Gateway Pacific Terminal

Air Quality Technical Report
Revised Site Layout

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Acronyms, Abbreviations, and Definitions

Note that in this section and throughout the rest of this report there are active hyperlinks that will jump to the referenced material or section. General hyperlinks are formatted like this. Hyperlinks for tables and figures are highlighted like **this**.

AERMOD	Air quality dispersion modeling system used in this analysis. The AERMOD modeling system consists of two pre-processors and a dispersion model. The meteorological preprocessor (AERMET) provides meteorological information, and a terrain pre-processor (AERMAP) characterizes terrain, and generates receptor grids for the dispersion model (AERMOD).
AESS	Automatic Engine Shutoff System, used by train locomotives to shutdown unneeded units when idling occurs for more than about 10 minutes, and when ambient temperatures exceed 40°F.
Air quality standard	Health-based standard representing a pollutant concentration in the ambient air usually over some averaging period like 1-hour, intended to protect the health and welfare of people with a margin of safety. See Table 1, page 11.
Ambient air	the air in outdoor locations to which the public has access, e.g., outside the property boundary of the emissions source
Area source	an emission source type defined in AERMOD. Area source emissions are released from a two-dimensional rectangular area and typically used to represent fugitive emission sources.
Areapoly source	an emission source type defined in AERMOD. Areapoly sources are similar to area sources in that emissions are released from two-dimensional areas, but such sources are not restricted to rectangular areas and can have more than four sides.
ASIL	Acceptable Source Impact Level – a *screening* level (as opposed to a *standard*) used to evaluate the potential impact of **TAP**s based on the estimated risk of a lifetime of exposure
Attainment/Nonattainment	a determination and classification made by EPA indicating whether ambient air quality in an area complies with (i.e., attains) or fails to meet (i.e., nonattainment) the requirements of one or more **NAAQS**
Averaging time	a specific length of time (e.g., 1 hour, 24-hours, 1 year) over which measured or model-calculated concentrations of an air pollutant are averaged for comparison with the **NAAQS** based on the same averaging period. Note that some NAAQSs are also based on multi-year averages of certain percentiles of measured or calculated concentrations.
BACT	Best Available Control Technology
BNSF	BNSF Railway Company
cf	cubic foot, a measure of volume
cfm	cubic feet per minute, a measure of air flow
CO	carbon monoxide, a criteria air pollutant
CO_2	carbon dioxide
CO_2e	Greenhouse gas equivalents (emissions of all GHGs expressed in terms of their "global warning potential")
Criteria air pollutant	an air pollutant specifically governed by the Federal Clean Air Act for which ambient air quality standards have been set. Criteria air pollutants include carbon monoxide, particulate matter, sulfur dioxide, nitrogen dioxide, ozone, and lead. See Table 1, page 11.

Dispersion model .... A computerized calculation tool used to estimate pollutant concentrations in the ambient air based on numeric simulations that consider the locations and rates of pollutant emissions and the effects of meteorological conditions, usually over specific averaging times (e.g., 8-hours)

dwt .... Deadweight tonnage is a measure of how much weight a ship is carrying or can safely carry. It is the sum of the weights of cargo, fuel, fresh water, ballast water, provisions, passengers, and crew. The term is often used to specify a ship's maximum permissible deadweight, and is expressed in long tons or metric tons (tonnes).

Ecology .... Washington State Department of Ecology

EPA.. US Environmental Protection Agency

Fugitive dust .... Potential air pollutant in the form of dust (or other pollutant) emitted from a non-point or non-mobile source such as dust from a road or from a storage pile caused by wind

GHG....................................... Greenhouse gas (e.g., carbon dioxide or methane) that contributes to the process of a gradual warming of the atmosphere that can result in global climate change

Global warming potential .... a measure of the potential of a gas to have an effect in the atmosphere that could lead to climate change based on the potential of the gas to cause global warming. This is a standard measure, typically based on a 100-year time horizon, used to compare each GHG with the global warming potential of carbon dioxide (CO_2), the most abundant GHG.

Terminal................................. Gateway Pacific Terminal, the proposed project

gr.. grains, a measure of mass

gr/cf.. grains/cubic foot

hp... horsepower

Knot .... a unit of speed equal to one nautical mile per hour, or approximately 1.151 mph

Long ton................................. also called imperial ton and equal to 2,240 pounds (1,016 kg)

Maintenance area .... An area that was once designated as nonattainment that has since come into compliance with the ambient air quality standard but where air quality control measures may remain in effect (in perpetuity).

Meteorological data set .... a compilation of meteorological data representing conditions over some period of time and including such things as wind speed and wind direction, and formatted as required by the dispersion model being used. This analysis used a meteorological data set covering 5 years.

Metric ton .... 1,000 kilograms (kg) = 2,204.6 pounds = tonne (see also short ton)

Micrometer/Micron .... one millionth of a meter; typically used to distinguish particle size; typical human hair is 100 about microns in diameter

mmtpy .... million metric tons per year

Modeling domain .... the area included in the **dispersion-modeling** analysis, such as in this case, which used a larger than 10 kilometer by 10 kilometer domain. Modeling receptors are distributed within this domain, usually over a standard grid pattern with receptors every 100 to 500 meters.

Modeling receptor .... a theoretical (i.e., often non-specific) location used in computer modeling at which air pollutant concentrations are calculated. Modeling may also use site-specific receptors representing individual locations.

Monte Carlo simulation .... a mathematical procedure using repeated random sampling methods to develop sufficient test results to reach statistically valid conclusions; often applied in situations in which uncertainty or intermittent/ unpredictable occurrences prevent more specific examination of possible outcomes. Additional discussion **here** (pg. 37)

mtyp .... metric tons per year

NAAQS .... National Ambient Air Quality Standard

Nautical mile (nm) .... The nautical mile is a unit of length that is about one minute of arc of latitude measured along any meridian, or about one minute of arc of longitude at the equator. By international agreement it is exactly 1,852 meters (approximately 6,076 feet).

NSPS .... New Source Performance Standard; rules that pertain to air pollution emission sources subject to air quality permits and newly manufactured equipment

NO_2 .... nitrogen dioxide, a **criteria** air pollutant

Nonattainment area .... An area delineated by regulatory agencies including US EPA and the Washington Department of Ecology in which an ambient air quality standards have been violated and where there is a program in place designed to reduce air pollution so that the standard attained.

NOx .... oxide of nitrogen, a general class of air pollutant without a specific air quality standard but used in monitoring air quality

NWCAA .... Northwest Clean Air Agency; the designated local air quality control agency in the project area

Particulate matter (PM) .... air pollutant comprised of solid or liquid particles; PM is usually characterized based on the particle size. See also PM_{10} and $PM_{2.5}$.

PM_{10} .... "Coarse" inhalable particulate matter with an aerodynamic size less than or equal to 10 micrometers (**microns**)

$PM_{2.5}$ .... "Fine" inhalable particulate matter with an aerodynamic size less than or equal to 2.5 micrometers (**microns**)

Point source .... an emission source type defined in AERMOD. Point source emissions are released from a single location.

ppm .... parts per million (a metric used in quantifying concentrations of air pollutants)

Receptor .... See modeling receptor.

Release height .... an AERMOD term defining the height above ground at which source emissions are released

Short ton .... 2,000 pounds (see also **metric ton** and long ton)

SO_2 .... Sulfur dioxide, a **criteria air pollutant**

Soiling .... A non-health-related effect of air pollution such as staining or deposition of a fine film typically on exterior surfaces

TAP .... Toxic air pollutant

tonne .... **metric ton**

tpy .... tons per year, an estimate of annual emissions

$\mu g/m^3$ .... micrograms per cubic meter (a metric used in quantifying concentrations of air pollutants)

Volume source .... an emission source type defined in AERMOD. Volume sources emit diffuse air pollutants from a three-dimensional area. Line sources, such as emissions from transiting trains, can be simulated using multiple, adjacent volume sources.

Preface

Pacific International Terminals, Inc. (P.I. Terminals), proposes to develop the Gateway Pacific Terminal (the "Terminal"), a multimodal terminal for transfer of dry bulk commodities, at Cherry Point in Whatcom County, Washington. Construction and operation of the Terminal and associated facilities require the approval of local, state, and federal agencies. Agency decision makers are to be informed of the potential environmental impacts of the proposed project by preparation of two Environmental Impact Statements, prepared under guidelines of the National Environmental Policy Act (NEPA) and under the State Environmental Policy Act (SEPA).

This report was prepared on behalf of P.I. Terminals and BNSF Railway Company, and provides technical information about the proposed Terminal Project and Custer Spur Improvements Project. The Terminal Project and Custer Spur Improvements Project are separate proposed actions but are addressed together in this report. This report has also been prepared to support specific permit applications and as part of the consultation process with resource agencies and affected Native American Nations.

The project considered in the air quality evaluation documented in this report differs in two fundamental ways compared with the 2012 site layout air quality analysis described in a previous report (dated February 5, 2013). First, the updated project site configuration includes a more compact and relocated active site area. Second, instead of a phased development with full capacity operation not expected until 2026, the updated project assumes full capacity operation in 2019. This report is intended to supersede and replace the previous report.

A more detailed description of the proposed Terminal is provided in Appendix B in the *Gateway Pacific Terminal Alternatives Report*, Pacific International Terminals, Inc., dated April 28, 2014. The revised site layout described in the Gateway Pacific Terminal Alternatives Report was developed to reduce wetland and stream impacts on the project site in accordance with the objectives of NEPA, the Clean Water Act and SEPA. [(1)]

[(1)] As described in the Project Alternatives Report, the revised site layout achieves the project objectives with less wetland, stream, and other impacts. Under the Clean Water Act, the revised site layout is considered preferable to the original layout. The revised site plan has been submitted for review under SEPA and NEPA, both of which require consideration of reasonable project alternatives.

1 Summary

The air quality analysis for the proposed Gateway Pacific Terminal (Terminal) Project described in this report considered air pollutant emissions and off-site concentrations that could result from the construction and operation of the proposed facility. The analysis considered operations with complete buildout and full capacity operations in 2019. In addition to evaluating air emissions from on-site activities, the air quality review also considered the air quality implications of locomotive operations along the Custer Spur and Terminal vessels transiting and hotelling near the site.

The air quality assessment of Terminal operations included development of detailed emission inventories based on spatially and temporally distributed emissions from the following sources:

- transiting and hotelling ocean-going commodity transport vessels
- harbor assist vessels (tugs)
- project-related locomotive operations along the Custer Spur and on the Terminal site; other potential rail traffic on Custer Spur was not included
- railcar commodity unloading within on-site buildings
- conveyor transport of coal to stackers/reclaimers and open storage
- coal stackers/reclaimers creating piles
- open storage fugitive emissions, including wind erosion
- mechanized stackers/reclaimers removing coal from piles and placing it onto conveyors
- conveyor transport of coal and other commodities (e.g., potash) to vessel loaders on the facility wharf
- vessel loading of coal and other commodities

Emissions from these sources and activities were then evaluated with air quality dispersion modeling. The air quality analysis considered emissions and concentrations of "criteria" air pollutants (e.g., particulate matter) and one selected toxic air pollutant, diesel particulate matter.

The air quality analysis indicated emissions from on-site activities and off-site commodity transport would not result in any off-site air pollutant concentrations exceeding the health-based ambient air quality standards for criteria pollutants. All model-calculated air pollutant concentrations except short-term NO_2 are less than the respective standards. Dispersion modeling indicated NO_2 concentrations in a small area near the transiting train tracks could rise to near the level of the 1-hour ambient standard in 2019, but would not exceed the standard.

There are no ambient air quality standards for diesel engine exhaust particulate matter (DPM). However, an analysis of DPM indicated facility operations and commodity transport would result in DPM concentrations exceeding the Washington State screening level for this pollutant in 2019. This report presents further information to put these concentrations into context.

2 Introduction

This report documents the air quality impact and mitigation assessment performed by ENVIRON International Corporation (ENVIRON) as part of the environmental review for the proposed Gateway Pacific Terminal (Terminal) project at Cherry Point in Ferndale, WA. The project location is depicted in **Figure 1**. The project vicinity is shown in **Figure 2**.

3 Project Description

The proposed project would create a deep-water, multimodal marine Terminal for exporting dry bulk commodities, designed with the intent to meet the operational needs of Pacific International Terminals in successfully servicing the international bulk commodity markets over the long term. The deep-draft wharf, access trestle, storage, and handling areas would allow the Terminal to efficiently load large, ocean-going vessels for shipping commodities to Asian and other international markets. Successful operation requires a sufficiently large land area for space to store cargo temporarily and to support the required rail infrastructure. A deep-draft wharf is necessary to accommodate the large Panamax and Capesize vessels that currently serve the commodity trade.

For safe and effective operation, the Terminal would be comprised of several types of infrastructure and facilities, including the following:

- A large rail yard able to safely manage 125 to 170-car commodity trains and their loads
- Unloading facilities with air quality (i.e., dust) control systems
- Secure open and closed storage areas including:
  - → An open stockyard with associated machinery, including stacking and reclaiming machines
  - → A 752,500 square foot closed storage area and associated machinery
  - → 6 silos and associated machinery
- A 3,000-foot long, deep-draft wharf with ship-loading equipment and an access trestle extending from the shoreline to the wharf
- Conveyor connections from commodity unloading areas to storage areas and from storage areas to the access trestle, wharf, and ship-loading equipment
- New buildings including administration, maintenance, Longshore building, and other support buildings
- Internal circulation and access roadways
- Potable water, wastewater, electrical power, lighting, water, fire, safety and security, and communications
- Industrial water and stormwater management systems; and
- Specific design features to avoid and minimize, or compensate for the environmental effects of the Terminal

After a general description of the expected operations, the following sections provide details on each component of the revised site layout and other aspects of the Terminal. The revised layout and the locations of these general functional areas are shown in **Figure 3**.

3.1 Terminal Operation

The Terminal would operate to transship large quantities of fairly uniform, granular materials from rail transportation to ocean-going vessels. Single-commodity trains are made up of specific and consistent railcar types designed for efficient loading and unloading of commodities. Trains of this type are often called "unit" trains because they travel as a unit from the production site to a Terminal.

Once a train arrives at the Terminal, it would pass through an unloading facility, and railcars would be emptied two at a time into a receiving hopper beneath the rails. Some types of railcars unload through bottom doors (e.g., potash) while rotary gondola-style coal cars are flipped upside down during emptying.

Once unloaded, the commodity would be moved from the dumper bin to either the open or closed storage area using large conveyors. At the open storage area, stacker/reclaimers would place the material in storage piles managed to minimize commodity loss and maximize the efficiency of handling. At the covered storage area, materials would be stored in silos. Enough material would be stored in open storage at the Terminal so that vessels could begin loading immediately once at berth.

3.1.1 Commodities to be Handled

It is anticipated that the Terminal would likely manage exports of coal, potash, agricultural products, calcined coke, mineral products, and other commodities initially, and would be developed to have the capacity to export up to 54 million metric tons per year of these materials. Of this total, 48 million metric tons would be coal and 6 million metric tons would be all other products. This analysis considered the air quality implications of coal as the primary commodity along with potash as the secondary commodity because transport of potash would involve the longest, heaviest trains.

3.2 Rail Access and On-Site Rail Configuration

3.2.1 Rail Access

The BNSF Railway Company (BNSF) would provide the freight access via BNSF's existing Pacific Northwest rail network. BNSF's existing Bellingham Subdivision runs approximately north-south roughly parallel to Interstate 5 in the project vicinity. This main line feeds the Custer Spur, the existing rail line developed to service the Cherry Point Industrial Urban Growth Area.

The Custer Spur branches west from the Bellingham Subdivision main line at Custer, then travels west, then south approximately 9 miles, terminating in the Cherry Point rail yard near the Phillips 66 Refinery, which is the southernmost industrial facility in the Heavy Impact Industrial zone.

Rail access to the Terminal would be provided from the Custer Spur. Improvements to approximately 6 miles of the Custer Spur would be necessary to accommodate the number, length, and weight of trains anticipated to access the Terminal. A new multiple-switch connection and new connecting tracks (referred to as leads) would be added to the Custer Spur north of BNSF's existing Elliot Rail Yard and route trains to connect to the Terminal's rail at the southwestern limit of the Elliot Yard and at the Terminal's property boundary.

The railcars used to haul bulk commodities have varying lengths, and the Terminal will be designed to allow for such variations. The Terminal will be designed to accommodate train lengths up to a maximum of 8,500 feet.

Up to three receiving and departure tracks would be developed on the south side of BNSF Cherry Point Subdivision line starting from the Custer Wye through the Intalco Yard, Valley View Road, to Ham Road. Each receiving and departure track would be long enough to provide a holding area for trains up to 8,500 feet long to avoid blocking at-grade public crossings or blocking of the railway main lines. Construction of the receiving and departure tracks would include a new railbed, trackage, bridge, and drainage structures.

The Custer Spur's rails would be upgraded from the existing jointed light-rail sections to 141-pound, continuous-welded rail. This upgrade is needed to accommodate the expected tonnage of transported commodities and to efficiently manage the required maintenance demands resulting from increased numbers of trains while maintaining current service levels. This rail upgrade would also include any required rehabilitation of the existing rail ties and other existing rail bed structural improvements. A new terminal lead would be constructed to connect existing tracks to the Terminal and improvements would be made to BNSF's existing Elliot Yard to support the additional rail connectivity.

When necessary based on Terminal volume, a second track would be added along the complete length of the Custer Spur from the Custer Wye approximately 6 miles to the new proposed Terminal connection point. The Custer Spur currently services several existing industries by way of a single main line track. A second track would protect existing rail service and switching capabilities for all customers along the line and efficiently accommodate increased rail traffic to and from the Terminal.

3.2.2 On-Site Rail Configuration

The revised site layout incorporates a single rail loop configured in a Figure-8 that would provide all the capacity to service the Terminal, including coal and most other commodities. (2) The loop would be located in the northeastern portion of the property to minimize wetland and stream impacts and keep grading to a minimum. The Figure-8 rail loop would have five inbound tracks and five outbound tracks (see **Figure 3**).

The Figure-8 loop would be designed to allow unobstructed unloading of railcars and would support staging a total of up to eight loaded, inbound bulk commodity trains preparing for dumping, and empty, outbound trains being inspected for departure. The loop would include a repair area for cars or locomotives. The rail would be built on an engineered railbed to provide a nearly level rail surface, thereby minimizing fuel consumption and improving rail operations and safety. Approaching the Terminal and traversing the proposed Terminal rail loops, trains would travel at an average speed of approximately 6 miles per hour.

(2) The layout proposed in 2012 included two separate rail loops.

At full utilization of the Terminal, up to eight unit trains carrying coal would arrive per day. Each train could consist of up to 150 railcars with a net carrying capacity of approximately 109 metric tons of coal per car (total 16,350 metric tons). A 150 railcar train plus locomotives would be approximately 8,300 feet long. Sometime after an initial operational phase, one additional train would bring a secondary commodity to the facility. For purposes of this analysis the secondary commodity was assumed to be potash because it would involve the longest, heaviest trains comprised of up to 170 cars weighing about 101 metric tons (total 17,272 metric tons). The 170-car trains and locomotives would be up to 8,500 feet long.

3.3 Rail Unloading

The commodity unloading facility would be comprised of three railcar dumpers in sheds, control facilities, scales, and dust control systems using baghouses. The railcar dumpers would be parallel to each other at the center of the Figure-8 loop. Two of the three dumper stations would each employ tandem rotary dumpers to simultaneously unload two gondola-style coal cars into a receiving hopper. The third dumper station would employ a single bottom dumper to simultaneously unload two railcars into a receiving hopper. The latter facility would be used for commodities requiring closed storage, for example potash. It is estimated that a single train could be unloaded, on average, in 4 to 6 hours.

The unloading station would be built on a concrete foundation structure designed to support the trains on continuous welded rails. The working area of each of the unloading stations would be protected by a shed with open ends.

3.4 Open Stockyard and Material Handling Equipment

Coal would be stored in a single large, open-air stockyard serviced by stacker/reclaimers and outloading/inloading conveyors with surge bins. The stockyard would be an approximately 80-acre, unpaved, level area with asphalt-surfaced lanes between piles at open storage. With coal stored in continuous piles, the total capacity of the stockyard would be approximately 2.75 million metric tons.

The open coal open storage area would be comprised of five linear piles managed with four stacker/reclaimers. The open storage piles would be approximately 2,100 feet long and up to about 70 feet high; the stacker/reclaimers would be approximately 110 feet high. The rail-mounted stacker/reclaimers would move along the lanes between piles to service the open storage.

Stacker/reclaimers would scoop commodities from open storage onto an outloading conveyor that connects to a shiploader. Reclaimers need to be able to reach almost all portions of a pile and move material quickly onto the outloading conveyors. Shiploaders load floating vessels while adjusting to tides and addressing load balance.

3.5 Closed Storage and Material Handling Equipment

Two A-frame buildings and six silos would be built for closed storage and material handling equipment. The A-frame buildings would cover approximately 17 acres and would be located southwest of the open storage area. The silos would be located west of the A-frame buildings near the intersection of Gulf and Henry Roads (see **Figure 3**).

The two A-frame storage sheds would have a total capacity of approximately 360,000 metric tons. For each shed, material would be moved by independent stacking/reclaiming equipment along the ridgeline and include a gallery structure supporting a conveyor, tripper, and soft drop chutes for moving materials into the structure. At the base of the walls and on top of the concrete retaining walls, a crane rail would support a reclaim machine to feed material onto an outloading conveyor.

The cast-in-place silos would each have a capacity of 13,500 metric tons for a total storage capacity of 81,000 metric tons. Each silo would be approximately 100 feet in diameter and 180 feet tall and built on steel pilings with concrete foundations. The bottom of each silo would have a steel hopper system that opens to feed onto an outloading conveyor.

3.6 Commodity Conveyors

Throughout the Terminal there would be inloading and outloading conveyors to move materials from one location to another. For coal moving from the unloading facilities to the open stockyard, inloading conveyors would connect at a transfer tower to one of four inloading conveyor lines. These inloading conveyors would feed materials to the stacker/reclaimers that service the open storage.

Coal moving from the stockyard to a ship would be reclaimed from the open storage area and loaded onto outloading conveyors that would move material to a surge bin that would regulate the flow of material onto two outloading conveyors traveling westward along the south side of Henry Road. These outloading conveyors would move through a transfer tower connecting to the trestle conveyors. The trestle conveyors would serve up to two shiploaders at the wharf. Outloading systems would operate only when a ship is present and ready to receive the coal.

Potash, for example, would be transferred from the unloading facilities to the closed storage area by an inloading conveyor located outside of the rail loop. Potash would be transferred from the closed storage area to a ship using outloading conveyors located at the west end of the closed storage area. The potash outloading conveyors would converge to a single outloading conveyor and run parallel to the coal outloading conveyors along the south side of Henry Road to the trestle and wharf.

Inloading and outloading conveyors used for material handling at the Terminal would be constructed with covers to control dust. The Inloading and outloading conveyors would be driven by electric motors. Transfer points between the inloading and outloading conveyors at transfer towers and at the surge bin would be equipped with passive enclosure dust control systems, including staggered conveyor curtains and covered chuting.

3.7 Wharf and Access Trestle

Gateway Pacific Terminal would incorporate a three-berth, deep-draft wharf with ship loading equipment and an access trestle extending from the shoreline to the wharf. The wharf would be approximately 3,000 feet and 105 feet wide. Access to the wharf would be provided by an access trestle 1,100-foot-long and no less than 50-feet-wide. The wharf and access trestle would include the following features:

- Trestle access corridor
- Access to trestle conveyors
- Access roadway
- Longshore Building
- Utilities and stormwater
- Water quality treatment from the wharf

3.7.1 Access Trestle

The access trestle would begin at a constructed abutment inland of the shoreline bluff, cross above the bluff, and descend to the wharf. The trestle would cross over the water from above the bluff, which would remain largely undisturbed at its existing elevation. The trestle's 50-foot width would allow two vehicles to pass each other as one enters and one leaves the wharf. The trestle would accommodate two enclosed conveyor lines running parallel at deck height. A third conveyor would be either stacked above the other two or cantilevered off to the side. Trestle conveyors would be fully enclosed.

3.7.2 Wharf

The wharf would be located at the trestle head and lie generally parallel to the shoreline. It would be designed to berth up to three vessels. The wharf would have one berth southeast of the trestle head and two berths northwest of the trestle head. See **Figure 3**. The wharf's three berths would be as follows:

- Berth 1 (northwestern-most berth) - 1,137 feet long
- Berth 2 - 1,227 feet long
- Berth 3 - 636 feet long

The wharf would support three shiploaders with an elevated gallery that would connect the shiploaders. The elevated gallery would contain the out-loading conveyors and be fully enclosed. The wharf would be sufficiently wide to allow two lanes of vehicle access. The wharf would also include berthing fenders and a vessel-mooring system.

Shiploaders are designed to fill the holds of vessels with dry bulk commodities. Commodities travel on enclosed conveyors to a shiploader, where the material is fed to a boom and into the hold of a ship. A shiploader travels the length of the berth on rails and the boom moves up, down, inward, outward, and side-to-side to fill the vessel's hold completely and evenly while accommodating changing vessel heights from tidal change. The material would discharge at the end of a boom through a chute specifically designed to reduce dust generation by containing the product flow into a tight stream. In addition, each shiploader would be equipped with a dust suppression system to minimize fugitive dust from both the transfer of the commodity from the wharf conveyor to the shiploader and from the end of the boom.

Each of the three berths would have embedded junction boxes and conduits for future "cold ironing" connections that would allow vessels to use shore power while at berth. The arrangement of mooring equipment on the wharf would allow vessels to berth with either side against the dock, depending on the direction of the prevailing wind and current. The wharf would accommodate vessels with capacities of up to 250,000 dead weight tons (dwt).

Upon initial development, commodities would be loaded into vessels at a peak rate of up to 10,000 metric tons per hour using a dedicated shiploader. Individual vessels would be loaded using a single shiploader. Typical operations for arriving vessels would include tug-assisted berthing, mooring, and preloading inspections. Once a vessel was cleared for loading, an operator would control the shiploader motions.

The cargo selection and vessel loading plan would be managed though a central control room. Complete vessel loading typically takes multiple shifts over several days. Post-loading operations include a draft survey to confirm shipment size, releasing mooring lines, and tug-assisted de-berthing.

3.8 Vessel Traffic

Commodities would be moved by ocean-going vessel to and from the Terminal. At full operational capacity, approximately 487 vessels (318 Panamax vessels and 169 Capesize vessels) are expected to call at the Terminal per year.

3.9 Buildings

The Terminal would have five main buildings: a maintenance building (15,000 square feet), Longshore building, a single-story administration building that includes changing facilities (7,200 square feet), and a Gatehouse (250 square feet). Paved parking areas with lighting and stormwater facilities would be located adjacent to these buildings.

3.10 Access Roadways

Main access to the Terminal would be via Henry Road. New internal paved access roads would connect to Henry Road. There would be service roads paralleling the rail tracks and others providing internal circulation. Approximately 4 miles of roads would be built within the Terminal. The new roads would be 24 feet wide with 3-foot shoulders on both sides.

3.11 Dust Control Measures during Operations

Terminal operators would implement procedures and install equipment to control dust during operations at the Terminal. While different commodities may require specialized handling practices, the equipment and operating procedures identified below represent potential options to effectively address the management of dust in connection with coal and potash handling operations.

3.11.1 Dust Control during Loading and Unloading Operations

Commodities arriving at the Terminal would be unloaded inside the unloading facility equipped with a dust collection system to control dust during railcar unloading. The dust control system would create negative pressure within the covered structure to collect dust generated during dumping and route it to a baghouse. The system would effectively reduce dust emissions vented from the shed during railcar unloading activities to less than 10 percent opacity.

Each unloading shed would be built over a receiving hopper with a conveyor to transport delivered commodity to the open stockyard or to one of the closed storage areas. Conveyors would be covered and operated to control dust during cargo transfer operations.

3.11.2 Dust Control at Conveyors and Transfer Points

Other than stacker/reclaimers at the commodities storage piles which would be uncovered, all inloading and outloading conveyors used to transfer commodities throughout the Terminal would be enclosed in a gallery and fully covered to minimize exposure to external conditions and reduce dust.

Specially designed passive enclosure dust controls, including staggered conveyor curtains and curved chuting, would be employed at transfer points to manage dust effectively during these operations. A fog-based dust control system would be used as needed during coal transfer operations at the Terminal. Such fogging systems generate atomized water droplets that adhere to the fugitive particles of coal to reduce airborne dust.

Dust control equipment and techniques related to ship loading were described previously.

3.11.3 Dust Control for Open Storage

Open storage of large quantities of dry commodities has the potential to generate windblown dust. Dust control measures to be implemented at the Terminal's coal open storage area would consist of a combination of compaction, fogging systems, water sprays, perimeter soil berms, regular pavement sweeping, and/or application of chemical surfactants. Water cannons along the stacker/reclaimer lanes in the open storage area would be used to apply surfactant for additional dust suppression in the open storage area when needed.

Water conservation features to be implemented would include controlling the dust suppression sprinkler system through an on-site meteorological station so that it would not operate during or just after rainfall, or when the materials in open storage are sufficiently damp. The sprinkler would operate only during sunny periods, while also taking into account the drying effect of wind.

3.12 Planned Terminal Construction

Large infrastructure involves large capital expenditures and large-scale construction activities. In 2012 it was believed that the Terminal would be built out in stages to pace with the growth of services. However currently most of the capacity of the Terminal has been reserved and thus the Terminal will be built in one continuous effort. The Terminal would open approximately 3 years following the start of construction.

4 Affected Environment

4.1 Regulatory Overview

4.1.1 Ambient Air Quality Standards and Attainment Status

Air quality is generally assessed in terms of whether concentrations of air pollutants are higher or lower than ambient air quality standards set to protect human health and welfare. Ambient air quality standards are set for what are referred to as "criteria" pollutants (e.g., carbon monoxide - CO, particulate matter, nitrogen dioxide - NO_2, and sulfur dioxide - SO_2). Three agencies have jurisdiction over the ambient air quality in the proposed project area: the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the Northwest Clean Air Agency (NWCAA). These agencies establish regulations that govern both the concentrations of pollutants in the outdoor air and rates of contaminant emissions from air pollution sources. Although their regulations are similar in stringency, each agency has established its own standards. Unless the state or local jurisdiction has adopted more stringent standards, the EPA standards apply. Applicable local, state, and federal ambient air quality standards are displayed in **Table 1**. These standards have been set at levels that EPA and Ecology have determined will protect human health with a margin of safety, including the health of sensitive individuals like the elderly, the chronically ill, and the very young.

Ecology and NWCAA maintain a network of air quality monitoring stations throughout the Puget Sound area. In general, these stations are located where there may be air quality problems, and so are usually in or near urban areas or close to specific large air pollution sources. Other stations located in more remote areas provide indications of regional or background air pollution levels. Based on monitoring information for criteria air pollutants collected over a period of years, Ecology and EPA designate regions as being "attainment" or "nonattainment" areas for particular pollutants. Attainment status is therefore a measure of whether air quality in an area complies with the federal health-based ambient air quality standards for criteria pollutants. Once a nonattainment area achieves compliance with the National Ambient Air Quality Standards (NAAQSs), the area is considered an air quality "maintenance" area. One aspect of the air quality study described here was to assess whether ambient air quality would continue to comply with the NAAQSs with the Terminal project operating, and thus, whether the Terminal project would result in any potential significant adverse air quality impacts.

Table 1. Applicable Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Terms of Compliance [a]	Concentration
Total Suspended Particulate (TSP) Annual Average (µg/m3) 24-Hour Average (µg/m3) WA State only; no federal standard	Geometric mean not to exceed Not to be exceeded more than once per year	60 µg/m3 150 µg/m3
Inhalable Particulate Matter (PM_{10}) Annual Average (µg/m3) 24-Hour Average (µg/m3)	Arithmetic mean; not to be exceeded The 3 year average of the 98th percentile of the daily concentrations must not exceed	50 µg/m^3 [b] 150 µg/m^3
Fine Particulate Matter ($PM_{2.5}$) Annual Average (µg/m^3) 24-Hour Average (µg/m^3)	The 3-year annual average of daily concentrations must not exceed The 3-year average of the 98th percentile of daily concentrations must not exceed	12 µg/m^3 [c] 35 µg/m^3
Sulfur Dioxide (SO_2) [b] Annual Average (ppm) 24-Hour Average (ppm) 1-Hour Average (ppm) 1-Hour Average (ppm) 1-Hour Average (ppm)	Annual arithmetic mean of 1-hour averages must not exceed 24-hour average must not exceed 1-hour average must not exceed The 3-year average of the 99th percentile of daily max 1-hour conc. must not exceed No more than twice in 7 consecutive days may 1-hour average exceed	0.02 ppm [b] 0.10 ppm [b] 0.40 ppm [b] 0.075 ppm 0.25 ppm [b]
Carbon Monoxide (CO) 8-Hour Average (ppm) 1-Hour Average (ppm)	The 8-hour average must not exceed more than once per year The 1-hour average must not exceed more than once per year	9 ppm 35 ppm
Ozone (O_3) 8-Hour Average (ppm)	The 3-year average of the 4th highest daily maximum 8-hour average must not exceed	0.075 ppm
Nitrogen Dioxide (NO_2) Annual Average (ppm) 1-Hour Average (ppm)	The annual mean of 1-hour averages must not exceed 3-year avg. of 98th percentile of daily max 1-hour averages must not exceed	0.053 ppm 0.1 ppm
Lead (Pb) Rolling 3-month Average	Rolling 3-month average not to exceed	0.15 µg/m^3

Note: µg/m^3 = micrograms per cubic meter; ppm = parts per million

[a] All limits are federal *and* state air quality standards except as noted. All indicated limits represent "primary" air quality standards intended to protect human health.

[b] Washington State standards; Washington applies more stringent annual and 24-hour limits for SO_2 than in federal rules. There is also a federal 0.5 ppm 3-hour average "secondary" standard for SO_2 to protect welfare.

[c] EPA issued a new 12 µg/m^3 annual standard on 12/14/2012 that will become effective on March 18, 2013; the previous annual standard was 15 µg/m^3.

4.1.2 Acceptable Source Impact Levels for Air Toxics

In addition to the health-based ambient air quality standards described above there are screening-level regulations for air pollutants that are known or suspected to be toxic or carcinogenic to people. These screening levels, known as Acceptable Source Impact Levels or ASILs, are applied in permitting processes for industrial pollution sources (e.g., a power plant). But these screening limits will not apply to any on-site sources associated with the Terminal project. [3] In addition, these limits do not apply to the mobile sources associated with facilities like the proposed Terminal project. These screening levels are sometimes used as benchmarks for considering concentrations of toxic air contaminants, so they are discussed more completely in later sections of this report.

4.1.3 Air Quality Conformity Review

Special air quality "conformity" rules apply in areas that are designated as nonattainment or maintenance for one or more air pollutants. These rules do not apply in the project study area because the area is considered in attainment for all criteria air pollutants. Consequently, neither the "transportation" nor the "general" conformity rules apply to this project.

4.2 Existing Air Quality Conditions

Existing sources of air pollution in the project study area include several industrial sources (refineries and bulk fuel storage facilities), local traffic sources, and residential wood burning associated with low density residential development. Residential wood burning produces a variety of air contaminants, including large quantities of inhalable coarse and fine particulate matter (PM_{10} and $PM_{2.5}$). With typical vehicular traffic, the air pollutant of concern is carbon monoxide (CO). Other pollutants include ozone precursors (hydrocarbons and nitrogen oxides – NO_x), coarse and fine particulate matter (PM_{10} and $PM_{2.5}$), and SO_2. The amounts of particulate matter generated by well-maintained individual vehicles are minimal compared with other sources (e.g., a wood-burning stove), and concentrations of SO_2 and NO_x are usually not high except near large industrial facilities. In Whatcom County, industrial sources likely comprise the largest contributors to ambient pollutant concentrations. Concentrations of air pollutants measured in the general vicinity of the project site are summarized in **Table 2**.

4.2.1 Carbon Monoxide

Carbon monoxide is the product of incomplete combustion. It is generated by transportation sources and other fuel-burning activities like residential space heating, especially heating with solid fuels like coal or wood. Carbon monoxide is often used as an indicator of possible air quality impacts related to roadway transportation sources because it is the pollutant emitted in the greatest quantity for which short-term health standards exist. CO impacts are usually highly

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(3) NWCAA rule 300.4 i) exempts from new source review permitting requirements any stationary internal combustion engine whose operation is limited to emergency situations and required testing and maintenance that operates fewer than 500 hours a year. Because these generators are the only stationary combustion sources associated with the Terminal facility, and because the ASILs only apply to stationary combustion sources, these screening levels do not apply to this project.

localized, and CO concentrations typically diminish within a short distance of roads. The highest ambient concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

There have been no measured violations of the CO ambient air quality standard within Washington State for several years. The project site is located in an area considered in attainment for CO.

Table 2. Summary of Measured Ambient Pollutant Concentrations

Pollutant	Monitoring Location	Averaging Period/(Source)	Measured Concentration	Unit	Year	Ambient Standard
$PM_{2.5}$	Bellingham Yew St	Annual, NAAQS (1)	6.0	µg/m³	2010	12
		24-hr, NAAQS (1)	15.8	µg/m³	2010	35
NO_2	Langley, BC	Annual, NAAQS (3)	11.8	µg/m³	2011	100
		1-hr, NAAQS 3-Yr Avg. of 98th percentile (3)	51.7	µg/m³	2009-2011	188
	La Conner, WA	1-hr, NAAQS 3-Yr Avg. of 98th percentile (2)	52.3	µg/m³	2009-2011	
SO_2	Bellingham Chestnut St	Annual, NAAQS (1)	14.2	µg/m³	1999	79
		24-hr Max, NAAQS (1)	36.7	µg/m³	1998	367
		1-hr, NAAQS 99th pct.	89.0	µg/m³	1998	196
Ozone	Custer Loomis	8-hr, NAAQS (1)	0.047	ppm	2010	9
		1-hr, Max, WA (1)	0.065	ppm	2010	0.12
Source: (1) Puget Sound Clean Air Agency: http://www.pscleanair.org/airq/datarequest.aspx; (2) US EPA: http://www.epa.gov/airquality/airdata/ad_maps.html; (3) Metropolitan Planning, Environmental and Parks Department, Metro Vancouver, BC						

4.2.2 Ozone

Ozone is a highly reactive form of oxygen created by sunlight-activated chemical transformations of nitrogen oxides and volatile organic compounds (hydrocarbons) in the atmosphere. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time, during which ozone precursors can be transported far from their sources. Transportation sources including large marine vessels, locomotives, and trucks are some of the sources that produce ozone precursors. Because ozone is not emitted directly, only very sophisticated air quality models are capable of considering ozone formation in the atmosphere, and such models are typically used for regional assessments of air quality plans. Thus, ozone modeling is not typically performed for project-specific reviews, and ozone was not considered in the air quality impact analysis for the Terminal project.

A large portion of the Puget Sound region was once designated as nonattainment for ozone based on violations of the 1-hour standard in effect at that time. In 1997, the EPA determined that the Puget Sound ozone nonattainment area had attained the public health-based NAAQS for ozone. At that time, EPA redesignated the Puget Sound region as attainment for ozone and approved the associated air quality maintenance plan. In 2005, EPA revoked the old 1-hour ozone standard in most areas of the US including the Puget Sound region. This action ended the maintenance status of this region. At the same time, however, the EPA adopted a new more stringent 8-hour average ozone standard that has since been made even more stringent and currently applies. [(4)] Some ozone measurements over the last few years have exceeded the 8-hour average standard (**Table 1**). If this pattern persists, the Puget Sound region may again be designated nonattainment for ozone. The ozone precursors (volatile organic compounds – VOCs – and oxides of nitrogen – NOx) are therefore important air pollutants in this region that will be considered as future air pollution control strategies are developed.

Ozone concentrations measured in the upper Puget Sound at the Custer-Loomis monitoring station indicate 8-hour concentrations reaching only about 60 percent of the NAAQS (**Table 2**). Under current air quality plans and policies, the potential future nonattainment status for ozone has no direct implications for the proposed Terminal project.

4.2.3 Inhalable Coarse and Fine Particulate Matter – PM_{10} and $PM_{2.5}$

Particulate matter air pollution is generated by industrial activities, fuel combustion sources like marine vessels, residential wood burning, locomotives, motor vehicle engines and tires, and other sources. Federal, state, and local regulations set limits for particulate concentrations in the air based on the size of the particles and the related potential threat to health. When first regulated, airborne particulate matter rules were based on concentrations of "total suspended particulate," which included all size fractions. As air sampling technology has improved and the importance of particle size and chemical composition have become more clear, ambient standards have been revised to focus on the size fractions thought to be most dangerous to human health. Based on the most recent studies, EPA has redefined the size fractions and set new, more stringent standards for particulate matter based on fine ($PM_{2.5}$) and coarse (PM_{10}) inhalable particulate matter to focus control efforts on the smaller size fractions.

There are currently health-based ambient air quality standards for PM_{10}, or particles less than or equal to about 10 micrometers (microns) in diameter, as well as for $PM_{2.5}$, or particulate matter less than or equal to 2.5 microns in diameter (**Table 1**). $PM_{2.5}$ and even smaller (ultra-fine) particles are now thought to be the most dangerous size fractions of airborne particulate matter.

With the revocation of the federal annual standard for PM_{10} in October 2006, the focus of ambient air monitoring and control efforts related to particle air pollution in the Puget Sound region has been almost entirely on $PM_{2.5}$. The measurement location closest to the project site is in Bellingham. Based on reported data at that location, measured $PM_{2.5}$ values are about one-half of the current 24-hour and annual NAAQS (**Table 2**).

[(4)] The current 8-hour ozone standard became effective May 27, 2008.

The Terminal project study area has never been included in a particulate matter nonattainment area. Particulate matter concentrations associated with the proposed Terminal project are analyzed in detail as part of the air quality review reported here.

4.2.4 Sulfur Dioxide (SO_2)

Sulfur dioxide is a colorless, corrosive gas produced by burning fuels containing sulfur like coal and oil, and by industrial facilities such as smelters, paper mills, power plants and steel manufacturing plants. Except near large emission sources, SO_2 levels are typically well below federal standards. Over the past decade the Puget Sound area has experienced a significant decrease in SO_2 from sources such as pulp mills, cement plants, and smelters. Additionally, levels of sulfur in diesel and gasoline fuels are decreasing due to federal regulations set by the US Environmental Protection Agency.

Existing SO_2 emission sources in the project area include large industry near the Cherry Point area, vessels in transit and generating electrical power while moored (hotelling), and diesel-fueled vehicles traveling area roadways that contribute to ambient background concentrations of SO_2. The nearest agency-operated SO_2 monitoring station was located in Bellingham up until 1999, but the BP Cherry Point Refinery has also measured SO_2 concentrations in more recent years. Measured concentrations at the BP monitoring station 2 km north of the Terminal site indicate background SO_2 concentrations in the project vicinity are approximately 53 percent of the restrictive 1-hour standard (**Table 2**, above). SO_2 concentrations associated with the proposed Terminal project are analyzed in detail as part of the air quality review reported here.

4.2.5 Nitrogen Oxides (NOx)

The sum of nitric oxide (NO) and nitrogen dioxide (NO_2) is commonly called oxides of nitrogen or NOx. Other oxides of nitrogen, including nitrous acid and nitric acid are part of the nitrogen oxide family. Of this family of gasses, NO_2 is the only component for which ambient air quality standards have been established, and this pollutant is used as the indicator for the larger group of nitrogen oxides. There is an annual average standard for NO_2 that has been in effect for many years.

EPA adopted a new 1-hour standard for NO_2 that became effective in April 2010. NO_2 has not been measured in the project vicinity, though measurements have been taken near La Conner, WA and Langley, BC. The reported 1-hour and annual average concentrations presented in **Table 2** indicate that background NO_2 concentrations are well below the current NAAQS. NO_2 concentrations attributable to sources associated with the proposed Terminal project are considered in detail in the air quality review documented in this report.

4.2.6 Toxic Air Pollutants (TAPs)

In addition to the criteria air pollutants for which health-protective air quality standards have been set, fuel combustion sources emit a number of known or suspected toxic air pollutants that may be directly harmful due to their chemistry and/or cause cancer or other detrimental effects to human health with long-term exposure. Although there are not any specific health-related air quality *standards* for such pollutants, EPA, Ecology, and NWCAA have established *screening* levels for a variety of toxic air pollutants (TAPs) that can be used in assessing the relative potential of adverse impacts. One TAP, diesel engine exhaust particulate matter (DPM), was considered in this analysis because information regarding Terminal project-related emissions of this pollutant is expected to be of interest during the environmental review phase for this project.

A common method of assessing potential risk related to exposure to TAPs is to estimate the likelihood of increases in cancer due to a lifetime of exposure (usually assumed to be 70 years) to a given contaminant. Some screening levels for assessing such potential risk are based on an increased risk of one additional cancer among one million people. Ecology and NWCAA have adopted this sort of conservative screening approach for TAPs using screening levels called Acceptable Source Impact Levels (ASILs). ASILs are used during air quality permitting review of proposed new or modified stationary emission sources and ASILs are applied based on the incremental changes in pollutant concentrations expected to occur due to proposed projects. The Washington State ASILs are ***not*** intended for use in evaluating emissions from mobile sources such as those associated with the Terminal project because such sources are not subject to air pollution permits. The ASILs nonetheless represent general benchmarks that can be used for assessing potential risk related to exposure to TAPs.

As screening levels, ASILs and guidelines used for reviewing potential impacts related to TAPs are based on estimated health impact thresholds derived through review of available scientific studies. Unlike the ambient air quality standards for criteria air pollutants which are adopted after rigorous review of the science involved, screening levels like ASILs are adopted based on much less thorough evaluations.

The ASIL referred to in this assessment is also fundamentally different than the ambient air quality standards (NAAQSs) adopted to protect human health and welfare with a margin of safety. The NAAQSs shown in **Table 1** are designed to protect against known or suspected short-term acute and long-term chronic health effects due to exposure over certain periods of time. The NAAQSs are based on protecting even the most sensitive populations from exposure over periods ranging from 1 hour to 1 year. For example, SO_2 standards are based on 1-hour, 3-hour, 24-hour, and annual average concentrations, and the ambient standards for other criteria pollutants are similarly based on time-weighted average exposure limits.

In contrast, the ASILs such as the one for DPM considered in this analysis are based on estimates of the possible risk of the additional incidence of cancer in a population with *continuous* (i.e., 24 hours per day) exposure over 70 years. So instead of standards based on relatively well-defined dose-responses, the long-term TAPs screening levels are based on the estimated potential risk associated with long-term, constant exposure. For this reason, the TAPs screening level are not given the same weight during emission source review processes, and do not have the same force of law as do the NAAQSs.

DPM Regulatory versus Impact Review

Combustion of diesel fuel generates small particulate matter both as direct emissions and as particles formed during atmospheric mixing and cooling. Direct emissions are primarily very small (i.e., < 1 micron) elemental carbon (EC) particles that are considered "filterable" because they can be captured on filters by passing the hot, undiluted exhaust from a stack through a filter. As the exhaust is diluted and cooled by mixing with air, additional particulate matter forms by condensation. The secondarily formed portion, sometimes referred to as the "condensable" fraction, is comprised primarily of organic carbon (OC) particles and complex mixtures of other substances. Because emission tests of stationary sources (e.g., generators) sometimes differentiate between the EC and the OC fractions of DPM, it is, in some instances, possible to consider only the direct EC emissions of stationary sources. In contrast, because mobile source DPM emissions are usually measured after the exhaust has mixed with and been cooled by air, it is very difficult to distinguish and separate the EC/OC fractions of DPM from mobile source engines.

During regulatory permitting reviews for stationary sources Ecology considers only the filterable, directly emitted particulate matter for comparison with the ASIL (Ecology 2014). But the air quality impact review of project-related DPM considered (and were dominated by) mobile source emissions for which it is not feasible to meaningfully differentiate between the EC and OC fractions of DPM. In addition, the health risk analyses that provided the basis of the DPM risk factor relied on studies that reflected human exposure to total DPM emissions (i.e., EC+OC). For these reasons, the review of project-related DPM emissions considered the EC + OC fractions from all sources. As a result, any comparison of model-calculated, project-related DPM concentrations to the Washington State ASIL would be inappropriate because Ecology only applies the ASIL to the EC portion of DPM.

Although the ASILs for TAPs do not apply to mobile sources associated with the proposed project, the ASIL for DPM is acknowledged in this assessment. The Washington TAP screening impact level for DPM is a 0.0033 μg/m^3 annual average concentration (**Table 3**). The US EPA has not adopted a similar cancer risk estimate for use at the federal level due to continuing uncertainties in the underlying data. EPA says, "[diesel exhaust] human exposure-response data are considered too uncertain to derive a confident quantitative estimate of cancer unit risk . . ." (EPA 2002). Instead, EPA uses a 5.0 μg/m^3 Reference Concentration (RfC) to represent the exposure through inhalation to which humans may be exposed throughout their lifetime without being likely to experience adverse *non-cancer* respiratory effects (**Table 3**).

The Washington State Department of Ecology indicated they consider the ASIL concentration for DPM to represent a "negligible risk," and went on to note that "even the least exposed Washingtonians are likely to be exposed to higher diesel particulate concentrations [than the ASIL]" (2008). Ecology also reported that EPA estimated the median DPM exposure in Washington to be 0.249 μg/m^3 – a level 75 times greater than the ASIL (Ecology 2008).

Table 3. Air Toxic Impact Screening Levels

Toxic Air Pollutant	Washington ASIL Annual Average (μg/m^3)	US EPA RfC (μg/m^3)
Diesel Engine Exhaust Particulate Matter (DPM)	0.00330	5.0

Note:

Acceptable Source Impact Levels (ASILs) represent screening levels intended to be used during permitting processes for stationary air pollution emission sources. ASILs do *not* apply to mobile sources and are not required to be considered during environmental reviews. This screening level is considered for discussion purposes only. The DPM ASIL is used in Washington as an indicator of potential risk of an increase in cancer rates of 1 in 1 million people exposed for 70 years. EPA has not adopted a cancer risk factor for DPM due to uncertainties in the underlying data; the EPA RfC is a non-cancer risk factor representing an estimated safe level of exposure over a lifetime.

Sources: WAC 173-460-150; EPA 2002

4.3 Meteorological Conditions and Climate

Air quality is substantially influenced by climate and meteorological conditions, so prevalent weather patterns are a major factor in long-term air quality conditions. Climate in the project study area is affected by regional geography. The lowlands of Northwest Washington are surrounded by mountains and water bodies. Mountainous regions dominate to the south, east (Cascades), and north (Coast Mountains in Canada), while the Strait of Georgia borders the west. The combination of mountains and water create a regional meteorology unique to the Pacific Northwest. The climate is dominated by cooler summers that are comparatively dry, and winters that are mild, wet, and cloudy. Annual average precipitation measured at Bellingham, Washington reaches 35 inches, with the wettest months being November, December, and January, and with an average snowfall of 13.7 inches.

Wind direction and wind speed are complicated by geography so it is more difficult to represent predominant winds using more distant climatological data. However, the BP Cherry Point Refinery (BP Cherry Point) measures wind speed and wind direction near its facility. ENVIRON used a 5-year meteorological data set (2001–2005) assembled for a previous modeling analysis (for a different project) in the Terminal analysis. A wind rose representing these data is presented and discussed in section **5.2.2**. This meteorological data set was used in the air quality modeling analysis documented in later sections of this report.

4.4 Greenhouse Gases and Global Climate Change

The phenomena of natural and human-caused effects on the atmosphere that cause changes in long-term meteorological patterns due to global warming and other factors is generally referred to as "climate change." Due to the importance of the "greenhouse effect" and related atmospheric warming to climate change, the gases that affect such warming are called greenhouse gases or GHGs. The GHGs of primary importance are carbon dioxide (CO_2), methane, ozone, and nitrous oxide. Because CO_2 is the most abundant of these gases, GHGs are usually quantified in terms of CO_2 equivalents, or CO_2e.

Transportation is a significant source of GHG emissions primarily through the burning of gasoline and diesel fuels. National estimates indicate the transportation sector (including on-road, construction, airplanes, and vessels) accounts for 25 percent or more of total domestic CO_2 emissions. In 2008, emissions estimates for Washington suggest transportation accounted for nearly half of GHG emissions because the state relies heavily on hydropower for electricity, unlike other states that rely more heavily on fossil fuels (e.g., coal, petroleum, and natural gas) to generate electricity. The next largest contributors to total gross GHG emissions in Washington were about 20 percent each in fossil fuel combustion in the residential, commercial, and industrial sectors and in electricity generation. Agricultural activities and specific industrial processes, such as aluminum or cement manufacturing, accounted for about 6 percent each, while solid waste management activities, including GHG emissions from landfills, contributed about 3 percent (Ecology 2010).

CO_2 is not considered an air "pollutant" that causes direct health-related impacts, so it is not subject to ambient standards used to gauge pollutant concentrations in the air. The GHG tabulation for this project was developed using accepted techniques for emission inventories, but this listing is intended only to provide a preliminary indication of potential project-related

GHG emissions based on estimated direct and indirect emissions from project-related fuel combustion sources within the project study area.

There are no specific emission reduction requirements or targets applicable to the Terminal project, nor are there any generally accepted emission level "impact" thresholds with which to assess potential localized or global impacts related to GHG emissions. The Washington Department of Ecology has issued internal guidance to assist its staff in determining which projects should be evaluated and how to evaluate GHG emissions under SEPA (Ecology 2011a). These guidelines suggest Ecology staff make SEPA decisions on a case-by-case basis. The suggested emission guidelines are discussed further in Mitigation Section **7.2**.

5 Analytical Methods

The air quality impact analysis included two basic steps: (1) emission inventory development to estimate emissions related to operation of the Terminal facilities in 2019 with full capacity operations, and (2) dispersion modeling to estimate resulting air contaminant concentrations in the ambient air associated with each of these phases of operation. The following sections discuss the methods employed and the critical assumptions involved in each portion of the analysis.

5.1 Emission Inventory Methods

The proposed facility would result in emissions from vessels and trains (i.e., fuel combustion sources) and "fugitive" (i.e., non-source specific) non-combustion emissions (i.e., dust) from coal and other commodity handling. There would also be two small (250 kW) on-site emergency generators that in the event of a power failure would allow the mechanical systems to shut down without being damaged. These emissions were considered in the original emission inventory and the original dispersion modeling analyses, but not updated for this analysis because they were determined to be a minimal source.

5.1.1 Emission Factor Tools and Sources

The emissions estimates for project-related sources employed several standard computer tools as well as emission rate calculations using formulas published by EPA. The application of these tools varied by the project phase being considered (i.e., construction or operation). Important assumptions employed in this portion of the assessment are summarized in **Table 4**.

Table 4. Emission Factors: Tools, Sources, and Critical Assumptions

Equipment Type	Tool/Method Source and Critical Assumptions
Terminal Construction Phase – Regarding GHG Emissions Only	
Tugs	EPA Current Methodologies in Preparing Mobile Source Port-related Emission Inventories, April 2009 (EPA, 2009) • Assume tugs use ultralow sulfur diesel 15 ppm (0.0015% S) fuel → 2015 goal of the Northwest Ports Clean Air Strategy [NWPCAS] and vessels in IMO ECAs) is 1,000 ppm [(a), (b)] • Conservatively assume Tier 2 engines → Tier 3 applies beginning in 2009 → Tier 4 applies beginning in 2014
Barge Cranes and Pile Drivers	EPA NON-ROAD Model • Non-road parameters assume default settings for WA state population/age distribution & control technology ratings • All equipment uses ultra-low sulfur diesel (ULSD) fuel
Excavators, Graders, Haul Vehicles	EPA NON-ROAD Model • Non-road parameters assume default settings for WA state population/age distribution & control technology ratings • All equipment uses ultra-low sulfur diesel (ULSD) fuel
Terminal Operational Phase – GHG and Criteria Pollutant Emissions	
Ocean-Going Vessels	EPA, 2009 • Emission factors based on 1,000 ppm (0.1%) S distillate fuel (the 2015 goal of the NWPCAS and vessels in IMO ECAs) [(a), (b)] • Bulk carrier average engine 11,000 kW, w/ 3 auxiliary engines at 612 kW each → 11,000 kW for mains; ENVIRON estimate based on review of available information • Load factors for engines and boilers from EPA as follows: → Main @ cruise - 0.27 → Main maneuvering - 0.2 → Aux @ cruise - 0.27 → Maneuvering - 0.45 → Hotelling - 0.1 • 2019 NOx emission factors (EFs) conservatively **not** adjusted for Tier 3 NOx • Transit speed assumed to be 5 knots
Tugs	EPA, 2009 • Tugs use ULSD • Auxiliary engines and load factors from EPA methods • Assumed Tier 2 engines • 2019 NOx emission factors (EFs) **not** adjusted for Tier 3 requirements Ausenco Sandwell • Tug power ratings at 5,000 hp (per vessel; assume 2 engines) • Assume 4 tugs for Capesize, 3 tugs for all other vessel sizes
Locomotives	EPA Emission Factors for Locomotives, 2009 • Assumed fleet average emission rates for line-haul engines (that reflect fuel

Table 4. Emission Factors: Tools, Sources, and Critical Assumptions

Equipment Type	Tool/Method Source and Critical Assumptions
	quality requirements) • Locomotive fuel use and time in notch setting per segment on on-site Figure-8 provided by BNSF modeling under conditions *without* AESS (automatic engine stop during idling); worst-case assessment because locomotives will use AESS when temperatures exceed 40°F. • Estimated daily and annual emissions from 150-car coal train (with 5 locomotives) in 2019 • Estimated daily and annual emissions 170-car potash trains (with 7 locomotives) in 2019 • Terminal rail traffic on Custer Spur was analyzed. Other potential future traffic on Custer Spur was not included in the analysis of project effects. → Modeling considered locomotive emission rates based on a fleet distribution for locomotive age → Considered a second scenario based on the EPA default fleet distribution *except* all locomotives fitted with engines older than Tier 2+ were assumed to be Tier 2+
Emergency Generators	EPA emission factors based on Standards for Stationary Compression Ignition Internal Combustion Engines, FR 40 CFR Parts 60, 85 et al. July 2006, Table 2 • New Source Performance Standards (NSPS) required emission rates • 2, 250 kW diesel-powered generators • These generators were not considered in the analysis of the revised layout facility because they were determined to be a minimal source of emissions
Coal Storage Pile Stacking and Reclaim	• Emission factors from AP-42, Section 13.2.4 • Emission factors in pounds per ton of material loaded • Additional factors needed are moisture content of the material (coal) and annual average wind speed • Moisture content of coal is 26.7% • Average wind speed is 5.86 mph, calculated from BP wind data • Throughput has been assumed to be 7,000 metric tons per hour for stacking (load-in) and 10,000 metric tons per hour for reclaim (load-out) for each stacker/reclaimer. • Refer to photo of large stacker/reclaimer in **Appendix A**
Conveyor Runs	• Most conveyors are covered or completely enclosed and only considered a source of emissions at transfer points that are vented to the atmosphere • Conveyors in the stacker reclaimer area are open. Emissions from these are considered with the wind erosion calculations. • Refer to photos of enclosed conveyors in **Appendix A**
Conveyor Transfer Points	• Conveyor transfer points are emission points only when vented to the atmosphere. Most conveyor transfer points, and all those involving coal with the exception of those on the wharf would be completely enclosed and dust would be controlled through the use of passive emission controls and dry fog applications. These sources were assumed to have zero emissions. • Conveyor transfer points for non-coal materials and the coal transfer points on the wharf will be enclosed, but vented to a fabric filter control device. Four 4 exhaust points were identified in addition to the railcar unloading station and

Table 4. Emission Factors: Tools, Sources, and Critical Assumptions

Equipment Type	Tool/Method Source and Critical Assumptions
	the shiploader as indicated **Figure 6**. • The exhaust from several transfer points is vented to a central baghouse located at the surge bin. This baghouse would have a 50,000 cfm air flow rate and 0.005 grains per cubic foot (gr/cf) loading • Three bin vent collectors, fabric filter systems similar to a baghouse, will be located at the wharf. Each bin vent collector will have an air flow rate of 5,000 cfm and 0.005 grains per cubic foot (gr/cf) loading.
Train car dumpers/ Baghouses	• The railcar unloading facility for coal would include two unloading buildings operating simultaneously on adjacent tracks; these buildings will enclose the dumping under negative air pressure to prevent dust escaping the open ends of the buildings, with the air drawn off to a baghouse. • The fan capacity for the coal railcar unloading facility assumed to be 300,000 cfm combined for both tracks with grain loading of 0.005 gr/cf • The closed storage commodity (i.e., potash) railcar unloading facility also would be enclosed with open ends, negative pressure, and vented to a baghouse • The baghouse fan size for potash was assumed to be 50,000 cfm with grain loading of 0.005 gr/cf
On-site Loaders (vehicles)	• On-site vehicles potentially generating dust include dozers and graders working in the open storage area. Emission factors for these sources have been taken from AP-42, Section 11.9, Table 11.9-1 (factor for dozers applied to front-end loader since no specific factor for front-end loaders) • Emission factor is rate of dust generated per hour of operation of the dozer/front-end loader • Additional factors needed for the emission computation are silt and moisture content of the material (coal) • Assumed a moisture content of the coal of 26.7% • Assumed a silt content of the coal of 2%
Ship Loading	• Emission factor for estimating ship loading emissions for coal taken from AP-42, Section 13.2.4 • Emission factor provides emissions in pounds per ton of material loaded • The maximum potential coal loading rate of 10,000 metric tons per hour was used in the calculation of emissions • Additional factors needed are moisture content of the material (coal) and annual average wind speed • Moisture content of coal is 26.7% • Average wind speed is 5.86 mph, calculated from BP wind data • Ship loading of materials from the closed storage commodity area (i.e., potash) will use specialized equipment called a "Cascade Bulk Material Loading Chute." This technique will minimize or eliminate dust from the vessel loading operations for the ship loading of potash. See example here: http://www.clevelandcascades.co.uk/chute.php • For purposes of calculation of emissions, an uncontrolled emission rate was first calculated on the basis of 3,000 metric tons per hour maximum potential loading rate for non-coal materials. Then a 95% control was assumed for the Cascade Bulk Material Loading Chute.

Table 4. Emission Factors: Tools, Sources, and Critical Assumptions

Equipment Type	Tool/Method Source and Critical Assumptions
	• A moisture content of 0.5% for the driest material, calcined coke, was assumed. • Refer to photo of ship hold coal loading in **Appendix A**
Wind Erosion Wind Erosion (con't)	• The only area subject to wind erosion is the stacker/reclaimer open storage area. • This entire area was assumed to be a source of fugitive coal dust including the open surface of the conveyors in the open storage area. • Emission factors for this operation are based on Shaw, et al. (2008), which calculates a separate emission rate for every hour based on the wind speed for each hour. This method is more conservative than AP-42 Section 13.2.5 that was used in the analysis of the 2012 site configuration. • For each hour: → The hourly average wind speed is used to estimate the fastest wind speed for that hour → From the fastest wind speed, a friction velocity is computed → The friction velocity is compared to a published "threshold" → Each hour with a friction velocity exceeding the threshold is considered a wind erosion event and emissions are calculated → Hours during which the friction velocity threshold is not exceeded are considered to be zero emission • The facility plans to water the surface of the exposed coal and apply surfactants or other dust palliative materials to the open surface of the coal to reduce emissions. It has been suggested by manufacturers and others that these dust control chemicals and water can produce as much as 90% control of emissions from the piles. **http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf** • For purposes of this analysis, the effect of the watering and chemical application was conservatively estimated to control 50% of the emissions that would otherwise evolve from an uncontrolled open storage.

(a) The Northwest Ports Clean Air Strategy is a cooperative agreement among the Ports of Seattle, Tacoma and Vancouver, BC developed to reduce emissions from these facilities in accord with progressively more stringent emissions controls that are consistent with the programs being implemented by the International Maritime Organization. These emission control strategies do not specifically apply to the proposed Terminal facility at Cherry Point, but application of such controls would be consistent with the aims of other ports in the area, and the project proponents have committed to implementation of these same controls as a means to minimize potential air quality impacts from the facility.

(b) The International Maritime Organization (IMO) has established a program to create and administer Emission Control Areas (ECA) intended to result in lower emissions within specially designated areas.

(c) ENVIRON also used dispersion modeling to evaluate the potential effects of annual train traffic based on 123-car grain trains, which would total about 512 per year if grain were to be a major export commodity. This modeling indicated grain train traffic would have only a minor effect on the maximum off-site concentrations of criteria pollutants, so the final modeling considered only potash trains.

5.1.2 Facility Operational Air Emissions – All Sources

ENVIRON estimated combustion source (i.e., vessels and trains) emissions associated with operation of the Terminal in 2019 based on the maximum expected commodity throughput at the operational facility. The combustion source emissions assessment used detailed operational scenarios of both peak day and annual levels of activities developed in discussions with Pacific International Terminals. Emission estimates considered the following sources: ocean-going vessels (OGVs) in transit over about three nautical miles from the junction of the east-west and north-south routes from the Strait of Juan de Fuca to the docks of the Terminal; OGVs hotelling at berth; harbor vessels (i.e., tugs) assisting OGVs during docking and undocking; incoming loaded and outgoing empty trains traveling along the Custer Spur; trains traveling through the Terminal's Figure-8 while waiting to unload, during unloading, and waiting to leave. Table 5 lists critical assumptions regarding facility operations and basic dispersion modeling characteristics associated with project-related combustion sources.

Table 5. Facility Operations and Dispersion Modeling Critical Assumptions – Combustion Sources

Equipment Type	Source and Critical Assumptions
Ocean-Going Vessels and Tugs	**Operations** • Transit speed at 5 knots • Emissions during transit to/from dock based on travel distance of about 3 nautical miles (nm) from dock to common route point • Maneuvering occurs with tugs assisting within ½ nm of dock and for ½ hour of activity to and from the dock • Assume 4 tugs for Capesize, 3 tugs for all other vessel sizes [a] • Time at berth (i.e., hotelling emissions) based on time required for loading Panamax (48 hours) and Capesize (71 hours) vessels, and based on expected numbers of each size vessel [a] → This includes 1 hour before and 1 hour after unloading [a] • Vessel numbers as follow: → 2019– Capesize 169; Panamax 318 (Total 487) • Position of vessels as follows (from Ausenco Sandwell) → Berth 1 – used for Panamax vessels in 2019; receiving coal → Berth 2 – used for Capesize vessels in 2019; receiving coal → Berth 3 –used for commodity loading in 2019, receiving potash from closed storage **Modeling** • Transiting vessels considered series of point sources along a 400-foot wide route • Annual modeling considered total annual emissions related to transiting, maneuvering, and hotelling vessels – distributed evenly in time and space along the 3-nm transiting route, maneuvering route, and at all three berth positions in 2019 [b] • Short-term modeling included a single vessel transiting, maneuvering, and at each berth with hourly emissions distributed evenly in time and space along the transiting route, maneuvering route, and all three berth positions in 2019 [c]
Locomotives	**Operations** • 150-car coal trains in 2019 for daily and annual emissions

Table 5. Facility Operations and Dispersion Modeling Critical Assumptions – Combustion Sources

Equipment Type	Source and Critical Assumptions
Locomotives (con't)	• 170-car potash train movements for emissions estimates and modeling in 2019 • Annual modeling based on total annual emissions from 9 trains/day evenly distributed in time and space across the entire year as emission sources located along the off and on-site rail as appropriate [(b)] • Annual modeling considered trains along all on-site rail routes and along the Custer Spur • Short-term modeling considered reasonable worst-case conditions during periods up to 24-hours long (because this is the longest "short-term" ambient standard) [(c)] • Short-term modeling assumed 7 trains on site during any (and every) 24-hour period as follows: → 2 trains idling in north portion of site waiting for connection to indexer for unloading → 3 trains being unloaded by indexing process → 2 trains idling in south portion of site waiting to leave → The 8 coal trains were assumed to be 150 cars with 5 locomotives → The 1 potash train was assumed to be 170 cars with 7 locomotives • Short-term modeling of on-site sources did not consider trains along the Custer Spur because the facility was assumed to be operating at capacity with no room for additional trains • Train routes to/from and on the site were treated as a series of volume sources, as follows: → Volume sources placed along the center of the track alignments with their centers spaced every 100 to 110 feet, and with widths varying as needed to encompass the tracks → Several point sources representing locations where locomotives would idle on site for long periods → Used SCREEN3 modeling technique to define stack and release heights; see discussion here (page 36)
Emergency Generators	• One generator located near the power substation near the unloading building • One generator located on the Terminal wharf • These generators were not considered in the analysis of the revised layout facility because they were determined to be a minimal source of emissions

(a) The number of tugs and the vessel times at berth used for the air quality modeling represent the upper ends of the planned operating ranges for the Terminal. The number of tugs required to maneuver a vessel will vary depending on weather conditions, tide state, and vessel dead weight tonnage. The assumed times at berth include immediate vessel maneuvering for arrival/departure, customs clearance, shiploader positioning, cargo loading, and a period of time for unscheduled equipment maintenance/inspection (i.e., delays that would prevent product loading). The estimates for these elements used in the air quality modeling analysis exceed the average duration expected for the Terminal.

(b) "Annual" modeling refers to the process of assessing pollutant emissions and concentrations based on expected emissions over an entire year. Calculated concentrations are compared with ambient standards based on annual statistics and/or with annual average health risk estimate criteria.

(c) "Short-term" modeling refers to assessments considering emissions and concentrations to be compared with short-term ambient standards such as 1-hour and 24-hour averages.

The combustion source emission factors applied in the analysis are listed in **Table 6**.

Table 6. Terminal Project Combustion Source Emission Factors

Train Locomotive Emission Factors (g/gal)									
2019 Scenario	**NOx**	**NO_2**	**PM10**	**PM2.5**	**HC**	**VOCs** [a]	**CO**	**SO_2**	**CO_2**
EPA Default [b]	103.0		2.5	2.4	3.9	4.1	26.6	0.09	10,217
Tier 2+ or Better [b]	84.3		1.36	1.3	2.3	2.4	26.6	0.09	10217
Vessel Emission Factors (g/kW-hr) [c]									
	NOx	**NO_2**	**PM10**	**PM2.5**	**HC**	**CH_4**	**CO**	**SO_2**	**CO_2**
Tug Main Engines	6.8	6.2	0.26	0.25	0.19	1.89	5	0.0065	690
Tug Aux Engines	6.1	6.2	0.13	0.13	0.21	1.89	0.9	0.0065	690
Vessel Main Engines	10.59	9.61	0.19	0.17	0.5	0.084	1.1	0.4	646
Vessel Main Engines (low load)	4.63	4.63	7.29	6.71	21.8	21.8	9.9	1.0	3.28
Vessel Aux Engines	10.59	9.61	0.18	0.17	0.4	0.084	1.1	0.42	691
Vessel Boiler	1.61	0.018	0.13	0.12	0.4	0.63	0.2	0.57	970
Emergency Generators (g/kW-hr) [d]									
Generators	9.2	These generators were not considered in the analysis of the revised layout facility because they were determined to be a minimal source of emissions							

[a] Emission factors for VOCs calculated as %HC

[b] The EPA default represents EPA's projected fleet distribution in 2019; the Tier 2+ or better scenario is based on this same distribution but with all locomotives rated less than Tier 2+ assumed to be Tier 2+.

[c] Emissions factors for vessel engines used in this assessment did not vary by year because no credit was taken for future improvements in vessel emission controls. Specific emission rates varied as a function of fuel quality.

[d] Two emergency 250 kW stationary generators; one near the unloading building and one on the wharf; both to operate under normal conditions for testing and maintenance only, and expected to operate fewer than 100 hours per year. NWCAA rule 300.4 i) exempts from new source review permitting requirements any stationary internal combustion engine whose operation is limited to emergency situations and required testing and maintenance and that operates fewer than 500 hours a year. These two generators are therefore not subject to new source review, and they were not considered in the air quality modeling for the revised site layout facility.

Sources:
Locomotive Emission Rates from USEPA Emission Factors for Locomotives, April 2009
Vessel Emission Factors from USEPA Current Methodologies in Preparing Mobile Source Port-related Emission Inventories, April 2009
Vessel boiler emission factors from CARB Emissions Estimation Methodology for Ocean-Going Vessels, May 2008
Regulation of the Northwest Clean Air Agency, Effective December 18, 2011

5.1.3 Facility Operational Air Emissions – Fugitive Dust Sources

Dust source emissions, which are subject to an air quality permit review, were considered with full facility buildout and maximum throughput because facility dust is the primary focus of the air quality permit, and the permit only requires consideration of the facility at full capacity. Dust emission sources associated with the project included coal unloading within the unloading facility – controlled by two baghouses; coal moved via open and covered conveyors; coal storage pile formation and extraction from the pile using stacker/reclaimers; two on-site loaders used to keep the coal pile storage yard tidy; coal pile fugitive (i.e., wind-blown) emissions; potash dumping in a building controlled by a baghouse; and ship-loading of all commodities at the offshore wharf. Table 7 provides additional information regarding the critical assumptions involved in the development of these emission scenarios.

Table 7. Facility Operations and Dispersion Modeling Critical Assumptions – Fugitive Sources

Equipment Type	Source and Critical Assumptions
Coal Pile Stacking and Reclaim	**Operations** Four stacker/reclaimers operating in the storage area; each stacker/reclaimer has the capacity to load in 7,000 metric tons (tonne) per hour and load out 10,000 tonne/hr Emissions calculations assumed two reclaimers would be loading in coal and two would be loading out coal **Modeling** Emissions of dust from both fugitive and non-fugitive emissions sources at the facility were modeled using AERMOD, applying a combination of Point and Area sources.
Conveyor Runs	Conveyors feeding the stacker/reclaimers will be open and were considered as part of emission sources within this area. Conveyors feeding the commodity export systems will be covered, so they were not considered as emission sources.
Conveyor Transfer Points	Conveyor transfer point emissions for coal were assumed to be zero since these are controlled by complete enclosure and dry fog with the exception of the bin vent collectors on the wharf. Conveyor transfer points for potash were based on fan flow rate and grain loading, thus no operational parameters were assumed. For modeling purposes, transfer points for the potash were assumed routed to a single point source of emissions located at the surge bin using the following parameters: → Release height of 60 feet → Exhaust Volume of 50,000 cfm → Exhaust velocity 4,500 ft/min → Stack effective diameter calculated from above 0.81 m
Train car dumpers/ Baghouses	Emissions for railcar unloading operations assumed negative pressure enclosures and baghouses, thus emissions calculations were based on fan flow rates and the assumed grain loading. No operations assumptions were necessary. For modeling purposes, baghouses were considered point sources of emissions using the following parameters:

Table 7. Facility Operations and Dispersion Modeling Critical Assumptions – Fugitive Sources

Equipment Type	Source and Critical Assumptions
Train car dumpers/ Baghouses (con't)	→ Coal one baghouse for both car dumpers → Baghouse release height of 85 feet → Exhaust volume of 300,000 cfm → Exhaust velocity 5,000 ft/min → Stack effective diameter calculated from above 1.32 m → Potash one baghouse → Baghouse release height of 70 feet → Exhaust volume of 50,000 cfm → Exhaust velocity 4,500 ft/min → Stack effective diameter calculated from above 1.15 m
Open Storage Area, including stackers/ reclaimers, open conveyors, and on-site loaders (vehicles)	Four Stacker/reclaimers operating, two loading in coal, two loading out coal Two on-site loaders or dozers units were assumed, operating 2 hours per day For modeling purposes these were combined in a single area source of 287,351 square meters (71 acres)
Ship Loading	For coal, the assumption was made that two ships would be loaded simultaneously, each at a rate of 10,000 tonne/hr For modeling purposes the ship loading operations were considered an area source of total area 35,137 square meters For potash, emissions from vessel loading were calculated based on a control of 95% over uncontrolled rates due to the use of the specialized loading chutes
Wind Erosion	Wind erosion emissions were modeled as part of the same area source used for the other open storage area emissions, an area source of 287,351 square meters (71 acres).

(a) "Annual" modeling refers to the process of assessing pollutant emissions and concentrations based on expected emissions over an entire year. Calculated concentrations are compared with ambient standards based on annual statistics and/or with annual average health risk estimate criteria.
(b) "Short-term" modeling refers to assessments considering emissions and concentrations to be compared with short-term ambient standards such as 1-hour and 24-hour averages.

Fugitive dust source emission factors are listed in **Table 8**.

Table 8. Terminal Project Dust Source Emission Factors

Emissions Source	Emission Factors
Baghouses and Bin Vent Collectors	Emissions based on the volumetric flow rate of air through the fabric filter multiplied by an assumed grain loading of 0.005 grains per cubic foot of air flow
Dozers and Front End Loaders	PM_{10} Emissions = $(0.75)(18.6)(s)^{1.5}/(M)^{1.4}$ lb/hr $PM_{2.5}$ Emissions = $(0.022)(78.4)((s)^{1.2}/(M)^{1.3}$ Where: s is silt content in % and M is moisture content in %
Stacker/Reclaimer Ship Loading	PM_{10} Emissions = $0.35)(0.0032)(U/5)^{1.5}/(M/2)^{1.4}$ lb/ton $PM_{2.5}$ Emissions = $(0.053)(0.0032)(U/5)^{1.5}/(M/2)^{1.4}$ lb/ton Where: U in annual average wind speed in mph and M is moisture content in %
Wind Erosion	Shaw et al., "An evaluation of the wind erosion module in DUSTRAN," ScienceDirect, Atmospheric Environment 42 (2008)

5.1.4 Dust Emission Controls included in Terminal Project Design

Air quality permitting rules that govern fugitive dust emissions from the proposed project require the use of Best Available Control Technology (BACT) for those sources subject to an air quality permit. [(5)] A BACT review includes consideration of all reasonably available means to reduce or control emissions, and the evaluation of both feasibility (i.e., whether such controls can be physically implemented and their potential effectiveness) and cost (i.e., based on expenditures per ton of emissions avoided). A BACT submittal is prepared as part of a permit application, and ENVIRON will be preparing a BACT report as part of the "Notice to Construct" permit application to the NWCAA. A brief review of the dust control mechanisms included in the Terminal project follows. These emission controls are believed to represent BACT for the proposed facility.

As shown in **Table 4** (page 21) and **Table 5** (page 25), the Terminal facility as proposed includes a number of components either specifically designed to minimize emissions associated with on-site operations or whose use would have this effect. These emission control components include the following:

- Commodity dumping inside buildings – all commodity hauling railcars would dump their loads inside negative pressure buildings that would collect dust and port it through baghouses. This would virtually eliminate emissions from the dumping buildings, while the baghouses would provide more that 99 percent control of emissions of fine particulate matter.
- The multiple large stacker/reclaimers used to create the coal piles within the stock yard area and to load coal from these piles onto conveyors would be electrically powered. Thus operation of this equipment would result in zero emissions on the project site from either the motors or the hydraulic systems.
- Coal pile forming via coal stackers will use state-of-the-art technology to minimize the distance of the drop from the stackers to the piles.
- All conveyors would be run using electrical conveyor drive motors.

[(5)] Northwest Clean Air Agency Regulations, Section 300.7

- All conveyor transfer points will be controlled using a combination of passive emission control (PEC) systems and/or dry fog emitters. PECs limit dust production at transfer chutes by "sliding" the coal from one belt to another instead of dropping it. PEC chutes are fully enclosed, and these chute enclosures are inside a building. In areas with insufficient space to allow the use of PEC chutes, particulate matter emissions will be controlled using dry fog technology. In these locations, dry fog, a sonic-induced mixture of 10-15 percent water and 85-90 percent air, is sprayed over the belt both before and after the transfer points, which are also completely enclosed to allow retention time for the fog to work. A transfer building provides secondary enclosure around the entire process. Within the transfer point, the particles in the fog are so tiny in size that they attract the dust in the transfer hoods, allowing the dust to agglomerate to the water fog. The combination of PECs and dry fog are expected to provide 100 percent control of emissions at all conveyor transfer points, so all controlled transfer points are considered zero emissions.
- The surface of the open storage pile for coal will be treated with dust palliative chemicals. These chemicals, typically surfactants, decrease the surface tension of the water in which they are mixed, allowing the water to penetrate more effectively into the irregular surfaces of the coal particles. The net effect is to bind the coal particles together, making them effectively larger and less subject to the erosive forces of the wind. This technique is widely used for open storage piles of coal and is effective at reducing emissions.
- In addition to, and in combination with the dust control chemicals, the open storage piles of coal will be equipped with water cannons. These are high pressure water spray systems that allow complete coverage of the coal piles with water. Water works with the dust control chemicals to agglomerate the smaller dust particles, making them less subject to the forces of the wind. ENVIRON assumed the combination of water spray and surfactants would provide 50 percent control of fugitive emissions from the open storage area.
- Emissions related to ship loading of commodities will be controlled via enclosure of the conveyors as described above and by the use of directional discharge mechanisms and shaped flow controls for coal ships that place the coal as gently as possible into open areas of the hold. Non-coal commodities will be loaded using Cascade Chute technology (see example). All vessel loading will minimize particulate matter emissions by ensuring the drops from conveyors occur below the combing of the hold (i.e., within the hold). [(6)]
- On-site locomotive emissions will be minimized when possible because locomotives will be fitted with an Automatic Engine Shutoff System (AESS) that would sometimes shut off unneeded locomotives. When trains are on-site waiting to unload and while the trains are moving through the indexer as coal cars are being unloaded, and when temperature are greater than 40°F, the AESS would shut down three of the five locomotives associated with each coal train, and the other two locomotives would be running only in a low-power idling mode sufficient to keep the onboard systems running. Note that, in order to be conservative, the use of the AESS was *not* considered in the air quality impact analysis even though temperatures in the project

[(6)] For purposes of the air quality assessment, shiploader emissions were based on coal and potash being loaded at the respective wharf locations.

area are less than 40°F only about 15 percent of the time, so factoring in AESS operations would result in emission reductions.

5.1.5 Greenhouse Gas (GHG) Emissions

ENVIRON estimated short-term GHG emissions associated with construction and long-term emissions related to operation of the proposed Terminal facility based on the 2012 site configuration. Those emissions estimates considered combustion source emissions directly related to the construction and operation of the facility (Scope 1), indirect emissions from purchased energy (Scope 2), and indirect emissions due to combustion sources associated with the operational activities of the facility (Scope 3). The estimates also included indirect emissions associated with product delivery by rail to the facility from the Custer Wye, along with emissions associated with exporting product via vessel (from the wharf out 3 nautical miles).

These estimates were not updated to reflect the emissions associated with the revised site layout configuration and operations because it is clear GHG emissions would be lower with this alternative than with the 2012 proposal.

5.2 Dispersion Modeling

ENVIRON used air quality dispersion modeling simulations to estimate ambient concentrations due to ships, trains, and on-site emission sources associated with the operations at the Terminal. This section discusses the methods used to develop these simulations to assess potential future pollutant concentrations in the area surrounding the facility.

5.2.1 Model Used

ENVIRON reviewed regulatory modeling techniques to select the most appropriate air quality model to simulate dispersion of air pollutants emitted by sources associated with the proposed project to estimate air pollutant concentrations.

ENVIRON selected AERMOD for this modeling analysis because it is the most up-to-date dispersion model currently available for handling the potential for exhaust plume downwash and plume impacts on intermediate and complex terrain. The terrain within close proximity on all sides of the Terminal facility site is relatively flat, while hillsides rise 100 to 500 feet in elevation to the north. The modeling considered emissions downwash related to the permanent physical structures on the site (i.e., not the vessels).

The U.S. EPA has designated AERMOD as the preferred guideline air dispersion model for air dispersion modeling (EPA "Guideline on Air Quality Models," codified as Appendix W to 40 CFR Part 51) for complex source configurations and for sources subject to exhaust plume down-wash. AERMOD incorporates numerical plume rise algorithms (the PRIME algorithms) that implicitly include the downwash effects a structure may have on an exhaust plume rather than using the wind tunnel based empirical algorithms of ISCST3. The PRIME algorithm also treats the geometry of upwind and downwind structures and their relationship to the emission point.

5.2.2 Modeling Procedures and Parameters

ENVIRON applied AERMOD to consider criteria pollutants using the regulatory defaults in addition to the options and data discussed in this section.

Model Setup and Application

ENVIRON employed the most recent version of AERMOD (Version 13350) with the default options for dispersion that depend on local meteorological data, regional upper air data, and the local physical characteristics of land use surrounding the facility. The Terminal site is located in an industrial area with sparse rural developments in the vicinity. The effects of increased surface roughness and other physical characteristics associated with urban land uses were not included in the modeling analysis during the preparation of the meteorological database based on wind direction as described below.

Elevation Data and Receptor Network

Terrain elevations for receptors and emission sources were prepared using digital elevation models developed by the United States Geological Survey (USGS) and available on the USGS Seamless Server system. These data have a horizontal spatial resolution of approximately 7 meters (m). The base elevation and hill height scale for each receptor were determined using the EPA terrain processor AERMAP (Version 11103). AERMAP generates a receptor output file that is read by AERMOD.

The dispersion modeling analyses used modeling receptors spaced 500 meters apart covering the 12-kilometer (km) by 12-km simulation domain, with a 5-km by 5-km nested receptor grid at 200-m spacing, a 3.1-km by 3.1-km nested receptor grid at 50-m spacing, and a 2-km by 2-km nested receptor grid at 25-m spacing. All four receptor grids were centered on the Gateway Pacific Terminal site. Model receptors were located at 10-m intervals along the boundary of the facility. The modeling receptor locations are depicted in **Figure 4**.

ENVIRON used a separate set of modeling receptors covering an 8.3 km by 9.5 km simulation domain to examine short-term air pollutant concentrations from off-site trains transiting on the Custer Spur from the Custer Wye to the Terminal. Within this area a series of receptor subareas were created at approximately 150 m, 450 m, 1,300 m, 3,000 m, and 4,750 m from the edge of the BNSF right-of-way. Within these subareas receptors were with 25-m, 50-m, 100-m, 200-m, and 500-m spacing, respectively. Thus the highest density receptor grids were closest to and along the entire length of the rail line so AERMOD could properly calculate maximum air pollutant concentrations related to off-site trains. The modeling receptor grids used for the transiting trains modeling are depicted in **Figure 5**.

Meteorological Data

ENVIRON constructed a 5-year meteorological data set for use in the AERMOD dispersion model using surface and upper air data. Wind speed and wind direction data were from the long-term meteorological monitoring station established and operated by BP. [7] Data from this monitoring station, which is about 2 kilometers due north of the northwest corner of the Terminal site provide a reasonable representation of meteorological conditions in the project vicinity. The BP station data were processed through the AERMOD meteorological processor AERMET (Version 13350) as on-site data. Regional meteorological data parameters not available from the BP station (i.e., cloud cover and ceiling height) were derived from surface observations from

[7] The BP met station is operated in accord with Prevention of Significant Deterioration (PSD) guidelines and other EPA guidance, including semi-annual independent audits.

the National Weather Service (NWS) station at Bellingham Airport, Washington, approximately 16 kilometers to the southeast.

A wind rose presenting wind speed and wind direction data for the five year period is shown in **Figure 7**. The wind rose indicates that the winds are predominantly light and are from the east-northeast and south-southwest directions. The average wind speed during the 5-year meteorological period was 2.6 meters per second (m/s), and calm conditions occurred less than 10 percent of the time.

Upper air data from Quillayute, Washington were also used for the 5-year meteorology data set. The Quillayute upper air data were compiled from the National Oceanic and Atmospheric Administration (NOAA) Forecast Systems Laboratory Radiosonde Database. [8]

EPA guidance indicates that surface parameters (albedo, Bowen ratio, and surface roughness) surrounding the primary meteorological site should be used in AERMET to construct the meteorological profiles used by AERMOD. Seasonal surface parameters were determined for the BP meteorological site using the AERMET preprocessor, AERSURFACE (Version 13016).

Daily versus Annual Operations

Operations of the proposed Terminal are generally expected to occur over 24-hours per day, 365 days per year. The air quality modeling scenarios used to simulate daily and annual levels of operations are described further below.

ENVIRON developed modeling scenarios for the facility to reflect both maximum daily throughput and maximum annual throughput in 2019 with complete buildout and full operation. The short-term (24-hour) scenario was used to estimate 1-hour, 3-hour, and 24-hour concentrations, and this profile was considered with modeling simulation using every day in the 5-year meteorological database.

The annual operations scenarios for combustion sources used a profile of hourly emissions throughout the year, reflecting realistic operational schedules in both future years. For fugitive dust sources, maximum potential emissions were calculated based on the capacity of the equipment. These sources and the resulting emissions were assumed to occur continuously for all conditions and all times.

Averaging Periods

Pollutant concentrations predicted by the model were averaged over annual and short-term (1, 3, 8, and 24-hour) periods, as appropriate for a given pollutant's ambient standards or screening level. The modeling assessments for the CO standards and the short-term SO_2 and NO_2 standards were based on the peak-day modeling described above. The assessments for comparison with the ambient standards for PM_{10}, $PM_{2.5}$, and the annual SO_2 and NO_2

[8] http://esrl.noaa.gov/raobs/

concentrations were all based on the annual operations modeling scenarios due to the statistical techniques required for assessing compliance. [(9)]

NO_2 Modeling - PVMRM

In accord with EPA guidance, ENVIRON applied the Plume Volume Molar Ratio Method (PVMRM) within AERMOD to allow the model to consider factors that affect both NO_2 emission rates and resulting concentrations in the ambient air. The PVMRM method accounts for both direct NO_2 emissions from stacks (e.g., locomotive exhausts) as well as atmospheric transformations that create NO_2 in the presence of estimated concentrations of ozone. Atmospheric formation of NO_2 from NOx sources in the project study area is almost certainly limited due to the lack of ozone. For this portion of the analysis ENVIRON assumed 10 percent of exhaust emissions were NO_2 and up to 80 percent of NOx could be converted to NO_2 in the atmosphere. [(10)] The background ozone concentration was estimated using data from the Bellingham ozone monitor, with substitutions for missing hours from the Custer-Loomis monitor. ENVIRON used these data to estimate hourly ozone concentrations for each day of the week in each of the four seasons, and applied the results in the PVMRM analysis.

Emission Source Locations, Characterization, and Release Parameters

Ship stack emissions from vessels in transit and hotelling at the dock were represented in the model as a series of **point sources**. Emissions from trains transiting to and from the site and traveling on the site were represented by series of **volume sources**. Dust emissions from fixed facilities (i.e., the bag houses) were treated as point sources, while dust emissions from the storage pile stockyard were considered as **area sources**. Finally, dust emissions associated with ship loading were considered as **areapoly sources**. Additional discussion of these sources follows.

Vessels in transit, harbor assist vessels (i.e., tugs), and vessels hotelling at the wharf during loading were considered as point sources in the AERMOD analysis. For point sources, AERMOD calculates thermal buoyancy and downwash effects on source emissions. Thermal buoyancy causes warmer plumes to rise and downwash effects push plumes downward as wind travels over buildings. **Table 9** (above) provides specific information regarding the modeling parameters for these sources. See also **Table 5** (page 25) and **Table 7** (page 28) for additional information regarding the assumptions and methods employed in the dispersion modeling.

Trains traveling to and from the site and traveling on the site were considered as a series of equally spaced volume sources that represented the variable emission conditions along these

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(9) For example, the PM2.5 24-hour standard is based on the 3-year average of the 98th percentile of daily concentrations, which eliminates one or more of the highest concentrations each year and requires averaging the results. These calculations can be completed with the AERMOD model based on the realistic annual operations scenario, and cannot be based on the worst-case day modeling process used to evaluate not-to-exceed short-term standards. Thus, the annual operations modeling scenario was used to consider PM2.5 and PM10 which are subject to statistical ambient standards.

(10) In-stack NO_2 to NOx emission ratio from P G Boulter, I S McCrae, and J Green, Transportation Research Laboratory, *Primary NO_2 Emissions From Road Vehicles in the Hatfield and Bell Commons Tunnels*, July 2007 as reported in the San Joaquin Valley Air Pollution Control District Air Modeling Guidance for NO_2.

curvilinear paths of travel. In AERMOD, volume sources are represented as a 3-dimensional Gaussian distribution of emissions. The model disperses the starting distribution of pollutant according to the meteorological conditions occurring in a given hour. Parameters describing the location and initial horizontal distribution of each volume source were determined using a series of equally spaced volumes per operational segment that followed the expanded alignment along the Custer Spur and onto and around the Terminal site. Unlike point sources, AERMOD does not consider the effects of thermal buoyancy or downwash on volume source emissions, and this approach is not entirely appropriate for representing the heated emissions from a locomotive stack. ENVIRON therefore employed an additional adjustment to compensate for this limitation in the AERMOD model.

In 2004, as part of the Roseville Rail Yard Study, the California Air Resources Board (CARB) developed a method to estimate initial locomotive plume rise adjustments from buoyancy and downwash effects using the EPA SCREEN3 model. [(11)] Consistent with the CARB's adjustment calculations, ENVIRON estimated initial plume height using SCREEN3 based on typical in-stack temperature and flow rates based on average notch settings and approximate speed of the trains during transit. [(12)] Thus, the release height and vertical dimension of emissions from transiting trains take into account not only the height of the vehicle emission sources, but the buoyancy of the emission gasses and downwash effects generated by the train's movement. ENVIRON used the resulting estimated stack and release heights (Table 9) in the AERMOD assessment.

Table 9. Combustion Source Modeling Parameters

POINT Sources				
Source	**Stack Height (m)**	**Stack Temp. (K)**	**Exit Velocity (m/s)**	**Exit Diam. (m)**
Transiting Bulk Carrier Vessels	40	673.15	20	0.5
Hotelling Bulk Carrier Vessels	40	673.15	20	0.5
Harbor Assist Vessels (tugs)	10	673.15	20	0.3
Idling Locomotives	4.5	374.15	1.85	0.60

VOLUME Sources			
Source	**Release Height (m)**	**Initial Lateral Dimension (m)**	**Initial Vertical Dimension (m)**
On-Site Trains	5.5	14.1 -15.6	2.1
Transiting Trains	10.7	14.2	2.5

(11) State of California Air Resources Board, 2004, *Roseville Rail Yard Study*; this method does not consider variability in ambient meteorological conditions and wind speeds because as a screening-level model, SCREEN3 assumes fairly basic, static conditions in estimating dispersion. This technique represents a reasonable and previously applied method for representing plume rise associated with locomotive emissions.

(12) ENVIRON received notch-specific temperature and flow rates from Steve Fritz of the Southwest Research Institute's Locomotive Technology Center.

The fugitive dust emissions sources associated with the project were considered as a point, area, and areapoly sources within the AERMOD analysis. Table 10 lists the source types and the emission parameters used in this portion of the analysis.

Table 10. Fugitive Dust Source Emission Parameters

POINT Sources				
Source	**Stack Height (m)**	**Stack Temp. (K)**	**Exit Velocity (m/s)**	**Exit Diam. (m)**
Railcar Dump 1 (coal)	25.91	293	25.83	1.321
Railcar Dump 2 (coal)	25.91	293	25.83	1.321
Railcar Dump 3 (coal)	25.91	293	25.83	1.321
Railcar Dump 4 (coal)	25.91	293	25.83	1.321
Railcar Dump (other)	21.34	293	22.86	1.146
Surge Bin Baghouse	18.29	293	22.86	0.811
Bin Vent Collector 1	18.29	293	22.86	0.363
Bin Vent Collector 2	18.29	293	22.86	0.363
Bin Vent Collector 3	18.29	293	22.86	0.363
AREAPOLY Sources				
Source	**Release Height (m)**	**No. of Vertices**	**Initial Sigma-z (m)**	
Shiploader (coal)	10.00	4	4.65	
Shiploader (other)	10.00	4	4.65	
AREA Sources				
Source	**Release Height (m)**	**X-dimension (m)**	**Y- dimension (m)**	**Initial Sigma-z (m)**
Storage Pile Equipment	0	446	645	4.65
Storage Pile Wind Erosion	0	446	645	4.65

5.3 Modeling Post-Processing: Transiting Trains Monte Carlo Simulations

The AERMOD assessment of 1-hour NO_2 concentrations from trains traveling on the Custer Spur was based on one loaded train traveling inbound and one empty outbound train. In the first step in the modeling analysis, locomotive emissions associated with this train traffic were considered in *every hour* of the entire 5-year meteorological data set. But because such a level of train traffic is not possible (i.e., 2x24=48 train passbys per day; even at maximum capacity the facility would handle fewer than half this many trains), ENVIRON used a second level of analysis to make the simulation of train traffic along the Custer Spur more realistic. This secondary processing employed a Monte Carlo probability analysis to create emissions scenarios based on a total of 18 train passbys each day (i.e., the maximum number associated with full operation in 2019) distributed into nine hours with two trains passing across each day.

The Monte Carlo simulations involved post-processing the hourly modeling results for each day of the 5 years analyzed to randomly select hours during which the train passbys would occur. Data from the hours selected for each day were considered for each modeling receptor. This process was repeated 1,000 times for each year. Results of this selection process were then used to compute the median hourly NO_2 concentrations for comparison with the 1-hour ambient air quality standard. This analysis process was consistent with the approach developed by Clint Bowman of the Washington State Department of Ecology for addressing compliance assessments of intermittent (or randomly occurring) emission sources (Ecology 2011b).

5.4 On-Site Emergency Generators

ENVIRON conducted AERMOD modeling to consider NO_2 emissions from two on-site emergency generators associated with the original site layout facility. These sources were determined to be minor sources, so they were not considered in the analysis of the revised site layout facility.

5.5 Methods for Assessing Fugitive Dust Over Water

Deposition of fugitive dust onto the sea waters near the Terminal from both open storage piles and from ship-loading activities was considered using AERMOD modeling to estimate particulate matter deposition at all over-water receptors in the modeling domain. See **Table 7** (page 28) for additional information regarding the assumptions employed in this modeling. Because there are no applicable standards for particulate matter deposition onto land or water and no objective criteria by which to interpret these modeling results, deposition estimates were compared with dust fall collection measurements taken at the Terminal meteorological station to determine whether the project would result in a significant increase in dust deposition.

5.6 Off-Site Traffic Impact Assessment

The analysis of potential air quality impacts of off-site project traffic was conducted in accord with EPA guidance (EPA 1992b). The analysis was based on a qualitative review of information compiled in the traffic impact assessment report for the project (AMEC 2012) that considered traffic conditions in 2026, the originally expected full buildout year and full capacity operation of the facility.

EPA guidance regarding traffic related air quality impacts suggests consideration of the most congested signalized intersection that would be affected by project traffic, and further suggests possibly conducting dispersion modeling for adversely affected intersections. In this context, "adversely affected" refers to deterioration in an intersection's level of service (LOS) to a degree that might adversely affect air quality nearby. [13]

[13] Level of service (LOS) is a measure of the relative efficiency of the operation of an intersection based on the amount of congestion that occurs, usually during a peak commute hour. The LOS for signalized intersections is the weighted average vehicle delay represented by a scale from A to F, with "A" representing little if any delay, and "F" representing congestion due to an intersection being over capacity. LOS "D," which is used as a threshold of *potential* for air quality impacts, results in delays of between 35 and 55 seconds per vehicle.

EPA suggests modeling the most congested intersections that would be directly affected by a project to the degree that LOS would be degraded to a LOS "D" or worse due to a project. [(13)] Consistent with EPA guidance, signalized intersections that would be affected by the proposed project were screened for possible analysis by reviewing the intersection LOS analyses provided by AMEC (2012). Based on these 2026 traffic data, none of the signalized intersections in the project study area would be adversely affected by project-related vehicle traffic to the extent that the LOS would degrade to LOS D or worse. These data are summarized in **Table 11**. As a result, because no intersections fall to an LOS of D or worse due to the project, no additional analysis is required to conclude project-related operational vehicle traffic would not result in air quality impacts due to increased congestion near off-site intersections. Note that this analysis does not reflect possible increases in vehicle delays on roadways affected by railroads crossing that would be obstructed by more project-related trains.

Table 11. Terminal Project Study Area LOS Summary – 2026

Signalized Intersection	Without Project		With Project	
	Volume	LOS/Delay	Volume	LOS/Delay
Grandview Rd. and Portal Way	1,947	C	1,965	C
Slater Rd. and Sunset Ave./Rural Ave.	2,155	C	2,163	C
Main St./W. Axton Rd and Riverside Dr./Labounty Dr.	2,976	C	2,976	C
Slater Rd. and Haxton Way	1,591	C	1,604	C
Source: AMEC 2012				

The analysis above was based on full capacity operation of the Terminal in 2026 (as originally envisioned), so it included projected future traffic beyond 2019 and what is now proposed as the first year of full capacity operation. Because Terminal-related surface vehicle traffic is the same in 2019 as was expected in 2026, the potential for air quality impacts at off-site intersections would be even less in 2019 than in 2026 because of the reduced growth in background traffic. For that reason, the review discussed above is applicable to the revised site layout Terminal with full capacity operation by 2019, and the potential for air quality impacts from off-site traffic is minimal.

6 Potential Impacts of the Proposed Project

6.1 Construction-Related Air Quality: Potential Impacts

Development of the Terminal project would include construction of new on-site buildings and other infrastructure improvements. There would also be substantial, multi-year efforts to re-grade, compact, and pave some of the site. Such activities could result in temporary, localized increases in particulate concentrations due to emissions from construction-related sources. For example, dust from construction activities such as excavation, grading, sloping and filling would contribute to ambient concentrations of suspended particulate matter. Construction contractor(s) would be required to comply with NWCAA regulations requiring that reasonable precautions be taken to minimize dust emissions.

If demolition of any existing structures is required it *might* require the removal and disposal of building materials that could possibly contain asbestos. If this proves to be the case, demolition contractors would be required to comply with EPA and NWCAA regulations related to the safe removal and disposal of any asbestos-containing materials.

Construction would require the use of heavy trucks, excavators, graders, work vessels, pile drivers, and a range of smaller equipment such as generators, pumps, and compressors. Emissions from existing industrial and transportation sources around the project area would very likely outweigh any emissions resulting from construction equipment. Pollution control agencies are nonetheless now urging that emissions from diesel equipment be minimized to the extent practicable to reduce potential health risks. The Terminal will minimize emissions from diesel-powered construction equipment to the extent practicable by taking steps such as those specified in section **7.1**. With appropriate controls, construction-related diesel emissions would not be likely to substantially affect air quality in the project vicinity.

Although some construction phases would cause odors, particularly during paving operations using tar and asphalt, any odors related to construction would be short-term and located within commercial/industrial land uses where such odors would likely go unnoticed. Construction contractor(s) would be required to comply with NWCAA regulations that prohibit the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

Construction equipment and material hauling can affect traffic flow in a project area if construction vehicles travel during peak periods or other heavy-traffic hours of the day and pass through congested areas.

With implementation of the controls required for the various aspects of construction activities and consistent use of best management practices to minimize on-site emissions, construction of the proposed project would not be expected to significantly affect air quality.

6.2 Operational Air Quality: Potential Impacts

6.2.1 Projected Annual Emissions

The estimated annual emissions of criteria air pollutants from full capacity operation of the Terminal facility in 2019 are presented in **Table 12**. Note that the emissions listed were distributed both spatially across the facility and temporally across each day of an entire year to provide the basis of the air quality dispersion modeling.

Table 12. Projected Annual 2019 Operational Emissions

Criteria Air Pollutant	Operational Sources	Operational Emissions (tons per year)
Inhalable Coarse Particulate Matter (PM10)	Vessels in Transit	1.4
	Vessels Hotelling	2.0
	On-Site Trains	1.5
	Off-Site Trains	2.4
Inhalable Fine Particulate Matter (PM2.5)	Vessels in Transit	1.3
	Vessels Hotelling	1.9
	On-Site Trains	1.5
	Off-Site Trains	2.3
Sulfur Dioxide (SO_2)	Vessels in Transit	1.5
	Vessels Hotelling	5.6
	On-Site Trains	0.1
	Off-Site Trains	0.1
Carbon Monoxide (CO)	Vessels in Transit	15.9
	Vessels Hotelling	10.4
	On-Site Trains	16.4
	Off-Site Trains	25.6
Nitrogen Dioxide (NO_2)	Vessels in Transit	59.2
	Vessels Hotelling	99.4
	On-Site Trains	63.3
	Off-Site Trains	99.2
Total Annual Emissions		
Inhalable Coarse Particulate Matter (PM10)		7.4
Inhalable Fine Particulate Matter (PM2.5)		7.0
Sulfur Dioxide (SO_2)		7.3
Carbon Monoxide (CO)		68.3
Nitrogen Dioxide (NO_2)		321.1

Assumes 100% of NOx emissions are NO_2
Vessels in Transit include tug assists during maneuvering
Train emissions without AESS; produces conservative results; including AESS would reduce emissions – see **Table 4**

6.2.2 Projected Off-Site Air Pollutant Concentrations

The results of the air quality dispersion modeling analysis of Terminal sources are summarized in the next two tables. **Table 13** presents the model-calculated future concentrations for criteria pollutants at the maximum impact locations affected by facility emissions in 2019 with full buildout and full capacity operation.

The dispersion modeling analysis considered facility operations in 2019 with vessels using distillate fuel containing 0.1 percent (1,000 ppm) sulfur. At the present time, vessel operations in Puget Sound use standard marine fuels containing an average of about 2.7 percent (27,000 ppm) sulfur (Starcrest 2012). Use of the cleaner, lower-sulfur fuel is a 2015 goal established by the International Maritime Organization adopted by the Northwest Ports Clean Air Strategy (2007). [(14)] The modeling analysis was based on vessels using the cleaner vessel fuel.

In addition to vessels, the modeling included on-site train movements with all time periods (i.e., averaging times), and included off-site trains in the annual operating scenarios. Off-site train movements related to short-term (i.e., non-annual) averaging periods are considered in the modeling results presented in **Table 14**.

2019 On-Site Activities, Vessel Hotelling and Transiting, On and Off-Site Trains

As shown in **Table 13**, model-predicted project-related criteria air pollutant concentrations at the maximum impact locations, including background, in 2019 are less than the levels allowed by all the short and long-term ambient air quality standards. All the model-projected highest concentrations shown in this table occur at or very near the property boundaries. Air pollutant concentrations at all other locations would therefore be lower than shown.

Off-site concentrations of $PM_{2.5}$ are of particular interest because of public concerns regarding dust from the proposed facility. As shown in **Table 2** (page 13), the measured 24-hour average $PM_{2.5}$ concentration at a Bellingham monitoring station was 15.8 µg/m^3 at a location that is probably heavily influenced by nearby traffic and residential wood burning and probably overstates background conditions in the project area. This background in conjunction with the worst-case, model-calculated 24-hour concentration due to project-related combustion sources results in a total concentration about 81 percent of the level allowed by the $PM_{2.5}$ NAAQS. On an annual average basis (consistent with the long-term NAAQS), and assuming a 6 µg/m^3 concentration from 2010 to represent background, the maximum total $PM_{2.5}$ concentration associated with the proposed Terminal facility (plus background) represents about 82 percent of the level allowed by the health-based $PM_{2.5}$ annual-average NAAQS at the most affected off-site receptor location.

As shown in **Table 13**, the combination of project-related 1-hour NO_2 with the estimated background concentration leads to a worst-case model-predicted concentration of about 95% of the 1-hour NAAQS. As indicated in the table notes, the project-related contribution is overstated

[(14)] This is a non-binding agreement among the Ports of Seattle and Tacoma, and the Port Authority of Vancouver, BC.

because the use of newer locomotives would result in lower NO_2 emissions. In addition, the NAAQS is intended to provide a margin of safety, so projected concentrations at any concentration less than the standard is thought to be protective of human health and welfare.

Table 13. Modeling Results: 2019 Criteria Pollutant Maximum Concentrations (µg/m^3)

Criteria Air Pollutant	Avg. Time	B/G Conc.[a]	Project Related Concentration [b], [c]	Project Plus B/G	Ambient Standard [d]
PM_{10}	Annual	12.0	25.2	37.2	50
	24-Hour	29.0	100.3	129.3	150
$PM_{2.5}$	Annual	6.0	3.8	9.8	12
	24-Hour	15.8	12.6	28.3	35
SO_2	Annual	14.2	0.06	14.3	52
	24-Hour	36.7	1.1	37.8	262
	3-Hour	14.1	6.2	20.3	1,310
	1-Hour	89.0	5.9	94.9	196
NO_2	Annual	11.8	25.5	37.3	100
	1-Hour	52.3	126.7 [e]	179.0	188

[a] Background concentrations based on measured levels. See **Table 2** (page 13).

[b] Reported pollutant concentrations are those occurring at the maximum impact location for each pollutant. Concentrations at all other locations are less than those reported here.

[c] Note that all of the short-term concentrations are based on modeling that considered maximum hourly activity during every hour of the 5-year meteorological data set, which is not a possible actual level of activity. These results are therefore intentionally skewed to represent very conservative conditions. Note that consistent with EPA guidance, the annual modeling results are based on 5-year averages from the 5-year meteorological data set instead of 3-year as per the NAAQSs.

[d] All ambient concentrations are expressed in terms of micrograms per cubic meter (µg/m^3); **Table 1** (page 11) which presents only the ambient air quality standards, includes some concentrations reported in parts per million (ppm).

[e] The air quality modeling for *off-site* trains assumed locomotives would be comprised according the EPA default fleet mix in 2019, except that all engines with emissions characteristics less than Tier 2+ were replaced with Tier 2+. This same assumption was *not* applied to on-site trains, and with the elimination of older locomotives from the system NO_2 concentrations from on-site activities would be even lower than indicated here.

6.2.3 Short-Term Air Pollutant Concentrations due to Locomotives Emissions from Transiting Trains

In addition to the modeling of all on-site sources associated with the proposed Terminal project, ENVIRON also performed an additional assessment of short-term air pollutant emissions and concentrations associated with locomotive emissions from transiting train passbys along the Custer Spur. **Table 14** displays the modeling/post-processing results for 2019. As shown, all projected short-term concentrations except 1-hour NO_2 are far less than the respective air quality standards. NO_2 is also less than the level allowed by the ambient standard based on the assumed use of locomotives that are all Tier 2+ or better. **Figure 9** shows the modeling domain and the highest model-projected 1-hour concentration of NO_2. **Figure 10** shows a larger scale view of the area where the highest model-projected 1-hour concentration of NO_2 is expected to occur.

Table 14. Modeling Results: 2019 Concentrations near Transiting Trains (μg/m^3)

Criteria Air Pollutant	Avg. Time	B/G Conc.[a]	Project Related Concentration [b], [c]	Project Plus B/G	Ambient Standard [d]
PM_{10}	24-Hour	29.0	0.44	29.4	150
$PM_{2.5}$	24-Hour	15.8	0.29	16.1	35
SO_2	24-Hour	36.7	0.05	36.7	262
	3-Hour	14.1	0.23	14.3	1,310
	1-Hour	89.0	0.3	89.3	1,050
NO_2	1-Hour	52.3	123.5 [e]	175.8	188

[a] Background concentrations based on measured levels. See **Table 2** (page 13).
[b] Reported pollutant concentrations are those occurring at the maximum impact location for each pollutant. Concentrations at all other locations are less than those reported here.
[c] Note that with the exception of NO_2, all the term concentrations reported here are based on modeling that considered maximum hourly activity during every hour of the 5-year meteorological data set, which is not a possible actual level of activity. These results therefore represent unrealistically conservative (or even possible) conditions.
[d] All ambient concentrations are expressed in terms of micrograms per cubic meter (μg/m^3); **Table 1** (page 11) which presents only the ambient air quality standards, includes some concentrations reported in parts per million (ppm).
[e] The air quality modeling for *off-site* trains assumed locomotives would be comprised according the EPA default fleet mix in 2019, except that all engines with emissions characteristics less than Tier 2+ were replaced with Tier 2+.

6.3 On-Site Emergency Generators

The AERMOD assessment of emissions from two 250 kW on-site emergency generators associated with the 2012 site layout indicated the maximum 1-hour concentration of NO_2 would be less than 24 μg/m^3, or only about 13 percent of the 188 μg/m^3 1-hour NAAQS. This modeling was not updated for the revised site layout facility,

6.4 Results of Fugitive Dust Modeling Over Water

ENVIRON used AERMOD modeling to estimate potential fugitive dust deposition to sea waters within the modeling domain by considering PM_{10} deposition at all over-water receptors. This modeling considered dust emissions from the open storage coal piles and both coal and potash from ship loading. A summary tabulation of estimated deposition is presented in **Table 15**. As shown, AERMOD results suggest PM_{10} loading of about 1.2 pounds/acre/year into water.

To provide a context for this deposition rate, the tabulation shown in **Table 16** presents an estimate of existing deposition based on particulate matter deposition measured at the Terminal site meteorological station over about 4 months in late 2013 and early 2014. As shown, based on assuming the existing deposition rate measured on the project site applies to nearby locations over water, existing sources are currently depositing particulate matter at a rate of about 7 pounds/acre/year into water. This suggests that the existing baseline deposition rate is almost six times higher than the rate estimated for project-related fugitive dust. This indicates the project would not have a material effect on the quantity of deposited material compared with existing deposition into water.

Table 15. AERMOD-Estimated Terminal Fugitive Dust Deposition onto Sea Water

Concentration Less Than or Equal to (g/m^2-yr)	Total Area	Estimated Annual Deposition Over Water
0.005	9,317,692 m^2	103 lbs/yr
0.01	6,657,139 m^2	147 lbs/yr
0.02	6,240,501 m^2	275 lbs/yr
0.05	8,162,633 m^2	900 lbs/yr
0.1	8,345,329 m^2	1,840 lbs/yr
0.2	5,019,669 m^2	2,213 lbs/yr
0.5	3,437,445 m^2	3,789 lbs/yr
1.0	2,578,302 m^2	5,684 lbs/yr
1.5	35,126 m^2	116 lbs/yr
Total Area Over Water within AERMOD Domain	49,793,836 m^2	15,067 lbs/yr
	19.2 mi^2	7.53 tpy
	12,304 acres	0.0006 tons/acre/yr
		1.2 lbs/acre/yr

Table 16. Estimated <u>Existing</u> Particulate Matter Loading into Water (Based on PM Deposition Measurements at Terminal Site Meteorological Station)

Start Date	End Date	Period	Total Loading [(a)]	Average Loading Per Day
9/5/2013	10/11/2013	36 days	3.6 μg/cm^2	0.1008 μg/cm^2
10/11/2013	11/16/2013	36 days	6.5 μg/cm^2	0.1794 μg/cm^2
11/16/2013	12/16/2013	30 days	7.6 μg/cm^2	0.2517 μg/cm^2
12/16/2013	1/27/2014	42 days	13.7 μg/cm^2	0.3267 μg/cm^2
Average Loading per Day				**0.2147 μg/cm^2**
Average Annual Loading at the Monitoring Site				78.3 μg/cm^2-yr
				783,483 μg/m^2-yr
				0.78 g/m^2-yr
Total Area of Water within AERMOD Domain				49,793,836 m^2
				19.23 mi^2
				12,304 acres
Estimated Total Loading into Water due to Existing Deposition Sources				39,012,606 g/yr
				43.0 tons/yr
				0.0035 tons/acre/yr
				7.0 lbs/acre/yr

[(a)] Existing deposition measured using a passive sampler at on-site meteorological station. Deposited materials were not size fractionated and represent total deposition during the periods indicated.

Finally, it is also possible to hypothesize regarding the potential project-related fugitive dust deposition based on the AERMOD-calculated concentrations of coarse particulate matter (PM_{10}) in the ambient air. The *maximum* (i.e., at a single receptor) model-predicted annual average PM_{10} concentration from all sources associated with the Terminal facility in 2019 with full capacity operation was 25.2 µg/m^3 (**Table 13**). This represents about 50 percent of the 50 µg/m^3 Washington ambient air quality standard. [(15)] Because the ambient air quality standards are intended to protect human health and welfare with a margin of safety, these results suggest that airborne particulate matter deposition into the water from emission sources at the Terminal would not result in significant impacts. And again, there are no applicable standards governing particulate matter deposition into the water.

Considering the potential impacts of deposition qualitatively based on comparing air quality modeling results with concentrations allowed by the NAAQSs is consistent with the approach US EPA has used in similar analyses. For example, in a letter regarding the level of analysis for deposition required as part of an assessment of potential impacts to endangered species, EPA said "Criteria pollutants were not evaluated [as part of the analysis] since the National Ambient Air Quality Standards (NAAQS) have been promulgated for most of the constituents that are protective of human health and the environment, including where appropriate, impacts to soil and vegetation. The demonstration of compliance with both the primary and secondary NAAQS, as indicated in the PSD permit application for the facility, precludes the need for additional analysis." [(16)] Based on this reasoning, the air quality analysis demonstrating compliance with the NAAQSs is sufficient to conclude, with no additional review, that other potential impacts related to particle deposition are adequately considered, and that the potential for significant environmental impacts from particle deposition onto land or into water would be minimal and unlikely to result in significant environmental impacts.

[(15)] Note that EPA has eliminated the federal annual average PM_{10} NAAQS.

[(16)] Letter from Pamela Blakley, Chief, Air Permits Section, US EPA Region 5 to Richard Nelson, Field Supervisor, Rock Island Illinois Field Office, United States Fish and Wildlife Service, April 5, 2007

6.5 GHG Emissions

The short term (construction) and long term (operational) GHG emissions were estimated to provide an indication of the potential for significant emissions as defined in SEPA. The sources and the extent of the area covered were the same as in the dispersion-modeling analysis described previously. The area considered included Custer Spur rail traffic, on-site rail, hotelling vessels, and ocean-going and harbor assist vessels (tugs) in transit between the facility wharf and the anchorage buoy.

A summary of the emission inventory tabulation associated with the 2012 site configuration is presented in **Table 17**. During both Phase 1 and at full capacity, about half of the GHG emissions result from purchased electricity required to operate the commodity-handling systems and emission control devices. The facility's use of purchased electricity to operate conveyors, dust collectors, and product-unloading systems would minimize GHG emissions compared with either diesel-powered units or on-site electrical power generation that would otherwise be associated with running these systems. GHG emission reduction features included in the project as proposed are discussed further in mitigation section **7.2**.

Product import and export activities account for most of the remaining GHG emissions. GHG emissions during the facility's opening year of operation are about half of the total annual emissions at full design capacity.

The total estimated annual facility GHG emissions in both years considered exceed the 10,000 metric ton CO_2e value Ecology suggests as an indicator of the need to quantify project-related GHG emissions during SEPA review, including "new" direct and "proximate" direct and indirect emissions (Ecology 2011a). This guidance also indicates projects with annual emissions of more than 25,000 metric tons CO_2e should provide a quantitative assessment of GHG emissions and an evaluation of the potential for impacts of changing climate on the project's new infrastructure. Note that at this time, the extent to which transportation-related GHG emissions should be included in such an analysis is "an unsettled question under SEPA case law" (Ecology 2011a).

A tabulation of estimated total construction-related GHG emissions associated with the 2012 site configuration is also presented in **Table 17**. These estimates consider the total time to prepare and construct the facility, including the deep-water trestle and wharf. Because construction is expected to occur between 2015 and 2018, the total construction emissions in **Table 17** would be much less on an annual basis.

These estimates were not updated to reflect the emissions associated with the revised site layout because, due to the smaller footprint and greater efficiency of the operation it is clear GHG emissions would be lower with this alternative than with the 2012 proposal.

Table 17. Summary of GHG Emissions from 2012 Configuration Proposal

Operational Emissions	Annual Emissions CO_2e - Metric Tons	
	2016 Phase 1	2026 Full Build Out
Direct Emissions		
On-Site Diesel Equipment	49	97
Indirect Emissions		
Purchased Energy [(a)]	9,939	24,847
Employee Commute	336	804
Rail Product Delivery [(b)]		
Transiting	3,317	6,644
On-Site	2,173	5,366
Vessel Product Export [(c)]		
Transiting	1,767	3,893
Hotelling	3,878	8,542
Annual Facility-Related GHG Emissions	**21,459**	**50,193**
Construction-Related Emissions	**Total Emissions CO_2e - Metric Tons**	
NonRoad Diesel Equipment - Landside [(d)]	6,659	
NonRoad Diesel Equipment - Over Water [(e)]	5,185	
In-Water Bubble Curtains	694	
Construction Employee Commute [(f)]	-	
Total Construction-related GHG Emissions	**12,537**	

(a) Based on emissions related to regional electrical generation, which may overstate GHG emissions in WA due to the heavy reliance on hydropower.

(b) "Rail Product Delivery" refers to locomotive operations to, from, and on the rail line Figure-8 of the Terminal site. Estimates of transiting-related emissions are based on locomotive engine emissions from trains traveling on the Custer Spur (only). On-site emissions are locomotive engine emissions while the trains are inside the property boundary, including all movements on the site, queuing before unloading, during unloading as the trains are advanced by the indexers, and during preparations to leave the site. Note that these projected emissions do not consider the GHG emission reductions that would result from the use of AESS to shut down unneeded locomotives because AESS is not used all the time (i.e., when temperature are less than about 40°F). Since temperatures exceed 40°F about 85% of the time, the locomotive AESS would reduce GHG to less than represented in this tabulation.

(c) "Vessel Product Export" Transiting emissions represent engine and boiler combustion emissions associated with transiting activities during the arrival and departure of vessels and assist tugs within about 3 nm of the wharf. Hotelling emissions are vessel-related combustion emissions from the auxiliary engines and boilers while the vessels are docked at the wharf.

(d) "NonRoad Diesel Equipment - Landside" are construction emissions that include engine combustion emissions from earthwork, soil stabilization, material and equipment delivery and landside construction. This does not include either importation of "fill" soils, if needed or construction of the Custer Spur improvements.

(e) "NonRoad Diesel Equipment – Over Water" are construction emissions from combustion sources used during trestle and wharf construction, but do not include delivery of construction materials, concrete, or equipment.

(f) Construction Employee data were not available at the time of this analysis.

6.6 Diesel Engine Exhaust Particulate Matter (DPM)

ENVIRON considered potential off-site concentrations of diesel engine exhaust particulate matter (DPM) associated with all on-site and transiting vessels and trains. The analysis used emissions of $PM_{2.5}$ from vessel and train sources associated with the project as a surrogate for DPM.

For this assessment ENVIRON used the AERMOD results for $PM_{2.5}$ across the entire modeling domain receptor grid to produce isopleths of estimated annual average DPM concentrations. These concentrations can be compared to the ASIL for DPM adopted by Washington State for use in screening for potential impacts during air quality permitting processes. Graphic results of the DPM analysis for 2019 with complete project buildout and full capacity operation are shown in **Figure 11**.

These figures depict isopleths representing several multiples of the Washington State DPM ASIL (i.e., annual average concentration = 0.0033 $\mu g/m^3$). The ASIL is a screening-level concentration suggesting a "negligible" potential risk of increasing the incidence of cancer by one in a population of 1 million people with a constant 70-year exposure to the screening-level concentration (Ecology 2008). The ASIL does not include any consideration of the actual relative dose of inhaled particulate matter based on such things as lung capacity, rates of respiration (e.g., for an adult versus a child), or varying amounts of time of actual exposure. The ASIL is simply a screening tool, and should not be taken to represent a definitive indication of risk.

As shown in **Figure 11**, projected annual average concentrations of DPM associated with the proposed Terminal facility operation in 2019 with full capacity operation exceed the ASIL throughout the modeling domain. Most of the modeling area (i.e., the area within the orange isopleths) is in the range of 10 times higher than the ASIL.

It is worth noting that these projected DPM levels are high in comparison with the ASIL because the DPM ASIL is a very low number. As a result, almost any diesel combustion source can easily result in model-projected concentrations exceeding this level. So, for example, anywhere within a mile or more of the I-5 corridor through Washington would likely be projected by modeling to be exposed to DPM concentrations exceeding this screening level. In fact, Ecology reported that EPA estimated the median exposure in Washington to be 75 times higher than the level of the ASIL (Ecology 2008). As explained in section **4.2.6**, the US EPA has not adopted a cancer risk factor for DPM because of continuing uncertainties in the underlying health risk data (EPA 2002). Consequently, these projected DPM concentrations should not be taken to represent actual risk.

6.7 Additional Discussion of Potential Project-Related Fugitive Dust

Members of the public have expressed concerns about potential impacts from fugitive dust potentially emitted from the project site. Some comments have pointed to apparent problems at the Westshore coal export terminal near Tsawwassen, British Columbia. The Westshore terminal has operated for over 40 years, and there have been occasional complaints from residents living downwind of the facility. Long-term air quality sampling and several studies of particulate matter collected at sites in Tsawwassen have indicated coal dust from the Westshore terminal plays a minor role in measurable PM_{10} levels in the ambient air. Three of these studies are summarized below (in chronological order).

6.7.1 Westshore Terminals Fugitive Dust Complaint Investigation

In 1998 a study of accumulated dirt and particles was conducted to consider the composition of the materials that were soiling objects ranging from walkways to building siding to picnic tables about which complaints were made based on the assumption that the soiling was due to coal from the Westshore Terminal. [17] This analysis, based on microscopic inspection of 31 samples from 22 locations, found coal particles in one sample of material accumulated over a winter on a table top on the beach in Tsawwassen. All other stains and soiling that resulted in complaints were found to be organic in nature, and not related to the coal export facility. Although there have been persistent *assumptions* regarding soiling problems stemming from this facility, this study concluded that coal dust was generally not the source of the soiling that was identified and tested. In addition, the study concluded that "none of our investigations resulted in conclusive evidence that emissions were excessive or that Westshore Terminal was in violation of its permit conditions." [17] And as discussed further below, there would be an even lower probability of nuisance-related effects associated with the Terminal facility.

6.7.2 Tsawwassen Particulate Air Quality Study

This 2002 study was based on particulate matter sampling at three locations near the Westshore terminal. [18] The study determined that measured levels of PM_{10} and $PM_{2.5}$ were well below the most stringent applicable Canadian air quality goals/standards, which are similar to the NAAQSs (**Table 1**, page 11). This study also concluded that measured concentrations of PM_{10} and $PM_{2.5}$ were similar in magnitude and pattern to concentrations measured elsewhere within the region, and that no site in the Tsawwassen area was unduly influenced by any one emission source, including the coal export terminal. Statistical analyses of collected data and microscopic examination of collection filters determined that coal dust from the Westshore terminal was not a major contributor to measured levels of PM_{10} or $PM_{2.5}$ at downwind locations. Although some larger particles of coal dust may have contributed to "soiling" of surfaces of boats at a marina or of table tops and cars near this old export terminal, this type of effect is not considered a human *health* impact due to particulate matter air pollution. In addition, due to both the physical setting (with greater distances and less unobstructed winds) and use of modern and more effective emission controls that will be employed at the Terminal (as described throughout this report), even such minor impacts would be unlikely in the vicinity of the Cherry Point facility.

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[17] Greater Vancouver Regional District, 1998, *Westshore Terminals Coal Dust Complaint Investigation,* Air Quality Department, Greater Vancouver Regional District, October 1998

[18] Greater Vancouver Regional District, 2002, *Tsawwassen Particulate Air Quality Study, 2002*, Air Quality Monitoring and Assessment Division Policy and Planning Department Greater Vancouver Regional District. Full study report available **here**:
(**http://www.metrovancouver.org/about/publications/Publications/TsawwassenAirQualityStudy.pdf**)

6.7.3 Delta Air Quality Monitoring Study

This study, conducted between June 2004 and March 2006 considered both fine particulate matter and other criteria air pollutants in the Tsawwassen area and reached conclusions similar to the 2002 study. [(19)] Specifically, the results of this analysis indicated all short-term (1-hour and 24-hour) and long-term (annual) air quality levels in the study area met the relevant Greater Vancouver Regional District (GVRD) objectives, and that fine particulate levels measured within the study area were the same as or less than other areas in the GVRD. [(19)]

6.7.4 Comparison of Terminal and Westshore Locales and Environs

The findings discussed above – that measured particulate matter concentrations near the Westshore coal terminal have not been found to reach levels that would endanger human health – would be expected to apply in the vicinity of the Terminal site as well. And because the physical environment of the Terminal site is even *less* conducive to conditions that would result in wind-blown dust events than the area near the Westshore facility, the potential for fugitive dust impacts would be even less. For example, the Westshore terminal is surrounded by water and within ten to fifty feet of sea level, so the entire coal storage area and ship-loading wharfs are exposed to uncontrolled winds over the water. While the vessel-loading wharf of the Terminal facility would be at the water, the on-site coal storage area would be more protected from winds because it would be upland about 3,000 feet from the water, about 110 feet above sea level, and partially surrounded by trees. These factors would reduce the potential for wind-blown dust events from the Terminal compared with the Westshore terminal.

Furthermore, the Terminal would employ new and improved emission control technologies compared with the older facilities at Westshore, which would greatly reduce the potential for fugitive emissions. See the listing of emission controls in section **7.2** (page 55). For these reasons, comparisons of the Terminal with Westshore are not appropriate.

6.7.5 Potential Fugitive Dust from Railcars during Transport

Some members of the public have expressed concerns regarding the potential for railcars transporting coal to the Terminal to emit fugitive dust near the rail line. As discussed further below, direct measurement studies of this issue have found there is no basis for air quality concerns related to this potential source of emissions.

Coal Loss Mechanisms

Coal can be lost from the railcars through three mechanisms: (•) spillage from the cars being over-filled which allows coal particles to fall off the stacked coal and over the sides of the cars; (•) the edges of the railcar (sills) as well as other surfaces on the railcar can be catchments for coal during filling and can lose coal due to vibration as the trains move; and (•) wind-related loss from the exposed surface at the top of the car.

[(19)] Greater Vancouver Regional District, 2006, *Delta Air Quality Monitoring Study, June 2004 - March 2006*, Air Quality Policy and Management Division, Policy and Planning Department, Greater Vancouver Regional District, August, 2006. Full study report available **here**.
(**http://www.metrovancouver.org/about/publications/Publications/DeltaAirQualityMonitoringStudy.pdf**)

The first two of these mechanisms can result in spillage/loss very near the coal-loading facility because any coal "available" to be lost in these manners will most likely fall from the cars within a relatively short distance of the loading facility. These two mechanisms can be effectively controlled to minimize such losses using car-loading and load-shaping techniques that are now in use at most modern coal-loading facilities. Consequently, only the last of the three mechanisms, wind-related loss, is pertinent to expressed concerns related to coal trains traveling through Washington State to the proposed Terminal.

Wind-related losses result from the shearing force that moving air imparts to the surface of the coal load over which it moves. The movement of the air with respect to the coal surface is the net effect of the motion of the cars plus the movement of air over the ground. The combined train and wind motion can lead to air velocities of 60 miles per hour or more. As air flows over the surface of the coal the moving air imparts force to any available coal particles, and if the force is sufficient, the particles will move. Without effective controls, this force can cause three types of motion of coal particles known as creep, saltation, and suspension. Creep refers to the process where wind rolls particles along a surface. In saltation, particles are picked up briefly and then return to the surface; saltation is akin to particles "bouncing" along the surface. With suspension, small particles are actually picked up by the wind and become suspended in the air and possibly carried greater distances.

Some early experimental studies that attempted to predict the mass of coal lost from railcars during transport were based on the *total* mass. These estimates included particles that might be subject to saltation or creep but that would be much too large to become suspended in the atmosphere. These early studies were overly simplistic in their methods and also predated implementation of what are now common coal dust control methods using more precise car-loading systems along with the application of surfactants. Consequently, using predictions from these early studies to estimate the potential loss of particulate matter from modern railcar transport is likely to grossly overestimate the quantity of any such fugitive dust particles likely to become airborne. In contrast, recent near-track air-sampling studies discussed below indicate fugitive emissions from railcar transport are typically minimal.

It is also worth noting that there is a finite amount of small coal particles in a railcar available to become airborne, and most such readily available particles are likely to be lost within a few miles of the loading point. For example, the US EPA estimates particulate matter emissions rates are highest during the first several miles of travel and decrease rapidly thereafter, with a "half-life" of only several *minutes*. [20] As a result, any small coal particles that are likely to be lost during shipment are most likely to be lost within a few miles of the loading facility, which significantly reduces the potential for such particles to become airborne at any locations within Washington State.

[20] US Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors*, Document AP-42, Fifth Edition, Section 13.2.5, Industrial Wind Erosion, November, 2006. P1. Link

Recent Australian Near-Track Airborne Particulate Matter Monitoring Study

A recent Australian study indicates that coal-hauling by trains is unlikely to result in greater particulate matter emissions than from other freight trains. Monitoring in 2012 and 2013 collected four size fractions of particulate matter (TSP, PM_{10}, $PM_{2.5}$, and PM_1) over a two month period near a coal hauling rail corridor in Australia. [(21)] The analyses performed on the collected data were peer reviewed and expanded to include more sophisticated analysis. [(22)] Together these reports provide strong evidence that coal trains do not result in any more emissions than any other freight-hauling trains. Ryan's findings were as follow: [(23)]

1) Found clear evidence that particulate levels were elevated for the several minutes during and after trains passed the monitoring station.
2) Effects were strongest and of a similar magnitude (approximately 10% increase above background levels) and highly statistically significant for freight **and** coal trains, both loaded and empty. (Emphasis added.)
3) There was **no** evidence that loaded coal trains produced more dust than empty coal trains. (Emphasis added.)
4) Non-statistically significant results indicated particulate levels associated with passing unloaded coal trains were higher than those associated with loaded coal trains and freight trains.
5) The effects were apparent for all measured particulate size fractions which included TSP, PM_{10}, $PM_{2.5}$, and PM_1, especially for freight and coal trains (loaded and empty). Passenger train effects were non-significant for PM_1 and only marginally significant for $PM_{2.5}$. Since coal dust is likely to be reflected in the larger particle fractions (i.e., TSP and PM_{10}), this finding suggests that other contaminants such as diesel exhaust may be larger contributors to the somewhat elevated PM levels than coal dust.
6) Particulate matter concentration increases during train passages were moderate, with TSP increases of about 2.4 to 2.8 $\mu g/m^3$ over background during freight and coal train (loaded and empty) passbys. Corresponding increases for PM_{10}, $PM_{2.5}$ and PM_1 were approximately 2.0, 0.7, and 0.12 $\mu g/m^3$, respectively. In other words, there was about a 10% increase in the various kinds/sizes of particulate measured associated with freight and coal trains.

And it is noteworthy that while some of the cars on the more than 900 coal trains considered in the Katestone/Ryan studies may have had shaped loads that would reduce wind related coal

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(21) Katestone Environmental Pty Ltd's *Pollution Reduction Program 4.2 Particulate Emissions from Coal Trains,* Prepared for Australian Rail Track Corporation Pty Ltd May 2013

(22) Ryan, Louise and Matthew Wand, 2014, *Re-analysis of ARTC Data on Particulate Emissions from Coal Trains*, Author: Prof Louise Ryan, on behalf of access:UTS Pty Ltd for NSW Environment Protection Authority, 25 February 2014 [a peer review and re-analysis of Katestone study

(23) Ibid. page 12

loss, few if any would have had surfactant applied. [(24)] Under these conditions, any increased emissions of coal dust from these trains would have been expected to be *greater* than in the western US where shippers of coal from the Powder River Basin of Wyoming and Montana, the source of coal that would be transshipped through the Terminal, are required by BNSF loading rules to take measures to substantially reduce coal dust losses. As discussed further in the next section, a coal shipper is deemed to be in compliance with the BNSF coal-loading rules if it uses both load shaping and application of surfactants.

BNSF Coal-Loading Rules

Since 2005 BNSF has conducted extensive research regarding both the impacts to the track structure of coal dust escaping from coal cars that are loaded at Powder River Basin (PRB) mines in Wyoming and Montana as well as effective methods of preventing the loss of coal dust from loaded trains. [(25)] Consistent with the findings and discussions presented above, BNSF's research and experience has shown that coal dust escaping railcars that have not been properly treated can be a problem near mine loading points, but that such losses decrease as the railcars move further from the loading location.

BNSF's research has shown that coal dust losses in transit can be substantially reduced by loading coal to an aerodynamic load profile and by applying a topper agent or surfactant to the loaded coal. During a seven-month period in 2010, BNSF undertook a large-scale field trial ("Super Trial") of coal dust mitigation measures to obtain more information on the effectiveness of various topper agents. Different topper agents were tested in the laboratory and in the field on operating coal trains to assess their efficacy in reducing coal dust losses. The BNSF Super Trial confirmed that the application of certain topper agents, when used in combination with a modified loading chute that has been adopted by PRB mines, can reduce coal dust losses by at least 85%. BNSF's PRB coal-loading rules now require that shippers take measures to substantially reduce coal dust losses. A coal shipper is deemed to be in compliance with BNSF's coal loading rules if it uses both load shaping and application of toppers that have been shown to reduce coal dust losses by at least 85%.

Railcar Fugitive Dust Emissions Conclusions

Based on the studies discussed above, it is highly unlikely that significant amounts of coal dust in size ranges that can become airborne would be emitted from railcars carrying coal in Washington State. As a result, it was not necessary to consider this potential emissions source in any greater detail in order to conclude that fugitive emissions from coal-hauling trains would not be expected to result in any significant air quality impacts.

[(24)] ENVIRON was involved in the pilot studies that preceded the Katestone work and has direct knowledge of the conditions under which coal is shipped in the study area. Email exchange indicated that although coal load treatments vary by source, in general, few trains use surfactants and most (not all) use load profiling. Personal communications: Michelle Manditch, ENVIRON Australia Pty Ltd, to Richard Steffel, ENVIRON International Corporation, 3/18/2014.

[(25)] http://www.bnsf.com/customers/what-can-i-ship/coal/coal-dust.html

7 Mitigation

7.1 Construction

Although significant air quality impacts are not anticipated due to construction of the proposed Terminal, construction contractors will be required to comply with all relevant federal, state, and local air quality rules. In addition, implementation of best management practices will reduce emissions related to the construction phase of the project. Management practices for reducing the potential for air quality impacts during construction include measures for reducing both exhaust emissions and fugitive dust. The Washington Associated General Contractors brochure *Guide to Handling Fugitive Dust from Construction Projects* and the NWCAA suggest a number of methods for controlling dust and reducing the potential exposure of people to emissions from diesel equipment. A list of some of the control measures that could be implemented to reduce potential air quality impacts from construction activities follows:

- Use only equipment and trucks that are maintained in optimal operational condition.
- Require all off-road equipment to have emission reduction equipment (e.g., require participation in Puget Sound Region Diesel Solutions, a program designed to reduce air pollution from diesel, by project sponsors and contractors).
- Use car-pooling or other trip-reduction strategies for construction workers.
- Implement restrictions on construction truck and other vehicle idling (e.g., limit idling to a maximum of 5 minutes).
- Spray exposed soil with water or other suppressant to reduce emissions of PM and deposition of particulate matter.
- Pave or use gravel on staging areas and roads that would be exposed for long periods.
- Cover all trucks transporting materials, wetting materials in trucks, or providing adequate freeboard (space from the top of the material to the top of the truck bed), to reduce PM emissions and deposition during transport.
- Provide wheel washers to remove particulate matter that would otherwise be carried off site by vehicles to decrease deposition of particulate matter on area roadways.
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.
- Stage construction to minimize overall transportation system congestion and delays to reduce regional emissions of pollutants during construction.

7.2 Operation

The proposed project includes measures that would serve to reduce emissions during operation of both the unloading and storage loops and the export conveyance systems of the facility as delineated below.

- Commodity dumping inside buildings – all commodity hauling railcars would dump their loads inside negative pressure buildings that would collect dust and port it through baghouses.
- The multiple large stacker/reclaimers used to create the coal piles within the stock yard area and to load coal from these piles onto conveyors would be electrically powered.
- Coal pile forming via coal stackers would use state-of-the-art technology to minimize the distance of the drop from the stackers to the piles.
- Vessel hold loaders for coal will use shaped flow controls to place the coal as gently as possible into open areas of the hold, while ensuring that all particulate matter emissions associated with the drop from the conveyor occur below the combing of the hold.

- Vessel loading of other commodities will use specialized chutes to contain commodities during loading and minimize drops into the holds.
- All conveyors would be run using electrical conveyor drive motors.
- All conveyor transfer points will be controlled using a combination of passive emission control (PEC) systems and/or dry fog emitters.
- The surface of the open storage pile for coal will be treated with dust palliative chemicals, effectively binding the coal particles together and making them less subject to the erosive forces of the wind. This technique is widely used for open storage piles of coal and is effective at reducing emissions.
- In combination with the dust control chemicals, the open storage piles of coal will be equipped with water cannons that allow complete coverage of the coal piles with water, making them less subject to the forces of the wind.
- On-site locomotive emissions will be minimized when possible because locomotives will be fitted with an Automatic Engine Shutoff System (AESS). The benefits of this emission control measure were not considered in the air quality impact assessment.
- All locomotive emissions should be reduced through use of only Tier 2+ or better engines
- GHG emissions associated with operation of the facility would be reduced by the following components included in the project as proposed:
    - → Conservation of natural areas on site by minimizing new clearing/grading and wetland impacts to the extent practicable
    - → Use of new, high-efficiency material-handling equipment
    - → Use of electrically-powered equipment rather than fuel-powered equipment where practicable
    - → Recycling/reuse of water
    - → Optimization of rail infrastructure to minimize unnecessary cargo movements
    - → Providing opportunities to Terminal customers to increase the GHG efficiency of their cargo handling / transport operations
    - → Use of teleconference and video conferencing to reduce employee travel
    - → Encouragement of carpooling during design, construction and Terminal operations
    - → Development of facility with an electrical power supplier that obtains >90% of their power from non-fossil fuel sources
    - → Recycling of used building materials where practicable

The analysis of the 2012 site configuration indicated use of purchased electrical power and the use of AESS for locomotives would avoid GHG emissions from direct operation of the facility by more than 65 percent compared with on-site electrical power generation and not using AESS (without consideration of long-distance transportation). Together, these and other features included in the proposed project represent sufficient reduction (per Ecology 2011a guidance document) to obviate the need for further assessment of the implications of project-related GHG emissions.

Based on these control features and the findings of the air quality impact assessment, no additional mitigation measures are warranted or proposed.

8 References

AMEC Earth & Environmental. 2012. *Engineered Traffic Study To Meet Whatcom County Major Project Permit Application Requirements*. AMEC Environment & Infrastructure, Inc. 11810 North Creek Parkway North, Bothell, WA 98011. March 2012

ENVIRON International Corporation. 2008. *Draft Report, Diesel Particulate Matter Mitigation Plan for the BNSF Railroad Hobart Rail Yard*, September 26, 2008 found at **http://www.arb.ca.gov/railyard/hra/hra.htm** (dated on web page as October 16, 2008)

Northwest Ports Clean Air Strategy. 2007. Port of Seattle, Port of Tacoma, Vancouver Port Authority. December 2007. http://www.portseattle.org/Environmental/Air/Seaport-Air-Quality/Pages/NWPorts-Clean-Air.aspx

Pacific International Terminals, Inc. 2014. Revised Site Layout Project Description, Appendix B in *Gateway Pacific Terminal Project Alternatives Report*. Pacific International Terminals, Inc., Seattle, Washington

Shaw, et al. 2008. *An evaluation of the wind erosion module in DUSTRAN.* ScienceDirect, Atmospheric Environment 42

Starcrest Consulting Group, LLC. 2012. *2011 Puget Sound Maritime Air Emissions Inventory.* Sept. 2012

US Environmental Protection Agency (EPA)

1992a. *Guideline for Modeling Carbon Monoxide from Roadway Intersections*. Office of Air Quality Planning and Standards. Technical Support Division. Research Triangle Park, North Carolina. EPA-454/R-92-005

1992b. *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. EPA-454/R-92-019

2002. *Health Assessment Document for Diesel Engine Exhaust*. National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC. EPA/600/8-90/057F. May 2002

2013. *AERMOD User's Guide Addendum*. EPA-454/B-03-001. December 2013

2006. *Current Methodologies and Best Practices in Preparing Port Emission Inventories*. USEPA Office of Policy, Economics and Innovation. January 2006 and updates April 2006

2008. NONROAD2008a Model, USEPA Office of Transportation and Air Quality. Model posted at **http://www.epa.gov/oms/nonrdmdl.htm**. July 2009

Washington Associated General Contractors (AGC). Undated. *Guide to Handling Fugitive Dust from Construction Projects*. Washington Associated General Contractors

Washing State Department of Ecology (Ecology)

2008. *Concerns about Adverse Health Effects of Diesel Engine Emissions White Paper*. Harriet Ammann and Mathew Kadlec. Publication 08-02-032. December 3, 2008

2010. *Washington State Greenhouse Gas Emissions Inventory 1990-2008*. Publication no. 10-02-046. December 2010

2011a. *Guidance for Ecology Including Greenhouse Gas Emissions in SEPA Reviews*. 6/3/11. http://www.ecy.wa.gov/climatechange/docs/sepa/20110603_SEPA_GHGinternalguidance.pdf

2011b. *A Monte Carlo Approach to Estimating Impacts from Highly Intermittent Sources on Short Term Standards*. Clint Bowman and Ranil Dhammapala, State of Washington, Department of Ecology. Presentation at the Northwest International Air Quality Environmental Science and Technology Consortium; June 1, 2011

2014. Personal communications between Rich Hibbard and Matthew Kadlec of Ecology and ENVIRON, April 2014

9 Figures

Note that beginning with this page the following figures are formatted for printing on the "front" side of double-sided pages, and the "back" sides of these pages are unnumbered, but nonetheless included in the page count.

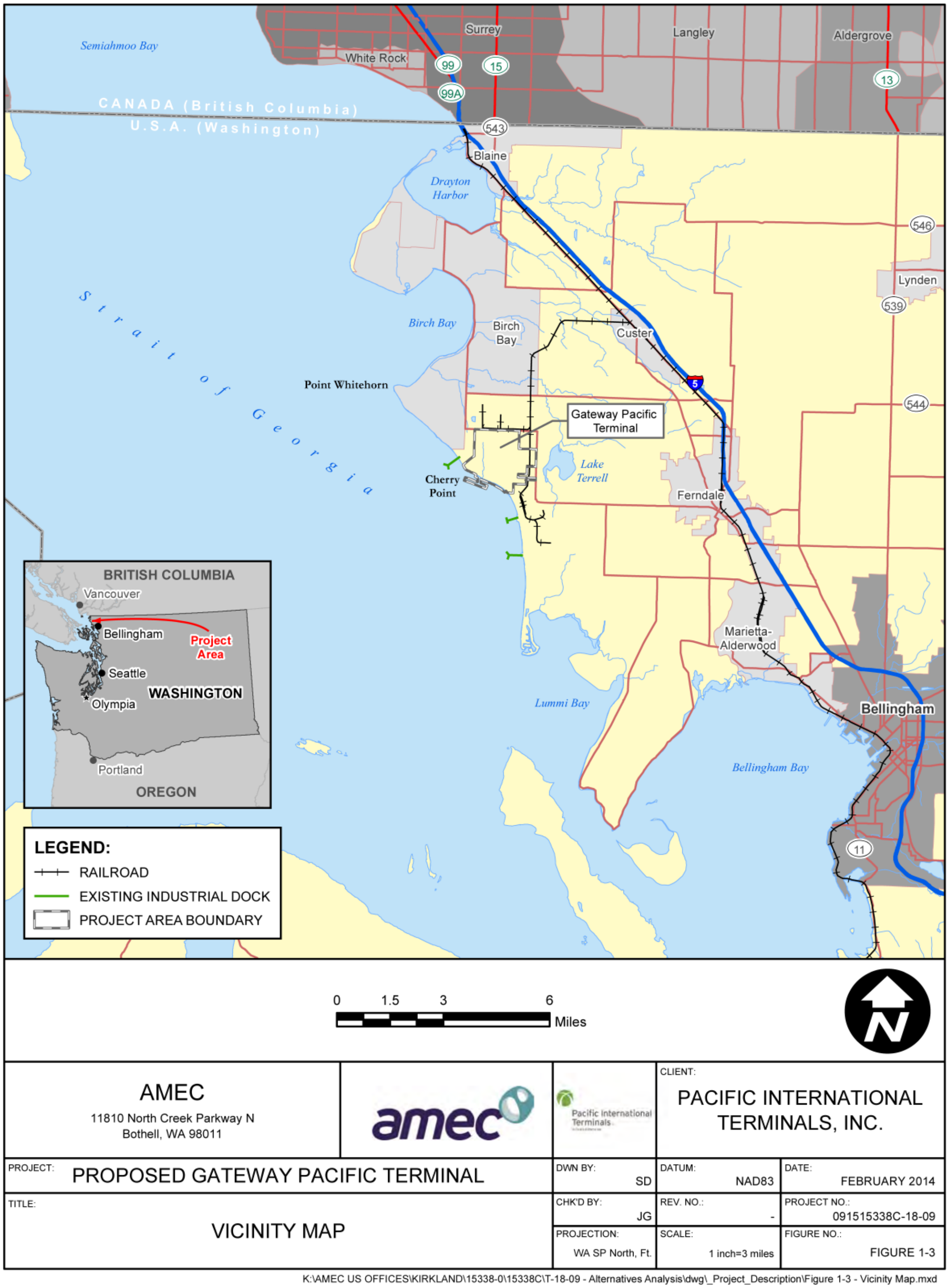


Figure 1. Project Location Map

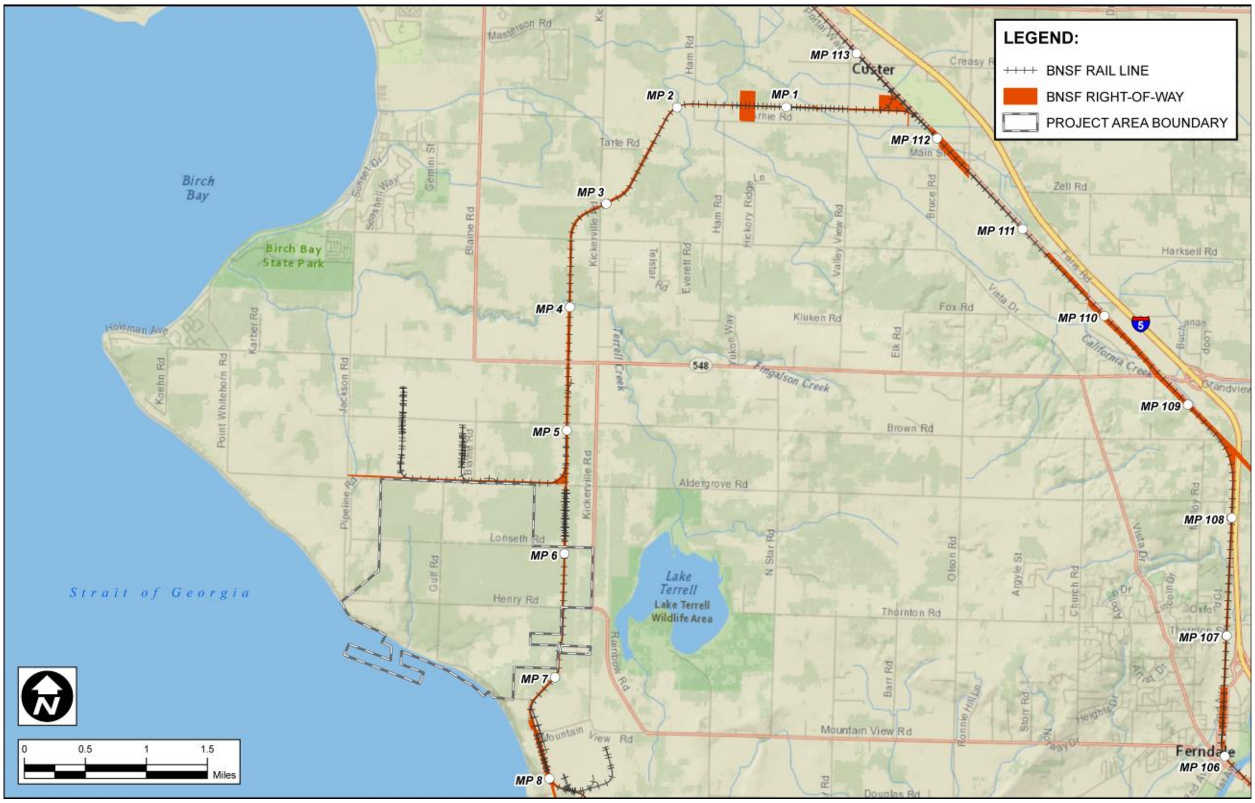


Figure 2. Project Vicinity Map

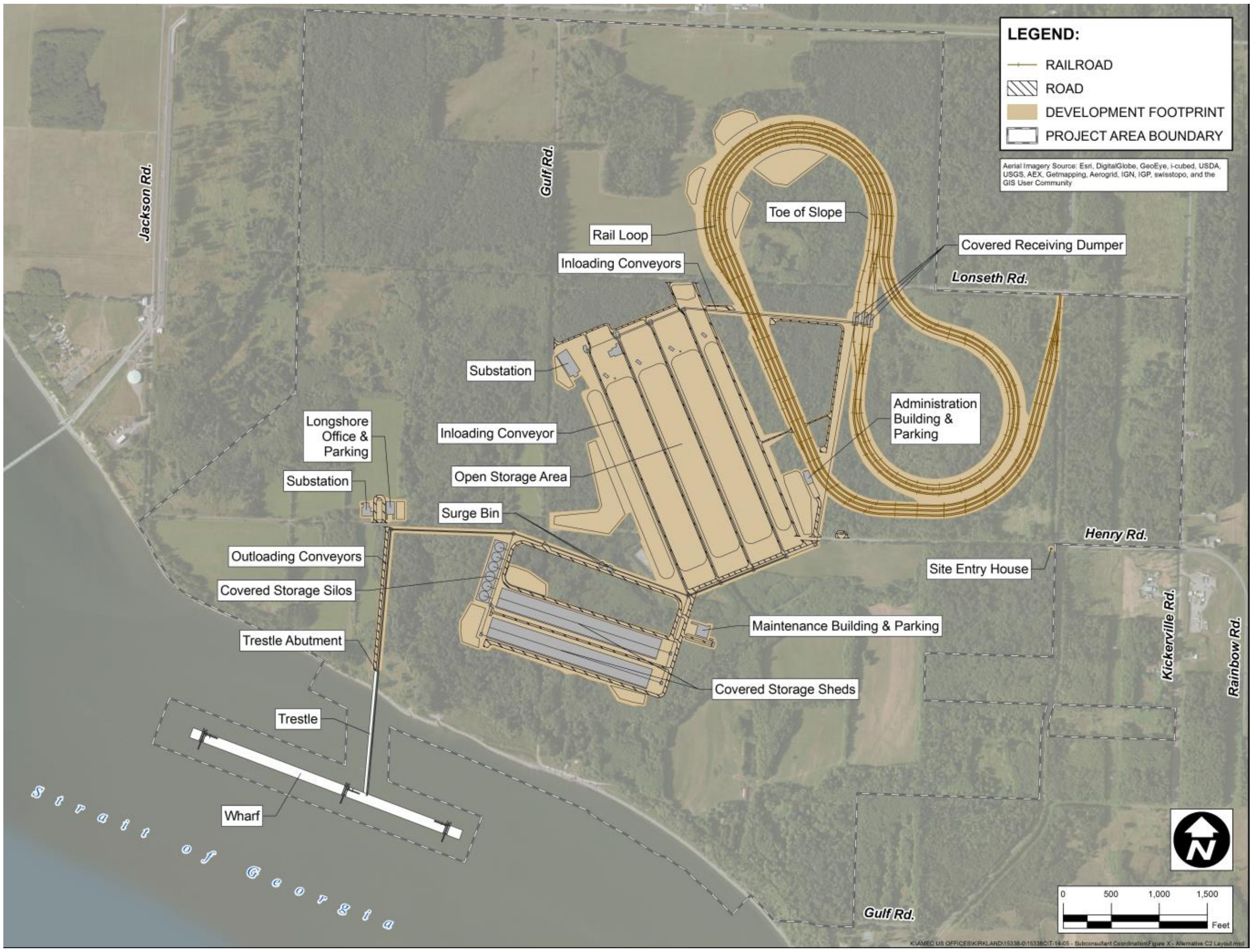


Figure 3. Terminal Facility General Layout

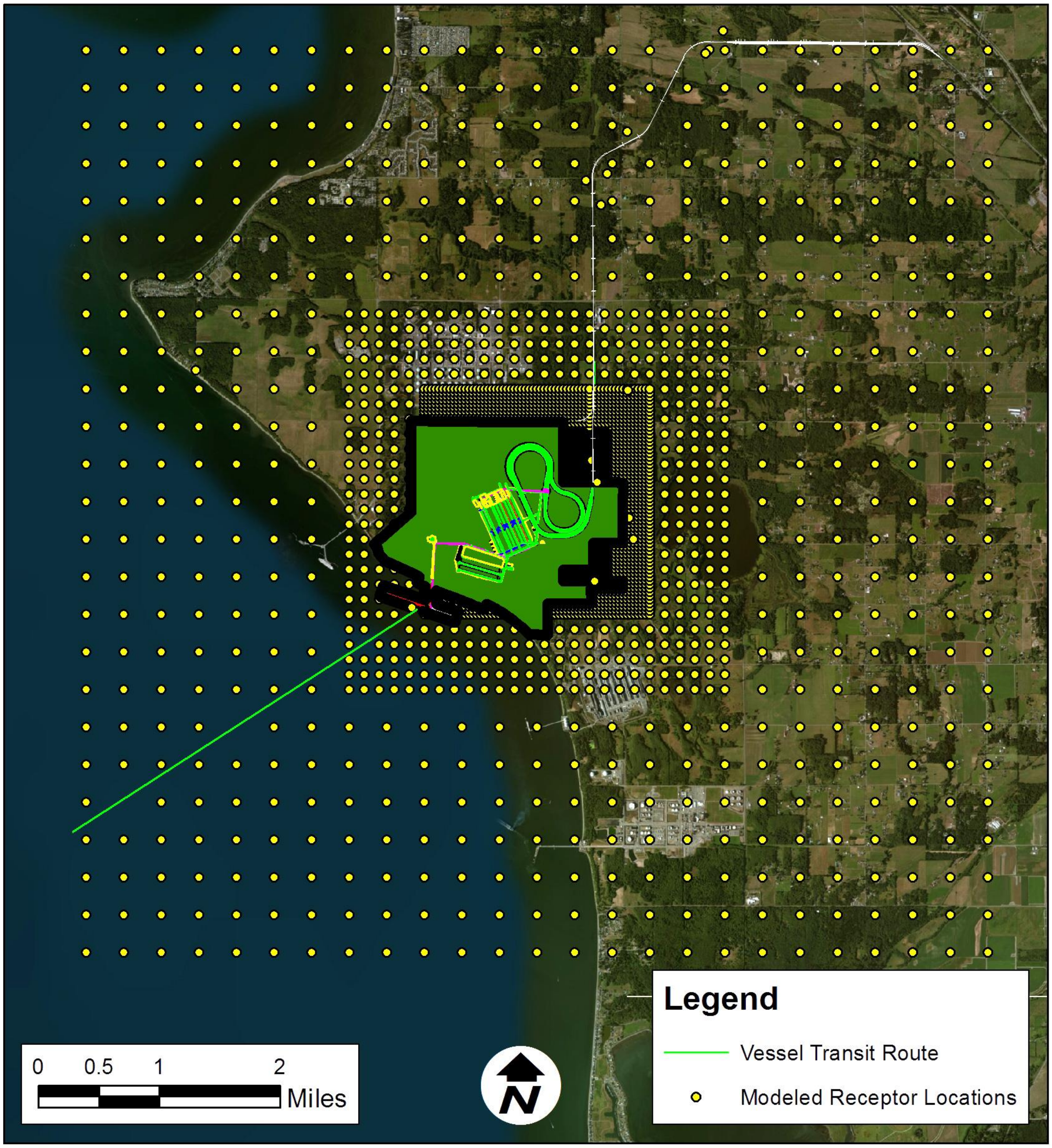


Figure 4. AERMOD Modeling Domain and Modeling Receptor Grids

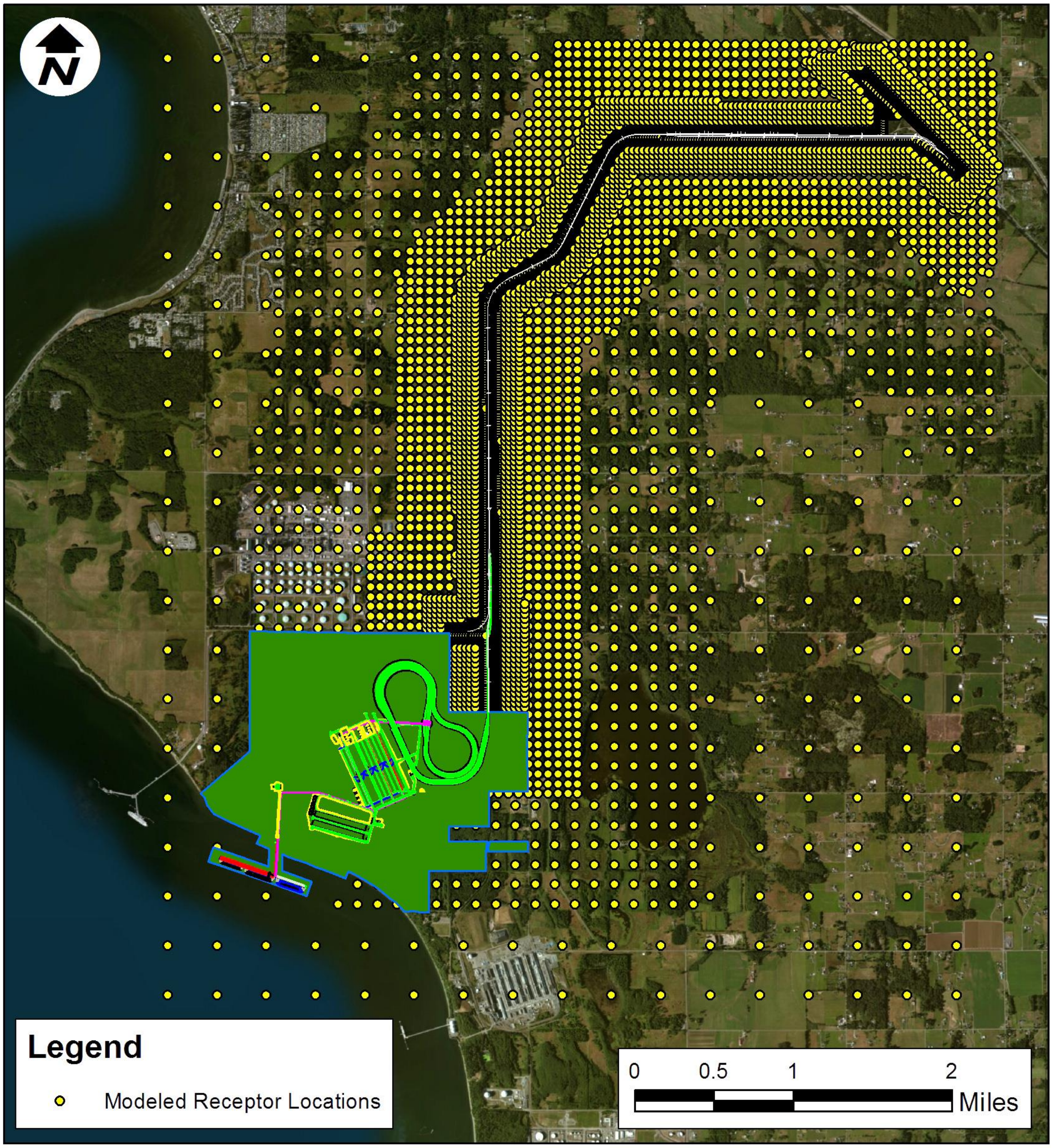


Figure 5. AERMOD Receptor Grids for Transiting Trains Modeling

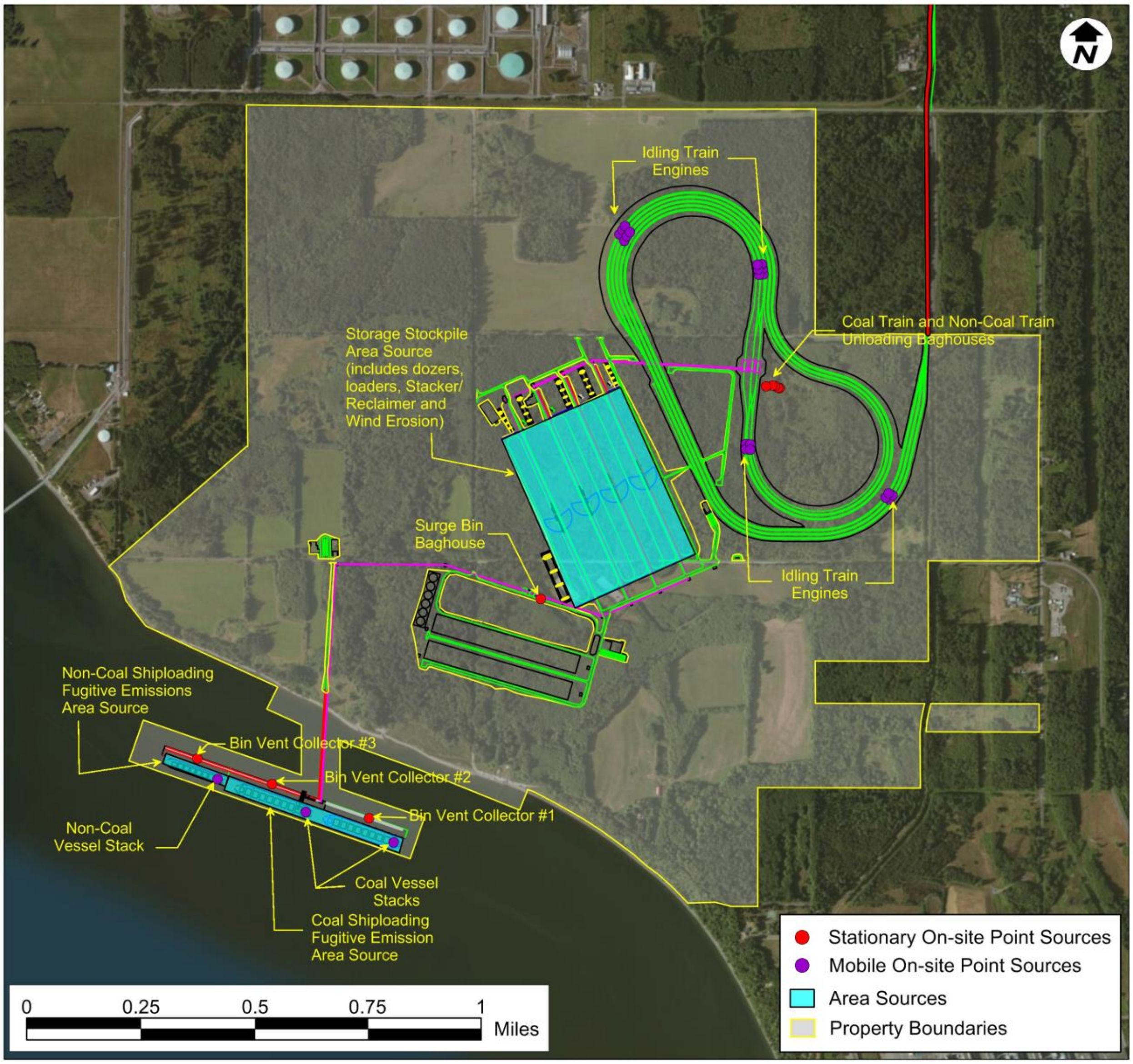


Figure 6. On-Site Emission Sources

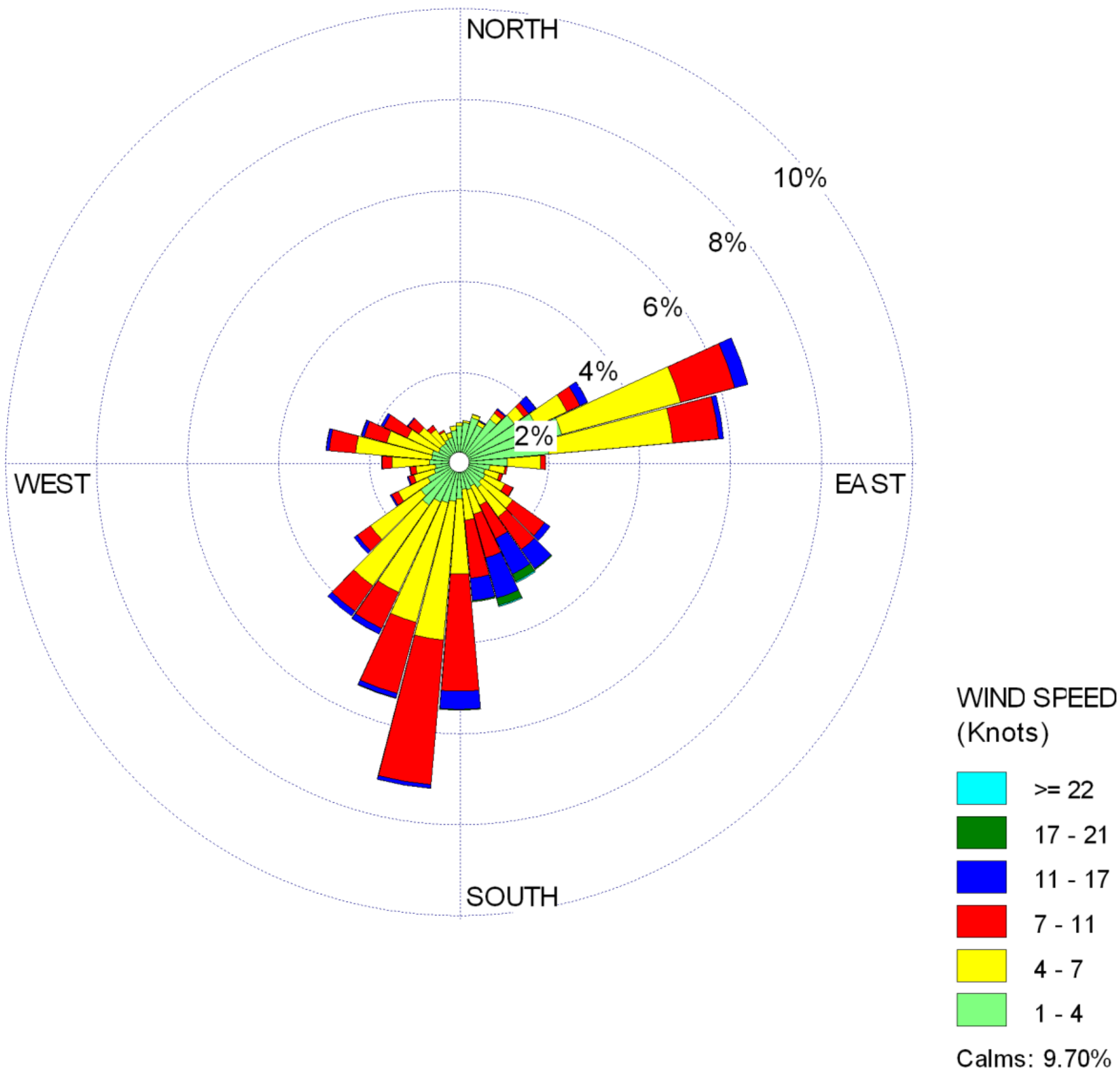


Figure 7. 5-Year Meteorological Data Set Wind Rose

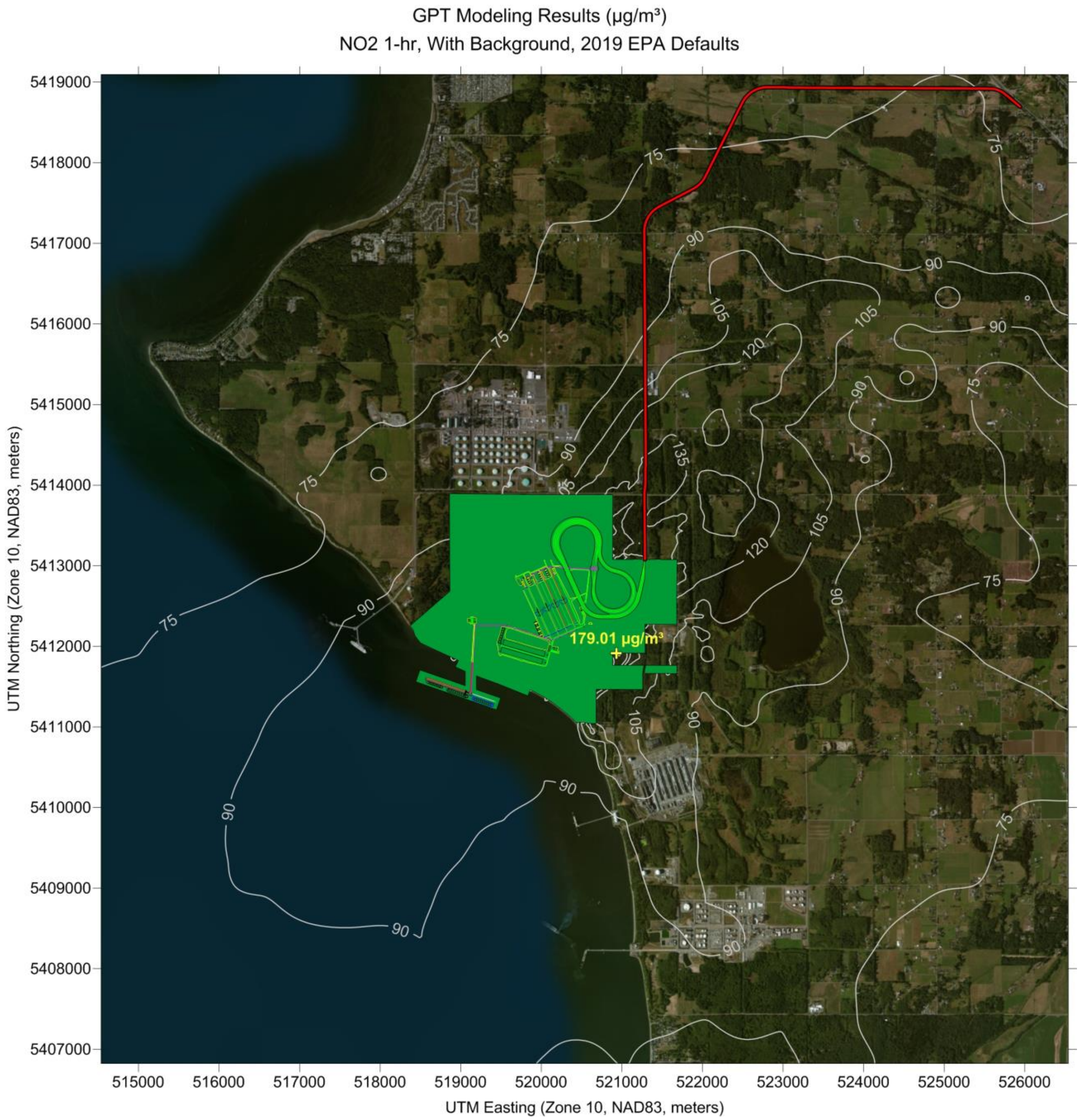


Figure 8. Modeling Results: 2019 1-Hour NO_2 Concentrations from On-Site Sources (µg/m^3)

Note that these results do ***not*** consider use of only Tier 2 or better locomotives, so with implementation of this control measure, concentrations would be lower than indicated here.

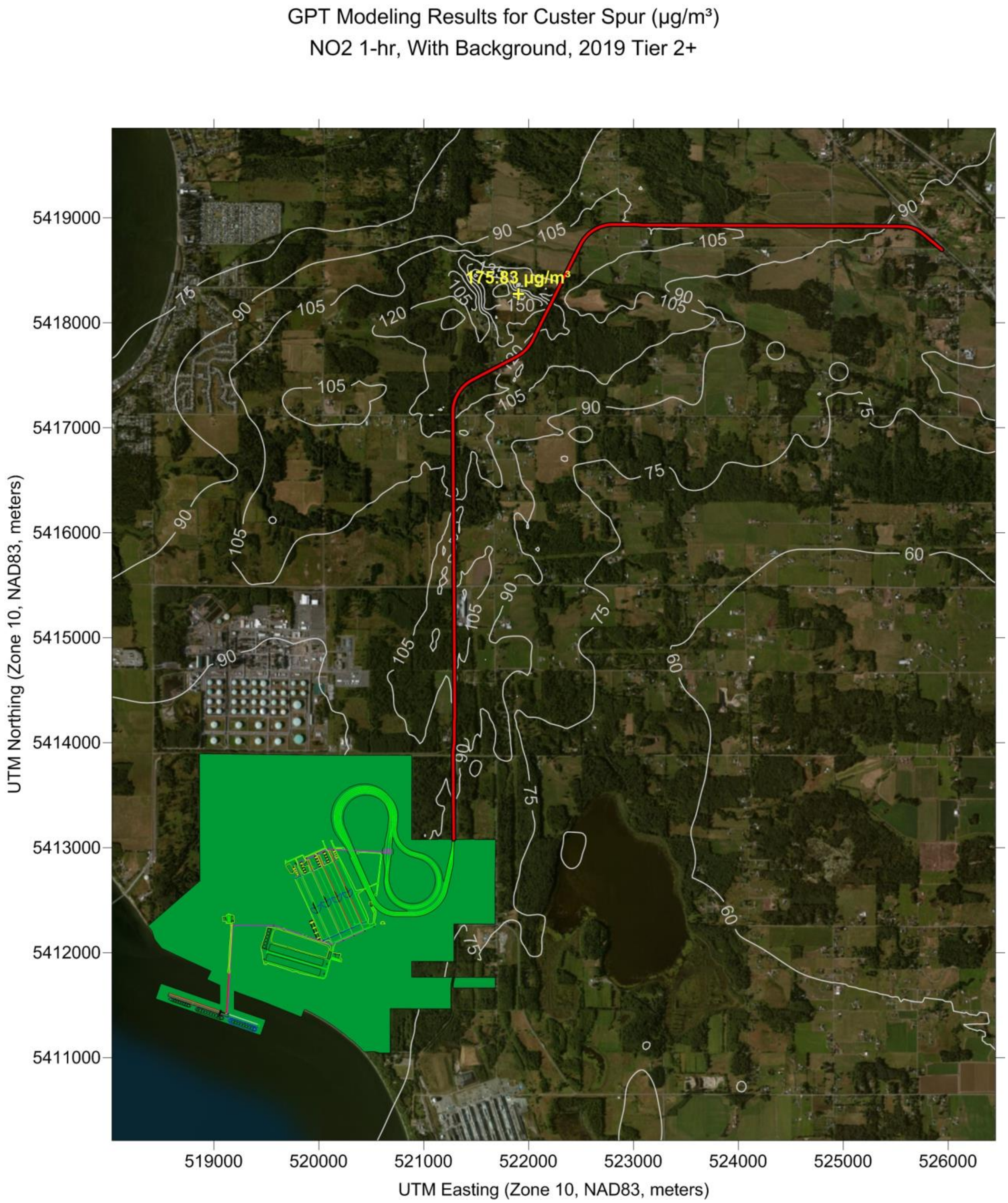


Figure 9. Modeling Results: 2019 1-Hour NO_2 Concentrations near Transiting Trains ($\mu g/m^3$)

Assumes Tier 2+ or better locomotives

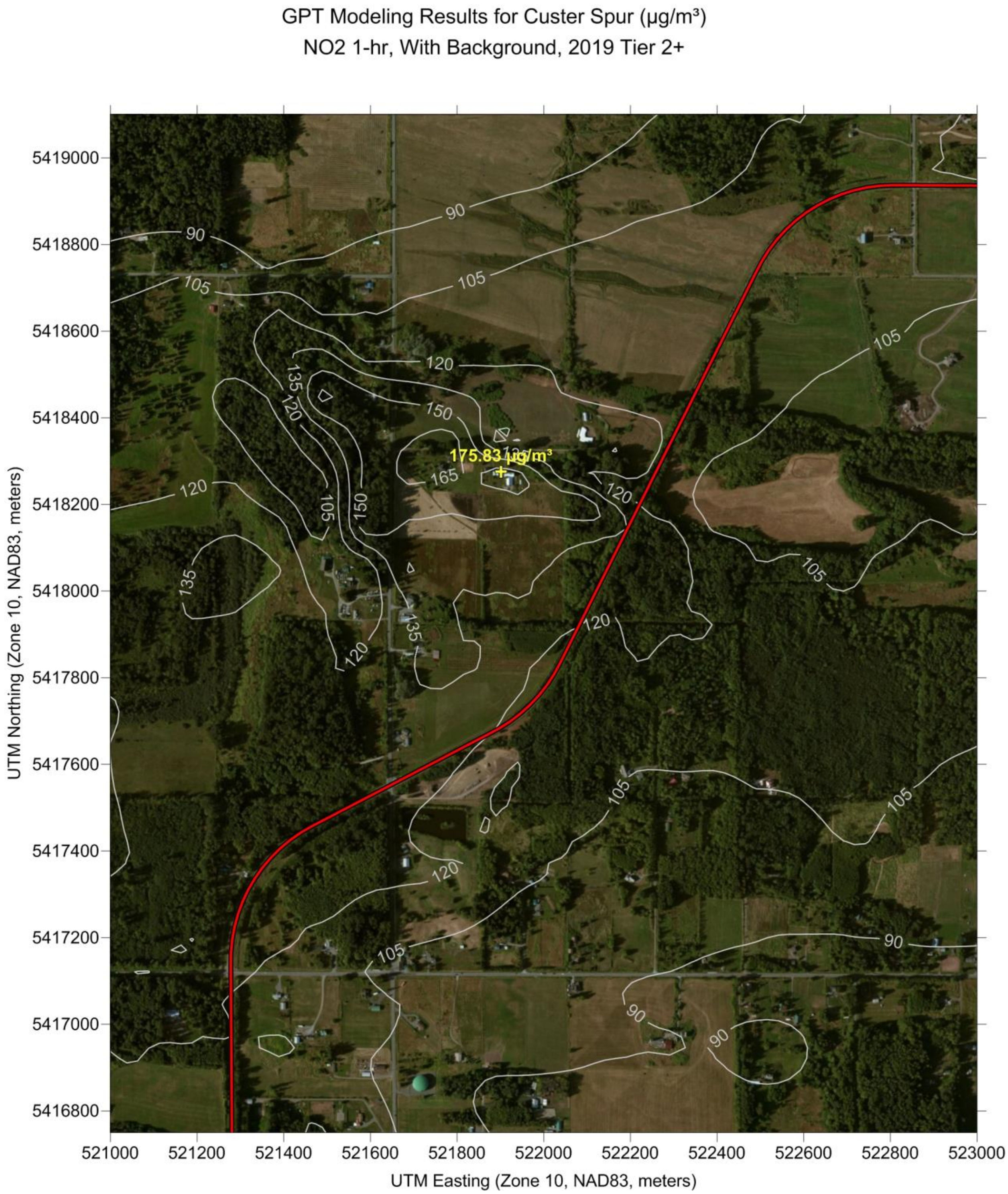


Figure 10. Modeling Results: 2019 1-Hour NO_2 Concentrations near Transiting Trains ($\mu g/m^3$) – Large Scale

Assumes Tier 2+ or better locomotives

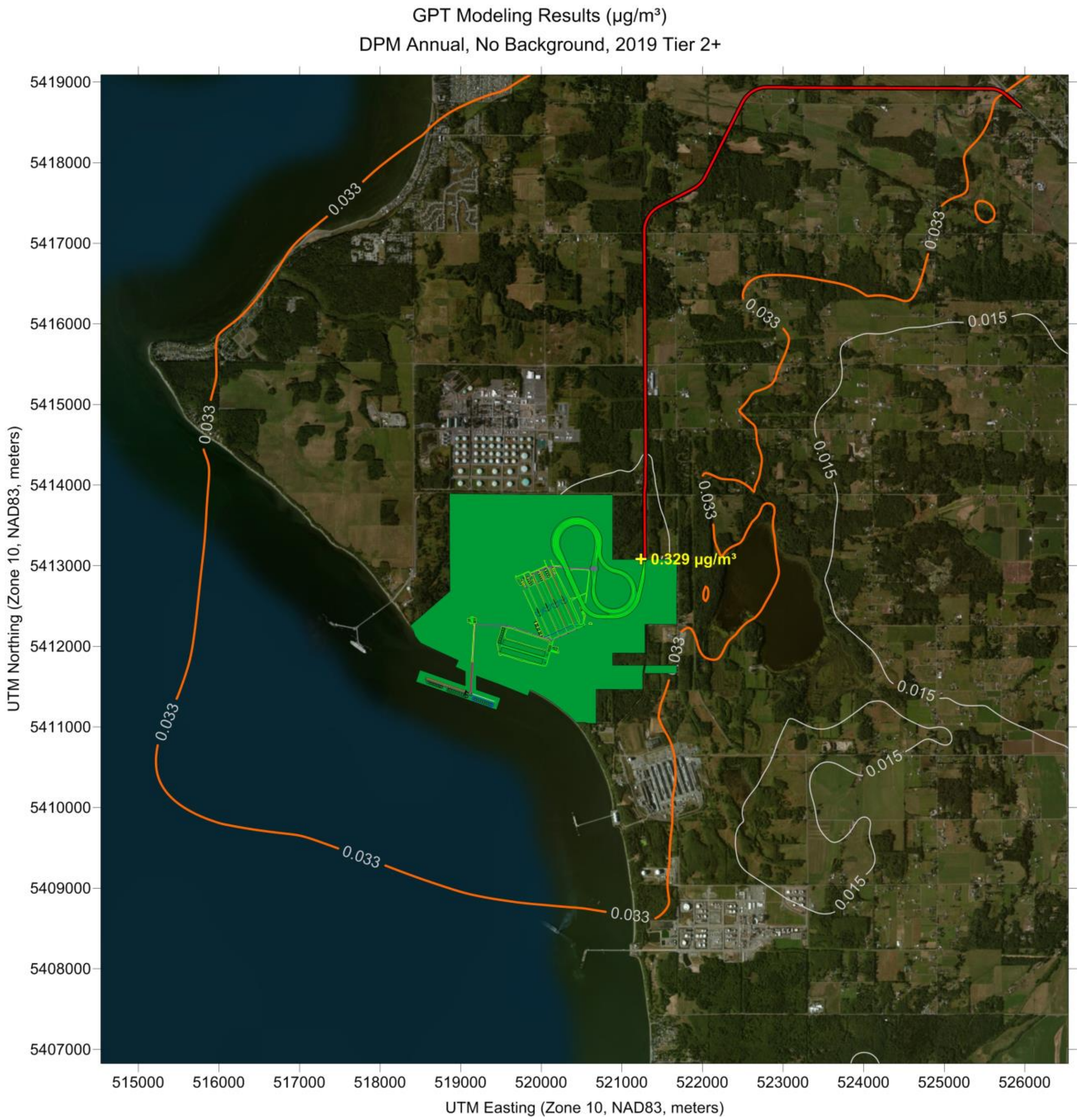


Figure 11. Modeling Results: 2019 Annual Average DPM Concentrations (µg/m^3)

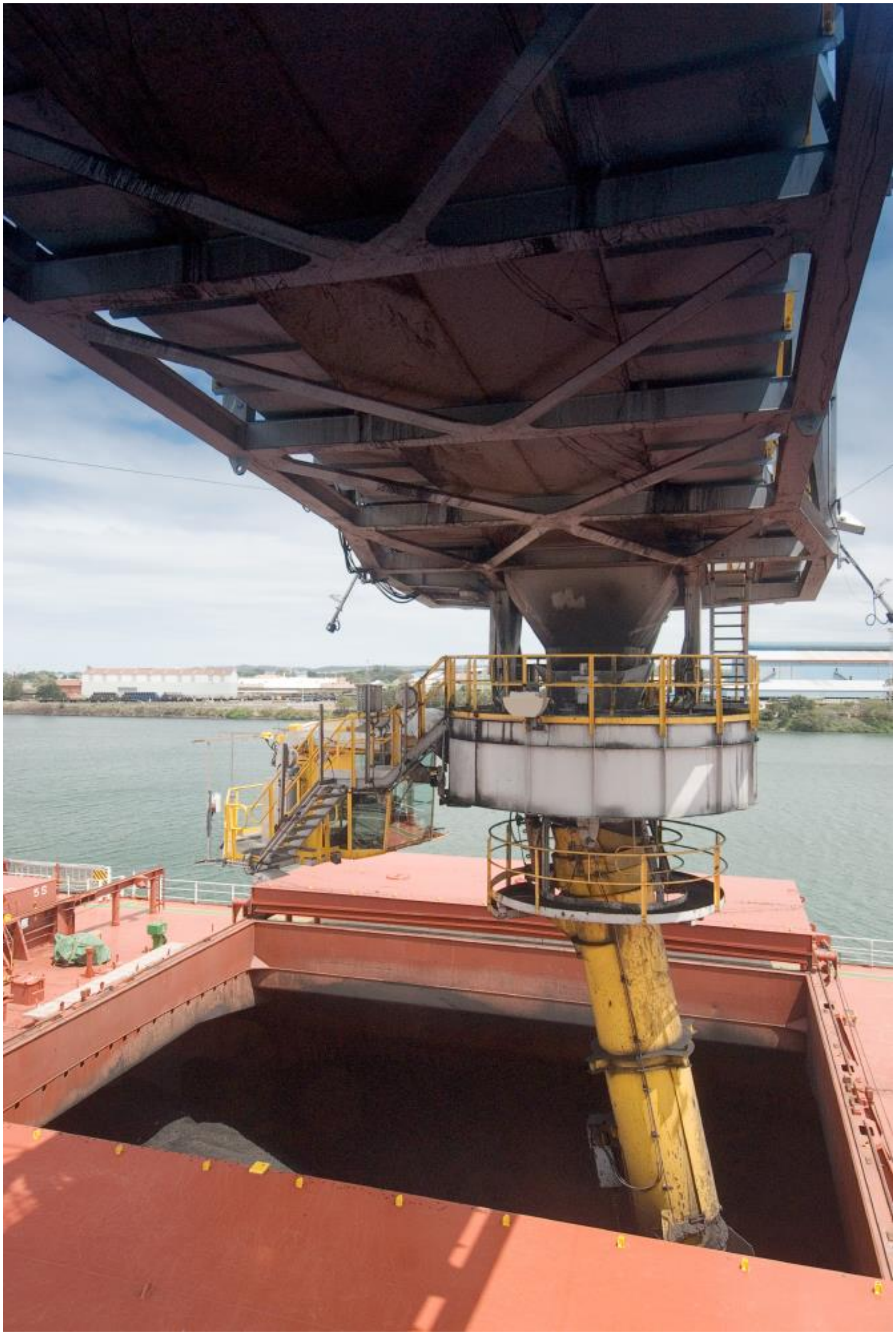
Appendix A: Coal-Handling Equipment Photos

Stacker/Reclaimer being fed by Open Conveyor – Adding to Pile

Enclosed Conveyor

Enclosed Conveyor with Close-Up of Returning Empty Belt Below

Enclosed Conveyor Viewed from Below



Vessel Loading Coal with Chute Well below Combing