3.10 AIR QUALITY AND GREENHOUSE GASES

In accordance with Federal Clean Air Act (CAA) and Washington Clean Air Act requirements, the air quality in a given region or area is measured by the concentration of various pollutants in the atmosphere. Air quality is a result, not only of the types and quantities of atmospheric pollutants and pollutant sources, but also surface topography, the size of the topological "air basin," and the prevailing meteorological conditions. Air quality can directly and indirectly affect the environment and public health.

Greenhouse gases (GHGs) are emitted from natural sources and are removed from the atmosphere by natural processes. GHGs are also emitted from human processes, which are now outpacing these natural processes. As GHGs increase, the atmosphere's ability to retain heat increases as well. Evidence shows that rising global temperatures accompany changes in weather and climate (USEPA 2016a) and result in sea level rise.

STUDY AREA AND METHODOLOGY

The proposed project could result in air quality impacts during project and wetland mitigation site construction, during operation of the rail unloading facility, from transport of crude oil via train to the facility, and during the return of empty cars to the mid-continent area. This assessment considers the impacts of the proposed activities on emissions of criteria air pollutants and GHGs as a result of the project, and the impacts from delay of motor vehicles near at-grade railroad crossings on the Anacortes Subdivision.

Study areas for proposed project impacts were identified at the regional and global levels, depending on the scale and type of emissions. Regional impacts to air quality were analyzed by calculating criteria air pollutants that would be emitted directly or indirectly as a result of the proposed project.

The Northwest Clean Air Agency (NWCAA) is responsible for protecting air quality within a specific area that includes Island, Skagit, and Whatcom counties. The NWCAA is responsible for enforcing federal, state, and local air quality regulations at stationary sources. Therefore, the study area falls under their jurisdiction. For GHGs, the area of analysis is the rail transport route from North Dakota to the Shell PSR and considers GHG emissions on a global scale. The study area for cumulative impacts would be the same as described for direct and indirect impacts.

Select laws, regulations, and guidance applicable to air quality, including GHG emissions and climate change, are summarized in Table 3.10-1.

Table 3.10-1 Laws, Regulations, and Guidance for Project-Related Air Quality and Greenhouse Gases

Laws, Regulations, and Guidance	Description
Federal	
Clean Air Act of 1963 (42 USC 7401) as amended	The comprehensive federal law that regulates air emissions from stationary and mobile sources and defines U.S. Environmental Protection Agency (USEPA) responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. In 2007, the U.S. Supreme Court ruled that greenhouse gases are air pollutants under the Clean Air Act.
National Ambient Air Quality Standards (NAAQS)	Specifies the maximum acceptable ambient concentrations for six criteria air pollutants: carbon monoxide (CO), ground-level ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and both fine inhalable particles with diameters that are generally 2.5 micrometers and smaller ($PM_{2.5}$), and inhalable particles with diameters generally 10 micrometers and smaller (PM_{10}). Primary National Ambient Air Quality Standards (NAAQS) set limits to protect public health, and secondary NAAQS set limits to protect public welfare. Areas of the country where air pollution levels persistently exceed the NAAQS may be designated "nonattainment."
The President's Climate Action Plan (2013)	A broad-based plan to cut carbon pollution in America, prepare the United States for the impacts of climate change, and lead international efforts to combat global climate change and prepare for its impact.
Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act (NEPA) Reviews (8/1/2016)	The Council on Environmental Quality (CEQ) released revised draft guidance that describes how federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews.
State	
State Environmental Policy Act (SEPA) (RCW 43.21c; WAC 197-11)	Helps state and local agencies in Washington identify possible environmental impacts that could result from a proposed action, alternatives to the proposed action, and potential impact minimization and mitigation measures. Information learned through the review process can be used to change a proposal to reduce likely impacts and inform permitting decisions at the state and local levels.

Laws, Regulations, and Guidance	Description
Washington State General Regulations For Air Pollution Sources (WAC 173-400) and Washington State Clean Air Act (RCW 70.94)	Establishes technically feasible and reasonably attainable standards and establishes rules generally applicable to the control and/or prevention of the emission of air contaminants and the public policy to preserve, protect, and enhance the air quality for current and future generations.
Washington State Operating Permit Regulation (WAC 173-401)	Establishes the elements of a comprehensive Washington State air operating permit program.
Washington State Controls for New Sources of Toxic Air Pollutants (WAC 173- 460)	Establishes the systematic control of new or modified sources emitting toxic air pollution to prevent air pollution, reduce emissions, and maintain air quality that will protect human health and safety.
Washington State Ambient Air Quality Standards (WAC 173-476)	Establishes maximum acceptable levels in the ambient air for particulate matter, lead, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), and carbon monoxide (CO).
Reporting of Green House Gases (WAC 173-441)	Establishes mandatory greenhouse gas (GHG) reporting requirements for owners and operators of certain facilities that directly emit GHG as well as for certain suppliers of liquid motor vehicle fuel, special fuel, or aircraft fuel. For suppliers, the GHGs reported are the quantity that would be emitted from the complete combustion or oxidation of the products supplied.
Clean Air Rule (WAC 173-442)	Establishes GHG emissions standards starting in 2017 for certain stationary sources, petroleum product producers and importers, and natural gas distributors.
Limiting Greenhouse Gas Emissions (RCW 70.235)	Limits and reduces emissions of GHGs consistent with the established emission reductions in RCW 70.235.020, minimizes the potential to export pollution, jobs, and economic opportunities, and reduces emissions at the lowest cost to Washington's economy, consumers, and businesses.
Washington State Clean Air Act (RCW 70.94)	Establishes the public policy to preserve, protect, and enhance the air quality for current and future generations. Establishes rules regarding preservation of air quality and penalties for violations.
Washington Carbon Pollution and Clean Energy Action (Executive Order 14-04, 2014)	In December 2014, Governor Inslee outlined a series of next steps to reduce carbon pollution in Washington State and improve energy independence through use of clean energy. This included the establishment of a Carbon Emissions Reduction Task force that provided recommendations on the design and implementation of a market-based carbon pollution program.

Laws, Regulations, and Guidance	Description
Washington's Leadership on Climate Change (Executive Order 09-05, 2009)	In 2009, Governor Gregoire directed state agencies to take actions to reduce climate-changing GHG emissions, to increase transportation and fuel-conservation options for Washington residents, and protect our state's water supplies and vulnerable coastal areas.
Path to a Low-Carbon Economy: An Interim Plan to Address Washington's Greenhouse Gas Emissions (2010)	In 2008, the Washington State Legislature approved the Climate Change Framework E2SHB 2815, which established state GHG emissions reduction limits in law RCW 70.235.020 and directed the Washington State Department of Ecology (Ecology) to develop a comprehensive plan to reduce the state's GHG emissions. This second edition of that plan focuses on the emissions reductions required by 2020.
Requirements of Strategy—Initial Climate Change Response Strategy (RCW 43.21M.020)	Directs the development of an integrated climate change response strategy that should address the impact of and adaptation to climate change, as well as the regional capacity to undertake actions, existing ecosystem and resource management concerns, and health and economic risks. In addition, the departments of: Ecology; Agriculture; Community, Trade, and Economic Development; Fish and Wildlife; Natural Resources; and Transportation, should include a range of scenarios for the purposes of planning in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to the impacts of climate change.

Criteria air pollutants are those for which a National Ambient Air Quality Standard (NAAQS) has been established, or pollutants that are precursors to the formation of other pollutants regulated by an NAAQS. The criteria air pollutants assessed in this analysis include:

- Nitrogen dioxide (NO_2) (a precursor to ozone [O_3] formation) is one of a group of highly reactive gases referred to as oxides of nitrogen (NO_x). NO_2 is used as the indicator pollutant for the larger group of NO_x.
- Particulate matter in two size ranges; one being smaller than 10 microns in diameter (PM_{10}), and the other being smaller than 2.5 microns in diameter ($PM_{2.5}$).
- Sulfur dioxide (SO_2).
- Volatile organic compounds (VOCs) (a precursor to O_3 formation).
- Carbon monoxide (CO).
- Lead (Pb).

NAAQS and Washington Ambient Air Quality Standards (WAAQS) for criteria air pollutants are summarized in Table 3.10-2. Except for the annual average SO_2 NAAQS where the WAAQS is 0.02 parts per million (ppm), the WAAQS for criteria air pollutants are the same as the NAAQS.

Table 3.10-2 National and Washington Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS and WAAQS	
		Primary	Secondary
PM_{10}	24-hour	150 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3
	24-hour	35 µg/m^3	35 µg/m^3
SO_2	Annual	0.030 ppm NAAQS 0.020 ppm WAAQS	
	24-hour	0.14 ppm	-
	3-hour	-	0.05 ppm
	1-hour	75 ppb	-
NO_2	Annual	53 ppb	53 ppb
	1-hour	100 ppb	-
O_3	8-hour	0.070 ppm	0.070 ppm
CO	8-hour	9 ppm	-
	1-hour	35 ppm	-
Lead (Pb)	Rolling 3-month	0.15 µg/m^3	0.15 µg/m^3

Notes:

1. The 24-hour and annual SO_2 NAAQS are slated for revocation by the U.S. Environmental Protection Agency (USEPA), once the newer 1-hour SO_2 NAAQS is fully implemented in terms of establishing attainment/nonattainment status for a given area.
2. Source: Title 40, Code of Federal Regulations (CFR), Part 50, and Washington Department of Ecology (Ecology) rules under the Washington Administrative Code (WAC), 173-476. Refer to the respective regulations for details on how attainment with each standard is determined.

Direct Emissions Analysis

The study area to assess air quality impacts from construction of the proposed project and wetland mitigation sites includes activities at those sites as well as use of the proposed haul routes for spoils disposal and the proposed routes for delivery of construction materials (Chapter 2, Figure 2-11). Direct emissions of criteria pollutants from on-site project construction activities were estimated based on equipment data and the proposed construction schedule, together with nonroad equipment emissions factors (i.e., the quantity of pollutant per a given unit of measure such as miles) generated by the U.S. Environmental Protection Act (USEPA) MOVES2014b (MOVES) model (USEPA 2016b). Fugitive dust from ground-disturbing activities and movement of materials over paved and unpaved roads was calculated by implementing methodologies as outlined in the USEPA AP-42, Fifth Edition, Volume 1, Chapter 13.2.2 and Chapter 13.2.3. On-road emission factors from MOVES were used to estimate emissions associated with trucks removing spoils materials and delivering construction materials. Rail unloading facility temporary construction activity emissions are expected to occur over approximately two years and wetland mitigation site temporary construction activity emissions are expected to occur over four years.

Direct criteria pollutant emissions from operations, by comparison, would occur over a longer time period commensurate with ongoing refinery operations and the large geographical area required for train transport of crude oil to the Shell PSR. Refinery site emissions (i.e., slow moving and idling locomotives on site) would be insignificant compared with the criteria pollutant emissions resulting from train transport of crude oil to and from the proposed project from the mid-continent area, and were assessed qualitatively.

Emissions from proposed locomotive activity along the rail corridor were estimated using BNSF Railway's 2014 system-wide average fuel efficiency identified in their latest annual report filed with the Surface Transportation Board (STB) (BNSF 2014). The report to the STB includes total system fuel use for line haul locomotives and the gross (freight plus empty train weight) ton miles of mass moved along the BNSF Railway system. This allows calculation of an average gross-ton-miles/gallon of diesel fuel (GTM/gallon), which is one measure of rail system efficiency.

In this analysis, the study area includes the rail corridor in Washington State for the transport of crude from the mid-continent area to the Shell PSR, and the return of empty rail cars that may follow a separate rail route (Chapter 2, Figure 2-9). This analysis considers the total weight of full and empty unit trains, together with the BNSF Railway system-wide efficiency in 2014 (954 GTM/gallon), to estimate the total annual fuel use for round-trip transport of 312 trains per year, both within Washington State and for the entire rail route to the mid-continent area.

The proposed fuel usage was then multiplied by pollutant-specific emission factors, based on USEPA guidance (USEPA-420-F-09-025 for criteria air pollutants, and 40 CFR 98 for GHGs). The emission factors for each pollutant, and the basis/inputs for the estimates are summarized in Table 3.10-3. For NO_x, PM_{10}, and VOCs, projected 2018 emission factors were used to represent ongoing emissions. This is a conservative estimate because, after 2018, USEPA suggests the use of lower emission factors (USEPA-420-F-09-025).

Table 3.10-3 Emissions Factors for Locomotives

Pollutant	Emission Factor (grams/gallon)	Emission Factor Basis
NO_x	108	Calendar year 2018, Table 5, USEPA-420-F-09-025
PM_{10}	2.7	Calendar year 2018, Table 6, USEPA-420-F-09-025
VOC	4.4	Calendar year 2018, Table 7, USEPA-420-F-09-025
CO	26.6	Tables 1 and 3, USEPA-420-F-09-025
SO_2	0.096	Mass balance, assuming 15 ppm sulfur in fuel
CO_2	10,206	40 CFR 98, Table C-1, for Dist. Fuel Oil No. 2
$PM_{2.5}$	2.6	Calendar year 2018, 0.97 times PM_{10} emissions factor per USEPA-420-F-09-025

The assumptions used for the fuel use calculations and the resulting fuel use quantities are shown in Table 3.10-4. The fuel totals at the bottom are for both full and empty train transport within Washington State only. Empty train fuel consumption is substantially lower than for full trains because of the lighter train weight and the shorter distance travelled.

Table 3.10-4 Calculation of Annual Locomotive Fuel Use in Washington

Parameter and Units	Full	Empty
Weight of oil in tank car (assumes 700 barrels per car) (pounds)	205,800	0
Weight of tank car (pounds)	285,300	79,500
Weight of one train (102 cars)(tons)	14,550	4,055
Locomotives weight (4 * 200 tons/locomotive)	800	800
Total weight per train (102 cars + 4 locomotives) (tons)	15,350	4,855
Fuel use per train mile (gallons)[1]	16.1	5.1
Washington one-way trip distance (miles)	649	502[2]
Fuel use per one-way Washington trip (gallons)	10,441	2,554
Total yearly fuel use for one-way trips (gallons)	3,257,558	796,854

Notes:

1. Calculated by dividing total train weight (gross tons) by 954 GTM/gallon.
2. Return trips would take a more direct route across the Cascade Mountains near the Snoqualmie Pass.

A small amount of additional hydrocarbon vapor emissions at the facility are expected during processing because of the higher volatility of Bakken crude, and the need to safely dispose of vapors. The resulting emissions are expected to be minimal and would be addressed through a Notice of Construction Permit (Notice of Construction Order of Approval), which would allow for increased emissions. This permit must be acquired before construction of the facility begins. These minor changes in facility emissions are not being quantitatively analyzed in this EIS. They would be addressed in the related permit application with NWCAA.

Indirect Emissions Analysis

The indirect operation-related emissions from implementation of the proposed project would include criteria air pollutant emissions from motor vehicles delayed along at-grade railroad crossings. The study area for the indirect emissions analysis is the Anacortes Subdivision from Burlington, Washington, to the Shell PSR, a distance of approximately 10 miles, and the Bellingham Subdivision from Burlington to the Skagit/Snohomish county line.

The analysis considers the emissions that would result from idling motor vehicles sitting in traffic due to delays caused by additional train traffic on the Anacortes and Bellingham subdivisions in Skagit County. This study area is consistent with the area used to study traffic delays in Chapter 3.16 – Vehicle Traffic and Transportation. The traffic delay analysis presented in that chapter for 24 at-grade railroad crossings within Skagit County was used for this assessment. The emissions factors for the idling motor vehicles were based on outputs from the MOVES2014a model for Skagit County for calendar year 2018. GHG emissions were calculated assuming a fuel consumption rate of 0.5 gallons per hour.

Indirect *life-cycle greenhouse gas emissions* of criteria pollutants were not assessed given the nature (replacement product) and scale of this project. Regardless of the alternatives analyzed in this EIS, life-cycle emissions that would result would be roughly the same given that the crude oil would continue to be refined at the Shell PSR regardless of the transport mechanism (i.e., marine vessel or unit train). The Shell PSR typically operates at capacity and this project does not propose an expansion of operations. As such, there is no anticipated difference in life-cycle emissions between either of the alternatives analyzed.

Life-cycle greenhouse gas emissions are measured by calculating the global-warming potential of electrical energy sources. A life-cycle assessment is performed on each energy source and the findings are presented in units of global warming potential per unit of electrical energy generated by that source.

Greenhouse Gas Emissions Analysis

Evidence shows that GHGs contribute to rising global temperatures that can lead to changes in weather and climate patterns (USEPA 2016a). The Washington State Department of Ecology (Ecology) has proposed a new rule and proposes to amend another (WAC 173-442, Clean Air Rule, and WAC 173-441, Reporting of Emissions of Greenhouse Gases) to regulate GHG emissions in response

See Appendix E for additional details relating to the GHG emissions estimate methodology.

to the Governor's Executive Order (E.O. 14-04, 2014). WAC 173-442 establishes emission reduction requirements for GHGs from stationary sources located in Washington State, petroleum fuel producers or importers distributing fuel in Washington State, and natural gas distributors within the state.

Ecology stipulates that parties covered under this rule will have an obligation to reduce their GHG emissions over time and can use a wide variety of options to do so. Ecology will also amend WAC 173-441 to change the emissions covered by the reporting program, modify reporting requirements, and update administrative procedures. Based on current GHG reporting from the Shell PSR, Ecology anticipates that the Clean Air Rule will apply.

An analysis has been conducted, based on estimates of GHG emissions likely to be caused by the proposed project, expressed as carbon dioxide equivalents (CO_2e). The analysis also assessed the potential impact of such emissions on the attainment of GHG goals established in RCW 70.235. In this chapter, GHGs and CO_2e are synonymous.

To assess GHGs associated with transportation, the analysis considers the increase in GHG emissions from trains assumed to originate in the mid-continent region (Williston, North Dakota), and the estimated decrease in marine vessel emissions currently used to transport Alaska North Slope crude oil from Valdez, Alaska, to the Shell PSR. Roundtrip emissions were calculated based on estimated fuel use for the transport of oil by rail or marine vessel.

Williston is the heart of production for crude oil from the Bakken region, the predominant formation from which the majority of oil is now being extracted in the Williston Basin. Currently, multiple tank car oil loading facilities exist along the rail line just west and east of Williston, which makes it a reasonable endpoint for estimation of GHG emissions associated with the proposed project. The factors listed in Table 3.10-3 were used to estimate the emissions from the 800-mile (full train) and 650-mile (empty train) one-way trips, assuming 312 trains per year. The analysis assumes that BNSF Railway would choose to use the shorter, 650-mile (empty-train) return trip route to save fuel and costs; however, this route could vary depending on operational conditions (Figure 3.10-2).

For comparison purposes, the marine vessel GHG emissions associated with the existing transport method of crude to the Shell PSR were calculated. The approach for this analysis is consistent with the USEPA guidance detailed in its publication, *Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data* (USEPA 2000). This analysis assumes that each ship would travel from Valdez, Alaska to the Shell PSR (1,408 miles one way). Twenty-seven tankers would be roughly equivalent to 312 proposed project trains annually.

The Washington State Climate Change Policy Laws and Executive Orders (Ecology 2016a) requires reduction of GHG emissions and tracking of emissions progress in a number of sectors. Locomotive emissions are not directly covered under Washington State law or policies for emissions tracking or reduction; therefore, no "significant" emission threshold for mitigation purposes is proposed for locomotive emissions. However, Washington State law requires that the GHG emissions will be reduced to:

- 1990 levels (88.4 million metric tons [MMT]) by 2020.
- 25 percent by 2035 (66.3 MMT).
- 50 percent by 2050 (44.2 MMT).

GHG emissions from the proposed transport of crude oil by rail to the Shell PSR relative to existing GHG emissions from transport of oil via marine vessel were calculated to determine the net change.

Climate

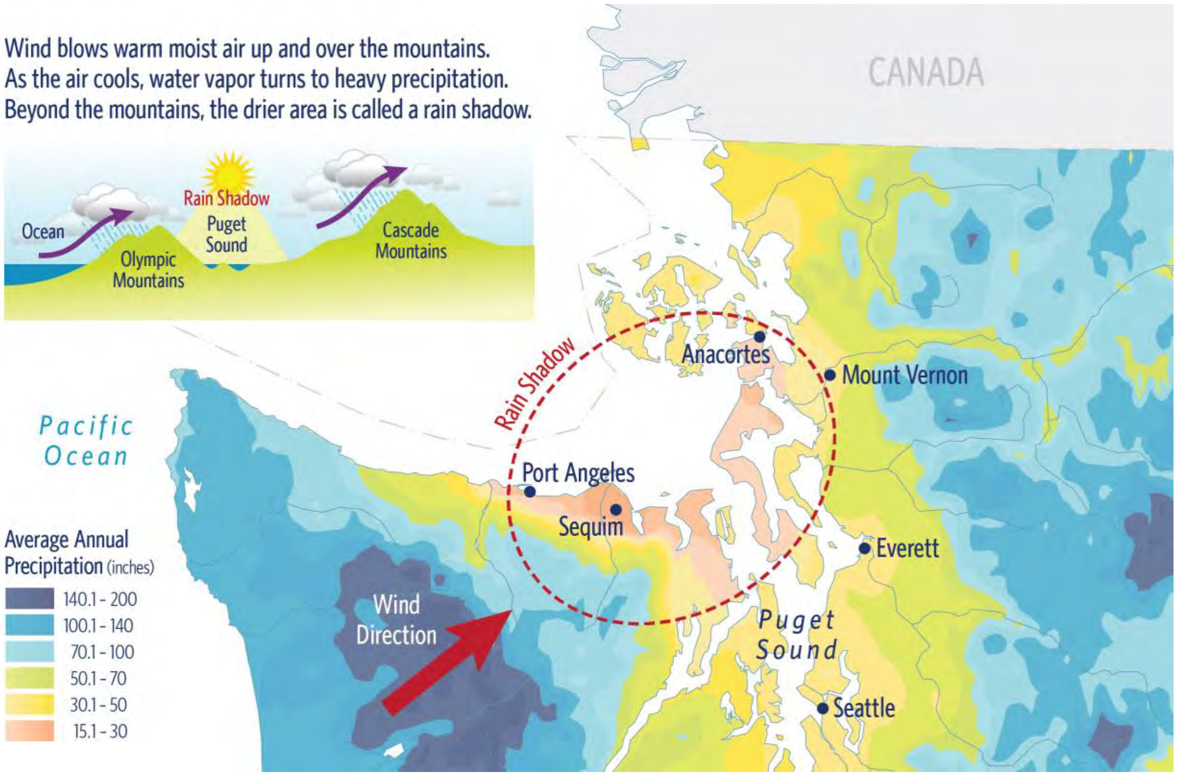
The climate in the 17 Washington State counties crossed by trains associated with the proposed project is variable, largely dependent on the proximity to the Pacific Ocean and presence of mountainous areas such as the Cascade Mountains. Portions of the extended study area west of the Cascades are greatly influenced by marine effects from the Pacific Ocean, which is characterized as a marine-type climate.

East of the Cascades, the climate possesses both continental and marine characteristics (Figure 3.10-1). In the mountainous regions of these counties, temperatures are coldest, generally coinciding with the winter months. The warmest temperatures in the extended study area are experienced east of the Cascade Mountains in the summer months. The study area west of the Cascade Mountains receives more rain than the east, as the mountains provide a rain shadow that creates a relatively arid climate in the east.

The significant terrain relief across the state, ranging from sea level to mountains and ridges that are thousands of feet higher, can contribute to elevated pollutant concentrations during periods of stable air and light winds, when pollutants tend to become trapped in valleys and low areas.

The proposed project site, wetland mitigation site, and Anacortes Subdivision are in a maritime environment that is subject to the temperature-moderating effects of the Pacific Ocean and its connected waterways. Precipitation follows an annual pattern common to the Pacific Northwest coastal region, with most of the annual precipitation falling in the autumn through winter months, followed by a relatively dry late spring and summer period. Figure 3.10-1 is a climate graphic for the Pacific Northwest.

Figure 3.10-1 Climate Patterns in the Pacific Northwest



Over the period of record from 1892 through 2014, the average annual precipitation for Anacortes is approximately 27 inches of liquid equivalent, with an average of about 5 inches of snow. For context, 10 inches of snow is roughly equivalent to one inch of rain. Average daily high temperatures in the summer months of July and August get as high as 72 F; in January, daily highs average 45 F. Average low temperatures for the months of July and August are 52 F; in January, the monthly average low is 34 F (Western Regional Climate Center 2016).

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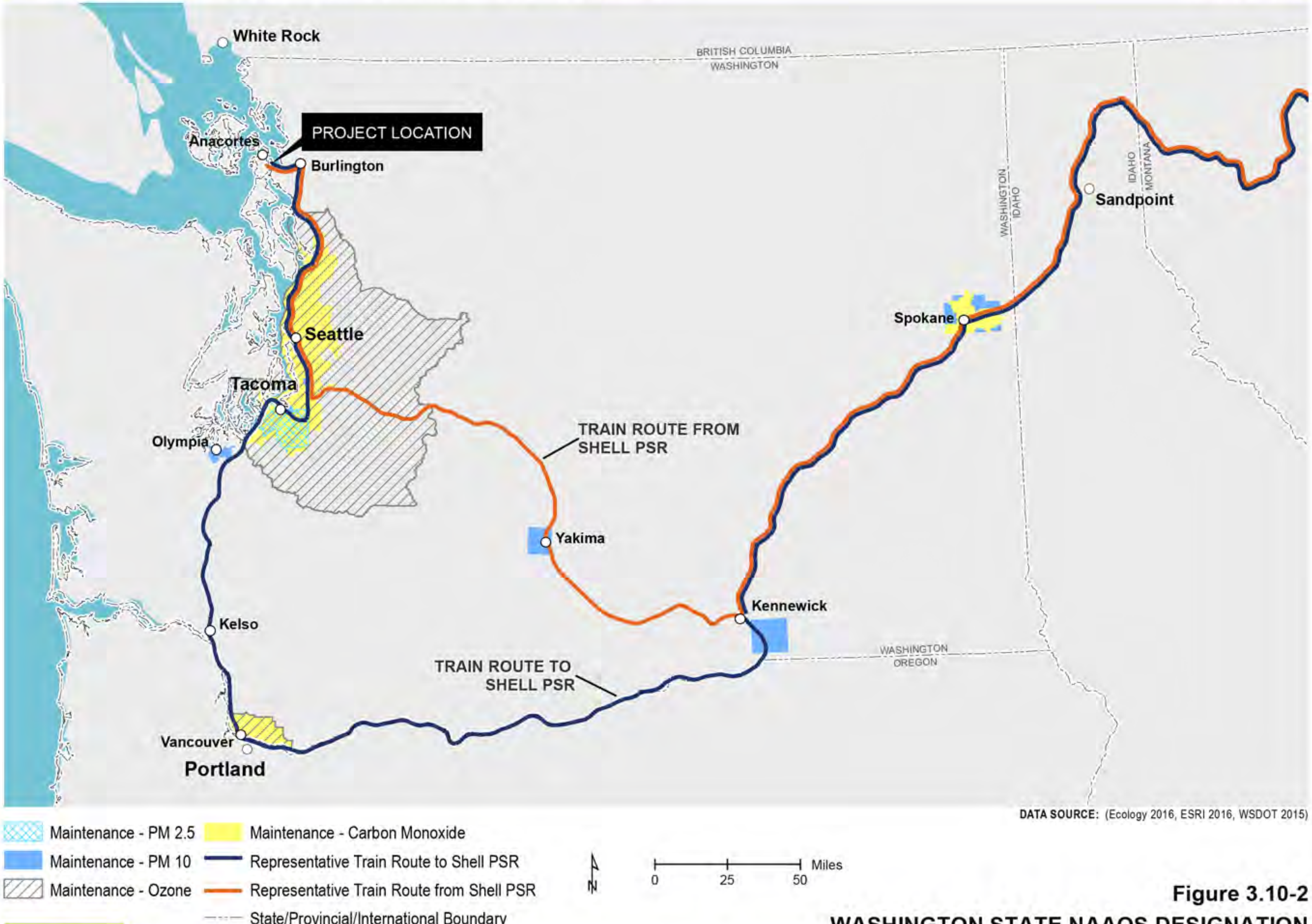

Figure 3.10-2
WASHINGTON STATE NAAQS DESIGNATION

AFFECTED ENVIRONMENT

Proposed Project Site, Wetland Mitigation Site, and Anacortes Subdivision

Monitoring data for pollutants subject to the NAAQS and WAAQS are collected throughout the region. Monitors for some pollutants (NO_2 and O_3) in Anacortes are relatively close to the proposed project site, wetland mitigation site, and Anacortes Subdivision. Other regional monitors are more distant, for example, in Marysville and in the Seattle-Tacoma metropolitan area. Table 3.10-5 summarizes the most recent three years of quality-checked criteria air pollutant monitoring data (2012–2014) for the monitor closest to the proposed project site (USEPA 2016a). Although more recent data has yet to be quality checked, it does appear to coincide with the trends from 2012–2014.

The USEPA uses three-year averages of the measured concentrations to make determinations of whether a given location is in attainment or *nonattainment* with the NAAQS.

According to U.S. environmental law, a nonattainment area is an area considered to have air quality worse than the National Ambient Air Quality Standards as defined in the Clean Air Act Amendments of 1970. Maintenance areas are former nonattainment areas that are now consistently meeting the NAAQS.

Table 3.10-5 Monitored Air Pollutant Concentrations in the Region

Pollutant	Averaging Period	Monitoring Site	Monitored Concentration				NAAQS
			2012	2013	2014	Average	
PM_{10} ($\mu g/m^3$)	24-hour	Beacon Hill, Seattle	27	28	23	26	150
$PM_{2.5}$ ($\mu g/m^3$)	Annual	Marysville (Anacortes)[2]	7.4	8.3 (7.7)	7.9 (5.9)	7.9 (6.8)	12
	24-hour		23	29 (13.9)	27 (13.7)	26 (13.8)	35
SO_2 (ppb)	Annual	Beacon Hill, Seattle (Anacortes)[3]	1.0	0.8 (1.7)	0.3 (1.7)	0.8 (1.7)	30
	24-hour		4.6	2.6 (5)	0.6 (5)	2.5 (5)	140
	1-hour		19	9 (13)	3 (16)	8 (15)	75
NO_2 (ppb)	Annual	Anacortes	5.0	5.7	5.4	5.6	53
	1-hour		22	23	26	25	100

Pollutant	Averaging Period	Monitoring Site	Monitored Concentration				NAAQS
			2012	2013	2014	Average	
O_3 (ppb)	8-hour	Anacortes	45	42	41	42	70
CO (ppm)	8-hour	Beacon Hill	0.9	1.5	1.0	1.3	9
	1-hour		0.7	1.3	0.8	1.1	35

Notes:

1. The 3-hour SO2 concentration data are not summarized because the 3-hour values were not provided in the monitor value query results from USEPA's on-line database. However, 3-hour average SO2 concentrations would be well below the NAAQS of 0.5 parts per million (ppm) (500 parts per billion [ppb]) for the 3-hour period, given they would be even lower than the 1-hour concentrations listed.
2. The PM2.5 monitor in Anacortes does not have three years of quality-checked data so the data have been provided in parentheses for this pollutant.
3. The Anacortes SO2 monitor began monitoring SO2 in January 2013; therefore, Beacon Hill data from 2012 to 2014 has been added to provide additional context on this pollutant.

These concentrations are below the NAAQS for all pollutants. The highest monitored concentration, in comparison to the corresponding NAAQS, is the 24-hour $PM_{2.5}$ concentration of 26 micrograms per cubic meter ($\mu g/m^3$), which is 74 percent of the NAAQS of 35 $\mu g/m^3$.

Sulfur dioxide (SO_2) concentrations, while already well below the NAAQS for each averaging period, appear to be decreasing significantly over the three-year period. The reduction is likely due to the fact that after 2012, USEPA rules required nonroad diesel engines, including locomotives, to begin using ultra low sulfur diesel (ULSD) fuel. The ULSD fuel has a maximum sulfur limit of 15 parts per million (ppm) by weight, compared with a limit of 500 ppm sulfur by weight prior to the ULSD requirement.

Measured pollutant concentrations in Anacortes and at regional monitors nearest the project area are less than NAAQS and WAAQS limits. Figure 3.10-2 shows areas along the probable rail routes to/from the proposed project site that are designated by USEPA as "maintenance" for NAAQS purposes. This means these areas have at some time in the past 20 years been in nonattainment status, but have since attained the NAAQS. It also means that delegated state and local air pollution control agencies have received USEPA approval of a maintenance plan that helps ensure these areas do not revert back into nonattainment for the specific NAAQS.

Extended Study Area

The rail corridor study area encompasses portions of 17 counties in Washington State. Table 3.10-6 lists the existing air pollutant levels for NO_x and PM_{10} in each county. USEPA's National Emissions Inventory (NEI) database for calendar year 2011, which is the latest quality-checked, three-year inventory available. Only NO_x and PM_{10} concentrations are provided because NO_x is the primary air pollutant associated with locomotive operations and PM_{10} analysis is a pollutant of concern for Ecology and Skagit County. All counties in Washington are in attainment for NO_x and PM_{10}. Though there is no federal standard for diesel particulate matter (DPM), $PM_{2.5}$ emitted from railroads is assumed to consist entirely of DPM, as per Ecology's 2011 Air Emissions Inventory (Ecology, 2011). Total $PM_{2.5}$ for the counties where project unit trains would operate were 4,995 tons in 2011.

Table 3.10-6 Project-Related NO_x and PM_{10} Emissions by County (Washington State)

County	Tank Car Status	Distance (miles)	Fuel (gallons/year)	Locomotive NO_x (tons)	2011 National Emissions Inventory NO_x (tons)	Project NO_x % of NEI	Locomotive PM_{10} (tons)	2011 NEI PM_{10} (tons)	Project PM_{10} % of NEI
Adams	Full/Empty	57.3	378,611	45.1	5,102	0.88	1.1	12,718	0.01
Benton	Empty	43.4	68,284	8.2	8,386	0.56	0.2	8,791	0.01
Benton	Full	64.8	323,720	38.7	8,386	0.56	1.0	8,791	0.01
Clark	Full	39.3	197,465	23.5	12,198	0.19	0.6	5,380	0.01
Cowlitz	Full	40.3	202,443	24.1	11,326	0.21	0.6	2,234	0.03
Franklin	Full/Empty	42.5	280,662	33.4	5,024	0.66	0.8	7,042	0.01
King	Empty	92.5	146,853	17.5	60,011	0.07	0.4	28,436	0.00
King	Full	39.7	199,262	23.7	60,011	0.07	0.6	28,436	0.00
Kittitas	Empty	72.4	114,898	13.7	5,772	0.24	0.3	2,362	0.01
Klickitat	Full	91.9	461,258	54.9	3,663	1.50	1.4	5,762	0.02
Lewis	Full	28.3	142,293	16.9	12,825	0.13	0.4	4,383	0.01
Lincoln	Full/Empty	16.4	108,548	12.9	3,555	0.36	0.3	14,891	0.00
Pierce	Full	40.5	203,539	24.2	24,368	0.10	0.6	9,681	0.01
Skagit	Full/Empty	28.4	187,664	22.3	10,409	0.21	0.6	3,470	0.02

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County	Tank Car Status	Distance (miles)	Fuel (gallons/year)	Locomotive NO_x (tons)	2011 National Emissions Inventory NO_x (tons)	Project NO_x % of NEI	Locomotive PM_{10} (tons)	2011 NEI PM_{10} (tons)	Project PM_{10} % of NEI
Skamania	Full	40.6	203,710	24.2	1,390	1.74	0.6	1,136	0.05
Snohomish	Full/Empty	44.9	296,979	35.3	22,232	0.16	0.9	8,580	0.01
Spokane	Full/Empty	48.6	320,797	38.2	16,322	0.23	1.0	19,426	0.00
Thurston	Full	25.3	126,861	15.1	8,852	0.17	0.4	4,061	0.01
Yakima	Empty	55.6	88,308	10.5	8,904	0.12	0.3	9,923	0.00

ENVIRONMENTAL IMPACTS

No Action Alternative

Because no construction or operation would take place under the no action alternative, there would be no new impacts to air quality or GHGs. Oil suppliers for the refinery would continue using existing available delivery methods. Assuming that marine vessels would continue to deliver crude oil from the Alaska North Slope, the volume of diesel fuel used would remain the same. Therefore, no appreciable change in air pollutant emissions would result.

Proposed Project Site, Wetland Mitigation Site, and Anacortes Subdivision

Direct Impacts

Construction

During construction, the primary sources of emissions would be nonroad construction equipment exhaust, fugitive dust from earthmoving operations, and on-road truck exhaust from hauling away spoils materials and delivering construction materials to both the project and wetland mitigation sites. Emissions would also result from workers' motor vehicles traveling to and from the construction site. Air quality emissions from the use of construction equipment, earthmoving operations, and on-road truck exhaust are provided in Tables 3.10-7 and 3.10-8 for the rail unloading facility and wetland mitigation site, respectively. These emissions are characterized as being minimal in the context of the other emissions, such as operational emissions associated with the unit train movements throughout the state and county.

Table 3.10-7 Rail Unloading Facility Annual Construction Emissions (tons per year)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	GHG
Nonroad Equipment Engines	0.35	0.98	0.00	0.13	0.06	0.03	385.1
On-Road Engines	0.019	0.088	0.000	0.004	0.003	0.003	23.16
Fugitive Dust					24.58	2.46	
Annual Total	0.37	1.06	0.00	0.13	24.64	2.49	408

Table 3.10-8 Wetland Mitigation Site Annual Construction Emissions (tons per year)

Source	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	GHG
Nonroad Equipment Engines	0.15	0.40	0.00	0.05	0.03	0.01	170.5
On-Road Engines	0.087	0.009	0.000	0.003	0.000	0.000	0.027
Fugitive Dust					27.74	2.77	
Annual Total	0.23	0.41	0.00	0.06	27.77	2.79	171

Operation

The direct emissions associated with operation of the rail unloading facility would include only a small amount of VOCs due to equipment leaks and wastewater treatment; no emissions of other criteria air pollutants are anticipated. Operation of the proposed facility is estimated to result in less than 1 ton per year of total VOC emissions, which is less than the USEPA's 100-ton-per-year significance threshold. Further, in accordance with its air permit for operation of the facility, the Shell PSR would be required to apply a leak detection and repair program to the VOC lines associated with facility operation. These activities would limit the potential VOC emissions. The operational air emissions from the proposed project would not contribute enough air pollutants to result in an exceedance of the NAAQS/WAAQS and, therefore, are not anticipated to result in public health effects.

Additional emissions from minor train movements at the rail unloading facility itself—to reposition cars, for example—were analyzed semi-qualitatively by scaling project emissions relative to other rail projects in the Millennium Bulk Terminals-Longview (MBTL) EIS (Cowlitz County and Ecology 2016a). NO_x emissions for the MBTL project, assuming eight round-trip trains a day, were modeled at being 15 $\mu g/m^3$, which is about 8 percent of the NO_x NAAQS. Assuming this project's locomotive emissions would be similar per unit train to those evaluated for the MBTL project NO_x concentrations would be about 1.8 $\mu g/m^3$, about 1 percent of the NO_x NAAQS, which is a level that does not represent an impact.

The proposed project is not expected to significantly affect GHG emissions from the Shell PSR, given it would not change the throughput capacity of the facility. The most recent quantity of GHG emissions that Shell reported to Ecology of 1,805,933 metric tons (MT) of GHG is not anticipated to change substantially with the switch from Alaskan crude oil to Bakken crude oil (Ecology 2016b). Chapters 1 and 2 of this EIS describe how the proposed project would change operations at the Shell PSR.

Extended Study Area

Direct Impacts

Rail Operation

The air pollutant that would be emitted in the greatest amount from locomotives operating on the rail corridor would be NO_x. Proposed project locomotive NO_x emissions by county are provided in Table 3.10-6 and compared with total county-wide NO_x emissions. In addition to NO_x emissions, $PM_{2.5}$ emissions are also provided in Table 3.10-6 to provide context on how DPM would change with the project for each county.

The calculated percent of county emissions represented by proposed project emissions for all criteria pollutants other than NO_x was less than 0.2 percent. As shown in Table 3.10-6, even for NO_x, the portion of project-related emissions does not exceed 2 percent in any county. For only two counties, Klickitat and Skamania, the NO_x proportion exceeds 1 percent because these are rural, relatively undeveloped areas with very low existing emissions. Given the low portion of current emissions in all counties traversed by the trains, no significant air quality impacts are expected from the increase in unit train traffic.

The DPM associated with rail operations in the counties that would be crossed by project unit trains is 373 tons of $PM_{2.5}$. Total locomotive $PM_{2.5}$ from the project would be approximately 12 tons, or 3.2 percent of total $PM_{2.5}$ railroad emissions in the counties crossed by project unit trains. The biggest percentage of $PM_{2.5}$ emissions would occur in Kittitas County at 35.2 percent. All other counties would have percentages of $PM_{2.5}$ of 5 percent or less. The DPM amounts per county or statewide represent a negligible change.

Emissions of NO_x, $PM_{2.5}$, and VOCs from the U.S. freight train locomotive fleet are on a downward trend because of the implementation of more restrictive emissions standards (73 FR 25098, USEPA 2008) for new and rebuilt locomotive engines. For example, between calendar year 2018 (which was assessed for this study) and 2040, the USEPA estimates that locomotive NO_x emissions will drop to approximately one-fourth of the 2018 rate.

Lastly, the operational air emissions from the transport of oil by rail in the extended study area would not contribute enough air pollutant emissions to result in an exceedance of the NAAQS/WAAQS and, therefore, is not anticipated to result in public health effects.

Motor Vehicle Delay Emissions at At-Grade Railroad Crossings

The air quality analysis considered the potential for increased emissions from motor vehicles delayed near at-grade railroad crossings in Skagit County due to the increase in train traffic that would be associated with the proposed project. The 24 at-grade railroad crossings studied in the traffic delay analysis presented in Chapter 3.16 – Vehicle Traffic and Transportation, were assessed for this effort. The annual delay hours for these crossings were added together, yielding an estimate of 6,553 vehicle delay hours per year associated with the proposed project. Emissions associated with delays for at-grade railroad crossings would be well below one ton per year for criteria pollutants. This is a relatively small amount in comparison to major source construction permitting thresholds for new stationary emissions sources (100 or 250 tons/year, depending on facility type).

Most of the fuel consumed during these vehicle delays would be gasoline with a small fraction of diesel fuel. The USEPA's emission factors for CO_2 provided in 40 CFR 98, Table C-1, yield a CO_2 emission factor of 19.35 pounds per gallon for gasoline and 22.5 pounds per gallon for diesel fuel, giving an approximate average of 20 pounds per gallon for a weighted average. For 1,638 gallons per year of additional fuel usage, this would equate to 32.8 MT per year of GHG emissions, which is a relatively small amount in comparison to the latest state (92 million MMT GHG), national (6,870 MMT GHG), or global (47,599 MMT GHG) inventories.

Greenhouse Gas Emissions

GHGs trap heat in the atmosphere that increases surface temperatures on Earth. Natural processes, such as volcanic activity, account for some of these emissions; however, emissions from human activities have increased substantially since the advent of the Industrial Age nearly 150 years ago. Climate Change impacts, such as rising sea levels, precipitation pattern changes, acidification of the oceans, and changes in surface temperatures are experienced locally as a result of increased GHGs in the atmosphere.

The Council on Environmental Quality (CEQ) final guidance on considering GHG emissions and climate change in the National Environmental Policy Act (NEPA) has two main components:

1. The effect of the proposed project GHG emissions in contributing to climate change.
2. The effect of climate change on the project.

Although this is a SEPA document and therefore not covered by the CEQ guidance, climate change effects were analyzed by estimating project GHGs and the potential impacts climate change would have on the project.

The GHG emissions associated with crude-by-rail transport were estimated for the entire rail route. This route is assumed to originate in Williston, North Dakota, with full tank cars proceeding across northern Montana, and entering Washington State just east of Spokane. The remainder of the route to Anacortes within Washington is shown in Chapter 2 (Figure 2-9). The return trip to the mid-continent region with empty tank cars is also shown in the figure. Note that alternate return routes to the mid-continent or locations other than Williston are likely, but the differences in estimated GHG emissions are not of a magnitude that would substantially change those provided in this EIS.

The GHG emissions from the proposed project (nearly all CO_2 from locomotive fuel combustion) would add to the global total GHG emissions and even without the proposed project, Bakken crude oil is likely to be produced and sent by rail to other areas of the country such as the Gulf Coast or East Coast. For that reason, this GHG analysis is conservative, as it treats the proposed project in isolation from the global oil market.

In addition to estimating GHG emissions from locomotive fuel combustion, this analysis considered the GHG reduction that would result from replacing Alaska North Slope crude oil transported by marine vessel for the equivalent amount of oil proposed to be brought to the Shell PSR by unit trains. For the purpose of this analysis, marine vessels are assumed to transport crude oil from Valdez, Alaska, to the Shell PSR, a travel distance by ship of approximately 1,400 miles. More detail on this GHG emissions estimate methodology is provided in Appendix E.

Table 3.10-9 shows the estimated GHG emissions from the proposed transport of crude oil from the mid-continent region, the emissions from transporting the equivalent amount of oil by marine vessel from Alaska, and the net increase due to replacing vessel transport with rail. In the context of other GHG emission sources, the amounts shown in Table 3.10-9 are relatively small, constituting a fraction of a percent of statewide emissions in Washington, and a fraction of global GHG emissions. However, these GHG emissions are part of a larger issue with climate change and this increase would be considered an impact in the context of emissions relative to Washington State's GHG reduction goals. Therefore, this increase in GHGs would need to be offset in other sectors to reach the State's goals. This would be in addition to the reductions that are required via the State's Clean Air Rule.

Table 3.10-9 GHG Emissions from Crude Oil Transport and Net Change

Emissions Source	Affected Route	Annual GHG Emissions (metric tons/year)
Rail Locomotives	Williston, ND, to Anacortes, WA	93,211
Oil Tanker Ships	Valdez, AK, to Anacortes, WA	48,224
Net Change (Increase)	"Global"	44,987

The potential for sea level rise is the main concern for how climate change could affect the proposed project. This could impact the proposed project infrastructure, given the project is located on an inland coastal waterway. Current average rates of global sea level rise based on satellite measurements are approximately 1 foot per century (University of Colorado 2016), and are about 0.5 feet per century based on actual tide gauge data (Houston and Dean 2011). The tide gauge data indicate no substantial acceleration or deceleration in rate of rise in recent decades (Houston and Dean 2011). Given the project would be built several feet above sea level, including the excavated bowl, and the project infrastructure's expected useful life is probably on the order of a 100 years or less, it is not expected that sea level rise would adversely affect the project infrastructure during its expected useful life.

In addition to the GHG emissions that would result from the project, an additional impact would occur from lost carbon sequestration resulting from clearing approximately 16.5 acres of forest on the project site. Annually, the tree stand is estimated to sequester 21.75 MT of GHG that would be lost if removed. The American Forests Organization (American Forests 2016) has identified that each acre of trees holds approximately 186 MT GHG, so displacing 16.5 acres would represent 3,069 MT GHG that would ultimately decay and be released to the atmosphere.

Cumulative Impacts

The operational air emissions from proposed project unit trains would not contribute enough air pollutant emissions to result in an exceedance of the NAAQS/WAAQS. Reasonably foreseeable future actions that would increase rail traffic would increase NO_x emissions for all counties. However, the USEPA's revised emission standards for new and rebuilt locomotives will lower emissions as older locomotives are replaced or rebuilt. USEPA has indicated that these improvements will reduce NO_x emissions by as much as 80 percent when fully implemented. Therefore, relative to existing NO_x levels, emissions will likely be lower as a result. The study area would remain in attainment and requirements for existing or new air operating permits would need to be met that would further minimize cumulative impacts to air quality.

As discussed above, GHG emissions as a result of proposed project operations would relate only to changes in the transport of materials to the facility, as throughput capacity of the Shell PSR is anticipated to remain the same. The change associated with the proposed project would increase

GHG emissions by approximately 44,987 MT per year. Because GHGs are a global issue that are transmitted within and beyond the state line, this increase in GHGs may need to be offset in other sectors to reach the state's goals. Therefore, from both global and state perspectives, the proposed project, combined with past, present, and reasonably foreseeable future actions, would contribute to a cumulative impact on GHG emissions.

MITIGATION MEASURES

Avoidance and Minimization

Impacts to air quality could be minimized by the implementation of the best management practices (BMPs) recommended as part of the Shoreline Substantial Development Permit. For example, during construction haul roads would be sprayed with water during construction to reduce dust and particulate matter emissions.

The VOCs from the direct operational emissions are governed by local, state, and federal regulatory requirements; therefore, no further mitigation is planned. The emissions from construction would be temporary, localized, and mitigated via BMPs. The emissions from individual locomotive operations are decreasing due to the revised USEPA emissions standards. Relative to the addition of trains for the project, these emissions standards would offset some, or all, of the increase in emissions depending on how USEPA finalizes the standards.

Mitigation

Shell would assess and update their facility-wide anti-idling policy, as necessary, to include the rail unloading facility to reduce GHG emissions from construction and operation of the proposed project. Shell would provide equipment operators training on best practices for reducing fuel consumption. The anti-idling policy could include:

- Measures like reduced idling times for older vehicles and effective maintenance programs.
- Various technologies such as idle management systems or automatic shutdown features.
- Alternative fuels and other fluids.

The policy would define any exemptions where idling is permitted for safety or operational reasons, such as when ambient temperatures are below levels required for reliable operation. The plan would be submitted to Ecology's Air Program for review and approval.

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