysis*, Canadian production growth may be more constrained by takeaway capacity than Bakken growth. Therefore, if the proposed facility were to receive diluted bitumen, the proposed action could slightly increase Canadian production. However, transloading of diluted bitumen at the proposed facility would depend on several factors. If the proposed facility is transshipping Bakken crude oil, capacity may be insufficient to handle Canadian crude oil. Moreover, to handle the heavy, viscous

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2 For comparison, the capacity of the proposed action would be approximately 49,000 barrels per day on average.
diluted bitumen, additional investment in storage tanks and other equipment would be required. Lastly, rail transport to the West Coast would need to be more economically favorable than rail transport to the Gulf Coast.

Therefore, the extended study area for rail transport focuses on the route between the Williston Basin and Centralia, Washington. Refer to Appendix Q, *Crude Oil Market Analysis*, for more information.

### 5.3.2 Destinations of Crude Oil

Vessels transporting crude oil from the project site would likely be bound for West Coast refineries in the Puget Sound or California markets. As described in Appendix Q, while crude oil could be exported with the recent lifting of the ban of exports of U.S. crude oil, the economics make this unlikely. Asian refineries, primarily Korean, Japanese, or Chinese, would be the likely foreign markets for crude oil transported from the project site. However, freight costs to Asian refineries can be high, especially for the smaller vessels that are likely to call at the proposed facility. Even on the largest possible vessels considered (Panamax), exports would incur very high transportation costs. Bakken crude oil producers would have to discount the price of oil at the well significantly to overcome the high transportation costs to Asia.

### 5.4 What rail and vessel transport occurs in the extended study area?

This section provides a discussion of recent changes related to the transport of oil, including crude oil, in and out of Washington State. It then describes existing conditions related to the rail and vessel transportation along the likely routes in the extended study area.

#### 5.4.1 Movement of Crude Oil

Nationwide, domestic transport of crude oil by rail increased dramatically between 2010 and 2014, from 20 million barrels to 385 million barrels per year (U.S. Energy Administration 2016a). In 2015, the number of barrels transported by rail dropped to 323 million barrels per year. The decline in crude-by-rail volume is attributed to a global shift in foreign and domestic crude oil prices between foreign and domestic crudes. Reductions in domestic production due to lower global oil prices and new and expanded oil pipeline capacity are also contributing factors (U.S. Energy Administration 2016b). The majority of crude oil transported by rail in the United States originates in the North Dakota and Montana regions of the Bakken formation. West Coast ports and refineries are the second largest recipient of Bakken crude oil after the East Coast. Mirroring national trends, there was a sharp rise in the volume of Bakken crude oil transported by rail to the West Coast, from 453,000 barrels in 2010 to 52 million barrels in 2014, followed by a slight decline in 2015 to 50 million barrels (U.S. Energy Administration 2016c).

Multiple sources of crude oil have been transported into Washington State over the years. Because the capacity of Washington’s refineries has not substantially changed over the last decade, the amount of crude oil transported into the state has been steady at about 8.5 billion gallons annually. The primary source of crude oil has been tanker delivery from Alaska’s North Slope; however, the region’s oil production has been declining since 1988 (U.S. Energy Information Administration).
With this decline, tanker delivery of crude oil has shifted to pipeline and more recently to rail tank car (Figure 5-1).

Washington State oil refineries exported about 2.6 billion gallons of refined products in 2011, an increase of 17% from 2008. In addition, in 2011, 487.2 million gallons of bunker (vessel) fuel were loaded onto tank vessels and exported from Washington State refineries (Washington State Department of Ecology 2015).

Oil, including diluted bitumen from Canada, is transported by pipeline to refineries in northern Puget Sound. Puget Sound refineries transfer refined products to the Olympic Pipeline, tank vessels, and trucks for transport. Diluted bitumen and Bakken crude oil are also transported by rail through Spokane to a facility on the Columbia River and refineries in Puget Sound. Most crude oil shipped by rail in Washington transits through the Columbia River Gorge but could transit over other rail routes.

Nineteen loaded crude oil unit trains pass through Washington State weekly, or approximately 988 per year, destined either for the storage facilities and refineries described above, or for facilities in Oregon and California. Additionally, crude oil tank cars are transported on mixed commodity unit trains; data on these tank car movements are unknown. Table 5-1 and Figure 5-2 illustrate how the mode of crude oil transport to Washington State has changed from 2003 to 2013.
Figure 5-1. Movement of Oil In and Out of Washington State

### Table 5-1. Estimated Annual Oil Imports by Mode of Transportation into Washington State

<table>
<thead>
<tr>
<th>Year</th>
<th>Vessel</th>
<th>Pipeline</th>
<th>Rail</th>
<th>Total</th>
<th>Vessel</th>
<th>Pipeline</th>
<th>Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>7.8030</td>
<td>0.7753</td>
<td>0.0000</td>
<td>8.5783</td>
<td>91.0</td>
<td>9.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2004</td>
<td>7.3171</td>
<td>1.2929</td>
<td>0.0000</td>
<td>8.6100</td>
<td>85.0</td>
<td>15.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2005</td>
<td>7.5884</td>
<td>1.0919</td>
<td>0.0000</td>
<td>8.6803</td>
<td>87.4</td>
<td>12.6</td>
<td>0.0</td>
</tr>
<tr>
<td>2006</td>
<td>7.4826</td>
<td>1.3079</td>
<td>0.0000</td>
<td>8.7905</td>
<td>85.1</td>
<td>14.9</td>
<td>0.0</td>
</tr>
<tr>
<td>2007</td>
<td>7.1744</td>
<td>1.6338</td>
<td>0.0000</td>
<td>8.8083</td>
<td>81.5</td>
<td>18.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2008</td>
<td>6.9090</td>
<td>1.7784</td>
<td>0.0000</td>
<td>8.6875</td>
<td>79.5</td>
<td>20.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2009</td>
<td>6.9398</td>
<td>1.5992</td>
<td>0.0000</td>
<td>8.5390</td>
<td>81.3</td>
<td>18.7</td>
<td>0.0</td>
</tr>
<tr>
<td>2010</td>
<td>5.5713</td>
<td>2.0129</td>
<td>0.0000</td>
<td>7.5842</td>
<td>73.5</td>
<td>26.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2011</td>
<td>6.1756</td>
<td>2.1769</td>
<td>0.0000</td>
<td>8.3525</td>
<td>73.9</td>
<td>26.1</td>
<td>0.0</td>
</tr>
<tr>
<td>2012</td>
<td>5.9210</td>
<td>2.0756</td>
<td>0.5092</td>
<td>8.5057</td>
<td>69.6</td>
<td>24.4</td>
<td>6.0</td>
</tr>
<tr>
<td>2013</td>
<td>5.7480</td>
<td>2.0652</td>
<td>0.7128</td>
<td>8.5260</td>
<td>67.4</td>
<td>24.2</td>
<td>8.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>74.6302</strong></td>
<td><strong>17.8100</strong></td>
<td><strong>1.2220</strong></td>
<td><strong>93.6621</strong></td>
<td><strong>79.7</strong></td>
<td><strong>19.0</strong></td>
<td><strong>1.3</strong></td>
</tr>
</tbody>
</table>


### Figure 5-2. Crude Oil Imports into Washington State by Mode (2003–2013)

5.4.2 Rail

This section describes the mainline routes that would likely be used to transport crude oil under the proposed action in the extended study area. It provides a general description of the route from Williston Basin to the Washington state line, with more detailed information about rail traffic, operations and maintenance, and risks related to existing operations in the state.

5.4.2.1 Mainline Routes, Traffic, and Commodities

This section describes the routes that are assumed for transport of crude oil related to the proposed action.

Williston Basin to Washington/Idaho State Line

BNSF serves 10 originating terminals in the Williston Basin. BNSF main lines connect to 16 of the top 19 oil-producing counties in central and western North Dakota, and five of the six oil-producing counties in eastern Montana (Figure 5-3). BNSF transports more than half of the oil produced in the North Dakota and Montana regions of the Bakken formation.

Figure 5-3. Williston Basin Originating Crude Oil by Rail Terminals
From Williston Basin, loaded unit trains would travel along the most northerly BNSF route through western North Dakota, Montana, and Idaho to the Washington/Idaho state line. Figure 5-4 illustrates a likely route that would be used to transport crude oil under the proposed action, although other routes could be used.

Infrastructure and operating information for this route are described below by state.

- **North Dakota.** The route from Williston Basin, North Dakota, to the North Dakota/Montana state line consists of parts of two BNSF subdivisions (North Dakota Department of Transportation 2007).
  - **Zap Subdivision.** This subdivision is a BNSF rail line that runs 80.5 miles from the Zap Station to Mandan, North Dakota, and operates with a maximum speed of 25 miles per hour and a maximum carload of 143 tons.
  - **Dickinson Subdivision.** The North Dakota portion of this subdivision is a BNSF rail line that runs 174.2 miles from Mandan, North Dakota, to the North Dakota/Montana state line and operates with a maximum speed of 60 miles per hour and a maximum carload of 143 tons.

Combined, these segments cover 254.7 miles. Rail traffic on these segments transports grain, oil, coal, and other commodities. Rail tonnage in North Dakota increased by approximately 50%
between 2000 and 2011, from 20 million tons per year to 30 million tons per year. By 2014, the tonnage increased to more than 65 million associated with a rise in Bakken oil shale activity. In 2015, tonnage originating in North Dakota dipped to less than 60 million tons per year, of which 28 million tons were crude oil (North Dakota Department of Transportation 2016).

- **Montana.** The route through Montana consists of parts of BNSF subdivisions and Yellowstone Valley Railroad (Montana Department of Transportation 2010).
  - **Dickinson Subdivision.** The Montana portion of this subdivision is a BNSF rail line that runs 39.1 miles from North Dakota/Montana State Line to Glendive, Montana, and operates with a maximum speed of 50 miles per hour and maximum carload of 143 tons.
  - **Glendive to Snowden Segment.** This segment is the Yellowstone Valley Railroad System rail line that runs 78.7 miles from Glendive to Bainville, Montana, and operates with a maximum speed of 45 miles per hour and maximum carload of 143 tons.
  - **Glasgow Subdivision.** This subdivision is a BNSF rail line that runs 130.3 miles from Bainville to Glasgow, Montana. The Glasgow Subdivision serves Amtrak passenger service as well as freight operations. Freight trains operate with a maximum speed between 50 and 60 miles per hour and maximum gross car weight of 143 tons.
  - **Milk River Subdivision.** This subdivision is a BNSF rail line that runs 155.8 miles from Glasgow to Pacific Junction, Montana. The Milk River Subdivision serves Amtrak passenger service as well as freight operations. Freight trains operate with a maximum speed of 60 miles per hour and maximum gross car weight of 143 tons.
  - **Hi Line Subdivision.** This subdivision is a BNSF rail line that runs 253.5 miles from Pacific Junction to Whitefish, Montana. The Hi Line Subdivision serves Amtrak passenger service as well as freight operations. Freight trains operate with a maximum speed between 30 and 55 miles per hour and a maximum gross car weight of 143 tons.
  - **Kootenai River Subdivision.** This subdivision is a BNSF rail line that runs 133.2 miles from Whitefish, Montana to the Montana/Idaho state line. The Kootenai River Subdivision serves Amtrak passenger service as well as freight operations. Freight trains operate with a maximum speed between 20 and 60 miles per hour and a maximum gross car weight of 143 tons.

Combined, the segments cover 790.6 miles. Rail traffic along these segments transports coal, farm products, lumber and wood products, crude oil, and other commodities.

- **Idaho.** The route through Idaho consists of part of one BNSF subdivision (Idaho Department of Transportation 2013):
  - **Kootenai River Subdivision.** The Idaho portion of this subdivision runs 101.1 miles from the Montana/Idaho state line to the Idaho/Washington state line and operates with a maximum speed of 60 miles per hour.

Rail traffic on this segment transports cereal grain, coal, agricultural products, wood products, chemicals and fertilizers, and crude oil. On average, 28 to 48 trains pass through the corridor daily.
**Washington State**

Washington State is served by two Class 1 railroads: BNSF and the Union Pacific Railroad (Figure 5-1). Except for two small segments of Union Pacific–owned track, Union Pacific operates in Washington State on BNSF tracks. In Washington State, crude oil is currently transported only along BNSF main lines (Washington State Department of Ecology 2015).

BNSF operates more than 1,604 miles of rail line in Washington State, which represent almost 10% of their total system. BNSF is the largest rail operator in Washington, handling 1.367 million carloads in 2011 (Washington State Department of Transportation 2014b:37).

Although BNSF has not specified a route for crude oil unit trains in Washington, based on current BNSF train operations (Washington State Department of Transportation 2014b), unit trains transporting crude oil to the project site and returning empty trains are expected to use the routes described below (Figure 5-5).³

- **Loaded trains:**
  - West from the state line to Spokane
  - Southwest through Pasco then west along the Columbia River Gorge to Vancouver
  - North to Centralia
- **Empty trains:**
  - North from Centralia to Auburn
  - East over Stampede Pass to Pasco
  - Northeast to Spokane

Infrastructure and traffic data for these route segments are described below and summarized in Table 5-2.

- **Idaho/Washington State Line to Spokane.** This segment covers 18.6 miles and is part of BNSF's Kootenai River Subdivision. It is a double track with centralized traffic control (CTC).⁴ Capacity is approximately 76 trains per day and current volume is approximately 70 trains per day. All BNSF trains between the eastern part of BNSF's system and points in Washington State move over this segment. Train traffic includes intermodal, grain, coal, and general manifest⁵ trains. Amtrak's Empire Builder passenger service between Chicago, Illinois; Seattle, Washington; and Portland, Oregon, also uses this segment.

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³ BNSF could choose alternative routes. As volume increases on any one-line segment, BNSF may revise operations to distribute traffic over existing infrastructure or expand infrastructure. In addition to the existing routes in Washington, Union Pacific routes in Oregon bordering the Columbia to the south also operate crude oil trains.

⁴ With CTC, electrical circuits monitor the location of trains, allowing dispatchers to control train movements from a remote location, usually a central dispatching office. The signal system prevents trains from being authorized to enter sections of track occupied by other trains moving in the opposite direction.

⁵ A manifest train is freight train with a mixture of car types and cargoes, also known as a mixed freight train.
- **Spokane to Pasco.** This segment covers 145.5 miles and is part of BNSF’s Lakeside Subdivision. This line is mostly single track with CTC. Capacity is approximately 37 trains per day and current volume is approximately 39 trains per day, which exceeds capacity. Train traffic on this segment includes intermodal, grain, coal, and general manifest trains. The Portland section of Amtrak’s Empire Builder passenger service uses this segment. BNSF is currently making upgrades to increase capacity on this segment, including adding a second main line in some areas.

- **Pasco to Vancouver.** This segment covers 221.4 miles and is BNSF’s Fallbridge Subdivision, also known as the Columbia River Gorge route. It is mostly single track with CTC. Capacity is approximately 40 trains per day and current volume is approximately 34 trains per day. Train traffic on this route includes intermodal, grain, coal, and mixed freight. The Portland section of Amtrak’s Empire Builder passenger service also uses this route. BNSF uses directional operations on this segment, which increases capacity by running westbound loaded unit trains on this segment and eastbound empty unit trains via Stampede Pass.

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6 The Union Pacific rail line runs parallel to the south side of the Columbia River in Oregon but is not expected to be used by trains related to the proposed action.
- **Vancouver to Centralia.** This segment covers 85.5 miles and is part of BNSF’s Seattle Subdivision. It is double track with CTC. Capacity is approximately 78 trains per day and current volume is approximately 50 trains per day. This line also carries all Union Pacific trains between Portland, Oregon and Tacoma. Traffic includes intermodal, grain, coal and other unit trains along with manifest trains. This section of the BNSF line is also a key route for passenger trains. Amtrak’s Coast Starlight trains to and from California and Amtrak Cascades trains between Eugene, Oregon and Seattle, Washington use this segment. Scheduled to be completed by 2017, the Washington State Department of Transportation is constructing 3.7 miles of a third main track on the BNSF Seattle Subdivision main line in the Longview-Kelso area. The purpose of the third main track is to enable two trains to pass while a train is simultaneously moving into or out of the Longview Junction yard. This would reduce the potential for delays to passenger and freight trains running through the area.

- **Centralia to Auburn.** This segment covers 72.5 miles and is part of BNSF’s Seattle Subdivision. There are two main tracks and traffic control is CTC. Capacity is approximately 78 trains per day and current volume is approximately 50 trains per day. Traffic on this line includes intermodal, empty coal, and grain trains returning to the east, as well as manifest trains. This segment is also a key section for passenger trains. Amtrak’s Coast Starlight trains use this route, as do Sound Transit Sounder commuter trains on the section between Tacoma and Auburn.

- **Auburn to Yakima.** This segment covers 139.6 miles and is part of BNSF’s Stampede Subdivision. It is mostly single track and traffic control is mostly traffic warrant control (TWC) with some segments of CTC. Capacity is approximately 39 trains per day and current volume is approximately seven trains per day. Traffic volume consists largely of empty coal and grain trains. BNSF uses directional operations on this segment, which increases capacity by running empty eastbound unit trains on this segment and westbound loaded unit trains via the Columbia River Gorge.

- **Yakima to Pasco.** This segment covers 89.4 miles and comprises BNSF’s Yakima Valley Subdivision. It is mostly single track and traffic control is mostly TWC with some segments of CTC. Capacity is approximately 39 trains per day and current volume is approximately seven trains per day. Traffic volume consists largely of empty coal and grain trains returning to the east and some manifest trains.

Table 5-2 summarizes existing infrastructure and 2015 traffic data for the BNSF route segments in Washington State expected to be used by crude oil trains under the proposed action. The far right column presents estimated utilization, expressed as estimated traffic as a percentage of estimated capacity.

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7 Under this control system, train crews obtain authority to occupy and move on a main track from the dispatcher in the form of a completed track warrant form. Usually the track warrant information is transmitted to the train crew by phone, radio, or electronic transmission to the locomotive.
Table 5-2. Rail Traffic and Infrastructure along Anticipated Crude Oil Mainline Routes in Washington State—2015*

<table>
<thead>
<tr>
<th>Route Segment</th>
<th>Subdivision</th>
<th>Existing Traffic Control System</th>
<th>Existing Main Tracks</th>
<th>Estimated Traffic (Trips per Day)</th>
<th>Estimated Capacity (Trips per day)</th>
<th>Estimated Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho/Washington State Line—Spokane</td>
<td>Spokane</td>
<td>CTC</td>
<td>2</td>
<td>70</td>
<td>76</td>
<td>92%</td>
</tr>
<tr>
<td>Spokane—Pasco</td>
<td>Lakeside</td>
<td>CTC</td>
<td>1</td>
<td>39</td>
<td>37</td>
<td>105%</td>
</tr>
<tr>
<td>Pasco—Vancouver</td>
<td>Fallbridge</td>
<td>CTC</td>
<td>1</td>
<td>34</td>
<td>40</td>
<td>85%</td>
</tr>
<tr>
<td>Vancouver—Centralia</td>
<td>Seattle</td>
<td>CTC</td>
<td>2</td>
<td>50</td>
<td>78</td>
<td>64%</td>
</tr>
<tr>
<td>Centralia—Auburn</td>
<td>Seattle</td>
<td>CTC</td>
<td>2</td>
<td>50</td>
<td>78</td>
<td>64%</td>
</tr>
<tr>
<td>Auburn—Yakima</td>
<td>Stampede</td>
<td>TWC</td>
<td>1</td>
<td>7</td>
<td>39</td>
<td>18%</td>
</tr>
<tr>
<td>Yakima—Pasco</td>
<td>Yakima Valley</td>
<td>TWC</td>
<td>1</td>
<td>7</td>
<td>39</td>
<td>18%</td>
</tr>
</tbody>
</table>


CTC = Centralized Traffic Control; TWC = Traffic Warrant Control

Figure 5-6 presents 2010 traffic volume and capacity information by segment of BNSF subdivisions in Washington State.
Figure 5-6. BNSF Mainline Daily Traffic and Utilization—2010

Source: Washington State Department of Transportation 2014b:41
5.4.2.2 Operating Characteristics

The BNSF mainline routes vary with respect to operating characteristics, as summarized below.

- **Track class.** The Federal Railroad Administration sets track classes from 1 to 9 based on the quality of the track. Track class determines speed limits and maximum train car weight. It also determines whether the rail line can accommodate passenger trains. The BNSF mainline routes in Washington State are maintained at Class 4 specifications.

- **Control system.** The train control system ensures safety by managing rail traffic through signaling systems.

- **Speed.** The Federal Railroad Administration sets the speed limit based on track class, although some large communities may establish permanent speed restrictions. While unloaded unit bulk trains can operate at maximum track speed, unit trains carrying crude oil are restricted to a maximum speed of 45 miles per hour.\(^8\) Lesser volumes of oil and hazardous materials, however, may be transported in manifest trains. These trains can operate at the maximum speed allowed for class track and freight trains.

The U.S. Department of Transportation Pipeline And Hazardous Materials Safety Administration’s final rule on Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains (May 2015) places several restrictions and requirements on the high-hazard flammable unit trains.\(^9\) These controls relate to speed restrictions, braking systems, and routing, as follows.

- **Speed.** All trains that include 20 or more tank cars carrying a Class 3 flammable liquid in a continuous block or 35 such tank cars throughout the entire train are designated as high-hazard flammable trains and are restricted to 50 miles per hour in all areas. If such trains include tank cars that do not meet the new enhanced standards, they are restricted to 40 miles per hour in high-threat urban areas. If such trains include tank cars that do not meet the new enhanced standards, they are restricted to 40 miles per hour in high-threat urban areas. High-threat areas in Washington State include Portland to Vancouver and a 10-mile buffer extending from the border of the combined area, and Seattle to Bellevue and a 10-mile buffer extending from the border of the combined area (49 Code of Federal Regulations [CFR] 1580, Appendix A).

- **Braking.** High-hazard flammable trains must have a functioning two-way end-of-train device or a distributed power braking system in place. In addition, high-hazard flammable unit trains must be operated with an electronically controlled pneumatic braking system. This system must be implemented by January 1, 2021, if the train is transporting one or more tank cars loaded with a Packing Group I flammable liquid and by May 1, 2023, if it is transporting one or more tank cars loaded with a Packing Group II or III flammable liquid.\(^{10}\)

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\(^8\) Exceedance is determined by the total weight of the train (cars and commodity without the weight of the locomotives) divided by the number of cars in the train with operable brakes.

\(^9\) A high-hazard flammable unit train is one that travels at speeds greater than 30 miles per hour and includes 70 or more tank cars loaded with Class 3 flammable liquids. Crude oil and ethanol are Class 3 flammable liquids.

\(^{10}\) The packing groups set requirements based on the degree of danger presented by the material (I: high, II: medium, or III: low), which reflects the boiling point and flashpoint for the material carried.
Routing. Railroads must select their route based on a routing analysis that addresses at least 27 specified safety and security factors. They must also provide an appropriate point of contact to state and/or regional fusion centers and other state, local, and tribal officials who contact the railroad to discuss routing decisions. This is in addition to the requirements to notify State Emergency Response Commissions set forth in a May 2014 Emergency Order, per a recent clarification from the U.S. Department of Transportation.

5.4.2.3 Maintenance and Inspections

The Federal Railroad Administration requires that railroads conduct track inspections as well as maintain and upgrade track. Crews monitor track condition and maintain or upgrade ties, rail, and ballast, as necessary. This maintenance program relies on continual inspection of the track and grade crossings. As noted in Section 4.2, Applicable Regulations, the National Transportation Safety Board has issued recommendations that railroads take into account, at a minimum, accumulated tonnage, track geometry, rail surface conditions, railhead wear, rail steel specifications, track support, residual stresses in the rail, rail defect growth rates, and temperature differentials.

BNSF’s maintenance program in Washington included 1,011 miles of track surfacing and undercutting work, and the replacement of nearly 50 miles of rail and close to 203,000 ties, as well as signal upgrades for federally mandated positive train control (BNSF Railway Company 2015).

Track Inspection

Federal law requires BNSF corridors be inspected four times a week, and BNSF says many heavily traveled routes are inspected daily. The BNSF inspectors would review the conditions of tracks and rights-of-way as well as whistle posts, crossbucks, and active warning devices.

Grade Crossings

BNSF is responsible for maintenance of active warning devices. BNSF staff members inspect each active warning device monthly, reviewing the functionality of gates and lights and of battery power sources (BNSF Railway Company 2013).

Wayside Detector System

Wayside detectors monitor the condition of passing trains and alert rail car operators to potential defects. Locations of wayside detectors along the BNSF main line in Washington State are presented in Table 5-3. The detectors include dragging equipment detection, rail car journal integrity exception reporting, wheel impact detectors, and slide fence detectors.
### Table 5-3. Location of Wayside Detectors by Subdivision

<table>
<thead>
<tr>
<th>Main Line</th>
<th>Route</th>
<th>Mileposts (MP)</th>
<th>Route Miles</th>
<th>Number of Wayside Detectors</th>
<th>Average Miles between Detectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia River Gorge</td>
<td>Sandpoint, ID to Spokane, WA</td>
<td>3.0–71.5</td>
<td>68.5</td>
<td>14</td>
<td>4.89</td>
</tr>
<tr>
<td></td>
<td>Spokane to Pasco</td>
<td>1.1–147.5</td>
<td>146.4</td>
<td>28</td>
<td>5.23</td>
</tr>
<tr>
<td></td>
<td>Pasco to Vancouver, WA</td>
<td>229.7–9.9</td>
<td>219.8</td>
<td>28</td>
<td>7.85</td>
</tr>
<tr>
<td>North-South</td>
<td>Vancouver, WA to Seattle</td>
<td>136.5–0.3</td>
<td>136.2</td>
<td>12</td>
<td>11.35</td>
</tr>
<tr>
<td></td>
<td>Seattle to Everett</td>
<td>0.0–32.2</td>
<td>32.2</td>
<td>4</td>
<td>8.05</td>
</tr>
<tr>
<td></td>
<td>Everett to Blaine</td>
<td>0.0–119.3</td>
<td>119.3</td>
<td>9</td>
<td>13.26</td>
</tr>
<tr>
<td>Stevens Pass</td>
<td>Everett to Wenatchee</td>
<td>1784.7–1650.2</td>
<td>134.5</td>
<td>22</td>
<td>6.11</td>
</tr>
<tr>
<td></td>
<td>Wenatchee to Spokane</td>
<td>1650.2–1481.6</td>
<td>168.6</td>
<td>11</td>
<td>15.33</td>
</tr>
<tr>
<td>Stampede Pass</td>
<td>Auburn to Ellensburg</td>
<td>0.0–102.6</td>
<td>102.6</td>
<td>18</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>Ellensburg to Pasco</td>
<td>1.9–127.0</td>
<td>125.1</td>
<td>12</td>
<td>10.43</td>
</tr>
</tbody>
</table>


### 5.4.2.4 Existing Risks along the Rail Routes

Under existing conditions, rail incidents, including collisions and derailments, can occur in the extended study area. Regardless of the cargo, such an incident can result in injury and death, as well as damage to the natural and built environment. As described in Section 5.4.2.1, Mainline Routes, Traffic, and Commodities, trains currently transport a broad range of flammable and toxic materials in this extended study area, including crude oil. Figure 5-7 illustrates the number of loaded crude oil trains along mainline routes in Washington State in 2014. Because of these existing transport commodities, potential consequences of a rail incident under existing conditions also include release of hazardous materials, fires, explosions, and toxic vapor clouds.
The Federal Railroad Administration released a preliminary investigation report on the derailment of a crude oil train on a Union Pacific line that resulted in an explosion and fire in Mosier, Oregon in June 2016. The agency determined that the Union Pacific derailment was caused by broken lag bolts that caused the track gauge to widen. Multiple lag bolts in this section of Union Pacific track were broken and sheared, causing the tie plates to loosen from ties. The loosened tie plates allowed the rails to be pushed outward as trains moved across them, eventually widening the track gauge, leading to the derailment. Broken and sheared lag bolts, while difficult to detect by high-rail inspection, are more detectable by walking inspection combined with indications of movement in the rail or track structure and/or uneven rail wear.

The Transportation Safety Board of Canada has also released reports on incidents caused by track infrastructure problems that resulted in derailments of crude oil trains. The reports have found that track infrastructure failures may have played a role in two incidents near Gogama, Ontario and a third incident that involved a mixed manifest train on the Ruel Subdivision near Minnipuka, Ontario on March 5, 2015. The report states that crude oil unit trains transporting heavily loaded tank cars will tend to impart higher than usual forces to the track infrastructure during their operation. These higher forces expose any weaknesses in the track structure, making the track more susceptible to failure. The Transportation Safety Board has issued a Safety Advisory Letter for risk assessments to assess track infrastructure conditions and determine whether additional risk control measures are required. As noted previously, the U.S. National Transportation Safety Board has also issued a recommendation that railroads take into account, at a minimum, accumulated tonnage, track...
depending on the specific location of a rail incident (e.g., proximity to population centers and 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. Chapter 4, Section 4.7.2.1, Recent Fires and Explosions Involving Crude Oil Trains, and Chapter 7, Section 7.3.4.2, Potential Costs Related to Environmental Health and Safety Concerns, provide information about recent incidents involving the transport of crude oil.

As discussed in Chapter 4, Section 4.2.2, What framework prepares for an incident? the National Contingency Plan provides for geographic response plans (GRPs) to prepare for potential incidents involving the release of oil. GRPs have two main objectives: to identify sensitive resources at risk of injury from oil spills and to direct response actions to protect these sensitive resources during the initial hours of a response.11 These plans help coordinate response efforts by the responsible party and federal and state agencies. Strategies in the plan are deployed by responders after the immediate concern of controlling and containing the source of a spill has been addressed. GRPs contain maps and descriptions of natural, cultural, and economic resources and identify strategies to reduce harm to those resources. They also prioritize which response strategies should be implemented based on the location of the spill.

Twenty-seven GRPs in Washington State have been completed (Washington State Department of Ecology 2016a). In 2016, four existing GRPs will be updated and four new GRPs will be developed. The new areas are the Lower Skagit River, Nooksack River, Samish River, and (Lower) Yakima River. Not all GRPs address responses for submerged or sinking oils (Washington State Department of Ecology 2015).

Even with preparedness planning, the equipment necessary for oil spill containment, responder health and safety monitoring, and fire suppression capabilities during a crude oil emergency are currently insufficient across much of Washington (Washington State Department of Ecology 2015). As noted in Chapter 4, Section 4.2.3, What framework responds to an incident? local fire departments currently lack the funding necessary to plan, train, and equip their communities for crude oil incidents. In 2006, the Washington State Department of Ecology (Ecology) administered a grant program that provided specialized oil spill response equipment and training to local first responders and tribes across Washington and trained over 1,000 first responders on how to safely and effectively deploy the equipment. Additional ongoing training is needed, including specialized training to address the needs of first responders who now face the additional risk of highly flammable crude oils currently being shipped by rail (Washington State Department of Ecology 2015).

The regulatory framework provides mechanisms for facilities and vessel operators to contribute funds in the forms of fees and taxes to support Ecology’s Spill Prevention, Preparedness, and Response Program. With the shift of crude oil imports away from tankers to rail and pipeline, where similar funding mechanisms are not as well developed, a vital funding source supporting Ecology’s program and other state entities has decreased. The additional costs for prevention, preparedness,

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and response activities are not sustainable with current funding mechanisms (Washington State Department of Ecology 2015). New final rules described in Section 4.2, Applicable Regulations, are intended to partially address this issue.

5.4.3 Vessel

As described in Section 5.3, What are the likely sources and destinations of crude oil? West Coast refineries are the most likely destinations of crude oil that would be transported from the project site.

5.4.3.1 Routes

Outside of state waters (3 nautical miles from the mouth of Grays Harbor), empty vessels travelling to the project site or laden vessels transporting crude oil from the project site would travel north to Puget Sound refineries or south to California refineries. Vessels transporting oil/bulk liquids as part of the proposed action are not expected to transit the Columbia River.

Under recommendations from the Pacific States/British Columbia Oil Spill Task Force, loaded tank vessels typically transit along routes 50 nautical miles from the coast and freight vessels transit 25 nautical miles from the coast.

Table 5-4 presents the number of vessels of more than 1,000 gross tons that called at selected West Coast ports in 2015.
Table 5-4. Number of Vessels of more than 1,000 Gross Tons Calling at Selected West Coast Ports—2015

<table>
<thead>
<tr>
<th>Port Location</th>
<th>Number of Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Washington</strong></td>
<td></td>
</tr>
<tr>
<td>Anacortes</td>
<td>205</td>
</tr>
<tr>
<td>Cherry Point</td>
<td>259</td>
</tr>
<tr>
<td>Everett</td>
<td>118</td>
</tr>
<tr>
<td>Port Angeles</td>
<td>244</td>
</tr>
<tr>
<td>Seattle</td>
<td>643</td>
</tr>
<tr>
<td>Tacoma</td>
<td>1,062</td>
</tr>
<tr>
<td>Kalama</td>
<td>274</td>
</tr>
<tr>
<td>Vancouver</td>
<td>344</td>
</tr>
<tr>
<td><strong>California</strong></td>
<td></td>
</tr>
<tr>
<td>Benicia</td>
<td>536</td>
</tr>
<tr>
<td>Martinez</td>
<td>29</td>
</tr>
<tr>
<td>Oakland</td>
<td>1,406</td>
</tr>
<tr>
<td>Pittsburg</td>
<td>86</td>
</tr>
<tr>
<td>Richmond</td>
<td>636</td>
</tr>
<tr>
<td>Stockton</td>
<td>234</td>
</tr>
<tr>
<td>San Francisco</td>
<td>41</td>
</tr>
<tr>
<td>Long Beach</td>
<td>1,835</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>1,853</td>
</tr>
<tr>
<td>San Diego</td>
<td>385</td>
</tr>
</tbody>
</table>

Source: U.S. Maritime Administration 2015

Puget Sound Destinations

Several large crude oil refineries are located in Puget Sound, including the BP and Phillips 66 refineries in Ferndale and the Tesoro and Shell refineries in Anacortes. Vessels transporting crude oil from the project site to Puget Sound refineries would travel north along the coast, past the Olympic Coast National Marine Sanctuary to the northwestern tip of Washington State, and enter the Strait of Juan de Fuca, which separates Vancouver Island to the north from the Olympic Peninsula to the south (Figure 5-8).

Large commercial vessels operating in Puget Sound typically call at ports in Port Angeles, Seattle, Tacoma, Olympia, or Vancouver, British Columbia. In 2015, large commercial vessels made approximately 5,196 trips to and from Washington ports in Puget Sound; approximately 3,400 of these trips were via the Strait of Juan de Fuca. There were an additional 5,990 large commercial vessel trips along the Strait of Juan de Fuca to access Canadian ports (Washington State Department of Ecology 2016b).
Vessels traveling from the project site to Puget Sound would pass the Olympic Coast National Marine Sanctuary, which comprises approximately 2,408 square nautical miles of coastal and ocean waters and the submerged lands off the central and northern coast of Washington State (Figure 5-8). The sanctuary, which is connected to both the Big Eddy Ecosystem and the California Current Large Marine Ecosystem, is one of North America’s most productive marine regions and undeveloped shorelines. The northern edge of the sanctuary begins just north of Cape Flattery, Washington, and the southern boundary is located approximately 12 nautical miles north of the entrance to Grays Harbor.

The sanctuary includes an area designated as an Area to Be Avoided by the International Maritime Organization in 1994 at the request of the U.S. government (Figure 5-9). The designation is intended to protect the sanctuary by limiting vessel transits off the coast of Washington to reduce the risk of marine casualties such as oil spills and the resulting environmental damage to the sanctuary. The designation applies to all ships 400 gross tons and greater and to any ships and barges that carry oil or hazardous materials as cargo or tanks containing residual oil. Complying with the Area to Be Avoided designation is a requirement under the terms of the Area to Be Avoided designation and is intended to protect the sanctuary from harm.
Avoided is voluntary, but in 2012 the compliance rate for all vessels over 400 gross tons was 98% (National Oceanic and Atmospheric Administration 2013).

**Strait of Juan de Fuca**

The Strait of Juan de Fuca, accessible from the Pacific Ocean, and its approaches provide access to Port Angeles, Puget Sound, and the San Juan Island Archipelago (Figure 5-8). To the north and
connected by Haro Strait and Boundary Pass is the Strait of Georgia. Deep-draft vessels entering the Strait of Juan de Fuca use the harbors at Port Angeles, Anacortes, Seattle, Tacoma, Olympia, and Bellingham, Washington, and Vancouver, British Columbia. The Strait of Juan de Fuca separates the south shore of Vancouver Island, Canada, from the north coast of Washington State. Commerce in this region is extensive. Vessels entering the Strait of Juan de Fuca for commerce may be foreign-flagged or U.S.-flagged.

From the Pacific Ocean, proposed action vessels would travel through the Strait of Juan de Fuca. The strait is about 11 miles wide for approximately 50 miles to Race Rocks and then widens to about 16 miles for 30 miles east to Whidbey Island, its eastern boundary (National Oceanic and Atmospheric Administration 2015). The waters are typically deep until near the shore with few outlying dangers, most of which are in the eastern part. The navigation of these waters is relatively simple in clear weather. In thick weather, because of strong and irregular currents, extreme caution and vigilance must be exercised.

**Vessel Traffic Management**

The U.S. Coast Guard commands a vessel traffic service system in Puget Sound to facilitate the safe and efficient transit of vessel traffic and to prevent collisions or groundings. This system conducts real-time reporting, monitoring, and management of vessel traffic and anchorage usage and provides instant information and advice 24 hours a day as needed. It also enforces navigation rules and special safety and security restrictions. It may adjust certain rules or restrictions for safety reasons.

Vessels are tracked using automated identification systems required on all large commercial vessels. The Marine Exchange of Puget Sound tracks vessels in Puget Sound, Grays Harbor, and off the Washington coast for 150 miles. The Merchants Exchange of Portland tracks vessels in the Lower Columbia River and off the Washington and Oregon coasts. An example of the large commercial vessel transits tracked along the coast of the Olympic Peninsula of Washington State is shown in Figure 5-10.

An International Maritime Organization-approved traffic separation scheme governs vessel traffic in Puget Sound and its approaches. This area is actively managed by a joint U.S.–Canadian Cooperative Vessel Traffic Service. The separation scheme consists of five sets of traffic lanes: the western approach and the southwestern approach from the ocean; the western lanes in the strait; the southern lanes to Port Angeles; the northern lanes to Victoria, British Columbia; and two precautionary areas, one west-northwest of Cape Flattery and the other north of Port Angeles. Each set of lanes consists of inbound and outbound traffic lanes with separation zones (National Oceanic and Atmospheric Administration 2015). Tank vessels are not required to meet the Rosario Strait one-way traffic rules in 33 CFR 161.55. Tug vessels are monitored by the U.S.–Canadian Cooperative Vessel Traffic Service during transit though Rosario Strait and Puget Sound.
Operations

Tankers over 125,000 deadweight tons\textsuperscript{12} bound for a U.S. port are prohibited from operating in Puget Sound (33 CFR 165.1303). All oil tankers (as defined in 33 CFR 168) and vessels of 40,000 deadweight tons or more must have tug escorts (Revised Code of Washington [RCW] 88.16.190). All escorts must be nearby to ensure timely and effective response, taking into consideration the sea and weather conditions, ship characteristics, and nearby traffic.

\textsuperscript{12} Deadweight ton refers to the ship's weight-bearing capacity: it is the sum of all cargo, provisions, and crew, but not the weight of the ship itself.
The Puget Sound Harbor Safety Committee has implemented a harbor safety plan with standards of care for bunkering (fueling), anchoring, and actions for incidents, towing vessels, and tanker escorts.

**Emergency Response**

To help protect Washington’s shorelines and waterways, the Washington State maritime industry has permanently stationed an emergency response towing vessel in Neah Bay. The tug is an important safety net to prevent disabled ships and barges from grounding off Washington’s outer coast or in the western Strait of Juan de Fuca. Tank vessels transiting to or from a Washington port through the Strait of Juan de Fuca (except for transits extending no further west than Race Rocks Light) must include the emergency response towing vessel stationed at Neah Bay in their oil spill contingency plans (RCW 88.46.130).

**Bunkering and Refueling**

Vessels transiting to Puget Sound may refuel (or bunker) while at dock or at anchor. Bunkering operations regularly occur in Puget Sound. Bunkering operations in Washington waters are subject to both U.S. Coast Guard regulations (33 CFR 155–156, 46 CFR Sections 12, 15, and 35) and Washington State regulations (WAC 317-40 and WAC 173-184) addressing bunkering, oil transfer operations and prebooming requirements. The Puget Sound Harbor Safety Plan includes standards of care for refueling operations.

**California Destinations**

California operates 11 public ports, including three megaports (Los Angeles, Long Beach, and Oakland); eight smaller niche ports (Hueneme, Humboldt Bay, Redwood City, Richmond, West Sacramento, San Diego, San Francisco, and Stockton); and one private port (Benicia). The Ports of Los Angeles and Long Beach form the largest port complex in the United States, handling 25% of all container cargo traffic in the United States. California has a large oil refining capacity—over 2 million barrels per day of crude oil, with the majority of this capacity in the Los Angeles region and San Francisco Bay Area. Bunkering Operations in California waters are subject to U.S. Coast Guard regulations, 33 CFR 155–156, and 14 California Code of Regulations, Chapter 3, Subchapter 6.

**5.4.3.2 Existing Risks along the Vessel Routes**

Under existing condition, vessel incidents such as collisions and groundings can occur in the extended study area. Regardless of the cargo, such an incident can result in injury, death, or an oil spill that could cause damage to the natural and built environment. Because vessels transport a broad range of flammable and toxic materials in the extended study area, potential consequences also include exposure to spilled materials, and fires, explosions, and toxic vapor clouds.

Depending on the specific location of a vessel incident (e.g., proximity to population centers or 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. Chapter 7, Section 7.3.4.2, Potential Costs Related to Environmental Health and Safety Concerns, provides additional information about recent incidents involving the transport of crude oil.

As discussed in Chapter 4, Section 4.2.2, What framework prepares for an incident? the National Contingency Plan provides for GRPs to prepare for potential incidents involving the release of oil.
GRPs have two main objectives: to identify sensitive resources at risk of injury from oil spills and to direct response actions to protect these sensitive resources during the initial hours of a response. These plans help coordinate response efforts by the responsible party and federal and state agencies. Strategies in the plan are deployed by responders after the immediate concern of controlling and containing the source of a spill has been addressed. GRPs contain maps and descriptions of natural, cultural, and economic resources and identify strategies to reduce harm to those resources. They also prioritize which response strategies should be implemented based on the location of the spill. The GRP response strategies are designed for use with persistent heavy oils that float on water and may not be suitable for other petroleum products or hazardous substances.

Twenty-seven GRPs in Washington State have been completed (Washington State Department of Ecology 2016a).

Even with preparedness planning, the equipment necessary for oil spill containment, responder health and safety monitoring, and fire suppression capabilities during a crude oil emergency are currently insufficient across much of Washington (Washington State Department of Ecology 2015). As noted in Section 4.2.3, What framework responds to an incident? many local fire departments currently lack the funding necessary to plan, train, and equip their communities for crude oil incidents. In 2006, Ecology administered a grant program that provided specialized oil spill response equipment and training to local first responders and tribes across Washington and trained over 1,000 first responders on how to safely and effectively deploy the equipment. Additional ongoing training is needed, including specialized training to address the needs of first responders who now face the additional risk of highly flammable or heavier crude oils currently or potentially being shipped by vessel (Washington State Department of Ecology 2015).

5.5 What are the potential impacts related to rail and vessel transport in the extended study area?

This section describes the potential impacts of rail and vessel transport in the extended study area under the no-action alternative and the proposed action.

5.5.1 No-Action Alternative

Under the no-action alternative, the proposed action would not occur and the applicant would continue to operate its existing facility as described in Chapter 2, Section 2.1.3.2, Existing Operations. It is assumed that growth in the extended study area would continue under the no-action alternative. Projected rail and vessel traffic under the no-action alternative and potential impacts are described below.

5.5.1.1 Rail Transport

This section describes projected rail traffic, planned capacity enhancements and maintenance, and potential impacts in the extended study area under the no-action alternative.

Traffic

Growth in rail traffic along the main line between Williston Basin and Washington through 2035 is expected to follow national trends. As described in Section 5.4.2.1, *Mainline Routes, Traffic, and Commodities*, a diverse range of freight is transported along the main line, including agricultural products, chemicals, forest products, farm and food products, coal, and petroleum products. While the volume of coal and petroleum products transported by rail nationwide has decreased slightly since 2014, the volume of other products such as grain and chemicals has increased (Association of American Railroads 2016). Transport of crude oil by rail, although currently on a downward trend since oil prices began to fall in 2014 and domestic crude became less economical to produce and transport, saw explosive growth from 2010 to 2014 (U.S. Energy Administration 2016a). The U.S. Energy Information Administration (2016d, 2016e) forecasts domestic production of crude oil to return to the recent peak in 2015 of 9.4 million barrels per day, the highest levels of domestic production since the 1970s, by 2025. A rebound in the domestic production of crude oil is expected to increase crude by rail transport, although some of the increase is likely to be offset by new pipeline capacity.

Estimates from before the recent drop in commodity prices suggest a long-term increase in rail traffic along the BNSF main line as more freight transits through Midwestern states to coastal ports and population centers. The Idaho Department of Transportation (2013) estimates that daily traffic on the Idaho portion of the BNSF Kootenai River Subdivision, which spans from Whitefish, Montana, to Spokane, Washington, will increase from 28 trips per day in 2012 to 70 trips per day in 2040, an increase of 133%. In Montana, the volume of freight shipped by rail 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).

Washington’s rail system is expected to handle more than 260 million tons of cargo by 2035—more than double the volume carried on the system in 2010 (Washington State Department of Transportation 2014b). This represents a compounded annual growth rate of 3.4% for commodities carried on the BNSF main lines.

Table 5-5 presents projected rail traffic in the state along the segments expected to be used by unit trains related to the proposed action, as described in Section 5.4.2.1, *Mainline Routes, Traffic, and Commodities*. The rail traffic projections in are based on data collected between 2010 and 2013 (Washington State Department of Transportation 2014b). Rail traffic is highly dynamic and fluctuates because of changing demand. The 2035 rail traffic estimates are intended to provide a “snapshot” of estimated rail traffic volumes; the rail traffic estimates do not represent actual volumes for 2035. The estimates do not include crude oil trains or rail traffic related to coal export terminals proposed in Washington State. The far right column presents estimated utilization, expressed as estimated traffic as a percentage of estimated capacity, assuming no improvements or operational changes.
### Table 5-5. Rail Traffic along Anticipated Crude Oil Mainline Routes in Washington State in 2015 and 2035

<table>
<thead>
<tr>
<th>Route Segment</th>
<th>Subdivision</th>
<th>Estimated 2015&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Projected 2035</th>
<th>Traffic Volumes&lt;sup&gt;b&lt;/sup&gt; Utilization&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho/Washington State Line–Spokane</td>
<td>Spokane</td>
<td>70</td>
<td>125</td>
<td>76</td>
</tr>
<tr>
<td>Spokane–Pasco</td>
<td>Lakeside</td>
<td>39</td>
<td>66</td>
<td>37</td>
</tr>
<tr>
<td>Pasco–Vancouver</td>
<td>Fallbridge</td>
<td>34</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Vancouver–Centralia</td>
<td>Seattle</td>
<td>50</td>
<td>85</td>
<td>78</td>
</tr>
<tr>
<td>Centralia–Auburn</td>
<td>Seattle</td>
<td>50</td>
<td>85</td>
<td>78</td>
</tr>
<tr>
<td>Auburn–Yakima</td>
<td>Stampede</td>
<td>7</td>
<td>13</td>
<td>39</td>
</tr>
<tr>
<td>Yakima–Pasco</td>
<td>Yakima Valley</td>
<td>7</td>
<td>13</td>
<td>39</td>
</tr>
</tbody>
</table>

<sup>a</sup> Extrapolated to 2015.

<sup>b</sup> Numbers do not include crude oil unit trains or rail traffic related to coal export terminal proposals in Washington State.

<sup>c</sup> Without improvements or operational changes.

Source: Washington State Department of Transportation 2014b.

Figure 5-11 presents 2010 traffic volume and capacity information by segment of the subdivisions.
Figure 5-11. BNSF Mainline Daily Traffic and Utilization—2035

Source: Washington State Department of Transportation 2014b:41
Table 5-6 presents proposed and operating facilities moving crude oil by rail in the extended study area in Washington State (Washington State Department of Ecology 2015).

Table 5-6. Proposed and Operating Facilities Moving Crude Oil by Rail

<table>
<thead>
<tr>
<th>Owner or Proponent</th>
<th>Location</th>
<th>Daily Trains (Empty and loaded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP Refinery</td>
<td>Cherry Point</td>
<td>2</td>
</tr>
<tr>
<td>NuStar Terminal</td>
<td>Vancouver</td>
<td>0.6</td>
</tr>
<tr>
<td>Phillips66 Refinery</td>
<td>Ferndale</td>
<td>1</td>
</tr>
<tr>
<td>Shell Refinery</td>
<td>Anacortes</td>
<td>2</td>
</tr>
<tr>
<td>Targa Sound Terminal</td>
<td>Tacoma</td>
<td>2</td>
</tr>
<tr>
<td>Tesoro Refinery</td>
<td>Anacortes</td>
<td>2</td>
</tr>
<tr>
<td>U.S. Oil Refinery</td>
<td>Tacoma</td>
<td>1</td>
</tr>
<tr>
<td>Vancouver Energy Terminal</td>
<td>Vancouver</td>
<td>8</td>
</tr>
</tbody>
</table>

Planned Capacity Enhancements

BNSF initiated the following capital project on the assumed rail routes in Washington State in 2015.

- Replacement of the Washougal River Bridge in Camas began in late 2014 and is expected to continue through 2016.

In addition, the following projects to improve reliability and on-time performance for passenger trains would have benefits for freight rail traffic (Washington State Department of Transportation 2014b).

- A third main line between Kelso and Longview is under construction and planned for completion in fall 2017.

- A new siding near Kalama—the Kelso Martin's Bluff New Siding Project—is under construction and planned for completion in fall 2017.

- A BNSF unit train staging yard could be constructed near Woodland, which would increase the efficiency of BNSF routes through the Columbia River Gorge and along the Interstate 5 corridor. BNSF currently stages unit grain trains in Pasco for movement to export terminals on the lower Columbia River, Puget Sound, and Grays Harbor. The distance between the Pasco staging yard and the export terminals increases the potential for train delays. A staging yard in Woodland would reduce the distance to the export terminals. This project would also benefit passenger trains by reducing conflicts with slower-moving freight trains. This project is currently in the discussion phase.

Potential Impacts

Increased 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, routine operations related to increased rail transport along the BNSF main lines would incrementally increase currently occurring impacts on the natural and built environment, summarized as follows.

- Emission of ambient air pollutants and air toxics from train engine exhaust.
- Incidental 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.

Increased rail transport along the BNSF main lines in Washington State would also increase the likelihood of rail incidents, including collisions and derailments. Moreover, the increase in transport of crude oil and other hazardous materials by rail would increase the likelihood that a rail incident would result in consequences such as oil spills, fires, or explosions. Although rail incidents and related consequences could occur more frequently with increased rail traffic generally and increased transport of crude oil and other hazardous materials specifically, if the types of materials transported do not change significantly, the potential consequences associated with a rail incident would remain similar in nature and magnitude to those that could occur under existing conditions.

Chapter 4, Section 4.7, *Impacts on Resources*, describes the impacts that could result from an oil spill, fire, or explosion. These impacts are not specific to a particular size event or a specific location; therefore, they can be generally applied to a potential event in the extended study area.

Depending on the specific location of a rail incident (e.g., proximity to population centers and 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 5.4.2.4, *Existing Risks along the Rail Routes*, there are existing preparedness and response gaps with respect to transport of crude oil by rail. While new final rules described in Chapter 4, Section 4.2.2, *What framework prepares for an incident?* are intended to partially address these gaps, 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.

### 5.5.1.2 Vessel Transport

This section describes projected vessel traffic and potential impacts in the extended study area under the no-action alternative.
Traffic

The outlook for vessel traffic along the U.S. West Coast is influenced by numerous global, national, and regional factors. An increase in large vessel traffic depends in large part on the health of the global economy and U.S. trade with Asian nations, which are a major source of ship traffic to West Coast ports. The Washington Public Ports Association and Washington State Department of Transportation sponsored a marine cargo forecast for Washington in 2011. This forecast estimates continued, steady growth through 2030 of all types of cargo transported by vessel, with from 0.2% increase in liquid bulk products such as petroleum to 6.8% increase in dry bulk products such as mineral ore (BST Associates 2011). With the recent drop in commodity prices, including crude oil, it is reasonable to assume that the near-term outlook for waterborne trade would be lower than these projections, but an increase in global trade in the long-term would likely result in an expansion of West Coast vessel traffic.

The volume of petroleum products transported by vessel along the West Coast is subject to global supply and demand as well as regional constraints. Domestic maritime trade (the transport by vessel from one U.S. port to another U.S. port, also referred to as coastwise trade) is required by law to be on U.S.-registered vessels. The Magnuson Amendment (33 United States Code [U.S.C.] 476) places limits on increasing the capacity of Washington’s Puget Sound. Given these limitations, continued growth in petroleum trade along the western region of the United States will depend on new infrastructure development and shipping capacity. Alternative means of transporting oil, including rail and pipeline, may also affect the volume of crude oil transported by vessel.

Because of the challenges and limitations of forecasting vessel traffic, projections of vessel traffic cannot be quantified for the extended study area. The following subsections describe general impacts associated with an increase in vessel traffic over existing conditions. A larger increase in vessel traffic would result in greater impacts and a smaller increase or decrease in vessel traffic would result in lesser impacts.

Potential Impacts

Increased vessel traffic along West Coast vessel routes and at Puget Sound and California ports 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.
Increased vessel transport in the extended study area would also increase the likelihood of vessel incidents. Moreover, the increase in transport of crude oil and other hazardous materials by vessel would increase the likelihood that a vessel incident would result in consequences such as oil spills, fires, or explosions. Although vessel incidents and related consequences could occur more frequently with increased vessel traffic generally and increased transport of crude oil and other hazardous materials specifically, if the types of materials transported do not change significantly, the potential consequences associated with a vessel incident would remain similar in nature and magnitude to those that could occur under existing conditions.

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 at a specific location; therefore, they can be generally applied to a potential event in the extended study area. Depending on the specific location of a vessel incident (e.g., proximity to population centers and 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.

### 5.5.2 Proposed Action

This section describes the impacts that could occur in the extended study area as a result of the transport of crude oil by rail and vessel related to the proposed action.

#### 5.5.2.1 Rail Transport

**Traffic**

The proposed action would result in 458 unit train trips\(^{14}\) per year (1.25 trips per day on average) at maximum throughput. Half of these trips would be loaded trains and half would be returning empties. Table 5-7 present these trips as a percentage of 2015 traffic estimates and 2035 traffic projections. As shown in the table, trips related to the proposed action represent between 1.3 and 8.9% of 2015 traffic estimates along the assumed routes; along the routes assumed for loaded trains, proposed action trips represent between 1.3 and 3.2% of 2015 estimates. Proposed action trips represent between 0.7 and 4.8% of 2035 projections along the assumed routes; along the assumed routes for loaded trains, proposed action trips represent between 0.7 and 1.9% of 2035 estimates.

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\(^{14}\) A trip represents one-way travel; in other words an inbound loaded train trip and outbound empty train trip are counted as two trips.
Table 5-7. Proposed Action Rail Trips as Percentage of Existing and Projected Rail Trips in the Extended Study Area under the No-Action Alternative

<table>
<thead>
<tr>
<th>Route Segment</th>
<th>Subdivision</th>
<th>Estimated 2015 Trips Per Daya</th>
<th>Proposed Action Trips as a Percentage</th>
<th>Projected 2035 Trips per Dayb</th>
<th>Proposed Action Trips as a Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idaho/Washington State Line–Spokane</td>
<td>Spokane</td>
<td>70</td>
<td>1.8%</td>
<td>125</td>
<td>1.0%</td>
</tr>
<tr>
<td>Spokane–Pasco</td>
<td>Lakeside</td>
<td>39</td>
<td>3.2%</td>
<td>66</td>
<td>1.9%</td>
</tr>
<tr>
<td>Pasco-Vancouverc</td>
<td>Fallbridge</td>
<td>34</td>
<td>1.8%</td>
<td>56</td>
<td>1.1%</td>
</tr>
<tr>
<td>Vancouver–Centralia c</td>
<td>Seattle</td>
<td>50</td>
<td>1.3%</td>
<td>85</td>
<td>0.7%</td>
</tr>
<tr>
<td>Centralia–Auburnd</td>
<td>Seattle</td>
<td>50</td>
<td>1.3%</td>
<td>85</td>
<td>0.7%</td>
</tr>
<tr>
<td>Auburn–Yakima d</td>
<td>Stampede</td>
<td>7</td>
<td>8.9%</td>
<td>13</td>
<td>4.8%</td>
</tr>
<tr>
<td>Yakima–Pasco d</td>
<td>Yakima Valley</td>
<td>7</td>
<td>8.9%</td>
<td>13</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

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 Assumes loaded proposed action trains only.
d Assumes empty proposed action trains only.
Source: Washington State Department of Transportation 2014b.

Potential Impacts

The proposed action could result in an increase in rail traffic along the BNSF main lines in the extended study area, which 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, routine rail transport along the BNSF main lines related to the proposed action could result in an incremental increase in the following impacts on the natural and built environment similar to existing conditions and the no-action alternative.

- Emission of ambient air pollutants and air toxics from train engine exhaust.
- Incidental 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 can be generally applied to 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.

In addition, crude oil rail transport along the BNSF main lines in Washington State under the proposed action could increase the likelihood of rail incidents and related consequences (i.e., oil
spills, fires, and explosions). 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 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 noted in Section 5.4.2.4, *Existing Risks along the Rail Routes*, there are existing preparedness and response gaps with respect to transport of crude oil by rail. While new final rules described in Chapter 4, Section 4.2.2, *What framework prepares for an incident?* are intended to partially address these gaps, 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 similar to the no-action alternative.

### 5.5.2.2 Vessel Transport

**Traffic**

The proposed action would result in 238 tank vessel trips per year (0.7 trip 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, proposed action vessel trips are compared to existing conditions.

Table 5-8 presents proposed action tank vessel trips as a percentage of existing large commercial vessel trips to and from selected West Coast destinations in the extended study area where proposed action vessel trips may occur. As shown in the table, proposed action vessel trips at maximum throughput operation (238 trips per year) would represent 4.5% of existing large commercial vessel traffic in Puget Sound, 4.0% of such traffic at larger ports accessed via San Francisco Bay, and 3.2% at Los Angeles area ports.  

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15 The Ports of Los Angeles and Long Beach, which are adjacent to each other.
Table 5-8. Proposed Action Vessel Trips as a Percentage of Existing Vessel Trips Related to Select West Coast Destinations

<table>
<thead>
<tr>
<th>Selected West Coast Destinations</th>
<th>Estimated Annual Trips 2015a</th>
<th>Proposed Action Trips as a Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puget Sound</td>
<td>5,196</td>
<td>4.5%</td>
</tr>
<tr>
<td>California</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Francisco Bay Area Ports</td>
<td>5,936</td>
<td>4.0%</td>
</tr>
<tr>
<td>Los Angeles–Long Beach Ports</td>
<td>7,376</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

* 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).


Potential Impacts

Vessel traffic related to the proposed action is anticipated to have a negligible impact on vessel traffic in the extended study area. However, it could result in an incremental increase in the following impacts on the natural and built environment similar to existing conditions and the no-action alternative.

- 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.

Crude oil vessel transport in the extended study area could result in an increased likelihood of a vessel incidents and related consequences (i.e., oil spills, fires, and explosions). 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 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 similar to the no-action alternative.

### 5.6 Would the proposed action have unavoidable and significant adverse impacts on rail and vessel transport in the extended study area?

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