



October 2009

**TRANSFIELD SERVICES PTY. LTD.,  
RINGWOOD, VICTORIA**

# EastLink Ambient Air Quality Monitoring Report July-September 2009

**Submitted to:**  
Transfield Services Pty. Ltd.

REPORT



This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

**Report Number:** 097613023 011 R Rev 0

**Distribution:**

- 1 Copy - Transfield Services Pty. Ltd.
- 1 Copy - Golder Associates Pty. Ltd.



**A world of  
capabilities  
delivered locally**





## Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
Transfield Services Pty. Ltd., EastLink Operations Centre, 2 Hillcrest Avenue, Ringwood, 3134	Ms. Marielle Bright	Revision 0	10/11/2009	Post



## Table of Contents

<b>1.0 INTRODUCTION</b> .....	<b>1</b>
<b>2.0 MONITORING LOCATIONS</b> .....	<b>2 - 3</b>
<b>3.0 AMBIENT AIR QUALITY MONITORING PARAMETERS</b> .....	<b>3</b>
<b>4.0 METHODS</b> .....	<b>4</b>
4.1 PM <sub>2.5</sub> .....	4
4.2 PM <sub>10</sub> .....	4
4.3 Carbon Monoxide.....	4
4.4 Oxides of Nitrogen .....	4
4.5 Meteorological Parameters .....	4
4.5.1 Wind Speed and Direction.....	4
4.5.2 Temperature and Relative Humidity .....	4
<b>5.0 AIR QUALITY GOALS</b> .....	<b>5</b>
<b>6.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/07/2009 – 31/07/2009</b> .....	<b>6 - 18</b>
6.1 Data Capture.....	6
6.2 Results .....	7
6.2.1 PM <sub>2.5</sub> .....	7
6.2.2 PM <sub>10</sub> .....	9
6.2.3 Carbon Monoxide .....	11
6.2.3.1 1-Hour Average.....	11
6.2.3.2 8-Hour Rolling Average.....	12
6.2.4 Oxides of Nitrogen.....	13
6.2.4.1 Nitric Oxide .....	13
6.2.4.2 Nitrogen Dioxide.....	14
6.2.5 Meteorological Data.....	15
6.3 Data Validation and Exception .....	17
<b>7.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/08/2009 – 31/08/2009</b> .....	<b>19 - 31</b>
7.1 Data Capture.....	19
7.2 Results .....	20



## Table of Contents

7.2.1	PM <sub>2.5</sub> .....	20
7.3	PM <sub>10</sub> .....	22
7.3.1	Carbon Monoxide .....	24
7.3.1.1	1-Hour Average.....	24
7.3.1.2	8-Hour Rolling Average.....	25
7.3.2	Oxides of Nitrogen.....	26
7.3.2.1	Nitric Oxide .....	26
7.3.2.2	Nitrogen Dioxide.....	27
7.3.3	Meteorological Data.....	28
7.4	Data Validation and Exception .....	30
<b>8.0</b>	<b>AMBIENT AIR QUALITY MONITORING PERIOD: 01/09/2009 – 30/09/2009.....</b>	<b>32 - 44</b>
8.1	Data Capture.....	32
8.2	Results .....	33
8.2.1	PM <sub>2.5</sub> .....	33
8.3	PM <sub>10</sub> .....	35
8.3.1	Carbon Monoxide .....	37
8.3.1.1	1-Hour Average.....	37
8.3.1.2	8-Hour Rolling Average.....	38
8.3.2	Oxides of Nitrogen.....	39
8.3.2.1	Nitric Oxide .....	39
8.3.2.2	Nitrogen Dioxide.....	40
8.4	Meteorological Data .....	41
8.5	Data Validation and Exception .....	43
<b>9.0</b>	<b>DISCUSSION .....</b>	<b>45 - 46</b>
9.1	Comparison with Air Quality Objectives .....	45
9.1.1	PM <sub>2.5</sub> and PM <sub>10</sub> .....	45
9.1.2	Nitrogen Dioxide.....	45
9.1.3	Carbon Monoxide .....	45
9.2	Data Capture Year to Date.....	45



## Table of Contents

### TABLES

Table 1: Site Locations .....	2
Table 2: SEPP (AQM) Schedule B Intervention Levels .....	5
Table 3: Data Capture Statistics - 1 Hour Averages .....	6
Table 4: Data Capture Statistics - 8 Hour Rolling Averages .....	6
Table 5: Data Capture Statistics - 24 Hour Averages .....	6
Table 6: PM <sub>2.5</sub> Concentration Percentiles (1 Hour Average) .....	7
Table 7: PM <sub>2.5</sub> Concentration Percentiles (24 Hour Average) .....	8
Table 8: PM <sub>10</sub> Concentration Percentiles (1 Hour Average) .....	9
Table 9: PM <sub>10</sub> Concentration (24 Hour Average) .....	10
Table 10: Carbon Monoxide Concentration Percentiles (1 Hour Average) .....	11
Table 11: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average) .....	12
Table 12: Nitric Oxide Concentration Percentiles (1 Hour Average) .....	13
Table 13: Nitrogen Dioxide Concentration Percentiles (1 Hour Average) .....	14
Table 14: Data Exceptions - Chaim Court .....	17
Table 15: Data Exceptions - Craig Road .....	17
Table 16: Data Exceptions - Heads Road .....	18
Table 17: Data Capture Statistics - 1 Hour Average .....	19
Table 18: Data Capture Statistics - 8 Hour Rolling Averages .....	19
Table 19: Data Capture Statistics - 24 Hour Averages .....	19
Table 20: PM <sub>2.5</sub> Concentration Percentiles (1 Hour Average) .....	20
Table 21: PM <sub>2.5</sub> Concentration Percentiles (24 Hour Average) .....	21
Table 22: PM <sub>10</sub> Concentration Percentiles (24 Hour Average) .....	22
Table 23: PM <sub>10</sub> Concentration Percentiles (24 Hour Average) .....	23
Table 24: Carbon Monoxide Concentration Percentiles (1 Hour Average) .....	24
Table 25: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average) .....	25
Table 26: Nitric Oxide Concentration Percentiles (1 Hour Average) .....	26
Table 27: Nitrogen Dioxide Concentration Percentiles (1 Hour Average) .....	27
Table 28: Data Exceptions - Chaim Court .....	30
Table 29: Data Exceptions - Craig Road .....	30
Table 30: Data Exceptions - Heads Road .....	31



## Table of Contents

Table 31: Data Capture Statistics - 1 Hour Averages .....	32
Table 32: Data Capture Statistics - 8 Hour Rolling Averages .....	32
Table 33: Data Capture Statistics - 24 Hour Averages .....	32
Table 34: PM <sub>2.5</sub> Concentration Percentiles (1 Hour Average) .....	33
Table 35: PM <sub>2.5</sub> Concentration Percentiles (24 Hour Average) .....	34
Table 36: PM <sub>10</sub> Concentration Percentiles (1 Hour Average) .....	35
Table 37: PM <sub>10</sub> Concentration Percentiles (24 Hour Average) .....	36
Table 38: Carbon Monoxide Concentration Percentiles (1 Hour Average) .....	37
Table 39: Carbon Monoxide Concentration Percentiles (8 Hour Rolling Average) .....	38
Table 40: Nitric Oxide Concentration Percentiles (1 Hour Average) .....	39
Table 41: Nitrogen Dioxide Concentration Percentiles (1 Hour Average) .....	40
Table 42: Data Exceptions - Chaim Court .....	43
Table 43: Data Exceptions - Craig Road .....	43
Table 44: Data Exceptions - Heads Road .....	44
Table 45: Data Capture - Year to Date .....	46

### FIGURES

Figure 1: Ambient Air Quality Monitoring Stations .....	2
Figure 2: PM <sub>2.5</sub> Concentration (1 Hour Average) .....	7
Figure 3: PM <sub>2.5</sub> Concentration (24 Hour Average) .....	8
Figure 4: PM <sub>10</sub> Concentration (1 Hour Average) .....	9
Figure 5: PM <sub>10</sub> Concentration (24 Hour Average) .....	10
Figure 6: Carbon Monoxide Concentration (1 Hour Average) .....	11
Figure 7: Carbon Monoxide Concentration (8 Hour Rolling Average) .....	12
Figure 8: Nitric Oxide Concentration (1 Hour Average) .....	13
Figure 9: Nitrogen Dioxide Concentration (1 Hour Average) .....	14
Figure 10: Chaim Court Wind Rose .....	15
Figure 11: Craig Road Wind Rose .....	15
Figure 12: Heads Road Wind Rose .....	16
Figure 13: PM <sub>2.5</sub> Concentration (1 Hour Average) .....	20
Figure 14: PM <sub>2.5</sub> Concentration (24 Hour Average) .....	21



## Table of Contents

Figure 15: PM <sub>10</sub> Concentration (1 Hour Average).....	22
Figure 16: PM <sub>10</sub> Concentration (24 Hour Average).....	23
Figure 17: Carbon Monoxide Concentration (1 Hour Average).....	24
Figure 18: Carbon Monoxide Concentration (8 Hour Rolling Average).....	25
Figure 19: Nitric Oxide Concentration (1 Hour Average) .....	26
Figure 20: Nitrogen Dioxide Concentration (1 Hour Average) .....	27
Figure 21: Chaim Court Wind Rose.....	28
Figure 22: Craig Road Wind Rose.....	28
Figure 23: Heads Road Wind Rose .....	29
Figure 24: PM <sub>2.5</sub> Concentration (1 Hour Average) .....	33
Figure 25: PM <sub>2.5</sub> Concentration (24 Hour Average) .....	34
Figure 26: PM <sub>10</sub> Concentration (1 Hour Average).....	35
Figure 27: PM <sub>10</sub> Concentration (24 Hour Average).....	36
Figure 28: Carbon Monoxide Concentration (1 Hour Average).....	37
Figure 29: Carbon Monoxide Concentration (8 Hour Rolling Average).....	38
Figure 30: Nitric Oxide Concentration (1 Hour Average) .....	39
Figure 31: Nitrogen Dioxide Concentration (1 Hour Average) .....	40
Figure 32: Chaim Court Wind Rose.....	41
Figure 33: Craig Road Wind Rose.....	41
Figure 34: Heads Road Wind Rose .....	42

### 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 July, 2009 to 30<sup>th</sup> September, 2009 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.



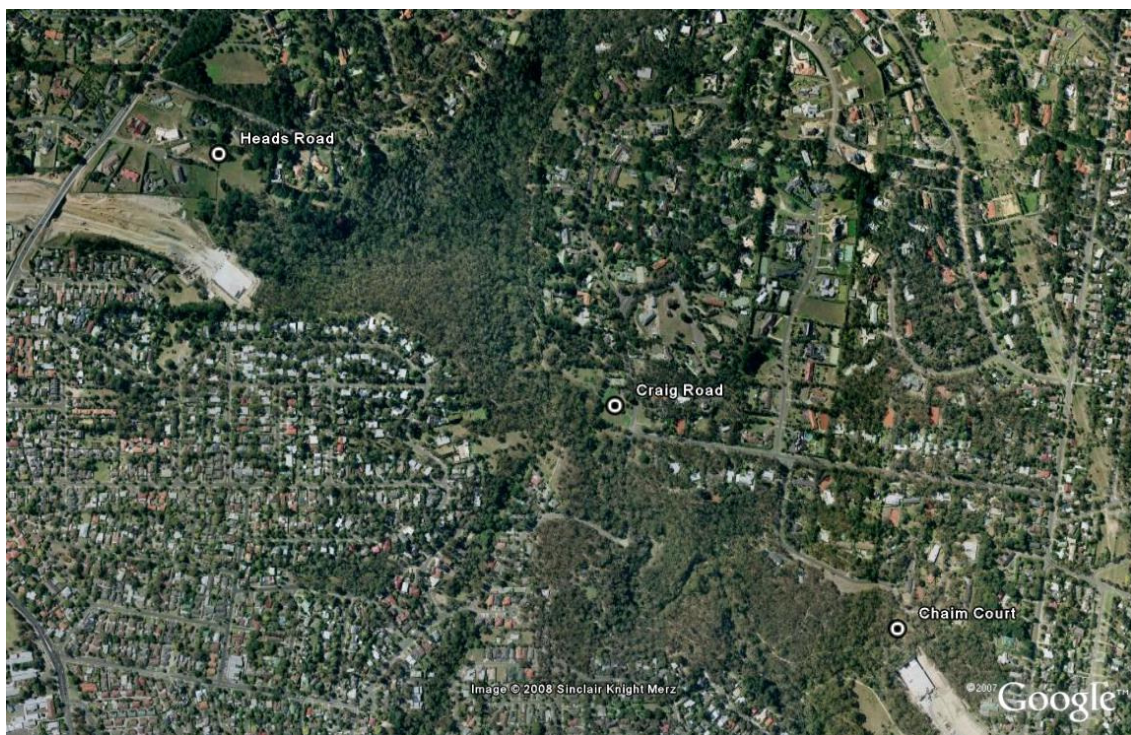


## 2.0 MONITORING LOCATIONS

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	GPS CO-ORDINATES (AMG)
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<sub>2.5</sub>);
- Particulate matter with an equivalent aerodynamic diameter less than 10 microns (PM<sub>10</sub>);
- Total oxides of nitrogen (NO<sub>x</sub>);
- Nitric oxide (NO);
- Nitrogen dioxide (NO<sub>2</sub>);
- Carbon monoxide (CO);
- Wind speed;
- Wind direction;
- Relative humidity;
- Ambient temperature; and
- Total solar radiation.



## **4.0 METHODS**

### **4.1 PM<sub>2.5</sub>**

PM<sub>2.5</sub> 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<sub>2.5</sub> size selective inlet (PM<sub>10</sub> WINS head fitted with a PM<sub>2.5</sub> sharp cut cyclone (SSC)) at 1 m<sup>3</sup>/h). The PM<sub>2.5</sub> 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 PM<sub>10</sub>**

PM<sub>10</sub> concentration in ambient air was determined in real time using a Tapered Element Oscillating Microbalance (TEOM) analyser. Ambient air was drawn through a PM<sub>10</sub> WINS size selective inlet at 1 m<sup>3</sup>/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.

PM<sub>10</sub> 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 – PM<sub>10</sub> 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, NO<sub>2</sub> and NO<sub>x</sub>) 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 PM<sub>10</sub> and Class 2 indicator, PM<sub>2.5</sub>, are displayed in Table 2.

**Table 2: SEPP (AQM) Schedule B Intervention Levels**

ATMOSPHERIC CONTAMINANT		INTERVENTION LEVEL	UNITS
Carbon monoxide	1 hour	29	ppm
Nitrogen dioxide	1 hour	140	ppb
PM <sub>10</sub>	24 hour	60	µg/m <sup>3</sup>
PM <sub>2.5</sub>	24 hour	36	µg/m <sup>3</sup>



## 6.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/07/2009 – 31/07/2009

### 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 1<sup>st</sup> July to 31<sup>st</sup> July, 2009 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 <sub>2.5</sub>	Chaim Crt.	738	744	99.2%
PM <sub>10</sub>	Chaim Crt	738	744	99.2%
	Craig Rd.	738	744	99.2%
	Heads Rd.	729	744	98.0%
NO, NO <sub>2</sub>	Chaim Crt	711	744	95.6%
	Craig Rd.	713	744	95.8%
	Heads Rd.	701	744	94.2%
CO	Chaim Crt	711	744	95.6%
	Craig Rd.	712	744	95.7%
	Heads Rd.	620	744	83.3%

**Table 4: Data Capture Statistics - 8 Hour Rolling Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt	744	744	100.0%
	Craig Rd.	744	744	100.0%
	Heads Rd.	644	744	86.6%

**Table 5: Data Capture Statistics - 24 Hour Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM <sub>2.5</sub>	Chaim Crt.	31	31	100.0%
PM <sub>10</sub>	Chaim Crt	31	31	100.0%
	Craig Rd.	31	31	100.0%
	Heads Rd.	30	31	96.8%



## 6.2 Results

### 6.2.1 PM<sub>2.5</sub>

PM<sub>2.5</sub> 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<sub>2.5</sub> (1-hour average) concentration statistics for the reporting period are given in Table 6. A plot of PM<sub>2.5</sub> (1-hour average) concentration for the reporting period is presented in Figure 2.

**Table 6: PM<sub>2.5</sub> Concentration Percentiles (1 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (1-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	32	27	25	20	17	12	9.9

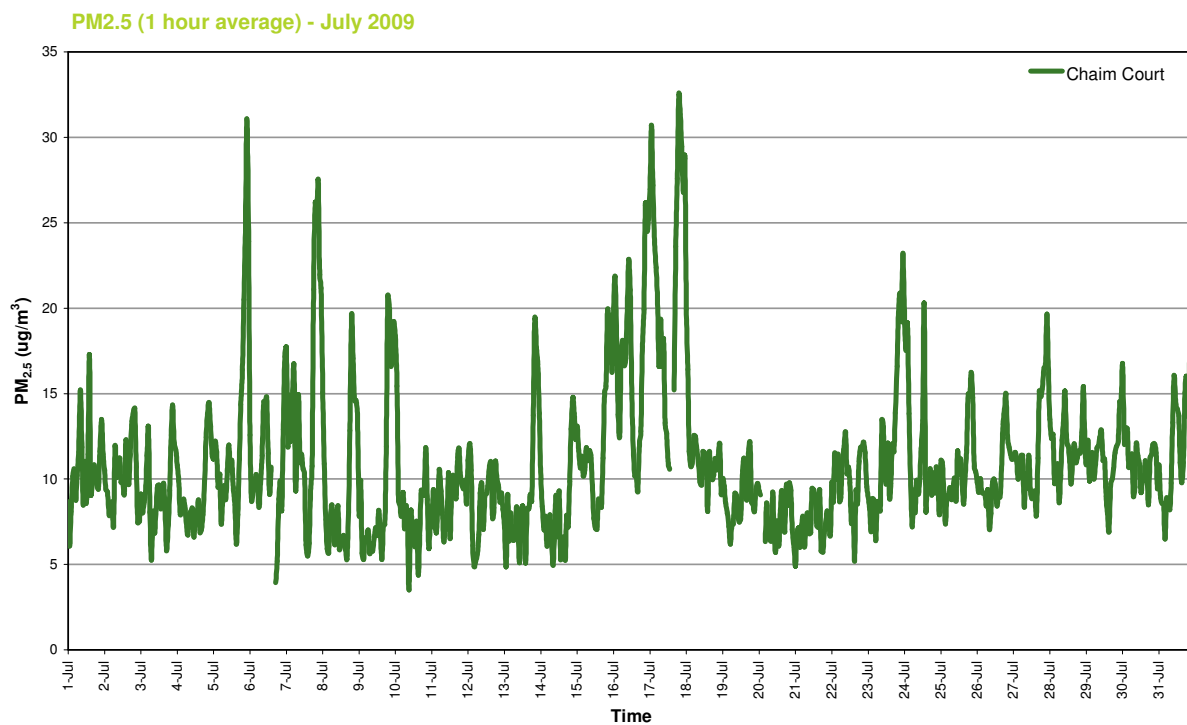


Figure 2: PM<sub>2.5</sub> Concentration (1 Hour Average)



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>2.5</sub> (24-hour average) concentration statistics for the reporting period are given in Table 7. A plot of PM<sub>2.5</sub> (24-hour average) concentration for the reporting period is presented in Figure 3.

**Table 7: PM<sub>2.5</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (24-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	22	20	19	16	13	12	11

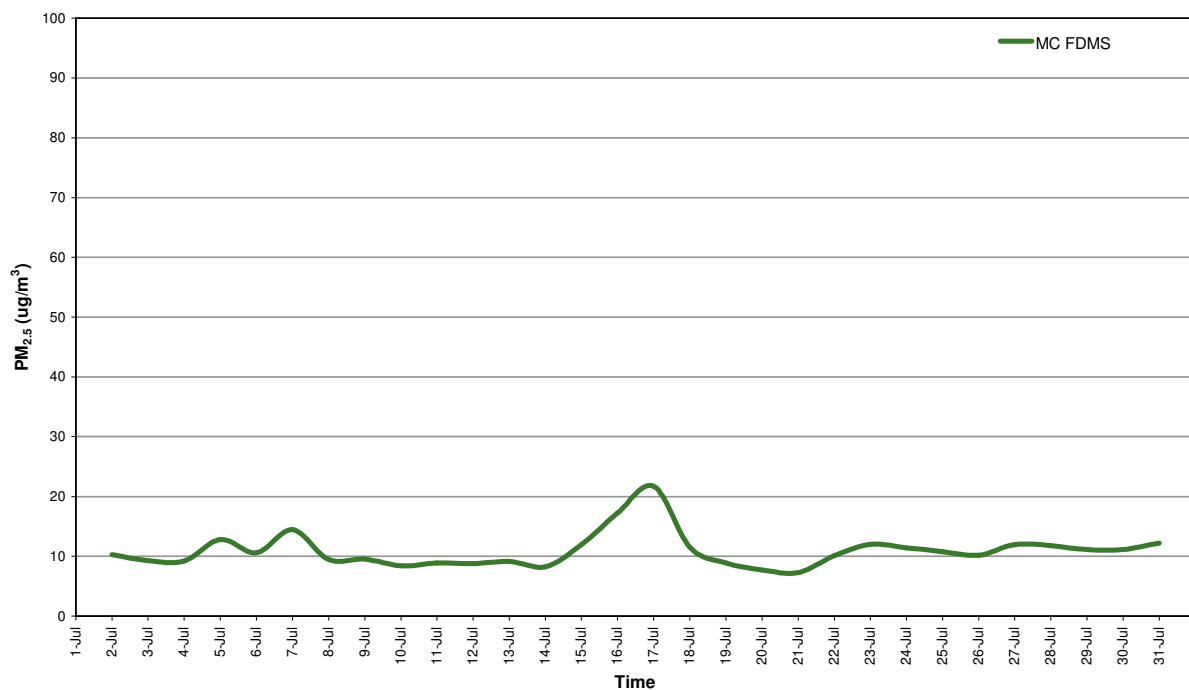


Figure 3: PM<sub>2.5</sub> Concentration (24 Hour Average)



## 6.2.2 PM<sub>10</sub>

PM<sub>10</sub> 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<sub>10</sub> (1-hour average) concentration statistics for the reporting period are given in Table 8. A plot of PM<sub>10</sub> (1-hour average) concentration for the reporting period is presented in Figure 4.

**Table 8: PM<sub>10</sub> Concentration Percentiles (1 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (1-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	66	23	19	16	13	10	7.1
Craig Rd	30	26	25	19	17	13	9.2
Heads Rd	31	24	22	19	16	12	9.0

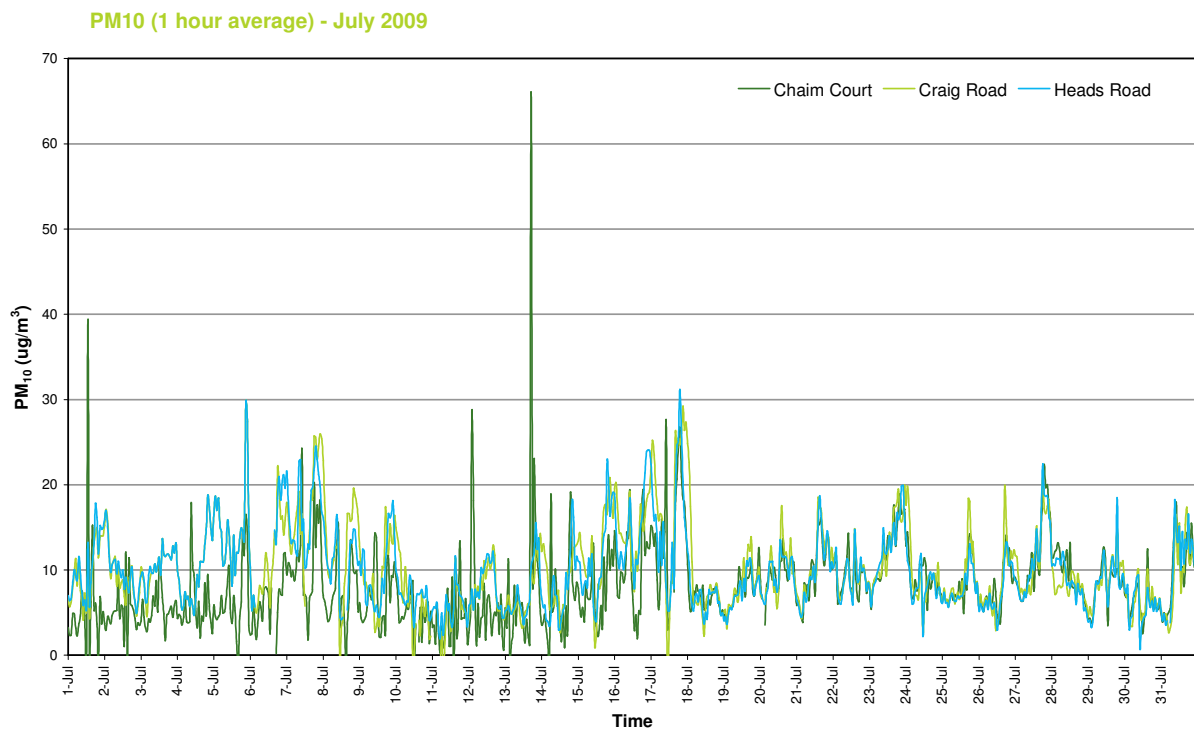


Figure 4: PM<sub>10</sub> Concentration (1 Hour Average)





# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>10</sub> (24-hour average) concentration statistics for the reporting period are given in Table 9. A plot of PM<sub>10</sub> (24-hour average) concentration for the reporting period is presented in Figure 5.

**Table 9: PM<sub>10</sub> Concentration (24 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (24-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	15	14	13	12	11	9.5	7.7
Craig Rd.	18	18	18	16	15	11	9.4
Heads Rd	17	17	16	15	15	11	9.5

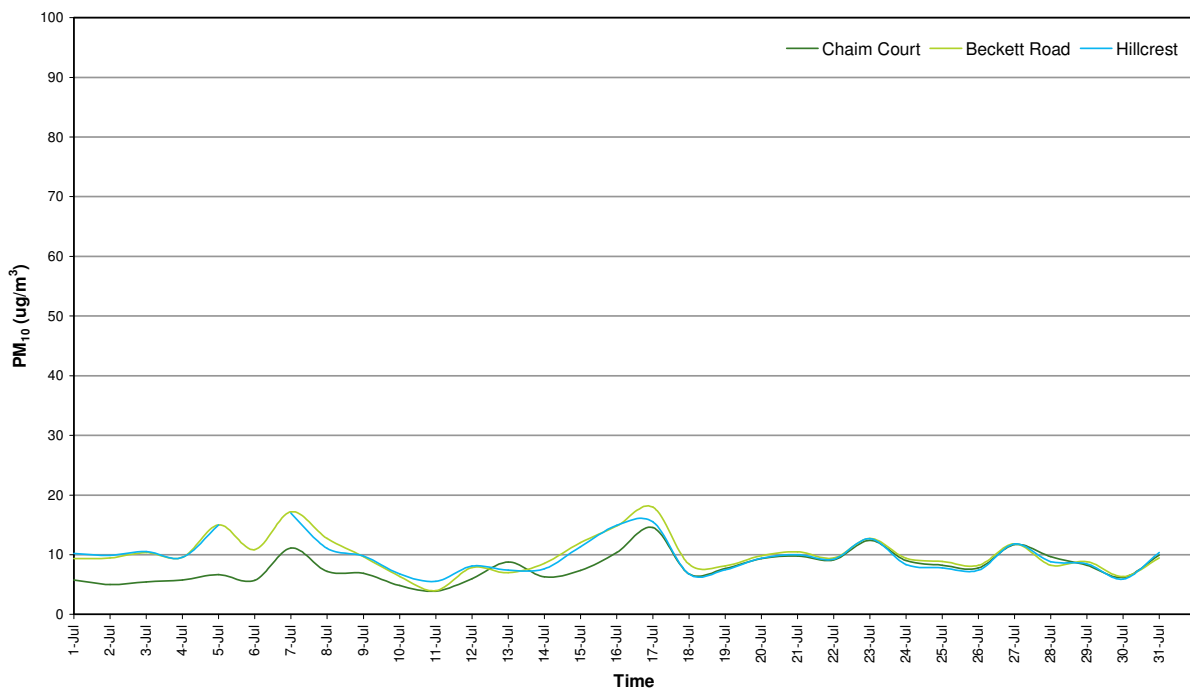


Figure 5: PM<sub>10</sub> Concentration (24 Hour Average)



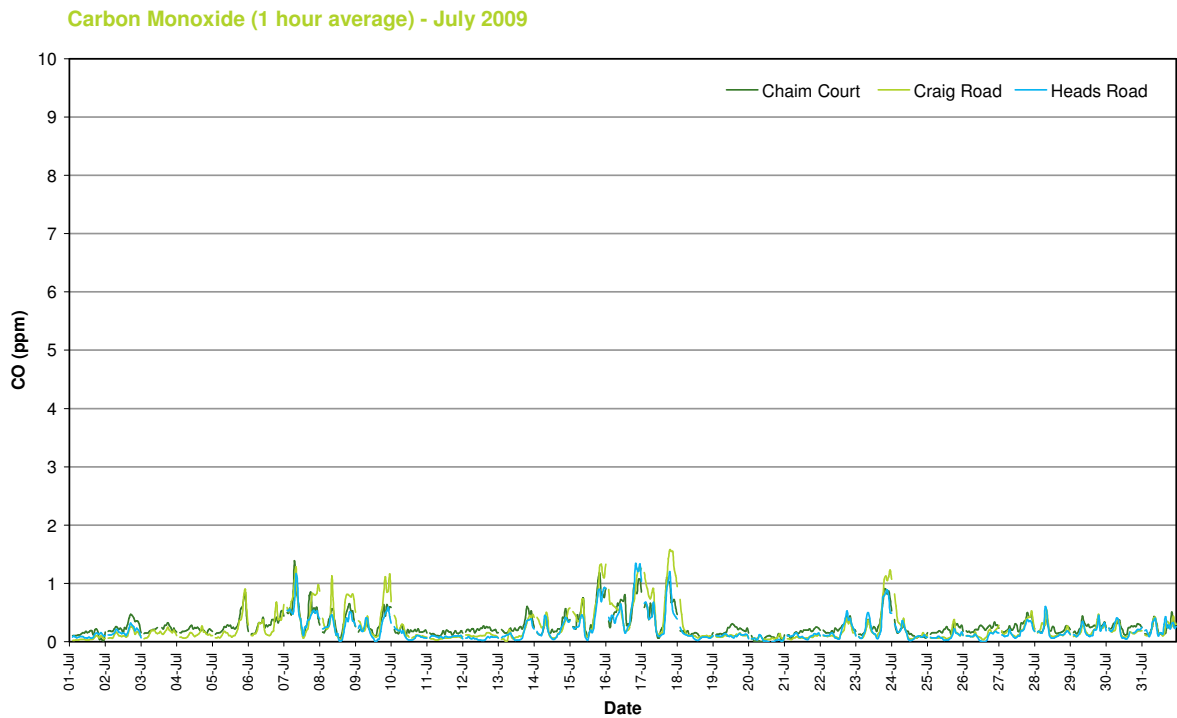
## 6.2.3 Carbon Monoxide

### 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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	1.4	1.0	0.85	0.69	0.53	0.31	0.22
Craig Rd	1.6	1.3	1.2	0.90	0.66	0.29	0.13
Heads Rd	1.3	1.0	0.90	0.60	0.45	0.25	0.13



*Figure 6: Carbon Monoxide Concentration (1 Hour Average)*

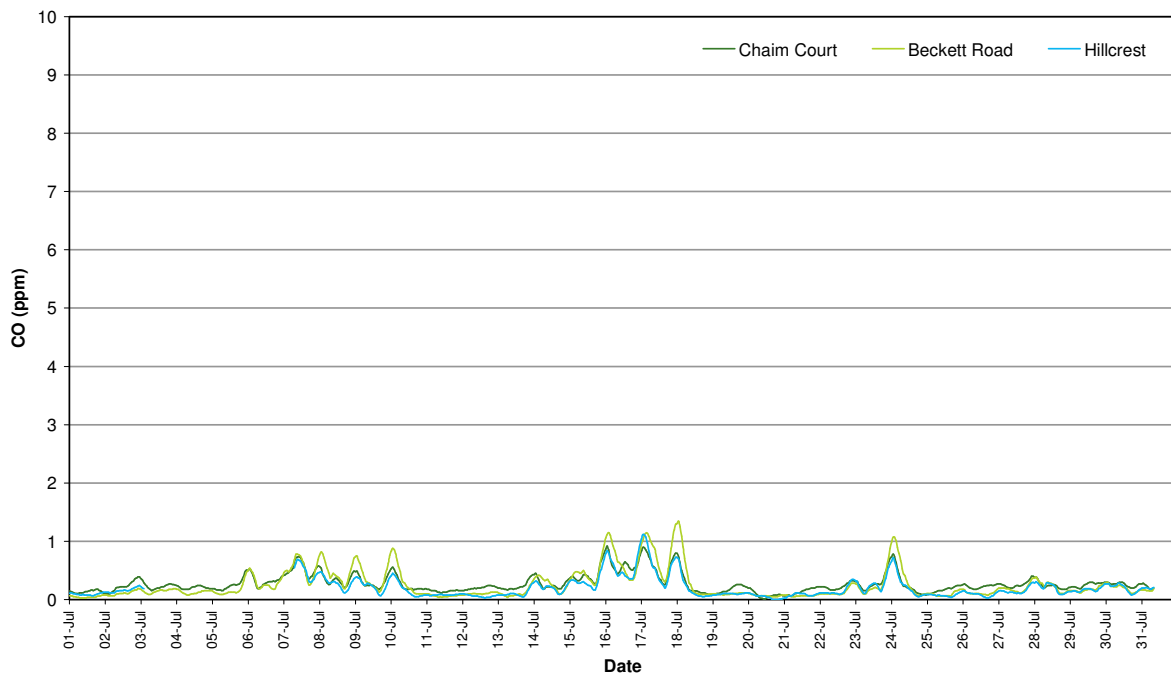


**6.2.3.2 8-Hour Rolling Average**

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	0.92	0.81	0.74	0.62	0.49	0.31	0.23
Craig Rd	1.4	1.1	1.1	0.83	0.61	0.30	0.16
Heads Rd	1.1	0.84	0.72	0.60	0.42	0.27	0.14



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



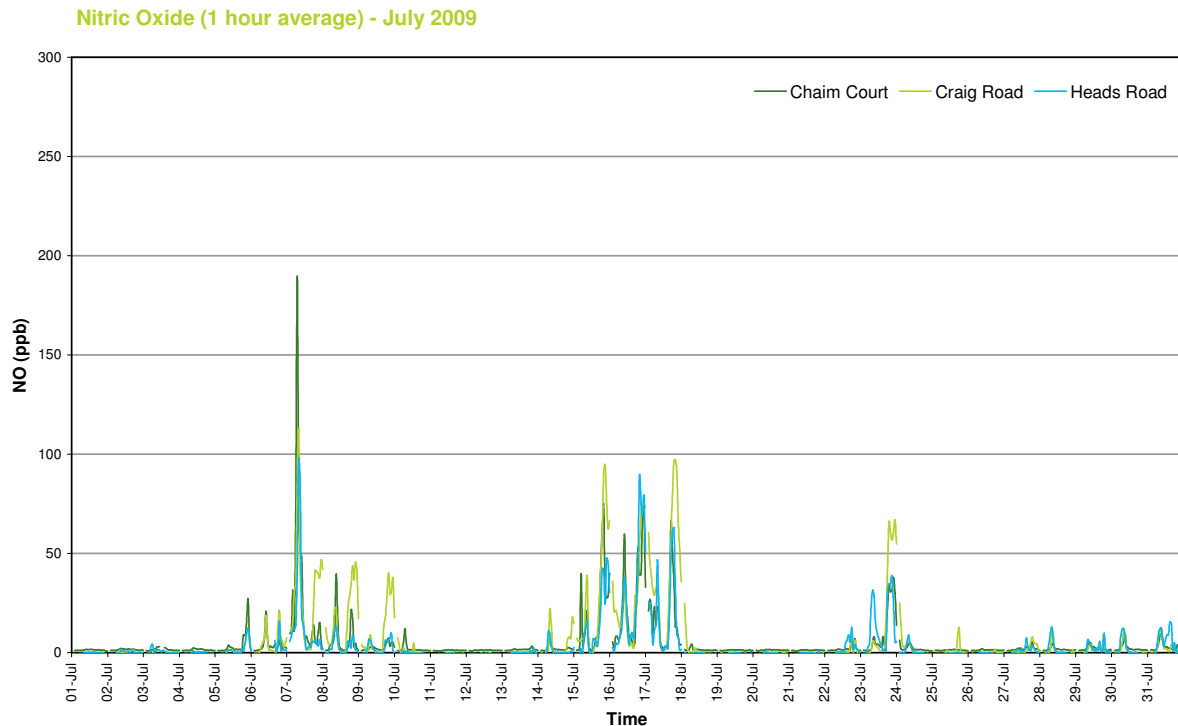
## 6.2.4 Oxides of Nitrogen

### 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 (ppm) (1-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	190	60	40	25	8.5	2.8	1.4
Craig Rd	110	78	66	41	22	3.1	<0.05
Heads Rd	97	61	42	20	9.7	1.7	<0.2



*Figure 8: Nitric Oxide Concentration (1 Hour Average)*

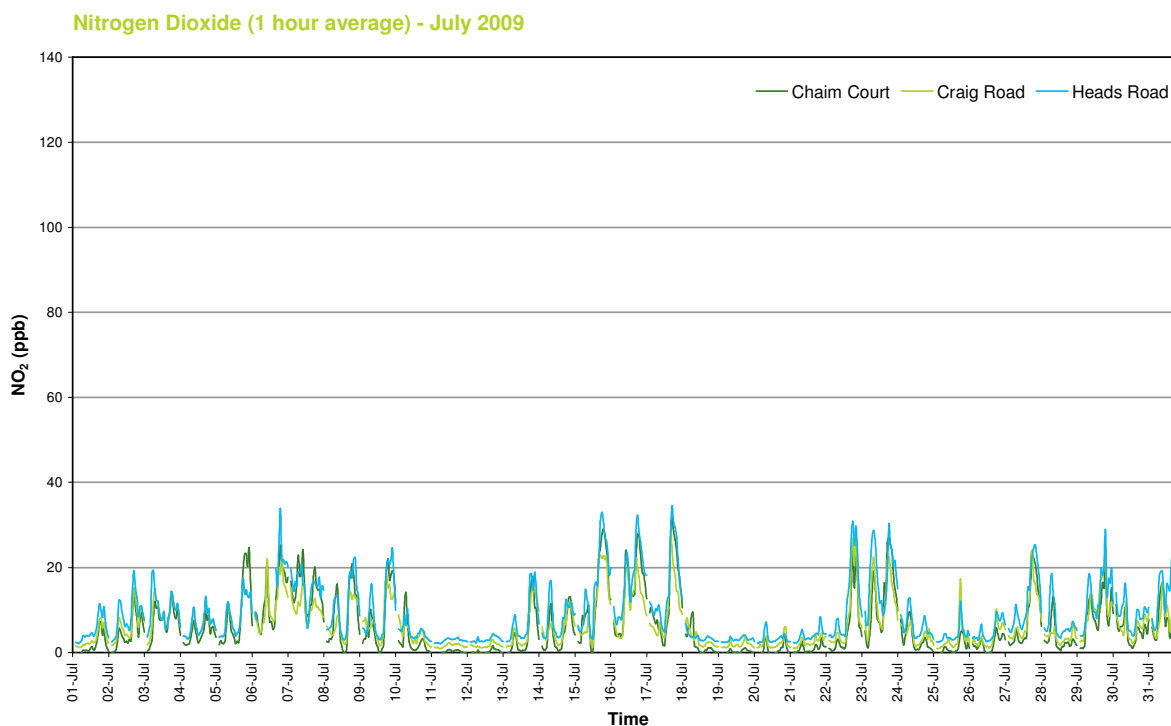


### 6.2.4.2 Nitrogen Dioxide

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	32	27	25	21	17	9.1	3.3
Craig Rd	28	23	22	17	14	9.5	5.0
Heads Rd	35	30	29	23	19	12	6.3



*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.

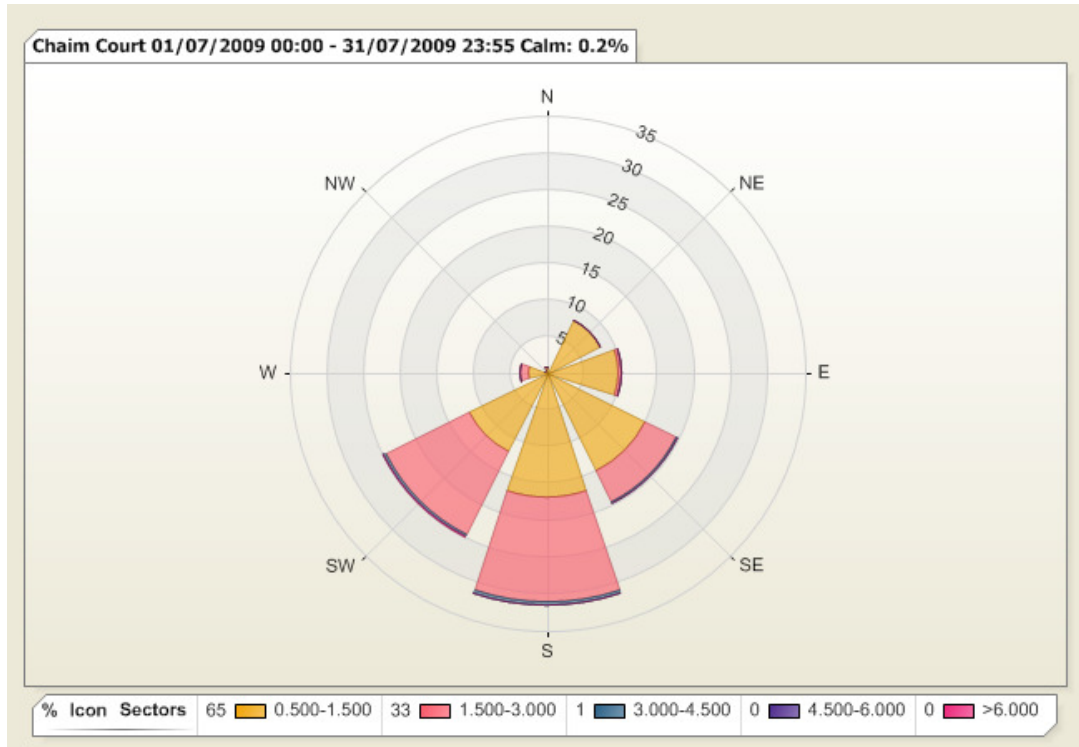


Figure 10: Chaim Court Wind Rose

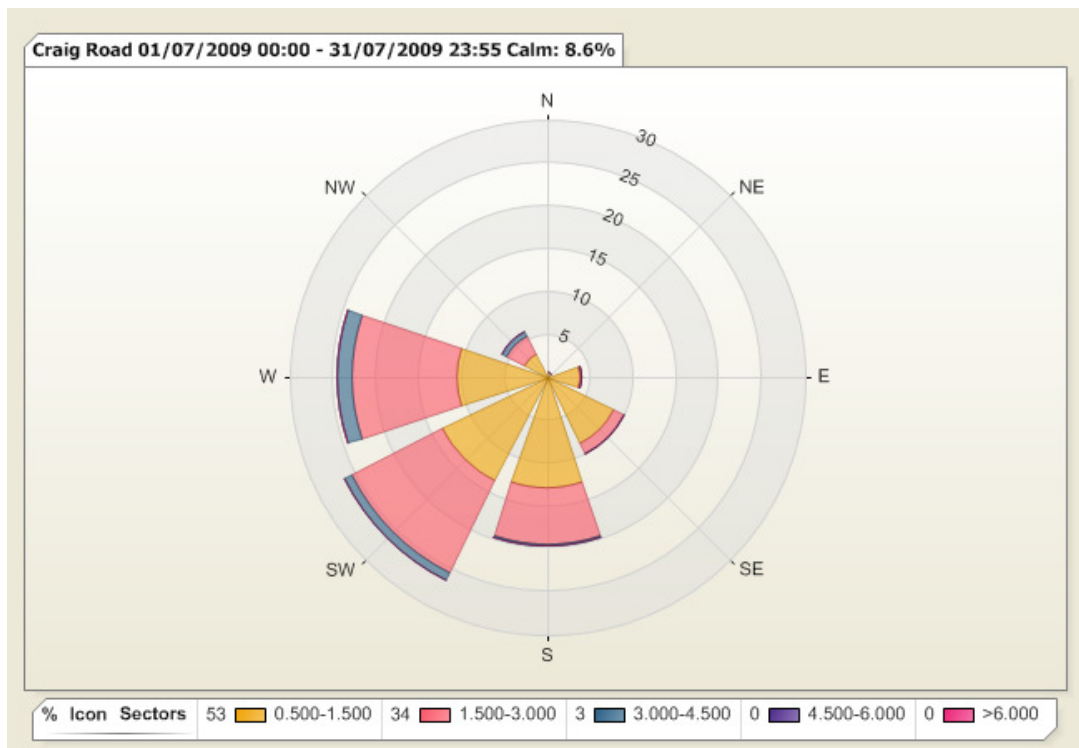


Figure 11: Craig Road Wind Rose



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

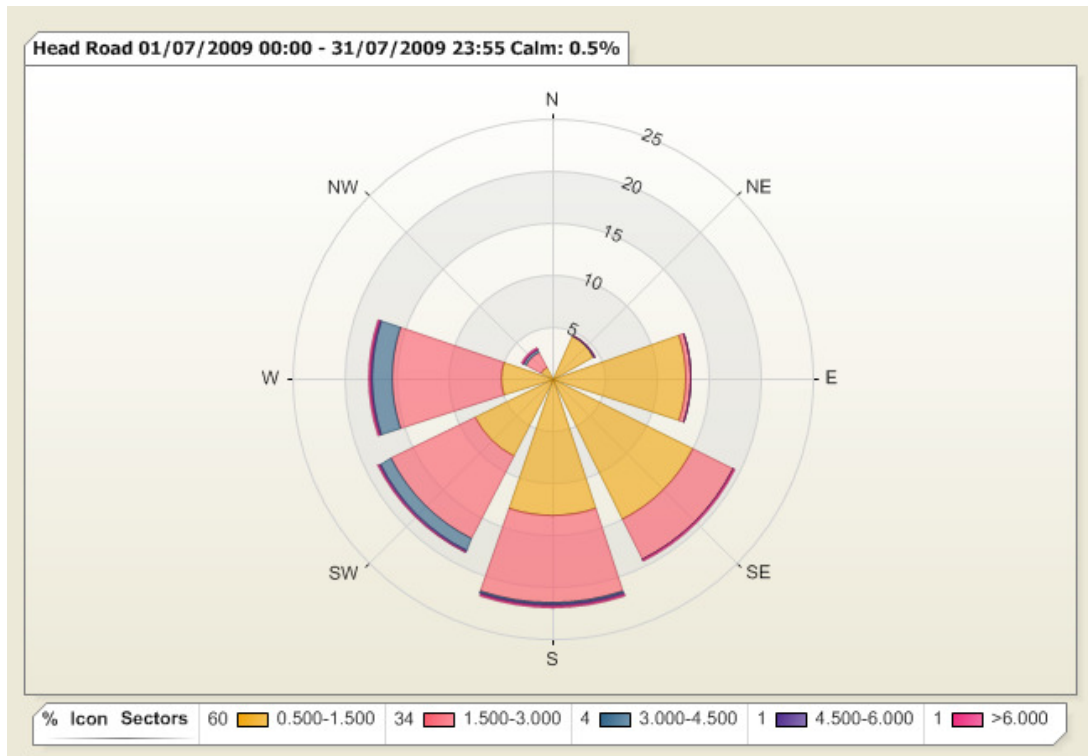


Figure 12: Heads Road Wind Rose



## 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
3/07/2009 12:25	3/07/2009 13:20	CO, NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
6/07/2009 15:35	6/07/2009 16:30	PM <sub>10</sub>	Maintenance/calibration
6/07/2009 15:40	6/07/2009 17:00	PM <sub>2.5</sub>	Maintenance/calibration
10/07/2009 13:45	10/07/2009 14:45	PM <sub>10</sub>	Maintenance/calibration
17/07/2009 13:35	17/07/2009 15:00	PM <sub>10</sub>	Maintenance/calibration
17/07/2009 14:20	17/07/2009 15:30	PM <sub>2.5</sub>	Maintenance/calibration
20/07/2009 2:20	20/07/2009 2:20	All parameters	Power failure
20/07/2009 2:20	20/07/2009 3:00	PM <sub>10</sub>	Power failure
20/07/2009 2:20	20/07/2009 4:00	PM <sub>2.5</sub>	Power failure

**Table 15: Data Exceptions - Craig Road**

Start	End	Parameter	Reason
7/07/2009 13:20	7/07/2009 13:20	All parameters	Power failure
7/07/2009 13:20	7/07/2009 13:55	PM <sub>10</sub>	Power failure
10/07/2009 12:55	10/07/2009 13:15	CO	Maintenance/calibration
10/07/2009 12:55	10/07/2009 13:05	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
10/07/2009 13:45	10/07/2009 14:45	PM <sub>10</sub>	Maintenance/calibration
11/07/2009 0:10	11/07/2009 2:35	PM <sub>10</sub>	Invalid data <sup>1</sup>
20/07/2009 2:20	20/07/2009 2:20	All parameters	Power failure
20/07/2009 2:20	20/07/2009 2:55	PM <sub>10</sub>	Power failure

**Note:**

<sup>1</sup> In the opinion of the data reviewer.





**Table 16: Data Exceptions - Heads Road**

Start	End	Parameter	Reason
3/07/2009 3:00	6/07/2009 23:55	CO	Invalid data - span drift <sup>1</sup>
6/07/2009 4:35	6/07/2009 15:40	All parameters	Datalogger error
7/07/2009 13:45	7/07/2009 14:10	CO	Maintenance/calibration
7/07/2009 13:45	7/07/2009 14:10	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
7/07/2009 16:05	7/07/2009 16:05	All parameters	Datalogger error
7/07/2009 16:20	7/07/2009 16:20	All parameters	Datalogger error
8/07/2009 11:20	8/07/2009 11:30	All parameters	Datalogger error
8/07/2009 14:35	8/07/2009 15:45	PM <sub>10</sub>	Invalid data <sup>1</sup>
30/07/2009 17:40	30/07/2009 17:55	CO	Maintenance/calibration
31/07/2009 5:20	31/07/2009 5:20	All parameters	Power failure
31/07/2009 5:20	31/07/2009 6:00	PM <sub>10</sub>	Power failure

**Note:**

<sup>1</sup> In the opinion of the data reviewer.



## 7.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/08/2009 – 31/08/2009

### 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 August to 31<sup>st</sup> August, 2009 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 Average**

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM <sub>2.5</sub>	Chaim Crt.	672	744	90.3%
PM <sub>10</sub>	Chaim Crt	725	744	97.4%
	Craig Rd.	742	744	99.7%
	Heads Rd.	666	744	89.5%
NO, NO <sub>2</sub>	Chaim Crt	694	744	93.3%
	Craig Rd.	711	744	95.6%
	Heads Rd.	495	744	66.5%
CO	Chaim Crt	694	744	93.3%
	Craig Rd.	653	744	87.8%
	Heads Rd.	631	744	84.8%

**Table 18: Data Capture Statistics - 8 Hour Rolling Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt	724	744	97.3%
	Craig Rd.	681	744	91.5%
	Heads Rd.	654	744	87.9%

**Table 19: Data Capture Statistics - 24 Hour Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM <sub>2.5</sub>	Chaim Crt.	27	31	87.1%
PM <sub>10</sub>	Chaim Crt	30	31	96.8%
	Craig Rd.	31	31	100.0%
	Heads Rd.	27	31	87.1%



## 7.2 Results

### 7.2.1 PM<sub>2.5</sub>

PM<sub>2.5</sub> 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<sub>2.5</sub> (1-hour average) concentration statistics for the reporting period are given in Table 20. A plot of PM<sub>2.5</sub> (1-hour average) concentration for the reporting period is presented in Figure 13.

**Table 20: PM<sub>2.5</sub> Concentration Percentiles (1 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (1-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	80	46	36	29	22	16	11

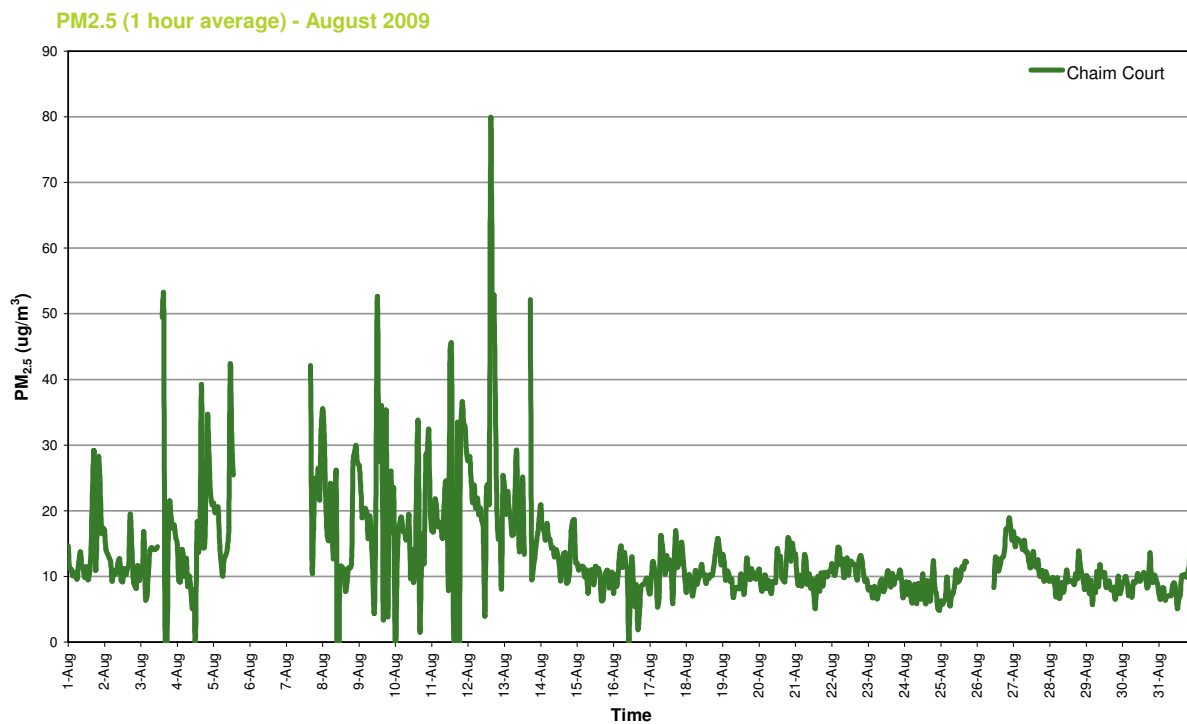


Figure 13: PM<sub>2.5</sub> Concentration (1 Hour Average)



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>2.5</sub> (24-hour average) concentration statistics for the reporting period are given in Table 21. A plot of PM<sub>2.5</sub> (24-hour average) concentration for the reporting period is presented in Figure 14.

**Table 21: PM<sub>2.5</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (24-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	26	25	24	22	20	15	11

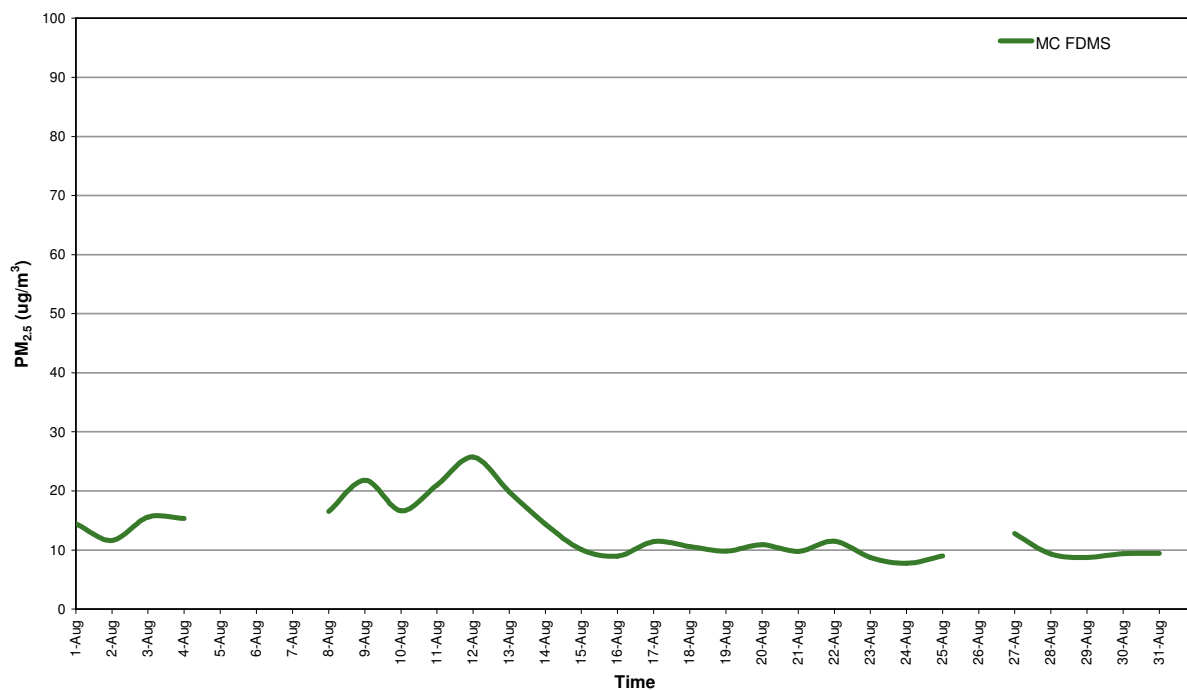


Figure 14: PM<sub>2.5</sub> Concentration (24 Hour Average)



### 7.3 PM<sub>10</sub>

PM<sub>10</sub> 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<sub>10</sub> (1-hour average) concentration statistics for the reporting period are given in Table 22. A plot of PM<sub>10</sub> (1-hour average) concentration for the reporting period is presented in Figure 15.

**Table 22: PM<sub>10</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (1-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	61	30	27	24	19	15	11
Craig Rd	34	29	27	25	19	15	11
Heads Rd	36	30	27	25	20	15	11

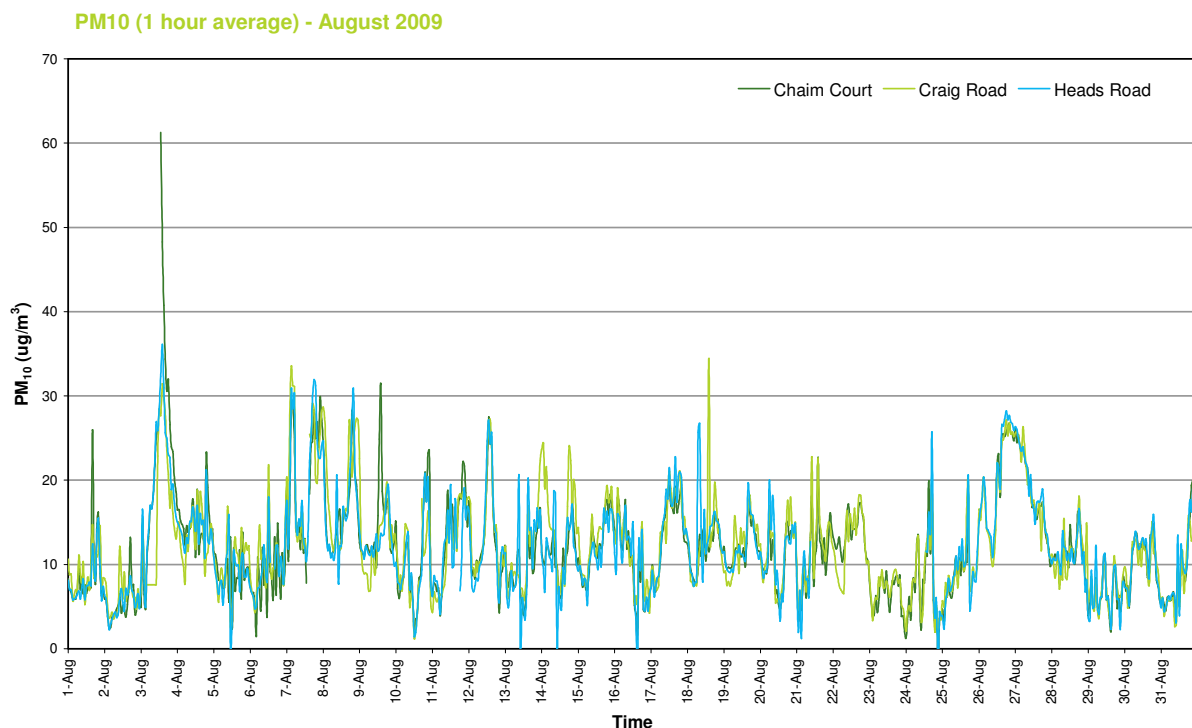


Figure 15: PM<sub>10</sub> Concentration (1 Hour Average)



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>10</sub> (24-hour average) concentration statistics for the reporting period are given in Table 23. A plot of PM<sub>10</sub> (24-hour average) concentration for the reporting period is presented in Figure 16.

**Table 23: PM<sub>10</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (24-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	24	23	22	19	17	14	11
Craig Rd.	21	21	20	19	19	14	12
Heads Rd	21	21	21	20	20	14	11

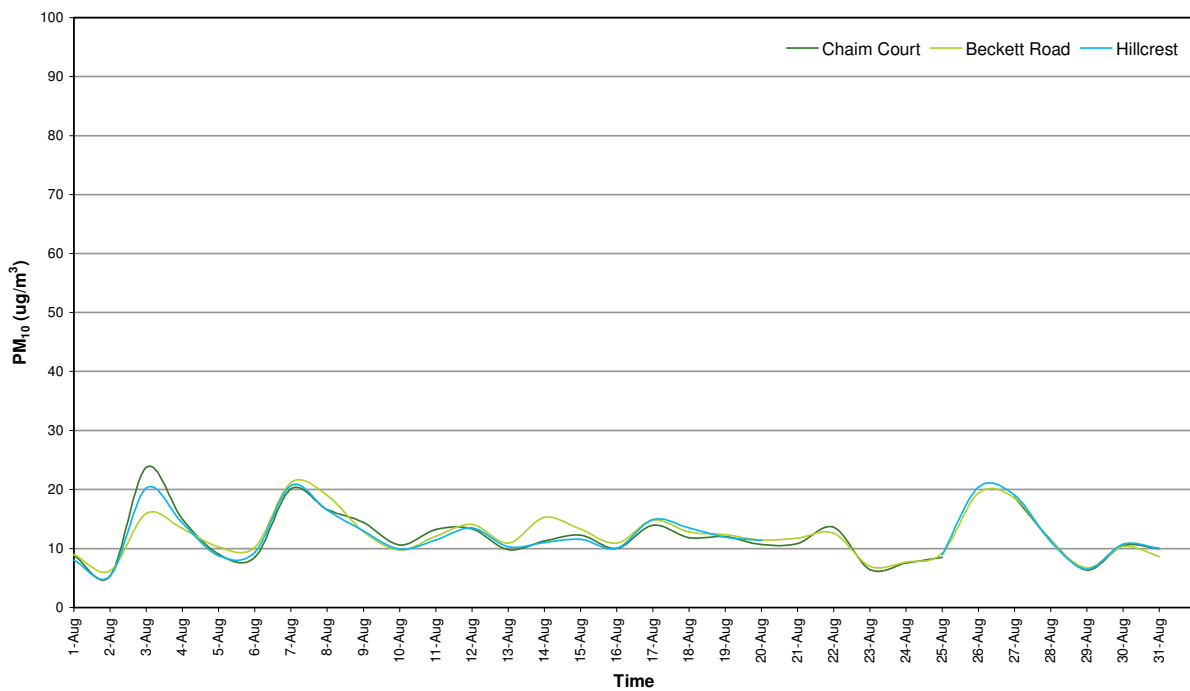


Figure 16: PM<sub>10</sub> Concentration (24 Hour Average)



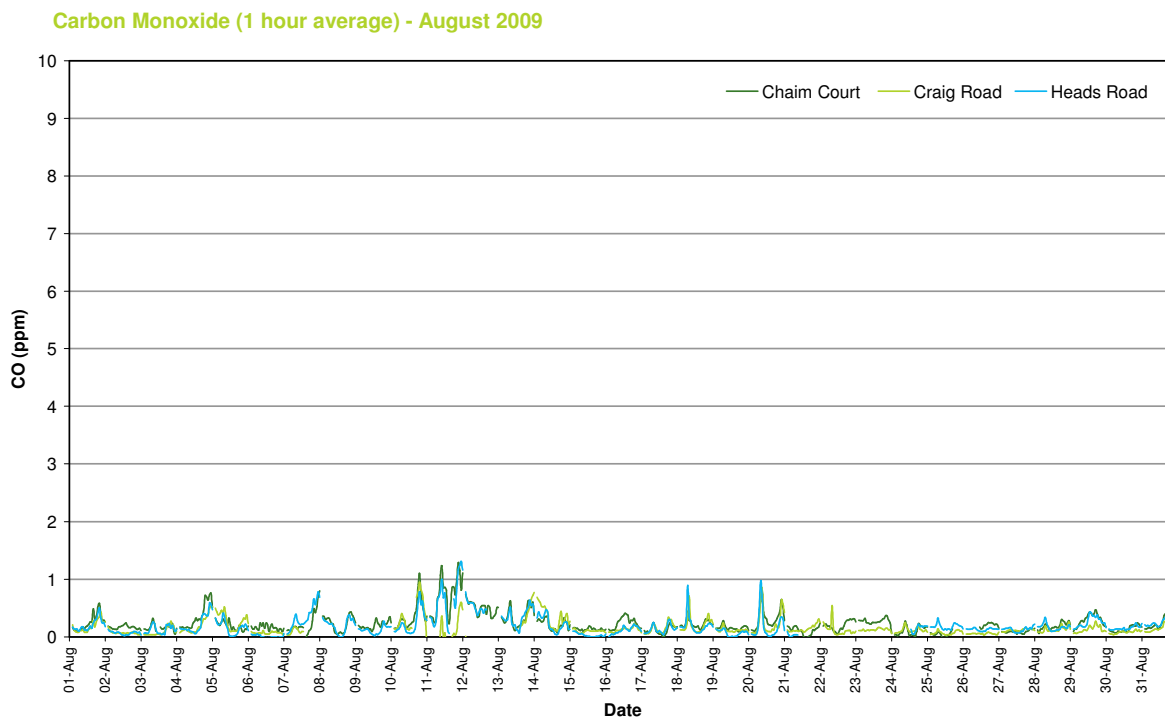
### 7.3.1 Carbon Monoxide

#### 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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	1.3	0.92	0.80	0.59	0.42	0.28	0.19
Craig Rd	0.95	0.71	0.64	0.44	0.31	0.16	0.11
Heads Rd	1.3	0.88	0.72	0.56	0.41	0.24	0.15



*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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	0.99	0.81	0.72	0.54	0.42	0.28	0.19
Craig Rd	0.74	0.61	0.52	0.35	0.28	0.17	0.11
Heads Rd	1.0	0.85	0.61	0.50	0.39	0.24	0.15

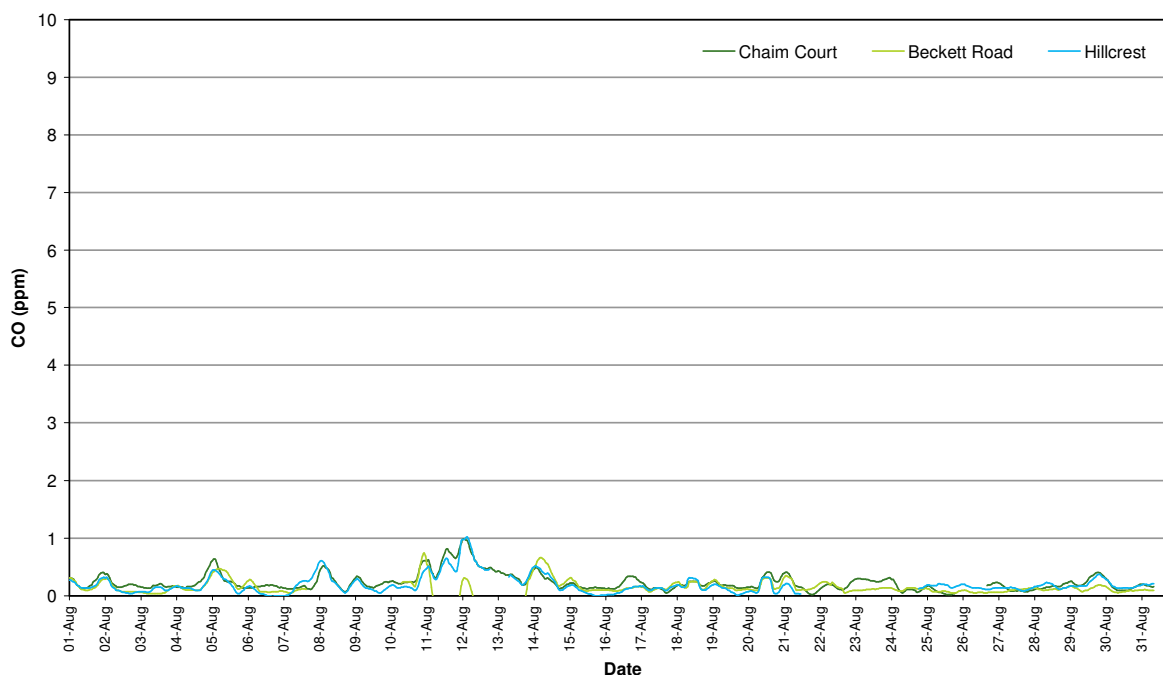


Figure 18: Carbon Monoxide Concentration (8 Hour Rolling Average)





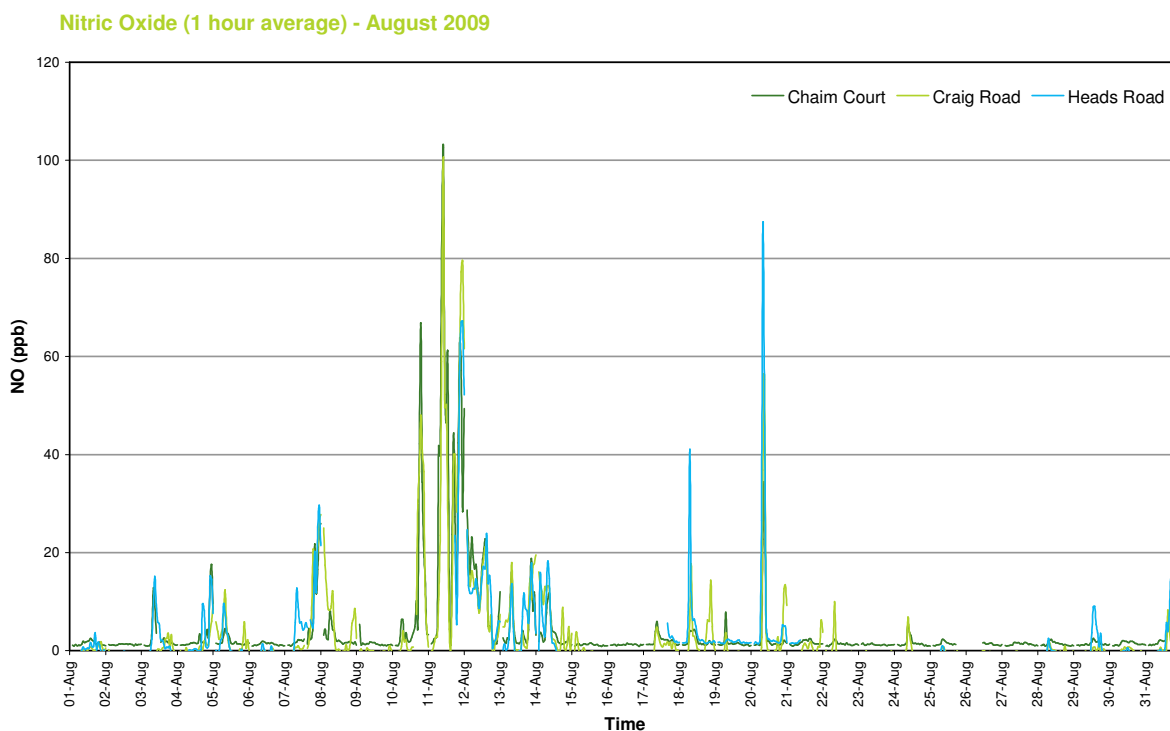
## 7.3.2 Oxides of Nitrogen

### 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 (ppm) (1-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	100	50	35	17	5.5	2.1	1.4
Craig Rd	100	50	37	17	8.8	1.2	<0.2
Heads Rd	87	52	25	15	9.2	2.1	<0.03



*Figure 19: Nitric Oxide Concentration (1 Hour Average)*

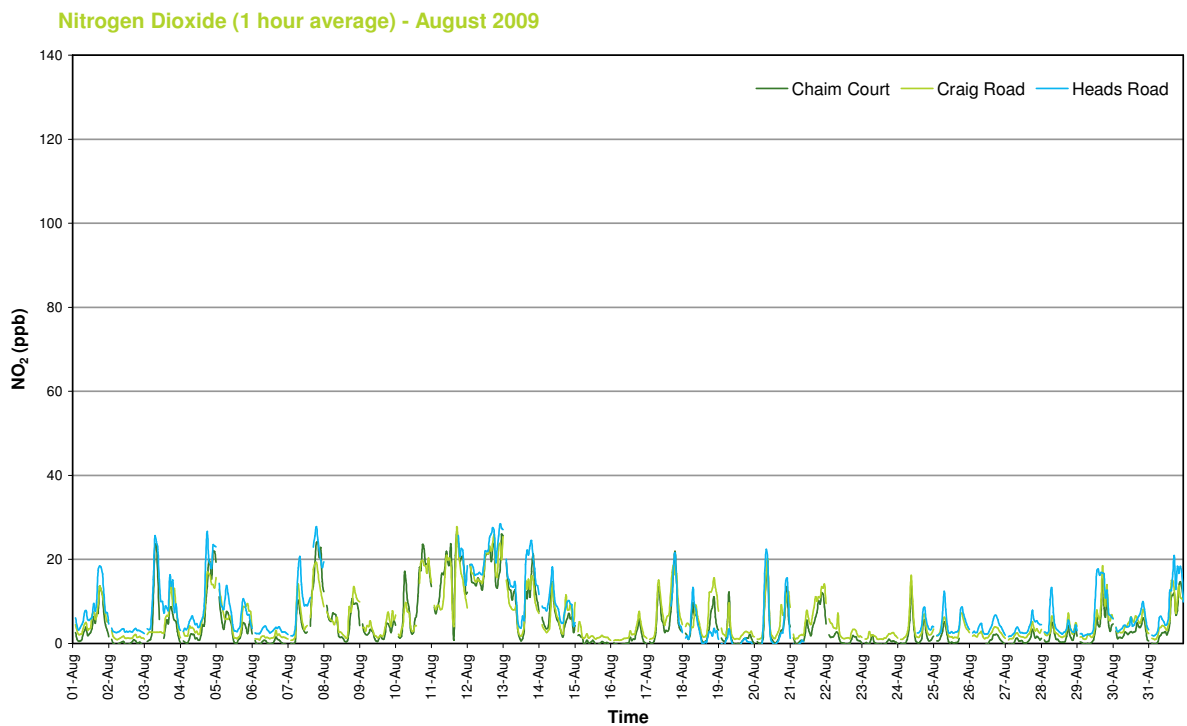


**7.3.2.2 Nitrogen Dioxide**

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	27	24	23	19	14	6.6	2.2
Craig Rd	28	23	20	17	14	7.9	3.6
Heads Rd	28	27	26	22	19	10	4.6



*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.

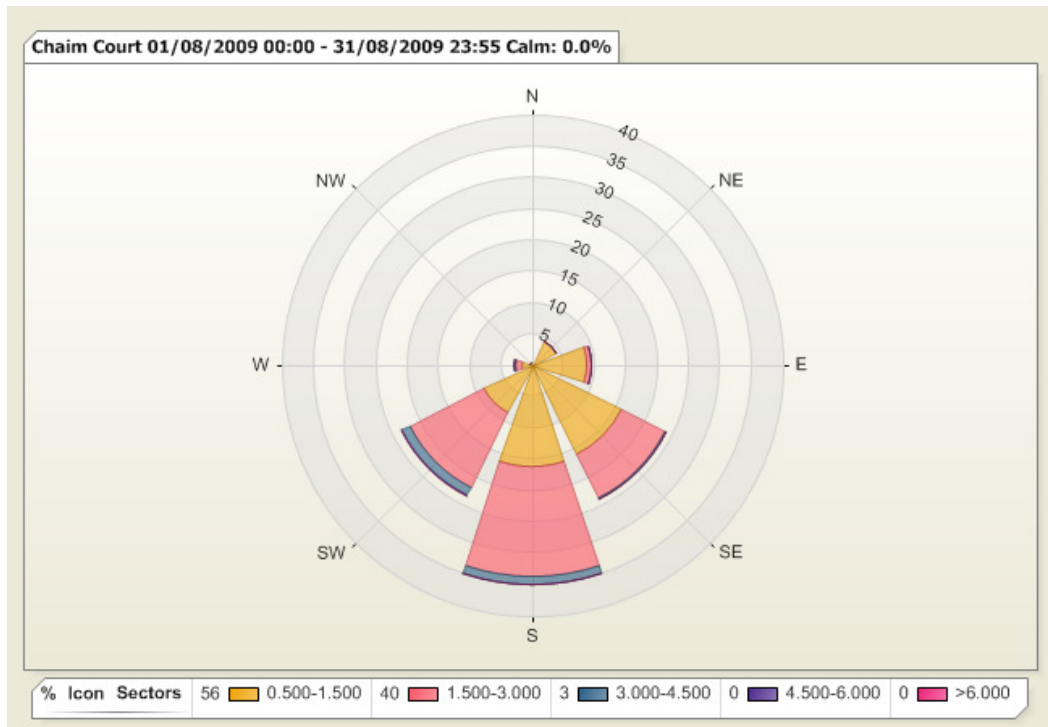


Figure 21: Chaim Court Wind Rose

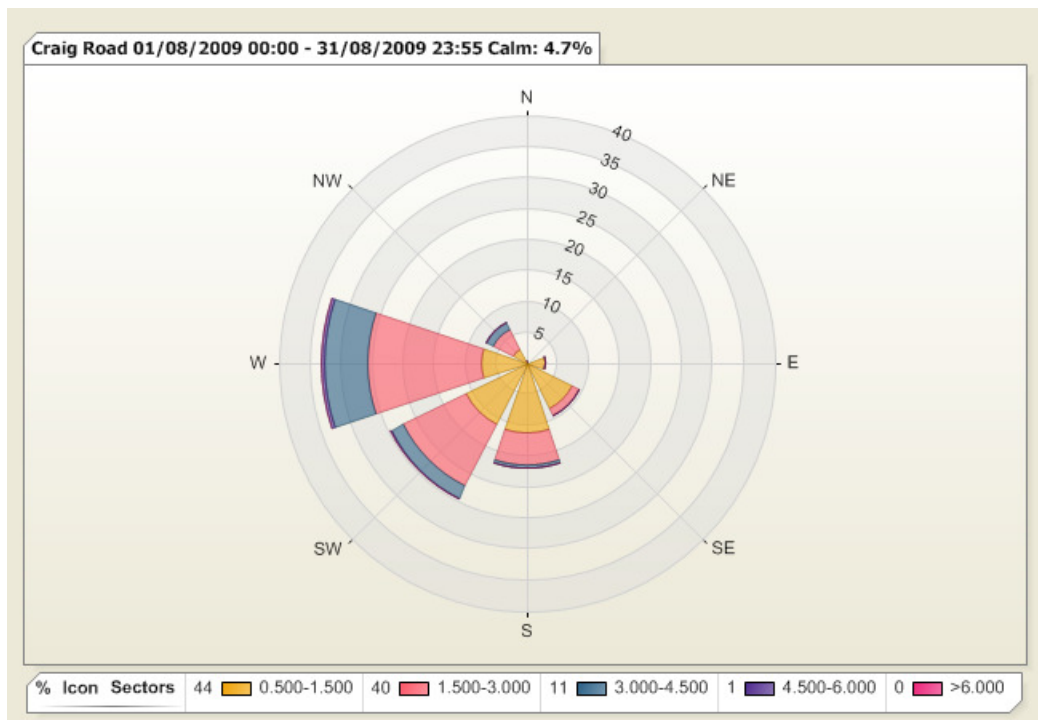


Figure 22: Craig Road Wind Rose



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

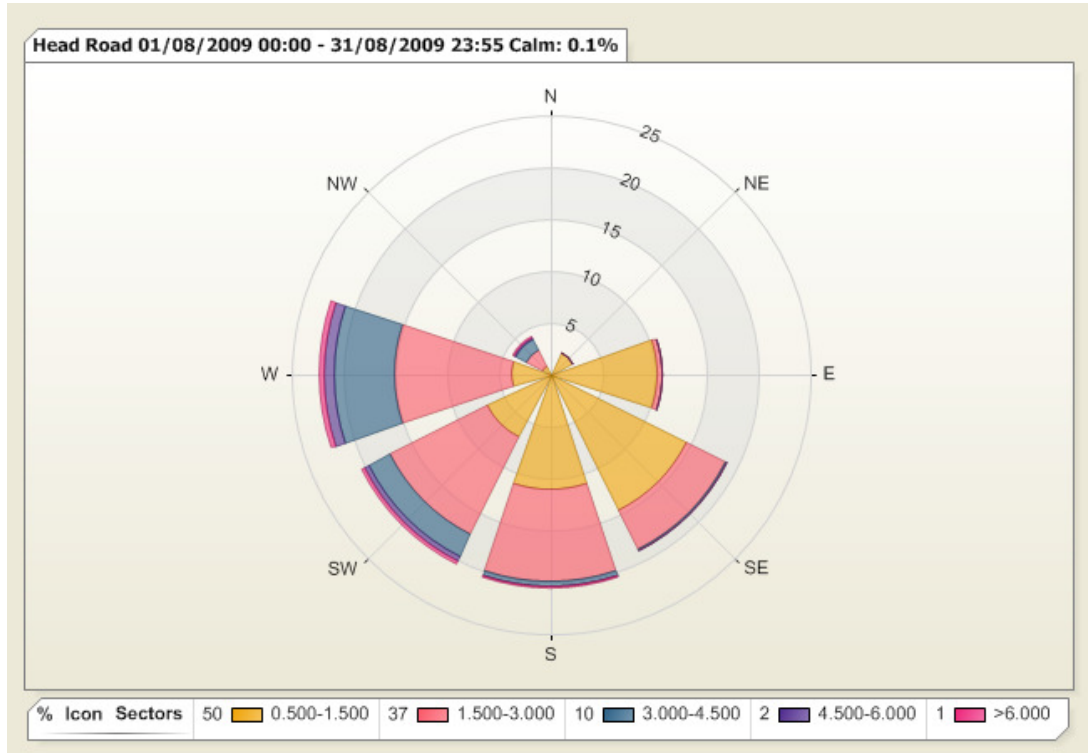


Figure 23: Heads Road Wind Rose



## 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
3/08/2009 11:40	3/08/2009 12:20	CO, NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
3/08/2009 11:50	3/08/2009 12:45	PM <sub>10</sub>	Invalid data <sup>1</sup>
3/08/2009 11:50	3/08/2009 13:25	PM <sub>2.5</sub>	Maintenance/calibration
5/08/2009 13:50	7/08/2009 14:00	PM <sub>2.5</sub>	Invalid data <sup>1</sup>
7/08/2009 14:05	7/08/2009 14:55	All parameters	Power failure
7/08/2009 14:05	7/08/2009 15:10	PM <sub>2.5</sub> , PM <sub>10</sub>	Power failure
13/08/2009 14:20	13/08/2009 17:00	PM <sub>2.5</sub>	Maintenance/calibration
25/08/2009 18:30	26/08/2009 10:20	All parameters	Datalogger error

**Note:**

<sup>1</sup> In the opinion of the data reviewer.

**Table 29: Data Exceptions - Craig Road**

Start	End	Parameter	Reason
3/08/2009 11:05	3/08/2009 11:10	All parameters	Power failure
7/08/2009 14:00	7/08/2009 14:25	Temp, RH, WS, WD	Power failure
7/08/2009 14:00	7/08/2009 15:00	NO, NO <sub>2</sub> , NO <sub>x</sub>	Power failure
7/08/2009 14:00	7/08/2009 15:10	PM <sub>10</sub>	Power failure
7/08/2009 14:00	9/08/2009 23:55	CO	Invalid data - unstable after power failure <sup>1</sup>
10/08/2009 15:05	10/08/2009 16:45	CO	Maintenance/calibration
10/08/2009 15:05	10/08/2009 15:40	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
10/08/2009 15:45	10/08/2009 16:45	PM <sub>10</sub>	Maintenance/calibration
13/08/2009 13:35	13/08/2009 14:05	CO	Maintenance/calibration
25/08/2009 18:30	25/08/2009 18:30	NO, NO <sub>2</sub> , NO <sub>x</sub>	Invalid data <sup>1</sup>

**Note:**

<sup>1</sup> In the opinion of the data reviewer.



**Table 30: Data Exceptions - Heads Road**

Start	End	Parameter	Reason
6/08/2009 14:10	6/08/2009 15:20	PM <sub>10</sub>	Maintenance/calibration
7/08/2009 16:10	7/08/2009 16:35	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
8/08/2009 1:40	11/08/2009 16:40	NO, NO <sub>2</sub> , NO <sub>x</sub>	Invalid data - span drift <sup>1</sup>
11/08/2009 16:40	11/08/2009 17:15	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
11/08/2009 16:40	11/08/2009 17:15	CO	Maintenance/calibration
11/08/2009 16:55	11/08/2009 17:40	PM <sub>10</sub>	Maintenance/calibration
12/08/2009 17:10	12/08/2009 23:55	CO	Maintenance/calibration
15/08/2009 1:40	17/08/2009 15:25	NO, NO <sub>2</sub> , NO <sub>x</sub>	Invalid data - span drift <sup>1</sup>
17/08/2009 15:25	17/08/2009 15:55	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
21/08/2009 10:20	24/08/2009 12:20	All parameters	Power failure
24/08/2009 12:35	24/08/2009 13:00	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
24/08/2009 12:35	24/08/2009 12:55	CO	Maintenance/calibration

**Note:**

<sup>1</sup> In the opinion of the data reviewer.



## 8.0 AMBIENT AIR QUALITY MONITORING PERIOD: 01/09/2009 – 30/09/2009

### 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 September to 30<sup>th</sup> September 2009 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 <sub>2.5</sub>	Chaim Crt.	710	720	98.6%
PM <sub>10</sub>	Chaim Crt	663	720	92.1%
	Craig Rd.	718	720	99.7%
	Heads Rd.	676	720	93.9%
NO, NO <sub>2</sub>	Chaim Crt	687	720	95.4%
	Craig Rd.	687	720	95.4%
	Heads Rd.	602	720	83.6%
CO	Chaim Crt	688	720	95.6%
	Craig Rd.	688	720	95.6%
	Heads Rd.	649	720	90.1%

**Table 32: Data Capture Statistics - 8 Hour Rolling Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
CO	Chaim Crt	720	720	100.0%
	Craig Rd.	720	720	100.0%
	Heads Rd.	654	720	90.8%

**Table 33: Data Capture Statistics - 24 Hour Averages**

Parameter	Station	Collected Periods	Available Periods	Data Capture
PM <sub>2.5</sub>	Chaim Crt.	30	30	100.0%
PM <sub>10</sub>	Chaim Crt	27	30	90.0%
	Craig Rd.	30	30	100.0%
	Heads Rd.	29	30	96.7%



## 8.2 Results

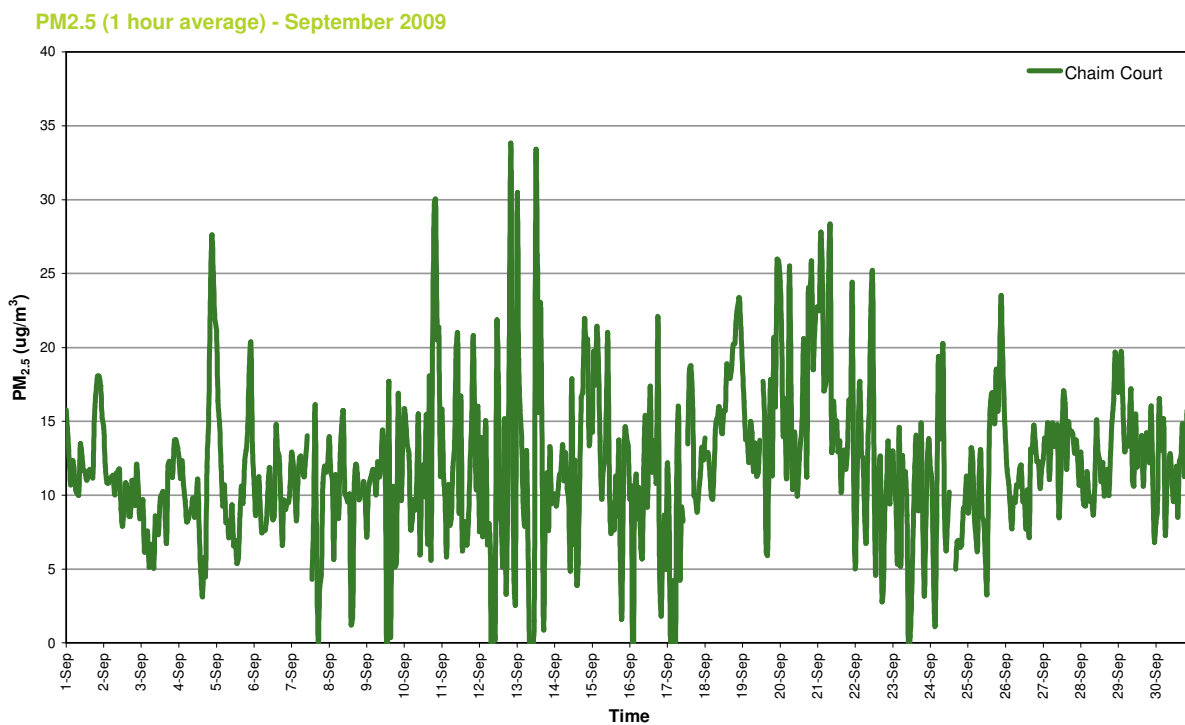
### 8.2.1 PM<sub>2.5</sub>

PM<sub>2.5</sub> 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<sub>2.5</sub> (1-hour average) concentration statistics for the reporting period are given in Table 34. A plot of PM<sub>2.5</sub> (1-hour average) concentration for the reporting period is presented in Figure 24.

**Table 34: PM<sub>2.5</sub> Concentration Percentiles (1 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (1-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	34	27	25	21	19	14	12



*Figure 24: PM<sub>2.5</sub> Concentration (1 Hour Average)*





# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>2.5</sub> (24-hour average) concentration statistics for the reporting period are given in Table 35. A plot of PM<sub>2.5</sub> (24-hour average) concentration for the reporting period is presented in Figure 25.

**Table 35: PM<sub>2.5</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> ) (24-hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	17	17	17	17	15	13	12

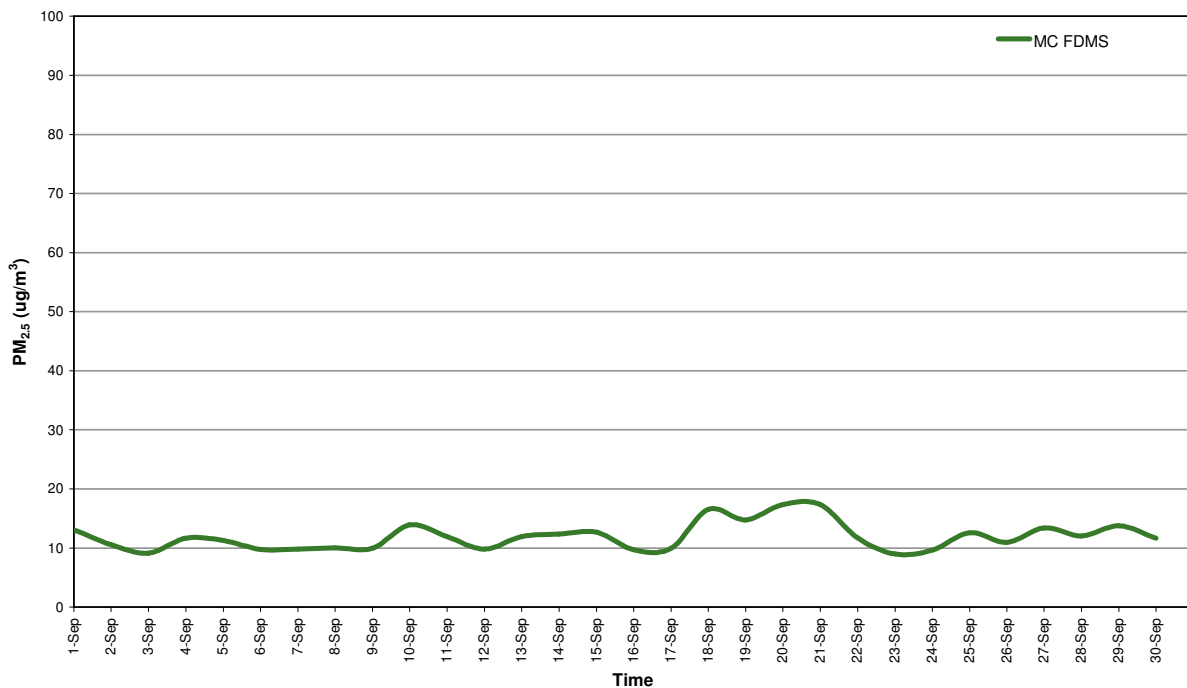


Figure 25: PM<sub>2.5</sub> Concentration (24 Hour Average)



### 8.3 PM<sub>10</sub>

PM<sub>10</sub> 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<sub>10</sub> (1-hour average) concentration statistics for the reporting period are given in Table 36. A plot of PM<sub>10</sub> (1-hour average) concentration for the reporting period is presented in Figure 26.

**Table 36: PM<sub>10</sub> Concentration Percentiles (1 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (1-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	130	62	38	25	20	16	12
Craig Rd	130	53	31	23	20	16	11
Heads Rd	130	58	35	24	21	15	11

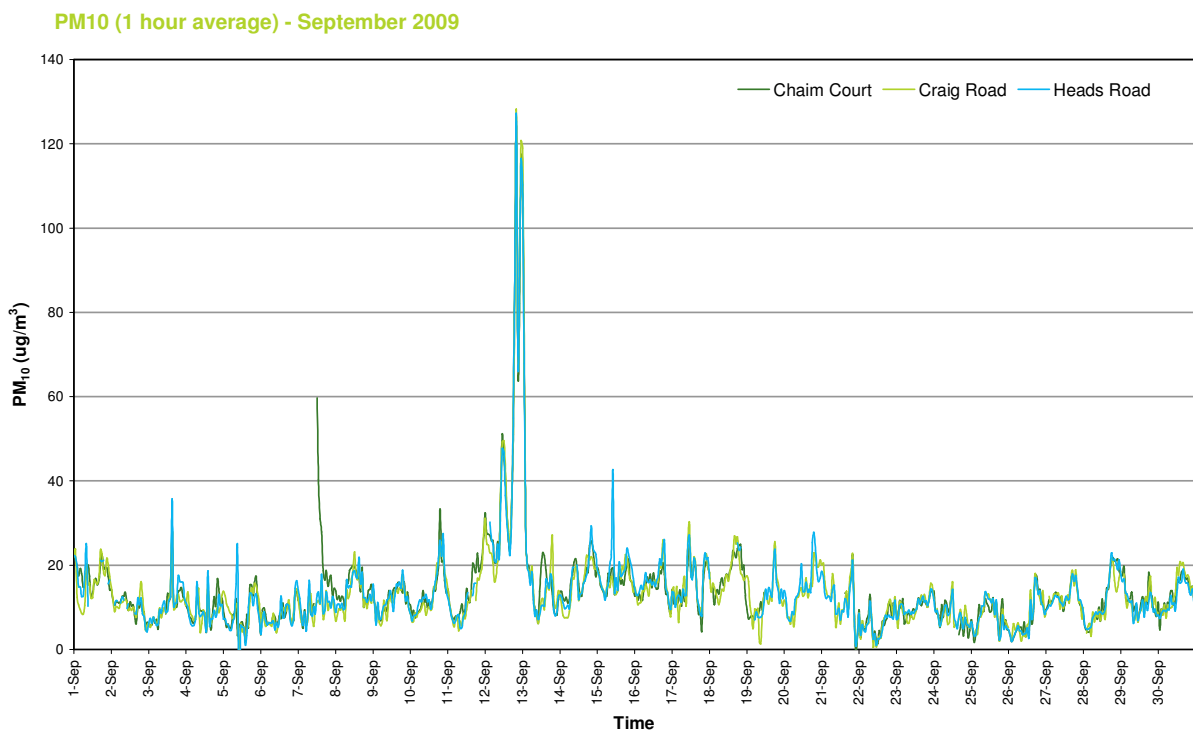


Figure 26: PM<sub>10</sub> Concentration (1 Hour Average)



# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

PM<sub>10</sub> (24-hour average) concentration statistics for the reporting period are given in Table 37. A plot of PM<sub>10</sub> (24-hour average) concentration for the reporting period is presented in Figure 27.

**Table 37: PM<sub>10</sub> Concentration Percentiles (24 Hour Average)**

Station	PM <sub>10</sub> Concentration (µg/m <sup>3</sup> ) (24-Hour Average)						
	Maximum	99 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	45	39	33	21	18	16	12
Craig Rd.	44	38	31	19	17	15	12
Heads Rd	47	39	32	19	18	15	12

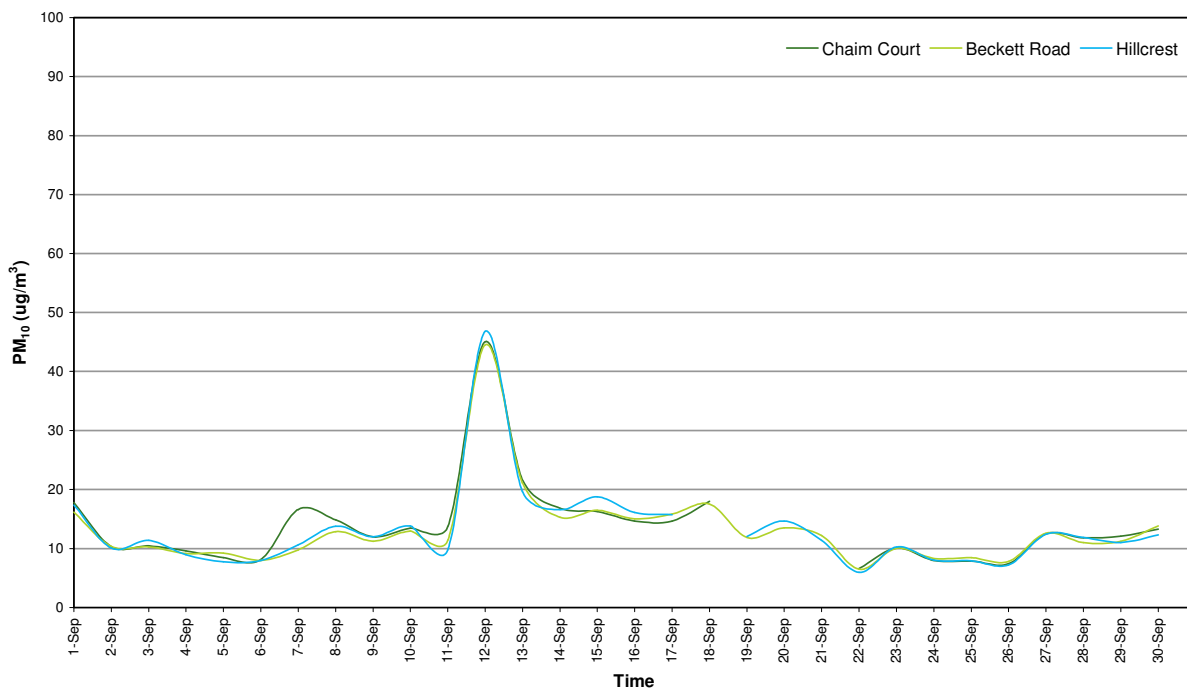


Figure 27: PM<sub>10</sub> Concentration (24 Hour Average)



### 8.3.1 Carbon Monoxide

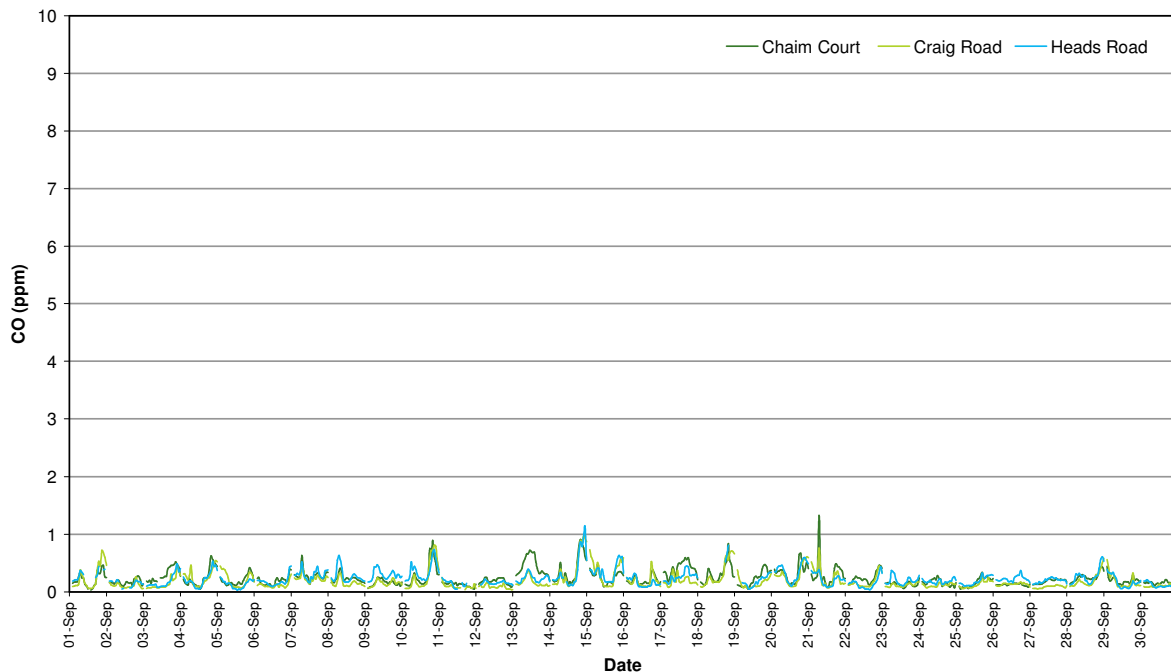
#### 8.3.1.1 1-Hour Average

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	1.3	0.75	0.66	0.52	0.42	0.28	0.20
Craig Rd	0.97	0.76	0.69	0.54	0.38	0.22	0.13
Heads Rd	1.1	0.69	0.59	0.47	0.39	0.28	0.20

**Carbon Monoxide (1 hour average) - September 2009**



*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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	0.72	0.62	0.54	0.47	0.39	0.28	0.21
Craig Rd	0.85	0.65	0.57	0.46	0.36	0.22	0.15
Heads Rd	0.77	0.54	0.49	0.41	0.36	0.28	0.21

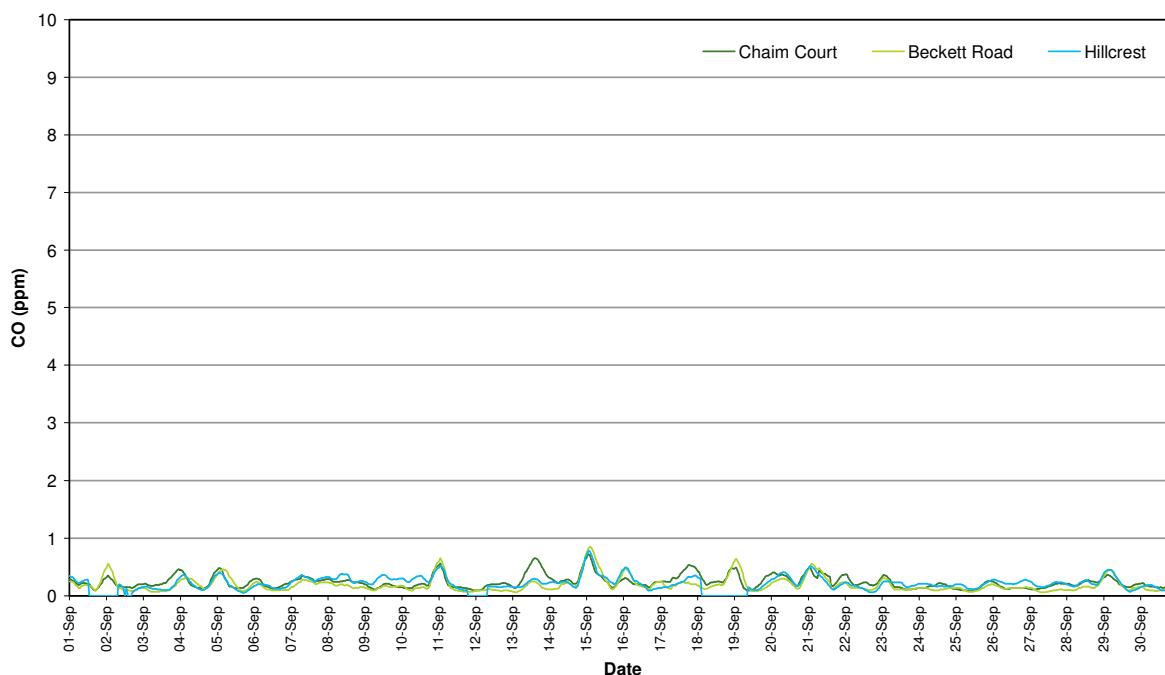


Figure 29: Carbon Monoxide Concentration (8 Hour Rolling Average)



### 8.3.2 Oxides of Nitrogen

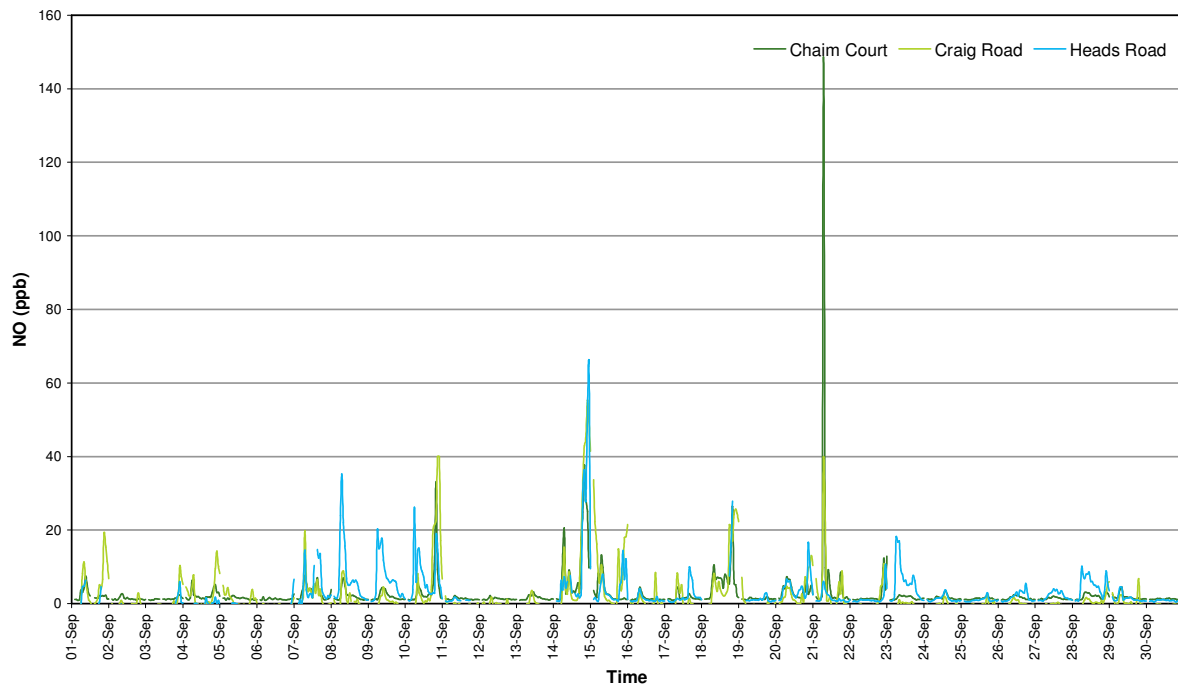
#### 8.3.2.1 Nitric Oxide

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	150	21	12	7.0	4.4	2.2	1.4
Craig Rd	55	40	22	13	6.6	1.5	<0.08
Heads Rd	65	28	18	12	6.5	3.1	1.1

**Nitric Oxide (1 hour average) - September 2009**



*Figure 30: Nitric Oxide Concentration (1 Hour Average)*



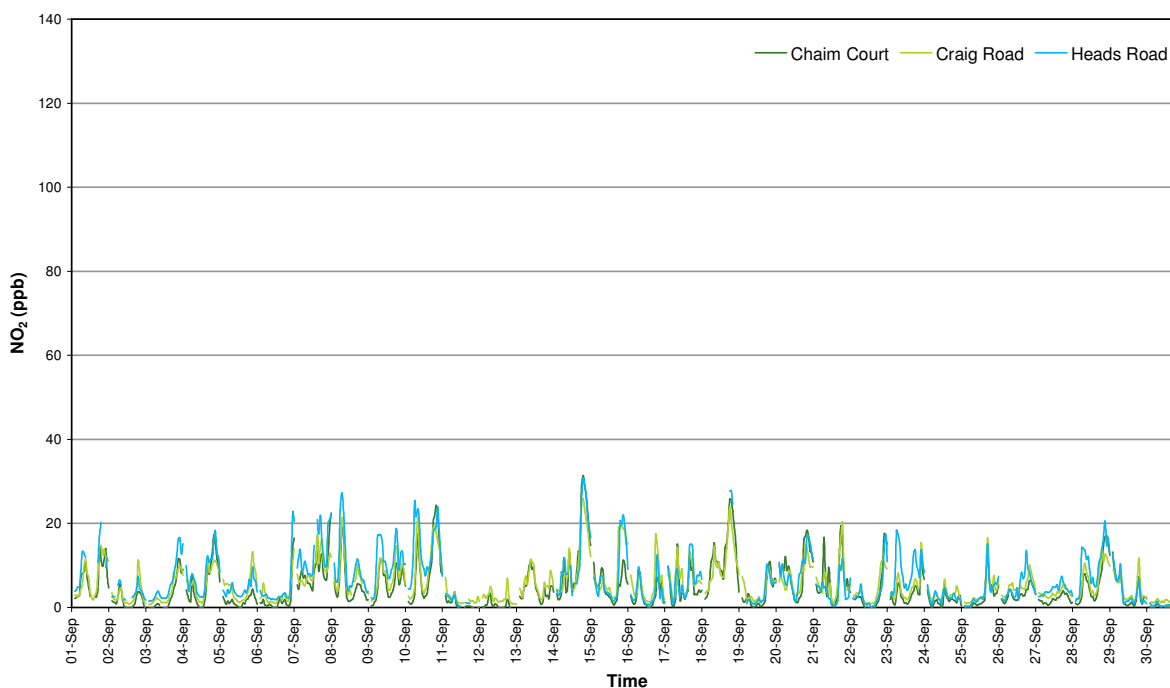
## 8.3.2.2 Nitrogen Dioxide

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 <sup>th</sup>	98 <sup>th</sup>	95 <sup>th</sup>	90 <sup>th</sup>	75 <sup>th</sup>	50 <sup>th</sup>
Chaim Crt	31	23	19	15	12	6.7	2.8
Craig Rd	26	21	19	15	12	7.8	4.4
Heads Rd	31	25	23	19	15	9.3	4.8

**Nitrogen Dioxide (1 hour average) - September 2009**



*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.

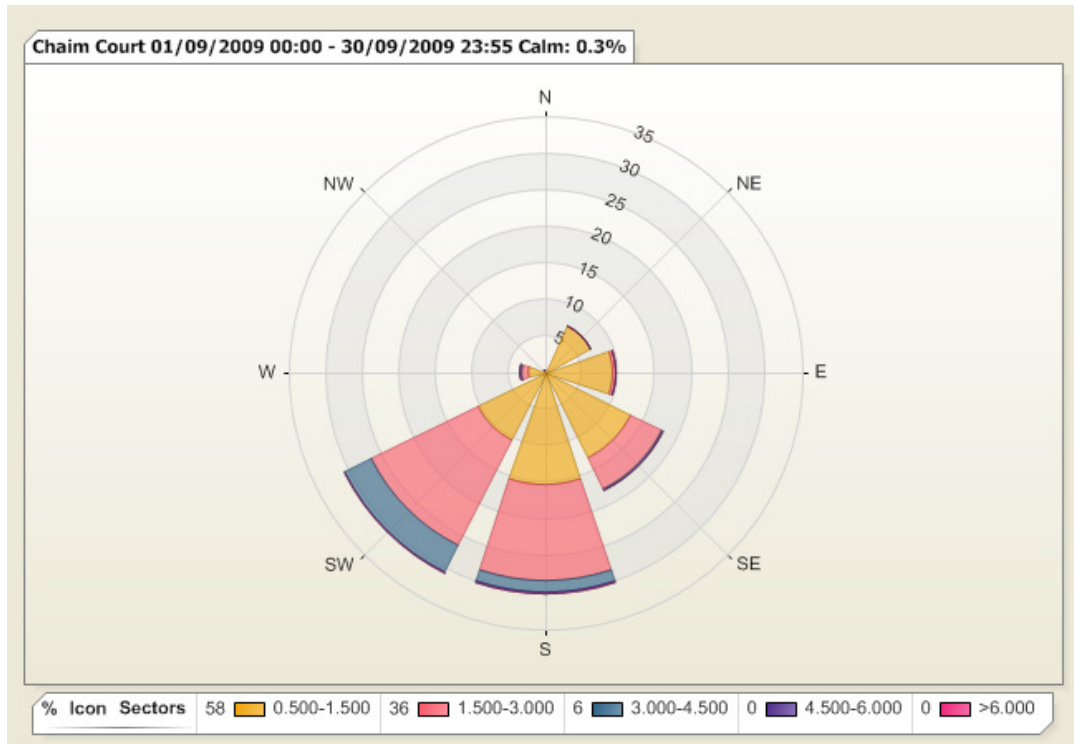


Figure 32: Chaim Court Wind Rose

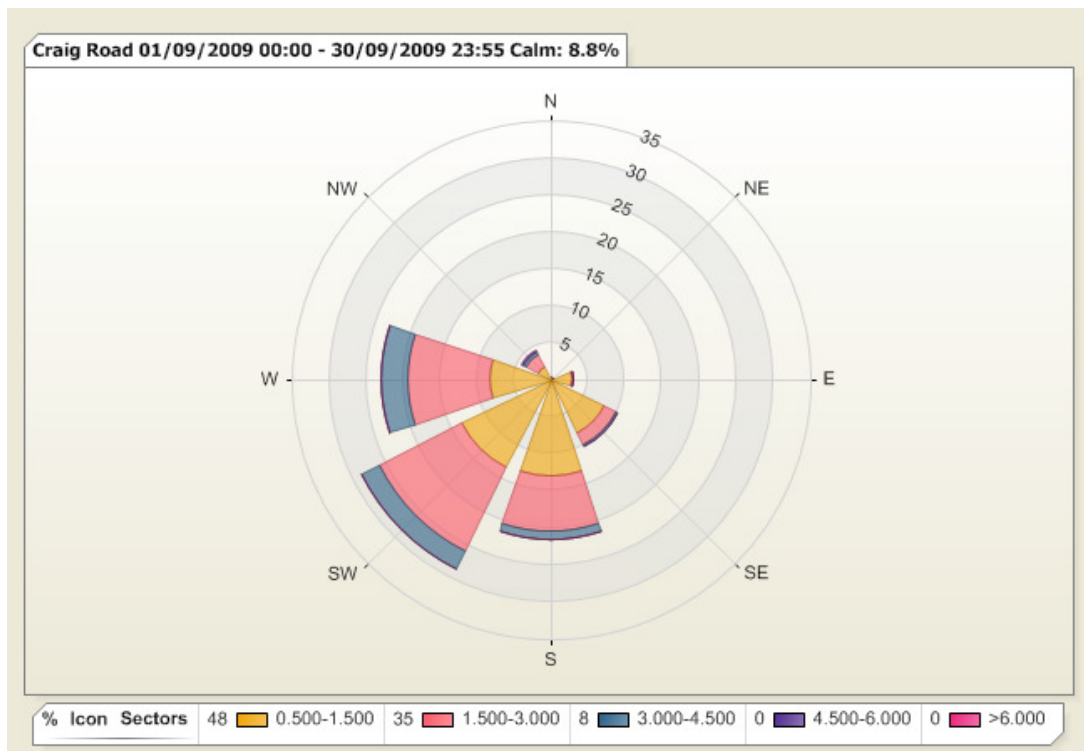


Figure 33: Craig Road Wind Rose





# EASTLINK AMBIENT AIR QUALITY MONITORING REPORT: JULY-SEPTEMBER 2009

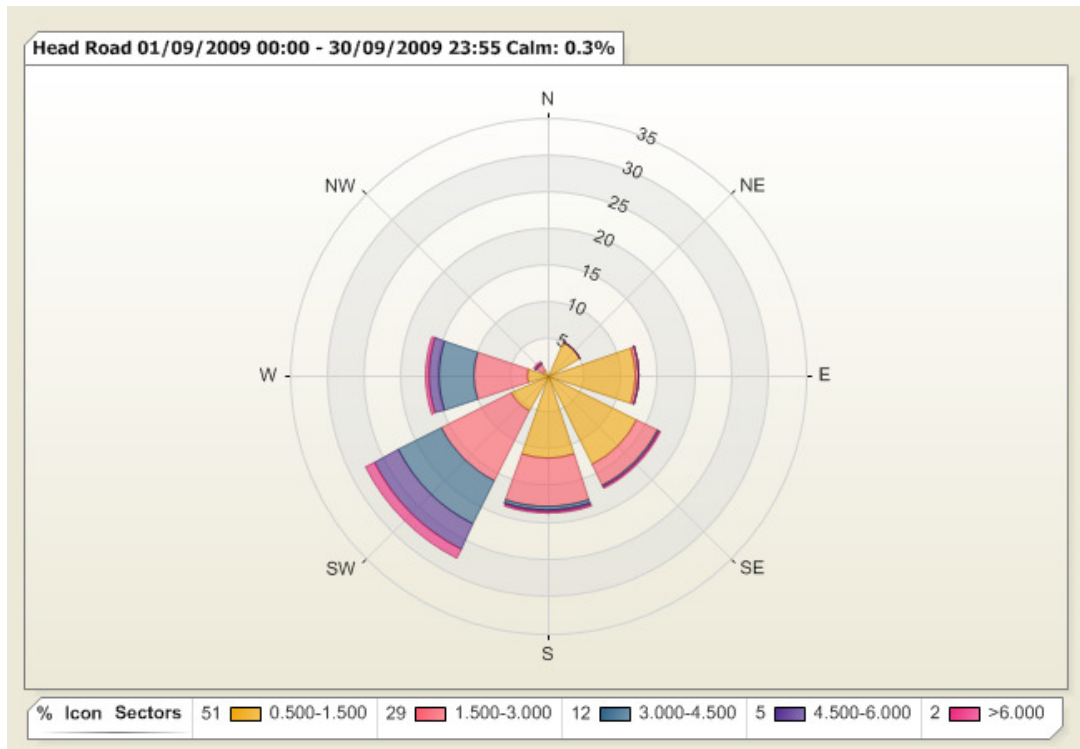


Figure 34: Heads Road Wind Rose



## 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
1/09/2009 13:20	1/09/2009 13:50	CO	Maintenance/calibration
1/09/2009 13:20	1/09/2009 14:20	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
1/09/2009 22:55	1/09/2009 22:55	All parameters	Datalogger error
3/09/2009 9:45	3/09/2009 10:30	All parameters	Power failure
7/09/2009 11:15	7/09/2009 12:05	PM <sub>10</sub>	Maintenance/calibration
7/09/2009 11:15	7/09/2009 12:20	PM <sub>2.5</sub>	Maintenance/calibration
8/09/2009 15:15	8/09/2009 15:20	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
14/09/2009 14:25	14/09/2009 15:35	Meteorological	Maintenance/calibration
17/09/2009 11:15	17/09/2009 12:20	PM <sub>2.5</sub>	Maintenance/calibration
18/09/2009 01:25	18/09/2009 2:10	All parameters	Power failure
19/09/2009 11:50	19/09/2009 12:45	PM <sub>2.5</sub> , PM <sub>10</sub>	Maintenance/calibration
19/09/2009 12:45	21/09/2009 14:15	PM <sub>10</sub>	Out of service
24/09/2009 13:25	24/09/2009 16:00	PM <sub>2.5</sub>	Maintenance/calibration
24/09/2009 13:30	24/09/2009 15:20	PM <sub>10</sub>	Maintenance/calibration

**Table 43: Data Exceptions - Craig Road**

Start	End	Parameter	Reason
8/09/2009 14:10	8/09/2009 15:05	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
11/09/2009 15:25	11/09/2009 16:25	CO	Maintenance/calibration
11/09/2009 15:25	11/09/2009 16:50	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
11/09/2009 16:40	11/09/2009 17:50	PM <sub>10</sub>	Maintenance/calibration



**Table 44: Data Exceptions - Heads Road**

Start	End	Parameter	Reason
1/09/2009 10:35	1/09/2009 11:20	All parameters	Datalogger error
1/09/2009 13:05	1/09/2009 13:50	All parameters	Datalogger error
1/09/2009 15:35	1/09/2009 16:20	All parameters	Datalogger error
1/09/2009 19:45	1/09/2009 20:30	All parameters	Datalogger error
1/09/2009 21:25	1/09/2009 22:10	All parameters	Datalogger error
2/09/2009 4:50	2/09/2009 5:35	All parameters	Datalogger error
2/09/2009 9:20	2/09/2009 10:05	All parameters	Datalogger error
2/09/2009 11:50	2/09/2009 12:35	All parameters	Datalogger error
2/09/2009 14:20	2/09/2009 15:05	All parameters	Datalogger error
7/09/2009 14:40	7/09/2009 15:05	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
8/09/2009 14:40	8/09/2009 14:45	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
11/09/2009 13:20	11/09/2009 14:45	CO	Maintenance/calibration
11/09/2009 13:20	11/09/2009 15:00	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
11/09/2009 14:05	11/09/2009 15:15	PM <sub>10</sub>	Maintenance/calibration
11/09/2009 19:30	12/09/2009 2:45	All parameters	Power failure
12/09/2009 2:45	14/09/2009 1:00	NO, NO <sub>2</sub> , NO <sub>x</sub>	Invalid data - span drift after power fail <sup>1</sup>
14/09/2009 9:55	14/09/2009 10:40	All parameters	Datalogger error
14/09/2009 13:25	14/09/2009 13:50	NO, NO <sub>2</sub> , NO <sub>x</sub>	Maintenance/calibration
18/09/2009 3:20	18/09/2009 4:05	All parameters	Datalogger error
18/09/2009 5:00	18/09/2009 5:45	All parameters	Datalogger error
18/09/2009 6:40	18/09/2009 7:25	All parameters	Datalogger error
18/09/2009 8:20	18/09/2009 9:05	All parameters	Datalogger error
18/09/2009 10:00	18/09/2009 10:45	All parameters	Datalogger error
18/09/2009 11:40	18/09/2009 12:25	All parameters	Datalogger error
18/09/2009 13:20	18/09/2009 14:05	All parameters	Datalogger error
18/09/2009 15:00	18/09/2009 15:45	All parameters	Datalogger error
18/09/2009 16:40	18/09/2009 17:25	All parameters	Datalogger error
18/09/2009 20:50	18/09/2009 21:35	All parameters	Datalogger error
18/09/2009 22:30	18/09/2009 23:15	All parameters	Datalogger error
19/09/2009 4:20	19/09/2009 5:05	All parameters	Datalogger error

**Note:**

<sup>1</sup> In the opinion of the data reviewer.



## 9.0 DISCUSSION

### 9.1 Comparison with Air Quality Objectives

#### 9.1.1 PM<sub>2.5</sub> and PM<sub>10</sub>

Assessment criteria for PM<sub>2.5</sub> and PM<sub>10</sub> are taken from the State Environment Protection Policy (Air Quality Management) (SEPP {AQM}) Schedule B intervention levels. The intervention levels for PM<sub>10</sub> and PM<sub>2.5</sub> are as follows:

- PM<sub>10</sub> (24-hour) 60 µg/m<sup>3</sup>;
- PM<sub>2.5</sub> (24 hour) 36 µg/m<sup>3</sup>.

There were no exceedence days of the PM<sub>2.5</sub> intervention level during the reported period. The maximum 24-hour average PM<sub>2.5</sub> concentration was 26 µg/m<sup>3</sup> on 12/08/2009 at Chaim Court monitoring station.

There were no exceedence days of the PM<sub>10</sub> intervention level during the reported period. The maximum 24-hour average PM<sub>10</sub> concentration was 47 µg/m<sup>3</sup> on 12/09/2009 at Heads Road monitoring station.

#### 9.1.2 Nitrogen Dioxide

The assessment criterion for NO<sub>2</sub> is taken from the SEPP (AQM) Schedule B intervention level. The intervention level for NO<sub>2</sub> is as follows:

- NO<sub>2</sub> (1 hour) 140 ppb.

There were no exceedences of the NO<sub>2</sub> intervention level during the reported period at any of the monitoring stations. The maximum 1-hour average NO<sub>2</sub> concentration was 35 ppb on 17/07/2009 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 17/07/2009 19:00 hours at Craig Road monitoring station. The maximum 8-hour average CO concentration was 1.4 ppm on 18/07/2009 07:00 hours reported at the Craig Road monitoring station.

### 9.2 Data Capture Year to Date

2009 data capture statistics for the period 01/01/2009 to 30/09/2009 are presented in Table 45.



**Table 45: Data Capture - Year to Date**

STATION	DATA CAPTURE STATISTICS % YEAR TO DATE (01/01/2009 – 30/06/2009)			
	PM <sub>2.5</sub>	PM <sub>10</sub>	NO <sub>x</sub>	CO
Chaim Crt	96.9	98.5	95.0	96.8
Craig Rd		99.5	96.4	95.7
Heads Rd		97.6	91.3	93.7



## Report Signature Page

**GOLDER, GOLDER ASSOCIATES AND THE GA GLOBE DESIGN ARE TRADEMARKS OF GOLDER ASSOCIATES CORPORATION.**

Mark Tulau  
Senior Environmental Scientist

Frank Fleer  
Principal Environmental Engineer

MT/FF/SLH

A.B.N. 64 006 107 857

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation.

w:\projects\2009\097613023\correspondence out\097613023 011 r rev 0 transfield services.doc



# **APPENDIX A**

## **Limitations**



## **LIMITATIONS**

This Document has been provided by Golder Associates Pty Ltd ("Golder") subject to the following limitations:

This Document has been prepared for the particular purpose outlined in Golder's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.

Conditions may exist which were not detected given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between assessment locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Golder's opinions are based upon information that existed at the time the information is collected. It is understood that the Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any assessments, designs, and advice provided in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.

Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, Golder's affiliated companies, and their employees, officers and directors.

This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

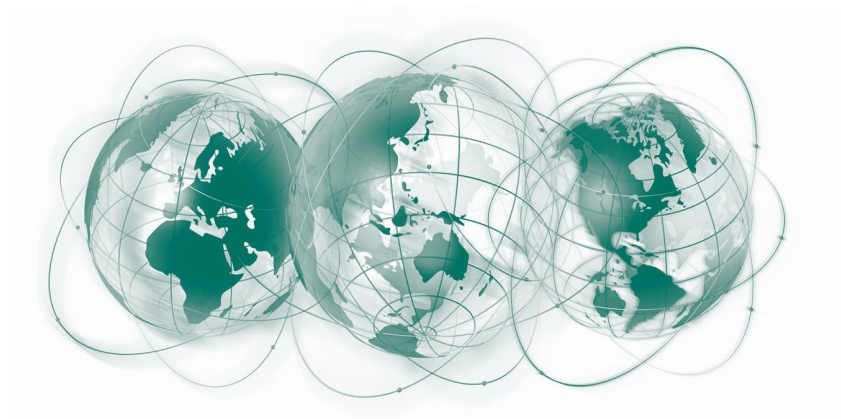
Golder Associates Pty Ltd GAP Form No. LEG04 RL1



At Golder Associates we strive to be the most respected global group of companies specialising in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organisational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

[solutions@golder.com](mailto:solutions@golder.com)  
[www.golder.com](http://www.golder.com)



**Golder Associates Pty Ltd**  
**Building 7, Botanicca Corporate Park, 570 – 588**  
**Swan Street**  
**Richmond Victoria 3121**  
**Australia**  
**T: +61 3 8862 3500**

