Environmental Air Assessment

Kiewit Marine Yard

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Executive Summary

Kiewit operates the Kiewit Marine Yard (Marine Yard) and is currently in the planning and design phase to develop and expand its operations. SLR Consulting (Canada) Ltd. (SLR) has completed an Environmental Air Assessment in support in accordance with the Project and Environmental Review Guidelines (PER Guidelines) required by the Vancouver Fraser Port Authority (VFPA), to evaluate potential environmental impacts from air emissions resulting from the proposed operations.

Through discussions between VFPA and Kiewit, the VFPA has determined a Level 1 Air Quality Assessment will be required for this permit application. Project Case emissions are expected to increase both at the Marine Yard and supply chain. Increased material handling activity at the Marine Yard is the primary source of total Project Case PM emission increases compared to the Baseline Case, which is expected to increase over 31% for TPM, PM_{10}, and $PM_{2.5}$ each. Supply chain transportation is the primary source of total Project Case NO_2, CO, SO_2, black carbon, DPM and GHG emissions. Emission increases ranging from 17% to 94% for NO_2, CO, SO_2, black carbon, and DPM. GHG emission increases range from 50% to 229%.

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Acronyms and Abbreviations

AQO	Air quality objectives
BAT	Best available techniques
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BC	British Columbia
CAC	Criteria air contaminant
CD	Chart datum
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
DAS	Disposal at Sea
DPM	Diesel particulate matter
ENV	British Columbia Ministry of Environment and Climate Strategy
GHG	Greenhouse gas
N_2O	Nitrous oxide
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
PM	Particulate matter
$PM_{0.1}$	Ultrafine particulate matter
$PM_{2.5}$	Fine particulate matter
PM_{10}	Inhalable particulate matter
PER	Project and Environmental Review Guidelines
PM	Particulate matter
RoRo Ramp	Roll-on/Roll-off ramp structure
SO_2	Sulphur dioxide
SO_X	Sulphur oxides
TPM	Total particulate matter
US EPA	United States Environmental Protection Agency
VFPA	Vancouver Fraser Port Authority

1.0 Introduction

Kiewit operates the Kiewit Marine Yard (Marine Yard) and is currently in the planning and design phase to develop and expand its operations. SLR Consulting (Canada) Ltd. (SLR) has completed an Environmental Air Assessment in support in accordance with the Project and Environmental Review Guidelines (PER Guidelines; VFPA 2021) required by the Vancouver Fraser Port Authority (VFPA), to evaluate potential environmental impacts from air emissions resulting from the proposed operations.

Through discussions between VFPA and Kiewit, the VFPA has determined a Level 1 Air Quality Assessment will be required for this permit application.

1.1 Facility Overview

Kiewit owns and operates an industrial waterfront property (Marine Yard) located in the Fraser Mills area along the Fraser River, at 1950 Brigantine Drive in Coquitlam, British Columbia (BC). The Marine Yard is used to support construction projects in the region and is split between a 6.83 acre freehold lot owned by Kiewit under the jurisdictional authority of the City of Coquitlam and a 36 acre lot leased from the VFPA; lease lot number COQ-332 (collectively, the Project Site).

The property is actively used to service Kiewit's Canadian marine fleet and other construction equipment. Yard operations generally consist of staging equipment and materials on land, transferring materials to/from barges and material preparation. Currently, a Disposal At Sea (DAS) operation is also conducted from the facility. The Marine Yard has several structures and fixed facilities that were installed by the previous owner, including an office building, truck weigh scale, boat ramp, and two marine bulkhead wall structures.

A portion of Kiewit's property at the eastern end of the site is currently leased to Quadrant Towing, which includes a fuel building, floating dock, and marine access ramp. Kiewit currently operates the yard from Monday to Friday, with work occurring on intermittent Saturdays. The yard operates with day shifts running from 6:00am to 5:00pm and night shifts from 6:00 pm to 4:00 am. For the purpose of this report, VFPA breakdown of shift hours are 7:00 am to 8:00 pm for day shifts, 8:00 pm to 10:00 pm for evening shifts, and 10:00 pm to 7:00 am for night shifts.

2.0 Project Description

2.1 Project Overview

Kiewit is planning to build-out the Marine Yard to ensure it meets today's environmental and engineering standards. Development and expansion of Kiewit's Marine Yard (the Project) involves the following activities and Project components:

- Construction of a pile-supported marine access trestle,
- Construction of a pile-supported conveyor structure,
- Construction of a Roll-on/Roll-off ramp structure (RoRo Ramp),
- Marine Yard expansion by infill and expansion of the stormwater treatment system,
- Dredging to remove accumulated sediments up to a depth of -6.5 chart datum (CD),

- Construction of three groupings of mooring dolphins,
- In-river marsh bench (habitat compensation area),
- Construction of a new truck weigh scale located in the upland area of the yard,
- Construction of a new truck wheel wash located in the upland area of the yard, and
- Construction of buried electrical services used to power equipment and yard lighting at various locations within the yard.

2.2 Baseline Case

The current operations and material throughput of the Marine Yard are defined as the Baseline Case. The property is actively used to service Kiewit's Canadian marine fleet and other construction equipment. Yard operations consist of staging equipment and materials on land, transferring materials to/from barges, material preparation, and a DAS operation. The baseline design throughput capacities of the Marine Yard are summarized in Table 1. Annual material throughput operations include mixed construction materials and clean soil. Mixed construction materials may include structural steel, precast concrete, timber, steel pipe, etc. These materials are not expected to generate emissions and are not included in emission estimations.

Table 1: Baseline Case Throughput Capacities

Materials	Average Throughput (m^3/year)	Storage Capacity (m^3)
Imported Aggregate [1]	0	3,000 [3]
Clean Soil [2]	375,000	

[1] Imported aggregates vary and may include Pit Run Gravel, Pit Run Sand, River Sand, Drain Rock, Granular Base and Granual Subbase.

[2] Clean soils are from excavation of native ground materials from around the lower mainland. Kiewit does not have gradation test results, or moisture content test results. These materials vary significantly from site to site.

[3] Storage pile volume is based on the current cumulative imported aggregate and clean soil volumes. Stockpiles are not enclosed.

2.3 Project Case

As described in Section 2.1, the proposed Project Case will expand the Marine Yard operations and the design throughput capacities (Table 2). This will increase Project Site and Supply Chain activities. Construction will begin in December 2024 and operations are expected begin in the summer of 2026. Project Case emissions are estimated for full operations in 2027.

Table 2: Project Case Throughput Capacities

Materials	Average Throughput (m^3/year)	Storage Capacity (m^3)
Imported Aggregate [1]	50000	10000 [3]
Clean Soil [2]	475000	

[1] Imported aggregates vary and may include Pit Run Gravel, Pit Run Sand, River Sand, Drain Rock, Granular Base and Granual Subbase.

[2] Clean soils are from excavation of native ground materials from around the lower mainland. Kiewit does not have gradation test results, or moisture content test results. These materials vary significantly from site to site.

[3] Storage pile volume is based on the current cumulative imported aggregate and clean soil volumes. Stockpiles are not enclosed.

2.4 No Project Case

The No Project Case will not increase current operations and is equivalent to the Baseline Case.

3.0 Geographic Scope

3.1 Facility

The Marine Yard is located on the waterfront along the north side of the Fraser River at 1950 Brigantine Dr. in Coquitlam, BC. The Marine Yard Project boundary for this Assessment is shown in appended Appendix B. The existing structures and fixed facilities include an office building, truck weigh scale, boat ramp, and two marine bulkhead wall structures. The Quadrant Towing leased portion of the property currently includes a fuel building, floating dock and marine access ramp. Kiewit does not control Quadrant Towing's operations. However, Kiewit uses Quadrant Towing for barge movements.

3.2 Supply Chain

The supply chain Project boundary includes both marine and truck transport. The supply chain boundaries are defined in appended Appendix C and are listed below:

- Marine Traffic Category 1 (DAS)
- Marine Traffic Category 2 (Projects)
- Truck Traffic Category A
- Truck Traffic Category B
- DAS Delivery Category
- Local Delivery Categories

All supply chain categories will be impacted by the Project Case operations. Marine and truck transport emissions calculated for this assessment are based on average annual operating hours and assumptions. Truck Transport Category A extends beyond the VFPA jurisdictional area. Emissions estimated for Category A are adjusted to reflect approximate emissions in the VFPA jurisdictional area (66%).

3.3 Receivers of Interest, Identification, and Proximity

There are multiple residential communities, schools, childcare centres, seniors' centres, and hospitals within the geographic scope of the Marine Yard. The nearest receivers of interest to the Marine Yard for each category are presented in Table 3 and Figure A.

Table 3: Nearest Receivers of interest, identification and proximity

Receiver of Interest	Nearest Receiver	Approximate Distance from Marine Yard (km)
Residence	1968 Brunette Ave	0.9
School	Cape Horn Elementary	1.4
Childcare	FunTime Family Daycare	1.1
Seniors Centre	Cartier House Seniors Community / Cherington Place	2.0
Hospital	Royal Columbian Hospital	3.2

4.0 Emission Sources

Baseline Case and Project Case annual emissions for the Marine Yard operations and supply chain were estimated for this assessment. The average annual operations were chosen for the Baseline Case, and anticipated future full year operations for were chosen for the Project Case. Full operations are anticipated to commence in 2027.

4.1 Primary Sources

The number of primary sources will be the same between the Baseline Case and Project Case. This includes emissions from land and marine equipment, material handling, truck transportation, and marine vessels. The Project case will have increased activity levels due to increased material throughput capacity.

The operations performed by Quadrant Towing related to Kiewit's site operations are included in the operational quantities captured in this assessment. Current fuel storage tanks are owned and used by Quadrant Towing, which are not directly to Kiewit's Marine Yard activities. Kiewit does have future provision for fuel storage shown in Figure A. Future fuel storage could be up to 60,000 L of Dye fuel, 60,000 L of Clear fuel and 20,000 L of gasoline. Vapour emissions from fuel storage were calculated to be negligible (Appendix D).

Table 4: Primary Source Characterization

Primary Source	Detail	• Mode	• Metric	Fuel	Supply Chain	Baseline / Project Case
Marine	Derrick Barges Cranes	• Duty cycle aggregation	• Time of operation • Estimated fuel consumption	Marine Diesel	No	Both
	Derrick Barges Deck Generators				No	Both
	Tug Boats				Yes	Both
On Road	Delivery Trucks	• Duty cycle aggregation	• Time of operation • Estimated fuel consumption	Diesel / Gasoline [1]	Yes	Both
	Kiewit Trucking			Biodiesel	Yes	Both
	Dump Truck			Diesel	Yes	Both
Non-Road	Telehandler	• Duty cycle aggregation	• Time of operation • Estimated fuel consumption	Biodiesel	No	Both
	Forklift			Biodiesel	No	Both
	Skidsteer			Biodiesel	No	Both
	Telescopic Boom Lift			Biodiesel	No	Both
	Land Based Cranes			Biodiesel	No	Both
	Loader			Biodiesel	No	Both
	Excavators			Biodiesel	No	Both
	Sweeper Trucks			Diesel	No	Both
Stationary	Light Plant	• Duty cycle aggregation	• Time of operation • Estimated fuel consumption	Biodiesel	No	Both
	Material Feeder	• Material handling	• Material throughput[2]	N/A [3]	No	Both
	Conveyors				No	Both
	Stacker				No	Both

Primary Source	Detail	• Mode	• Metric	Fuel	Supply Chain	Baseline / Project Case
Fugitive	Dust [4]	• Material handling • Material storage • Unpaved roads	• N/A	N/A	No	Both
	Vapours [5]	• Material handling • Material storage	• N/A	N/A	No	Future Case [5]

[1] Delivery truck fuel may be diesel or gasoline. Diesel conservatively assumed for emission calculations.

[2] Material throughput emission calculations are based on total imported aggregate and clean soils throughputs and assumed number of transfer points. Mixed construction materials were assumed to emit negligible emissions.

[3] The material feeder, conveyors, and stacker are electric powered.

[4] Other material handling, material storage are not included in emission calculations. Emission factors are not available for mixed construction throughputs defined in Table 1 and Table 2, and emissions are expected to be negligible. Activity data specific to material storage are limited to Table 1 and Table 2. Material storage pile erosion emissions are not included in emission calculations. Activity data specific to Marine Yard unpaved road is assumed from average dump truck activity with water suppression.

[5] Fugitive vapours are expected from future fuel storage and Marine Yard welding activities. Fuel storage and welding emissions are assumed to be negligible.

4.2 Emission Variability

Marine Yard and supply chain emissions are expected to vary by time of day and periodic heavy weekly throughputs. General activity metrics for the primary sources incorporated into the annual emissions estimations are presented in Table 5. The yard operates with day shifts running from 6:00am to 5:00pm and night shifts from 6:00 pm to 4:00 am. For the purpose of this report, VFPA breakdown of shift hours are 7:00 am to 8:00 pm for day shifts, 8:00 pm to 10:00 pm for evening shifts, and 10:00 pm to 7:00 am for night shifts. Maximum emissions from the Marine Yard are expected during the day shift operations on weekdays, when most equipment is operational. Equipment operations are reduced during evening and night shift hours. Most equipment are operational five days a week, with minimal weekend hours (one to two shifts a month at reduced hours). Kiewit operates 50 weeks per year.

Table 5: Average Primary Source Activity Metrics

Primary Source	Detail	Average/Typical Activity Metrics (Baseline Case)	Average/Typical Activity Metrics (Project Case)
Marine	Derrick Barges Cranes	• One of five in use at any given time. • Assumed 1522 activity hours per year, with 5% operating time and 95% idle time.	
	Derrick Barges Deck Generators	• One of five in use at any given time. • Assumed 1522 activity hours per year, with 5% operating time and 95% idle time.	
	Tug Boats	• Two Projects and two DAS tug boats of 14 in use at any given time. • Assumed 811 Projects activity hours per year, with 50% operating time and 50% idle time. • Assumed 1086 DAS activity hours per year, with 50% operating time and 50% idle time.	• Two Projects and two DAS tug boats of 14 in use at any given time. • Assumed 811 Projects activity hours per year, with 50% operating time and 50% idle time. • Assumed 1361 DAS activity hours per year, with 50% operating time and 50% idle time.
On Road	Delivery Trucks	• Local delivery truck models vary. • Average of 12 local delivery trucks per day, with a maximum three trucks running simultaneously. • Assumed 9750 activity hours per year, with 5% operating time and 95% idle time.	
	Kiewit Trucking	• Average of 7 trucks running simultaneously. • Assumed 9000 activity hours per year, with 5% operating time and 95% idle time for Truck Traffic Category A. • Assumed 6750 activity hours per year, with 5% operating time and 95% idle time for Truck Traffic Category B.	• Average of 12 trucks running simultaneously. • Assumed 23143 activity hours per year, with 5% operating time and 95% idle time for Truck Traffic Category A. • Assumed 17357 activity hours per year, with 5% operating time and 95% idle time for Truck Traffic Category B.
	Dump Truck	• DAS delivery trucks include typical dump trucks, mixture of tandem dumps, tridem dumps, end dumps, both individually and with truck and trailer combinations. • Average of 80 DAS loads per dayshift. • Assumed 1900 activity hours per year, with 50% operating time and 50% idle time.	• DAS delivery trucks include typical dump trucks, mixture of tandem dumps, tridem dumps, end dumps, both individually and with truck and trailer combinations. • Average of 100 DAS loads per dayshift. • Assumed 2375 activity hours per year, with 50% operating time and 50% idle time.

Primary Source	Detail	Average/Typical Activity Metrics (Baseline Case)	Average/Typical Activity Metrics (Project Case)
Non-Road	Telehandler	• Only one in use at a given time. • Assumed 850 activity hours per year, with 50% operating time and 50% idle time.	
	Forklift	• Only one in use at a given time. • Assumed 850 activity hours per year, with 50% operating time and 50% idle time.	
	Skidsteer	• Only one in use at a given time. • Assumed 850 activity hours per year, with 50% operating time and 50% idle time.	
	Telescopic Boom Lift	• Only one in use at a given time. • Assumed 50 activity hours per year, with 50% operating time and 50% idle time.	
	Land Based Cranes	• Only one in use at a given time. • Assumed 100 activity hours per year, with 50% operating time and 50% idle time.	
	Loader	• Only one in use at a given time. • Assumed 3095 activity hours per year, with 50% operating time and 50% idle time.	• Only one in use at a given time. • Assumed 3895 activity hours per year, with 50% operating time and 50% idle time.
	Excavators	• One of two in use at any given time. • Assumed 648 activity hours per year, with 50% operating time and 50% idle time.	• One of two in use at any given time. • Assumed 773 activity hours per year, with 50% operating time and 50% idle time.
	Sweeper Trucks	• Only one in use at a given time. • Assumed 822 activity hours per year, with 50% operating time and 50% idle time.	• Only one in use at a given time. • Assumed 1096 activity hours per year, with 50% operating time and 50% idle time.
Stationary	Light Plant	• Only one in use at a given time. • Assumed 110 activity hours per year, with 100% operating time and 0% idle time.	• Only one in use at a given time. • Assumed 117 activity hours per year, with 100% operating time and 0% idle time.
	Material Feeder	• Emissions based on average annual imported aggregate and clean soil	• Emissions based on average annual imported aggregate and clean soil
	Conveyors		

Primary Source	Detail	Average/Typical Activity Metrics (Baseline Case)	Average/Typical Activity Metrics (Project Case)
	Stacker	throughputs, and average number of transfer points. • Assumed clean soil throughput of 562500 tonnes/year.	throughputs, and average number of transfer points. • Assumed imported aggregate throughput of 75000 tonnes/year. • Assumed clean soil throughput of 712500 tonnes/year.
Fugitive	Unpaved Roads	• Assumed average 80 dump truck loads per weekday shift, with two monthly weekend shifts.	• Assumed average 100 dump truck loads per weekday shift, with two monthly weekend shifts.

4.3 Pollutants of Concern

Criteria air contaminants (CACs), black carbon, diesel particulate matter (DPM), and greenhouse gas (GHG) emissions emitted from the Marine Yard and supply chain are considered in this assessment. Baseline and Project Case CACs include particulate matter (PM), nitrogen dioxide (NO_2), carbon monoxide (CO), and sulphur dioxide (SO_2). Particulate matter is reported as Total Particulate Matter (TPM), inhalable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$). Calculated nitrogen oxides (NO_X) and sulphur oxides (SO_X) are assumed to be equivalent to NO_2 and SO_2 respectively. Black carbon and DPM emissions are assumed to be a fraction of combustion $PM_{2.5}$ emissions. GHG emissions from combustion estimated in this assessment include carbon monoxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

Listed fugitive emissions from Table 4 and associated pollutants were excluded from the annual emissions estimations. Mixed construction material handling, material storage, and unpaved roads are not included in emission calculations. Emission factors are not available for the mixed construction throughputs defined in Table 1 and Table 2, and emissions are expected to be negligible from the defined materials. Activity data specific to material storage are limited to Table 1 and Table 2. Material storage pile erosion emissions are not included in emission calculations and are assumed to be incorporated in the material handling estimations.
Activity data specific to Marine Yard unpaved road activity is not available, but emissions are minimized through use of sweeper trucks. Fugitive vapours are expected from future fuel storage and Marine Yard welding activities. Fuel storage and welding emissions are assumed to be negligible.

5.0 Current Condition

5.1 Air Quality

Ambient air quality objectives (AQOs) are established by levels of government to ensure long-term protection of the environment and public health from CACs. For this assessment, the Metro Vancouver and BC AQOs (MV 2020) are used for comparison with baseline air quality.
A summary of the ambient air quality objectives considered for this study is provided in Table 6. Since Metro Vancouver does not have AQOs for TPM, the British Columbia Ministry of Environment and Climate Strategy (ENV) objective for TPM is considered here (ENV 2021a).

Table 6: Ambient Air Quality Objectives

Pollutant Species	Averaging Period	AQO ($\mu g/m^3$)	AQO Regulatory Agency
CO	1-Hour	14,900	MV
	8-Hour	5,700	MV
NO_2	1-Hour	113	MV
	Annual	32	MV
SO_2	1-Hour	183	MV
	Annual	13	MV
$PM_{2.5}$	24-Hour	25	MV
	Annual	8(6)	MV
PM_{10}	24-Hour	50	MV
	Annual	20	MV
TPM	24-Hour	120	BC MOE
	Annual	60	BC MOE

The baseline ambient air quality (current condition) is assumed to be equivalent to concentrations measured at the nearest air quality monitoring station(s) to the Marine Yard. To address the background air quality for the Marine Yard site, the concentration of CO, NO_2, SO_2 and $PM_{2.5}$, monitoring at the ambient air quality stations are taken from the British Columbia Ministry of Environment (ENV 2024). As there is no PM_{10} and TPM data available from nearby stations for the period of assessment, the baseline estimation for PM_{10} and TPM is not considered for the Marine Yard.

The $PM_{2.5}$ and NO_2 baselines are calculated from the New Westminster Sapperton Park monitoring station (BC Station ID: E308566; NAPS Station ID: 100103), located closest to the Marine Yard. The CO and SO_2 baselines are calculated from the Port Moody Rocky Point Park monitoring station (BC Station ID: 310162; NAPS Station ID: 100111) located north of the Marine Yard. Ambient air quality monitoring station locations are shown in Figure A. A summary of the background air quality concentrations is shown in the Table 7 for years 2019 to 2021. For all the three years, the baseline concentrations are well within the ambient air quality objectives, with the exception of the 24-hour average concentration of $PM_{2.5}$ during 2020 and 2021.

Table 7: Background Ambient Air Quality Concentration Summary

Pollutant Species	Station Name	Averaging Period	Baseline Concentration (µg/m³)			Calculation Basis
			2019	2020	2021	
CO	Port Moody Rocky Point Park Station	1-Hour	2319	2164	1505	Maximum of hourly data
		8-Hour	861	2032	1127	Maximum of 8-hour rolling average of hourly data
NO_2	New Westminster Sapperton Park Station	1-Hour	81.7	74.4	69.3	98th percentile of the daily maximum 1-hour concentration
		Annual	30.0	26.9	26.1	Annual average of hourly data
SO_2	Port Moody Rocky Point Park Station	1-Hour	12.6	111.9	117.2	Maximum of hourly data
		Annual	0.7	0.7	0.6	Annual average of hourly data
$PM_{2.5}$	New Westminster Sapperton Park Station	24-Hour	23.2	197.6 [1]	92.5 [1]	Maximum of 24-hour rolling average of hourly data
		Annual	6.3	7.5	5.7	Annual average of hourly data

[1] These baseline $PM_{2.5}$ 24-Hour averaging concentrations exceed the AQO. Exceedances are due to wildfire events. With the wildfire events removed, the 24-Hour concentrations are 21 µg/m³ and 14 µg/m³ for 2020 and 2021 respectively (MV 2021; MV 2022).

Based on the MV air quality climate action document, namely Caring for the Air 2021 report (MV 2021), during 2020 the $PM_{2.5}$ levels throughout the region were higher than the AQO at more than half the monitoring stations including the New Westminster station. This short-term high concentration was due to the smoke from out-of-region wildfires. Although the annual average concentration was within the MV AQO, the 24-hour averages were exceeding. With wildfire events removed, the AQO was met at 21 µg/m³ (MV 2021).

In 2021, the annual average for $PM_{2.5}$ was well within the MV AQO but the maximum of 24-hour rolling average exceeded the MV AQO. The Metro Vancouver air quality climate action document for 2022 (MV 2022) stated that a widespread exceedance in $PM_{2.5}$ level took place throughout the monitoring network in August due to wildfire smoke. With wildfire events removed, the AQO was met at 14 µg/m³ (MV 2021). According to Metro Vancouver's annual air quality summary report 2022 (MV 2023), the summer months experienced elevated $PM_{2.5}$ concentrations due to the wildfires in BC and the United States since 2015. The highest monthly concentrations were recorded in 2017, 2018, and 2020.

The concentrations of gaseous pollutants CO, NO_2 and SO_2 have significantly reduced since 2011. A sharp decreasing trend in SO_2 concentrations is attributed to the strict lower sulphur content requirements for Marine fuels. Although there is an enhancement in seasonal wildfire events for the region, the state of background ambient air quality in the vicinity of the Marine Yard site is considered as good. (MV 2023)

5.2 Meteorological influences

The Marine Yard lies between the Port Mann Bridge Mid Span meteorological station (Native ID: 14092) operated by the Ministry of Transportation and Infrastructure, and the New Westminister meteorological station (Native ID: T46) operated by Metro Vancouver (ENV 2020). To understand the prevailing wind condition over the Marine Yard site, the wind data is taken from two stations located on either side of the Marine Yard. In absence of wind data from the Port Mann Bridge Mid Span station for the period considered for assessment, the nearby Federal PITT MEADOWS CS meteorological station (Climate ID: 1106178; Station ID: 6830) is considered (Environment and Natural Resources 2024). The New Westminister station is located to the west whereas the PITT MEADOWS CS station is located to the east of the Marine Yard. The station locations are shown in Figure A, and the station wind roses are shown in Figures 1 and 2.

Figure 1: Wind Roses for New Westminister Station

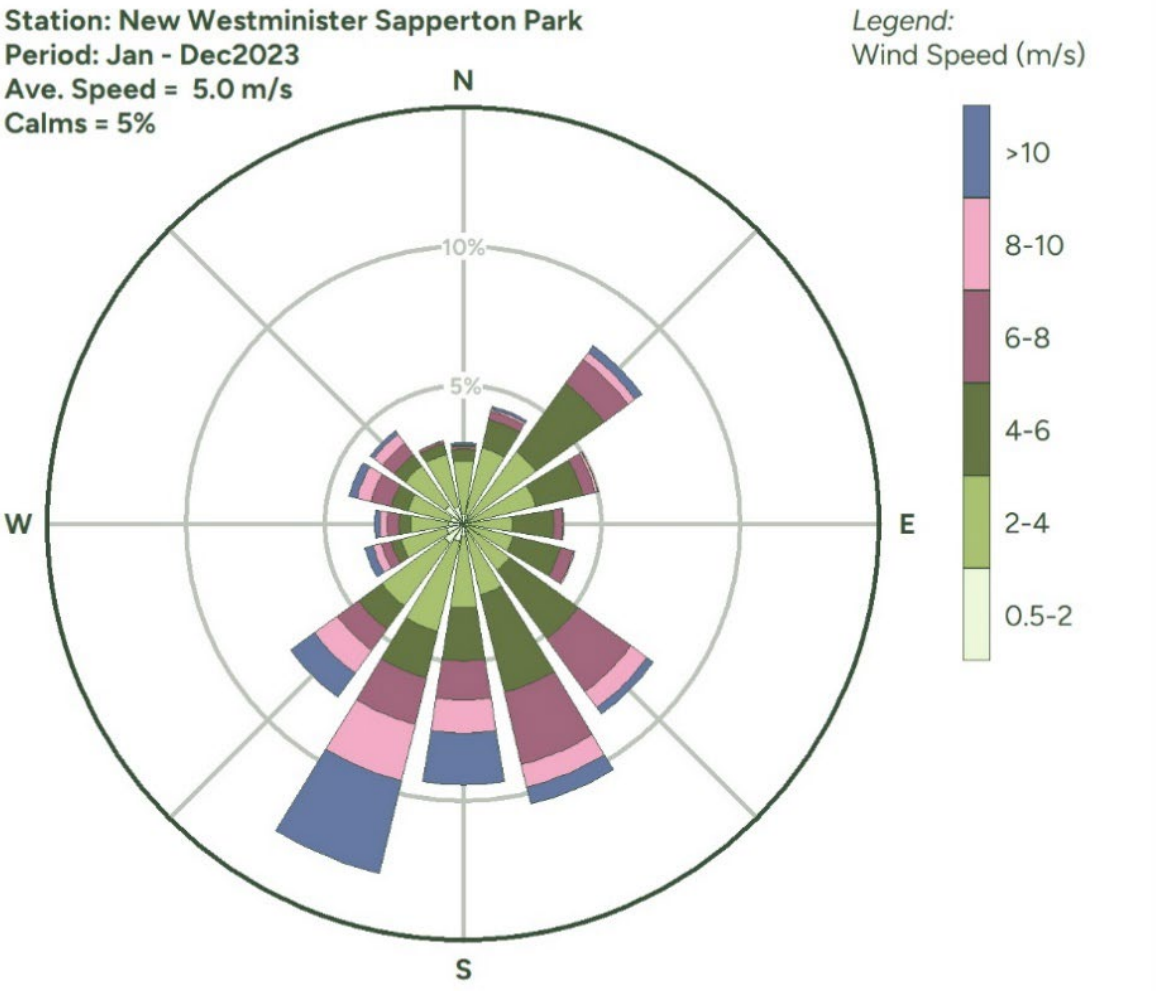
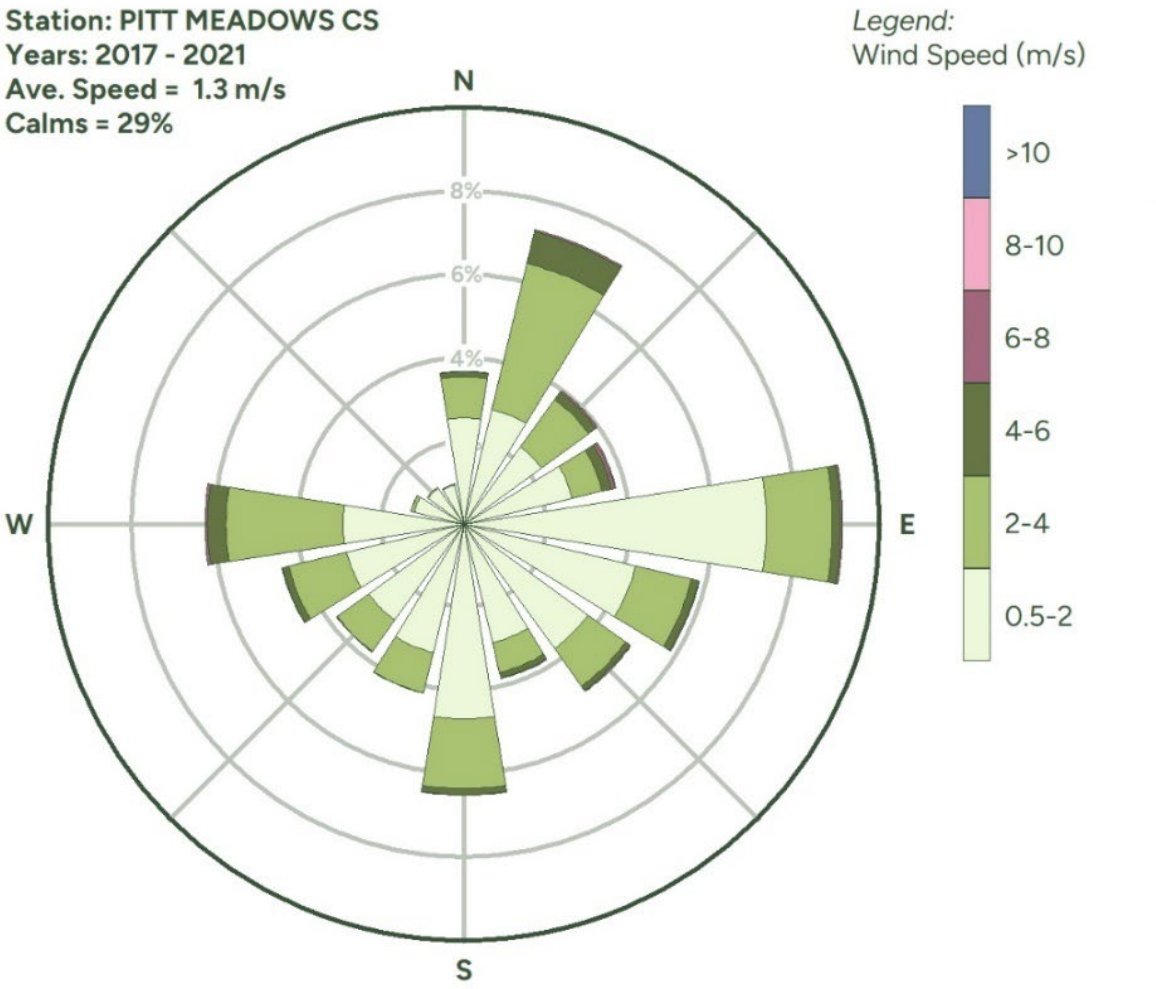


Figure 2: Wind Rose for PITT MEADOWS CS Station



The annual wind rose for the New Westminster station indicates the predominance of southwesterly winds, where the wind rose for the PITT MEADOWS CS station denotes the prevalence of easterly wind. In absence of in-situ wind parameter measurements at the Marine Yard site, we can conclude that the expected wind at the Marine Yard site may be either from east or from the southwest direction, or an average between these stations.

5.3 Historical Trends

The Baseline Case uses average annual throughput and operations to estimate emissions shown in Table 1 and Table 2. The proposed Project Case emissions are based on anticipated average annual throughput and operations in 2027.

6.0 Future Condition

6.1 Horizon Year

Construction will begin in December 2024 and is expected to end in 2027. Future Project Case operations are expected begin in 2027.

6.2 Design Capacity Limitation

Project Case design throughput capacity would be constrained by vehicle movements through the neighboring easement access points. Capacity improvements through the easements of the neighboring properties is not expected.

7.0 Emission Estimates

Primary emission sources included in the calculations are characterized in Section 4.1, and a description of activity metrics are in Section 4.2 of this assessment. Emission estimates between Baseline Case and Project Case use the same calculation assumptions. Emission methodologies and assumptions are described in Appendix A.

7.1 Baseline Case

The Baseline Case emission estimates are based on annual average throughputs and equipment activity levels. Baseline Case total estimated annual average emissions are summarized in Table 8, with Marine Yard and supply chain subtotals. Further Baseline Case emissions breakdowns are presented in Table A.

Table 8: Baseline Case Estimated Annual Average Emissions (tonnes/year)

Geographic Boundary	CACs						Other		GHGs		
	TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Marine Yard TOTAL	660.76	312.24	47.35	2.38	4.23	0.02	0.11	0.10	552.68	0.04	0.04
Supply Chain TOTAL	0.61	0.61	0.56	16.00	12.07	0.31	2.00	0.56	1284.04	0.22	0.09
Baseline Case TOTAL	**661.37**	**312.85**	**47.91**	**18.37**	**16.30**	**0.32**	**2.10**	**0.66**	**1836.72**	**0.27**	**0.13**

7.2 Project Case

The Project Case emission estimates are based on future annual average throughputs and equipment activity levels expected in 2027. Project Case total estimated annual average emissions are summarized in Table 9, with Marine Yard and supply chain subtotals. Further Project Case emissions breakdowns are presented in Table B.

Table 9: Project Case estimated Annual Average Emissions (tonnes/year)

Geographic Boundary	CACs						Other		GHGs		
	TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Marine Yard TOTAL	868.98	410.64	62.25	2.64	4.93	0.02	0.13	0.11	873.42	0.05	0.04
Supply Chain TOTAL	0.93	0.93	0.85	22.64	17.54	0.36	3.96	0.85	5178.10	0.36	0.15
Project Case TOTAL	**869.90**	**411.57**	**63.10**	**25.28**	**22.47**	**0.38**	**4.09**	**0.97**	**6051.52**	**0.40**	**0.20**

8.0 Mitigation Potential

The Marine Yard Baseline Case assumes the same mitigation measures or Best Available Technology Not Entailing Excessive Cost (BANTEEC) are applied for the Project Case, with the exception of a new proposed wheel wash station shown in Figure A. A wheel wash station will mitigate PM transferred from the Marine Yard to the supply chain. Transferred fugitive wheel PM is not included in the emission calculations.

9.0 Impact Potential

9.1 Compare Baseline Case to Project Case

Both Marine Yard and supply chain emissions are expected to increase for the Project Case for all pollutants of concern. Table 10 summarizes the emission percent increases between the Baseline Case to Project Case, as well as the Marine Yard and supply chain subcategory emission increases.

The increased Marine Yard material handling will have to largest contribution to the overall Project Case PM total emissions. Although the supply chain PM emission contributions to the total Baseline and Project Case PM are small compared to the Marine Yard, the supply chain PM will increase by 95%. However, increased supply chain transportation will have the largest contribution to NO_2, CO, SO_2, black carbon, DPM, and GHG emission increases.

Table 10: Baseline Case to Project Case Percent Increase (%) of Estimated Annual Average Emissions

Geographic Boundary	CACs						Other		GHGs		
	TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Marine Yard	31.51 %	31.52 %	31.49 %	11.00 %	16.45 %	1.61%	23.15%	12.78 %	58.03%	7.73%	17.79 %
Supply Chain	51.50 %	51.50 %	51.50 %	41.55 %	45.32 %	18.34 %	98.29%	51.50 %	303.27 %	59.10 %	71.02 %
TOTAL	**31.53 %**	**31.55 %**	**31.72 %**	**37.60 %**	**37.82 %**	**17.54 %**	**94.46%**	**45.63 %**	**229.47 %**	**50.89 %**	**55.05 %**

9.2 Conclusions

Project Case emissions are expected to increase both at the Marine Yard and supply chain. Increased material handling activity at the Marine Yard is the primary source of total Project Case PM emission increases compared to the Baseline Case, which is expected to increase over 31% for TPM, PM_{10}, and $PM_{2.5}$ each. Supply chain transportation is the primary source of total Project Case NO_2, CO, SO_2, black carbon, DPM and GHG emissions. Emission increases ranging from 17% to 94% for NO_2, CO, SO_2, black carbon, and DPM. GHG emission increases range from 50% to 229%.

With current ambient concentrations for NO_2, CO, and SO_2 well within the AQO, proposed Project Case activity is not expected to contribute to ambient AQO exceedances.
Current ambient $PM_{2.5}$ concentrations vary from year to year and exceed AQO during wildfire events. Proposed Project Case activity may cumulatively add to ambient $PM_{2.5}$, but best practices will mitigate the Project Case impact.

10.0 Closure

If you should have any questions, please contact Craig Vatcher at cvatcher@slrconsulting.com, or Nadine de Bruyn at ndebruyn@slrconsulting.com.

Regards,

SLR Consulting (Canada) Ltd.

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Air Quality Engineer

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Tables

Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

SLR Project No.: 201.088941.00001

May 13, 2024

Table A: Baseline Case Estimated Annual Average Emissions (tonnes/year)

Primary Source	Supply Chain	CACs						Other		GHGs		
		TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Derrick Barge Cranes	No	0.0315	0.0315	0.0290	0.9264	0.0747	0.0124	0.0090	0.0290	265.5798	0.0250	0.0071
Derrick Barge Generators	No	0.0038	0.0036	0.0036	0.0670	0.0846	0.0015	0.0011	0.0036	4.7495	0.0004	0.0001
Telehandler	No	0.0008	0.0008	0.0008	0.0153	0.1917	0.0000	0.0006	0.0008	9.4461	0.0005	0.0002
Forklift	No	0.0184	0.0184	0.0169	0.3389	0.2965	0.0001	0.0131	0.0169	20.8673	0.0011	0.0035
Skidsteer	No	0.0056	0.0056	0.0052	0.1036	0.9066	0.0003	0.0040	0.0052	63.8041	0.0034	0.0010
Elevated work platform	No	0.0002	0.0002	0.0002	0.0040	0.0350	0.0000	0.0002	0.0002	2.4651	0.0001	0.0000
Delivery Trucks	Yes (Local Delivery Category)	0.0688	0.0688	0.0633	1.2651	1.1069	0.0004	0.5469	0.0633	84.1374	0.0325	0.0162
Kiewit Trucking	Yes (Truck Traffic Category A)	0.0719	0.0719	0.0662	1.3235	1.1580	0.0004	0.5721	0.0662	81.5019	0.0341	0.0171
Kiewit Trucking	Yes (Truck Traffic Category B)	0.0809	0.0809	0.0744	1.4889	1.3028	0.0005	0.6437	0.0744	91.6897	0.0384	0.0192
Land Based Cranes	No	0.0039	0.0039	0.0036	0.0716	0.0627	0.0000	0.0028	0.0036	4.4099	0.0002	0.0001
Loader	No	0.0119	0.0119	0.0109	0.2188	1.9148	0.0007	0.0084	0.0109	134.7656	0.0072	0.0225
Excavators	No	0.0007	0.0007	0.0006	0.0372	0.1472	0.0000	0.0005	0.0006	7.1031	0.0004	0.0012
Light Plant	No	0.0000	0.0000	0.0000	0.0009	0.0008	0.0000	0.0000	0.0000	0.0289	0.0000	0.0000
Dump Trucks	Yes (DAS Delivery Category)	0.0678	0.0678	0.0623	1.2466	1.0908	0.0004	0.1421	0.0623	82.9107	0.0084	0.0042
Sweeper Trucks	No	0.0322	0.0322	0.0297	0.5934	0.5192	0.0002	0.0676	0.0297	39.4623	0.0040	0.0020
Tug Boats (Projects)	Yes (Marine Traffic Category 2)	0.0938	0.0938	0.0863	3.1072	2.1577	0.0885	0.0268	0.0863	274.7831	0.0470	0.0134
Tug Boats (DAS)	Yes (Marine Traffic Category 1)	0.2284	0.2284	0.2101	7.5650	5.2535	0.2154	0.0651	0.2101	669.0156	0.0629	0.0180

Primary Source	Supply Chain	CACs						Other		GHGs		
		TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Material Handling (Aggregates)	No	0.0000	0.0000	0.0000								
Material Handling (Clean Soil)	No	659.0771	311.7257	47.2042								
Unpaved Roads	No	1.5727	0.4057	0.0406								
Marine Yard TOTAL		**660.76**	**312.24**	**47.35**	**2.38**	**4.23**	**0.02**	**0.11**	**0.10**	**552.68**	**0.04**	**0.04**
Supply Chain TOTAL		**0.61**	**0.61**	**0.56**	**16.00**	**12.07**	**0.31**	**2.00**	**0.56**	**1284.04**	**0.22**	**0.09**
Baseline Case TOTAL		**661.37**	**312.85**	**47.91**	**18.37**	**16.30**	**0.32**	**2.10**	**0.66**	**1836.72**	**0.27**	**0.13**

Table B: Project Case estimated annual average emissions (tonnes/year)

Primary Source	Supply Chain	CACs						Other		GHGs		
		TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Derrick Barge Cranes	No	0.0315	0.0315	0.0290	0.9264	0.0747	0.0124	0.0090	0.0290	265.5798	0.0250	0.0071
Derrick Barge Generators	No	0.0038	0.0036	0.0036	0.0670	0.0846	0.0015	0.0011	0.0036	4.7495	0.0004	0.0001
Telehandler	No	0.0008	0.0008	0.0008	0.0153	0.1917	0.0000	0.0006	0.0008	17.1747	0.0005	0.0002
Forklift	No	0.0184	0.0184	0.0169	0.3389	0.2965	0.0001	0.0131	0.0169	37.9406	0.0011	0.0035
Skidsteer	No	0.0056	0.0056	0.0052	0.1036	0.9066	0.0003	0.0040	0.0052	116.0075	0.0034	0.0010
Elevated work platform	No	0.0002	0.0002	0.0002	0.0040	0.0350	0.0000	0.0002	0.0002	4.4820	0.0001	0.0000
Delivery Trucks	Yes (Local Delivery Category)	0.0688	0.0688	0.0633	1.2651	1.1069	0.0004	0.5469	0.0633	580.2579	0.0325	0.0162
Kiewit Trucking	Yes (Truck Traffic Category A)	0.1850	0.1850	0.1702	3.4032	2.9778	0.0011	1.4712	0.1702	1445.3545	0.0877	0.0438
Kiewit Trucking	Yes (Truck Traffic Category B)	0.2081	0.2081	0.1914	3.8286	3.3500	0.0012	1.6551	0.1914	1626.0238	0.0987	0.0493
Land Based Cranes	No	0.0039	0.0039	0.0036	0.0716	0.0627	0.0000	0.0028	0.0036	8.0179	0.0002	0.0001
Loader	No	0.0150	0.0150	0.0138	0.2754	2.4098	0.0009	0.0106	0.0138	308.3637	0.0091	0.0283
Excavators	No	0.0008	0.0008	0.0008	0.0444	0.1756	0.0000	0.0006	0.0008	15.4059	0.0005	0.0014
Light Plant	No	0.0001	0.0001	0.0000	0.0009	0.0008	0.0000	0.0000	0.0000	0.0309	0.0000	0.0000
Dump Trucks	Yes (DAS Delivery Category)	0.0847	0.0847	0.0779	1.5583	1.3635	0.0005	0.1776	0.0779	188.4334	0.0105	0.0053
Sweeper Trucks	No	0.0430	0.0430	0.0396	0.7911	0.6922	0.0002	0.0902	0.0396	95.6662	0.0054	0.0027
Tug Boats (Projects)	Yes (Marine Traffic Category 2)	0.0938	0.0938	0.0863	3.1072	2.1577	0.0885	0.0268	0.0863	499.6056	0.0470	0.0134
Tug Boats (DAS)	Yes (Marine Traffic Category 1)	0.2863	0.2863	0.2634	9.4807	6.5838	0.2699	0.0816	0.2634	838.4256	0.0788	0.0225
Material Handling (Aggregates)	No	32.0559	15.1616	2.2959								

Primary Source	Supply Chain	CACs						Other		GHGs		
		TPM	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2	Black Carbon	DPM	CO_2	CH_4	N_2O
Material Handling (Clean Soil)	No	834.8310	394.8525	59.7920								
Unpaved Roads	No	1.9658	0.5071	0.0507								
Marine Yard TOTAL		**868.98**	**410.64**	**62.25**	**2.64**	**4.93**	**0.02**	**0.13**	**0.11**	**873.42**	**0.05**	**0.04**
Supply Chain TOTAL		**0.93**	**0.93**	**0.85**	**22.64**	**17.54**	**0.36**	**3.96**	**0.85**	**5178.10**	**0.36**	**0.15**
Project Case TOTAL		**869.90**	**411.57**	**63.10**	**25.28**	**22.47**	**0.38**	**4.09**	**0.97**	**6051.52**	**0.40**	**0.20**

Figures

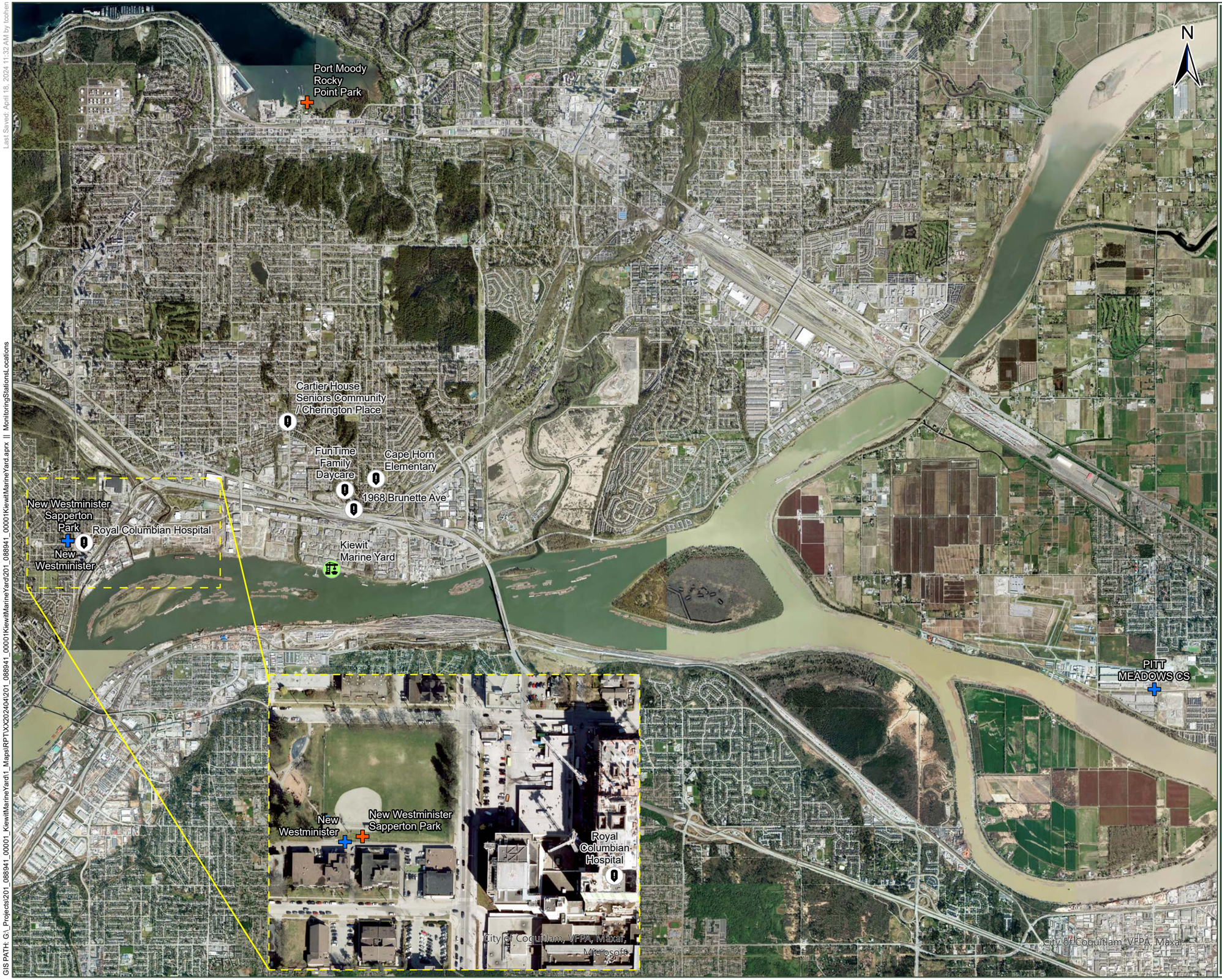
Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

SLR Project No.: 201.088941.00001

May 13, 2024



LEGEND:

- AIR QUALITY STATION
- METEOROLOGICAL STATION
- POINTS OF INTEREST
- KIEWIT MARINE YARD

NOTES:
SATELLITE IMAGERY: CITY OF COQUITLAM - 03/30/2023

0 250 500 1,000 1,500 m

SCALE 1:50,000
PAGE SIZE: 11 x 17
NAD 1983 UTM Zone 10N

THIS MAP IS FOR CONCEPTUAL PURPOSES ONLY
AND SHOULD NOT BE USED FOR NAVIGATION

ENVIRONMENTAL AIR ASSESSMENT
KIEWIT MARINE YARD
PETER KIEWIT SONS ULC
210 – 4350 STILL CREEK DRIVE, BURNABY, BC V5C 0G5

KIEWIT MARINE YARD

MONITORING STATIONS

SLR

FIGURE NO:
A

DATE: April 19, 2024

PROJECT NO: 201.088941.00001

Last Saved: April 18, 2024 11:32 AM by tcohen

GIS PATH: G:_Projects\201_088941_00001_KiewitMarineYard\1_Maps\RPT\XX20240412\01_088941_00001KiewitMarineYard\201_088941_00001KiewitMarineYard.aprx || MonitoringStationsLocations

Appendix A Estimation Methodologies

Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

SLR Project No.: 201.088941.00001

May 13, 2024

A.1 Combustion Emission Estimation Methodologies

CAC emissions for combustion primary sources assume TIER emission standards (ECCC 2017) as the emission factors for $PM_{2.5}$, NO_2, and CO. TIER levels were retrieved from equipment specifications where available or assumed to be the lowest TIER emission level where appropriate. The SO_2 emissions are assumed from sulphur fuel content regulations for marine diesel and conventional diesel (ECCC 2013; Transport Canada 2014). Diesel combustion $PM_{2.5}$ size fraction factors were used to calculate TPM and PM_{10} emissions (Krause and Smith 2006).

Black carbon emissions are a fraction of combustion particulate emissions. The assumed black carbon to $PM_{2.5}$ ratios were retrieved from Canada's Black Carbon Inventory (ECCC 2016) and MOVES documentation (US EPA 2023b). DPM from diesel combustion is composed of $PM_{2.5}$ and ultrafine particles ($PM_{0.1}$) (US EPA 2009). Therefore, DPM is assumed to be equivalent to $PM_{2.5}$ for this assessment's combustion sources.

GHG emissions for this assessment are calculated using the Canada's National Inventory Report (ECCC 2023) for mobile equipment, and the 2020 BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions (ENV 2021b) for stationary equipment.

All diesel combustion estimates calculated using kWh-based emission rates were weighted according to their equipment percent operation and idle times. Operating time assumes a 100% emission factor, while idle time assumes a 10% emission factor.

A.2 Material Handling and Unpaved Roads Emission Estimation Methodologies

Imported aggregates vary and may include Pit Run Gravel, Pit Run Sand, River Sand, Drain Rock, Granular Base and Granual Subbase. Clean soils are from excavation of native ground materials from around the lower mainland. Kiewit does not have gradation test results, or moisture content test results. These materials vary significantly from site to site.

Marine Yard material handling emissions were calculated using the United States Environmental Protection Agency (US EPA) AP-42 emission factor Equation 1 from Section 13.2.4 (US EPA 2006b). Aggregate and clean soil moisture contents were assumed to be equivalent to the average "various limestone products" and "clay/dirt mix" from AP-42 Table 13.2.4-1. The average wind speed of 5 m/s from the New Westminister station was applied as a conservative speed for the Marine Yard. To apply the emission factor, average bulk densities of imported aggregate and clean soil were assumed to be 1040 kg/m^3 and 1500 kg/m^3 respectively (Lafarge Canada 2024; Hossain et al. 2015). Emissions were multiplied by an assumed average of three transfer points (unloading, loading, and piling).

Unpaved road PM emissions were calculated using AP-42 Section 13.2.2 (US EPA 2006a) and average dump truck activity. A rain factor (55%) and water suppression reduction factor (85%) were applied.

Appendix B Marine Yard Project Boundary

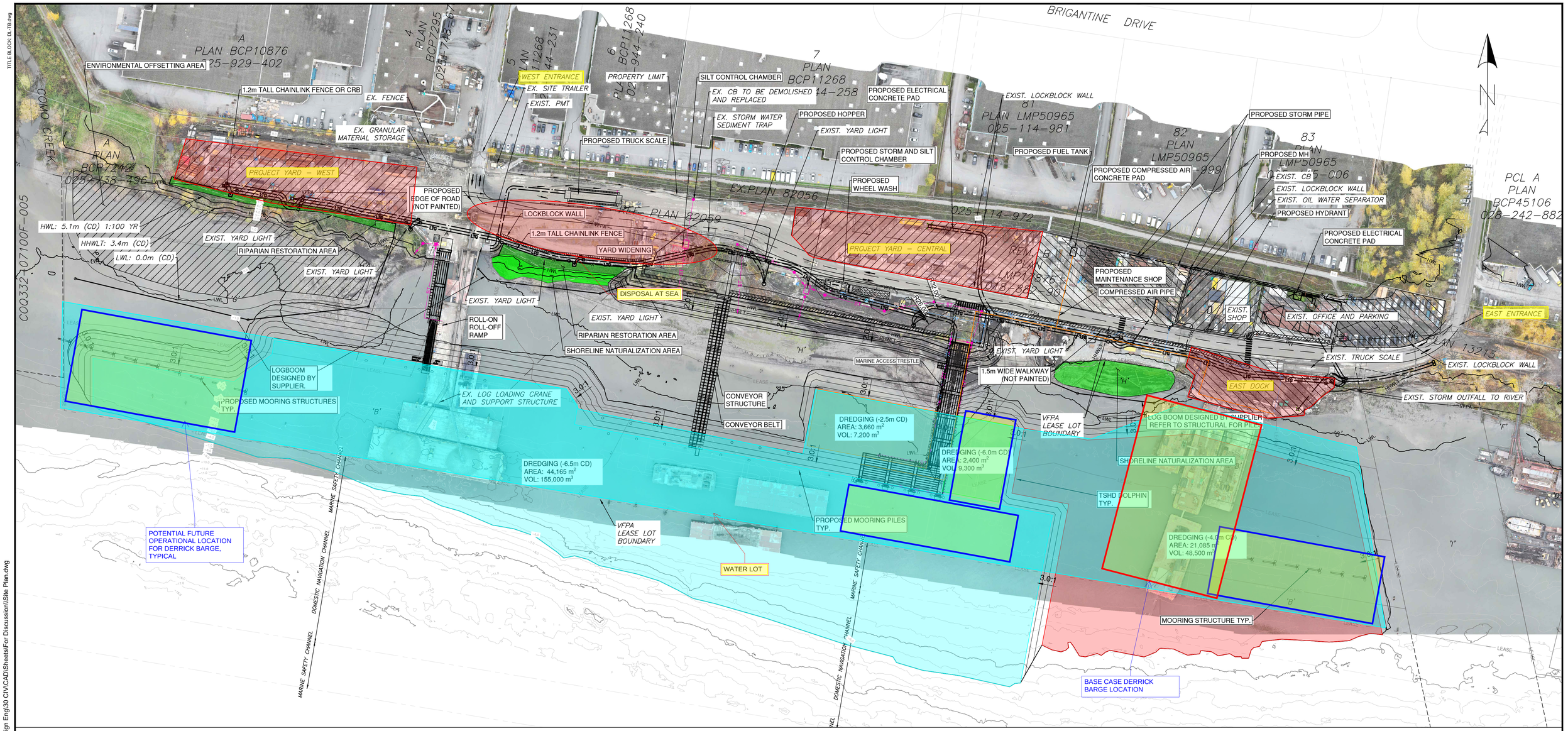
Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

SLR Project No.: 201.088941.00001

May 13, 2024



VFPA DRAWING NUMBER:
XXX-XXX-XX-XXXX

Ref. No.	REFERENCE

Kiewit

No.	Date	REVISION	Dr'n	Ch'd

PORT of vancouver
Vancouver Fraser Port Authority
ENGINEERING DEPARTMENT

DESIGN BY	
DRAWN BY	C.F.
APPROVED	
DATE	2023-FEB-20
SCALE	1:1000
VFPA SITE	

WCD MARINE YARD BUILD-OUT
COQUITLAM, BC
SITE PLAN

SIZE	DWG.	SHEET	REV.
D		X of X	

TITLE BLOCK DL-TB.dwg

DATE: 2024/02/26 - 4:45pm
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Appendix C Supply Chain Project Boundary

Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

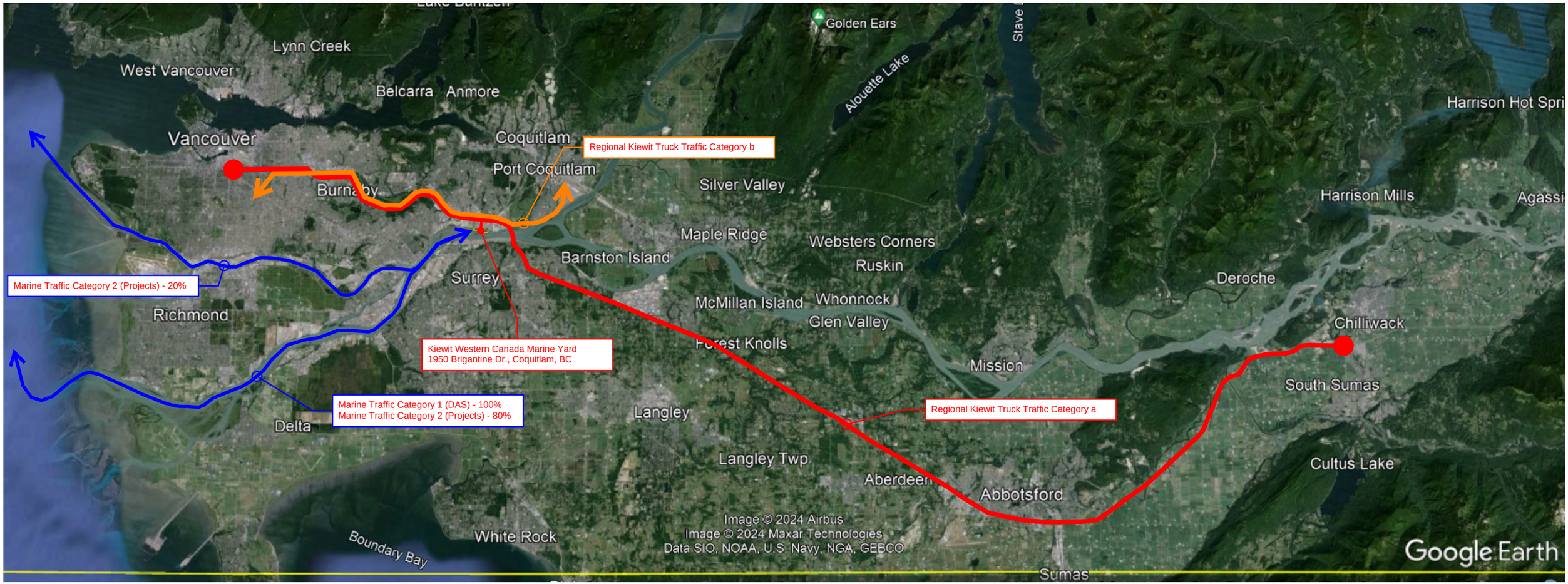
SLR Project No.: 201.088941.00001

May 13, 2024

Kiewit - WCD Marine Yard

Environmental Noise Assessment and Air Assessment 2024 - Supply Chain Boundary Maps - Figure 1 Marine and Regional Trucking Routes

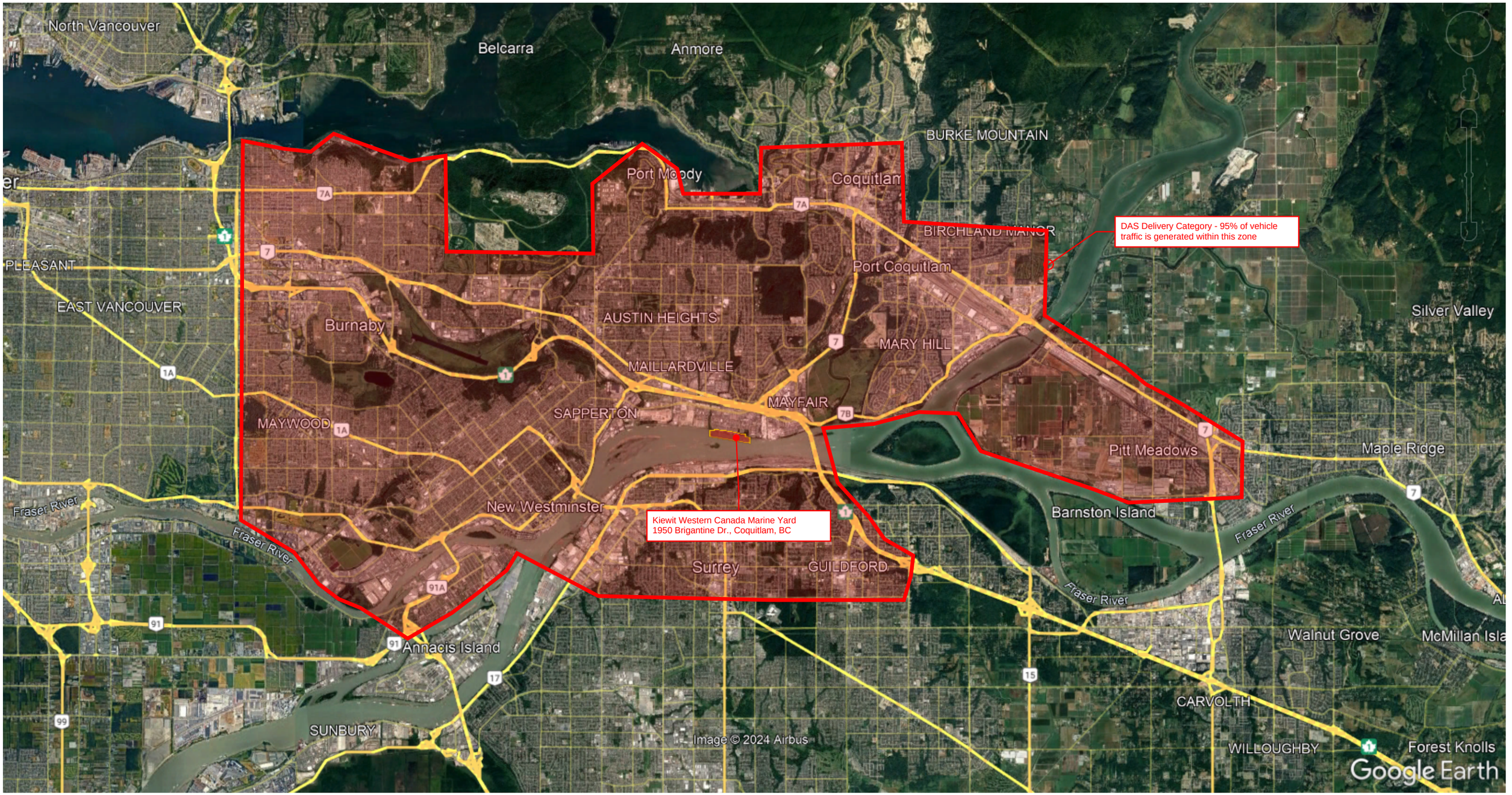
March 6, 2024



Kiewit - WCD Marine Yard

Environmental Noise Assessment and Air Assessment 2024 - Supply Chain Boundary Maps - Figure 2 DAS Delivery Category

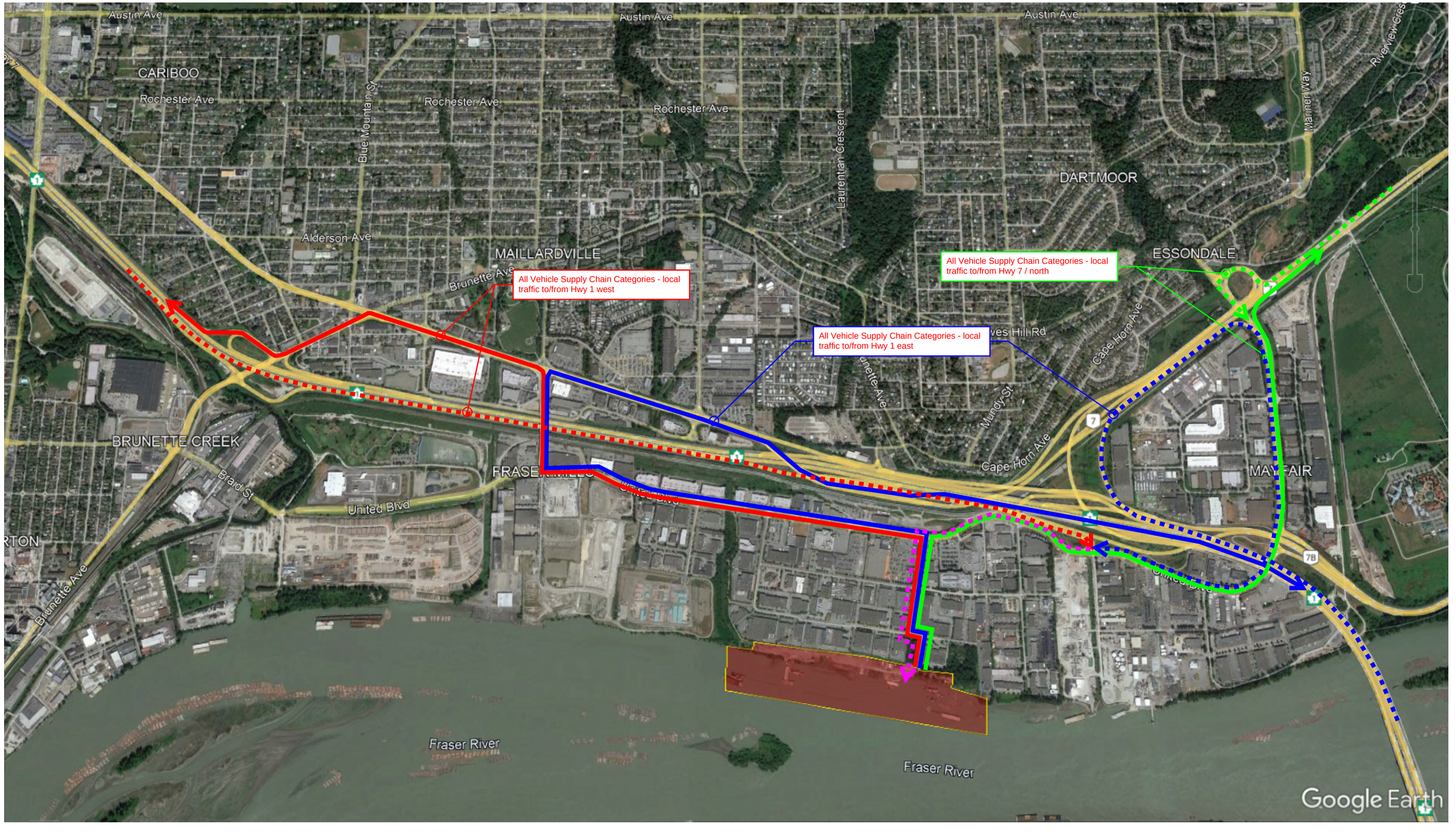
March 6, 2024



Kiewit - WCD Marine Yard

Environmental Noise Assessment and Air Assessment 2024 - Supply Chain Boundary Maps - Figure 3 Local Vehicle Routes - DAS Delivery and Local Delivery Categories

updated: March 19, 2024



Appendix D Fuel Tank Emission Estimations

Environmental Air Assessment

Kiewit Marine Yard

Peter Kiewit Sons ULC

SLR Project No.: 201.088941.00001

May 13, 2024

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	KDye1
City:	Seattle-TAC AP
State:	Washington
Company:	Kiewit
Type of Tank:	Horizontal Tank
Description:	Kiewit tanks

Tank Dimensions

Shell Length (ft):	43.00
Diameter (ft):	8.00
Volume (gallons):	15,850.32
Turnovers:	163.38
Net Throughput(gal/yr):	2,589,686.36
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Seattle-TAC AP, Washington (Avg Atmospheric Pressure = 14.51 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

KDye1 - Horizontal Tank
Seattle-TAC AP, Washington

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	53.43	49.51	57.36	52.03	0.0052	0.0044	0.0060	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

KDye1 - Horizontal Tank
Seattle-TAC AP, Washington

Annual Emission Calcaulations	
Standing Losses (lb):	1.6334
Vapor Space Volume (cu ft):	1,376.6979
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0266
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,376.6979
Tank Diameter (ft):	8.0000
Effective Diameter (ft):	20.9336
Vapor Space Outage (ft):	4.0000
Tank Shell Length (ft):	43.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0052
Daily Avg. Liquid Surface Temp. (deg. R):	513.1033
Daily Average Ambient Temp. (deg. F):	52.0083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	511.6983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,052.6667
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0266
Daily Vapor Temperature Range (deg. R):	15.7027
Daily Vapor Pressure Range (psia):	0.0015
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0052
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0044
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0060
Daily Avg. Liquid Surface Temp. (deg R):	513.1033
Daily Min. Liquid Surface Temp. (deg R):	509.1776
Daily Max. Liquid Surface Temp. (deg R):	517.0289
Daily Ambient Temp. Range (deg. R):	14.8500
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0052
Vapor Space Outage (ft):	4.0000
Working Losses (lb):	14.5629
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0052
Annual Net Throughput (gal/yr.):	2,589,686.3590
Annual Turnovers:	163.3838
Turnover Factor:	0.3503
Tank Diameter (ft):	8.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	16.1963

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

KDye1 - Horizontal Tank
Seattle-TAC AP, Washington

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	14.56	1.63	16.20

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	KGas1
City:	Seattle-TAC AP
State:	Washington
Company:	Kiewit
Type of Tank:	Horizontal Tank
Description:	Kiewit tanks

Tank Dimensions

Shell Length (ft):	20.00
Diameter (ft):	8.00
Volume (gallons):	5,283.44
Turnovers:	6.66
Net Throughput(gal/yr):	35,191.58
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Seattle-TAC AP, Washington (Avg Atmospheric Pressure = 14.51 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

KGas1 - Horizontal Tank
Seattle-TAC AP, Washington

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 9)	All	53.43	49.51	57.36	52.03	4.0454	3.7349	4.3764	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

KGas1 - Horizontal Tank
Seattle-TAC AP, Washington

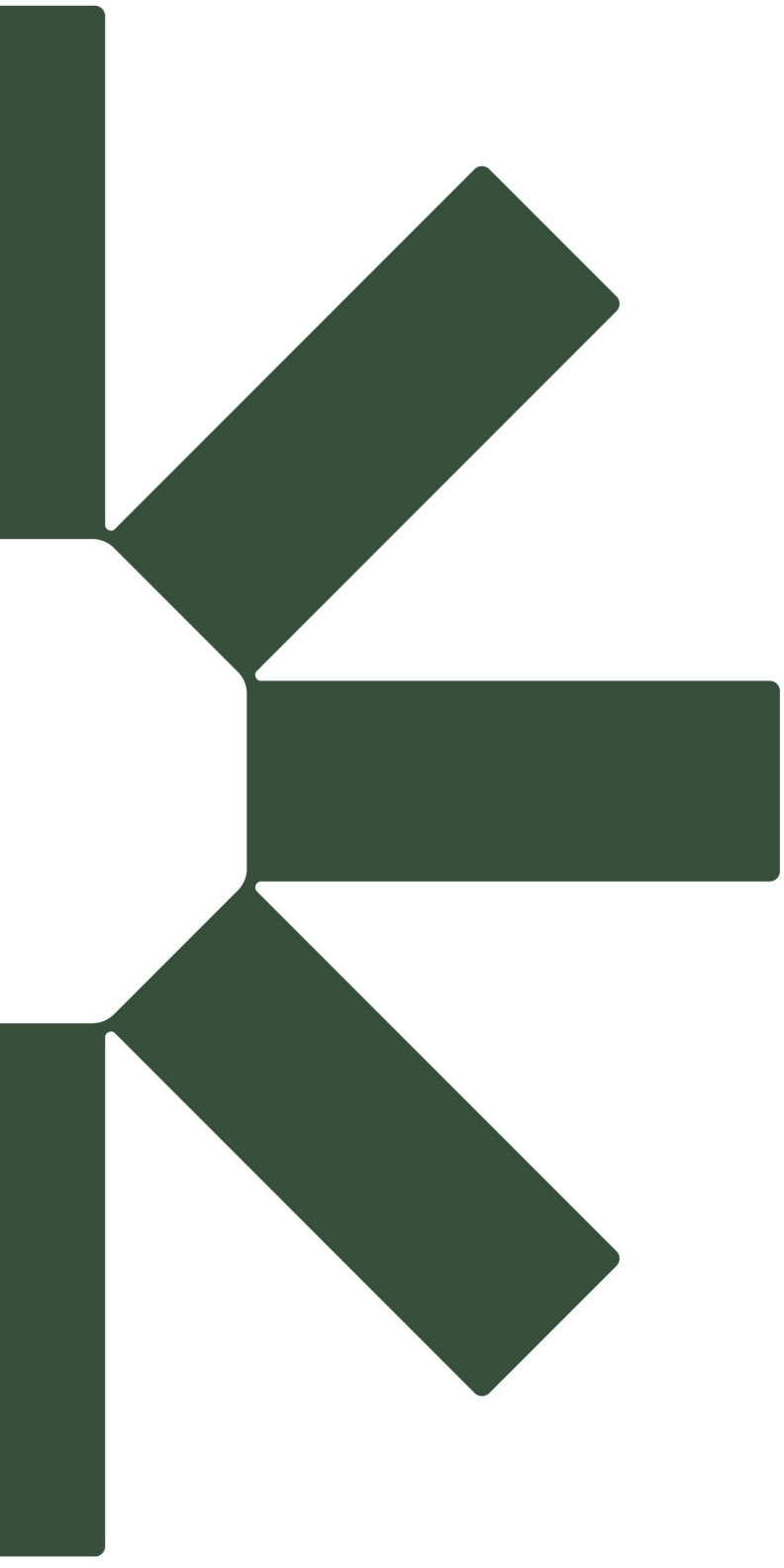
Annual Emission Calcaulations	
Standing Losses (lb):	533.5680
Vapor Space Volume (cu ft):	640.3246
Vapor Density (lb/cu ft):	0.0492
Vapor Space Expansion Factor:	0.0862
Vented Vapor Saturation Factor:	0.5383
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	640.3246
Tank Diameter (ft):	8.0000
Effective Diameter (ft):	14.2766
Vapor Space Outage (ft):	4.0000
Tank Shell Length (ft):	20.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0492
Vapor Molecular Weight (lb/lb-mole):	67.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.0454
Daily Avg. Liquid Surface Temp. (deg. R):	513.1033
Daily Average Ambient Temp. (deg. F):	52.0083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	511.6983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,052.6667
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0862
Daily Vapor Temperature Range (deg. R):	15.7027
Daily Vapor Pressure Range (psia):	0.6415
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.0454
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	3.7349
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	4.3764
Daily Avg. Liquid Surface Temp. (deg R):	513.1033
Daily Min. Liquid Surface Temp. (deg R):	509.1776
Daily Max. Liquid Surface Temp. (deg R):	517.0289
Daily Ambient Temp. Range (deg. R):	14.8500
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.5383
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	4.0454
Vapor Space Outage (ft):	4.0000
Working Losses (lb):	227.1053
Vapor Molecular Weight (lb/lb-mole):	67.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.0454
Annual Net Throughput (gal/yr.):	35,191.5814
Annual Turnovers:	6.6607
Turnover Factor:	1.0000
Tank Diameter (ft):	8.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	760.6732

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

KGas1 - Horizontal Tank
Seattle-TAC AP, Washington

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	227.11	533.57	760.67



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