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TRANSFIELD SERVICES PTY. LTD.

EastLink Ambient Air Quality Monitoring Report January-March 2010

Submitted to:
Transfield Services Pty. Ltd.,
EastLink Operations Centre,
2 Hillcrest Avenue,
Ringwood, 3134

REPORT



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APPENDICES

APPENDIX A

Limitations



1.0 INTRODUCTION

EastLink is a 39-kilometre motorway running between Donvale in Melbourne's north east to Frankston in Melbourne's south east with two tunnels under the Mullum Mullum Valley. Transfield Services, who are responsible for operation and maintenance of the road, commissioned Golder Associates Pty. Ltd. {trading as Golder AWN} to provide ambient air quality monitoring services for the EastLink Road project. The services provided include:

- Operational and maintenance services of the EastLink ambient air monitoring stations; and
- NATA endorsed ambient air quality monitoring reports.

Monitoring commenced on the 29th June 2008 with the opening of the EastLink motorway. Results for the monitoring period 1st January, 2010 to 31st March, 2010 inclusive are contained in the following report.

Your attention is drawn to the document - "Limitations", which is included in Attachment A of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.



2.0 MONITORING LOCATIONS

Three ambient air quality monitoring stations (AAQMS) are located along the Mullum Mullum valley in close proximity to the tunnel portals and ventilation stacks. The locations are described in Table 1 and depicted in Figure 1.

Table 1: Site Locations

Station Name	Location	AMG Co-Ordinates
Chaim Court	Chaim Court, Donvale	342532E, 5814022S
Craig Road	Corner Craig Rd. and Beckett Rd. Donvale	341971E, 5814450S
Heads Road	Hillcrest Reserve, Heads Road, Donvale	341195E, 5814923S

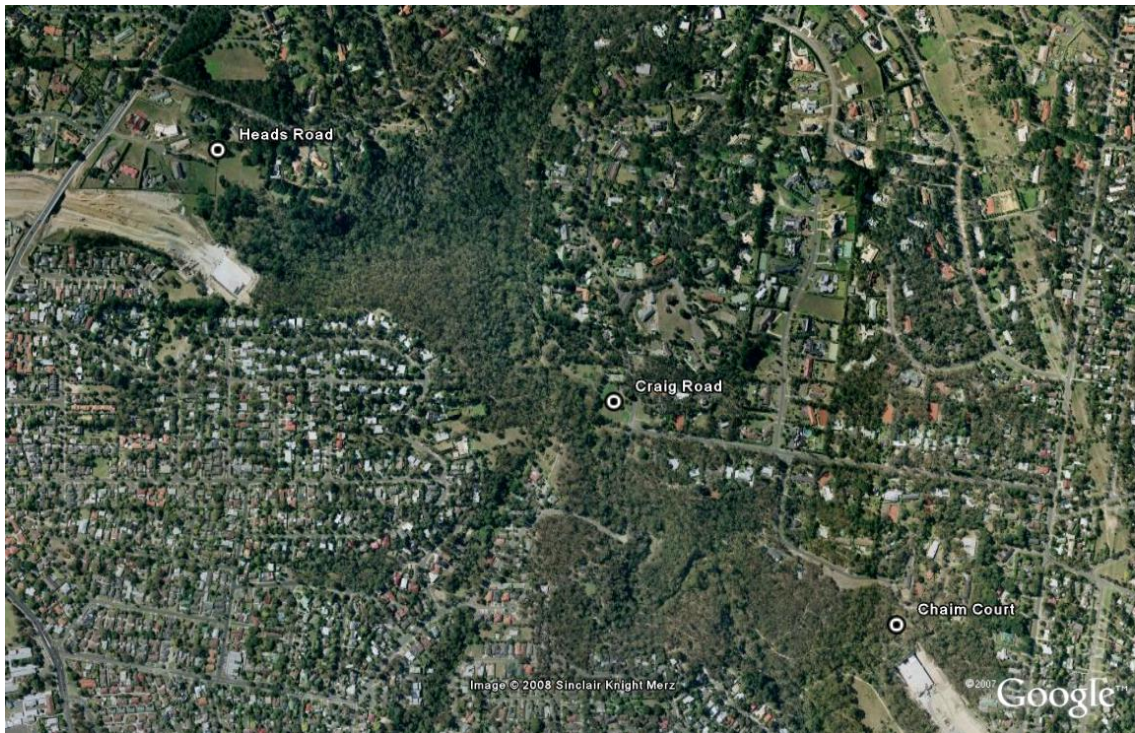


Figure 1: Ambient Air Quality Monitoring Stations



3.0 AMBIENT AIR QUALITY MONITORING PARAMETERS

The following ambient air quality parameters are monitored continuously, with averages logged at 5 minute intervals:

- Particulate matter with an equivalent aerodynamic diameter less than 2.5 microns (PM_{2.5});
- Particulate matter with an equivalent aerodynamic diameter less than 10 microns (PM₁₀);
- Total oxides of nitrogen (NO_x);
- Nitric oxide (NO);
- Nitrogen dioxide (NO₂);
- Carbon monoxide (CO);
- Wind speed;
- Wind direction;
- Relative humidity;
- Ambient temperature; and
- Total solar radiation.



4.0 METHODS

4.1 PM_{2.5}

PM_{2.5} concentration in ambient air was determined in real time using a Tapered Element Oscillating Microbalance (TEOM) analyser fitted with the Flow Dynamics Measurement System (TEOM-FDMS).

Ambient air was drawn through a PM_{2.5} size selective inlet (PM₁₀ WINS head fitted with a PM_{2.5} sharp cut cyclone (SSC)) at 1 m³/h). The PM_{2.5} fraction passes through the FDMS unit which compensates for loss of volatile material from the TEOM filter. Measurements were made in real-time (2 s intervals) with the 5-minute averages logged. From the logged data 1-hour and 24-hour averages were then calculated.

4.2 PM₁₀

PM₁₀ concentration in ambient air was determined in real time using a Tapered Element Oscillating Microbalance (TEOM) analyser. Ambient air was drawn through a PM₁₀ WINS size selective inlet at 1 m³/h. Measurements were made in real-time (2 s intervals) with the 5-minute averages logged. From the logged data 1-hour and 24-hour averages were then calculated.

The sample stream is heated to 50°C to maintain a low and therefore relatively constant humidity.

PM₁₀ monitoring was conducted in accordance with Australian Standard AS 3580.9.8, "Methods for Sampling and Analysis of Ambient Air: Determination of Suspended Particulate Matter – PM₁₀ Continuous Direct Mass Method Using a Tapered Element Oscillating Microbalance Analyser".

4.3 Carbon Monoxide

Carbon monoxide monitoring was conducted in accordance with Australian Standard AS 3580.7.1-1992, "Determination of Carbon Monoxide – Direct Reading Instrumental Method".

4.4 Oxides of Nitrogen

Oxides of nitrogen (NO, NO₂ and NO_x) monitoring was conducted in accordance with Australian Standard AS 3580.5.1, "Determination of Oxides of Nitrogen – Chemiluminescence Method".

4.5 Meteorological Parameters

4.5.1 Wind Speed and Direction

Wind speed and direction was measured by an ultrasonic anemometer located 10 m above ground level.

4.5.2 Temperature and Relative Humidity

Temperature and relative humidity were measured by a combined temperature- humidity sensor.

The sensors comprise a platinum resistance thermometer (PRT) to measure temperature and a capacitive thin-film polymer sensor to measure humidity.



5.0 AIR QUALITY GOALS

The Environment Protection Act of 1970 provides a legislative framework for the protection of the environment in Victoria. Section 16(1) details the provision for environment protection policies to stipulate environment protection for any element or segment of the environment. The State Environment Protection Policy (Air Quality Management) {SEPP (AQM)} is relevant to the ambient air quality objectives of the EastLink monitoring programme.

The intention of the SEPP (AQM) is to manage emissions to the air environment so that “beneficial uses of the air environment are protected, Victoria’s air quality goals and objectives are met”, with an overall emphasis on continual improvement, with regard to the economic and social development of the State.

The SEPP (AQM) provides the framework for this objective through the classification of air quality indicators and the stipulation of management strategies and criteria. Applicable to the EastLink ambient monitoring programme are the assessment criteria for local or neighbourhood air monitoring data contained within Schedule B. The criteria are listed as intervention levels which are used to determine whether the beneficial uses of the air environment are protected.

The Schedule B intervention levels for Class 1 indicators, carbon monoxide, nitrogen dioxide and PM₁₀ and Class 2 indicator, PM_{2.5}, are displayed in Table 2.

Table 2: SEPP (AQM) Schedule B Intervention Levels

Atmospheric Contaminant	Averaging Period	Intervention Level	Units
Carbon monoxide	1 hour	29	ppm
Nitrogen dioxide	1 hour	140	ppb
PM ₁₀	24 hour	60	µg/m ³
PM _{2.5}	24 hour	36	µg/m ³



6.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/01/2010 – 31/01/2010

6.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance procedures.

The data capture statistics for the reporting period 1st January to 31st January, 2010 are shown in Tables 3-5. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Section 6.3 provides further information on the reasons for invalid data periods.

Table 3: Data Capture Statistics - 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	627	744	84.3%
PM ₁₀	Chaim Crt.	685	744	92.1%
	Craig Rd.	734	744	98.7%
	Heads Rd.	741	744	99.6%
NO, NO ₂	Chaim Crt.	526	744	70.7%
	Craig Rd.	704	744	94.6%
	Heads Rd.	545	744	73.3%
CO	Chaim Crt.	656	744	88.2%
	Craig Rd.	705	744	94.8%
	Heads Rd.	711	744	95.6%

Table 4: Data Capture Statistics - 8 Hour Rolling Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt.	684	744	98.7%
	Craig Rd.	734	744	98.7%
	Heads Rd.	743	744	99.9%

Table 5: Data Capture Statistics - 24 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	25	31	80.6%
PM ₁₀	Chaim Crt.	28	31	90.3%
	Craig Rd.	30	31	96.8%
	Heads Rd.	31	31	100.0%



6.2 Results

6.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM_{2.5} (1-hour average) concentration statistics for the reporting period are given in Table 6. A plot of PM_{2.5} (1-hour average) concentration for the reporting period is presented in Figure 2.

Table 6: PM_{2.5} Concentration Percentiles (1 Hour Average)

Station	PM _{2.5} Concentration ($\mu\text{g}/\text{m}^3$) (1-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	23	19	18	15	12	9.5	6.2

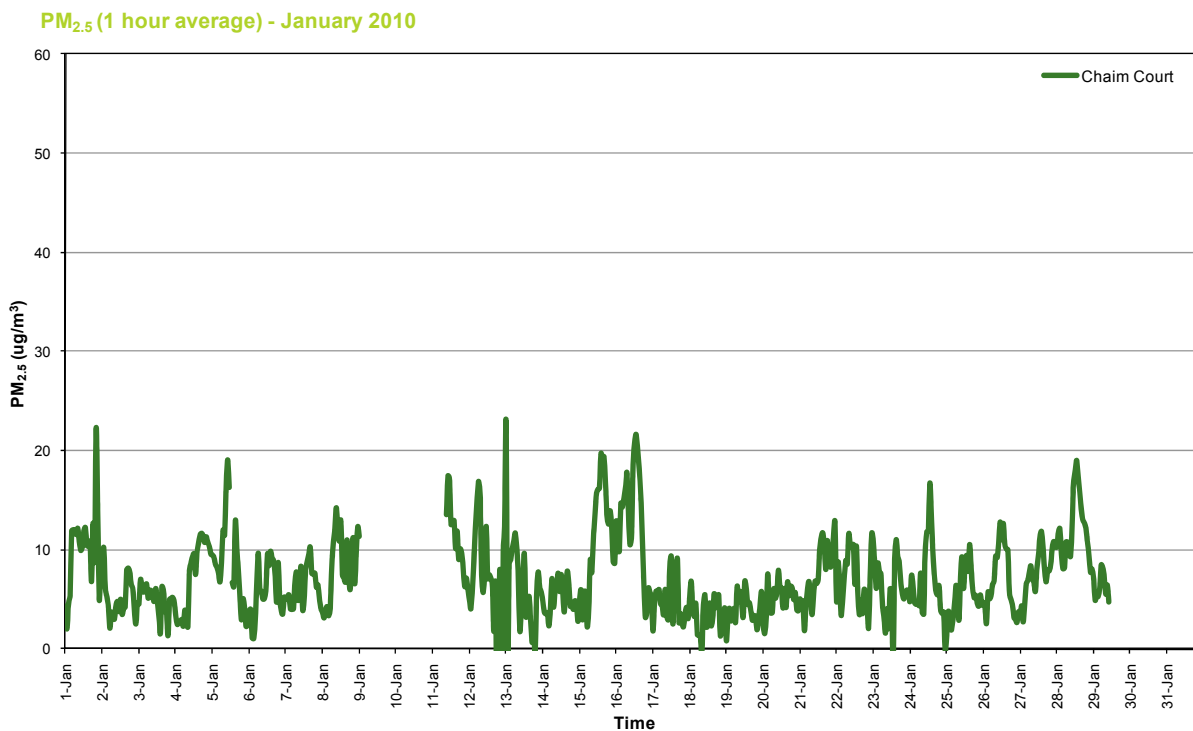


Figure 2: PM_{2.5} Concentration (1 Hour Average)



EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JANUARY-MARCH 2010

PM_{2.5} (24-hour average) concentration statistics for the reporting period are given in Table 7. A plot of PM_{2.5} (24-hour average) concentration for the reporting period is presented in Figure 3.

Table 7: PM_{2.5} Concentration Percentiles (24 Hour Average)

Station	PM _{2.5} Concentration (µg/m ³) (24-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	13	13	12	12	10	7.5	6.7

PM_{2.5} (24 hour average) - January 2010

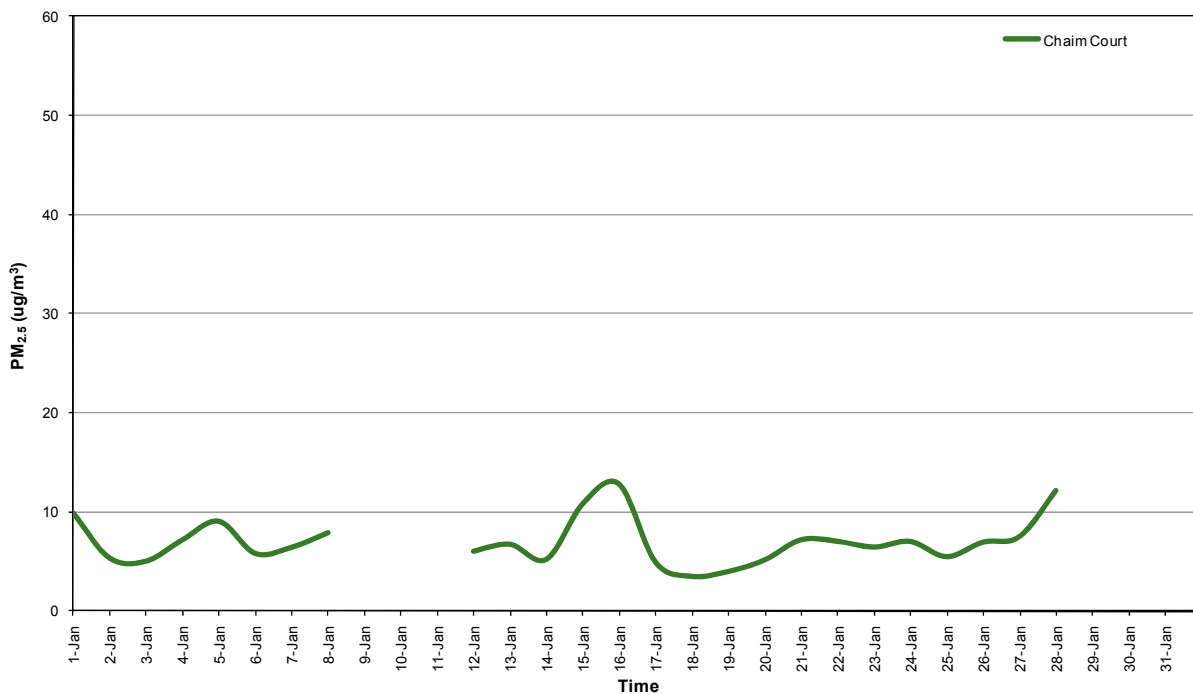


Figure 3: PM_{2.5} Concentration (24 Hour Average)



6.2.2 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM₁₀ (1-hour average) concentration statistics for the reporting period are given in Table 8. A plot of PM₁₀ (1-hour average) concentration for the reporting period is presented in Figure 4.

Table 8: PM₁₀ Concentration Percentiles (1 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	120	59	46	35	30	24	17
Craig Rd.	170	54	47	38	31	24	17
Heads Rd.	300	77	55	37	30	23	16

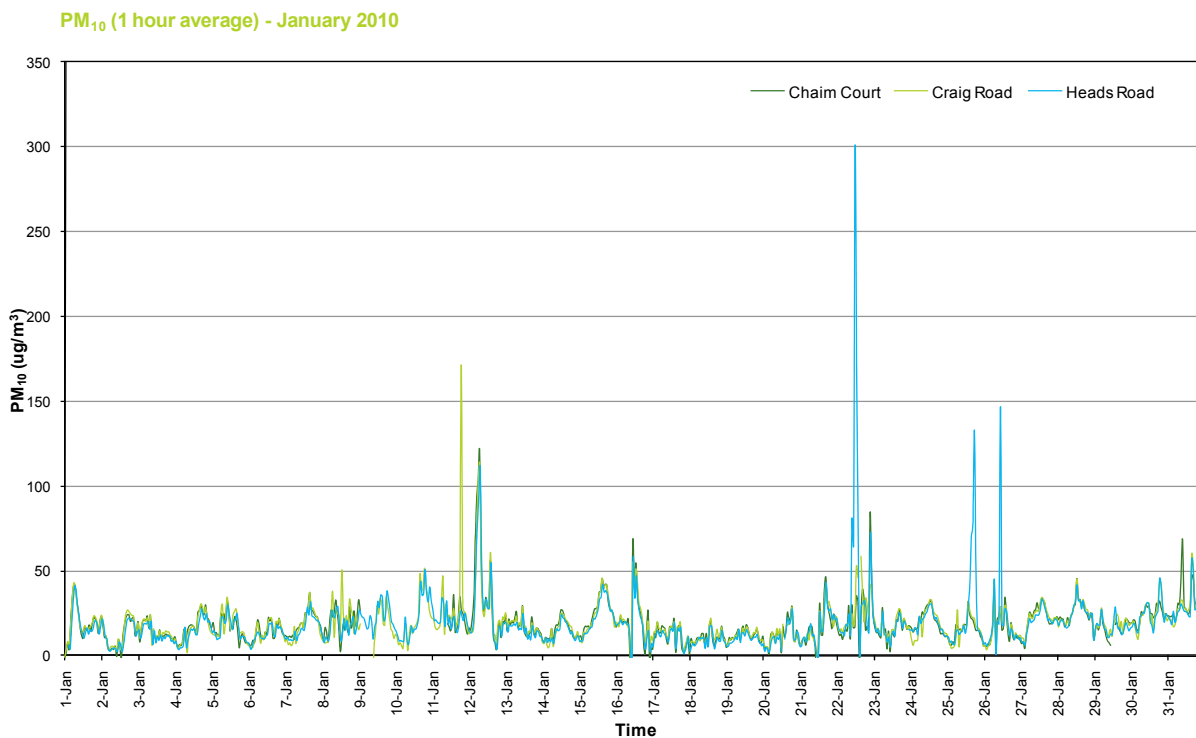


Figure 4: PM₁₀ Concentration (1 Hour Average)



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PM₁₀ (24-hour average) concentration statistics for the reporting period are given in Table 9. A plot of PM₁₀ (24-hour average) concentration for the reporting period is presented in Figure 5.

Table 9: PM₁₀ Concentration Percentiles (24 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (24-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	36	35	33	29	26	21	17
Craig Rd.	33	32	31	29	27	22	18
Heads Rd	47	43	38	30	26	23	17

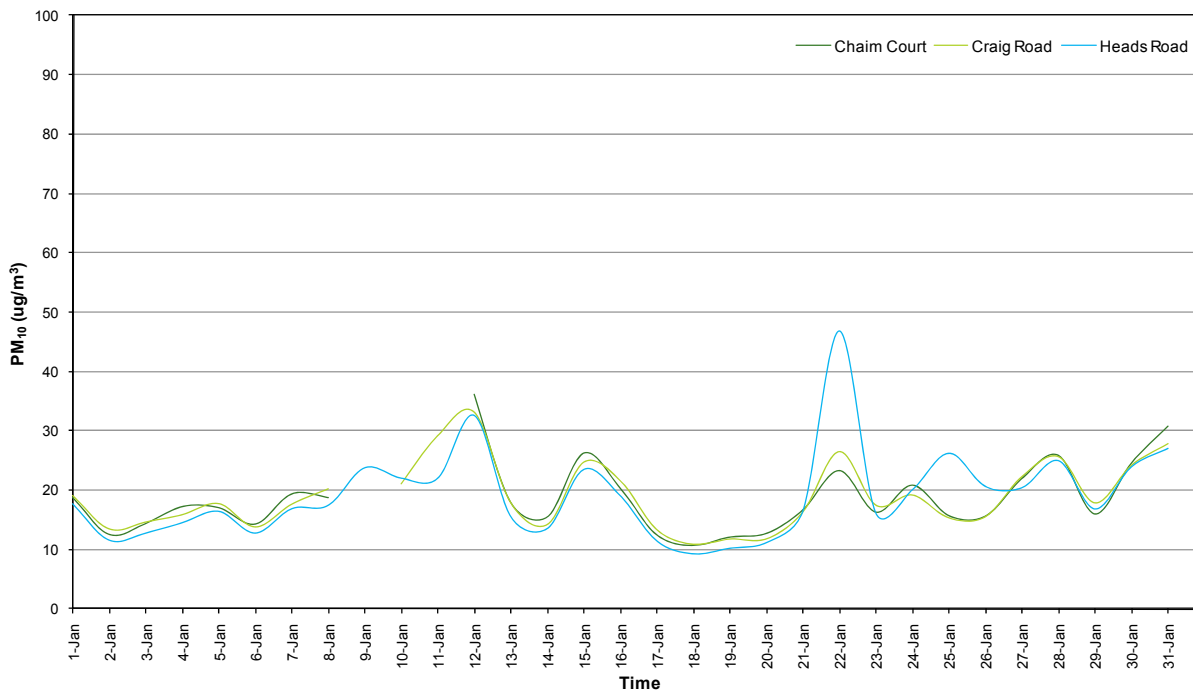


Figure 5: PM₁₀ Concentration (24 Hour Average)



6.2.3 Carbon Monoxide

6.2.3.1 1-Hour Average

Carbon monoxide (1-hour average) concentration statistics for the reporting period are given in Table 10. A plot of carbon monoxide (1-hour average) concentration for the reporting period is presented in Figure 6.

Table 10: Carbon Monoxide Concentration Percentiles (1 Hour Average)

Station	Carbon Monoxide Concentration (ppm) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.45	0.36	0.34	0.30	0.24	0.17	0.10
Craig Rd.	0.65	0.42	0.35	0.26	0.21	0.15	0.10
Heads Rd.	0.42	0.31	0.28	0.25	0.22	0.18	0.13

Carbon Monoxide (1 hour average) - January 2010

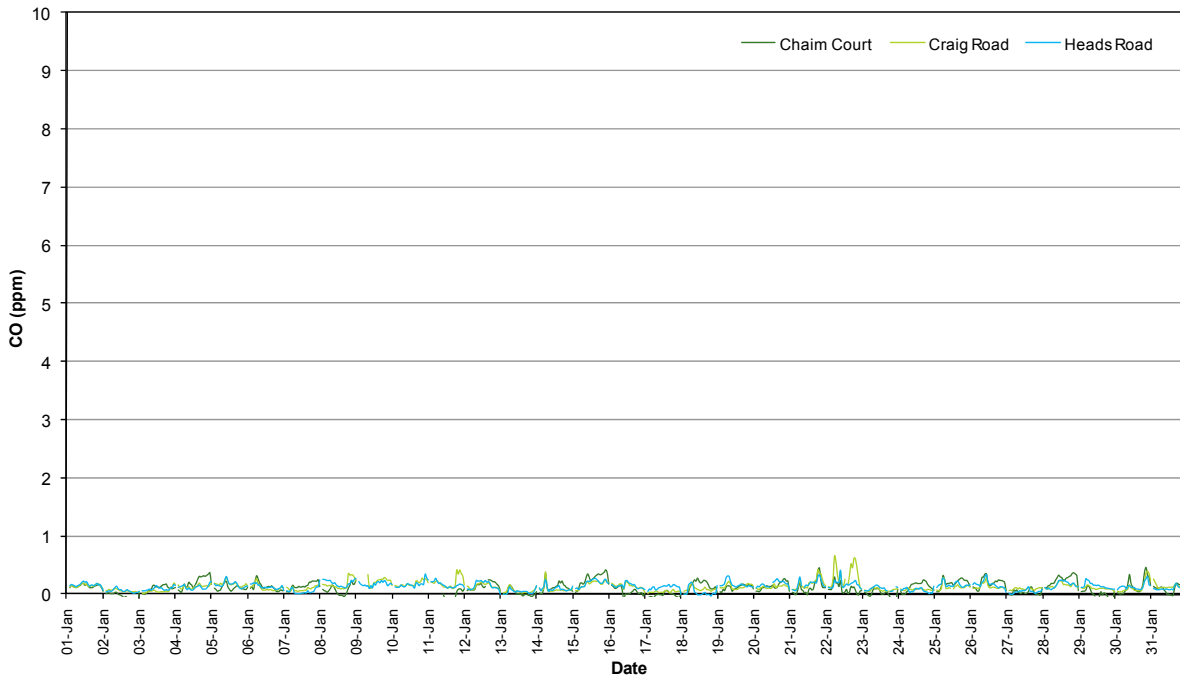


Figure 6: Carbon Monoxide Concentration (1 Hour Average)



6.2.3.2 8-Hour Rolling Average

Carbon monoxide (8-hour rolling average) concentration statistics for the reporting period are given in Table 11. A plot of carbon monoxide (8-hour rolling average) concentration for the reporting period is presented in Figure 7.

Table 11: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average)

Station	Carbon Monoxide Concentration (ppm) (8-Hour Rolling Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.35	0.31	0.29	0.25	0.22	0.16	0.11
Craig Rd.	0.44	0.33	0.30	0.25	0.2	0.15	0.11
Heads Rd.	0.26	0.24	0.23	0.23	0.21	0.17	0.14

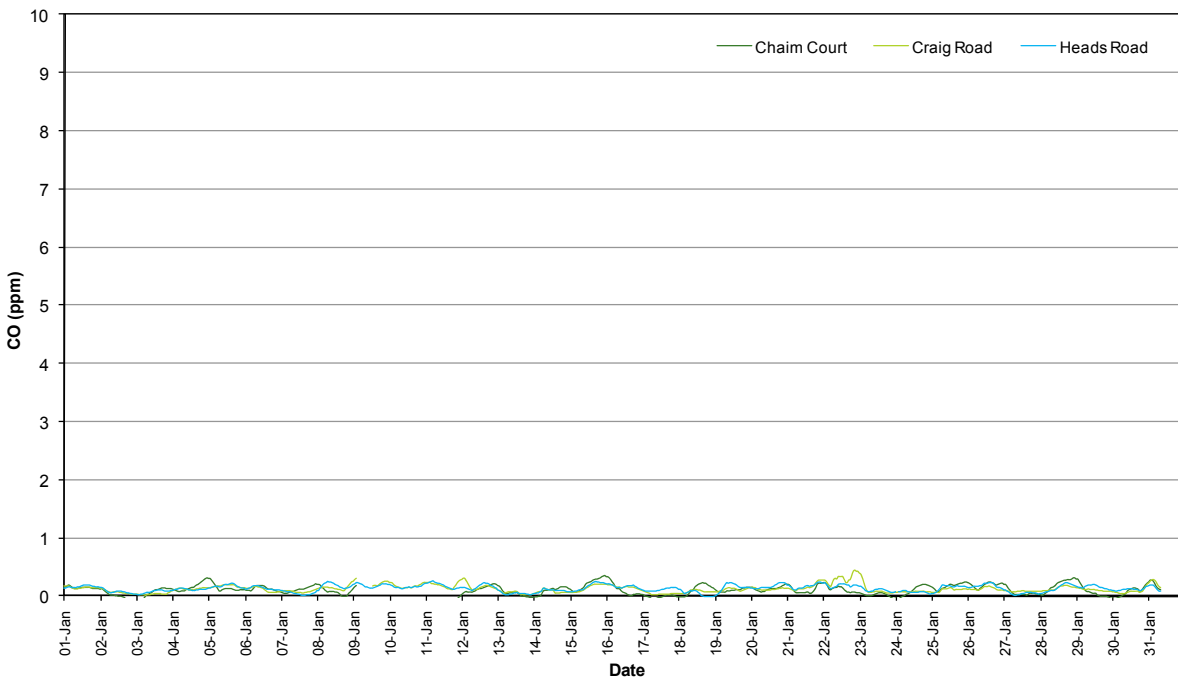


Figure 7: Carbon Monoxide Concentration (8 Hour Rolling Average)



6.2.4 Oxides of Nitrogen

6.2.4.1 Nitric Oxide

Nitric oxide (1-hour average) concentration statistics for the reporting period are given in Table 12. A plot of nitric oxide (1-hour average) concentration for the reporting period is presented in Figure 8.

Table 12: Nitric Oxide Concentration Percentiles (1 Hour Average)

Station	Nitric Oxide Concentration (ppb) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	43	18	14	8.5	5.5	2.6	< 1
Craig Rd.	25	11	7.8	4.2	2.4	0.88	< 1
Heads Rd.	21	16	11	7.3	5.1	3.0	1.2

Nitric Oxide (1 hour average) - January 2010

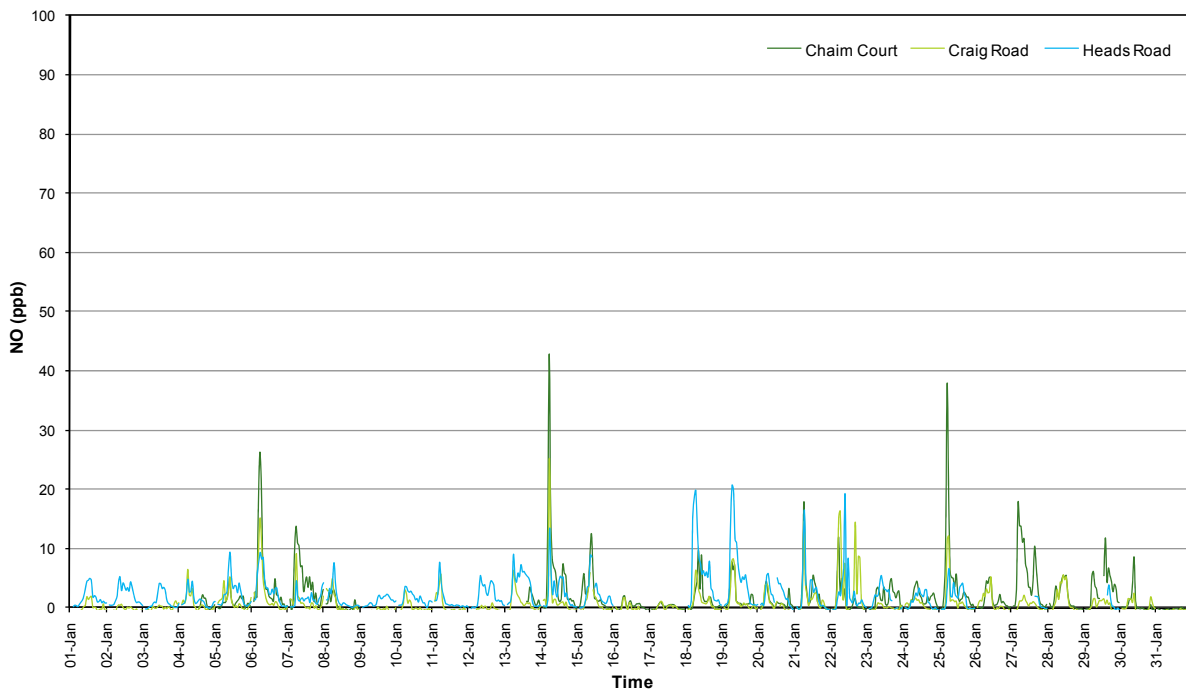


Figure 8: Nitric Oxide Concentration (1 Hour Average)



6.2.4.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) concentration statistics for the reporting period are given in Table 13. A plot of nitrogen dioxide (1-hour average) concentration for the reporting period is presented in Figure 9.

Table 13: Nitrogen Dioxide Concentration Percentiles (1 Hour Average)

Station	Nitrogen Dioxide Concentration (ppb) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	24	17	15	13	12	8.5	5.9
Craig Rd.	25	19	16	12	9.7	6.5	4.1
Heads Rd.	26	19	16	13	11	8.0	5.2

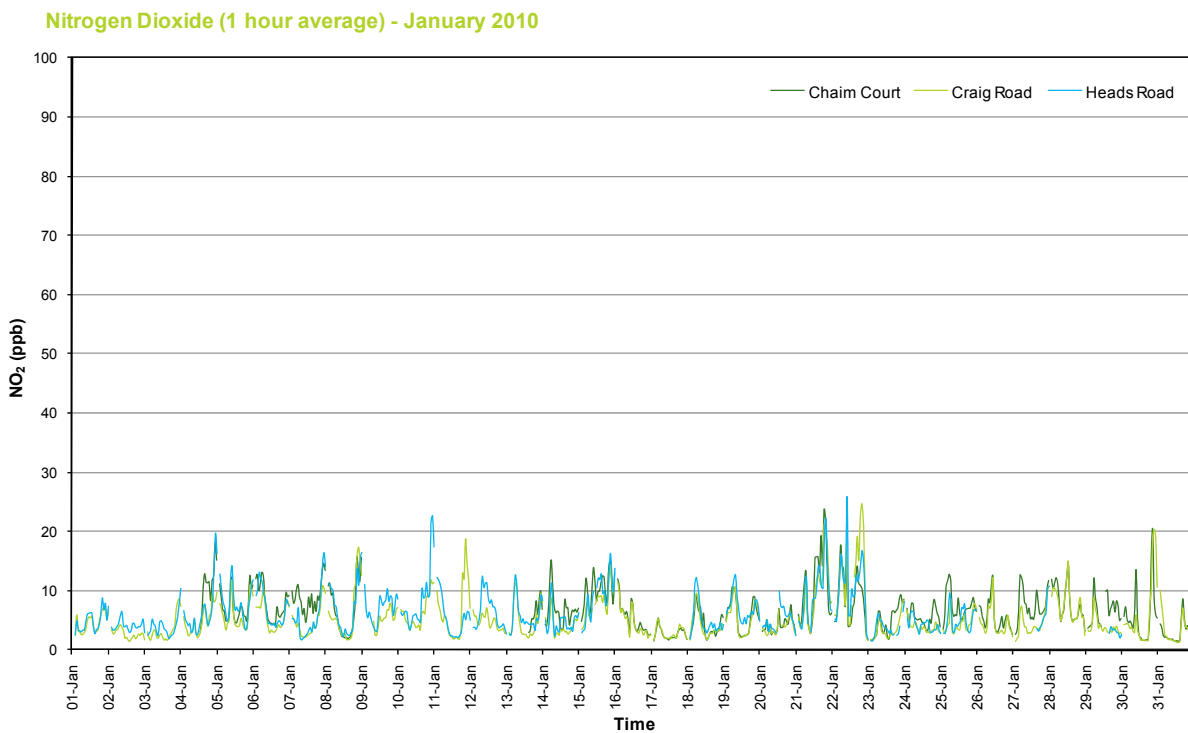


Figure 9: Nitrogen Dioxide Concentration (1 Hour Average)



6.2.5 Meteorological Data

Wind speed and direction for each of the monitoring stations are presented as wind roses in Figures 10 – 12.

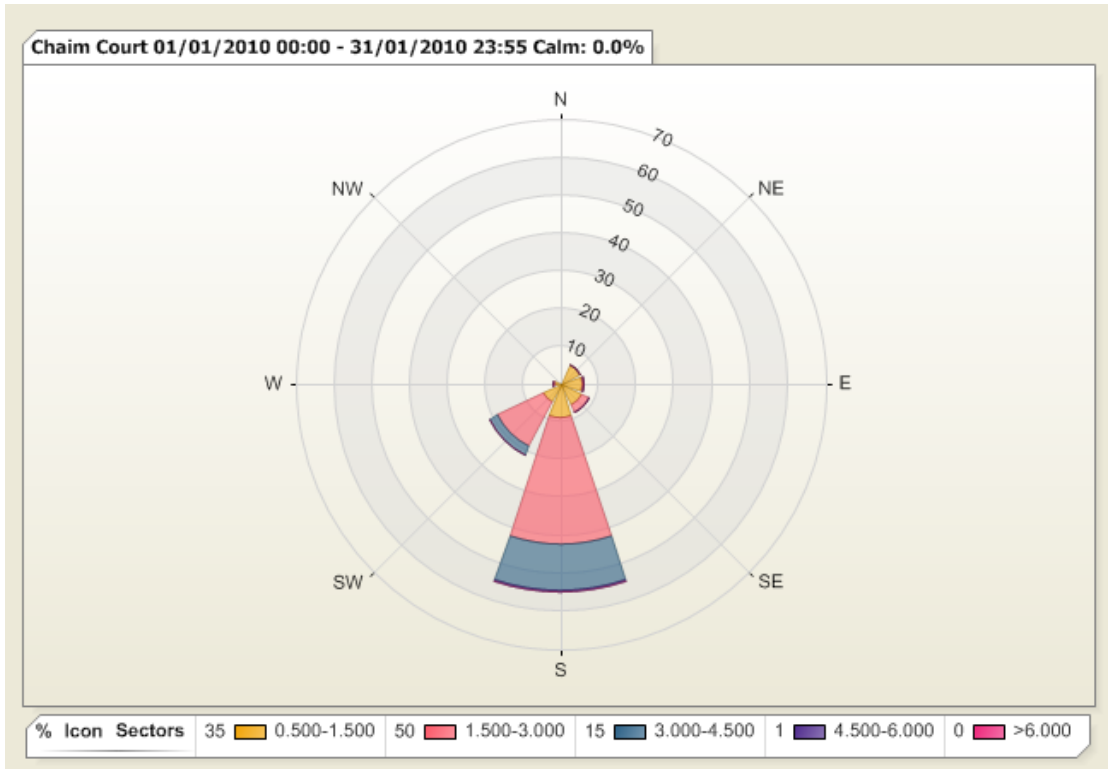


Figure 10: Chaim Court Wind Rose

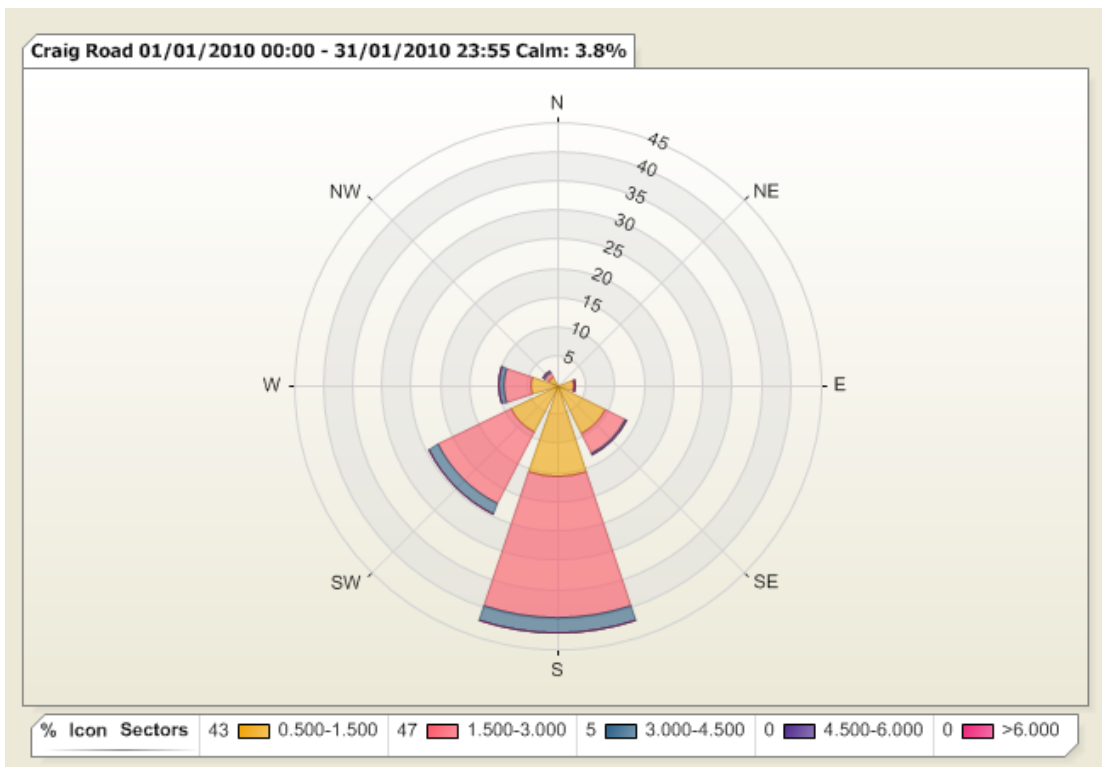


Figure 11: Craig Road Wind Rose

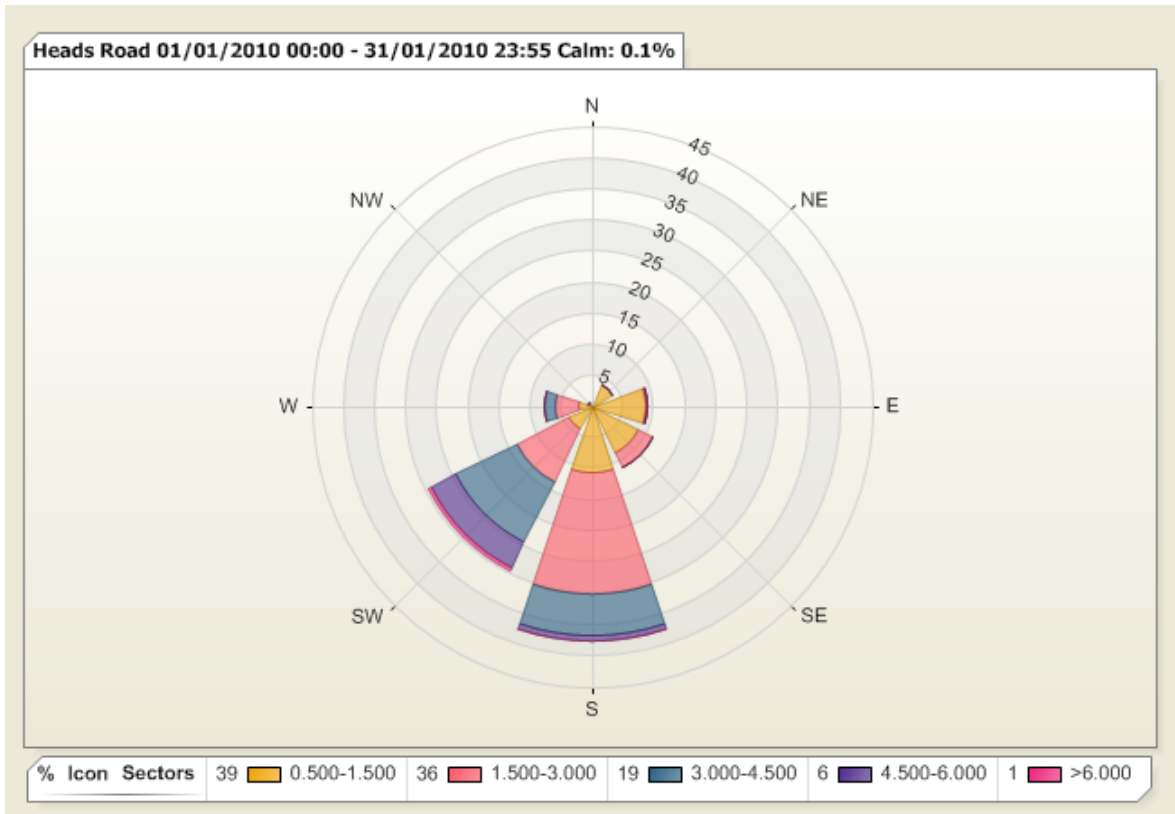


Figure 12: Heads Road Wind Rose



6.3 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 14 – 16 list the data exceptions for Chaim Court, Craig Road and Heads Road monitoring stations respectively. Data during automatic calibrations of the gaseous analysers has also been removed from the data sets.

Table 14: Data Exceptions – Chaim Court

Start	End	Parameter	Reason
1/01/2010 1:40	4/01/2010 12:20	NO, NO ₂ , NO _x	Invalid data - span drift
5/01/2010 12:55	5/01/2010 14:10	PM ₁₀	Maintenance/calibration
5/01/2010 12:55	5/01/2010 14:10	PM _{2.5}	Maintenance/calibration
9/01/2010 1:55	11/01/2010 9:35	All parameters	Power failure
11/01/2010 9:35	11/01/2010 10:00	CO	Maintenance/calibration
11/01/2010 9:40	13/01/2010 14:45	NO, NO ₂ , NO _x	Unstable after power outage
12/01/2010 15:00	12/01/2010 15:25	CO	Maintenance/calibration
29/01/2010 12:25	29/01/2010 13:50	CO	Maintenance/calibration
29/01/2010 12:25	29/01/2010 13:40	NO, NO ₂ , NO _x	Maintenance/calibration
29/01/2010 12:30	29/01/2010 13:35	PM ₁₀	Maintenance/calibration
29/01/2010 12:30	29/01/2010 13:35	PM _{2.5}	Maintenance/calibration

Table 15: Data Exceptions – Craig Road

Start	End	Parameter	Reason
9/01/2010 1:55	9/01/2010 7:20	All parameters	Power failure
9/01/2010 7:20	9/01/2010 7:55	CO, NO, NO ₂ , NO _x	Unstable after power outage
9/01/2010 7:20	9/01/2010 8:40	PM ₁₀	Unstable after power outage
15/01/2010 10:15	15/01/2010 10:55	NO, NO ₂ , NO _x	Maintenance/calibration
20/01/2010 13:45	20/01/2010 14:05	CO	Maintenance/calibration
20/01/2010 13:45	20/01/2010 14:30	NO, NO ₂ , NO _x	Maintenance/calibration
20/01/2010 14:25	20/01/2010 15:20	PM ₁₀	Maintenance/calibration
22/01/2010 14:25	22/01/2010 15:00	CO	Maintenance/calibration
22/01/2010 14:25	22/01/2010 15:00	NO, NO ₂ , NO _x	Maintenance/calibration
22/01/2010 14:50	22/01/2010 15:45	PM ₁₀	Maintenance/calibration
25/01/2010 11:55	25/01/2010 12:25	CO	Maintenance/calibration



Table 16: Data Exceptions – Heads Road

Start	End	Parameter	Reason
15/01/2010 11:15	15/01/2010 12:00	NO, NO ₂ , NO _x	Maintenance/calibration
16/01/2010 1:00	18/01/2010 1:00	NO, NO ₂ , NO _x	Invalid data - span drift
20/01/2010 12:15	20/01/2010 12:50	CO	Maintenance/calibration
20/01/2010 12:15	20/01/2010 12:50	NO, NO ₂ , NO _x	Maintenance/calibration
20/01/2010 13:00	20/01/2010 13:50	PM ₁₀	Maintenance/calibration
23/01/2010 22:20	23/01/2010 23:05	All Parameters	Communications error
26/01/2010 1:00	27/01/2010 15:35	NO, NO ₂ , NO _x	Invalid data - span drift
28/01/2010 3:00	29/01/2010 15:20	NO, NO ₂ , NO _x	Invalid data - span drift
30/01/2010 1:00	31/01/2010 23:55	NO, NO ₂ , NO _x	Invalid data - span drift



7.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/02/2010 – 28/02/2010

7.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance procedures.

The data capture statistics for the reporting period 1st February to 28th February, 2010 are shown in Tables 17-19. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Section 7.3 provides further information on the reasons for invalid data periods.

Table 17: Data Capture Statistics – 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	648	672	96.4%
PM ₁₀	Chaim Crt.	658	672	97.9%
	Craig Rd.	662	672	98.5%
	Heads Rd.	628	672	93.5%
NO, NO ₂	Chaim Crt.	630	672	93.8%
	Craig Rd.	635	672	94.5%
	Heads Rd.	507	672	75.4%
CO	Chaim Crt.	630	672	93.8%
	Craig Rd.	635	672	94.5%
	Heads Rd.	602	672	89.6%

Table 18: Data Capture Statistics - 8 Hour Rolling Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt	650	672	98.2%
	Craig Rd.	660	672	98.2%
	Heads Rd.	629	672	93.6%

Table 19: Data Capture Statistics - 24 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	26	28	92.9%
PM ₁₀	Chaim Crt.	27	28	96.4%
	Craig Rd.	27	28	96.4%
	Heads Rd.	26	28	92.9%



7.2 Results

7.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM_{2.5} (1-hour average) concentration statistics for the reporting period are given in Table 20. A plot of PM_{2.5} (1-hour average) concentration for the reporting period is presented in Figure 13.

Table 20: PM_{2.5} Concentration Percentiles (1 Hour Average)

Station	PM _{2.5} Concentration (µg/m ³) (1-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim CRT.	47	29	24	20	15	11	7.1

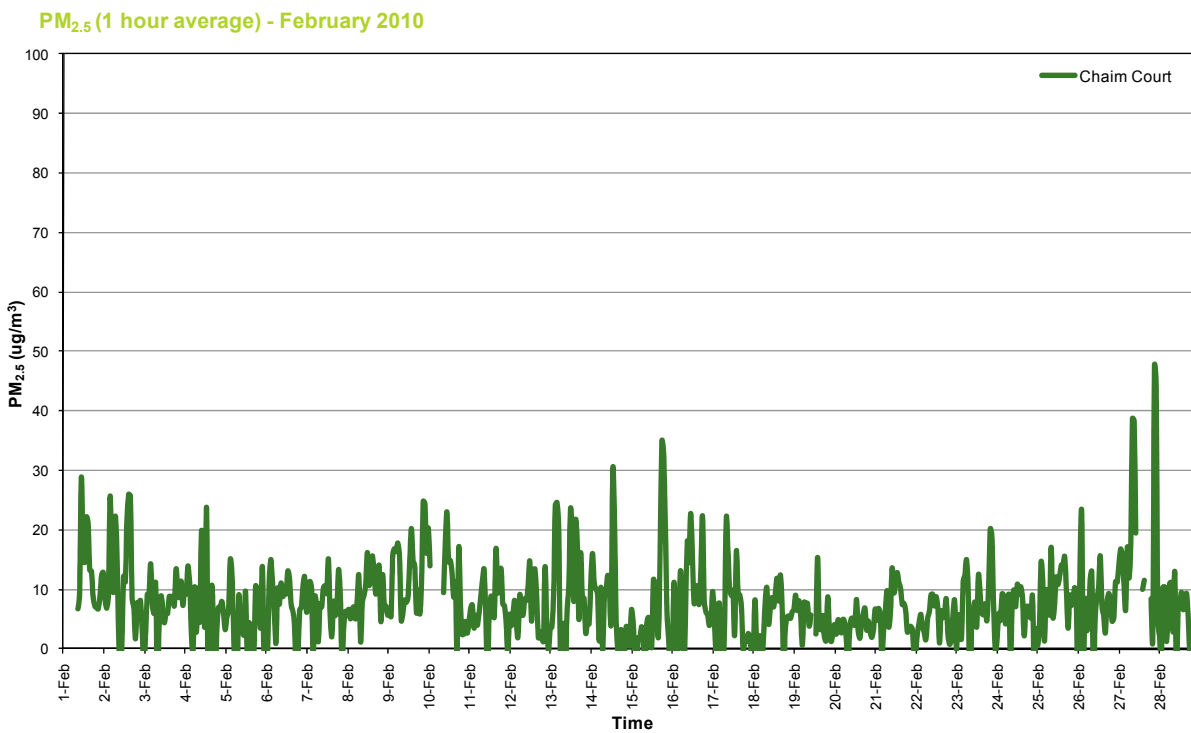


Figure 13: PM_{2.5} Concentration (1 Hour Average)



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PM_{2.5} (24-hour average) concentration statistics for the reporting period are given in Table 21. A plot of PM_{2.5} (24-hour average) concentration for the reporting period is presented in Figure 14.

Table 21: PM_{2.5} Concentration Percentiles (24 Hour Average)

Station	PM _{2.5} Concentration (µg/m ³) (24-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	17	16	15	12	11	8.3	6.9

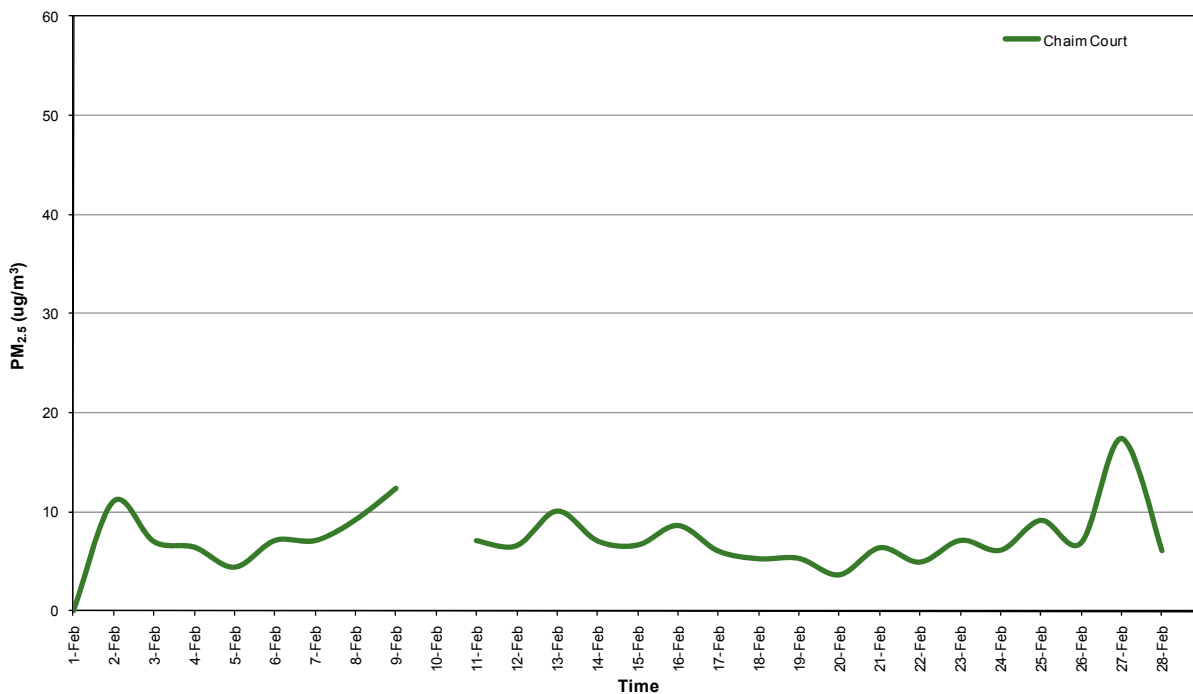


Figure 14: PM_{2.5} Concentration (24 Hour Average)



7.3 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM₁₀ (1-hour average) concentration statistics for the reporting period are given in Table 22. A plot of PM₁₀ (1-hour average) concentration for the reporting period is presented in Figure 15.

Table 22: PM₁₀ Concentration Percentiles (1 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	49	39	38	32	27	22	17
Craig Rd.	74	48	44	35	28	22	15
Heads Rd.	72	49	42	35	29	22	16

PM₁₀ (1 hour average) - February 2010

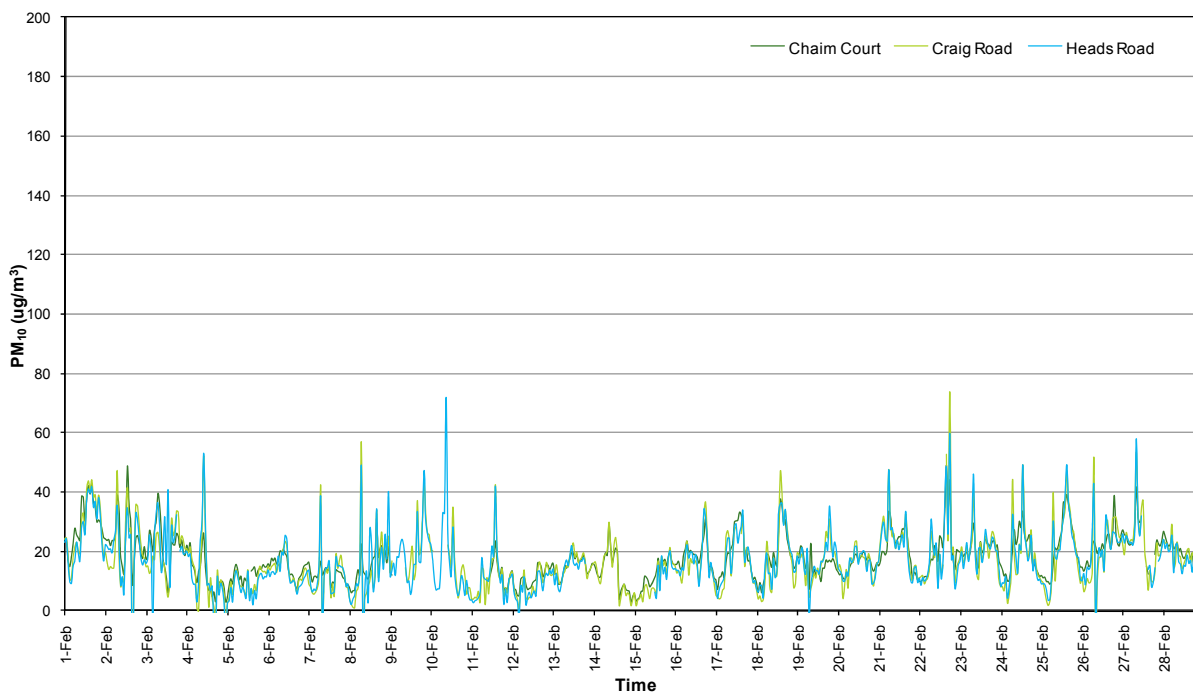


Figure 15: PM₁₀ Concentration (1 Hour Average)



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PM₁₀ (24-hour average) concentration statistics for the reporting period are given in Table 23. A plot of PM₁₀ (24-hour average) concentration for the reporting period is presented in Figure 16.

Table 23: PM₁₀ Concentration Percentiles (24 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (24-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	29	28	27	24	23	21	18
Craig Rd.	28	27	26	23	22	20	17
Heads Rd	26	25	25	23	22	20	17

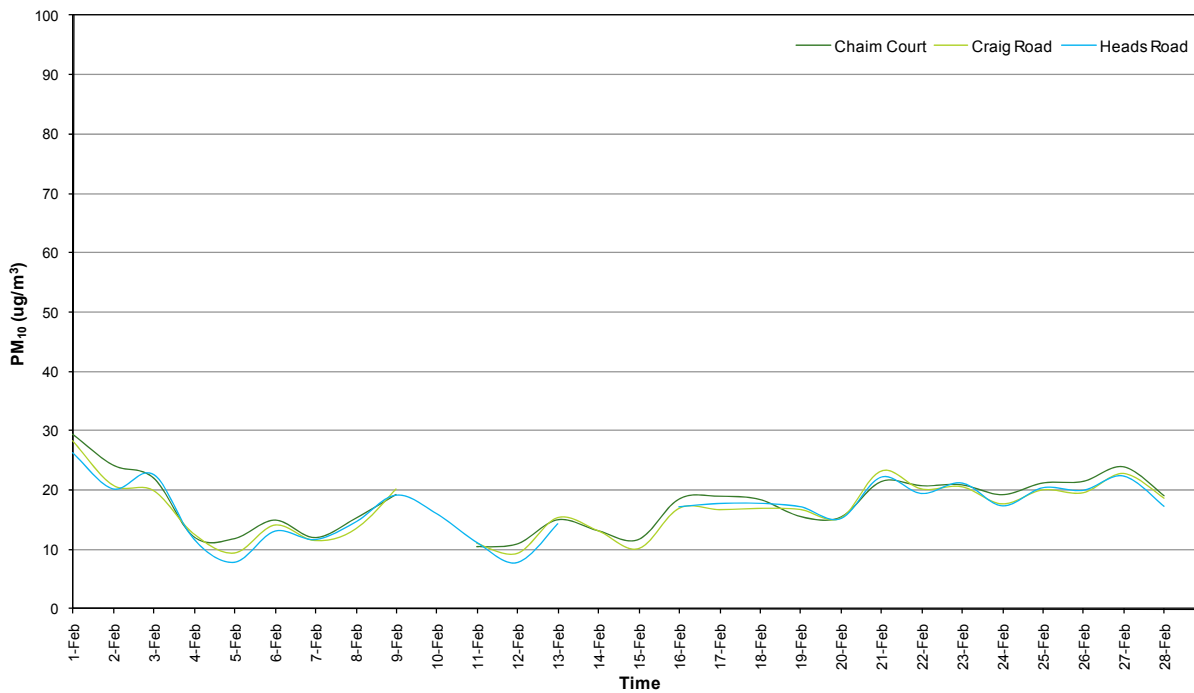


Figure 16: PM₁₀ Concentration (24 Hour Average)



7.3.1 Carbon Monoxide

7.3.1.1 1-Hour Average

Carbon monoxide (1-hour average) concentration statistics for the reporting period are given in Table 24. A plot of carbon monoxide (1-hour average) concentration for the reporting period is presented in Figure 17.

Table 24: Carbon Monoxide Concentration Percentiles (1 Hour Average)

Station	Carbon Monoxide Concentration (ppm) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.72	0.45	0.39	0.30	0.25	0.18	0.10
Craig Rd.	0.59	0.39	0.36	0.27	0.22	0.17	0.12
Heads Rd	0.48	0.37	0.33	0.28	0.23	0.18	0.13

Carbon Monoxide (1 hour average) - February 2010

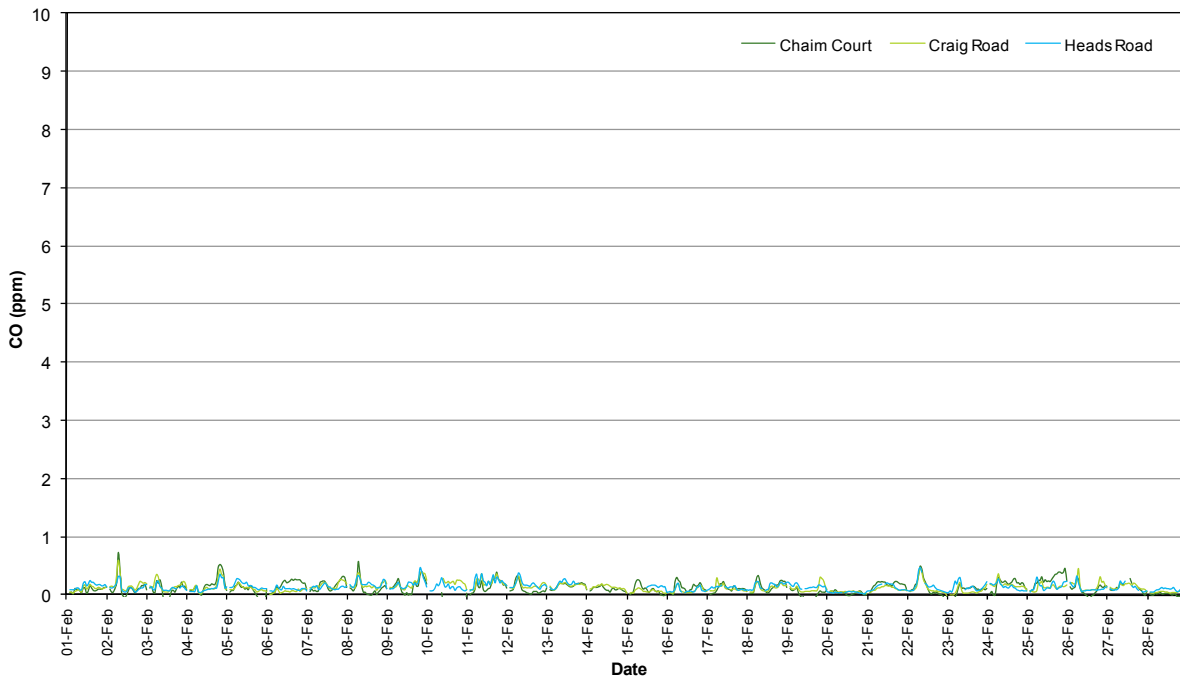


Figure 17 Carbon Monoxide Concentration (1 Hour Average)



7.3.1.2 8-Hour Rolling Average

Carbon monoxide (8-hour rolling average) concentration statistics for the reporting period are given in Table 25. A plot of carbon monoxide (8-hour rolling average) concentration for the reporting period is presented in Figure 18.

Table 25: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average)

Station	Carbon Monoxide Concentration (ppm) (8-Hour Rolling Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.38	0.34	0.30	0.25	0.22	0.17	0.12
Craig Rd.	0.34	0.26	0.25	0.23	0.21	0.17	0.13
Heads Rd.	0.29	0.27	0.26	0.23	0.21	0.17	0.14

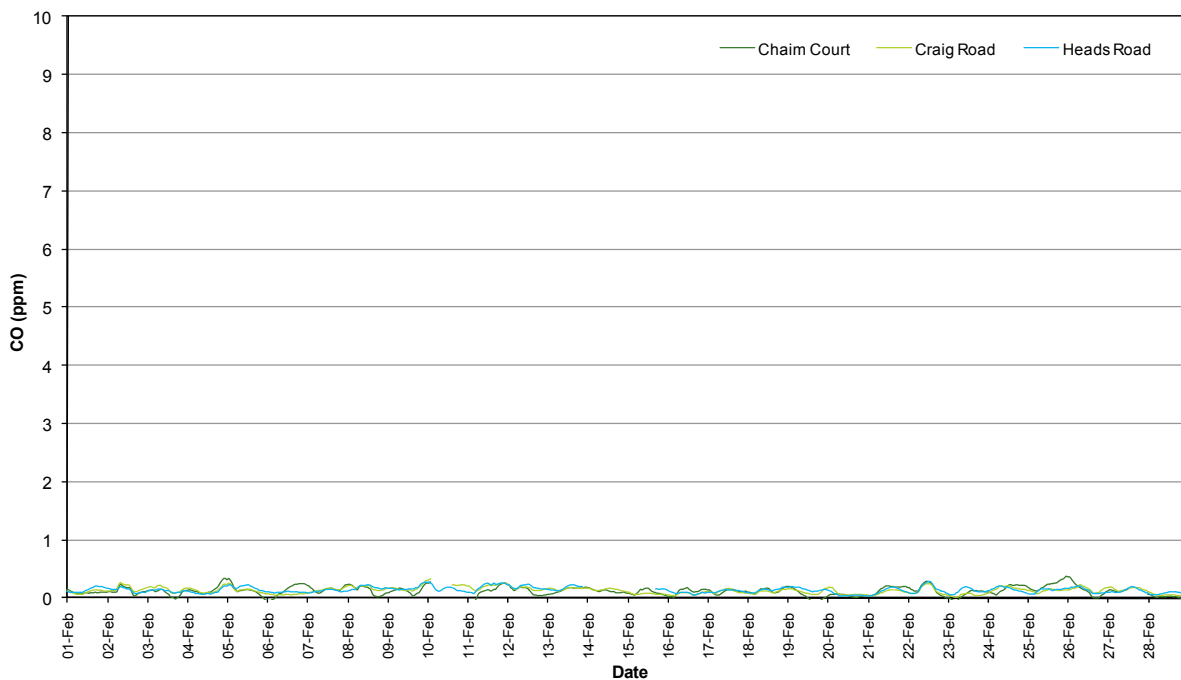


Figure 18: Carbon Monoxide Concentration (8 Hour Rolling Average)



7.3.2 Oxides of Nitrogen

7.3.2.1 Nitric Oxide

Nitric oxide (1-hour average) concentration statistics for the reporting period are given in Table 26. A plot of nitric oxide (1-hour average) concentration for the reporting period is presented in Figure 19.

Table 26: Nitric Oxide Concentration Percentiles (1 Hour Average)

Station	Nitric Oxide Concentration (ppb) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	59	28	24	13	9.4	3.6	1.1
Craig Rd.	32	15	12	7.4	4.5	1.2	< 1
Heads Rd.	35	13	11	7.9	6.2	2.9	< 1

Nitric Oxide (1 hour average) - February 2010

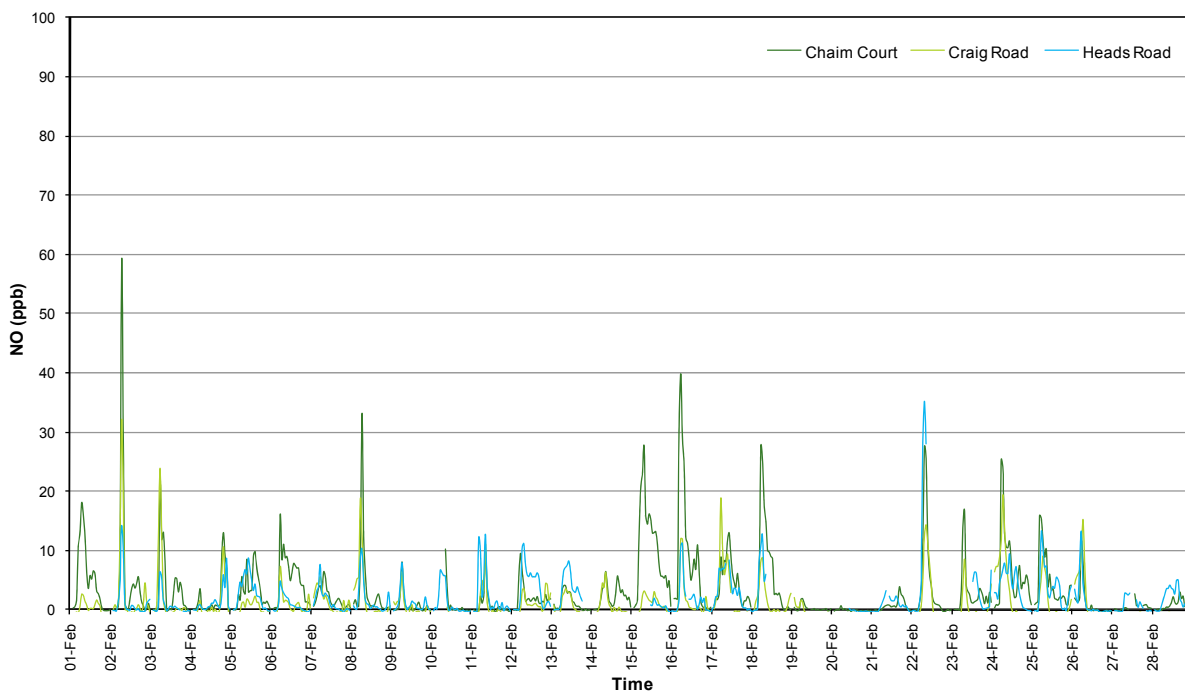


Figure 19: Nitric Oxide Concentration (1 Hour Average)



7.3.2.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) concentration statistics for the reporting period are given in Table 27. A plot of nitrogen dioxide (1-hour average) concentration for the reporting period is presented in Figure 20.

Table 27: Nitrogen Dioxide Concentration Percentiles (1 Hour Average)

Station	Nitrogen Dioxide Concentration (ppb) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	28	22	18	16	13	10	7.4
Craig Rd.	28	17	15	13	11	9.0	6.6
Heads Rd.	34	21	18	14	12	9.1	6.0

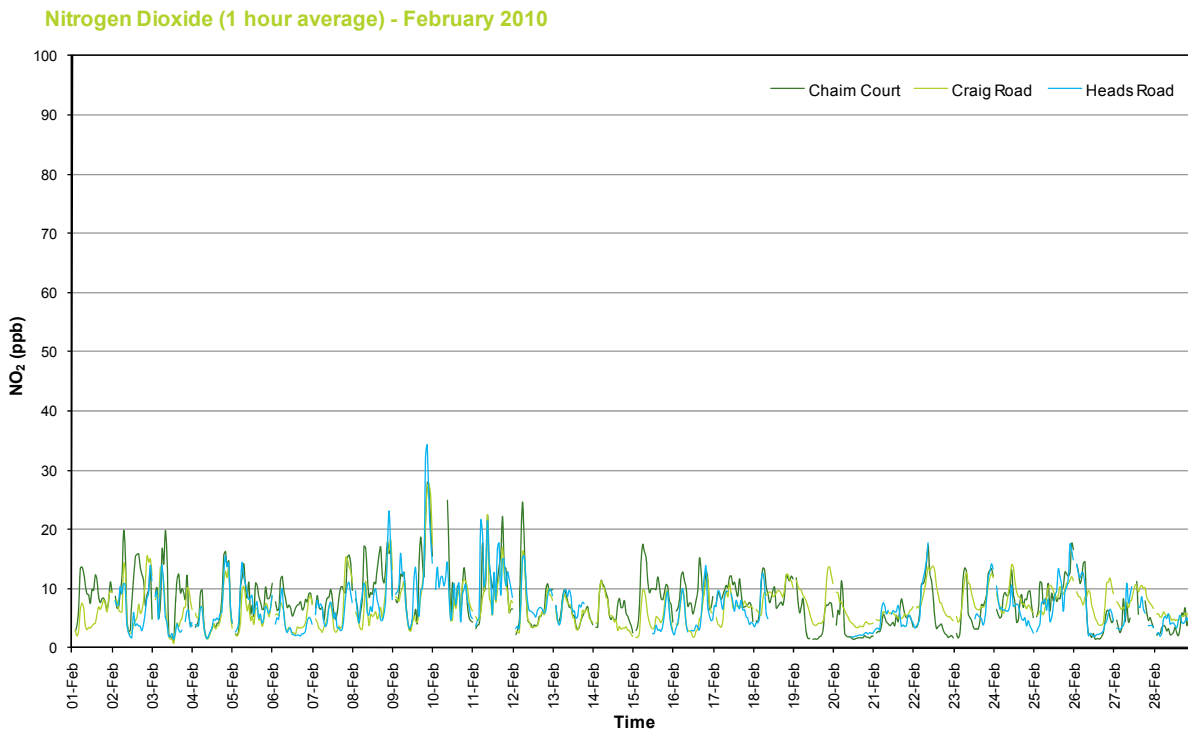


Figure 20: Nitrogen Dioxide Concentration (1 Hour Average)



7.3.3 Meteorological Data

Wind speed and direction for each of the monitoring stations are presented as wind roses in Figures 21 – 23.

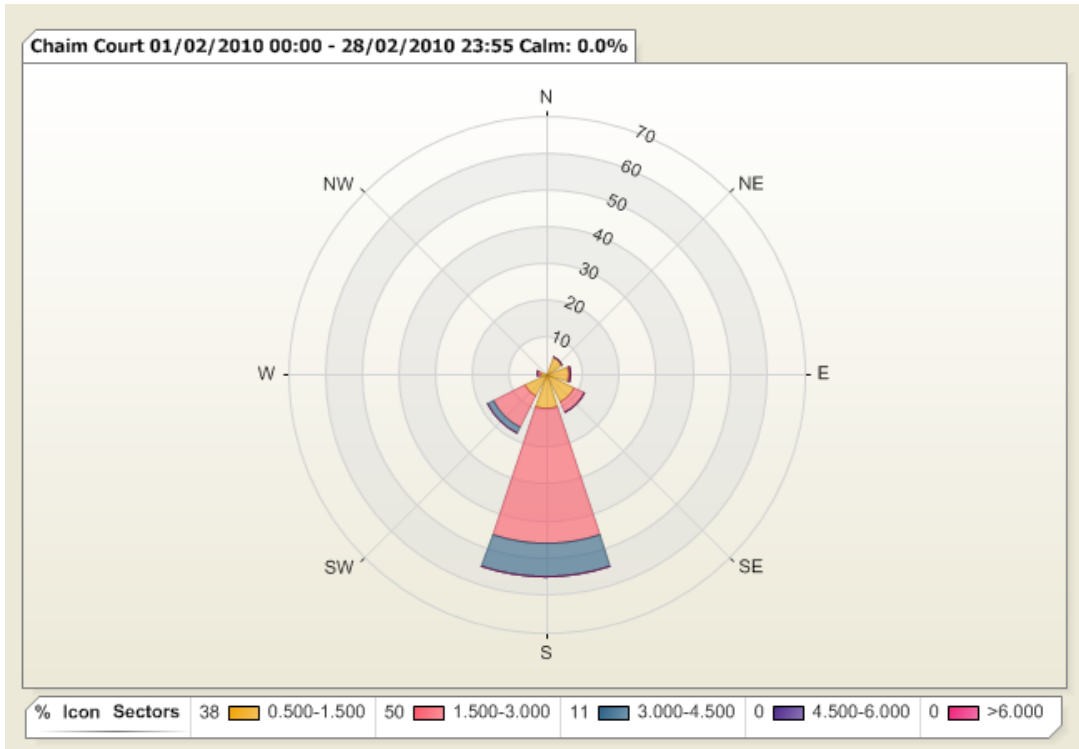


Figure 21: Chaim Court Wind Rose

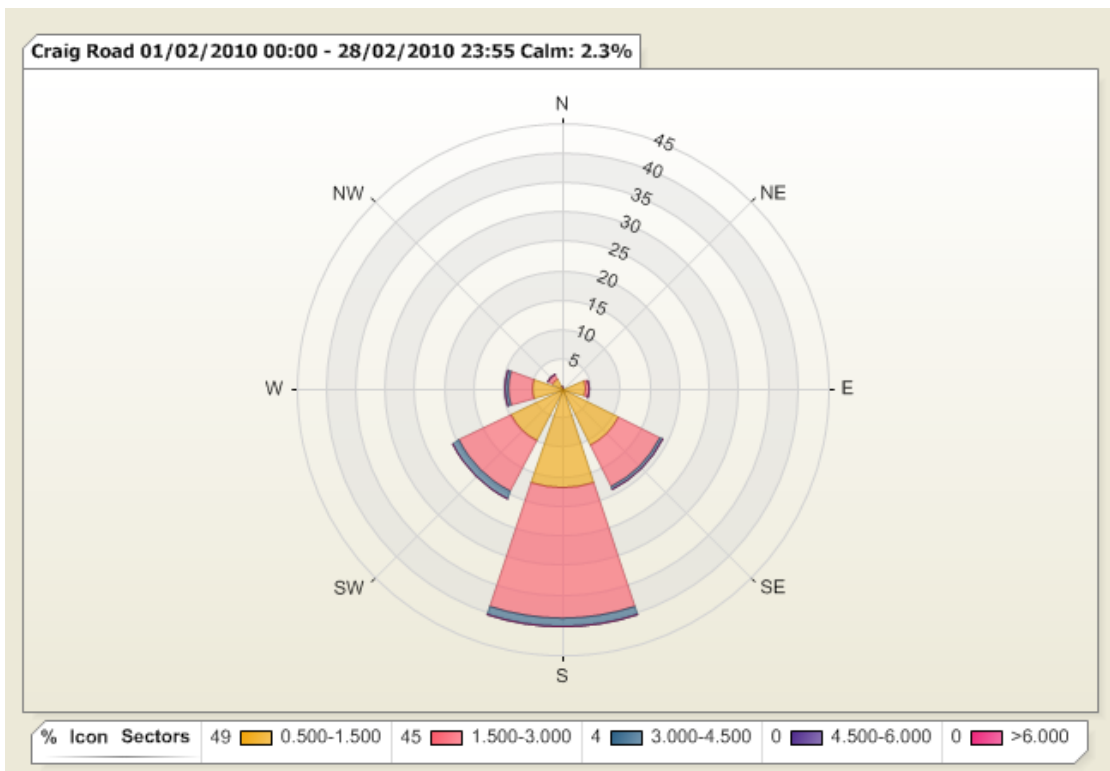


Figure 22: Craig Road Wind Rose

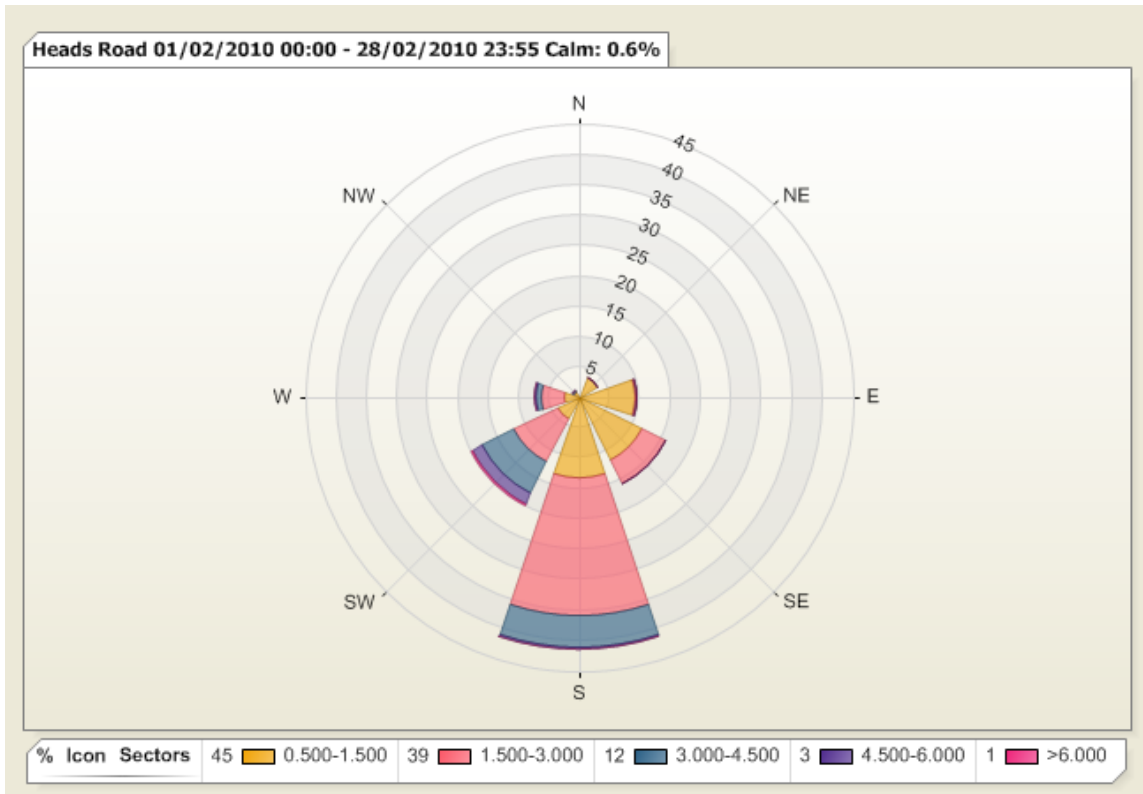


Figure 23: Heads Road Wind Rose



7.4 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 28 – 30 list the data exceptions for Chaim Court, Craig Road and Heads Road monitoring stations respectively. Data during automatic calibrations of the gaseous analysers has also been removed from the data sets.

Table 28: Data Exceptions - Chaim Court

Start	End	Parameter	Reason
10/02/2010 3:00	10/02/2010 9:05	All parameters	Power failure
17/02/2010 14:40	17/02/2010 14:50	Windspeed, direction	Maintenance/calibration
19/02/2010 11:25	19/02/2010 12:05	CO	Maintenance/calibration
19/02/2010 11:25	19/02/2010 12:05	NO, NO ₂ , NO _x	Maintenance/calibration
19/02/2010 12:00	19/02/2010 12:45	PM _{2.5} , PM ₁₀	Maintenance/calibration
27/02/2010 10:50	27/02/2010 11:35	All parameters	Communications fault
27/02/2010 12:30	27/02/2010 13:15	All parameters	Communications fault
27/02/2010 15:50	27/02/2010 16:35	All parameters	Communications fault
27/02/2010 17:30	27/02/2010 18:15	All parameters	Communications fault

Table 29: Data Exceptions - Craig Road

Start	End	Parameter	Reason
10/02/2010 1:50	10/02/2010 9:35	All parameters	Power failure
15/02/2010 15:25	15/02/2010 15:40	Windspeed, direction	Maintenance/calibration
17/02/2010 13:00	17/02/2010 13:15	CO	Maintenance/calibration
17/02/2010 13:00	17/02/2010 13:35	NO, NO ₂ , NO _x	Maintenance/calibration
17/02/2010 13:20	17/02/2010 14:15	PM ₁₀	Maintenance/calibration

Table 30: Data Exceptions - Heads Road

Start	End	Parameter	Reason
1/02/2010 3:00	2/02/2010 1:35	NO, NO ₂ , NO _x	Invalid data - span drift
3/02/2010 19:30	3/02/2010 19:45	All parameters	Communications fault
13/02/2010 19:45	15/02/2010 10:15	All parameters	Power failure
15/02/2010 10:15	15/02/2010 11:15	CO, NO, NO ₂ , NO _x	Maintenance/calibration
15/02/2010 10:15	15/02/2010 11:50	PM ₁₀	Maintenance/calibration
25/02/2010 14:15	25/02/2010 14:30	Windspeed, direction	Maintenance/calibration
27/02/2010 11:55	27/02/2010 12:40	All parameters	Communications fault
27/02/2010 14:25	27/02/2010 15:10	All parameters	Communications fault
27/02/2010 20:15	27/02/2010 21:00	All parameters	Communications fault



8.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/03/2010 – 31/03/2010

8.1 Data Capture

Data capture is defined as the number of valid data periods collected divided by the number of available data periods. Valid data excludes periods where the instrument is unavailable due to calibration and maintenance and excludes periods where the data has been rejected due to quality assurance procedures.

The data capture statistics for the reporting period 1st March to 31st March, 2010 are shown in Tables 31-33. Averages were only collected for those periods where the 5-minute data constituted 75% data capture.

Section 8.3 provides further information on the reasons for invalid data periods.

Table 31: Data Capture Statistics – 1 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	704	744	94.6%
PM ₁₀	Chaim Crt.	734	744	98.7%
	Craig Rd.	741	744	99.6%
	Heads Rd.	670	744	90.1%
NO, NO ₂	Chaim Crt.	710	744	95.4%
	Craig Rd.	707	744	95.0%
	Heads Rd.	580	744	78.0%
CO	Chaim Crt.	710	744	95.4%
	Craig Rd.	708	744	95.2%
	Heads Rd.	640	744	86.0%

Table 32: Data Capture Statistics - 8 Hour Rolling Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt.	744	744	99.1%
	Craig Rd.	737	744	99.1%
	Heads Rd.	672	744	90.3%

Table 33: Data Capture Statistics – 24 Hour Averages

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM _{2.5}	Chaim Crt.	28	31	90.3%
PM ₁₀	Chaim Crt.	30	31	96.8%
	Craig Rd.	31	31	100.0%
	Heads Rd.	27	31	87.1%



8.2 Results

8.2.1 PM_{2.5}

PM_{2.5} was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM_{2.5} (1-hour average) concentration statistics for the reporting period are given in Table 34. A plot of PM_{2.5} (1-hour average) concentration for the reporting period is presented in Figure 24.

Table 34: PM_{2.5} Concentration Percentiles (1 Hour Average)

Station	PM _{2.5} Concentration (µg/m ³) (1-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim CRT.	35	27	24	19	17	12	7.8

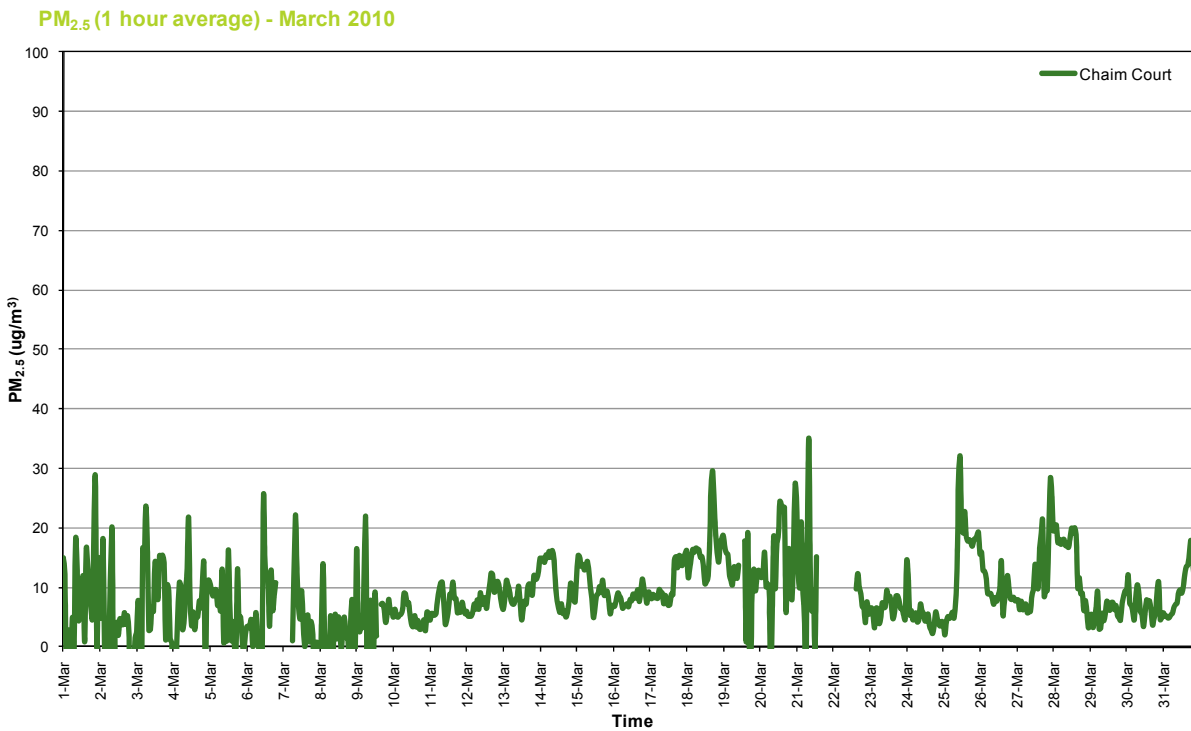


Figure 24: PM_{2.5} Concentration (1 Hour Average)



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PM_{2.5} (24-hour average) concentration statistics for the reporting period are given in Table 35. A plot of PM_{2.5} (24-hour average) concentration for the reporting period is presented in Figure 25.

Table 35: PM_{2.5} Concentration Percentiles (24 Hour Average)

Station	PM _{2.5} Concentration (µg/m ³) (24-hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	17	16	16	15	14	11	8.4

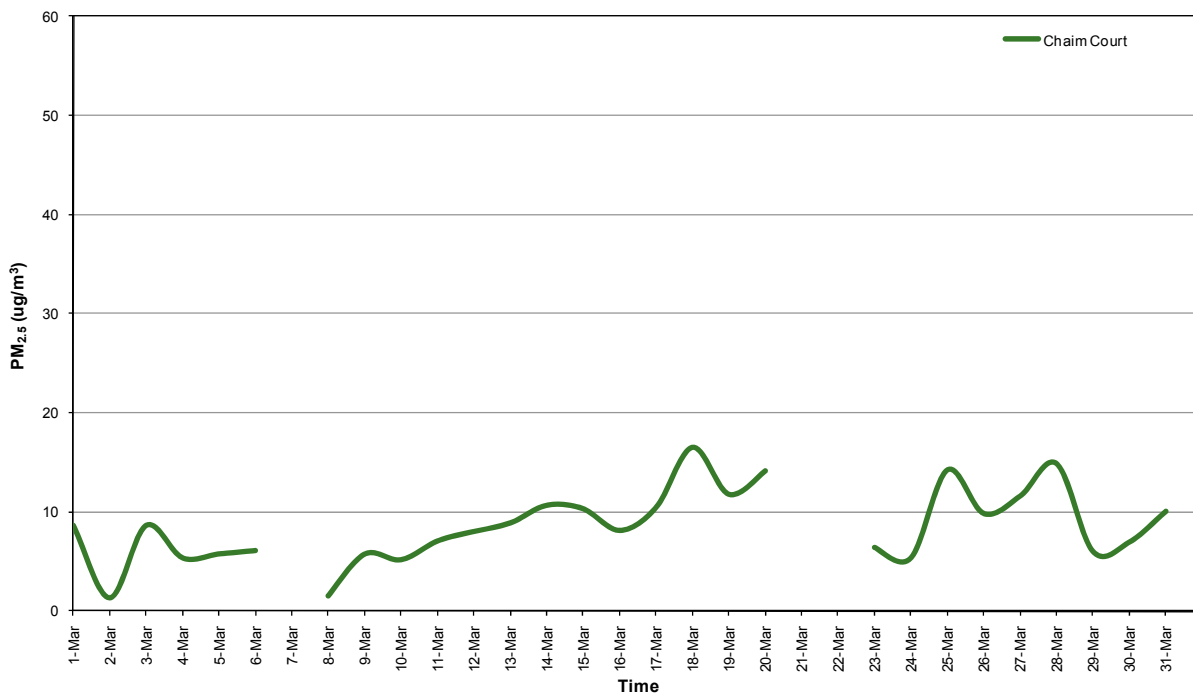


Figure 25: PM_{2.5} Concentration (24 Hour Average)



8.3 PM₁₀

PM₁₀ was continuously monitored and 5-minute averages logged. The 5-minute average data was then transformed to 1-hour and 24-hour averages for reporting.

PM₁₀ (1-hour average) concentration statistics for the reporting period are given in Table 36. A plot of PM₁₀ (1-hour average) concentration for the reporting period is presented in Figure 26.

Table 36: PM₁₀ Concentration Percentiles (1 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	46	37	34	29	26	20	15
Craig Rd.	65	51	45	35	29	21	14
Heads Rd.	63	49	43	36	30	22	16

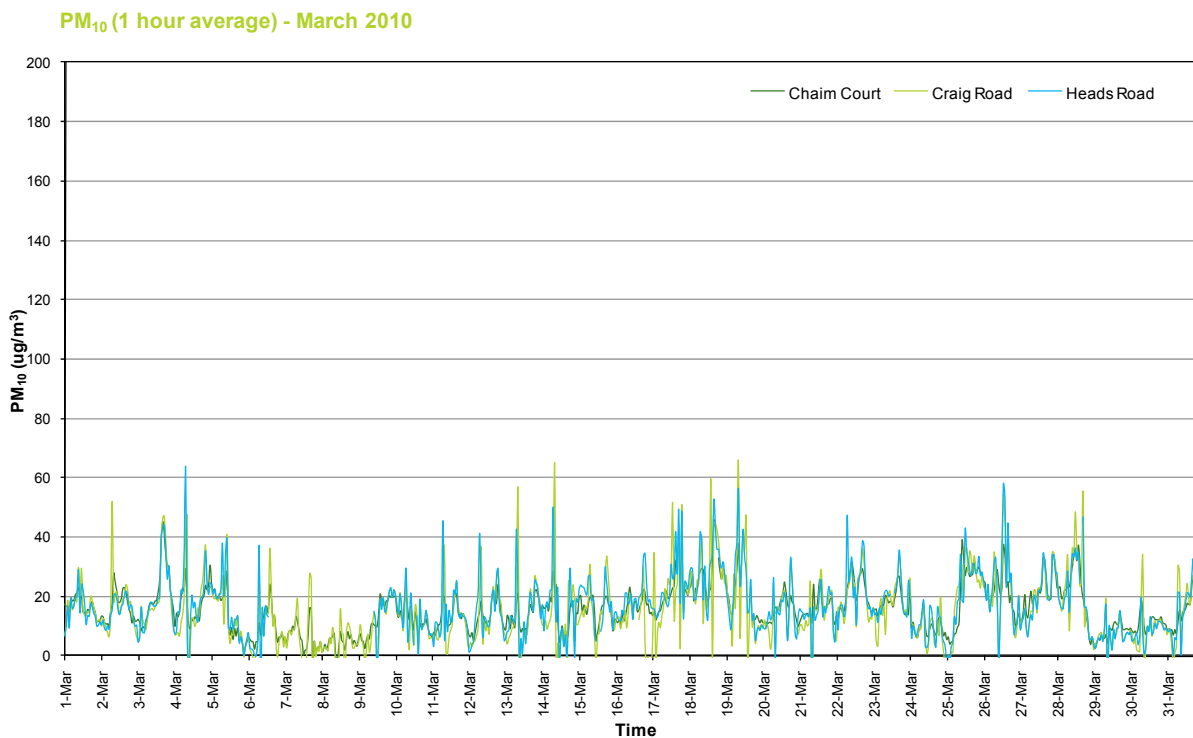


Figure 26: PM₁₀ Concentration (1 Hour Average)



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PM₁₀ (24-hour average) concentration statistics for the reporting period are given in Table 37. A plot of PM₁₀ (24-hour average) concentration for the reporting period is presented in Figure 27.

Table 37: PM₁₀ Concentration Percentiles (24 Hour Average)

Station	PM ₁₀ Concentration (µg/m ³) (24-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	27	26	24	22	21	20	16
Craig Rd.	28	27	25	23	22	20	14
Heads Rd	30	28	27	24	23	21	16

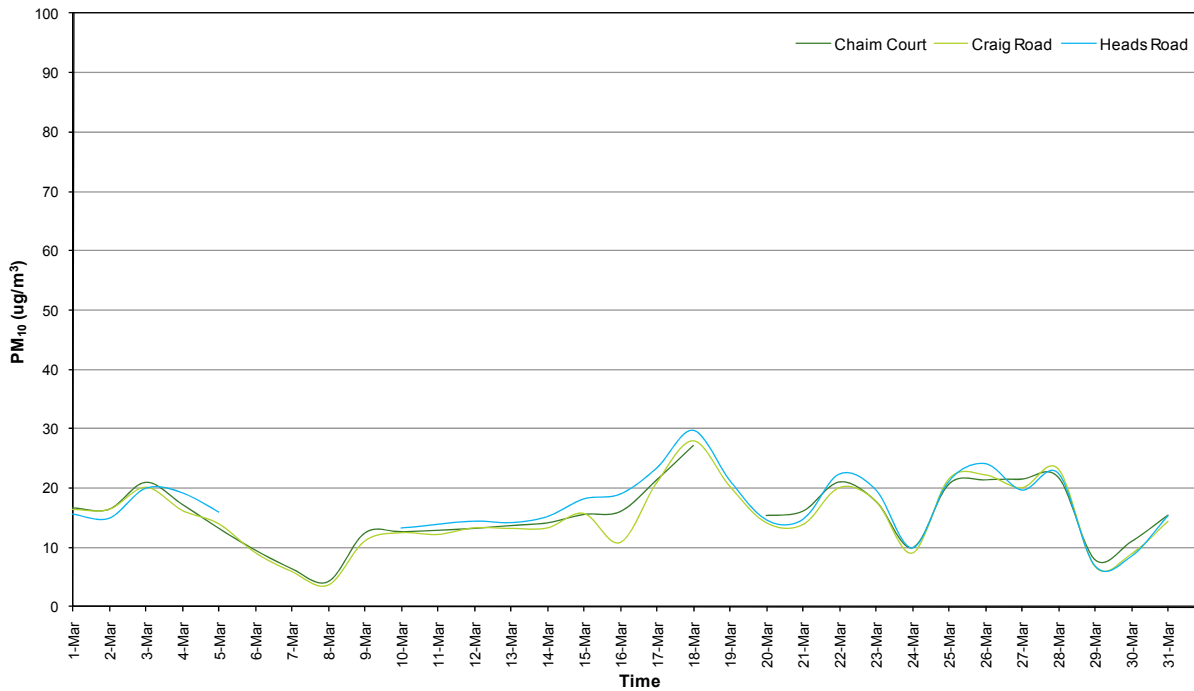


Figure 27: PM₁₀ Concentration (24 Hour Average)



8.3.1 Carbon Monoxide

8.3.1.1 1-Hour Average

Carbon monoxide (1-hour average) concentration statistics for the reporting period are given in Table 38. A plot of carbon monoxide (1-hour average) concentration for the reporting period is presented in Figure 28.

Table 38: Carbon Monoxide Concentration Percentiles (1 Hour Average)

Station	Carbon Monoxide Concentration (ppm) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.71	0.46	0.40	0.34	0.29	0.20	0.11
Craig Rd.	0.85	0.47	0.41	0.35	0.28	0.20	0.14
Heads Rd.	0.70	0.49	0.44	0.33	0.27	0.21	0.14

Carbon Monoxide (1 hour average) - March 2010

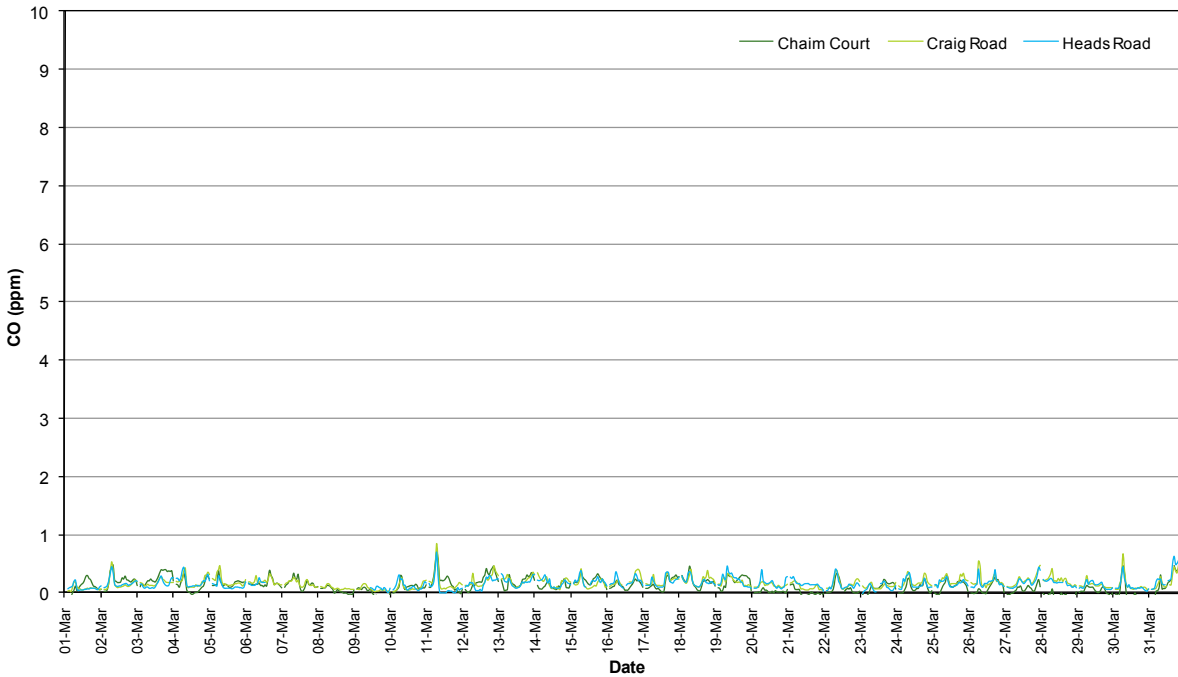


Figure 28: Carbon Monoxide Concentration (1 Hour Average)



8.3.1.2 8-Hour Rolling Average

Carbon monoxide (8-hour rolling average) concentration statistics for the reporting period are given in Table 39. A plot of carbon monoxide (8-hour rolling average) concentration for the reporting period is presented in Figure 29.

Table 39: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average)

Station	Carbon Monoxide Concentration (ppm) (8-Hour Rolling Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	0.39	0.37	0.34	0.28	0.24	0.18	0.12
Craig Rd.	0.38	0.32	0.31	0.28	0.25	0.20	0.15
Heads Rd.	0.54	0.32	0.29	0.25	0.23	0.20	0.16

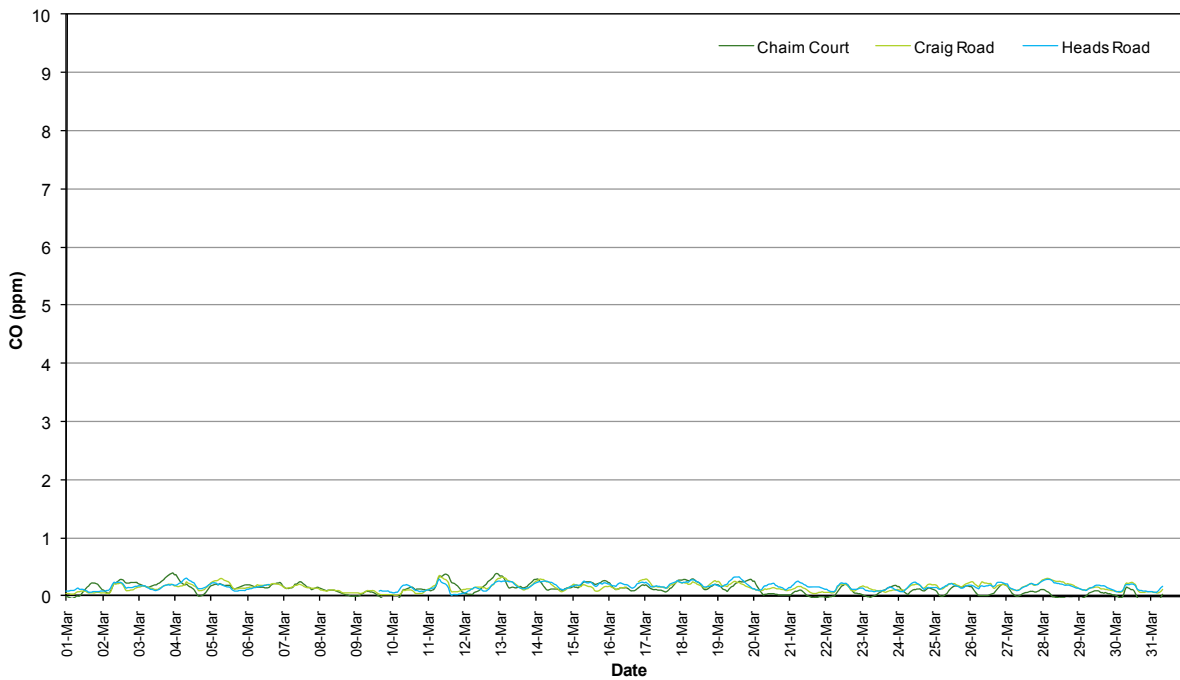


Figure 29: Carbon Monoxide Concentration (8 Hour Rolling Average)



8.3.2 Oxides of Nitrogen

8.3.2.1 Nitric Oxide

Nitric oxide (1-hour average) concentration statistics for the reporting period are given in Table 40. A plot of nitric oxide (1-hour average) concentration for the reporting period is presented in Figure 30.

Table 40: Nitric Oxide Concentration Percentiles (1 Hour Average)

Station	Nitric Oxide Concentration (ppm) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	79	38	26	12	7.2	2.2	< 1
Craig Rd.	59	29	16	10	6.4	1.4	< 1
Heads Rd.	37	25	16	9.5	6.3	3.1	< 1

Nitric Oxide (1 hour average) - March 2010

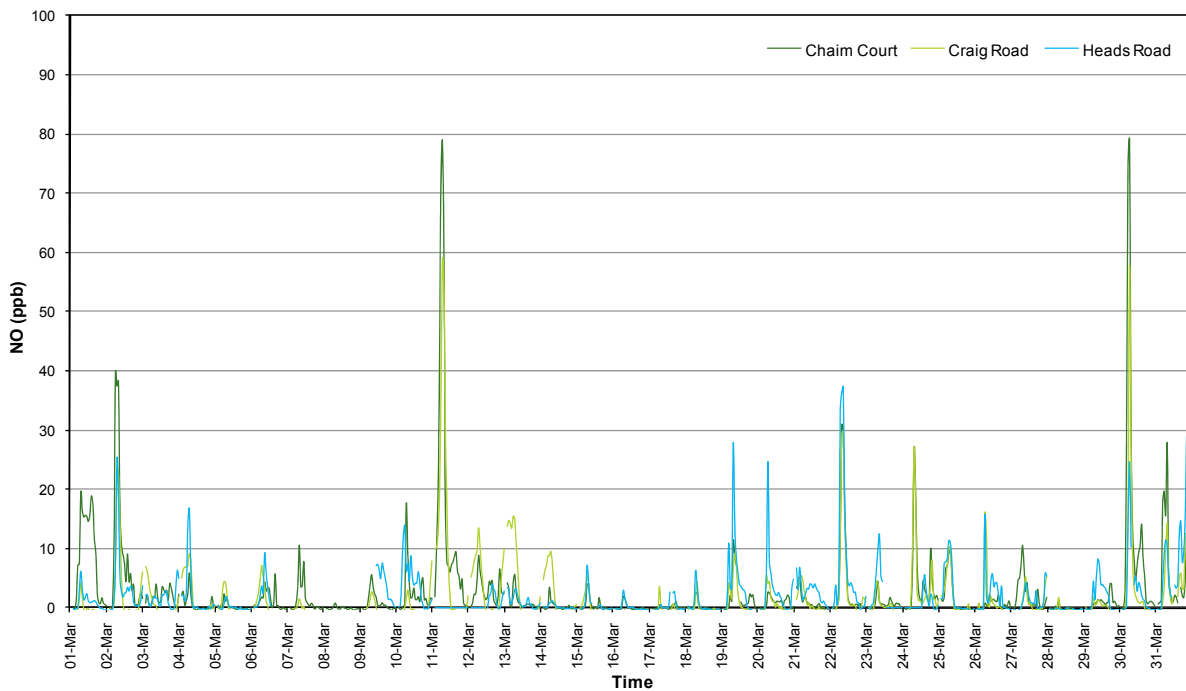


Figure 30: Nitric Oxide Concentration (1 Hour Average)



8.3.2.2 Nitrogen Dioxide

Nitrogen dioxide (1-hour average) concentration statistics for the reporting period are given in Table 41. A plot of nitrogen dioxide (1-hour average) concentration for the reporting period is presented in Figure 31.

Table 41: Nitrogen Dioxide Concentration Percentiles (1 Hour Average)

Station	Nitrogen Dioxide Concentration (ppb) (1-Hour Average)						
	Maximum	99 th	98 th	95 th	90 th	75 th	50 th
Chaim Crt.	35	28	21	17	15	11	7.1
Craig Rd.	33	20	18	15	13	9.9	7.5
Heads Rd.	39	27	23	18	15	11	6.6

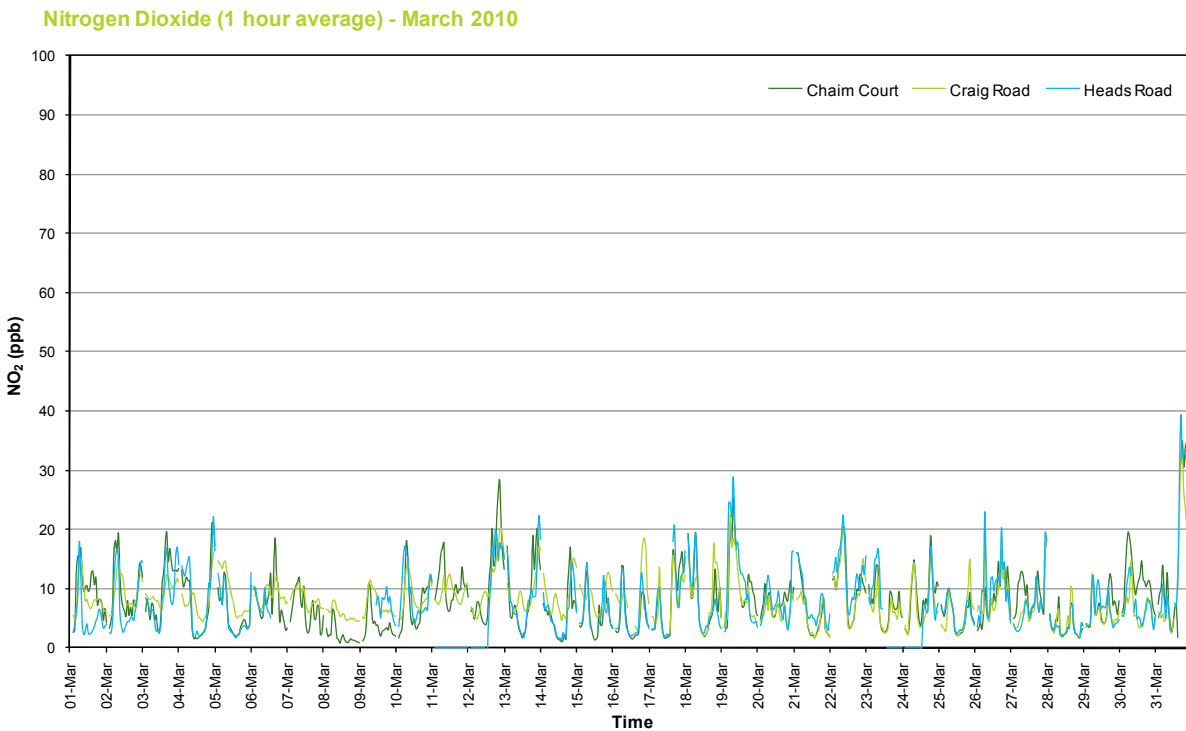


Figure 31: Nitrogen Dioxide Concentration (1 Hour Average)



8.4 Meteorological Data

Wind speed and direction for each of the monitoring stations are presented as wind roses in Figures 32 – 34.

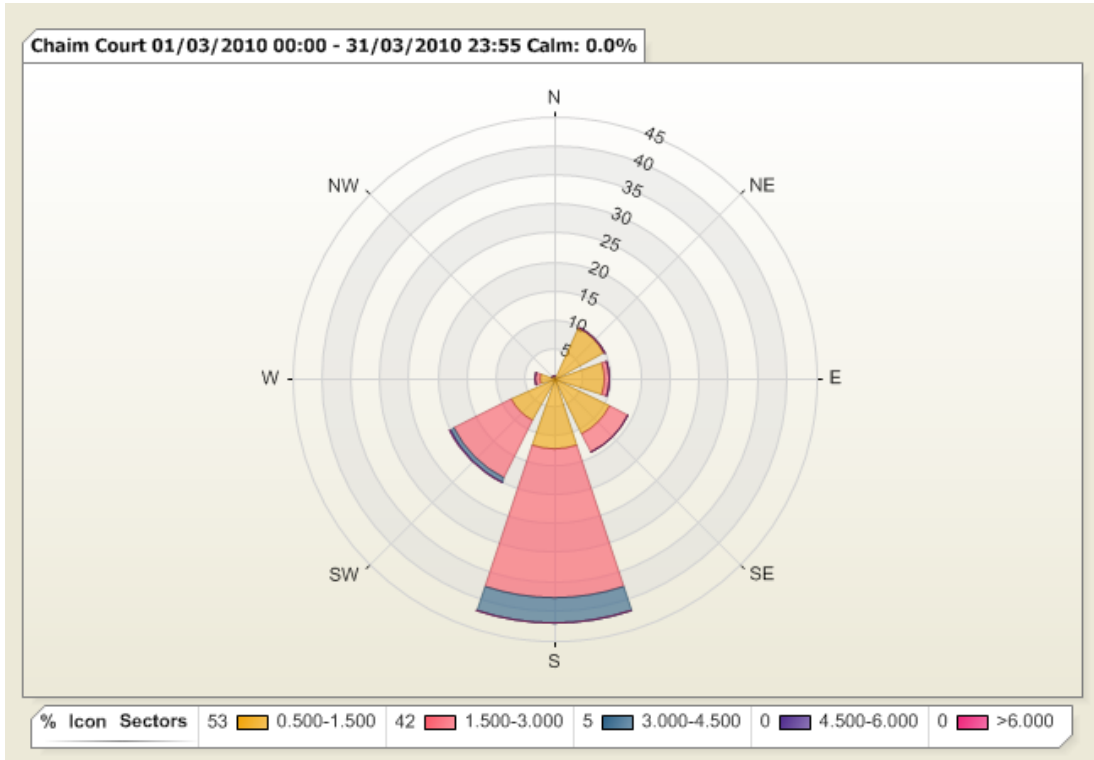


Figure 32: Chaim Court Wind Rose

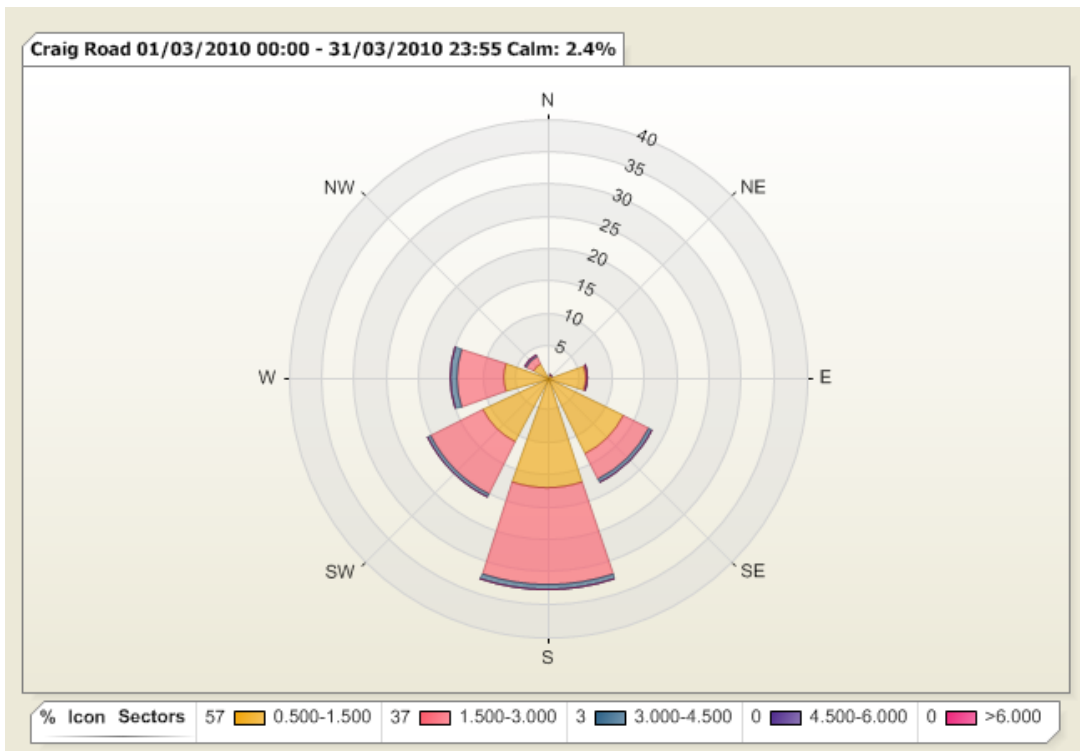


Figure 33: Craig Road Wind Rose

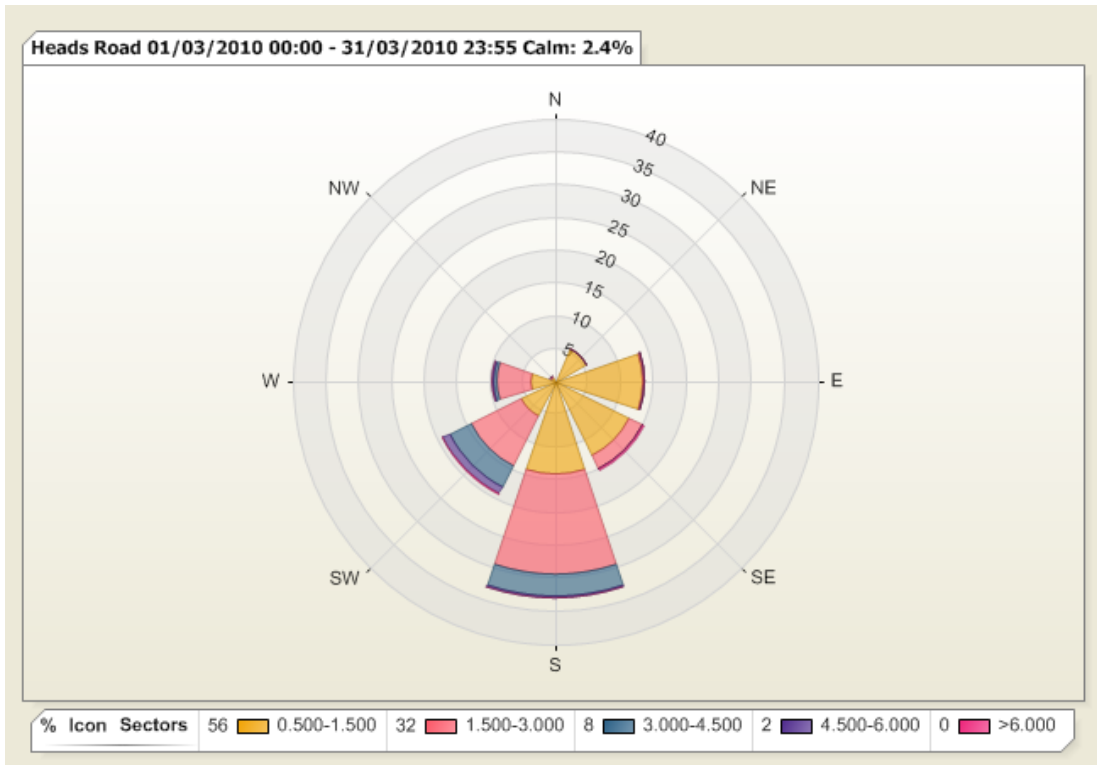


Figure 34: Heads Road Wind Rose



8.5 Data Validation and Exception

Data contained in the report has been validated against performance and calibration requirements for each instrument. Data during maintenance and calibration periods has been removed from the validated data sets. Tables 42 – 44 list the data exceptions for Chaim Court, Craig Road and Heads Road monitoring stations respectively. Data during automatic calibrations of the gaseous analysers has also been removed from the data sets.

Table 42: Data Exceptions - Chaim Court

Start	End	Parameter	Reason
17/03/2010 18:05	17/03/2010 18:20	PM ₁₀	Invalid data ¹
19/03/2010 11:00	19/03/2010 12:00	CO	Maintenance/calibration
19/03/2010 11:00	19/03/2010 12:00	NO, NO ₂ , NO _x	Maintenance/calibration
19/03/2010 11:15	19/03/2010 13:15	PM ₁₀	Maintenance/calibration
19/03/2010 11:15	19/03/2010 13:15	PM _{2.5}	Maintenance/calibration
19/03/2010 12:10	19/03/2010 13:05	NO, NO ₂ , NO _x	Maintenance/calibration
19/03/2010 13:55	19/03/2010 18:40	PM ₁₀	Maintenance/calibration
19/03/2010 13:55	19/03/2010 18:40	PM _{2.5}	Maintenance/calibration
22/03/2010 12:50	22/03/2010 13:30	CO	Maintenance/calibration
30/03/2010 8:50	30/03/2010 9:10	CO	Maintenance/calibration
31/03/2010 15:55	31/03/2010 16:30	NO, NO ₂ , NO _x	Maintenance/calibration
31/03/2010 16:05	31/03/2010 16:30	CO	Maintenance/calibration

Note:

¹ In the opinion of the data reviewer.

Table 43: Data Exceptions - Craig Road

Start	End	Parameter	Reason
16/03/2010 14:15	16/03/2010 14:55	All parameters	Communications fault
16/03/2010 11:40	16/03/2010 15:00	CO	Maintenance/calibration
31/03/2010 13:00	31/03/2010 13:40	CO	Maintenance/calibration
16/03/2010 11:40	16/03/2010 15:00	NO, NO ₂ , NO _x	Maintenance/calibration
31/03/2010 13:00	31/03/2010 14:50	NO, NO ₂ , NO _x	Maintenance/calibration
16/03/2010 12:20	16/03/2010 15:00	PM ₁₀	Maintenance/calibration



Table 44: Data Exceptions - Heads Road

Start	End	Parameter	Reason
6/03/2010 14:00	9/03/2010 9:30	All parameters	Power failure
9/03/2010 9:30	9/03/2010 10:20	CO	Maintenance/calibration
9/03/2010 9:30	9/03/2010 10:20	NO, NO ₂ , NO _x	Maintenance/calibration
10/03/2010 12:55	10/03/2010 13:40	PM ₁₀	Maintenance/calibration
11/03/2010 1:40	12/03/2010 12:25	NO, NO ₂ , NO _x	Invalid data - span drift
12/03/2010 12:25	12/03/2010 12:55	NO, NO ₂ , NO _x	Maintenance/calibration
12/03/2010 12:50	12/03/2010 13:00	CO	Maintenance/calibration
15/03/2010 11:35	15/03/2010 12:40	CO	Maintenance/calibration
15/03/2010 11:35	15/03/2010 13:15	NO, NO ₂ , NO _x	Maintenance/calibration
15/03/2010 12:20	15/03/2010 13:35	PM ₁₀	Maintenance/calibration
16/03/2010 11:55	16/03/2010 13:10	CO	Maintenance/calibration
17/03/2010 14:45	17/03/2010 15:15	NO, NO ₂ , NO _x	Maintenance/calibration
23/03/2010 12:40	23/03/2010 13:25	All parameters	Maintenance/calibration
23/03/2010 13:25	24/03/2010 0:55	NO, NO ₂ , NO _x	Maintenance/calibration
28/03/2010 16:05	28/03/2010 16:50	All parameters	Communications fault
30/03/2010 9:40	30/03/2010 10:00	NO, NO ₂ , NO _x	Maintenance/calibration
31/03/2010 12:10	31/03/2010 12:40	CO	Maintenance/calibration
31/03/2010 12:10	31/03/2010 12:40	NO, NO ₂ , NO _x	Maintenance/calibration



9.0 DISCUSSION

9.1 Comparison with Air Quality Objectives

9.1.1 PM_{2.5} and PM₁₀

Assessment criteria for PM_{2.5} and PM₁₀ are taken from the State Environment Protection Policy (Air Quality Management) (SEPP {AQM}) Schedule B intervention levels. The intervention levels for PM₁₀ and PM_{2.5} are as follows:

- PM₁₀ (24-hour) 60 µg/m³;
- PM_{2.5} (24 hour) 36 µg/m³.

There were no exceedence days of the PM_{2.5} intervention level during the reported period. The maximum 24-hour average PM_{2.5} concentration was 17 µg/m³ on 27/02/2010 at Chaim Court monitoring station.

There were no exceedence days of the PM₁₀ intervention level during the reported period. The maximum 24-hour average PM₁₀ concentration was 47 µg/m³ on 22/01/2010 at Heads Road monitoring station.

9.1.2 Nitrogen Dioxide

The assessment criterion for NO₂ is taken from the SEPP (AQM) Schedule B intervention level. The intervention level for NO₂ is as follows:

- NO₂ (1 hour) 140 ppb.

There were no exceedences of the NO₂ intervention level during the reported period at any of the monitoring stations. The maximum 1-hour average NO₂ concentration was 39 ppb on 31/03/2010 17:00 hours at Heads Road monitoring station.

9.1.3 Carbon Monoxide

Assessment criteria for CO are taken from the (SEPP AQM) Schedule B intervention level and the State Environment Protection Policy (Ambient Air Quality) {SEPP (AAQ)} air quality objective. The intervention and SEPP (AAQ) levels for CO are as follows:

- CO (1 hour) 29 ppm {SEPP (AQM)};
- CO (8-hour) 9 ppm {SEPP (AAQ)}.

There were no exceedences of the CO intervention level or SEPP (AAQ) objective during the reported period at any of the monitoring stations. The maximum 1-hour average CO concentration was 1.6 ppm on 21/01/2010 09:30 hours at Heads Road monitoring station. The maximum 8-hour average CO concentration was 0.54 ppm on 31/03/2010 23:00 hours reported at the Heads Road monitoring station.



9.2 Data Capture Year to Date

2010 data capture statistics for the period 01/01/2010 to 31/03/2010 are presented in Table 45.

Table 45: Data Capture Year to Date

	PM_{2.5}	PM₁₀	NO_x	CO
Chaim Court	91.8	96.4	87.9	93.9
Craig Road	-	99.1	95.9	96.0
Heads Road	-	94.6	77.0	91.9



Report Signature Page

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APPENDIX A

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