Tollaust Pty Ltd - Lane Cove Tunnel

Marden St and Sirius Rd Stack Air Quality Monitoring Validated Data Report

01 December 2025 to 31 December 2025

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Distribution

Format	Recipient	Details
PDF	Matt Ottaran	matt.otaran@ventia.com
PDF	Alisha Koirala	alisha.koirala@ventia.com
PDF	Scott Tinsley	STinsley@transurban.com
PDF	James Kao	JKao@transurban.com
PDF	Sujoy Nandi	SNandi@transurban.com
PDF	Adnan Luqman	adluqman@transurban.com

Prepared by

Tim Allfrey
12 January 2026

Approved by

Bruno Nourdine
12 January 2026

Norditech Accreditations

We operate a fully compliant NATA-approved lab, and our engineers are factory-trained in the repair and maintenance of most types of gas analysers on the market, including circuit board level repairs. Our instrument technicians' training is constantly updated to stay current with the latest gas analyser market trends.

Quality ISO 9001 SAI GLOBAL
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NATA WORLD RECOGNISED ACCREDITATION

Accreditation number: 19660

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Glossary

The following terms and abbreviations are used in this report

Abbreviation	Meaning
°C	Degrees Celsius
%	Percent
CO	Carbon monoxide
eq.	Equivalents
kPa	kiloPascal
mg/m^3	Milligrams per cubic meter at dry, standard temperature and pressure (0°C and 101.3 kPa)
NMHC	Non-methane hydrocarbons
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
RH	Relative Humidity
TSP	Total Suspended Particulate
VOC	Volatile organic compounds
VSO	Ventilation Stack Outlet

1. Executive Summary

The Lane Cove Tunnel runs for 3.6km between North Ryde and Artarmon, linking the M2 Motorway and the Gore Hill Freeway and forms part of Sydney's motorway network. The tunnel commenced operation in March 2007.

Two stacks provide ventilation for the tunnel, one at the western end of the tunnel (Sirius Road, Lane Cove West), and one at the eastern end of the tunnel (Marden St, Artarmon). The Sirius Road stack comprises two partitions, north and south. Sirius Road results are a combined weighted average to the two partitions.

This report presents the monthly validated stack data for December 2025 to Tollaust Pty Ltd for the Lane Cove Tunnel.

1.1 Compliance to limits

The Minister's Conditions of Approval (MCoA) designates limits to which pollutants being discharged from the ventilation stacks must meet. (MCoA 173).

There were nil exceedances of the prescribed limits during the reporting period.

2. Introduction

2.1 Project Background

Norditech were contracted by Tollaust Pty Ltd in December 2018 to provide continuous stack air quality monitoring and reporting services for Lane Cove Tunnel.

Norditech is a NATA accredited organisation (Accreditation Number 19660)

Addresses of relevant parties:

Norditech Pty Ltd
2/87 Station Rd
Seven Hills NSW 2147

Ventia
43 Bourke Street
Woolloomooloo, NSW 2000

This report presents the validated Marden St and Sirius Rd ventilation stack data for December 2025.

- Describe air quality measurements.
- Reports any readings above the LCT Limits.
- Compare monitoring results.
- It has been quality assured.

2.2 Outlet Monitor Locations

The locations of the Marden St and Sirius Rd ventilation stacks are detailed in the table and figure below.

Location	Latitude	Longitude
Marden St (Eastern Stack)	-33.815025°	151.179246°
Sirius Rd (Western Stack)	-33.807887°	151.146074°

Table 1. Lane Cove Tunnel ventilation stack GPS Coordinates

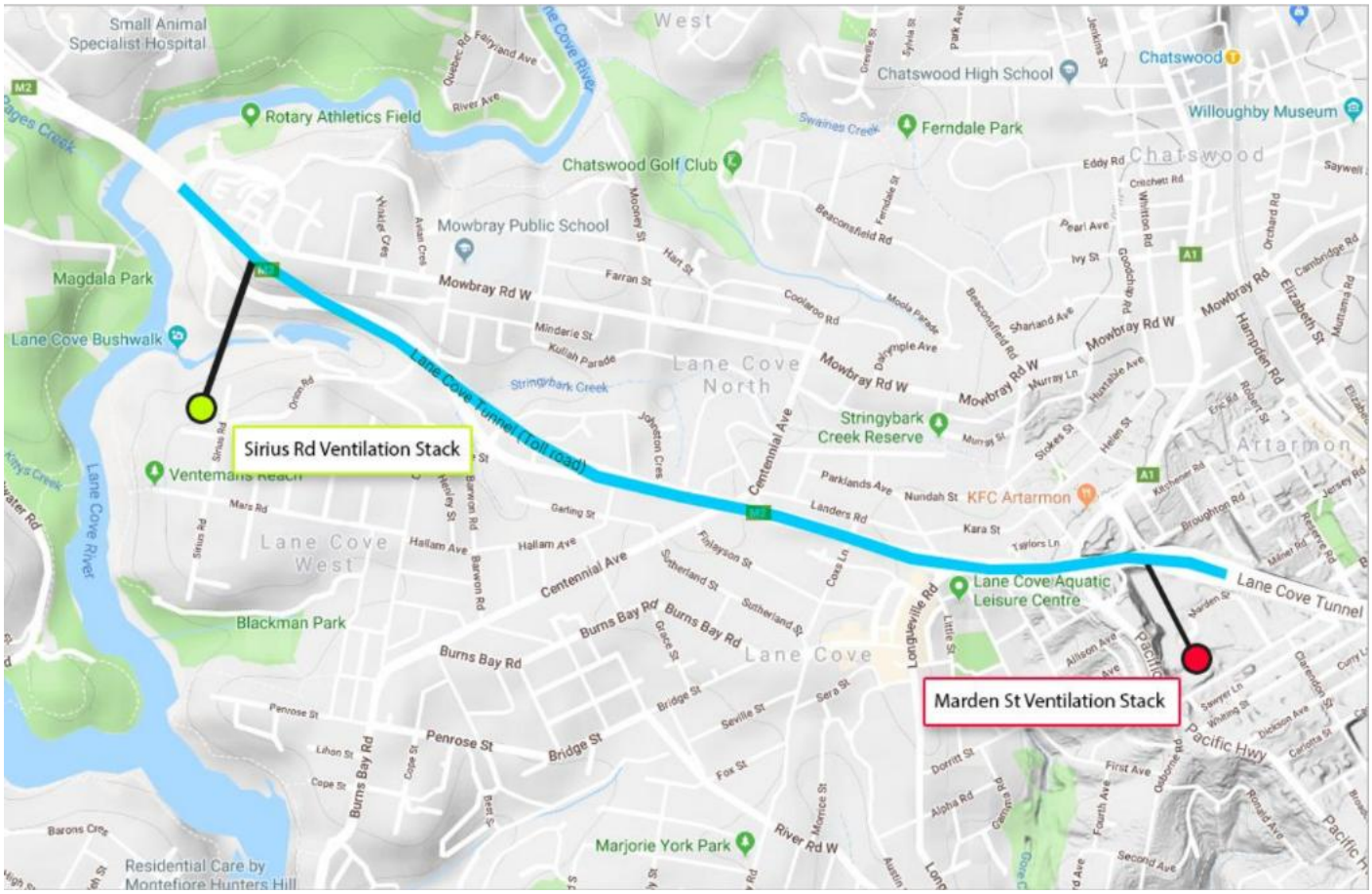

Figure 1. Lane Cove Tunnel ventilation stack locations

2.3 Scope

In tunnel air is discharged via two ventilation stacks – one located at Marden St, Artarmon, and one located at Sirius Rd, Lane Cove West. The Sirius Rd stack comprises of two separate partitions (North and South). For each stack, monitoring as per the requirements of MCoA 172 is undertaken. Each partition of the Sirius Rd stack is monitored by separate air quality monitoring stations.

Gaseous parameters are sampled by an extractive sampling system with automatic purging. Volatile organic compounds are measured using the flame ionization detection principle. Oxides of nitrogen are measured using chemiluminescence. Carbon monoxide is measured using non-dispersive infra-red absorption.

Particulates PM10 and PM2.5 are measured using tapered element oscillating microbalances, via an isokinetic sampling system.

Monthly routine maintenance is undertaken by Norditech. Maintenance is performed as per the relevant Australian Standard or in house method. Maintenance cycles generally involve 1, 3, 6 and 12 monthly scheduled items.

3. Monitoring Equipment

3.1 Outlet Monitors

The Instrument of Approval requires each ventilation outlet to be continuously monitored in accordance with the requirements of Table 2.

Pollutant / Parameter	Frequency	Equivalent Reference Method	Description of the Method
CO	Continuous	In house method TP.003	In-house methods 9.5 - Extractive dilution and 6.3 - Carbon monoxide by gas filter correlation spectrophotometry
NO, NOx, NO2	Continuous	In house method TP.001	In-house methods 9.5 – Extractive dilution and 6.1 - Oxides of nitrogen by chemiluminescence
PM_{10}	Continuous	AS/NZS 3580.9.8 In house method TP.005 AS 4323.1	In-house method 7.5 – Measurement of PM10, PM2.5 and TSP using Beta Attenuation Monitor.
$PM_{2.5}$	Continuous	In house method TP.026 AS 4323.1	In-house method 7.5 – Measurement of PM10, PM2.5 and TSP using Beta Attenuation Monitor.
CH4, NMHC, VOC[2]	Continuous	In house method TP.006	In-house method 9.5 - Monitoring of methane and non-methane hydrocarbons by direct extraction
Relative Humidity	Continuous	In house method TP.014	In-house method 9.8 – Continuous monitoring of moisture using relative humidity and temperature probe
Temperature	Continuous	In house method TP.012	In-house method 9.3 - Temperature by instrumental techniques
Flow Rate	Continuous	TBA	In-house method 9.2 - Gas flow by ultrasonic techniques

Table 2. Monitoring requirements

The pollutant and parameters will be continuously measured using the instruments identified in Table 3 below.

Pollutant/ Parameter	Instrument	Units of Measure	Range	Resolution	Uncertainty
CO	Ecotech Serinus S30	mg/m^3	0 – 123 mg/m^3	0.01 $\mu g/m^3$	± 8.2% of reading at 62.5mg/m^3 (k=1.96)
NO	Ecotech Serinus S40	mg/m^3	0 – 31ppm	0.01ppb	± 8.1% of reading for range 25.7 – 32.8mg/m^3 (k=1.96)
NO_x	Ecotech Serinus S40	mg/m^3	0 – 33 ppm	0.01 ppb	± 8.1% of reading for range 25.7 – 32.8mg/m^3 (k=1.96)
NO_2	Ecotech Serinus S40	mg/m^3	0 – 33 ppm	0.01 ppb	± 8.5% of reading at 25.7mg/m^3 (k=1.96)
CH_4	Baseline 9000, ENVEA HC51M	mg/m^3	0 – 17ppm	0.1 ppm	±12% of reading + 0.3mg/m^3 for range 3.5 – 17mg/m3 (k=2.0)
NMHC (as propane)	Baseline 9000, ENVEA HC51M	mg/m^3	0 – 20 ppm	0.01 ppm	±13% of reading + 0.56mg/m^3 for range 3.5 – 20mg/m3 (k=2.0)
PM_{10}	Rupprecht & Patashnick TEOM with Ecotech and Norditech ISS isokinetic sampling system	$\mu g/m^3$	0 – 5000 µg/m3	0.1 µg/m3	±5.0 µg/m3 or 3.6% of reading, whichever is the greater (k=1.96)
PM_{25}	Rupprecht & Patashnick TEOM with Ecotech and Norditech ISS isokinetic sampling system	$\mu g/m^3$	0 – 5000 µg/m3	0.1 µg/m3	±5.0 µg/m3 or 3.6% of reading, whichever is the greater (k=1.96)
Temperature	Vaisala HMT330	°C	0 - 50 °C	0.1 °C	± 0.6 ˚C, (k=2.0)
Relative Humidity	Vaisala HMT330	%	0 - 100 %	1 %	± 6%, (k=2.0)
Flow Rate	Flowsic100 USD 55SSTI Ultrasonic flow sensor	m^3/s	±40 m^3/s	1 m^3/s	±0.1 for velocity measurement1

Table 3. Outlet Measured Parameters and Instruments

4. Air Quality Limits

Air quality goals provided are provided in Condition 173 of the Minister's Conditions of Approval issued by the Director-General for the Lane Cove Tunnel project. The air quality goals are shown in the table below.

Location	Pollutant / Parameter	Type of Measurement	Concentration Limit	Unit
Marden St (Eastern Stack)	CO	Average – 30 minutes	62.5	mg/m^3
	NO_x	Average – 30 minutes	25.7	mg/m^3
	PM_{10}	Average – 30 minutes	1200	$\mu g/m^3$
	VOC (as propane)	Average – 30 minutes	6.3	mg/m^3
Sirius Rd (Western Stack)	CO	Average – 30 minutes	62.5	mg/m^3
	NO_x	Average – 30 minutes	32.8	mg/m^3
	PM_{10}	Average – 30 minutes	1600	$\mu g/m^3$
	VOC	Average – 30 minutes	6.3	mg/m^3
Combined Stacks	CO	Annual	1530	t/annum
	NO_x	Annual	229	t/annum
	PM10	Annual	14	t/annum
	VOC	Annual	153	t/annum

Table 4. Ventilation Outlet Air Quality Limits

5. Data Validation and Reporting

5.1 Validation

Data validation is performed as per Norditech's data validation procedure TP.022. The data validation process identifies any data that is deemed not to be valid. This data is flagged as invalid in the database and is removed from the reported data.

Data may be deemed invalid for several reasons, including but not limited to:

- Instrument fault
- Instrument calibration out of tolerance
- Maintenance activities

For further details and explanations of reasons for invalidating data, please refer to section Data Validation Explanations.

Initial visual inspection of data is performed by inspection of graphs to identify any anomalies in the data set.

Site visit logs and maintenance and calibration certificates are cross referenced to the data set and any data affected by maintenance activities are flagged.

Instrument drift and calibration tolerances are checked and data flagged in the database as necessary as per NATA compliance requirements.

5.2 Reporting

The data is reported in real time at the Lane Cove Tunnel website (URL. http://lanecovetunnel.com/))

Summary monthly data is recorded and reported within the OMCS and is included in the attachments to this report.

a. Carbon Monoxide
b. Oxides of Nitrogen
c. Nitrogen Dioxide
d. Nitrogen Monoxide
e. Volatile Organic Compounds
f. PM_{10}
g. $PM_{2.5}$
h. Stack Temperature
i. Stack Flow
j. Relative Humidity

Averages are based on all readings within the averaging period.

In addition to this, the OMCS can generate ad hoc reports for specific events or periods, and these will be included in the report as required, to provide additional detail for an abnormal event or incident.

Data reported via the OMCS has not been validated. This report provides validated data for the VSO sensors.

All data within this report is reported as 'End Time'. Ie the 1hour average result for 2:00 is the average of the 1minute data from 1:00 through to 2:00.

5.3 Data Collection

At each Air Quality Monitoring Station, data is logged to a Congrego data logger at 5-minute average intervals. Each 5-minute average is calculated from data sampled at 10 second intervals.

Data is transferred automatically to Norditech's data collection software via a TCP/IP link, at a frequency of not greater than 1 hour. Two datasets are maintained by Norditech, one for data validation and reporting purposes, and a non-validated data set for reference purposes.

5.3.1 Data Availability

Data availability refers to the amount of available data for the reporting period. Data availability is calculated using the following formula:

$$\text{Data availability } \% = \frac{\text{sum of available data points}}{\text{sum of possible data points}} * 100$$

Where:

- Sum of available data points is the number of validated 1 hour average data points for the reporting period
- Sum of possible data points is the number of theoretically available data points for the reporting period

5.3.2 Unit Conversions

Total oxides of nitrogen (NOx) results are expressed as NO2 equivalents in mg/m3. As of 1/03/2021, VOC results are expressed as non-methane hydrocarbons as propane equivalents in mg/m3. Prior to this date VOC results were expressed as total VOCs as methane equivalent.

Stack velocity readings are converted to flow rate using the following stack areas:

- Marden Street Stack area 59.8919 m2
- Sirius Road Stack – North Partition area 35.95 m2
- Sirius Road Stack – South Partition area 36.19 m2

Pollutant and flow data are reported at reference conditions: 0°C, 101.325 kPa, dry.

5.3.3 Combined Sirius Road South and Sirius Road North results

Data from the Sirius Road stack are combined results of the north and south partitions. Stack velocity is used to determine whether a partition is active or inactive, and this determines the calculation for the total Sirius Road ventilation stack results.

The table below shows the criteria used to determine how the total Sirius Road ventilation stack data is calculated.

LCT Tunnel Sirius Rd Ventilation Stack Reporting Conditions	
Partitions Active	Calculation
None	Combined result is based on weighted total from both partitions. Weighting is calculated as a function of the ratio of partition flows to total flow
One	Active partition is reported
Both	Combined result is based on weighted total from both partitions. Weighting is calculated as a function of the ratio of partition flows to total flow
Unknown in either partition	No result provided as it cannot be determined whether each partition is active or not

Table 5: Sirius Rd Reporting Condition criteria

5.3.4 Accumulative Load

Accumulative loads are calculated from the monthly measured emission in tonnes for each stack for CO, NOx, PM10 and VOC. The measured emissions are converted to an estimated monthly total emission by taking into account the data capture of each parameter, using the following formula:

$$estimated\ monthly\ total\ emission = \frac{measured\ monthly\ emission}{available\ data\ \%} * 10$$

The estimated monthly total emissions for each parameter for each stack are then added together to give the total emission per parameter per month.

The accumulative load is then calculated as the sum of the previous 12 months estimated total emission for each parameter.

If there is less than 50% data availability for any parameter, then data for the last valid previous month (i.e. above 50% data availability) is substituted.

6. Calibrations and Maintenance

6.1 Maintenance

Device	Frequency
Outlet Air Quality Sensors – CEMS Gas monitors	1 monthly
Outlet Air Quality Sensors – CEMS Particulate Monitor	1 monthly
Outlet Air Quality Sensors – CEMS Meteorological Sensors	6 monthly
Outlet Air Quality Sensors – CEMS Velocity Sensors	Based on the Manual Stack Testing frequency

Table 6. Indicative Maintenance requirements

6.2 Calibration

The table below identifies the times at which the daily gaseous parameter automatic span and zero checks are performed.

Further to the span and zero checks, the CO analysers perform nightly background reference cycles.

This data is removed from the dataset, however are not included in the data validation tables.

Nightly span and zero times for NO, NO_2, NO_x, CO, CH4 and NMHC			
Station	**Parameters**	**Span / Zero cycle time**	**Daily Calibration Checks Times**
Marden St	CO	1:00 – 2:00	23:45 – 23:50
	NO, NO2, NOx	1:00 – 2:00	-
	VOC	1:00 – 2:00	-
Sirius Rd South	CO	1:00 – 2:00	23:45 – 23:50
	NO, NO2, NOx	1:00 – 2:00	-
	VOC	1:00 – 2:00	-
Sirius Rd North	CO	1:00 – 2:00	23:45 – 23:50
	NO, NO2, NOx	1:00 – 2:00	-
	VOC	1:00 – 2:00	-

Table 7. Daily Calibration Checks Times

There are no valid data available for all gaseous parameters during these times. These automatic calibration cycles are not included in the data validation tables in Section 8.

The CEMS particulate monitors are to be manually calibrated at 3 monthly intervals as described in the Operation and Maintenance manuals prepared for the project. The CEMS particulate monitors will also undergo gravimetric correlation testing at yearly intervals as described in the Operation and Maintenance manuals prepared for the project.

A list of all the devices and the latest calibration details are included in the table below, and in an excel spreadsheet.

Lane Cove Tunnel Ventilation Stack Outlet Last Scheduled Calibration Dates – December 2025				
Marden St				
Sensor	**Date of Last Scheduled Maintenance**	**Maintenance Type**	**Date of Last Scheduled Calibration**	**Calibration Frequency**
CO	17/12/2025	1 Monthly	17/12/2025	1 Monthly
$NO/NO_2/No_x$	17/12/2025	1 Monthly	17/12/2025	1 Monthly
VOC	17/12/2025	1 Monthly	17/12/2025	1 Monthly
PM10	17/12/2025	1 Monthly	17/12/2025	1 Monthly
PM2.5	17/12/2025	1 Monthly	17/12/2025	1 Monthly
Temperature	27/08/2025	12 Monthly	27/08/2025	6 Monthly
Relative Humidity	27/08/2025	12 Monthly	27/08/2025	6 Monthly
Flow Rate	N/A	N/A	09/08/2024	6 Monthly

Table 8. Marden St Last Scheduled Maintenance and Calibration Dates

Lane Cove Tunnel Ventilation Stack Outlet Last Scheduled Calibration Dates – December 2025				
Sirius Rd South				
Sensor	**Date of Last Scheduled Maintenance**	**Maintenance Type**	**Date of Last Scheduled Calibration**	**Calibration Frequency**
CO	10/12/2025	1 Monthly	10/12/2025	1 Monthly
$NO/NO_2/No_x$	10/12/2025	1 Monthly	10/12/2025	1 Monthly
VOC	10/12/2025	1 Monthly	10/12/2025	1 Monthly
PM10	17/12/2025	1 Monthly	17/12/2025	1 Monthly
PM2.5	30/12/2025	1 Monthly	30/12/2025	1 Monthly
Temperature	28/07/2025	6 Monthly	28/07/2025	6 Monthly
Relative Humidity	28/07/2025	6 Monthly	28/07/2025	6 Monthly
Flow Rate	N/A	N/A	23/07/2024	6 Monthly

Table 9. Sirius Rd South Last Scheduled Maintenance and Calibration Dates

Note: The air conditioning unit of the Sirius Road North PM2.5 cabinet was faulty since 16/12/2025. The unit was replaced on 30/12/2025. Last maintenance and calibration were performed during an unscheduled visit on 30/12/2025, when the new air conditioning unit was installed.

Lane Cove Tunnel Ventilation Stack Outlet Last Scheduled Calibration Dates – December 2025				
Sirius Rd North				
Sensor	**Date of Last Scheduled Maintenance**	**Maintenance Type**	**Date of Last Scheduled Calibration**	**Calibration Frequency**
CO	10/12/2025	1 Monthly	10/12/2025	1 Monthly
$NO/NO_2/No_x$	10/12/2025	1 Monthly	10/12/2025	1 Monthly
VOC	10/12/2025	1 Monthly	10/12/2025	1 Monthly
PM10	17/12/2025	1 Monthly	17/12/2025	1 Monthly
PM2.5	15/09/2025	1 Monthly	15/09/2025	1 Monthly
Temperature	26/08/2025	6 Monthly	26/08/2025	6 Monthly
Relative Humidity	26/08/2025	6 Monthly	26/08/2025	6 Monthly
Flow Rate	N/A	N/A	30/07/2024	6 Monthly

Table 10. Sirius Rd North Last Scheduled Maintenance and Calibration Dates

Note: The air conditioning unit of the Sirius Road North PM2.5 cabinet is currently faulty and awaiting replacement. As a result, the PM2.5 dust monitor has been set out of service until the air conditioner is replaced.

7. Above Goal Readings

Instances of the ventilation stack pollutants exceeding the MCoA goals during the reporting period are presented in the table below.

There were nil exceedances of the prescribed limits during the reporting period.

Lane Cove Tunnel – Marden St Above Goal Readings – December 2025						
Pollutant	**Concentration Limit**	**Units**	**Averaging Period**	**Number of Above Goal Readings**	**Date Time of Above Goal Reading**	**Above Goal Reading**
CO	62.5	mg/m^3	30 minutes	0	-	-
NO_x	25.7	mg/m^3	30 minutes	0	-	-
PM_{10}	1200	$\mu g/m^3$	30 minutes	0	-	-
VOC	6.3	mg/m^3	30 minutes	0	-	-

Table 11. Marden St Above Goal Readings

Lane Cove Tunnel – Sirius Rd Above Goal Readings – December 2025						
Pollutant	**Concentration Limit**	**Units**	**Averaging Period**	**Number of Above Goal Readings**	**Date Time of Above Goal Reading**	**Above Goal Reading**
CO	62.5	mg/m^3	30 minutes	0	-	-
NO_x	32.8	mg/m^3	30 minutes	0	-	-
PM_{10}	1600	$\mu g/m^3$	30 minutes	0	-	-
VOC	6.3	mg/m^3	30 minutes	0	-	-

Table 12. Sirius Rd Above Goal Readings

Lane Cove Tunnel – Combined Stacks Above Goal Readings – December 2025						
Pollutant	**Concentration Limit**	**Units**	**Averaging Period**	**Number of Above Goal Readings**	**Date Time of Above Goal Reading**	**Above Goal Reading**
CO	1530	t/annum	Annual	0	-	-
NO_x	229	t/annum	Annual	0	-	-
PM_{10}	14	t/annum	Annual	0	-	-
VOC	153	t/annum	Annual	0	-	-

Table 13. Combined Stacks Annual Above Goal Readings

8. Documentation

Validated data for Marden St Stack is presented in the Excel workbook named "202512 LCT Marden St Stack Validated data.xlsx". The workbook consists of the following sheets:

1. Cover
2. Marden St 5m Avg
3. Marden St Span Zero Data
4. Marden St Data Validation

Validated data for Sirius Rd Stack is presented in the Excel workbook named "202512 LCT Sirius Rd Stack Validated data.xlsx". The workbook consists of the following sheets:

1. Cover
2. Sirius Rd Combined 5m Avg
3. Flow Temp RH Individual 5m Avg
4. Sirius Rd South Span Zero Data
5. Sirius Rd North Span Zero Data
6. Sirius Rd South Data Validation
7. Sirius Rd North Data Validation

9. Results

9.1 Data Availability

Data availability for the ventilation stack outlet sensors is provided in the table below.

LCT Tunnel – Ventilation Stack Data Availability – December 2025								
Location	**CO (%)**	**NO (%)**	**NO2 (%)**	**NOx (%)**	**PM_{10} (%)**	**$PM_{2.5}$ (%)**	**VOC (%)**	**Flow (%)**
Marden St Stack	92.7%	93.3%	93.3%	93.3%	96.7%	94.6%	92.5%	98.0%
Sirius Rd Stack	90.2%	93.3%	93.3%	93.3%	95.3%	18.0%	93.3%	98.3%

Table 14. LCT data availability

Note: The air conditioning unit of the Sirius Road North PM2.5 cabinet is currently faulty and awaiting replacement. As a result, the PM2.5 dust monitor has been set out of service until the air conditioner is replaced, which has led to a low capture rate for this parameter.

9.2 Tabulated Results

9.2.1 Summary of 30 minute Average Ventilation Outlet Data

The following table presents 30 minute average minimum, maximum and daily average data for the Marden St Stack, and Sirius Rd combined stack.

30 minute averages are calculated from 5 minute average data. The daily average is calculated from 30 minute average data.

LCT Tunnel – Marden St Stack Summary – December 2025								
	CO	**NO**	**NO_2**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**Flow**
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	m^3/s
	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average
Minimum	0.48	0.00	0.02	0.03	-9.22	-9.70	0.00	9.41
Maximum	6.09	3.43	0.65	5.85	217.44	119.73	0.87	559.12
Average	2.02	0.79	0.19	1.40	49.44	17.42	0.17	473.83
Limit	62.50	N/A	N/A	25.70	1200.00	N/A	6.30	N/A

Table 15. Summary of 30-minute average data Marden St

LCT Tunnel – Sirius Rd Stack Summary – December 2025								
	CO	**NO**	**NO_2**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**Flow**
	mg/m^3	mg/m^3	mg/m^3	mg/m^3	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	m^3/s
	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average
Minimum	0.12	-0.01	0.01	-0.00	-5.99	-5.05	0.00	7.54
Maximum	1.83	0.47	0.19	0.84	322.80	120.24	0.55	566.22
Average	0.55	0.11	0.06	0.24	40.45	30.16	0.16	456.77
Limit	62.50	N/A	N/A	32.80	1600.00	N/A	6.30	N/A

Table 16. Summary of 30-minute average data Sirius Rd

9.2.2 Summary of 30 minute Average Flow, Relative Humidity and Temperature

The following table presents 30 minute average minimum, maximum and daily average flow, relative humidity, and temperature data for the Marden St Stack, and Sirius Rd North and South partitions.

30 minute averages are calculated from 5 minute average data. The daily average is calculated from 30 minute average data.

LCT Tunnel Ventilation Stack Flow, RH, Temperature Summary– December 2025									
Parameter	**Marden St (Eastern Stack)**			**Sirius Rd – South Partition**			**Sirius Rd – North Partition**		
	Flow	**RH**	**Temperature**	**Flow**	**RH**	**Temperature**	**Flow**	**RH**	**Temperature**
	m^3/s	%	°C	m^3/s	%	°C	m^3/s	%	°C
	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average	30 minute average
Minimum	9.41	16.37	20.40	3.90	14.97	15.49	5.66	4.24	15.18
Maximum	559.12	77.00	33.74	496.70	86.57	44.44	570.37	86.81	39.89
Average	473.83	48.76	26.25	300.09	50.53	24.57	172.90	47.83	24.64

Table 17. Summary of 30-minute average data Sirius Rd

9.2.3 Summary of Accumulated Load for Combined Stacks

Lane Cove Tunnel Ventilation Stack Outlet Accumulative Load November 2024 – December 2025				
Location	**Carbon Monoxide**	**Oxides of Nitrogen**	**PM_{10}**	**VOC**
	Tonnes	**Tonnes**	**Tonnes**	**Tonnes**
Accumulative Load for past 12 months	37.71	26.58	1.29	3.59
Annual Limit (Tonnes)	1530	229	14	153

Table 18. Summary of Accumulated Load for Combined Stacks

9.3 Graphical Representations

9.3.1 Marden St Stack - Monthly Charts

The following charts present 30-minute average minimum, maximum and daily average data CO, NOx, PM10 and VOC for the Marden St Stack.

30-minute averages are calculated from 5-minute average data. The daily average is calculated from 30-minute average data.

9.3.1.1 Marden St Monthly CO Averages

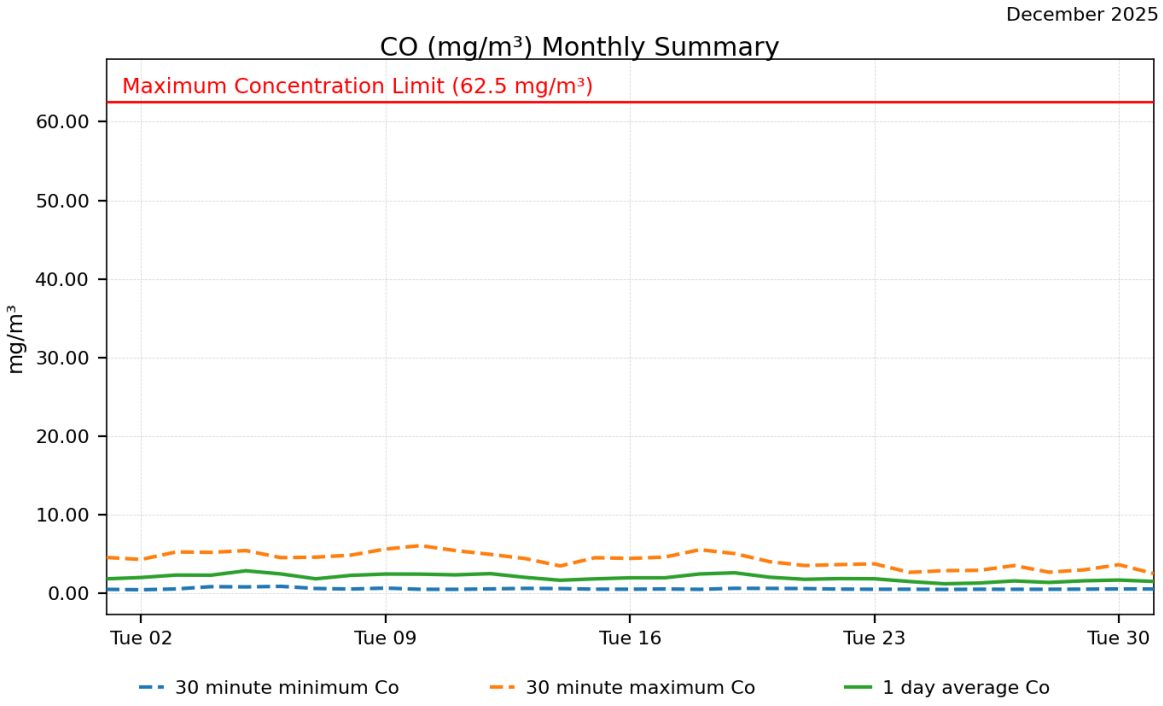

Figure 2. Marden St CO Averages

9.3.1.2 Marden St Monthly VOC Averages

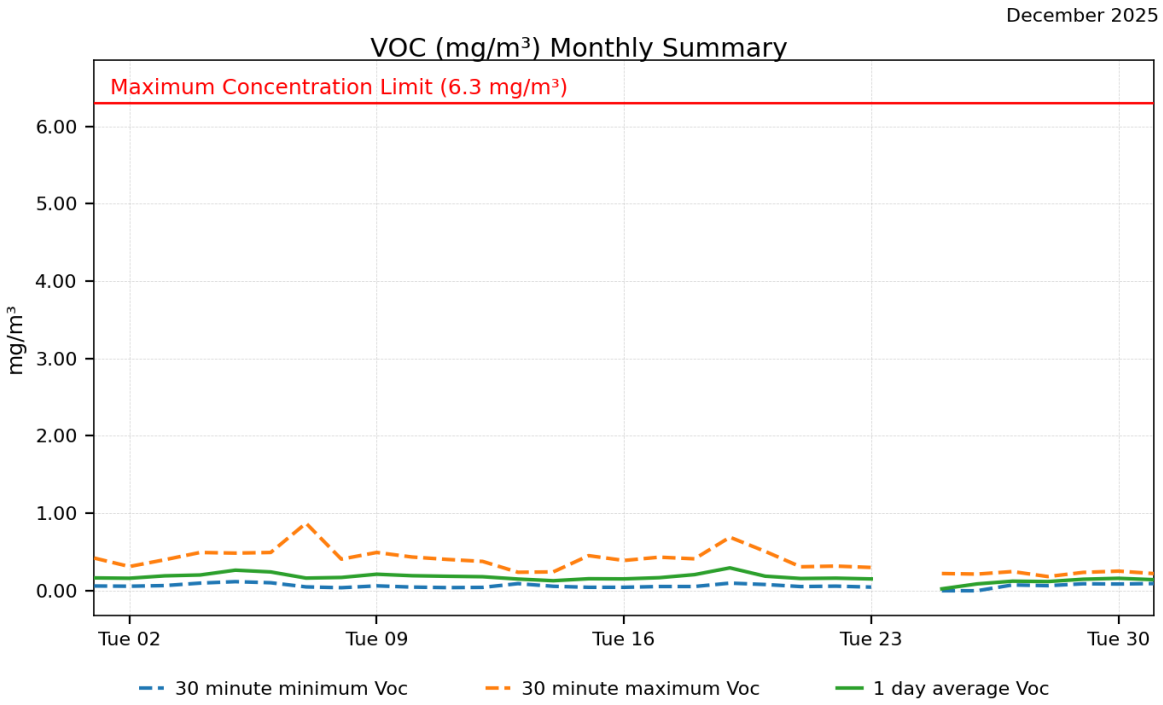

Figure 3. Marden St VOC Averages

9.3.1.3 Marden St Monthly NO_x, NO_2 Averages

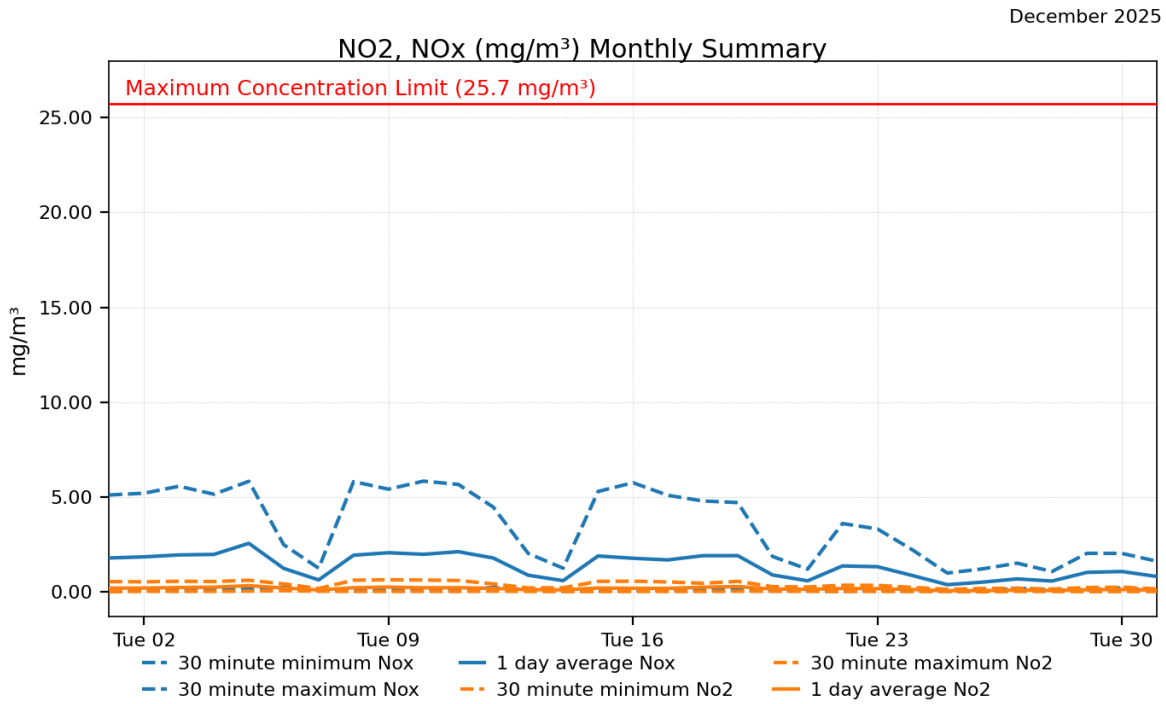

Figure 4. Marden St NOx, NO_2 Averages

9.3.1.4 Marden St Monthly PM_{10} Averages

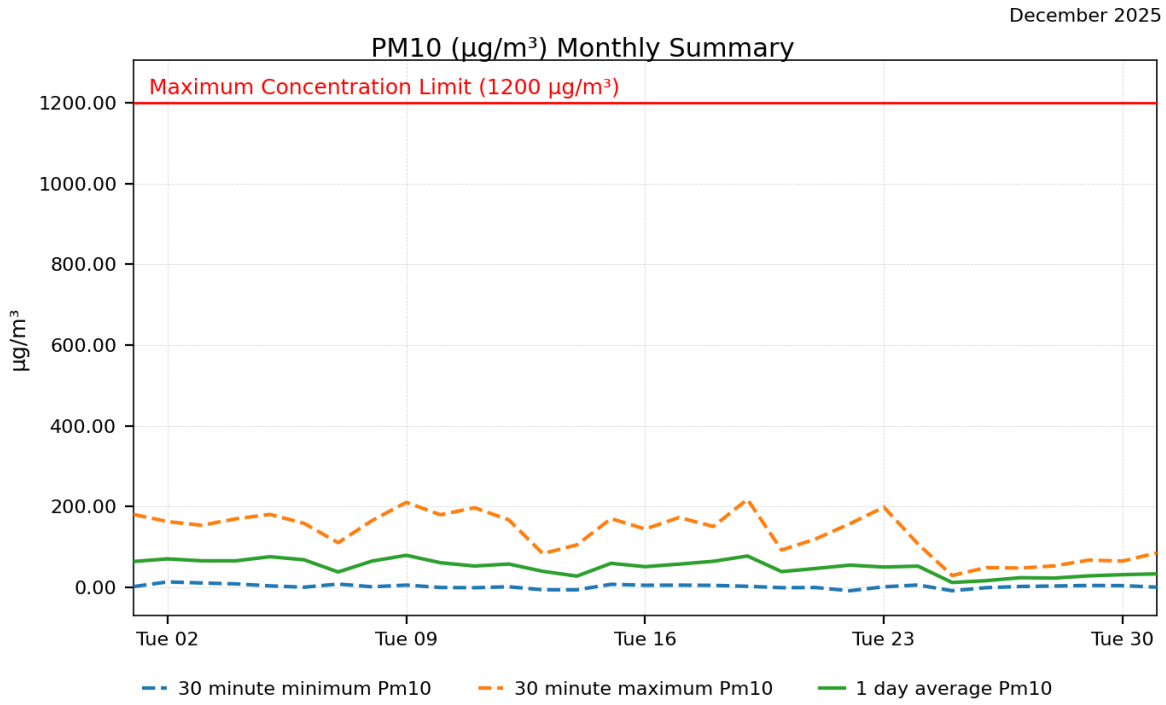

Figure 5. Marden St PM_{10} Averages

9.3.2 Sirius Rd Stack - Monthly Charts

The following charts present 30-minute average minimum, maximum and daily average data CO, NOx, PM10 and VOC for the Marden St Stack, and Sirius Rd combined stack.

30-minute averages are calculated from 5-minute average data. The daily average is calculated from 30-minute average data.

9.3.2.1 Sirius Rd Monthly CO Averages

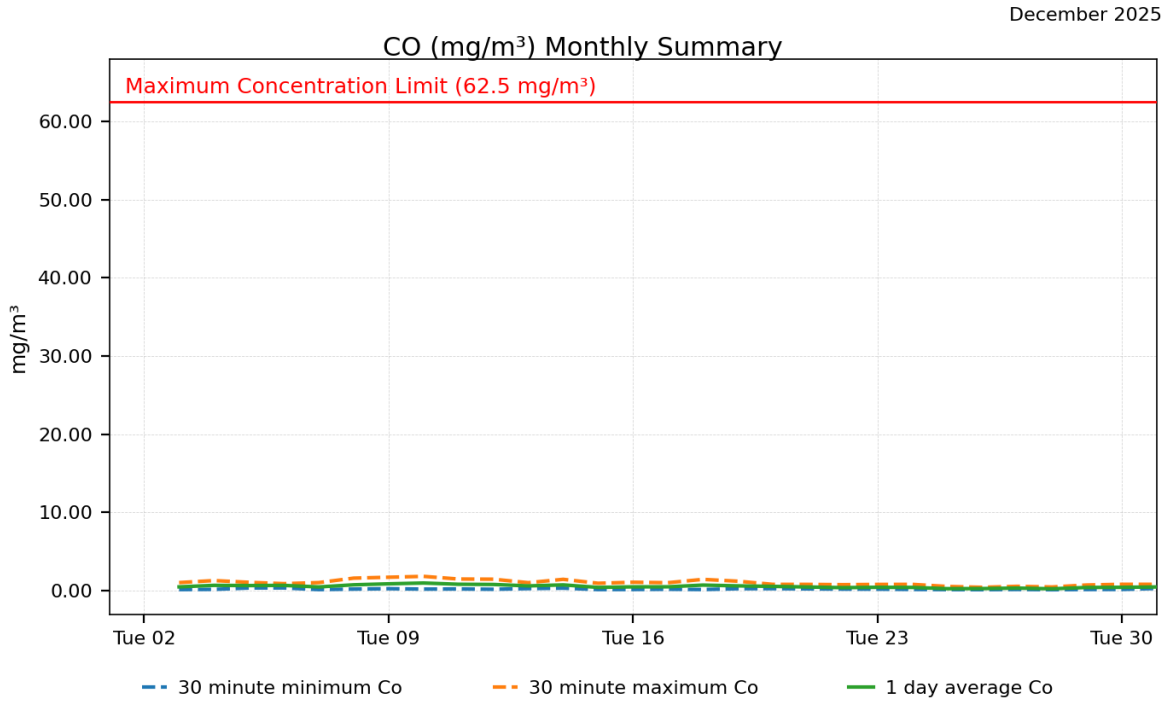

Figure 6. Sirius Rd CO Averages

9.3.2.2 Sirius Rd Monthly VOC Averages

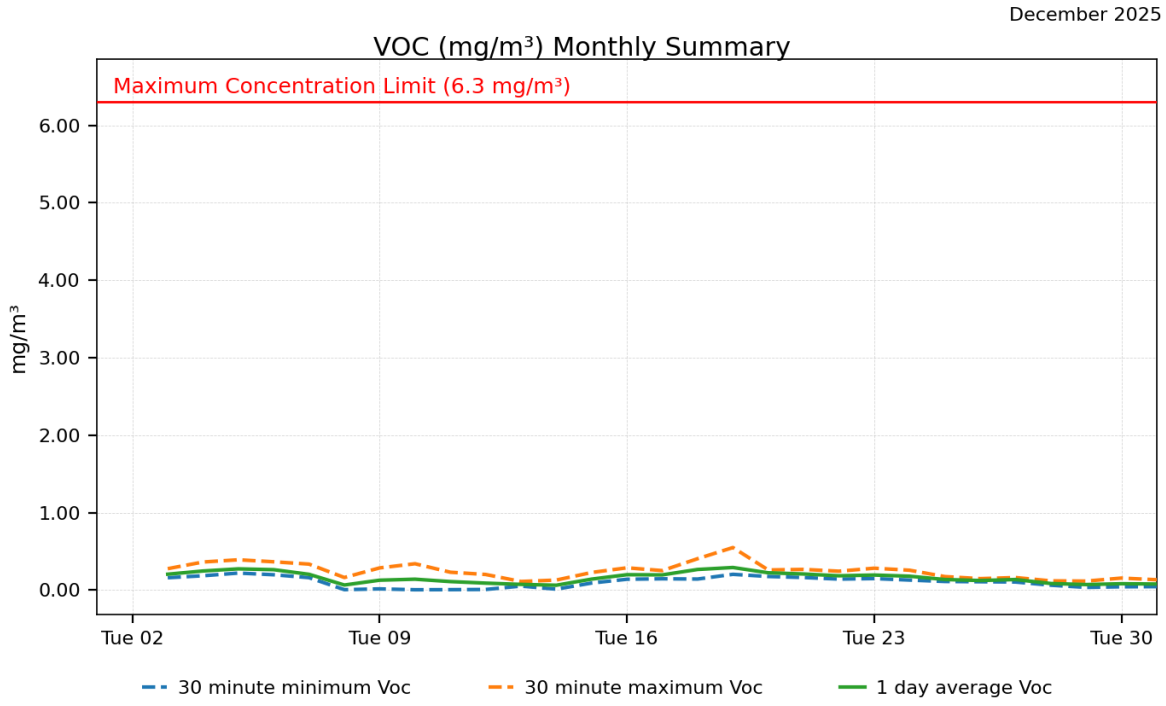

Figure 7. Sirius Rd VOC Averages

9.3.2.3 Sirius Rd Monthly NO_x, NO_2 Averages

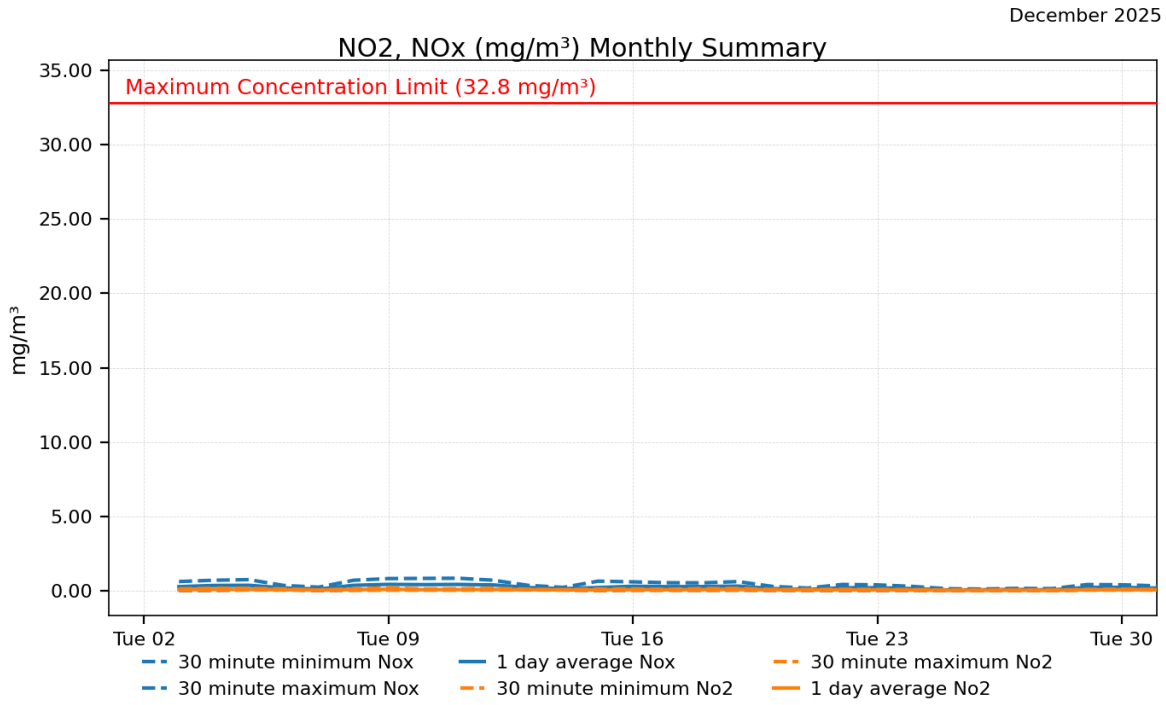

Figure 8. Sirius Rd NOx, NO_2 Averages

9.3.2.4 Sirius Rd Monthly PM_{10} Averages

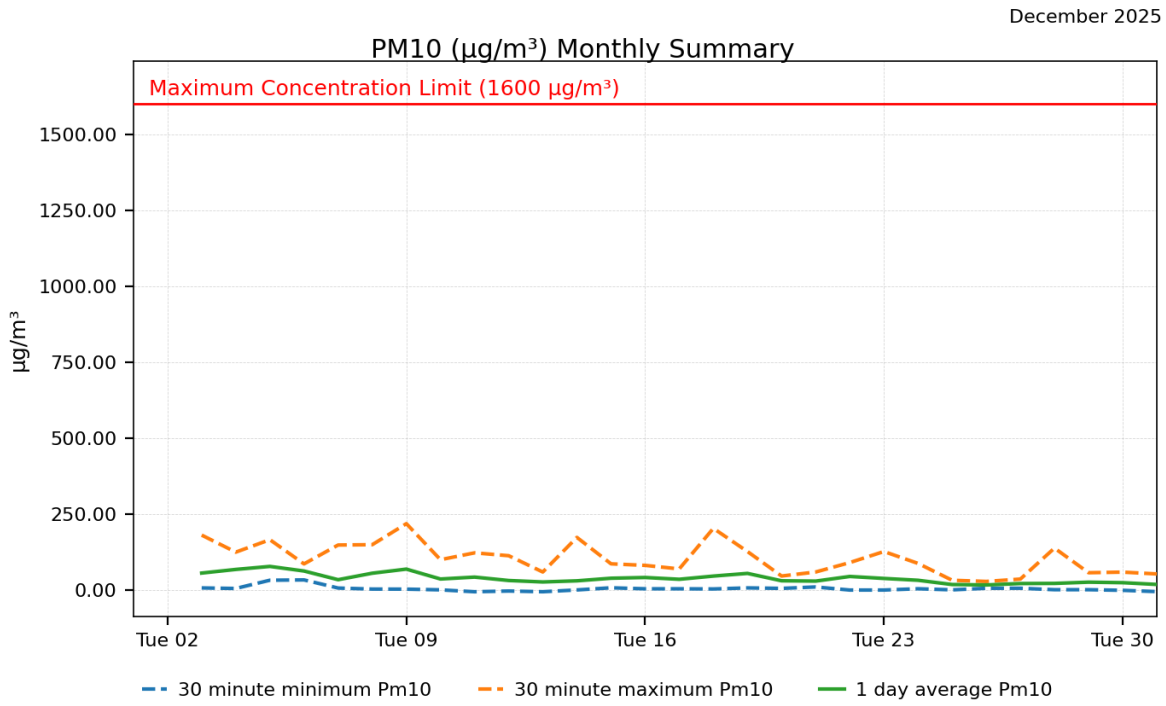

Figure 9. Sirius Rd PM_{10} Averages

9.3.3 Accumulative Loads

The following charts present annual accumulative total loads CO, NO_x, PM_{10} and VOC for the Lane Cove Tunnel ventilation stacks

9.3.3.1 Combined Stacks CO Accumulative Load

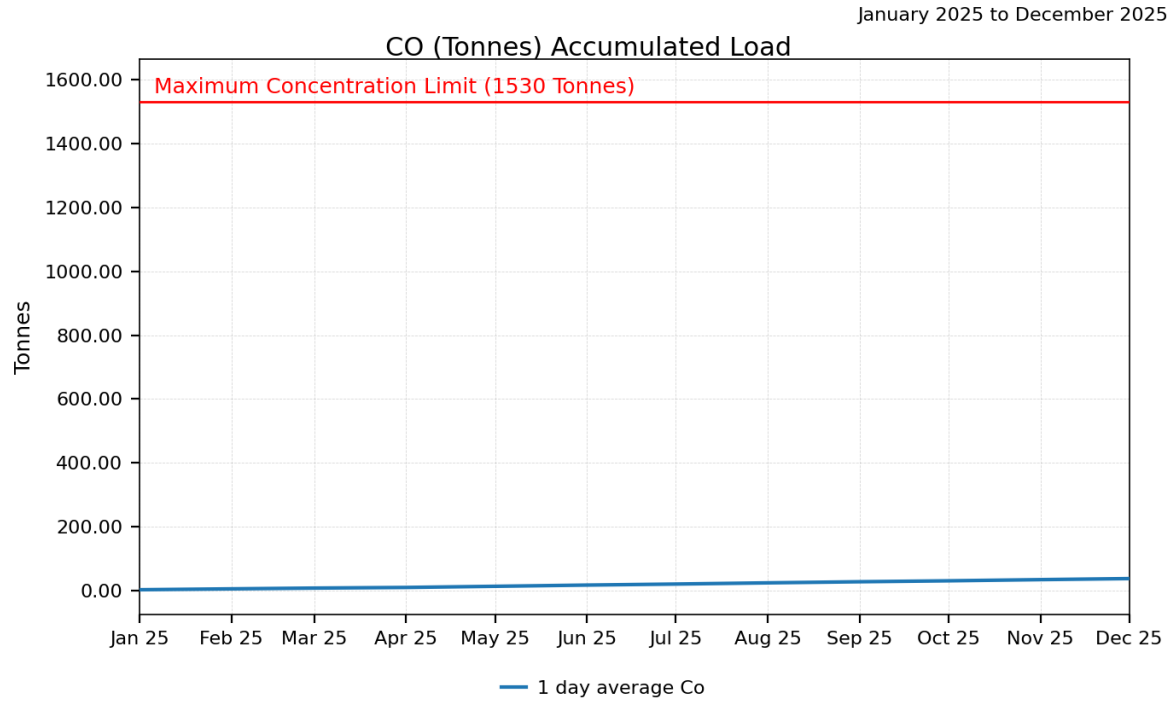

Figure 10. Combined Stacks CO Accumulative Load

9.3.3.2 Combined Stacks VOC Accumulative Load

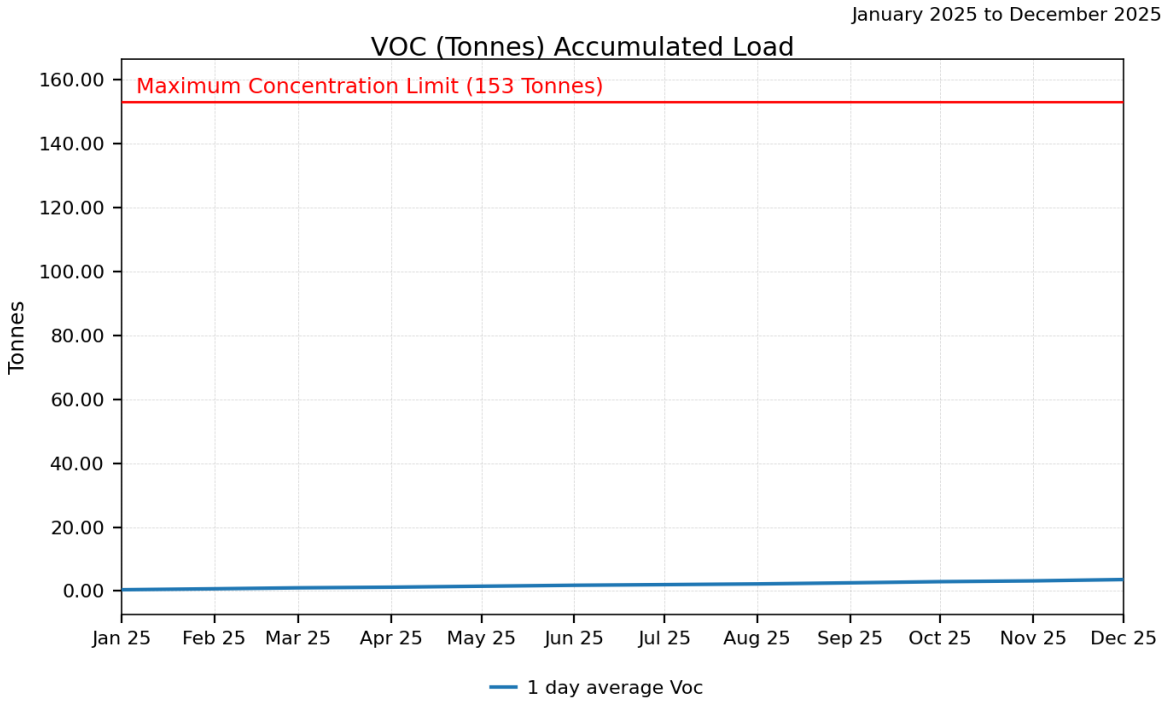

Figure 11. Combined Stacks VOC Accumulative Load

9.3.3.3 Combined Stacks NO_x Accumulative Load

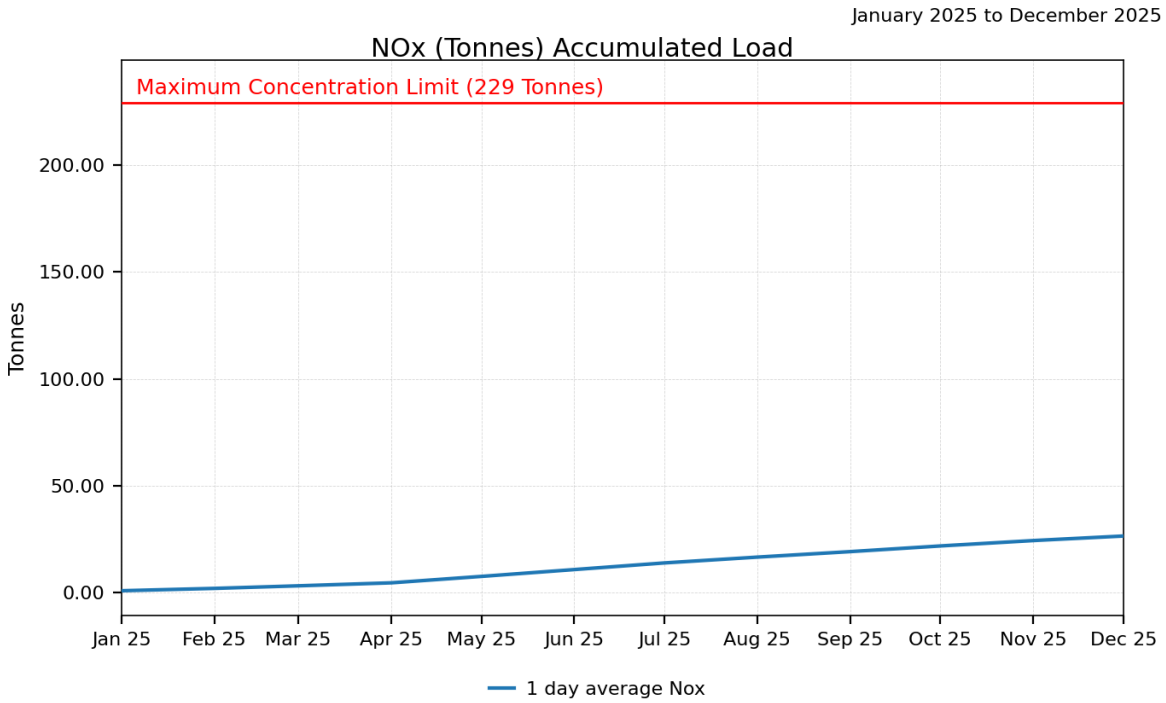

Figure 12. Combined Stacks NO_x Accumulative Load

9.3.3.4 Combined Stacks PM_{10} Accumulative Load

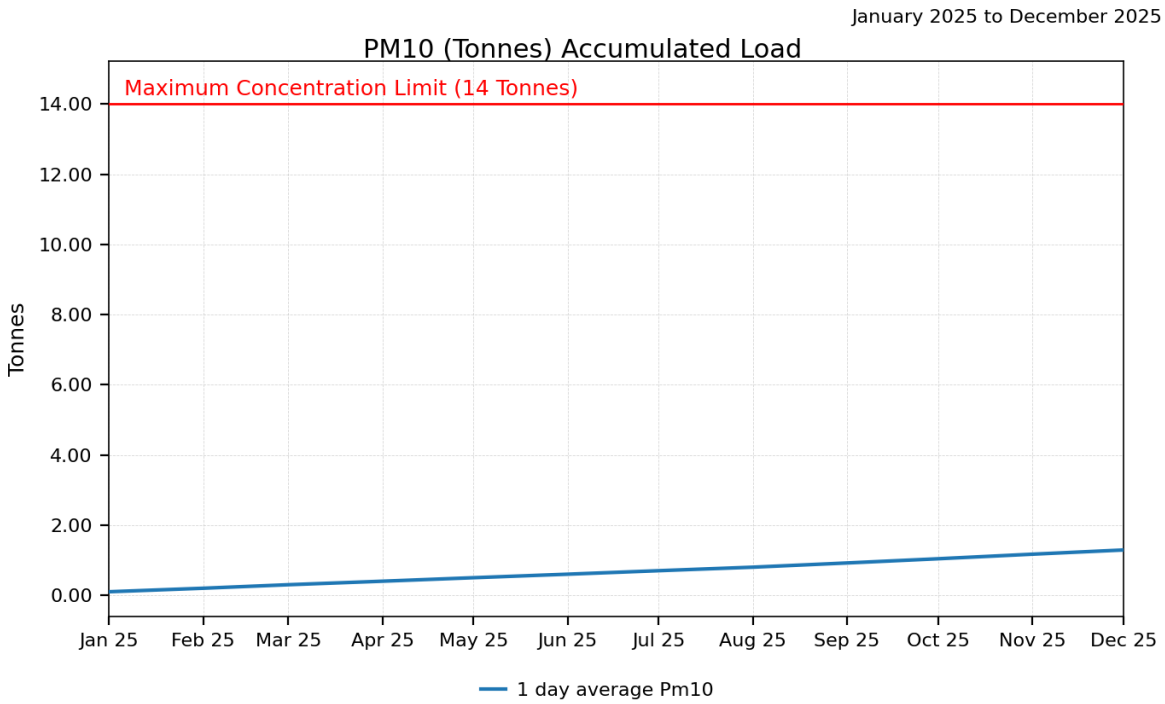

Figure 13. Combined Stacks NO_x Accumulative Load

9.3.4 Marden St Stack - Three Monthly Trends

The following charts present 1day average CO, NOx, PM10 and VOC for the Marden St Stack in three months.

The daily average is calculated from 30-minute average data.

9.3.4.1 Marden St Three Monthly CO 1day Averages

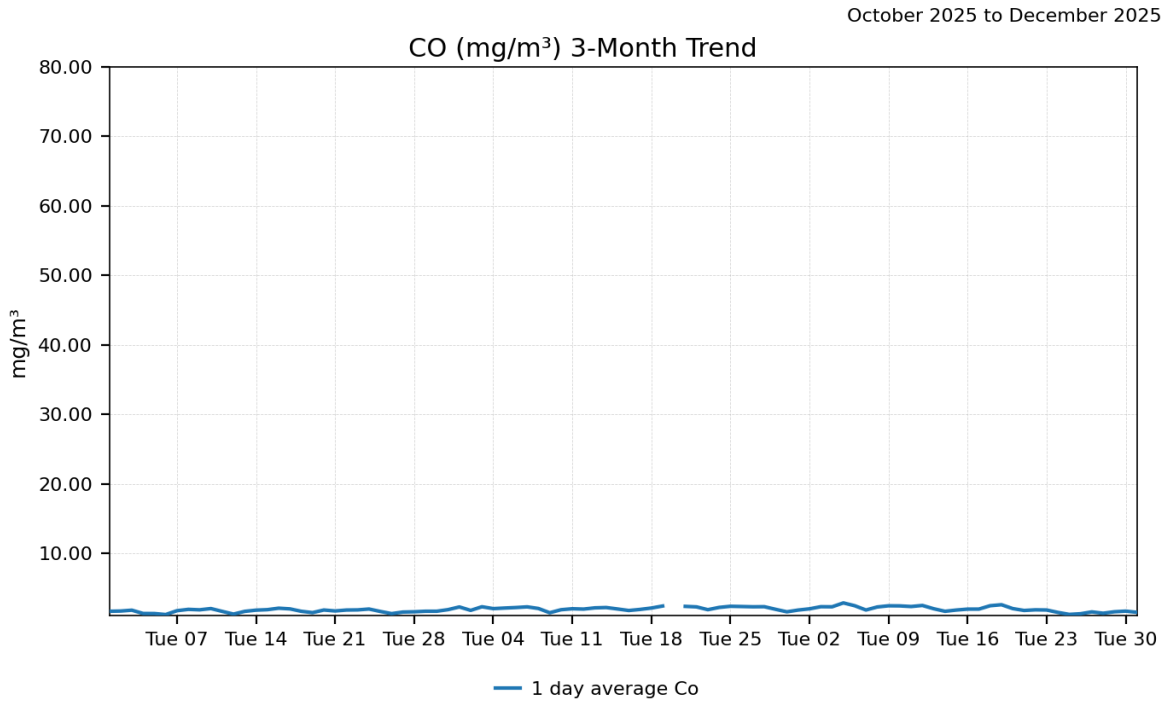

Figure 14. Marden St Three Monthly CO 1day Averages

9.3.4.2 Marden St Three Monthly VOC 1day Averages

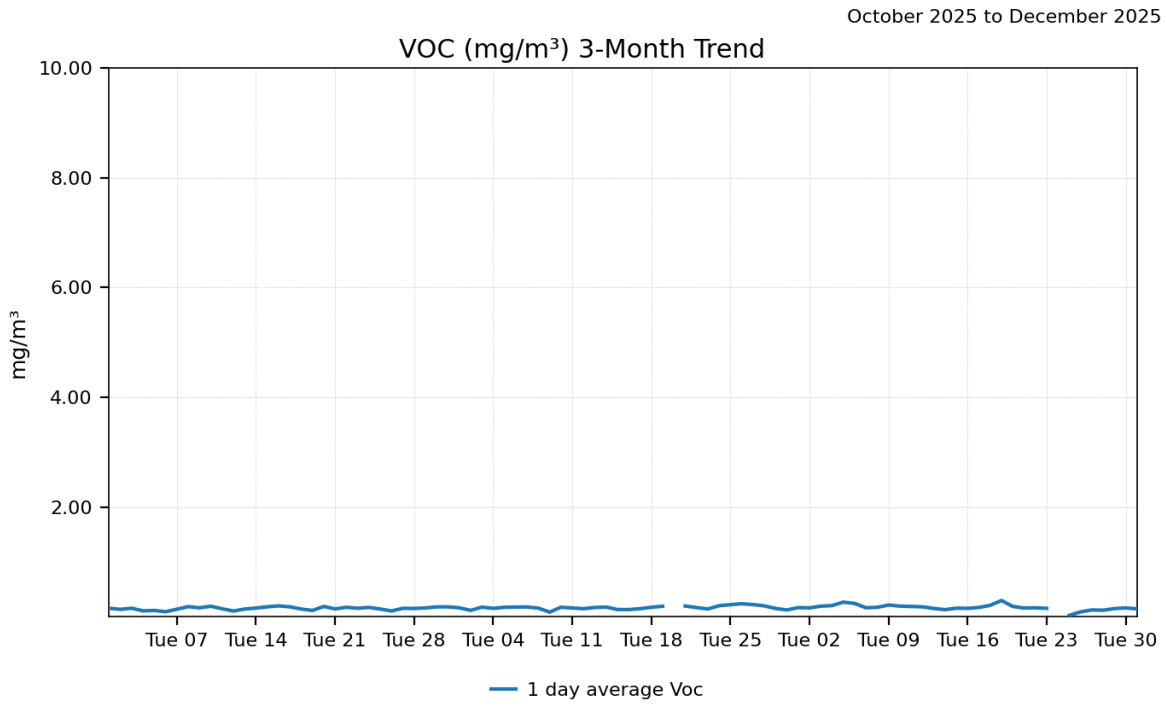

Figure 15. Marden St Three Monthly VOC 1day Averages

9.3.4.3 Marden St Three Monthly NO_x, NO_2 1day Averages

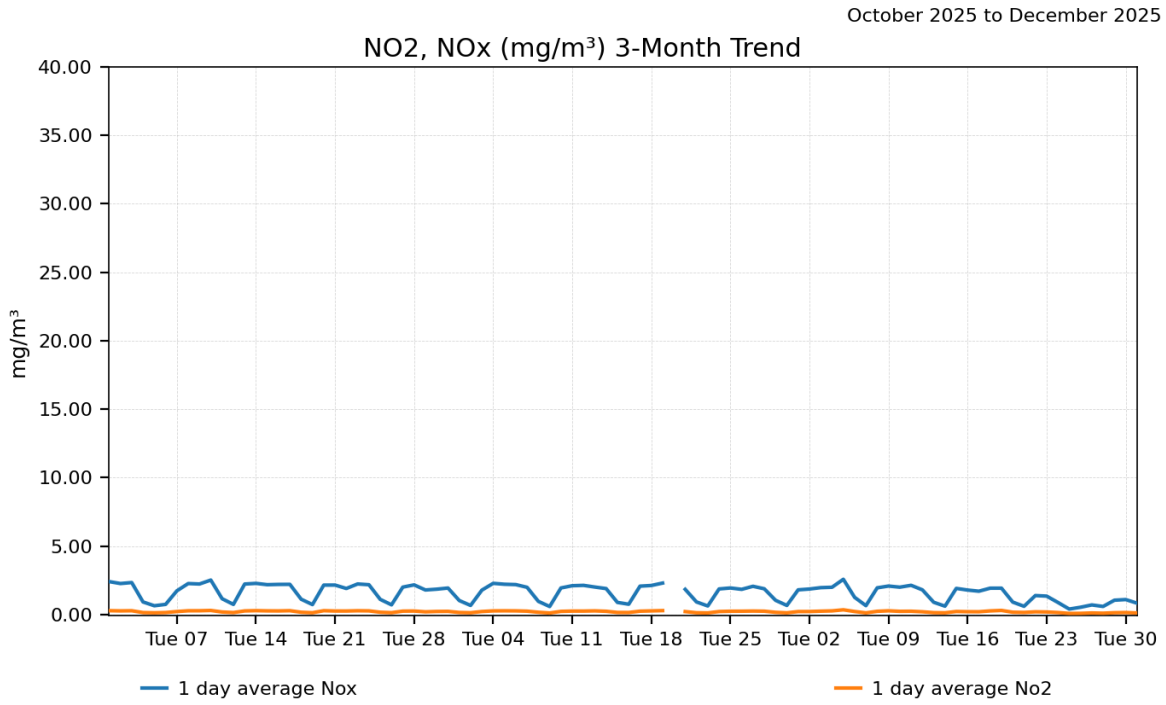

Figure 16. Marden St Three Monthly NO_x, NO_2 1day Averages

9.3.4.4 Marden St Three Monthly PM_{10} 1day Averages

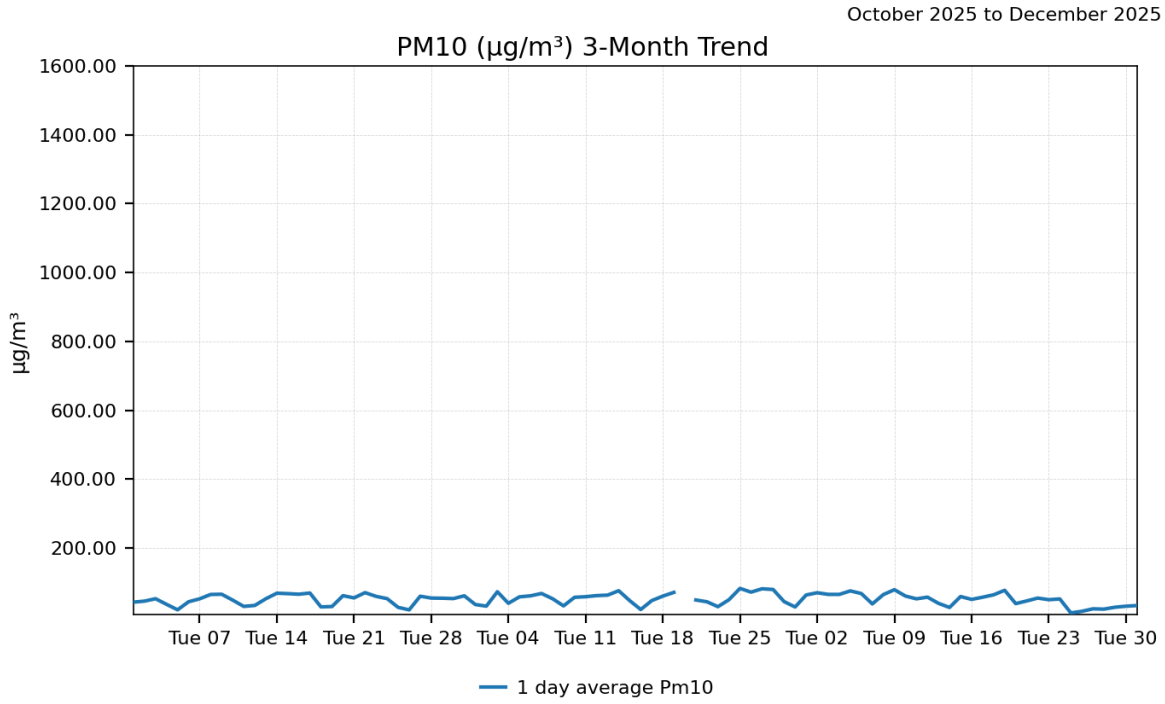

Figure 17. Marden St Three Monthly PM_{10} 1day Averages

9.3.5 Sirius Rd Stack - Three Monthly Trends

The following charts present 1-day average CO, NOx, PM10 and VOC for the Sirius Rd Stack in three months.

The daily average is calculated from 30-minute average data.

9.3.5.1 Sirius Rd Three Monthly CO 1day Averages

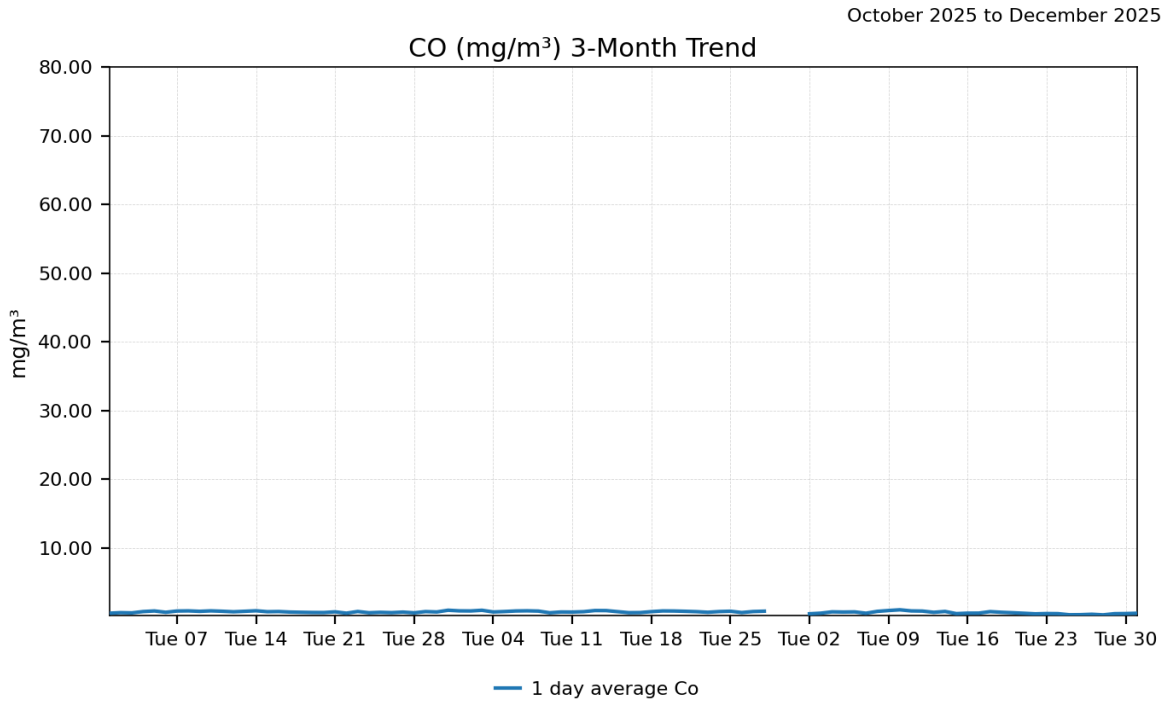

Figure 18. Sirius Rd Three Monthly CO 1day Averages

9.3.5.2 Sirius Rd Three Monthly VOC 1day Averages

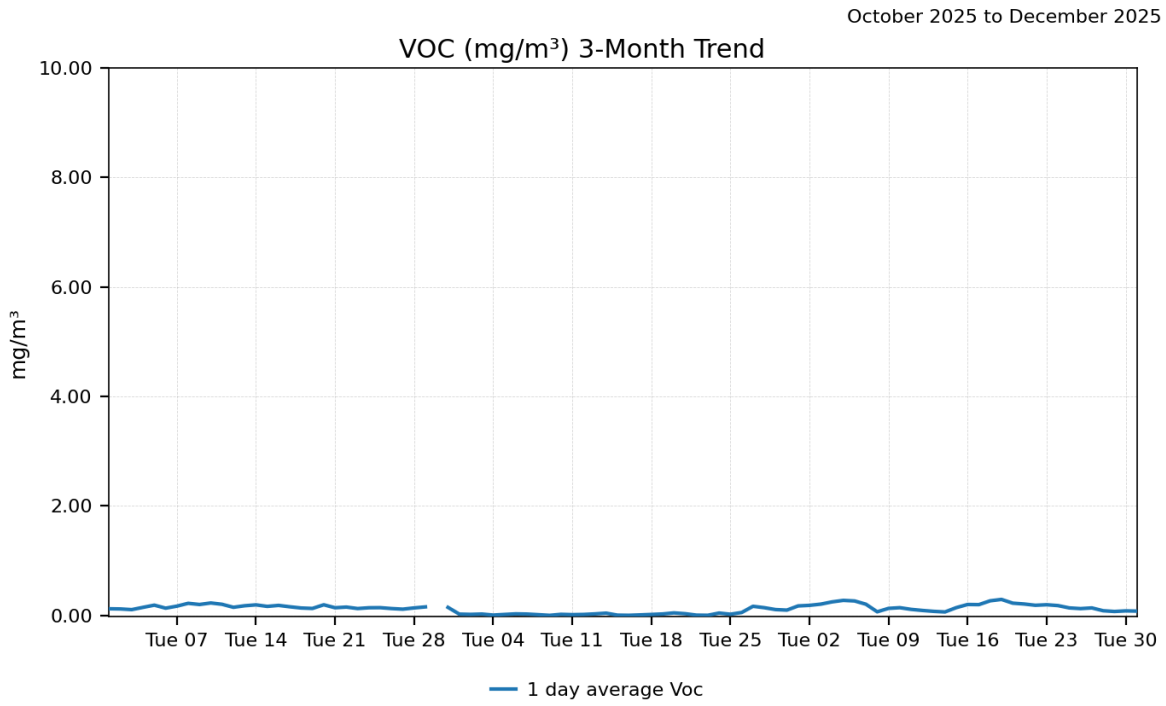

Figure 19. Sirius Rd Three Monthly VOC 1day Averages

9.3.5.3 Sirius Rd Three Monthly NO_x, NO_2 1day Averages

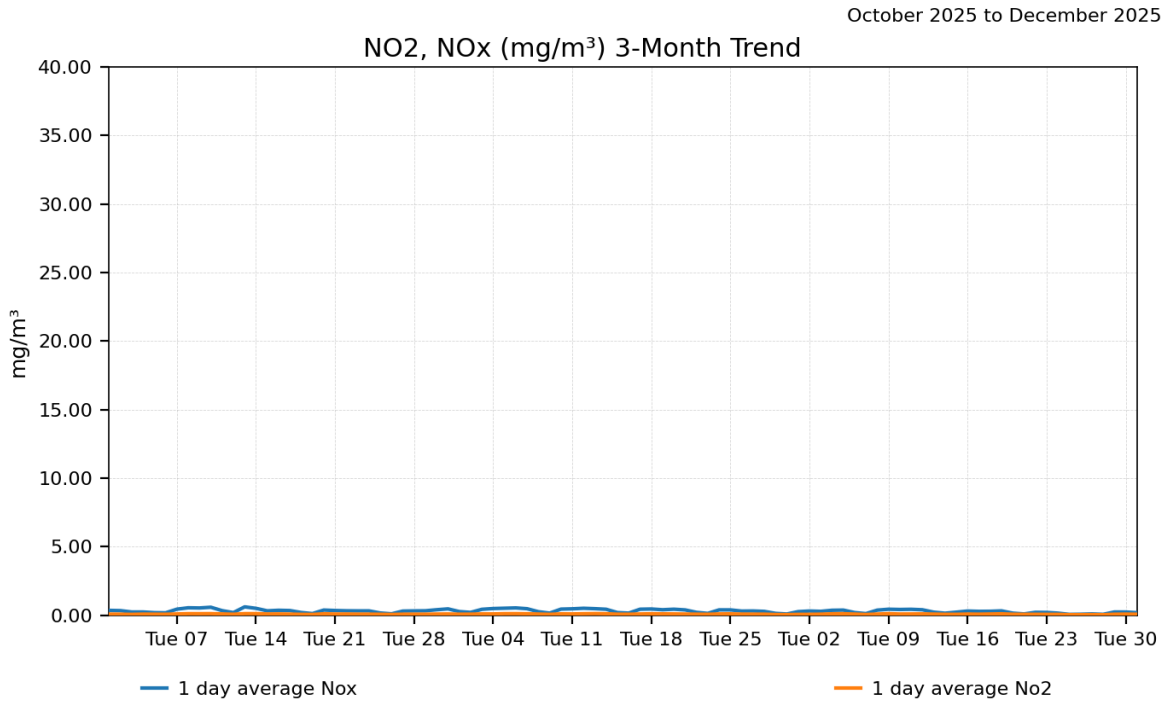

Figure 20. Sirius Rd Three Monthly NO_x, NO_2 1day Averages

9.3.5.4 Sirius Rd Three Monthly PM_{10} 1day Averages

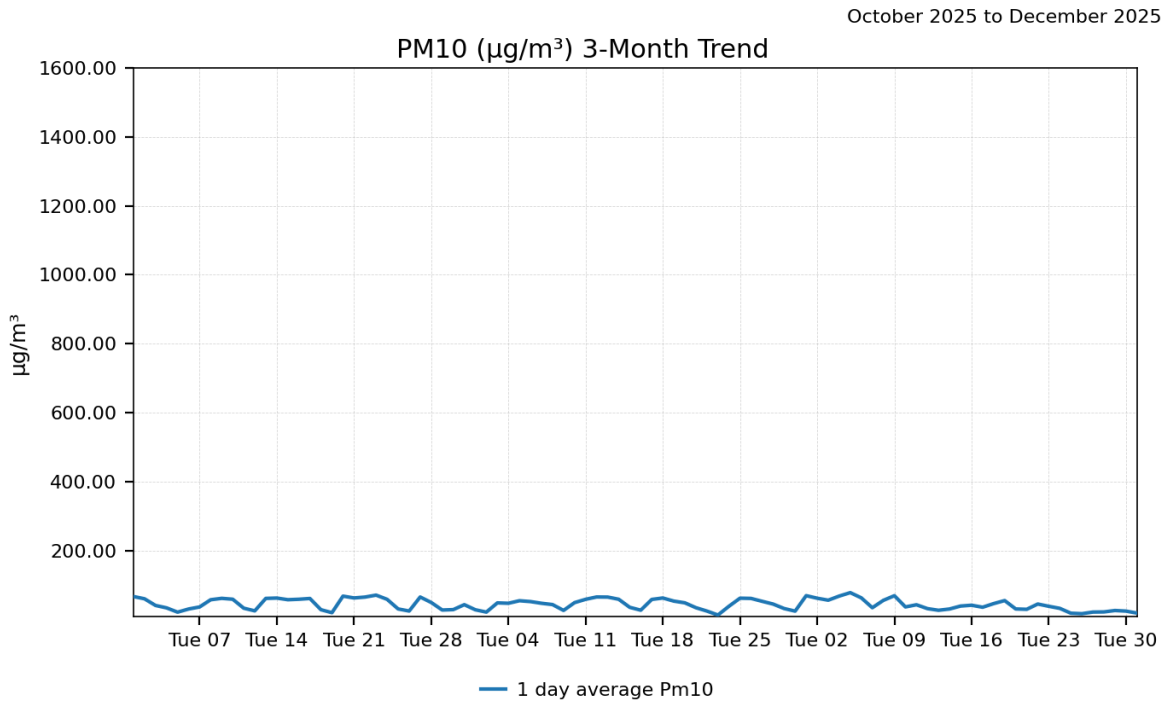

Figure 21. Sirius Rd Three Monthly PM_{10} 1day Averages

10. Data Exceptions

This section outlines any issues noted with the monitoring equipment during the reporting period.

Lane Cove Tunnel – Marden St Data Validation Table – December 2025						
Date from	**Date to**	**Parameters affected**	**Reason**	**Hours Affected**	**Validated By**	**Date**
1/12/2025 0:00	3/12/2025 9:30	CH4	Multiplier applied to data: Multiplier A: 0.931677 Multiplier B: 0.931677	N/A	TA	2/01/2026
1/12/2025 0:00	3/12/2025 9:30	NMHC	Multiplier applied to data: Multiplier A: 0.941423 Multiplier B: 0.941423	N/A	TA	2/01/2026
1/12/2025 1:30	31/12/2025 15:45	PM10, PM2.5	Intermittent unrealistic data - negative	N/A	TA	2/01/2026

7/12/2025 2:05	17/12/2025 9:15	NMHC	Multiplier applied to data: Multiplier A: 0.954603 Multiplier B: 0.954603	N/A	TA	2/01/2026
1/12/2025 13:05	1/12/2025 14:00	All parameters	Maintenance	0.92	TA	2/01/2026
3/12/2025 9:30	3/12/2025 11:00	All parameters	Maintenance	1.50	TA	2/01/2026
17/12/2025 9:15	17/12/2025 10:50	All parameters	Maintenance	1.58	TA	2/01/2026
17/12/2025 10:55	17/12/2025 11:35	PM10, PM2.5	Instrument stabilisation following maintenance	0.67	TA	2/01/2026
23/12/2025 8:40	23/12/2025 9:55	All parameters	Maintenance	1.25	TA	2/01/2026
24/12/2025 2:05	24/12/2025 8:25	VOC	Calibration out of tolerance	6.33	TA	2/01/2026
24/12/2025 8:30	24/12/2025 12:00	All parameters	Maintenance	3.50	TA	2/01/2026
24/12/2025 12:05	31/12/2025 23:59	NMHC	Multiplier applied to data: Multiplier A: 0.953967 Multiplier B: 0.953967	N/A	TA	2/01/2026
25/12/2025 9:05	25/12/2025 10:30	All parameters	Maintenance	1.42	TA	2/01/2026
26/12/2025 8:45	26/12/2025 10:25	All parameters	Maintenance	1.67	TA	2/01/2026

Table 19. Marden St Data Validation Table

Lane Cove Tunnel – Sirius Rd South Data Validation Table – December 2025						
Date from	**Date to**	**Parameters affected**	**Reason**	**Hours Affected**	**Validated By**	**Date**
1/12/2025 0:00	1/12/2025 9:25	CO	Offset applied to data: Offset A: +0.12 Offset B: +0.12	N/A	TA	2/01/2026
1/12/2025 9:30	1/12/2025 12:05	All parameters	Maintenance	2.6	TA	2/01/2026
1/12/2025 12:10	2/12/2025 8:35	CO	Instrument fault	20.4	TA	2/01/2026
1/12/2025 21:00	31/12/2025 15:45	PM10, PM2.5	Intermittent unrealistic data - negative	N/A	TA	2/01/2026
2/12/2025 8:40	2/12/2025 9:20	All parameters	Maintenance	0.7	TA	2/01/2026
2/12/2025 10:55	2/12/2025 12:20	All parameters	Maintenance	1.4	TA	2/01/2026
3/12/2025 11:45	3/12/2025 13:05	All parameters	Maintenance	1.3	TA	2/01/2026
3/12/2025 13:25	14/12/2025 17:00	PM2.5	Intermittent power interruptions due to	N/A	TA	2/01/2026

			faulty air conditioner			
10/12/2025 12:20	10/12/2025 15:15	All parameters	Maintenance	2.9	TA	2/01/2026
16/12/2025 8:10	30/12/2025 16:15	PM2.5	Instrument fault	344.1	TA	2/01/2026
17/12/2025 12:55	17/12/2025 13:35	All parameters	Maintenance	0.7	TA	2/01/2026
18/12/2025 8:30	18/12/2025 10:35	All parameters	Maintenance	2.1	TA	2/01/2026
23/12/2025 10:45	23/12/2025 11:25	All parameters	Maintenance	0.7	TA	2/01/2026
25/12/2025 2:15	31/12/2025 23:59	NMHC	Multiplier applied to data: Multiplier A: 0.95 Multiplier B: 0.95	N/A	TA	2/01/2026
29/12/2025 8:40	29/12/2025 10:45	All parameters	Maintenance	2.1	TA	2/01/2026
30/12/2025 12:45	30/12/2025 13:25	All parameters	Maintenance	0.7	TA	2/01/2026
31/12/2025 8:50	31/12/2025 10:00	All parameters	Maintenance	1.2	TA	2/01/2026

Table 20. Sirius Rd South Data Validation Table

Lane Cove Tunnel – Sirius Rd North Data Validation Table – December 2025						
Date from	**Date to**	**Parameters affected**	**Reason**	**Hours Affected**	**Validated By**	**Date**
1/12/2025 0:00	31/12/2025 23:55	PM2.5	A/C fault - PM2.5 setup as out of service waiting replacement	743.9	TA	2/01/2026
1/12/2025 1:05	31/12/2025 11:45	PM10	Intermittent unrealistic data - negative	N/A	TA	2/01/2026
1/12/2025 9:35	1/12/2025 12:25	All parameters	Maintenance	2.8	TA	2/01/2026
2/12/2025 9:30	2/12/2025 16:40	All parameters	Maintenance	7.2	TA	2/01/2026
3/12/2025 11:40	3/12/2025 13:15	All parameters	Maintenance	1.6	TA	2/01/2026
10/12/2025 9:45	10/12/2025 12:00	All parameters	Maintenance	2.3	TA	2/01/2026
17/12/2025 13:15	17/12/2025 13:35	All parameters	Maintenance	0.3	TA	2/01/2026

Table 21. Sirius Rd North Data Validation Table

11. Report Summary

There was nil above goal readings recorded during the reporting period.

12. Data validation explanations

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Offset or Multiplier Applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to a communication fault between the logger and the instrument.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Missing data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how the operation of the instrument is being affected.
Instrument out of service refers to an unavailability of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was unavailable due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Warm up after power interruption refers to the start up period of an instrument after power has been restored.