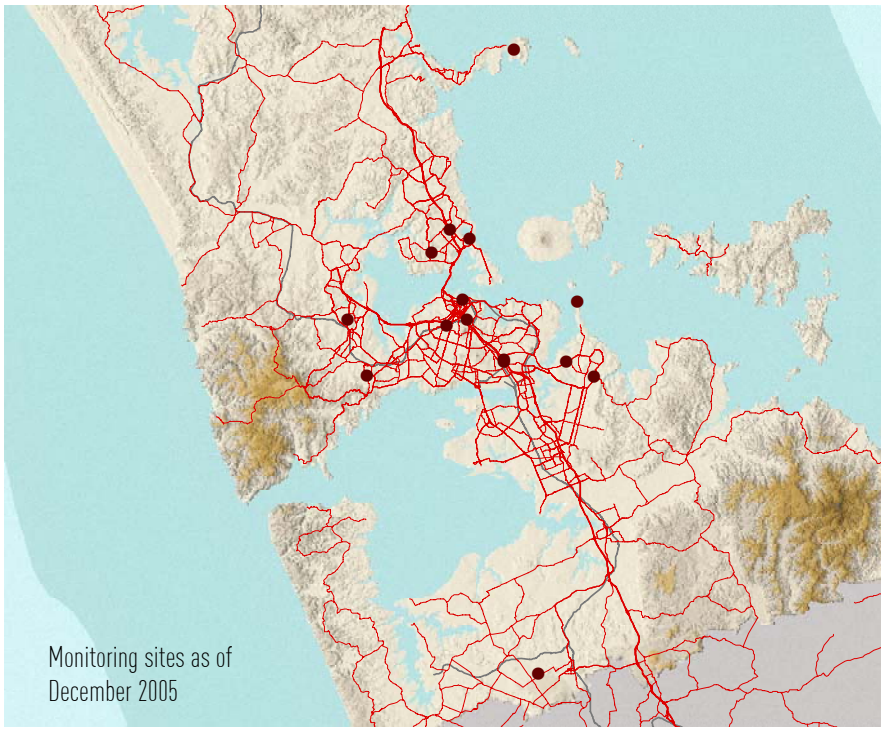
Auckland
Regional Council
TE RAUHITANGA TAIAO

The ambient air quality monitoring network in the Auckland Region

July 2006 TP296



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Introduction

This report summarises the Auckland region ambient air quality monitoring network as at December 2005, with an overview of where, what and how air pollutants are monitored. Metadata such as site description, surrounding area characteristics and local sources of air pollution are included for both current and discontinued monitoring sites.

Continuous instrumental ambient air quality monitoring has been performed in the Auckland region for several decades. The Auckland Regional Council (ARC) has data from 1964, which marks the commencement of total suspended particulate (TSP) and lead (Pb) monitoring by the former Department of Health (DoH). In addition to providing information for local and national bodies, three sites in Auckland have contributed data to the World Health Organisation (WHO) Global Environmental Monitoring (GEMS) programme since 1977. There have also been numerous short survey and passive monitoring programmes, although they are not covered in this report.

Early ambient air quality monitoring by the DoH was from two sites (Mt Albert and Penrose) measuring TSP as a weekly average and lead as a monthly average. The addition of sulphur dioxide (SO_2) and smoke in 1975, and oxides of nitrogen (NOx) in 1987 further expanded the monitoring programme. In 1991 the Resource Management Act (RMA 1991) repealed the Clean Air Act of 1972, and handed responsibility of air quality management to regional councils. By June 1993 the ARC had taken over the majority of ambient air quality monitoring in the region.

The current network

The current network for instrumental monitoring of ambient air quality comprises 13 permanent and one mobile site for pollutant monitoring, and three sites that measure meteorological parameters only. There are an additional six sites for survey-type, non-regulatory methods of monitoring ambient air quality; four of these were decommissioned at the end of 2005. Carbon monoxide (CO) is measured at eight sites, oxides of nitrogen (NOx) at ten sites; particulates at 12 sites; ozone (O_3) at four sites; lead at three sites and sulphur dioxide at one site. Continuous monitoring of benzene and 1,3 butadiene has also recently started at Khyber Pass Rd.

The network extends from Pukekohe to the Whangaparaoa Peninsula, and from Henderson to Botany Downs. Sites range in their scope; some monitor a single parameter, such as the non-regulatory pole -mounted Mini/MicroVols measuring PM_{10} on one in every three days; others measure a suite of pollutants on a continuous basis, have co-located meteorological equipment and house the analysing equipment in air conditioned sheds. Meteorological monitoring is now undertaken at all continuous sites because information on local meteorology is essential for understanding pollutant

sources, short term events, chemical reactions, the trends in data and why exceedences have occurred. There is one background rural PM_{10} site (Pukekohe), which is expected to provide information on the contribution of PM_{10} in the urban areas which may not be from urban sources.

Most sites are operated by the Auckland Regional Council alone; some are operated by local councils, or are Ministry for the Environment sites, with co-located ARC monitoring equipment. In both the latter cases the ARC has a data sharing arrangement with the sister organisation. For the ARC sites, the data collection and equipment maintenance is performed by contractors, specifically the National Institute of Water and Atmospheric Research Ltd (NIWA), and either the Institute of Environmental Science and Research Limited (ESR) to the end of 1999, or from 2000 the Laboratory Services – Air Quality Department of Watercare Services Limited (WSL).

The longest running still-current site is at Takapuna, in the grounds of Westlake Girls High School on the North Shore. This site has been operating since 1995, with meteorological parameters measured here since 1994. The most recent addition to the network is Ceramco Park in Glen Eden, which commenced monitoring in December 2005.

Changes to the monitoring network

Over the years since the commencement of air monitoring, the nature of monitoring and overall objectives have changed. This reflects international trends in monitoring, including increasing concern with smaller particles and hazardous air pollutants, improved instrumentation, and an improved understanding of air quality in Auckland. The main changes that have affected the monitoring network over the past 20 years include[1]:

- *Shift to monitoring smaller particles*. Initially particulate monitoring was comprised solely of total suspended particulates (TSP) monitoring as the main concern was soiling from dust as opposed to health impacts from finer inhalable or respirable dust. In 1994, the first PM_{10} (particles less than ten microns in size) monitor was installed in Penrose so that compliance with the 1994 Ambient Air Quality Guidelines could be monitored. The Ministry for the Environment (MfE) set the PM_{10} guideline on the basis of international standards that were promulgated with the recognition that PM_{10} concentrations were a better measure of particles associated with adverse health effects than TSP. With the increasing concern overseas and nationally about smaller particles in the $PM_{2.5}$ range (particles less than 2.5 microns in size), the

[1] For more information readers should also refer to ARC (1997) *TP88: Ambient Air Quality: Monitoring Results for the Auckland Region 1964 to 1995* and BW Graham & H Narsey (1993) *Air Pollution Monitoring in New Zealand 1960 – 1992, MESC Report S93/27 prepared for the Department of Health* Institute of Environmental Health and Forensic Sciences.

Auckland Regional Council also initiated monitoring of $PM_{2.5}$ at Mt Eden (Kelly St) in 1997.

- *Change in focus for gaseous pollutants*. Long term monitoring of sulphur dioxide commenced in Penrose[2] in 1975 due to the concern about potential levels of sulphur dioxide produced by industries using coal and heavy fuel oil in the local area. Over the years sulphur dioxide (SO_2) levels have decreased, except for a period when diesel vehicle use increased (leading to increased concentrations of SO_2) and prior to the introduction of lower sulphur fuel in Auckland. Concentrations of SO_2 are now generally low and therefore the network is not being expanded. However, a 'watching brief' is being held of the monitoring results from Penrose to ensure that concentrations do not increase as they did due to the influx of diesel vehicles in the mid-nineties.

  Long term carbon monoxide (CO) monitoring commenced in Queen St in 1991. Due to the number of exceedences of the eight-hour guidelines at that site (and subsequent sites) the network of carbon monoxide monitors increased over the years. Carbon monoxide concentrations have also generally fallen in recent years (with improved vehicle technologies) and, although monitoring of carbon monoxide will continue because there is still the potential for exceedences to occur, it is likely that this part of the network will be reduced as instruments are retired.

  Long term NOx monitoring for the Ministry of Health (MOH) commenced in Penrose[3] in 1987 with initial concern about contribution to photochemical smog. Following overseas trends and concerns about the effects of nitrogen dioxide (NO_2) directly on human health, the number of NOx monitoring sites has slowly increased over the region. Takapuna and Henderson were selected for monitoring NOx because they were located near to major sources such as vehicles and industry (and they lie within the sea breeze circulation zone which can have additional contributions of pollutants generated by other parts of the city). Peak monitoring sites were also installed in Khyber Pass and Queen St and these sites frequently measure exceedences of guidelines and standards.

- *Concern about photochemical smog*. Early monitoring of ozone was undertaken in the 1970s mainly by the New Zealand Electricity Department to determine the effects of NOx emissions from proposed new gas fired power stations. The results of this monitoring indicated that elevated ozone concentrations do occur in the Auckland Region due to photochemical reactions. Permanent continuous monitoring commenced with the installation of an ozone analyser at the Mangere Wastewater Treatment Plant in 1995 (this

[2] Note: short term monitoring had also been undertaken at other locations prior to that (refer to report by BW Graham and H Narsey, 1993).
[3] Monitoring was also undertaken from 1978 to 1993 at the ESR offices at Fenton St, Mt Eden, although the ARC does not hold this data. Other short term studies had also been taken prior to that (refer report by BW Graham and H Narsey, 1993).

coincided with monitoring of the boundary layer using the acoustic sounder at the treatment plant). This site was moved to Musick Pt because prevailing winds (synoptic south-westerlies and sea breezes) push rush hour air pollutants past that location and then frequently return them later on in the day, allowing sufficient time for photochemical pollutants to form. Elevated ozone concentrations had also been measured at Musick Pt in the 1980s, further strengthening the case for selecting that site. NOx is monitored at Musick Pt so that the effects of photochemical reactions can be monitored (this site provides background information on NOx). Urban airshed modelling indicated that sites further from Auckland were likely to be affected by elevated ozone and hence the ozone monitoring sites at Pukekohe and Whangaparaoa were installed.

Results from the current monitoring sites show that there is continuing evidence of photochemistry occurring in the Auckland region and that elevated levels of ozone can occur during summer. Two eight-hour exceedences have been recorded at one site (Musick Pt) during 2002 and in the past all of the current sites have recorded peaks that are over 90% of the guidelines (for either or both of the 1-hr or 8-hr guidelines).

- *Move to more frequent and continuous monitoring*. Early sampling of TSP, PM_{10} and $PM_{2.5}$ was initially undertaken on a one in six day regime when concerns were primarily for nuisance effects. This monitoring was consistent with USEPA procedures, but there was concern that the sampling was too infrequent to give a reliable annual average and that a lot of the peaks may have been missed. The frequency of monitoring therefore changed from one in six day to one in three day sampling in early 2001 with growing concern for fine dust impacts on human health. Continuous sampling is necessary when considering human health risk so instruments were developed accordingly. The ARC have further upgraded the monitoring network over the past few years so that most of the PM_{10} monitoring sites are now continuously monitoring using Beta Gauge technology. Khyber Pass will be upgraded in early 2006. Queen St is the remaining site without continuous PM_{10} sampling, although daily 24-hr gravimetric samples are being collected there. In future, $PM_{2.5}$ monitoring sites will also be upgraded to continuous monitoring. Additional reasons for upgrading PM_{10} and $PM_{2.5}$ sites to Beta Gauges are that more information can be obtained about daily trends (and hence the effect of different sources) and because continuous monitors are more cost effective to operate and less prone to operator error than gravimetric sampling. Gravimetric sampling will continue in future for survey sampling (e.g. prior to setting up a new monitoring site), to co-locate with Beta Gauges at new sites (because the gravimetric Partisol sampling more closely matches the USEPA Federal Reference Method) and for speciation sampling.

Continuous monitoring has been undertaken for gaseous pollutants for many years, although earlier 24-hr data of SO_2 and NOx (collected for the MOH) is from wet chemistry methods.

- *Changes in air quality guidelines and standards*. International air quality standards for particulate matter and nitrogen dioxide have become more stringent in the last ten years because health studies have shown that the previous standards were not sufficient to protect the health of sensitive populations. The New Zealand ambient air quality guidelines for these pollutants were also reduced in 2002 to be consistent with these changes. Even with the lower limit of 50 $\mu g/m^3$ for PM_{10} (averaged over a 24-hr period), it is recognised that there are still likely to be health effects at concentrations below this and a 'no adverse effect level' has not yet been established internationally. WHO have determined adverse effects at 5$\mu g/m^3$ and have been using 7.5$\mu g/m^3$ as a start point for calculating health impacts and associated cost benefit analysis[4]. A greater level of health effects are produced by diesel particulate matter so speciation of particles is becoming more important. The MfE have recommended that if PM_{10} levels are within guideline levels, "*efforts should be made to maintain, and where possible, further reduce levels*"[5].

  Overseas and New Zealand studies have also recently highlighted the relative exposure of populations to the chronic effects of long term exposure to lower peaks but higher average background concentrations, particularly for PM_{10}. This was recognised in the MfE 2002 amendment to the ambient air quality guidelines, when the recommended maximum annual concentration was reduced from 40 $\mu g/m^3$ to 20 $\mu g/m^3$. Some future monitoring sites in Auckland will be established so that the long-term exposure to PM_{10} at locations with lower peaks but typically higher long-term averages can be further investigated.

  In 2005, the Ministry for the Environment promulgated the National Environmental Standards for Air Quality. These standards require regional councils to monitor in areas where the standard is likely to be breached[6]. Based on data from recent years, it is expected that the standards for NO_2 and for PM_{10} will be breached in future in the Auckland airshed. There also is the potential for the CO and ozone standards to be breached. Therefore the ARC will continue to monitor these parameters in the region.

[4] Künzli, N., Kaiser, R., Medina, S., Studnicka, M., Chanel, O., Filliger, P., Henry, M., Horak, F., Puybonnieux-Texier, V., Quenel, P., Schneider, J., Seethaler, R., Vergnaud, J-C., and Sommer, H. (2000). Public-health impact of outdoor and traffic-related air pollution: a European assessment, *The Lancet*, Vol 356, September 2000, pp 795-801.
[5] Ministry for the Environment (2002) *Ambient Air Quality Guidelines*
[6] Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004, SR 2004/309, September 2004.

Over the past few years, two long-term sites at Penrose Great South Road (1964-2004) and Mt Eden Kelly St. (1982-2005) have been decommissioned. The loss of the long-term sites is regrettable for it represents the closure of an extended dataset, which can be invaluable for observation of long term trends in ambient air quality. New sites can be difficult to procure, as they must be carefully selected in order to attain the multiple goals of long-term tenure, site security and accessibility, whilst also being representative of the area to be monitored. The site must be as far as possible compliant with AS2922 –1987 Australian Standard for Ambient Air – Guide for the Siting of Sampling Units[7]. Furthermore, the planning process can mean that a considerable period of time elapses between selection of a suitable location that meets all the criteria, and the commencement of monitoring.

Structure of this report and source material

The report contains tables presenting a summary of ambient air quality and meteorological sites, followed by a site inventory. Current site profiles form the main part of the document, with discontinued sites in the appendix. Explanation of terms used in the metadata can also be found in the appendix.

The content of this report is sourced primarily from technical publications (TPs) of ambient air quality data, the ARC metadata files, the monthly, quarterly and annual monitoring reports prepared for the ARC by NIWA and WSL, and the GEMS reports. In some instances specific site visits were made to clarify detail. Not all site information was available for past sites and in these cases the information was therefore left blank.

The precise number of sites that have been operated in the region depends on how sites are classified. Where a site has been relocated in a minor way, but has essentially retained similar characteristics (e.g. Queen St, which has had several locations within a few city blocks) the data has been treated as continuous. Therefore while this metadata report details 45 sites, the monitoring data will record fewer.

[7] Manuell, D. (ed) (2000) *Air Pollution Measurement Manual Volume 3 Australian Standards Fifth Edition* The Clean Air Society of Australia and New Zealand.

Table 1: Current ambient air quality monitoring at sites in the Auckland region and the meteorological parameters measured on site (table continues over page). Start date is for the site only and may vary for individual pollutant monitoring.

Site Name	NZTM Easting	NZTM Northing	City	From	Pollutants Monitored in 2005 (method)	Meteorological Parameters Measured (mast height above ground)
Botany Downs	1771363	5912351	Manukau	01.10.03	PM_{10} (Beta Gauge)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Rainfall, Solar Radiation (6 m)
Glen Eden (Ceramco Park)	1747144	5912490	Waitakere	01.12.05	CO NOx PM_{10} (Beta Gauge)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
Henderson I (A) (Lincoln Rd)	1745140	5918533	Waitakere	15.12.93	CO NOx PM_{10} (Beta Gauge, Partisol)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
Khyber Pass	1757826	5918507	Auckland	29.10.96	CO NOx PM_{10} (Partisol) $PM_{2.5}$ (Partisol) Benzene & 1,3 Butadiene	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (12.8m)
Kingsland (Kowhai)	1755691	5917772	Auckland	02.04.04	NOx PM_{10} (Beta Gauge, Partisol) $PM_{2.5}$ (Partisol), TSP/ Lead Ozone	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)

Table 1 (cont):

Site Name		NZTM Easting	NZTM Northing	City	From	Pollutants Monitored (method)	Meteorological Parameters Measured (mast height above ground)
Mt Eden II (B) (Kelly St Shed)*		1756895	5918020	Auckland	06.02.01	NOx PM_{10} (Beta Gauge, Partisol) $PM_{2.5}$ (Partisol)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity (6m)
Musick Point II (Telecom Building)		1769523	5920383	Manukau	04.02.99	NOx Ozone	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (17m)
Pakuranga		1768407	5913944	Manukau	26.06.98	CO PM_{10} (Beta Gauge)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
Penrose II (B) (Gavin St Substation)		1761751	5914176	Auckland	06.01.87	NOx PM_{10} (Beta Gauge, HiVol) TSP/Lead Speciation Sampling SO_2	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
Penrose IV	A	1761741	5914109	Auckland	05.03.04	CO	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
(Gavin St Mobile)	B	1761713	5914132		16.06.04	NOx	
	C	1761744	5914201		08.10.04	PM_{10} (Beta Gauge)	
	D	1761666	5914111		09.03.05		

*Site decommissioned 20 January 2006

Table 1 **(cont):**

Site Name	NZTM Easting	NZTM Northing	City	From	Pollutants Monitored (method)	Meteorological Parameters Measured (mast height above ground)
Pukekohe	1765441	5880820	Manukau	21.10.96	Ozone PM_{10} (Beta Gauge)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation, Rainfall* (10m)
Queen St II (CML Building)	1757414	5920573	Auckland	22.12.82	CO NOx PM_{10} (Sequential Partisol) $PM_{2.5}$ (Partisol).	Nil
Takapuna I (Westlake)	1756059	5928077	North Shore City	31.05.95	CO NOx PM_{10} (Beta Gauge, Partisol)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (10m)
Whangaparaoa	1762823	5947227	Rodney	09.04.98	Ozone	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation** (10m)

*Note: Pukekohe met data is owned by NIWA
**Note: Whangaparaoa meteorological parameters are not measured on site but can be obtained from a MetService site approximately 1.5km to the northeast. Met data is owned by NIWA.

Table 2: Sites with non-regulatory, survey methods of monitoring ambient air quality (meteorological parameters not measured).

Site Name	NZTM Easting	NZTM Northing	City	From	To	Pollutants Monitored (method)
Beach Haven	1751851	5927391	North Shore City	16.06.03	17.09.03	PM_{10} (MicroVol)
Glen Eden II (Glen Eden Intermediate)	1747187	5912361	Waitakere	03.01.01	31.12.05	PM_{10} (MiniVol)
Glenfield	1753009	5928435	North Shore City	16.06.03	31.12.05	PM_{10} (MiniVol)
Henderson I (B)	1745010	5918588	Waitakere	17.09.00	29.12.05	PM_{10} (MiniVol)
Highbury (Bank St)	1754067	5925628	North Shore City	16.06.03	Ongoing	PM_{10} (MicroVol)
Manurewa II (Manurewa South Primary School)	1768599	5899827	Manukau	28.08.01	31.12.05	PM_{10} (MiniVol)
Manurewa III (Manurewa West Primary School)	1767863	5900689	Manukau	28.08.01	31.12.05	PM_{10} (MiniVol)
Takapuna II (Lake Rd)	1758067	5927171	North Shore City	16.06.03	Ongoing	PM_{10} (MicroVol)

Table 3: Past ambient air quality monitoring sites in the Auckland region and the meteorological parameters measured on site (continues over page). Start /finish dates are for the site only and may vary for individual pollutant monitoring.

Site Name	NZTM Easting	NZTM Northing	City	From	To	Pollutants Monitored (method)	Meteorological Parameters Measured (mast height)
Dominion Road I (Metropolitan Rentals)	1755966	5917151	Auckland	01.01.94	11.02.96	CO NOx	Nil
Dominion Road II (Veg Market)	1756071	5917343	Auckland	06.12.01	27.06.02	CO NOx	Nil
East Tamaki	1766483	5907649	Manukau	01.07.98	13.08.02	CO PM_{10} (Grimm Particulate Sampler)	Nil
Hobson Street	1756787	5919905	Auckland	05.09.96	31.03.00	CO	Nil
Mangere (Mangere Bridge)	1757853	5907384	Manukau	15.08.95	15.05.96	Ozone	Vertical Wind Profile Mixing Height (Acoustic sounder)
Manurewa I (Post Office)	1768721	5901000	Manukau	04.03.96	21.03.97	CO	Nil
Mt Albert	1753860	5915893	Auckland	31.01.64	17.01.96	TSP (HD MedVol)	Nil
Mt Eden I (Fenton St)	1756578	5918264	Auckland	06.03.75	31.12.83	TSP (HD Med Vol) Lead	Nil

Table 3 (cont):

Site Name	NZTM Easting	NZTM Northing	City	From	To	Pollutants Monitored (method)	Meteorological Parameters Measured (mast height)
Mt Eden II (A) (Kelly St ESR Bldg)	1756842	5918033	Auckland	29.12.82	31.01.01	NOx PM_{10} (Partisol) $PM_{2.5}$ (Partisol) TSP (HD Med Vol, Partisol) Lead	Nil
Musick Point (Gardeners' Shed)	1769506	5919367	Manukau	17.01.96	07.01.99	Ozone NOx	Wind Speed, Wind Direction (6m)
Newton (Canada St Mobile)	1756842	5919298	Auckland	03.07.02	07.03.03	CO NOx PM_{10} (Sequential Partisol)	Nil
Northcote	1756513	5926270	North Shore City	24.08.83	05.04.02	TSP (HD MedVol, Partisol) Lead	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation
One Tree Hill	1758130	5914091	Auckland	12.02.96	04.05.96	NOx	Nil
Penrose I (Great South Rd) Clinic Roof	1761872	5913547	Auckland	31.01.64	03.07.02	PM_{10} (HiVol, Partisol) $PM_{2.5}$ (Partisol) TSP/Lead (HD MedVol) SO_2 (Wet Chem.) Smoke	Nil
Penrose II (A) (Gavin Street Caravan)	1761730	5914177	Auckland	1989	2001	NOx	Nil

Table 3 (cont):

Site Name	NZTM Easting	NZTM Northing	City	From	To	Pollutants Monitored (method)	Meteorological Parameters Measured (mast height)
Penrose III (A) (ACI Trailer, Great South Rd)	1761847	5913542	Auckland	17.11.00	28.08.01	NOx SO_2 (Fluorescence) Smoke	Nil
Penrose III (B) (ACI Shed, Great South Rd)	1761847	5913542	Auckland	31.08.01	31.12.03	NOx PM_{10} (Partisol and TEOM) $PM_{2.5}$ (Partisol) TSP/Lead (HD MedVol) SO_2 (Fluorescence)	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation (6m)
Queen St I (Cruickshank and Miller)	1757325	5920228	Auckland	25.09.75	22.12.82	TSP (HD MedVol)	Nil
Queen St III (Tisdalls)	1757429	5920516	Auckland	01.01.91	30.06.00	CO	Nil
Sky Tower*	1757110	5920502	Auckland	03.04.98	29.03.04	Ozone	Wind Speed, Wind Direction, Temperature (318m above MSL)

*Note: Sky Tower met data is owned by NIWA

Table 4: Sites with 10m met masts only (no pollutant monitoring).

Site Name	NZTM Easting	NZTM Northing	City	From	Meteorological Parameters Measured
Henderson Te Pai Park	1745468	5919216	Waitakere	15.11.94	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation
Onehunga	1760436	5911538	Auckland	18.08.94	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation
Wiri	1766415	5904322	Manukau	26.05.95	Wind Speed, Wind Direction, Ambient Temperature, Relative Humidity, Solar Radiation

Site Inventory

Site name

Botany Downs

Address

Our Lady Star of the Sea School
14 Oakridge Way
Howick, Manukau

	Easting	Northing	Elevation (m)
NZMG	2681783	6474020	40
NZTM	1771363	5912351	

General site characteristics

Urban

Topography

Undulating with a general slope down towards the west.

Micro met characteristics

Well exposed to winds from all directions; slight sheltering from houses, fence and trees to the north.

Site - view from the west.

Site description and area characteristics

Air conditioned shed at the NW corner of playing fields at the school, next to a fence. Most houses in the area are <15 years old; large houses on medium sized (approximate average size -700m^2) sites; approximately 10% with chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 25 permits granted for new domestic fires. Few large trees in the area.

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential (during winter)

Distance from road and other major sources

Approx 10m W to school parking; 50m W to bus pickup/drop-off; approx 80m W to Oakridge Way and 50m NE to Crescent Hills Court (residential streets).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Tree ~5m high, 5m from shed.

AS2922 compliant?

No; tree ~5m high, ~5m from shed.

Monitoring commenced

01.10.03

Monitoring ceased

Ongoing

Pollutants monitored (current)

PM_{10} (Beta Gauge): 19.03.05 to date

Pollutants monitored (past)

CO: 01.10.03 – 31.01.05
TSP, PM_{10} and $PM_{2.5}$ (Grimm particulate sampler): 01.10.03 - 31.01.05

Inlet height (m)

3-3.5

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation, rainfall.

Mast height (m)

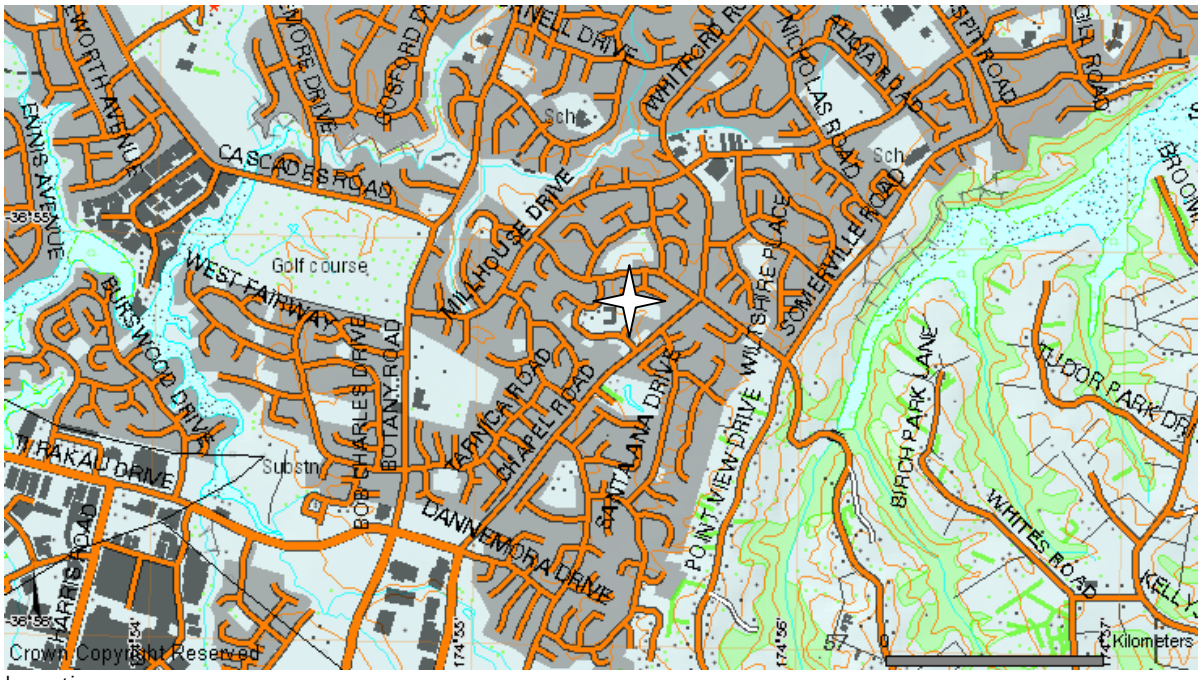
6 (up to end of Jan 2005 mast height was 8m).

Data Owner

ARC (Manukau City Council owns data up to the end of January 2005).

Site - view from the east.

View south from site.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Glen Eden
(Ceramco Park)

Address

Adjacent to 50 and 52 Meadowvale Rise
Ceramco Park
Glen Eden, Waitakere

	Easting	Northing	Elevation (m)
NZMG	2657563	6474207	40
NZTM	1747144	5912490	

General site characteristics

Urban

Topography

Undulating

Micro met characteristics

Hills to NE may influence wind flows from this direction.

Site viewed from the south.

Site description and area characteristics

Air conditioned shed at SE corner of park, 5m from house and 20m from road. Most houses in the area 1980s and newer (medium-sized sections, few chimneys), but Glen Eden to the N has a lot of older houses (1960s); larger sections, approx 75% with chimneys.

Air Quality Management Area

Urban

Predominant sources

Residential home heating (during winter) and some vehicle emissions

Distance from road and other major sources

20m S to Meadowvale Rise (residential street, aligned SW-NE)

Vehicle counts

N/a

Any nearby features that could affect measurements?

AS2922 compliant?

Yes

Monitoring commenced

01.12.05

Monitoring ceased

ongoing

Pollutants monitored (current)

CO: 01.12.05 to date
NOx: 01.12.05 to date
PM_{10} (Beta Gauge): 01.12.05 to date

Pollutants monitored (past)

Nil

Inlet height (m)

3.8 gas
4.0 particulate

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

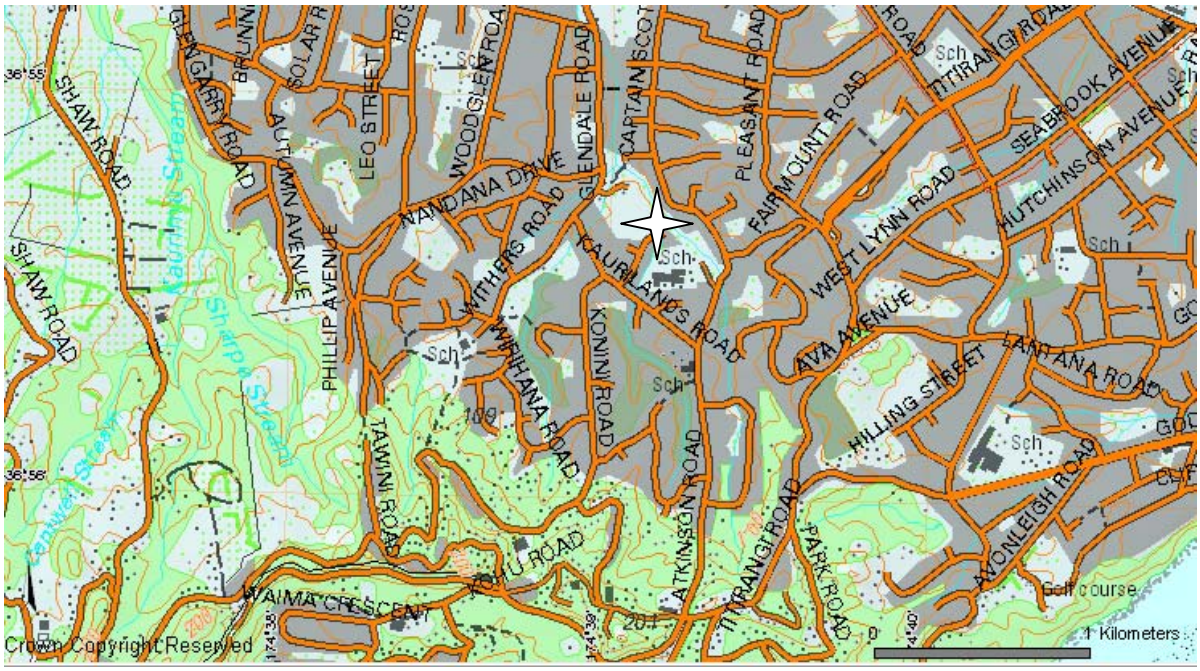
6

Data Owner

ARC

Site viewed from north, Meadowvale Rise beyond.

View west from site over Ceramco Park.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Henderson I (A)
(Lincoln Rd)

Address

Henderson Intermediate School
70 Lincoln Rd
Henderson, Waitakere

	Easting	Northing	Elevation (m)
NZMG	2655570	6480255	29.9
NZTM	1745140	5918533	

General site characteristics

Urban

Topography

Surrounding area is flat.

Micro met characteristics

Site is exposed to winds from all directions.

Site viewed from the south.

Site description and area characteristics

Air conditioned shed at the front of the Henderson Intermediate School grounds, approximately 10m from the western side of Lincoln Road. Henderson commercial district <1km N; Houses in area 1960s onward; approx 50% with chimneys. Note: PM_{10} Minivol (03.01.01 – 29.12.05) located approximately 150m NW of shed, in self contained housing attached to school building and facing north over playing fields.

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential (during winter)

Distance from road and other major sources

10 m E to Lincoln Road (arterial road, aligned N-S)

Vehicle counts

Lincoln Road 13,300 7 day ADT 1999.

Any nearby features that could affect measurements?

There are a number of trees (~ 8m tall, canopy ~6m diameter) to the west of the shed in the school grounds. There is a school incinerator > 20m W of the site. Parking for 25 cars within 50m of shed, plus parking for 6 cars (school drop off point) on access road adjacent to Lincoln Rd. Lighted pedestrian crossing 10m SE of site on Lincoln Rd.

AS2922 compliant?

No; 10m tree ~5m to SW, plus school incinerator ~25m to SW.

Monitoring commenced

15.12.93

Monitoring ceased

ongoing

Pollutants monitored (current)

CO: 12.06.98 to date
NOx: 11.04.03 to date
PM_{10} (Beta Gauge): 01.01.03 to date
PM_{10} (Partisol): 18.07.98 to date

Pollutants monitored (past)

TSP (HD Med Vol): 15.12.93 - 24.12.97
Lead: 15.12.93 - 31.12.97
PM_{10} (MiniVol (non regulatory method)):
01.01.03 – 31.12.05

Inlet height (m)

3.0 gas
3.5 particulate

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

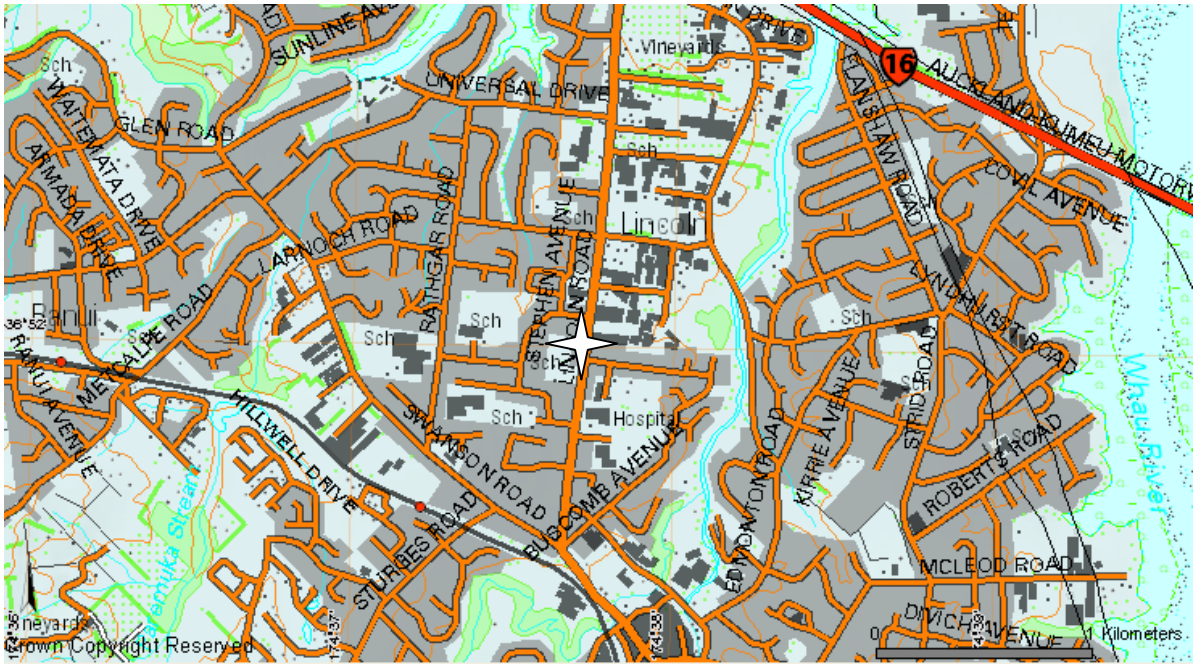
6

Data Owner

ARC

Site viewed from east side of Lincoln Road.

Inlets and met mast on roof of shed.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site name

Khyber Pass

Address

National Institute of Water and Atmosphere
269 Khyber Pass Rd
Newmarket, Auckland

	Easting	Northing	Elevation (m)
NZMG	2668258	6480203	60
NZTM	1757826	5918507	

General site characteristics

Urban

Topography

Khyber Pass slopes down gently W-E; Mountain Rd dips at the junction with Khyber Pass.

Micro met characteristics

Buildings on the southern side of Khyber Pass will shield the intakes from southern flow. The buildings on the southern side and the valley nature of the road may result in some canyon effect.

View east along Khyber Pass Rd towards Newmarket - gas inlet attached to side of building.

Site description and area characteristics

SE corner of Khyber Pass and Mountain Road intersection. Khyber Pass slopes down to the east and Newmarket shopping centre (700m E). The Southern Motorway is approx 250m W-SW from the site. Mixed residential to NW, (older houses -approximately 60% with chimneys)/commercial/light industry. Newmarket shopping precinct <1km E. Lion Nathan brewery is across the road to N; Auckland Domain is 250m to N.

Air Quality Management Area

Urban

Predominant sources

Vehicle

Distance from road and other major sources

Particulate inlet 1.5m E of Mountain Rd and 8m from intersection; gas inlet 3.9m S of Khyber Pass Rd (arterial, aligned WNW-ESE) and 12.5m from intersection. Traffic frequently queues beyond the position of the inlet. 250m W to Southern Motorway (aligned NW-SE).

Vehicle counts

27,027; 7 day average; Khyber Pass Rd, west of Mountain Rd (19/02/2006)

Any nearby features that could affect measurements?

Inlets adjacent to 3 storey NIWA building. The lighted intersection and sloping topography of Mountain Rd (dipping at the intersection) and Khyber Pass Rd will increase average vehicle emissions. Railway line 70m to NW.

AS2922 compliant?

No: but not deemed necessary as site purpose is to monitor peak pollutant levels.

Monitoring commenced

29.10.96

Monitoring ceased

ongoing

Pollutants monitored (current)

CO: 29.10.96 to date
NOx: 15.04.98 to date
PM_{10} (Partisol): 02.03.98 to date
$PM_{2.5}$ (Partisol): 03.10.02 to date
Benzene and 1,3 Butadiene:
September 2005 to date

Pollutants monitored (past)

Non-Methane Hydrocarbons:
17.07.96 - 31.10.01

Inlet height (m)

3.8 gas
3.0 particulate

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

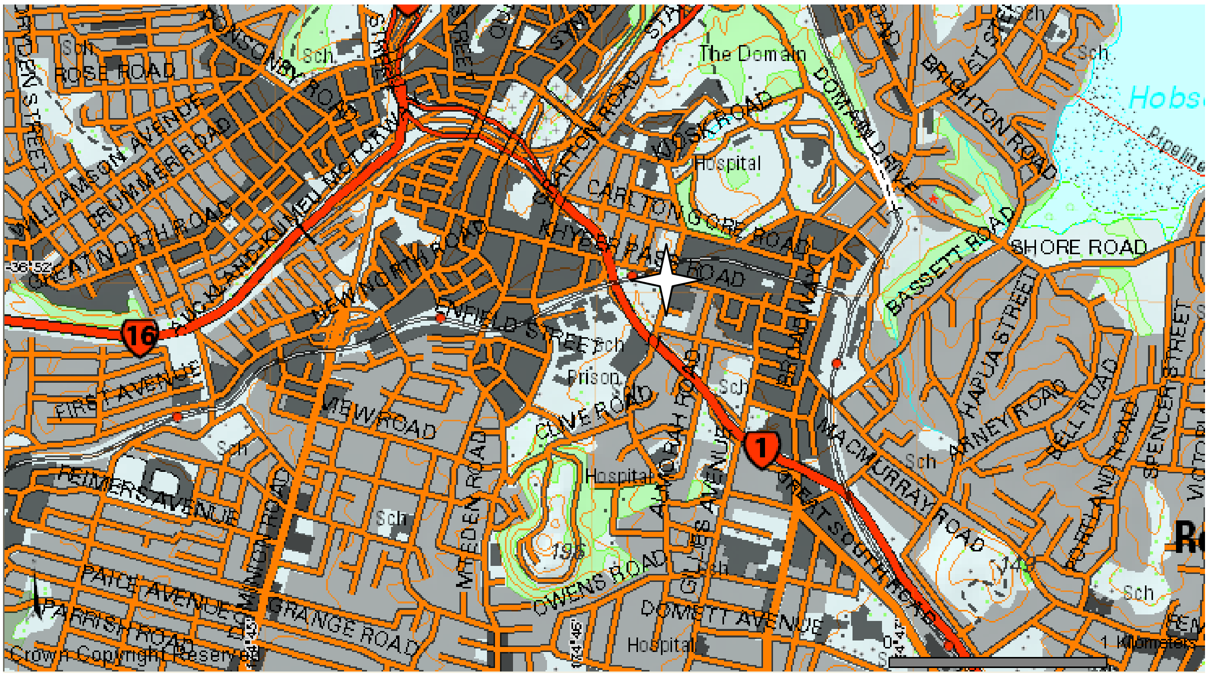
12.8

Data Owner

ARC

View from west side of Mountain Road. Partisol inlet attached to power pole.

Site looking up Khyber Pass Rd (inlet out of office window above Eastern HiFi Sign).



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Kingsland
(Kowhai)

Address

Kowhai Intermediate School
26 Onslow Rd
Mt Eden, Auckland

	Easting	Northing	Elevation (m)
NZMG	2666121	6479473	60
NZTM	1755691	5917772	

General site characteristics

Urban

Topography

Undulating to hilly. Mt Eden (summit 196m) 1.5km to ESE.

Micro met characteristics

Site is relatively well exposed to winds from all directions with the exception of SW - house and tree belt (5m tall, 30m from shed) may shelter from this direction.

Site viewed from south west.

Site description and area characteristics

Within the grounds of Kowhai Intermediate School, at the western end of playing fields, adjacent to outdoor pool enclosure. Residential to W, S and E (mostly larger older houses dating from 1920s with small sections, some later additions); commercial premises to N-NE. Mt Eden rugby stadium 120m to SW.

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential home heating (during winter)

Distance from road and other major sources

100m N to New North Rd (arterial road, aligned NW-SE); approx 50m W to Sandringham Rd (arterial road, aligned NW-SE)

Vehicle counts

23,958; 5-day average (23/03/2005) Sandringham Rd S of New North Rd

Any nearby features that could affect measurements?

Railway line and Kingsland station 140m to NW.

AS2922 compliant?

Yes

Monitoring commenced

02.04.04

Monitoring ceased

ongoing

Pollutants monitored (current)

NOx: 02.04.04 to date
PM_{10} (Beta Gauge): 08.04.04 to date
PM_{10} (Partisol): 23.04.04 to date
$PM_{2.5}$ (Partisol): 22.04.04 to date
TSP: 12.05.04 to date
Lead: 01.06.04 to date
Ozone: 20.05.04 to date

Inlet height (m)

3

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation

Mast height (m)

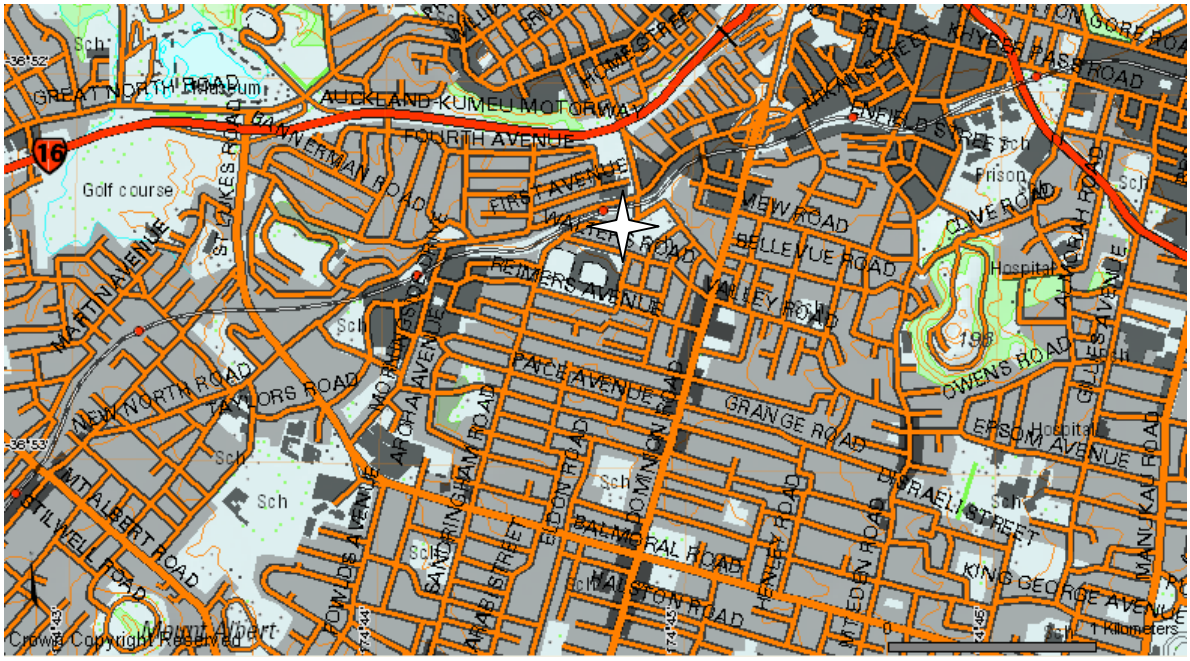
6

Data Owner

ARC and MfE
NOx, Particulate and Ozone data owned by ARC; TSP and Pb data owned by MfE.

View west from site to Sandringham Road.

View south from site.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Mt Eden II (B)
(Kelly St shed)

Address

17 Kelly St
Mt Eden, Auckland

	Easting	Northing	Elevation (m)
NZMG	2667325	6479718	86
NZTM	1756895	5918020	

General site characteristics

Urban

Topography

Flat in immediate area, undulating to hilly beyond. Mt Eden (summit 196m) approx 700m to SSE.

Micro met characteristics

Surrounding buildings and tall trees may cause localised turbulence.

Site in grounds of former ESR Science Centre.

Site description and area characteristics

Air conditioned shed 40m SW of Mt Eden Rd in the grounds of ESR Science Centre (buildings demolished 2004). On the W side of Mt Eden Rd and to the S are residential premises (mostly larger older houses dating from 1920s with small sections, plus some later additions). On the E side of Mt Eden Rd and to the N are commercial premises. Mt Eden summit (196m) is about 0.7km SSE. A railway track (aligned E-W) is about 200m to the north.

Air Quality Management Area

Urban

Predominant sources

Vehicle

Distance from road and other major sources

20m E to Mt Eden Rd (arterial road, aligned N-S); 200m (approx) N to railway track (aligned E-W)

Vehicle counts

15,000 7-day ADT (1999)

Any nearby features that could affect measurements?

Street parking for shops on both sides of Kelly St and Mt Eden Rd

AS2922 compliant?

No; trees taller than meteorological mast may influence parameters being monitored.

Monitoring commenced

06.02.01 (relocated from ESR building)

Monitoring ceased

Site decommissioned January 2006

Pollutants monitored (current)

Nil

Pollutants monitored (past)

NOx: 06.02.01 – 18.01.06
PM_{10} (Beta Gauge): 17.07.02 – 18.01.06
PM_{10} (Partisol): 08.02.01 – 20.12.05
$PM_{2.5}$ (Partisol (sat)): 16.02.01 – 19.12.05
TSP (Partisol (sat)): 21.02.01 - 05.04.02
TSP/Pb (HD Med Vol): 14.02.01 - 27.10.04

Inlet height (m)

3 (gas)
3.5 (particulate)

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity.

Mast height (m)

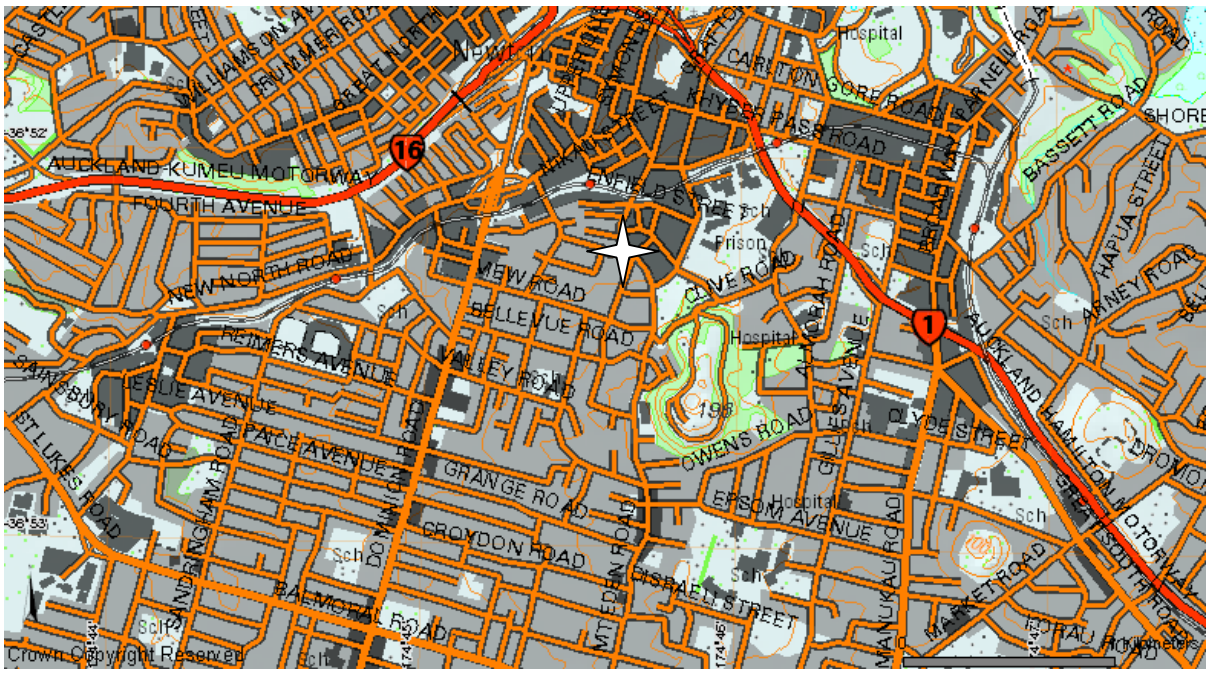
6

Data Owner

ARC and MfE
NOx, TSP and Pb data owned by MfE;
PM_{10} / $PM_{2.5}$ data owned by ARC

Inlets on roof of shed.

View NW towards site from Mt Eden showing surrounding area characteristics. Photo taken 2005.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Musick Point II
(Telecom Building)

Address

Howick Golf Course
Musick Pt
Bucklands Beach, Manukau

	Easting	Northing	Elevation (m)
NZMG	2679959	6482056	45
NZTM	1769523	5920383	

General site characteristics

Urban

Topography

The peninsula is undulating; bounded by steep cliffs that drop approximately 20m to harbour below.

Micro met characteristics

The site is well exposed to 'urban plume' emission from central Auckland City (12km W).

Site on top of tower- view from the south.

Site description and area characteristics

Located on the roof of the Telecom building near the tip of the Musick Point peninsular that extends N into the Hauraki Gulf. Many mature trees <8m on the golf course which takes up the northern end of the peninsula. Houses at the southern end and in neighbouring Bucklands Beach range from approximately 80 to <5 years old; low to medium density with a range of section sizes. About 30% of houses have chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 5 permits granted for new domestic fires.

Air Quality Management Area

Urban

Predominant sources

Urban plume (predominantly industrial and vehicle emissions). Potentially affected by emissions associated with groundskeepers' vehicles.

Distance from road and other major sources

50m from car park; 1km from Musick Point Rd (residential street)

Vehicle counts

N/a

Any nearby features that could affect measurements?

Nil

AS2922 compliant?

Yes

Monitoring commenced

04.02.99

Monitoring ceased

ongoing

Pollutants monitored (current)

NOx: 04.02.99 to date
Ozone: 04.02.99 to date

Pollutants monitored (past)

Non-Methane Hydrocarbons:
20.02.02 - 07.11.02.

Inlet height (m)

15

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

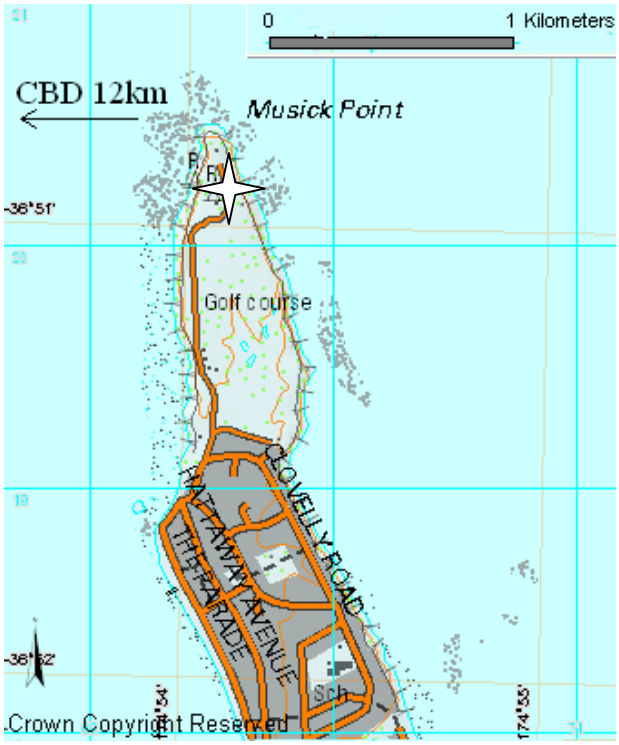
17

Data Owner

ARC

Gas inlet.

Met mast.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Pakuranga

Address

Bell Reserve
Adjacent to 262A Pakuranga Road
Pakuranga, Manukau

	Easting	Northing	Elevation (m)
NZMG	2678830	6475619	16
NZTM	1768407	5913944	

General site characteristics

Urban

Topography

The surrounding land is undulating; the reserve extends N from a dip in Pakuranga Highway, which is aligned SW-NE.

Micro met characteristics

Exposed to north of shed - no containment north/south. At the base of a valley in Pakuranga Road- containment east/west.

Shed (looking north towards Bell Reserve).

Site description and area characteristics

Air conditioned shed at the SW corner of Bell Reserve about 7.5m from Pakuranga Road. Houses in the area are of mixed age - from 1960s to <5 years old, mostly on medium sized sites. About 50% of houses have chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 45 permits were granted for new domestic fires.

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential home heating (during winter)

Distance from road and other major sources

7.5m SE to Pakuranga Highway (arterial road, aligned SW-NE)

Vehicle counts

42,420 ADT (2003) Pakuranga Road between Bells and Fortune, <1km to north

Any nearby features that could affect measurements?

Small tree approx 2m from inlet - other large trees more than 10m N of inlet - not in sampling path.

AS2922 compliant?

Yes

Monitoring commenced

26.06.98

Monitoring ceased

ongoing

Pollutants monitored (current)

CO: 26.06.98 to date
PM_{10} (Beta Gauge): 07.03.05 to date

Pollutants monitored (past)

Nil

Inlet height (m)

3

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

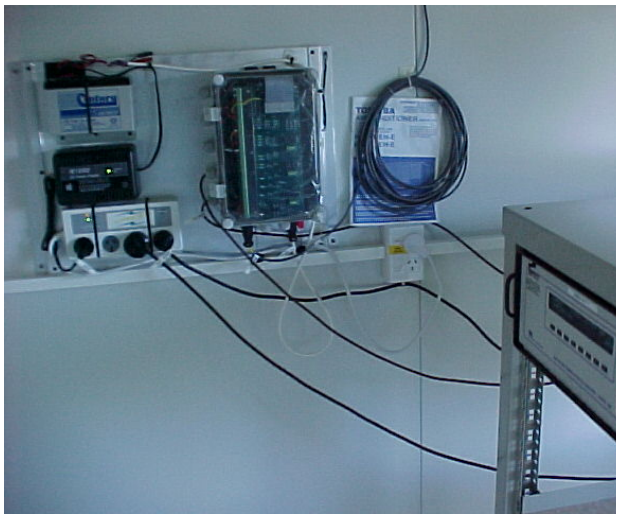
Mast height (m)

6

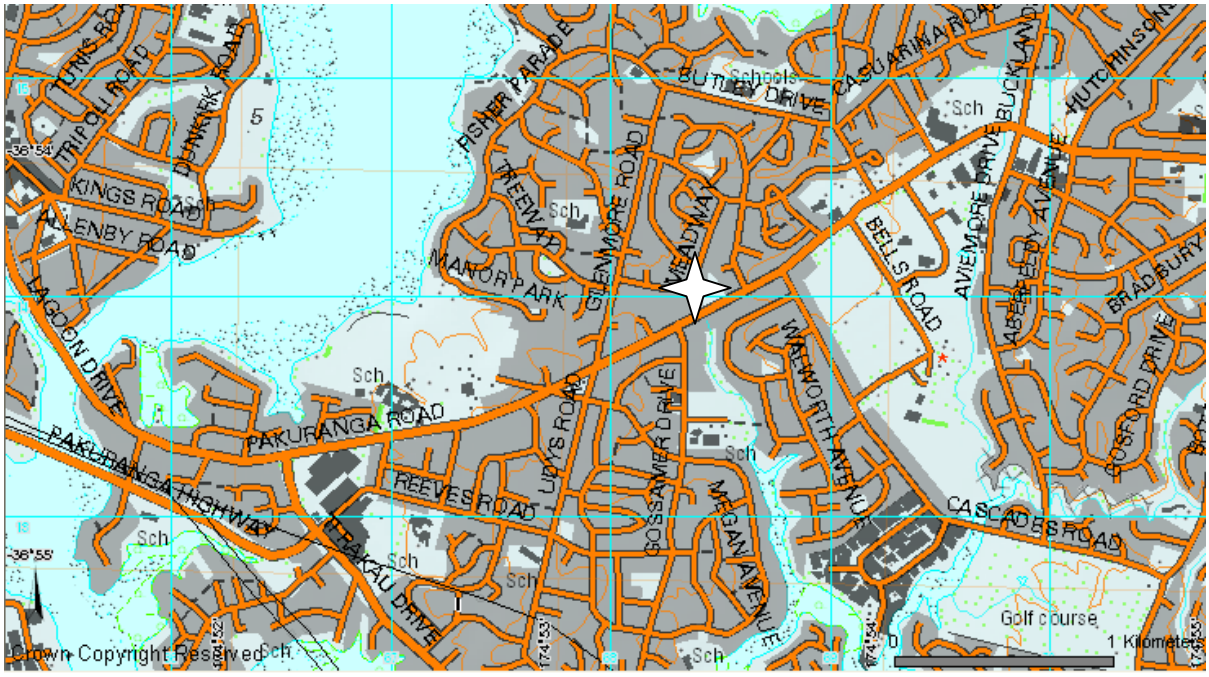
Data Owner

ARC

Shed and Pakuranga Rd, looking west.



Monitoring equipment inside shed.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site Name

Penrose II (B)
(Gavin St Substation)

Address

19 Gavin St
Penrose, Auckland

	Easting	Northing	Elevation (m)
NZMG	2672174	6475864	40
NZTM	1761751	5914176	

General site characteristics

Industrial

Topography

Flat

Micro met characteristics

Surrounding structures will both shield the monitor and introduce more turbulence into the flow.

Site, viewed from north west.

Site description and area characteristics

Air conditioned shed within the Gavin St substation, approximately 106m NE of the Southern Motorway. The motorway is approximately 2m lower than the ground level at the monitoring site. There is also a mobile trailer here (exact location varies). From NW-S and to the NE are industrial premises; residential to the N and SW. Houses date from 1930s onward; about 50% with chimneys.

Air Quality Management Area

Industrial

Predominant sources

Vehicle and industry

Distance from road and other major sources

106m SW to Southern Motorway (aligned N-S)

Vehicle counts

140,380 AADT (2005) SH1 Ellerslie Panmure Hwy to South Eastern Hwy

Any nearby features that could affect measurements?

Substation structures and buildings near to shed - NE; Three stacks (300m S) at ACI Glass.

AS2922 compliant?

Yes

Monitoring commenced

November 2000

Monitoring ceased

Ongoing

Pollutants monitored (current)

NOx: November 2000 to date
PM_{10} (Beta Gauge): 22.05.03 to date
PM_{10} (HiVol): 20.05.03 to date
Speciation Sampling: 18.10.05 to date
Sulphur Dioxide: 01.04.03 to date
TSP: 17.05.04 to date
Lead (HD Med Vol): 01.06.04 to date

Pollutants monitored (past)

Nil

Inlet height (m)

2.5 NOx, SO_2 and Beta Gauge
1.8 HiVol and RAAS

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

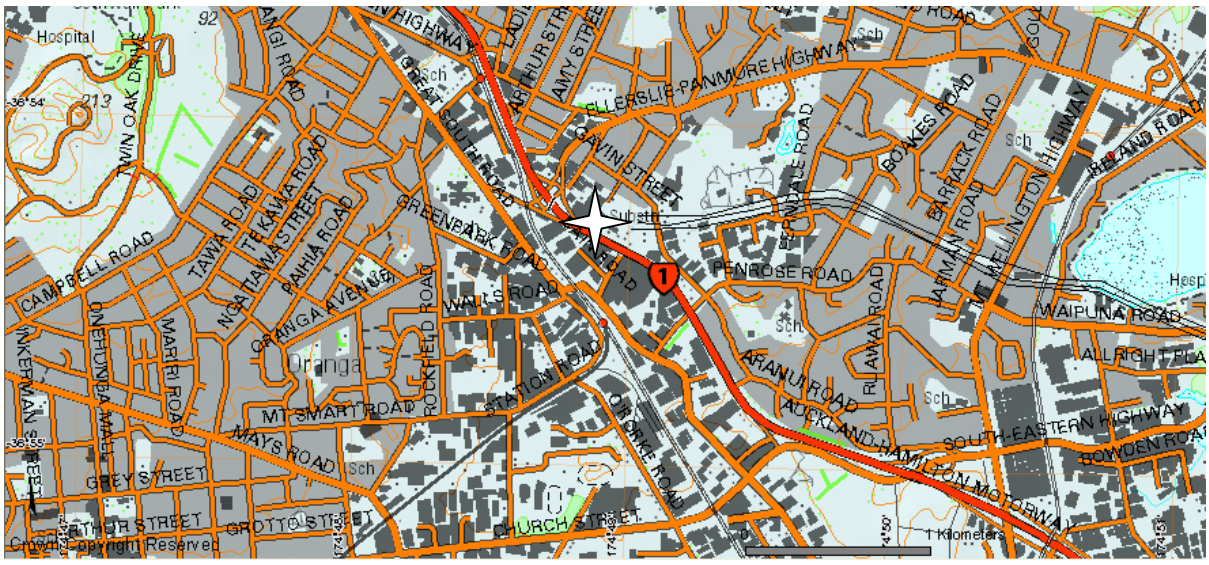
6

Data Owner

ARC and MfE
NOx and SO_2 data owned by MfE
Particulate data owned by ARC

RAAS and Beta Gauge adjacent to shed.

Site viewed from the south.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Penrose IV - four locations
Gavin St (Mobile)

Address

19 Gavin St
Penrose, Auckland

Easting	Northing	Elevation (m)
These vary – see table on next page.		

General site characteristics

Industrial

Topography

Flat

Micro met characteristics

Site is reasonably well exposed to winds from all directions, although there will be some sheltering from warehouse-size buildings to W.

Mobile trailer at site two.

Site description and area characteristics

This site has been operating since March 2004 and has had four locations in the grounds of the Transpower substation at Penrose. The monitoring equipment is located within an air conditioned mobile trailer, NE and (at present) approximately 15m from Southern Motorway. This site was established in order to compare monitoring data recorded at different proximities to the motorway and the permanent MfE site, also at the substation. Surrounding area is mostly light industry with some residential properties. Of the latter, many houses date from 1930s onward; approximately 50% with chimneys.

Air Quality Management Area

Industrial

Predominant sources

Vehicle and industry

Distance from road and other major sources

Varies; currently 15m NE of Southern Motorway, has been as far as 120m NE of motorway.

Vehicle counts

140,380 AADT (2005) SH1 Ellerslie Panmure Hwy to South Eastern Hwy

Any nearby features that could affect measurements?

Three stacks (300m S) at ACI Glass. Trees and substation structures may affect measurements at some locations.

AS2922 compliant?

Yes

Monitoring commenced

05.03.04

Monitoring ceased

Ongoing

Pollutants monitored

CO: 01.04.04 to date
NOx: 01.04.04 to date
PM_{10} (Beta Gauge): 04.10.05 to date

Inlet height (m)

2.5

Meteorological parameters measured on site

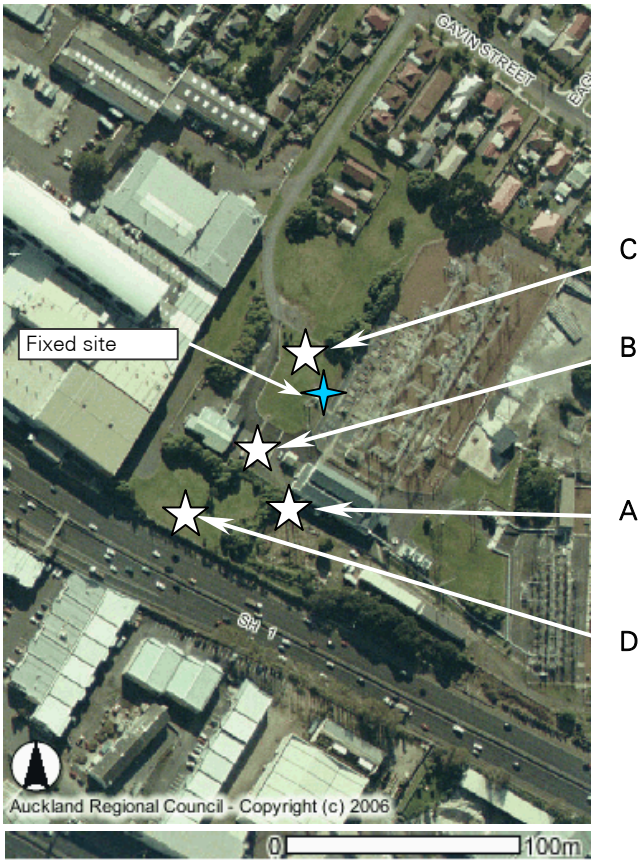
Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

6

Data Owner

ARC



Locations of the four mobile trailer sites and the permanent site.

Site	NZMG Easting	NZMG Northing	NZTM Easting	NZTM Northing	Elevation (mast) (m)	Distance from road (m)	Start	Finish
A	2672164	6475797	1761741	5914109	32.4	46	05.03.04	16.06.04
B	2672136	6475820	1761713	5914132	30.4	62	16.06.04	07.10.04
C	2672167	6475889	1761744	5914201	33.5	125	08.10.04	09.03.05
D	2672089	6475799	1761666	5914111	38.8	15	09.03.05	ongoing

Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Pukekohe

Address

Crop and Food Research Station
Cronin Rd
Pukekohe, Franklin

	Easting	Northing	Elevation (m)
NZMG	2675800	6442500	89
NZTM	1765441	5880820	

General site characteristics

Rural

Topography

The wider area is undulating; the land immediately to the west of the shed is flat, with a gentle slope from the shed down to the east, north and south.

Micro met characteristics

Surrounding structures are unlikely to significantly influence the ozone concentrations measured. However, the site is quite well protected- there are greenhouses and sheds plus hedges that may influence air flow.

Site, with adjacent met station behind.

Site description and area characteristics

Air conditioned shed located within the Crop and Food Research Station, Pukekohe. The site is located approximately 2.5km west of the Pukekohe urban area. There are greenhouses and sheds 8m to N and 20m from W to SW; a 4m hedge 30m to the S, an 8m hedge 40m to the E and an 8m hedge 50m to the N. Surrounding area is used for horticulture and agriculture.

Air Quality Management Area

Rural

Predominant sources

Rural activities

Distance from road and other major sources

100m from Cronin Road (rural road).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Surrounding structures are unlikely to significantly influence the ozone concentrations measured.

AS2922 compliant?

Yes

Monitoring commenced

21.10.96

Monitoring ceased

Ongoing

Pollutants monitored (current)

Ozone: 21.10.96 to date
PM_{10} (Beta Gauge): 01.04.05 to date

Inlet height (m)

3

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation, rainfall.

Mast height (m)

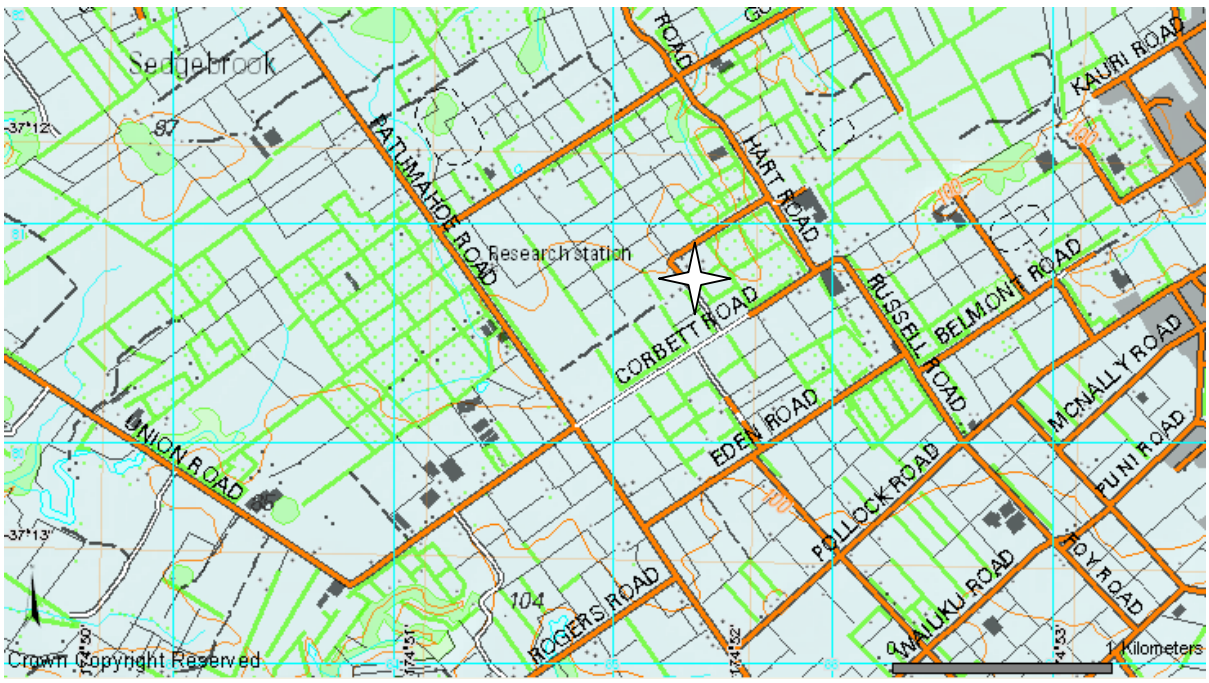
10

Data Owner

ARC
Met data owned by NIWA

View south from site to shelter belt.

View west from site to met station and greenhouses.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site name

Queen St II
(CML Building)

Address

155 Queen St
Auckland

	Easting	Northing	Elevation (m)
NZMG	2667850	6482270	15
NZTM	1757414	5920573	

General site characteristics

Urban

Topography

Queen St slopes gently down to the N; Wyndham St and Victoria St both slope steeply towards Queen St.

Micro met characteristics

Pollutants are likely to entrained within the urban canyon formed by the tall buildings on either side of Queen St during calm conditions. Wind flows are also likely to be channelled along this corridor.

Site viewed from eastern side of Queen St.

Site description and area characteristics

Western side of Queen St between Wyndham St and Victoria in Auckland's CBD. Both of these intersections have traffic lights. Queen St is located within a valley. The monitors are located to the front of the CML building, close to the junction with Wyndham Street. All instruments are located at 1st floor height (i.e. above the verandah).

Air Quality Management Area

Urban

Predominant sources

Vehicle

Distance from road and other major sources

3m to Queen St

Vehicle counts

20,738 7-day average (14/03/2004) Queen St north of Wellesley St

Any nearby features that could affect measurements?

Within 2 metres of street parking, and <20m S of traffic-signal controlled intersection of Wyndham St and Queen St .

AS2922 compliant?

No; but not deemed necessary as site purpose is to monitor peak pollutant levels.

Monitoring commenced

22.12.82 (relocated from 296 Queen St)

Monitoring ceased

Ongoing

Pollutants monitored (current)

CO: 06.10.98 to date
NOx: 04.02.04 to date
PM_{10} (Sequential Partisol): 27.12.98 to date
$PM_{2.5}$ (Partisol): 26.06.02 to date

Pollutants monitored (past)

TSP (HD Med Vol): 22.12.82 - 03.04.02
TSP ((Partisol) (sat)): 03.12.97 - 20.04.02
Lead: 01.01.83 - 30.06.99

Inlet height (m)

3.5 gas
3.0 particulate

Meteorological parameters measured on site

Nil

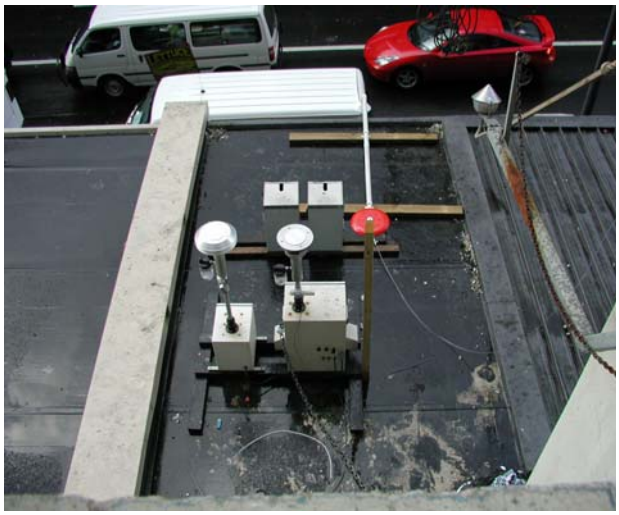
Mast height (m)

n/a

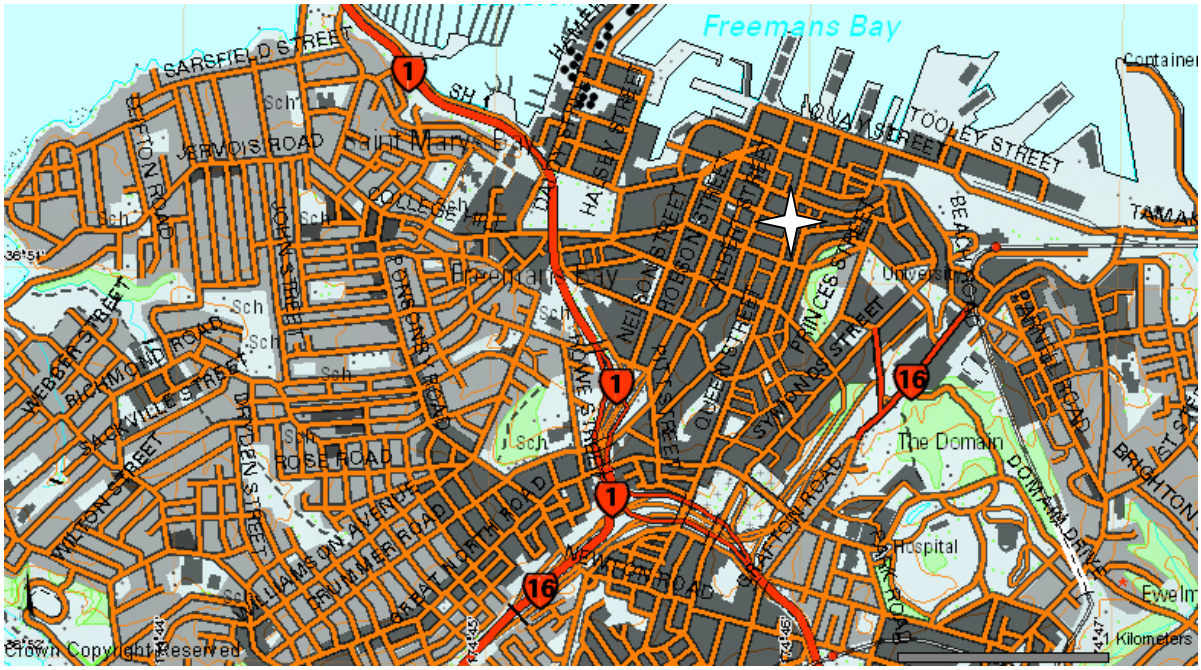
Data Owner

ARC

Partisol inlets on awning.



Inlets from above.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site name

Takapuna I
(Westlake)

Address

Westlake Girls High School
2 Wairau Rd
Takapuna, North Shore City

	Easting	Northing	Elevation (m)
NZMG	2666510	6489778	21
NZTM	1756059	5928077	

View of site from south; Northern Motorway beyond.

Partisol and gas inlets on roof of shed.

General site characteristics

Urban

Topography

Flat to the W and S, hilly to the N.

Micro met characteristics

This site is relatively well exposed to winds from all directions. However the hills to the N will influence flow condition from this direction and channel N and S wind flows.

Site description and area characteristics

Air conditioned shed in N corner of the Westlake Girls High School playing fields, 6m from Wairau Culvert. Bounded to the E by Wairau Rd (20m NE). The W side is bounded by the Southern Motorway (60 SW) which is about 3m above the level of the site. Houses in area are of mixed age from 1960's onward; about 75% with chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 9 permits were granted for new domestic fires.

Air Quality Management Area

Urban

Predominant sources

Vehicle (and some home heating)

Distance from road and other major sources

30m N to Wairau Rd (arterial road aligned NW-SE); 60m W to Northern Motorway (aligned NNW-SSE)

Vehicle counts

109,680 AADT (2005) SH1 Tristram Ave to Northcote Rd; Wairau Rd: 24000- 7-day ADT – 1996;

Any nearby features that could affect measurements?

Lighted intersection of Wairau Rd and Forrest Hill Rd about 90m E of site. Head office (and working yard) of Atlas Concrete approximately 100m to E. Wairau commercial/industrial park extends W and NW from 200m (W).

AS2922 compliant?

Yes

Monitoring commenced

31.05.95

Monitoring ceased

ongoing

Pollutants monitored (current)

CO: 27.07.95 to date
NOx: 13.06.01 to date
PM_{10} (Beta Gauge): 10.02.04 to date
PM_{10} (Partisol): 13.04.02 to date

Pollutants monitored (past)

PM_{10} (Hi Vol): 01.11.96 – 29.12.01
PM_{10} (TEOM): 31.05.95 – 31.08.99
$PM_{2.5}$ (TEOM): 22.03.96 – 23.10.96
Non-Methane Hydrocarbons:
08.11.02 – 25.02.03

Inlet height (m)

3

Meteorological parameters measured on site

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

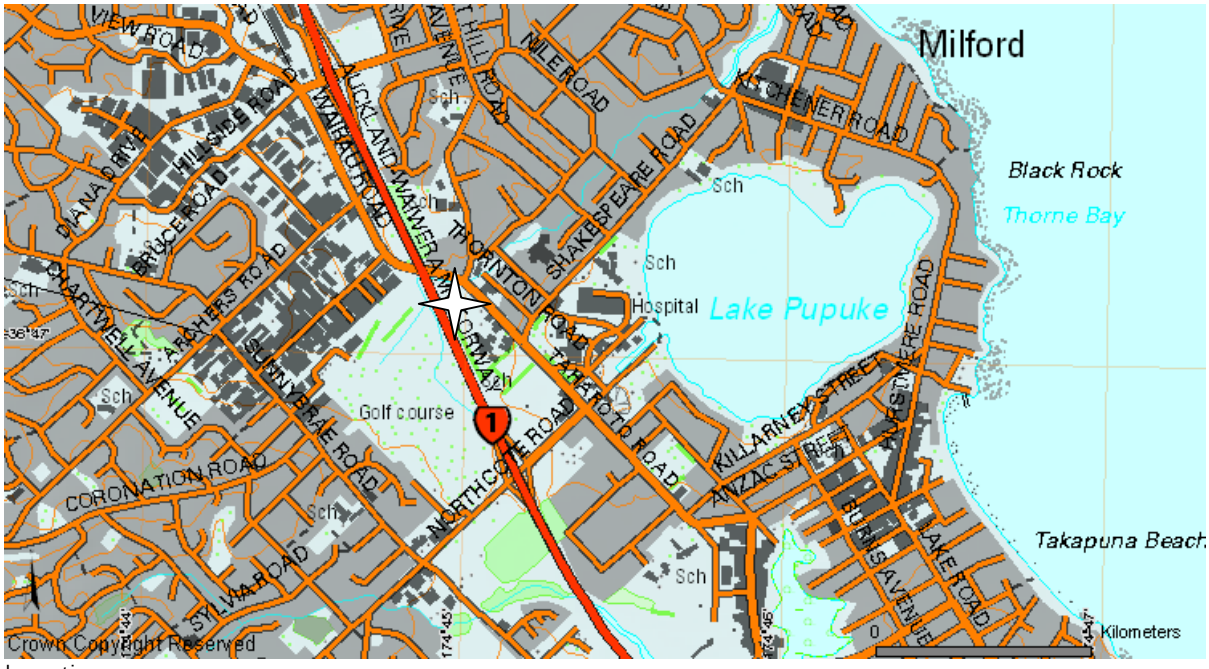
10

Data Owner

ARC

View south east from site towards school.

Site from south west –Wairau Road beyond.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Whangaparaoa

Address

Shakespear Regional Park
Whangaparaoa, Rodney

	Easting	Northing	Elevation (m)
NZMG	2673315	6508915	83
NZTM	1762823	5947227	

General site characteristics

Rural

Topography

Undulating to hilly

Micro met characteristics

Wind flows from the E to SE are likely to be influenced by the tanks, shed, tower and trees located near the site. These structures may shield the site, scavenge O_3 and introduce turbulence. However, site is relatively well exposed to 'urban plume'.

Site, looking west towards the mainland.

Site description and area characteristics

Air conditioned shed located below the summit of a hill within the Shakespear Regional Park. Surrounding area is undulating to hilly, with grassy paddocks and native vegetation (mainly in gullies). Residential suburbs approx 1.2km to W (houses of mixed age, ranging from 1930s to <5 years old); Hauraki Gulf 1-1.5km to N, S and E.

Air Quality Management Area

Rural

Predominant sources

Urban plume (predominantly industrial and vehicle emissions). Some emission associated with groundskeepers' vehicles.

Distance from road and other major sources

200m W to park access road, 900m NW to Whangaparaoa Rd.

Vehicle counts

10,205/month at Army Bay counter 1km north of site (July 2004)

Any nearby features that could affect measurements?

Two metres E of the shed is another shed (1.8m(l)x1.8m(w)x2.1m(h)). Another two metres E is a tower, 6m high with a diameter of 1.8m. Three metres SE of the monitoring shed is a row of 3 water storage tanks. Behind these tanks are another 2 tanks. Each tank is 2.8m high with a diameter of 3.5m. Behind the tank are several large trees and an access road (rangers' vehicles only).

AS2922 compliant?

Yes

Monitoring commenced

09.04.98

Monitoring ceased

ongoing

Pollutants monitored (current)

Ozone

Inlet height (m)

3.1

Meteorological parameters measured *

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast height (m)

10

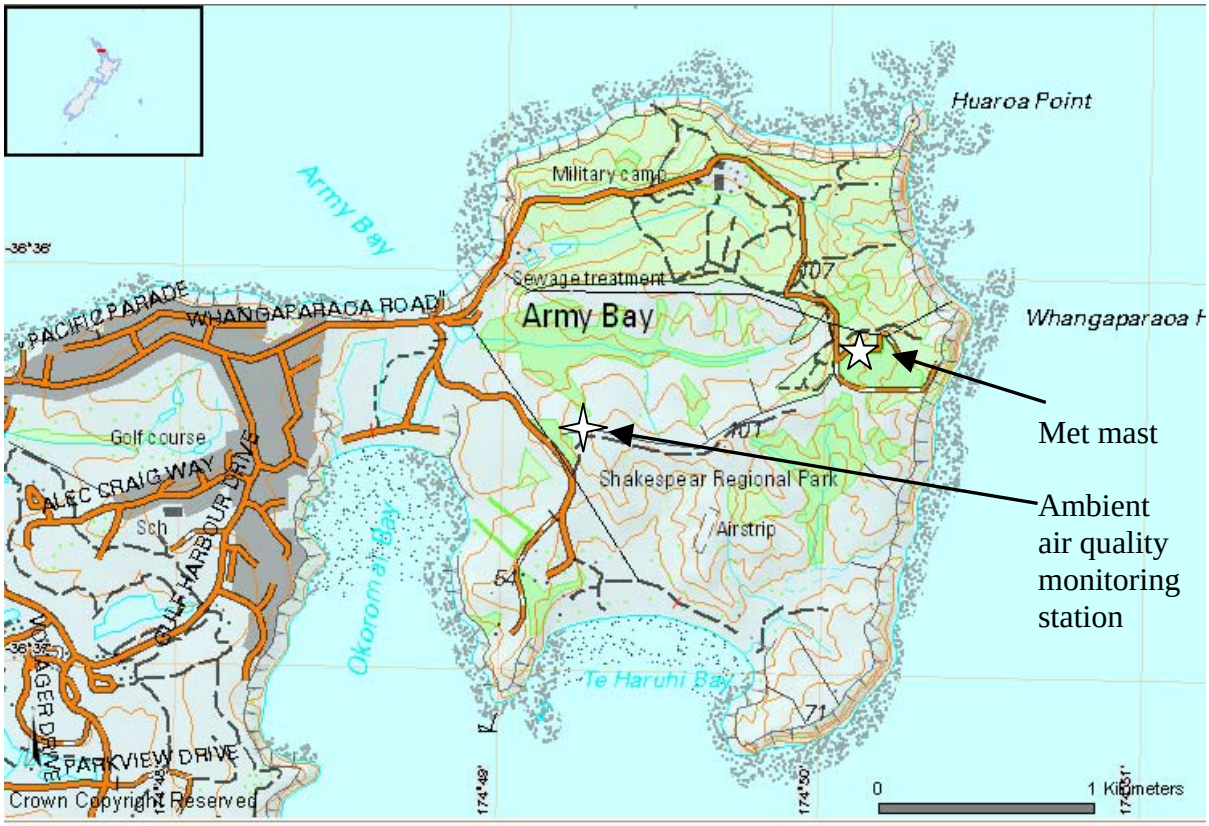
Data Owner

ARC

*Whangaparaoa met data is available from a Met service mast approximately 1.5km north east of the air quality monitoring station.
NZMG ref: 2674599E, 6509200N
NZTM ref: 1764106E, 5947514N
CliFlo Agent No. 1400; Network No. A64683

Site on hill as viewed from the north west.

Site from the north, monitoring shed at right.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site Name

Glen Eden II
(Glen Eden Intermediate)

Address

Glen Eden Intermediate School
23 Kaurilands Rd
Titirangi, Waitakere

	Easting	Northing	Elevation (m)
NZMG	2657605	6474078	40
NZTM	1747187	5912361	

General site characteristics

Urban

Topography

Undulating

Micro met characteristics

Site fairly well exposed to all directions; hills to NE may influence wind flows from this direction.

Monitor attached to pole in school grounds.

Site description and area characteristics

Monitor is attached to a power pole at western end of playing fields. Most houses in the area 1980s and newer (medium-sized sections, no chimneys), but Glen Eden to N has a lot of older houses (1960s); larger sections, approx 75% with chimneys.

Air Quality Management Area

Urban

Predominant sources

Vehicle and home heating

Distance from road and other major sources

100m W to Meadowvale Rise (residential street, aligned SSW-NNE); 225m SW to Kaurilands Rd (aligned NW-SE)

Vehicle counts

N/a

Any nearby features that could affect measurements?

Eucalyptus tree (6m) <5m W of inlet. School buildings 1-2 storeys ~30m to S. Residential houses ~30m W-NE

AS2922 compliant?

No; ~6m tree <5m W of inlet.

Monitoring commenced

03.01.01

Monitoring ceased

31.12.05

Pollutants monitored

PM_{10} MiniVol (non regulatory method)

Inlet height (m)

2.5

Meteorological parameters measured on site

Nil

Mast height (m)

N/a

Data Owner

ARC

View south from site towards school buildings.

View west from site towards residential area.

Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site Name

Glenfield

Address

51 Easton Park Parade
Glenfield, North Shore City

	Easting	Northing	Elevation (m)
NZMG	2663460	6490142	40
NZTM	1753009	5928435	

General site characteristics

Urban

Topography

Hilly

Micro met characteristics

Site is the side of a hill; the land slopes fairly steeply down to the SSE/up to the NNW.

Monitor in self contained housing.

Site description and area characteristics

Monitor on a platform in the front garden of a private residence, situated adjacent to hedge and child's playhouse. Surrounding area is residential, medium sized sections; most houses single storey 1960s-1990's; approx 75% with chimneys. Mature stand of trees behind houses, 30m to W and 50m to E.

Air Quality Management Area

Urban

Predominant sources

Vehicle and home heating (winter)

Distance from road and other major sources

4m E to Easton Park Parade (suburban route, aligned NNW-SSE)

Vehicle counts

N/a

Any nearby features that could affect measurements?

Monitor is <1m from shrubs bordering the property to E (these were level with inlet on site visit 26/07/05); 2m from 2m high hedge to the N. Approx 6m to house (chimney at the front of house).

AS2922 compliant?

No; inlet <2m from ground, ~2m N to 2m high hedge.

Monitoring commenced

16.06.03

Monitoring ceased

31.12.05

Pollutants monitored

PM_{10} MiniVol (non regulatory method)

Inlet height (m)

1.5

Meteorological parameters measured on site

Nil

Mast height (m)

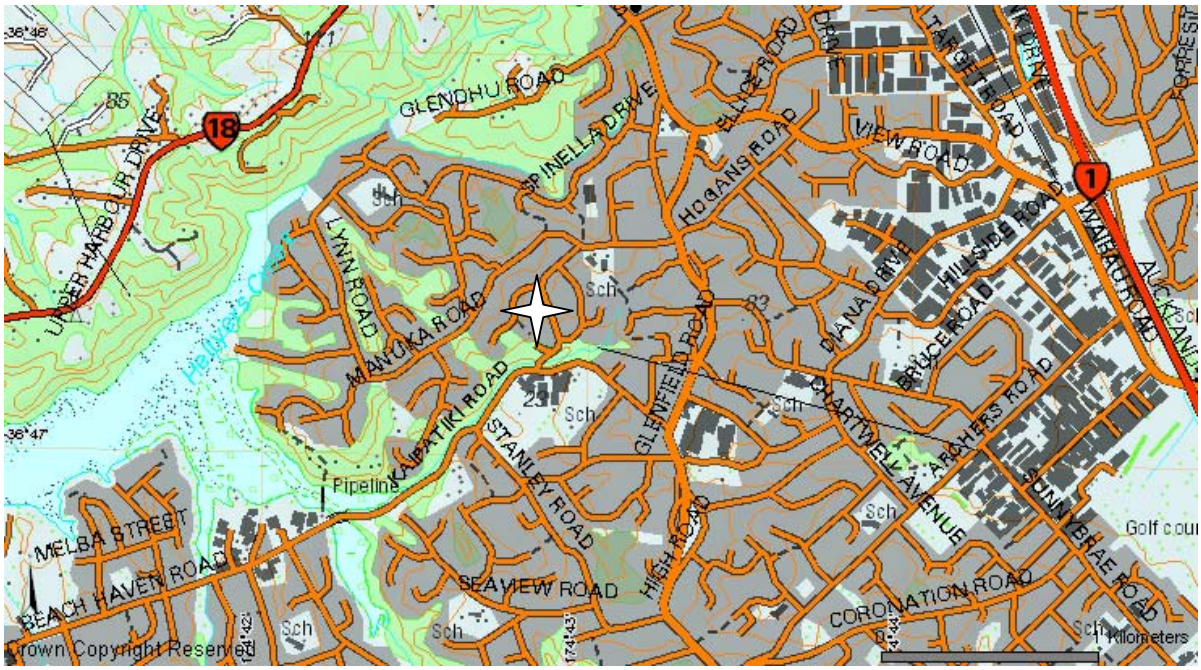
n/a

Data Owner

ARC

View south down Easton Park Parade.

View north up Easton Park Parade.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site Name

Henderson I (B)
(Lincoln Rd)

Address

Henderson Intermediate School
70 Lincoln Rd,
Henderson, Waitakere

	Easting	Northing	Elevation (m)
NZMG	2645440	6480310	29.9
NZTM	1745010	5918588	

General site characteristics

Urban

Monitor in self contained housing attached to the school building.

Topography

Surrounding area is flat

Micro met characteristics

Site is exposed to winds from the north as surrounding school buildings (SE, SW and S) may shelter winds from these directions.

Site description and area characteristics

Monitor is in a self-contained, air conditioned shed attached to school building and faces north over playing fields. Site surrounded by buildings 180° east, south and west. Note: Current Henderson site located approximately 150m SE of shed, in self contained housing at the front of the school grounds.

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential (during winter)

Distance from road and other major sources

Approximately 100 m E to Lincoln Road (arterial road, aligned N-S) 150 – 200 m from northern residential boundary and 30 m from western residential boundary.

Vehicle counts

Lincoln Road 13,300 7 day ADT 1999.

Any nearby features that could affect measurements?

Site situated within 5m of a large 6m tall tree. Internal school access road within 10m of monitoring site.

AS2922 compliant?

No; Site is attached to a building and the sampling inlet is not less that 1m above roof height. A large tree (approximately 6m in height) is 5m NW from monitor.

Monitoring commenced

17.09.00

Monitoring ceased

29.12.05

Pollutants monitored

PM_{10} MiniVol (non regulatory method)

Inlet height (m)

3.1

Site view looking west

Meteorological parameters measured on site

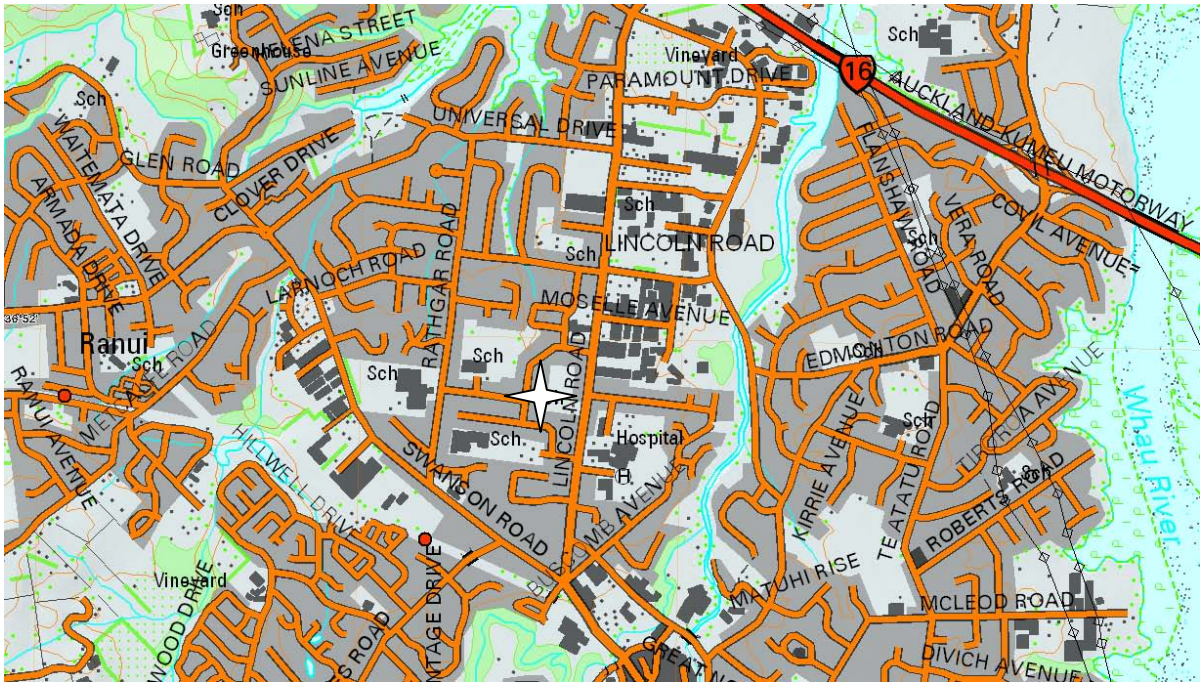
Nil

Mast height (m)

Nil

Data Owner

ARC



Location map.
Map sourced from NZTopo*Online*, extracted May 2006, Crown Copyright Reserved.

Site name

Highbury (Bank St)

Address

3 Bank Street
Birkenhead, North Shore City

	Easting	Northing	Elevation (m)
NZMG	2664513	6487333	80
NZTM	1754067	5925628	

General site characteristics

Urban

Topography

Hilly

Micro met characteristics

Site is protected from NW and SW airflow by houses. Relatively exposed to other directions. Surrounding area slopes down to E.

Monitor attached to fence.

Site description and area characteristics

Monitor is attached to a fence at the end of a driveway of a private residence. 5m W to house; 8m SW to house next door. Steep slope down to N of site. Residential, large sections, houses mostly older (1900s-1960s); approx 75% with chimneys.

Air Quality Management Area

Urban

Predominant sources

Vehicle and home heating

Distance from road and other major sources

25m W to Bank St (residential street, aligned NNW to SSE); 75m S to Pupuke Rd (suburban route, aligned WSW to ENE).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Monitor is at end of driveway and adjacent to two-car carport. Slope of surrounding area means that inlet is approximately level with access road and approximately 1.5m below Bank St. Vigorous vine (jasmine) covering fence and encroaching on inlet. Stand of native vegetation in gully 20m to NE.

AS2922 compliant?

No; two storey house with chimney 5m to NNW, carport 4m to SW.

Monitoring commenced

16.06.03

Monitoring ceased

ongoing

Pollutants monitored (current)

PM_{10} MicroVol (non regulatory method)

Inlet height (m)

2

Meteorological parameters measured on site

Nil

Mast height (m)

n/a

Data Owner

NSCC

Site viewed from west.

Site viewed from south west.

Location map.

Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site Name

Manurewa II
(Manurewa South Primary)

Address

Manurewa South Primary School
39 Tawa Crescent
Manurewa, Manukau

	Easting	Northing	Elevation (m)
NZMG	2678994	6461501	25
NZTM	1768599	5899827	

General site characteristics

Urban

Topography

The site is on the summit of a small rise, the land to the east is relatively flat; undulating to the west.

Micro met characteristics

The site is well exposed to winds from all directions.

Monitor attached to school building.

Site description and area characteristics

Monitor attached to roof of school building, about 10 from road. Several mature trees >10m within 100m of site and several in the surrounding area. Most houses in the area are 1960s to 1970s era; predominantly on full sites with large yards. approximately 75-80% have chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 32 permits were granted for new domestic fires (note that this number will include some overlap with the count from Manurewa West Primary).

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential (during winter)

Distance from road and other major sources

10m from Tawa Crescent (residential street, aligned NNW-SSE).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Parking for 9 cars and a car 'drop off lane' immediately adjacent to the building where the monitor is located. School crossing <50m away. School incinerator <50m to SE.

AS2922 compliant?

No; ~4m tree, <5m to W, school incinerator <50m to SE.

Monitoring commenced

28.08.01

Monitoring ceased

31.12.05

Pollutants monitored (current)

PM_{10} MiniVol (non regulatory method)

Pollutants monitored (past)

Nil

Inlet height (m)

3

Meteorological parameters measured on site

Nil

Mast height (m)

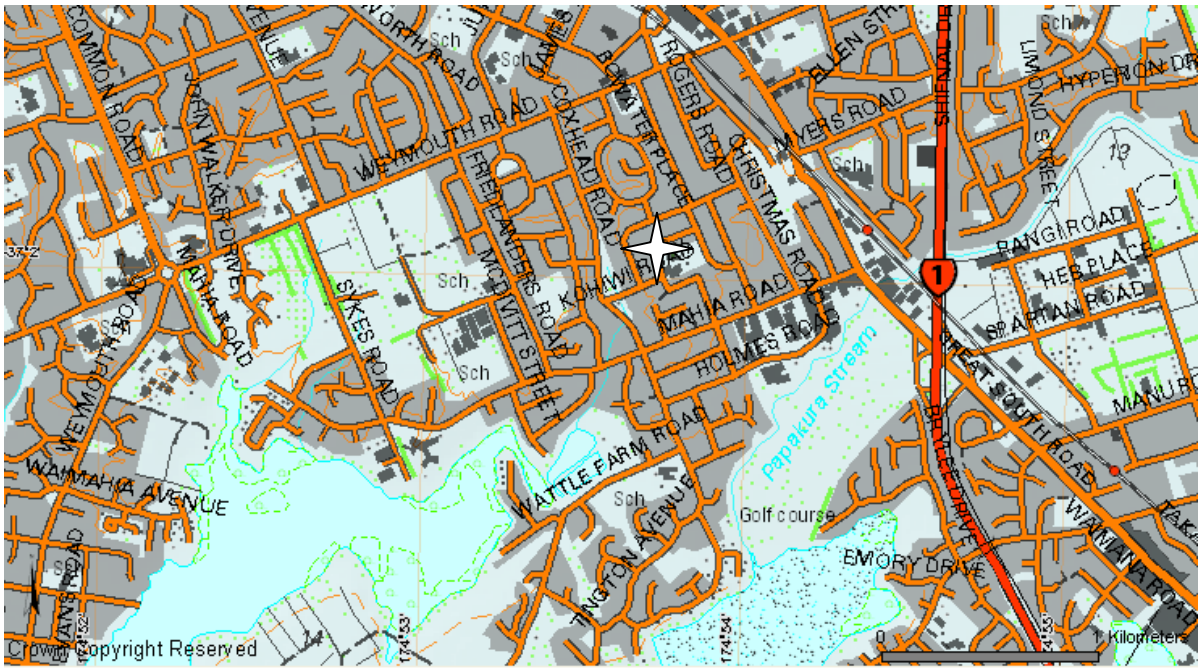
n/a

Data Owner

ARC

View south from site to Tawa Crescent.

View west from site to Tawa Crescent.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site Name

Manurewa III
(Manurewa West Primary)

Address

Manurewa West Primary School
31 McKean Ave
Manurewa, Manukau

	Easting	Northing	Elevation (m)
NZMG	2678260	6462365	25
NZTM	1767863	5900689	

Monitor attached to reading room/library building.

General site characteristics

Urban

Topography

Flat

Micro met characteristics

Surrounding buidlings and trees may affect micro met characteristics. Houses immediately to the E and SE of the school (from 20m away) are slightly elevated, so that the monitor is about level with the top of the fence, and below their roof line. This may provide sheltering from winds from this direction.

Site description and area characteristics

Monitor is mounted on (old) library fascia in playground, in S cnr of school grounds. Most houses in the immediate area are 1960s to 1970s era, although there are several new subdivisions on the western fringes of the suburb. Houses predominantly on full sites with large yards. Approx 75-80% have chimneys. During the period May 2004-May 2005, for a circle of 1.5km radius around the site, 40 permits were granted for new domestic fires (note that this number will include some overlap with the count from Manurewa South Primary).

Air Quality Management Area

Urban

Predominant sources

Vehicle and residential (during winter)

Distance from road and other major sources

60m SE to Glendon Place (suburban cul-de-sac) and 90m SW to Mc Kean Ave (residential street).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Two large deciduous trees <20m to NE of inlet.

AS2922 compliant?

No; Two large trees <20m to NE of inlet.

Monitoring commenced

28.08.01

Monitoring ceased

31.12.05

Pollutants monitored (current)

PM_{10} MiniVol (non regulatory method)

Pollutants monitored (past)

Nil

Inlet height (m)

3

Meteorological parameters measured on site

Nil

Mast height (m)

n/a

Data Owner

ARC

Site viewed from the west.

View south west from site to school buildings <10m away.

Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved

Site name

Takapuna II
(Lake Rd)

Address

488-490 Lake Rd
Takapuna, North Shore City.

	Easting	Northing	Elevation (m)
NZMG	2668516	6488868	<20
NZTM	1758067	5927171	

General site characteristics

Urban

Topography

Flat

Micro met characteristics

Surrounding buildings may cause localised turbulence. Monitor may be shielded from SW wind flows by multi-storey building immediately opposite.

Monitor attached to pole on east side of Lake Rd.

Site description and area characteristics

Monitor is attached to a power pole on the kerb. Lake Road runs through the heart of Takapuna's shopping precinct. Most buildings in immediate vicinity (within a circle of 300m radius) are low-rise (3-6 storeys) business/commercial premises. Residential houses, townhouses and apartments beyond. Takapuna Beach approx 350m E, Lake Pupuke 550m to NW. Note that photos are representative only as they are of the previous site; monitor is a now approximately 25m north of position shown.

Air Quality Management Area

Urban

Predominant sources

Vehicle

Distance from road and other major sources

<1m; Monitor is attached to a power pole that extends from the kerb on Lake Rd (aligned NNW-SSE; one lane each way plus bus stop either side).

Vehicle counts

N/a

Any nearby features that could affect measurements?

Car park (approximately 80 car capacity) immediately E of site. Bus stops are either side of road. A 6 storey building is 15m across the road to SW. Some high rise buildings <300m to S.

AS2922 compliant?

No; <5m from traffic lane.

Monitoring commenced

16.06.03

Monitoring ceased

ongoing

Pollutants monitored (current)

PM_{10} MicroVol (non regulatory method)

Pollutants monitored (past)

Nil

Inlet height (m)

2.5

Meteorological parameters measured on site

Nil

Mast height (m)

n/a

Data Owner
NSCC

View north west along Lake Road. This photo is taken from the old site. The new location of monitor is attached to next power pole on the near side of the road.

Car park immediately east of monitor.

Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Henderson (met)

Address

Te Pai Park
Lincoln Road
Henderson, Waitakere

	Easting	Northing	Elevation (m)
NZMG	2655900	6480937	23
NZTM	1745468	5919216	

General site characteristics

Urban

Topography

Surrounding area is flat

Micro met characteristics

Site is exposed to winds from all directions.

Site description and area characteristics

In Te Pai Park, adjacent to netball courts and car park.

Monitoring commenced

15.11.94

Mast height (m)

10

Meteorological parameters measured

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast – view from the east.

Mast top.

Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Onehunga (met)

Address

Waikaraka Park
Captain Springs Road
Onehunga

	Easting	Northing	Elevation (m)
NZMG	2670854	6473229	5
NZTM	1760436	5911538	

General site characteristics

Industrial

Topography

Surrounding area is flat. A small embankment (approximately 3m high) to S.

Micro met characteristics

Site is well exposed to winds from all directions.

Site description and area characteristics

Adjacent to Waikaraka Park off Captain Springs Road. Approx 300m north of Manukau Harbour (Mangere Inlet).

Monitoring commenced

18.08.94

Mast height (m)

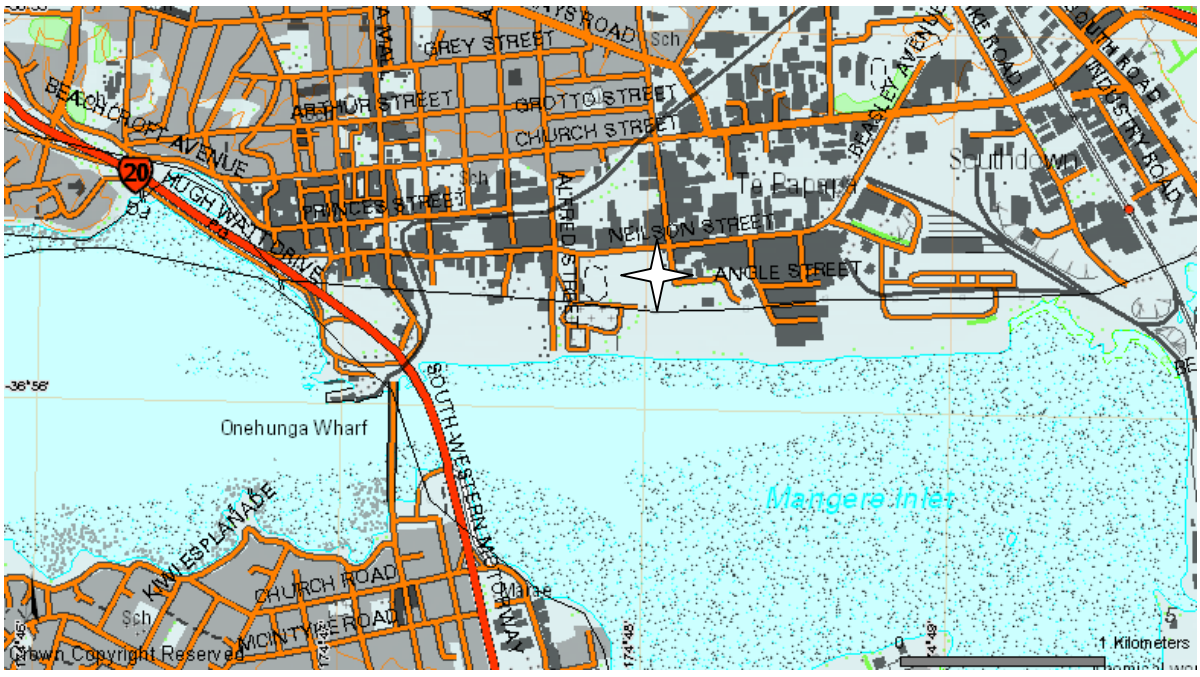
10

Meteorological parameters measured

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast –viewed from the southwest.

Mast top.



Location map.
Map sourced from NZTopo*Online*, extracted January 2006, Crown Copyright Reserved.

Site name

Wiri (met)

Address

Behind K Mart Manukau
55 Lambie Drive
Manukau

	Easting	Northing	Elevation (m)
NZMG	2676819	6466001	18
NZTM	1766415	5904322	

General site characteristics

Industrial

Topography

Flat

Micro met characteristics

The site is open to the N, S and W, with sheltering from large commercial premises (approx 6m high) <50m to the E of 10m mast; 15m from 5m mast and shed.

Site description and area characteristics

Site is located on the west bank of Puhinui Stream (orientation NW-SE) behind K Mart.

Monitoring commenced

26.05.95

Mast height (m)

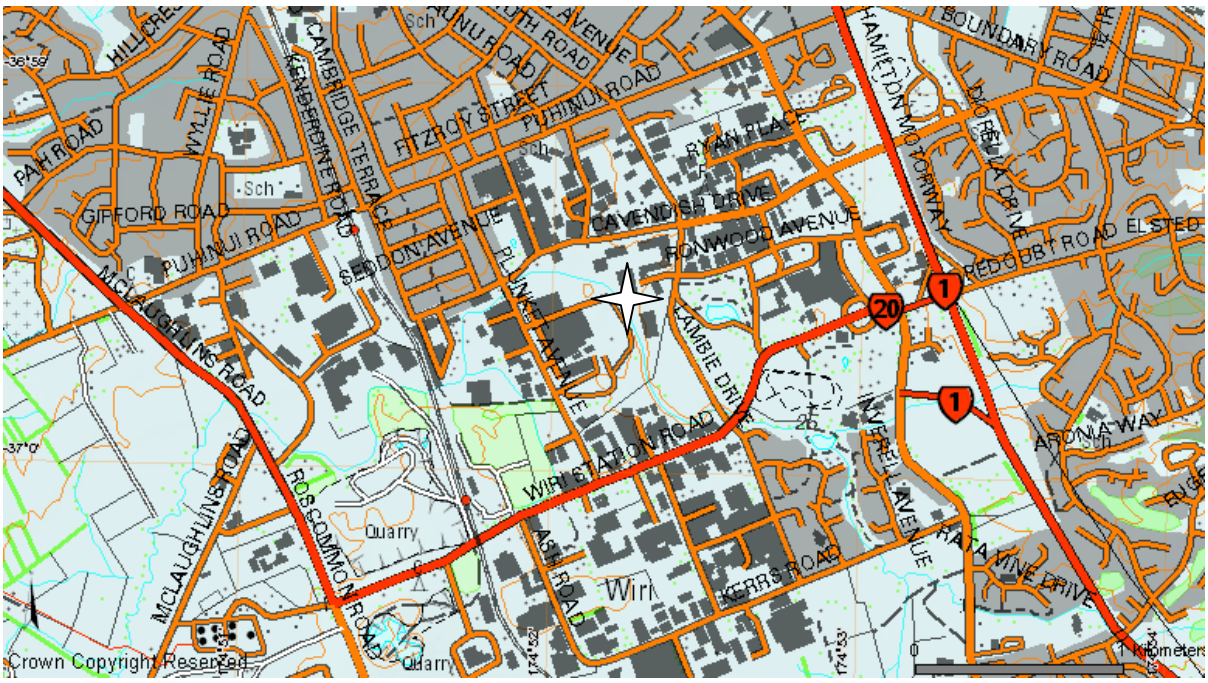
10

Meteorological parameters measured

Wind speed, wind direction, ambient temperature, relative humidity, solar radiation.

Mast –viewed from the north west

Mast top.



Location map.
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