5.1 NO ACTION ALTERNATIVE

The No Action Alternative includes the Status Quo Baseline and three scenarios that could result if the Presidential Permit is denied or the proposed Project is not otherwise implemented. These are carried forward for analysis under the No Action Alternative in this Final Supplemental Environmental Impact Statement (Final Supplemental EIS). See Section 2.2, Description of Alternatives, for detailed descriptions of the Status Quo Baseline and the scenarios and how they were developed.

The White House Council on Environmental Quality guidance states that if denial of a Proposed Action would result in predictable actions by others, the consequences of adopting the No Action Alternative should be considered in the EIS (Council on Environmental Quality 1981). In this case, given the Government of Canada's (and Alberta's) stated commitment to develop the oil sands, the global crude oil market dynamics, the economic modeling done as part of the Final Supplemental EIS, and the examples of market responses over the past few years regarding crude oil transport in North America, it is likely that if the proposed Project did not proceed, producers of Western Canadian Sedimentary Basin (WCSB) and Bakken crude oil production would continue to utilize alternative transport infrastructure to accommodate increasing production of WCSB and Bakken crude oils. Therefore, the No Action Alternative considers the Status Quo Baseline and scenarios that include the potential consequences of denying the Presidential Permit for the proposed Project or if the proposed Project were not otherwise built. It is important for both the policy makers (i.e., the U.S. Department of State [the Department]) and the public to understand the potential effects of the implementation of other reasonable crude oil transport scenarios.

Under the Status Quo Baseline, the proposed Project would not be built. The environmental conditions under the baseline would therefore be the same as those described in the respective resource sections in Chapter 3, Affected Environment, and the impacts along the pipeline corridor associated with the proposed Project would not occur. The Status Quo Baseline serves as the baseline against which impacts from project alternatives, including the proposed Project, can be compared.

Producers in the WCSB and Bakken formation have responded to constraints in pipeline capacity by seeking to implement alternative transport options, but it is difficult to predict exactly how this may happen in the future. In the past 2 years, there has been exponential growth in the use of rail to transport crude oil throughout North America, primarily originating from the Bakken in North Dakota and Montana but also increasingly utilized in other production areas, including the WCSB. Because of the flexibility of rail delivery points, once loaded onto trains the crude oil could be delivered to refineries, terminals, and/or port facilities throughout North America, including the Gulf Coast area.

In developing alternative transport scenarios, efforts were made to focus on reasonably likely scenarios that would occur if the permit were denied. Among others factors, likelihood was determined by analyzing what would be practical (e.g., economically competitive), take advantage of existing infrastructure to the extent possible, use proven technologies, and are similar to transport options currently being utilized. To facilitate comparisons with the proposed Project, the scenarios were developed considering the following criteria:

- Transport similar quantities of crude oil as the proposed Project (e.g., up to 730,000 barrels per day [bpd] of WCSB crude oil and up to 100,000 bpd of Bakken crude oil);
- Transport the crude oil from the Hardisty area of Alberta and Bakken area of Montana/North Dakota to the same primary market as the proposed Project (i.e., Gulf Coast area refineries); and
- Operate in approximately the same timeframe as the proposed Project (i.e., after 2016).

The three scenarios—Rail/Pipeline, Rail/Tanker, and Rail Direct to the Gulf Coast—are described in more detail in Section 2.2, Description of Alternatives, and are intended to be representative of likely oil and transportation industry responses to extended constraints in additional pipeline capacity. Nevertheless, modifications of these scenarios or possibly other transport methods could also be developed. To evaluate the scenarios, assumptions were needed regarding the location and design of necessary transportation improvements (i.e., new and/or expanded rail terminals and crude oil storage facilities in Lloydminster, Saskatchewan, Epping, North Dakota, and Stroud, Oklahoma; a required pipeline interconnection between Stroud and Cushing, Oklahoma; and expanded port facilities at Prince Rupert, British Columbia). Lloydminster was chosen as the origination point for WCSB because it is relatively close to the starting point for the proposed Project and has access to two major railroad systems—the Canadian Pacific Railway System (CPRS) and Canadian National (CN)—which have been shipping large quantities of crude by rail in recent years with plans for adding more capacity.

As a matter of policy, in addition to its environmental analysis of the proposed Project in the United States, the Department has included information regarding potential impacts in Canada (see Section 4.15.4, Extraterritorial Concerns). In so doing, the Department was guided by Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions), which stipulates the procedures and other actions to be taken by federal agencies with respect to environmental impacts outside of the United States. The Canadian government conducted an environmental review of the portion of the proposed pipeline in Canada. As a result, and consistent with Executive Order 12114, the Department did not conduct an in depth assessment of the potential impacts of the Canadian portion of the proposed pipeline). Information related to impacts from the proposed Project and its alternatives associated with development of the oil sands is included in Section 1.4, Market Analysis, and in Section 4.15.4.2, Concerns Related to Oil Sands Extraction.

5.1.1 No Action Alternative Scenarios Description and Impacts Summary

This section summarizes the potential impacts of the three scenarios under the No Action Alternative. The environmental effects of these scenarios are described in 5.1.2.2, Rail/Pipeline Scenario; 5.1.2.3, Rail/Tanker Scenario; and 5.1.2.4, Rail Direct to the Gulf Coast Scenario. Impacts from Potential Releases are discussed in Section 5.1.3 for all these scenarios. Under the Status Quo Baseline, the direct, indirect, and cumulative impacts associated with construction and operation of the proposed Project in the proposed Project area would not occur. The Status Quo Baseline is a snapshot of the crude oil delivery systems at current levels, and is used as a comparison for other alternatives and scenarios. Environmental conditions would therefore be the same as those associated in the respective resource sections in Chapter 3, Affected Environment.

5.1.1.1 Rail/Pipeline Scenario

Under this scenario, the WCSB crude in the form of dilbit would be transported to Gulf Coast area refineries via the following modes and routes (see Figure 2.2.4-1):

- Loaded onto rail in Lloydminster, Saskatchewan, from seven new, existing and/or expanded rail terminals[1] and transported approximately 1,900 miles (using CPRS and BNSF Railway Company [BNSF]) or approximately 2,000 miles (using CN and Union Pacific [UP] routing) along existing rail lines via common carrier railroads to seven new rail terminals at Stroud, Oklahoma. Stroud was selected as the destination rail terminal because, currently, there are no railroads that go all the way to Cushing. These representative routes are used for analysis purposes only;
- Transferred to new oil storage facilities and pipeline at Stroud, Oklahoma, and transported via a new pipeline approximately 17 miles to the existing oil terminal at Cushing, Oklahoma. Crude oil is currently being shipped by this method, but it is assumed that additional pipeline capacity would be needed to accommodate the added volume of crude oil; and
- Transferred by existing pipelines from Cushing approximately 533 miles to the Gulf Coast area for refining.

The Bakken crude would be transported via the following modes and routes (see Figure 2.2.4-2):

- Loaded onto rail from a new rail terminal in Epping, North Dakota,[2] and transported approximately 1,347 miles to new rail terminals with storage tanks at Stroud, Oklahoma, via common carrier railroad (assumed to be the same terminals identified for the WCSB crude);
- Transported from Stroud via a new pipeline approximately 17 miles to the existing oil terminal at Cushing, Oklahoma; and
- Transferred by existing pipeline approximately 533 miles from Cushing, Oklahoma, to the Gulf Coast area for refining.

As discussed in detail below, potential impacts would result from construction and operation of the new or expanded rail terminals in Lloydminster, and new terminals in Epping and Stroud. Local and regional effects from these terminals would include loss of vegetation and habitat, displacement of wildlife, noise effects on sensitive human and animal receptors, increased air emissions, and risk of spills. The increased number of unit trains along the routes between production areas in Canada and North Dakota would affect communities through elevated air emissions and noise from the trains, and increased risk of spills and collisions (see Section 5.1.1.4, Risk and Potential Releases Summary). Additionally, there would be construction impacts associated with the 17-mile new pipeline from Stroud to Cushing and potential impacts associated with releases during operations. Some areas would see increased congestion and delays where at-grade tracks cross roads. There would also be an undefined number of jobs created by a pipeline construction project.

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[1] Five of the seven terminals would be existing operating terminals in the Alberta-Saskatchewan area. The equivalent of two new terminals would be built in Lloydminster, which may be a combination of new construction or expansions to existing facilities.

[2] The Epping area currently has one operating rail on-loading facility. For the purposes of analysis, because of future expected expansion of exports from the Bakken field, one additional terminal would be needed.

5.1.1.2 Rail/Tanker Scenario

Under this scenario, new, existing, or expanded rail terminals would be built in Lloydminster, Saskatchewan, from which the crude oil would be transported by existing rail lines to Prince Rupert, British Columbia. A new rail terminal would off-load and store the crude oil for delivery to an expanded port for loading onto tankers. From Prince Rupert, crude oil would be shipped on tankers along the Pacific Coast, through the Panama Canal, and up through the Gulf of Mexico for delivery to the Gulf Coast refineries. A new rail terminal would be built in Epping, North Dakota, with the Bakken crude oil transported by existing rail lines to a new rail terminal in Stroud, Oklahoma. A 17-mile pipeline interconnection would need to be built between Cushing and Stroud, Oklahoma, to deliver the oil to the Gulf Coast area refineries via existing pipelines.

As discussed in detail below, potential impacts would result from construction and operation of the new rail terminals in Lloydminster and the new terminal/expanded port in Prince Rupert to ship WCSB, as well as from construction and operation of the new terminal in Stroud to accommodate Bakken crude oil. Local and regional effects from these terminals would include loss of vegetation and habitat, displacement of wildlife, noise effects on sensitive human and animal receptors, and increased risk of spills and air emissions. Marine impacts could include an elevated risk of spills in coastal and offshore waters from the increase in tanker transportation. In addition, air emissions would rise from these tankers and would be subject to U.S. Environmental Protection Agency (USEPA) regulation in U.S. jurisdictional waters. The increased number of unit trains along the routes between Epping and Stroud would affect communities through elevated air emissions and noise from the trains, and increased risk of spills and collisions (see Section 5.1.1.4, Risk and Potential Releases Summary). Additionally, there would be construction impacts associated with the 17-mile new pipeline from Stroud to Cushing and potential impacts associated with releases during operations. Some towns and cities would see increased congestion and delays where at-grade tracks cross roads.

However, if WCSB crude oil reaches a Pacific port, regardless of whether by rail or by pipeline, the economics for movement via tanker would favor shipping the oil to Asia rather than the Gulf Coast area. The cost of transporting crude oil via tanker from Prince Rupert to Houston/Port Arthur is estimated to be approximately $4.70/barrel (bbl), whereas the transport cost via tanker from Prince Rupert to refinery ports in Asia (e.g., Ulsan, South Korea and Dalian, China), is estimated to be only approximately $1.70 and $2.00/bbl, respectively. The lower transport cost to Asia versus the Gulf Coast area is attributable to shorter trip duration (30 to 37 days to Asia versus about 45 days to the Gulf Coast area), avoiding the Panama Canal toll (about $0.70/bbl), and being able to use a larger tanker because it would not be constrained by the Panama Canal. A very large crude carrier tanker to China would have a capacity of almost 2 million bbl versus a Suezmax tanker to the Gulf Coast area with a capacity of about 884,000 bbl). The EnSys (EnSys 2010) report indicated that if the option were available to export crude from the West Coast of Canada to Asia, it would likely be utilized.[3]

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[3] The updated modelling described in Section 1.4, Market Analysis, provides additional details about the relative economics of different export routes from the WCSB.

5.1.1.3 Rail Direct to the Gulf Coast Scenario

This scenario would involve the transport of WCSB crude oil from existing, new, or expanded terminal facilities in Lloydminster, Saskatchewan, by rail directly to the Gulf Coast area. This scenario differs from the Rail/Pipeline Scenario in that once the crude oil is on railcars; it would be transported to the Gulf Coast rather than off-loading it in Stroud and shipping by pipeline from the Cushing hub.

As discussed in detail below, the impacts under this scenario would be similar to those under the Rail/Pipeline Scenario, except rail impacts would extend along the entire routes to the Gulf Coast. In the Houston/Port Arthur area, the crude would be delivered to existing terminals in the area for onward delivery to regional refineries.

5.1.1.4 Risk and Potential Releases Summary

Historical rail incident[4] data were analyzed to evaluate potential releases associated with rail transport in the United States. The results help provide insight into what could potentially occur with respect to spill volume, incident cause, and incident frequency for the No Action Alternative scenarios that involve rail transport. In addition, rail incident frequencies were compared to frequencies for other modes of transport (i.e., pipeline, marine) to provide insight when comparing alternatives. Although the product to be transported by the proposed Project is crude oil, incidents for petroleum products were also analyzed to provide a comparison to a larger dataset and a higher volume transported.

As detailed in Section 5.1.3.2 , Historical Rail Incidents Analysis, subsection entitled *Spill Size Distribution and Frequencies*, the following conclusions regarding rail and other modes of crude oil transportation can be made:

- Considering spill volume, pipeline transport has the highest number of barrels released per ton-mile and barrels released per barrels transported for both crude oil and petroleum products.
- Considering spill frequency, rail transport has the highest number of reported releases per ton-mile compared to marine or pipeline transport for both crude oil and petroleum products and the highest number of releases per barrel transported.
- Comparing incident frequency, rail transport had the highest number of incidents per ton-mile reported between 2002 and 2009 for both crude oil and petroleum products of all modes of transport. Pipelines have a higher incident frequency than marine for crude oil, while marine has a higher incident frequency than pipelines for petroleum products.
- More fires and explosions were reported for crude oil and petroleum pipelines between January 2002 and July 2012 than for rail transport. For both crude oil and petroleum transport, there were fewer reported injuries and fatalities resulting from rail fires and explosions than from pipeline fires and explosions. Marine fire and explosion data were not readily available for this report.

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[4] The terms *incident* and *accident* can be used interchangeably or with specified definitions in various agency reports and databases. For the purposes of this report, the term *incident* has been selected for consistency.

A projection of injury and fatality frequencies onto the crude oil transport volume for the proposed Project was also done. Adding 830,000 bpd to the yearly transport mode volume indicates a potential additional 49 injuries and six fatalities for the rail alternative compared to one additional injury and no fatalities for the proposed Project on a yearly basis.

Results of this analysis are discussed further in Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios.

5.1.2 No Action Alternative Scenarios Detailed Impact Assessment

The following sections detail the potential impacts under each of the No Action Alternative scenarios. The development and operational activities envisioned for each scenario are described in Section 2.2, Description of Alternatives, and are, in part, derived from activities currently being conducted by the oil, pipeline, rail, and marine tanker industries.

5.1.2.1 Status Quo Baseline

Under the Status Quo Baseline, the direct, indirect, and cumulative impacts associated with construction and operation of the proposed Project in the Project area would not occur. The Status Quo Baseline is a snapshot of the crude oil delivery systems at current levels and is used as a comparison for other alternatives and scenarios. Environmental conditions under the baseline would therefore be the same as those described in the respective resource sections in Chapter 3, Affected Environment.

5.1.2.2 Rail/Pipeline Scenario

Under the Rail/Pipeline Scenario, up to 730,000 bpd of WCSB crude oil and up to 100,000 bpd of Bakken crude oil would be transported by rail to Stroud, Oklahoma, for delivery by existing pipelines to the Gulf Coast area. This scenario is described in more detail in Section 2.2.4.1, Rail/Pipeline Scenario. In summary, this scenario would include the following components for transporting the WCSB crude oil:

- New and expanded rail terminals that would equal the construction equivalent of two new rail terminals plus crude oil storage facilities in the Lloydminster, Saskatchewan, area with access to both CPRS and CN Class I major rail systems. The WCSB crude oil would be loaded onto unit trains at existing facilities as well as the new or expanded rail facilities. It is expected that it would require up to 12 100-car unit trains per day to ship 730,000 bpd of the WCSB as dilbit south to Stroud, Oklahoma near the Cushing hub in Oklahoma. The maximum amount of new construction needed under this scenario would require about 1,000 acres.
- The construction of a new 500-acre rail terminal in Epping, North Dakota,[5] to transport Bakken crude oil approximately 1,347 miles to up to seven new rail terminals with storage tanks at Stroud, Oklahoma, via common carrier railroad (assumed to be the same terminals identified for the WCSB crude).

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[5] The Epping area currently has one operating rail on-loading facility. For the purposes of analysis, because of future expected expansion of exports from the Bakken field, one additional terminal would be needed.

- The construction of a new pipeline approximately 17 miles from Stroud to the existing oil terminal and pipeline hub at Cushing.
- The transportation of up to 830,000 bpd of WCSB and Bakken crude oil by existing pipelines approximately 533 miles from Cushing to the Gulf Coast area for refining.

The two representative rail routes for WCSB transport from Lloydminster to Stroud were chosen for analysis purposes only. The exact routes and levels of use at any one time could be different in practice because of congestion on certain lines, track maintenance, and other factors outside the scope of this assessment. While CN and CPRS are the two railroads used in this analysis, they may use the assets (i.e., tracks) of other carriers, such as BNSF Railway Company, Union Pacific, or other owners through the United States (Cambridge Systematics 2007).

While the CPRS railroad serves both the WCSB area (Lloydminster) and the Bakken area, it was assumed that an alternate rail route would be used from Epping, North Dakota, to Cushing to deliver Bakken crude oil, because the trains out of Canada would be fully loaded at their origination point in Lloydminster and could not acquire additional cargo in Epping.

In summary, the Rail/Pipeline Scenario would take advantage of some existing rail terminals and rail lines, existing crude oil pipelines, and the existing Cushing storage facility, and would require little if any new rail tracks. It would require the construction of new or expanded rail terminals and crude oil storage facilities in Lloydminster, new terminals in Epping and Stroud, as well as a new pipeline from the proposed Stroud rail terminals to the existing Cushing tank farm. There is the potential that some improvements may be required along the existing rail lines and crude oil pipelines included in this scenario; the location, scale, and timing of these improvements are unknown, but it is believed that they would be minor in comparison with the overall scale of the scenario, and they are thus not considered in this analysis.

The environmental setting and potential impacts for the Rail/Pipeline Scenario are described below for each resource. Because the rail lines from Lloydminster and Epping to Stroud and the existing Keystone pipeline from Cushing to the Gulf Coast area refineries already exist, with little or no improvements to these facilities assumed to be necessary, the discussion of environmental setting and impacts for the Rail/Pipeline Scenario focuses on the proposed new facilities (i.e., the three new rail terminals/oil storage complexes in Lloydminster, Epping, and Stroud and the new pipeline connections to Cushing). The existing rail line and pipeline segments are only discussed in terms of the primary resources that would be affected by increased rail traffic (i.e., air, noise, climate change, and socioeconomics, including traffic and transportation) and the increased potential for accidental releases (as a result of greater throughput). Since no new construction would be needed along these existing segments, it is assumed that there would be little potential for impacts to other resources (i.e., geology, soils, water, wetlands, vegetation, wildlife, fish, threatened and endangered species, land use, and cultural resources) as a result of increased rail traffic along the existing rail lines, other than an increased potential for impacts from accidental releases.

Geology

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new or expanded facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the geologic resources of these three areas is provided below.

The geology at the Lloydminster terminal sites is predominantly composed of Cretaceous and Tertiary formations overlain with glacial till. The rock formations consist of sandstone, shale, and limestone. The geology in the vicinity of the Epping terminal site is predominantly composed of Cretaceous sedimentary rocks such as the Dakota Group (predominantly sandstone and shale), in addition to aeolian (wind driven) deposits. At the site of the Stroud terminals, Upper Paleozoic (Permian) rock is present. Earthquake potential and seismic activity are low for all three terminal sites (Earthquaketrack.com 2012).

Potential Impacts

During construction of the new or expanded rail terminals, oil storage facilities, and pipeline for the Rail/Pipeline Scenario, approximately 5,227 acres of land would need to be graded and shallow bedrock may be encountered. Rock ripping (i.e., the break up and removal of rock material with an excavator) could be necessary where dense material, (i.e., paralithic bedrock, abrupt textural change, or strongly contrasting textural stratification) is present. The impacts of rock ripping would be limited to the immediate construction area and would not result in any significant impacts to the underlying geology.

Excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection could damage or destroy paleontological resources during construction. The potential for finding paleontological resources in the areas that would be disturbed is unknown. Since the proposed construction would occur on privately owned land, construction under this scenario would only be subject to applicable provincial or state requirements regarding the protection of paleontological resources.

The proposed rail terminals, oil storage facilities, and pipeline would be located in areas where there would be no anticipated impact to access of any existing surface mines and quarries or known fossil fuel or mineral resources. In terms of geologic hazards, the proposed facilities would not be located near any known active faults and would be outside of known zones of high seismic hazard, landslides, and subsidence.

Routine operations of the Rail/Pipeline Scenario would not require disturbance of, or impacts to, the underlying geology, paleontological resources, or mineral and fossil fuel resources. The rail terminal and pipeline facilities would be designed to withstand potential seismic hazards and would be located in areas that are not susceptible to landslides or subsidence.

Soils

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the soil resources of these three areas is provided below.

The Lloydminster terminal complex would be located in an area in Saskatchewan where the soils consist primarily of Chernozemic soils. In general, these soils are deep with dark-colored surface horizons and brownish to lighted-colored subsurface horizons that have high organic matter content with textures that range from heavy clays to sands.

The soils found in the general vicinity of the Epping terminal site consist of the Williams-Bowbells association and the Williams-Zahill and the Zahl-Williams-Zahill complex. The Williams-Bowbells association soils are typically clay loams, deep, and moderately well drained and are found in landscapes with slopes that ranges from 0 to 6 percent slopes. The Williams-Zahill and Zahl-Williams-Zahill complex soils are found in knolls areas with slopes that range from 6 to 9 percent and are deep and well drained.

The soils found in the area in which the Stroud terminal and Cushing pipeline would be located consist primarily of Port-Pulaski, Dornell-Stephville, and Renfrow-Vernon-Bonhan associations. In general, these soils are deep to shallow, loamy over sandstone, clay, or shale on nearly level to strongly sloping landscapes.

Potential Impacts

During construction of the rail terminals, oil storage facilities, and pipeline for the Rail/Pipeline Scenario, typical clearing, grading, trench excavation, and equipment traffic would disturb approximately 5,227 acres of land, which would likely result in soil erosion, loss of topsoil, soil compaction, and possibly soil contamination (e.g., fuel leaks, herbicide use). Most of these impacts could be mitigated by the use of standard construction erosion and sediment control methods (e.g., silt fences, sediment ponds) and soil remediation essentially identical to those proposed for the proposed Project. As construction is completed, the disturbed sites would be restored in a manner similar to that for the proposed Project. Approximately 5,103 acres of land, however, would be permanently impacted by this scenario as a result of construction of rail terminals and crude oil storage facilities.

During the operational phase of the Rail/Pipeline Scenario, there would remain the potential for minor soil erosion, compaction, differential settling, and contamination from vehicle/pipeline spills and leaks. Maintenance procedures as described for the proposed Project would be implemented to address these potential impacts.

Water Resources

Groundwater

Environmental Setting

The new or expanded Lloydminster terminals would be located in Saskatchewan where groundwater is perched[6] on glacial till and more recent deposits that include glacial outwash and thin soils. Groundwater is shallow or at the surface in many areas around the terminal as evident by the numerous shallow lakes, ponds, and wetlands. Shallow groundwater is reported to be high in nitrates, with drinking water pumped from deeper aquifers below the till. Because of the landscape and flatness of the till in this area, lateral groundwater flow (hydraulic conductivity) and gradient are low and shallow.

The prospective Stroud terminals and pipeline to Cushing would be located in a fairly flat area of Oklahoma. Pennsylvanian-age sandstone, shale, and limestone underlie Quaternary-age loess and alluvial deposits. The major water source for residences, crops, and industry in this part of central Oklahoma is the Ada-Vamoosa Aquifer, which consists of Pennsylvanian sandstones (Ryder 1996). In 1985 in Lincoln County, up to 2 million gallons per day of water were withdrawn from this aquifer; those withdrawal rates have increased substantially since 1985. Groundwater in the area is shallow (depth of about 50 feet) and deepens to the west of Stroud, Oklahoma. Dissolved solids are reportedly less than 500 milligrams per liter yielding high-quality freshwater. Groundwater in the area of the Cushing terminal, located just northwest of Stroud, is similar in quantity and quality, although it occurs at a depth of about 100 feet.

The Epping terminal would be located in a fairly flat agricultural area of northeastern North Dakota. Groundwater in the vicinity of the planned terminal near Epping, North Dakota, is within the Lower Tertiary Fort Union Formation, which consists of sandstone and shale beds within interbedded coal in some areas. This unit is part of the Northern Great Plains Aquifer System, and extends into Montana where the proposed Project pipeline crosses the unit. Wells extracting groundwater from this unit in North Dakota are typically greater than 300 feet deep and yield up to 100 gallons per minute. Groundwater in the vicinity may also be present in alluvium aquifers in unconsolidated sediments overlying the Tertiary rocks. These alluvial deposits consist of 100 feet or more of fine-grained glacial till with interbedded and overlying sand and gravel deposits. The permeability of these deposits is highly variable, with well yields ranging from 1 to 1,000 gallons per minute (Whitehead 1996).

Potential Impacts

Potential groundwater impacts related to rail terminal construction are anticipated to be related to releases of refined petroleum products used as vehicle fuels and lubricants, as well as releases of crude oil. In addition, there could be potential releases and/or spills associated with operations, including crude oil loading/unloading of railcars and railcar derailment or pipeline failure. The releases of refined petroleum products associated with construction activities would typically be relatively small in volume (less than 2,100 gallons); however, releases of crude oil associated with operations could be larger, ranging from 42,000 to 840,000 gallons. Impacts from

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[6] Perched groundwater is defined by the USGS as: "unconfined groundwater separated from an under-lying main body of groundwater by an unsaturated zone" (USGS n.d.).

construction and operation of the 17-mile pipeline would be similar to those of the proposed Project, including the potential for releases to impact groundwater.

Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios, discusses the potential risks of these releases during rail transport of the crude oil. Loading and unloading would only occur at the new rail terminals near Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud, Oklahoma. In addition to the risk of crude oil spills during loading and unloading, derailment releases of refined petroleum products (e.g., diesel fuels, motor oils, and lubricants) may also occur during construction and operation of new rail terminals. Although the initial impacts of potential releases or spills at the rail terminals may be contained or limited to soil, potential impacts to groundwater may occur depending on the depth to groundwater, soil characteristics (porosity, permeability, etc.), spill volume and extent, and whether the spill reaches surface waterbodies, which could be interconnected to groundwater.

Downward migration of the releases to groundwater would be attenuated by intervals of fine-grained sediments and glacial till in unconsolidated deposits; however, there is the potential to impact groundwater quality. Migration characteristics of the release in groundwater would be expected to be similar to that discussed for other potential Project-related petroleum releases in Section 4.3.3.1, Groundwater.

Surface Water

Environmental Setting

The two representative rail routes between Lloydminster and Stroud would cross through a variety of surface water resources, including lakes, reservoirs, natural and man-made ponds, as well as intermittent and perennial streams and rivers. Some of the larger rivers that would be crossed in Saskatchewan and Manitoba include the North and South Fork of the Saskatchewan River in Saskatchewan and the Assiniboine River and Red River in Manitoba. In the United States, larger rivers that would be crossed include the Red River, which forms the border between Minnesota and North Dakota; the Mississippi River, Saint Louis River, and Vermilion River in Minnesota; the Des Moines River in Iowa; the Missouri River on the border of Nebraska and Iowa; the Platte River in Nebraska; and the Arkansas River in Oklahoma.

The Lloydminster terminals location is characterized by existing oil and gas wells, rail terminal infrastructure, agricultural, and livestock uses with intermittent streams and isolated open-water features that may be connected to shallow groundwater. Residential and park areas of Lloydminster are within 1 mile of the potential terminal complex. Large, open waterbodies are within 2 miles of the potential terminal complexes. The relatively flat topography is likely conducive to sheet flow and infiltration. Surface waterbodies may have use as agricultural or stock water sources.

The Stroud terminals area is characterized by open grassland with partial forest coverage. Surface water features include natural and manmade open waterbodies and intermittent grass-lined to bare stream courses with generally wide bed structures. The proximity to the community of Stroud varies based on the potential terminal sites. Surface waterbodies may have use as agricultural or stock water sources.

The Epping terminal location is characterized by cultivated agricultural uses with grass-lined intermittent streams and isolated natural and manmade open water features. Large, open waterbodies are located within 2 miles of the community of Epping (approximately 12 miles northeast of Williston, North Dakota), the location of the potential terminal site. Surface waterbodies may have use as agricultural or stock water sources.

Potential Impacts

Potential surface water impacts related to rail terminal construction are anticipated to be primarily related to sedimentation from erosion of disturbed soils and releases of refined petroleum products used as vehicle fuels and lubricants. Operational impacts would primarily be related to releases and spills associated with crude oil loading/unloading of railcars, and railcar derailment or pipeline failure. Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios, discusses the potential risks of these releases during rail transport of the crude oil. The proper implementation of Spill Prevention, Control, and Countermeasure (SPCC) plans (in the United States) and equivalent plans in Canada could minimize the potential for releases of crude oil or other hazardous materials (e.g., diesel fuel, motor oil, lubricants) to reach surface waterbodies during rail terminal construction and operations. Similarly, implementation of stormwater management could mitigate impacts to water quality and runoff volumes from the terminals.

The representative terminals would likely be located outside of designated floodplains, and the initial impacts of potential releases or spills may be contained. The representative rail and the pipeline routes would cross up to 1216 perennial streams and 42 major waterbodies in the United States with the potential for pipeline exposure as a result of erosion during high water events. As with the proposed Project, any pipeline built under this scenario would be required to be buried below the calculated scour depth at stream crossings.

Effects from pipeline construction to water resources would be associated with soil erosion, which could cause sedimentation to nearby waterbodies and potential releases from equipment (e.g., oil, fuel, solvents). Operational impacts of the pipeline would be limited to possible soil erosion prior to full surface reclamation and potential releases that could contaminate waterbodies.

Wetlands

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma (including a 17-mile pipeline connection between the two communities). A brief overview of wetland resources of these three areas is presented below.

The Lloydminster terminals would be located in the Aspen Parkland Level III Ecoregion, which lies within an area with a moderately high concentration of prairie pothole wetlands, commonly referred to as the Prairie Pothole Region (PPR) (USEPA 2010, USEPA 2011). The PPR is not a USEPA ecoregion, but rather a general region of the United States and Canada where there is a high density of prairie pothole wetlands. While there is no exact boundary of the PPR, most government agencies and non-government organizations agree upon its general boundaries, which stretches through the Canadian provinces of Saskatchewan, Alberta, and Manitoba, and the U.S. states of North Dakota, South Dakota, Nebraska, Minnesota, Iowa, and Montana (USEPA 2011, Gleason et al. 2008, Kantrud et al. 1989). As discussed in Section 3.4.3.1, Sensitive Wetland Areas, and Section 3.5, Terrestrial Vegetation, prairie potholes are water-holding depressions of glacial origin (Sloan 1972). Prairie pothole wetlands associated with the conceptual Lloydminster terminal complex include emergent (herbaceous) and scrub-shrub wetlands associated with wet meadows, streams, and open water features.

The Epping, North Dakota, terminal would be located in the Northwestern Glaciated Plains Level III Ecoregion (USEPA 2011). This ecoregion is located within the broader PPR described above. Wetlands associated with the Epping, North Dakota, terminal include emergent (herbaceous) wetlands associated with prairie pothole wet meadows, streams, and open water features, most of which are managed for agricultural purposes.

The southern extent of the route would cross the northeast corner of Oklahoma to the Stroud, Oklahoma, terminals. Ecoregions include the Central Great Plains and Cross Timbers USEPA Level III Ecoregions (USEPA 2011), where the primary wetlands are forested and herbaceous wetlands.

Potential Impacts

Based on preliminary aerial photo interpretation, construction of the Lloydminster terminals could impact approximately 6 acres of herbaceous wetlands, 50 acres of scrub-shrub wetlands, and 17 acres of open water habitat. Construction of the Epping terminal could result in approximately 2 acres of temporary or permanent impacts to herbaceous wetlands and associated shallow ponds (pothole wetlands) based on wetland coverage provided by the National Wetland Inventory (NWI) database (NWI 2012). Construction of the Stroud terminals and along the Cushing pipeline could result in about 11 acres of temporary or permanent impacts to open water features and approximately 5 acres of temporary or permanent impacts to woody wetlands based on the wetland coverage provided by the NWI database (NWI 2012). These estimates of potential wetland impacts at these representative rail station locations, which are based on aerial photo interpretations and secondary sources such as NWI mapping, are intended to be illustrative of the magnitude of actual impacts that may occur. Wetland acreages estimated using the NWI (2012) database may differ from wetland acreages estimated using the National Land Cover Database (NLCD) (Fry et al. 2011) presented in the following section and in Table 5.1-1 below. If rail terminals were constructed, the actual acreage of wetland impacts would be determined through a formal wetland delineation.

Effects from pipeline construction to wetlands would be similar to those of the proposed Project, including temporary impacts and permanent conversion of some wetland types. Operational impacts of the pipeline would be limited to potential releases that could contaminate wetlands.

Terrestrial Vegetation

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the terrestrial vegetation resources of these three areas is provided below.

The new or expanded Lloydminster terminal complexes would be located in the Aspen Parkland Level III Ecoregion. The parkland is considered transitional between the boreal forest to the north and the grasslands to the south. Open stands of trembling aspen and shrubs occur on most sites, and bur oak and grassland communities occupy increasingly drier sites on loamy Black Chernozemic soils (The Ecological Framework of Canada [TEFC] 2012a). Geographic Information System (GIS) analysis indicates the existing land cover of the approximately 1,000 acres impacted for the representative Lloydminster terminal sites would include Grassland/Pasture, Developed Land, Open Water, Shrub/Scrub Wetlands, and Emergent Wetlands. The Epping terminal would be located in the Northwestern Glaciated Plains Level III Ecoregion and the Glaciated Dark Brown Prairie Level IV Ecoregion. GIS analysis indicates the existing land cover of the approximately 500-acre terminal site is comprised of Grassland/Pasture, Developed, and Cultivated Cropland. The Stroud terminals would be located in the Central Great Plains and Cross Timbers Level III Ecoregions. GIS analysis utilizing the 2006 NLCD (Fry et al. 2011) indicates the existing land cover of the approximately 3,500-acre Stroud terminal complex is composed of Grassland/Pasture, Developed, Deciduous Forest, Cultivated Cropland, and Open Water.

Potential Impacts

The Rail/Pipeline Scenario would temporarily affect approximately 5,227 acres of terrestrial vegetation where new or expanded facilities and the Stroud to Cushing pipeline would be built. Permanent impacts would be about 5,103 acres. Although the exact design and location for the terminals is not known, the general impacts to terrestrial vegetation associated with these facilities are presented below in Table 5.1-1. Deciduous forests within the Stroud terminal sites may be considered biologically unique landscapes or vegetative communities of conservation concern.

Table 5.1-1 Potential Impacts to Terrestrial Vegetation by Landcover Type under the Rail/Pipeline Scenario

	Acreage			
Land Cover	**Lloydminster**	**Stroud**[a]	**Epping**	**Total Acres**
Grassland/pasture	785	2,101	40	2,926
Developed	140	127	6	273
Deciduous forest	0	1,174	0	1,174
Cultivated cropland	0	85	455	540
Open water	17	13	0	30
Scrub/shrub wetlands	49	0	0	49
Emergent wetlands	6	0	0	6
Total	**1,000**[b]	**3,500**[a,b]	**500** [b]	**5,000**[a,b]

Sources: Fry et al. (NLCD) 2011 and U.S. Geological Survey (USGS) GAP 2011

[a] Plus land for a new pipeline between Stroud and Cushing that would affect 227 acres temporarily and cause 103 acres of permanent disturbance.
[b] May not add up due to rounding.

Wildlife

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the wildlife resources of these three areas is presented below.

The Lloydminster terminal area is home to large game, small game furbearers, upland game birds, waterfowl, and non-game wildlife. There are over 600 species of birds and mammals in Saskatchewan, and their territorial ranges in southern Saskatchewan are shrinking. Human activities and development over the last century (including roads, towns and cities, agriculture, and industry) have reduced 75 percent of the natural areas in the province's agricultural region (Government of Saskatchewan 2012a). The Lloydminster area lies within the Central Flyway, which is a major migration route for birds (U.S. Fish and Wildlife Service [USFWS] 2012). The terminals would also lie within an ecoregion known as Aspen Parkland, which provides a major nesting habitat for waterfowl and includes habitat for white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), snowshoe hare (*Lepus americanus*), cottontail (*Sylvilagus* spp.), red fox (*Vulpes vulpes*), northern pocket gopher (*Thomomys talpoides*), Franklin's ground squirrel (*Poliocitellus franklinii*), and bird species such as sharp-tailed grouse (*Tympanuchus phasianellus*) and black-billed magpie (*Pica hudsonia*) (TEFC 2012a).

The representative Epping rail terminal would be located in the Prairie Potholes bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the U.S. North American Bird Conservation Initiative (USNABCI). This conservation region provides breeding and migratory habitat to over 200 species of birds (USNABCI 2000).

The representative Stroud terminals and potential pipeline would be in an area that is home to large and small game and furbearers, upland game birds, waterfowl, and non-game wildlife. This area also lies within the Central Flyway, which is a major migration route for birds (USFWS 2012). It would be located in two Level III Ecoregions: the Central Great Plains and the Cross Timbers (USEPA 2012). The Stroud terminals would be located in the Oaks and Prairies bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the USNABCI (2000). This conservation region serves as a transition zone between the Great Plains and the forests of the eastern United States and is a complex mix of prairie, savanna, cross timbers, and shrubland. Among the priority land birds that use this mix of woodland and open country are scissor-tailed flycatcher (*Tyrannus forficatus*), painted bunting (*Passerina ciris*), and Mississippi kite (*Ictinia mississippiensis*), with a small population of black-capped vireos (*Vireo atricapilla*) in areas of denser shrub. Agriculture and urbanization have made tremendous impacts on this region, leaving very little natural habitat available for healthy priority bird populations (USNABCI 2000).

Potential Impacts

Construction of the representative rail terminals and pipeline for the Rail/Pipeline Scenario would have direct and indirect, as well as, temporary and permanent impacts on wildlife resources and result in the clearing of approximately 5,103 acres (permanent disturbance) and

5,227 acres (temporary disturbance) of wildlife habitat, including approximately 1,424 acres of grasslands, 335 acres of forest habitat, and 24 acres of emergent and scrub/shrub wetland habitats. Approximately 2,166 acres of these impacts would be permanent. Direct impacts could occur due to vegetation removal or conversion, obstructions to movement patterns, or the removal of native habitats that may be used for foraging, nesting, roosting, or other wildlife uses (Barber et al. 2010). Indirect impacts to wildlife are difficult to quantify and are dependent on the sensitivity of the species, individual, type and timing of activity, physical parameters (e.g., cover, climate, and topography), and seasonal use patterns of the species (Berger 2004). Short-term impacts on wildlife would occur during construction and may extend beyond construction activities. Long-term impacts on wildlife could extend through the life of a project and possibly longer for those habitats that require many years to be restored (Harju et al. 2010). Permanent impacts would result from construction of the rail terminals and oil storage facilities that convert natural habitat, and where operational maintenance of the pipeline right-of-way (ROW) permanently alters vegetation characteristics (Braun 1998). The facilities would not affect any federal/national or provincial/state wildlife areas.

Operations at the rail terminals would generate noise, vibration, traffic, and human presence, which would have indirect impacts to surrounding habitats making them less attractive for more sensitive wildlife species. Because the rail terminals lie within the Central Flyway, it is possible that these operational impacts could affect migratory birds.

Effects from pipeline construction to wildlife resources would be similar to those of the proposed Project, including loss of habitat, noise, and potential collisions with equipment. Operational impacts of the pipeline would be limited to the potential fragmentation and loss of habitat or potential releases that could contaminate wildlife habitat.

Fisheries

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new or expanded facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma (including the 17-mile pipeline between the two communities). A brief overview of the aquatic resources of these three areas is provided below.

In the Lloydminster area, the provincial government of Saskatchewan manages fisheries within its borders except for aboriginal fishing and fish habitat protection, which are managed by the federal government of Canada and the Department of Fisheries and Oceans. Most of Canada’s prairies have been converted to farmlands, and the fisheries therein have been subject to alterations brought about by agriculture such as channelization and sedimentation from run-off. Moreover, streams originating in Canada’s interior plains have variable water quality and are usually high in suspended and dissolved solids, and high in turbidity due to erosion (Rosenburg et al. 2005). This is best exemplified by the silt-laden Saskatchewan River, whose prairie reaches contain warm water species like northern pike, walleye, sauger, and yellow perch (Table 5.1-2). Upstream, forested reaches are dominated by cold water species such as cutthroat, rainbow, bull, brook and brown trout (Rosenburg et al. 2005) (Table 5.1-2).

Table 5.1-2 Common Representative Species of the Saskatchewan River[a]

Warm water fish species[a]	Cold water fish species[a]
northern pike (*Esox lucius*)	cutthroat trout (*O. clarki*)
walleye (*Sander vitreus*)	rainbow trout[b] (*O. mykiss*)
sauger (*Sander canadensis*)	bull trout (*Salvelinus confluentus*)
goldeye (*Hiodon alosoides*)	brook trout[b] (*S. fontinalis*)
yellow perch (*Perca flavescens*)	brown trout[b] (*Salmo trutta*)
lake sturgeon (*Acipenser fulvescen*)	mountain whitefish (*Prosopium williamsoni*)

Source: Rosenburg et al. 2005

[a] This list is non-inclusive. Some rivers in the basin are very species-rich (e.g., Assiniboine/Red River are represented by 94 fish species in 18 families).
[b] Non-native

The representative Epping terminal would be located in a prairie region of North America that shares many of the same fisheries characteristics and many of the same species that are expected to be present as in the proposed Project areas and is characterized by prairie streams draining the glaciated plains, with attendant low stream gradient, high sediment load (in many cases), subject to perennial drying and flooding, and flowing through sparsely populated agricultural lands. There are warm water and cold water fisheries present in the area, having commercial and recreational value.

The Stroud terminals and pipeline would be located in the Southern Plain Basin, which is drained by two large, separate river systems: the Arkansas and Red rivers. The entire state of Oklahoma is within the basin, and the basin includes many commercially and recreationally valuable fisheries. Streams of the Arkansas River drainage, which would be crossed by this scenario, contain many warm water, big river species such as paddlefish, gars, and shad (Table 5.1-3). The Arkansas River system is fragmented by five major reservoirs on the mainstem (Matthews et al. 2005). A large tributary of the Arkansas River, the Neosho (Grand) River, originates in the Flint Hills of Kansas. Native and endemic fish species are represented in the headwaters and include isolated populations of formerly widespread species like the Topeka shiner (*Notropis Topeka*), and isolated populations of cardinal shiner (*Luxilus cardinalis*), southern redbelly dace (*Chrosomus erythrogaster*), and the endemic and federally threatened Neosho Madtom (*Noturus placidus*). The downstream river reaches are impounded by a series of five major reservoirs (Matthews et al. 2005).

Table 5.1-3 Representative Fish Species in the Stroud Area

Common Arkansas River Fish		
paddlefish (*Polyodon spathula*)	white bass (*Morone chrysops*)	channel catfish (*Ictalurus punctatus*)
gars (*Lepisosteus sp.*)	largemouth bass (*Micropterus salmoides*)	flathead catfish (*Pylodictis olivaris*)
gizzard shad (*Dorosoma cepedianum*)	spotted bass (*Micropterus punctulatus*)	blue catfish (*Ictalurus furcatus*)
smallmouth buffalo (*Ictiobus bubalus*)	striped bass[a] (*Morone saxatilis*)	
bigmouth buffalo (*Ictiobus cyprinellus*)	sunfish (*family Centrarchidae*)	

Source: Matthews et al. 2005

[a] non-native

Potential Impacts

During construction, the Rail/Pipeline Scenario would temporarily disturb approximately 5,227 acres, including construction of the pipeline from Stroud to Cushing, which would increase the potential for erosion and for sediment to enter waterbodies. Excessive suspended sediment could interfere with respiration in fish and invertebrates, leading to mortality or reduced productivity in rearing and spawning (Newcombe and Jensen 1996, Sutherland 2007, Wood and Armitage 1997). Suspended sediment could result in short-term impairment of foraging efficiency for species that are visual predators. Longer-term effects could occur if sediment covers spawning gravels, preventing water exchange and oxygen to developing eggs or young fish (sack or emerging fry), potentially causing increased mortality, and reducing recruitment to the population (Newcombe and MacDonald 1991).

The quantity, cover, and type of riparian bank vegetation in the affected area vary depending upon site-specific waterbody conditions and locations. Removal of bank vegetation (including overhead cover) could lead to bank instability and erosion. Loss of riparian vegetation reduces shading, potentially causing an increase in water temperature and a reduction in dissolved oxygen; nutrient input, food input, and hiding cover (Brown et al. 2002, Ohmart and Anderson 1988). A reduction in escape cover could increase vulnerability of certain species to predation. Loss of riparian vegetation and disturbance to the bank and substrate could alter benthic communities and change food availability (Brown et al. 2002).

Most of these impacts could be mitigated by the use of standard construction erosion and sediment control methods (e.g., silt fences, sediment ponds) essentially identical to those proposed for the proposed Project, as well as maintenance of riparian buffers. These mitigation measures would reduce the potential impacts.

Most impacts to fish from this scenario would initially occur during construction, but can be permanent and could continue throughout operations. During operations, the reduction of trees along affected waterbodies could result in a permanent loss of shading, nutrients, and habitat enrichment features for fish. Herbicides would potentially be used to control vegetation during proposed Project operation. The use of herbicides near waterbodies could harm aquatic organisms, including fish. Herbicides could enter a waterbody through runoff, seepage through the soil, and/or direct introduction to water during application through overspray or wind drift. Mitigation measures would likely include maintenance of riparian buffers and the provision of appropriate stormwater management measures to control runoff volumes and improve water quality.

Threatened and Endangered Species

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma (including the 17-mile pipeline between the two communities). A brief overview of the federal threatened, endangered, proposed and candidate species, Bureau of Land Management (BLM) sensitive species, state threatened and endangered species, and species of conservation concern present in these three areas is presented below.

The Lloydminster terminals would be located in one of the most altered landscapes in North America (Government of Saskatchewan 2012a), which is generally unfavorable habitat for threatened and endangered species. The terminals would cover approximately 1,000 acres, which currently is primarily grassland/pasture according to aerial interpretation. Because Lloydminster is in a grassland region of North America that shares many of the same qualities as the grasslands that would be traversed by the proposed Project, Lloydminster may be inhabited by many of the same protected species that are expected to occur in the proposed Project area. In particular, Lloydminster is within the whooping crane (*Grus americana*) Central Flyway (see Section 3.8, Threatened and Endangered Species and Species of Conservation Concern). The nesting range for the piping plover (*Charadrius melodus*) (a federally threatened species, Saskatchewan endangered species, and Canada Species at Risk Act [SARA] endangered species) and the nesting range for the Sprague's pipit (*Anthus spragueii*) (a U.S. federal candidate species and a Canada SARA threatened species) include the Lloydminster area (Saskatchewan Conservation Data Centre 2012).

There is no federally designated critical habitat in the area where the Epping terminal would be located.

The Stroud area is inhabited by a variety of common wildlife species. Agriculture and urbanization have made tremendous impacts on this region, leaving very little natural habitat available for federal threatened, endangered, proposed and candidate species, BLM sensitive species, state threatened and endangered species, and species of conservation concern , which in general prefer habitat in its natural, unfragmented state. This area lies within the Central Flyway, which is a major migration route for birds (USFWS 2012). Of note, the Stroud terminals and pipeline would be within the Central Flyway for the Arkansas-Wood Buffalo population of the whooping crane (see Section 3.8, Threatened and Endangered Species and Species of Conservation Concern). There is no federally designated critical habitat in the area where the Stroud terminals would be located.

Potential Impacts

Although no site specific surveys for the presence of any threatened or endangered species have been conducted, the Lloydminster, Epping, and Stroud terminals and pipeline between Stroud and Cushing would likely be located in areas that have been already impacted by agriculture and urbanization, leaving little suitable habitat for federal threatened, endangered, proposed and candidate species, BLM sensitive species, state threatened and endangered species, and species of conservation concern. These representative terminal locations and pipeline corridor would not be located within designated critical habitat for any federally listed threatened or endangered species.

The Rail/Pipeline Scenario is located within the central migration corridor for the Arkansas-Wood Buffalo population of the whooping crane; however, the three representative terminal sites are already relatively disturbed, and they offer little habitat for the whooping crane. Detailed field surveys would need to be conducted to confirm the absence of any federal threatened, endangered, proposed and candidate species, BLM sensitive species, state threatened and endangered species, and species of conservation concern, and consultation would need to occur with the USFWS, appropriate state agencies in North Dakota and Oklahoma, and appropriate Canadian agencies.

Land Use, Recreation, and Visual Resources

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the land use, recreation, and visual resources of these three areas is provided below.

Aside from developed areas in and around Lloydminster itself, the area surrounding the Lloydminster terminal site is almost entirely used for cropland, with small patches of grassland and numerous small lakes and ponds (Natural Resources Canada 2012). However, some residential and park areas of Lloydminster are within 1 mile of the potential terminal complex.

Except for the developed areas in and near the town of Epping itself, the area surrounding Epping is primarily agricultural. Land within approximately 1 mile of Epping includes pasture land to the east, and grasslands and shrub/scrub areas to the north, south, and west. Cultivated crops surround these land uses (U.S. Geological Survey [USGS] 2006). Epping is approximately 12 miles northwest of Lake Sakakawea, a reservoir on the Missouri River used for flood control, hydroelectric power, irrigation, and recreation (North Dakota Parks and Recreation Department 2012). Lewis and Clark State Park, on the northern shoreline of Lake Sakakawea, is the closest land-based public recreation area. Other public lands with recreational value are found along the entire shoreline of the lake, which extends through much of North Dakota. There are no other regionally significant recreation areas near Epping.

The area around Stroud is primarily rangeland with developed and forest land comprising most of the remaining areas (USGS 2006). Portions of the Deep Fork Wildlife Management Area lie along the Deep Fork of the Canadian River, approximately 8 miles southeast of Stroud. Managed by the Oklahoma Department of Wildlife Conservation (ODWC), the Wildlife Management Area provides outdoor recreation and hunting opportunities (ODWC 2012). There are no other federal lands, state parks, or regionally significant recreation areas near Stroud.

The states of Oklahoma and North Dakota have no formal guidelines for managing visual resources on private or state-owned lands. The Historic Route 66 National Scenic Byway passes through Stroud. The Scenic Byway designation enables the State of Oklahoma to obtain grants from the Federal Highway Administration to upgrade the road in accordance with its Corridor Management Plan.

Potential Impacts

The only land use, recreation, and visual impacts from this scenario would be the construction and operation of the Lloydminster, Epping, and Stroud rail terminals, as well as a permanent ROW for the pipeline. The Stroud terminal complex area would encompass about 3 percent of the land in Creek and Lincoln counties. The 500-acre Epping terminal would cover less than one-tenth of 1 percent of the approximately 1.4 million acres in Williams County, North Dakota. Similarly, the 1,000 acres needed for new or expanded terminals near Lloydminster represent a fraction of 1 percent of the approximately 5.9 million acres of land in Census Division 17 of Saskatchewan—an approximate equivalent to a U.S. county (Statistics Canada 2012a). The pipeline would require approximately 103 acres for a permanent ROW between Stroud and Cushing.

The Lloydminster terminals would likely be located in an agricultural area, but along existing rail lines. Terminal construction in this location would be expected to result in some land use changes in the area as more land may be converted to crude oil storage and transport uses. The Epping and Stroud terminals would likely be located in areas that already have rail terminals transporting crude oil, so little land use, recreation, or visual impact would be anticipated. Land use, recreation, and visual impacts of the Stroud pipeline would be proportionally similar to those of the proposed Project.

Socioeconomics

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new facilities in Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma (including the 17-mile pipeline between the two communities). This section also includes consideration of the rail lines and pipelines as operational use of these segments could affect socioeconomic resources. An overview of the socioeconomic resources of these areas is provided below.

The Canadian National route would intersect 49 U.S. counties in six different states and 17 Canadian census divisions within three provinces (Table 5.1-4). It would go through seven metropolitan areas: Saskatoon, Saskatchewan; Winnipeg, Manitoba; Duluth, Minnesota/ Wisconsin; Minneapolis-St. Paul, Minnesota/Wisconsin; Des Moines, Iowa; Kansas City, Kansas/Missouri; and Tulsa, Oklahoma. The CPRS route would intersect 63 U.S. counties in eight states and eight Canadian census divisions within the Province of Saskatchewan (Table 5.1-5). It would go through nine metropolitan areas: Saskatoon, Saskatchewan; Regina, Saskatchewan; Fargo, North Dakota/Minnesota; Sioux Falls, South Dakota; Sioux City, Nebraska/Iowa; Omaha, Nebraska; St. Joseph, Kansas/Missouri; Kansas City, Kansas/Missouri; and Tulsa, Oklahoma. In comparison, the proposed pipeline Project would intersect 30 U.S. counties in four states and one metropolitan area: Rapid City, South Dakota.

Table 5.1-4 U.S. States and Counties and Canadian Provinces/Census Divisions within the Rail/Pipeline Scenario—Canadian National Route

State (U.S.)/ Province (CA)	Number of Counties (U.S.)/Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Pipeline Corridor		
Canada		
Saskatchewan	7	17, 16, 12, 11, 10, 6, 5
Manitoba	9	15, 7, 8, 9, 10, 11, 12, 2, 1
Ontario	1	Rainy River District
United States		
Minnesota	16	Roseau, Lake of the Woods, Koochiching, St. Louis, Carlton, Kanabec, Pine, Isanti, Anoka, Hennepin, Ramsey, Washington, Dakota, Rice, Steele, Freeborn
Wisconsin	1	Douglas
Iowa	10	Worth, Cerro Gordo, Franklin, Hardin, Story, Polk, Warren, Marion, Lucas, Wayne
Missouri	8	Mercer, Grundy, Daviess, Livingston, Caldwell, Clay, Ray, Jackson

State (U.S.)/ Province (CA)	Number of Counties (U.S.)/Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Kansas	7	Johnson, Miami, Anderson, Linn, Allen, Neosho, Labette
Oklahoma	7	Craig, Mayes, Creek, Tulsa, Wagoner, Lincoln, Muskogee
Terminal Facilities		
Canada		
Saskatchewan	1	17
United States		
Oklahoma	2	Lincoln, Creek

Table 5.1-5 U.S. States and Counties and Canadian Provinces/Census Divisions within the Rail/Pipeline Scenario—Canadian Pacific Route

State (U.S.)/ Province (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Pipeline Corridor		
Canada		
Saskatchewan	8	17, 13, 12, 11, 6, 7, 2, 1
United States		
North Dakota	15	Burke, Renville, Williams, Mountrail, Ward, McHenry, Pierce, Wells, Eddy, Foster, Griggs, Steele, Barnes, Cass, Richland
Minnesota	14	Clay, Wilkin, Grant, Traverse, Stevens, Pope, Swift, Kandiyohi, Chippewa, Yellow Medicine, Lincoln, Lyon, Pipestone, Rock
South Dakota	1	Minnehaha
Iowa	6	Lyon, Sioux, Plymouth, Woodbury, Mills, Fremont
Nebraska	6	Dakota, Thurston, Burt, Dodge, Saunders, Cass
Missouri	7	Atchison, Holt, Andrew, Buchanan, Platte, Clay, Jackson
Kansas	7	Wyandotte, Johnson, Miami, Linn, Bourbon, Crawford, Cherokee
Oklahoma	7	Craig, Ottawa, Rogers, Delaware, Tulsa, Lincoln, Creek
Terminal Facilities		
Canada		
Saskatchewan	1	17
United States		
North Dakota	1	Williams
Oklahoma	2	Lincoln, Creek

Population[7]

The population of the census divisions and counties that would be crossed by the CN route in 2010/2011 was approximately 8 million. The corresponding population of the CPRS route in 2010/2011 was just over 4.5 million (Table 5.1-6). In comparison, the pipeline corridor population under the proposed Project was 263,298 in 2010 (see Table 3.10-5). Of the rail corridor populations, a relatively small portion (about 166,000 persons) lives in the counties and census divisions adjacent to the representative new and/or expanded terminals (Lloydminster, 40,000; Williams County, North Dakota, 22,000; and Lincoln and Creek counties in Oklahoma, 104,000).

Table 5.1-6 Rail/Pipeline Corridor Populations

CN Route		**CPRS Route**	
State (U.S)/Province (CA)	**Population[a]**	**State (U.S)/Province (CA)**	**Population[a]**
Rail/Pipeline Corridor		**Rail/Pipeline Corridor**	
Canada		Canada	
Saskatchewan	663,722	Saskatchewan	746,435
Manitoba	905,577	United States	
Ontario	20,370	North Dakota	297,431
United States		Minnesota	221,809
Minnesota	3,112,972	South Dakota	169,468
Wisconsin	44,159	Iowa	194,943
Iowa	694,980	Nebraska	117,516
Missouri	966,689	Missouri	1,102,508
Kansas	656,214	Kansas	820,037
Oklahoma	908,006	Oklahoma	882,912
Rail/Pipeline Corridor Total	*7,972,689*	*Rail/Pipeline Corridor Total*	*4,553,059*
Terminal Facilities[b]		**Terminal Facilities[b]**	
Canada		Canada	
Saskatchewan	40,135	Saskatchewan	40,135
United States		United States	
		North Dakota	22,398
Oklahoma	104,240	Oklahoma	104,240
Project Area Total	*7,972,689*	*Project Area Total*	*4,553,059*

Source: U.S. Census Bureau 2010; Statistics Canada 2012b

[a] Population data are from 2010 for the United States and from 2011 for Canada.
[b] Populations near the representative new or expanded terminal facilities are included in the corridor totals above.
Note: The table only includes the population of the counties and census divisions the route would go through, not the population of the states/provinces as a whole.

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[7] Population data were collected by county in the United States and by census division in Canada. Existing lodging and housing is discussed in the Potential Impacts section below.

Environmental Justice

Populations near the terminal facilities were evaluated on a range of geographies: city, census division, province, county, and state. A total of two meaningfully greater minority populations were identified: an aboriginal population in Census Division 17 in Saskatchewan (12,000 persons out of a population of 40,000), and a multiracial population in Williams County, North Dakota (644 persons out of a population of 22,400) (see Appendix O, Socioeconomics, for detailed data).

Public Services

The city of Lloydminster has two fire departments and is patrolled by the Royal Canadian Mounted Police. A total of 20 police/sheriff departments, 28 fire departments, and four medical facilities would be located near the terminals in the United States. Appendix O, Socioeconomics, includes a table listing these facilities.

Traffic and Transportation

In 2005, the existing railroads that would be utilized under this scenario had between 25 and 200 freight trains per day depending on the segment (Cambridge Systematics 2007). Some segments were near or above capacity, especially in the American Midwest between St. Paul, Minnesota, and Oklahoma and along the Gulf Coast area (Cambridge Systematics 2007).

Potential Impacts

The Rail/Pipeline Scenario would require new terminal facilities in three locations, and it would use existing rail lines for most of the crude oil transport. Thus, the analyses of potential socioeconomic impacts are focused on the immediately affected areas near Lloydminster, Epping, and Stroud/Cushing.

Population/Housing

The impacts of the Rail/Pipeline Scenario on population and housing would be small. This scenario is expected to bring approximately 5,500 construction jobs and approximately 450 operations jobs to the areas of the terminals in the United States (see Table 2.2-4). In Epping, North Dakota, the employment of approximately 750 terminal construction jobs would represent a 3.5 percent population increase for Williams County. In Lincoln and Creek counties, the population influx from Stroud/Cushing terminal construction jobs would increase the population by 4.5 percent.

A number of additional jobs would be created by the construction of the pipeline between Stroud and Cushing. These job numbers have not been estimated, but it is assumed to be much lower than for the terminals. Therefore, it is not expected that the pipeline would create an additional demand on housing during its construction.

Jobs numbers in Lloydminster could not be estimated reliably because the economic model used for the employment analysis does not extend into Canada. However, based on the jobs that would occur at terminals in the United States, the construction jobs at Lloydminster could reasonably be expected to total at least 1,000.

In Lloydminster, the number of hotel/motel rooms is approximately 1,075 (TripAdvisor 2012). This number would likely be insufficient to house the workers that would need lodging. In this area, additional lodging would need to be made available for workers. While the 287 hotel/motel rooms near Stroud/Cushing alone would not provide capacity for the approximately 4,800 workers needed, the cities of Tulsa and Oklahoma City, Oklahoma, are both within commuting distance, and would provide enough commercial housing to accommodate the workforce. Epping, North Dakota, has approximately 1,500 hotel/motel rooms (TripAdvisor 2012), suggesting it would be able to accommodate the approximately 750 workers that would be needed for terminal construction.

Local Economic Activity

Construction

Key components of this scenario would include new terminal facilities to transfer and transport crude oil in Lloydminster, Saskatchewan; Stroud, Oklahoma; and Epping, North Dakota. Construction costs for these facilities would range from about $110 million in Epping to $185 million in Lloydminster and $700 million in Stroud. Much of the construction workforce for each location would likely be local, which for Stroud would encompass the Tulsa and Oklahoma City metropolitan areas. The local workforce sourcing area for Epping would include cities and towns throughout North Dakota. It is uncertain how wide of an area would provide the construction workforce in Lloydminster, but given Lloydminster's relatively small population, it would likely encompass communities within Alberta and Saskatchewan.

As discussed in Section 4.10.3.1, Construction, economic effects are distinguished by whether they are direct, indirect, or induced. Using the heavy construction sector in a model of the U.S. economy (MIG, Inc. 2011), employment and earnings effects are estimated for the rail terminals in Stroud and Epping. Direct employment effects of facility construction would include approximately 4,800 jobs over a 2-year period at Stroud; and approximately 750 jobs over a single-year period at Epping. Estimates for Lloydminster could not be made because the modeling system used for the economic impact analyses does not extend into Canada. However, based on the jobs that would occur at terminals in the United States, the construction jobs at Lloydminster could reasonably be expected to total at least 1,000. Indirect and induced employment effects could occur nationally for rail terminal construction in the United States, but are likely to be more concentrated near the facilities. Indirect and induced jobs supported by the construction activity in Epping would amount to 1,250, while 7,900 jobs would be supported over a 2-year period (3,950 per year) by construction in Stroud. In total, approximately 2,000 direct, indirect, and induced jobs would be supported by construction activity in Epping and about 12,700 direct, indirect, and induced jobs (6,350 per year) by construction activity in Stroud.

Earnings supported by construction activity follow a similar pattern as employment. For the Stroud terminals, it is estimated that about $124.7 million of direct earnings would be supported in each of the 2 years of construction. For the Epping terminal, about $39.2 million of direct earnings would be supported. While direct effects are generally localized around the construction sites, indirect and induced effects could occur across the United States. Indirect and induced earnings would come to about $416.6 million for the construction in Stroud ($208.3 million per year), and about $65.5 million for the construction in Epping. In total, approximately $666.1 million of earnings ($333 million per year) would be supported by construction activity in Stroud, and another $104.7 million by construction activity in Epping. Additional earnings would occur in Canada but could not be estimated by the economic model used for the analysis.

No specific estimates for pipeline construction between Stroud and Cushing were made, but it is assumed that some temporary jobs would be created by such a project.

Operations

Operations costs are estimated to range from $49 million annually Stroud, $14 million annually for Lloydminster, and $7 million annually for Epping. Using the transportation support sector in the same economic model discussed above, annual terminal employment is estimated to range from 400 jobs at the Stroud facility to 50 jobs at Epping (Table 2.2-4). Indirect and induced effects for annual operations in Stroud would come to about 600 jobs. Operations in Epping would support 100 jobs. In total, annual operations in Stroud would support about 1,000 jobs while operations in Epping would support about 150 jobs. These effects are national estimates, but most effects could be expected to occur near the rail terminals. Estimates for Lloydminster could not be made because the modeling system used for the economic impact analyses does not extend into Canada.

Earnings supported by facility operations follow a similar pattern as employment. For the Stroud terminals, it is estimated that about $27.7 million of direct earnings would be supported each year. For the Epping terminal, about $3.9 million of direct earnings would be supported annually. Indirect and induced earnings would come to about $29.9 million for operating the terminals in Stroud, and about $4.3 million for operations in Epping. In total, approximately $57.6 million of earnings would be supported by operations in Stroud, and another $8.2 million by operations in Epping, in addition to the earnings supported by operations in Lloydminster (not estimated here).

Operational socioeconomic effects resulting from trains transporting WCSB and Bakken crude oil daily could not be estimated. However, it is reasonable to expect annual increases in maintenance and other operational costs of track, crossings, bridges, and related facilities throughout the rail systems.

Environmental Justice

Portions of one or both of the two identified meaningfully greater minority populations could potentially be affected by construction or operations activities related to the terminals. No meaningfully greater low-income populations were identified. Impacts to minority and low-income populations would be similar to those described for the proposed Project and could result in increased competition for medical or health services in underserved populations. Williams County, North Dakota, which contains a minority population, is or contains Health Professional Shortage Areas (HPSAs) and Medically Underserved Areas/Populations (MUA/Ps). Canada does not define HPSAs and MUA/Ps, so it is unknown whether or not the minority population in Saskatchewan exists in a medically underserved area. Appendix O, Socioeconomics, provides information about the HPSAs and MUA/Ps in relation to areas with minority and/or low-income populations.

Tax Revenues

Under the Rail/Pipeline Scenario, the new terminal in Epping would cost approximately $110 million and new terminals in Stroud would cost approximately $700 million; both would generate state and local government sales and use tax and fuel tax revenue during construction. During construction the new or expanded terminals in Lloydminster would also cost about $200 million and generate provincial sales taxes, goods and services taxes, and hotel taxes. Once in operation and on the tax roll, the terminals would generate county property tax revenue. Many states along the rail routes would assess a property or similar tax on the new railcar traffic passing through, generating additional revenue. Railcar taxes typically go to a state fund for use according to each state's tax policy. The Canadian terminals would generate municipal property tax revenue (Government of Saskatchewan 2012b).

Property Values

Impacts to private property values in North Dakota and Oklahoma could occur under the Rail/Pipeline Scenario if there are land uses that would experience offsite nuisance effects but would receive no offsetting consideration from being in the vicinity of the terminals, although there already are oil transportation facilities near these sites. Construction and operation of rail facilities, additional connecting pipelines, and additional train traffic could have an adverse effect on local property values. These would be long-term impacts, extending through the operations phase.

Traffic and Transportation

Under this scenario, up to 14 unit trains per day would arrive at Stroud, including up to 12 from Lloydminster, Saskatchewan, and up to two from Epping, North Dakota. Depending on the mix of train types and the type of control system used, a typical Class I railroad segment could accommodate up to 48 unit trains per day with one set of tracks or up to 100 trains per day with two sets of tracks (Cambridge Systematics 2007). An increase of up to 14 trains per day for crude rail shipments from Lloydminster to Stroud could strain some segments of these rail networks by increasing volume by up to 56 percent. Therefore, while the rail system as a whole could accommodate additional traffic under this scenario, railroads might need to add infrastructure components (e.g., passing tracks or a second set of tracks) or upgrade control equipment. These upgrades would likely occur on property owned by the railroads. As of 2007, most of the rail corridors included in this scenario had or, with upgrades already likely to occur regardless of crude oil transport, were likely to have substantial available capacity (Cambridge Systematics 2007[8]).

Construction of the rail terminals at Epping and Stroud would involve large numbers of road trips by heavy trucks to transport construction materials and equipment to and from the sites. Especially near Stroud, where seven rail terminals would be built, this increased traffic could cause congestion on major and local roadways, and could require temporary traffic management solutions such as police escorts for oversize vehicles.

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[8] A follow-up study published by the American Association of Railroads in 2008 found that little had changed in rail capacity since the 2007 study. The most recent studies were conducted in 2009 as a supplemental report to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment (Christensen 2009).

Under the Rail/Pipeline Scenario, rail loading and offloading facilities would likely be sited to avoid disruption of major surface transportation routes. This scenario would marginally increase delays for motorists at at-grade railroad crossings by adding additional periods of time when trains use those crossings; however, most major roads (i.e., freeways and high-traffic arterial roads) have grade-separated railroad crossings. Increased crossing delays would therefore have negligible impacts on regional or metropolitan-scale traffic patterns.

The increased number of trains under this scenario would also increase the risk of train/motor vehicle collisions with the associated risk of increased accidents, injuries, and fatalities. Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios, discusses these risks in detail.

Cultural Resources

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new and/or expanded facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. A brief overview of the cultural resources in these three areas is provided below.

While no cultural resources studies have been conducted in the Lloydminster area for this Final Supplemental EIS, review of aerial photographs shows that a small portion of the approximately 1,000 acres that could potentially be developed has already been disturbed by development, including structures and roads. This preliminary review shows that most of the area appears undeveloped, and would have the potential for intact cultural resources.

No cultural resources studies have been conducted in Stroud, Oklahoma, or Epping, North Dakota. However, both areas have undeveloped land adjacent to a transportation corridor, with close proximity to water resources. The regional topography, proximity to a transportation corridor, access to water, and apparent lack of prior disturbance appear to suggest a relatively high potential for intact cultural resources.

Potential Impacts

Any ground disturbance, especially of previously undisturbed ground, could potentially directly impact cultural resources. The area of potential effects (APE) for this scenario has not been subjected to systematic cultural resources studies at this time. The potential of the APE to include intact buried cultural resources would require evaluation through research and cultural resources surveys. If cultural resources were identified, follow-up studies could be required. In general terms, the archaeological potential of heavily disturbed areas, such as might be found in active rail yards, or within developed transportation corridors, is normally lower than in undisturbed areas. Archaeological potential is also contingent upon factors such as access to water, soil type, and topography, and would have to be evaluated for each area to be disturbed. Aboveground facilities have the potential to indirectly impact cultural resources from which they may be visible or audible. The potential for increased rail traffic to contribute to indirect impacts would require consideration. The APE would have to be evaluated for historic structures and archaeological sites that could be impacted by this scenario.

Air and Noise

Environmental Setting

The Rail/Pipeline Scenario would include the construction of new and/or expanded facilities in three areas: Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma. This section also includes consideration of the rail lines and pipeline, as operational use of these segments could affect air and noise resources. An overview of the air and noise characteristics of these areas is provided below.

The areas around the Lloydminster, Epping, and Stroud terminal sites are generally rangeland and other agricultural uses. The rail routes associated with this scenario would cross multiple rural counties in Canada and the United States. The existing air quality (including greenhouse gases [GHGs]) in Lloydminster, Epping, and Stroud is expected to be similar to that of the proposed Project area due to the similarities in land use (i.e., rangeland and agriculture).

Potential Impacts

This scenario would include new rail terminals in Lloydminster, Epping, and Stroud. On an aggregate basis, criteria pollutant emissions, direct and indirect GHG emissions, and noise levels during the operation phase for this scenario would be higher than that of the proposed Project (see Section 4.12.3, Potential Impacts), mainly due to the increased regular operation and location of diesel locomotives, railcars, and new rail terminals. Additionally there would be potential construction and operations impacts associated with the new pipeline.

Air Quality

Emissions of criteria pollutants would be generated during the construction and operation of the Rail/Pipeline Scenario. Emissions attributed to construction of the new rail terminals and pipeline under this scenario were not quantified due to a lack of design data. However, construction-related emissions would be short-term, be similar in type, and have greater magnitude compared to those of the proposed Project.

During the operation phase, WCSB crude oil would be transported over railroads extending from Lloydminster, Saskatchewan, to Stroud, Oklahoma; and Bakken crude would be transported via rail from Epping, North Dakota, to Stroud. Under this scenario, two railway routes were evaluated from Lloydminster to Stroud: CPRS Rail Route (1,903 miles); and CN Rail Route (2,008 miles). In terms of an air quality analysis, the only difference in the railway routes is the difference in route distances, so only one of the railway routes (CPRS Rail Route) was assessed in detail. Air quality impacts associated with the CN Railway Route would have a similar but slightly greater air quality impact as the CPRS Rail Route due to the longer rail length.

The trains transporting the WCSB and Bakken crudes would consume large amounts of diesel fuel each day, which equate to direct emissions of hydrocarbons (HCs) or volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Emissions of VOCs would also be generated by *breathing* from 82 storage tanks holding over 6 million bbl of crude oil. The total operational emissions (tons) estimated over the life of the project (50 years) presented in Table 5.1-7 are significantly greater than those associated with the combined construction and operation of the proposed Project.

Table 5.1-7 Comparison of Criteria Pollutant Emissions for the Rail/Pipeline Scenario and Proposed Project over a 50-Year Period

	Criteria Pollutant Emissions (tons)[a]					
Sources	**HC/VOC**	**CO**	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Rail/Pipeline Scenario (operation phase)[a]	115,520	455,002	1,912,935	56,337	37,338	35,867
Proposed Project (construction phase; 6 to 8 months)[b]	130	2,531	1,214	50.2	6,781	1,398
Proposed Project (operation phase)[b]	22.5	NA[c]	NA	NA	NA	NA

[a] Details of air emission calculations for the Rail/Pipeline Scenario, including activity data, emission factors, and assumptions used, can be found in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.
[b] Summary of criteria pollutant emissions, assumption used, and sources of emission factors and activity data can be found in Tables 4.12-2 and 4.12-4.
[c] NA = not applicable

The rail emissions accounted for return trips (i.e., both loaded cargo going south and return trips without diluent going north). Detailed annual operational emissions (with activity data, emission factors, and assumptions) for this scenario can be found in Table 1 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions. During its long-term operation, the proposed Project is expected to emit 0.45 tons of VOCs per year during operations or 22.5 tons over its 50-year life (i.e., from approximately 55 intermediate mainline valves along the pipeline route and from pump station components such as valves, pumps, flanges, and connectors). In aggregate, over the same 50 year period as the proposed Project, this scenario would emit approximately 115,520 tons of VOCs, which is over 5,100 times greater than for the proposed Project at just 22.5 tons. No other criteria pollutants or hazardous air pollutants would be emitted during the proposed Project operations (see Section 4.12.3.1, Air Quality). Unlike the proposed Project, for which human receptors (residences) are located at least 1,320 feet away from the air emission sources described above (i.e., pumps, valves, flanges and connectors at the pump stations), this scenario has human receptors as close as 39 feet to some segments of the rail line (e.g., in Cass, North Dakota).

The Rail/Pipeline Scenario would also generate fugitive VOC and methane emissions (direct emissions) from equipment at the new rail terminals and potential pump stations required for pipeline interconnections. Due to the speculative nature of these facilities, fugitive emissions could not be quantified.

Greenhouse Gases

Direct emissions of GHGs would occur during the construction and operation of the Rail/Pipeline Scenario. GHGs would be emitted during the construction phase from several sources or activities, such as clearing and open burning of vegetation during site preparation, operation of on-road vehicles transporting construction materials, and operation of construction equipment for the new pipeline, rail segments, multiple rail terminals, and fuel storage tanks. Due to limited activity data, GHG emissions from construction of the Rail/Pipeline Scenario were not quantified; however, these emissions would occur over short-term and temporary periods, similar to the proposed Project.

During the operation of this scenario, GHGs would be emitted directly from the combustion of diesel fuel in railcars[9] traveling approximately 1,903 to 2,008 miles from Lloydminster, Saskatchewan, to Stroud, Oklahoma, and 1,347 miles from Epping, North Dakota, to Stroud, Oklahoma. As indicated earlier, two railway routes were evaluated under this scenario from Lloydminster, Saskatchewan, to Stroud, Oklahoma: CPRS Rail Route (1,903 miles) and CN Rail Route (2,008 miles). GHG impacts associated with the CN Rail Route would have a similar but slightly greater regional/global GHG impact as the CPRS Rail Route due to the longer route distance. The operation of diesel-fueled trains hauling Bakken crude to Epping, North Dakota, would also result in GHG emissions. The rail emissions accounted for return trips (i.e., both loaded cargo going south and return trips without diluent going north). The resulting direct emissions of GHGs (3,253,216 metric tons of carbon dioxide equivalents [CO_2e] per year) from this scenario can be found in Table 2 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions. The Rail/Pipeline Scenario would also result in indirect emissions of GHGs due to the operation of 15 new and/or existing rail terminals and 11 potential pumping stations (one for the Cushing tank farm in Oklahoma, 10 along the southern Gulf Coast pipeline segment). The new and/or existing rail terminals would be required in Saskatchewan, North Dakota, and Oklahoma, and each is projected to require 5 megawatts (MW) of electric power to operate. Five of the seven terminals at Lloydminster (Saskatchewan) would be existing operating terminals. The equivalent of two new terminals would be built in Lloydminster, which may be a combination of new construction or expansions to existing facilities. The terminals in North Dakota and Oklahoma would be new. Indirect GHG emissions for this scenario would be 1,111,395 metric tons of CO_2e per year.[10]

In aggregate, the total annual GHG emissions (direct and indirect) attributed to this scenario would be 4,364,611 metric tons CO_2e, which is about 40 percent greater than for the entire route encompassing the proposed Project[11] at 3,123,859 metric tons CO_2e (see Section 4.14.2, Direct and Indirect Greenhouse Gas Emissions).[12]

Noise

Noise would be generated during the construction and operation of the Rail/Pipeline Scenario. Noise would be generated during the construction phase from the use of heavy construction equipment and vehicles for the new pipeline, rail segments, and multiple rail terminals and fuel

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[9] The use of liquefied natural gas (LNG) as a fuel source for trains is being developed and tested, with some media reports suggesting commercial application by 2016/2017 (for example Reuters 2013, Railway Age 2013). The use of LNG could reduce GHG emissions compared to the use of diesel fuel. The use of LNG has not been factored into the current GHG calculations and results.

[10] The calculated GHG emissions stated in this section assume that the pumps along the pipeline alignment would operate at their full horsepower (hp) capacity (6,500 hp per pump). This is a conservative assessment because in reality very few pumps would reach their rated motor hp. If it was assumed that the pumps would operate on average at 90 percent of their design condition loading, and the variable speed drives would operate the pumps at part load on average 85 percent, an operating hp of 3569 per pump would be obtained. In this instance, the GHG emissions for the proposed Project and those portions of alternative scenarios associated with the pumps would be of the order of 50 to 60 percent lower.

[11] To facilitate comparison of GHG emissions across the alternatives for operational GHG emissions, an assessment was made of GHG emissions for the alternatives along the entire route from Hardisty, Alberta, to the Gulf Coast (including pipelines in Canada and from Steele City to the Gulf Coast).

[12] The indirect lifecycle GHG emissions are expected to be the same because the same volume of WCSB crude oil would be transported.

storage tanks. Due to limited activity/design data, noise levels from the construction of this scenario were not quantified; however, this noise would occur over a short-term and temporary period, so construction noise impacts are expected to be comparable to those of the proposed Project.

During operation of the railcars that comprise this scenario, noise would be generated from the locomotives, movement of freight cars and wheels making contact with the rails as the train passes, train horns, and warning bells (crossing signals) at street crossings. People living near rail yards, siding, or terminals likely would experience additional noise due to trains standing for extended periods with their engines idling, as well as from trucks and other mobile sources moving in and out of the yard/terminal. As indicated earlier, two railway routes were considered under this scenario for the transfer of crude oil from Lloydminster, Saskatchewan, to Stroud, Oklahoma: CPRS Rail Route (1,903 miles); and CN Rail Route (2,008 miles). Both rail routes were evaluated separately for this noise assessment because the routes cross different states with different noise sensitive areas (NSAs) or receptors. Unlike the proposed Project, for which human receptors (residences) are located at least 1,320 feet away from the noise sources (pump stations), this scenario has human receptors as close as 39 feet to some segments of the rail line (e.g., in Cass, North Dakota).

The day-night sound level (Ldn) from both rail routes was calculated in accordance with the methodology described by U.S. Department of Transportation (USDOT 2006) for commuter rail system. The calculation assumes up to 730,000 bbl of WCSB crude oil transported per day from Lloydminster, Saskatchewan, to a storage facility at Stroud, Oklahoma, 594 bbl of crude oil (assumed dilbit) per railcar, three diesel-powered locomotives per unit train with an average speed of 40 miles per hour (mph), and 100 railcars per train. Aerial photography was used to identify the closest NSAs within half a mile of the rail corridor for both rail routes. The existing noise levels at the closest NSAs were estimated using the methodology described in USDOT 2006, which is based on the proximity of the NSAs to the existing rail routes. The noise calculations do not include potential noise from train horns, warning bells (crossing signals) at street crossings, and locomotive idling at layover tracks near terminals. The noise calculations also exclude potential noise attenuation from barriers such as vegetation blocking the line of sight between the source (train) and some receptors (NSAs).

Noise levels would vary depending on the distance of closest NSAs to the rail routes. This additional rail traffic could result in noise increases of approximately 10 decibels on the A-weighted scale (dBA) above existing levels (ambient noise levels are estimated to be 73 dBA at the closest NSA) at the source. Under the CPRS Route, Ldn levels could be as high as 83 dBA at the closest NSA in Cass, North Dakota (39 feet from the rail route). This level of Project-induced noise at an NSA is greater than the expected noise level at an NSA from pump station operations under the proposed Project, which was estimated to be approximately 61 dBA at 1,320 feet or a quarter mile from the closest receptors (see Section 4.12.3.2, Noise). Similarly, under the CN route, Ldn levels (including existing levels) could be as high as 81 dBA at the closest NSA in Marion, Iowa (47 feet from the rail route). The addition of noise from train horns, warning bells, and locomotive idling would further increase noise levels at these NSAs, unless there are barriers present such as vegetation that blocks the line of sight between the trains and the NSAs. Table 5.1-8 shows a comparison of the predicted noise levels at closest NSAs for the Rail/Pipeline Scenario (CPRS route) and the Proposed Project. Similarly, Table 5.1-9 shows a comparison of the predicted noise levels at closest NSAs for the Rail/Pipeline Scenario

(CN route) and the Proposed Project. Detailed operational noise emissions (with activity data, distance to closest NSA, and assumptions) for this scenario can be found in Tables 3 and 4 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.

Table 5.1-8 Comparison of Predicted Noise Levels at Closest Noise Sensitive Area for the Rail/Pipeline Scenario (CPRS Route) and the Proposed Project

Source	Closest Noise Sensitive Area to Source	Distance to Source (Railway or Pump Station) (feet)	Estimated Existing Ldn Levels (dBA)	Total Ldn at Closest NSA, including Existing Ldn (dBA)
Rail/Pipeline Scenario – CPRS Route (operation phase)	Residence near railway in Cass County, North Dakota	39.0	72.7	82.5
Proposed Project (operation phase)	Residences located north-northeast of Pump station 25 in Nebraska	1,320	35.0	61.4

Table 5.1-9 Comparison of Predicted Noise Levels at Closest Noise Sensitive Area for the Rail/Pipeline Scenario (CN Route) and the Proposed Project

Source	Closest Noise Sensitive Area to Source	Distance to Source (Railway or Pump Station) (feet)	Estimated Existing Ldn Levels (dBA)	Total Ldn at Closest NSA, including Existing Ldn (dBA)
Rail/Pipeline Scenario – CN Route (operation phase)	Residence near railway in Marion County, Iowa	47.0	71.1	81.5
Proposed Project (operation phase)	Residences located north-northeast of Pump station 25 in Nebraska	1,320	35.0	61.4

This scenario also has the potential for noise due to the transport of 100,000 bpd of Bakken crude via trains from Epping, North Dakota, to the storage facility at Stroud, Oklahoma (approximately 1,347 miles). Noise from the Epping-Stroud route was not quantified because approximately 90 percent of this rail route is the same as the CPRS route.

Based on the increased train traffic/volume and proximity of the NSAs to the rail routes, noise impacts from the Rail/Pipeline Scenario (i.e., CPRS route plus Epping-Stroud route or CN Route plus Epping-Stroud route) would be greater than those of the proposed Project.

Climate Change Effects on the Scenario

Environmental Setting

Historical Climate Trends

The historical changes in temperature for the region affected by the Rail/Pipeline Scenario are presented below in Table 5.1-10 and are similar to those discussed in Section 4.14, Greenhouse Gases and Climate Change. Overall, temperatures have been warming compared to historical averages. These historical climate trends are expected to continue and to intensify according to

GHG emissions levels and associated projections of climate change (Intergovernmental Panel on Climate Change [IPCC] 2007 and 2012).

Table 5.1-10 Historical Changes in Temperature by State (1895-2009)

State	Annual Average (˚F Increase)	Summer Average (˚F Increase)	Winter Average (˚F Increase)
Montana	1.6	1.0	1.7
North Dakota	2.9	1.8	5.0
South Dakota	2.2	1.6	3.9
Nebraska	1.2	0.7	1.8
Kansas	1.1	0.6	2.0
Iowa	1.0	0.4	1.5
Minnesota	1.4	0.9	2.4
Missouri	0.4	0.0	0.9
Oklahoma	1.2	0.7	2.5

Sources: Breckner 2012; High Plains Regional Climate Center (HPRCC) 2012; Southern Climate Impact Planning Program (SCIPP) 2012; Midwest Regional Climate Center (MRCC) 2012

˚F = degrees Fahrenheit

Projected Climate Trends

As part of preparation of this Final Supplemental EIS, an analysis was performed to evaluate the potential impacts of climate change on facilities that would be built under the Rail/Pipeline Scenario. The routes for the Rail/Pipeline Scenario would cross through several of the climate regions in the US that were already discussed in Section 4.14, Greenhouse Gases and Climate Change. The Rail/Pipeline Scenario routes are east of the proposed Project pipeline route and pass through the Continental, Dry Temperate, and Prairie Climate Regions. In general, these climate regions are projected to experience the same overall trends in temperature, precipitation, and extreme event (see Tables 4.14-10 and 4.14-11).

Potential Impacts

The impacts of climate change on the pipeline portion (construction and operation) of the Rail/Pipeline Scenario would be similar to the proposed Project due to similarities in climate regions (see Section 4.14.5, Climate Change Impacts on the Proposed Project). The climate modeling results described in Table 4.14-10 show very small relative differences between the affected climate regions in projected future temperature changes over baseline conditions by 2040. For precipitation, the relative difference is greater due to the differences in the baseline precipitation rates for each climate region (see Table 4.14-11). Increased high temperatures could have an impact on operation of the existing rail line. Increased hot temperatures above a certain level can cause compression and expansion of rail line (sun kinks or thermal misalignments). Extreme events can also damage the rail line, which can lead to service interruptions or derailment.

5.1.2.3 Rail/Tanker Scenario

Under the Rail/Tanker Scenario, up to 730,000 bpd of WCSB crude oil would be transported by rail to Prince Rupert, British Columbia, and then by tanker to the Gulf Coast area. Up to 100,000 bpd of Bakken crude oil would be transported by rail and pipeline, similar to the Rail/Pipeline Scenario. The Rail/Tanker Scenario is described in more detail in Section 2.2.4.2, Rail/Tanker Scenario.

The new facilities in Lloydminster and Prince Rupert would include the following:

- Two new loading terminals (or equivalent of new construction and expansions at existing facilities) at Lloydminster to load up to 730,000 bpd of WCSB crude oil. The specifications of these terminals would be the same as those discussed under the Rail/Pipeline Scenario (see Section 2.2.4.1);
- One new off-loading rail terminal at Prince Rupert. This terminal would likely be a single facility consisting of 6 double loop tracks capable of off-loading 12 unit trains per day of WCSB. This terminal has been estimated to be about 3,000 acres,[13] although it could be smaller. No design criteria exists for this representative facility;
- Storage tanks at Prince Rupert would total just under 7,000,000 barrels (14 tanks, each with 496,000 barrels of capacity), and would be designed to handle volumes shipped on Suezmax vessels (1 million barrel cargo);
- Transport via Suezmax crude oil vessels south along the Pacific Coast, through the Panama Canal, and north into the Gulf of Mexico. Suezmax tankers were used for the analysis because they are the largest vessels that can traverse the Panama Canal; and
- Off-loading of the crude oil onto smaller vessels for final transport to U.S. Gulf Coast refineries.

Under this scenario, Bakken crude oil would still be transported via rail to Stroud/Cushing as proposed in the Rail/Pipeline Scenario. The following are components for transporting the Bakken crude oil:

- A representative rail terminal and storage facility, approximately 500-acres in size would be built near Epping, North Dakota (to accommodate increased rail volume), where the Bakken crude oil would be loaded onto up to two 100-car unit trains per day
- Transport along approximately 1,350 miles of existing rail lines from the proposed Epping rail terminal to a new 500-acre rail terminal and oil storage complex near Stroud, Oklahoma, where the crude oil would be offloaded. No specific railroad company or route between Epping and Stroud was identified for this segment, as Bakken crude oil is currently being transported via rail from Epping to Stroud by CPRS and BNSF along numerous routes.
- Transport via a new approximately 17-mile-long pipeline from the proposed Stroud crude oil storage complex to the existing Cushing, Oklahoma, crude oil terminal (referred to herein as the Cushing pipeline).

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[13] This number was derived by using the 500-acre per terminal used for the other crude by rail terminals in this and other scenarios. To arrive at 730,000 bpd throughput, 6 equivalent terminals times 500 acres was used. It is likely that an economy of scale would reduce the footprint of the actual terminal.

- Temporary storage in existing facilities at Cushing pending delivery via existing crude oil pipelines (e.g., Keystone Gulf Coast pipeline that is currently under construction) to Gulf Coast area refineries.

The locations for these new and/or expanded rail terminals and the expanded port in Prince Rupert are meant to provide representative examples. The exact locations of the rail facilities are currently not known. Similarly, the exact rail routes used at any one time could differ from those presented here because of congestion on certain lines, track maintenance, and other factors outside the scope of this document.

In summary, the Rail/Tanker Scenario would take advantage of existing rail lines and crude oil pipelines and the existing Cushing storage facility and require little if any new rail tracks, but would require the construction of new rail terminals and crude oil storage facilities in Lloydminster, Prince Rupert, Epping, and Stroud; port expansion in Prince Rupert; as well a new, approximately 17-mile-long Stroud-Cushing pipeline. There is the potential that some improvements may be required along the existing rail lines and crude oil pipelines included in this scenario; the location, scale, and timing of these improvements are unknown, but they are believed to be minor in comparison with the overall scale of the scenario, and are thus not considered in this analysis.

The environmental setting and potential impacts for the Rail/Tanker Scenario are described below for each resource. Since the rail lines from Lloydminster to Prince Rupert and from Epping to Stroud and the pipeline from Cushing to the Gulf Coast area refineries already exist or are under construction, little or no improvements to these facilities are assumed to be necessary. Because no new construction would be needed, it is assumed that there would be no construction impact to any resources along these segments.

There would also be little potential for operational impacts from increased rail traffic along the existing rail lines for most resources, although due to increased rail traffic there would be an increased potential for impacts associated with accidental releases, train/motor vehicle collisions, noise, and congestion in towns and cities. Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios, describes these impacts in more detail. Also, the impacts related to accidental releases would be similar in type but not in magnitude or occurrence, as the proposed Project. These impacts are described in Chapter 4, Environmental Consequences.

In addition, transport of the crude oil via tankers from Prince Rupert to the Gulf Coast area refineries would not have any terrestrial effects on geology, soils, groundwater, wetlands, vegetation, land use, socioeconomics, noise, or cultural resources, other than in the event of a spill, which is discussed in Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios. Air emissions from the use of tankers are described below in the Air Impacts section of this scenario.

The Gulf Coast area refineries already receive crude oil shipments via tankers from other locations; the Rail/Tanker Scenario is expected to simply displace these sources of crude oil with WCSB crude oil. Therefore, no new construction or new operational impacts are expected to occur as a result of this scenario at the Gulf Coast area refineries or surrounding habitats or communities.

The Rail/Tanker Scenario would include the construction of new and/or expanded facilities in four areas: Lloydminster, Saskatchewan; Prince Rupert, British Columbia; Epping, North Dakota; and Stroud/Cushing, Oklahoma. The resources of the Lloydminster, Epping, and Stroud/Cushing areas are the same as those described for the Rail/Pipeline Scenario; therefore, the environmental setting discussion for each resource below only describes the setting for the Prince Rupert area. See Section 5.1.2.2, Rail/Pipeline Scenario, for a description of the environmental setting for the Lloydminster, Epping, and Stroud/Cushing areas.

In addition, the discussion of impacts for the Rail/Tanker Scenario below focuses on the prospective new rail terminals and expanded port facilities at Prince Rupert, as the impacts at the other rail terminals and the Cushing pipeline would be the same as the for the Rail/Pipeline Scenario. The only exception would be that only one rail terminal would be needed at Stroud (as opposed to seven terminals in the Rail/Pipeline Scenario) under this scenario, as it would only receive Bakken crude oil and not WCSB crude; therefore, the extent of the potential impacts at this location would be proportionately less. Where applicable, impacts for the total Rail/Tanker Scenario (including impacts from new construction at Lloydminster, Epping, Stroud/Cushing, and Prince Rupert) are referenced for comparison purposes (e.g., total wetland impacts). The existing rail lines are only discussed in terms of resources that would be affected by increased rail traffic (i.e., air, noise, socioeconomics) and the relative risk of accidental releases.

Geology

Environmental Setting

The local surface geology at the Prince Rupert site consists of bedrock (granitic rocks) overlain by glacial outwash and a thin soil cover. The local surface geology predominantly displays metamorphic formations overlain with colluvium and glacial till. The area is highly foliated, and topography is quite ridged (City of Prince Rupert 1995). Prince Rupert is located along the coastal region of Canada, which is seismically active.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb approximately 6,303 acres of land. The construction and operational impacts on resources at the Lloydminster and Epping terminals, as well as, the Stroud to Cushing pipeline would be essentially the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential geological impacts at this location would be proportionately less.

At Prince Rupert, depth to bedrock is expected to be relatively shallow, so rock ripping and some blasting could be necessary. The impacts of rock ripping and blasting are limited to the immediate area and would not result in any significant impacts to the underlying or nearby geology. Excavation activities, erosion of fossil beds exposed due to grading, and unauthorized collection could damage or destroy paleontological resources during construction. The potential for finding paleontological resources in the areas that would be disturbed is unknown. The proposed Prince Rupert rail terminals and port complex would be located in areas that would not impact access to any existing surface mines and quarries or known fossil fuel or mineral resources. In terms of geologic hazards, the Prince Rupert terminals would be located along the coastal region of Canada, which is seismically active. In addition, the presence of steep slopes increases the risk of landslides. For this reason, the facility would need to be located in a relatively flat area away from potential landslides.

Routine operations of the Rail/Tanker Scenario would not involve disturbance of, or impacts to, the underlying geology, paleontological resources, or mineral and fossil fuel resources. The Prince Rupert rail terminals and port facilities would be designed to withstand potential seismic hazards and would be located in areas that are not susceptible to subsidence.

Soils

Environmental Setting

The Prince Rupert terminals would be located in British Columbia. The soil groups that occur between Lloydminster and Prince Rupert include the Brunisols, Gray Luvisols, and Black Chernozemics. Podzols and Luvisols are the soil groups that would be traversed in British Columbia. In general, the Brunisols and Luvisols soil groups are associated with forest vegetation, are usually not well developed, and have a calcareous layer in the subsoil. The Podzol soils are relatively infertile and light-colored, and are typically found in coniferous forest areas in cool and humid regions. The Chernozemic soils are dark colored soils that have high organic matter content with textures that range from heavy clays to sands. The soils found within the Prince Rupert terminal and in the port area are typically organic soils over residual soils. These organic soils exhibit various stages of organic matter decomposition. The organic layer varies in depth, ranging from a thin veneer to about 12 inches.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb approximately 6,303 acres of land. The types of construction and operational impacts on soil resources at the Lloydminster, Epping, and Stroud terminal complexes and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential soil impacts at this location would be proportionately less. The following discussion of soil impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the proposed terminals and port expansion in Prince Rupert would result in the disturbance of approximately 3,000 acres of land for the construction of the rail terminal complex and approximately 1,200 acres for the expansion of the port. Potential impacts to the soil resources of the area could result from vegetation clearance, landscape grading, and re-contouring to ensure proper drainage, the installation of stormwater drainage systems, construction of the required infrastructure, and other construction activities.

One of the primary concerns during construction activities is soil erosion and sedimentation. Potential impacts to soils from erosion are expected to occur in areas where the slopes are greater than 20 percent and where the erosion potential due to their nature is high. Based on available landscape and soils information, the soils found in the area are not highly erodible and the required infrastructure would be located in areas that are relatively flat. Therefore, the impact of the proposed terminal complex and port construction activities on soil erosion would be minor.

Potential impacts resulting from the movement of heavy equipment required to support the planned clearance and construction activities may also impact the soil resources by causing the rutting[14] and compaction of susceptible soils. In general, compaction and rutting could affect hydrology and result in the loss of soil by erosion and productivity. Given that the soils of the area are primarily organic over residual material, which are less susceptible to compaction, compaction and rutting is not considered a widespread concern, and the impacts to the soil resources are expected to be minor.

Water Resources

Groundwater

Environmental Setting

The Prince Rupert terminals and port expansion would occur in British Columbia on Kaien Island, which receives about 102 inches of rainfall per year. The terminals would be located on an inlet that is part of the eastern Pacific Ocean on the Venn Passage near the much larger Inland Passage, which extends from Washington State to Alaska along the islands and mainland of British Columbia, Canada. Venn and Inland Passages are marine (salt water) waterbodies. The islands consist of bedrock (granitic rocks) overlain by glacial outwash and a thin soil cover. Groundwater is shallow, poor quality, and unused. Drinking water is derived from lakes on the mainland. Water quality in the terminal complex area is seawater and inland brackish.

Potential Impacts

The construction and operational impacts on water resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude, and therefore the extent of the potential groundwater impacts at this location would be proportionately less. The following discussion of impacts to groundwater resources for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

During construction of the facilities at Prince Rupert, the primary potential impacts to groundwater would be spills or leaks from construction equipment. Potential mitigation for these impacts includes having appropriate plans in place and appropriate cleanup materials available.

During operations of the facilities at Prince Rupert, the primary potential impacts to groundwater would again most likely be spills or leaks from operation equipment or associated with crude oil unloading of railcars. Although the initial impacts of potential releases or spills may be contained or limited to soil, potential impacts to groundwater may occur depending on the depth to

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[14] Rutting may occur when soil strength is not sufficient to support the applied load from vehicle traffic.

groundwater, soil characteristics (e.g., porosity, permeability), spill volume and extent, and whether the spill reaches surface waterbodies, some of which are interconnected to groundwater. The potential impacts to groundwater from spills or releases of crude oil or refined petroleum products as part of construction and operation of the rail portion of the Rail/Tanker Scenario would be similar to those expected for the proposed Project. These effects are discussed in more detail in Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios. Mitigation for these potential spills and leaks would be similar to those for the proposed Project.

Surface Water

Environmental Setting

The upland character surrounding the potential Prince Rupert terminal area is dominated by bog forest uplands and the flowing surface waterbodies are predominantly precipitation-fed and shallow groundwater-fed intermittent streams. Some open waterbodies are present in the southeast portion of Kaien Island. Tidal shore zones are of a rugged and rocky nature and receive wave energy generated by naturally occurring fetch and large wakes from marine traffic. Winter winds are strong and from the southeast to southwest, with surface currents predominantly northward from the Hecate Strait. Lighter summer winds have less influence on currents and allow freshwater runoff from land and deep water tidal effects to exert more control and provide variation in summer current patterns. Significant wind and tidal mixing tend to occur where waters are shallow and around islands and rocky points of land. The coastal landscape is predominantly fjords carved into the granitic Coast Mountains, created by the last of several glacial periods approximately 12,000 years ago. Shores tend to be rocky and steep with beaches restricted to sheltered areas adjacent to estuaries, and the navigable straits and channels provide a wide variety of exposures and habitats.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb approximately 6,303 acres of land. The construction and operational impacts on surface water resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential surface water impacts at this location would be proportionately less. Under this scenario, the representative rail route from Epping to Cushing crosses up to 330 perennial stream and 14 major waterbodies in the United States. The following discussion of surface water impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the facilities at Prince Rupert would disturb approximately 4,200 acres. The primary potential impacts to surface waters include erosion and sedimentation and spills/leaks of hazardous materials. Mitigation for these impacts includes having appropriate Canadian spill control plans in place and appropriate cleanup materials available.

During operations, the primary potential impacts to surface waters include stormwater runoff, flooding potential, and spills or leaks from operation equipment or associated with crude oil unloading of railcars. Stormwater management measures would likely mitigate the impacts of stormwater runoff. The port's coastal location would potentially increase the risk of flooding. The potential impacts to inland surface waters from spills or releases of crude oil or refined petroleum products as part of the operation of the Rail/Tanker Scenario would be similar to those expected for the proposed Project. These effects are discussed in more detail in Section 5.1.3, Potential Risk and Safety Under the No Action Alternative Scenarios. Mitigation for these potential spills and leaks would be similar to those for the proposed Project.

The potential impacts to marine surface waters from spills or releases of crude oil or refined petroleum products as part of the operation of the Rail/Tanker Scenario may be possible during transportation by flowline, underwater pipeline, or tanker. Affected coastal areas could include oiled shorelines, estuaries, and coastal wetlands. Effects to deep-water environments could include sinking oil, subsurface plumes, migrating and dispersing oil slicks, and remnant or residual oil components. The specific exposures and magnitude of potential impacts from marine spills would depend on a number of conditions, such as the type and amount of oil and its behavior once in contact with waterbodies, the physical characteristics of the affected area, weather conditions and season, the direction and strength of currents, the biological characteristics of the affected species, and their sensitivity to oil pollution in their habitat. Typical effects on marine organisms vary from toxicity (for lighter oils) to smothering (heavier oils and degraded petroleum).

When spilled oil reaches shorelines and coastal zones, it can interact with beach sand and gravel, rocks and vegetation. Waves, water currents, and wind move the oil onto shore with the surf and tide. Sediments, sands, and gravels saturated with oil may be unable to protect and nurture vegetation and sea bottom dwelling (benthic) organisms. Wildlife dependent on coastal habitats including mammals, reptiles, amphibians, and birds are at risk of poisoning as well as tissue contamination and feather oiling from coastal and shoreline oiling. Rocks and boulders coated with sticky residue are visually offensive and interfere with recreational uses of the shoreline. The potential effects on deep ocean and coastal habitats also include smothering, which could induce mass mortality. In the case of large or widespread spills, as opposed to smaller localized spills, some marine or aquatic species may not be able to reach alternative or unaffected habitat and could be significantly impacted.

Oil released in open water or in shoreline areas will in varying degrees evaporate, disperse, emulsify, degrade, and decompose over time. The weather, seasonal and climatic conditions, and ocean temperature may accelerate or delay these processes. Decaying oil often coalesces into a tar-like substance, which may come ashore to foul surf and tidal zones as well as adhere to bottom and shoreline sediments.

In British Columbia, terminal operators and transporters would be required to develop and institute an Industry Emergency Response Plan in accordance with the British Columbia Emergency Program Act.

Wetlands

Environmental Setting

Prince Rupert, British Columbia, is in the USEPA Level III Coastal Gap and Coastal Western Hemlock-Sitka Spruce Forest Ecoregion. These ecoregions contain extensive wetlands, including freshwater forested, scrub-shrub, and herbaceous wetlands associated with wet meadows, lakes, and rivers. These ecoregions are also characterized by intertidal marine wetlands and estuarine wetlands. Refer to the Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Resource Impacts from Potential Releases*, for a general discussion of the wetlands resources that are associated with the Rail/Tanker Scenario.

Potential Impacts

Potential adverse impacts to wetlands associated with this scenario are similar to those described in the Rail/Pipeline Scenario (see Section 5.1.2.2), with the addition of new facilities in Prince Rupert, British Columbia. Overall, construction of the proposed rail terminals (including those for Lloydminster, Epping, Stroud, and Prince Rupert), oil storage facilities, an expanded port, and the pipeline for the Rail/Tanker Scenario would permanently affect about 6,303 acres of land (and temporarily disturb a total of 6,427 acres), some of which include wetland habitat. The construction and operational impacts on wetland resources at the Lloydminster and Epping complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. Therefore, the following discussion of wetland impacts for the Rail/Tanker Scenario focuses on potential impacts at the smaller Stroud, Oklahoma, terminal and the Prince Rupert facilities.

Construction of the 500-acre Stroud terminal for the Rail/Tanker Scenario would result in approximately 3 acres of temporary or permanent impacts to freshwater ponds, and additional impacts to streams, based solely on the presence of wetlands known to occur according to the NWI database (NWI 2012). New rail terminals and an expanded port would be required at Prince Rupert. Based on preliminary aerial photo interpretation, it is estimated that approximately 10 acres of emergent (herbaceous) wetlands, 35 acres of scrub-shrub wetlands, and 6 acres of open water habitat would be affected by permanent impacts as a result of the Prince Rupert terminal construction. Other wetland types likely present that were not readily identifiable using aerial photo interpretation may include freshwater woody wetlands, estuarine wetlands and intertidal wetlands.

These estimates of potential wetland impacts at these representative terminal locations, which are based on aerial photo interpretations and secondary sources such as NWI mapping, are intended to be illustrative of the magnitude of actual impacts that may occur. Please note that wetland acreages estimated using the NWI (2012) database may differ from terrestrial vegetation wetland acreages estimated using the NLCD (Fry et al. 2011) presented in Table 5.1-11. If rail terminals are constructed, the actual acreage of wetland impacts would likely be determined through formal wetland delineation.

Terrestrial Vegetation

Environmental Setting

The Prince Rupert terminals and port facilities would be located in the Coastal Gap Level III Ecoregion. The vegetation immediately adjacent to the Pacific Ocean includes stunted, open-growing western red cedar, yellow cedar, and western hemlock with some stunted shore pine and Sitka spruce (TEFC 2012b). There are also open areas present within the affected areas. It is unclear if biologically unique landscapes or vegetation communities of concern exist within the conceptual Prince Rupert terminal complex boundary.

Potential Impacts

Overall, construction of the proposed rail terminal complexes, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb about 6,303 acres (Table 5.1-11). The construction and operational impacts on terrestrial vegetation at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it is only receiving Bakken crude oil and not WCSB crude, and therefore the extent of the potential terrestrial vegetation impacts at this location would be proportionately less. Therefore, the following discussion of terrestrial vegetation impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Table 5.1-11 Potential Impacts to Terrestrial Vegetation by Landcover Type under the Rail/Tanker Scenario

	Acreage				
Land Cover	**Prince Rupert**	**Lloydminster**	**Stroud**[a]	**Epping**	**Total Acres**
Grassland/pasture	805	787	371	40	2003
Developed	279	140	21	6	446
Deciduous forest	2953	0	106	0	3059
Cultivated cropland	0	0	0	455	455
Open water	20	17	0	0	37
Scrub/shrub wetlands	112	49	0	0	161
Emergent wetlands	30	6	0	0	36
Total[b]	**4,200**	**1,000**	**500**	**500**	**6,200**

Sources: Fry et al. (NLCD) 2011 and USGS GAP 2011

[a] Plus land for a new pipeline between Stroud and Cushing that would temporarily affect 227 acres and permanently disturb 103 acres.

[b] Numbers may not add up due to rounding.

The prospective rail terminal complex and port facilities at Prince Rupert would require the clearing of up to 4,200 acres of natural vegetation, most of which is forested based on aerial photo interpretation. There does not appear to be any biologically unique landscapes or communities of conservation concern within the terminal complex boundary. Nearly all of these impacts would be permanent as natural habitats are converted for use as rail terminals and port facilities.

Wildlife

Environmental Setting

The habitat found in and around the Prince Rupert terminals and along the Pacific Coast is in the Coastal Gap Ecoregion (TEFC 2012a). Many wildlife species use this coastal area for hunting, foraging, roosting, breeding, and nesting (Tourism Prince Rupert 2012). Terrestrial wildlife characteristic of this ecoregion are shown on Table 5.1-12.

Table 5.1-12 Terrestrial Wildlife Characteristics of the Prince Rupert Ecoregion

Common Name	Scientific Name
Grizzly bear	*Ursus arctos horribilis*
Black bear	*Ursus americanus*
Mountain goat	*Oreamnos americanus*
Black-tailed deer	*Odocoileus hemionus columbianus*
Wolf	*Canis lupus*
Moose	*Alces alces*
Mink	*Mustela sp.*
Bald eagle	*Haliaeetus leucocephalus*

Source: TEFC 2012a

The Prince Rupert terminal complex would be located in the Northern Pacific Rainforest (Region 5) bird conservation region, which is an ecologically distinct region in North America with similar bird communities, habitats, and resource management issues as defined by the USNABCI (2000). The coast of the Northern Pacific Rainforest is characterized by river deltas and pockets of estuarine and freshwater wetlands set within steep, rocky shorelines. These wetlands provide critical nesting, wintering, and migration habitat for internationally significant populations of waterfowl and other wetland-dependent species. The area includes major stopover sites for migrating shorebirds, especially western sandpipers (*Calidris mauri*) and dunlins (*Calidris alpina*). Black oystercatchers (*Haematopus bachmani*), rock sandpipers (*Calidris ptilocnemis*), black turnstones (*Arenaria melanocephala*), and surfbirds (*Aphriza virgata*) are common wintering species. Nearshore marine areas support many nesting and wintering sea ducks. Many seabirds breed on offshore islands, including important populations of ancient murrelet (*Synthliboramphus antiquus*), rhinoceros auklet (*Cerorhinca monocerata*), tufted puffin (*Fratercula cirrhata*), common murre (*Uria aalge*), western gull (*Larus occidentalis*), glaucous-winged gull (*Larus glaucescens*), and Leach's storm-petrel (*Oceanodroma leucorhoa*). Pelagic waters provide habitat for large numbers of shearwaters (*Calonectris* spp. and *Puffinus* spp.), storm-petrels (*Hydrobatidae*), and black-footed albatross (*Phoebastria nigripes*) (USNABCI 2000).

Potential Impacts

Overall, construction of the proposed rail terminal complexes, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would disturb approximately temporarily disturb a total of 6,427 acres and permanently disturb 6,303 acres. The construction and operational impacts on wildlife resources at the Lloydminster, Epping, and Stroud terminal complexes and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore the extent of the potential wildlife resource impacts at this location would be proportionately less. The following discussion, therefore, of wildlife resource impacts for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Construction of the proposed rail terminal complex and port facilities at Prince Rupert would have impacts on wildlife resources, and result in the clearing of approximately 4,200 acres of wildlife habitat. Direct impacts could occur due to vegetation removal or conversion, obstructions to movement patterns, or the removal of native habitats that may be used for foraging, nesting, roosting, or other wildlife uses (Barber et al. 2010). Indirect impacts to wildlife are difficult to quantify and are dependent on the sensitivity of the species, individual, type and timing of activity, physical parameters (e.g., cover, climate, and topography), and seasonal use patterns of the species (Berger 2004). Most of these impacts would likely be permanent.

Fisheries

Environmental Setting

Prince Rupert is an important deepwater port and transportation hub of the northern coast of British Columbia. It is located on the northwest shore of Kaien Island, which is connected to the mainland by a short bridge. The town of Prince Rupert is just north of the mouth of the Skeena River, a major salmon-producing river. Key commercial fisheries include Pacific salmon, halibut, herring, and groundfish, which are processed from Prince Rupert (see Table 5.1-13). The Prince Rupert area supports a high density of streams and rivers that host an array of valuable recreational fisheries for salmon, rainbow trout, lake trout, cutthroat trout, char, Arctic grayling, and northern pike (see Table 5.1-13). These fisheries (both commercial and recreational) are managed by Canada's Department of Fisheries and Oceans.

Table 5.1-13 Fish Species Relevant to Prince Rupert Facilities

Pacific salmon/ Anadromous Species	Marine/Commercial Species	Freshwater/Recreational Species
Chinook salmon (*Oncorhynchus tshawytscha)*	walleye pollock (*Theragra chalcogramma)*	rainbow trout (*O. mykiss*)
sockeye salmon (*O. nerka*)	Pacific cod (*Gadus macrocephalus*)	lake trout (*Salvelinus namaycush*)
coho salmon (*O. kisutch*)	Pacific herring (*Clupea pallasi*)	cutthroat trout (*O. clarki*)
chum salmon (*O. keta*)	Pacific halibut (*Hippoglossus stenolepi*s)	Arctic grayling (*Thymallus arcticus*)
pink salmon (*O. gorbuscha*)	Pacific sardine (*Sardinops sagax*)	northern pike (*Esox lucius*)

Sources: Irvine and Crawford 2012; Department of Fisheries and Oceans 2012

Potential Impacts

The types of construction and operational impacts on fishery resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be similar to those identified for the Rail/Pipeline Scenario The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential aquatic resource impacts at this location would be proportionately less. The following discussion, therefore, of fishery impacts for the Rail/Tanker Scenario only focuses on potential impacts at the Prince Rupert facilities. New impacts to commercial and recreational fisheries' habitats from the construction and operation of the facilities in Prince Rupert could include impacts to marine intertidal zones as well as fish spawning zones (e.g., herring), if present. There would likely be short-term impacts to the benthic (bottom dwelling) community during construction of the berths and mooring facilities. Bottom-dwelling fish (i.e., halibut, flounder, and rockfish) and marine invertebrates (i.e., clams, mussels, crabs, and other bivalves and crustaceans) could potentially be impacted during construction as well, but these effects are expected to be minor and temporary or short-term in duration.

Additional shipping traffic would increase underwater sound because large vessels, including tankers, put out relatively high noise levels (Popper and Hastings 2009). Fish and other aquatic organisms (including invertebrates and marine mammals) use sound as a means of communication and detection within the marine acoustic environment. Increased shipping traffic could mask natural sounds by increasing the ambient noise environment from Prince Rupert Harbor and along the marine route to the Gulf Coast area. Long-lasting sounds, such as those caused by continuous ship operation, could cause a general increase in background noise and there is a risk that such sounds, while not causing immediate injury, could mask biologically important sounds, cause hearing loss in affected organisms, and/or have an impact on stress levels and on the immune systems of aquatic species (Popper and Hastings 2009).

Exotic and invasive species are sometimes transferred in the ballast water of tanker ships. Ballast water management procedures, such as those required by the International Convention for the Control and Management of Ships' Ballast Water and Sediments of the International Maritime Organization, would need to be implemented to manage and treat ballast water discharged into Prince Rupert Harbor to mitigate potential releases of invasive or exotic species into the marine environment.

Threatened and Endangered Species

Environmental Setting

This section focuses on animal and plant species present in the Prince Rupert area that are Canada SARA protected. As a coastal area along the Pacific Migratory Bird Route, and an area that receives significant precipitation and is heavily forested, many wildlife species inhabit the area, as discussed in Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Resource Impacts from Potential Releases*. According to the British Columbia Conservation Data Centre (2012), only one SARA threatened/endangered species is known to occur in Prince Rupert—the green sturgeon (*Acipenser medirostris*), a Pacific Ocean inhabitant. In addition, several SARA special concern species occur in Prince Rupert, including western toad (*Anaxyrus boreas*), coastal tailed frog (*Ascaphus truei*), North American racer (*Coluber constrictor*), grey whale (*Eschrichtius robustus*), and Stellar sea lion (*Eumetopias jubatus*) (British Columbia Conservation Data Centre 2012).

Potential Impacts

The construction and operational impacts on federal threatened, endangered, proposed and candidate species, BLM sensitive species, state threatened and endangered species, and species of conservation concern at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential impacts to threatened and endangered species at this location would be proportionately less. The following discussion, therefore, focuses on potential impacts at the Prince Rupert facilities.

As indicated above, only one SARA threatened/endangered species is known to occur in the Prince Rupert area—the green sturgeon. The green sturgeon is typically found along nearshore marine waters, but is also commonly observed in bays and estuaries. The expansion of the proposed port facility could have minor adverse effects on the green sturgeon, but the sturgeon could readily avoid the port area. Impacts to threatened and endangered aquatic species from accidental releases and spills are described in the Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Resource Impacts from Potential Releases*.

Increased shipping traffic at Prince Rupert and as the vessels transit to the Gulf Coast area refineries may affect the feeding success of marine mammals (including threatened and endangered species) through disturbance, because the noise generated by tankers could reduce the effectiveness of echolocation used by marine mammals to forage for food. Whales use underwater vocalizations to communicate between individuals while hunting and while engaged in other behaviors. Increased underwater noise from additional shipping traffic could disrupt these vocalizations and alter the behavior of pods of whales. Moreover, additional boat and tanker traffic could also increase the potential for collisions between marine mammals and shipping vessels. These effects would be additive in nature and could potentially add to existing disturbance effects and collision risks caused by the current level of shipping traffic, commercial and recreational fishing, and cruise ship passage.

Land Use, Recreation, and Visual Resources

Environmental Setting

Land use, recreation, and visual resources for the Prince Rupert area where the new terminals and expanded port facilities would be built differ sharply from the other terminal sites. Prince Rupert is located on an inlet of the Pacific Ocean in a heavily forested area of British Columbia. Urban land use is generally limited to the communities in and around the city of Prince Rupert, with some small outlying communities and villages in the area. Given Prince Rupert’s role as a terminus of the Alaska Ferry System, many people see the port and surrounding areas in a recreational context. The area is largely undeveloped and people would be sensitive to changes in the visual landscape.

Potential Impacts

Overall, construction of the proposed rail terminal complex, oil storage facilities, and port facilities for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb approximately 6,303 acres of land in Prince Rupert (Natural Resources Canada 2012). If constructed on previously undeveloped land or on land adjacent to recreational land, new facilities would primarily affect mixed forest, recreation, and visual resources (Natural Resources Canada 2012). The construction and operational impacts on land use, recreation, and visual resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario.

Socioeconomics

Environmental Setting

This scenario would be located in nine Canadian census divisions within three provinces: British Columbia, Alberta, and Saskatchewan (see Table 5.1-14). The WCSB rail route would affect the metropolitan area of Edmonton, Alberta. The Bakken to Stroud rail corridor would intersect 61 U.S. counties in eight states. This scenario assumes construction of terminal facilities in Prince Rupert, British Columbia; Lloydminster, Saskatchewan; Epping, North Dakota; and Stroud/Cushing, Oklahoma.

Table 5.1-14 U.S. States and Counties and Canadian Census Divisions affected by the Rail/Tanker Scenario

State (U.S.)/Province (CA)	Number of Counties (U.S.)/Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Rail/Tanker Corridor		
Canada		
British Columbia	4	Skeena-Queen Charlotte, Kitimat-Stikine, Bulkley-Nechako, Fraser-Fort George
Alberta	4	15, 14, 11, 10
Saskatchewan	1	17
Bakken to Stroud Rail Corridor		
United States		
North Dakota	13	Williams, Mountrail, Ward, McHenry, Pierce, Wells, Eddy, Foster, Griggs, Steele, Barnes, Cass, Richland
Minnesota	14	Clay, Wilkin, Grant, Traverse, Stevens, Pope, Swift, Kandiyohi, Chippewa, Yellow Medicine, Lincoln, Lyon, Pipestone, Rock
South Dakota	1	Minnehaha
Iowa	6	Lyon, Sioux, Plymouth, Woodbury, Mills, Fremont
Nebraska	6	Dakota, Thurston, Burt, Dodge, Saunders, Cass
Missouri	7	Atchison, Holt, Andrew, Buchanan, Platte, Clay, Jackson
Kansas	7	Wyandotte, Johnson, Miami, Linn, Bourbon, Crawford, Cherokee
Oklahoma	7	Craig, Ottawa, Rogers, Delaware, Tulsa, Lincoln, Creek
Terminal Facilities		
Canada		
British Columbia	1	Skeena-Queen Charlotte
Saskatchewan	1	17
United States		
North Dakota	1	Williams
Oklahoma	2	Lincoln, Creek

Population[15]

In 2010-2011, just over 1.5 million persons lived along the corridors in Canada affected by the Rail/Tanker Scenario (see Table 5.1-15) compared to approximately 263,298 persons for the proposed Project (see Table 3.10-5).

Table 5.1-15 Population Affected Under the Rail/Tanker Scenario

State (U.S.)/Province (CA)	Population[a]
Rail/Tanker Corridor	
Canada	
British Columbia	187,232
Alberta	1,360,721
Pipeline Corridor Total	*1,547,953*
Terminal Facilities	
United States	
North Dakota	22,398
Project Area Total	*1,570,351*

Sources: U.S. Census Bureau 2010; Statistics Canada 2012b

[a] Population data are from 2011 for Canadian areas.
Note: The table only includes the population of the counties and census divisions the route would go through, not the population of the states/provinces as a whole.

Environmental Justice

Several areas potentially affected by this option contain meaningfully greater minority or low income populations:

- Prince Rupert City and the district in which it is located, Skeena-Queen Charlotte, contain aboriginal populations that exceed 35 percent of their total populations.
- Census Division 17 in Saskatchewan has an aboriginal population, 12,000 persons out of a population of 40,000.
- At the representative terminal in Epping, Williams County, North Dakota, the multiracial population is 644 persons out of a total population of 22,400. Detailed data for this environmental justice assessment are presented in Appendix O, Socioeconomics.

Public Services

A total of 56 police/sheriff departments, 166 fire departments, and 7 medical facilities would be located near the terminals in the United States. The City of Lloydminster has two fire departments and the City of Prince Rupert has one. Both cities are patrolled by the Royal Canadian Mounted Police. Appendix O, Socioeconomics, includes a table listing these facilities.

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[15] Population data were collected by county in the United States and by census division in Canada.

Traffic and Transportation

The Rail/Tanker Scenario would utilize existing Class I railroads to transport crude oil from Lloydminster to the Port of Prince Rupert, British Columbia, for shipment to existing ports along the Gulf Coast area. The rail lines have capacity to accommodate increased rail volumes. Prince Rupert and the Gulf Coast area both have substantial international shipping activity. The Gulf Coast area crude oil ports likely to be used under this scenario are already designed and configured to accept deliveries of crude oil, while the Prince Rupert port facilities are not configured in this way.

Potential Impacts

This section also includes consideration of the Lloydminster to Prince Rupert and Epping to Stroud rail lines; the Cushing pipeline; and the pipeline for onward delivery of crude oil from Cushing to Gulf Coast area refineries because socioeconomics is a resource that could be affected by scenario operations. Additionally, this scenario would include the transportation of crude from Epping, North Dakota, to Stroud/Cushing, Oklahoma, as detailed in the CPRS Rail/Pipeline Route (see the Socioeconomics subsection in Section 5.1.2.2, Rail/Pipeline Scenario). An overview of the potential construction and operational impacts is presented below.

Population/Housing

Construction and operations activities are not expected to have a significant effect on population and housing for this scenario. Because construction and operations job estimates have not yet been determined for this scenario, worker requirements for Prince Rupert, Lloydminster, and Epping are assumed to be minor, similar to those under the Rail/Pipeline Scenario. During construction, additional temporary housing could be needed in Lloydminster and in Prince Rupert. In Lloydminster, the number of hotel/motel rooms is approximately 1,075 (TripAdvisor 2012). This number would likely be insufficient to house the workers that would need lodging. Prince Rupert only has about 740 hotel/motel rooms (TripAdvisor 2012). Epping has enough short-term housing so that additional accommodations would not be necessary. While the 287 hotel/motel rooms near Stroud/Cushing alone would not provide capacity for the 4,800 workers needed, the cities of Tulsa and Oklahoma City, Oklahoma, are both within commuting distance, and would likely provide enough commercial housing to accommodate the workforce.

Local Economic Activity

This scenario would include transportation of WCSB crude oil that is primarily located outside the United States. New rail infrastructure and operations would occur in western Canada as crude oil would be transported to Prince Rupert. Tanker infrastructure and operations would be affected as ships would transport crude oil from Prince Rupert through the Panama Canal to Texas ports near Houston. Other than U.S. firms that may own and operate tankers, U.S. industries would only become engaged in the transport of WCSB crude oil as tankers approach Gulf Coast area ports. Firms involved in lightering (off-loading onto smaller ships for final delivery in the Port of Houston), port management, unloading, and transport of the oil from the port to refineries would all realize workforce and payroll effects. Because details regarding port operations are beyond the scope of this analysis, economic effects were not estimated.

Construction

Direct capital costs and employment required by facility construction in Lloydminster are identical to those for the Rail/Pipeline Scenario. Direct construction expenditures for facilities at Prince Rupert would be approximately $700 million.[16] Estimates of employment and earnings effects for Lloydminster and Prince Rupert could not be made because the models used for the economic analyses in this Final Supplemental EIS do not extend into Canada. However, based on the jobs estimated for the Rail/Pipeline Scenario, the construction jobs at Lloydminster could reasonably be expected to total at least 1,000.

The transport of Bakken crude oil would require facilities identical to those described for the Rail/Pipeline Scenario. As discussed above, effects resulting from facility construction in Stroud would total 12,600 jobs and $666.1 million in earnings over 2 years. Construction effects in Epping would total 2,000 jobs and $104.7 million in earnings in a single year.

Operations in Stroud would support 1,000 jobs and $57.6 million in earnings annually, while operations in Epping would support 150 jobs and $8.2 million in earnings each year.

Environmental Justice

Minority and low-income populations could be potentially affected by construction and operations activities related to the terminals. Impacts to minority and low-income populations during construction and would be similar to those described for the proposed Project and could possibly result in increased competition for medical or health services in underserved populations. Williams County, North Dakota; contains one or more minority populations, contain HPSAs and MUA/Ps. Canada does not define HPSA and MUA/P, so it is unknown whether or not the minority populations in Prince Rupert or Lloydminster exist in a medically underserved area.

Tax Revenues

Under the Rail/Tanker Scenario a variety of taxes would be paid to a range of different jurisdictions and entities:

- Construction of a new rail terminal in North Dakota costing about $110 million would generate state and local government sales and use tax and fuel tax revenue. During operations, the facility would generate county property tax revenue.
- The Panama Canal Authority is an autonomous entity of the Government of Panama that operates the Panama Canal on a for-profit basis. Ships pay a toll to use the canal. Tankers carrying petroleum pay tolls set per 10,000 tons of laden weight as defined in the Panama Canal Universal Measurement System (Panama Canal Authority 2012).

The Port of Houston comprises public docks and facilities owned, managed, and leased by the Port of Houston Authority and facilities owned by the Authority’s partners and lessees located on the Houston Ship Channel (Port of Houston Authority 2012). Deliveries of crude oil could go to refineries fronting the Houston Ship Channel. The Port Arthur International Public Port is connected to the Gulf of Mexico Intracoastal Waterway and the Sabine-Neches Ship Channel.

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[16] Cost estimates are based on the cost of the Enbridge Northern Gateway marine terminal in Kitimat (Enbridge 2010).

Deliveries of crude oil could go to a refinery with docks on the Sabine-Neches Ship Channel (Port Arthur International Public Port 2011).

Private companies located and operating at both Houston and Port Arthur are state and local government taxpayers. Some facilities are located within U.S. Foreign Trade Zones at each port, which allows U.S. tax-free import-export activity. The U.S. government through the U.S. Army Corps of Engineers develops, maintains, and operates the Houston Ship Channel, the Intracoastal Waterway, and the Sabine-Neches Ship Channel as tax-supported public waterways.

During construction, the terminals in Lloydminster and Prince Rupert would generate provincial sales taxes, goods and services taxes, and hotel taxes. Once in operation and on the tax roll, the Canadian terminals would generate municipal property tax revenue (Government of Saskatchewan 2012b, British Columbia 2012).

Property Values

Impacts to private property values in North Dakota could occur because of the Rail-Tanker Scenario if there are residential land uses that would experience offsite nuisance effects. There would be no offsetting consideration from being in the vicinity of the Epping terminal, as there already are rail transportation facilities near this site. Impacts to private property values that might occur during operations along the permanent ROW of the proposed Project or its appurtenant facilities would be avoided by the Rail/Pipeline Scenario.

Traffic and Transportation

This scenario would add up to 12 unit train trips per day to the CN and CPRS rail lines between Lloydminster and Prince Rupert and up to two unit trains from Epping, North Dakota, to the Gulf Coast area via existing Class I railways in the United States. As described in Section 5.1.2.2, Rail/Pipeline Scenario, these Class I railroads typically have adequate capacity to accommodate such increased demand with little or no infrastructure upgrades. New facilities would be required, including loading facilities in Lloydminster, a new terminal in Epping and Stroud, and new tank and marine terminals in Prince Rupert.

Construction of the tank and marine terminals at Prince Rupert and the rail terminal at Epping would involve large numbers of road trips by heavy trucks to transport construction materials and equipment to and from the sites. Construction in Prince Rupert could also potentially involve vessel deliveries of material. This traffic could cause congestion on major roadways, and would likely require temporary traffic management solutions such as police escorts for oversize vehicles. There would a potential increase in train/motor vehicle collisions at road crossings due to the increased number of trains per day with the associated risk of increased accidents, injuries, and fatalities. Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Resource Impacts from Potential Releases*, describes the increases in risk and occurrence for this type of impact.

One to two additional Suezmax tanker vessels per day (430 tankers per year) would travel between Prince Rupert and the Gulf Coast area refinery ports via the Panama Canal. The WCSB crude oil arriving by tanker vessels would be essentially displacing current tankers bringing crude oil from other countries; therefore, there would be no net increase in vessel traffic in the Gulf of Mexico or the refinery port areas.

Cultural Resources

Environmental Setting

No cultural resources studies have been conducted for the Prince Rupert area. A review of aerial photographs shows that a small portion of the area that could potentially be developed has already been disturbed by development, including port facilities, structures, and roads. This preliminary review shows that most of the area appears undeveloped and would have the potential for intact surface or buried cultural resources.

Potential Impacts

Overall, construction of the proposed rail terminals, oil storage facilities, port facilities, and the pipeline for the Rail/Tanker Scenario would temporarily disturb a total of 6,427 acres and permanently disturb approximately 6,303 acres. The construction and operational impacts on cultural resources at the Lloydminster, Epping, and Stroud terminal complex sites and along the Cushing pipeline route would be the same as for the Rail/Pipeline Scenario. The only exception would be that the size of the rail terminal at Stroud would be less under this scenario, as it would only receive Bakken crude oil and not WCSB crude. Therefore, the extent of the potential impacts to threatened and endangered species at this location would be proportionately less. The following discussion, therefore, on impacts to cultural resources for the Rail/Tanker Scenario focuses on potential impacts at the Prince Rupert facilities.

Any ground disturbance, especially of previously undisturbed ground, could potentially directly impact cultural resources. The APE for this scenario has not been subjected to systematic cultural resources studies at this time. The potential of the APE to include intact surface or buried cultural resources would require evaluation through research and cultural resources surveys. If cultural resources were identified, follow-up studies could be required. In general terms, the archaeological potential of heavily disturbed areas, such as might be found in active rail yards or within developed transportation corridors, is normally lower than in undisturbed areas. Archaeological potential is also contingent upon factors such as access to water, soil type, and topography, and would have to be evaluated for each area to be disturbed. Aboveground facilities have the potential to indirectly impact cultural resources from which they may be visible or audible. The potential for increased rail traffic to contribute to indirect impacts would also require consideration. The APE would have to be evaluated for historic structures and archaeological sites that could be impacted by this scenario.

Air and Noise

Environmental Setting

The areas surrounding the port at Prince Rupert and destination ports in the Gulf Coast area are mostly industrial due to the large marine vessel traffic and loading and unloading of cargoes. Due to the current industrial activities at the ports in Prince Rupert and the Gulf Coast area, the existing air emissions (including GHGs) and noise levels for this scenario are expected to be higher than for the area through which the proposed Project would pass.

Potential Impacts

This section also includes consideration of the Lloydminster to Prince Rupert and Epping to Stroud rail lines and the Cushing pipeline because air and noise is a resource that could be affected by scenario operations. A brief overview of potential construction and operational impacts is presented below. Under this scenario, Bakken crude oil would be transported from Epping, North Dakota, via existing railroad systems, and the air and noise impacts would be the same as described under the Rail/Pipeline Scenario above. The marine portion of this scenario is mostly located in open ocean away from receptors such as residences and businesses. On an aggregate basis, criteria pollutant emissions, direct and indirect GHG emissions, and noise levels during the operation phase for this scenario would be significantly higher than that of the proposed Project (see Section 4.12.3, Potential Impacts), mainly due to the increased regular operation of diesel locomotives, railcars, tankers, and new rail and marine terminals.

Air Quality

Emissions of criteria pollutants would be generated during the construction and operation of the Rail/Tanker Scenario. Emissions attributed to construction of the new rail, pipeline, and marine facilities under this scenario were not quantified due to a lack of design data. However, construction-related emissions would be short-term, similar in type, and have a greater magnitude compared to those of the proposed Project.

The rail cars and tankers transporting the crudes would consume large amounts of diesel fuel and fuel oil each day, which equate to direct emissions HC/VOCs, carbon monoxide (CO), NO_x, SO_2, PM_{10}, and $PM_{2.5}$. Emissions of VOCs would also be generated by the *breathing* of 85 storage tanks holding over 12 million bbl of crude oil. The criteria pollutant emissions would vary by transportation segment, particularly during marine-based transit. Oil tankers traveling from the Prince Rupert marine terminal through the Panama Canal to Houston/Port Arthur pass through several different operational zones, including reduced speed zones leading into and out of the ports, North American Emission Control Areas where the use of low-sulfur marine fuel is mandated, and offshore areas where the tankers travel at cruise speeds.

During the return trip, tankers are filled with seawater (ballast) to achieve buoyancy necessary for proper operation, which affects the transit speeds of the vessel. Furthermore, the tankers spend several days loading or unloading cargo at each marine terminal with auxiliary engines running (an activity called hoteling). The tanker emission calculations included return trips (i.e., both loaded cargo going south and unloaded cargo going north). In aggregate, the total operational emissions (tons) estimated over the life of the project (50 years), presented in Table 5.1-16, are several times greater than those associated with the combined construction and operation of the proposed Project (see Section 4.12.3.1, Air Quality). Detailed operational emissions (with activity data, emission factors, and assumptions) for this scenario can be found in Tables 5 and 6 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions. During its long-term operation, the proposed Project is expected to emit 0.45 tons of VOCs per year or 22.5 tons over the life of the project from approximately 55 intermediate mainline valves along the pipeline route and from pump station components (valves, pumps, flanges, and connectors). In aggregate, the total VOC emissions over the life of this scenario (i.e., for the same period of operation as the proposed Project) are approximately 136,365 tons, which is over 6,000 times greater than for operations under the proposed Project at just 22.5 tons.

Table 5.1-16 Comparison of Criteria Pollutant Emissions for the Rail/Tanker Scenario and Proposed Project over a 50-Year Period

	Criteria Pollutant Emissions (tons)[a]					
Sources	**HC/VOC**	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Rail/Tanker Scenario[a]	136,365	435,152	2,922,124	1,315,895	187,365	173,719
Proposed Project (construction phase; 6-8 months)[b]	130	2,531	1,214	50.2	6,781	1,398
Proposed Project (operation phase)[b]	22.5	NA[c]	NA	NA	NA	NA

[a] Details of air emission calculations for the Rail/Tanker Scenario, including activity data, emission factors, and assumptions used, can be found in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.
[b] Summary of criteria pollutant emissions, assumption used, and sources of emission factors and activity data can be found in Table 4.12-2 and 4.12-4.
[c] NA = not applicable

No other criteria pollutant or hazardous air pollutants would be emitted during the proposed Project operations (see Section 4.12.3.1, Air Quality). Fugitive VOC emissions (direct emissions) would also be generated under this scenario from valves, pumps, flanges, and connectors at the new rail and marine port and potential pump stations. Due to limited design/activity data, these fugitive emissions could not be quantified.

Greenhouse Gases

Direct emissions of GHGs would occur during the construction and operation of the Rail/Tanker Scenario. GHGs would be emitted during the construction phase from several sources or activities, such as clearing and open burning of vegetation during site preparation, operation of on-road vehicles transporting construction materials, and operation of construction equipment for the new pipeline, rail segments, multiple rail and marine terminals, and fuel storage tanks. Due to limited activity data, GHG emissions from construction of the Rail/Tanker Scenario were not quantified; however, these emissions would occur over a short-term and temporary period, so construction GHG impacts are expected to be comparable to the proposed Project.

During operation of the railcars and tankers that comprise this scenario, GHGs would be emitted directly from the combustion of diesel fuel in railcars[17] traveling over 4,800 miles and fuel oil in marine tankers traveling over 13,600 miles round-trip. As indicated earlier, the emissions would vary by transportation segment, particularly during marine-based transit, which occurs in various segments. Oil-filled tankers traveling from the Prince Rupert marine terminal through the Panama Canal to Houston/Port Arthur pass through several different operational zones, including reduced speed zones leading into and out of the ports, North American Emission Control Areas where the use of low-sulfur marine fuel is mandated, and offshore areas where the tankers travel at cruise speeds. The tanker emission calculations included return trips (i.e., both loaded cargo going south and unloaded cargo going north). The resulting direct GHG emissions (3,684,163 metric tons of CO_2e per year) from this scenario can be found in Tables 7 and 8 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.

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[17] The use of LNG as a fuel source for trains is being developed and tested, with media reports suggesting commercial application by 2016/2017 (for example Reuters 2013, Railway Age 2013). The use of LNG could reduce GHG emissions compared to the use of diesel fuel. The use of LNG has not been factored into the current GHG calculations and results.

The Rail/Tanker Scenario would also result in indirect emissions of GHGs due to the operation of 5 new and/or existing rail terminals, the expanded port in Prince Rupert, and potential pumping stations. The new and/or existing rail terminals would be required in Prince Rupert, British Columbia, Lloydminster, Saskatchewan, Epping, North Dakota, and Stroud, Oklahoma, and each is projected to require 5 MW of electric power to operate, except for the Prince Rupert terminal which is projected to require 30 MW. Five of the seven terminals at Lloydminster (Saskatchewan) are existing operating terminals. The remaining two terminals as well as all terminals in Prince Rupert, North Dakota, and Oklahoma are new. Indirect GHG emissions are 307,309 metric tons of CO_2e per year) for this scenario. In aggregate, the total annual GHG emissions (direct and indirect) attributed to this scenario are approximately 3,991,472 metric tons CO_2e, which is approximately 28 percent greater than the entire route encompassing the proposed Project[18] at 3,123,859 metric tons CO_2e (see Section 4.14.2, Direct and Indirect Greenhouse Gas Emissions).[19] The indirect lifecycle GHG emissions are expected to be the same because the same volume of WCSB crude oil would be transported (see Section 4.14.3, Incremental Indirect Lifecycle Greenhouse Gas Emissions).

Noise

Noise would be generated during the construction and operation of the Rail/Tanker Scenario. During the construction phase, heavy construction equipment and vehicles would be used for the new pipelines in Stroud and Prince Rupert, the rail and marine terminals, and fuel storage tanks. Although noise levels from the construction of this scenario were not quantified due to the lack of activity/design data, this noise would occur over a short-term and temporary period, so construction noise impacts are expected to be similar in type to those of the proposed Project. However, since the terminals and expanded port would be relatively concentrated construction sites rather than a long, linear project, noise impacts would be larger in magnitude for the surrounding area.

During operation of the railcars and tanker ships that comprise this scenario, noise would be generated from the locomotives, movement of freight cars and wheels making contact with the rails as the train passes, train horns, warning bells (crossing signals) at street crossings, and tanker engines during hoteling and maneuverings at the new rail and marine terminals in Prince Rupert, British Columbia and the existing terminals at the Gulf Coast area. Noise from the railcars would be similar to those described for the Rail/Pipeline Scenario, so NSAs in the immediate vicinity of the rail route in Canada would be impacted in a similar manner. The majority of the transport distance for this scenario (approximately 70 percent) is located in the open ocean, away from human receptors such as residences and businesses however, there would be an increase in noise effects to marine mammals.

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[18] To facilitate comparison of GHG emissions across the alternatives for operational GHG emissions, an assessment was made of GHG emissions for the alternatives along the entire route from Hardisty, Alberta, to the Gulf Coast (including pipelines in Canada and from Steele City to the Gulf Coast).

[19] The indirect lifecycle GHG emissions are expected to be the same because the same volume of WCSB crude oil would be transported.

Climate Change Effects on the Scenario

Environmental Setting

The climate change effects examined as part of this Final Supplemental EIS could be broadly grouped into three categories:

- Temperature;
- Precipitation; and
- Sea level rise and coastal dynamics (tanker only).

Information on temperature and precipitation is presented in Section 4.14.5, Climate Change Impacts on the Proposed Project. New information on sea level rise is presented in this section. Most of the Rail/Tanker Scenario is outside the boundaries of this Final Supplemental EIS, with the endpoint of this scenario in Texas, so consideration of climate effects in the subtropical climate region is included here. The tanker portion of this scenario is primarily affected by severe storm events, sea level rise, and coastal dynamics.

Sea Level Rise and Coastal Dynamics

Sea level rise is a climate change effect applicable only to the tanker portion of the Rail/Tanker Scenario. Sea levels are projected to rise due to glacial melting and thermal expansion of the water. The rate, total increase, and likelihood of the rise is in part dependent on how rapid the ice sheets warm and is a source of ongoing scientific uncertainty. The U.S. Global Change Research Program estimates that sea level rise could be between 3 to 4 feet by the end of the century. Table 5.1-17 presents the expected sea level rise for high and low emissions scenarios.

Table 5.1-17 Global Sea Level Rise Projections

Period	Emissions Scenarios	Global Sea Level Rise
2070/2099	Low Emission B1[a]	25 to 29 inches
2070/2099	Higher Emission A1F1[b]	37 to 41 inches

Source: USGCRP 2009 and 2013

[a] The B1 scenario assumes very rapid economic growth, a world population that peaks around 2050, and very fast innovation and adoption of energy-efficient technologies.

[b] The A1F1 scenario assumes rapid economic growth, and a world population that peaks around 2050. Technological innovation and adoption of energy-efficient technologies is fossil intensive.

The vulnerability of coastal zones is increasing along the Gulf Coast due to hurricanes and other severe storm events. For the Gulf Coast, it is likely that shoreline erosion and flooding will occur along the coast from the changes in sea level rise and coastal dynamics (U.S. Global Change Research Program [USGCRP] 2013). There would also likely be similar impacts from elevated sea levels and potentially larger and more intense storms along the Canadian west coast.

Subtropical Climate Region

Under the Rail/Tanker Scenario, the southern terminus would be located in the Gulf Coast area and would include ports in the Houston/Port Arthur, Texas, which is in the subtropical climate region. Table 5.1-17 summarizes projected sea level rise for future scenarios of high and low GHG emissions. Any increase in sea level shifts the mean high tide and the impacts of storm surge and saltwater intrusion further inland.

Oceanic Climate Region

Located in the Oceanic climate regime, the Prince Rupert area would likely experience similar impacts as the Houston/Port Arthur area with higher sea levels and saltwater intrusion.

Potential Impacts

The impacts of climate change effects on the construction and operation of the rail portion of the Rail/Tanker Scenario are similar to that of the proposed Project due to similarities in climate regions. However, the projected future climate change effect on sea level rise (i.e., tanker portion) does have the potential to adversely affect tanker ports in the Gulf Coast area. The region is in the Subtropical climate region, and along the coast of this region the sea level rise and subsidence already compound existing challenges. Increasing sea level projections due to climate change as described above shift the mean high tide and the impacts of storm surge and saltwater intrusion further inland, which would negatively affect reliable operation of the port infrastructure for tanker traffic. Mitigation of these climate effects could be addressed by making engineering and operational changes at the port.

5.1.2.4 Rail Direct to the Gulf Coast Scenario

This scenario would involve the transport of WCSB crude oil from new terminal facilities in Lloydminster, Saskatchewan, by rail directly to the Gulf Coast area. This scenario differs from the Rail/Pipeline Scenario in that once the crude oil is on railcars, it would be transported to the Gulf Coast rather than off-loading it in Stroud and shipping by pipeline from the Cushing hub.

This mode of transportation is currently used to ship some crude oil from the WCSB and Bakken regions. As noted in Section 2.2.4, No Action Alternative Scenario Descriptions, independent developers have already expanded or have plans to expand capacity of off-load crude by rail facilities in the Gulf Coast region. Therefore, no new rail terminals are anticipated under this scenario. (See Table 1.4-8 for a list of existing and proposed off-loading facilities in the Gulf Coast.)

The Lloydminster to the Gulf Coast route would transport up to 730,000 bpd to replace quantities currently contracted by the proposed Project. New or expanded rail loading facilities totaling about 1,000 acres would be built in Lloydminster (see Section 2.2.4.1, Rail/Pipeline Scenario), with existing or recently proposed loading facilities handling the remaining WCSB crude oil for shipping to the Gulf Coast. Rail would be used to transport up to 100,000 bpd of crude oil from a new terminal in Epping, North Dakota, to transport Bakken crude oil to refineries in the Gulf Coast area.

Existing infrastructure would be used; however, track improvements and new rolling stock may be needed (e.g., insulated rail cars with steam coils to transport railbit or bitumen). As noted in Section 2.2.4.1, Rail/Pipeline Scenario, producers have begun to use rail to transport crude oil to market refineries in the absence of existing pipeline capacity (see also Section 1.4, Market Analysis). Figure 2.2.4.5 shows representative rail routes from Lloydminster, Saskatchewan, and Epping, North Dakota, to the Gulf Coast. Rail distances from Lloydminster to Port Arthur, Texas, and from Epping to Port Arthur are approximately 2,485 miles and 1,916 miles, respectively.

For the purposes of the analysis in this Final Supplemental EIS, it has been assumed that dilbit would be delivered to the Gulf Coast, although it is likely that other forms of crude oil would be shipped. Hauling crude oil by truck was not considered a viable option as it would be inefficient to transport large quantities from the rail terminals to refiners. Once the crude oil arrives in the Gulf Coast area, it would be off-loaded at existing facilities such as GT Logistics in Port Arthur, TX and delivered to area refineries by pipeline or barge. In Houston, the locations will either be near the ship channel (with access to marine) or in locations such as Mt. Belvieu, Texas, where there are connections by pipeline to a number of refiners.

The environmental setting and potential impacts for construction of new terminals in Lloydminster and Epping are the same as those described in Section 5.1.2.2, Rail/Pipeline Scenario. The discussion of environmental setting and impacts under this scenario focuses on the proposed new and/or expanded facilities in the Lloydminster and Epping areas, and in terms of resources that would be affected by increased rail traffic along the entire rail routes (e.g., air, noise, climate change, and socioeconomics) and the increased potential for accidental releases (see Section 5.1.3, Potential Risk and Safety Under the No Action Alternative Scenarios).

Because no new construction would be needed along these existing segments, it is assumed that there would be little potential for impacts to other resources (i.e., geology, soils, wetlands, vegetation, wildlife, fish, threatened and endangered species, land use, and cultural resources) as a result of increased rail traffic along the existing rail lines, other than an increased potential for impacts from accidental releases. Under this scenario, the representative rail routes would cross up to 711 perennial streams and 40 major water bodies in the United States.

Socioeconomics

Environmental Setting

The Rail Direct to Gulf Coast Scenario would intersect 194 U.S. counties in 15 states and 26 Canadian census divisions (Table 5.1-18) in four provinces. It would go through 41 metropolitan areas across Canada and the United States (Table 5.1-19). In comparison, the proposed Project would intersect 30 U.S. counties in four states and only one metropolitan area: Rapid City, South Dakota.

Table 5.1-18 U.S. States and Counties and Canadian Provinces/Census Divisions Affected by the Rail Direct to Gulf Coast Scenario

State (U.S.)/ Province (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Lloydminster to Gulf Coast Rail Corridor (CN)		
Canada		
Saskatchewan	6	13, 12, 11, 10, 6, 5
Manitoba	9	15, 7, 8, 9, 10, 11, 12, 2, 1
Ontario	1	Rainy River District
United States		
Minnesota	5	Roseau; Lake of the Woods; Koochiching; St. Louis; Carlton
Wisconsin	20	Douglas; Washburn; Sawyer; Rusk; Chippewa; Taylor; Clark; Marathon; Wood; Portage; Waupaca; Outagamie; Winnebago; Fond du Lac; Dodge; Washington; Waukesha; Walworth; Racine; Kenosha
Illinois	21	Lake; Cook; Will; Kankakee; Iroquois; Ford; Champaign; Douglas; Coles; Cumberland; Shelby; Effingham; Clay; Fayette; Marion; Washington; Perry; Jackson; Union; Pulaski; Alexander
Missouri	1	Mississippi
Kentucky	4	Ballard; Carlisle; Hickman; Fulton
Tennessee	5	Obion; Dyer; Lauderdale; Tipton; Shelby
Arkansas	11	Crittenden; St. Francis; Monroe; Prairie; Arkansas; Jefferson; Lincoln; Desha; Drew; Chicot; Ashley
Louisiana	9	Morehouse; Ouachita; Caldwell; La Salle; Grant; Rapides; Allen; Beauregard; Calcasieu
Texas	3	Newton; Orange; Jefferson
Terminal Facilities		
United States		
None	0	
Lloydminster to Gulf Coast Rail Corridor (CP)		
Canada		
Saskatchewan	8	17, 13, 12, 11, 6, 7, 2, 1
United States		
North Dakota	13	Burke; Ward; Renville; McHenry; Pierce; Sheridan; Wells; Foster; Stutsman; Barnes; Cass; Ransom; Richland
Minnesota	15	Wilkin; Grant; Douglas; Pope; Stearns; Kandiyohi; Meeker; Wright; Hennepin; Anoka; Scott; Dakota; Rice; Steele; Freeborn
Iowa	10	Worth; Cerro Gordo; Franklin; Hardin; Story; Polk; Warren; Marion; Lucas; Wayne
Missouri	8	Mercer; Grundy; Livingston; Daviess; Caldwell; Ray; Clay; Jackson
Kansas	7	Johnson; Miami; Linn; Anderson; Allen; Neosho; Labette
Oklahoma	8	Craig; Mayes; Wagoner; Muskogee; McIntosh; Pittsburg; Atoka; Bryan
Texas	18	Grayson; Cooke; Denton; Tarrant; Johnson; Hill; McLennan; Falls; Robertson; Milam; Brazos; Grimes; Waller; Montgomery; Harris; Liberty; Hardin; Jefferson

State (U.S.)/ Province (CA)	Number of Counties (U.S.)/ Census Divisions (CA)	Counties (U.S.)/Census Divisions (CA)
Terminal Facilities		
Canada		
Saskatchewan	1	17
United States		
None	0	0
	Epping to Gulf Coast Rail Corridor	
North Dakota	13	Williams; Mountrail; Ward; McHenry; Pierce; Wells; Eddy; Foster; Griggs; Steele; Barnes; Cass; Richland
Minnesota	14	Clay; Wilkin; Traverse; Grant; Stevens; Pope; Swift; Kandiyohi; Chippewa; Yellow Medicine; Lyon; Lincoln; Pipestone; Rock
South Dakota	1	Minnehaha
Iowa	7	Lyon; Sioux; Plymouth; Woodbury; Pottawattamie; Mills; Fremont
Nebraska	7	Dakota; Thurston; Burt; Dodge; Saunders; Sarpy; Douglas
Missouri	7	Atchison; Holt; Andrew; Buchanan; Platte; Clay; Jackson
Kansas	9	Leavenworth; Wyandotte; Johnson; Miami; Linn; Anderson; Allen; Neosho; Labette
Oklahoma	8	Craig; Mayes; Wagoner; Muskogee; McIntosh; Pittsburg; Atoka; Bryan
Texas	18	Grayson; Cooke; Denton; Tarrant; Johnson; Hill; McLennan; Falls; Robertson; Milam; Brazos; Grimes; Waller; Montgomery; Harris; Liberty; Hardin; Jefferson
Terminal Facilities		
United States		
North Dakota	1	Williams

Table 5.1-19 U.S. and Canadian Metropolitan Areas along the Rail Direct to Gulf Coast Scenario

Metropolitan[a] Area	State (U.S.)/Province (CA)
Canada	
Saskatoon	Saskatchewan
Regina	Saskatchewan
Brandon	Manitoba
Portage la Prairie	Manitoba
Winnipeg	Manitoba
United States	
Fargo	North Dakota/Minnesota
St. Cloud	Minnesota
Duluth	Minnesota/Wisconsin
Minneapolis-St. Paul-Bloomington	Minnesota/Wisconsin
Eau Claire	Wisconsin
Wausau	Wisconsin
Appleton	Wisconsin
Oshkosh-Neenah	Wisconsin
Fond du Lac	Wisconsin
Milwaukee-Waukesha-West Allis	Wisconsin
Racine	Wisconsin

Metropolitan[a] Area	**State (U.S.)/Province (CA)**
Chicago-Joliet-Naperville	Illinois/Indiana/Wisconsin
Kankakee-Bradley	Illinois
Champaign-Urbana	Illinois
Sioux Falls	South Dakota
Sioux City	Iowa/Nebraska/South Dakota
Ames	Iowa
Des Moines-West Des Moines	Iowa
Omaha-Council Bluffs	Nebraska/Iowa
St. Joseph	Missouri/Kansas
Kansas City	Missouri/Kansas
Cape Girardeau-Jackson	Missouri/Illinois
Memphis	Tennessee/Mississippi/Arkansas
Pine Bluff	Arkansas
Tulsa	Oklahoma
Monroe	Louisiana
Alexandria	Louisiana
Lake Charles	Louisiana
Sherman-Denison	Texas
Dallas-Fort Worth-Arlington	Texas
Waco	Texas
College Station-Bryan	Texas
Houston-Sugar Land-Baytown	Texas
Beaumont-Port Arthur	Texas

[a] Metropolitan statistical areas are geographic entities defined by the Office of Management and Budget for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics. A metro area contains a core urban area of 50,000 or more population, and may contain one or more counties, one or more of which contain the urban core.

Population[20]

The population of the census divisions and counties that would be crossed by the Rail Direct to Gulf Coast route in 2010/2011 was approximately 30.6 million (Table 5.1-20). In comparison, the pipeline corridor population under the proposed Project was approximately 263,298 in 2010 (see Table 3.10-5). Of the approximately 30.6 million population, a relatively small portion (about 62,000 persons) lives in the counties and census divisions adjacent to the northern terminals (Lloydminster, 40,000, and Williams County, North Dakota, 22,000).

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[20] Population data were collected by county in the United States and by census division in Canada.

Table 5.1-20 Rail Corridor Population

State (U.S.)/Province (CA)	Population[a]
Rail Corridors	
Canada	
Saskatchewan	749,213
Manitoba	905,577
Ontario	20,370
United States	
North Dakota	325,309
Minnesota	2,968,788
South Dakota	169,468
Wisconsin	2,060,338
Illinois	7,281,135
Iowa	983,081
Missouri	1,187,459
Kansas	879,946
Nebraska	768,225
Kentucky	25,068
Tennessee	1,086,682
Arkansas	271,782
Louisiana	614,829
Oklahoma	323,050
Texas	8,402,834
Rail Corridor Total	*29,019,109*
Terminal Facilities[b]	
Canada	
Saskatchewan	40,135
United States	
North Dakota	22,398

Source: U.S. Census Bureau 2010; Statistics Canada 2012b

[a] Population data are from 2010 for U.S. areas and from 2011 for Canadian areas.
[b] Populations near terminal facilities are included in the corridor totals above.
Note: The table only includes the population of the counties and census divisions that the route would go through, not the population of the states/provinces as a whole.

Environmental Justice

Populations near the terminal facilities were evaluated on a range of geographies: city, census division, province, county, and state. An aboriginal population in Census Division 17 was identified in Saskatchewan (12,000 persons out of a population of 40,000), and a multiracial population was identified in Williams County, North Dakota (644 persons out of a population of 22,400). See Appendix O, Socioeconomics, for detailed data.

Public Services

The City of Lloydminster has two fire departments and is patrolled by the Royal Canadian Mounted Police. A total of three police/sheriff departments, seven fire departments, and two medical facilities would be located near the Epping terminal. Appendix O, Socioeconomics, includes a table listing these facilities.

Traffic and Transportation

In 2005, the existing railroads that would be utilized under this scenario had between 25 and 200 freight trains per day depending on the segment (Cambridge Systematics 2007). Some segments were near or above capacity, especially in the Midwest between St. Paul, Minnesota, and the Gulf Coast area (Cambridge Systematics 2007).

Potential Impacts

The Rail Direct to Gulf Coast Scenario would require new or expanded terminal facilities in Lloydminster, Saskatchewan and Epping, North Dakota. No new rail lines are considered under this scenario. Thus, the analyses of potential socioeconomic impacts are focused on the immediately affected areas near Lloydminster and Epping. This section also discusses other impacts to socioeconomic resources such as traffic and environmental justice.

Population/Housing

The impacts of the Rail Direct to Gulf Coast Scenario on population and housing would be small. This scenario is expected to bring over 2,700 construction jobs and 250 operations jobs to the areas of the terminals. In Epping, North Dakota, employment of approximately 750 terminal construction jobs would represent a 3.5 percent population increase for Williams County. Therefore, effects on the local population from an influx of construction workers would be negligible.

In Lloydminster, the number of hotel/motel rooms is approximately 1,075 (TripAdvisor 2012). This number would likely be insufficient to house the workers that would need lodging. In this area, additional lodging would need to be made available for workers. Epping, North Dakota, has approximately 1,500 hotel/motel rooms (TripAdvisor 2012), suggesting it would be able to accommodate the approximately 750 workers that would be needed for terminal construction.

Local Economic Activity

Construction

Key components of this scenario would include new or expanded terminal facilities in Lloydminster, Saskatchewan and Epping, North Dakota. Construction costs for these facilities would range from approximately $110 million in Epping to $185 million in Lloydminster. Much of the construction workforce for each location would likely be local, which for Epping would include cities and towns throughout North Dakota. It is uncertain how wide of an area would provide the construction workforce in Lloydminster, but given Lloydminster’s relatively small population, it would likely encompass communities within Alberta and Saskatchewan.

Direct employment effects of facility construction would include approximately 750 jobs at Epping. As noted earlier, estimates for Lloydminster could not be made because the modeling system used for the economic impact analyses does not extend into Canada. However, based on the jobs that would occur at terminals in the United States, the construction jobs at Lloydminster could reasonably be expected to total at least 1,000.

Indirect and induced employment effects could occur nationally for rail terminal construction in the United States, but are likely to be more concentrated near the facilities. Indirect and induced jobs supported by the construction activity in Epping would amount to approximately 1,250. Construction could be completed in about 1 year.

Earnings supported by construction activity follow a similar pattern as employment. For the Epping terminal, about $39.2 million of direct earnings would be supported. While direct effects are generally localized around the construction sites, indirect and induced effects could occur across the United States. Indirect and induced earnings would amount to about $65.5 million for the construction in Epping.

Operations

Operations costs are estimated to be about $49 million annually for Lloydminster and $7 million annually for Epping. Using the transportation support sector in the same economic model discussed above, annual terminal employment is estimated to be approximately 50 jobs at the Epping facility (Table 2.2-4). Indirect and induced effects for annual operations in Epping would come to about 100 jobs. In total, annual operations in Epping would support about 150 jobs. These effects are national estimates, but most effects could be expected to occur near the rail terminals. For the reasons mentioned above, employment in the Lloydminster area could not be estimated.

Earnings supported by facility operations follow a similar pattern as employment. For the Epping terminal, about $3.9 million of direct earnings would be supported annually. Indirect and induced earnings would come to about $4.3 million for operating the terminal in Epping. A total of about $8.2 million of earnings would be supported by operations in Epping. Operational socioeconomic effects along the rail routes resulting from trains transporting WCSB and Bakken crude oil daily could not be estimated. However, it is reasonable to expect annual increases in maintenance and other operational costs of track, crossings, bridges, and related facilities throughout the rail systems.

Environmental Justice

Minority and low-income populations could be potentially affected by construction and operations activities related to the terminals. Impacts to minority and low-income populations during construction and operations would be of a similar type to those described for the proposed Project and could possibly result in increased competition for medical or health services in underserved populations. Williams County, North Dakota contains one or more minority populations, HPSAs, and MUA/Ps. Canada does not define HPSA and MUA/P; therefore, it is unknown whether or not the minority populations in Lloydminster exist in a medically underserved area. Appendix O, Socioeconomics, provides information about the HPSAs and MUA/Ps in relation to areas with minority and/or low-income populations.

Tax Revenues

Under the Rail Direct to Gulf Coast Scenario, the new terminal in Epping could cost approximately $110 million. The terminal would generate state and local government sales and use tax and fuel tax revenue during construction. During construction, the new or expanded terminals in Lloydminster could cost about $185 million and generate provincial sales taxes, goods and services taxes, and hotel taxes. Once in operation and on the tax roll, the terminals would generate county and/or municipal property tax revenue. Most states along the rail routes would assess a property or similar tax on the new railcar traffic passing through, generating additional revenue for these states. Railcar taxes typically go to a state fund for use according to each state’s tax policy. The Canadian terminals would generate municipal property tax revenue (Government of Saskatchewan 2012b).

Property Values

Impacts to private property values in North Dakota could occur under the Rail Direct to Gulf Coast Scenario if there are land uses that would experience offsite nuisance effects but would receive no offsetting consideration from being in the vicinity of the terminal, although there already are oil transportation facilities near these sites. Construction and operation of rail facilities, additional connecting pipelines, and additional train traffic could have an adverse effect on local property values. These would be long-term impacts extending through the operations phase.

Traffic and Transportation

A typical Class I railroad segment could accommodate up to 48 unit trains per day with one set of tracks or double that with two sets of tracks (Cambridge Systematics 2007). An increase of up to 12 unit trains per day for crude by rail shipments from Lloydminster to the Gulf Coast would strain some segments of these rail networks by increasing volume by up to 56 percent. The rail line from Epping to the Gulf Coast overlaps 90 percent of the same route that could be used from Lloydminster to the Gulf Coast, which would further congest the line with an additional 2 unit trains a day and the return trips for all 14 trains.

To accommodate new rail traffic in this scenario, railroads may need to add infrastructure components (e.g., passing tracks or a second set of tracks) or upgrade control equipment. These upgrades would likely occur on property owned by the railroads. As of 2007, most of the rail corridors included in this scenario had or, with upgrades already likely to occur regardless of crude oil transport, were likely to have substantial available capacity (Cambridge Systematics 2007). Overall, the rail system could accommodate additional traffic under this scenario. Some segments may experience congestion, but would likely be able to handle the extra traffic.

Construction of the rail terminals at Epping would involve large numbers of road trips by heavy trucks to transport construction materials and equipment to and from the sites. This increased traffic could cause congestion on major and local roadways, and could require temporary traffic management solutions such as police escorts for oversize vehicles.

Under the Rail Direct to Gulf Coast Scenario, rail loading and offloading facilities would be sited to avoid disruption of major surface transportation routes. This scenario would marginally increase delays for motorists at at-grade railroad crossings by adding to the time that trains use those crossings. Assuming the Rail Direct to Gulf Coast Scenario would add up to 14 unit trains per day (see Section 2.2.3.2, Identification and Screening of No Action Alternative Scenarios, and Table 2.2-2), or 28 total unit train movements (delivery and return), this scenario would add an equivalent of 1 to 2 additional train movements on average per hour.

Most major roads (i.e., freeways and high-traffic arterial roads) have grade-separated railroad crossings. Increased crossing delays would hamper traffic movements on smaller roads and in rural areas, but would have negligible impacts on regional or metropolitan-scale traffic patterns. The increase in rail traffic would also increase the risk and occurrence of train/motor vehicle collisions at crossings. Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Resource Impacts from Potential Releases*, describes these impacts in greater detail.

Air and Noise

Environmental Setting

The Rail Direct to the Gulf Coast Scenario would include the construction of new facilities in two areas: Lloydminster, Saskatchewan and Epping, North Dakota. Two new or expanded loading facilities would be built in Lloydminster and an additional 5 existing terminals would be used to transport 730,000 bpd of WCSB. One new terminal would be needed in Epping to ship 100,000 bpd of Bakken crude oil. This section also includes consideration of the rail lines as operational use of these segments could affect air and noise resources. An overview of the air and noise characteristics of these areas is provided below.

The areas around the Lloydminster and Epping terminal sites are generally rangeland and other agricultural uses. The rail routes associated with this scenario would cross many rural communities in Canada and the United States. The existing air quality (including GHGs) in Lloydminster and Epping is similar to that of the proposed Project through this region (i.e., rangeland and agriculture).

While no new rail terminals would be required in the Gulf Coast area under this scenario, the increased rail traffic would affect air quality and cause an increase in noise along the routes to existing facilities. The Beaumont-Port Arthur area (i.e., Hardin, Jefferson, and Orange counties) were designated attainment/unclassifiable under the 2008 8-hour ozone National Ambient Air Quality Standards, effective July 20, 2012 (Texas Commission on Environmental Quality 2013). The Beaumont-Port Arthur area had previously been in nonattainment for the 2008 8-hour ozone National Ambient Air Quality Standards (i.e., poor air quality). Due to the improved air quality in the Beaumont-Port Arthur area over the past few years, the existing air quality in the proposed Project area (Epping, North Dakota, and Cushing, Oklahoma, are in attainment areas) is currently comparable to the existing air quality in the BPA area.

Potential Impacts

This scenario would include new rail terminals in Lloydminster and Epping. On an aggregate basis, criteria pollutant emissions, direct and indirect GHG emissions, and noise levels during the operation phase for this scenario would be higher than that of the proposed Project (see Section 4.12.3, Potential Impacts), mainly due to the increased regular operation and location of diesel locomotives, railcars, and existing, new and/or expanded rail terminals.

Air Quality

Emissions of criteria pollutants would be generated during the construction and operation of the Rail Direct to the Gulf Coast Scenario. Due to limited activity/design data, air emissions during construction were not quantified; however, emissions would similar in type to those of the proposed Project, although they would occur over a short-term and temporary period. Since the new and expanded terminals and expanded port would be relatively compact construction sites, rather than a long, linear project, air emissions would be larger in magnitude for the surrounding area.

During the operational phase, WCSB crude oil would be transported regularly over railroads extending from Lloydminster, Saskatchewan, to the Houston/Port Arthur, Texas area, and Bakken crude would be transported via rail from Epping, North Dakota, to Houston/Port Arthur, Texas area. Under this scenario, two railway routes were evaluated: Lloydminster, Saskatchewan, to Port Arthur, Texas, Rail Route (2,485 miles); and Epping, North Dakota, to Port Arthur, Texas (1,916 miles).

The trains transporting the WCSB and Bakken crudes would consume large amounts of diesel fuel each day, which equate to direct emissions of HCs or VOCs, CO, NO_x, SO_2, and PM_{10} and $PM_{2.5}$. This scenario also accounts for the fugitive HC/VOC emissions from the 28 storage tanks and four storage tanks at Lloydminster and Epping, respectively. Crude oil from the existing Port Arthur terminals would be shipped immediately to nearby refineries and storage facilities. The total operational emissions (tons) estimated over a 50-year period of the scenario (to be comparable to the proposed Project) for both railway routes presented in Table 5.1-21 are significantly greater than those associated with the combined construction and operation of the proposed Project.

Table 5.1-21 Comparison of Criteria Pollutant Emissions for the Rail Direct to the Gulf Coast Scenario and Proposed Project over a 50-Year Period

	Criteria Pollutant Emissions (tons)[a]					
Sources	**HC/VOC**	**CO**	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Rail Direct to the Gulf Coast Scenario (operation phase)[a]	132,299	571,781	2,423,458	59,389	47,038	45,276
Proposed Project (construction phase; 6 to 8 months)[b]	130	2,531	1,214	50.2	6,781	1,398
Proposed Project (operation phase)[b]	22.5	NA[c]	NA	NA	NA	NA

[a] Details of air emission calculations for the Rail to the Gulf Coast Scenario, including activity data, emission factors, and assumptions used can be found in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.
[b] Summary of criteria pollutant emissions, assumption used, and sources of emission factors and activity data can be found in Tables 4.12-2 and 4.12-4.
[c] NA = not applicable

The rail emissions associated with the Rail Direct to the Gulf Coast Scenario accounted for return trips (i.e., both loaded cargo going south and return trips without diluent going north). Detailed annual operational emissions (with activity data, emission factors, and assumptions) for this scenario can be found in Table 9 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions. The proposed Project is expected to emit 0.45 tons of VOCs per year during operations or 22.5 tons over the life of the project if a 50-year project life is assumed (i.e., from approximately 55 intermediate mainline valves along the pipeline route and from pump station components such as valves, pumps, flanges, and connectors). In aggregate, the total VOC emissions over the life of the project (i.e., during its long-term operation) attributed to this scenario are approximately 132,299 tons, which is over 5,800 times greater than for the proposed Project at just 22.5 tons.

No other criteria pollutants or hazardous air pollutants would be emitted during the proposed Project operations (see Section 4.12.3.1, Air Quality). Unlike the proposed Project, for which human receptors (residences) are located at least 1,320 feet away from the air emission sources described above (i.e., pumps, valves, flanges and connectors at the pump stations), this scenario has human receptors as close as 15 feet to some segments of the rail line (e.g., in Labette, Kansas, and Denton, Texas).

The air emission calculations for the Rail Direct to the Gulf Coast Scenario assume that dilbit would be transported from Lloydminster, Saskatchewan, to Port Arthur, Texas, which is expected to be piped directly to nearby refineries. The Bakken crude is also expected to be piped from Port Arthur to the nearby refineries. If other crude types such as railbit or bitumen are transported from Lloydminster to Port Arthur, the calculated emissions in Table 5.1-21 above are expected to increase slightly due to the slight increase in unit trains per day (i.e., reduced maximum load per rail car) and the additional emissions associated with barging the railbit or bitumen from Port Arthur to nearby refineries (instead of piping).

Greenhouse Gases

Direct emissions of GHGs would occur during the construction and operation of the Rail Direct to the Gulf Coast Scenario. GHGs would be emitted during the construction phase from several sources or activities, such as clearing and open burning of vegetation during site preparation, operation of on-road vehicles transporting construction materials, and operation of construction equipment for the new rail terminals. Due to limited activity/design data, GHG emissions from new construction under this scenario were not quantified. Greenhouse gas emissions would occur over short-term and temporary periods, similar to the proposed Project, but in greater concentrations across smaller areas.

During the operations, GHGs would be emitted directly from the combustion of diesel fuel in railcars[21] traveling approximately 2,485 miles from Lloydminster, Saskatchewan, to Port Arthur, Texas, and 1,916 miles from Epping, North Dakota, to Port Arthur, Texas. The rail emissions accounted for return trips (i.e., both loaded cargo going south and return trips without diluent going north). The resulting direct emissions of GHGs for the two railway routes associated with this scenario are estimated to be 4,066,962 metric tons of CO_2e per year for the Lloydminster plus Epping route (see Table 10 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions).

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[21] The use of LNG as a fuel source for trains is being developed and tested, with news reports suggesting commercial application by 2016/2017 (Reuters 2013, Railway Age 2013). The use of LNG could reduce GHG emissions compared to the use of diesel fuel. The use of LNG has not been factored into the current GHG calculations and results.

The Rail Direct to the Gulf Coast Scenario would also result in indirect emissions of GHGs due to the operation of 12 new and/or existing rail terminals. The new and/or existing rail terminals would be required in Saskatchewan (five existing, two new) and North Dakota (one new), and Texas (four existing); each is projected to require 5 megawatts (MW) of electric power to operate. Indirect GHG emissions for this scenario would total 361,940 metric tons of CO_2e per year.

In aggregate, the total annual GHG emissions (direct and indirect) attributed to this scenario are approximately 4,428,902 metric tons CO_2e (Lloydminster plus Epping route), which is about 42 percent greater than for the entire route encompassing the proposed Project[22] at 3,123,859 metric tons CO_2e (see Section 4.14, Greenhouse Gases and Climate Change).

The GHG emission calculations for the Rail Direct to the Gulf Coast Scenario assume that dilbit would be transported from Lloydminster, Saskatchewan, to Port Arthur, Texas, which would likely be piped or barged to nearby refineries. The Bakken crude is also expected to be piped from Port Arthur to the nearby refineries. If other crude types such as railbit or bitumen are transported from Lloydminster to Port Arthur, the calculated GHG emissions in Table 5.1-21 above would increase marginally due to the slight increase in unit trains per day (i.e., reduced maximum load per rail car) and the additional emissions associated with barging the railbit or bitumen from Port Arthur to nearby refineries (instead of piping).[23]

Noise

Noise would be generated during the construction and operation of the Rail Direct to the Gulf Scenario. Noise would be generated during the construction phase from the use of heavy construction equipment and vehicles for the multiple rail terminals. Due to limited activity/design data, noise levels from the construction of this scenario were not quantified. However, noise from construction would be similar in type and magnitude as the proposed Project, but would have more localized effects compared to the Project's linear impacts.

During operation of the railcars, noise would be generated from the locomotives, movement of freight cars and wheels making contact with the rails as the train passes, train horns, and warning bells (crossing signals) at street crossings. People that live near rail yards, siding, or terminals likely would experience additional noise due to trains standing for extended periods with their engines idling, as well as from trucks and other mobile sources moving in and out of the yard/terminal. As indicated earlier, this scenario involves the transport of WSCB crude from Lloydminster to Port Arthur (2,485 miles). Unlike the proposed Project, for which human receptors (residences) are located at least 1,320 feet away from the noise sources (pump stations), this scenario has human receptors as close as 15 feet to some segments of the rail line.

The day-night sound levels (Ldn) for the Lloydminster to Port Arthur rail route were calculated in accordance with the methodology described by U.S. Department of Transportation (USDOT 2006) for commuter rail system. The calculation assumes up to 730,000 bbl of WCSB crude oil transported per day from Lloydminster to Port Arthur, 594 bbl of crude oil per railcar

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[22] To facilitate comparison of GHG emissions across the alternatives for operational GHG emissions, an assessment was made of GHG emissions for the alternatives along the entire route from Hardisty, Alberta, to the Gulf Coast (including pipelines in Canada and from Steele City to the Gulf Coast).

[23] The indirect lifecycle GHG emissions are expected to be the same because the same volume of WCSB crude oil would be transported.

(assumed dilbit), three diesel-powered locomotives per train unit with a speed of 40 mph, and 100 railcars per train. Aerial photography was used to identify the closest NSAs within half a mile of the rail corridor for both rail routes. The existing noise levels at the closest NSAs were estimated using the methodology described in USDOT 2006, which is based on the proximity of the NSAs to the existing rail routes. The noise calculations do not include potential noise from train horns, warning bells (crossing signals) at street crossings, and locomotive idling at layover tracks near terminals. The noise calculations also exclude potential noise attenuation from barriers such as vegetation blocking the line of sight between the source (train) and some receptors (NSAs).

Noise levels would vary depending on the distance from the closest NSAs to the rail route. This additional rail traffic could result to noise increases of approximately 10 decibels on the A-weighted scale (dBA) above existing levels (ambient noise levels are estimated to be 81 dBA at the closest NSA) at the source. Under this rail route, Ldn levels (including existing levels) could be as high as 91 dBA at the closest NSA in Labette, Kansas (15 feet from the rail route) and Denton, Texas (16 feet from the rail route). This level of project-induced noise at an NSA is greater than the expected noise level at an NSA from pump station operations under the proposed Project, which was estimated to be approximately 61 dBA at 1,320 feet or a quarter mile from the closest receptor. (see Section 4.12.3.2, Noise). The addition of noise from train horns, warning bells, and locomotive idling would further increase noise levels at these NSAs, unless there are barriers present such as vegetation that blocks the line of sight between the trains and the NSAs. Table 5.1-22 shows a comparison of the predicted noise levels at closest NSAs for the Direct Rail to the Gulf Coast Scenario and the Proposed Project. Detailed operational noise emissions (with activity data, distance to closest NSA, and assumptions) for this scenario can be found in Table 11 in Appendix Y, Estimated Criteria Pollutants, Noise, and GHG Emissions.

Table 5.1-22 Comparison of Predicted Noise Levels at Closest Noise Sensitive Area for the Direct Rail to the Gulf Coast Scenario and the Proposed Project

Source	Closest Noise Sensitive Area to Source	Distance to Source (Railway or Pump Station) (feet)	Estimated Existing Ldn Levels (dBA)	Total Ldn at Closest NSA, including Existing Ldn (dBA)
Direct Rail to the Gulf Coast Scenario (operation phase)	Residence near railway in Labette County, Kansas, and Denton County, Texas	15-16	80.5-81	90.3-90.8
Proposed Project (operation phase)	Residences located north-northeast of Pump station 25 in Nebraska	1,320	35.0	61.4

This scenario also has the potential for noise due to the transport of 100,000 bpd of Bakken crude via trains from Epping, North Dakota, to Port Arthur, Texas (approximately 1,916 miles). Approximately 50 percent of this rail route (Kansas to Texas) is the same as the Lloydminster to Port Arthur route. The remaining 50 percent of this route (North Dakota to Missouri) goes through multiple towns in North Dakota, Minnesota, Iowa, and Missouri. The closest NSAs in these states are approximately 25 to 40 feet from the rail route; therefore, Ldn levels for this portion of the Epping to Port Arthur route are also expected to be high (85 to 88 dBA). Based on the increased train traffic/volume and proximity of the NSAs to the rail routes, noise impacts from the Rail Direct to the Gulf Coast Scenario would be greater than those of the proposed Project.

Climate Change Effects on the Scenario

Environmental Setting

The Rail Direct to the Gulf Coast Scenario passes through the Dry Temperate and Prairie climate regions, which are the same climate regions as the proposed Project. This scenario also passes through the Subtropical climate region in Texas.

Historical Climate Trends

The historical changes in temperature for the region affected by the Rail Direct to the Gulf Coast Scenario are presented in Table 5.1-23 and are similar to those discussed in Section 4.14.5, Climate Change Impacts on the Proposed Project. Overall, temperatures have been warming compared to historical averages. These historical climate trends are expected to continue and to intensify according to GHG emissions levels and associated projections of climate change (Intergovernmental Panel on Climate Change [IPCC] 2007 and 2012).

Table 5.1-23 Historical Changes in Temperature by State (1895-2009)

State	Annual Average (˚F Increase)	Summer Average (˚F Increase)	Winter Average (˚F Increase)
North Dakota	2.9	1.8	5.0
Nebraska	1.2	0.7	1.8
Kansas	1.1	0.6	2.0
Iowa	1.0	0.4	1.5
Minnesota	1.4	0.9	2.4
Missouri	0.4	0.0	0.9
Oklahoma	1.2	0.7	2.5
Texas	0.1	0.8	3.9

[a] Source: Breckner 2012; Source: HPRCC 2012; SCIPP 2012; MRCC 2012; Southern Regional Climate Center (SRCC) 2013
˚F = degrees Fahrenheit

Climate Change Effects

The climate change effects examined as part of this Final Supplemental EIS could be broadly grouped into three categories

- Temperature
- Precipitation and severe storm events
- Sea level rise

Information on temperature and precipitation for the climate regions the same as the proposed Project (Dry Temperate and Prairie) is presented in Section 4.14.5, Climate Change Impacts on the Proposed Project. Climate effects in the Subtropical climate region are presented here.

Subtropical Climate Region

For temperature effects in the subtropical climate region, the A2 scenario in Table 5.1-24 predicts an annual maximum mean daily summer temperature increase of as much as 4.9°F for the region by 2040–2069. Average annual minimum mean daily temperatures are also expected to increase 3.8°F over the same period. Precipitation decreases are also expected between 2010 and 2099. Under the A2 emissions scenario as shown in Table 5.1-24, the decrease in average annual precipitation for the Subtropical Temperate climate region by 2040 to 2069 is projected to be 1.9 inches.

Table 5.1-24 Projected Changes in Temperature and Precipitation in the Subtropical Climate Region under A2 Emissions Scenario

Period	Season	Temperature (°F Increase)	Precipitation (Decrease in Inches)
2040/2069	Summer	4.9	1.7
2040/2069	Winter	2.7	0.1
2040/2069	Annual	3.8	1.9

Source: Joyce et al. 2011

Information on climate effects in the subtropical region for sea level rise and coastal dynamics is presented in Table 5.1-17, Global Sea Level Rise Projections.

Potential Impacts

The climate change effects on the rail network and construction and operation of the rail transloading facilities are similar to the proposed Project due to similarities in the regions. However, rail is particularly vulnerable to climate change impacts since the infrastructure can be stressed by age and demand levels above the design thresholds. Severe storm events can further degrade the system and cause damage and disruption. During severe rainstorms, railroads that follow riverbeds, such as the representative routes, may be vulnerable to flooding, which degrades or washes out nearby rail beds, culverts, or bridges. Additionally, the warmer climate and increased drought may affect slope stability and cause rail track stress and track buckling which can lead to increased risk of derailments (USGCRP 2013).

In the Gulf Coast area, hurricanes and sea level rise will increase risk of coastal impacts including flooding of rail lines and unloading facilities (including docks) near tidewater (USGCRP 2013). The magnitude and challenge of these problems will continue to increase as the changes become more prominent. Mitigation of these climate effects could be addressed by conducting monitoring and surveillance of the rail lines and facilities to preemptively identify areas that are at high risk or affected by climate change. Further, weather conditions could affect shipments during severe storms and may delay arrival of crude oil before, during, and possibly after severe storm events.

5.1.3 Potential Risk and Safety under the No Action Alternative Scenarios

This section describes the risks of potential releases from transporting crude oil by rail as compared to pipelines and marine vessels that would be relied upon under the various No Action Alternative scenarios discussed above.

Historical rail incident data were analyzed to evaluate potential releases associated with rail transport in the United States. The results help provide insight into what could potentially occur with respect to spill volume, incident cause, and incident frequency for the No Action Alternative scenarios that involve rail transport.

In addition, rail incident frequencies were compared to frequencies for other modes of transport (i.e., pipeline, marine) to provide insight when comparing alternatives. Although the product to be transported by the proposed Project is crude oil, incidents for petroleum products were also analyzed to provide a comparison to a larger dataset and a higher volume transported.

A projection of injury and fatality frequencies onto the crude oil transport volume for the proposed Project was also done. Adding 830,000 bpd to the yearly transport mode volume indicates a potential additional 49 injuries and six fatalities for the rail alternative compared to one additional injury and no fatalities for the proposed Project on a yearly basis.

5.1.3.1 Derailment of Crude by Rail Train in Lac-Mégantic, Québec, Canada

A recent incident in Canada illustrates some of the risk inherent in shipping crude by rail. In July 2013, a derailment involving 72 Class 111 tank cars carrying Bakken crude oil occurred in Lac-Mégantic, Québec, Canada (approximately 155 miles east of Montreal) (Shingler 2013). The 1.4-kilometer-long freight train, operated by Montreal, Maine and Atlantic Railway Corporation (MMA), was transporting roughly 51,000 barrels of crude oil (Reuters 2013) from the Bakken Region to the Irving Oil Refinery in Saint John, New Brunswick (Montreal Gazette 2013b).

While the investigation continues as of the publication of the Final Supplemental EIS, it is apparent that the braking system failed. It is known that a fire had occurred in the locomotive earlier in the evening of the incident, which was extinguished. After the fire, rail employees confirmed that the train was secure and no serious damage had occurred.

The train had been parked on the main line for the night in Nantes, Quebec because the siding was occupied. Early in the morning of July 6, the train, which was parked on a 1.2 percent slope in Nantes, began to roll downhill towards the town of Lac-Mégantic, about 7 miles east of Nantes. The unoccupied train gained speed as it headed towards Lac-Mégantic, eventually reaching an estimated 63 mph as it approached a 10 mph curve in the downtown area, where it derailed.

Several of the tank cars ruptured and exploded, with additional crude oil being ejected along the train's direction. The explosions and ensuing fire claimed 47 lives and destroyed approximately 30 structures. The fire and smoke caused over 2,000 people to evacuate from the area.

The Canadian Transportation Safety Board conducted a subsequent review of shipping documents and Material Safety Data Sheets (MSDSs) for the oil carried by the train, the results of which indicated several discrepancies pertaining to the Packing Group into which the product was categorized. Based on its flash point, crude oil is classified as a Class 3 flammable liquid. However, since crude oils can have a wide range of flash points, they are also divided into Packing Groups to more appropriately categorize their hazards. Packing Group I products have a lower range of crude oil flash points and Packing Group III products have a higher range of crude oil flash points. Materials with lower flash points would be expected to ignite more easily than those with higher flash points.

Following the Lac-Mégantic incident, the Canadian Transportation Safety Board analyzed samples of the crude oil aboard the derailed train and determined that the product had a flash point below -35 °C and an initial boiling point of between 43.9 and 48.5 °C, categorizing the oil into Packing Group II. The low flash point of the material likely explains why it ignited almost instantly after the train derailed.

Given this information, a Rail Safety Advisory Letter from the Canadian Transportation Safety Board (dated September 11, 2013) indicated the potential need to re-evaluate the use of Class 111 tank cars as a safe means to transport crude oils categorized in Packing Groups I and II. In addition, the Canadian Transportation Safety Board suggested that the Pipeline and Hazardous Material Safety Administration (PHMSA) re-evaluate the current procedures by which oil suppliers and transportation companies categorize crude oil.

5.1.3.2 Historical Rail Incidents Analysis

Analysis of historical rail incident data was done to evaluate potential releases associated with rail transport in the United States. Details in PHMSA incident reports (PHMSA 2012a), ton-miles reported by the Research and Innovative Technology Administration (RITA 2012), and barrels of transport reported by the Association of American Railroads (AAR 2012) were analyzed to show the distribution of historical spill volumes, incident causes, and frequencies of crude oil rail incidents contained in the PHMSA database. The results help provide insight into what could potentially occur with respect to spill volume, incident cause, and incident frequency for the No Action Alternative scenarios that involve rail transport. In addition, rail incident frequencies are compared to frequencies for other modes of transport, such as pipeline or marine transport, to provide insight when comparing alternatives.

The method used for this analysis was to filter the PHMSA hazardous material incident database (PHMSA 2012a) covering a fixed period of time by commodity type to obtain a subset of data specific to crude oil rail transport. The historical spill size distributions and incident cause distributions were then summarized for the time period covered: January 2002 through July 2012.

The PHMSA incident reports, ton-miles of transport reported by the Research and Innovative Technology Administration (RITA 2012), and total barrels of transport reported by the Association of American Railroads (AAR 2012) were analyzed to determine spill and incident frequencies for crude oil rail incidents contained in the PHMSA database.

Spill frequencies include frequencies for the number of reported spills as well as the volume spilled over the time period covered. The frequencies for volume and reported spills were calculated using two methods: dividing the volume released (in barrels) or number of reported spills by 1) the number of ton-miles transported, and 2) the total number of barrels transported.

Incident frequencies include frequencies for all reported incidents, injuries, and fatalities over the time period covered. Dividing the number of incidents by the number of ton-miles of transport provides an incident frequency for the mode of transport (incidents per ton-mile represent the number of incidents for every ton-mile of transport over a duration of 1 year).

Frequencies were also determined for pipeline and marine crude oil transport using the same methods as discussed above. Pipeline incident data were obtained through the PHMSA hazardous liquid incident database (PHMSA 2012b) and were used to analyze pipeline incidents for the time period covered. A detailed historic incident analysis for pipelines is included in Appendix K, Historic Pipeline Incident Analysis, and is not discussed further in this section. The PHMSA hazardous material incident database does not contain incidents related to bulk marine transport; therefore, the U.S. Coast Guard Marine Information for Safety and Law Enforcement incident database was used to evaluate marine incidents for tank ships and tank barges (U.S. Coast Guard [USCG] 2013). Total barrels transported for pipeline and marine were estimated based on barrels transported between Petroleum Administration for Defense District jurisdictions reported by the U.S. Energy Information Administration (EIA 2013).

An additional analysis was conducted to determine spill and incident frequencies for petroleum products transported by rail, pipeline, and marine for use as a comparison to crude oil frequencies. The same methodology and sources discussed above were used for this analysis.

Historical Incident Data

PHMSA collects data on hazardous material incidents transported by a variety of modes including but not limited to pipeline, water, and rail transport in the United States. This data can be used to provide insight into spill volume, incident cause, and incident frequency. PHMSA incident data for the period from January 2002 through July 2012 (10.58 years of data) were determined to be appropriate for use in this analysis because it was the only available database that contained raw data[24] that could be filtered to include only crude oil incidents (PHMSA 2012a). Not all 2002-2012 incident records are complete. Incident cause was unknown for one incident and 29 percent of incident records reported more than one incident cause, leaving the primary cause of these incidents open to subjective interpretation. All reported database incidents were counted, even if the information was incomplete or unspecified (*blank* or *Unknown*, *Miscellaneous*, and *Other*).

PHMSA collects information that is available to the general public on reportable rail incidents. Information collected for each incident includes the following:

- The date of each reportable incident;
- The type of hazardous liquid associated with the train involved in the incident;
- The volume of hazardous liquid spilled in the incident; and
- The cause of the incident.

The PHMSA hazardous material incident dataset (PHMSA 2012a), which includes incidents for all hazardous material transport, can be filtered to include only crude oil rail incidents. However, the PHMSA hazardous material rail incident data do not detail the type of crude oil involved with each incident, and so the historical incident summary cannot be specific to dilbit, synthetic crude oil, or Bakken crude oil, but rather could only be specific to crude oil in general.

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[24] Raw data are data that have not been processed; they must be analyzed and/or manipulated for any meaningful information or conclusions to be drawn from them.

Table 5.1-25 shows a summary of historic incidents for rail crude oil transport (PHMSA 2012a). Appendix K, Historical Pipeline Incident Analysis, shows that 79 percent of crude oil pipeline incidents resulted in a small spill (0 to 50 bbl), 17 percent in a medium spill (50 to 1,000 bbl), and 4 percent in a large spill (greater than 1,000 bbl). Rail spill volumes were analyzed using two methods for comparison to pipelines in the historic pipeline incident analysis: 1) determining the rail spill volumes that would result in the same percentages as the historic pipeline incident analysis for small, medium, and large pipeline spills (i.e., 79 percent, 17 percent, and 4 percent); and 2) using the same rail spill size distribution as the historic pipeline incident analysis (i.e., small, medium, and large) and determining the incident percentages for those spill volumes. The first method allows for an equal comparison of rail spill volume ranges to pipeline spill volume ranges for the same percentage of incidents. The results show that 79 percent of crude oil rail incidents resulted in spills less than 0.24 bbl (PHMSA 2012a) compared to 79 percent of pipeline incidents resulting in spills less than 50 bbl (Appendix K, Historical Pipeline Incident Analysis). The second method of spill distribution allows for a comparison of the percentage of crude oil rail spills to crude oil pipeline spills for the same spill size distribution. Results show that 97 percent of crude oil rail incidents fell in the small spills category (0 to 50 bbl), compared to 79 percent of crude oil pipeline incidents falling in the small spills category (Appendix K, Historical Pipeline Incident Analysis) (PHMSA 2012a).

Table 5.1-25 Historic Incident Summary, Crude Oil: Rail Transport and Reported Elements

Item	Value	Unit
January 2002–July 2012	10.58	Years of data
Total incidents	99	Reported incidents
Total releases	98	Reported incidents with a release
Railroad mileage	4,400,000,000	Ton-miles 2002-2009
Incident rate per ton-mile[a]	3.41E-09[c]	Reported incident per ton-mile
Spills per billion bbl transported[b]	330.9	Spills per billion bbl transported
Barrels released per billion bbl transported[b,d]	1088	Barrels released per billion bbl transported
Evacuations	2	Reported incidents with an evacuation
Total evacuated	36	People
Total time evacuated	31	Hours
Maximum incident volume reported	1,923	Barrels
Median incident volume reported	0.048	Barrels
Average incident volume reported	22.9	Barrels
0-50 barrels	97%	Percentage of incidents
50-1,000 barrels	2%	Percentage of incidents
> 1,000 barrels	1%	Percentage of incidents
0-0.24 barrels	79%	Percentage of incidents
0.24-40 barrels	17%	Percentage of incidents
40-1,923 barrels	4%	Percentage of incidents

Sources: PHMSA 2012a, RITA 2012, AAR 2012

[a] Incident rate is based on 2002 to 2009 incidents only. Railroad ton-miles were not available for 2010 to 2012.

[b] Spill rate and barrels released rate are based on 2003 through July 2012 incidents. Barrels transported was not available for 2002.

[c] Scientific notation 3.41E-09 = 0.00000000341

[d] To avoid bias in calculations of barrels released per billion barrels transported, a 2008 release of 1922.5 barrels of crude oil transported by rail was excluded in the total barrels released used for this calculation.

A summary of historic incidents resulting in an evacuation for rail and pipeline crude oil transport is shown below in Table 5.1-26. For rail, there were two evacuations occurring in 2008 with a total of 36 people evacuated between the two incidents (PHMSA 2012a). Both incidents were caused by a derailment leading to a fire. The Lac-Mégantic rail incident is not included in these results, as this incident occurred after the time period subject to the analysis. For pipelines, there were a total of 20 reported incidents leading to an evacuation with a total of 1,411 people evacuated between the 20 incidents from January 2002 to July 2012 (PHMSA 2012b). The largest number of people evacuated related to a pipeline incident was 500 people in 2003 due to third-party excavation damage to the body of a pipe. A comparison of the number of people evacuated for crude oil incidents and petroleum product incidents for both pipeline and rail transport is discussed further in Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Comparison of Rail, Pipeline, and Marine Spill and Incident Frequencies.*

Table 5.1-26 Evacuations Due to Crude Oil Spills by Year: Rail and Pipeline

Year	Number of People Evacuated Rail[a]	Number of People Evacuated Pipeline[b]
2002	0	38
2003	0	502
2004	0	8
2005	0	0
2006	0	8
2007	0	17
2008	36	263
2009	0	4
2010	0	531
2011	0	40
2012	0	0
2002–2012	**36**	**1,411**

Sources: PHMSA 2012a, PHMSA 2012b

[a] The Lac-Mégantic rail incident was omitted from this analysis, as it occurred in July 2013. This incident resulted in the evacuation of approximately 2,000 people.

Historic Rail Incident Cause Distribution

A summary of hazardous material rail incidents reported to PHMSA from January 2002 through July 2012 (PHMSA 2012a) and an incident cause breakdown for crude oil incidents is shown in Tables 5.1-27 and 5.1-28. For hazardous material rail incidents, there were 99 reported crude oil incidents out of a total of 7,914 hazardous material rail incidents reported in the PHMSA hazardous material database for the time period referenced.

Of the incidents contained in Table 5.1-27, 7,815 incidents were not related to crude oil and are not salient to this evaluation. The remaining 99 incidents involving crude oil were used and their causes are shown in Table 5.1-28.

Table 5.1-27 Summary of PHMSA Database and Incident Causes: Rail

Main Categories		**Subset**	
Description	**Number of Incidents**	**Description**	**Number of Incidents**
Hazardous Material Rail Incidents	7,914	Non-crude oil Rail incidents	7,815
		Crude oil Rail incidents	**99**

Source: PHMSA 2012a

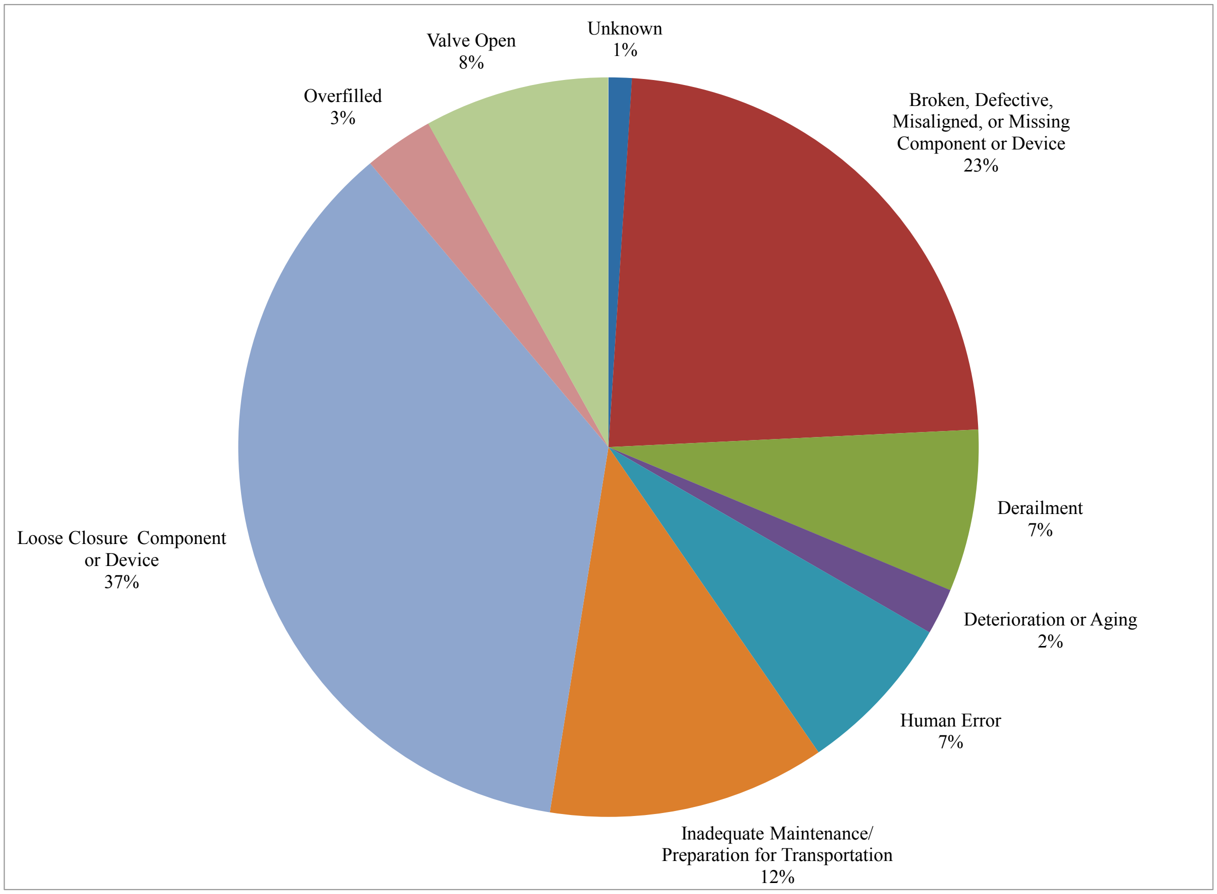
Note: **Bold** = Subsets of data used in this analysis

Table 5.1-28 Rail Incident Causes

Causes	**Valve**	**Other**	**Gasket**	**Liquid Valve**	**Manway or Dome Cover**
Unknown	0	1	0	0	0
Broken	6	2	4	3	8
Derailment	1	5	0	0	1
Deterioration	0	1	1	0	0
Fire, Temp or Heat	0	0	0	0	0
Human Error	0	3	0	0	4
Inadequate Maintenance	1	1	2	1	7
Loose	4	3	0	13	16
Overfilled	3	0	0	0	0
Over pressurized	0	0	0	0	0
Valve Open	1	1	0	6	0

Of these 99 crude oil incidents, more than 60 percent of rail incidents were caused by loose, broken, defective, misaligned, or missing components (e.g., manways, dome covers, valves). A total of 36 of the incidents involved a manway or dome cover, and 39 incidents were related to valves (e.g., liquid, auxiliary, vacuum relief, bottom outlet, or pressure relief valves).

Overall, 95 percent of incidents occurred during transit, 4 percent during loading or unloading, and 1 percent during in-transit storage (PHMSA 2012a). The two reported medium spills (50 to 1,000 bbl) were caused by a defective bottom outlet valve and a derailment. The largest reported rail spill was caused by a fire resulting from a derailment. An incident cause was not specified for one reported incident related to a leaking vent. Incident cause distribution for crude oil rail incidents reported between January 2002 and July 2012 is shown in Figure 5.1.3-1 below.



Source: PHMSA 2012a

Note: 99 incidents reported between January 2002 and July 2012

Figure 5.1.3-1 Historic Incident Cause, Crude Oil: Rail Transport, Reported Elements

Spill Size Distribution and Frequencies

Spill impacts were analyzed for spill volumes of 0-50 bbl, 50-1,000 bbl, and greater than 1,000 bbl for crude oil rail spills occurring between January 2002 and July 2012.[25] As shown in Table 5.1-25, small spills (0 to 50 bbl) accounted for 97 percent of crude oil rail spills with the majority of these incidents occurring during transit (PHMSA 2012a). A total of 96 small spills were reported for crude oil rail transport, 92 of which were less than 1 barrel. Of the two reported medium spills (50 to 1,000 bbl), one occurred during unloading and one occurred during transit. The only reported large spill (greater than 1,000 bbl) occurred during transit and resulted in a release of 1,923 bbl. Based on a review of spill size distribution and incident cause, incidents occurring during loading/unloading and derailments while in transit typically resulted in larger spill volumes than other incidents. Figure 5.1.3-2 shows a summary of the spill size distribution for rail crude oil incidents in the PHMSA incident database.

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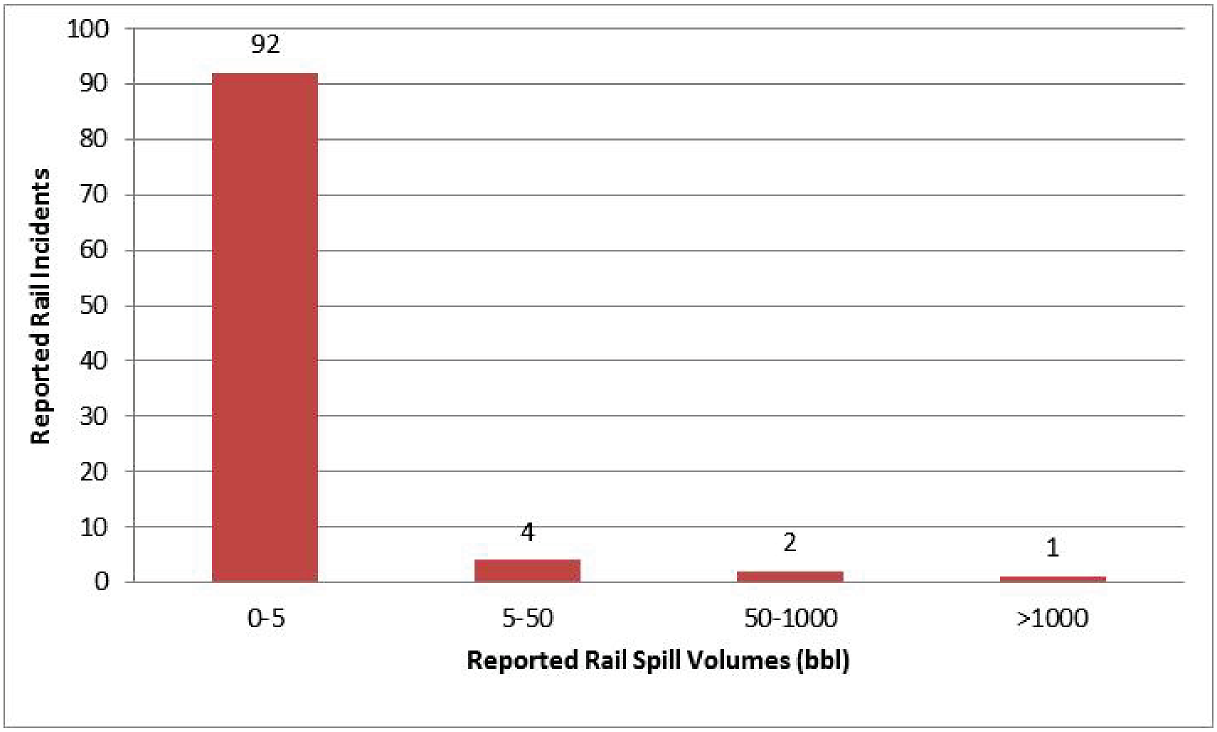
[25] Figure 5.1.3-2 is broken down into four levels of spill volume for comparison to the pipeline analysis included in Appendix K, Historical Pipeline Incident Analysis.



Source: PHMSA 2012a

Notes: Ninety-nine reported incidents between January 2002 and July 2012

Figure 5.1.3-2 Historic Incident Spill Volumes, Crude Oil Rail Transport

Spill frequencies include frequencies for the number of reported releases as well as the volume released over the time period covered. In general, spill frequencies were calculated by dividing the number of reported spills or barrels released by the total ton-miles or barrels transported. This represents the number of spills or volume spilled for every ton-mile or barrel of transport over a duration of 1 year. In general spill frequencies were calculated using two methods: 1) dividing the volume released (in barrels) or number of spills by the number of ton-miles transported; and 2) dividing the volume released (in barrels) or number of spills by the total barrels transported. Ton-miles were only reported for 2002-2009 (RITA 2012); therefore, spill frequencies for ton-miles of transport are calculated from 2002-2009 (ton-mile data after 2009 have not been published). Barrels of transport were derived from the number of crude oil carloads transported from 2003-2012 (AAR 2012). Spill frequencies for barrels transported are calculated based on 2002-2012 data. Spill frequencies and supporting data are summarized from January 2002 to July 2012 in Table 5.1-29. A comparison of spill frequencies for crude oil and petroleum transport via rail, pipeline, and marine is discussed further in Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Comparison of Rail, Pipeline, and Marine Spill and Incident Frequencies.*

Table 5.1-29 Estimated Crude Oil Transported by Rail and Spill Frequencies by Year

Year	Ton-miles Transported	Barrels Transported	No. of Spills	Barrels Released	Spills /Million Ton-miles	Spills /Million Barrels Transported	Barrels Released/Million Ton-miles	Barrels Released/ Million Barrels Transported
2002	500,000,000	N/A	1	0.02	0.0020	N/A	0.00005	N/A
2003	500,000,000	8,775,774	0	0	0.0000	0	0	0
2004	500,000,000	7,112,154	1	0.02	0.0020	0.14	0.00005	0.003
2005	400,000,000	4,306,848	2	35.81	0.0050	0.46	0.08952	8.315
2006	400,000,000	3,376,506	1	1.67	0.0025	0.30	0.00417	0.494
2007	400,000,000	4,221,168	1	0.01	0.0025	0.24	0.00003	0.003
2008	700,000,000	6,783,000	8	1,931.04	0.0114	1.18	2.75862	284.700
2009	1,000,000,000	7,739,760	1	0.01	0.0010	0.13	0.00001	0.002
2010	N/A	21,137,970	9	117.13	N/A	0.43	N/A	5.541
2011	N/A	46,946,214	32	93.55	N/A	0.68	N/A	1.993
2012	N/A	62,850,564	42	87.21	N/A	0.67	N/A	1.388
2003–2009	3,900,000,000	42,315,210	14	1,968.56	0.0036	0.33	0.50476	46.52[a]

Sources: PHMSA 2012a; RITA 2012; AAR 2012

[a] This value is statistically skewed due to a single spill event of 1,922.5 barrels. Discounting this single spill would result in a value of 1.09.

Notes:

- Spill frequencies per ton-mile are only reported for 2003 to 2009. Ton-mile data were not available for 2010 to 2012.
- Spill frequencies per barrels transported are reported for 2003 to 2012. Transport volume data were not available for 2002.
- Barrels of crude oil transported is calculated from reported AAR carloads of crude petroleum transported per year.

In summary, crude oil rail incidents reported in the PHMSA database show the following:

- Spills occurring while loading/unloading tend to result in larger spill volumes than spills occurring during transit, other than spills caused by derailment; and
- Loose closure components or devices and broken, defective, misaligned, or missing components or devices are the dominant causes for rail incidents.

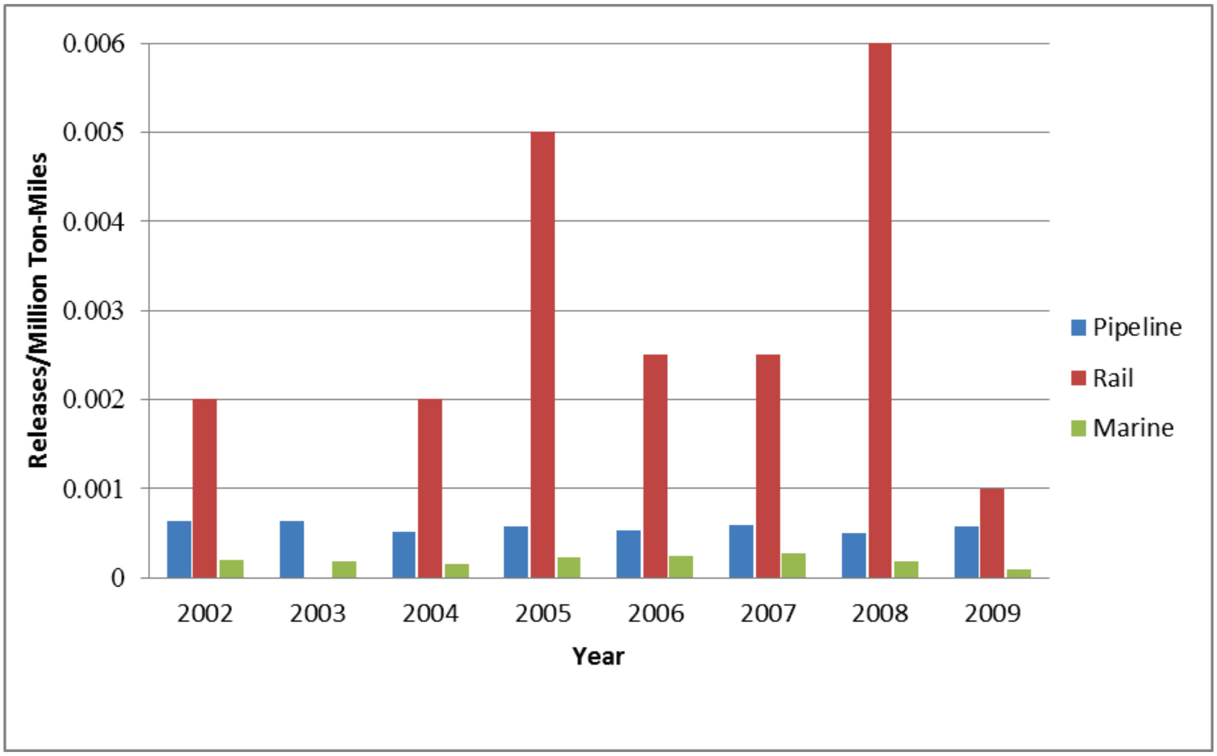
Additional data were collected for marine and pipeline incidents to assess spill and incident frequencies for other modes of transport considered in alternatives to the proposed Project. Pipeline incident data were obtained through the PHMSA hazardous liquid incident database and were used to analysis pipeline incidents occurring from January 2002 to July 2012 (PHMSA 2012b). The PHMSA hazardous material incident database does not contain incidents related to bulk marine transport; therefore, the U.S. Coast Guard Marine Information for Safety and Law Enforcement incident database for tank ships and tank barges was used to evaluate marine incidents for transport (USCG 2013). Total barrels transported for pipeline and marine were estimated based on barrels transport between Petroleum Administration for Defense District districts reported by the EIA (2013). Marine and pipeline incident data were analyzed and frequencies were calculated using the same methods as discussed for rail.

The information requirements for incident reporting to PHMSA have increased over the years. The January 2010 through July 2012 dataset contains more fields with regard to loss estimation and root causes, which results in a more detailed characterization of spills compared to the 2002 to 2010 dataset. Not all 2002 to 2012 incident records are complete and important data fields are often blank or null, ambiguous (indicated as *unknown* or *miscellaneous*), or incorrectly attributed, leaving the characterization of certain incidents undetermined or open to subjective interpretation. The RITA, AAR, and USCG databases document ton-mile transported, incidents, and commodity transported. In part, the information in these databases overlap but the definition used for the reporting fields might not be the same and requires cautious analysis when comparing the data. Additionally, reported ton-miles transported after 2009 are not available for this analysis, which has limited the timeframe to compare the incident rate between pipeline, rail, and marine modes to 2002 through 2009. Because of the timeframe restriction, recent incidents such as the Mayflower, Arkansas, pipeline spill; Lac- Mégantic rail spill and fire; Vicksburg, Mississippi, barge spill; and Tioga, North Dakota, pipeline spill are not recorded in the dataset used here.

Incident data were analyzed for both crude oil and petroleum products transported by rail, pipeline, and marine using the sources listed above. This analysis was conducted to compare crude oil and petroleum spill and incident frequencies for different modes of transport and is intended to provide insight into what could potentially occur with respect to spill and incident frequency for alternative modes of transport. Although the product to be transported by the proposed Project is crude oil, incidents for petroleum products were also analyzed to provide a comparison to a larger dataset and a higher volume transported.

Comparing the spills frequencies shown in Figures 5.1.3-3, 5.1.3-5, and 5.1.3-7 for crude oil and Figures 5.1.3-4, 5.1.3-6, and 5.1.3-8 for petroleum products, the following observations can be made:

- Overall, pipeline transport has the highest number of barrels released per ton-mile (Figures 5.1.3-5 and 5.1.3-6) and barrels released per barrels transported (Figures 5.1.3-7 and 5.1.3-8) for both crude oil and petroleum products.
- Overall, rail transport has the highest number of reported releases per ton-mile than marine or pipeline transport for both crude oil and petroleum products (Figures 5.1.3-3 and 5.1.3-4) and the highest number of releases per barrel transported.
- Marine transport has a higher number of releases per ton-mile for petroleum products than it does for crude oil only, while pipeline transport has little change in frequency between the two commodities (Figures 5.1.3-3 and 5.1.3-4).



Note: The vertical axis (releases per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2008 rail value (0.0114 barrels released per million ton-miles).

Figure 5.1.3-3 Number of Releases per Million Ton-Miles Transported, Crude Oil: Pipeline, Rail, and Marine

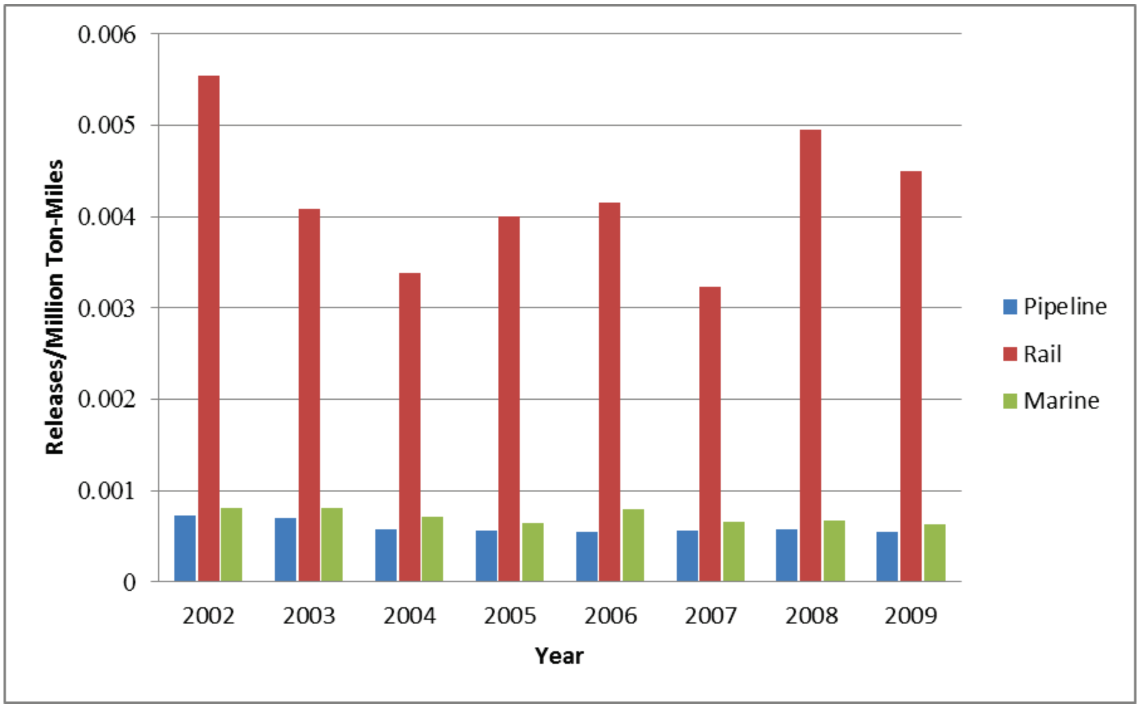
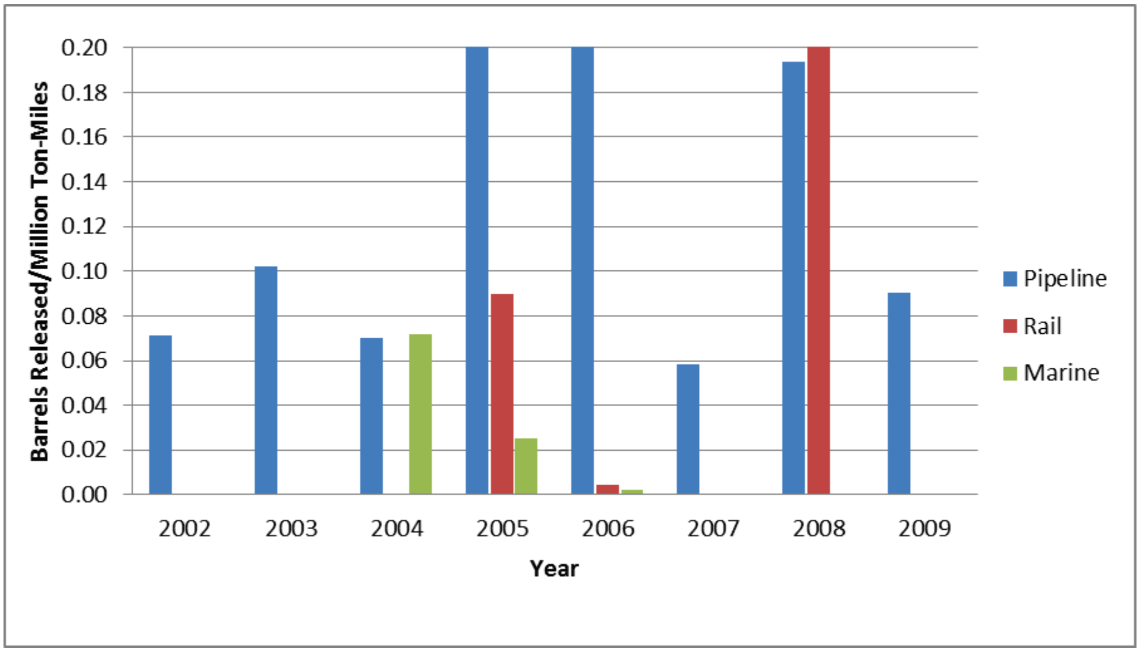
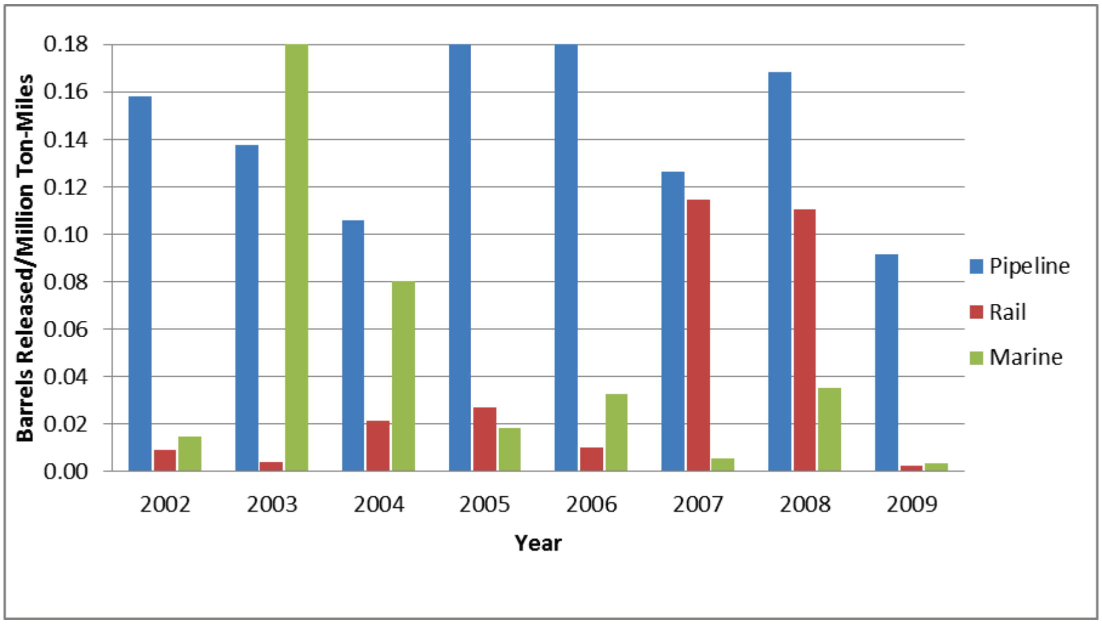


Figure 5.1.3-4 Number of Releases per Million Ton-Miles Transported, Petroleum: Pipeline, Rail, and Marine



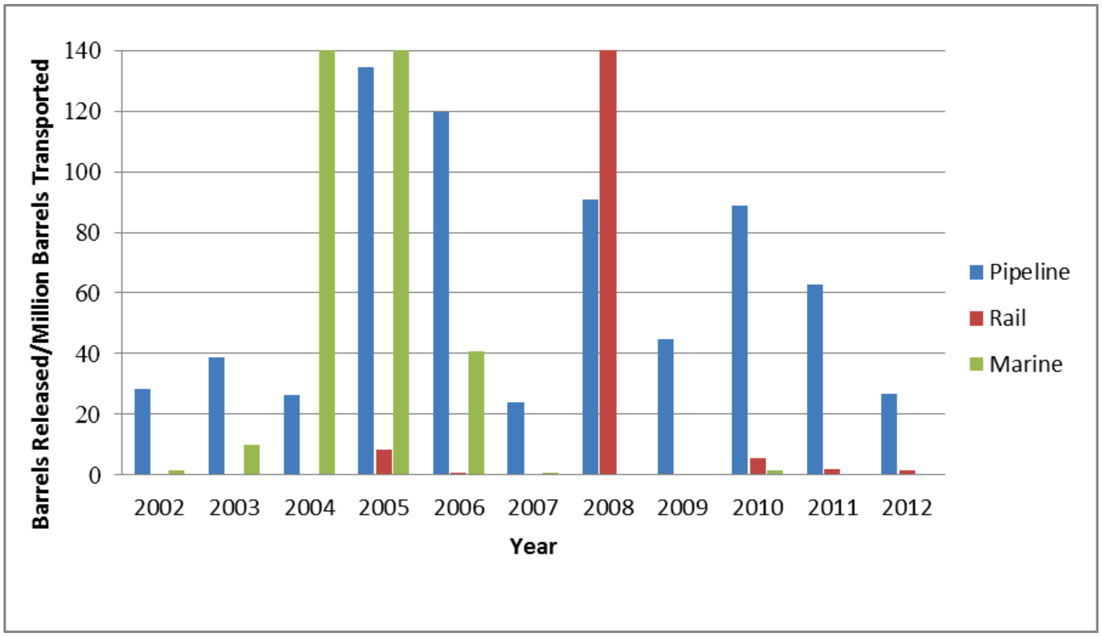
Note: The vertical axis (barrels released per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2008 rail value (2.75 barrels released per million ton-miles).

Figure 5.1.3-5 Number of Barrels Released per Million Ton-Miles Transported, Crude Oil: Pipeline, Rail, and Marine



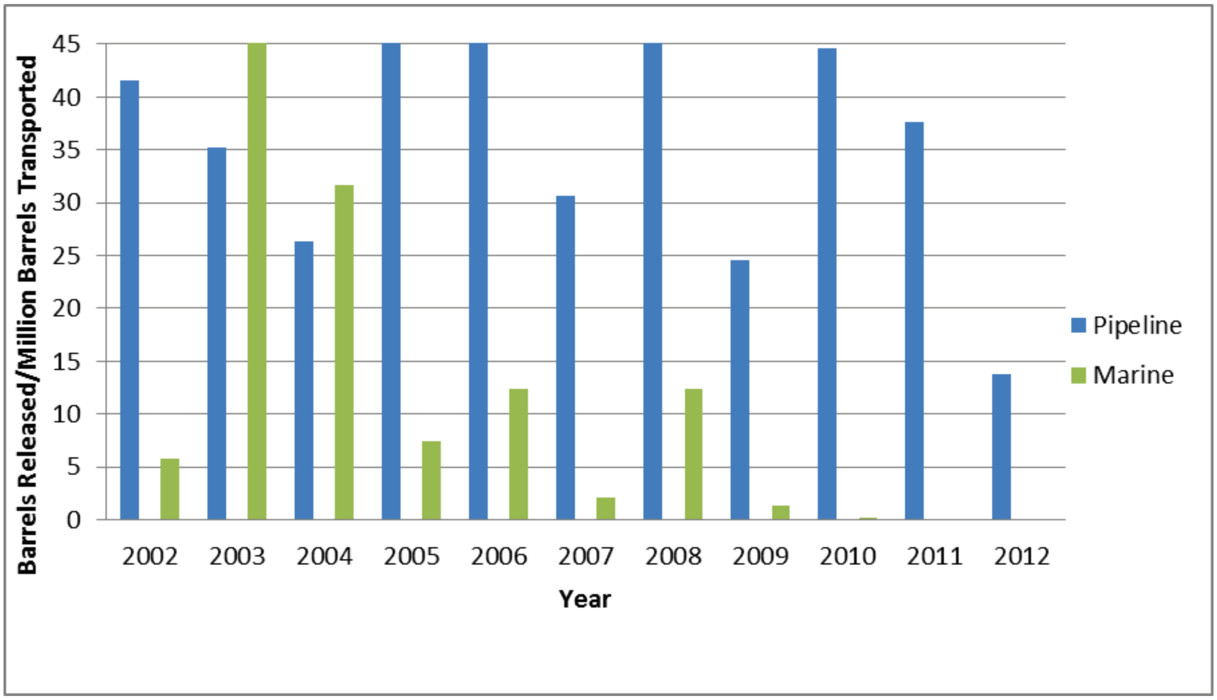
Notes: The vertical axis (barrels released per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2005 pipeline value (0.22 barrels released per million ton-miles).

Figure 5.1.3-6 Number of Barrels Released per Million Ton-Miles Transported, Petroleum: Pipeline, Rail, and Marine



Notes: The vertical axis (barrels released per million barrels transported) was adjusted to show the lower reported values. The highest reported value is the 2004 Marine value (1,088.21 barrels releases per million barrels transported). The rail 2002 barrels transported data are not available.

Figure 5.1.3-7 Number of Barrels Released per Million Barrels Transported, Crude Oil: Pipeline, Rail, and Marine



Notes: The vertical axis (barrels released per million barrels transported) was adjusted to show the lower reported values. The highest reported value is the 2003 marine value (80.1 barrels released per million barrels transported). The rail total barrels transported data are not available for all petroleum products.

Figure 5.1.3-8 Number of Barrels Released per Million Barrels Transported, Petroleum: Pipeline and Marine

In addition to spill frequencies, incident frequencies were compared across all transport modes (rail, pipeline, and marine). Incident frequencies are shown in Figure 5.1.3-9 for crude oil and Figure 5.1.3-10 for petroleum products. Comparing the number of incidents per ton-miles reported between 2002 and 2009, rail transport had the highest incident frequency for both crude oil and petroleum products of all modes of transport. Pipelines have a higher incident frequency than marine for crude oil, while marine has a higher incident frequency than pipelines for petroleum products.

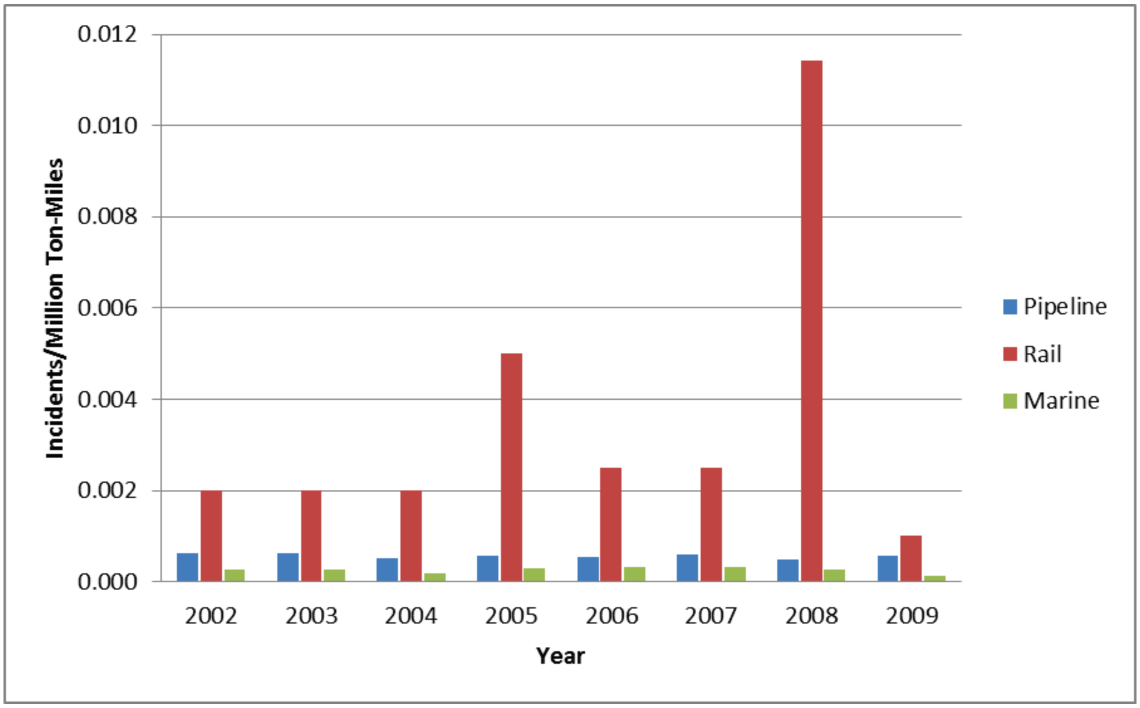


Figure 5.1.3-9 Number of Incidents per Million Ton-Miles Transported, Crude Oil: Pipeline, Rail, and Marine

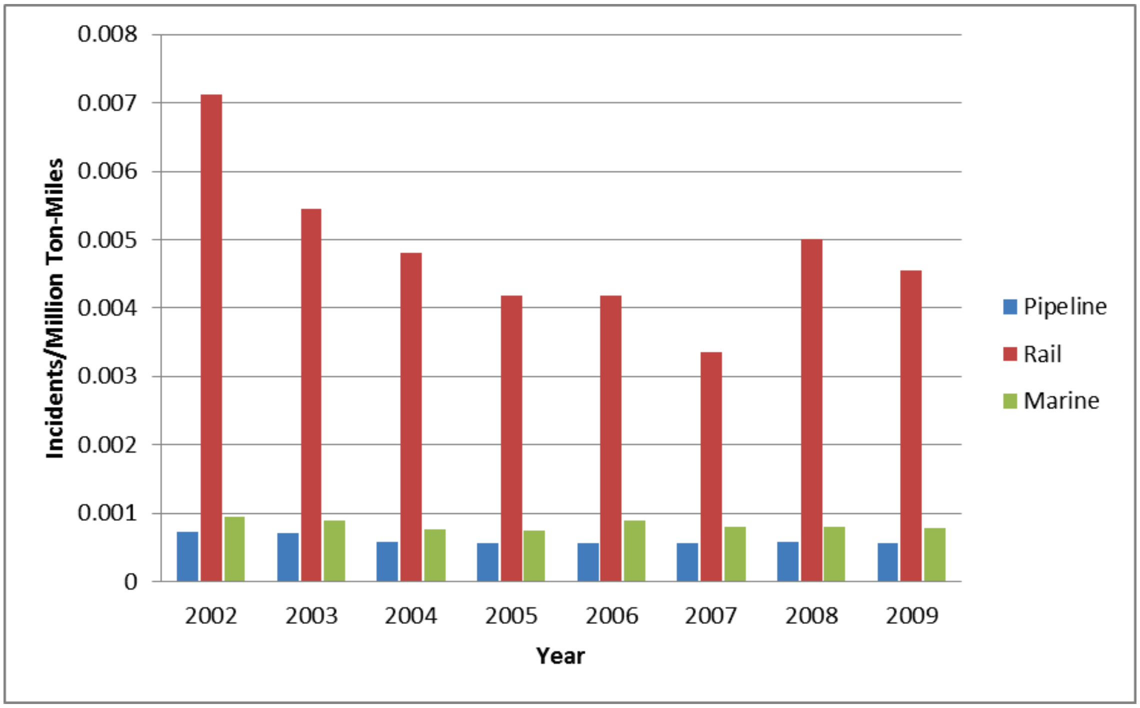
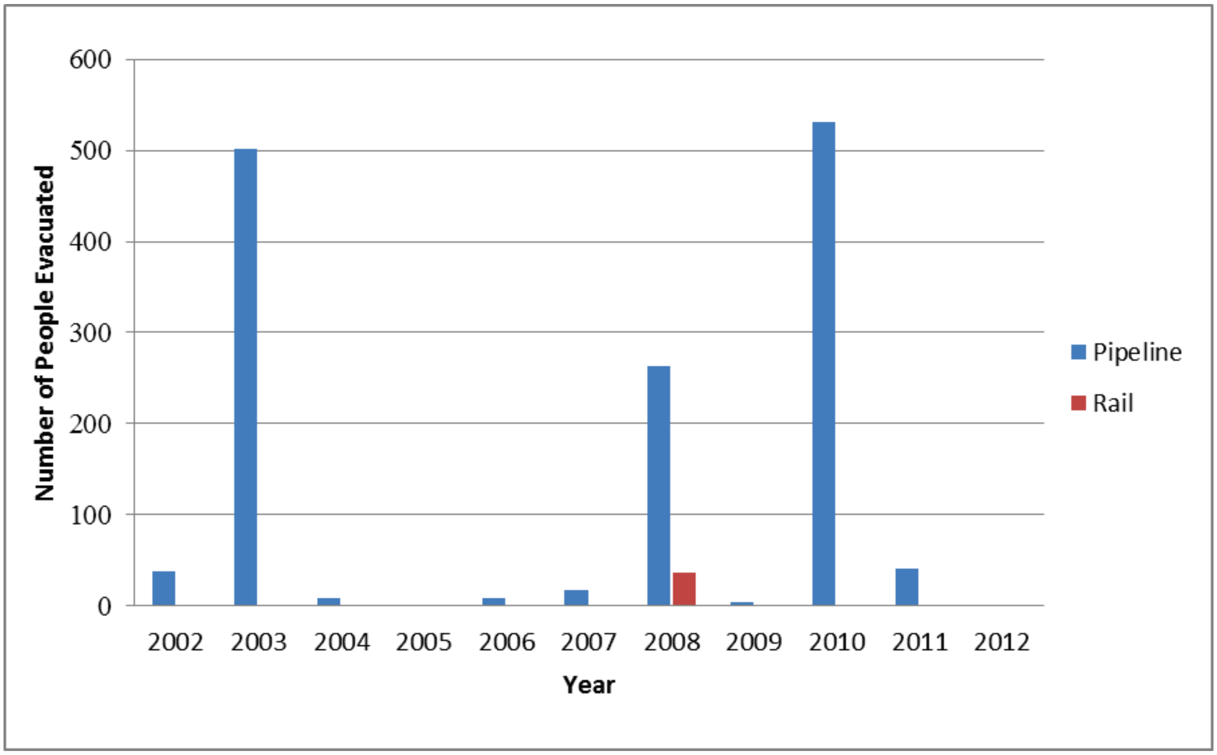


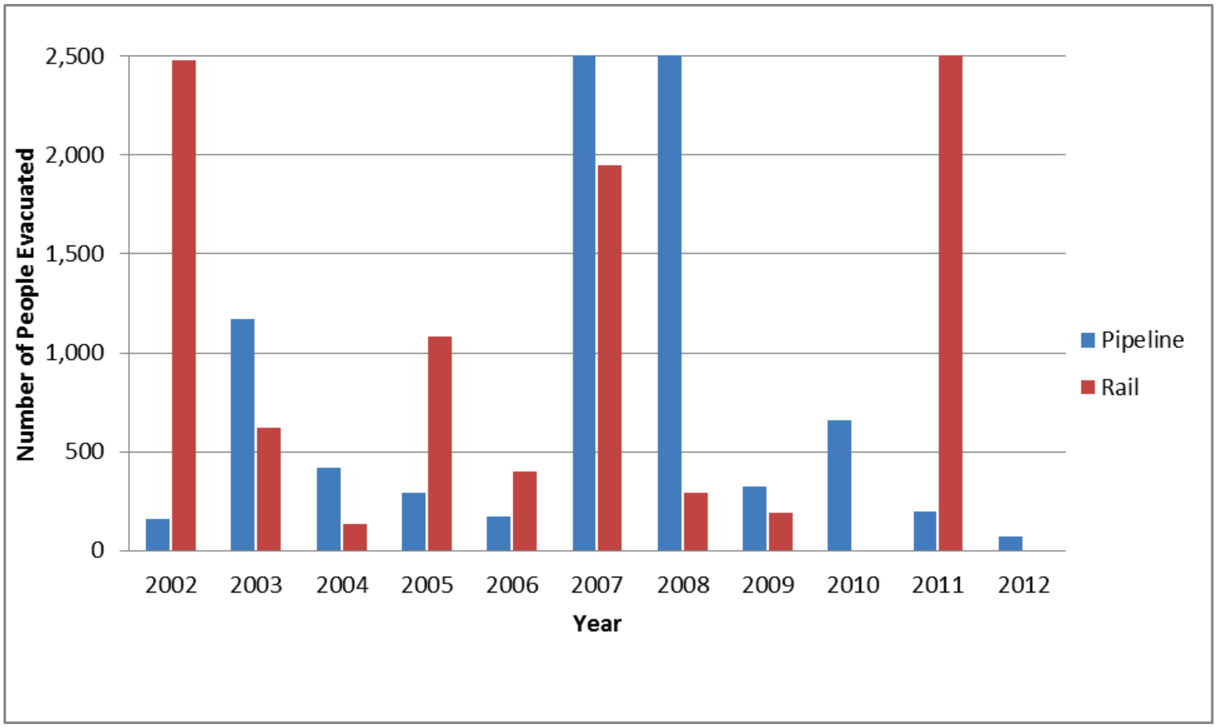
Figure 5.1.3-10 Number of Incidents per Million Ton-Miles Transported, Petroleum: Pipeline, Rail, and Marine

The total number of people evacuated due to an incident for rail, pipeline, and marine crude oil and petroleum transport is shown in Figures 5.1.3-11 and 5.1.3-12, respectively. For crude oil incidents, pipelines have a higher number of people evacuated between 2002 and 2012. A different result is found for petroleum products transported, showing rail to have a higher number of people evacuated over the same time frame. As indicated, this analysis does not include the Mayflower, Arkansas, pipeline spill; Lac- Mégantic rail spill and fire; Vicksburg, Mississippi, barge spill; and Tioga, North Dakota, pipeline spill, which occurred in 2013.



Note: Marine evacuation data are not available.

Figure 5.1.3-11 Number of People Evacuated, Crude Oil: Pipeline and Rail

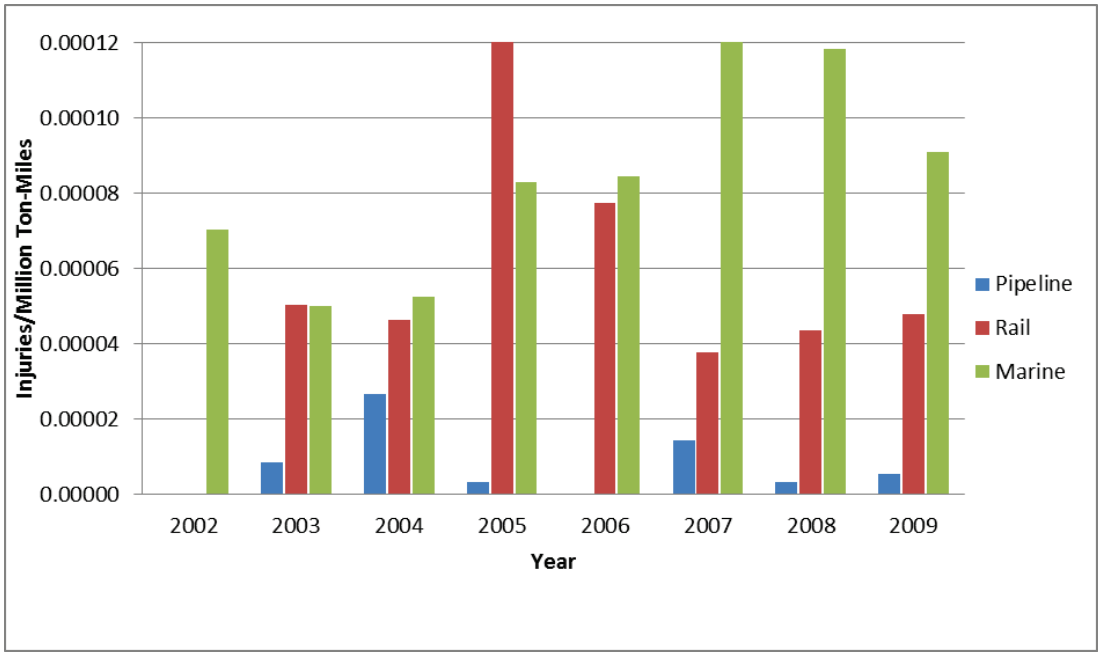


Notes: Marine evacuation data are not available. The vertical axis (number of people evacuated) was adjusted to show the lower reported values. The highest reported value is the 2011 rail value (10,030 people evacuated).

Figure 5.1.3-12 Number of People Evacuated, Petroleum: Pipeline and Rail

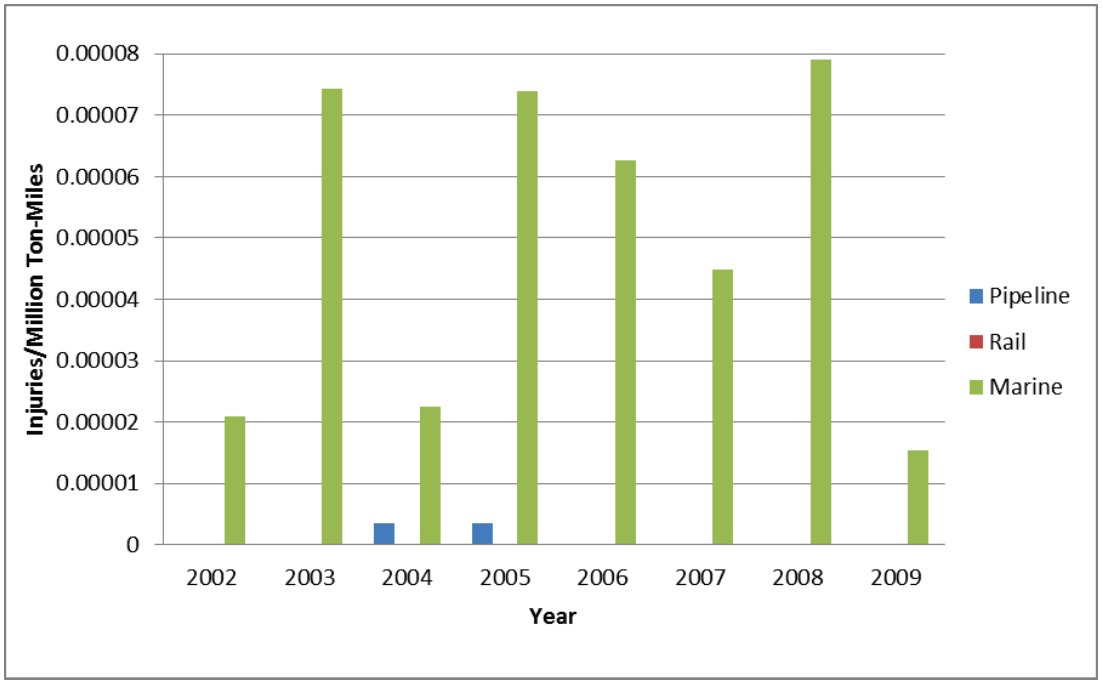
Figures 5.1.3-13 through 5.1.3-16 show the number of injuries and fatalities for both crude oil and petroleum products per ton-mile transported by marine, rail, and pipeline. In every year analyzed, marine injury frequencies were the highest of the different modes of transport, with the exception of petroleum products transported by rail in 2003 (Figure 5.1.3-13). Also, in every year analyzed, marine fatality frequencies were the highest of the different modes of transport, with the exception of crude oil pipeline transport in 2007 (see Figure 5.1.3-15) and petroleum products transported by rail in 2005 (Figure 5.1.3-16).

Since there were very few to no reported injuries and fatalities for pipeline and rail transport between 2002 and 2009, an additional analysis was conducted based on a larger dataset to evaluate these frequencies. This analysis was conducted for all Class I rail incidents reported by the Federal Rail Administration (FRA 2012) and liquid petroleum incidents reported by PHMSA (PHMSA 2012b). Further details of this analysis are included in Section 5.1.3.2, Historical Rail Incidents Analysis, subsection entitled *Injury and Fatality Incident Review*.



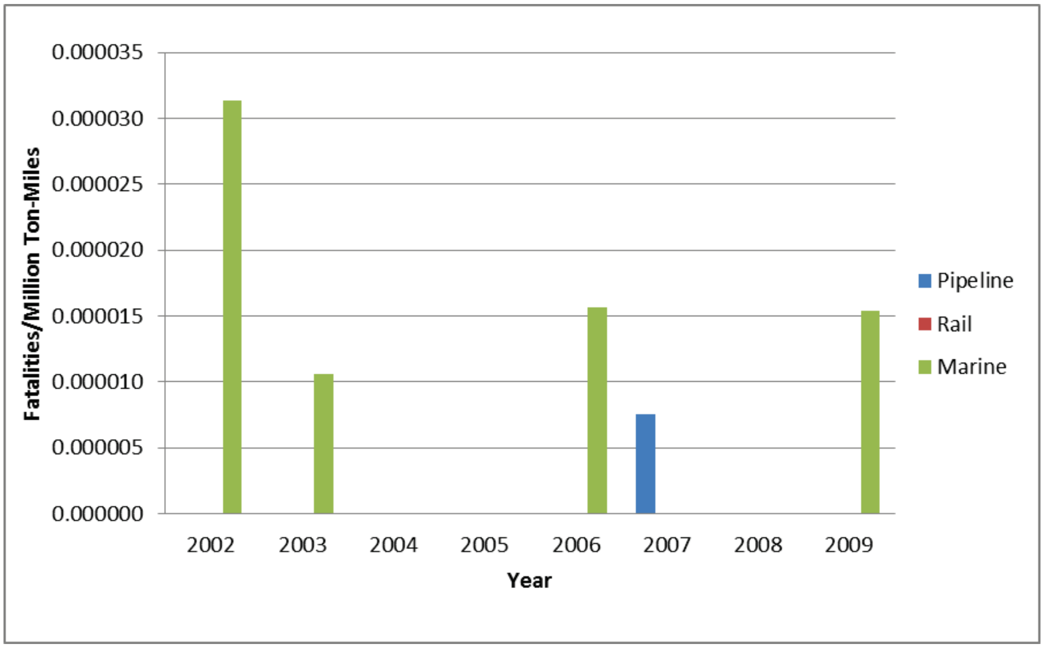
Notes: The vertical axis (injuries per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2005 rail value (0.0009 injuries per million ton-miles).

Figure 5.1.3-13 Number of Injuries per Million Ton-Miles Transported, Petroleum: Pipeline, Rail, and Marine



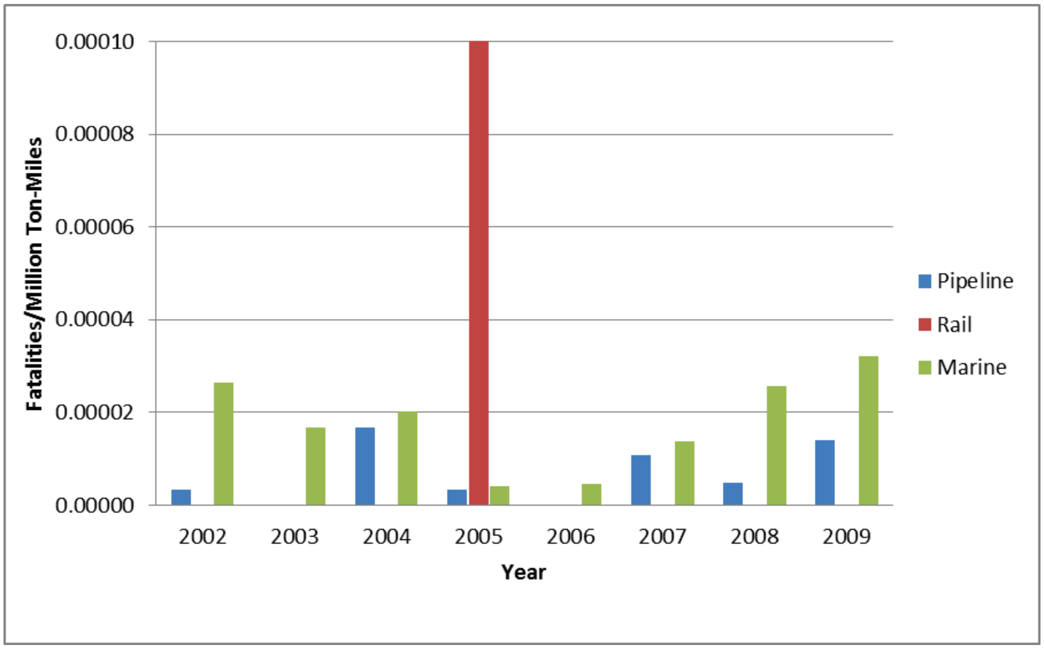
Note: No reported injuries for rail crude oil transport from 2002-2009

Figure 5.1.3-14 Number of Injuries per Million Ton-Miles Transported, Crude Oil: Pipeline, Rail, and Marine



Note: No reported fatalities for rail crude oil transport from 2002-2009

Figure 5.1.3-15 Number of Fatalities per Million Ton-Miles Transported: Crude Oil: Pipeline, Rail, and Marine



Notes: The vertical axis (fatalities per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2005 rail value (0.0003 fatalities per million ton-miles).

Figure 5.1.3-16 Number of Fatalities per Million Ton-Miles Transported: Petroleum Pipeline, Rail, and Marine

Injury and Fatality Incident Review

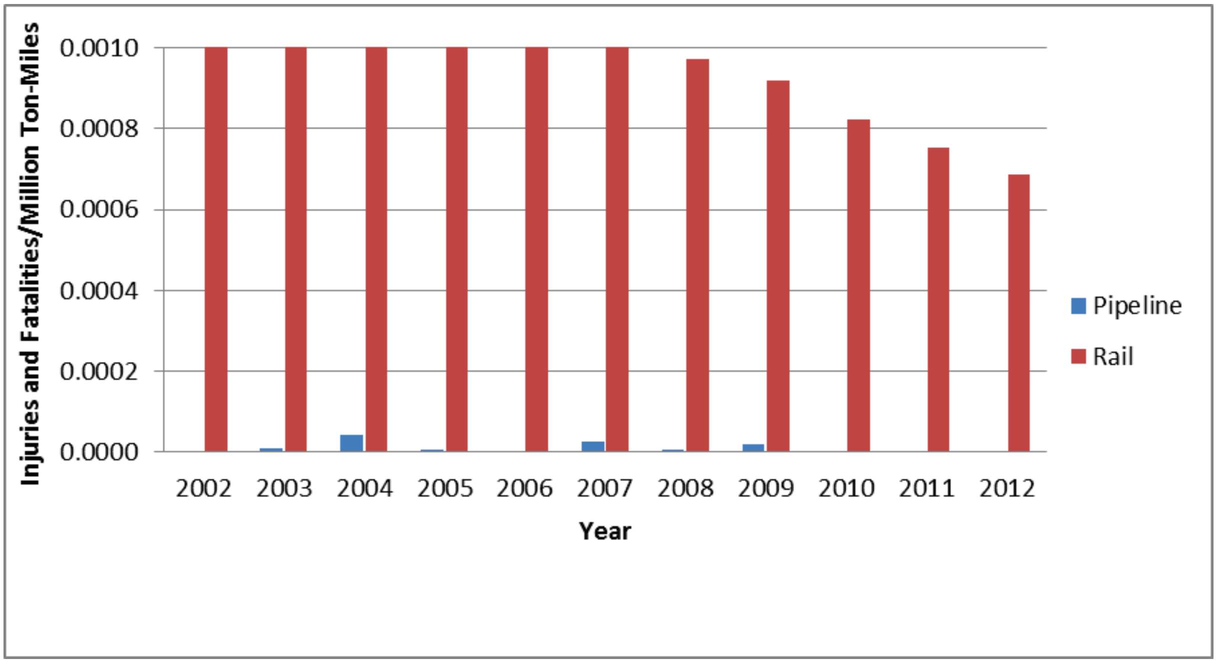
Historical incident data within the Federal Railroad Administration (FRA) incident database and PHMSA incident database were analyzed to show the distribution of historic injuries and fatalities for all materials transported by Class I railroads and all hazardous liquid transport, respectively. This analysis was done to understand what has previously occurred with respect to pipelines and freight rail transport, regardless of materials transported, within the United States. Although spills may have occurred as a result of these incidents, this analysis was not focused on spill related incidents.

The FRA groups rail incidents into three categories, each of which has its own reporting requirements: 1) highway-rail grade crossing incidents; 2) rail equipment incidents; and 3) deaths, injuries, and occupational illnesses. A total of 30,881 incidents, 16,946 injuries, and 2,228 fatalities were reported for all materials transported by Class I railroads between 2002 and 2012 (FRA 2012). The FRA defines a highway-rail incident as any impact between a rail and a highway user at a crossing site, regardless of severity. These incidents include motor vehicles and other highway/roadway/sidewalk users at both public and private crossings. A total of 7,946 highway-rail incidents were reported from 2002-2012. Of all reported Class I railroad incidents, 41 percent of fatalities and 16 percent of injuries were the result of a highway-rail crossing incident. A rail equipment incident is defined by the FRA as an event involving on-track rail equipment that results in monetary damage to the equipment and track above a certain threshold. Although 8,452 incidents were reported between 2002 and 2012 for rail equipment incidents, only 1 percent of fatalities and 4 percent of injuries for all reported rail incidents were the result of rail equipment incidents (FRA 2012). Incidents that did not fall into rail equipment incidents or highway-rail incidents are grouped into *other accidents/incidents* category by the FRA, which includes any event that resulted in a fatality, an injury, or an occupational illness. The majority of reported rail incidents fall into this category with 58 percent of fatalities and 81 percent of injuries for all rail incidents not related to rail equipment or highway-rail crossing. Trespassers account for 94 percent of fatalities reported in this category. Overall, rail incidents, injuries, and fatalities significantly dropped in 2004 and have continued to steadily decrease over time (FRA 2012).

PHMSA's Office of Pipeline Safety collects a variety of information from the pipeline operators under its jurisdiction in accordance with pipeline safety regulations. PHMSA maintains an incident database for the transport of hazardous liquids by pipeline. The hazardous liquid pipeline database was filtered to include only onshore petroleum pipeline incidents occurring between 2002 and 2012. A total of 3,699 incidents, 46 injuries, and 19 fatalities were reported for all hazardous liquids transported by pipeline between 2002 and 2012 (PHMSA 2012b). Of the reported injuries, 69.6 percent were related to incidents occurring along the pipeline, including valve sites, 28.3 percent were related to pump/metering stations and terminal tank farms, and 2.2 percent were related to onshore equipment and piping associated with belowground storage. The majority of reported hazardous liquid pipeline fatalities involved incidents occurring at pipeline and value sites, and at pumping/metering stations and terminal tank farms.

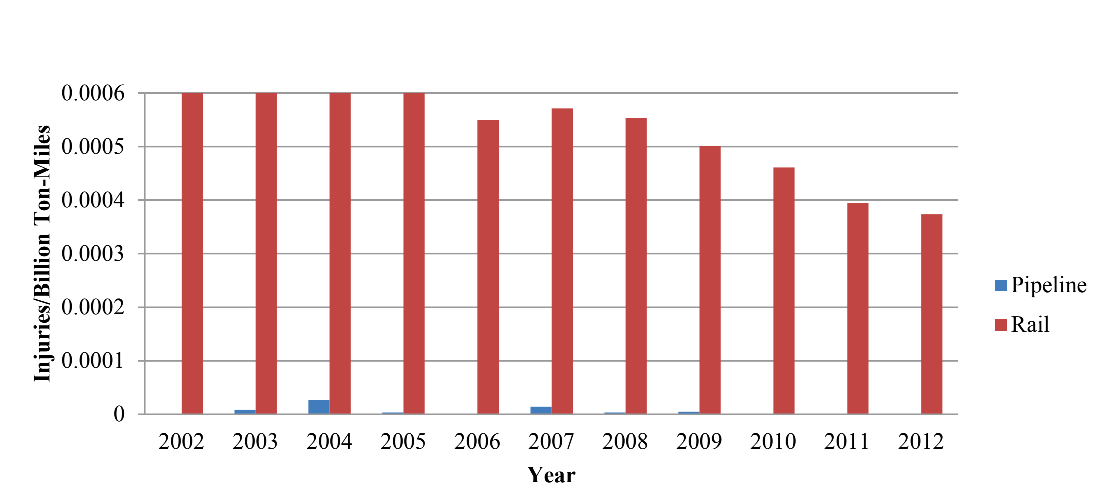
RITA (2012) provides an overview of ton-miles of freight by mode of transport from 1960 to 2010, including Class I rail and petroleum pipelines. Additionally, AAR annually publishes Class I railroad statistics, which included reported ton-miles (AAR 2012).

Petroleum pipelines account for 64,114 miles of the 182,618 miles of hazardous liquid pipeline reported in 2011 (PHMSA 2011). Based on this statistic, petroleum transport ton-miles are expected to be lower than all hazardous liquid ton-miles transport. These transportation statistics were used to assess injury and fatality frequencies for rail and pipeline transport that are summarized in Figures 5.1.3-17, 5.1.3-18, and 5.1.3-19. Frequencies were calculated for the number of injuries and fatalities using petroleum product incidents obtained from the hazardous liquid pipeline database (PHMSA 2012b) and reported petroleum pipeline ton-miles (RITA 2012).



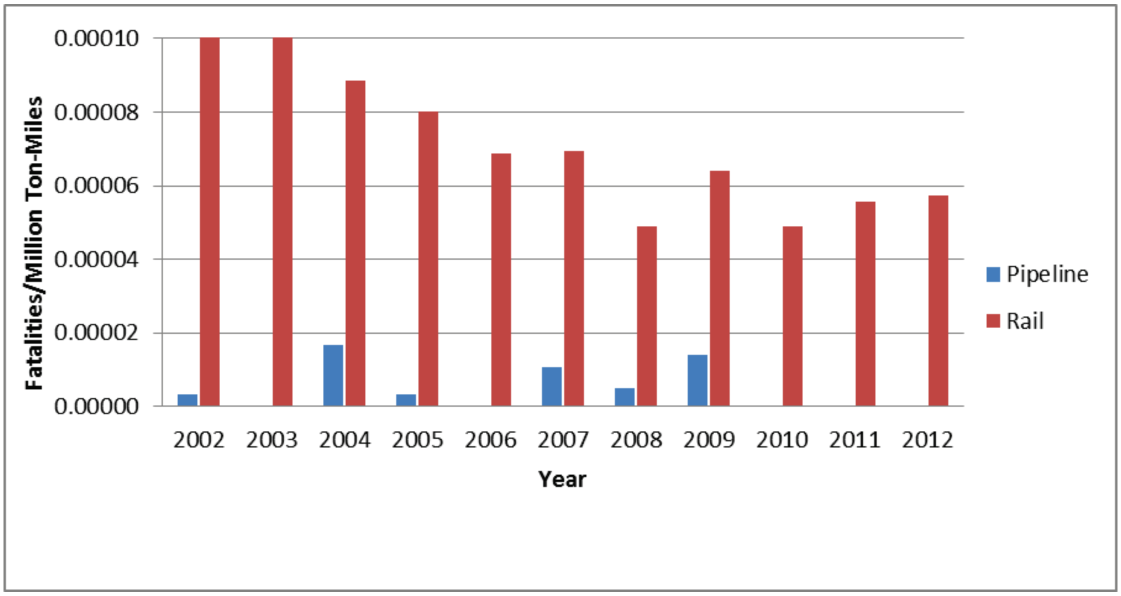
Notes: The vertical axis (injuries and fatalities per million ton-miles) was adjusted to show the lower reported values. The highest report value is the 2002 rail value (0.005367 injuries and fatalities per million ton-miles). Pipeline ton-miles are for all petroleum products. Frequencies for pipelines are reported based on available data from 2002-2009.

Figure 5.1.3-17 Number of Injuries and Fatalities per Million Ton-Miles Transported: Petroleum Pipeline and Class I Rail



Notes: The vertical axis (injuries per million ton-miles) was adjusted to show the lower reported values. The highest report value is the 2002 rail value (0.00293 injuries per million ton-miles). Pipeline ton-miles are for all petroleum products. Frequencies for pipelines are reported based on available data from 2002-2009.

Figure 5.1.3-18 Number of Injuries per Million Ton-Miles Transported: Petroleum Pipeline and Class I Rail

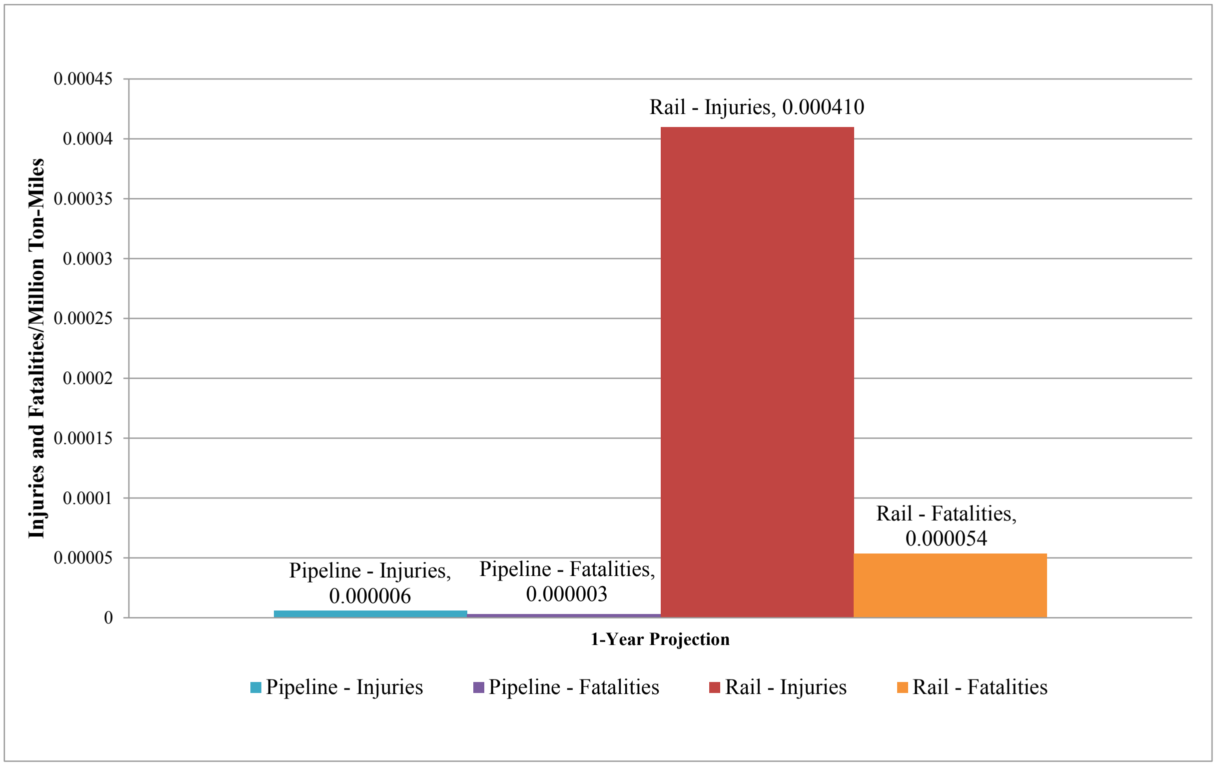


Notes: The vertical axis (fatalities per million ton-miles) was adjusted to show the lower reported values. The highest report value is the 2002 rail (0.00042 fatalities per million ton-miles). Pipeline ton-miles are for all petroleum products. Frequencies for pipelines are reported based on available data from 2002-2009.

Figure 5.1.3-19 Fatalities per Million Ton-miles Transported: Petroleum Pipeline and Class I Rail

Injury and fatality frequencies were projected to evaluate the effect of an increase in crude oil transport volume due to the proposed Project. Transport ton-miles were estimated for the proposed Project route and the rail alternative route from Lloydminster, Saskatchewan, and Epping, North Dakota, to Port Arthur, Texas, based on a transport volume of 830,000 bpd. Incident data from 2010 to 2012 were used and mileage was based on the routing of each alternative. Injuries and fatalities were estimated based on average injury and fatality frequencies and the ton-miles of transport for each mode.

Annual baseline injuries and fatalities without an increase in transport volume from rail transport or pipeline are projected to be approximately 712 injuries and 94 fatalities compared to three injuries and two fatalities for petroleum pipeline. Using the frequency rates based on these incidents (Figure 5.1.3-20) and adding an annualized 830,000 bpd from the proposed Project to the yearly transport volume indicates a potential additional 49 injuries and six fatalities for rail alternative compared to one additional injury and no additional fatality for the proposed Project on a yearly basis.



Note: Incidents reported from 2009 to 2012 are based on PHMSA and FRA incident databases.

Figure 5.1.3-20 Projection of One Year of Injuries and Fatalities: Pipeline and Rail

Pipeline and Hazardous Material Safety Administration Reporting

PHMSA currently has six National Transportation Safety Board rail recommendations that are under review. The recommendations augment existing rail legislation and work with the FRA and the National Transportation Safety Board to cover the following topics:

- Immediate notification to emergency responders (R-07-4);
- Enhanced protection of USDOT tank cars in ethanol and crude oil services (R-12-5);
- Bottom outlet valve closure (R-12-6);
- Adoption of AAR center sill or draft sill attachment designs (R-12-7);
- Optimum separation requirements between locomotives and hazardous material cars (R-07-4); and
- Loading and unloading of hazardous materials (R-04-10).

PHSMA, in coordination with FRA and the Transportation Security Administration has revised requirements for hazardous materials regulations and secure transportation of those materials in commerce by rail. The April 2008 Interim final rule on *Hazardous Materials: Enhancing Rail Transportation Safety and Security for Hazardous Materials Shipments; Railroad Safety Enforcement Procedures; Interim Final Rule and Proposed Rule* sets forth requirements for all rail carriers to compile annual data on certain shipments to analyze safety and security risks along rail routes (49 Code of Federal Regulations [CFR] Parts 172 and 174).

Federal Railroad Administration

The FRA is part of the USDOT and the FRA's Office of Railroad Safety advocates and regulates safety throughout the industry. In 2008, the Rail Safety Improvement Act was enacted to govern different aspects related to railroad safety (e.g., labor requirements for railroad workers, positive train control implementation, standards for track inspections, certification of locomotive conductors, and safety at highway-rail grade crossings).

Reporting requirements for railroad incidents are included in major statutory authorities identified in 49 CFR Part 225: the Accident Reports Act of 1910 and the Federal Railroad Safety Act of 1970. Also included in 49 CFR Part 225 are the amendments to the Accident Reports Act, within the *Miscellaneous Amendments to the Federal Railroad Administration's Accident/ Incident Reporting Requirements; Final Rule*. (FRA 2010) This rule became effective June 1, 2011, and supplemental information is provided in the *FRA Guide* and the *Companion Guide* (FRA 2011). This final rule amends reporting requirements previously included in the 1910 and 1960 Accident Reports Act and Amendments, which sets forth monthly incident reporting requirements. The final rule continues to require each railroad carrier provide monthly reports to FRA, irrespective of whether any incidents occurred.

The final rule describes the incident telephonic reporting requirements to the National Response Center, as related to fatalities that occur at highway-rail grade crossings as a result of train incidents. Telephonic reporting to the National Response Center is required for highway-rail grade crossing fatalities if 1) a death occurs within 24 hours of the incident; or 2) an incident results in damage of $150,000 or more to railroad and non-railroad property.

According to CFR 225.11, railroad incidents are divided into three groups, each of which has its own reporting requirements for filing with FRA: 1) highway-rail grade crossing incidents; 2) rail equipment incidents; and 3) deaths, injuries and occupational illnesses. There is an electronic reporting system in place and the reporting requirements generally follow guidelines set forth by Occupational Safety and Health Administration incident reporting requirements.

Additional Pipeline vs. Rail Reporting Requirements

The reporting requirements for pipelines and rail were evaluated to assess if there would be a change in the volume of agency-related reporting for the proposed Project and the rail alternative. Based on the projected frequency shown in Figure 5.1.3-20, the proposed Project could result in one additional injury/fatality incident or the rail alternative could result in an additional 55 incidents. The reporting criteria by PHMSA and FRA indicate these additional incidents could translate to one additional report to PHMSA or an additional 68 reports to FRA annually.

Fire and Explosion Incident Review

A summary of PHMSA historic incidents resulting in a fire or explosion for rail and pipeline crude oil transport is shown below in Table 5.1-30. For rail, there were two reported incidents resulting in fires in 2008 and no reported explosions from January 2002 to July 2012 (PHMSA 2012a). The two rail fire incidents were caused by a train derailment and resulted in the evacuation of 36 people combined for the two incidents. One of these incidents resulted in a spill greater than 1,000 bbl. These data do not include the Lac-Mégantic rail incident, which occurred in July 2013.

Table 5.1-30 Fires and Explosions Due to Crude Oil Spills by Year: Rail and Pipeline

	Crude Oil Incidents				Petroleum Incidents			
	Number of Fires		Number of Explosions		Number of Fires		Number of Explosions	
Year	Rail	Pipeline	Rail	Pipeline	Rail	Pipeline	Rail	Pipeline
2002	0	2	0	1	0	6	0	2
2003	0	0	0	0	0	6	0	3
2004	0	3	0	1	0	12	0	4
2005	0	1	0	1	1	10	1	3
2006	0	0	0	0	1	8	0	2
2007	0	3	0	0	2	11	1	2
2008	2	0	0	0	4	3	0	3
2009	0	2	0	0	0	6	0	3
2010	0	1	0	0	0	7	0	1
2011	0	4	0	1	1	10	0	3
2012	0	1	0	0	0	2	0	0
2002–2012	**2**	**17**	**0**	**4**	**9**	81	**2**	26

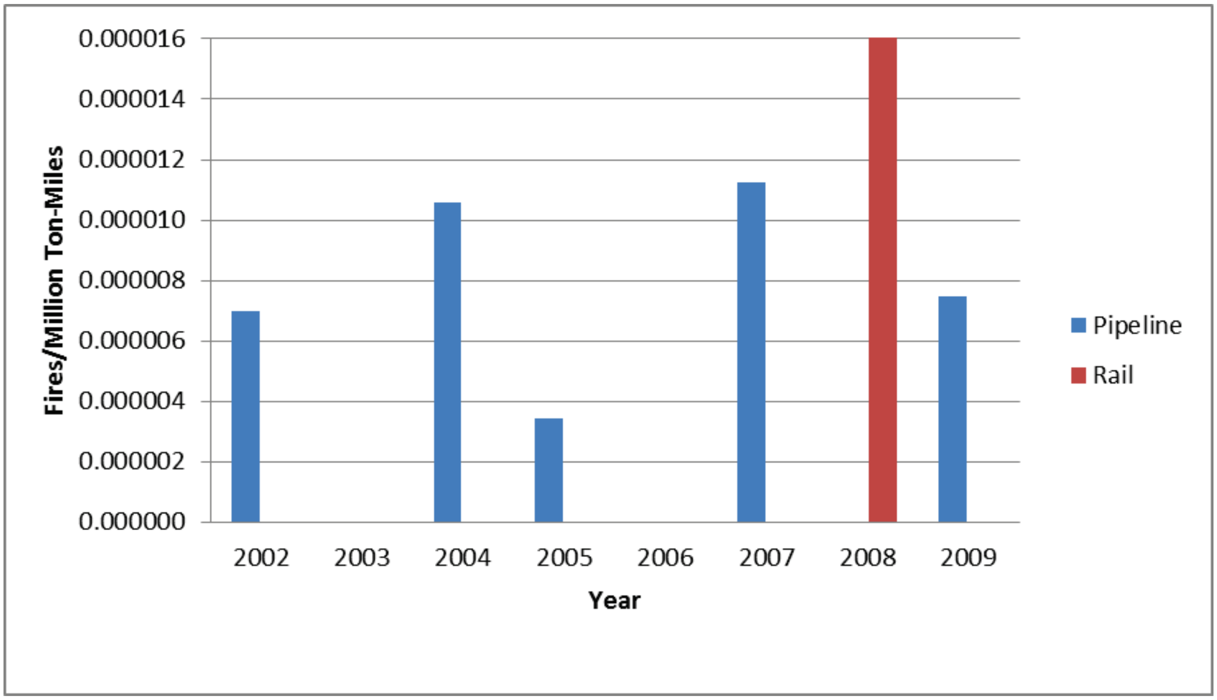
Source: PHMSA 2012a

For pipelines, there were 17 reported incidents where a fire occurred and four incidents where an explosion occurred (PHMSA 2012b). Of the 17 pipeline fire incidents, one incident resulted in three injuries and two fatalities. This incident was caused by a third-party vehicle accident resulting in a crude oil release of 1,500 bbl. Two additional fire incidents were reported where one person was injured each time. The majority of spills resulting from these incidents were less than 10 bbl. Only one injury and no fatalities were reported due to a crude oil pipeline explosion.

Incident causes for crude oil pipeline fires and explosions include incorrect operation, internal corrosion, equipment malfunction, and outside force damage. Three fire incidents resulted in people being evacuated and no explosion incidents resulted in evacuation.

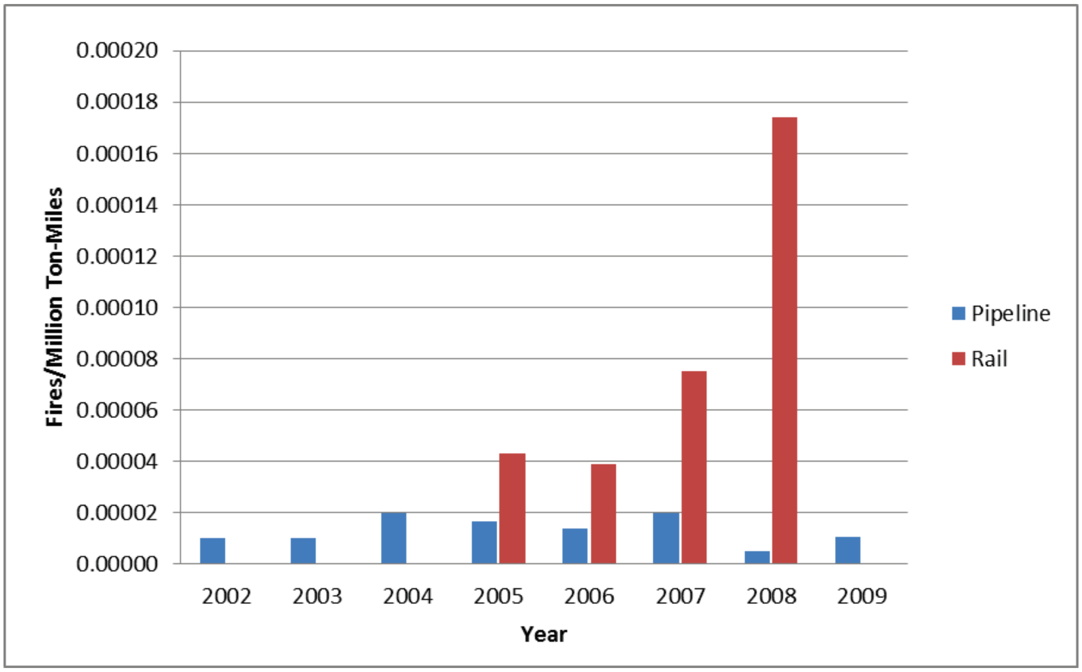
Comparison of Rail, Pipeline, and Marine Spill and Incident Frequencies

Incident frequencies for fires resulting from crude oil and petroleum transport by rail and pipeline are compared in Figures 5.1.3-21 and 5.1.3-22. Incident frequencies for explosions are shown in Figure 5.1.3-23 and 5.1.3-24. More fires and explosions were reported for crude oil and petroleum pipelines between January 2002 and July 2012 than for rail transport. For both crude oil and petroleum transport there were fewer reported injuries and fatalities resulting from rail fires and explosions than from pipeline fires and explosions. Marine fire and explosion data were not readily available for this report.



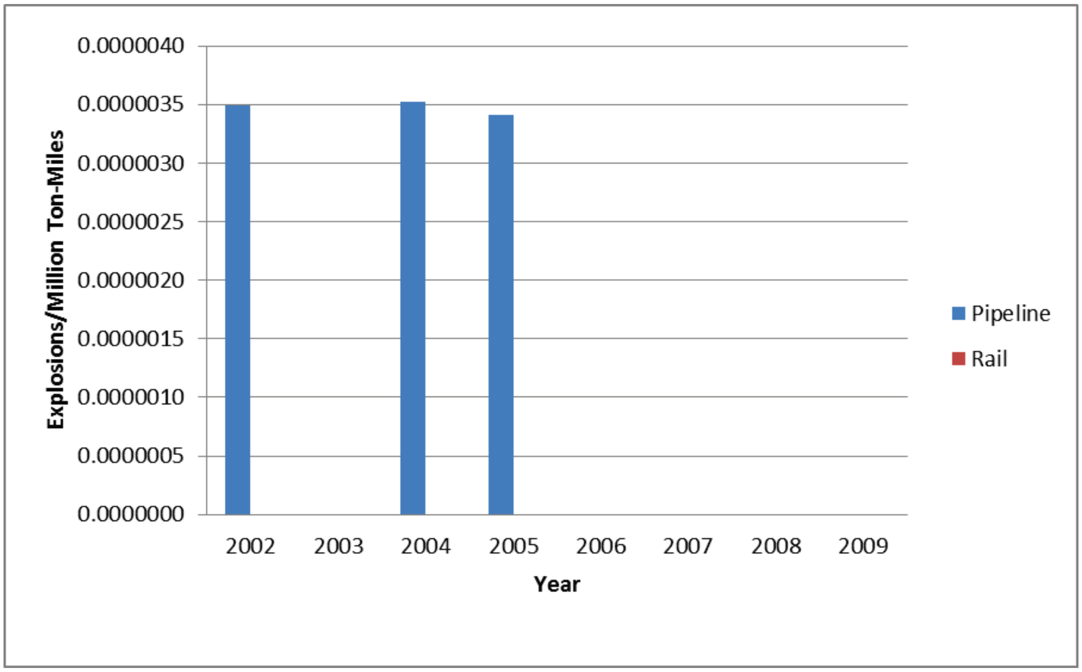
Notes: The vertical axis (fires per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2008 rail value (2.86 fires per million ton-miles). Incident data for marine fires are not available.

Figure 5.1.3-21 Number of Fires per Million Ton-Miles Transported, Crude Oil: Pipeline and Rail



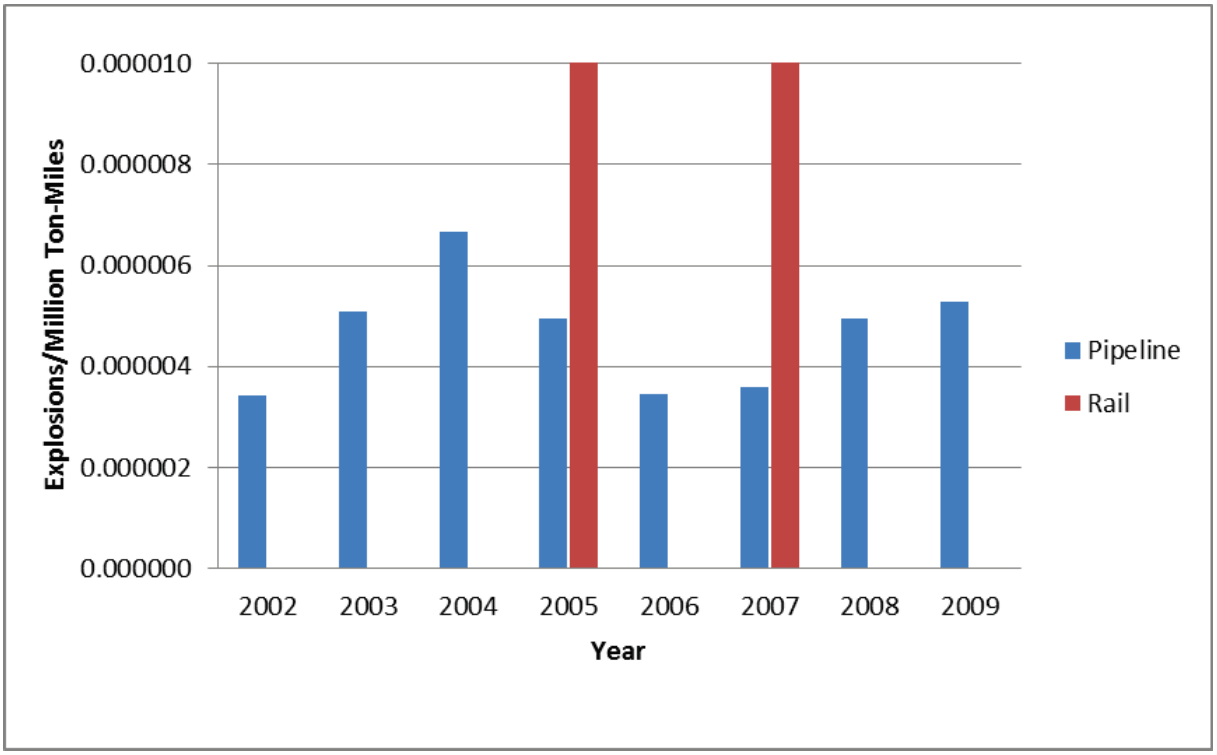
Notes Incident data for marine fires are not available.

Figure 5.1.3-22 Number of Fires per Million Ton-Miles Transported, Petroleum: Pipeline and Rail



Notes: There were no reported explosions for rail from 2002 to 2009. Incident data for marine fires are not available.

Figure 5.1.3-23 Number of Explosions per Million Ton-Miles Transported, Crude Oil: Pipeline and Rail



Notes: The vertical axis (explosions per million ton-miles) was adjusted to show the lower reported values. The highest reported value is the 2008 rail value (0.000038 explosions per million ton-miles). Incident data for marine explosions are not available.

Figure 5.1.3-24 Number of Explosions per Million Ton-Miles Transported, Petroleum: Pipeline and Rail

Resource Impacts from Potential Releases

Resource impacts from potential releases of crude oil for the No Action Alternative scenarios would largely be the same type compared to the proposed Project. Spills would impact soils, surface water, groundwater (and ocean environments in the case of the Rail/Tanker Scenario), vegetation, wildlife habitat, fisheries, and other resources, as would spills from the proposed Project. For detailed descriptions of the types of impacts from potential spills, refer to the respective resource impact analyses in Chapter 5.

Potential spills from tankers could range from small to catastrophic if a large spill were to occur at sea with a fully laden ship. The occurrence rate for that type of event, however, is very low. The effects of a large spill could extend hundreds, if not thousands of miles along the coast, possibly in inaccessible regions. Large tanker crude oil spills, such as the M/V *Exxon Valdez* in Prince William Sound, Alaska in 1989, extended for thousands of square miles and severely affected fisheries and other ecological resources throughout the region.

Each of the scenarios would use transportation methods currently being used by industry, with rail, rail and pipeline, and rail and tanker modes. Impacts would continue to occur, but with higher occurrence as more trains and tankers would be used than are currently used. Risk by mode of transportation would vary under the different scenarios. For example, under the Rail/Pipeline Scenario, rail would be used between production in Canada and North Dakota and Stroud, and would therefore increase risks along those rail networks between those places.

Similarly, the Rail Direct to the Gulf Coast Scenario would increase risk from releases from trains for those portions of the routes that are different from those used for the Rail/Pipeline Scenario.

Under the Rail/Tanker Scenario, the rail routes to British Columbia would be different than for the other two scenarios, with the correspondingly increased risk of spills along those routes, including pristine areas in the Canadian Rockies and Coastal Range and along the coast; the Bakken rail routes would remain the same as the Rail/Pipeline Scenario.

Predicting specifically where and how much crude oil would be discharged into the environment under the various No Action Alternative scenarios is not possible; therefore, it is not known where potential resource impacts from spills would occur and what those impacts would be. Based on the analysis above in Section 5.1.3, Potential Risk and Safety under the No Action Alternative Scenarios, spills from rail and their associated resource impacts would likely be smaller but occur at a higher frequency than spills from pipelines.

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