Report

Peka Peka - Otaki (PP2O) Scheme Assessment Report Addendum (SARA), Air Quality Assessment

JANUARY 2011

Prepared for

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Abbreviations

Abbreviation	Description
AADT	Annual Average Daily Traffic
AC	Auckland Council
Background Air Quality	Ambient concentrations of air pollutants found in areas close to the proposed expressway alignment. Existing concentrations are comprised from naturally occurring sources such as sea salt as well as anthropogenic sources such as vehicles and fuel burning home heaters
CO	Carbon monoxide
Design Year	A point in time 10 years after the opening of the expressway
Do Nothing	Assumes the project does not proceed and the current SH section is maintained
Do Something	The project is implemented
HCV	Heavy Commercial Vehicles
LCV	Light Commercial Vehicles
M2PP	MacKays to Peka Peka
MfE	Ministry for the Environment
MoT	Ministry of Transport
NES	National Environmental Standards
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Mono-nitrogen oxides
NZ	New Zealand
NZTA	New Zealand Transport Agency
O_3	Ozone
Opening Year	The year the project is implemented.
Opus	Opus Consultants Limited
PM_{10}	Particulate matter with an aerodynamic diameter <10 µm
PP2O	Peka Peka - Otaki
RMA	Resource Management Act
RoNS	Road of National Significance
SARA	Scheme Assessment Report Addendum
SH	State Highway
SO_2	Sulphur dioxide
TAPM	The Air Pollution Model
Tier 1 Assessment	First stage of an assessment, also known as a screening assessment
Tier 2 Assessment	Second stage of an assessment, also known as a scoping assessment
Tier 3 Assessment	Third and final stage of an assessment, also known as a detailed assessment
URS	URS New Zealand Limited
USA	United States of America
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VEPM	Vehicle Emissions Prediction Model
VOC	Volatile Organic Compounds
WHO	World Health Organisation
µm	Unit of length (micron)

Abbreviation	Description
m	Unit of length (metre)
km	Unit of length (kilometre)
km/hr	Unit of speed (kilometres per hour)
m/s	Unit of speed (metres per second)
$\mu g/m^3$	Concentration (microgram per cubic metre)
g/kW.hr	Emission Rate (grams per kilowatt per hour)
g/km	Emission Rate (grams per kilometre)
kW	Unit of Energy (kilowatt)

Executive Summary

URS New Zealand Limited (URS) has been engaged by Opus Consultants Limited (Opus) to assess the potential effects of discharges to air associated with the construction of an expressway between Peka Peka and Otaki (PP2O) as part of the Wellington Northern Corridor Road of National Significance (RoNS). The following presents a summary of the findings from the assessment of environmental effects associated with air quality.

Assessment of Effects from Vehicle Emissions

The ambient concentration of nitrogen dioxide (NO_2), carbon monoxide (CO) and PM_{10} were assessed for the opening year (2016) and the design year (2026). The results of the assessment indicate that a reduction in concentration can be expected between 2016 and 2026 for the pollutants assessed. This reduction in concentrations is due to the large decrease in vehicle emissions expected due to improvements in vehicle emission technologies.

The results of air dispersion modelling indicate that reductions in the concentration of vehicle air pollutants can be expected in the Township of Otaki along the existing State Highway and especially around the Mill Road/State Highway 1 intersection. For both of the years assessed, concentrations are generally predicted to increase in areas located within 200 m of the expressway. However this increase is relatively small and likely to only be experienced by a small number of receptors due to location of the proposed expressway alignment, which takes vehicle traffic to the east and away from the Otaki Township. The settlement of Te Horo can also expect improvements in air quality, especially properties on the western side of State Highway 1. A small increase in concentrations is predicted in areas located on the eastern side of the expressway, however this is not likely to be significant. Overall URS considers that the proposed alignment will improve air quality in the region for the long-term.

Assessment of Effects from the Construction of the Expressway

The primary air discharge from the construction of the expressway will be dust. This will require mitigation in some areas to reduce the potential for nuisance effects. Generally properties located within 100 m of construction activities will be significant affected and mitigation will be required.

A number of mitigation measures have been recommended to reduce the potential for dust emissions, with the primary measures being: placing a 100 m wide envelope placed around construction areas where practical, speed restrictions on construction vehicles operating near sensitive receptors, use of water tankers to dampen surfaces that have the potential to create dust and the covering of stockpiles when not in use.

There will also be minor emissions (exhaust fumes) from construction vehicles. These are not considered significant due to the relatively small number of vehicles that will be operating during the construction project.

1 Project Description

The planned upgrading of State Highway (SH) 1 between Peka Peka and Otaki North is "part of the Wellington Northern Corridor Road of National Significance – a planned four-lane expressway from Wellington Airport to Levin."

SH 1 is the major route in and out of Wellington, linking the centres of Palmerston North, Wanganui and Levin with Wellington. By improving transport networks through the Kapiti Coast, this project will contribute to economic growth and productivity.

Currently the Peka Peka to North Otaki section of SH 1 has a relatively poor and worsening safety record. It also experiences high levels of congestion during peak periods, weekends and holiday periods. This congestion is compounded by a high proportion of local traffic, and an increasing level of shopping-generated parking and pedestrian movements in the Otaki urban area. A bypass of Otaki, and the provision of a high-standard highway through the area will increase the efficiency of movements between Wellington and the North, will ease local congestion, improve safety, and will facilitate local, regional and national economic development.

The scope of this project is therefore to construct a high quality four-lane expressway bypassing the township of Otaki and the settlement of Te Horo. Together with the MacKays to Peka Peka section to the south, it forms the Kapiti Expressway and when both sections are completed will provide a superior transport corridor providing much improved, reliable and safer journeys through the Kapiti Coast.

The project seeks to safeguard for double tracking of the main trunk rail line and also involves the relocation of the track through Otaki in order to accommodate the proposed expressway.

Site description/existing environment

2.1 Scope

This section of the report provides an overview of the environment between Peka Peka and Otaki (PP2O), the area in which the PP2O expressway will be constructed. At the time of writing this report there is limited information on the air quality for the region, therefore the information provided in this section is indicative of overall air quality within the region. In order to address this lack of information URS has commenced a short-term air quality monitoring programme, however this is not expected to be completed until late January 2012. At the completion of monitoring the results will be used in support of resource consent application for the project. A description of the monitoring programme has been provided in Section 2.5.

2.2 Land Use and Topography

The proposed expressway alignment runs alongside the existing SH 1 through land which is zoned rural and residential. The main Township of Otaki and the settlement of Te Horo are located between the coast, approximately 4 km to the west, and the Tararua Ranges 3 km to the east. The rural land is mainly used for beef and sheep farming as well as market gardening activities.

The North Island Main Trunk Railway Line follows the alignment of SH 1 from Peka Peka to Otaki. The railway line is mainly used to transport freight, with a passenger service currently using the railway line twice a day.

2.3 Sensitive Receptors

A sensitive receptor is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution e.g. retirement villages, aged care facilities, hospitals, schools, early childhood education centres, marae, other cultural facilities, and sensitive ecosystems.

There are a number of residential and commercial properties, churches and schools located near to the proposed alignment at both Otaki and Te Horo. URS has identified the location of these sensitive receptors and has incorporated a number of them into the modelling assessment as discrete receptors

Table 2-1 presents the sensitive (discrete) receptors that URS has selected to assist in the assessment of effects from the proposed expressway. URS has not included all of the residential locations as discrete receptors for practical purposes, but has instead selected a number of locations where concentrations are expected to provide a worst-case assessment of effects from the expressway. Effects on the other sensitive receptors are likely to be less than at the selected locations.

The modelling discussed later in the report also considered all other properties within 200 m of the proposed alignment.

The location of these selected sensitive (discrete) receptors is also shown in Figure 2-1, the Township of Otaki and Figure 2-2, the settlement of Te Horo.

2 Site description/existing environment

Table 2-1 Sensitive (Discrete) Receptors

Sensitive Receptors	Receptor No.	Receptor Location (UTM, Zone 60)	Type
Otaki			
286 Main Hwy	R1	344482 m E, 5486230 m S	Residential Property
Otaki Motel	R2	344549 m E, 5486270 m S	Accommodation
270A Main Hwy	R3	344905 m E, 5486526 m S	Residential Property
56A Rahui Road	R4	344814 m E, 5485998 m S	Residential Property
153 Main Hwy	R5	344084 m E, 5485778 m S	Residential Property
Otaki College	R6	344149 m E, 5486189 m S	School
239 Main Hwy	R7	344390 m E, 5486102 m S	Residential Property
Highway Baptist Church	R8	344978 m E, 5486613 m S	Church
Otaki Convention Centre	R9	344616 m E, 5486010 m S	Convention Centre
Te Horo			
Te Horo School	R1	342215 m E, 5480630 m S	School
26 School Road	R2	341501 m E, 5481253 m S	Residential Property
Red House Café	R3	341361 m E, 5481285 m S	Commercial Property
97 Gear Road	R4	341262 m E, 5480587 m S	Residential Property
845 SH 1	R5	341170 m E, 5480929 m S	Residential Property
961 SH 1	R6	341766 m E, 5481955 m S	Residential Property
937 SH 1	R7	341612 m E, 5481690 m S	Residential Property

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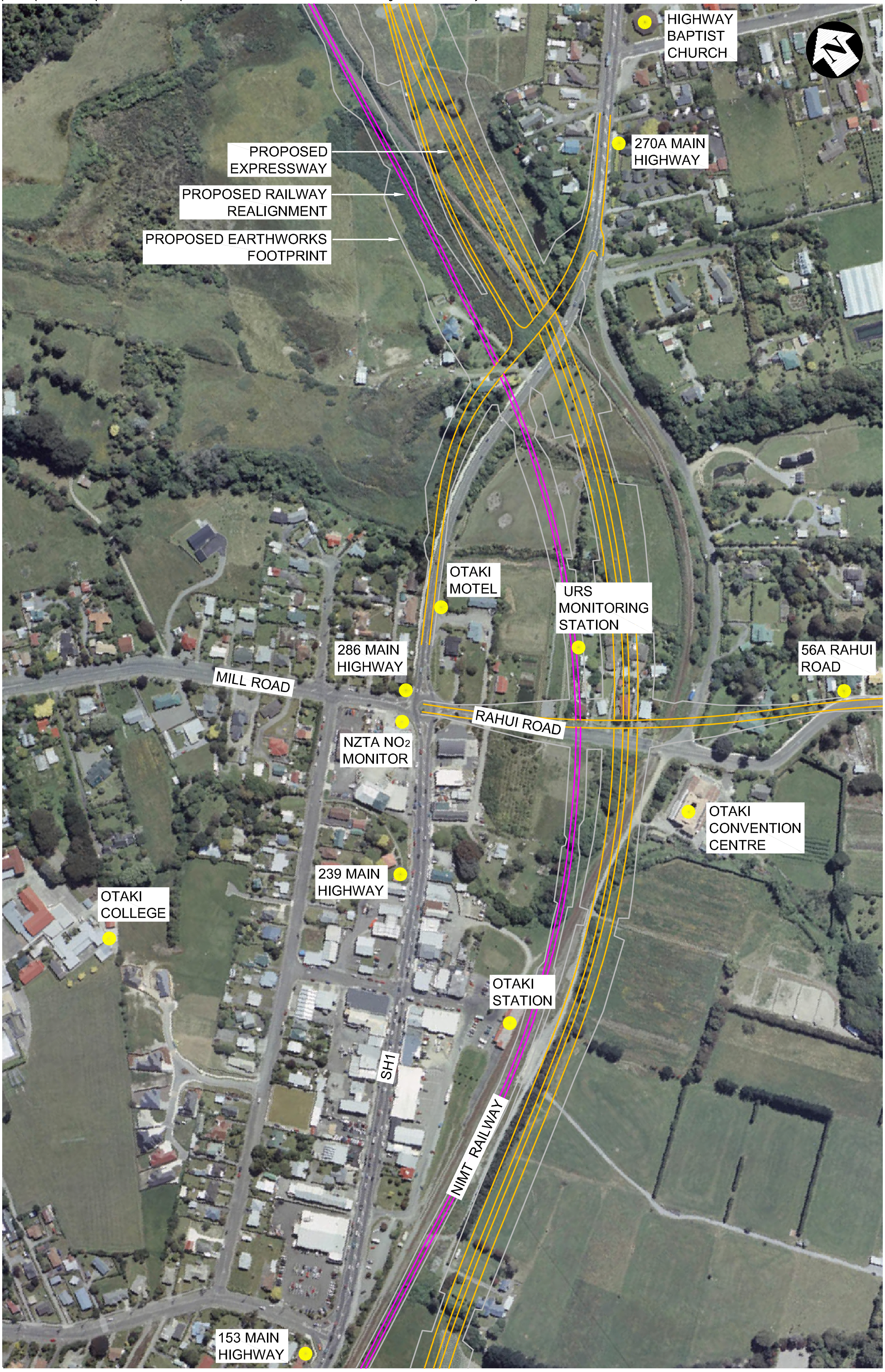

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OTAKI TOWNSHIP

FIGURE 2-1

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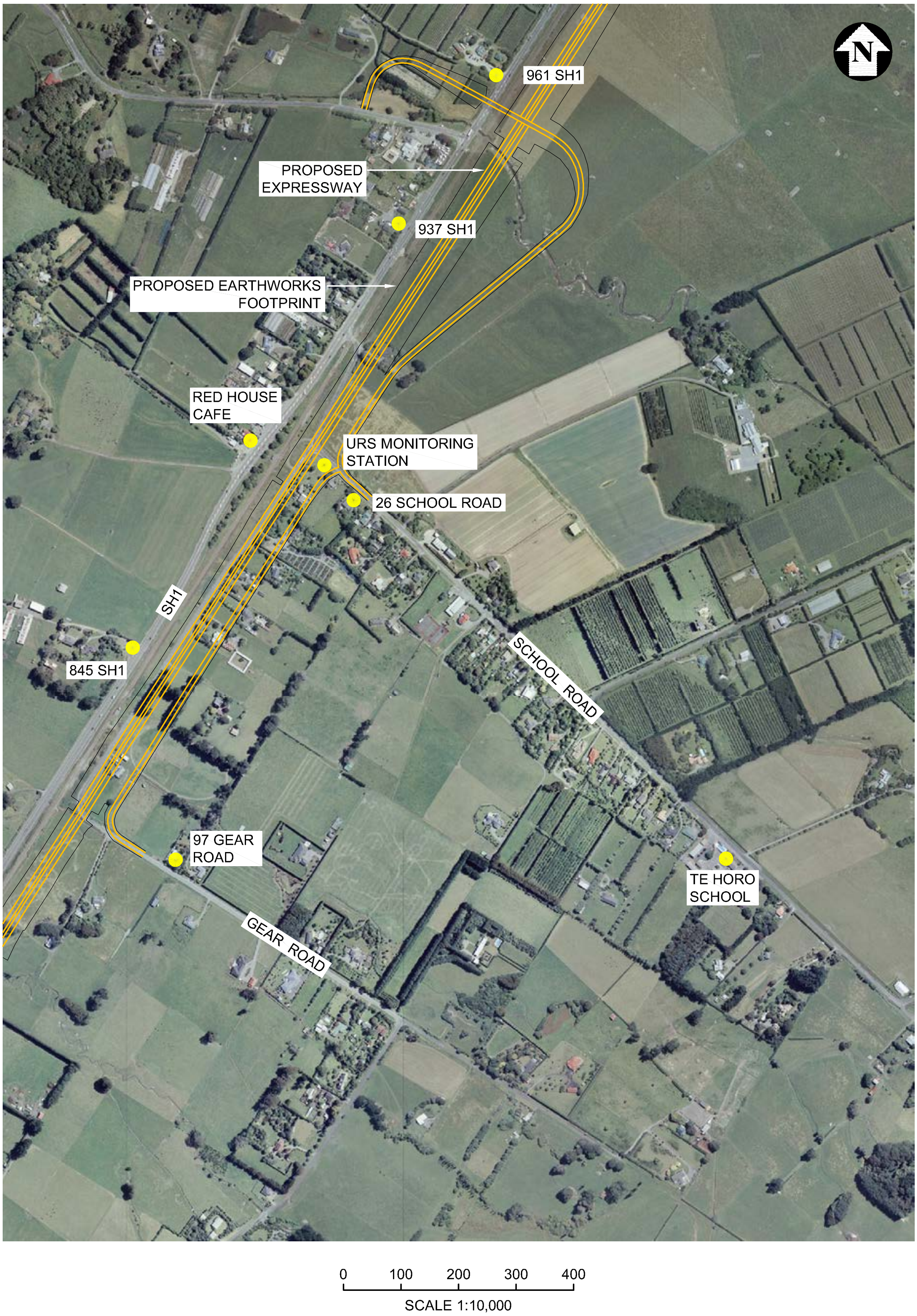

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TE HORO SETTLEMENT

FIGURE 2-2

2.4 Meteorology

In the absence of publically available meteorological data for the Otaki region, URS installed a weather station at Te Horo, halfway between Peka Peka and Otaki. The weather station was commissioned in March 2011 at 7 Gear Road. The weather station measures wind speed and direction, temperature, humidity and rainfall. A wind rose of the collected wind data for the period 04 March 2011 to 31 August 2011 is presented in Figure 2-3.

Due to the short duration of monitoring conducted at this location and the requirement that a minimum of one full year of meteorological data is used to assess air emissions, URS has also reviewed and used meteorological data collected at Levin and Paraparaumu. The Levin monitoring site is located approximately 21 km to the north of Otaki and Paraparaumu is 23 km to the south. Wind roses for the Levin and Paraparaumu monitoring sites for the period 01 January 2005 to 31 August 2011 are presented in Figures 2-4 and 2-5 respectively.

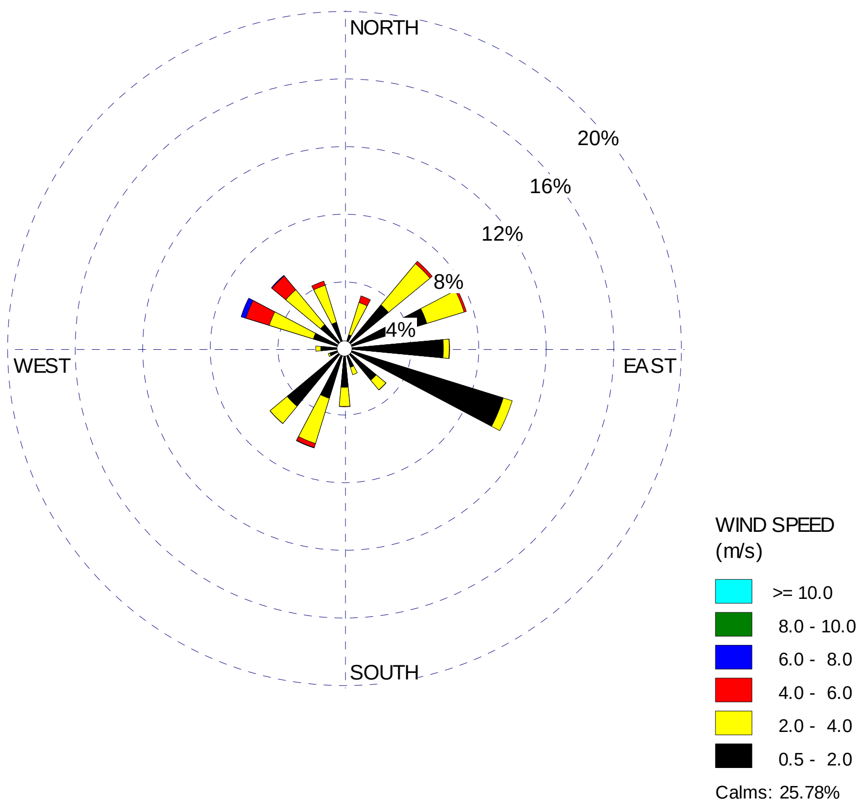

Figure 2-3 Te Horo Meteorological data for the period 04 March 2011 to 31 August 2011

Figure 2-3 shows that the predominant wind direction measured at Te Horo for the monitoring period is from the southeast, with a large number of calms and low wind speeds measured, when compared to the monitoring data from Levin and Paraparaumu. This is most likely due to the different heights at which the anemometer (wind speed sensor) is located, as wind speed increases with height above ground. The Te Horo station anemometer was located at 5 m compared to the other stations which have a height of 10 m.

When comparing the data to date it appears that the frequency of wind directions in the scheme area is better represented by those measured at Levin as opposed to Paraparaumu, as can be seen in Figures 2-4 and 2-5 respectively.

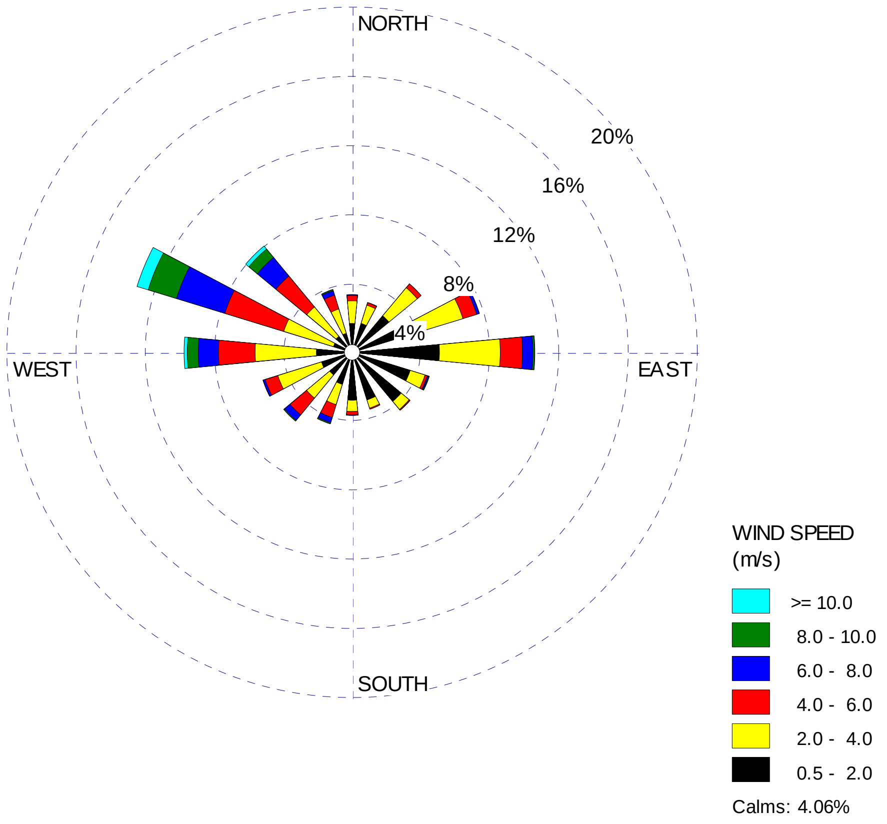

Figure 2-4 Levin Meteorological data for the period 01 January 2005 to 31 August 2011

2 Site description/existing environment

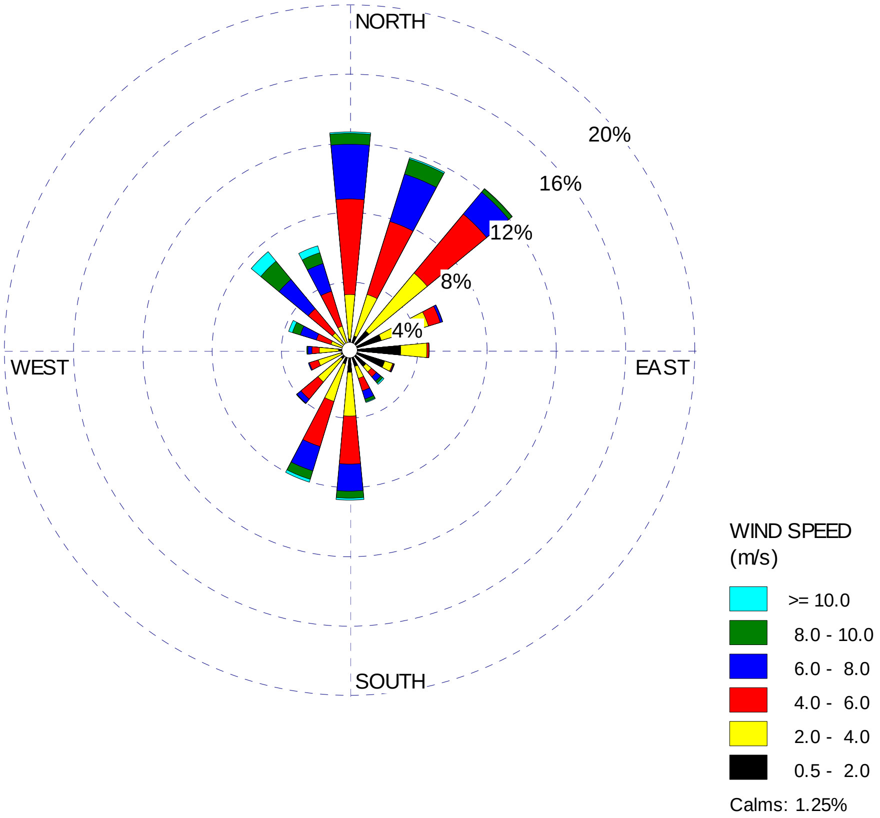

Figure 2-5 Paraparaumu Meteorological data for the period 01 January 2005 to 31 August 2011

2.5 Background Ambient Air Quality

2.5.1 NZTA Passive NO_2 Monitoring Programme

As previously mentioned, URS is unaware of any comprehensive background monitoring conducted near to the proposed alignment. However the New Zealand Transport Agency (NZTA) has setup a comprehensive network of monitoring sites throughout New Zealand[12] measuring short-term nitrogen dioxide (NO_2) concentrations. As part of this network, monitoring has been conducted in Otaki at the corner of Mill Road and SH 1. Monitoring at this location commenced in March 2010 and will continue for the foreseeable future. NO_2 measurements are collected as monthly averages using passive diffusion tubes which are supplied and analysed by Staffordshire County Council Scientific Services.

To date the monitoring station has measured moderate levels of NO_2. This is primarily due to its close location relative to the intersection, where vehicles have to slow and queue. Figure 2-6 presents the monthly NO_2 concentrations measured at this site. The data shows that NO_2 concentrations are lowest during summer months and highest during the winter. This is most likely due to meteorological conditions and the contribution of combustion emissions from wood burners in the Otaki Township. The average monthly concentration for the period March 2010 to May 2011 was 18 µg/m³ and the annual average concentration for the period March 2010 to February 2011 was 17 µg/m³. No adverse effects are expected from NO_2 concentrations at this location as the annual average is below the World Health Organisations (WHO)[3] guideline of 40 µg/m³.

The data presented below was provided by the NZTA and at the time of writing this report had not undergone all of the required quality assurance checks, therefore a high degree of confidence in the data is not assured.

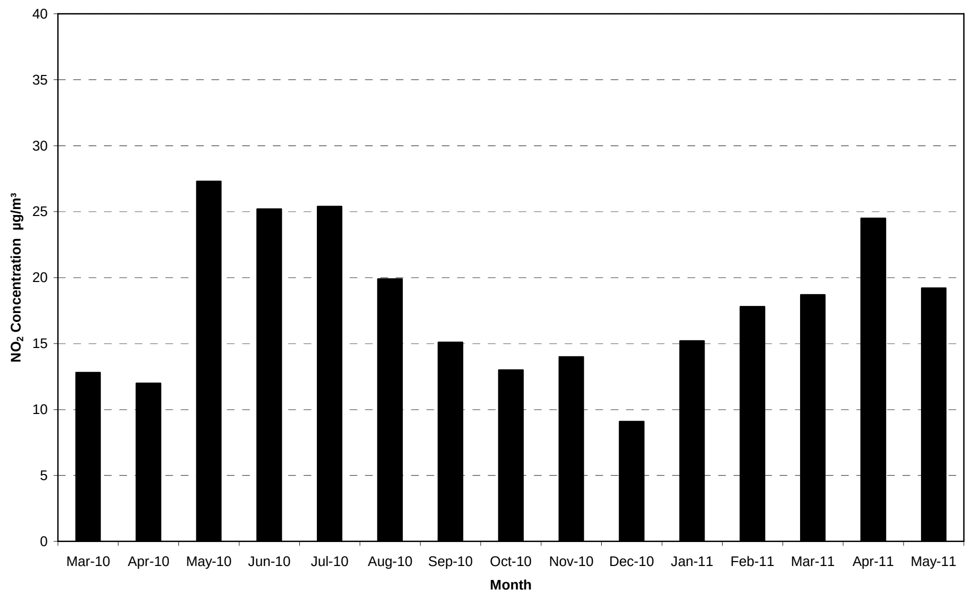

Figure 2-6 Summary of NO_2 monitoring conducted at Otaki (March 2010 - May 2011)

[1] NZTA Ambient Air Quality (nitrogen dioxide) monitoring network report) 2007 -2009
[2] NZTA Ambient Air Quality (nitrogen dioxide) monitoring network site metadata report 2007-2010
[3] World Health Organisation Air Quality Guidelines Global Update, 2005

2 Site description/existing environment

2.5.2 URS Monitoring

On 3 August 2011 URS began monitoring NO_2 using the same method mentioned in Section 2.5.1 at three locations, Rahui Road in Otaki, 7 Gear Road in Te Horo and at the Beca[4] operated Paraparaumu monitoring station on Raumati Road.

The Te Horo monitoring site is located in a semi-rural area approximately 70 m from SH 1 and 40 m from the main railway line, and provides a good approximation of NO_2 concentrations within Te Horo.

The Paraparaumu monitoring location was selected in order to verify measured passive badge concentrations with the co-located continuous NO_X (nitrogen oxide (NO) and NO_2) monitor located at the site. The results will be compared and a correction factor will be applied, if necessary, to the other NO_2 passive badge monitors located at Otaki and Te Horo to assist in the calibration of the traffic air dispersion modelling results to be presented in the Assessment of Environmental Effects (AEE) report.

Continuous PM_{10} and carbon monoxide (CO) monitors were also installed at Rahui Road on 19 July 2011 to provide additional information on the other air pollutants of concern. The Rahui Road monitoring site is located approximately 150 m to the south east of the Mill Road/SH 1 intersection and at a sufficient distance that it is not significantly influenced by traffic emissions. This site is likely to provide a good approximation of background concentration within the Otaki Township.

2.5.3 Background Concentrations

In the absence of comprehensive monitoring data for the Otaki Region and with no other monitoring stations located nearby, data from the recently commissioned Beca operated monitoring station located at Paraparaumu was used to assist in the estimation of background concentrations for the area surrounding Otaki and Te Horo. The monitoring site is located in an urban area, approximately 1 km from SH 1. The contributions of pollutants measured at this site are from combustion emissions from home heating and vehicle emissions from Raumati Road which is located next to the site. The concentrations measured at this site are likely to be higher than the background concentrations found in the area surrounding the proposed expressway alignment. Therefore the use of these values will provide a conservative estimate of background concentrations for the Otaki and Te Horo Townships. The data collected for the period February to July 2011 was reviewed and the background concentrations for NO_2, CO and PM_{10} are presented in Table 2-1.

Table 2-2 Peka Peka to Otaki Airshed Background Concentrations

Contaminant	Averaging Period	Average Concentration (µg/m³)	Maximum Concentration (µg/m³)
NO_2	1-hour 24-hour	7 7	39 18
CO	1-hour 8-hour	250 250	3,000 1,300
PM_{10}	24-hour Annual	12 12[5]	25 -

[4] M2PP Alliance monitoring
[5] The annual average was assumed from the average 24-hour data collected for the period February to July 2011.

Regulatory Requirements

3.1 Resource Management Act

Section 15(1)(c) of the Resource Management Act 1991 (RMA) states that any discharge from an industrial or trade premise into air requires a Resource Consent unless that discharge is expressly allowed by a rule in a Proposed Regional Plan and Regional Plan, or a regulation.

3.2 National Environmental Standards

The National Environmental Standards for Air Quality (NES)[6] promulgated by the Ministry for the Environment (MfE) set standards PM_{10}, CO, NO_2, SO_2 and O_3 which must not be exceeded. These standards must be achieved in all locations within New Zealand. Table 3-1 includes a list of the standards.

Table 3-1 Assessment Criteria

Contaminant	Averaging Period	Air Quality Criteria (µg/m³)
PM_{10}	24-hour	50
CO	8-hour	10,000
NO_2	1-hour	200
SO2	1-hour	350
O_3	1-hour	150

3.3 Greater Wellington Regional Council Air Plan

The Regional Air Quality Management Plan became operative on 8 May 2000 and provides objectives, policies, and methods in order to sustainably manage air quality within the region. The air plan sets out regional ambient air quality guidelines for a number of pollutants relevant to this project and the guidelines for these pollutants are presented in Table 3-2.

Table 3-2 Regional Ambient Air Quality Guidelines Regional Ambient Air Quality Guidelines

Indicator	Maximum Acceptable Level (µg/m³)	Averaging Times
Particulates	50	24 hours
	20	Annual
Carbon Monoxide	10,000	8 hours
Nitrogen Dioxide	300	1 hour
	100	24 hours

[6] Ministry for the Environment, Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, an other toxics) Regulations 2004

3.4 Kapiti District Plan

The Kapiti district council does not have any specific rules relating to air quality that are applicable to this construction project. The plan instead refers to the Regional Air Quality Management Plan for the Wellington Region.

3.5 Other Relevant Regulatory Documents

There are a number of other documents that relate to environmental management of the transport network. These are the Land Transport Management Act, New Zealand Transport Strategy, Regional Land Transport Strategies, Government Policy Statement and the NZTA's Environment Plan. These documents provide policies, objectives, strategies and plans designed to help sustainably manage the environmental effects from the transport network. However these documents do not provide any rules or guidelines, with regard to air quality, against which ambient concentrations of pollutants can be assessed.

Vehicle Emission Assessment Methodology

A traffic dispersion model was used to predict the concentration of various pollutants at specific locations along the existing SH and at locations near to the proposed expressway. The results of modelling were then used to assist in the assessment of air quality effects from the operation of the expressway.

4.1 Dispersion Modelling

The traffic dispersion model CAL3QHCR version 2.0 has been used in this assessment. CAL3QHCR is accepted by the United States Environmental Protection Agency (USEPA) as a guideline model to be used in all regulatory applications involving the prediction of pollutant concentrations downwind of highways in relatively uncomplicated terrain,.

CAL3QHC is recommended by the MfE, particularly in more complex situations where the effects of vehicles passing through intersections is being assessed[7].

Like all dispersion models, CAL3QHCR has requirements for a number of inputs in order to make it function. The following sections describe the inputs used in this assessment.

4.2 Vehicle Volumes and Speed

Annual average daily traffic flows (AADT) for the base year 2010 were obtained from the NZTA[8]. Projected AADT's for 2026 (opening year plus ten) were provided by Opus Consultants Limited (Opus), for two scenarios; 'do minimum' and 'do something'. Traffic data for 2016 (opening year) for the same two scenarios was then extrapolated using annual growth factors, also provided by Opus.

Traffic data was not available for Mill Road and Rahui Road for 2010 therefore URS has assumed AADT's of 10 % of the SH 1 traffic flow for these links. These values were based on field observations by URS staff.

Measured vehicle speed data was not available, therefore traffic was assumed to be free flowing at the designated speed limit. The SH 1 roundabout intersection with Mill Road was an exception to this assumption, with speed reduced to 10 km/h within 50 m of the roundabout to represent vehicles slowing down and queuing to negotiate the roundabout.

It was assumed that peak traffic periods were between 7 am and 9 am and 5 pm and 7 pm. During this time the traffic flow was assumed to be 10% of the AADT[9]. For other times the traffic flow was assumed to be the average hourly traffic flow (AADT/24).

At the time of writing this report URS was unable to accurately determine the number of locomotives operating between Peka Peka and Otaki on a daily basis. This is due to the large variability in the types of locomotives and the frequency at which they operate. However, in discussions with KiwiRail staff it was estimated that on average a total of 15 locomotives operate per day on this section of railway line. This total includes 2 passenger locomotives and 13 freight locomotives and this has been used in this assessment.

[7] Ministry for the Environment, Good Practice Guide for Atmospheric Dispersion Modelling, 2004
[8] http://www.nzta.govt.nz/resources/state-highway-traffic-volumes/index.html
[9] Ministry for the Environment, Good Practice Guide for Assessing Discharges to Air from Land Transport, May 2008

4.3 Vehicle Fleet Profile

Heavy Commercial Vehicle (HCV) data for the base year 2010 was obtained from NZTA, and projected HCV data for 2026 was provided by Opus. Growth factors provided by Opus were then used to extrapolate HCV numbers for 2016. Detailed fleet composition data was not available for this assessment and therefore the default vehicle fleet profile within the emissions model (discussed in Section 4.4) was used to obtain the proportion of vehicles within each category including cars, light commercial vehicles (LCV), HCV and buses based on the HCV data available.

4.4 Vehicle Emission Rates

4.4.1 Road Transport Emissions

The Auckland Council's (AC) Vehicle Emissions Prediction Model (VEPM) version 3.0 was used in conjunction with traffic data provided to determine emission factors for NO_x, CO and PM_{10} for the five scenarios modelled. NO_2 emission factors were conservatively estimated as 20% of the NO_x value. This is in accordance with guidance found in the MfE Good Practice Guide[10].

VEPM was selected in accordance with the NZTA's Standard for Producing Air Quality Assessments for State Highway Projects[11]. VEPM provides emission factors for various pollutants for a range of vehicle fleet categories including passenger cars, light duty and heavy duty vehicles[12]. VEPM uses these emission factors in combination with a fleet profile to obtain an average fleet emission factor. The emission factors consider a number of variables including:

- Vehicle speed
- Impact of cold engine operation
- Impact of catalytic converter removal
- Impact of fuel properties
- Impact of emission degradation due to vehicles accumulated distance travelled (petrol vehicles only)
- Fleet profile

4.4.2 Locomotive Emissions

The majority of New Zealand's fleet of locomotives are powered using large diesel engines, with the mainstays of the current fleet being the DX, DFT and DC locomotives, equipped with GM EMD 645 and GE 7FDL series engines. A report written by the Ministry of Transport (MoT) in 1999 [13] estimated the emissions from these types of diesel engines, using emission factors provided by the USEPA. The report determined that the USEPA emission factors are representative of the New Zealand Locomotive fleet as variants of the engines mentioned above were used in the tests performed by the USEPA to determine the emission factors. Table 4-1 presents the fleet averaged emission factors for locomotives from the United States of America (USA).

[10] Ministry for the Environment, Good Practice Guide for Assessing Discharges to Air from Land Transport, May 2008
[11] Draft NZTA's Standard for Producing Air Quality Assessments for State Highway Projects, Version 5, 16 July 2010
[12] Emissions Impossible Ltd, Instructions For Using The Vehicle Emissions Prediction Model (VEPM) Version 3.0, February 2009
[13] Ministry of Transport, Impacts of Rail Transport on Local Air Quality, July 1999.

4 Vehicle Emission Assessment Methodology

Table 4-1 USEPA Emission Factors for Locomotive in Current Service

	NO_x		$*NO_2$		CO		PM	
	g/kW.hr	**g/km**	**g/kW.hr**	**g/km**	**g/kW.hr**	**g/km**	**g/kW.hr**	**g/km**
Line Haul	17.3	865	3.5	173	1.7	85	0.43	22
Switch Yard	23.2	1160	4.6	232	2.5	125	0.59	30

*The NO_2 emission factors are base on 20% of the NO_x value.

The g/km emission factors were calculated using the average New Zealand fleet locomotive power output of 1,500 kW and the assumption that average speed of locomotives operating on the section of track between Peka Peka and Otaki is 30 km/hr.

4.5 Modelling Input Data

4.5.1 Meteorology

The CAL3QHCR model uses meteorological data for any length of time from one hour to one year. As there is not currently sufficient local wind data available to use for the Peka Peka to Otaki scheme at this time, an artificial meteorological data set was developed using the meteorological component of The Air Pollution Model (TAPM). This model takes the synoptic weather patterns for New Zealand and applies them over the terrain of the area to be modelled and applies corrections to the wind flows based on real meteorological data for locations within the area. In this assessment URS has used surface meteorological data collected from the Levin and Paraparaumu Aero meteorological stations for the year 2010. This data was processed using TAPM to produce multi-dimensional hourly varying wind fields. The meteorological data was then used in the dispersion model for all of the scenarios assessed. A wind rose of the TAPM generated wind data is presented in Figure 4-1. The TAPM generated wind rose data shows many similarities with winds measured by the Te Horo station, with both sets of data showing a predominant wind direction from the south east and a large proportion of winds from the north east.

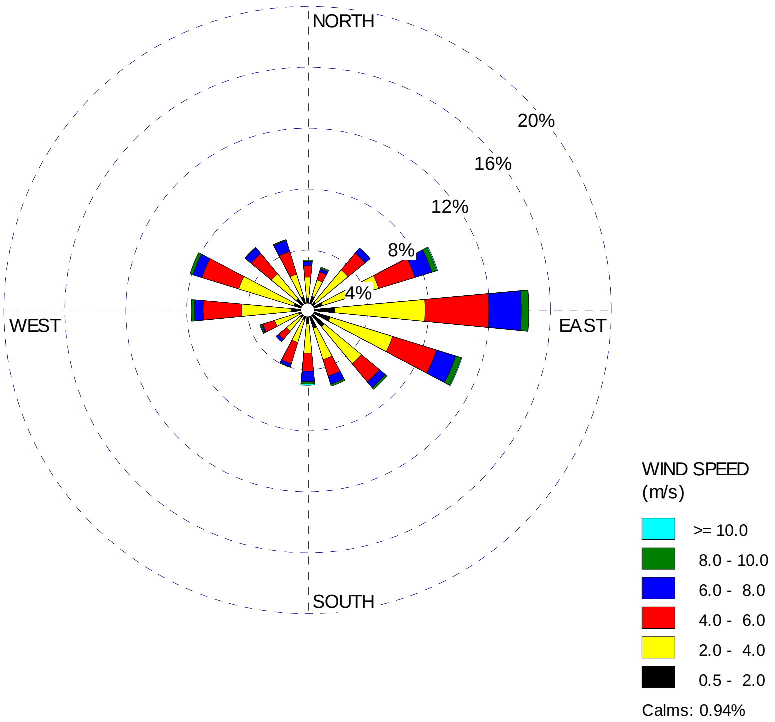

Figure 4-1 TAPM Generated Meteorological data Otaki for the year 2010

4.5.2 Terrain

As described in Section 2.2, the surrounding area is relatively flat with the nearest hills approximately 3 km to the east. Therefore no specific terrain parameters have been included in the model.

4.5.3 Modelling Options

There are also a number of minor options that need to be defined in the model. Table 4-1 shows the settings selected for the two locations assessed.

Table 4-2 Modelling Options

Location	Surface Roughness Length	Urban or Rural Settings	Road at Grade Level	Receptor Height (m)
Otaki	Suburban	Urban	Yes	0
Te Horo	Rural	Rural	Yes	0

4.6 Surface Roads in the Modelling Domain

Traffic data for 2010 for the roads considered in this assessment was obtained from NZTA's Traffic Data Booklets. Appendix A presents a summary of the surface roads information used in the model.

4.7 Significance Criteria for Incremental Analysis

The MfE has recommended a set of criteria to determine whether the predicted concentrations of road traffic pollutants are likely to be 'significant' (MfE, 2008)[14]. These are absolute criteria and are not related to the existing air quality and are for incremental analysis only. The significance criteria relevant to this assessment are presented in Table 4-2.

The significance of changes in air quality has been presented in the following section using the results of air dispersion modelling. A significant change in pollutant concentrations has been indicated with either a '+', indicating an improvement by more than the threshold concentration or a '-', indicating degradation in air quality by more than the threshold concentration. Minor changes less than the threshold concentration have been indicated with a '0'.

Table 4-3 MfE Ambient Air Quality Significance Criteria

Pollutant	Threshold Concentration	Averaging Period
PM_{10}	3 µg/m³	24-hour
NO_2	20 µg/m³	1-hour
CO	1 mg/m³	8-hour

[14] Good Practice Guide for Atmospheric Dispersion Modelling, Air Quality Technical Report No.27, Ministry for the Environment, 2004.

Assessment of Environmental Effects

5.1 Tier 1 Assessment

A Tier 1 assessment of the proposed corridor has been conducted by URS and the results of this air quality assessment were presented in a letter to Allan Planning & Research Ltd on 27 July 2011[15]. In summary, the Tier 1 assessment found that the proposed corridor has a 'Medium' air quality risk and therefore requires a more detailed evaluation in the form of a Tier 3 assessment.

5.2 Tier 3 Assessment

The air quality assessment focused primarily on Otaki and Te Horo, with the main air quality concern and focus being properties located near to the existing intersection of Mill Road and SH 1 in Otaki, and properties located adjacent to the proposed expressway alignment at Te Horo.

The intersection at Otaki has the highest potential to cause air quality effects, when compared to other links of the road network between Peka Peka Road and Taylors Road. This is due to the relatively high traffic flow and slow speed at which the intersection is taken, along with vehicles having to queue at the intersection during peak periods. The construction of the expressway will allow traffic to bypass this intersection and consequently a reduction in vehicle emissions at this location is expected.

Any potential effects at other locations along the PP2O route will be less than those experienced at Otaki, due to the lower emissions produced by vehicles travelling at highway speeds compared to the higher emissions produced by vehicles having to slow and queue to negotiate the intersection of Mill Road and SH 1, therefore specific consideration for these locations is not required.

5.3 Modelling Scenarios

Five scenarios were assessed for the two townships where the expressway will pass, Otaki and Te Horo. These scenarios are as follows:

1. Existing Situation – 2010 was modelled using available traffic and meteorological data
2. Opening Year (2016) Do Something – The project is implemented.
3. Opening Year (2016) Do Minimum – Assumes the project does not proceed and the current SH section is maintained.
4. Design Year (2026) Do Something – The project is implemented.
5. Design Year (2026) Do Minimum – Assumes the project does not proceed and the current SH section is maintained.

5.4 Pollutants Modelled

The dispersion model was used to predict concentrations of NO_2, CO and PM_{10} at Otaki and NO_2 and PM_{10} concentrations at Te Horo. CO concentrations were not modelled at Te Horo as predicted concentrations at Otaki showed values well below guidelines and modelled NO_2 and PM_{10} concentrations were found to be lower at Te Horo than at Otaki.

Volatile Organic Compounds (VOC) were not assessed as the ambient concentrations near traffic links are expected to be below guidelines. If NO_2 and PM_{10} concentrations are found to exceed NES then a more detailed assessment of VOC concentrations may be required

15 URS New Zealand Limited, Peka Peka to Otaki – Assessment of alternative corridors Acoustics and Air Quality, 27 July 2011.

5.5 Validation of Modelling Results

The air quality at the Mill Road/SH 1 intersection was modelled for the current situation and predicted NO_2 concentrations at the location of the NZTA passive NO_2 monitor where compared with actual monitoring data. When comparing the results it was found that the model under-predicted concentrations by a factor of 3.5. Therefore to adjust the modelled data to correlate with measured values a correction factor of 3.5 was applied to all modelling results for all pollutants.

This under-prediction is likely to be caused by an underestimation of the emission factors used, due to various assumptions made regarding the composition of the vehicle fleet as URS was not provided with a full break-down of the vehicle composition for the year 2010.

In addition, the latest NZTA ambient air quality report[16] makes mention of the fact that the passive NO_2 monitors used are not directly comparable to measurements from continuous gas analysers (the reference method). The report refers to a recent study which found that passive monitors had the potential to over-report concentrations by up to 30%. URS has not taken this uncertainty into account when using the concentrations measured at the Mill Road/SH 1 intersection to calibrate the dispersion model, therefore the model has the potential to overestimate concentrations by up to 30%.

5.6 Model Conservatism

Due to the number of conservative assumptions that have been made as part of this assessment with respect to traffic flows, emission and correction factors, URS considers that it is likely that the model will conservatively predict ground level concentrations, and as such the results should not be considered as definitive. Instead, the results of modelling should primarily be used to demonstrate the magnitude of changes in concentration at receptors. However URS has also used the model results to indicate whether compliance with the NES would be achieved.

Emissions from locomotives have the potential to significantly improve between 2010 and 2026, with the replacement and upgrade with newer models of locomotive which utilise improved engine technology. However at the time of writing this report, URS was unable to determine what types of locomotives will be replaced, when they will be replaced or what the replacement will be. Therefore URS has assumed that emissions from the locomotive fleet will not improve for the years modelled. This assumption is conservative, but with the lack of information no other assumption can be justified.

[16] NZTA Ambient air quality (nitrogen dioxide) monitoring network report 2007-2009 , 2010.

5.7 Assessment of Environmental Effects from Vehicle Emissions

As discussed previously, five modelling scenarios were assessed to determine the concentration of air pollutants in areas near to the existing SH 1 and the proposed expressway. The results indicated that the highest concentrations were expected for the 2016 scenarios, with a reduction in concentrations expected over the next ten years to 2026. This reduction in concentrations is due to the large decrease in vehicle emissions expected due to improvements in vehicle emission technologies. This large decrease in emissions is slightly offset by a small increase in vehicle traffic expected over this period, however overall the reduction is still significant. Therefore the results of modelling for 2026 are not considered any further, however they have still been presented in tables within this section.

5.7.1 Assessment of Environmental Effects at Otaki from Vehicle Emissions

NO_2, CO and PM_{10} concentrations were predicted in areas within 200 m of the existing SH and the proposed expressway at the Otaki Township. This section of the report discusses and presents the results of air dispersion modelling. The location of the discrete receptors used has been shown on Figures 5-1 and 5-2 to allow for comparison of predicted concentrations with their relative location. The location of the road vehicle links have been shown as blue lines and rail links as brown lines.

Nitrogen Dioxide

The results of 1-hr NO_2 modelling are presented in Table 5-1, Figures 5-1, 5-2 and 5-3.

Table 5-1 Predicted 99.9%ile 1-hr NO_2 (Excluding Background) at Otaki

Receptors		Existing 2010 (µg/m³)	Do Minimum (µg/m³)		Do Something (µg/m³)		Significance of Change	
			2016	2026	2016	2026	2016	2026
1	286 Main Hwy	127	144	106	69	51	+	+
2	Otaki Motel	81	79	57	37	27	+	+
3	270A Main Hwy	52	42	32	38	29	0	0
4	56A Rahui Road	9	9	8	11	9	0	0
5	153 Main Hwy	66	68	49	36	29	+	+
6	Otaki College	8	8	7	7	6	0	0
7	239 Main Hwy	47	47	34	25	19	+	0
8	Highway Baptist Church	42	34	27	31	23	0	0
9	Otaki Convention Centre	23	22	20	40	31	0	0

Based on the traffic modelling data provided, the construction of the expressway in 2016 will reduce the number of vehicles using the Mill Road/SH 1 intersection by up to 57 %. This reduction in traffic flow from the opening of the expressway, along with improvements in vehicle emission technology, will significantly reduce NO_2 emissions and concentrations around the intersection. This is evident when

5 Assessment of Environmental Effects

looking at Table 5-1 which indicates a reduction in NO_2 concentrations at two receptors, 286 Main Hwy and the Otaki Motel, both located within 50 m of the intersection.

A reduction in NO_2 concentrations is also predicted at properties located alongside SH 1 to the southwest of the intersection. The reduction in concentration at these locations is caused by a reduction in vehicle traffic and improvements in vehicle fleet emissions.

Concentrations of NO_2 at Otaki College are not expected to significantly change from existing levels for both the ‘Do Minimum’ and ‘Do Something’ scenarios. This is because the College is located at a sufficient distance from SH 1 and the proposed expressway that vehicle emissions will have little effect on ambient concentrations at this location.

The ‘Do Something’ scenario will result in a small increase in NO_2 concentration in areas located within 200 m of the expressway to the east of Otaki. This is indicated by the increase in concentration from 22 µg/m³ for the ‘Do Minimum’ scenario to 40 µg/m³ for ‘Do Something’ scenario predicted at the Otaki Convention Centre. However these increases are not considered significant.

As discussed in Section 2.5.3, the average hourly background NO_2 concentration is likely to be approximately 7 µg/m³ with a maximum 1-hr average of 39 µg/m³. Even assuming that worst-case predicted concentrations from vehicle emissions coincide with the maximum background concentration of 39 µg/m³, predicted concentrations at all of the receptor locations for the ‘Do Minimum’ and ‘Do Something’ scenarios are likely to be below the 1-hr NES of 200 µg/m³.

In summary the change in ambient NO_2 concentrations from the construction of the expressway are either positive or not considered significant in Otaki.

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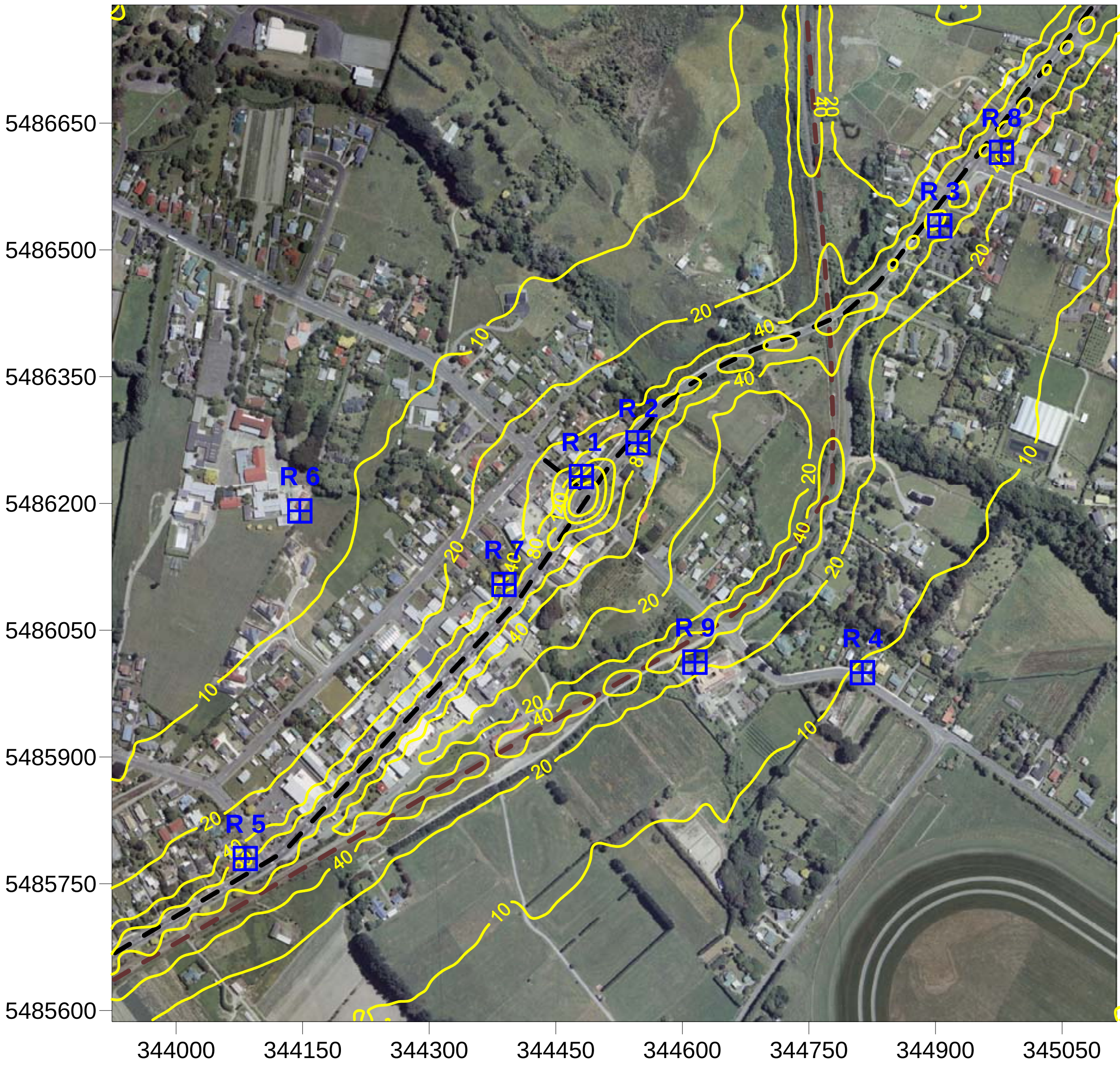

Figure 5-1 Otaki - Predicted 99.9%ile 1-hr NO_2 Concentrations (Excluding Background) - 2016 Do Minimum

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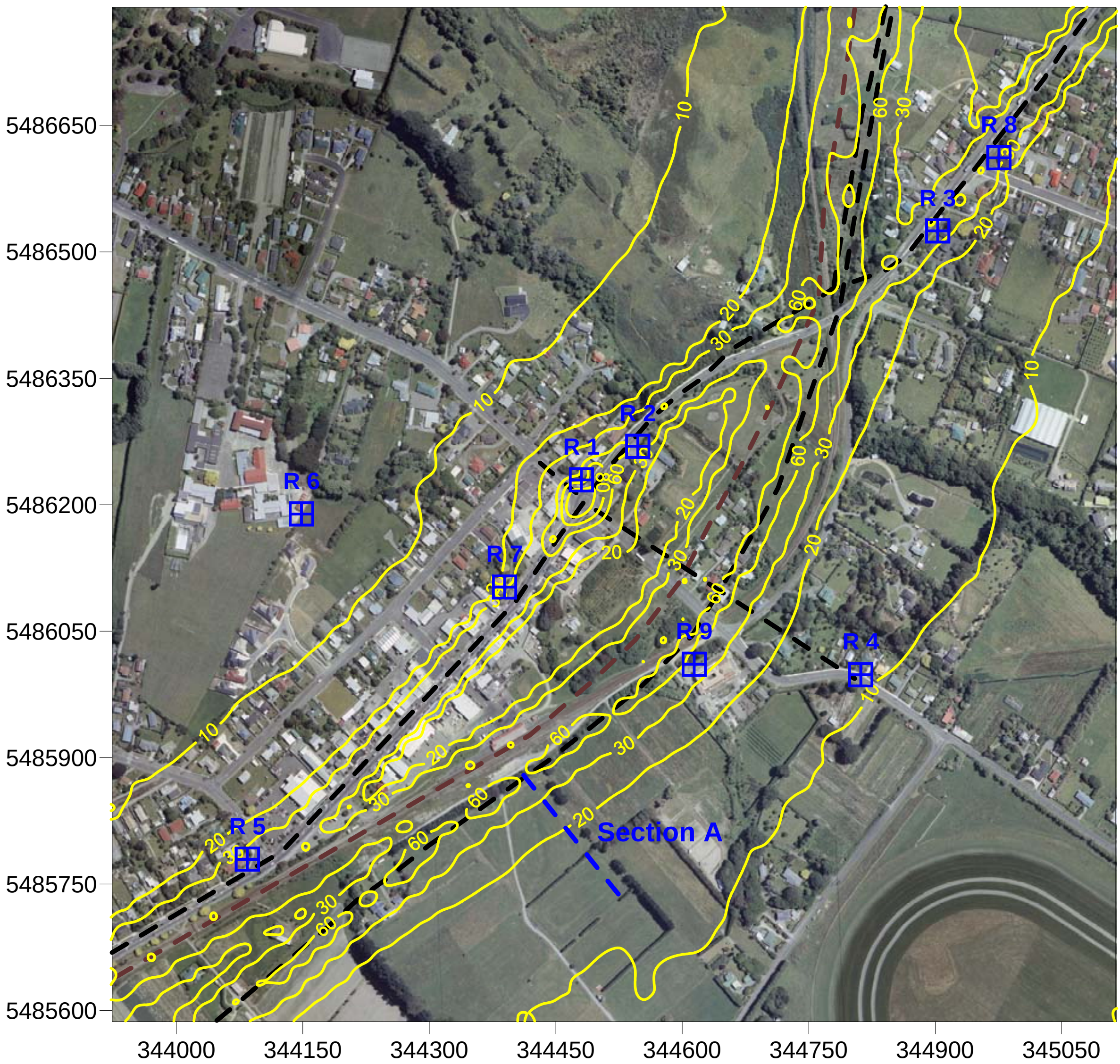

Figure 5-2 Otaki - Predicted 99.9%ile 1-hr NO_2 Concentrations (Excluding Background) - 2016 Do Something

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Expressway NO_2 Emissions

Table 5-1 indicates that none of the receptors assessed are likely to be significantly negatively affected by NO_2 concentrations. However if a receptor is located sufficiently close to the proposed expressway a significant increase in concentrations is likely. However the concentration of NO_2 immediately adjacent to the expressway is not expected to exceed NES. This is shown in Figure 5-3 which presents a cross-section of NO_2 1-hr (Excluding Background) concentrations for the proposed expressway for the 2016 'Do Something scenario'. Figure 5-2, Section A shows the location where the cross-section was taken. The cross-section is representative of concentrations found near to the roadside for a typical section of the expressway where traffic travels at highway speeds. The Figure shows that concentrations are less than 70 µg/m³ at the roadside. Concentrations then drop to half this level at a distance of 30 m and are near background levels within 100 m.

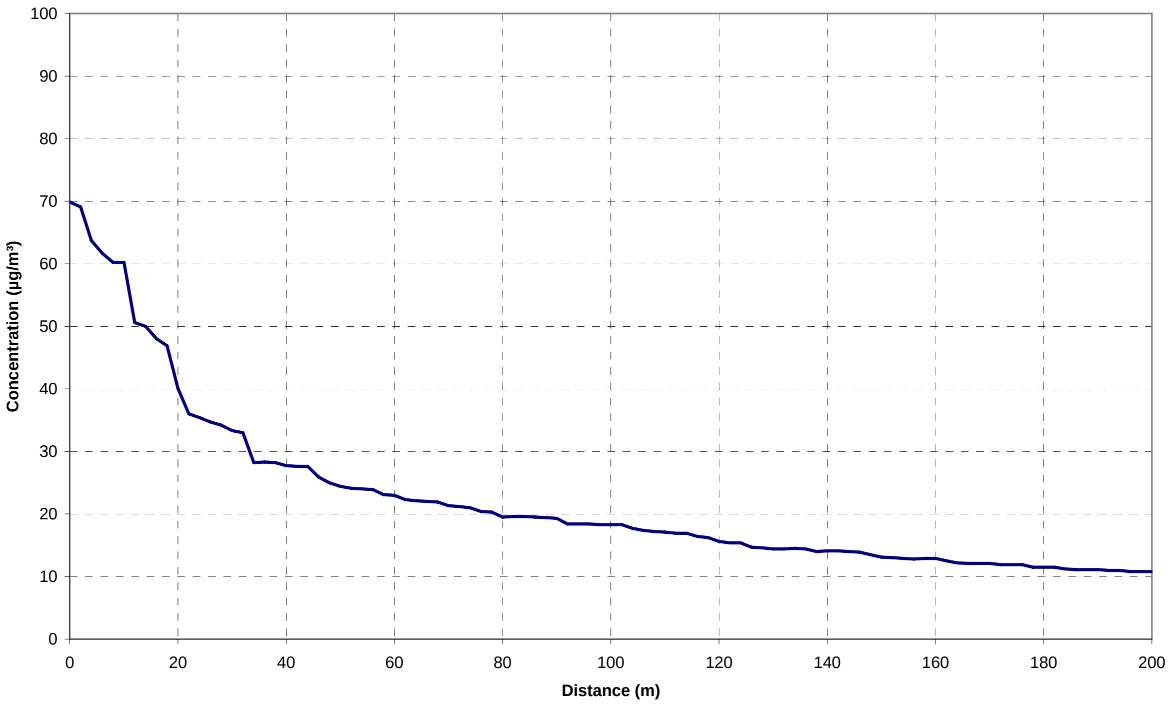

Figure 5-3 Cross Section of the Proposed Expressway for 2016 Do Something

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Carbon Monoxide

Table 5-2 presents the predicted 8-hr CO concentrations, excluding background, for all of the modelled scenarios and also shows the significance of any predicted changes in CO concentrations. For the 'Do Minimum' scenario the concentrations are predicted to be below NES with the highest concentrations predicted around the Mill Road/SH 1 intersection at receptors 286 Main Hwy and Otaki Motel. For the 'Do Something' Scenario the construction of the expressway is expected to cause a reduction in CO concentrations near the intersection and a small increase in emissions in areas located adjacent to the expressway. The increase expected in these areas is likely to be relatively small due to the high expressway speed (100 kph), and consequently low emissions, when compared to the slow speed that vehicles negotiate the Mill Road/SH 1 intersection.

In summary the change in ambient CO concentrations from the construction of the expressway are not considered to be significant.

Table 5-2 Maximum 8-hr CO Concentrations (Excluding Background) at Otaki

Receptors		Existing 2010 (µg/m³)	Do Minimum (µg/m³)		Do Something (µg/m³)		Significance of Change	
			2016	2026	2016	2026	2016	2026
1	286 Main Hwy	2,668	1,450	626	522	174	0	0
2	Otaki Motel	1,218	429	197	128	81	0	0
3	270A Main Hwy	661	371	197	128	23	0	0
4	56A Rahui Road	23	1	1	1	1	0	0
5	153 Main Hwy	650	336	151	116	46	0	0
6	Otaki College	58	1	1	1	1	0	0
7	239 Main Hwy	452	232	116	116	1	0	0
8	Highway Baptist Church	499	267	151	116	35	0	0
9	Otaki Convention Centre	116	1	1	139	1	0	0

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PM_{10}

The highest predicted 24-hr PM_{10} concentrations were found to be near the Mill Road/SH 1 intersection as shown in Table 5-3 for the 'Do Minimum' Scenario. The construction of the expressway is predicted to reduce these concentrations on the existing state highway and in areas near to the intersection. This is shown in Table 5-3 as a '+' change at receptors located at 286 Main Hwy and at the Otaki Motel.

Assuming that the highest predicted PM_{10} concentrations for the 'Do Minimum' Scenario (19 µg/m³) are experienced at the same time as maximum background values (25 µg/m³) the concentration of PM_{10} are likely to be below the NES guideline of 50 µg/m³.

In summary the change in ambient PM_{10} concentrations from the construction of the expressway are either positive or not considered significant.

Table 5-3 Maximum 24-hr PM_{10} Concentrations (Excluding Background) at Otaki

Receptors		Existing 2010 (µg/m³)	Do Minimum (µg/m³)		Do Something (µg/m³)		Significance of Change	
			2016	2026	2016	2026	2016	2026
1	286 Main Hwy	16	19	12	9	5	+	+
2	Otaki Motel	11	9	6	5	3	+	+
3	270A Main Hwy	7	6	6	4	3	0	+
4	56A Rahui Road	1	1	1	1	1	0	0
5	153 Main Hwy	7	7	5	4	3	+	0
6	Otaki College	1	1	1	1	1	0	0
7	239 Main Hwy	6	6	4	3	2	+	+
8	Highway Baptist Church	5	5	5	3	2	0	+
9	Otaki Convention Centre	2	2	2	4	3	0	0

5.7.2 Assessment of Environmental Effects at Te Horo from Vehicle Emissions

NO_2 and PM_{10} concentrations were predicted in areas near to of the existing SH and the proposed expressway at the settlement of Te Horo. This section of the report discusses and presents the results of air dispersion modelling. The location of the discrete receptors used is shown on Figure 5-4 and 5-5 to allow for comparison of predicted concentrations with their relative location.

Nitrogen Dioxide

The results of 1-hr NO_2 modelling are presented in Table 5-4, Figures 5-4 and 5-5.

Predicted 1-hr NO_2 concentrations for both the 'Do Minimum' and Do Something' scenarios at Te Horo, including background, are below the NES. The construction of the expressway is likely to cause a reduction in concentrations on the western side of SH 1. This is shown in Table 5-4 as a positive change in NO_2 concentration at receptors Red House Café, 845, 961 and 937 SH1. For the 'Do Something' scenario an increase in concentration is expected at the intersection of School and Gear Road which is within 20 m of the proposed expressway. However this increase is relatively small and just above the MfE's criteria for significant change.

Concentrations at Te Horo School, for both scenarios, are not expected to significantly change with predicted values well below NES even when potential background is considered.

Table 5-4 Predicted Maximum NO_2 1-hr Concentrations (Excluding Background) at Te Horo

Receptors		Existing 2010 (µg/m³)	Do Minimum (µg/m³)		Do Something (µg/m³)		Significance of Change	
			2016	2026	2016	2026	2016	2026
1	Te Horo School	10	8	5	11	9	0	0
2	26 School Road	29	26	21	48	36	-	0
3	Red House Café	115	98	85	36	31	+	+
4	97 Gear Road	18	16	12	19	15	0	0
5	845 SH 1	76	66	42	39	31	+	+
6	961 SH 1	111	95	64	52	45	+	+
7	937 SH 1	122	105	79	47	40	+	+

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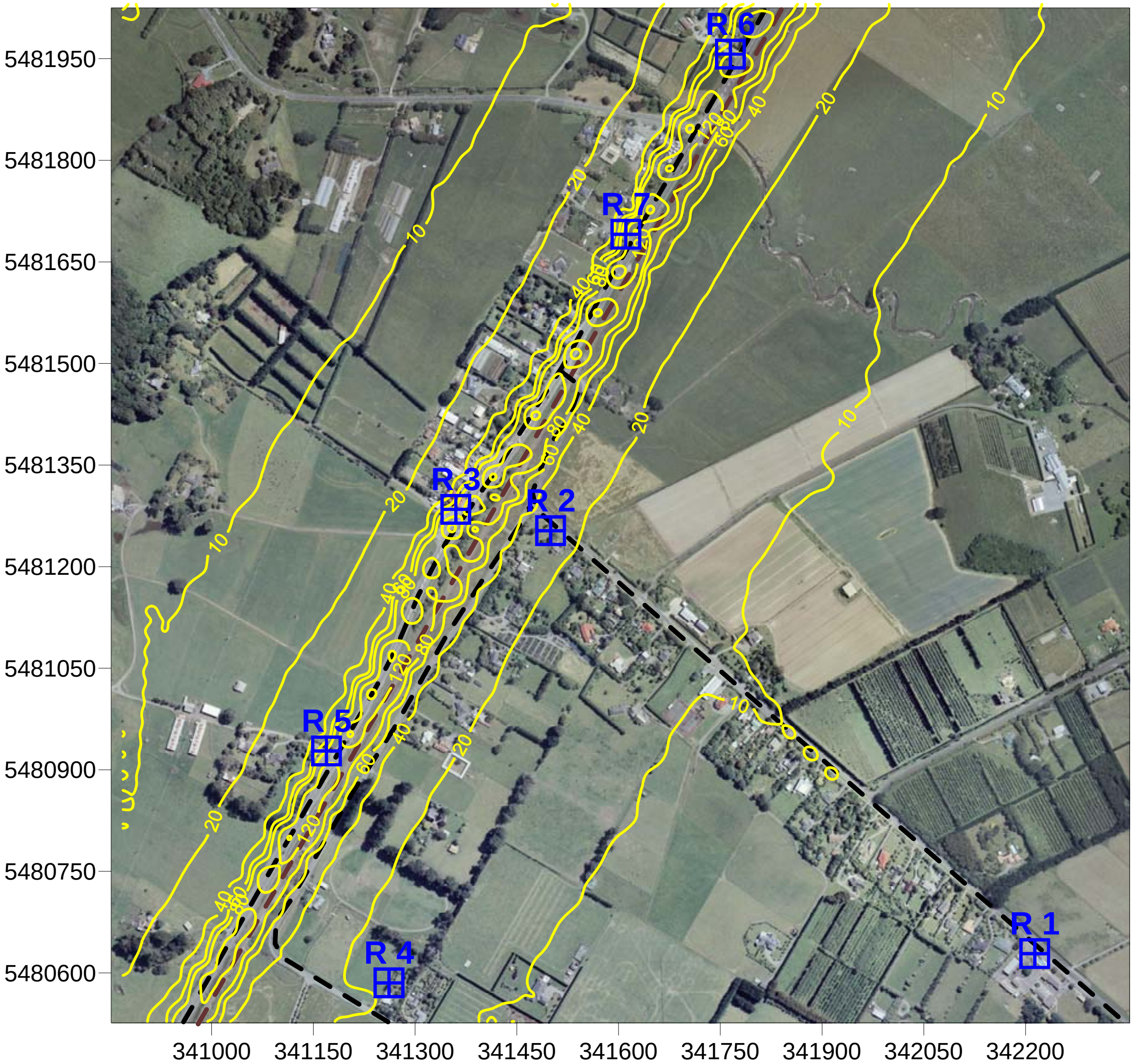

Figure 5-4 Te Horo - Predicted 99.9%ile 1-hr NO_2 Concentrations (Excluding Background) - 2016 Do Minimum

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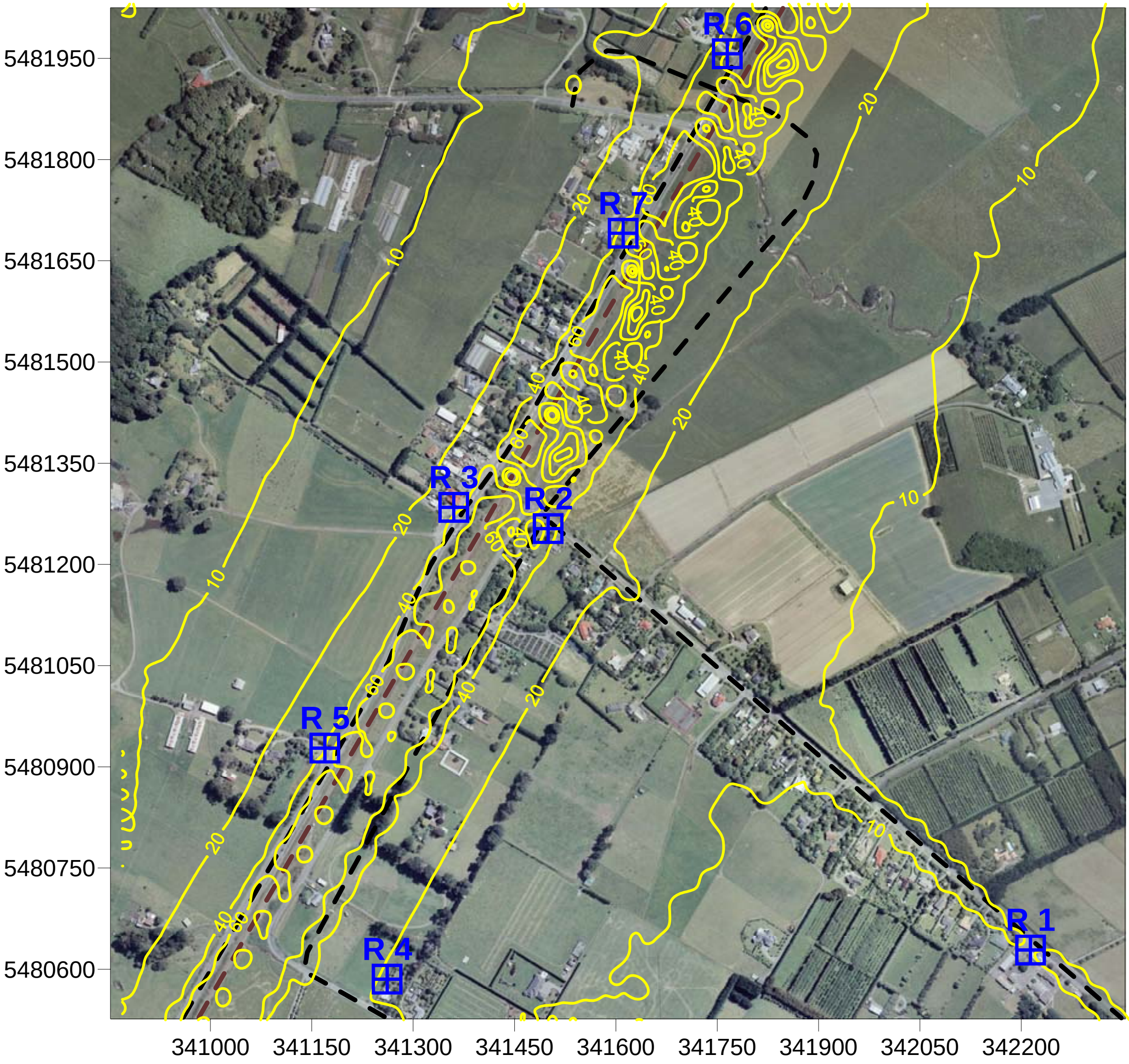

Figure 5-5 Te Horo - Predicted 99.9%ile 1-hr NO_2 Concentrations (Excluding Background) - 2016 Do Something

PM_{10}

Table 5-5 indicates that 24-hr PM_{10} concentrations are predicted to be below the NES for both the 'Do Minimum' and 'Do something' scenarios, even when background concentrations are included. A significant reduction in concentrations is expected on the western side of SH 1 due to the expressway construction. This is shown in Table 5-5 as a positive change in PM_{10} concentration at receptors Red House Café, 845, 961 and 937 SH1. For the 'Do Something' scenario an increase in concentration is expected at the intersection of School and Gear Road. However this increase is relatively small and is just equal to the MfE's criteria for significant change.

Concentrations at Te Horo School, for both scenarios, are not expected to significantly change with predicted values well below NES.

Table 5-5 Predicted Maximum PM_{10} 24-hr Concentrations (Excluding Background) at Otaki

Receptors		Existing 2010 (µg/m³)	Do Minimum (µg/m³)		Do Something (µg/m³)		Significance of Change	
			2016	2026	2016	2026	2016	2026
1	Te Horo School	1	1	1	2	1	0	0
2	26 School Road	3	3	2	5	4	0	0
3	Red House Café	11	10	8	4	3	+	+
4	97 Gear Road	2	2	1	2	2	0	0
5	845 SH 1	9	8	7	4	4	+	+
6	961 SH 1	11	10	8	4	4	+	+
7	937 SH 1	12	11	9	4	3	+	+

5.7.3 Summary of Effects from Vehicle Emissions Associated with PP2O

The results of dispersion modelling for the Otaki Township show that reductions in the concentration of vehicle air pollutants can be expected along the existing SH and around the Mill Road/SH 1 intersection. An increase in concentrations can generally be expected in areas located within 200 m of the expressway, however this is expected to be relatively small and likely to only be experienced by a small number of receptors, due to location of the proposed expressway alignment, which takes vehicle traffic to the east and away from the Otaki Township.

The settlement of Te Horo can also expect improvements in air quality especially for properties on the western side of SH 1. A small increase in concentrations is expected in areas adjacent to the eastern side of the expressway, however this increase is expected to be minor when compared to the overall improvements associated with the construction of the expressway.

Overall URS considers that the proposed alignment will result in an improvement in air quality for the region.

5.7.4 Degree of Effect

In accordance with the NZTA PSF/13 a ‘Low’ rating has been selected for the proposed alignment due to the general improvement in air quality that is expected from the construction of the expressway.

5.8 Assessment of Environmental Effects from the Construction of the Expressway

During the construction phase of the project there is potential for nuisance dust from construction activities and combustion emissions from construction vehicles to affect properties.

5.8.1 Construction Dust

The various construction activities required as part of the project have the potential to result in the generation of significant quantities of nuisance dust if not appropriately controlled. The potential effects of this dust will depend on the location of sensitive receptors relative to construction activities. Generally within 100 m of construction the effects will be significant and mitigation will be required. For residences or activities located more than 300 m from the construction activities it is unlikely that there will be any significant air quality effects.

A number of procedures have been presented in the following section designed to mitigate against these effects.

5.8.2 Combustion Emissions from Construction Vehicles

The construction of the expressway will require a number of vehicles to operate along the length of the scheme for the duration that works occur. These vehicles will cause a small increase in the level of combustion emissions in areas adjacent to where the works are occurring. Given the relatively small number of vehicles that will be operating at any point in time it is unlikely that the emissions will result in any significant increase in ambient concentrations.

The small increase in combustion emissions associated with construction activities is not expected to cause non-compliances of the NES.

Addressing Effects and Meeting Requirements

This section of the report presents the potential mitigation measures that will be used to control the potential effects of discharges to air.

6.1 Operation of the Expressway

No specific mitigation is recommended. However it is suggested that passive NO_2 monitoring is conducted during the opening year of the expressway, with monitors installed at various locations within Otaki and Te Horo. The purpose of this study is to demonstrate compliance with NES and to validate the predicted concentrations and assessments presented in this report.

6.2 Construction of the Expressway

6.2.1 General Activities

The construction activity associated with PP2O has the potential to generate significant quantities of dust if unmitigated. Therefore, it is necessary to consider the mitigation measures that will be used to control the emissions, and then make an assessment of the potential effects based on the controlled emissions.

The mitigation measures that are contained in the following sections are consistent with the MfE Good Practice Guide for assessing and managing the environmental effects of dust emissions[17].

The measures that are recommended should be used on the entire project to assist in the mitigation of effects may include:

- A 100 m wide envelope placed around construction areas where practical.
- Having a full time community liaison person who is available to deal with any concerns or complaints.
- Having a comprehensive complaints procedure.
- House cleaning service available for significantly affected properties..
- Temporary relocation of the residents of severely affected properties.
- Team dedicated to monitoring environmental effects.
- Monitoring of dust emissions with the use of continuous dust monitors near sensitive receptors.

For residences located sufficiently close (<50 m) to construction activities, where construction contractors are unable to control ambient dust concentrations to acceptable levels, there may be a requirement to install air conditioning units to reduce dust levels inside the residence. The installation of air conditioning units may also be necessary for residents located close to construction activities which have particular health issues, where elevated dust concentrations (less than those tolerated by the general population) could cause health effects e.g. People with Chronic Obstructive Pulmonary Disease (COPD).

[17] Good Practice Guide for assessing and managing the environmental effects of dust emissions, (Ministry for the Environment, September 2001)

6 Addressing Effects and Meeting Requirements

Earthworks

In this project there will be considerable quantities of material excavated and placed as fill, as the expressway, bridges, intersections and related structures are constructed. The following management measures are recommended to minimise dust emissions:

- Removal and stockpiling of topsoil should only take place within 100 m of occupied properties when the wind is blowing towards the sensitive area if wind speeds are below 10 m/s.
- Construction vehicles operating within 100 m of sensitive areas will travel at less than 20 km/hr, unless the construction area or haul road is fitted with operational sprinklers.
- Removal of cut material or placement of fill material within 100 m of occupied properties should only occur for wind speeds above 10 m/s if the wind is blowing away from the property.
- Where cut material is to be utilised immediately as fill material, the haul distance should be minimised as far as practical.
- Material that is placed in temporary stockpiles that will not be disturbed for more than three months will be vegetated or covered with hydroseed or mulch as soon as practicable.
- All finished cut or canal batters will be vegetated or covered with hydroseed or mulch as soon as practicable.
- The covering of loads and storage areas with tarpaulins or enclosures.
- Reduction of the speed at which construction vehicles can travel at when operating near sensitive receptors.
- Fixed sprinklers. These should be installed along selected sections of the main haul roads, and in areas where large volumes of construction traffic will be experienced for extended periods of time, or adjacent to sensitive locations.
- Watercarts. These should be used on the haul roads and in areas where it is not appropriate to install a fixed use sprinkler system.
- Wheel wash. Wheel washes should be installed to prevent the transportation of material onto sealed surfaces where the material can become a source of dust emissions.
- Application of dust suppression chemicals to haul roads. The chemicals can be applied to roads using watercarts and work by bonding dust particles together to prevent them from becoming airborne and causing dust nuisance effects. The effectiveness of this type of dust suppression is limited during periods where the haul road is heavily used. Therefore it is more effective to apply the dust suppression during weekends when low numbers of vehicles are using the haul roads. This will help to minimise wind erosion and the associated dust nuisance effects, during periods where the haul road is not used.

6.2.2 Stockpiled Material

In this project there will be quantities of material excavated and placed as fill, as the expressway and associated structures are constructed. The following management measures are recommended to be used to minimise dust emissions from stockpiles:

- Removal and stockpiling of topsoil will only take place within 100 m of occupied properties when the wind is blowing towards the sensitive area if wind speeds are below 10 m/s.
- The size of stockpiles should be kept to a minimum.
- Installation of wind breaks around large stockpiles.
- If practicable stockpiled material should be covered with a tarpaulin.

7 Costs

Due to the limited information available regarding the construction process and timeline at the time of writing this report, URS has not attempted to provide costs for the recommended construction mitigation required for this project. However the cost of the following mitigation measures should be considered for budgeting purposes.

- Use of watercarts on any temporary haul roads or work yards.
- Use of fixed sprinklers to control dust from haul roads and stockpiles.
- House cleaning service available for significantly affected properties.
- Installation of Wheel washes.
- Air Quality Monitoring.
- Rehabilitation of cut/fill batters, haul roads and stockpiles.
- House cleaning service available for significantly affected properties.
- The installation of air-conditioning units at properties significantly affected.
- Temporary relocation of the residents of severely affected properties.

8 Limitations

URS New Zealand Limited (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Opus Consultants Limited and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 2011.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared during September 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A Summary of Surface Roads Information

Traffic Links	Base Year 2010		2016 Do Minimum		2016 Do Something		2026 Do Minimum		2026 Do Something	
	HCV%	AADT	HCV%	AADT	HCV%	AADT	HCV%	AADT	HCV%	AADT
Expressway										
North of Taylors Road			13%	16,586	25%	16,681	12%	17,204	24%	17,152
Otaki on-ramp					26%	2,904			25%	2,984
Otaki on-ramp					26%	2,904			25%	2,984
Otaki on-ramp -2					26%	2,904			25%	2,984
Otaki off-ramp					25%	3,004			23%	3,088
Otaki off-ramp -2					25%	3,004			23%	3,088
North of Otaki on-ramp					25%	13,849			24%	14,243
North of Mill Road					25%	10,944			23%	11,259
North of Riverbank Road					25%	10,944			23%	11,259
North of Otaki Gorge Road					25%	10,944			23%	11,259
Otaki Gorge off-ramp					32%	3,720			31%	3,807
Otaki Gorge off-ramp -2					32%	3,720			31%	3,807
Otaki Gorge on-ramp					34%	3,700			32%	3,782
Otaki Gorge on-ramp -2					34%	3,700			32%	3,782
North of School Road	18%	16,798			28%	18,364			27%	18,849
Mary Crest					28%	18,364			27%	18,849
North of Peka Peka Road					28%	18,364			27%	18,849
South of Peka Peka Road					30%	13,860			29%	14,203
Eastern Arterial										
South of Te Manuao Rd			13%	17,575	18%	5,337	12%	18,221	17%	5,514
North of Mill Road	9%	16,606	13%	17,575	22%	7,536	12%	18,221	21%	7,763
North of Mill Road Overbridge					22%	7,536			21%	7,763
North of Mill Road					22%	7,536			21%	7,763
North of Riverbank Road	9%	16,606	19%	18,595	26%	6,812	18%	19,208	24%	7,004
Mill Road/SH1	9%	16,606	19%	18,595	26%	6,812	18%	19,208	24%	7,004
Mill Road/SH1	9%	16,606	19%	18,595	26%	6,812	18%	19,208	24%	7,004
Mill Road/SH1	9%	16,606	19%	18,595	26%	6,812	18%	19,208	24%	7,004
North of Otaki Gorge Road			22%	21,034	29%	9,468	21%	21,686	27%	9,711
North of School Road			24%	20,682	20%	2,589	23%	21,283	19%	2,673
North of School Road -2					20%	2,589			19%	2,673
Mary Crest			26%	20,832	20%	3,609	24%	21,426	19%	3,727
North of Peka Peka Road			26%	20,811	18%	4,128	24%	21,398	17%	4,268
South of Peka Peka Road			25%	21,899	18%	10,098	23%	22,535	17%	10,441
Local Road										
Otaki Gorge Rd			9%	1,032	14%	501	8%	1,076	13%	520
Old Hautere Rd			10%	558	11%	482	9%	580	11%	501
Overbridge at Otaki Gorge Rd					30%	4,399			28%	4,510
Overbridge at Otaki Gorge Rd -2					30%	4,399			28%	4,510
School Rd	11%	554	11%	676	14%	1,608	10%	702	13%	1,668
Gear Rd	13%	1,915	13%	2,353	18%	2,573	12%	2,444	17%	2,661
Overbridge at School Rd					17%	4,068			16%	4,211
Overbridge at School Rd -2					17%	4,068			16%	4,211
Mill Road	9%	1,661	19%	1,859	26%	681	18%	1,921	24%	700
Rahui Road					26%	681			24%	700
Rahui Road Overbridge					26%	681			24%	700

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