



# **Waterview Operational Air Quality Monitoring Report May 2018**

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Document No: [Subject]

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# 1 INTRODUCTION

## 1.1 OVERVIEW

The Waterview Tunnel opened on 02 July 2017. This report includes analysis of validated air quality monitoring data for Waterview Tunnel Joint Operations (WTJO) for the period May 2018. This air quality monitoring report has been prepared in accordance with Waterview Connection BOI Operational Air Quality Condition OA.4.

## 1.2 WATERVIEW OPERATIONAL AIR QUALITY REQUIREMENTS

Waterview Connection BOI Operational Air Quality Conditions OA.2 – OA.8 (refer Appendix A) set out the requirements for monitoring of ambient air quality in the vicinity of the tunnel portals and of emissions from one of the tunnel portals.

Two ambient air quality stations (one near the northern end and one near the southern end of the Waterview Tunnel) and one portal analyser are required to be operated for a minimum period of 2 years. The two ambient stations measure concentrations of particulates (PM<sub>2.5</sub> & PM<sub>10</sub>) and nitrogen dioxide (NO<sub>2</sub>) as well as wind speed and wind direction. The portal analyser measures concentrations of NO<sub>2</sub>.

Condition OA.2 stipulates that the results of ambient monitoring are to be compared with the National Environmental Standards for air quality and Auckland Regional air quality targets, which are shown in Table 1.

Table 1. WTJO ambient air quality criteria

Pollutant	Threshold concentration	Averaging period
Fine particles (PM <sub>10</sub> )	50 µg/m <sup>3</sup> 20 µg/m <sup>3</sup>	24-hour Annual
Fine particles (PM <sub>2.5</sub> )	25 µg/m <sup>3</sup> 10 µg/m <sup>3</sup>	24-hour Annual
Nitrogen dioxide	200 µg/m <sup>3</sup> 100 µg/m <sup>3</sup> 40 µg/m <sup>3</sup>	1-hour 24-hour Annual

This monitoring is required to continue until the Air Quality Peer Review Panel (required under condition OA.7) recommend that it is no longer necessary. Results are required to be reported monthly for the first 12 months and quarterly thereafter (OA.4).

## 1.3 MONITORED PARAMETERS AND LOCATIONS

Monitoring locations are shown in Appendix B. Locations and types of instrumentation have been agreed with Auckland Council and the Air Quality Peer Review Panel.

A portal monitoring station with Cavity Attenuated Phase Shift Spectroscopy (CAPS) NO<sub>2</sub> analyser has been installed at the rear of 93 Hendon Avenue near the Southern portal, to monitor NO<sub>2</sub> in accordance with the requirements of consent condition OA.2 and to demonstrate compliance with consent condition OA.8. The portal station is located approximately 80 m from the southern tunnel portal on the residential boundary (40 m from SH20). SH20 is screened from the nearest receptors within the southern approach trench.

Two ambient air quality monitoring stations have been installed to monitor particulates (BAM-1020 analysers, PM<sub>10</sub> and PM<sub>2.5</sub>), nitrogen dioxide (Chemiluminescence NO<sub>x</sub> analyser), wind speed and wind direction in accordance with conditions OA.2 and OA.3.

The southern ambient air quality station is located in the approximate location of the original pre-construction baseline monitoring for the WTJO, near 5 Barrymore Road. The southern station is also located adjacent to the residential area at Hendon Avenue, approximately 470 m from the southern tunnel portal (25 m from SH20) where SH20 achieves grade.

Under condition OA.2, the northern ambient air quality station is required to be located at Waterview School subject to agreement by the School; this agreement was not secured. The northern station is therefore located in the approximate location of the original pre-construction baseline monitoring for the WTJO, near the operation maintenance building. This station is located approximately 100 m from the northern tunnel portal downwind in the prevailing wind direction (25 m from SH20, 330 m SH16 and 20 m from Great North Road), with no obstruction between the adjacent traffic sources and air quality station. This location is likely to experience higher levels than the proposed location at the School and is therefore considered conservative.

## 1.4 DATA MANAGEMENT

Data are downloaded and checked daily by suppliers Ecotech and monthly validated reports provided to the WTJO. A daily summary of results (non-validated data) is provided to the WTJO and, in the event that WTJO air quality criteria are exceeded, email/text alerts are sent, so investigation can be initiated.

Ecotech calibrates the air quality stations on a monthly basis, and attend the site if a fault is detected during the daily checks. Calibration and equipment fault reports are forwarded to the WTJO.

The valid data exception report for May 2018 is attached as Appendix C.

## 2 MONITORING RESULTS AND ANALYSIS

### 2.1 SUMMARY STATISTICS

A comparison of the monitored levels of NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> against the WTJO air quality criteria is shown in Table 2 for May 2018. This shows that measured air quality concentrations were below the WTJO ambient air quality criteria.

Monitoring sites used for compliance monitoring should achieve at least 95% data capture and a minimum of 75% valid data should be collected when calculating averages<sup>1</sup>. All monitoring stations achieved the requirements for 75% valid data and 95% data capture in May 2018.

Data measured in previous months is summarised in Appendix D and original baseline data in Appendix F.

Table 2. Air quality monitoring results for May 2018

AQ Station	Description	% valid data capture	% data capture	Concentration in µg/m <sup>3</sup>	WTJO air quality criteria in µg/m <sup>3</sup>
Northern ambient air quality station	Maximum 1-hour average NO <sub>2</sub>	96.1	100	83.5	200
	Maximum 24-hour average NO <sub>2</sub>	94.9	100	46.4	100
	Maximum daily average PM <sub>2.5</sub>	99.1	100	21.8	25
	Maximum daily average PM <sub>10</sub>	98.9	99.7	29.9	50
Southern ambient air quality station	Maximum 1-hour average NO <sub>2</sub>	96.2	99.5	64.8	200
	Maximum 24-hour average NO <sub>2</sub>	94.4	99.3	36.5	100
	Maximum daily average PM <sub>2.5</sub>	98.0	98.8	21.9	25
	Maximum daily average PM <sub>10</sub>	97.6	98.9	26.5	50
Portal air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	94.5	98.0	78.7	200

### 2.2 EXCEEDENCES OF AIR QUALITY CRITERIA

The Waterview Connection BOI Operational Air Quality Condition OA.5 requires that when an exceedance of the WTJO air quality criteria occur, an investigation shall be undertaken into the cause of the exceedance and that this be reported to the Air Quality Peer Review Panel and Auckland Council.

There were no exceedances of the WTJO air quality criteria in May 2018.

Measured concentrations at all air quality stations were below the air quality criteria and less than 50% of the air quality criteria for NO<sub>2</sub>.

<sup>1</sup> Ministry for the Environment. 2009. Good Practice Guide for Air Quality Monitoring and Data Management 2009. Wellington: Ministry for the Environment.

## 2.3 POLLUTION ROSES

Pollution roses illustrate the relationship between wind direction and air pollutant concentrations. They are a useful tool to visualise the directions from which air pollution is received in order to identify potential air pollution sources. The wind directions in which the highest contaminant concentrations are measured would indicate the presence of upwind sources of that contaminant.

Pollution roses based on the hourly monitoring data are provided in Appendix E for May 2018.

In summary, the pollution roses show that:

- The highest NO<sub>2</sub> concentrations at the northern station were measured in wind directions ranging from west to northwest, from the direction of the adjacent SH20 alignment.
- The highest concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at the northern station were measured in winds from the east-northeast to east, from upwind of the SH20 alignment.
- The peak NO<sub>2</sub> concentrations at the portal station were distributed over a range of directions from south to west from the direction of the SH20 alignment and east-northeast to east, from upwind of the SH20 alignment (from the direction of Hendon Ave).
- The highest concentrations of NO<sub>2</sub> at the southern station were predominantly measured in winds from the west, from the direction of the SH20 alignment.
- The highest concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at the southern station were measured in wind directions ranging from the northeast to east, from upwind of the SH20 alignment.
- The NO<sub>2</sub> pollution roses indicate that the main source of NO<sub>2</sub> at the monitoring sites is likely to be traffic emissions. The PM<sub>10</sub> and PM<sub>2.5</sub> pollution roses for the northern and southern stations indicate that the highest concentrations were measured upwind of the SH20 alignment and may not be from a traffic-related source.

## 2.4 TRAFFIC DATA AND POLLUTANT TRENDS

The daily traffic flow through the Waterview tunnel during May 2018 is shown in Figure 1 below with daily average nitrogen dioxide concentrations. The traffic flow shows a distinct weekly pattern, with traffic flows generally increasing from Monday to Friday and dropping off at the weekend, with the lowest traffic flow on Sundays.

The northern air quality station shows the highest measured levels of NO<sub>2</sub>. The northern station is located closer to major traffic sources than the other two stations and has no obstruction between the adjacent traffic sources and the air quality station. The portal and southern stations show similar NO<sub>2</sub> concentrations.

The weekly pattern of PM<sub>2.5</sub> and PM<sub>10</sub> concentrations show a weak correspondence with daily traffic flows, as shown in Figure 2. PM<sub>10</sub> concentrations at the northern station were higher than those measured at the southern station and PM<sub>2.5</sub> concentrations were higher at the southern station than the northern station.

The average hourly diurnal patterns of NO<sub>2</sub> concentrations show a good correspondence with average hourly traffic flow, with the highest concentrations in the morning and afternoon around peak traffic times, as shown in Figure 3. Diurnal patterns of PM<sub>2.5</sub> and PM<sub>10</sub> concentrations do not show a strong correspondence with diurnal traffic flow, showing a morning peak, which is sustained throughout the day, as shown in Figure 4. In particular, the highest PM<sub>2.5</sub> concentrations occur in the evening (between 9 and 11 pm), after the afternoon traffic peak which occurs between 4 and 5 pm.

Trends in the monthly average NO<sub>2</sub> concentration measured each month since May 2017 are shown in Figure 5. These show the pollutant level changes after tunnel opening in July 2017 and the seasonality of NO<sub>2</sub> concentrations. Monthly average NO<sub>2</sub> concentrations have increased since January 2018, and are now similar to the concentrations in the first 3 months after opening.

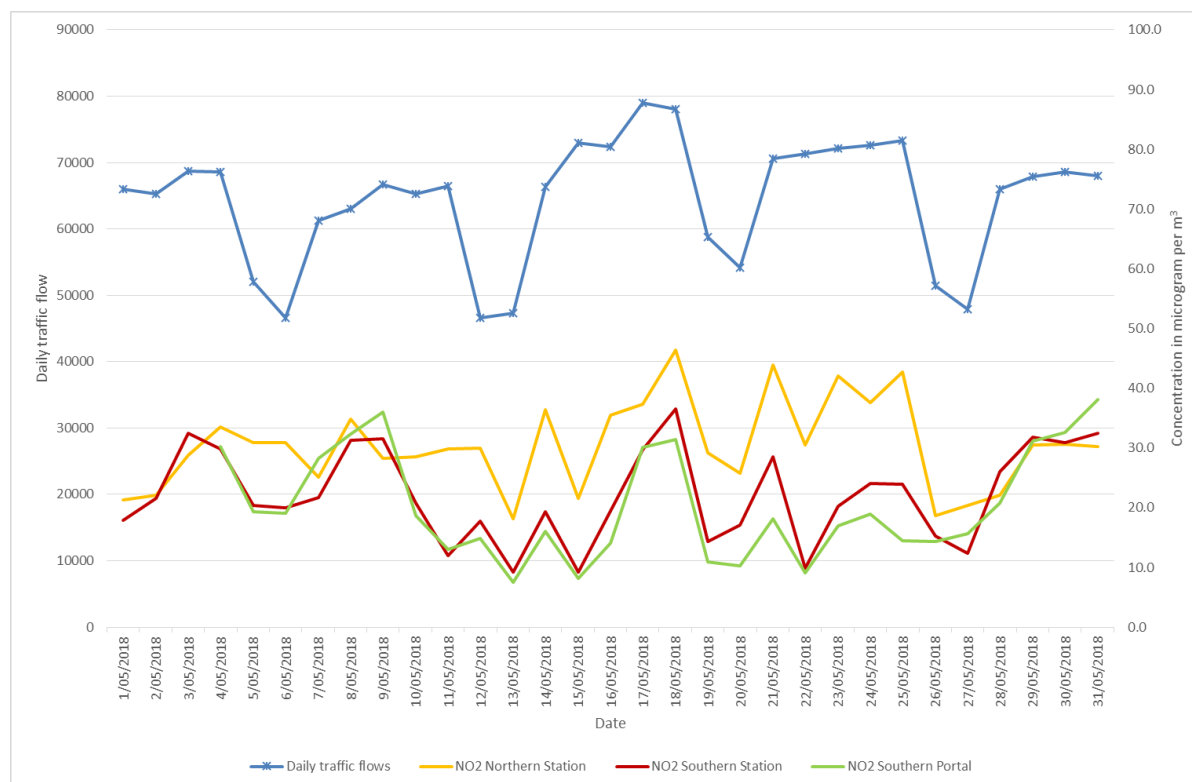


Figure 1: Waterview tunnel daily traffic flows and daily average NO<sub>2</sub>, May 2018

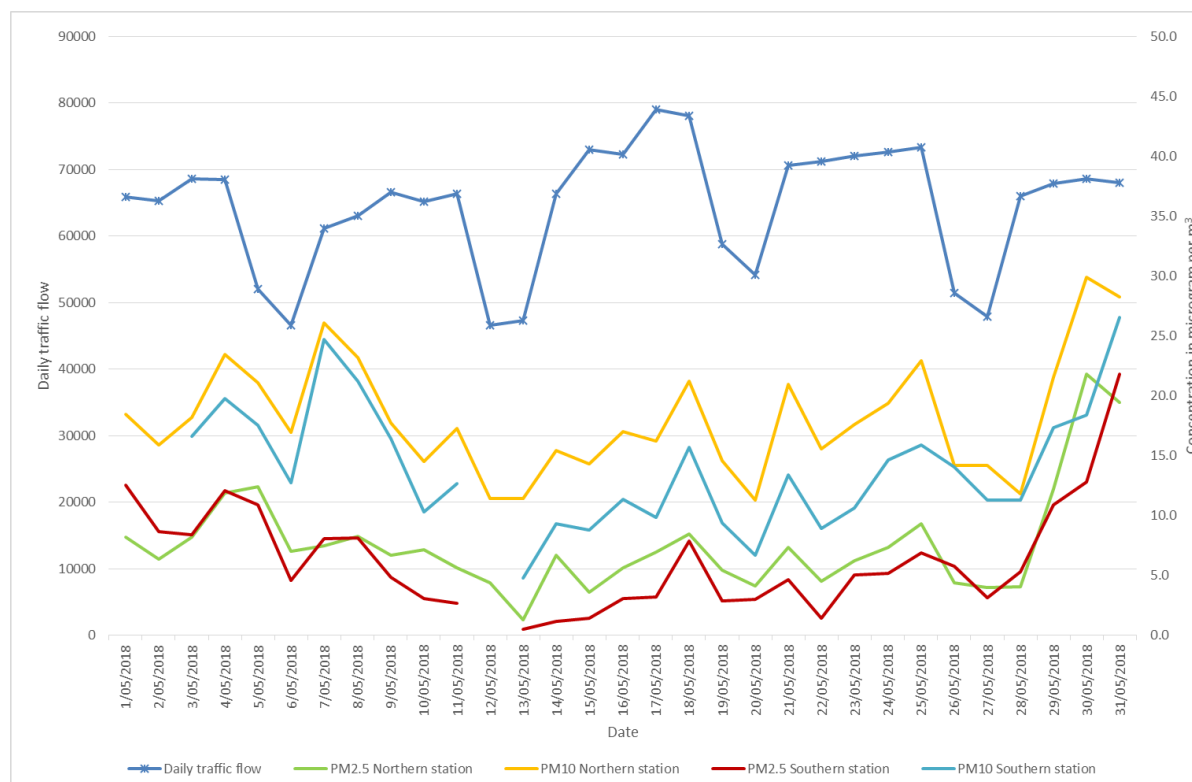


Figure 2: Waterview tunnel daily traffic flows and daily average PM<sub>2.5</sub> and PM<sub>10</sub>, May 2018

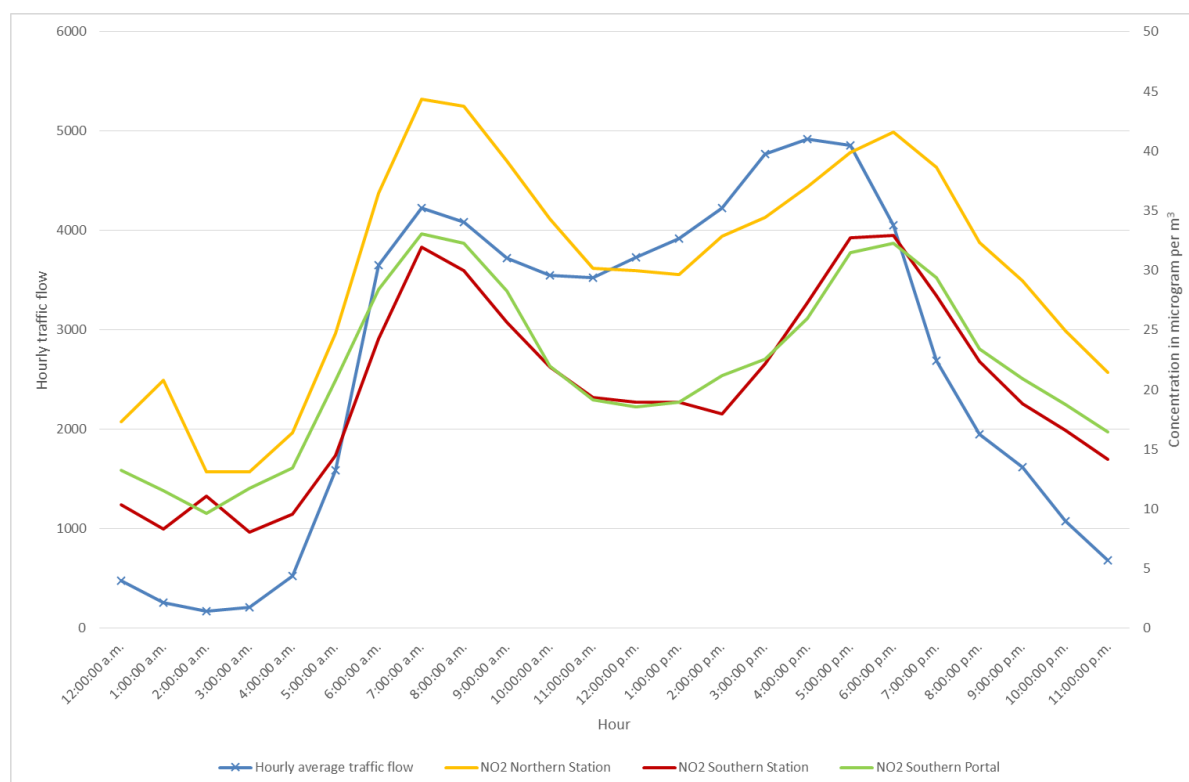


Figure 3: Diurnal hourly average traffic flow and nitrogen dioxide concentrations

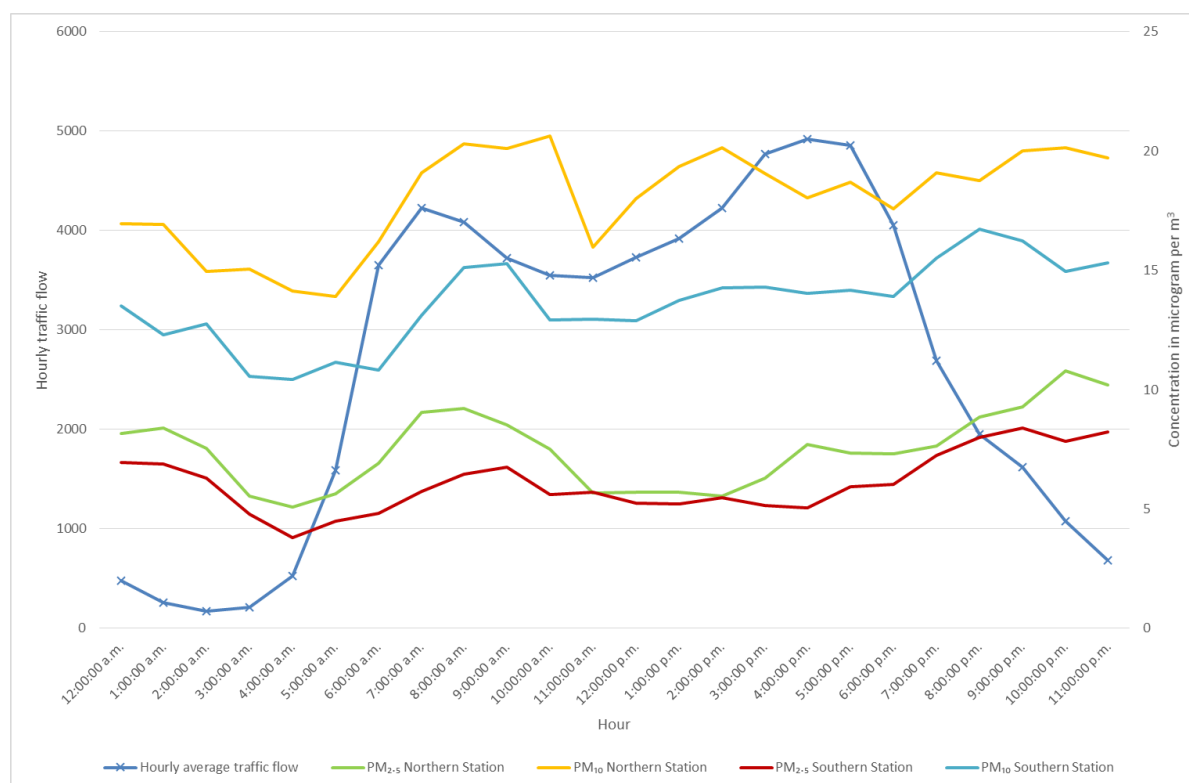


Figure 4: Diurnal hourly average traffic flow and PM<sub>2.5</sub> and PM<sub>10</sub> concentrations



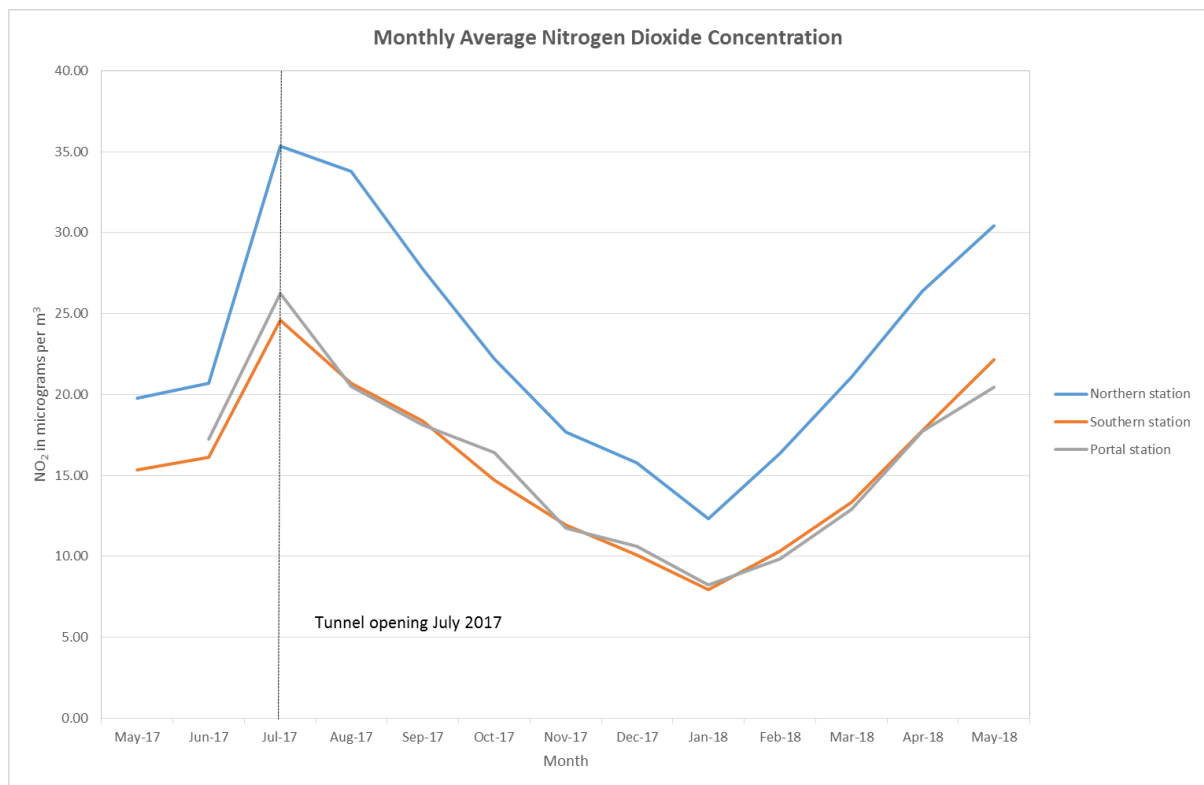


Figure 5: Monthly average nitrogen dioxide concentrations

### 3 CONCLUSION

This air quality monitoring report has been prepared in accordance with Waterview Connection BOI Operational Air Quality Condition OA.4, and includes analysis of validated air quality monitoring data for May 2018.

The analysis of NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> data for the two ambient air quality stations and NO<sub>2</sub> data for the portal air quality station has shown that measured air quality concentrations were below the WTJO ambient air quality criteria during May 2018.

All monitoring stations achieved the recommended 75% valid data capture for averaging and 95% data capture in May 2018.

Monthly average NO<sub>2</sub> concentrations have increased since January 2018. The highest measured concentrations of NO<sub>2</sub> were recorded at the northern station. This station is located closer to major traffic sources than the other two stations and has no obstruction between the adjacent sources and air quality station. The concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> were slightly higher at the northern station than the southern station.

Analysis of NO<sub>2</sub> pollution roses and diurnal trends indicates that the main source of NO<sub>2</sub> concentrations is traffic emissions.

The highest concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> were measured upwind of SH20 in May 2018. Additionally diurnal PM<sub>2.5</sub> and PM<sub>10</sub> concentrations do not correspond strongly with traffic flow. This indicates that traffic-related emissions are unlikely to be the main source of particulate concentrations in May 2018.

## APPENDIX A: AIR QUALITY CONDITIONS

**OA.1** The vents used to discharge emissions in the tunnels shall discharge vertically into air at a height of 15m, as follows: (a) The northern ventilation stack will be at a height of 15m. This height shall be calculated from the lowest existing ground level along the Great North Road boundary, adjacent to the ventilation stack; and (b) The southern ventilation stack will be at a height of 15m calculated from the post-construction ground level of the Alan Wood Reserve averaged at a distance of 10m from the exterior walls the ventilation stack location and shall not be impeded by any obstruction that may in the opinion of the Peer Review Panel (Condition OA. 7) decrease the vertical efflux velocity (in other words, the average velocity of material emitted into the atmosphere).

**OA.2** Prior to the tunnels becoming operational, the NZTA shall establish two ambient air quality monitoring stations and one portal air quality monitoring station. The location and types of these monitoring stations shall be selected by the NZTA in consultation with the Auckland Council and Peer Review Panel (Condition OA.7), providing that one ambient monitoring station will be located within the Waterview Primary School (subject to agreement by the School).

Ambient air quality shall be monitored continuously in real time, to monitor potential effects associated with the operation of the ventilation system from the tunnels. Ambient monitoring shall include fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) and nitrogen dioxide. Portal monitoring shall include nitrogen dioxide. Results shall be compared with the relevant National Environmental Standards for air quality and Auckland Regional air quality targets (as identified in Chapter 4 of the Auckland Regional Plan: Air, Land and Water, 2010). Monitoring shall be undertaken at each site until the Peer Review Panel recommends that monitoring is no longer necessary. The locations, operation and maintenance schedules of the continuous monitors shall, as far as practicable, comply with the requirements of AS/NZ 3580.1.1: 2007 Method for Sampling and Analysis of Ambient Air – Guide to Siting Air Monitoring Equipment, and with methods specified in the National Environment Standards.

**OA.3** Continuous monitoring of wind speed and direction shall be undertaken at each ambient air quality monitoring location as required by Condition OA.2. The locations of wind speed and direction monitors shall, as far as practicable, comply with the requirements of AS 2923:1987 Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications.

**OA.4** For the first 12 months of tunnel operation, the results of the ambient air quality monitoring shall be reported via validated reports and issued for information via the Project website (monthly). Following this period, and for a period of at least 12 months, reporting shall take place quarterly as follows: Quarter 1 (December to February) by 31 March, Quarter 2 (March to May) by 30 June, Quarter 3 (June to August) by 30 September and Quarter 4 (September to December) by 31 December.

**OA.5.** If the monitoring required by Condition OA.2 shows that concentrations of contaminants in ambient air at the monitoring locations exceeds the relevant National Environmental Standards for air quality, or Regional Air Quality Targets (as identified in Chapter 4 of the Auckland Regional Plan: Air, Land and Water), the NZTA shall undertake an investigation into the cause of the exceedance and report this to the Peer Review Panel (Condition OA.7) and the Major Infrastructure Team Manager, Auckland Council.

**OA.6.** The air quality monitoring shall be undertaken in general accordance with the Operational Air Quality Management Procedure (Appendix O of Technical Report G.1 Assessment of Air Quality Effects) submitted with this application.

**OA.7.** A Peer Review Panel shall be appointed by NZTA with the agreement of Major Infrastructure Team Manager, Auckland Council for the purpose of reviewing the ambient air quality monitoring programme and results. The Peer Review Panel shall consist of two independent experts in air quality with experience in ambient air quality monitoring and emissions from motor vehicles. The Peer Review Panel shall review all ambient monitoring, relevant traffic data and tunnel emissions and provide a summary report including any interpretation and recommendations to NZTA, Auckland Council and the Community Liaison Group(s) within 6 months of the tunnels becoming operational and annually thereafter.

**O.A.8** The tunnel ventilation system shall be designed and operated to ensure that any air emitted from the tunnel portals does not cause the concentration of nitrogen dioxide (NO<sub>2</sub>) in ambient air to exceed 200 micrograms per cubic metre, expressed as a rolling 1 hour average, at any point beyond the designation boundary that borders an air pollution sensitive land use.

Advice Note: The above standard reflects the National Environmental Standard for Nitrogen Dioxide (NO<sub>2</sub>) concentration in ambient air.

## APPENDIX B: MONITORING LOCATIONS

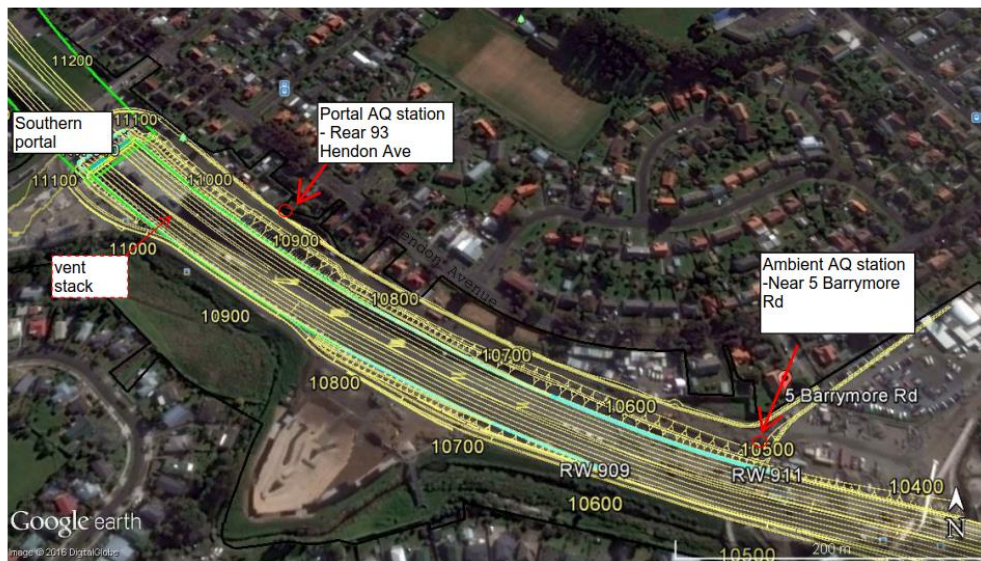


Figure B 1: Southern area stations

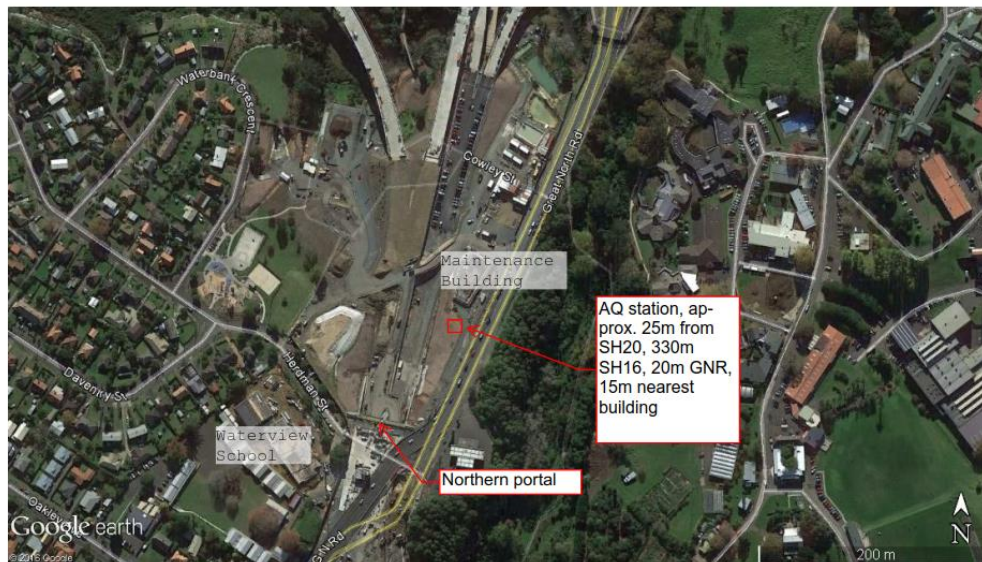


Figure B 2: Northern area station

## APPENDIX C: VALID DATA EXCEPTION REPORT

## North ambient air quality station

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/05/2018 1:00	31/05/2018 1:40	Automatic overnight span calibration check from approximately 1:00 - 1:40	NO, NO <sub>2</sub> , NO <sub>x</sub>	AE	15/06/2018
01/05/2018 16:00	01/05/2018 16:00	Unrealistic data spike	PM <sub>10</sub>	AE	15/06/2018
03/05/2018 12:00	03/05/2018 15:05	Scheduled monthly maintenance. Data intermittently affected	NO, NO <sub>2</sub> , NO <sub>x</sub> , PM <sub>10</sub> , PM <sub>2.5</sub>	AE	15/06/2018
04/05/2018 0:00	04/05/2018 0:00	Beta count error	PM <sub>10</sub>	AE	15/06/2018
30/05/2018 12:00	30/05/2018 17:35	Scheduled 6-monthly maintenance. Data intermittently affected	All parameters	AE	15/06/2018

## South ambient air quality station

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/05/2018 1:00	31/05/2018 1:30	Automatic overnight span calibration check from approximately 1:00 - 1:30	NO, NO <sub>2</sub> , NO <sub>x</sub>	AE	15/06/2018
02/05/2018 9:00	02/05/2018 15:00	Scheduled monthly maintenance. Data intermittently affected	NO, NO <sub>2</sub> , NO <sub>x</sub> , PM <sub>10</sub> , PM <sub>2.5</sub>	AE	15/06/2018
03/05/2018 0:00	03/05/2018 0:00	Beta count error	PM <sub>10</sub> , PM <sub>2.5</sub>	AE	15/06/2018
12/05/2018 1:00	12/05/2018 8:00	Power interruption followed by instrument stabilisation	All parameters	AE	15/06/2018
30/05/2018 19:00	30/05/2018 20:55	Scheduled 6-monthly maintenance	NO, NO <sub>2</sub> , NO <sub>x</sub>	AE	15/06/2018
31/05/2018 9:00	31/05/2018 12:00	Scheduled 6-monthly maintenance (cont.)	All parameters	AE	15/06/2018

## Portal air quality station

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/05/2018 0:45	25/05/2018 0:45	Automatic background check, nightly for 5 minutes	NO <sub>2</sub>	AE	15/06/2018
01/05/2018 2:00	31/05/2018 2:30	Automatic overnight span calibration check from approximately 2:00 - 2:30	NO <sub>2</sub>	AE	15/06/2018
02/05/2018 16:15	02/05/2018 17:45	Scheduled monthly maintenance	NO <sub>2</sub>	AE	15/06/2018
02/05/2018 17:50	03/05/2018 7:55	Unrealistic data caused by instrument fault with co-located NO <sub>x</sub> analyser	NO <sub>2</sub>	AE	15/06/2018
03/05/2018 8:00	03/05/2018 9:00	Unscheduled maintenance - co-located NO <sub>x</sub> analyser restarted. NO <sub>2</sub> readings returned to normal	NO <sub>2</sub>	AE	15/06/2018
04/05/2018 8:40	18/05/2018 6:55	Intermittent data transmission errors	NO <sub>2</sub>	AE	15/06/2018



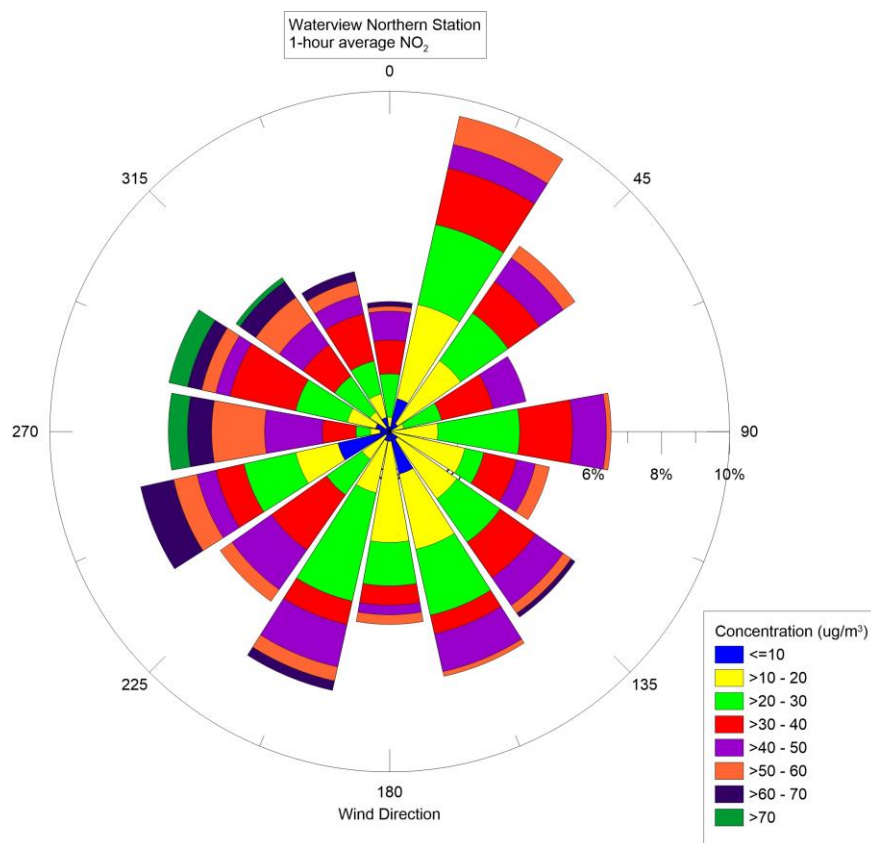
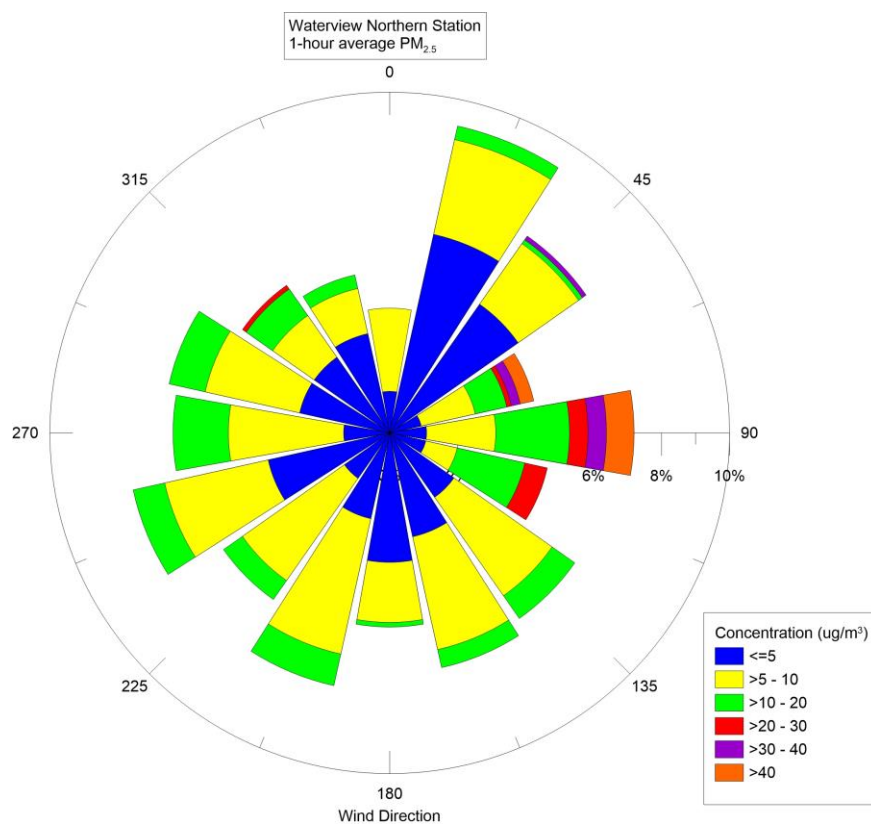
Start Date	End Date	Reason	Change Details	User Name	Change Date
26/05/2018 0:40	31/05/2018 0:40	Automatic background check, nightly for 5 minutes	NO <sub>2</sub>	AE	15/06/2018
30/05/2018 19:00	30/05/2018 20:15	Scheduled yearly maintenance	NO <sub>2</sub>	AE	15/06/2018
31/05/2018 12:35	31/05/2018 14:45	Scheduled yearly maintenance (cont.)	NO <sub>2</sub>	AE	15/06/2018

## APPENDIX D: PREVIOUS MONTHLY DATA

AQ Station	Description	Pre Tunnel Opening Concentration in $\mu\text{g}/\text{m}^3$		Post Tunnel Opening Concentration in $\mu\text{g}/\text{m}^3$											Project air quality criteria in $\mu\text{g}/\text{m}^3$
		May 2017	June 2017	July 2017	Aug 2017	Sept 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	
Northern ambient air quality station	Maximum 1-hour average $\text{NO}_2$	65.5	58.2	96.8	93.2	91.3	77.9	62.1	57.8	53.6	62.9	62.1	69.8	83.5	200
	Maximum 24-hour average $\text{NO}_2$	30.2	36.9	46.4	54.1	44.8	39.4	26.5	31.7	24.7	30.2	34.3	42.7	46.4	100
	Maximum daily average $\text{PM}_{2.5}$	<b>32.7</b>	24.9	24.8	16.9	14.0	10.5	11.3	10.8	16.0	13.1	11.3	14.4	21.8	25
	Maximum daily average $\text{PM}_{10}$	35.7	33.3	31.0	26.4	26.9	31.3	35.1	24.4	36.0	27.6	31	32.8	29.9	50
Southern ambient air quality station	Maximum 1-hour average $\text{NO}_2$	64.1	70.3	73.3	63.5	73.4	61.9	50.5	44.7	32.8	51.7	41.1	57.0	64.8	200
	Maximum 24-hour average $\text{NO}_2$	30.0	30.8	38.2	34.7	27.4	25.5	20.7	16.9	18.5	17.9	22.8	29.6	36.5	100
	Maximum daily average $\text{PM}_{2.5}$	23.2	19.1	<b>26.5</b>	12.6	12.1	13.3	9.8	8.1	14.0	9.8	11	15.9	21.9	25
	Maximum daily average $\text{PM}_{10}$	35.8	31.8	31.8	28.8	31.6	37.9	22.0	20.1	34.0	26.7	23.9	27.3	26.5	50
Portal air quality station	Maximum rolling 1-hour average $\text{NO}_2$	70.8	80.6	86.9	73.8	84.9	62.6	63.5	51.2	46.7	46	51	67.4	78.7	200

It should be noted that construction activities on site in the vicinity of the stations, including vehicle movements on haul roads, will have contributed to measured particulate levels pre tunnel opening. Baseline measurements of  $\text{PM}_{2.5}$  were also elevated in May 2017 during the night time due to domestic smoke from adjacent residential properties.

## **APPENDIX E: POLLUTION ROSES FOR MAY 2018**

Figure D 1: Northern station 1-hour average  $\text{NO}_2$ Figure D 2: Northern station 1-hour average  $\text{PM}_{2.5}$

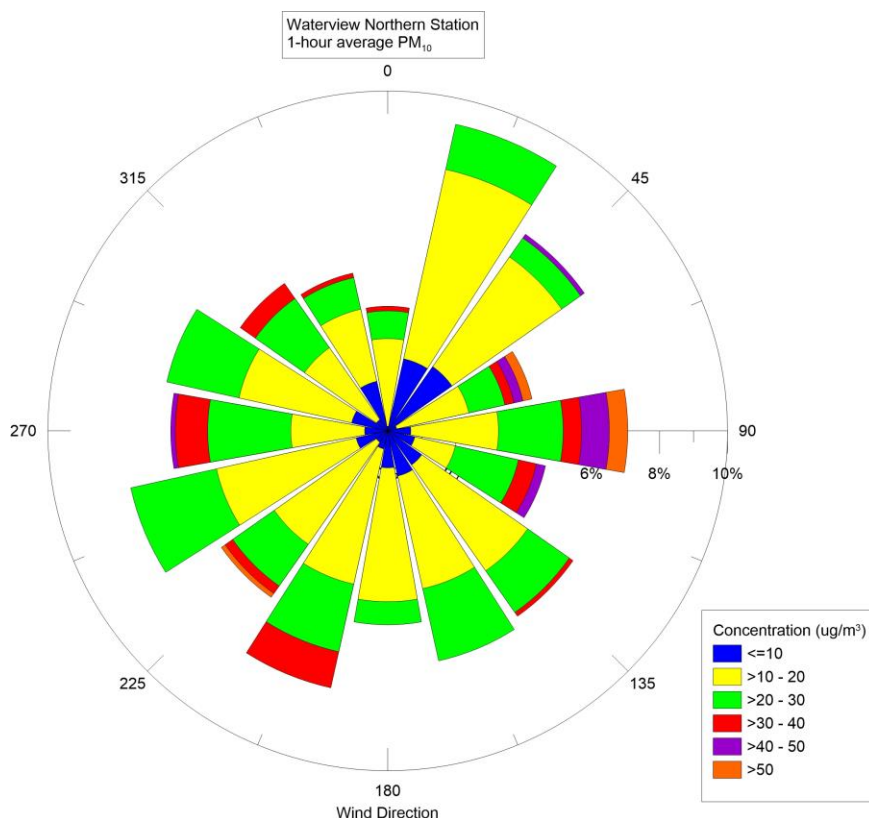


Figure D 3: Northern station 1-hour average PM<sub>10</sub>

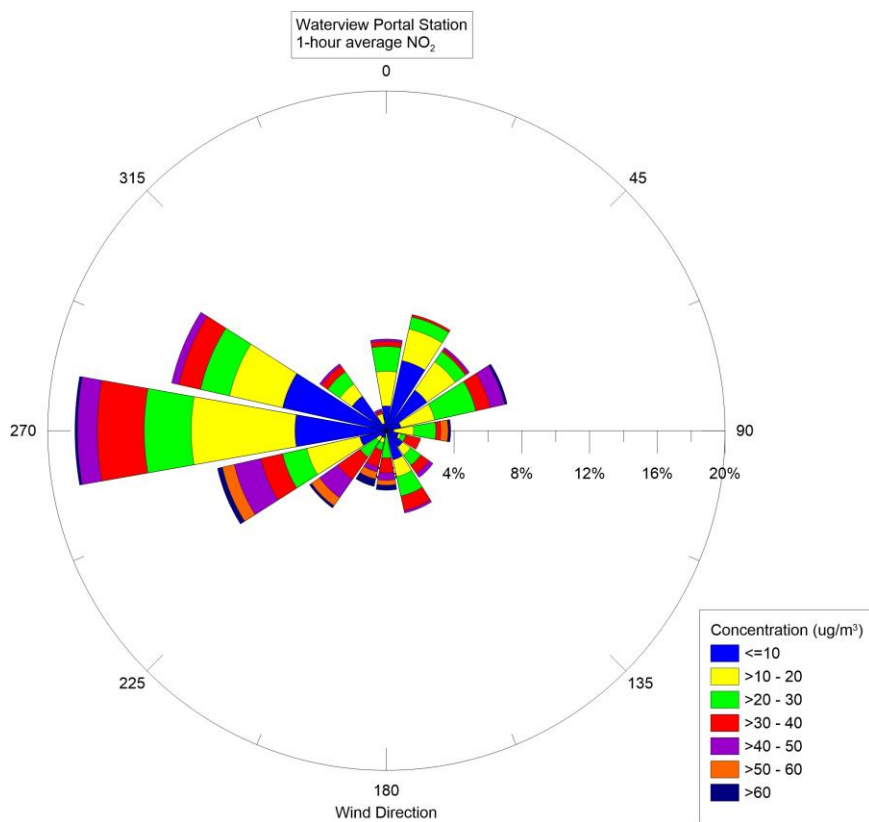
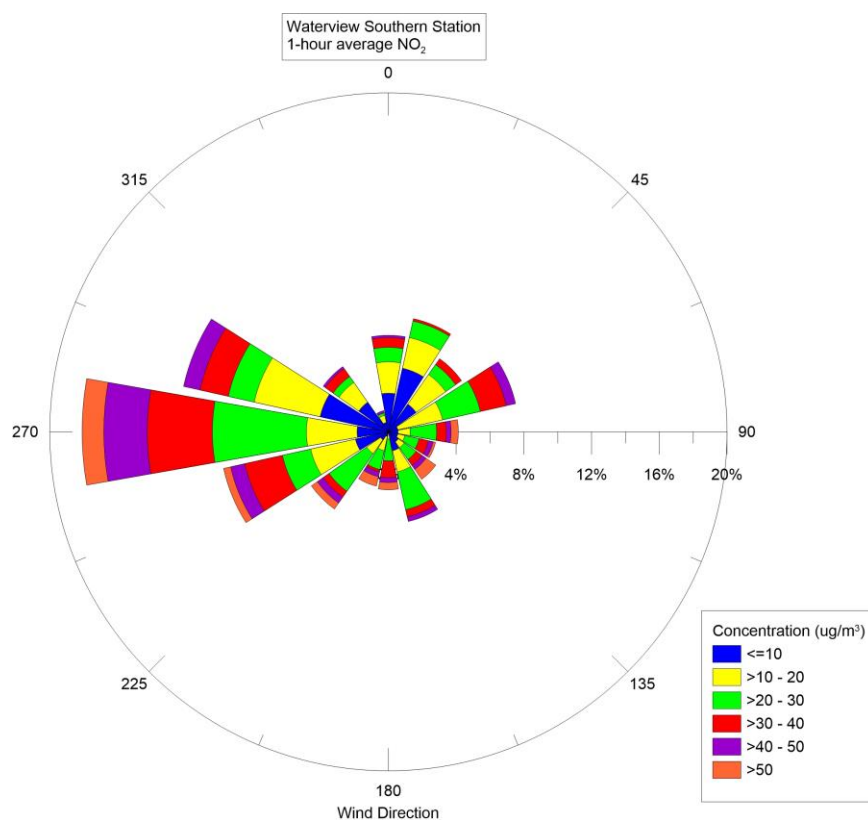
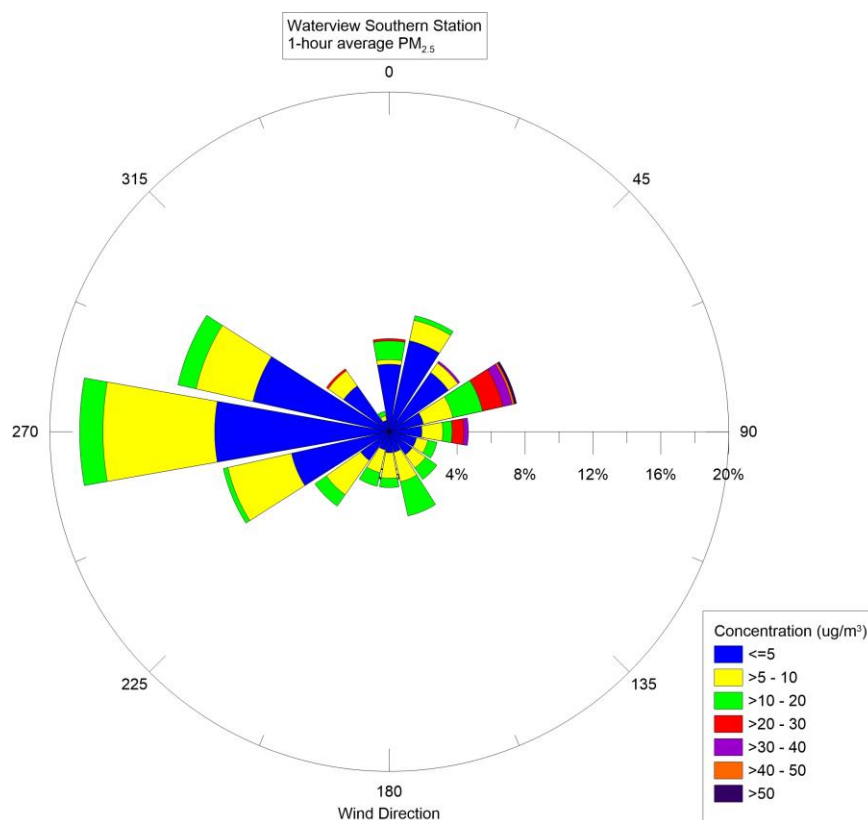


Figure D 4: Portal station 1-hour average NO<sub>2</sub>

Figure D 5: Southern station 1-hour average  $\text{NO}_2$ Figure D 6: Southern station 1-hour average  $\text{PM}_{2.5}$

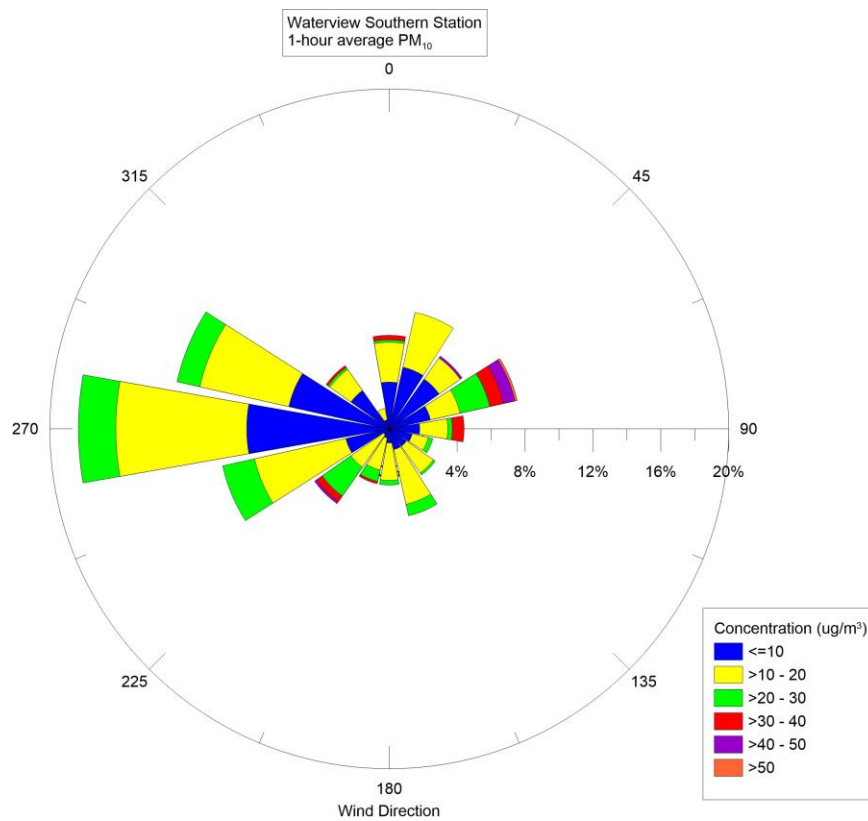


Figure D 7: Southern station 1-hour average  $PM_{10}$



## APPENDIX F: ORIGINAL BASELINE MONITORING DATA

Air Quality Station	Description	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06						
Northern Area - Cowley St air quality station	Maximum rolling 1-hour average NO <sub>2</sub>													
	Maximum 24-hour average NO <sub>2</sub>													
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>													
Southern Area - Alan Wood air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	55	59	59	53	112	39	57						
	Maximum 24-hour average NO <sub>2</sub>	25	34	31	26	86	17	19						
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>	32	44	23	22	19	63	22						
Air Quality Station	Description	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	
Northern Area - Cowley St air quality station	Maximum rolling 1-hour average NO <sub>2</sub>								55	66	61	50	44	
	Maximum 24-hour average NO <sub>2</sub>								29	36	28	30	23	
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>								25	32	28	28	24	
Southern Area - Alan Wood air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	28	35	37	53	56	56	61	51	61	44	42	38	
	Maximum 24-hour average NO <sub>2</sub>	10	13	15	27	34	32	28	20	25	18	17	13	
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>	21	19	19	19	32	35	22	31	17	24	24	14	
Air Quality Station	Description	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	
Northern Area - Cowley St air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	38	43	46	57	71	71	81	71	62	66	119	62	
	Maximum 24-hour average NO <sub>2</sub>	20	23	27	27	39	42	41	38	34	35	35	30	
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>	29	21	22	24	37	31	33	16	18	20	27	18	
Southern Area - Alan Wood air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	26	38	42	54	59	67	58	52	45	43	34	36	
	Maximum 24-hour average NO <sub>2</sub>		20	19	25	30	38	32	21	21	16	13	14	
	Maximum daily average PM <sub>2.5</sub>													
	Maximum daily average PM <sub>10</sub>	24	18	21	19	37	27	30	17	15	19	22	15	

Air Quality Station	Description	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Northern Area - Cowley St air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	74	265				55	103	99	77	93	83	80
	Maximum 24-hour average NO <sub>2</sub>	37	48				26	56	48	44	45	30	39
	Maximum daily average PM <sub>2.5</sub>												
	Maximum daily average PM <sub>10</sub>	20	29	26	29	27	50	43	32	135	31	33	25
Southern Area - Alan Wood air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	29	32	38	40	51	62	44	51	37			
	Maximum 24-hour average NO <sub>2</sub>	9	15	18	20	24	30	22	20	18			
	Maximum daily average PM <sub>2.5</sub>												
	Maximum daily average PM <sub>10</sub>	17	26	20	21	25	38	30	28	117			
Air Quality Station	Description	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10
Northern Area - Cowley St air quality station	Maximum rolling 1-hour average NO <sub>2</sub>	52	57	58	56	55	23	265	70	41	93	101	85
	Maximum 24-hour average NO <sub>2</sub>	29	30	33	33	28	11	46	22	22	30	34	27
	Maximum daily average PM <sub>2.5</sub>						16	29	34	10	10	13	8
	Maximum daily average PM <sub>10</sub>	21	27	23	20	28	20	35	39	26	27	22	30
Southern Area - Alan Wood air quality station	Maximum rolling 1-hour average NO <sub>2</sub>												
	Maximum 24-hour average NO <sub>2</sub>												
	Maximum daily average PM <sub>2.5</sub>												
	Maximum daily average PM <sub>10</sub>						44	40	37	24	26	22	30

Results taken from: *Ambient Air Quality Monitoring Summary Report, Beca 09 May 2011.*