NORDITECH
ENVIRONMENTAL MONITORING TECHNOLOGIES

# Brisbane Motorway Services

## CLEM7 Ambient Air Quality Monitoring Report
## December 2017
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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

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## Document Control

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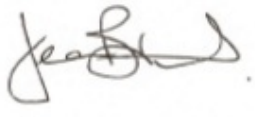

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## Glossary

The following terms and abbreviations may be found throughout this report:

| | |
|---|---|
| °C | Degrees Celsius |
| µg/m$^3$ | Micrograms per cubic meter at standard temperature and pressure (0°C, 101.3kPa) |
| AT | Ambient Temperature |
| AQMS | Air Quality Monitoring Station |
| Calm | Wind condition where wind speed is below the operating range of the wind sensor |
| CO | Carbon Monoxide |
| CO (CoG) | Coordinator General's Report on EIS |
| Deg | Degrees (True North) |
| EPA | Environment Protection Authority |
| HVAS | High Volume Air Sampler |
| m/s | Meters per second |
| NO | Nitric Oxide |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Nitrogen Oxides |
| $PM_{10}$ | Particulate matter of 10 microns or less aerodynamic equivalent size |
| $PM_{2.5}$ | Particulate matter of 2.5 microns or less aerodynamic equivalent size |
| ppb | Parts per billion |
| ppm | Parts per million |
| RH | Relative Humidity |
| SR | Solar Radiation |
| TSP | Total Suspended Particulate |
| W/m$^2$ | Watts per square meter |
| WD | Vector Wind Direction |
| WS | Vector Wind Speed |

# 1. Executive Summary

This report contains the meteorological, gaseous and particulate data from the Clem 7 ambient air quality monitoring network located at Hawthorne Street, Royal Brisbane Hospital, Northey Street and Landcenter for December 2017.

The tables and graphs on the following pages summarise the maximum measured values for each pollutant during this period.

## Exceedance Reporting

There were no readings over the relevant Air Quality Standards during the reporting period.

## Notes

Measurement of a number of parameters in this report do not comply with applicable standards and/or is not covered by Norditech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

The CO and NOx analysers at Royal Brisbane Hospital and Landcenter have been removed for use at Hawthorne Street and Northey Street stations.

The TEOM at Landcenter has been removed for use at Hawthorne Street.

Meteorological data for Hawthorne Street is included for reference purposes only due to the elevation of these parameters. The mast was removed for repairs by BMS on 18/10/2016 with the meteorological parameters currently at a height of 2.5m above ground level.

| Maximum Values for Hawthorne Street | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | EPP Goal | Unit | Averaging Period | Maximum Value | Wind Direction | Date & Time |
| $NO_2$ | 120 | ppb | 1 Hour | 33 | 217.4 | 08/12/2017 17:00 |
| CO | 9 | ppm | 8 Hours | 0.6 | 118.5 | 31/12/2017 22:00 |
| $PM_{2.5}$ | 25 | µg/m3 | 24 Hours | 7.4 | 119.0 | 15/12/2017 |
| $PM_{10}$ | 50 | µg/m3 | 24 Hours | 23.7 | 75.5 | 02/12/2017 |

Table 1 - Hawthorne Street maximum values

Figure 1 - Hawthorne Street Nitrogen Dioxide 1hr averages

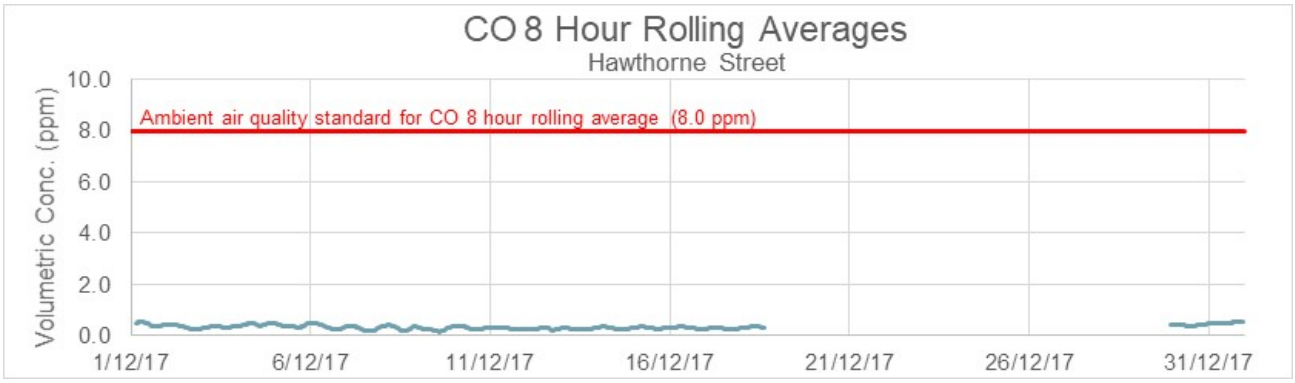

Figure 2 - Hawthorne Street Carbon Monoxide 8hr rolling averages

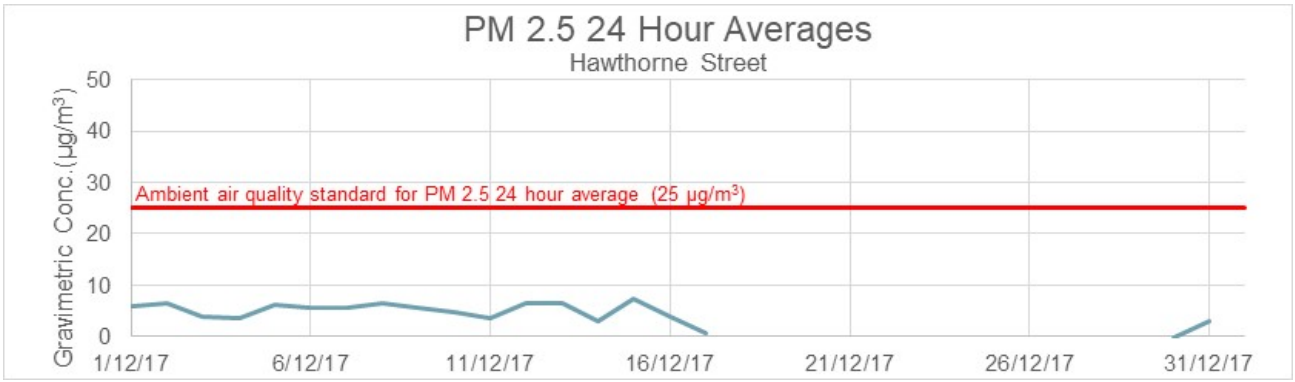

Figure 3 - Hawthorne Street PM2.5 24hr averages

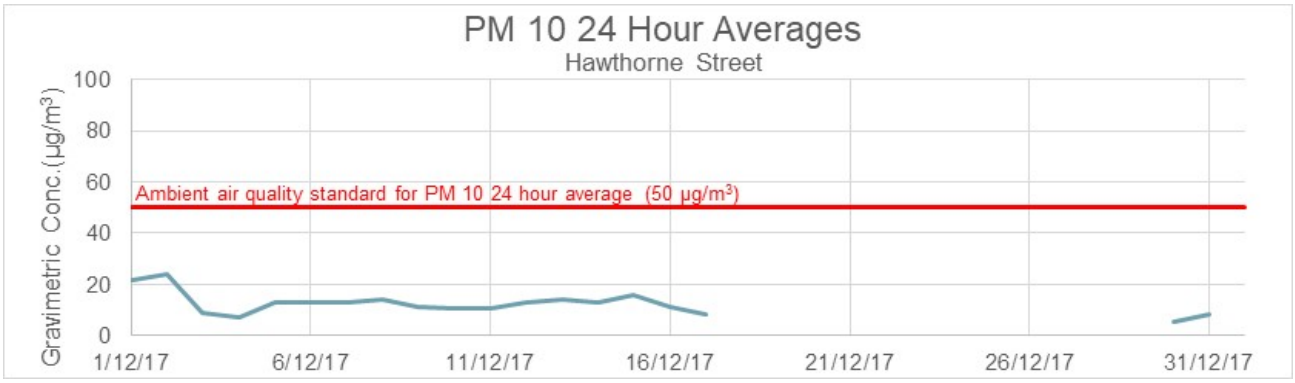

Figure 4 - Hawthorne Street PM10 24hr averages

| Maximum Values for Royal Brisbane Hospital | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | EPP Goal | Unit | Averaging Period | Maximum Value | Wind Direction | Date & Time |
| $NO_2$ | 120 | ppb | 1 Hour | - | - | - |
| CO | 9 | ppm | 8 Hours | - | - | - |
| $PM_{2.5}$ | 25 | µg/m3 | 24 Hours | 4.9 | 173.2 | 23/12/2017 |
| $PM_{10}$ | 50 | µg/m3 | 24 Hours | 10.2 | 173.2 | 23/12/2017 |

Table 2 - Royal Brisbane Hospital maximum values

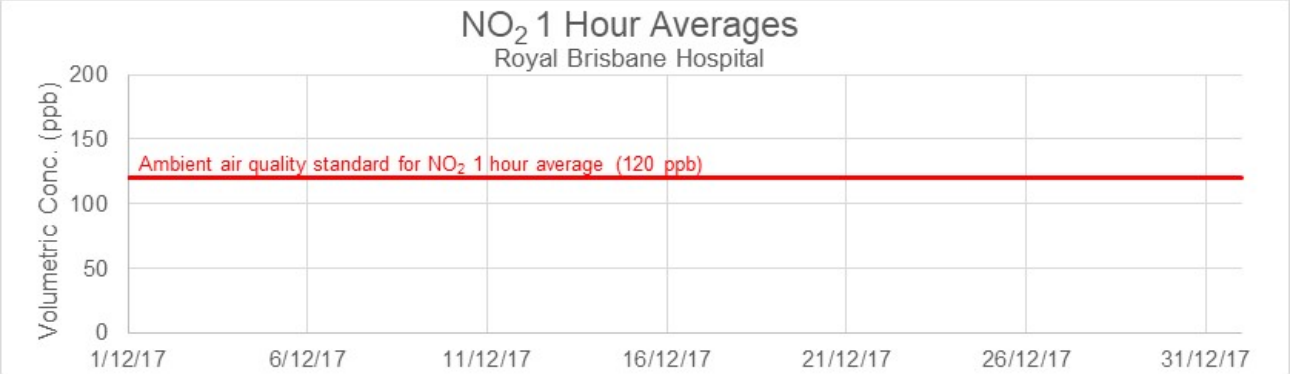

Figure 5 - Royal Brisbane Hospital Dioxide 1hr averages

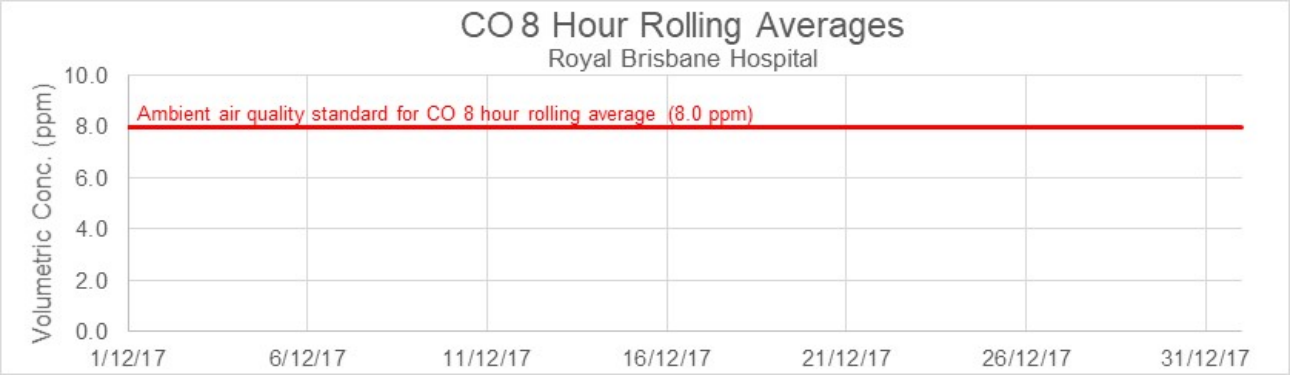

Figure 6 - Royal Brisbane Hospital Carbon Monoxide 8hr rolling averages

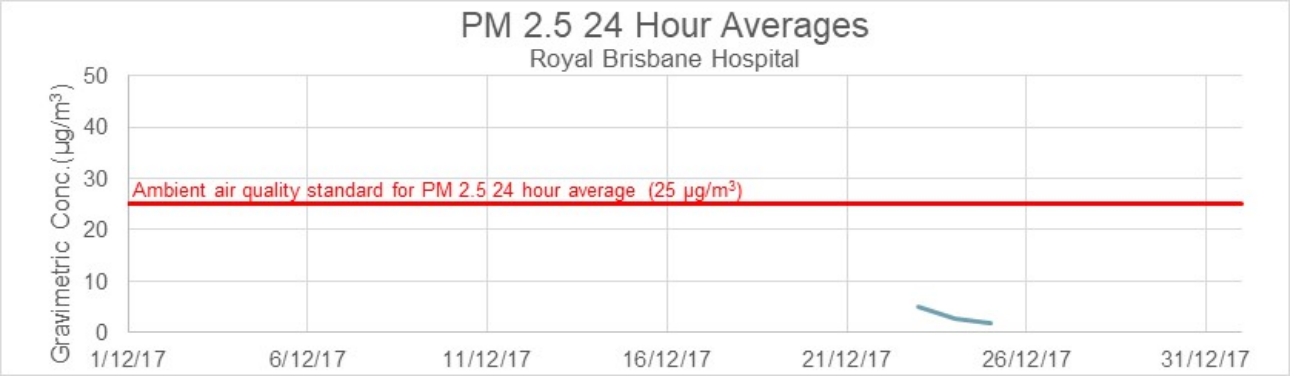

Figure 7 - Royal Brisbane Hospital PM2.5 24hr averages

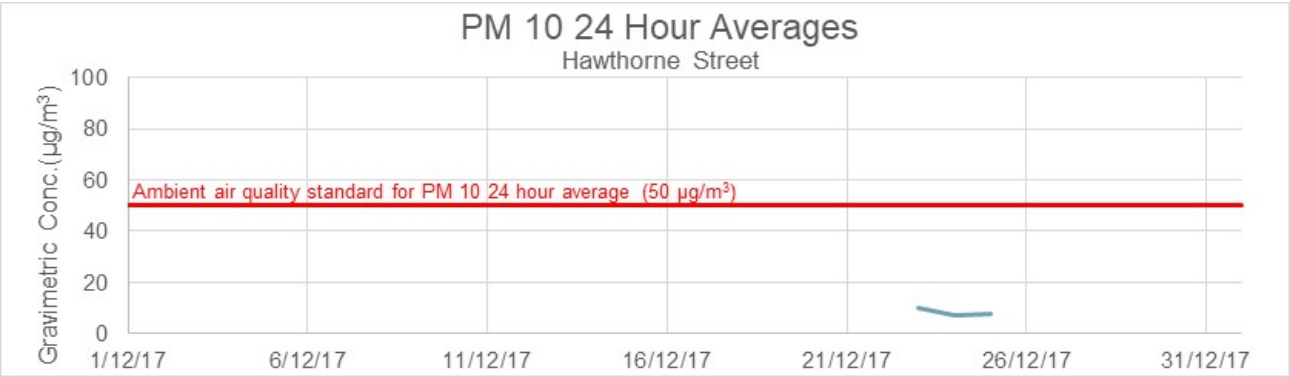

Figure 8 - Royal Brisbane Hospital PM10 24hr averages

| Maximum Values for Northey Street | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | EPP Goal | Unit | Averaging Period | Maximum Value | Wind Direction | Date & Time |
| $NO_2$ | 120 | ppb | 1 Hour | 17 | 252.6 | 08/12/2017 04:00 |
| CO | 9 | ppm | 8 Hours | 0.5 | 10.2 | 04/12/2017 23:00 |
| $PM_{2.5}$ | 25 | µg/m3 | 24 Hours | 10.4 | 161.7 | 07/12/2017 |
| $PM_{10}$ | 50 | µg/m3 | 24 Hours | 25.9 | 117.9 | 18/12/2017 |

Table 3 - Northey Street maximum values

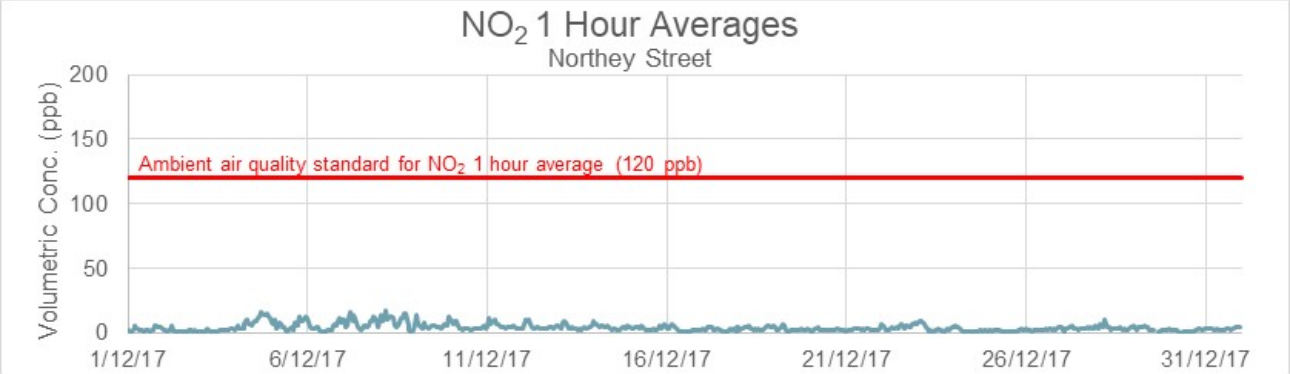

Figure 9 - Northey Street Nitrogen Dioxide 1hr averages

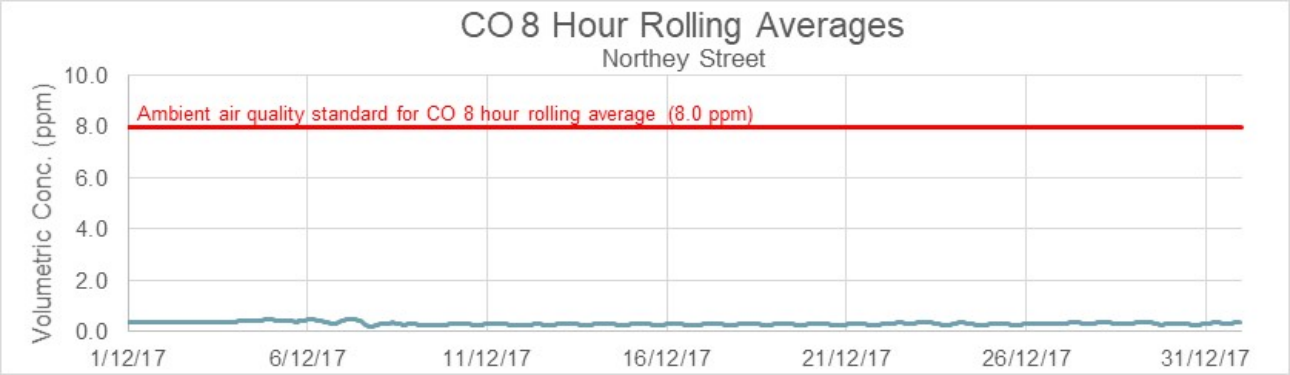

Figure 10 - Northey Street Carbon Monoxide 8hr rolling averages

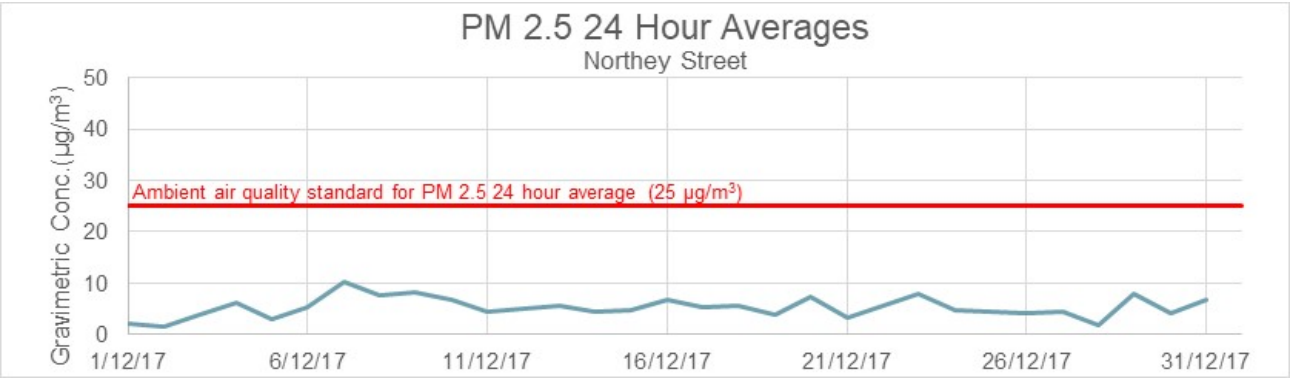

Figure 11 - Northey Street PM2.5 24hr averages

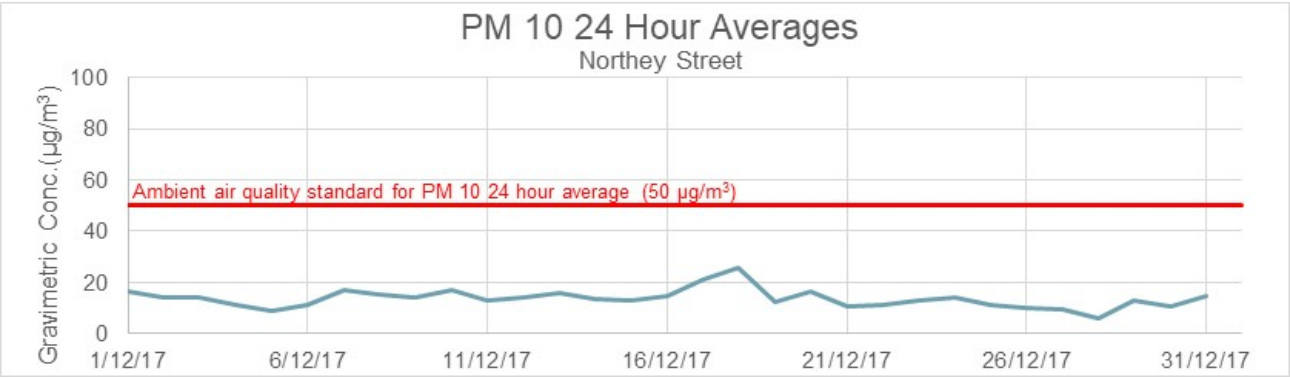

Figure 12 - Northey Street PM10 24hr averages

| Maximum Values for Landcenter | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | EPP Goal | Unit | Averaging Period | Maximum Value | Wind Direction | Date & Time |
| $NO_2$ | 120 | ppb | 1 Hour | - | - | - |
| CO | 9 | ppm | 8 Hours | - | - | - |
| $PM_{2.5}$ | 25 | µg/m3 | 24 Hours | 11.7 | 184.7 | 05/12/2017 |
| $PM_{10}$ | 50 | µg/m3 | 24 Hours | 18.7 | 136.6 | 01/12/2017 |

Table 4 - Landcenter maximum values

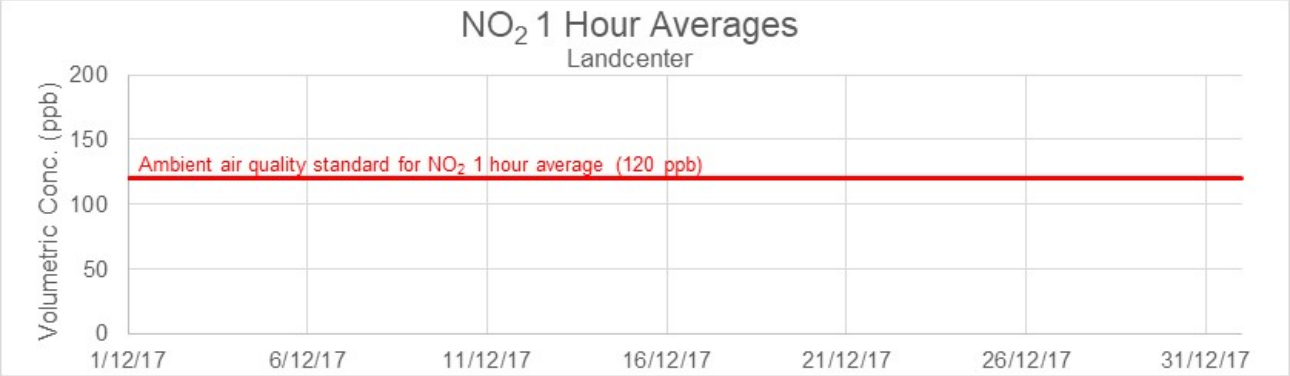

Figure 13 - Landcenter Nitrogen Dioxide 1hr averages

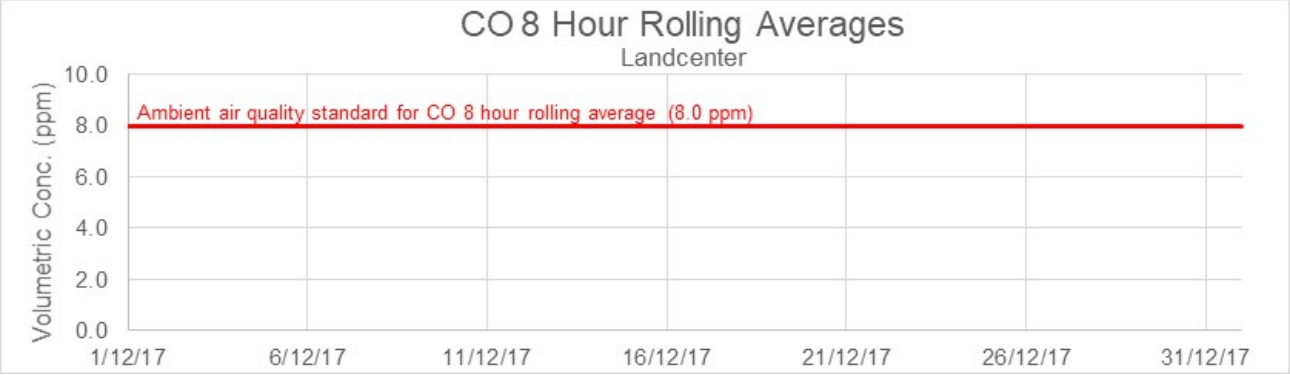

Figure 14 - Landcenter Carbon Monoxide 8hr rolling averages

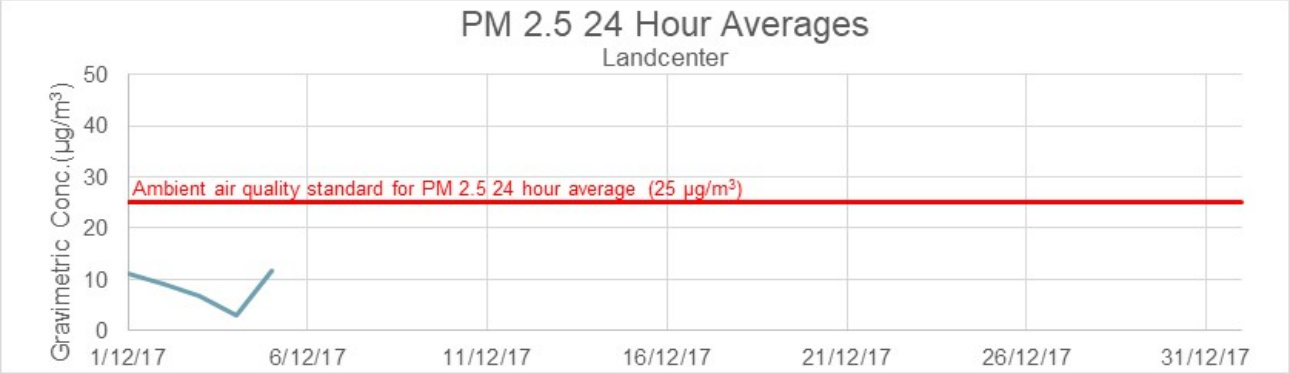

Figure 15 - Landcenter PM2.5 24hr averages

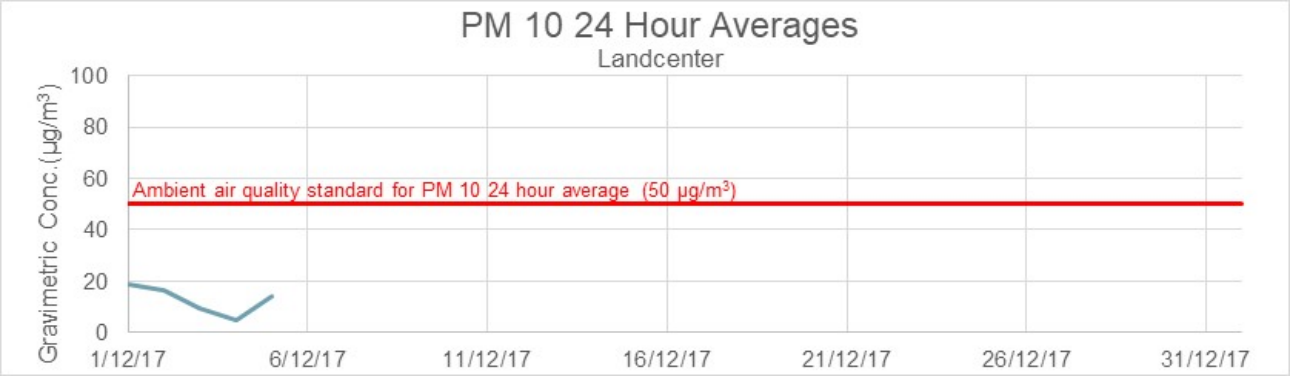

Figure 16 - Landcenter PM10 24hr averages

# 2. Introduction

Norditech Pty Ltd was appointed by Brisbane Motorway Services in October 2017 to operate, maintain and report on the CLEM7 Air Quality Monitoring Network. The CLEM7 Air Quality Monitoring Network consists of four sites located as described in Table 5.

This report presents the data for December 2017.

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

# 3. Monitoring and Data Collection

## 3.1. Site Locations

The sites consist of four ambient air quality monitoring stations. Station location and parameters monitored are described below.

| CLEM7 Site Location Coordinates | | | |
|---|---|---|---|
| Site Name | Latitude | Longitude | Height Above Sea Level |
| Hawthorne Street | -27º 29' 14.40" | 153º 2' 0.81" | 25m |
| Royal Brisbane Hospital | -27º 26' 55.58" | 153º 1' 38.78" | 28m |
| Northey Street | -27º 26' 30.81" | 153º 1' 38.13" | 4m |
| Landcenter | -27º 29' 5.10" | 153º 2' 7.86" | 14m |

Table 5 - Site Location Coordinates

Siting audits were conducted to assess for compliance with AS/NZS 3580.1.1:2016 Methods for sampling and analysis of ambient air.

The siting of the Royal Brisbane Hospital and Landcenter stations complies with the guidelines in AS/NZS 3580.1.1:2016. The stations are classified as neighbourhood stations according to AS/NZS 3580.1.1:2016.

The siting of the Hawthorne Street and Northey Street station do not fully comply with the guidelines in AS/NZS 3580.1.1:2016. Refer to section 3.3.1 for further details.

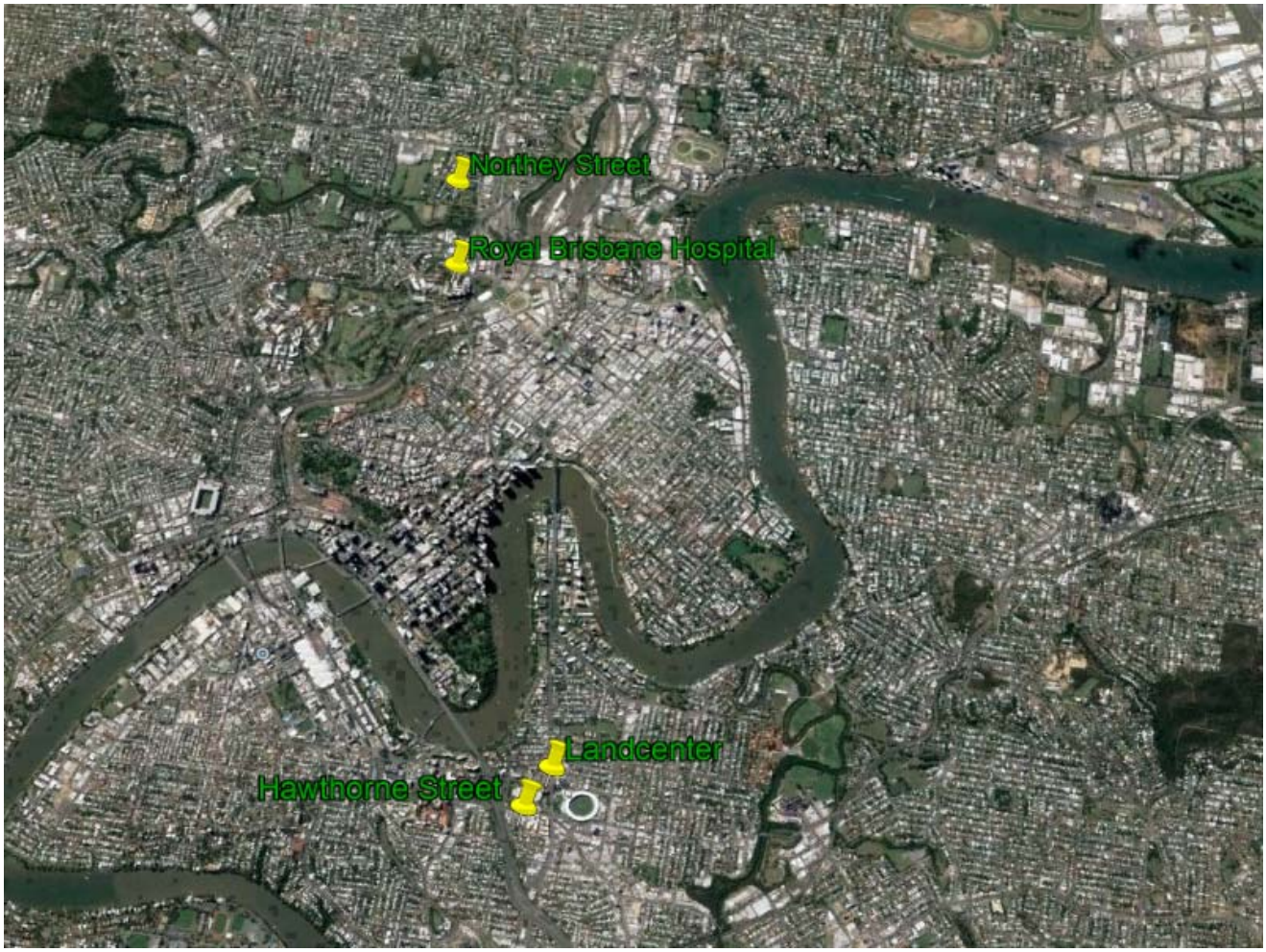


Figure 17 - Site Locations

## 3.2. Monitored Parameters

Table 6 below details the instruments used at the Clem 7 monitoring stations. Definitions of any abbreviated parameter names used throughout the report can be found in the glossary at the start of the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring stations.

| CLEM7 Instrumentation Details | |
|---|---|
| Parameter Measured | Instrumentation Method Used |
| NO, $NO_2$, $NO_x$ | Thermo 42i - chemiluminescence |
| CO | Thermo 48i – infrared absorption |
| $PM_{10}$ | Thermo 1405 - TEOM (Tapered Element Oscillating Microbalance) |
| $PM_{2.5}$ | Thermo 1405 - TEOM (Tapered Element Oscillating Microbalance) |
| TSP | Lear Siegler Australasia PK-2100 High Volume Sampler – gravimetric filter weighing method |
| Wind Speed (10m) | RM Young 05103$V^2$ - cup and vane |
| Wind Direction (10m) | RM Young 05103$V^2$ - cup and vane |
| Sigma (10m) | Calculation |
| Ambient Temperature (10m) | RM Young 41382V – 100 Ohm Platinum RTD |
| Relative Humidity (10m) | RM Young 41382V – Rotronic Hygromer |
| Solar Radiation (10m) | RM Young 70201 – Pyranometer |

Table 6 - Instrumentation Details

## 3.3. Data Collection Methods

Table 7 and 8 below show the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

| CLEM7 Gaseous and Particulate Methods | | |
|---|---|---|
| Parameter Measured | Instrumentation Method Used | Description of Method |
| NO, $NO_2$, $NO_x$ | AS 3580.5.1-2011 | Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method |
| | Norditech Laboratory Manual | In-house method TP.001-Oxides of Nitrogen |
| 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 |
| | Norditech Laboratory Manual | In-house method TP.003-Carbon Monoxide |
| $PM_{10}$ (TEOM) | AS/NZ 3580.9.13-2013 | Methods for sampling and analysis of ambient air. Method 9.13: Determination of suspended particulate matter – PM2.5 continuous direct mass method using a tapered element oscillating microbalance analyser. |
| | Norditech Laboratory Manual | In-house method TP.005-TEOM |
| $PM_{2.5}$ (TEOM) | AS/NZ 3580.9.13-2013 | Methods for sampling and analysis of ambient air. Method 9.13: Determination of suspended particulate matter – PM2.5 continuous direct mass method using a tapered element oscillating microbalance analyser. |
| | Norditech Laboratory Manual | In-house method TP.005-TEOM |
| TSP (HiVol) | AS/NZ 3580.9.3-2003 | Methods for sampling and analysis of ambient air. Method 9.3: Determination of suspended particulate matter – Total suspended particulate matter (TSP) – High volume sampler gravimetric method |
| | Norditech Laboratory Manual | In-house method TP.011-HVAS TSP |

Table 7 - Gaseous and Particulate Methods

| CLEM7 Meteorological Methods | | |
|---|---|---|
| Parameter Measured | Instrumentation Method Used | Description of Method |
| Vector Wind Speed (Horizontal) | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.006-Wind Speed and Direction |
| Vector Wind Direction | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.006-Wind Speed and Direction |
| Sigma | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.006-Wind Speed and Direction |
| Ambient Temperature | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.012-Ambient Temperature |
| Relative Humidity | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.014-Relative Humidity |
| Solar Radiation | AS 3580.14.2014 | Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications |
| | Norditech Laboratory Manual | In-house method TP.024-Solar Radiation |

Table 8 - Meteorological Methods

### 3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Clem7 monitoring networks according to the methods detailed in Table 7 and 8 above.

**At all Clem 7 sites;**

- Due to the configuration and small volume of the equipment enclosures, rack temperature is not able to be maintained within the specified deviation from the set point (±3°C) mandated by AS/NZS 3580.5.1.

- Measurement of solar radiation does not comply with AS/NZS 3580.14 and are not covered by Norditech's NATA scope of accreditation due to overdue or absent calibrations.

- Wind sensors RM Young 05103 do not comply with the performance specifications of AS/NZS 3580.14 and data is not covered by Norditech's NATA scope of accreditation. In addition, measurement of wind speed and direction at all sites does not comply with AS/NZS 3580.14 due to overdue calibration.

- The method used to measure PM10 (AS/NZ 3580.9.13-2013) sites is not covered by Norditech's NATA scope of accreditation. Australian Standard AS/NZ 3580.9.13-2013 *Methods for sampling and analysis of ambient air. Method 9.8: Determination of suspended particulate matter – PM2.5 continuous direct mass method using a tapered element oscillating microbalance analyser* does not specifically cover the measurement of PM10 by 1405-DF, however this is the most applicable standard to this type of instrument. In addition, measurement of PM10 at all sites does not comply with the requirements of AS/NZS 3580.9.13 due to overdue maintenance including noise checks.

- Measurement of TSP is not covered by Norditech's NATA scope of accreditation and does not comply with AS/NZS 3580.9.3 due to overdue pressure and temperature calibration.

- Nightly zero and span checks are not currently being performed due to removal of gas cylinders by Ecotech. Checks will resume once new cylinders have been installed.

In addition to the above, the following is applicable as listed below;

**Hawthorne Street**

- The location of the monitoring station does not fully comply with the guidelines of AS/NZS 3580.1.1-2016: Methods for Sampling and Analysis of Ambient Air - Guide to Siting Air Monitoring Equipment due to the proximity of nearby trees.

- Siting of the wind speed and wind direction sensors at Hawthorne Street does not meet AS/NZS 3580.14 guidelines, due to possible air flow disturbances caused by nearby trees at Hawthorne Street.

- Meteorological sensors (wind speed, wind direction, sigma, ambient temperature and relative humidity) at Hawthorne Street are currently located at approximately 2.5m elevation. BMS technicians removed the faulty mast on 18/10/2016 for servicing. Maintenance has been temporarily suspended pending re-installation of the mast.

Measurement of these parameters does not meet Australian Standard AS/NZS 3580.14 and is not covered by Norditech's NATA scope of accreditation due to the sensor elevation and overdue maintenance and calibrations.

- Measurement of gaseous parameters (CO, oxides of nitrogen) at Hawthorne Street is not covered by Norditech's NATA scope of accreditation and does not comply with AS/NZS 3580.5.1 / AS/NZS 3580.7.1 (as applicable) due to oxides of nitrogen analyser overdue converter efficiency check, multipoint linearity check and overdue gas diluter calibration and leak check.

- HVAS motor faulty, last good run on 14/10/2017. Will resume running once replacement HVAS is installed.

**Royal Brisbane Hospital**

- Siting of the wind speed and wind direction sensor does not meet AS/NZS 3580.14 guidelines, due to possible air flow disturbances caused by a building wall on one side of the site.

- Measurement of ambient temperature and relative humidity does not meet Australian Standard AS/NZS 3580.14 requirements and is not covered by Norditech's NATA scope of accreditation due to overdue maintenance and calibrations.

- Removed CO and NOx analysers for use in Hawthorne and Northey street stations.

- TEOM not operating due to instrument faults. Awaiting further instruction from BMS to resolve.

**Northey Street**

- The location of the monitoring station does not fully comply with the guidelines of AS/NZS 3580.1.1-2016: Methods for Sampling and Analysis of Ambient Air - Guide to Siting Air Monitoring Equipment due to the proximity of nearby trees.

- Measurement of ambient temperature and relative humidity does not meet Australian Standard AS/NZS 3580.14 requirements and is not covered by Norditech's NATA scope of accreditation, due to overdue calibrations.

- Measurement of gaseous parameters (CO, oxides of nitrogen) is not covered by Norditech's NATA scope of accreditation and does not comply with AS/NZS 3580.5.1 / AS/NZS 3580.7.1 (as applicable), due to overdue calibration system proficiency audit, gas diluter calibration and leak check.

**Landcenter**

- Removed CO, NOx and PM instruments for use at Northey and Hawthorne Street stations.

### 3.3.2. Data Acquisition

Data are recorded to a WinAQMS data logger located at each site at 5 minute averaging periods, calculated from 10 second samples. All data are retrieved periodically, approximately on an hourly basis, over a private 3G network, to a central WinCollect database where data validation is performed to remove any data not deemed as valid prior to reporting.

During automatic zero and span operations readings are flagged with a “Span” or “Zero” status. Up to 40 minutes of ambient readings are not measured during this period.

## 3.4. Data Validation and Reporting

### 3.4.1. Validation

Norditech 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. Norditech 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. Validation is performed by the operator, and the validation is reviewed. All data is checked and graphs and reports are generated based on the verified 1-hour, 8-hour and 24-hour data.

### 3.4.2. Reporting

The reported data is in three Microsoft Excel format files named “BMS Clem7 Monthly Data Report Dec-17.xls”, “Clem7 Validated Annual Mean Data Report Year-To-Date Dec-17.xls” and “Clem7 Validated Annual Mean Data Report Financial Year 17-18 Dec-17.xls”.
BMS Clem7 Monthly Data Report Dec-17 is validated monthly dust data and the TSP weighing results represented in this report. The file consists of eight Excel worksheets:

1. Cover
2. 5-minute Data
3. 1-Hour Data
4. Daily Data
5. TSP – Hawthorne St
6. TSP – Royal Brisbane Hospital
7. TSP – Northey St
8. TSP – Landcenter

Clem7 Validated Annual Mean Data Report Year-To-Date Dec-17 is validated monthly data as presented in this and previous reports for the calendar year to date. The file consists of nine Excel worksheets:

1. Cover
2. YTD 2017 PM2.5 5-minute Data

3. YTD 2017 PM2.5 1-hour Data
4. YTD 2017 PM2.5 Daily Data
5. YTD 2017 PM2.5 Monthly Data
6. YTD 2017 PM10 5-minute Data
7. YTD 2017 PM10 1-hour Data
8. YTD 2017 PM10 Daily Data
9. YTD 2017 PM10 Monthly Data

Clem7 Validated Annual Mean Data Report Financial Year 17-18 Dec-17 is validated monthly data as presented in this and previous reports for the financial year to date. The file consists of nine Excel worksheets:

1. Cover
2. FY16-17 PM2.5 5-minute Data
3. FY16-17 PM2.5 1-hour Data
4. FY16-17 PM2.5 Daily Data
5. FY16-17 PM2.5 Monthly Data
6. FY16-17 PM10 5-minute Data
7. FY16-17 PM10 1-hour Data
8. FY16-17 PM10 Daily Data
9. FY16-17 PM10 Monthly Data

All averages greater than 5 minute averages are calculated from the 5 minute average data set. 75% valid data must be available to calculate re-averaged data. For example, to calculate a 1hr average from 5 minute data, there must be a minimum of 9 out of 12 valid 5 minute average data points available.

Averaging period of 8 hour rolling average is calculated at the end of the period, i.e. the 8 hour rolling average at 10:00am includes data from 02:00am to 10:00am. Averaging periods of 1 hour and 24 hours are reported for the beginning of the period, i.e. the hourly average 02:00am is for the data collected from 2:00am to 3:00am. One-hour averages are calculated based on a clock hour. One day and 1-year averages are calculated based on calendar days.

Annual averages start from January 1$^{st}$ and contain the average of the current year's data.

All data is recorded to Australian Eastern Standard Time.

## Wind Data Reporting

Wind speed, wind speed gust and wind direction data associated with calm wind conditions are reported in accordance with the requirements of AS 3580.14 2014. Calm wind conditions are defined as wind speeds below the starting threshold of the wind speed / direction sensors. Sensor starting thresholds are given in Table 10 under "Measurement Range".

In this report, calm wind speed readings in tabulated data are reported as 0 m/s. Wind direction readings during calm periods are excluded from the tabulated data (reported as nulls).

Calm readings are excluded from wind roses; however, the percentage of calm data is indicated at the bottom of the graph. In all other graphic representations of the data, wind speed wind and direction values are reported as logged, without calm filters applied.

## 4. Air Quality Standards

The air quality standards for pollutants monitored at the Clem7 monitoring network are based on the Australian National Environmental Protection (Ambient Air Quality) Measure (NEPM) – 2011. These air quality standards are shown in Tables 9 and 10 below.

| CLEM7 Air Quality Standards (NEPM) | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Exceedance Level | Units | Maximum Allowable Exceedances |
| CO | 8 hours (rolling, based on 1 hour averages) | 9.0 | Ppm | 1 day a year |
| $NO_2$ | 1 hour | 120 | Ppb | 1 day a year |
| $NO_2$ | 1 year | 30 | $\mu g/m^3$ | None |
| $PM_{10}$ | 1 day | 50 | $\mu g/m^3$ | None (see note) |
| $PM_{10}$ | 1 year | 25 | $\mu g/m^3$ | None (see note) |
| $PM_{2.5}$ | 1 day | 25 | $\mu g/m^3$ | None (see note) |
| $PM_{2.5}$ | 1 year | 8 | $\mu g/m^3$ | None (see note) |

Table 9 - CLEM7 Air Quality Standards (NEPM)

| CLEM7 Air Quality Goals (Queensland Environmental Protection Air Policy 2008) | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Exceedance Level | Units | Maximum Allowable Exceedances |
| CO | 8 hours (rolling, based on 1 hour averages) | 9.0 | Ppm | 1 day a year |
| CO (CoG) | 8 hours (rolling, based on 1 hour averages) | 8.0 | Ppb | 1 day a year |
| $NO_2$ | 1 hour | 120 | $\mu g/m^3$ | 1 day a year |
| $NO_2$ | 1 year | 30 | $\mu g/m^3$ | None |
| $PM_{10}$ | 1 day | 50 | $\mu g/m^3$ | None |
| $PM_{2.5}$ | 1 day | 25 | $\mu g/m^3$ | None |
| $PM_{2.5}$ | 1 year | 8 | $\mu g/m^3$ | None |

Table 10 - CLEM7 Air Quality Goals (Queensland Environmental Protection Air Policy 2008)

Note:

Exceptional events are excluded from this standard. 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 authorised hazard reduction burning; or continental scale windblown dust.

Norditech will include any valid data identified as being associated with an exceptional event in all report tables and graphic representations. However, 1-day averages associated with exceptional events will not be counted as exceedances of the Air Quality standard.

# 5. Calibrations and Maintenance

## 5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturers 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%.

| Units and Uncertainties | | | | |
|---|---|---|---|---|
| Parameter | Resolution | Units | Uncertainty | Measurement Range |
| NO, $NO_x$ (Thermo 42i) | 1 | ppb | ±2.10% of reading + 2.22% of full scale<br>K factor of 2.0 | 0 ppb to 500 ppb |
| $NO_2$ (Thermo 42i) | 1 | ppb | ±2.10% of reading + 2.22% of full scale<br>K factor of 2.0 | 0 ppb to 500 ppb |
| CO (Thermo 48i) | 0.1 | ppm | ±2.10% of reading + 2.22% of full scale<br>K factor of 2.0 | 0 ppm to 100 ppm |
| TSP | 0.1 | $\mu g/m^3$ | ±7.19% of reading<br>K factor of 20 | 7 $\mu g/m^3$ to full scale |
| $PM_{10}$, $PM_{2.5}$ (TEOM) | 0.1 | $\mu g/m^3$ | ±1.83% of reading + 0.22 $\mu g/m^3$<br>K factor of 2.0 | 0 $\mu g/m^3$ to 1 $g/m^3$ |
| Vector Wind Speed | 0.1 | m/s | ±0.46 m/s or 3.96% of reading, whichever is greater<br>K factor of 2.0 | 0 m/s to 15 m/s |
| Vector Wind Direction | 1 | deg | ±5.05 deg<br>K factor of 2.0 | 0 to 360 deg |
| Solar Radiation | 1 | $W/m^2$ | ±15 $W/m^2$ or 3% of reading, whichever is greater<br>K factor of 2.0 | 0 to 1100 $W/m^2$ |
| Ambient Temperature | 0.1 | °C | ±0.26 °C<br>K factor of 20 | 0°C to 50°C |
| Relative Humidity | 1 | % | ± 3.62%<br>K factor of 2.0 | 0 to 100% |

Table 11 - Units and Uncertainties

## 5.2. Automatic Calibration Checks

Automatic span and zero calibration checks run each night for gaseous parameters.

See Table 12 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

| Automatic span and zero calibration checks for $NO_x$, $NO_2$, NO and CO | |
|---|---|
| Station | Span / Zero cycle time (approximate) |
| Hawthorne Street | 01:00 – 01:55 |
| Royal Brisbane Hospital | 01:00 – 01:55 |
| Northey Street | 01:00 – 01:55 |
| Landcenter | 01:00 – 01:55 |

Table 12 - Automatic span and zero calibration checks for NOx, NO2, NO and CO

## 5.3. Maintenance

The maintenance schedule is kept per the manufacturers recommendations and applicable standards.

### 5.3.1. Maintenance Notes

Dust data across all sites is affected by unstable shelter temperature controlled by the air conditioner. The FDMS instruments are sensitive to minor changes in temperature resulting in patches of noisy data, especially overnight when temperatures are cooler. A number of adjustments to the air conditioner have been tried over time at all sites without success.

Note: The mast at Hawthorne Street was lowered and removed by BMS technicians on 18/10/2016 for off-site maintenance. Meteorological instruments were removed and maintenance tasks were performed. All data for wind speed, wind direction, sigma, ambient temperature and relative humidity are currently at 2.5m elevation, and data in this report is included for reference purposes only.

### 5.3.2. Calibration and Maintenance Summary Tables

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

Tables 13, 14, 15 and 16 indicate when the particulate, gas and meteorological equipment were last calibrated.

| Maintenance Table Hawthorne Street | | | | |
|---|---|---|---|---|
| Parameter | Date of Last Maintenance | Maintenance Type | Last Calibration Date | Calibration Cycle |
| NO, $NO_2$, $NO_x$ | 29/12/2017 | Monthly | 06/11/2017 | Monthly |
| CO | 29/12/2017 | Monthly | 06/11/2017 | Monthly |
| $PM_{2.5}$, $PM_{10}$ | 23/08/2017 | Monthly | 23/08/2017 | 6-Monthly |
| TSP | 27/10/2017 | Weekly filter change | 29/09/2017 | 2-Monthly |
| AT, RH[3] | 13/06/2016 | Monthly | 06/05/2015 | Yearly |
| Solar Radiation[3] | 19/07/2016 | Monthly | Not Avaliable | Yearly |
| WS, WD[3] | 23/08/2017 | 3 Monthly | 24/10/2017 | Yearly |

Table 13 – Maintenance Table Hawthorne Street

| Maintenance Table Royal Brisbane Hospital | | | | |
|---|---|---|---|---|
| Parameter | Date of Last Maintenance | Maintenance Type | Last Calibration Date | Calibration Cycle |
| NO, $NO_2$, $NO_x$ | 25/01/2017 | Instrument Shutdown | 15/12/2016 | Monthly |
| CO | 08/08/2017 | Instrument Shutdown | 08/08/2017 | Monthly |
| $PM_{2.5}$, $PM_{10}$ | 08/08/2017 | Instrument Shutdown | 08/08/2017 | 6-Monthly |
| TSP | 29/12/2017 | Weekly filter change | 29/09/2017 | 2-Monthly |
| AT, RH[3] | 08/08/2017 | 6 Monthly | 08/08/2017[5] | Yearly |
| Solar Radiation[3] | 08/08/2017 | Monthly | Not Avaliable | Yearly |
| WS, WD[3] | 08/08/2017 | 3 Monthly | 18/09/2015[6] | Yearly |

Table 14 – Maintenance Table Royal Brisbane Hospital

| Maintenance Table Northey Street | | | | |
|---|---|---|---|---|
| Parameter | Date of Last Maintenance | Maintenance Type | Last Calibration Date | Calibration Cycle |
| NO, $NO_2$, $NO_x$ | 29/12/2017 | Monthly | 17/11/2017 | Monthly |
| CO | 29/12/2017 | Monthly | 17/11/2016 | Monthly |
| $PM_{2.5}$, $PM_{10}$ | 24/08/2017 | Monthly | 24/08/2017 | 6-Monthly |
| TSP | 29/12/2017 | Weekly filter change | 29/09/2017 | 2-Monthly |
| AT, RH[3] | 24/08/2017 | Monthly | 17/05/2017[5] | Yearly |
| Solar Radiation[3] | 24/08/2017 | Monthly | Not Avaliable | Yearly |
| WS, WD[3] | 24/08/2017 | 3-Monthly | 18/09/2015[6] | Yearly |

Table 15 – Maintenance Table Northey Street

| Maintenance Table Landcenter | | | | |
|---|---|---|---|---|
| Parameter | Date of Last Maintenance | Maintenance Type | Last Calibration Date | Calibration Cycle |
| NO, $NO_2$, $NO_x$ | 23/08/2017 | Instrument Shutdown | 23/08/2017 | Monthly |
| CO | 23/08/2017 | Instrument Shutdown | 23/08/2017 | Monthly |
| $PM_{2.5}$, $PM_{10}$ | 23/08/2017 | Instrument Shutdown | 23/08/2017 | 6-Monthly |
| TSP | 29/12/2017 | Weekly filter change | 29/09/2017 | 2-Monthly |
| AT, RH[3] | 23/08/2017 | Monthly | 24/01/2017 | Yearly |
| Solar Radiation[3] | 23/08/2017 | Monthly | Not Avaliable | Yearly |
| WS, WD[3] | 23/08/2017 | 3-Monthly | 23/10/2014[6] | Yearly |

Table 16 – Maintenance Table Landcenter

[3] Maintenance temporarily suspended. See 3.3.1 for details
[4] On-site function check only
[5] Single point precision check only. Last multipoint calibration 15/09/2015
[6] On-site function check only

# 6. Results

## 6.1. Data Capture

Data capture is based on 5-minute data and refers to the amount of available data for the reporting period.

Data capture rates are calculated as per the following formula:

$$\text{Data Capture Rate \%} = \frac{\text{Available data points}}{\text{Total data points}} * 100$$

where:
Available data points = Total number of 5 minute averages for the reporting period in which valid data was recorded. This excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.

Total data points = Total number of 5 minute averages for the reporting period inclusive of invalid data.

Table 17 below displays the data capture statistics for December 2017. Bold values in the table indicate data capture below 95%.

Instruments disabled or removed from site have been grey-scaled.

| Data Capture (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Station | NO, $NO_2$, $NO_x$ | CO | $PM_{2.5}$ | $PM_{10}$ | AT | RH | SR | WS, WD, Sigma |
| Hawthorne Street | **62.3** | **62.3** | **56.2** | **56.2** | **56.6** | **56.6** | **56.6** | **56.6** |
| Royal Brisbane Hospital | **0.0** | **0.0** | | | 100.0 | 100.0 | 100.0 | 100.0 |
| Northey Street | 99.8 | 99.8 | 95.6 | 95.6 | 99.9 | 99.9 | 99.9 | 99.9 |
| Landcenter | **0.0** | **0.0** | **16.5** | | **88.6** | **88.6** | **88.6** | **88.6** |

Table 17 – Monthly Data Capture Rates

## 6.2. Air Quality Summary

Tables 18 to 21 below, detail any exceedances of the EPP Goal and NEPM Standard that were observed during this reporting period.

| Exceedances Recorded for Hawthorne Street | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Allowable Limit | Value of Exceedance | Date of Exceedance |
| Carbon Monoxide | 8 hour (rolling average) | 8 ppm | - | - |
| Nitrogen dioxide | 1 hour | 120 ppb | - | - |
| PM2.5 | 24 hour | 25 µg/m$^3$ | - | - |
| PM10 | 24 hour | 50 µg/m$^3$ | - | - |

Table 18 – Exceedances Recorded for Hawthorne Street

| Exceedances Recorded for Royal Brisbane Hospital | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Allowable Limit | Value of Exceedance | Date of Exceedance |
| Carbon Monoxide | 8 hour (rolling average) | 8 ppm | - | - |
| Nitrogen dioxide | 1 hour | 120 ppb | - | - |
| PM2.5 | 24 hour | 25 µg/m$^3$ | - | - |
| PM10 | 24 hour | 50 µg/m$^3$ | - | - |

Table 19 – Exceedances Recorded for Royal Brisbane Hospital

| Exceedances Recorded for Northey Street | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Allowable Limit | Value of Exceedance | Date of Exceedance |
| Carbon Monoxide | 8 hour (rolling average) | 8 ppm | - | - |
| Nitrogen dioxide | 1 hour | 120 ppb | - | - |
| PM2.5 | 24 hour | 25 µg/m$^3$ | - | - |
| PM10 | 24 hour | 50 µg/m$^3$ | - | - |

Table 20 – Exceedances Recorded for Northey Street

| Exceedances Recorded for Landcenter | | | | |
|---|---|---|---|---|
| Parameter | Time Period | Allowable Limit | Value of Exceedance | Date of Exceedance |
| Carbon Monoxide | 8 hour (rolling average) | 8 ppm | - | - |
| Nitrogen dioxide | 1 hour | 120 ppb | - | - |
| PM2.5 | 24 hour | 25 µg/m$^3$ | - | - |
| PM10 | 24 hour | 50 µg/m$^3$ | - | - |

Table 21 – Exceedances Recorded for Landcenter

## 6.3. Tabulated Data for Hawthorne Street

*Hawthorne Street Gaseous and Particulate Data*

| Hawthorne Street Gaseous and Paticulate Data December 2017 | | | | | | |
|---|---|---|---|---|---|---|
| Date | NO ppb | $NO_2$ ppb | $NO_x$ ppb | CO ppm | $PM_{2.5}$ $\mu g/m^3$ | $PM_{10}$ $\mu g/m^3$ |
| 1/12/2017 | 11 | 9 | 21 | 0.5 | 6.1 | 21.6 |
| 2/12/2017 | 7 | 8 | 14 | 0.3 | 6.6 | 23.7 |
| 3/12/2017 | 5 | 7 | 12 | 0.3 | 3.9 | 9.1 |
| 4/12/2017 | 8 | 13 | 21 | 0.4 | 3.5 | 6.9 |
| 5/12/2017 | 4 | 11 | 15 | 0.4 | 6.3 | 13.2 |
| 6/12/2017 | 4 | 10 | 14 | 0.4 | 5.6 | 12.8 |
| 7/12/2017 | 5 | 14 | 19 | 0.3 | 5.6 | 12.9 |
| 8/12/2017 | 6 | 17 | 23 | 0.3 | 6.6 | 14.0 |
| 9/12/2017 | 4 | 9 | 13 | 0.3 | 5.7 | 11.4 |
| 10/12/2017 | 3 | 7 | 10 | 0.3 | 4.8 | 10.8 |
| 11/12/2017 | 4 | 12 | 16 | 0.3 | 3.7 | 10.7 |
| 12/12/2017 | 5 | 8 | 13 | 0.3 | 6.4 | 13.1 |
| 13/12/2017 | 6 | 10 | 16 | 0.3 | 6.5 | 14.4 |
| 14/12/2017 | 7 | 11 | 18 | 0.3 | 2.9 | 12.8 |
| 15/12/2017 | 8 | 11 | 18 | 0.3 | 7.4 | 16.0 |
| 16/12/2017 | 6 | 7 | 14 | 0.3 | 3.8 | 11.0 |
| 17/12/2017 | 4 | 7 | 10 | 0.3 | 0.8 | 8.2 |
| 18/12/2017 | - | - | - | - | - | - |
| 19/12/2017 | - | - | - | - | - | - |
| 20/12/2017 | - | - | - | - | - | - |
| 21/12/2017 | - | - | - | - | - | - |
| 22/12/2017 | - | - | - | - | - | - |
| 23/12/2017 | - | - | - | - | - | - |
| 24/12/2017 | - | - | - | - | - | - |
| 25/12/2017 | - | - | - | - | - | - |
| 26/12/2017 | - | - | - | - | - | - |
| 27/12/2017 | - | - | - | - | - | - |
| 28/12/2017 | - | - | - | - | - | - |
| 29/12/2017 | - | - | - | - | - | - |
| 30/12/2017 | 7 | 5 | 12 | 0.4 | -0.3 | 5.7 |
| 31/12/2017 | 6 | 8 | 14 | 0.5 | 3.0 | 8.6 |
| Minimum | 2.876 | 5.270 | 9.924 | 0.3 | -0.3 | 5.7 |
| Date of Minimum | 10/12/2017 | 30/12/2017 | 10/12/2017 | 9/12/2017 | 30/12/2017 | 30/12/2017 |
| Maximum | 11.473 | 17.014 | 22.999 | 0.5 | 7.4 | 23.7 |
| Date of Maximum | 1/12/2017 | 8/12/2017 | 8/12/2017 | 31/12/2017 | 15/12/2017 | 2/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 22 – Hawthorne Street Gaseous and Particulate Data

*Hawthorne Street Meteorological Data*

| Hawthorne Street Meteorological Data December 2017 | | | | | |
|---|---|---|---|---|---|
| Date | Wind Speed m/s | Wind Direction deg | Temperature °C | Relative Humidity % | Solar Radiation W/m$^2$ |
| 1/12/2017 | 1.1 | 68.2 | 24.5 | 75.1 | 227.5 |
| 2/12/2017 | 1.9 | 75.5 | 25.1 | 75.4 | 238.2 |
| 3/12/2017 | 0.9 | 170.1 | 25.9 | 73.7 | 177.5 |
| 4/12/2017 | 0.5 | 172.7 | 22.2 | 86.6 | 89.9 |
| 5/12/2017 | 0.8 | 169.5 | 23.5 | 76.3 | 190.3 |
| 6/12/2017 | 0.7 | 213.9 | 25.0 | 53.8 | 310.1 |
| 7/12/2017 | 0.8 | 145.4 | 25.7 | 53.3 | 300.8 |
| 8/12/2017 | 0.8 | 191.9 | 24.9 | 68.3 | 182.2 |
| 9/12/2017 | 0.9 | 166.5 | 23.9 | 67.9 | 293.6 |
| 10/12/2017 | 0.9 | 165.3 | 23.2 | 69.8 | 218.2 |
| 11/12/2017 | 0.8 | 151.4 | 23.2 | 65.9 | 201.6 |
| 12/12/2017 | 0.9 | 161.4 | 23.6 | 62.3 | 240.0 |
| 13/12/2017 | 0.9 | 116.6 | 24.0 | 66.8 | 192.9 |
| 14/12/2017 | 0.9 | 129.4 | 24.7 | 66.1 | 282.2 |
| 15/12/2017 | 1.0 | 119.0 | 25.7 | 68.0 | 292.2 |
| 16/12/2017 | 1.1 | 103.9 | 25.7 | 71.9 | 244.3 |
| 17/12/2017 | 0.9 | 97.5 | 25.8 | 65.3 | 234.8 |
| 18/12/2017 | - | - | - | - | - |
| 19/12/2017 | - | - | - | - | - |
| 20/12/2017 | - | - | - | - | - |
| 21/12/2017 | - | - | - | - | - |
| 22/12/2017 | - | - | - | - | - |
| 23/12/2017 | - | - | - | - | - |
| 24/12/2017 | - | - | - | - | - |
| 25/12/2017 | - | - | - | - | - |
| 26/12/2017 | - | - | - | - | - |
| 27/12/2017 | - | - | - | - | - |
| 28/12/2017 | - | - | - | - | - |
| 29/12/2017 | - | - | - | - | - |
| 30/12/2017 | 1.1 | 180.9 | 27.4 | 70.1 | 196.0 |
| 31/12/2017 | 0.5 | 142.7 | 27.3 | 76.4 | 153.2 |
| Minimum | 0.5 | 68.2 | 22.2 | 53.3 | 89.9 |
| Date of Minimum | 4/12/2017 | 1/12/2017 | 4/12/2017 | 7/12/2017 | 4/12/2017 |
| Maximum | 1.9 | 213.9 | 27.4 | 86.6 | 310.1 |
| Date of Maximum | 2/12/2017 | 6/12/2017 | 30/12/2017 | 4/12/2017 | 6/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 23 – Hawthorne Street Meteorological Data

*Hawthorne Street Calibration Data*

| Hawthorne Street Calibration Data December 2017 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | NO Zero | NO Precision | NO Span | $NO_2$ Zero | $NO_2$ Precision | $NO_2$ Span | $NO_x$ Zero | $NO_x$ Precision | $NO_x$ Span | CO Zero | CO Precision | CO Span |
| 1/12/2017 | 1 | 392 | 409 | -1 | 8 | 8 | 0 | 400 | 416 | 0.1 | 39.7 | 38.4 |
| 2/12/2017 | 1 | 392 | 410 | 0 | 8 | 9 | 1 | 400 | 418 | 0.0 | 39.7 | 38.3 |
| 3/12/2017 | 2 | 392 | 411 | 0 | 8 | 6 | 1 | 400 | 416 | 0.0 | 39.7 | 38.3 |
| 4/12/2017 | 2 | 392 | 416 | 0 | 8 | 6 | 2 | 400 | 420 | 0.0 | 39.7 | 38.3 |
| 5/12/2017 | 1 | 392 | 415 | 1 | 8 | 6 | 1 | 400 | 420 | 0.0 | 39.7 | 38.3 |
| 6/12/2017 | 2 | 392 | 418 | 0 | 8 | 6 | 2 | 400 | 422 | 0.0 | 39.7 | 38.3 |
| 7/12/2017 | 2 | 392 | - | 0 | 8 | - | 2 | 400 | - | 0.0 | 39.7 | - |
| 8/12/2017 | 2 | 392 | - | 0 | 8 | - | 2 | 400 | - | 0.0 | 39.7 | - |
| 9/12/2017 | 2 | 392 | - | 0 | 8 | - | 1 | 400 | - | 0.0 | 39.7 | - |
| 10/12/2017 | 1 | 392 | - | 0 | 8 | - | 1 | 400 | - | 0.0 | 39.7 | - |
| 11/12/2017 | 1 | 392 | - | 0 | 8 | - | 1 | 400 | - | 0.0 | 39.7 | - |
| 12/12/2017 | 1 | 392 | - | 0 | 8 | - | 1 | 400 | - | 0.0 | 39.7 | - |
| 13/12/2017 | 1 | 392 | - | -1 | 8 | - | 0 | 400 | - | 0.0 | 39.7 | - |
| 14/12/2017 | 1 | 392 | - | 0 | 8 | - | 0 | 400 | - | 0.0 | 39.7 | - |
| 15/12/2017 | 1 | 392 | - | -1 | 8 | - | 0 | 400 | - | 0.0 | 39.7 | - |
| 16/12/2017 | 1 | 392 | - | 0 | 8 | - | 1 | 400 | - | 0.0 | 39.7 | - |
| 17/12/2017 | 1 | 392 | - | 0 | 8 | - | 0 | 400 | - | 0.0 | 39.7 | - |
| 18/12/2017 | 1 | 392 | - | 0 | 8 | - | 0 | 400 | - | 0.0 | 39.7 | - |
| 19/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 20/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 21/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 22/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 23/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 24/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 25/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 26/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 27/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 28/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 29/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 30/12/2017 | 2 | 392 | 401 | 0 | 8 | 2 | 2 | 400 | 402 | 0.0 | 39.7 | 39.7 |
| 31/12/2017 | 3 | 392 | 399 | -1 | 8 | 4 | 2 | 400 | 401 | 0.0 | 39.7 | 39.8 |

Table 24 – Hawthorne Street Calibration Data

## 6.4. Graphic Representations for Hawthorne Street

Validated 5-minute data for NO, NO2, Nox, CO, PM2.5 and PM10 were used to construct the following monthly graphical representations.

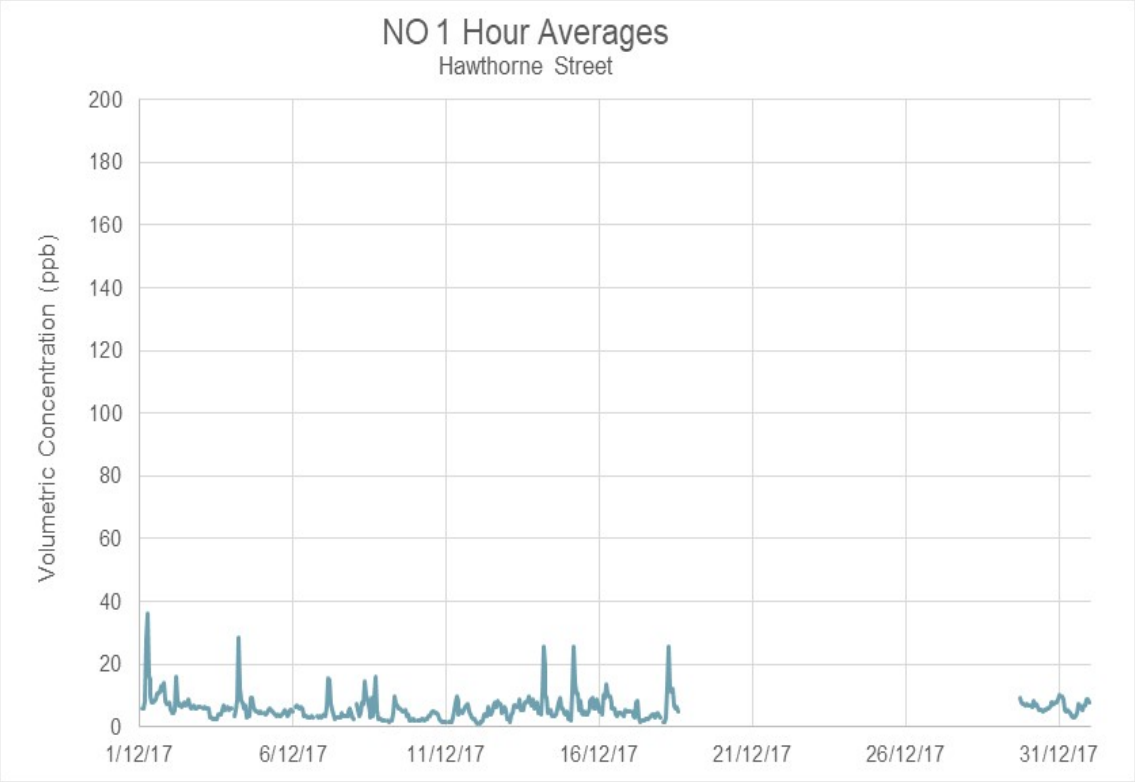


Figure 18 – Hawthorne Street 1 Hour Averaged NO Data

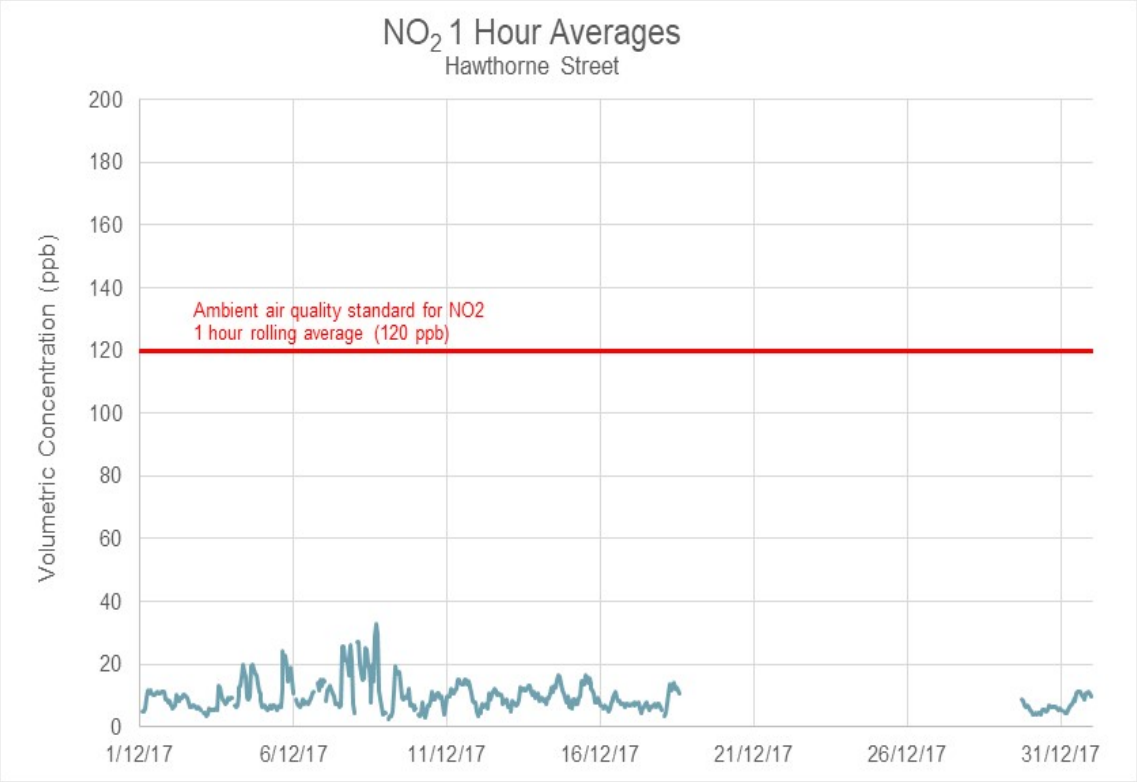


Figure 19 – Hawthorne Street 1 Hour Averaged $NO_2$ Data

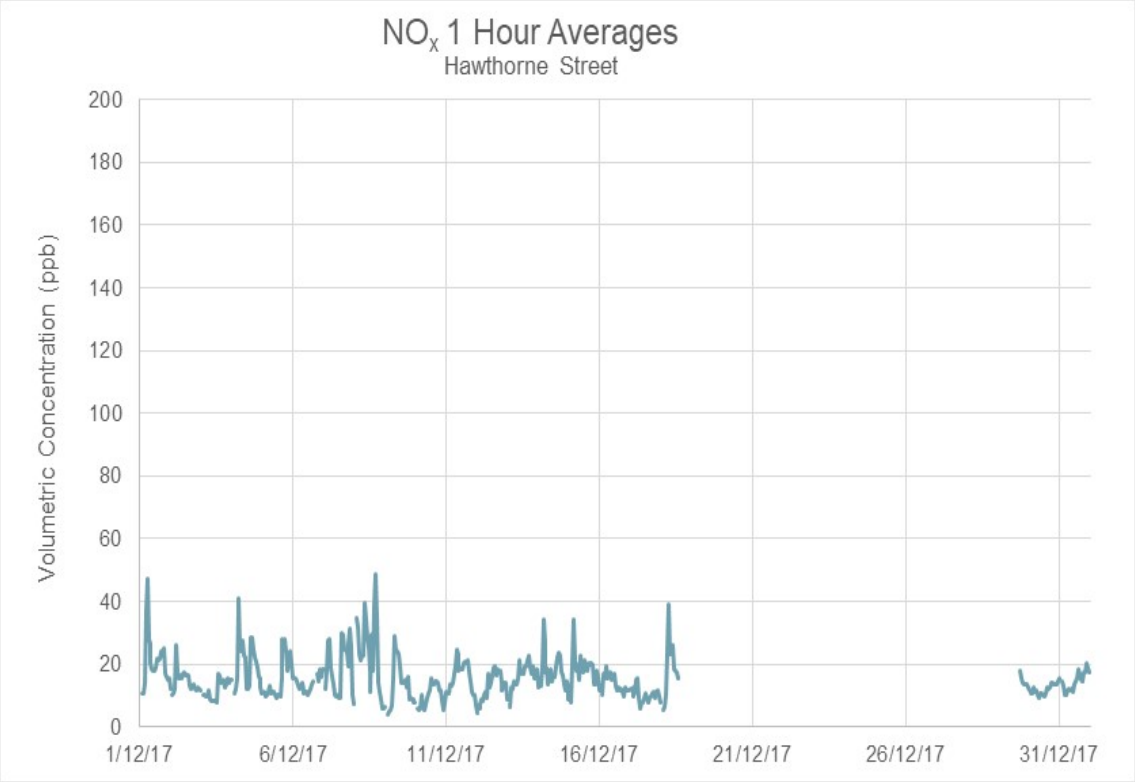


Figure 20 – Hawthorne Street 1 Hour Averaged $NO_x$ Data

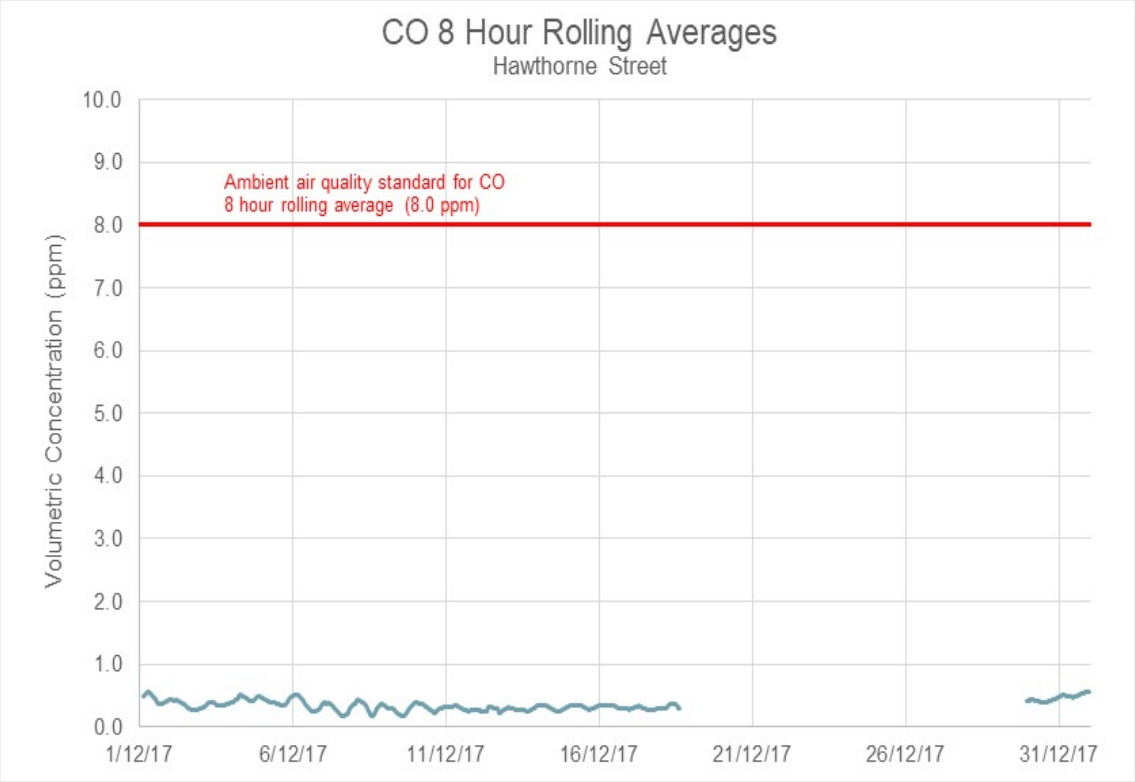


Figure 21 – Hawthorne Street 1 Hour Averaged CO Data

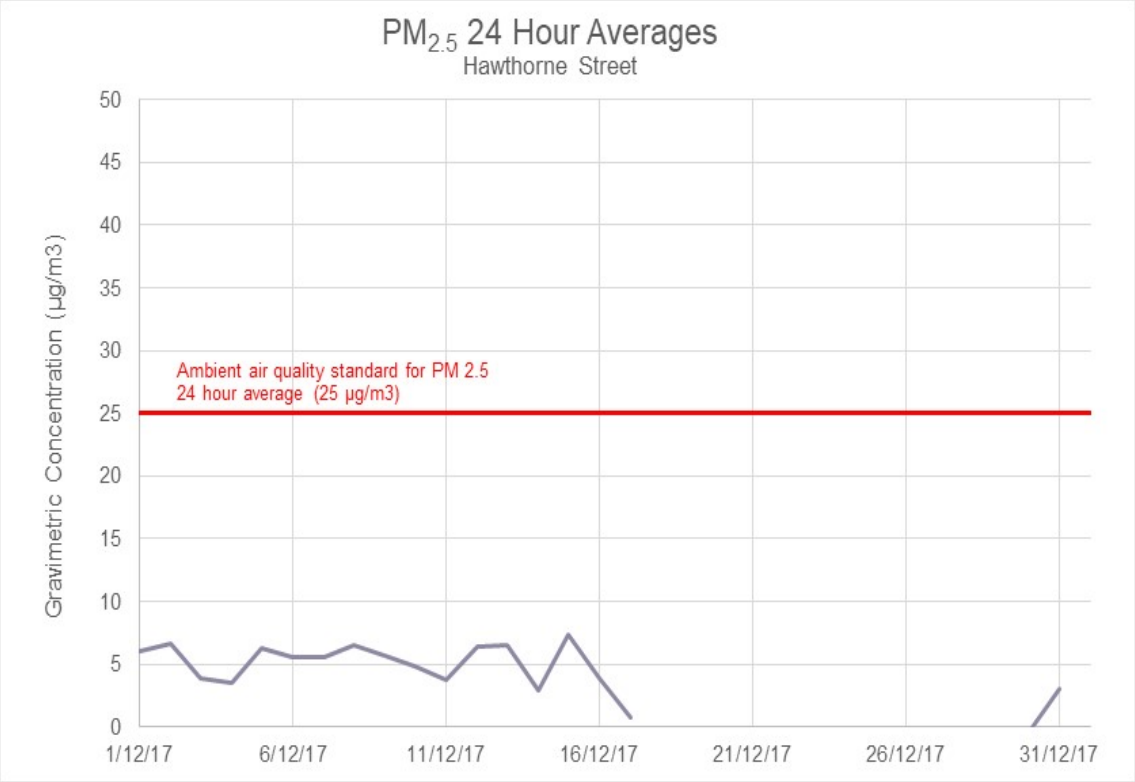


Figure 22 – Hawthorne Street 1 Hour Averaged $PM_{2.5}$ Data

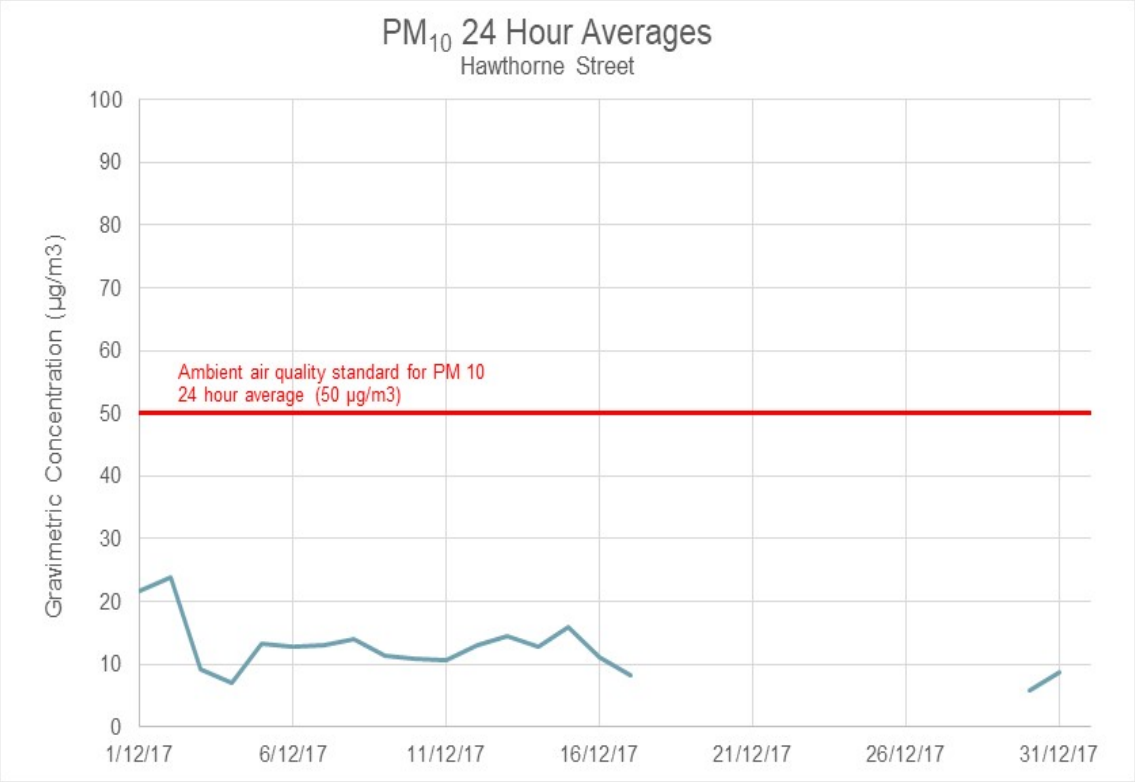


Figure 23 – Hawthorne Street 1 Hour Averaged $PM_{10}$ Data

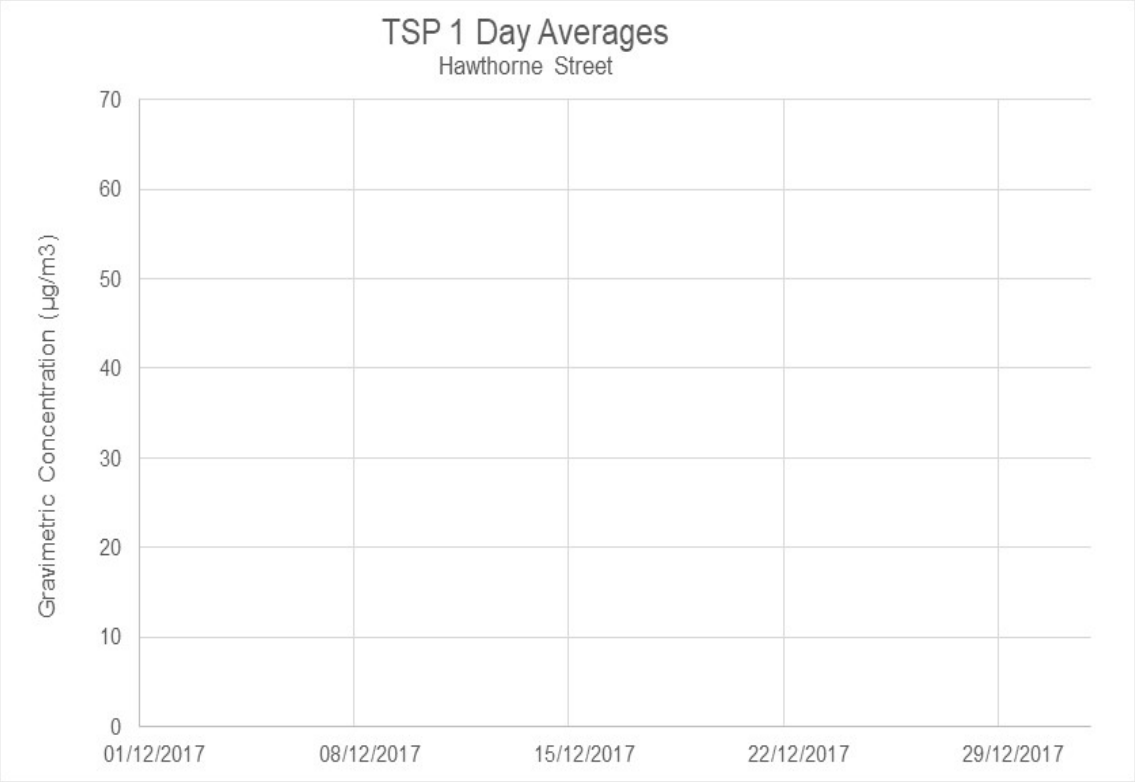


Figure 24 – Hawthorne Street TSP Data

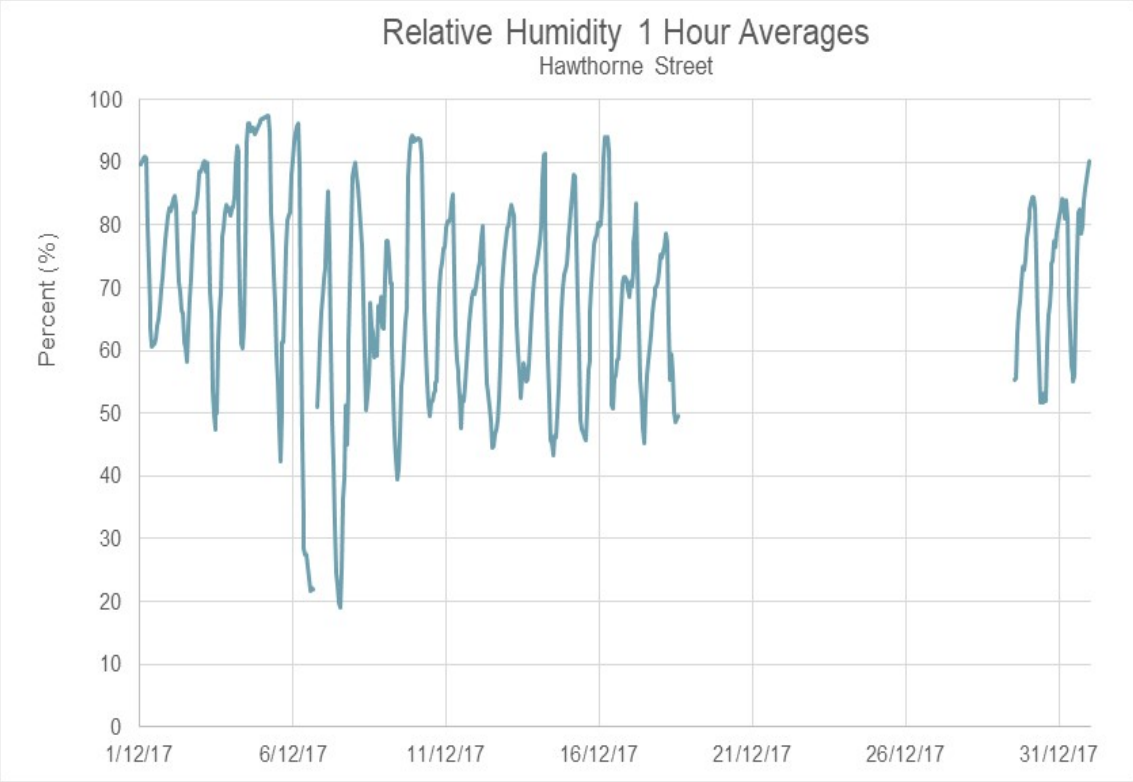


Figure 25 – Hawthorne Street 1 Hour Averaged Relative Humidity Data

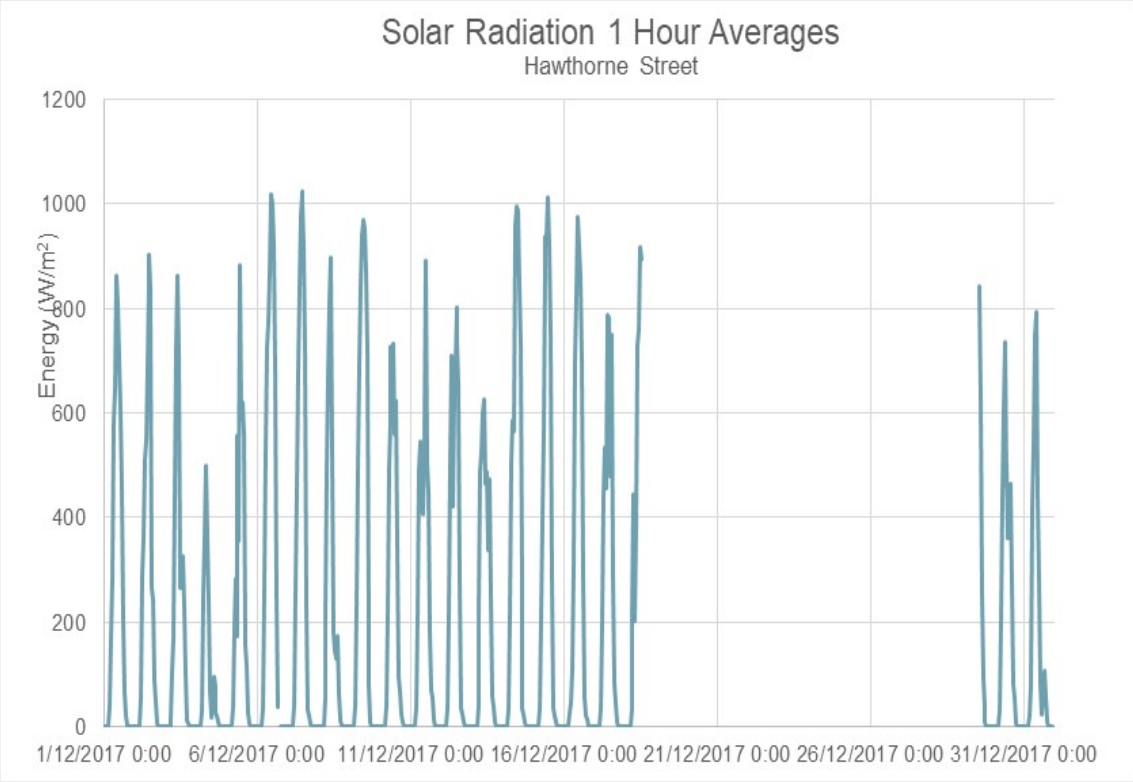


Figure 26 – Hawthorne Street 1 Hour Averaged Solar Radiation Data

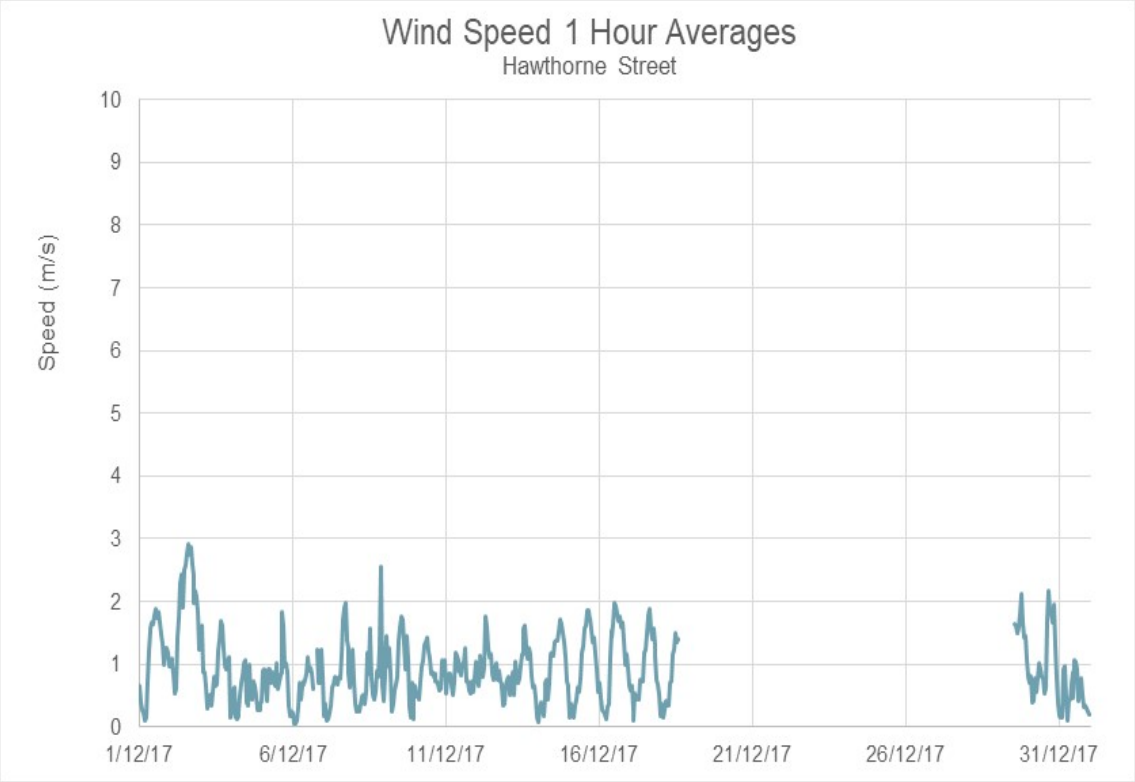


Figure 27 – Hawthorne Street 1 Hour Averaged Wind Speed Data

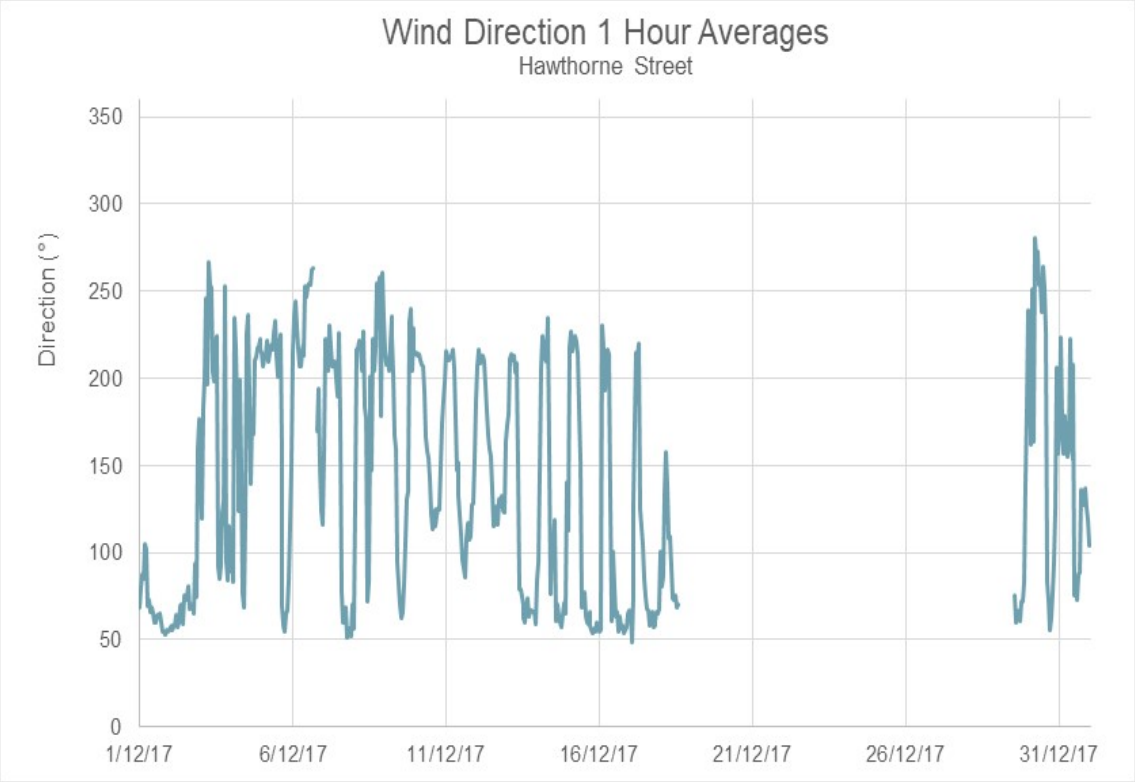


Figure 28 – Hawthorne Street 1 Hour Averaged Wind Direction Data

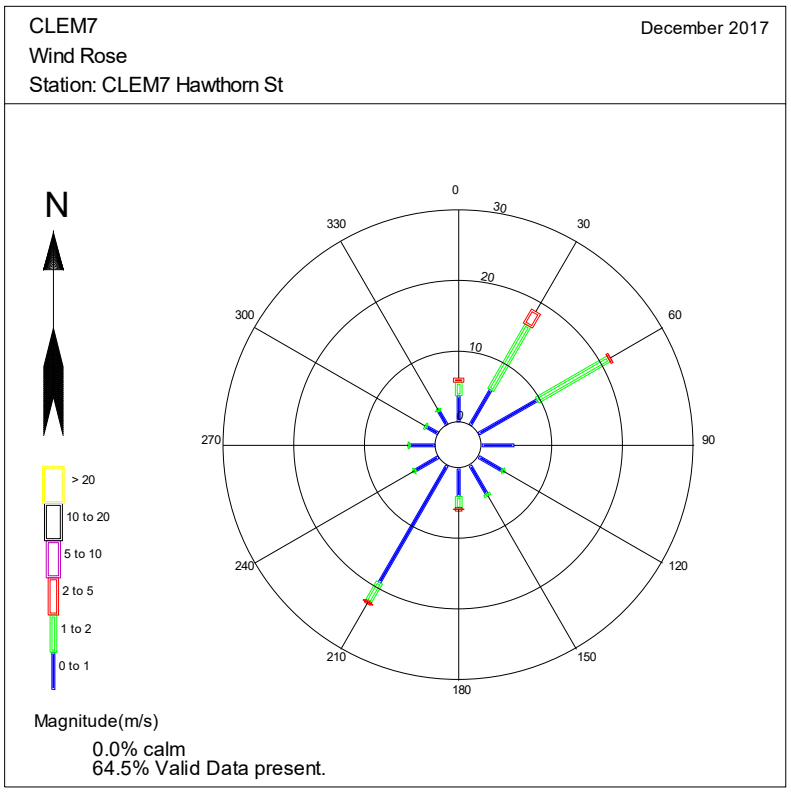


Figure 29 – Hawthorne Street 1 Hour Averaged Monthly Wind Rose

## 6.5. Tabulated Data for Royal Brisbane Hospital

*Royal Brisbane Hospital Gaseous and Particulate Data*

| Royal Brisbane Hospital Gaseous and Paticulate Data December 2017 | | | | | | |
|---|---|---|---|---|---|---|
| Date | NO ppb | $NO_2$ ppb | $NO_x$ ppb | CO ppm | $PM_{2.5}$ $\mu g/m^3$ | $PM_{10}$ $\mu g/m^3$ |
| 1/12/2017 | - | - | - | - | - | - |
| 2/12/2017 | - | - | - | - | - | - |
| 3/12/2017 | - | - | - | - | - | - |
| 4/12/2017 | - | - | - | - | - | - |
| 5/12/2017 | - | - | - | - | - | - |
| 6/12/2017 | - | - | - | - | - | - |
| 7/12/2017 | - | - | - | - | - | - |
| 8/12/2017 | - | - | - | - | - | - |
| 9/12/2017 | - | - | - | - | - | - |
| 10/12/2017 | - | - | - | - | - | - |
| 11/12/2017 | - | - | - | - | - | - |
| 12/12/2017 | - | - | - | - | - | - |
| 13/12/2017 | - | - | - | - | - | - |
| 14/12/2017 | - | - | - | - | - | - |
| 15/12/2017 | - | - | - | - | - | - |
| 16/12/2017 | - | - | - | - | - | - |
| 17/12/2017 | - | - | - | - | - | - |
| 18/12/2017 | - | - | - | - | - | - |
| 19/12/2017 | - | - | - | - | - | - |
| 20/12/2017 | - | - | - | - | - | - |
| 21/12/2017 | - | - | - | - | - | - |
| 22/12/2017 | - | - | - | - | - | - |
| 23/12/2017 | - | - | - | - | 4.9 | 10.2 |
| 24/12/2017 | - | - | - | - | 2.7 | 7.3 |
| 25/12/2017 | - | - | - | - | 1.8 | 7.9 |
| 26/12/2017 | - | - | - | - | - | - |
| 27/12/2017 | - | - | - | - | - | - |
| 28/12/2017 | - | - | - | - | - | - |
| 29/12/2017 | - | - | - | - | - | - |
| 30/12/2017 | - | - | - | - | - | - |
| 31/12/2017 | - | - | - | - | - | - |
| Minimum | - | - | - | - | 1.8 | 7.3 |
| Date of Minimum | - | - | - | - | 25/12/2017 | 24/12/2017 |
| Maximum | - | - | - | - | 4.9 | 10.2 |
| Date of Maximum | - | - | - | - | 23/12/2017 | 23/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 25 – Royal Brisbane Hospital Gaseous and Particulate Data

*Royal Brisbane Hospital Meteorological Data*

| Royal Brisbane Hospital Meteorological Data December 2017 | | | | | |
|---|---|---|---|---|---|
| Date | Wind Speed m/s | Wind Direction deg | Temperature °C | Relative Humidity % | Solar Radiation W/m$^2$ |
| 1/12/2017 | 3.2 | 90.8 | 24.3 | 73.3 | 284.6 |
| 2/12/2017 | 2.6 | 146.8 | 24.6 | 76.6 | 265.5 |
| 3/12/2017 | 1.4 | 229.9 | 25.2 | 76.3 | 168.8 |
| 4/12/2017 | 0.9 | 186.4 | 22.1 | 85.9 | 107.3 |
| 5/12/2017 | 1.0 | 168.7 | 23.6 | 73.2 | 207.3 |
| 6/12/2017 | 1.4 | 254.5 | 24.8 | 49.6 | 323.8 |
| 7/12/2017 | 1.1 | 168.6 | 25.6 | 49.4 | 320.7 |
| 8/12/2017 | 1.2 | 213.1 | 24.7 | 69.0 | 191.8 |
| 9/12/2017 | 1.7 | 159.7 | 23.6 | 66.3 | 302.7 |
| 10/12/2017 | 1.4 | 147.3 | 23.2 | 66.7 | 238.5 |
| 11/12/2017 | 1.6 | 140.8 | 23.2 | 64.0 | 238.5 |
| 12/12/2017 | 1.7 | 144.2 | 23.4 | 61.1 | 280.2 |
| 13/12/2017 | 2.2 | 125.8 | 23.9 | 65.9 | 255.2 |
| 14/12/2017 | 1.4 | 166.0 | 24.2 | 65.2 | 298.1 |
| 15/12/2017 | 1.5 | 167.7 | 25.0 | 68.4 | 297.0 |
| 16/12/2017 | 1.9 | 118.0 | 25.6 | 69.4 | 254.2 |
| 17/12/2017 | 1.9 | 120.4 | 25.4 | 64.4 | 303.0 |
| 18/12/2017 | 2.0 | 121.7 | 25.0 | 63.0 | 290.4 |
| 19/12/2017 | 1.6 | 218.0 | 25.3 | 67.5 | 301.7 |
| 20/12/2017 | 2.1 | 219.8 | 26.1 | 69.2 | 319.3 |
| 21/12/2017 | 1.7 | 190.4 | 26.4 | 66.2 | 292.3 |
| 22/12/2017 | 1.3 | 175.5 | 25.2 | 75.2 | 190.7 |
| 23/12/2017 | 1.4 | 192.5 | 25.8 | 73.0 | 259.1 |
| 24/12/2017 | 1.6 | 208.3 | 26.3 | 67.1 | 313.7 |
| 25/12/2017 | 2.0 | 201.2 | 26.4 | 68.8 | 296.1 |
| 26/12/2017 | 2.0 | 151.0 | 23.4 | 81.5 | 184.8 |
| 27/12/2017 | 1.6 | 136.9 | 24.2 | 72.3 | 235.2 |
| 28/12/2017 | 1.5 | 133.2 | 24.7 | 71.5 | 188.5 |
| 29/12/2017 | 1.6 | 177.4 | 25.6 | 75.1 | 281.4 |
| 30/12/2017 | 1.6 | 235.8 | 26.8 | 72.4 | 226.9 |
| 31/12/2017 | 1.3 | 152.3 | 26.9 | 77.0 | 162.4 |
| Minimum | 0.9 | 90.8 | 22.1 | 49.4 | 107.3 |
| Date of Minimum | 4/12/2017 | 1/12/2017 | 4/12/2017 | 7/12/2017 | 4/12/2017 |
| Maximum | 3.2 | 254.5 | 26.9 | 85.9 | 323.8 |
| Date of Maximum | 1/12/2017 | 6/12/2017 | 31/12/2017 | 4/12/2017 | 6/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 26 – Royal Brisbane Hospital Meteorological Data

*Royal Brisbane Hospital Calibration Data*

| Royal Brisbane Hospital Calibration Data December 2017 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | NO Zero | NO Precision | NO Span | $NO_2$ Zero | $NO_2$ Precision | $NO_2$ Span | $NO_x$ Zero | $NO_x$ Precision | $NO_x$ Span | CO Zero | CO Precision | CO Span |
| 1/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 2/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 3/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 4/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 5/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 6/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 7/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 8/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 9/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 10/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 11/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 12/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 13/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 14/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 15/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 16/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 17/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 18/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 19/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 20/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 21/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 22/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 23/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 24/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 25/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 26/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 27/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 28/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 29/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 30/12/2017 | - | 399 | - | - | 0 | - | - | 399 | - | - | 40.8 | - |
| 31/12/2017 | - | 400 | - | - | 1 | - | - | 400 | - | - | 41.8 | - |

Table 27 – Royal Brisbane Hospital Calibration Data

## 6.6. Graphic Representations for Royal Brisbane Hospital

Validated 5-minute data for NO, NO2, Nox, CO, PM2.5 and PM10 were used to construct the following monthly graphical representations.

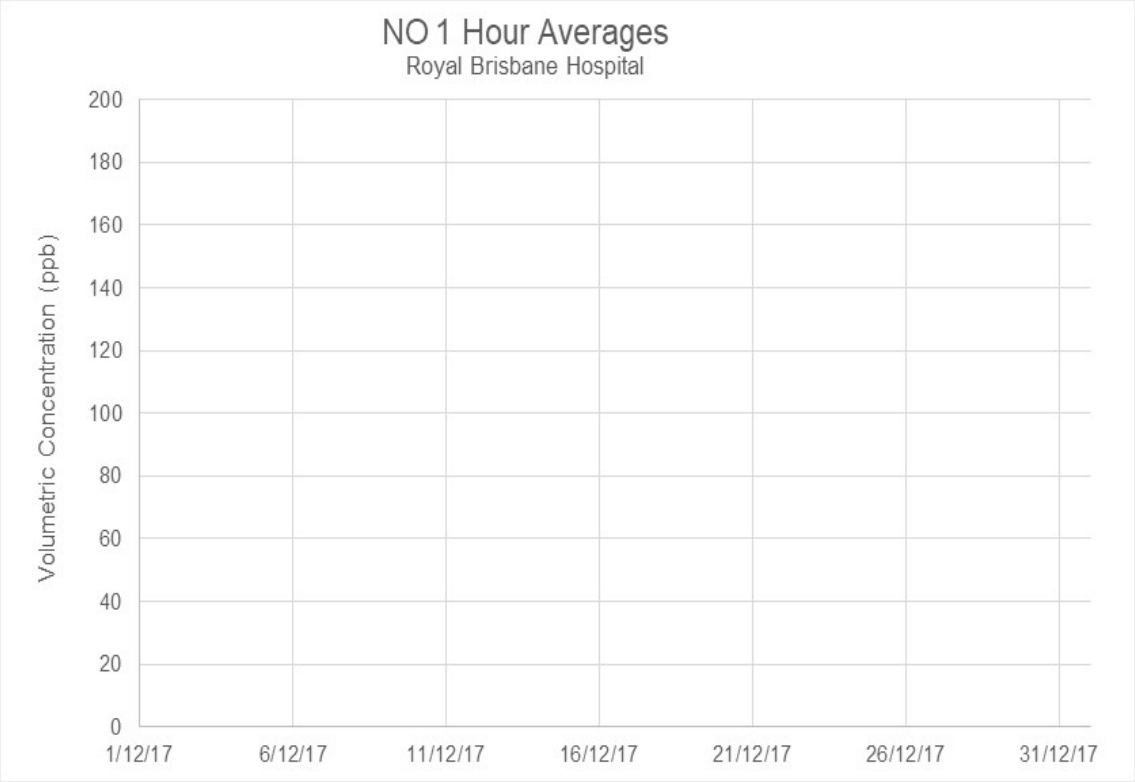


Figure 30 – Royal Brisbane Hospital 1 Hour Averaged NO Data

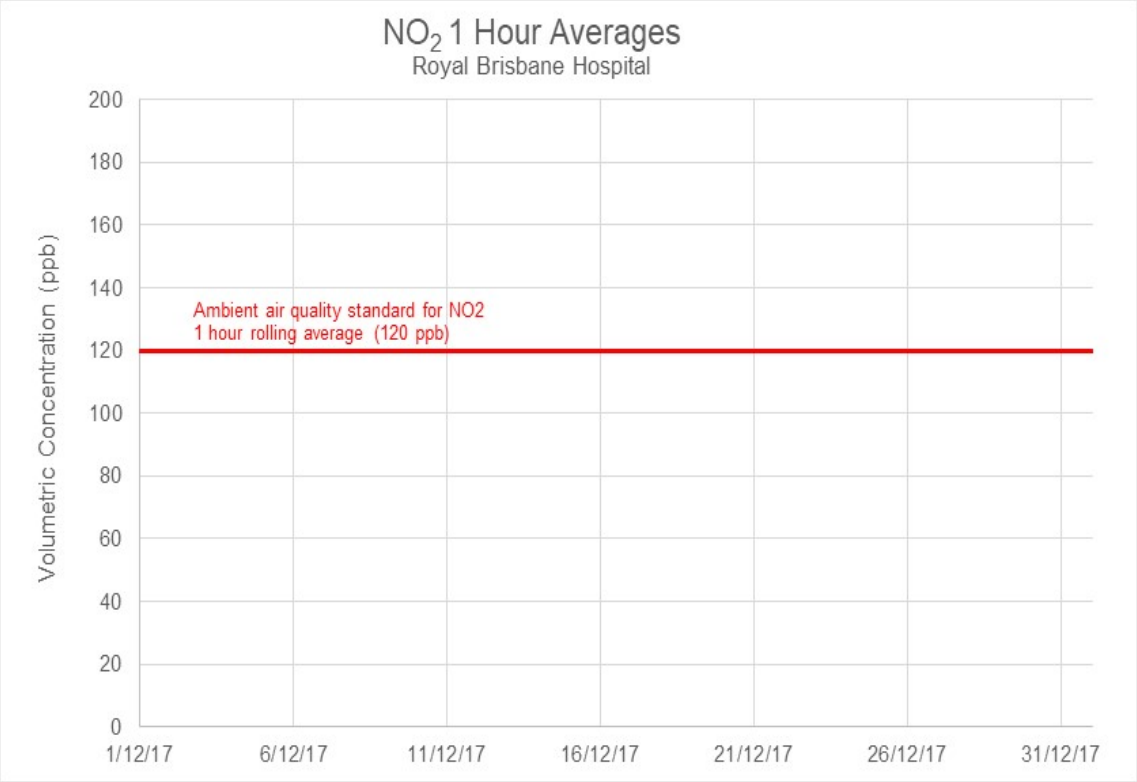


Figure 31 – Royal Brisbane Hospital 1 Hour Averaged $NO_2$ Data

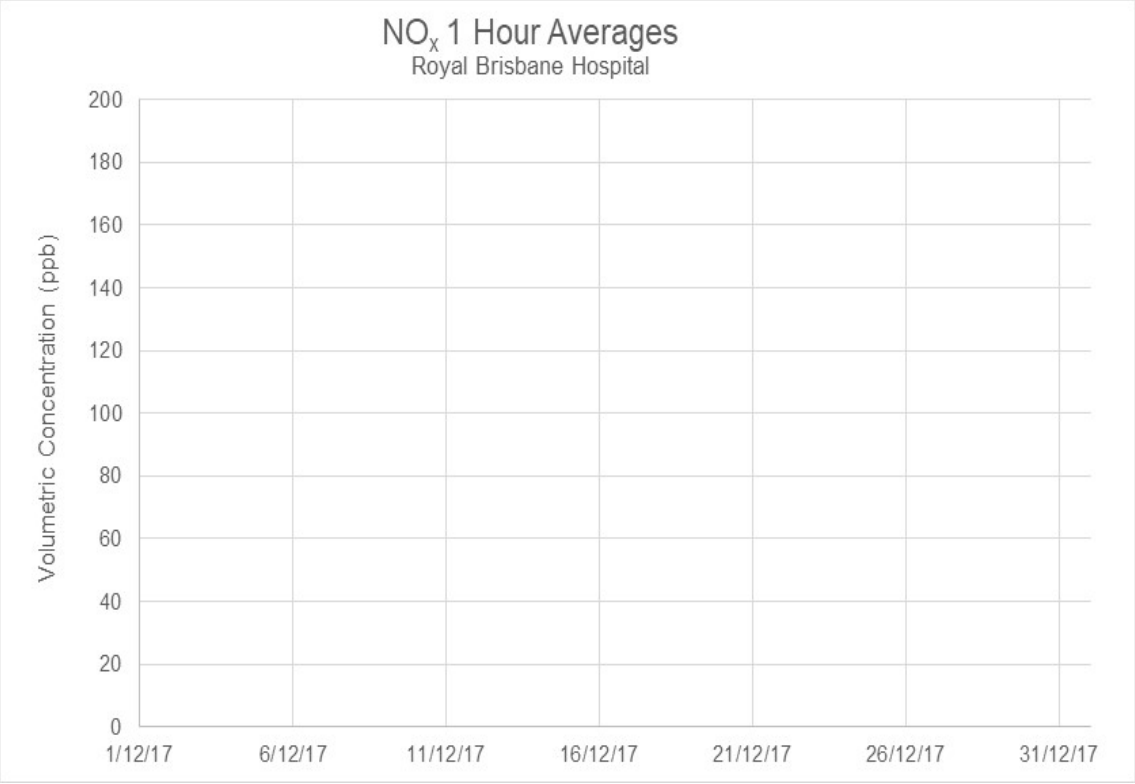


Figure 32 – Royal Brisbane Hospital 1 Hour Averaged $NO_x$ Data

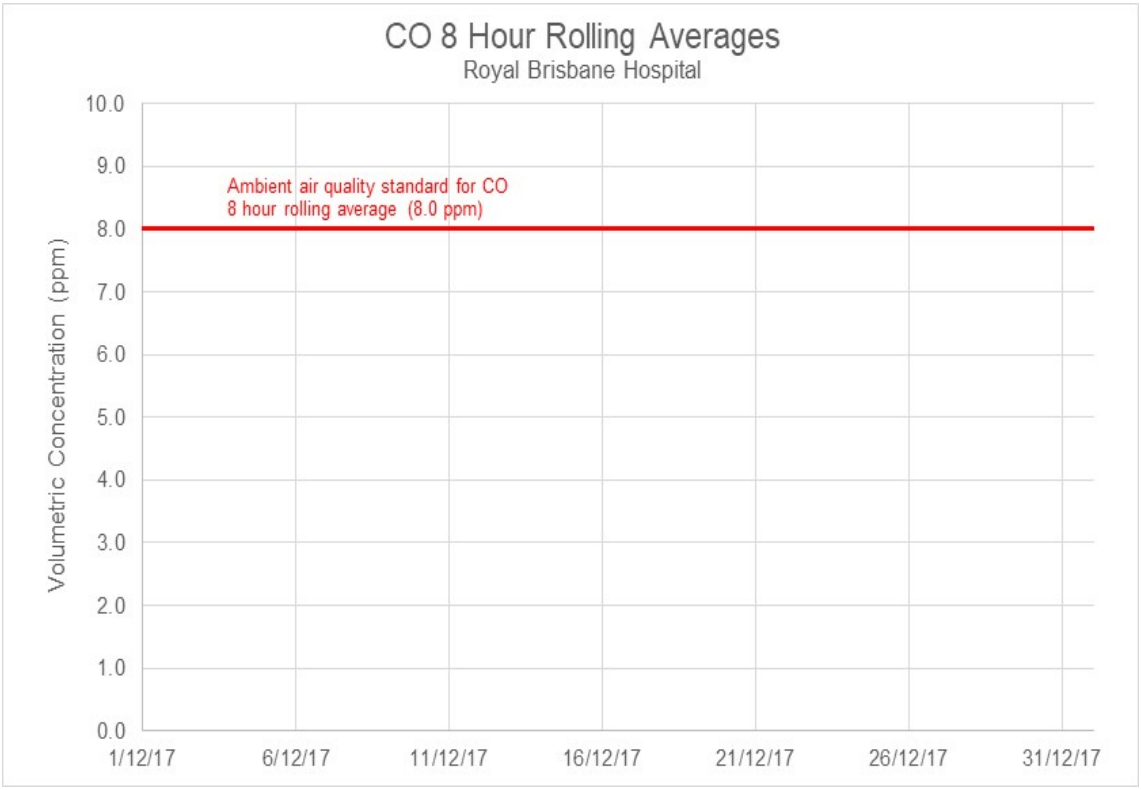


Figure 33 – Royal Brisbane Hospital 1 Hour Averaged CO Data

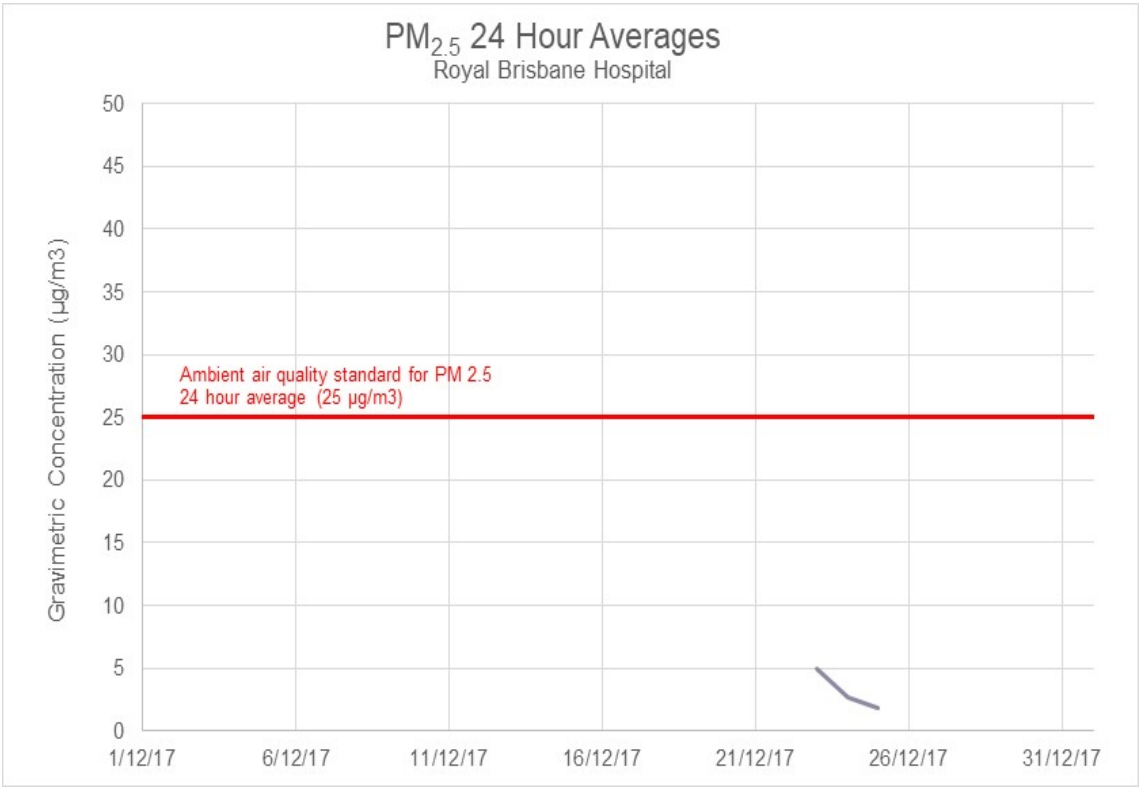


Figure 34 – Royal Brisbane Hospital 1 Hour Averaged $PM_{2.5}$ Data

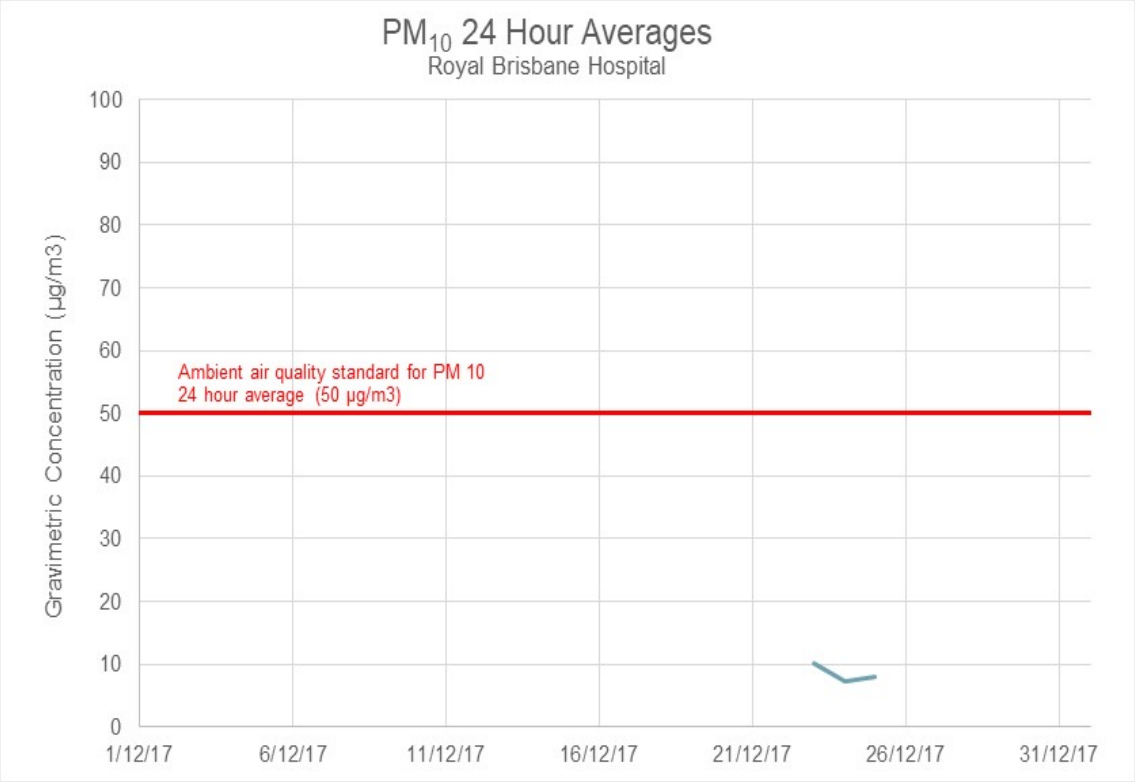


Figure 35 – Royal Brisbane Hospital 1 Hour Averaged $PM_{10}$ Data

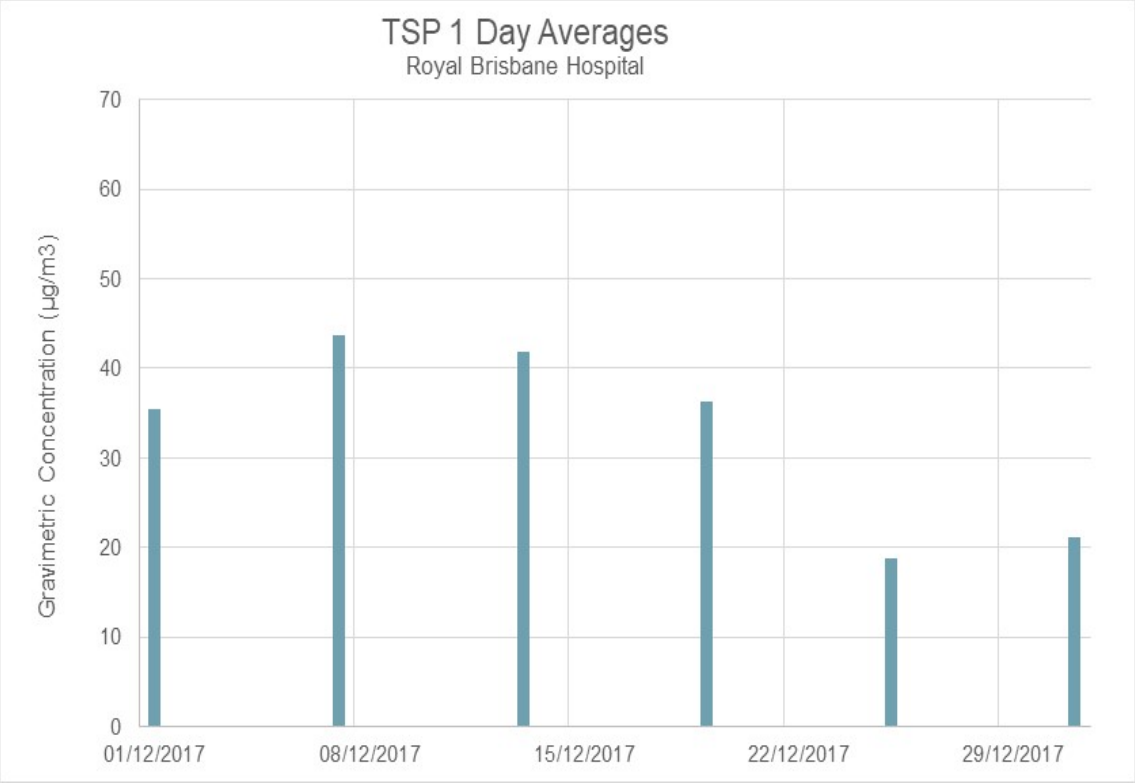


Figure 36 – Royal Brisbane Hospital TSP Data

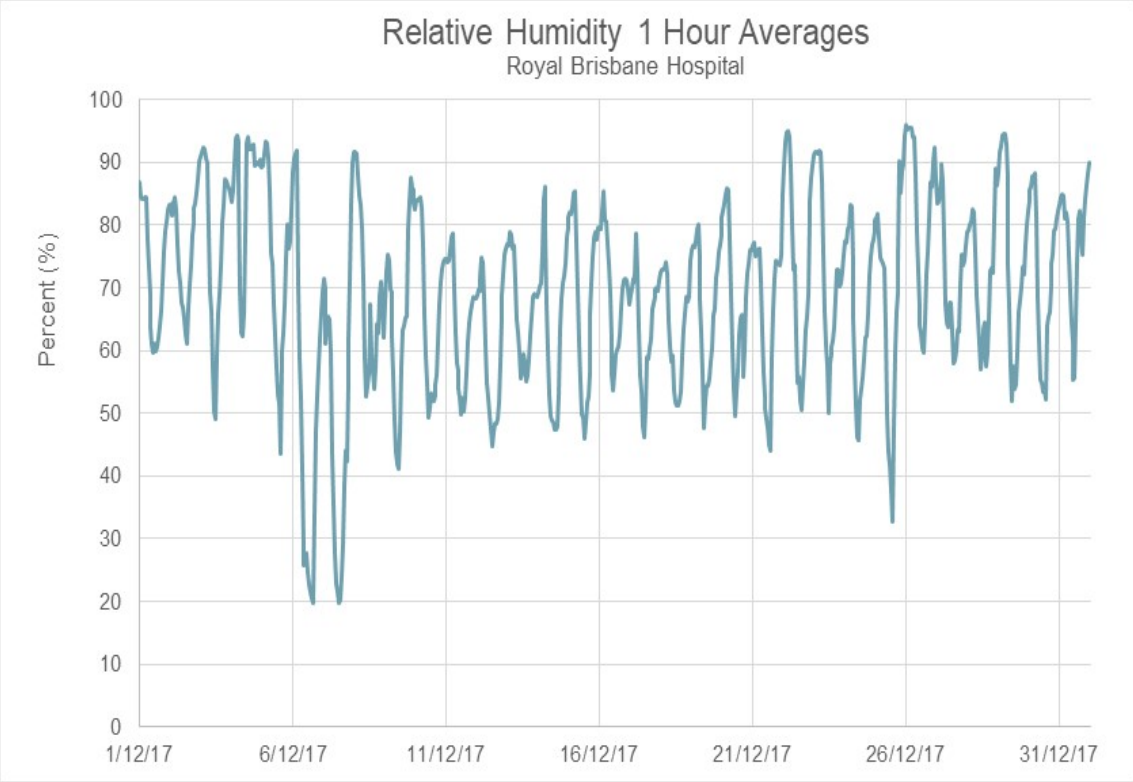


Figure 37 – Royal Brisbane Hospital 1 Hour Averaged Relative Humidity Data

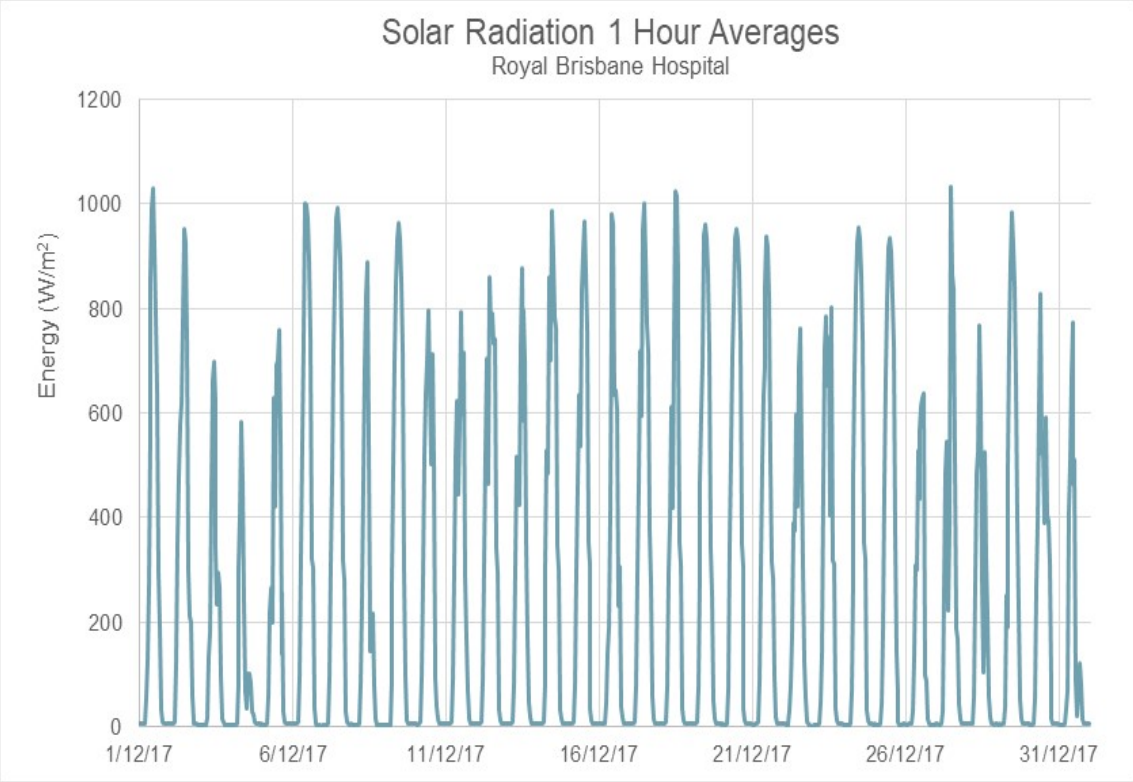


Figure 38 – Royal Brisbane Hospital 1 Hour Averaged Solar Radiation Data

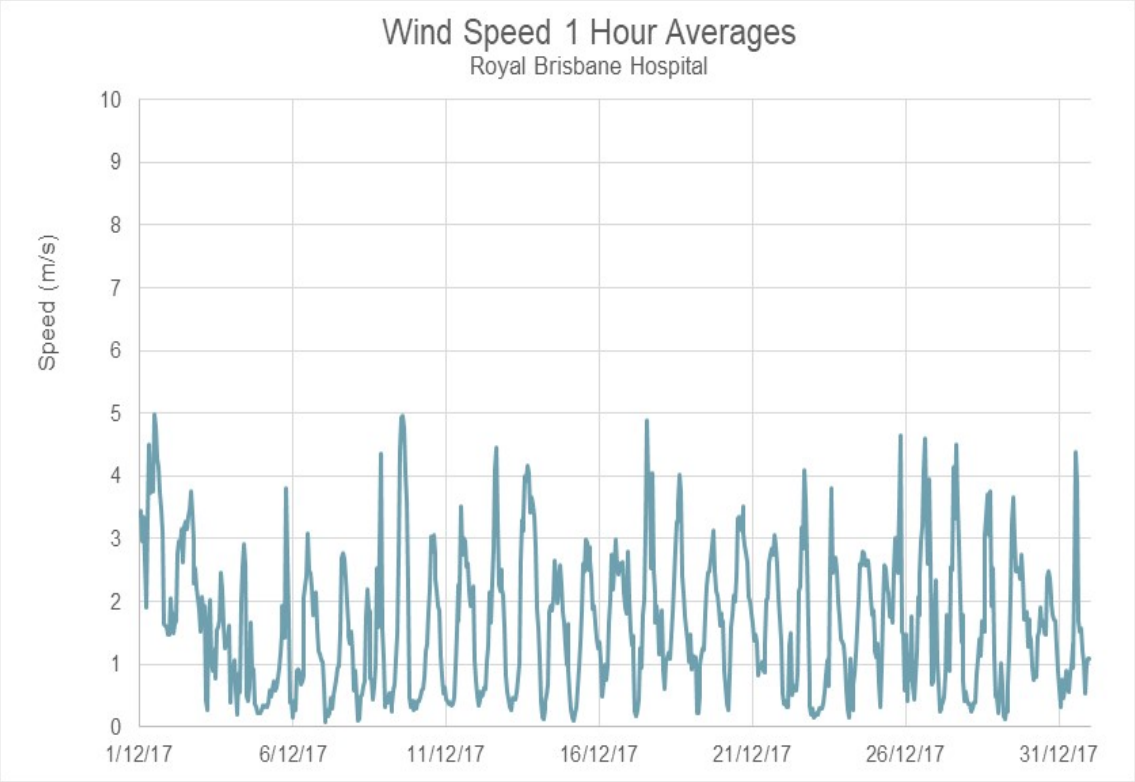


Figure 39 – Royal Brisbane Hospital 1 Hour Averaged Wind Speed Data

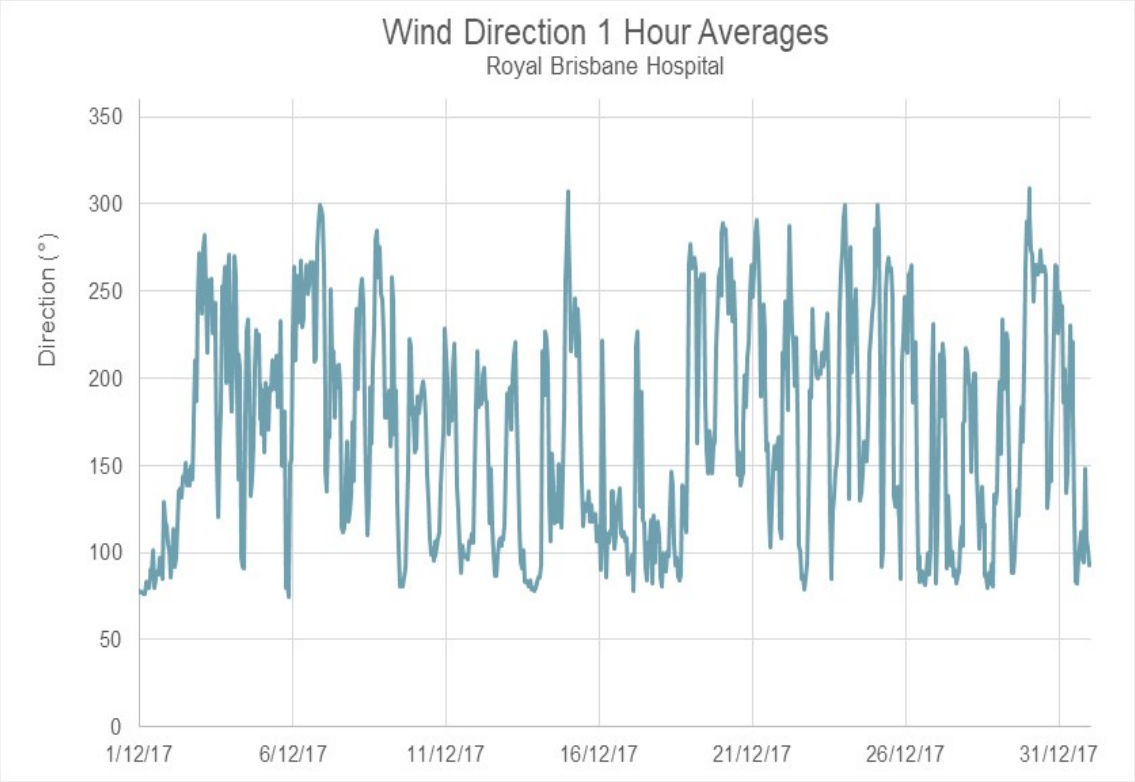


Figure 40 – Royal Brisbane Hospital 1 Hour Averaged Wind Direction Data

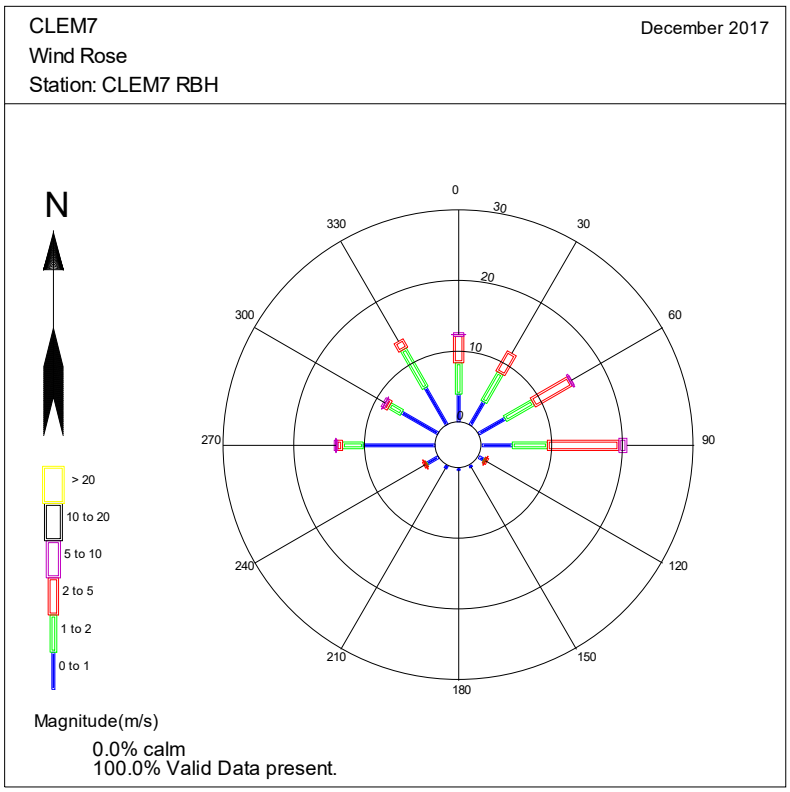


Figure 41 – Royal Brisbane Hospital 1 Hour Averaged Monthly Wind Rose

## 6.7. Tabulated Data for Northey Street

*Northey Street Gaseous and Particulate Data*

| Northey Street Gaseous and Paticulate Data December 2017 | | | | | | |
|---|---|---|---|---|---|---|
| Date | NO ppb | $NO_2$ ppb | $NO_x$ ppb | CO ppm | $PM_{2.5}$ $\mu g/m^3$ | $PM_{10}$ $\mu g/m^3$ |
| 1/12/2017 | 2 | 3 | 4 | 0.4 | 2.3 | 16.4 |
| 2/12/2017 | 1 | 1 | 2 | 0.4 | 1.7 | 14.2 |
| 3/12/2017 | 1 | 2 | 2 | 0.4 | 3.9 | 14.1 |
| 4/12/2017 | 3 | 9 | 11 | 0.4 | 6.1 | 11.4 |
| 5/12/2017 | 1 | 6 | 7 | 0.4 | 3.2 | 8.9 |
| 6/12/2017 | 1 | 5 | 5 | 0.4 | 5.3 | 11.5 |
| 7/12/2017 | 4 | 8 | 12 | 0.4 | 10.4 | 17.0 |
| 8/12/2017 | 3 | 9 | 12 | 0.3 | 7.8 | 15.2 |
| 9/12/2017 | 1 | 6 | 7 | 0.3 | 8.2 | 14.5 |
| 10/12/2017 | 1 | 4 | 5 | 0.3 | 6.9 | 17.0 |
| 11/12/2017 | 2 | 5 | 7 | 0.3 | 4.4 | 13.0 |
| 12/12/2017 | 4 | 5 | 8 | 0.3 | 5.0 | 13.9 |
| 13/12/2017 | 4 | 4 | 8 | 0.3 | 5.5 | 15.8 |
| 14/12/2017 | 3 | 4 | 7 | 0.3 | 4.6 | 13.5 |
| 15/12/2017 | 3 | 3 | 6 | 0.3 | 4.8 | 12.8 |
| 16/12/2017 | 1 | 2 | 4 | 0.3 | 6.7 | 14.7 |
| 17/12/2017 | 1 | 2 | 4 | 0.3 | 5.4 | 21.0 |
| 18/12/2017 | 2 | 4 | 6 | 0.3 | 5.7 | 25.9 |
| 19/12/2017 | 1 | 3 | 4 | 0.3 | 3.9 | 12.4 |
| 20/12/2017 | 1 | 2 | 3 | 0.3 | 7.2 | 16.4 |
| 21/12/2017 | 1 | 3 | 4 | 0.3 | 3.4 | 10.9 |
| 22/12/2017 | 2 | 4 | 7 | 0.3 | 5.7 | 11.1 |
| 23/12/2017 | 1 | 3 | 4 | 0.3 | 7.9 | 13.2 |
| 24/12/2017 | 1 | 2 | 2 | 0.3 | 4.7 | 14.2 |
| 25/12/2017 | 0 | 1 | 1 | 0.3 | 4.3 | 11.4 |
| 26/12/2017 | 1 | 2 | 3 | 0.3 | 4.3 | 10.4 |
| 27/12/2017 | 1 | 3 | 4 | 0.3 | 4.6 | 9.7 |
| 28/12/2017 | 1 | 4 | 5 | 0.3 | 1.9 | 6.1 |
| 29/12/2017 | 2 | 3 | 5 | 0.3 | 8.1 | 13.2 |
| 30/12/2017 | 0 | 1 | 2 | 0.3 | 4.3 | 10.9 |
| 31/12/2017 | 0 | 3 | 3 | 0.3 | 6.9 | 14.7 |
| Minimum | 0.150 | 1.167 | 1.314 | 0.3 | 1.7 | 6.1 |
| Date of Minimum | 25/12/2017 | 25/12/2017 | 25/12/2017 | 9/12/2017 | 2/12/2017 | 28/12/2017 |
| Maximum | 4.286 | 8.905 | 12.204 | 0.4 | 10.4 | 25.9 |
| Date of Maximum | 7/12/2017 | 4/12/2017 | 7/12/2017 | 4/12/2017 | 7/12/2017 | 18/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 28 – Northey Street Gaseous and Particulate Data

*Northey Street Meteorological Data*

| Northey Street Meteorological Data December 2017 | | | | | |
|---|---|---|---|---|---|
| Date | Wind Speed m/s | Wind Direction deg | Temperature °C | Relative Humidity % | Solar Radiation W/m$^2$ |
| 1/12/2017 | 16.4 | 70.2 | 25.2 | 72.7 | 253.3 |
| 2/12/2017 | 14.2 | 97.0 | 25.6 | 75.4 | 247.0 |
| 3/12/2017 | 14.1 | 196.8 | 25.9 | 75.4 | 178.2 |
| 4/12/2017 | 11.4 | 189.5 | 22.5 | 86.1 | 91.0 |
| 5/12/2017 | 8.9 | 174.0 | 23.9 | 73.6 | 188.0 |
| 6/12/2017 | 11.5 | 239.6 | 24.7 | 54.1 | 307.9 |
| 7/12/2017 | 17.0 | 161.7 | 25.5 | 53.2 | 293.4 |
| 8/12/2017 | 15.2 | 214.1 | 25.1 | 69.1 | 180.2 |
| 9/12/2017 | 14.5 | 169.0 | 24.3 | 66.1 | 282.4 |
| 10/12/2017 | 17.0 | 154.0 | 23.9 | 66.2 | 221.3 |
| 11/12/2017 | 13.0 | 146.1 | 23.9 | 63.7 | 212.6 |
| 12/12/2017 | 13.9 | 152.1 | 24.1 | 61.1 | 255.8 |
| 13/12/2017 | 15.8 | 124.1 | 24.6 | 65.8 | 243.2 |
| 14/12/2017 | 13.5 | 155.0 | 24.6 | 67.1 | 284.6 |
| 15/12/2017 | 12.8 | 137.5 | 25.5 | 69.4 | 283.6 |
| 16/12/2017 | 14.7 | 116.4 | 26.2 | 70.2 | 245.4 |
| 17/12/2017 | 21.0 | 109.1 | 26.0 | 65.4 | 287.9 |
| 18/12/2017 | 25.9 | 117.9 | 25.7 | 63.9 | 251.3 |
| 19/12/2017 | 12.4 | 181.3 | 25.9 | 68.3 | 283.1 |
| 20/12/2017 | 16.4 | 166.6 | 27.1 | 68.0 | 302.8 |
| 21/12/2017 | 10.9 | 135.3 | 27.2 | 65.9 | 270.2 |
| 22/12/2017 | 11.1 | 180.9 | 25.7 | 76.1 | 189.9 |
| 23/12/2017 | 13.2 | 173.2 | 26.4 | 72.9 | 239.6 |
| 24/12/2017 | 14.2 | 171.4 | 26.8 | 68.4 | 298.1 |
| 25/12/2017 | 11.4 | 159.9 | 27.3 | 68.8 | 286.0 |
| 26/12/2017 | 10.4 | 148.7 | 24.1 | 81.7 | 186.2 |
| 27/12/2017 | 9.7 | 137.1 | 25.1 | 71.9 | 230.1 |
| 28/12/2017 | 6.1 | 143.8 | 25.5 | 71.5 | 170.6 |
| 29/12/2017 | 13.2 | 169.0 | 26.3 | 75.3 | 269.3 |
| 30/12/2017 | 10.9 | 182.8 | 27.6 | 71.8 | 211.1 |
| 31/12/2017 | 14.7 | 129.7 | 27.7 | 76.3 | 160.5 |
| Minimum | 6.1 | 70.2 | 22.5 | 53.2 | 91.0 |
| Date of Minimum | 28/12/2017 | 1/12/2017 | 4/12/2017 | 7/12/2017 | 4/12/2017 |
| Maximum | 25.9 | 239.6 | 27.7 | 86.1 | 307.9 |
| Date of Maximum | 18/12/2017 | 6/12/2017 | 31/12/2017 | 4/12/2017 | 6/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 29 – Northey Street Meteorological Data

*Northey Street Calibration Data*

| Northey Street Calibration Data December 2017 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | NO Zero | NO Precision | NO Span | $NO_2$ Zero | $NO_2$ Precision | $NO_2$ Span | $NO_x$ Zero | $NO_x$ Precision | $NO_x$ Span | CO Zero | CO Precision | CO Span |
| 1/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 2/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 3/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 4/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 5/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 6/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 7/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 8/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 9/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 10/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 11/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 12/12/2017 | 5 | 392 | 195 | 0 | 8 | 2 | 5 | 400 | 197 | 0.0 | 39.7 | 39.7 |
| 13/12/2017 | 5 | 392 | 228 | 0 | 8 | 1 | 5 | 400 | 229 | 0.1 | 39.7 | 39.7 |
| 14/12/2017 | 5 | 392 | 243 | 0 | 8 | 1 | 5 | 400 | 244 | 0.1 | 39.7 | 39.7 |
| 15/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 16/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 17/12/2017 | 0 | 392 | 390 | 0 | 8 | 7 | 0 | 400 | 396 | 0.0 | 39.7 | 39.7 |
| 18/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 19/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 20/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 21/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 22/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 23/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 24/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 25/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 26/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 27/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 28/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 29/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 30/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 31/12/2017 | - | 393 | - | - | 9 | - | - | 401 | - | - | 40.7 | - |

Table 30 – Northey Street Calibration Data

## 6.8. Graphic Representations for Northey Street

Validated 5-minute data for NO, NO2, Nox, CO, PM2.5 and PM10 were used to construct the following monthly graphical representations.

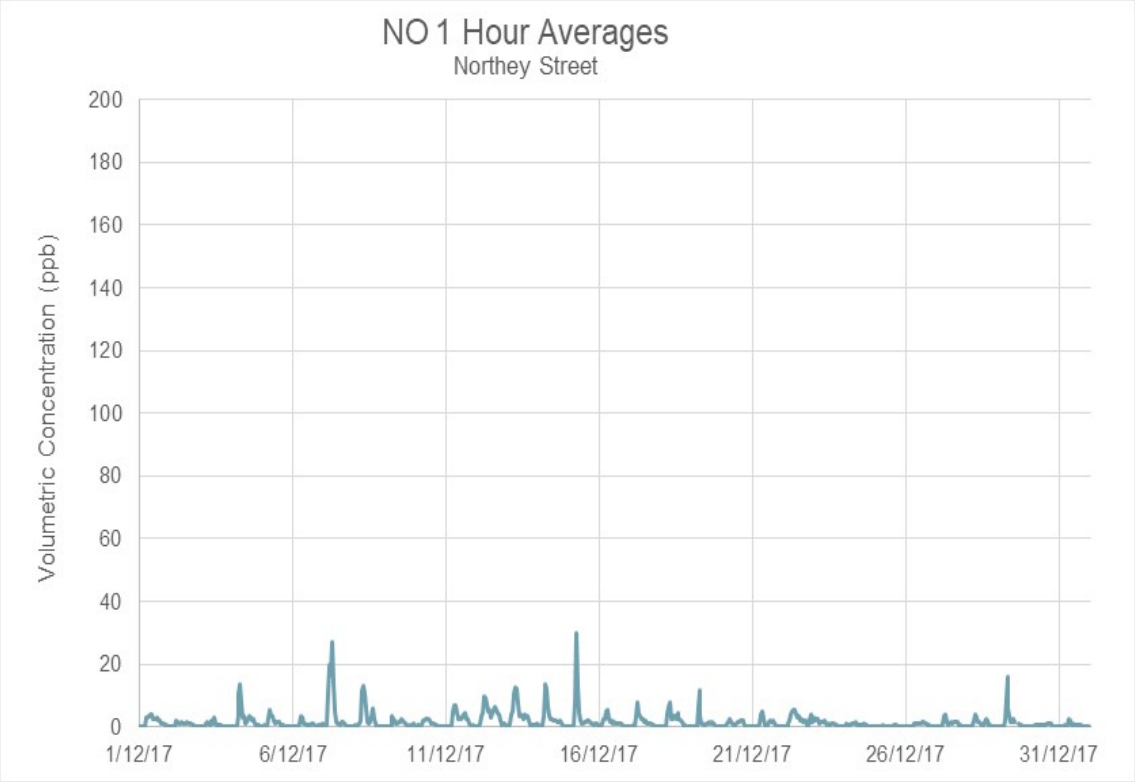


Figure 42 – Northey Street 1 Hour Averaged NO Data

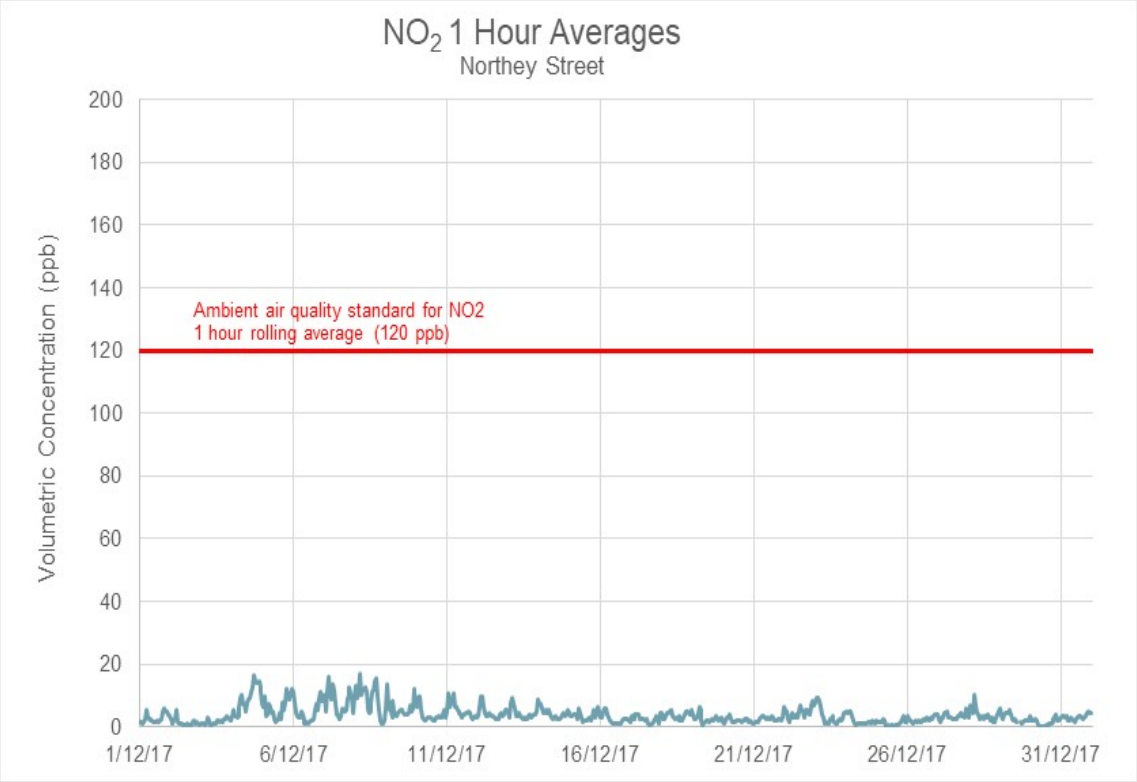


Figure 43 – Northey Street 1 Hour Averaged $NO_2$ Data

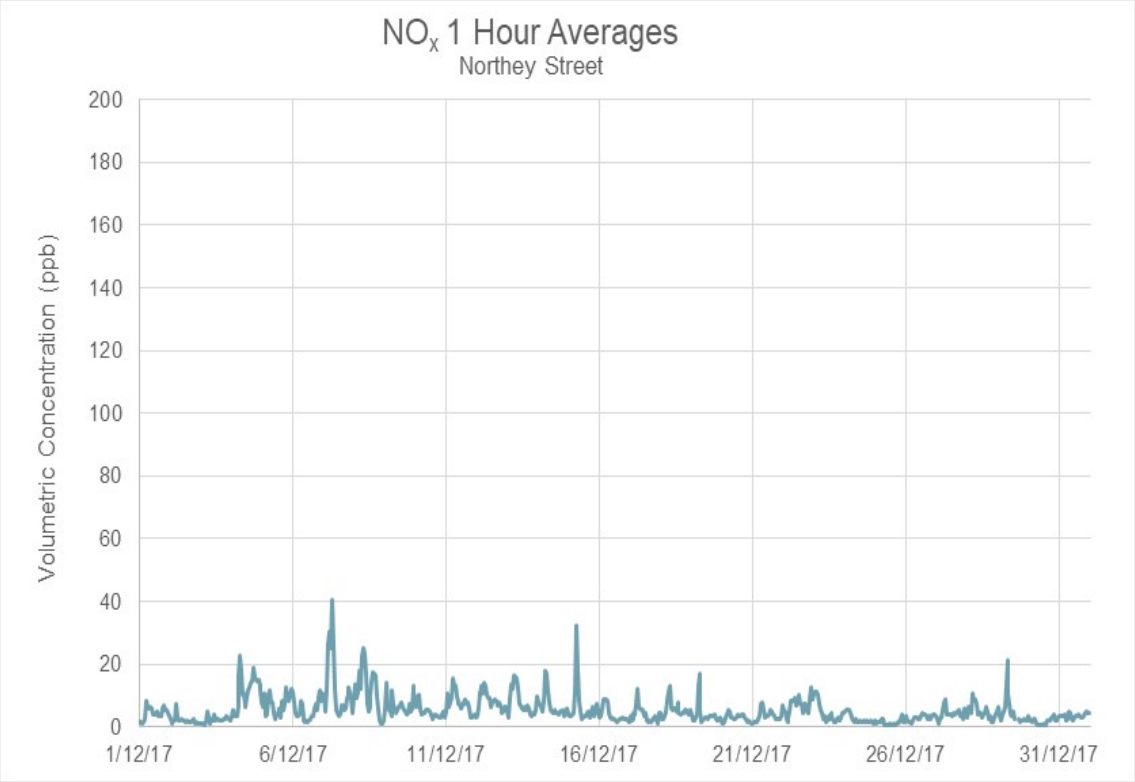


Figure 44 – Northey Street 1 Hour Averaged $NO_x$ Data

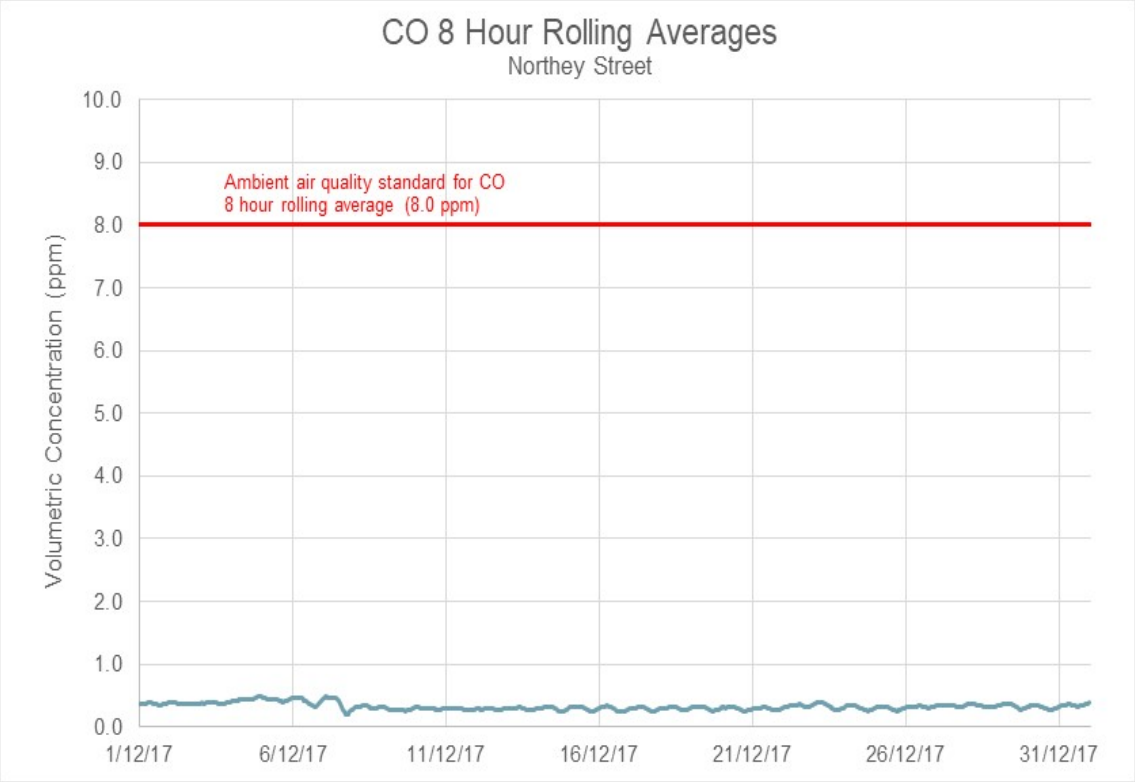


Figure 45 – Northey Street 1 Hour Averaged CO Data

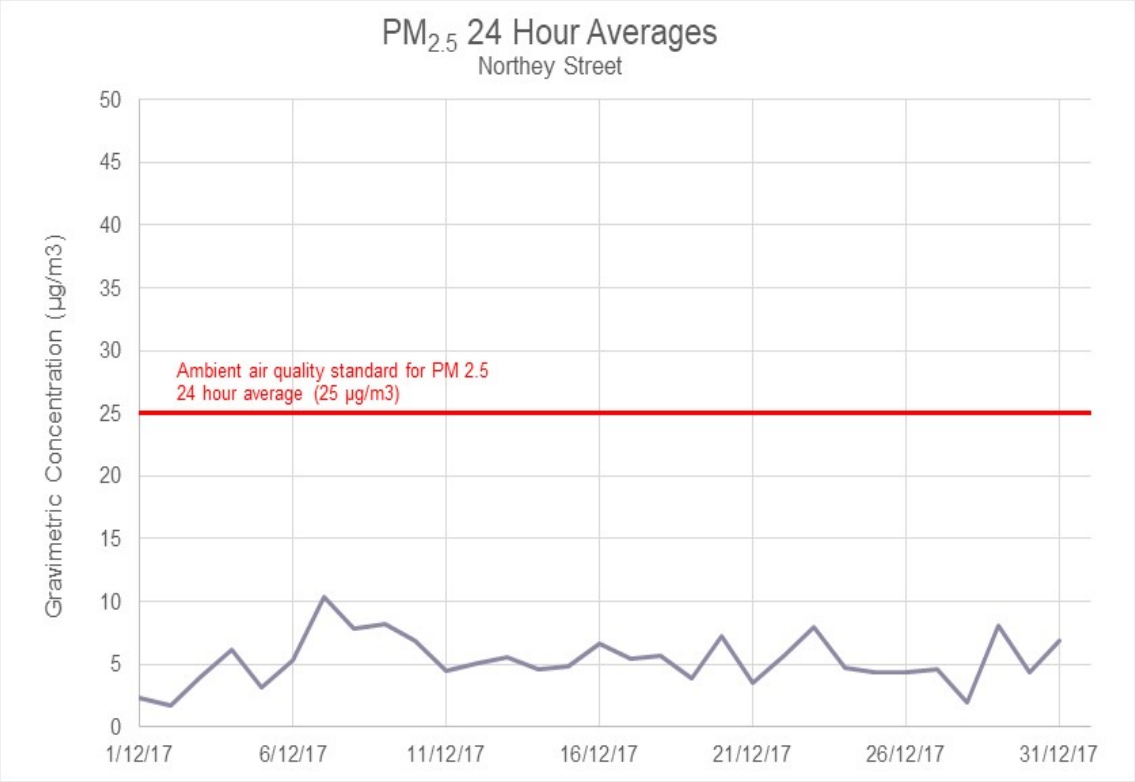


Figure 46 – Northey Street 1 Hour Averaged $PM_{2.5}$ Data

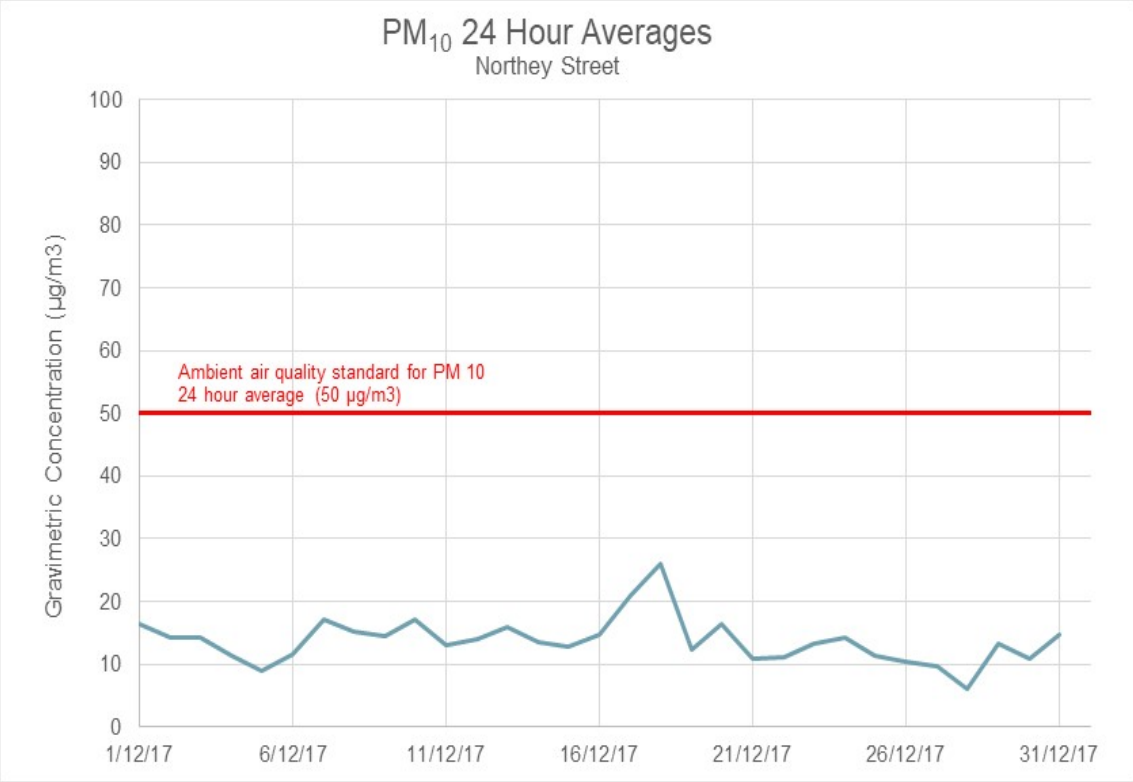


Figure 47 – Northey Street 1 Hour Averaged $PM_{10}$ Data

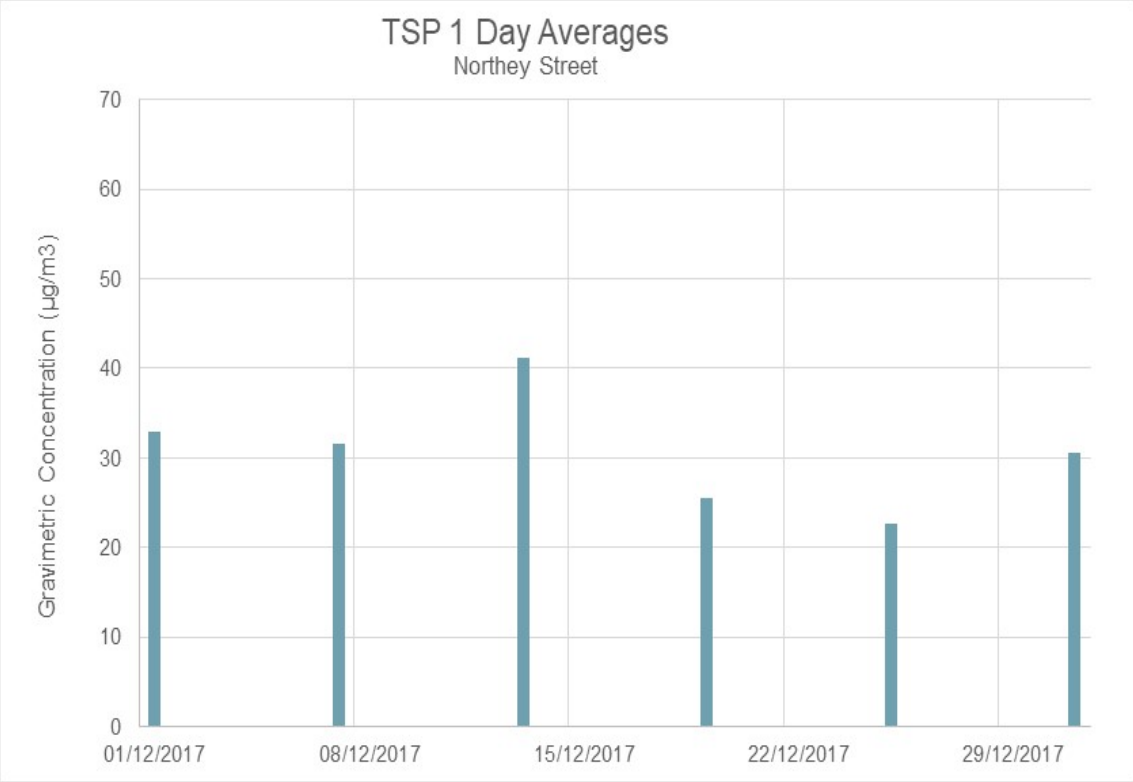


Figure 48 – Northey Street TSP Data

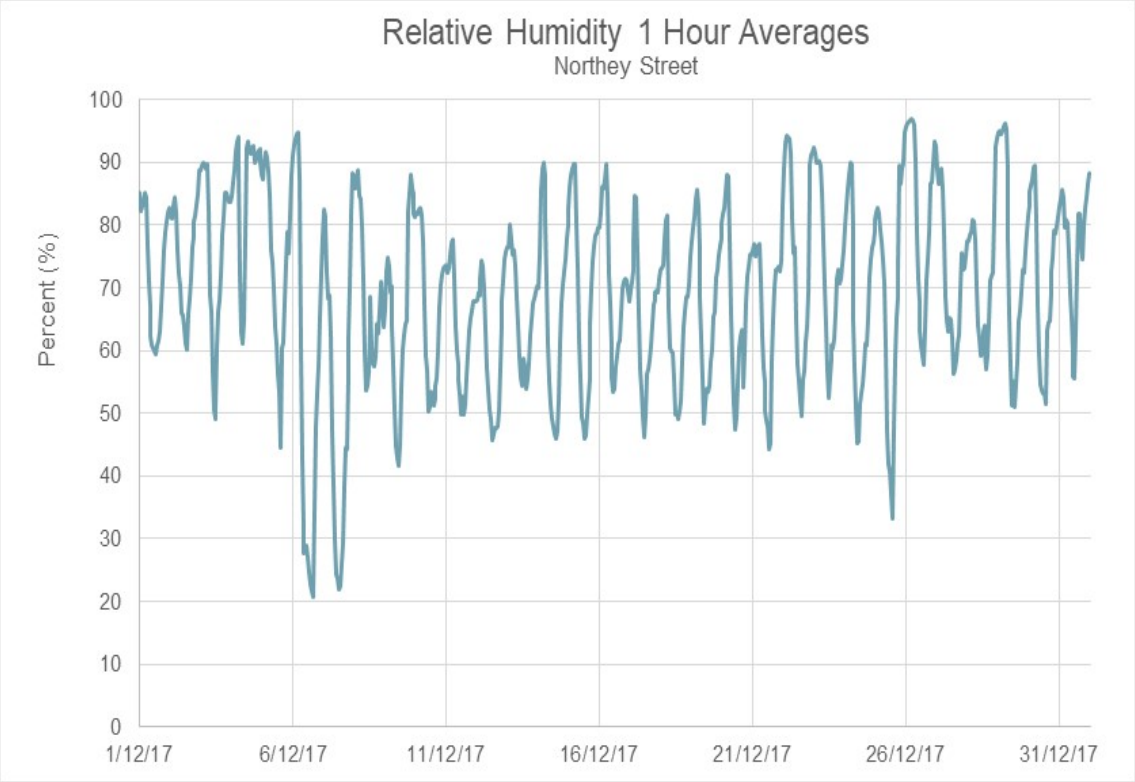


Figure 49 – Northey Street 1 Hour Averaged Relative Humidity Data

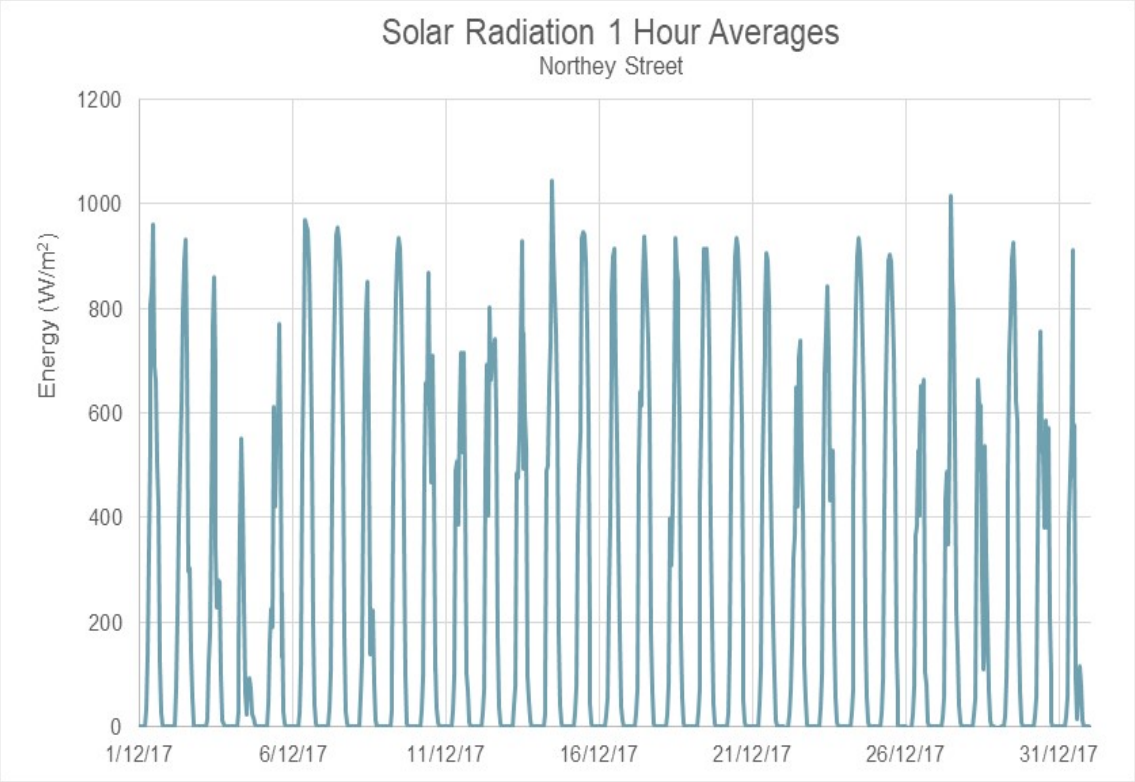


Figure 50 – Northey Street 1 Hour Averaged Solar Radiation Data

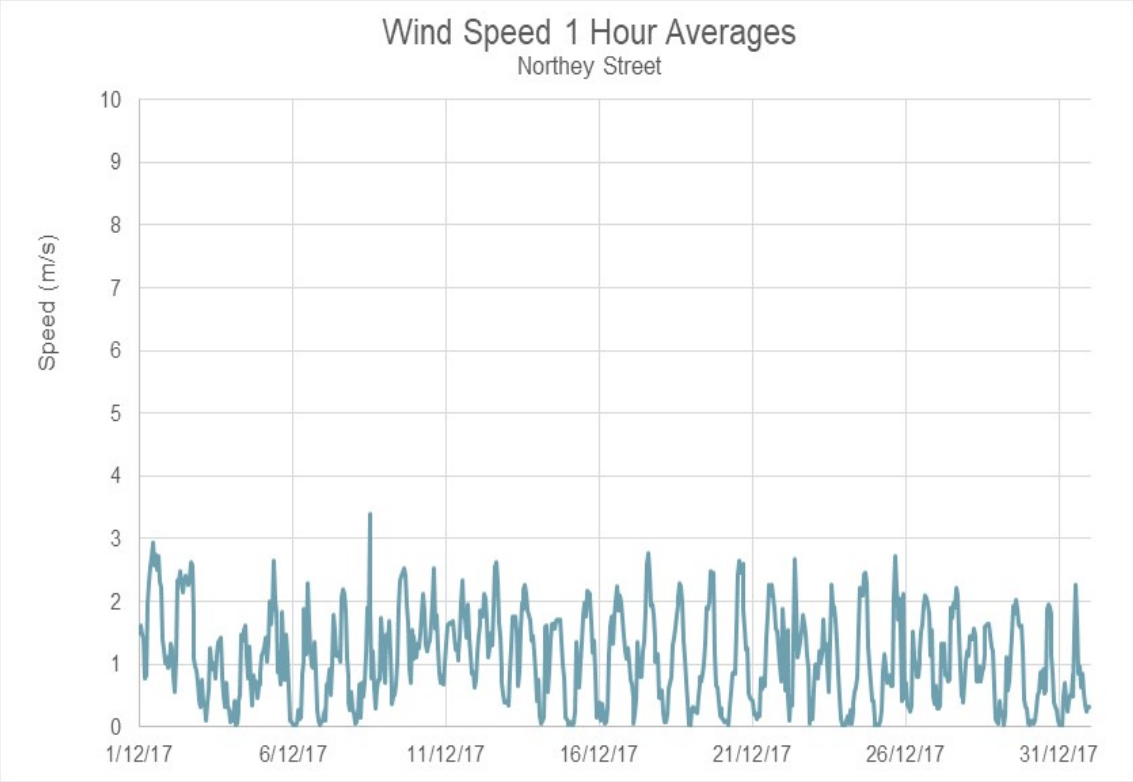


Figure 51 – Northey Street 1 Hour Averaged Wind Speed Data

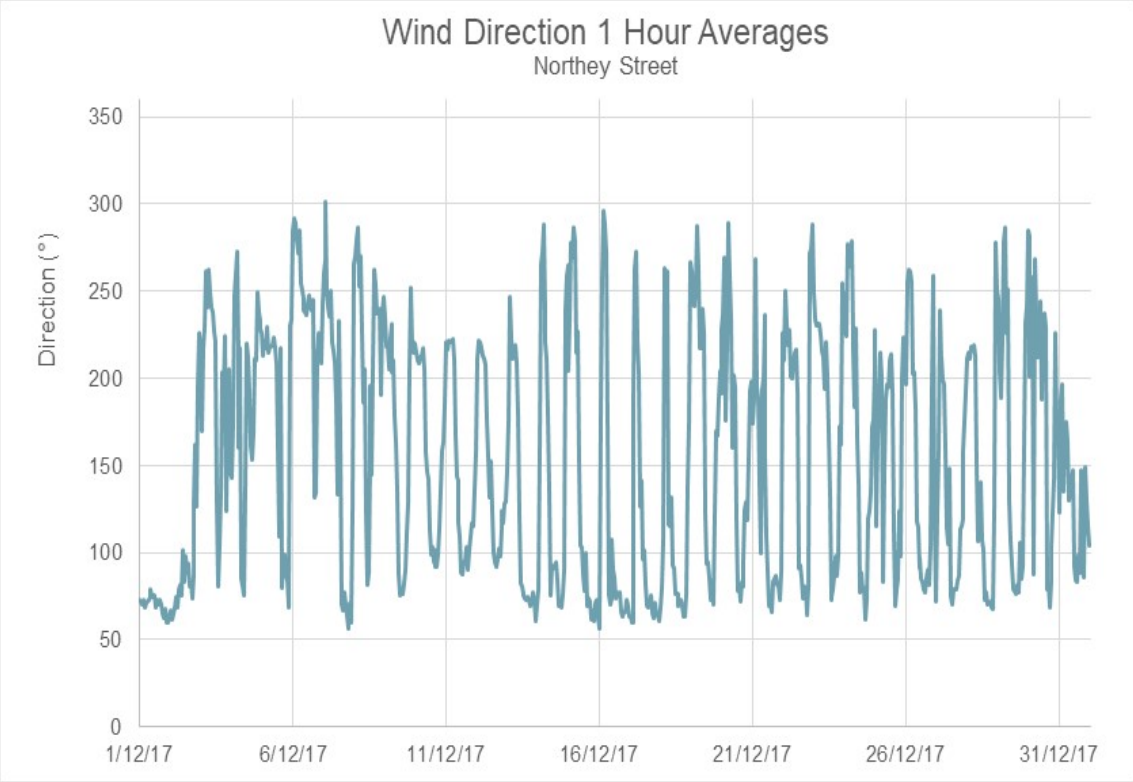


Figure 52 – Northey Street 1 Hour Averaged Wind Direction Data

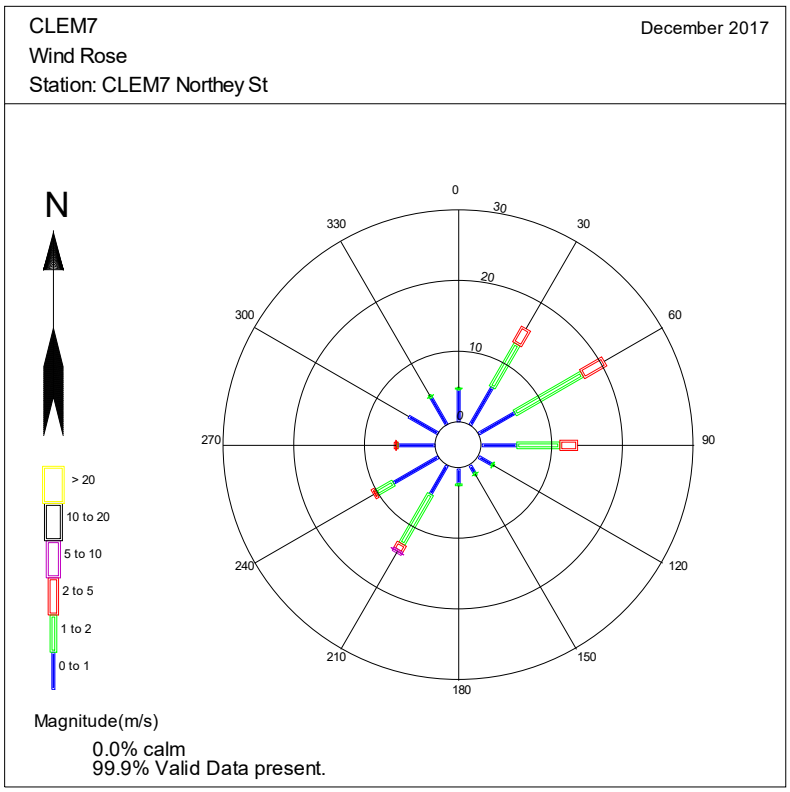


Figure 53 – Northey Street 1 Hour Averaged Monthly Wind Rose

## 6.9. Tabulated Data for Landcenter

*Landcenter Gaseous and Particulate Data*

| Landcenter Gaseous and Paticulate Data December 2017 | | | | | | |
|---|---|---|---|---|---|---|
| Date | NO ppb | $NO_2$ ppb | $NO_x$ ppb | CO ppm | $PM_{2.5}$ $\mu g/m^3$ | $PM_{10}$ $\mu g/m^3$ |
| 1/12/2017 | - | - | - | - | 11.1 | 18.7 |
| 2/12/2017 | - | - | - | - | 9.0 | 16.4 |
| 3/12/2017 | - | - | - | - | 6.7 | 9.5 |
| 4/12/2017 | - | - | - | - | 3.1 | 5.2 |
| 5/12/2017 | - | - | - | - | 11.7 | 14.0 |
| 6/12/2017 | - | - | - | - | - | - |
| 7/12/2017 | - | - | - | - | - | - |
| 8/12/2017 | - | - | - | - | - | - |
| 9/12/2017 | - | - | - | - | - | - |
| 10/12/2017 | - | - | - | - | - | - |
| 11/12/2017 | - | - | - | - | - | - |
| 12/12/2017 | - | - | - | - | - | - |
| 13/12/2017 | - | - | - | - | - | - |
| 14/12/2017 | - | - | - | - | - | - |
| 15/12/2017 | - | - | - | - | - | - |
| 16/12/2017 | - | - | - | - | - | - |
| 17/12/2017 | - | - | - | - | - | - |
| 18/12/2017 | - | - | - | - | - | - |
| 19/12/2017 | - | - | - | - | - | - |
| 20/12/2017 | - | - | - | - | - | - |
| 21/12/2017 | - | - | - | - | - | - |
| 22/12/2017 | - | - | - | - | - | - |
| 23/12/2017 | - | - | - | - | - | - |
| 24/12/2017 | - | - | - | - | - | - |
| 25/12/2017 | - | - | - | - | - | - |
| 26/12/2017 | - | - | - | - | - | - |
| 27/12/2017 | - | - | - | - | - | - |
| 28/12/2017 | - | - | - | - | - | - |
| 29/12/2017 | - | - | - | - | - | - |
| 30/12/2017 | - | - | - | - | - | - |
| 31/12/2017 | - | - | - | - | - | - |
| Minimum | - | - | - | - | 3.1 | 5.2 |
| Date of Minimum | - | - | - | - | 4/12/2017 | 4/12/2017 |
| Maximum | - | - | - | - | 11.7 | 18.7 |
| Date of Maximum | - | - | - | - | 5/12/2017 | 1/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 31 – Landcenter Gaseous and Particulate Data

*Landcenter Meteorological Data*

| Landcenter Meteorological Data December 2017 | | | | | |
|---|---|---|---|---|---|
| Date | Wind Speed m/s | Wind Direction deg | Temperature °C | Relative Humidity % | Solar Radiation W/m$^2$ |
| 1/12/2017 | 18.7 | 136.6 | 24.6 | 78.5 | 257.9 |
| 2/12/2017 | 16.4 | 191.5 | 25.1 | 78.9 | 273.8 |
| 3/12/2017 | 9.5 | 213.0 | 25.7 | 77.5 | 196.4 |
| 4/12/2017 | 5.2 | 168.9 | 22.5 | 89.5 | 104.4 |
| 5/12/2017 | 14.0 | 184.7 | 23.6 | 79.4 | 216.7 |
| 6/12/2017 | - | 214.0 | 25.1 | 55.0 | 341.1 |
| 7/12/2017 | - | 186.9 | 25.7 | 54.9 | 340.5 |
| 8/12/2017 | - | 196.2 | 24.9 | 71.4 | 195.1 |
| 9/12/2017 | - | 183.2 | 24.0 | 69.6 | 308.9 |
| 10/12/2017 | - | 159.5 | 23.2 | 71.8 | 241.3 |
| 11/12/2017 | - | 157.6 | 23.3 | 67.8 | 244.0 |
| 12/12/2017 | - | 158.3 | 23.5 | 64.4 | 276.9 |
| 13/12/2017 | - | 142.3 | 24.1 | 69.1 | 234.4 |
| 14/12/2017 | - | 179.8 | 24.6 | 68.7 | 312.0 |
| 15/12/2017 | - | 175.1 | 25.5 | 71.3 | 329.6 |
| 16/12/2017 | - | 163.5 | 25.9 | 73.8 | 273.1 |
| 17/12/2017 | - | 154.3 | 25.7 | 68.0 | 268.4 |
| 18/12/2017 | - | 158.7 | 25.4 | 65.8 | 271.4 |
| 19/12/2017 | - | 206.7 | 25.9 | 69.6 | 309.7 |
| 20/12/2017 | - | 222.8 | 26.7 | 70.7 | 327.2 |
| 21/12/2017 | - | 189.6 | 27.1 | 67.8 | 305.4 |
| 22/12/2017 | - | 168.0 | 25.7 | 77.5 | 191.7 |
| 23/12/2017 | - | 195.6 | 26.1 | 77.0 | 276.3 |
| 24/12/2017 | - | 205.6 | 27.0 | 68.2 | 325.6 |
| 25/12/2017 | - | 196.8 | 26.8 | 71.6 | 304.0 |
| 26/12/2017 | - | 150.6 | 23.8 | 85.0 | 189.8 |
| 27/12/2017 | - | 150.5 | 24.6 | 75.7 | 219.6 |
| 28/12/2017 | - | - | - | - | - |
| 29/12/2017 | - | - | - | - | - |
| 30/12/2017 | - | - | - | - | - |
| 31/12/2017 | - | - | - | - | - |
| Minimum | 5.2 | 136.6 | 22.5 | 54.9 | 104.4 |
| Date of Minimum | 4/12/2017 | 1/12/2017 | 4/12/2017 | 7/12/2017 | 4/12/2017 |
| Maximum | 18.7 | 222.8 | 27.1 | 89.5 | 341.1 |
| Date of Maximum | 1/12/2017 | 20/12/2017 | 21/12/2017 | 4/12/2017 | 6/12/2017 |

There will be no daily results if there is less than 75% valid data for that day

Table 32 – Landcenter Meteorological Data

*Landcenter Calibration Data*

| Landcenter Calibration Data December 2017 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | NO Zero | NO Precision | NO Span | $NO_2$ Zero | $NO_2$ Precision | $NO_2$ Span | $NO_x$ Zero | $NO_x$ Precision | $NO_x$ Span | CO Zero | CO Precision | CO Span |
| 1/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 2/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 3/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 4/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 5/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 6/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 7/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 8/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 9/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 10/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 11/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 12/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 13/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 14/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 15/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 16/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 17/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 18/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 19/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 20/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 21/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 22/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 23/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 24/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 25/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 26/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 27/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 28/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 29/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 30/12/2017 | - | 392 | - | - | 8 | - | - | 400 | - | - | 39.7 | - |
| 31/12/2017 | - | 393 | - | - | 9 | - | - | 401 | - | - | 40.7 | - |

Table 33 – Landcenter Calibration Data

## 6.10. Graphic Representations for Landcenter

Validated 5-minute data for NO, NO2, Nox, CO, PM2.5 and PM10 were used to construct the following monthly graphical representations.

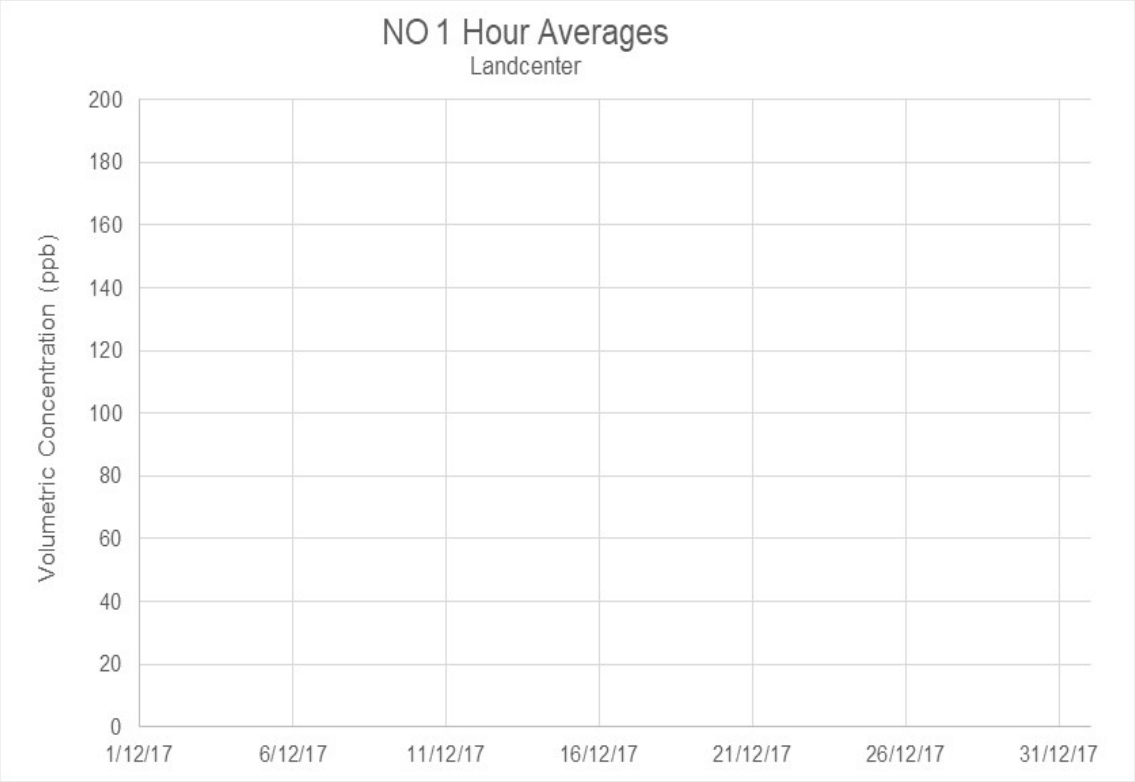


Figure 54 – Landcenter 1 Hour Averaged NO Data

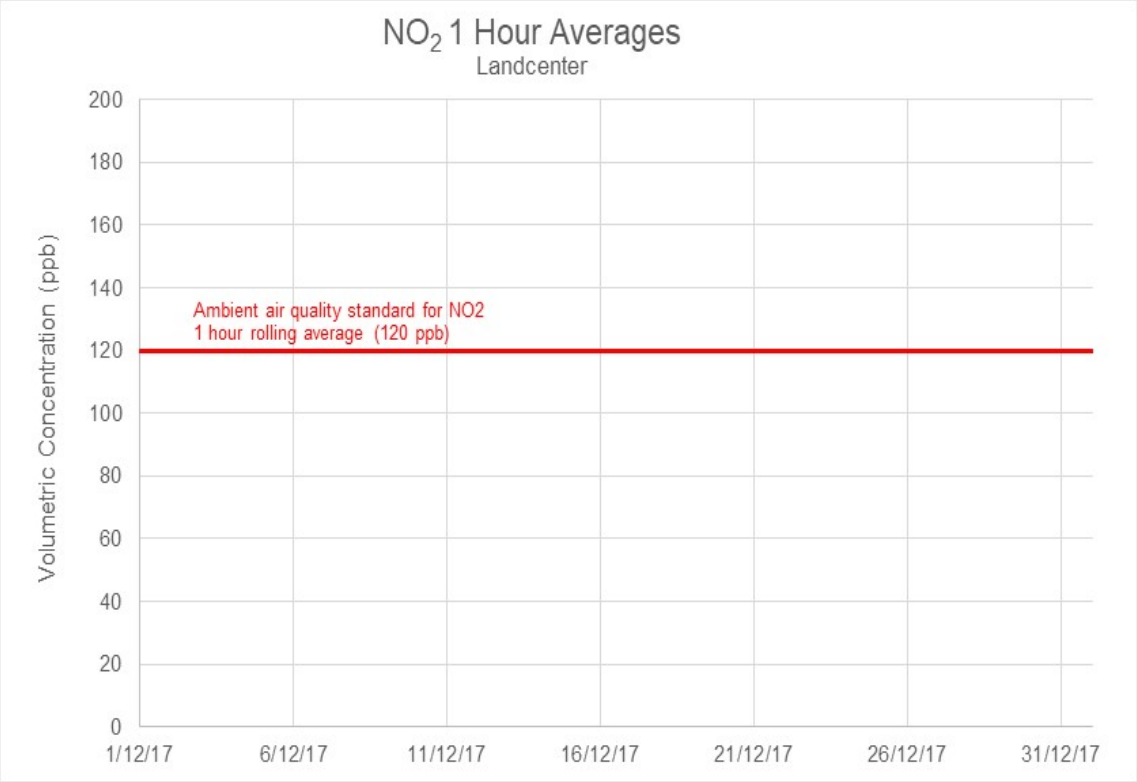


Figure 55 – Landcenter 1 Hour Averaged $NO_2$ Data

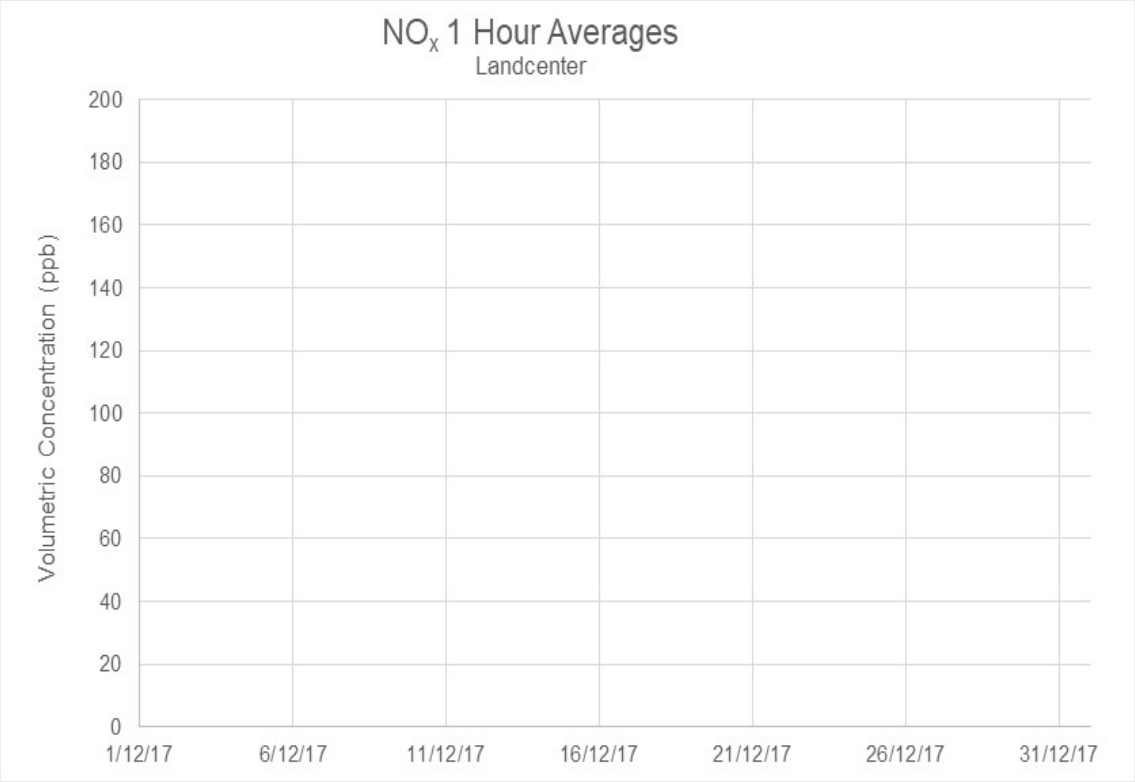


Figure 56 – Landcenter 1 Hour Averaged $NO_x$ Data

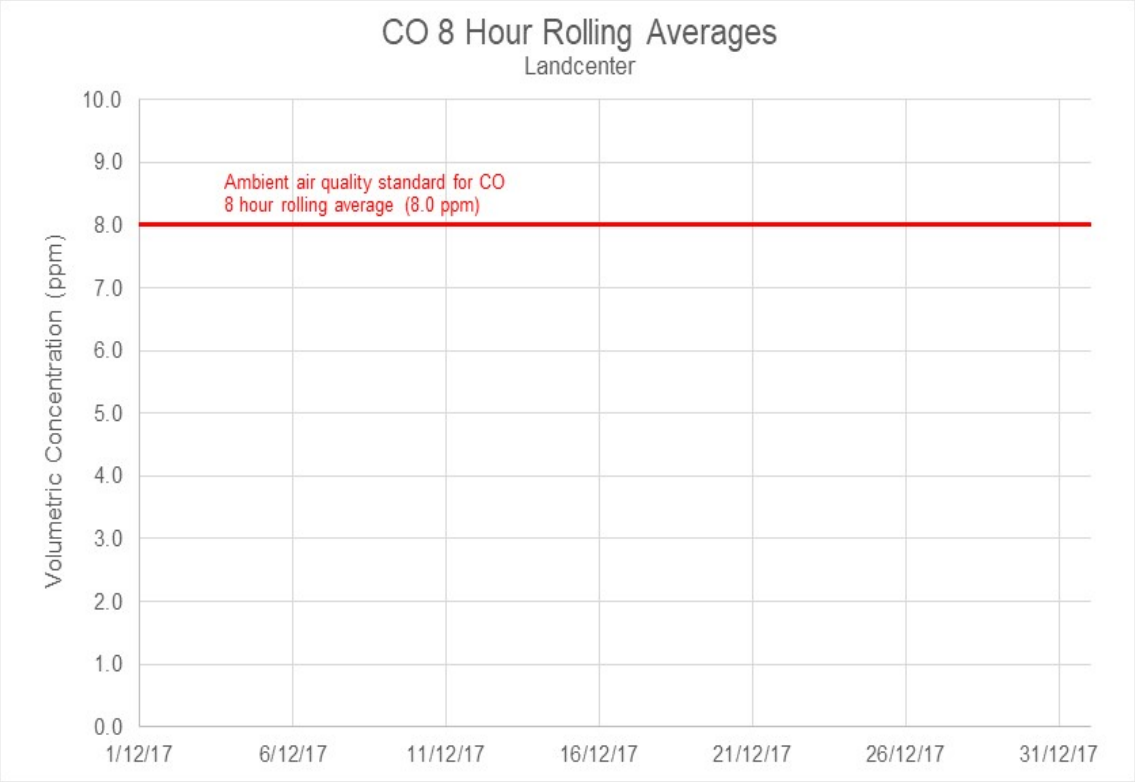


Figure 57 – Landcenter 1 Hour Averaged CO Data

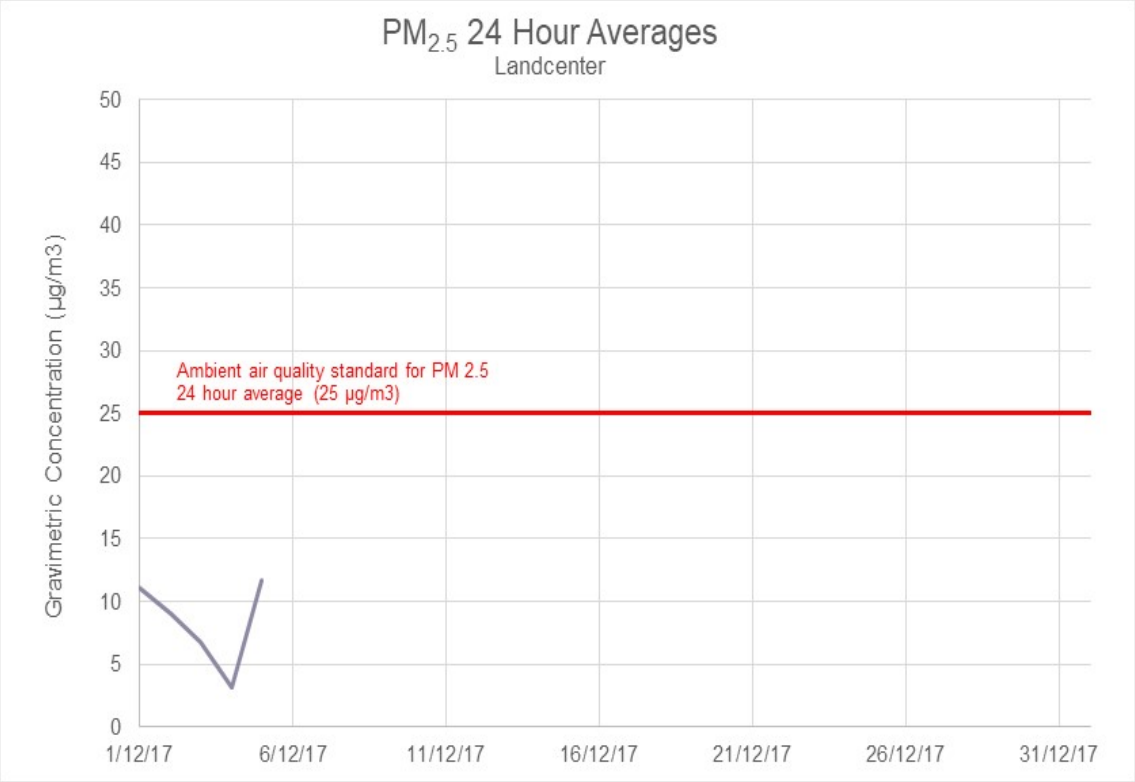


Figure 58 – Landcenter 1 Hour Averaged $PM_{2.5}$ Data

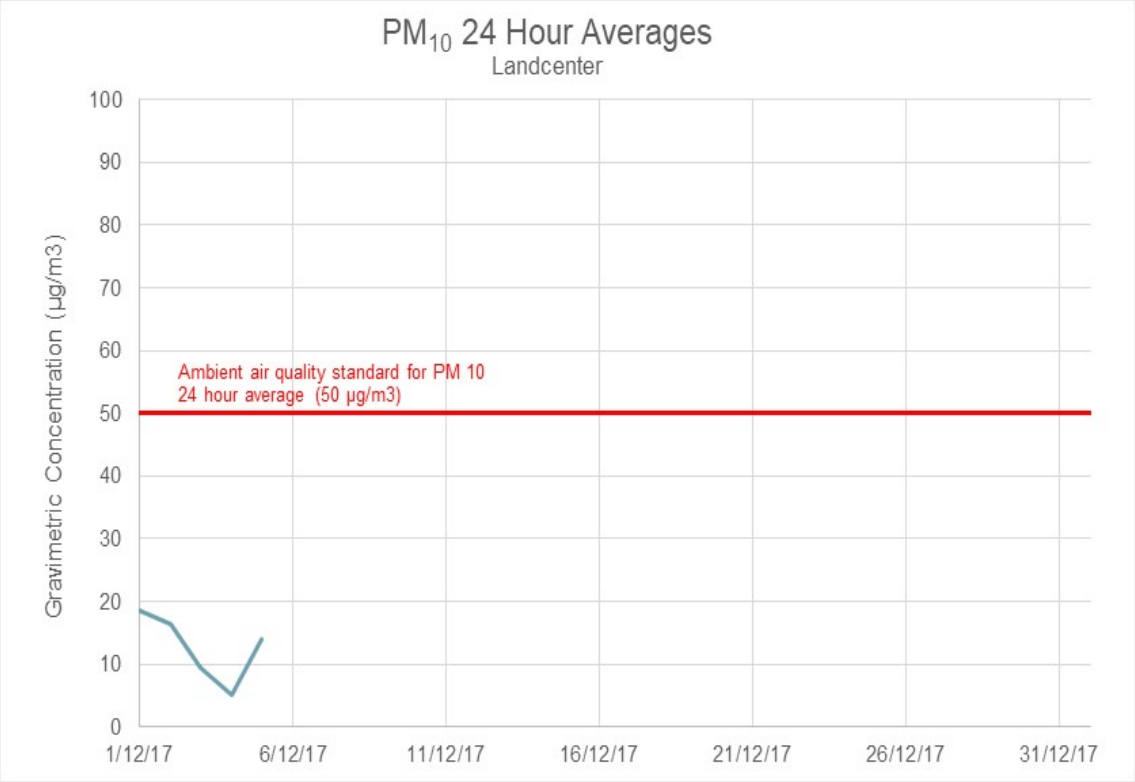


Figure 59 – Landcenter 1 Hour Averaged $PM_{10}$ Data

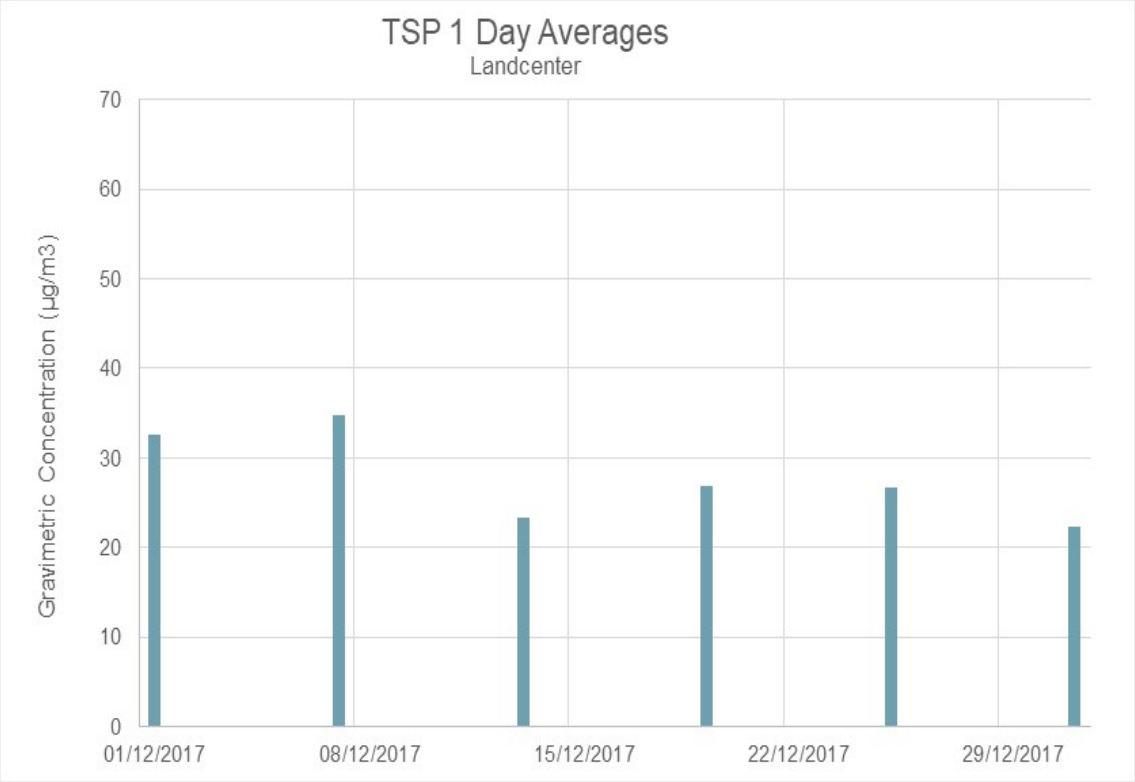


Figure 60 – Landcenter 1 TSP Data

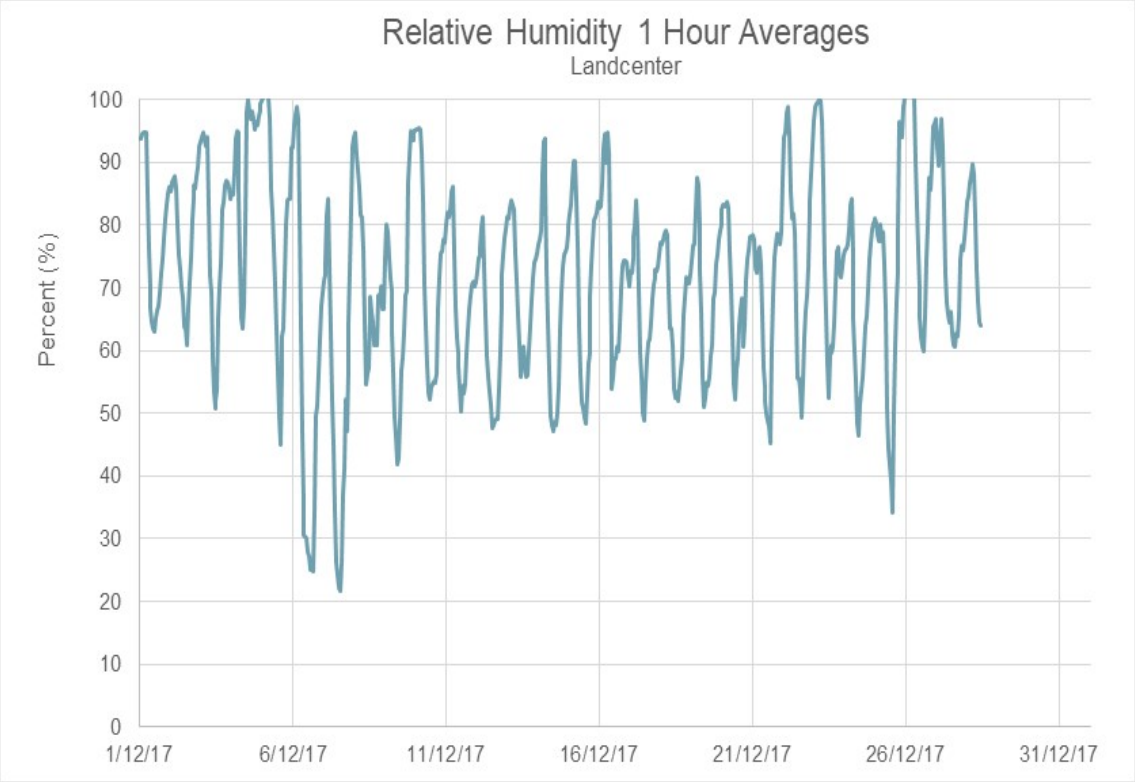


Figure 61 – Landcenter 1 Hour Averaged Relative Humidity Data

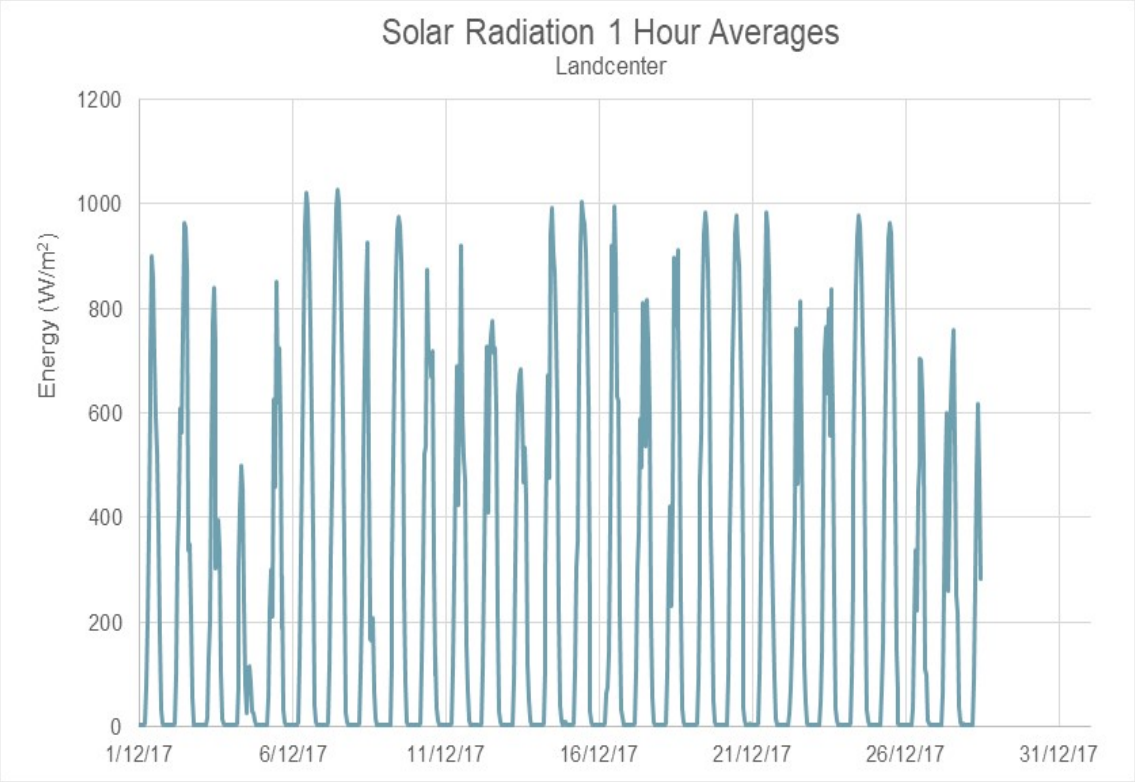


Figure 62 – Landcenter 1 Hour Averaged Solar Radiation Data

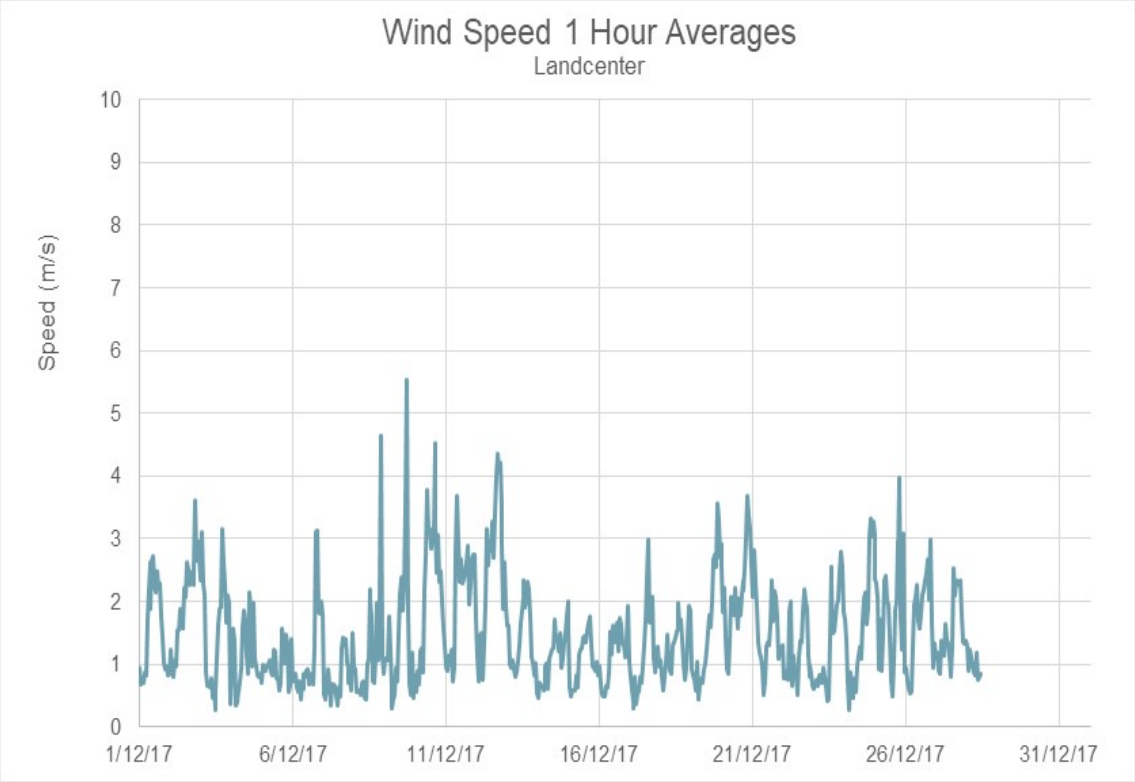


Figure 63 – Landcenter 1 Hour Averaged Wind Speed Data

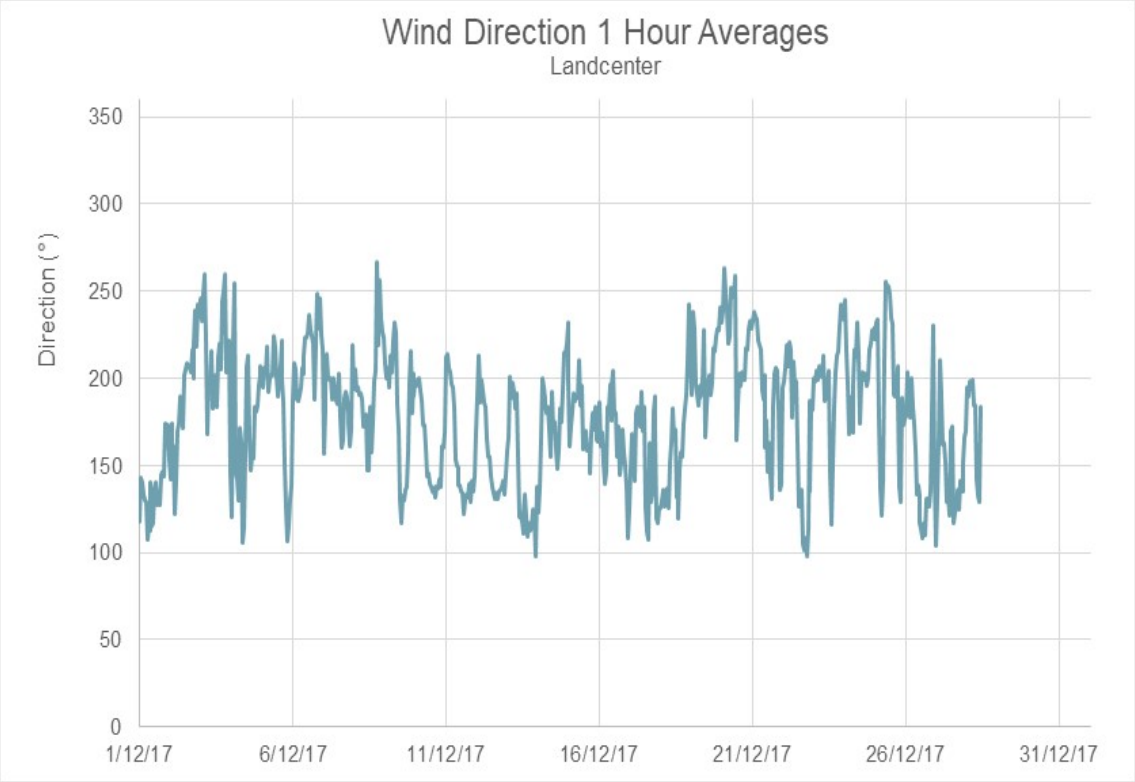


Figure 64 – Landcenter 1 Hour Averaged Wind Direction Data

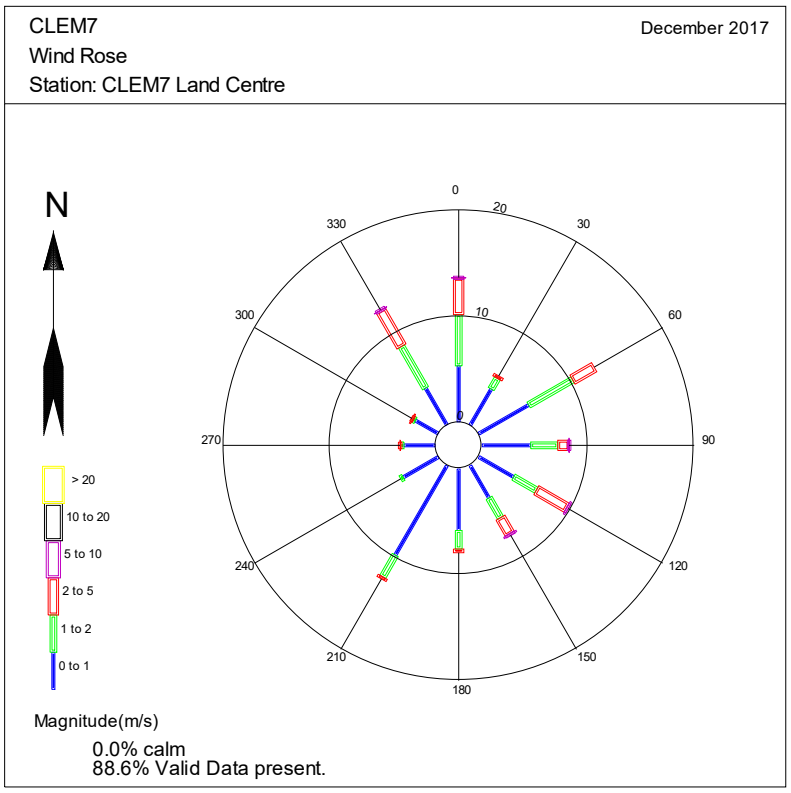


Figure 65 – Landcenter 1 Hour Averaged Monthly Wind Rose

# 7. Validation Tables

The following tables outline any data removed during the data validation process, or automatically invalidated by the data acquisition system.

## Hawthorne Street Data Validation Table

| Hawthorne Street Data Validation Table | | | | | |
|---|---|---|---|---|---|
| Start Date | End Date | Affected Parameters | Details of change | Validation Date | Changed By |
| 06/12/2017 17:30 | 06/12/2017 18:25 | All parameters | Maintenance | 19/01/2018 | CP |
| 06/12/2017 18:30 | 06/12/2017 21:25 | PM2.5, PM10 | Stabilisation after Maintenance | 19/01/2018 | CP |
| 18/12/2017 14:05 | 29/12/2017 13:05 | All parameters | Logger failure | 19/01/2018 | CP |
| 29/12/2017 13:05 | 29/12/2017 16:30 | NO, NO2, NOx, CO, M2.5, PM10 | Stabilisation after Maintenance | 19/01/2018 | CP |

Table 34 – Hawthorne Street Data Validation Table

## Royal Brisbane Hospital Data Validation Table

| Royal Brisbane Hospital Data Validation Table | | | | | |
|---|---|---|---|---|---|
| Start Date | End Date | Affected Parameters | Details of change | Validation Date | Changed By |
| 1/12/2017 0:00 | 31/12/2017 23:55 | NO, NO2, NOx, CO, | Instruments removed from service due to faults | 19/01/2017 | CP |
| 1/12/2017 0:00 | 22/12/2017 16:20 | PM2.5, PM10 | Instrument fault | 19/01/2017 | CP |
| 25/12/2017 22:50 | 31/12/2017 23:55 | PM2.5, PM10 | Instrument fault | 19/01/2017 | CP |

Table 35 - Royal Brisbane Hospital Data Validation Table

## Northey Street Data Validation Table

| Northey Street Data Validation Table | | | | | |
|---|---|---|---|---|---|
| Start Date | End Date | Affected Parameters | Details of change | Validation Date | Changed By |
| 7/12/2017 11:50 | 7/12/2017 12:10 | All parameters | Maintenance | 19/01/2018 | CP |
| 7/12/2017 14:55 | 31/12/2017 14:05 | PM2.5, PM10 | Intermittent instrument fault | 19/01/2018 | CP |
| 29/12/2017 14:40 | 29/12/2017 15:25 | NO, NO, NOx, CO | Maintenance | 19/01/2018 | CP |
| 29/12/2017 15:30 | 29/12/2017 18:50 | PM2.5, PM10 | Stabilisation after Maintenance | 19/01/2018 | CP |

Table 36 - Northey Street Data Validation Table

## Landcenter

| Landcenter Data Validation Table | | | | | |
|---|---|---|---|---|---|
| Start Date | End Date | Affected Parameters | Details of change | Validation Date | Changed By |
| 1/12/2017 0:00 | 31/12/2017 23:55 | NO, NO2, NOx, CO | Instruments removed from service | 19/01/2018 | CP |
| 6/12/2017 16:50 | 31/12/2017 23:55 | PM2.5, PM10 | Instrument relocated to Hawthorn St | 19/01/2018 | CP |
| 28/12/2017 11:15 | 31/12/2017 23:55 | All parameters | Logger relocated to Hawthorn St | 19/01/2018 | CP |

Table 37 - Landcenter Data Validation Table

## 8. Report Summary

Data capture for all parameters collected at Hawthorne Street was below 95.0% for the reporting period.

Data capture for all parameters collected at Royal Brisbane Hospital was above 95.0% for the reporting period for the MET data. CO and NOx analyser were removed.

Data capture for all parameters collected at Northey Street was above 95.0% for the reporting period.

Data capture for all parameters collected at Landcenter was below 95.0% for the reporting period for the MET data. $PM_{2.5}$ was removed for use at Hawthorne Street.

Please refer to Table 17 for data capture rates, and to Tables 34-37 for data exceptions.

There were zero exceedances of the Clem 7 air quality goals recorded for the reporting month.

Measurement of a number of parameters in this report do not comply with applicable standards and/or is not covered by Norditech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

# Appendix

## Explanation of Exception Table

**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.

**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 stabilisation period before normal operation commences.
Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

**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 analyser 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 analyser 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.

**Shadow on sensor** refers to the same period of time every day when a shadow is cast over the solar radiation sensor causing unnatural low readings.

**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.

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