

# TfNSW – Rozelle Interchange WestConnex 3B Project

## Ambient Air Quality and Weather Monitoring

### Validated Report

## 1<sup>st</sup> October 2023 – 31<sup>st</sup> October 2023

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## Executive Summary

The Rozelle Interchange and Iron Cove Link will provide a new underground motorway interchange to City West Link and provide an underground bypass of Victoria Road between the Iron Cove Bridge and the ANZAC Bridge, with links to the approved Western Harbour Tunnel.

The interchange in Rozelle will be mostly underground and located at the site of the old Rozelle Rail Yards.

This Report details ambient air measurements. It is part of the commitment to the Minister and the community to report air quality measurements in real-time (raw data as the measurements occur) as well as validated reports. It is important to re-publish the data in reports because the raw data needs to be checked and collated by approved air quality experts and 'translated' into a format that is easy to understand and can be interpreted by both experts and laypeople.

This report details results at four external ambient air quality monitoring stations located at Quirk Street, Chapman Road, Manning Street and Bridgewater Park between 1<sup>st</sup> October 2023 and 31<sup>st</sup> October 2023

## Report Summary

Percentage availability for all parameters at the WestConnex 3B Ambient Air Quality Monitoring Network was above 95% during the reporting month except for PM<sub>2.5</sub>, PM<sub>10</sub>, CO, NO, NO<sub>2</sub>, NO<sub>x</sub>, WS, WD, Sigma, AT 2m, AT 10m data capture of Chapman Road station due to a power outage. WS, WD, Sigma at Manning Street station was due to flatlined data and PM<sub>10</sub> at Bridgewater Park station that were mainly due to instrument faults.

Please refer to Table 11, and Tables 17-20 for details.

There were 14 exceedances of the air quality goals at the WestConnex 3B Ambient Air Quality Monitoring station for the reporting month.

Please refer to Tables 12-15 in Section 5.2 – Air Quality Monthly Summary for further information.

## 1.0 Introduction

Acoem Australasia (Ecotech) was commissioned by TfNSW – Rozelle Interchange to provide monitoring and data reporting for the WCX 3B Project ambient air quality and weather monitoring network, located as detailed in Table 1. Acoem Australasia (Ecotech) commenced data collection in October 2022.

This report presents the available data for October 2023.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

## 2.0 Monitoring and Data Collection

### 2.1. Siting Details

The WCX 3B Project monitoring network consists of four ambient air quality and weather monitoring stations. The stations' location and siting details are described below.

**Table 1: WCX 3B Project Monitoring Site Locations**

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Quirk Street	33°52'00.3"S, 151°10'18.0"E	23
Chapman Road	33°52'20.8"S, 151°10'29.5"E	6
Manning Street	33°51'50.1"S, 151°09'25.2"E	15
Bridgewater Park	33°51'33.9"S, 151°09'58.1"E	9

A siting audit to assess sites for compliance with *AS/NZS 3580.1.1:2016* and *AS/NZS 3580.14:2014* have been completed as follows:

- Quirk Street on 18/10/2023
- Chapman Road on 13/10/2023
- Manning Street on 24/10/2023
- Bridgewater Park on 01/11/2022



**Figure 1: WCX 3B Project Monitoring Station Locations**



## 2.2. Monitored Parameters

Tables 2 below detail the parameters monitored and the instruments used at the WCX 3B Project monitoring stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

**Table 2: Parameters measured at the WCX – 3B Monitoring Stations**

Parameter Measured	Instrument and Measurement Technique	Elevation
CO	Acoem Australasia (Ecotech) Serinus 30 – NDIR gas filter correlation infrared photometry	2 m
NO, NO <sub>2</sub> , NO <sub>x</sub>	Acoem Australasia (Ecotech) Serinus 40 – gas phase chemiluminescence	2 m
PM <sub>2.5</sub>	Met One BAM 1020 – Beta ray attenuation	2 m
PM <sub>10</sub>	Thermo – 1405 TEOM (Tapered Element Oscillating Microbalance)	2m
Differential Temperature (Elevation 2m)	Rotronics HC2A-S3 Standard Meteo Probe	2 m
Differential Temperature (Elevation 10m)	Rotronics HC2A-S3 Standard Meteo Probe	10 m
Wind Speed (Horizontal, elevation 10m)	Gill Windsonic Op3	10 m
Wind Direction (Elevation 10m)	Gill Windsonic Op3	10 m
Sigma	Calculation	-

### 2.3. Data Collection Methods

Table 3 below shows the methods used for data collection.

**Table 3: Methods**

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO <sub>2</sub> , NO <sub>x</sub>	AS 3580.5.1 - 2011	Methods for sampling and analysis of ambient air - Method 5.1: Determination of oxides of nitrogen-Chemiluminescence method
CO	AS 3580.7.1 - 2011	Methods for sampling and analysis of ambient air. Method 7.1: Determination of carbon monoxide—Direct-reading instrumental method
PM <sub>10</sub> (TEOM)	AS 3580.9.8-2022	Methods for sampling and analysis of ambient air. Method 9.8: Determination of suspended particulate matter - PM <sub>10</sub> continuous direct mass method using a tapered element oscillating microbalance analyzer.
PM <sub>2.5</sub> (BAM 1020)	AS/NZS 3580.9.12-2022 <sup>1</sup>	Methods for sampling and analysis of ambient Air - Method 9.12: Determination of suspended particulate matter—PM <sub>2.5</sub> beta attenuation monitors
Vector Wind Speed (Horizontal)	AS 2923-1987 <sup>2</sup>	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
Vector Wind Direction	AS 2923-1987 <sup>2</sup>	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
Sigma	AS 2923-1987 <sup>2</sup>	Methods of sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
Atmospheric Temperature	USEPA (2000) EPA 454/R-99-005 <sup>2</sup>	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications

<sup>1</sup> As approved by the Department of Planning and Environment on 30<sup>th</sup> August 2021.

<sup>2</sup> Superseded by AS/NZ 3580.14 2014 but specifically referenced in ministerial conditions.

Note: Two different measurement techniques are used for monitoring PM<sub>10</sub> and PM<sub>2.5</sub> at the WCX 3B Project Stations. Studies conducted in Canada, the United States and other countries have found that the Tapered Element Oscillating Microbalance (TEOM) monitors can under report concentrations compared to the Beta Attenuation Monitors (BAM), especially when the air contains a large proportion of semi-volatile particulate matter, which may be the case during cooler seasons when the air contains less coarse dust and a greater proportion of semi-volatile organic compounds such as those associated with wood smoke. As a result, it is normal to see occasional periods where PM<sub>10</sub> < PM<sub>2.5</sub> and this situation does not necessarily indicate a fault with either instrument.

### 2.3.1. NATA Endorsement and Conformity with Standards

Unless stated below, parameters are monitored at the WCX 3B Project Stations according to the stated methods detailed in Table 3 above.

### 2.3.2. Data Acquisition

Data acquisition is performed using a PC based Congrego logger situated at each of the monitoring sites. Each logger is equipped with a 4G modem for remote data collection. The recorded data is remotely collected from the Air Quality Monitoring Station (AQMS) loggers on a daily basis (using Airodis™ version 5.2) and stored at Acoem Australasia (Ecotech)'s Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

## 2.4. Data Validation and Reporting

### 2.4.1. Validation

The Acoem Australasia (Ecotech) ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Acoem Australasia (Ecotech) ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations, and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g., backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute (all parameters except PM<sub>2.5</sub>) and one-hour data (PM<sub>2.5</sub> only) as appropriate.

### 2.4.2. Reporting

Data is reported in four Microsoft Excel format files named:

- *WestConnex 3B Site 1 Quirk Street Monthly Data Report October 2023.xlsx*
- *WestConnex 3B Site 2 Chapman Road Monthly Data Report October 2023.xlsx*
- *WestConnex 3B Site 3 Manning Street Monthly Data Report October 2023.xlsx*
- *WestConnex 3B Site 4 Bridgewater Park Monthly Data Report October 2023.xlsx*

Each Excel file consists of 6 worksheets:

1. Cover
2. Contents
3. 5-Minute Data
4. 1-hour Data
5. 24-hour Data
6. Valid Data Exception Report

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute (all parameters except PM<sub>2.5</sub>) and one-hour data (PM<sub>2.5</sub> only). Averages are based on a minimum of 75% valid readings within the averaging period. Where data capture is low for a particular parameter, summary values (e.g., monthly maximum

and minimum) may be based on less than 75% valid samples. The reader should use caution when interpreting these values as they may not be representative of conditions for the entire sample period.

Averaging periods of eight hours or less are reported for the end of the period, i.e., the hourly average 02:00 am is for the data collected from 1:00 am to 2:00 am. 1-hour averages are calculated based on a clock hour. 24-hour averages are calculated based on calendar days.

**Table 4: Automatic Span / Zero/ Stabilization and Background checks at WestConnex 3B stations**

Station	Parameter	Span / Zero / Stabilization	Background
Quirk Street	NO / NO <sub>2</sub> / NO <sub>x</sub>	01:00 – 01:25	n/a
	CO	01:00 – 01:25	23:55 – 00:00
Chapman Road	NO / NO <sub>2</sub> / NO <sub>x</sub>	01:00 – 01:25	n/a
	CO	01:00 – 01:25	23:50 – 23:55
Manning Street	NO / NO <sub>2</sub> / NO <sub>x</sub>	01:00 – 01:25	n/a
	CO	01:00 – 01:25	23:45 – 23:50
Bridgewater Park	NO / NO <sub>2</sub> / NO <sub>x</sub>	01:00 – 01:25	n/a
	CO	01:00 – 01:25	23:45 – 23:50

### 3.0 Air Quality Goals

The air quality goals and criteria for pollutants monitored at the WestConnex 3B Project ambient monitoring sites are based on SSI-7485 Planning Approval Condition E6. The air quality goals and criteria are shown in Table 5 below.

Table 5: WestConnex 3B Project - Air Quality Goals

Parameter	Time Period	Goal Level	Units
CO	8 hours (rolling, based on 1-hour averages)	9.0	ppm
NO <sub>2</sub>	1 hour	0.12	ppm
PM <sub>10</sub>	1 day	50	µg/m <sup>3</sup>
	1 year	25	µg/m <sup>3</sup>
PM <sub>2.5</sub>	1 day	25	µg/m <sup>3</sup>
	1 year	8	µg/m <sup>3</sup>

Note:

This report will include all valid data points that exceed the defined air quality standards. The Ambient Air Quality NEPM includes a provision for excluding 1-day PM<sub>10</sub> or PM<sub>2.5</sub> averages associated with “exceptional events” from the total exceedances of the Air Quality standard. The definition of an “exceptional event” is included below for reference. It is the responsibility of the end user of this data to evaluate whether any reported exceedances are associated with exceptional events and are eligible to be excluded from the exceedance total. Monitoring and reporting of exceedances during the operational project will be in accordance with the Planning Approval Conditions E10, E11 and E12.

As per the Ambient Air Quality NEPM, **Exceptional event** means a fire or dust occurrence that adversely affects air quality at a particular location, and causes an exceedance of 1-day average standards in excess of normal historical fluctuations and background levels, and is directly related to: bushfire; jurisdiction authorized hazard reduction burning; or continental scale windblown dust.

## 4.0 Calibrations and Maintenance

### 4.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

**Table 6: Units and Uncertainties**

Parameter	Units	Resolution	Uncertainty	Measurement Range <sup>3</sup>
NO, NO <sub>x</sub> (S40)	ppm	0.001 ppm	± (6% of reading + 0.011 ppm) k factor of 2.0	0 to 0.5 ppm LDL = 0.0004 ppm
NO <sub>2</sub> (S40)	ppm	0.001 ppm	± (6% of reading + 0.011 ppm) k factor of 2.0	0 to 0.5 ppm LDL = 0.0004 ppm
CO (S30)	ppm	0.1 ppm	± (7% of reading + 0.8 ppm) k factor of 2.0	0 to 50 ppm LDL = 0.04 ppm
PM <sub>2.5</sub> (BAM1020)	µg/m <sup>3</sup>	1 µg/m <sup>3</sup>	24Hr: ± (5.5% of reading + 4.0 µg/m <sup>3</sup> ) (in range 0 - 100 µg/m <sup>3</sup> ) Hr: ± (8% of reading + 8.0 µg/m <sup>3</sup> ) k factor of 2.0	0 to 1000 µg/m <sup>3</sup> LDL <sub>24hr</sub> = 1.0 µg/m <sup>3</sup> LDL <sub>hr</sub> = 4.8 µg/m <sup>3</sup>
PM <sub>10</sub> (TEOM)	µg/m <sup>3</sup>	0.1 µg/m <sup>3</sup>	± 5.0 µg/m <sup>3</sup> or 3.6% of reading, whichever is the greater K factor of 2.0	0 to 1 g/m <sup>3</sup> LDL = 5 µg/m <sup>3</sup>
Vector Wind Speed	m/s	0.1 m/s	± 0.4 m/s or 2 % of reading, whichever is greater K factor of 2.0	0 to 30 m/s
Vector Wind Direction	deg	1 deg	± 4 deg K factor of 2.0	0 to 360 deg <i>Starting threshold:</i> 0 m/s

<sup>3</sup> Uncertainties may not be calculated based on the full measurement range. The max measurement range for gas analyzers is defined as the full scale (FS=Span/0.8).

Parameter	Units	Resolution	Uncertainty	Measurement Range <sup>3</sup>
Ambient Temperature	°C	0.1°K	± 0.6°K K factor of 2.0	263.15°K to 323.15°K



**4.2. Maintenance**

**4.2.1. Calibration & Maintenance Summary Tables**

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Tables 7-10 indicate when the pollutant and meteorological equipment were last maintained/calibrated.

**Table 7: WCX Quirk Street Maintenance Table - October 2023**

Parameter	Date of Last Scheduled Maintenance	Maintenance Type <sup>4</sup>	Date of Last Calibration	Calibration Cycle
NO, NO <sub>2</sub> , NO <sub>x</sub>	17/10/2023	Yearly	17/10/2023	Yearly
CO	17/10/2023	Yearly	17/10/2023	Yearly
PM <sub>10</sub>	16/10/2023	Yearly	16/10/2023	Yearly
PM <sub>2.5</sub>	16/10/2023	Yearly	16/10/2023	Yearly
WS/WD/Sigma	18/10/2023	Yearly	28/03/2022 <sup>5</sup>	2 Yearly
Differential Temperature 2m	18/10/2023	6 Monthly	18/10/2023	Yearly
Differential Temperature 10m	18/10/2023	6 Monthly	18/10/2023	Yearly

<sup>4</sup> Additional visits may have been made as required.

<sup>5</sup> Wind sensor calibrated on 28/03/2022 and installed at this site on 25/10/22.

Table 8: WCX Chapman Road Maintenance Table October 2023

Parameter	Date of Last Scheduled Maintenance	Maintenance Type <sup>6</sup>	Date of Last Calibration	Calibration Cycle
NO, NO <sub>2</sub> , NO <sub>x</sub>	11/10/2023	Yearly	11/10/2023	Monthly
CO	11/10/2023	Yearly	11/10/2023	Monthly
PM <sub>10</sub>	11/10/2023	Yearly	11/10/2023	Yearly
PM <sub>2.5</sub>	11/10/2023	Yearly	11/10/2023	Yearly
WS/WD/Sigma	11/10/2023	Yearly	25/03/2022 <sup>7</sup>	2 Yearly
Differential Temperature 2m	12/10/2023	6 Monthly	12/10/2023 <sup>8</sup>	Yearly
Differential Temperature 10m	12/10/2023	6 Monthly	12/10/2023 <sup>9</sup>	Yearly

<sup>6</sup> Additional visits may have been made as required.

<sup>7</sup> Wind sensor calibrated on 25/03/22 and installed at this site on 20/10/22.

<sup>8</sup> Function check only. Laboratory calibration performed 4/04/22.

<sup>9</sup>Function check only. Laboratory calibration performed 7/04/22.

Table 9: WCX Manning Street Maintenance Table October 2023

Parameter	Date of Last Scheduled Maintenance	Maintenance Type <sup>10</sup>	Date of Last Calibration	Calibration Cycle
NO, NO <sub>2</sub> , NO <sub>x</sub>	19/10/2023	Yearly	19/10/2023	Yearly
CO	19/10/2023	Yearly	19/10/2023	Yearly
PM <sub>10</sub>	18/10/2023	Yearly	18/10/2023	Yearly
PM <sub>2.5</sub>	18/10/2023	Yearly	18/10/2023	Yearly
WS/WD/Sigma	24/10/2023	Yearly	08/04/2022 <sup>11</sup>	2 Yearly
Differential Temperature 2m	24/10/2023	Yearly	24/10/2023 <sup>12</sup>	6 Monthly
Differential Temperature 10m	24/10/2023	Yearly	24/10/2023 <sup>13</sup>	6 Monthly

<sup>10</sup> Additional visits may have been made as required.

<sup>11</sup> Wind sensor calibrated on 08/04/22 and installed at this site on 19/10/22.

<sup>12</sup> Function check only. Laboratory calibration performed 31/03/22.

<sup>13</sup> Function check only. Laboratory calibration performed 7/04/22.

Table 10: WCX Bridgewater Park Maintenance Table October 2023

Parameter	Date of Last Scheduled Maintenance	Maintenance Type <sup>14</sup>	Date of Last Calibration	Calibration Cycle
NO, NO <sub>2</sub> , NO <sub>x</sub>	26/10/2023	Monthly	26/10/2023	Monthly
CO	26/10/2023	Monthly	26/10/2023	Monthly
PM <sub>10</sub>	26/10/2023	Monthly	01/11/2022	Yearly
PM <sub>2.5</sub>	26/10/2023	Monthly	01/11/2022	Yearly
WS/WD/Sigma	26/10/2023	Monthly	26/03/2022 <sup>15</sup>	2 Yearly
Differential Temperature 2m	26/10/2023	Monthly	12/05/2023 <sup>16</sup>	6 Monthly
Differential Temperature 10m	26/10/2023	Monthly	12/05/2023 <sup>17</sup>	6 Monthly

<sup>14</sup> Additional visits may have been made as required.

<sup>15</sup> Wind sensor calibrated on 26/03/22. Installed at this site and function check performed on 01/11/22.

<sup>16</sup> Function check only. Laboratory calibration performed 31/03/22.

<sup>17</sup> Function check only. Laboratory calibration performed 4/04/22.

## 5.0 Results

### 5.1. Data Capture

Valid data capture refers to the amount of valid data collected during the report period. It is based on 5-minute data, for gaseous and meteorological parameters and 1-hour data for particulate parameters.

The percentage of valid data captured is calculated using the following equation:

$$\text{Valid Data capture} = (\text{Reported air quality data} / \text{Total data}) \times 100\%$$

Where:

- Reported air quality data = Number of samples (instrument readings) which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, equipment failures, planned and unplanned maintenance.
- Total data = Total number of samples (instrument readings) expected for the sampling period. Total data is calculated based on the same averaging period as “reported air quality data” and the duration of the corresponding report period. e.g., for 5-minute data collected over a month of 31 days, the total data would be equal to 12 (5-minute samples in an hour) x 24 (hours in a day) x 31 (days in a month) = 8928 samples.

Table 11 below displays data capture statistics for October 2023. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data capture are included in the Valid Data Exception Tables, see section 6.0.

Table 11: Data Capture for WCX 3B Project Ambient Air Quality Network

Parameter	Data Capture (%)			
	Quirk Street	Chapman Road	Manning Street	Bridgewater Park
PM <sub>2.5</sub>	95.7	<b>85.3</b>	96.5	99.7
PM <sub>10</sub>	95.7	<b>73.3</b>	96.3	<b>84.8</b>
CO	96.4	<b>84.1</b>	96.6	97.1
NO, NO <sub>2</sub> , NO <sub>x</sub>	97.1	<b>86.2</b>	96.9	97.8
WS, WD, Sigma	99.2	<b>88.5</b>	<b>62.4</b>	99.9
AT 2m	99.2	<b>88.5</b>	98.8	99.9
AT 10m	99.2	<b>88.5</b>	98.8	99.9

## 5.2. Air Quality Monthly Summary

Tables 12-15 below include a summary of any exceedances recorded at the WCX 3B Project stations during the reported period<sup>18</sup>.

**Table 12: WCX Quirk Street Exceedances Recorded for October 2023**

Parameter	Time Period	Value of Exceedance	Date of Exceedance
NO <sub>2</sub> (ppm)	1 hour	-	-
CO (ppm)	8-hour rolling	-	-
PM <sub>10</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>19</sup>	-	-
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>20</sup>	-	-

<sup>18</sup> Exceedances are based on the decimal places reported.

<sup>19</sup> Insufficient data to report annual average. The first annual average concentrations will be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.

<sup>20</sup> As in 21 above.

**Table 13: WCX Chapman Road Exceedances Recorded for October 2023**

Parameter	Time Period	Value of Exceedance	Date of Exceedance
NO <sub>2</sub> (ppm)	1 hour	-	-
CO (ppm)	8-hour rolling	-	-
PM <sub>10</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>21</sup>	-	-
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>22</sup>	-	-

<sup>21</sup> Insufficient data to report annual average. The first annual average concentrations will be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.

<sup>22</sup> As per 23 above.



**Table 14: WCX Manning Street Exceedances Recorded for October 2023**

Parameter	Time Period	Value of Exceedance	Date of Exceedance
NO <sub>2</sub> (ppm)	1 hour	-	-
CO (ppm)	8-hour rolling	-	-
PM <sub>10</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>23</sup>	-	-
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>24</sup>	-	-

<sup>23</sup> Insufficient data to report annual average. The first annual average concentrations will be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.

<sup>24</sup> As per 25 above.

**Table 15: WCX Bridgewater Park Exceedances Recorded for October 2023**

Parameter	Time Period	Value of Exceedance	Date of Exceedance
NO <sub>2</sub> (ppm)	1 hour	-	-
CO (ppm)	8-hour rolling	-	-
PM <sub>10</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>25</sup>	-	-
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	24-hour	-	-
	Annual <sup>26</sup>	-	-

<sup>25</sup> Insufficient data to report annual average. The first annual average concentrations will be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.

<sup>26</sup> As per 27 above.

### 5.3. Tabulated data

#### 5.3.1. Annual average

Table 16 displays monthly averages of the PM<sub>2.5</sub> and PM<sub>10</sub> parameters collected at WCX 3B ambient air monitoring stations for 2023. Averages shown are for the 2023 calendar year, up to the current reported month. Table requires at least 75% valid data to display a monthly average. Footer values are based on all available data for 2023 rather than the average of individual months. This gives an indication of performance against the annual objectives.

**Table 16: PM<sub>10</sub> and PM<sub>2.5</sub> Averages at the WCX 3B Ambient Air Monitoring Stations 2023**

Month	Quirk Street		Chapman Road		Manning Street		Bridgewater Park	
	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )
Jan-23	14.6	4	16.4	4	15.1	3	15.2	3
Feb-23	17.9	4	20.2	5	17.0	4	18.6	3
Mar-23	17.4	4	21.6	6	17.4	4	18.3	3
Apr-23	12.7	3	16.4	5	13.1	3	13.7	3
May-23	14.1	5	19.8	7	13.9	4	14.1	5
Jun-23	13.1	6	20.4	9	12.8	5	12.8	5
Jul-23	14.2	7	24.3	12	13.5	6	14.9	5
Aug-23	14.5	6	20.3	9	13.8	6	14.7	5
Sep-23	20.7	11	28.3	13	19.7	9	20.5	9
Oct-23	18.6	5	23.2	7	17.5	4	18.2	4
Nov-23	-	-	-	-	-	-	-	-
Dec-23	-	-	-	-	-	-	-	-
Average	15.8	6	20.9	8	15.4	5	16.1	4

### 5.4. Graphic Representations

This section displays graphs of the pollutants and meteorological parameters monitored at the WCX 3B Project for October 2023. The graphs are based on validated 5-minute or 1-hour data as appropriate.

### CO 8-Hour (Rolling, based on 1-Hour Averages)

October 2023

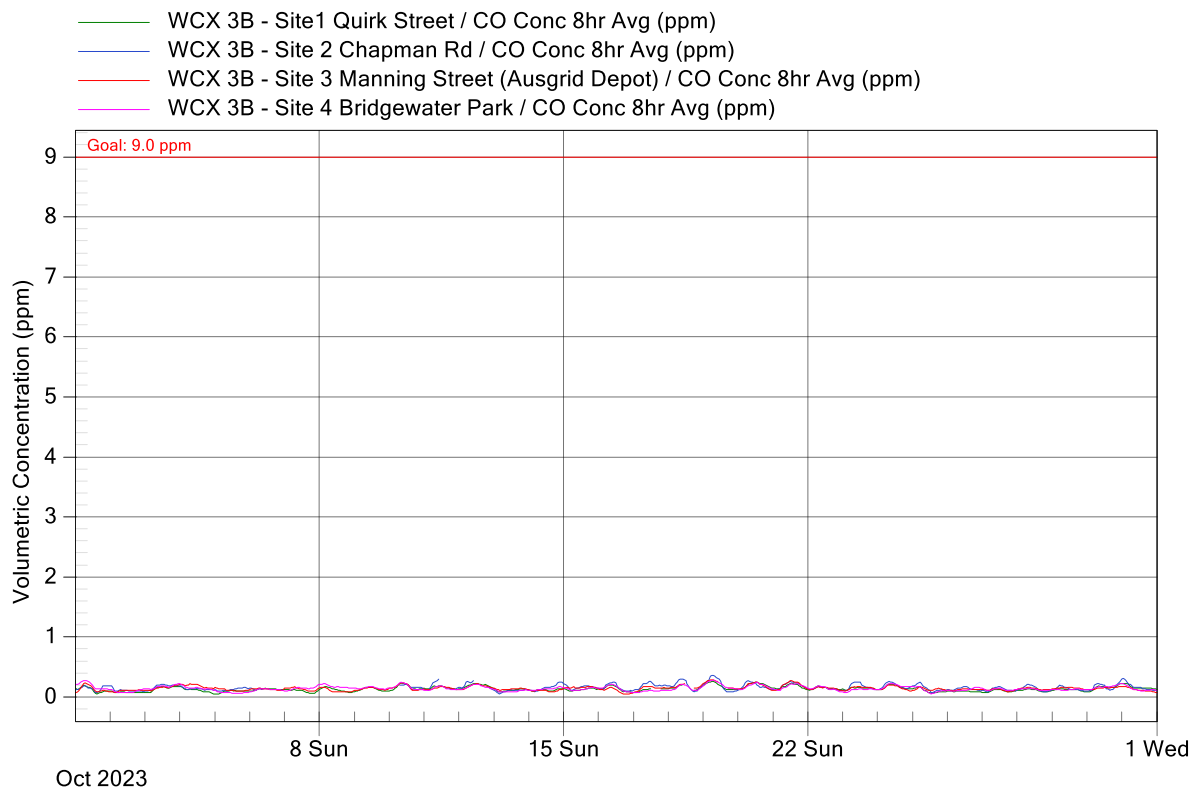
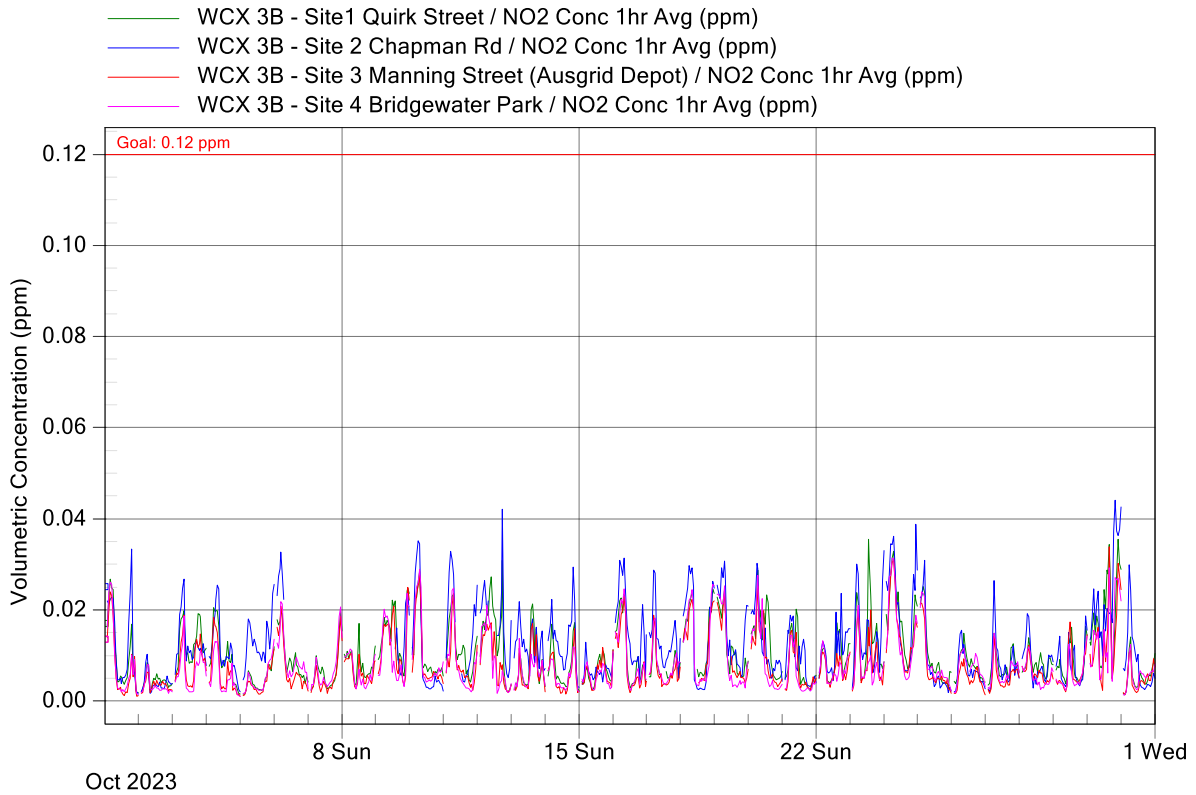


Figure 2: WCX 3B Project Air Monitoring Stations - CO 8-Hour Rolling Graph for October 2023

## NO<sub>2</sub> 1-Hour Averages

October 2023



**Figure 3: WCX 3B Project Air Monitoring Stations - NO<sub>2</sub> 1-Hour Averages Graph for October 2023**

### PM<sub>10</sub> 24-Hour Averages

October 2023

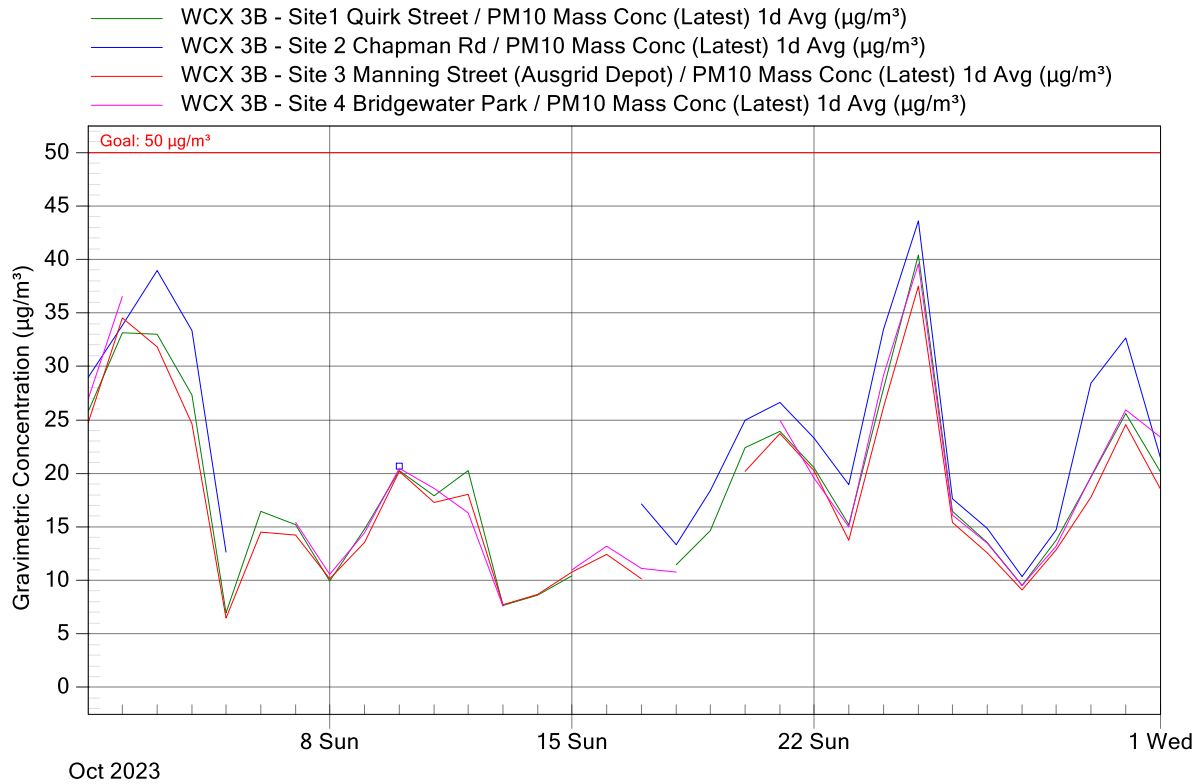


Figure 4: WCX 3B Project Air Monitoring Stations - PM<sub>10</sub> 24-Hour Averages Graph for October 2023

### PM<sub>2.5</sub> 24-Hour Averages

October 2023

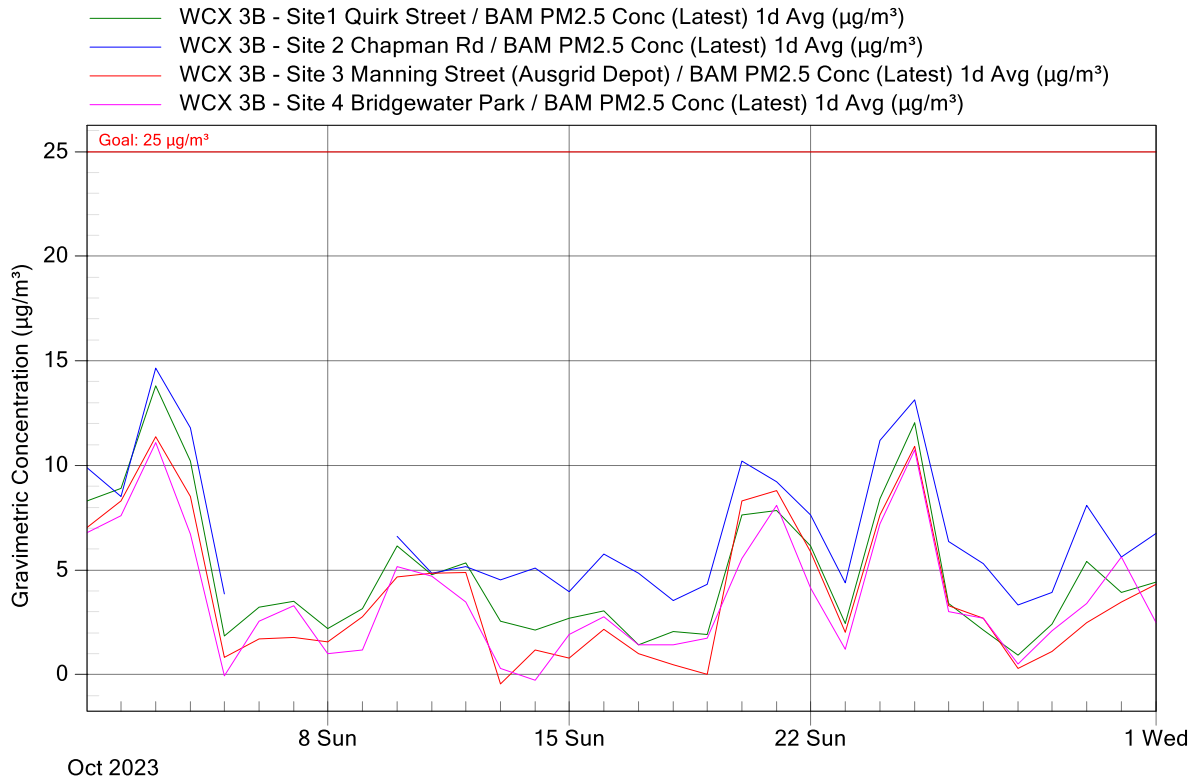
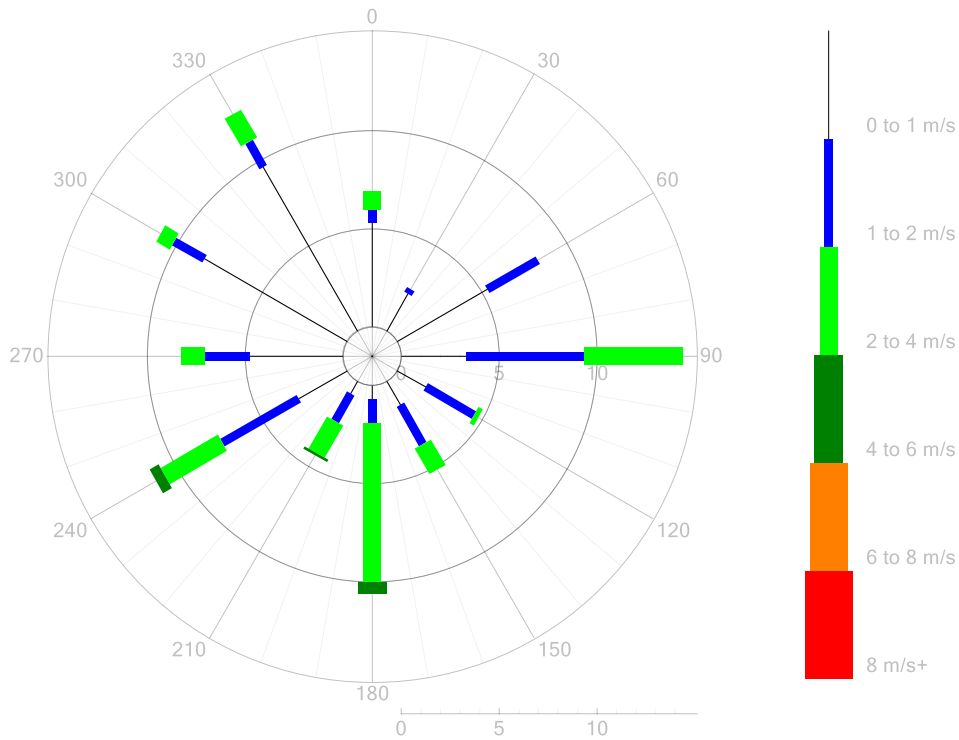


Figure 5: WCX 3B Project Air Monitoring Stations - PM<sub>2.5</sub> 24-Hour Averages Graph for October 2023

### Site 1 Quirk Street - Wind Rose (1-Hour Averages)

Wind Rose

October 2023



99.2% valid data present

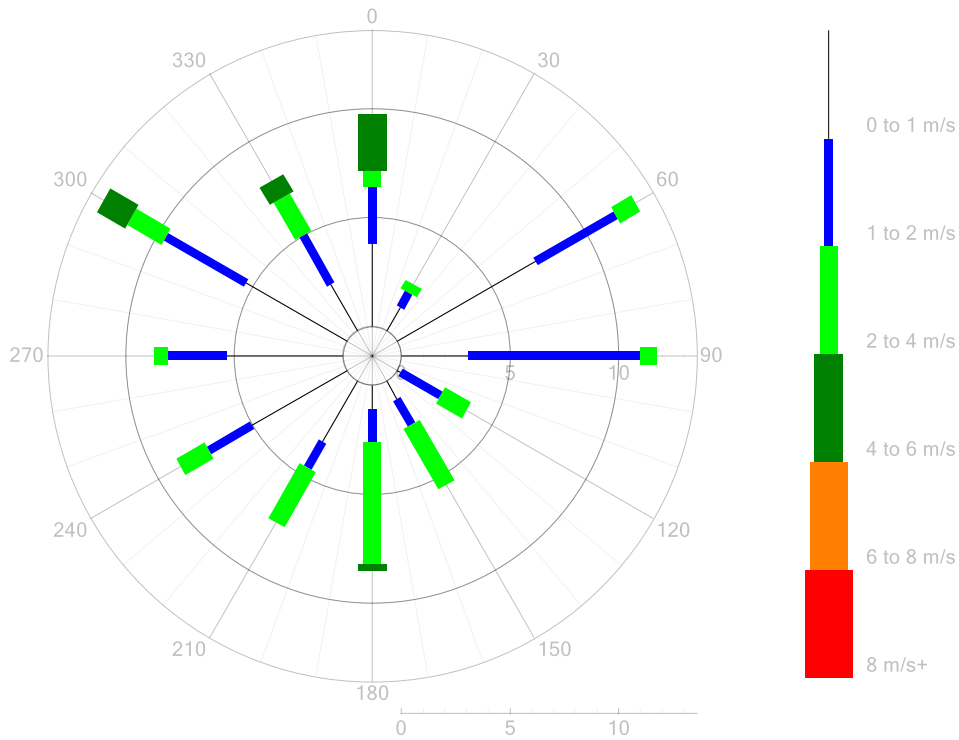
Figure 6: WCX Quirk Street - Wind Rose of October 2023



### Site 2 Chapman Road - Wind Rose (1-Hour Averages)

Wind Rose

October 2023



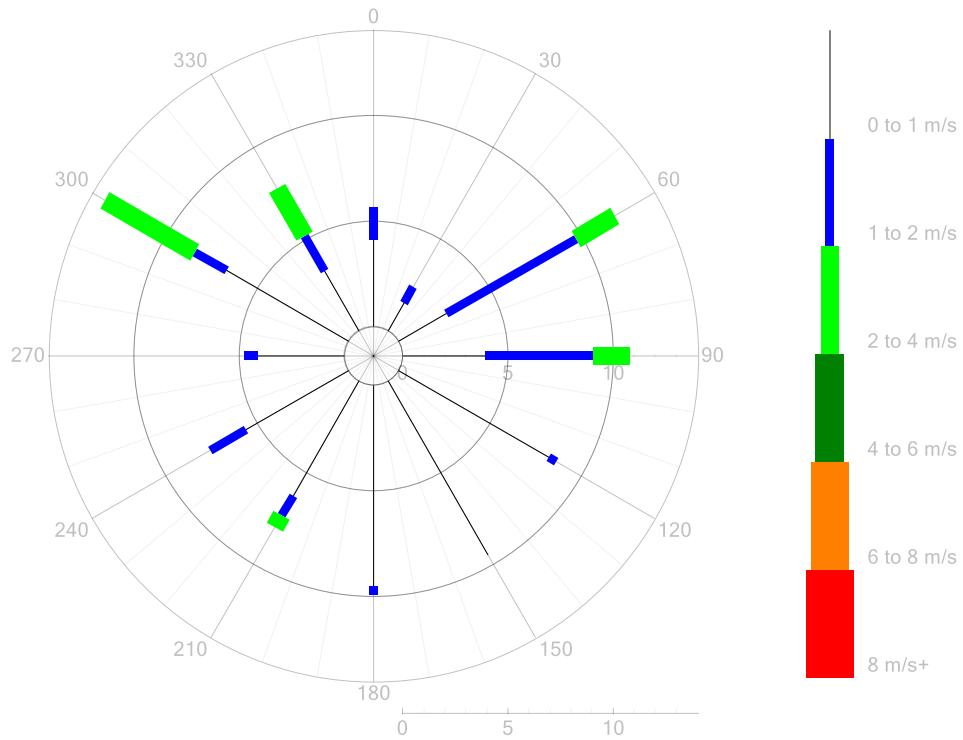
88.3% valid data present

Figure 7:WCX Chapman Road - Wind Rose of October 2023

### Site 3 Manning Street - Wind Rose (1-Hour Averages)

Wind Rose

October 2023



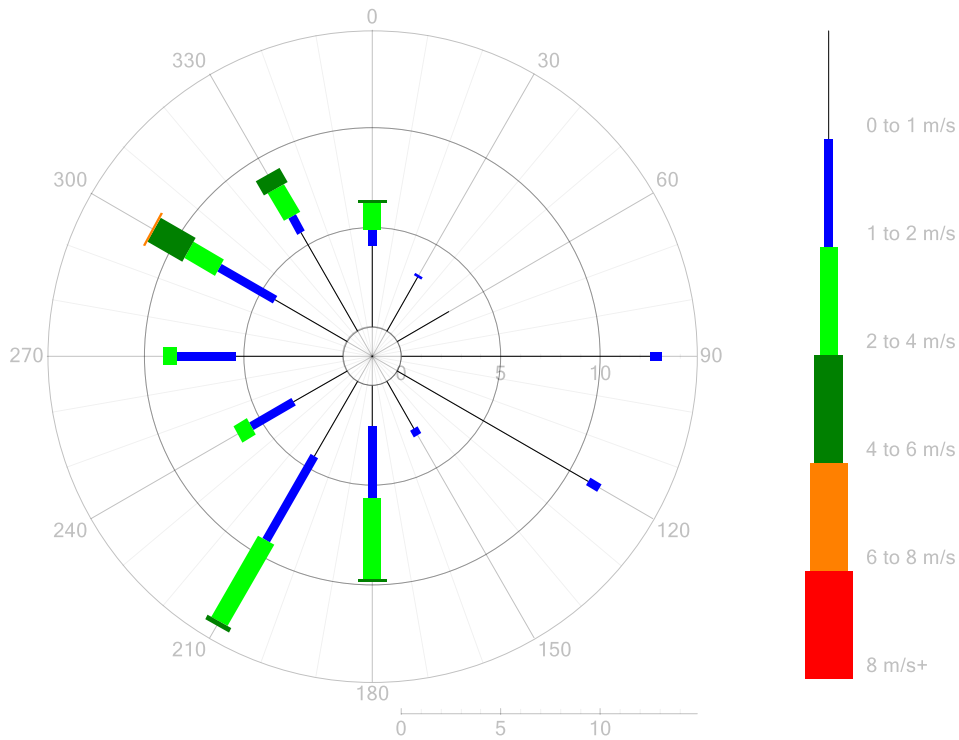
62.4% valid data present

Figure 8:WCX Manning Street - Wind Rose of October 2023

### Site 4 Bridgewater Park - Wind Rose (1-Hour Averages)

Wind Rose

October 2023



99.9% valid data present

Figure 9:WCX Bridgewater Park - Wind Rose of October 2023

## 6.0 Valid Data Exception Tables

Tables 17–20 below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

**Table 17: WCX Quirk Street Valid Data Exception Table**

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/10/23 00:00	02/10/23 00:55	Linear offset of A= +0.15ppm and B= +0.0 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
04/10/23 00:05	04/10/23 23:50	Linear offset of A= -0.05 ppm and B= +0.07 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
05/10/23 01:30	06/10/23 00:55	Linear offset of A= +0.0ppm and B= -0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
06/10/23 01:30	07/10/23 00:55	Linear offset of A= -0.01 ppm and B= +0.12 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
10/10/23 01:30	11/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.12 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
11/10/23 01:30	12/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.07 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
12/10/23 13:45	12/10/23 14:20	Intermittent unrealistic negative readings	PM <sub>10</sub>	EQ	28/11/23
15/10/23 01:30	16/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.04 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
16/10/23 09:40	16/10/23 14:00	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 1)	PM <sub>2.5</sub> , PM <sub>10</sub>	EQ	28/11/23
16/10/23 14:05	17/10/23 10:55	Scheduled yearly maintenance - Overnight zero test	PM <sub>2.5</sub> , PM <sub>10</sub>	EQ	28/11/23
17/10/23 11:00	17/10/23 14:00	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 2)	All parameters	EQ	28/11/23
17/10/23 14:00	18/10/23 00:55	Linear offset of A= +0.06 ppm and B= +0.11 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
18/10/23 09:00	18/10/23 12:10	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 3)	All parameters	EQ	28/11/23
19/10/23 01:30	20/10/23 00:55	Linear offset of A= +0.0ppm and B= +0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

Start Date	End Date	Reason	Change Details	User Name	Change Date
20/10/23 01:30	21/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.1 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
21/10/23 01:30	22/10/23 00:55	Linear offset of A= +0.0ppm and B= +0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
23/10/23 01:30	24/10/23 00:55	Linear offset of A= +0.0ppm and B= +0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
25/10/23 01:30	26/10/23 00:55	Linear offset of A= -0.01 ppm and B= +0.09 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
27/10/23 01:30	28/10/23 00:55	Linear offset of A= +0.01 ppm and B= +0.04 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
31/10/23 01:30	31/10/23 23:50	Linear offset of A= +0.0ppm and B= +0.11 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

**Table 18: WCX Chapman Road Valid Data Exception Table**

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/10/23 00:00	02/10/23 00:55	Linear offset of A= -0.1 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
01/10/23 07:15	04/10/23 19:45	Intermittent unrealistic negative readings	PM <sub>10</sub>	EQ	28/11/23
02/10/23 01:35	30/10/23 00:55	Intermittent static offset between +0.05 to +0.1 ppm applied to correct baseline	CO	EQ	28/11/23
04/10/23 01:35	05/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
05/10/23 01:35	06/10/23 00:55	Linear offset of A= +0.1 ppm and B= +0.22 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
06/10/23 07:30	09/10/23 15:00	Intermittent power outage followed by instrument stabilization	All parameters	EQ	28/11/23
09/10/23 13:15	09/10/23 13:55	Non scheduled maintenance - inspection site after reported fault, electrician came and resolved power issue	All parameters	EQ	28/11/23
09/10/23 14:00	10/10/23 00:55	Instrument fault - significant negative drift unable to correct data	CO	EQ	28/11/23
10/10/23 01:35	10/10/23 08:55	Linear offset of A= +0.2 ppm and B= +0.55 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

Start Date	End Date	Reason	Change Details	User Name	Change Date
10/10/23 09:10	11/10/23 00:55	Linear offset of A= +0.05 ppm and B= +0.0 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
11/10/23 09:00	11/10/23 13:10	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 1)	All parameters	EQ	28/11/23
11/10/23 13:15	12/10/23 08:55	Scheduled yearly maintenance - Ovrenight zero test	PM <sub>10</sub> , PM <sub>2.5</sub>	EQ	28/11/23
11/10/23 13:15	12/10/23 00:55	Linear offset of A= +0.1 ppm and B= +0.5 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
12/10/23 09:00	12/10/23 13:40	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 2)	All parameters	EQ	28/11/23
16/10/23 01:35	17/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
17/10/23 01:35	18/10/23 00:55	Linear offset of A= +0.05 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
19/10/23 01:35	20/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.1 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
20/10/23 01:35	21/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.13 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
25/10/23 01:35	26/10/23 00:55	Linear offset of A= -0.1 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
26/10/23 01:35	27/10/23 00:55	Linear offset of A= +0.05 ppm and B= +0.17 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
27/10/23 01:35	28/10/23 00:55	Linear offset of A= +0.05 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
30/10/23 01:35	31/10/23 00:55	Linear offset of A= -0.1 ppm and B= +0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
31/10/23 01:35	31/10/23 23:45	Linear offset of A= +0.1 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

Table 19: WCX Manning Street Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/10/23 10:35	31/10/23 10:30	Intermittent unrealistic negative readings	NO, NO <sub>2</sub> , NO <sub>x</sub> , PM <sub>10</sub>	EQ	28/11/23
02/10/23 01:30	31/10/23 23:50	Intermittent static offsets between +0.05ppm to +0.25 ppm applied as required to correct zero error	CO	EQ	28/11/23
04/10/23 01:30	05/10/23 00:55	Linear offset of A= +0.3 ppm and B= +0.37 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
05/10/23 01:30	06/10/23 00:55	Linear offset of A= +0.3 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
06/10/23 01:30	07/10/23 00:55	Linear offset of A= +0.25 ppm and B= +0.38 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
08/10/23 01:30	09/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.1 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
09/10/23 01:30	10/10/23 00:55	Linear offset of A= +0.15 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
10/10/23 01:30	11/10/23 00:55	Linear offset of A= +0.04 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
12/10/23 23:00	10/10/23 10:20	Instrument fault - data flatlined	WS, WD, Sigma	EQ	28/11/23
13/10/23 01:30	14/10/23 00:55	Linear offset of A= +0.1 ppm and B= +0.05 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
17/10/23 01:30	18/10/23 00:55	Linear offset of A= +0.1 ppm and B= +0.2 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
18/10/23 10:00	18/10/23 12:20	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 1)	All parameters	EQ	28/11/23
18/12/23 12:25	19/10/23 09:20	Scheduled yearly maintenance - Overnight zero test	PM <sub>2.5</sub> , PM <sub>10</sub>	EQ	28/11/23
19/10/23 09:25	19/10/23 11:35	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 2)	All parameters	EQ	28/11/23
24/10/23 10:25	24/10/23 14:35	Scheduled yearly maintenance - Instrument calibration & checks followed by instrument stabilization (day 3)	AT 2m, AT 10m, WS, WD, Sigma	EQ	28/11/23
25/10/23 01:30	26/10/23 00:55	Linear offset of A= +0.0 ppm and B= +0.15 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

Start Date	End Date	Reason	Change Details	User Name	Change Date
26/10/23 01:30	27/10/23 00:55	Linear offset of A= +0.1 ppm and B= +0.18 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23

**Table 20: WCX Bridgewater Park Valid Data Exception Table**

Start Date	End Date	Reason	Change Details	User Name	Change Date
03/10/23 15:25	20/10/23 12:50	Intermittent instrument fault - frozen instrument followed by instrument stabilization	PM <sub>10</sub>	EQ	28/11/23
20/10/23 12:55	20/10/23 13:55	Non scheduled maintenance - rebooted TEOM	PM <sub>10</sub>	EQ	28/11/23
24/10/23 01:30	25/10/23 00:55	Linear offset of A= +0.0 ppm and B= -0.04 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
25/10/23 01:30	26/10/23 00:55	Linear offset of A= -0.1 ppm and B= +0.11 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23
26/10/23 12:00	26/10/23 13:55	Scheduled monthly maintenance	All parameters	EQ	28/11/23
31/10/23 01:30	31/10/23 23:40	Linear offset of A= -0.02 ppm and B= +0.07 ppm applied to correct the drift in CO baseline	CO	EQ	28/11/23



## 7.0 Report Summary

Percentage availability for all parameters at the WestConnex 3B Ambient Air Quality Monitoring Network was above 95% during the reporting month except for PM<sub>2.5</sub>, PM<sub>10</sub>, CO, NO, NO<sub>2</sub>, NO<sub>x</sub>, WS, WD, Sigma, AT 2m, AT 10m data capture of Chapman Road station due to a power outage. WS, WD, Sigma at Manning Street station was due to flatlined data and PM<sub>10</sub> at Bridgewater Park station that were mainly due to instrument faults.

Please refer to Table 11, and Tables 17-20 for details.

- There were no exceedances of the air quality goals at the WestConnex 3B Ambient Air Quality Monitoring station for the reporting month.

Please refer to Tables 12-15 in Section 5.2 – Air Quality Monthly Summary for further information.

## Appendix 1 - Definitions & Abbreviations

ERS	Environmental Reporting Services
AQMS	Air Quality Monitoring Station
AQM	Air Quality Monitor
BAM	Beta Attenuation Monitors
TEOM	Tapered Element Oscillating Microbalance
°	Degrees (True North)
K	Kelvin
LDL	Lower Detectable Limit
$\mu\text{g}/\text{m}^3$	Micrograms per cubic meter at standard temperature and pressure (0°C and 101.3 kPa)
AT	Ambient Temperature
calm	Wind conditions where the wind speed is below the operating range of the wind sensor
CO	Carbon monoxide
$\text{mg}/\text{m}^3$	Milligrams per cubic meter at standard temperature and pressure (0°C and 101.3 kPa)
mm	Millimeter
NO	Nitric oxide
NO <sub>2</sub>	Nitrogen dioxide
NO <sub>x</sub>	Oxides of nitrogen
PM <sub>10</sub>	Particulate less than 10 microns in equivalent aerodynamic diameter
PM <sub>2.5</sub>	Particulate less than 2.5 microns in equivalent aerodynamic diameter

ppb	Parts per billion
ppm	Parts per million
RH	Relative Humidity
WD	Vector Wind Direction
WS	Vector Wind Speed

## Appendix 2 - Explanation of Exception Table

**Automatic filter tape advance** refers to the movement of the filter paper by the analyzer to an unused spot.

**Automatic background check** refers to when analyzer 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 analyzer's fine zero measurement.

**Automatic span/zero check.** The E-Sampler is programmed to perform a zero calibration check whereby air is passed through filter element, removing particulates, before entering the sensor in the analyzer. Data is invalidated when these checks occur.

**Beta count failure** refers to a fault in the functioning of the EBAM. A one-minute beta count was less than the maximum acceptable counts during operation.

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

**Calibration correction factor 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

**Commissioning** refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilization period before normal operation commences.

**Data transmission error** refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

**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.

**Gap in 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 operation of the instrument is being affected.

**Instrument out of service** refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

**Linear offset or multiplier** refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

**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 switched off due to maintenance.

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

**Overnight zero out of tolerance** refers to when the automatic zero reading measured by the analyzer falls outside the expected 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.

**Static offset or multiplier** refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

**Tape break** refers to the breaking of the EBAM/BAM sample tape during operation.

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