FINAL REPORT

TRANS MOUNTAIN PIPELINE WESTRIDGE MARINE TERMINAL

BURNABY, BRITISH COLUMBIA

2024 ANNUAL AIR QUALITY AND METEOROLOGICAL MONITORING REPORT

RWDI #2105728

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1 SUMMARY

This report summarizes ambient air quality measurements made at the Trans Mountain Westridge Marine Terminal (WMT) Air Quality Monitoring (AQM) station during the operational period from May 12, 2024, to December 31, 2024. This follows an extended baseline period that occurred from June 6, 2022 to May 11, 2024. This monitoring program addresses the requirements of the Canada Energy Regulator (CER) Condition 52 for the Trans Mountain Expansion Project.

The objective of the WMT AQM program during this operational period was to monitor the ambient air quality in the vicinity of the WMT and other emission sources in the area and assess these measurements relative to the applicable Ambient Air Quality Objectives (AAQOs). The monitoring methods follow the Air Emissions Management Plan for Westridge Marine Terminal (Trans Mountain 2017, CER Condition 52 Filing ID A84415; CER Approval A85416) and the Ambient Air Quality Monitoring Plan for the Westridge Marine Terminal, Burnaby Terminal and Sumas Terminal (AQMP) (Trans Mountain 2020).

The WMT AQM station continuously monitors the following air quality parameters: particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen oxides (NO_X, NO, NO_2), sulphur dioxide (SO_2), ozone (O_3), total reduced sulphurs (TRS), and benzene, toluene, ethylbenzene, xylene (BTEX), visibility, and diesel particulate matter (DPM) based on black carbon. Additionally, the station has a sequential sampler for fine particulate $PM_{2.5}$ speciation and two passive samplers for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2). This AQM station also continuously monitors the following meteorological parameters: wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and precipitation. Data recovery rates over the course of the operational period were above 97%, except for BTEX and visibility. Visibility had availability of 79.1%. BTEX had an availability of 64.4%, below the 75% target (CCME 2019).

Throughout the monitoring period from May 12 to December 31, 2024, there were no exceedances of the relevant AAQOs. The measured values were determined to be low when compared with the available AAQO. Preliminary comparisons between the Thermo Sharp 5030i ($PM_{2.5}$), Magee aethalometer (BC & DPM) and Nikira (visibility) sensor data had medium to strong correlations and further analysis is underway. The baseline values were generally higher than during operations or had differences less than the accuracy and precision of the instruments used. Overall, monitoring indicates WMT operations are not likely having an adverse impact on local ambient air quality.

No comparison to the annual AAQOs can be made as the operational reporting period covers less than 75% of the 2024 year. Monitored data will be compared against the annual AAQOs in 2025 and onwards.

Air Quality Monitoring Station Location
Westridge Marine Terminal

Map Projection: NAD 1983 UTM Zone 10N
Trans Mountain Pipeline - Burnaby, B.C.

True North

Project #: 2105728

Drawn by: PIP	Figure: 1
Approx. Scale:	1:5,000
Date Revised: Feb 26, 2025	

Map Document: C:\Working Folder\Jobs_America\P2105728\P2105728_TMEP.aprx

2 BACKGROUND

2.1 Geographical Area

The location of the WMT AQM station is shown in **Figure 1**. The WMT AQM station is located to the west of the jet fuel tank bay. The marine terminal sits on the south side of Burrard inlet, at the base of Burnaby Mountain, across from the entrance to Indian Arm. The surrounding land use is a mixture of forest parklands, residential, and industrial. Highway 7A passes the southern edge of WMT shielded behind a vegetation buffer of mixed forest and shrubs.

2.2 Air Emission Sources

Westridge Marine Terminal is the end point of the Trans Mountain Pipeline system in Canada. For the Project, two vapour recovery units (VRU) and a new vapour combustion unit (VCU) were added to replace the existing VCU. Three new berths for tanker traffic were built along with a utility berth for tugs and other support craft.

The WMT is one of several industrial emission sources along the shores of the Burrard inlet. These sources include the Port of Vancouver, Chemtrade, Erco Worldwide, Parkland refinery, other tanker loading facilities and the Pacific Coast Terminal in Port Moody. Many of these facilities emit VOCs that may contain benzene, xylenes and hydrogen sulphide, and combustion products like NO_x and $PM_{2.5}$.

3 MONITORING INSTRUMENTS

The WMT AQM station is equipped with air quality and meteorological monitoring instruments shown in Table 1. The ambient air quality and meteorological parameters being monitored are recorded at 1-minute and 60-minute intervals, as per BC Field Sampling Manual requirements (2020), on a Campbell Scientific CR1000x datalogger. The raw data is stored on the datalogger and is also pushed to a central database for processing and backup. Data is automatically checked using an automated diagnostic observation tool called HORNET and by a technician daily to ensure maximum uptime and data quality of the monitoring parameters. As required by Condition 52, the hourly raw data is also publicly available on the Envision data platform and accessible through the Trans Mountain website.

Table 1. Air Quality and Meteorological Monitoring Instrumentation

Instrument	Parameters measured	Units
Thermo Sharp 5030i	Respirable Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$
Thermo 42iQ	Nitrous Oxide/Nitrogen Dioxide/Total Oxides of Nitrogen ($NO/NO_2/NO_x$)	ppb
Thermo 43iQ	Sulphur Dioxide (SO_2)	ppb
Thermo 49iQ	Ozone (O_3)	ppb
Thermo 43iQTL with CDN101 Thermal Oxidizer	Total Reduced Sulphur (TRS)	ppb
AMA GC 5000	Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	ppb
Nikira OEA	Visibility	km
CSCC Field Camera	Visibility	N/A
Met One Super SASS	Speciated $PM_{2.5}$	$\mu g/m^3$
Magee AE-33 Aethalometer	Black Carbon (BC)	ng/m^3
Passive Samplers	NO_2 and SO_2	ppb
R.M. Young 5305-10-L	Wind speed and wind direction	m/s and degrees
Ott Pluvio	Precipitation	mm
Vaisala HC2-S3-L	Relative humidity and air temperature	% and ^oC
CSCC CS 106	Barometric pressure	mb

The gas analyzers (Thermo 42iQ, 43iQ, 49iQ, and 43iQTL with CDN101) are zero and span checked daily using the internal zero (charcoal and/or purafil cartridge) and span (permeation wafer in an internal permeation oven) system, referred to as the IZS system. The AMA GC 5000 is zero and span checked daily, but with certified standard span gas and a dilution system. Automatic IZS checks are performed daily, and the checks consist of a zero and span check followed by a purge over a 30-minute period for the Thermo analyzers and 75-minute time-period for the AMA GC 5000. These checks provide a way to monitor daily performance of the analyzer. The IZS checks are not for calibration purposes but are merely a diagnostic tool to identify instrument drift. Monthly calibration visits are undertaken to perform full range linear calibrations and maintenance for all the analyzers.

3.1 $PM_{2.5}$

The SHARP 5030i is a hybrid nephelometric/radiometric particulate mass monitor capable of providing precise, real-time measurements with a superior detection limit. The SHARP incorporates a high sensitivity light scattering photometer whose output signal is continuously referenced to the time-averaged measurement of an integral beta attenuating mass sensor. The SHARP also incorporates a dynamic inlet heating system designed to maintain the relative humidity of the air passing through the filter tape constant.

The SHARP 5030i monitor is calibrated once a month to ensure accuracy and validity of its data. The $PM_{2.5}$ inlet head and sharp cut cyclone are located on the roof of the AQM building. The inlet and cyclone are cleaned routinely to ensure performance. The monthly calibration process consists of the following: zeroing the nephelometer if necessary, calibration of ambient temperature, calibration of barometric pressure, and flow calibration. Instrument mass foil checks are performed quarterly or if diagnostics indicate a requirement to do so in accordance with the BC FSM (Section 10 of SOP-05b).

3.2 NITROGEN OXIDES

The Thermo 42iQ Nitrogen Oxide (NO_X) analyzers use chemiluminescence detection, coupled with microprocessor technology to provide sensitivity and stability for ambient air quality applications. The instrument determines real-time concentration of nitric oxide (NO), total nitrogen oxides (NO_X) (the sum of NO and NO_2), and nitrogen dioxide (NO_2). The amount of NO is measured by detecting the chemiluminescence reaction that occurs in the reaction cell when NO molecules are exposed to ozone (O_3). The NO and O_3 molecules collide in the reaction cell and enter a higher energy state.

When these excited molecules return to a stable energy state, they emit a photon of light which is proportional to the amount of NO in the sample stream of gas entering the analyzer.

To determine the total NO_X ($NO+NO_2$) measurement, sample gas is periodically bypassed through a heated molybdenum converter cartridge that converts any NO_2 molecules in the sample stream into NO (any existing NO molecules in the stream remain as is). The instrument will switch the sample stream through the converter periodically and then through the reaction cell where the same chemiluminescence reaction occurs with ozone.

The resultant response produced is now the sum of NO and converted NO_2, producing a NO_X measurement. The resultant NO_2 determination is the NO_X measurement subtracted from the NO measurement.

3.3 SULPHUR DIOXIDE

The Thermo 43iQ Sulphur Dioxide (SO_2) Analyzer is a microprocessor-controlled analyzer that determines the concentration of SO_2 in a sample gas drawn through the instrument. In the sample chamber, sample gas is excited by ultraviolet light causing the SO_2 to absorb energy from the light and move to an active state (SO_2*). These active SO_2* molecules must decay into a stable state back to SO_2, and when this happens a photon of light is released which is recognized by the instrument as fluorescence. The instrument measures the amount of florescence to determine the amount of SO_2 present in the sample gas.

3.4 OZONE

Monitoring for Ozone (O_3) employs a Thermo 49iQ analyzer which provides sensitivity and stability. The instrument determines real-time concentration of O_3 in a sample gas drawn through the instrument. The sample is split into two gas streams using solenoids, one stream is stripped of O_3 by a scrubber to become a reference gas. Each stream is then intermittently stored in two different cells within which the UV light intensities are measured, and the instrument calculates the O_3 concentrations.

3.5 TOTAL REDUCED SULPHUR

TRS monitoring uses a Thermo 43iQTL Trace Level continuous SO_2 analyzer in conjunction with an CDN-101 thermal oxidizer convertor (oxidizer). This instrument is a two-fold device. First, sample air passes through SO_2 scrubber beads to eliminate any SO_2 molecules that might be in the sample air stream. Secondly, sample air is then passed through a glass tube surrounded by an oven inside of the oxidizer which is continuously heated to 800°C and any reduced sulfur compounds are converted into SO_2 molecules which is then directed to the SO_2 analyzer.

The 43iQTL is a microprocessor-controlled analyzer that determines the concentration of SO_2 in a sample gas drawn through the instrument. In the sample chamber, sample gas is exposed to pulsating ultraviolet light which causes the SO_2 molecules to become excited and enter into a higher energy state. When the light is shut off during one of the pulse cycles, these excited SO_2 molecules decay into a lower energy state where fluoresced light is emitted proportionally to the SO_2 concentration in the gas stream. This fluorescence is read by a photo-multiplier tube, and the instrument reports the concentration of SO_2 in a ratio of 1:1 for TRS.

3.6 BTEX

Monitoring of benzene, toluene, ethylbenzene, m, p-xylenes and o-xylene (BTEX) is conducted using an AMA Gas Chromatograph (GC) Model 5000 BTX fitted with a flame ionization detector (FID). An ambient air sample is drawn into the instrument every 15 min and the gaseous eluent is ignited to produce gas-phase ions of the analytes of interest. These ions are detected by an electrode and the integration of the electrical signal produced is calibrated and used to quantify the concentration of each analyte in the sample. An AMA HG 500 ultra-high purity generator uses deionized water and compressor to generator ultra-high purity Hydrogen (H_2) as a supply gas for the FID flame and act as a carrier gas for the GC.

3.7 VISIBILITY

Visibility monitoring is conducted using a Nikira Optical Extinction Analyzer (Model NIK-OEA-52001-C01OP). The instrument combines open-path cavity ringdown measurements with a patented self-referencing system to rapidly measure and calculate the optical extinction coefficient of ambient aerosols. Ambient air is drawn into the cavity at ~1m/s where direct optical extinction coefficient measurement is made. The cavity is closed off to ambient air and purged with filtered air to provide a background measurement to use in a comparison

calculation for aerosol optical extinction. A Campbell Scientific CFCC field camera takes photographs of the horizon each hour of the day so the OEA visibility readings can be confirmed by visual records.

3.8 SPECIATED PARTICULATE MATTER

Sampling for speciated particulate matter uses a Met One Super SASS (Speciation Air Sampling System). The SASS collects samples for chemical and gravimetric analysis of ambient $PM_{2.5}$ particles. The Super SASS accommodates eight sampling canisters used in groups of four. Each of the canisters has its own $PM_{2.5}$ cutoff cyclone; denuder ring and tandem filter holders. The collection media used in each of the canisters can be varied as needed to the types of analysis to be performed. In the case of the Westridge Super SASS canisters 1 and 2 are Teflon, canister 3 is nylon, canister 4 has two quartz filters. The Super SASS samples every 6 days for 24 hours, following the National Air Pollutions Surveillance Program sampling schedule. The canisters are collected weekly and sent to an outside laboratory for analysis. The canisters are analyzed for total PM_{25}, inorganic ions, nitrates, organic and elemental carbon with carbon black calculated from the other analytes. Periodically throughout the year, heavy metals are included in the analysis when the filters are visibly stained with particulates.

3.9 BLACK CARBON & DIESEL PARTICULATE MATTER

Black carbon (BC) is measured using a Magee Model AE33 Aethalometer. This unit collects aerosol particles continuously by drawing the aerosol laden air stream through a spot on a filter tape. The aerosols are analyzed by the transmission of light through one portion of the filter tape containing the sample compared to an unloaded portion of the filter tape. This analysis is done on 7 wavelengths spanning near infra-red to near ultraviolet. The Aethalometer calculates the concentrations of optically absorbing aerosols from the rate of attenuation of light transmitted through the filter. The results of the two sample spots are combined to determine the BC mass concentration. DPM is then calculated as a function of the BC based on a previous ambient sampling survey conducted by MV. Each month, the validity of the readings are checked via verification of flow rates through the unit and the use of neutral density optical filters measuring the attenuation of each of the wavelengths.

3.10 PASSIVE SAMPLING

Nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) samples were collected using passive samplers. Samplers are deployed at two locations at the terminal for roughly 30 days of exposure before being replaced with fresh media. The unexposed sampling media are opened and placed in a sampler holder. The open samplers include a trapping agent that collects the target pollutant. After the exposure period, the samplers are sealed, collected then sent to an outside laboratory for analysis.

3.11 METEOROLOGY

The AQM station continuously monitors the wind speed (WS) and wind direction (WD) using a 10 m tower mounted R.M. Young Model 5305-10-L wind speed/wind direction sensor. The wind mast is located over the water halfway between Berths 1/2 and 3 as shown in Figure 1. Relative humidity and temperature are measured using a Vaisala HC2-S3-L probe at the AQM station. Barometric pressure is measured using a CSCC Model CS 106. Precipitation is measured using an Ott Pluvio, a highly sensitive weight-based measurement system that maximizes capture and quantification of snow and rain, with the attachment of a wind shield and antifreeze inside the collection bucket. Meteorological equipment is physically inspected every 3-months to annually, or more frequently, if data QA/QC indicates the need. Calibrations for these sensors are recertified following manufacturer recommendations (typically every 1 to 2 years).

4 SUMMARY OF AMBIENT MEASUREMENTS

Data validity is the percentage of hourly values available over the given period of time that remain after final data quality assurance and control checks (QA/QC). For measured values to be compared to hourly, 8-hour, 24-hour and annual average values there needs to be >75% of the data available for each relevant time period in accordance with the Alberta (AB), Metro Vancouver (MV) and BC AAQO as informed by the Canadian Council of Ministers of the Environment (CCME 2019). Similar requirements exist in Alberta and BC in their respective ambient air monitoring guideline documents.

4.1 $PM_{2.5}$

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly $PM_{2.5}$ data validity was 99.5%. Data validity is the percentage of hourly values available over the given period of time, that remain after final data quality assurance and control checks (QA/QC). Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events that were over the MV 24-hour AAQO in 2024. The maximum 1-hour mean $PM_{2.5}$ concentration during the monitoring period was in December 2024 with a value of 25.5 µg/m^3. During the baseline period from June 6, 2022, to May 11, 2024, the mean concentration was 5.7 µg/m^3. The operational period mean concentration was 4.7 µg/m^3.

4.2 NITROGEN OXIDES

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly NO_x data validity was 99.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events exceeding the 1-hour NO_2 AAQO during the 2024 operational monitoring period. The highest maximum 1-hour mean NO_x concentration during the operational period was in December 2024 with a value of 122.1 ppb with NO_2 contributing to 22% of the total NO_x measured. The highest maximum 1-hour mean NO_2 concentration occurred in July 2024 with a value of 49.7 ppb. During the baseline period from June 6, 2022, to May 11, 2024, the mean NO_2 concentration was 11.8 ppb. The mean NO_2 concentration during operations in 2024 was 9.7 ppb.

During the operational monitoring period, fresh media for the two passive samplers were deployed each month. Summary statistics are presented in Appendix Table A10. During the baseline period June 6, 2022 to May 11, 2024, the maximum 30-day NO_2 concentration was 13.5 ppb. During the operational period May 12, 2024 to December 31, 2024, the maximum 30-day NO_2 concentration was 6.2 ppb at the western sampler. Generally, the mean concentrations from the passive samplers were equal to or less than the monthly mean concentrations measured by the continuous analyzers in the AQM station and trended in similar directions.

4.3 SULPHUR DIOXIDE

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly SO_2 data validity was 98.6%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no events that were over the 1-hour SO_2 AAQO during the 2024 operational monitoring period. The highest maximum 1-hour mean during the operational period was in June 2024 with a value of 4.0 ppb, which is 5% of the AAQO (70 ppb). During the baseline period from June 6, 2022 to May 11, 2024, the highest 1-hour and 24-hour means were 40.7 ppb and 5.1 ppb, respectively, and the mean for that period was 0.4 ppb. The operational period mean concentration was also 0.4 ppb and the highest 1-hour and 24-hour means were 4.0 and 1.3 ppb, respectively.

During the operational monitoring period May 12, 2024 to December 31, 2024, fresh media for the two passive samplers were deployed each month. Summary statistics are presented in Appendix Table A10. During the baseline period June 6, 2022 to May 11, 2024, the maximum 30-day SO_2 value was 1.0 ppb. During the operational period May 12, 2024 to December 31, 2024, the maximum 30-day SO_2 value was 0.7 ppb. Generally, the mean concentrations from the passive samplers were equal to or less than the monthly mean concentrations measured by the continuous analyzers in the AQM station and trended in similar directions. There were no events over the 30-day SO_2 AAQO during the monitoring period.

4.4 OZONE

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly O_3 data validity was 98.4%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no O_3 events over the 1-hour or 8-hr AAQO limits during the monitoring period. The highest maximum 1-hour mean during the monitoring period was measured in July 2024 with a value of 75.8 ppb. During the baseline period from June 6, 2022 to May 11, 2024, the highest 1-hour and 24-hour means were 82.7 ppb and 40.3 ppb, respectively, and the mean for that period was 16.6 ppb. During the operational period, the highest 1-hour and 24-hour mean concentrations were 75.8 ppb and 34.6 ppb, respectively, and the period mean was 17.7 ppb.

4.5 TOTAL REDUCED SULPHUR

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly TRS data validity was 97.1%. Summary statistics are presented in Appendix Tables A1, A2 and A6. There were no TRS readings events over the 1-hour average AAQO of 5 ppb. During the baseline period from June 6, 2022 to May 11, 2024, the highest 1-hour and 24-hour means were 2.2 ppb and 0.8 ppb, respectively, and the period mean

concentration was 0.3 ppb. During the operational period, the highest 1-hour and 24-hour means were 1.4 ppb and 0.8 ppb, respectively, and the period mean concentration was 0.4 ppb.

4.6 BTEX

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly BTEX data validity was 64.4%. Summary statistics are presented in Appendix Tables A3, A4 and A6. The gas chromatograph (GC) unit from Sumas Terminal AQM Station required ongoing repairs. The GC uptime was maximized across the Trans Mountain network by rotating GC instrumentation between stations to maintain annual uptime >75% at all stations. During the rotation on October 17, 2024, the returned Sumas GC was installed at Westridge. During daily checks, it was determined that the GC required further repairs. The resulting invalidated data brought the calculated availability below 75%. The GC was re-installed on December 19, 2024.

Trans Mountain compares measured benzene, toluene, ethylbenzene and xylenes values to the Alberta AAQOs, as BC does not have objectives for these pollutants.

There were no events exceeding the benzene, toluene, ethylbenzene, or xylenes 1-hour, 24-hour or annual Alberta AAQOs during the operational monitoring period. During the baseline period the mean values of benzene, toluene ethylbenzene and xylenes were 0.2 ppb, 3.3 ppb, 0.5 ppb, and 3.7 ppb, respectively. The mean values of benzene, toluene, ethylbenzene and xylenes during operations were 0.1 ppb, 0.9 ppb, 0.6 ppb, and 1.6 ppb, respectively.

4.7 VISIBILITY

During the operational monitoring period May 12, 2024 to December 31, 2024, the hourly visibility data validity was 79.1%. Summary statistics are presented in Appendix Table A5. Lower data validity in October and November 2024 were due to fouling of the laser that required cleaning at the same time as the unit at Burnaby and a spare was not initially available. Communication issues with the spare OEA further reduced uptime. The minimum 1-hour mean monthly values were measured in September of 2024 (33.2 km). During the baseline period the mean distance was 455.1 km. The mean distance during operations was 352.9 km.

Images are captured by a camera every hour onsite and can be made available for future reference. There are no AAQO or criteria in BC for visibility. Based on a theoretical distance provided by the manufacturer, RWDI invalidates data over 15 000 km to eliminate extreme values.

4.8 SPECIATED PARTICULATE MATTER

During the operational monitoring period of May 12, 2024 to December 31, 2024, there were 39 National Air Pollution Surveillance (NAPS) sampling dates for the Super SASS sampler. Of those 39 dates, 37 successful 24-hour samples were collected, giving a 95.0% availability. The two missed sample dates were due to one set of sample canisters being lost in transit. The missing canister set resulted in a set not arriving in time to be deployed for the October 15, 2024 sample date. The late arriving set was used as a blank.

During the July 2024 monthly calibrations, canister 1 (PM) failed its flow check and so the PM results from June 6, 2024 to July 23, 2024, were deemed invalid.

During the baseline period June 10, 2022 to May 11, 2024, the highest recorded sample was carbon black at 80.1 µg/m^3. During the operational period May 12, 2024 to December 31, 2024, the highest recorded sample was particulate at 5.8 µg/m^3. During the baseline period June 10, 2022 to May 11, 2024, the mean PM value was 2.6 µg/m^3. The January 2023 to December 2023 and January 2024 to May 11, 2024 mean PM values were 1.9 µg/m^3 and 1.1 µg/m^3, respectively. During the operation period May 12, 2024 to December 31, 2024, the mean PM value was 1.6 µg/m^3. During the operational period, fluoride, phosphate and carbon black were below their reportable detection limits (RDL).

4.9 BLACK CARBON & DIESEL PARTICULATE MATTER

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly BC and DPM data validity was 98.2%. Summary statistics are presented in Appendix Table A5. There are no current AAQO for BC and DPM. During the baseline period the highest 1-hour mean BC and DPM were 18,267.0 ng/m^{3}and 16930.0 ng/m^3, respectively on October 22, 2022. During that same period the BC and DPM mean values were 691.9 ng/m^3 and 631.6 ng/m^3, respectively. During operations, the highest 1-hour mean of BC and DPM were 3988.5 ng/m^3 and 4304.0 ng/m^3, respectively, recorded in December 2024. During operations, the BC and DPM mean values were 648.8 ng/m^3 and 601.3 ng/m^3, respectively. Preliminary comparisons between the Thermo Sharp 5030i ($PM_{2.5}$), Magee aethalometer (BC & DPM) and Nikira (visibility) sensor data indicated medium to strong correlations and further analysis is underway. Medium to strong positive correlations between these instruments reassuringly indicates that they are all independently recording air quality events of a similar nature.

4.10 METEOROLOGY

During the operational monitoring period from May 12, 2024 to December 31, 2024, the hourly meteorological data validity ranged from 99.9 to 100.0%. Summary statistics are presented in Appendix Tables A7 and A8. The anemometer is powered by solar panel with battery backup. The short downtimes were related to issues with the datalogger in the AQM station. A wind rose, which visually plots the joint frequencies of wind speed and wind direction, is shown in **Figure 2** for the operational monitoring period.

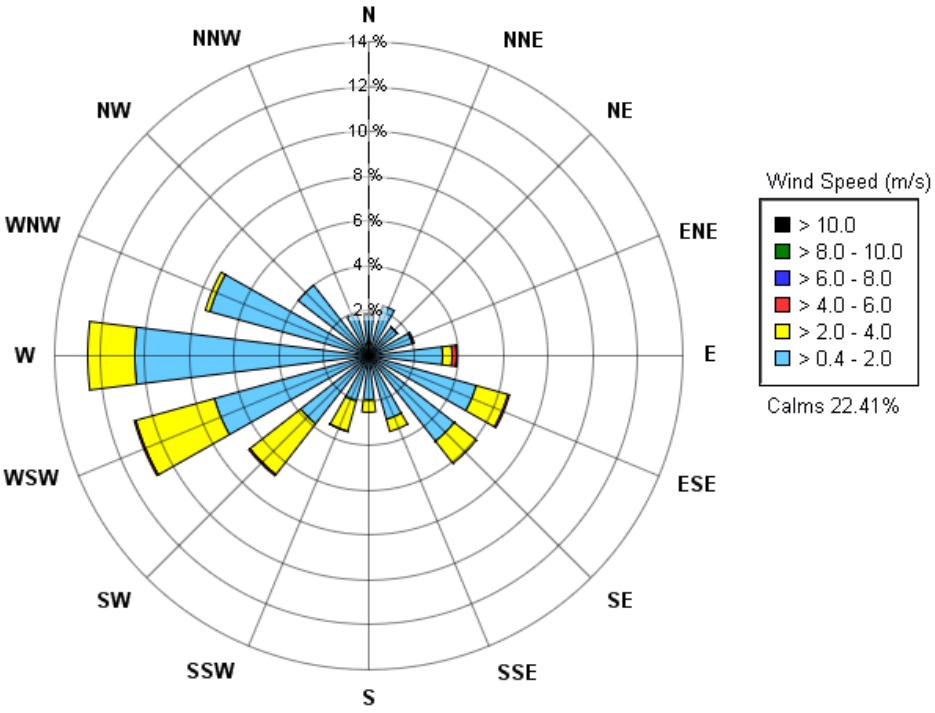

Figure 2 Westridge Marine Terminal Wind Rose – May 12, 2024 to December 31, 2024

5 DISCUSSION

Data validity for most parameters meets the minimum data completeness criteria acceptable range of >75% over the operational period, excluding BTEX. The GC availability was 64.4% for the operational period as a result of technical maintenance issues. When possible, the WMT AQM station measurements were compared with the nearby Burnaby Kensington Park, Burnaby Mountain, Burnaby Terminal AQM, and Sumas AQM stations. All the comparable data over this baseline period showed a close agreement in measurements, suggesting that a reliable data set was achieved.

Throughout the monitoring period from May 12, 2024 to December 31, 2024, there were no exceedances of the relevant AAQOs. Measured values were determined to be low when compared the available AAQO. The baseline period values were generally higher than during the operational period or had differences less than the accuracy and precision of the instruments used. It is unclear why certain measurements were higher during the baseline time period. It could be due to construction activity or meteorological conditions.

No comparison to the annual AAQOs can be made as the operational reporting period covers less than 75% of the 2024 year. Monitored data will be compared against the annual AAQOs in 2025 and onwards.

6 REFERENCES

Canadian Council of Ministers of the Environment, 2019. Ambient Air Monitoring And Quality Assurance/Quality Control Guidelines. Downloaded from: https://ccme.ca/en/res/ambientairmonitoringandqa-qcguidelines_ensecure.pdf

Trans Mountain Pipeline, 2017. Air Emissions Management Plan for Sumas and Burnaby Terminals. Trans Mountain Expansion Project. CER Condition 79.

Trans Mountain Pipeline, 2020. Ambient Air Quality Monitoring Plan for the Westridge Marine Terminal, Burnaby Terminal and Sumas Terminal. Trans Mountain Expansion Project.

7 GENERAL STATEMENT OF LIMITATIONS

This report entitled Westridge Marine Terminal 2024 Annual Air Quality and Meteorological Monitoring Report was prepared by RWDI AIR Inc. ("RWDI") for Trans Mountain ("Client"). The findings and conclusions presented in this report have been prepared for Trans Mountain and are specific to the project described herein ("Project"). This report was prepared using scientific principles, published methodologies and professional judgment in assessing available information and data. The findings presented within this document are based on available data within the limits of the existing information, budgeted scope of work, and schedule. The conclusions contained in this report are based on the information available to RWDI when this report was prepared; subsequent changes made by the Client after the date of this report have not been reflected in the conclusions.

This report was prepared for the exclusive use of Trans Mountain. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. RWDI accepts no responsibility for damages, if any, suffered by any third party as result of decisions made or actions based on this report.

APPENDIX A

Table A1. Trans Mountain Westridge Maximum 1-hour and 24-hour Summary Statistics

Westridge Marine Terminal 2024 Statistics	Maximum 1-hour Mean							Maximum 24-hour Mean						
Compound	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	TRS	O_3	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	TRS	O_3
Units	$\mu g/m^3$	ppb						$\mu g/m^3$	ppb					
AAQO	-	-	-	**60**[1,2]	**70**[1]	**5**[1]	**82** [1]	**25**[3]	-	-	-	-	-	-
May 12 to May 31	10.4	60.6	32.5	35.7	1.3	0.7	47.6	7.1	23.5	6.0	17.4	0.4	0.6	32.3
June	10.2	85.4	61.1	35.8	4.0	0.9	58.3	7.3	29.0	11.9	17.4	1.3	0.5	30.9
July	21.0	87.4	62.7	49.7	2.8	1.1	75.8	15.0	37.4	13.8	23.9	0.7	0.7	34.6
August	23.1	78.9	59.7	34.7	2.9	0.9	52.1	18.6	30.6	15.3	20.9	0.8	0.6	27.9
September	22.9	99.7	69.0	33.2	3.5	1.4	39.9	16.7	38.4	17.2	21.1	1.1	0.8	21.9
October	12.1	77.0	59.4	29.2	1.5	0.9	37.0	7.6	31.4	17.5	16.2	0.6	0.5	26.9
November	18.5	61.2	42.0	29.2	1.0	0.9	34.9	10.9	27.5	12.3	15.1	0.7	0.4	27.6
December	25.5	122.1	102.5	27.4	1.4	1.0	34.5	10.6	68.8	57.4	16.6	1.0	0.7	28.3
May 12 to December 31	25.5	122.1	102.5	49.7	4.0	1.4	75.8	18.6	68.8	57.4	23.9	1.3	0.8	34.6

Notes:
- indicates that no AAQO available
[1] Metro Vancouver 1-hour desirable AAQO.
[2] Metro Vancouver 98th percentile of daily maximumm1-hour concentration averaged over 3 years AAQO.
[3] Metro Vancouver 24-hour rolling average AAQO.
N/A- Not available: Data validity is below 75%.
Bold text indicates the maximum mean exceeds the AAQO.

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A2. Trans Mountain Westridge Monthly Mean and Valid Data Summary Statistics

Westridge Marine Terminal 2024 Statistics	Monthly Mean							Valid Data						
Compound	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	TRS	O_3	$PM_{2.5}$	NO_x	NO	NO_2	SO_2	TRS	O_3
Units	$\mu g/m^3$	ppb						Percentage of Time (hourly)						
AAQO	**8**[1]	-	-	**17**[1]	**5**[1]	-	**8**[2]							
May 12 to May 31	3.2	10.1	1.8	8.3	0.2	0.4	25.6	99.6	99.2	99.2	99.2	99.0	99.0	99.2
June	3.5	12.5	3.1	9.3	0.4	0.3	22.6	99.9	99.4	99.4	99.4	99.6	99.6	99.2
July	6.5	18.2	5.2	13.0	0.3	0.5	21.1	99.7	99.3	99.3	99.3	99.3	99.2	98.5
August	7.0	14.0	4.2	9.7	0.3	0.4	18.9	99.7	98.5	98.5	98.5	95.6	82.7	97.8
September	6.1	15.9	5.5	10.3	0.4	0.5	12.9	99.3	99.0	99.0	99.0	99.0	99.0	97.9
October	4.0	14.3	4.3	9.9	0.3	0.4	12.3	99.2	99.2	99.2	99.2	98.8	99.3	98.5
November	3.9	10.9	2.7	8.2	0.4	0.3	13.7	99.6	99.6	99.6	99.6	98.9	98.9	98.5
December	3.5	16.9	7.8	9.1	0.6	0.4	14.5	99.3	98.4	98.4	98.4	98.9	98.9	97.6
May 12 to December 31	4.7	14.1	4.3	9.7	0.4	0.4	17.7	99.5	99.1	99.1	99.1	98.6	97.1	98.4

Notes:
- No AAQO available
N/A- Not available: Data validity is below 75%.
[1] Metro Vancouver AAQO based on annual average
[2] Metro Vancouver AAQO based on 8-hour average

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A3. Trans Mountain Westridge Maximum 1-hour and 24-hour BTEX Summary Statistics

Westridge Marine Terminal 2024 Statistics	Maximum 1-hour Mean				Maximum 24-hour Mean			
Compound	Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Units	ppb				ppb			
AAQO	**9**[1]	**499**[1]	**460**[1]	**530**[1]	**-**	**106**[2]	**-**	**161**[2]
May 12 to May 31	2.6	7.5	5.5	14.5	0.3	1.5	0.9	2.9
June	3.1	5.7	8.7	14.6	0.4	1.5	2.6	3.9
July	1.6	8.1	10.9	20.4	0.2	2.3	2.4	6.4
August	1.3	11.7	7.5	17.0	0.3	2.8	1.4	3.7
September	2.2	9.8	10.8	22.7	0.6	3.0	2.2	5.8
October	N /A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
November	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
December	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May 12 to December 31	3.1	11.7	10.9	22.7	0.6	3.0	2.6	6.4

Notes:
- No AAQO available
[1] Alberta AAQO 1-hour average
[2] Alberta AAQO 24-hour average
N/A – Not Available: data validity is below 75%

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A4. Trans Mountain Westridge Monthly Mean and Valid Data BTEX Summary Statistics

Westridge Marine Terminal 2024 Statistics	Monthly Mean				Valid Data			
Compound	Benzene	Toluene	Ethylbenzene	Xylene	Benzene	Toluene	Ethylbenzene	Xylene
Units	ppb				Percentage of Time (hourly)			
AAQO	**0.9**[1]	-	-	-				
May 12 to May 31	0.1	0.5	0.4	1.0	90.6	90.6	90.6	90.6
June	0.1	0.5	0.5	1.0	95.6	95.6	95.6	95.6
July	0.1	1.0	0.7	1.7	95.7	95.7	95.7	95.7
August	0.1	0.9	0.7	1.5	94.9	94.9	94.9	94.9
September	0.2	1.8	0.8	2.6	94.9	94.9	94.9	94.9
October	N/A	N/A	N/A	N/A	3.5	3.5	3.5	3.5
November	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0
December	N/A	N/A	N/A	N/A	39.9	39.9	39.9	39.9
May 12 to December 31	0.1	0.9	0.6	1.6	64.4	64.4	64.4	64.4

Notes:
- No AAQO available
N/A- Not available: Data validity is below 75%.
[1] Alberta AAQO based on annual average

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A5. Trans Mountain Westridge Maximum 1-hour and 24-hour, Monthly Mean and Valid Data for Visibility and Diesel Particulate Matter Summary Statistics

Westridge Marine Terminal 2024 Statistics	Maximum 1-hour Mean			Maximum 24-hour Mean			Minimum 1-hour Mean	Monthly Mean			Valid Data	
Compound	DPM	BC	Visibility*	DPM	BC	Visibility	Visibility	DPM	BC	Visibility	DPM and BC	Visibility
Units	ng/m^3		km	ng/m^3		km	km	ng/m^3		km	Percentage of Time (hourly)	
AAQO	-	-	-	-	-	-	-	-	-	-		
May 12 to May 31	2219.0	2056.8	6315.4	867.7	804.2	1143.5	97.5	330.5	306.3	520.2	99.6	100.0
June	2145.0	1988.0	4664.6	781.9	724.6	2329.5	100.0	383.0	355.0	525.9	99.6	98.1
July	2756.0	2554.6	2051.9	1394.1	1292.1	438.5	52.8	706.0	654.3	194.8	99.6	100.0
August	3915.0	3628.2	2527.1	1895.1	1756.4	746.7	37.5	774.7	718.0	175.3	99.6	100.0
September	4206.0	3898.3	2030.0	2513.7	2329.7	1002.0	33.2	933.8	865.4	266.7	99.0	85.1
October	3327.0	3083.0	N/A	1590.1	1473.6	N/A	N/A	742.1	687.7	N/A	96.1	44.9
November	1954.0	1810.9	N/A	1060.0	982.3	N/A	N/A	551.5	511.2	N/A	92.5	17.2
December	4304.0	3988.5	1776.1	2398.1	2222.5	830.0	50.5	768.9	712.6	434.4	99.3	87.4
May 12 to December 31	4304.0	3988.5	6315.4	2513.7	2329.7	2329.5	33.2	648.8	601.3	352.9	98.2	79.1

Notes:
- No AAQO available
N/A- Not available: Data validity is below 75%
*RWDI Uses 15,000 km as a maximum cutoff for visibility

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A6. Trans Mountain Westridge 1-hour and 24-hour Average AAQO exceedances

Westridge Marine Terminal 2024 Event Statistics	1-hour average > AAQO								8-hour Average	24-hour average > AAQO		
Compound	NO_2	SO_2	TRS	O_3	B[1]	T[1]	E[1]	X[1]	O_3[2]	$PM_{2.5}$	T[1]	X[1]
AAQO	60[3]	70	5	82	9	499	460	530	62	25[3]	106	161
	ppb								ppb	µg/m³	ppb	
Units	Number > AAQO											
May 12 to May 31	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0
May 12 to December 31	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

[1] B-Benzene, T-Toluene, E-Ethylbenzene, X-Xylenes, AAQO values adopted from Alberta

[2] 4th highest daily maximum 8-hr average averaged over 3 consecutive years

[3] 24-hour rolling average.

Bold text indicates events that exceed the AAQO.

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A7. Trans Mountain Westridge Maximum and Minimum Meteorological Summary Statistics

2024 Meteorological Statistics	Maximum 1-hour Mean					Minimum 1-hour Mean				
Parameter	WS	Temp	RH	Pres	Rain	WS	Temp	RH	Pres	Rain
Units	m/s	°C	%	mb	mm	m/s	°C	%	mb	mm
May 12 to May 31	8.3	22.5	100.0	1030.0	6.0	0.2	7.4	28.7	1007.3	0.0
June	7.4	28.4	100.0	1025.0	9.6	0.1	9.1	24.6	996.6	0.0
July	8.0	31.1	100.0	1026.3	3.1	0.0	12.1	29.2	1010.0	0.0
August	8.4	29.8	100.0	1027.0	6.2	0.0	11.0	33.7	1006.0	0.0
September	8.9	28.5	100.0	1032.3	7.5	0.0	7.5	37.3	1003.0	0.0
October	5.3	23.2	100.0	1029.0	15.6	0.1	4.1	36.5	1003.4	0.0
November	10.5	13.5	100.0	1031.0	8.8	0.2	1.4	37.4	996.5	0.0
December	8.4	13.2	100.0	1034.1	11.0	0.1	0.4	46.9	989.6	0.0
May 12 to December 31	10.5	31.1	100.0	1034.1	15.6	0.0	0.4	24.6	989.6	0.0

Notes:

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A8. Trans Mountain Westridge Monthly Mean and Valid Data Meteorological Summary Statistics

2024 Meteorological Statistics	Monthly Mean					Total	Valid Data					
Parameter	WS	Temp	RH	Pres	Rain	Rain	WS	WD	Temp	RH	Pres	Rain
Units	m/s	°C	%	mb	mm	mm	Percentage of Time (hourly)					
May 12 to May 31	2.4	13.3	75.9	1018.1	0.2	122.9	100.0	100.0	100.0	100.0	100.0	100.0
June	2.2	16.1	74.3	1016.2	0.1	93.2	100.0	100.0	100.0	100.0	99.9	100.0
July	2.2	20.7	69.7	1017.8	0.2	33.1	100.0	100.0	100.0	100.0	100.0	100.0
August	1.8	19.2	80.4	1017.3	0.1	74.3	100.0	100.0	100.0	100.0	100.0	100.0
September	1.5	16.4	87.3	1016.3	0.1	73.2	100.0	100.0	100.0	100.0	100.0	100.0
October	1.5	11.3	92.9	1017.9	0.5	337.4	100.0	100.0	100.0	100.0	100.0	100.0
November	2.1	7.5	95.5	1014.5	0.4	255.0	100.0	100.0	100.0	100.0	100.0	100.0
December	2.0	6.6	98.4	1016.8	0.4	284.6	100.0	100.0	99.7	99.7	99.7	99.7
May 12 to December 31	2.0	13.9	84.8	1016.8	0.2	1261.3	100.0	100.0	100.0	100.0	99.9	100.0

Notes:

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A9. Trans Mountain Westridge Summary of Super SASS Sampling Results Statistics

Time Period	Minimum														
Parameter	Particulate	Ammonium	Calcium	Fluoride	Magnesium	Nitrate	Nitrite	Phosphate	Potassium	Sodium	Sulfate	Nitrate	Elemental Carbon	Organic Carbon	Carbon Black
Units	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)	(µg/m^3)
May 12, 2024, to Dec 26, 2024	<0.412	<0.0005	<0.001	<0.0002	<0.0004	<0.003	<0.006	<0.002	<0.0005	<0.0003	<0.003	<0.003	<0.019	<0.054	<0.041
Time Period	**Maximum**														
May 12, 2024, to Dec 26, 2024	5.779	0.004	0.012	<0.0002	0.013	0.014	0.036	<0.002	0.014	0.006	0.018	0.009	0.701	0.815	<0.083
Time Period	**Mean**														
May 12, 2024, to Dec 26, 2024	1.581	0.001	0.006	<0.0002	0.006	0.006	0.018	<0.002	0.003	0.002	0.007	0.006	0.121	0.531	<0.042

Notes:
Minimum values include the mean reportable detection limit (RDL) for the period
< = samples below RDL were not included in mean calculations, biasing the mean to higher values

Operational period data collected from May 12, 2024 to December 31, 2024.

Table A10. Trans Mountain Westridge 30-day Passive Sampler Summary Statistics, Comparison with Continuous Ambient Results

Time Period	Minimum					
Parameter	NO_2 East	NO_2 West	AQM NO_2	SO_2 East	SO_2 West	AQM SO_2
AAQO	-	-	-	11	11	11
Units	ppb	ppb	ppb	ppb	ppb	ppb
May 2, 2024 to Dec 31, 2024	3.8	4.5	4.0	0.2	0.2	0.2
Time Period	**Maximum**					
May 2, 2024 to Dec 31, 2024	5.9	6.2	13.3	0.7	0.7	0.6
Time Period	**Mean**					
May 2, 2024 to Dec 31, 2024	4.9	5.2	9.2	0.4	0.4	0.4

Notes:
AQM station values are based on monthly averaged 1-hour values for the respective time periods.
The AAQO for 30-day SO_2 is taken from Alberta.
- No AAQO available

Operational period data collected between May 2, 2024 to December 31, 2024. Passive samplers are a 30-day average.