Eastern Busway
EB2 and EB3 Residential

Noise and Vibration Operational Effects Assessment

Document Number: EBA-2-R-2-PL-RP-000034

Eastern Busway

Quality Information

Document Number: EBA-2-R-2-PL-RP-000034

Document History and Status			
Rev	**Date**	**Author**	**Status**
A	1 Feb 2022	Shivam Jakhu	Draft for review
B	15 Mar 2022	Shivam Jakhu	Draft for review
C	23 Mar 2022	Shivam Jakhu	Draft for review

Document Approval				
Action	**Name**	**Position**	**Date**	**Signature**
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Terms and Definitions

Table 1-1. Terms and definitions.

Term	Definition
EB2	Eastern Busway Section 2
EB3R	Eastern Busway Section 3 Residential
AUP	Auckland Unitary Plan Operative in Part
AADT	Average Annual Daily Traffic
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
PPF	Protected Premises and Facilities
Altered Road	As defined in NZS 6806:2010 Section 1.5.2: Subject to 1.5.4, an altered road means an existing road that is subject to the alterations of the horizontal or vertical alignment where at any assessment position at any one or more PPF meets criteria 1.5.2 (a) or (b).
AMETI	Auckland Manukau Eastern Transport Initiative
RRF	Reeves Road Flyover
CoRTN	Calculation of Road Traffic Noise, a report setting out a road traffic noise prediction method

Executive Summary

An assessment of road traffic noise from the EB2 and EB3R projects in line with the requirements of New Zealand Standard 6806:2010 has been carried out.

The assessment considers the following scenarios:

- Existing scenario – Noise environment as it currently exists.
- Do Nothing scenario – Noise environment in the design year, assuming that the Project was not built.
- Do Minimum scenario – Noise environment in the design year, assuming that the Project was built, but without implementing any noise mitigation measures as recommended by the acoustic assessment.
- Mitigation scenarios – Noise environment in the design year, assuming that the Project was built, with different noise mitigation options implemented for each Mitigation scenario.

For the chosen Mitigation scenario, noise barriers are proposed at the following Protected Premises and Facilities (PPFs, as defined in NZS 6806:2010):

- 23B Dale Crescent, along the western and southern parcel boundaries
- 2 Dale Crescent, between the building and Pakuranga Highway
- 4 Edgewater Drive, along the north-eastern parcel boundary
- 2A Wheatley Avenue, along the north-eastern parcel boundary

Noise effects in terms of the change in noise levels the projects will bring about have been considered when comparing the Do Nothing scenario and chosen Mitigation scenario. In summary:

- Noise levels will either reduce or change by a negligible amount at 454 out of 552 PPFs.
- Noise levels will increase by a slight margin at 48 out of 552 PPFs. This noise level change will be perceptible.
- Noise levels will increase by a moderate margin at 45 out of 552 PPFs. This noise level change will be noticeable.
- Noise levels will increase by a significant margin at 5 out of 552 PPFs. This noise level change will correspond to a doubling in loudness.

The noise levels expected at PPFs near the project are considered typical of an urban environment, and do not consider future developments that have not yet been consented. We consider that noise effects from road traffic will be reasonable after construction of EB2 and EB3R.

Noise from buses and bus stops has also been assessed. Noise from buses travelling along the busway and stopping/pulling away from bus stops is unlikely to be perceptible above existing traffic noise levels along Ti Rakau Drive. Noise effects from buses are therefore considered to be negligible.

1 Introduction

1.1 Overview of the Eastern Busway Project

The Eastern Busway Project (the Project) is a package of works focusing on promoting an integrated, multi-modal transport system to support population and economic growth in southeast Auckland. This involves the provision of a greater number of improved public transport choices and aims to enhance the safety, quality and attractiveness of public transport and walking and cycling environments. The Project includes:

- 5km of two-lane busway
- New bridge for buses across Pakuranga Creek
- Improved active mode infrastructure (walking and cycling) along the length of the busway
- Three intermediate bus stations
- Two major interchange bus stations.

The Project forms part of the previous Auckland Manukau Eastern Transport Initiative (AMETI) programme (the programme) which includes a dedicated busway and bus stations between Panmure, Pakuranga and Botany town centres. The dedicated busway will provide an efficient rapid transit network (RTN) service between the town centres, while local bus networks will continue to provide more direct local connections within the town centre areas. The Project also includes new walking and cycling facilities, as well as modifications and improvements to the road network.

The programme includes the following works which do not form part of the Eastern Busway Project:

- Panmure Bus and Rail Station and construction of Te Horeta Road (completed)
- Eastern Busway 1 (EB1) – Panmure to Pakuranga (completed).

The Eastern Busway Project consists of the following packages:

- Early Works Consents – William Roberts Road (WRR) extension from Reeves Road to Ti Rakau Drive (LUC60401706); and Project Construction Yard at 169 – 173 Pakuranga Road (LUC60403744).
- Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station **(this Assessment)**
- Eastern Busway 3 Residential (EB3R) – Ti Rakau Drive from the South-Eastern Arterial (SEART) to Pakuranga Creek, including Edgewater and Gossamer Intermediate Bus Stations **(this Assessment)**
- Eastern Busway 3 Commercial (EB3 Commercial) – Gossamer Drive to Guys Reserve, including two new bridges, and an offline bus route through Burswood
- Eastern Busway 4 – Guys Reserve to a new bus station in the Botany Town Centre, including a link road through Guys Reserve.

The overall Project is shown in Figure 1 below.

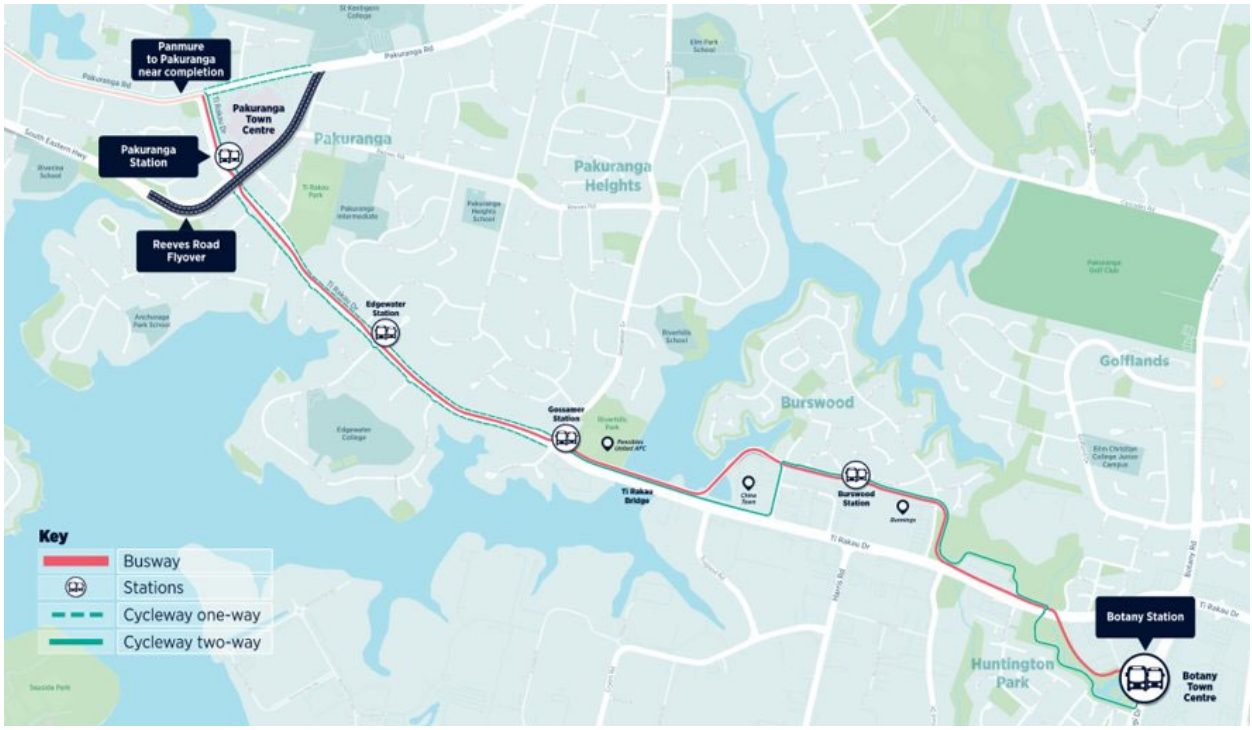


Figure 1. Project alignment

1.2 Project Objectives

The Project objectives are:

1. Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options;
2. Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form;
3. Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network;
4. Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centre;
5. Provide transport infrastructure that is safe for everyone; and
6. Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.

1.3 Specialist assessment

This report describes our assessment of road traffic noise effects associated with EB2 and EB3R once operational. Noise levels have been predicted and assessed in line with the methodology set out in New Zealand Standard 6806:2010 "*Acoustics – Road traffic noise*". Effects associated with predicted changes in noise levels have also been assessed.

This noise and vibration assessment involves:

- Considering relevant noise criteria;
- Measuring existing noise levels;

- Predicting and assessing future road traffic noise from EB2/EB3R;
- Determining the areas that may be affected by EB2/EB3R; and
- Considering the measures required to avoid, remedy or mitigate potential road traffic noise effects.

2 Proposal Description

The below is a summary of the works proposed within the EB2 and EB3R packages. Refer to the AEE for additional detail on the works proposed.

1.1 Eastern Busway 2

The EB2 section of the Project commences from the intersection of Ti Rakau Drive and Pakuranga Road, connecting with EB1, and traverses east along Ti Rakau Drive to the intersection of SEART. The north-south extent of EB2 is between SEART and Pakuranga Road along Reeves Road and William Roberts Road. The main components of EB2 are described below.

1.1.1 Busway and Pakuranga Town Centre Bus Station

A segregated dedicated two-way busway is proposed along Ti Rakau Drive to provide prioritised access for bus services between Pakuranga Town Centre and Botany. From Pakuranga Road to SEART, the busway will run on the northern side of Ti Rakau Drive.

The proposed Pakuranga bus station is a key facility for services running to and from the Panmure Station Interchange, Howick, Highland Park, Eastern Beach, Bucklands Beach and Sunnyhills. The bus station will be located along the northern side of Ti Rakau Drive, on land currently occupied for Pakuranga Plaza and 26 Ti Rakau Drive. The bus station will feature two platforms and will contain a mixture of street furniture and structures, including bus shelters, electronic messaging signage and seating. New proposed pedestrian crossings will provide connections to the bus station and Pakuranga Plaza. Modifications to the Ti Rakau Drive median strip, landscaping, and general traffic lane reconfiguration will enable safe and efficient bus movement for the busway once it becomes operative.

1.1.2 Reeves Road Flyover (RRF)

The RRF will provide two general traffic lanes in each direction connecting SEART to Pakuranga Road, to reduce local traffic congestion along Pakuranga Road and Ti Rakau Drive. The RRF will start opposite Paul Place Reserve, pass over Ti Rakau Drive and Reeves Road, before finishing at a new intersection with Pakuranga Road. Traffic lanes for the RRF will be elevated and run through the centre of SEART, requiring the relocation of the SEART off-ramp to the north of the existing off-ramp.

1.1.3 Walking and Cycling Facilities

EB2 includes improvements to active transport infrastructure and connections. This includes a new cycleway, improved footpaths, and new pedestrian crossings. These works will improve the safety and connectivity of walking and cycling links across Pakuranga Town Centre.

1.1.4 Supporting Works

A range of works will be undertaken in support of the EB2 package. This includes the relocation of network utility services, new street lighting, earthworks, removal of vegetation, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

1.2 Eastern Busway 3 Residential

The EB3R section of the busway is a continuation of EB2 from the intersection of SEART and Ti Rakau Drive, with the proposed dedicated busway proceeding centrally along Ti Rakau Drive towards

Gossamer Drive and Riverhills Park in the east. EB3R will largely occur within land vested as road or land currently owned by Auckland Transport. The construction of EB3R will take a staged approach to minimize disruption to the existing road network and its users. The main components of EB3R have been described below.

1.2.1 Edgewater and Gossamer Intermediate Bus Stations

EB3R includes two intermediate bus stations on Ti Rakau Drive, located within the vicinity of Edgewater Drive and Gossamer Drive. Both stations will have separate platforms for eastbound and westbound bus movements. A range of street furniture and structures will also be constructed, such as modular bus shelters pedestrian linkages, electronic messaging signage, seating and cycling storage facilities.

1.2.2 Western Bridge Abutment

EB3R includes construction of the western bridge abutment for a new future bridge across Pakuranga Creek . The abutment will be located within the area that is currently the southeastern section of Riverhills Park. Only the bridge abutment is included in the EB3R package of works. The remaining parts of the bridge will form part of the EB3C approval package.

1.2.3 Walking and Cycling Facilities

Provision has been made for walking and cycling along the route of EB3R. This includes footpaths and uni-directional cycleways located on either side of Ti Rakau Drive from SEART to Gossamer Drive. Signalised pedestrian crossings will be provided at key intersections along Ti Rakau Drive, including adjacent to the proposed Edgewater bus station.

1.2.4 Associated changes the road network

The proposed changes to the road network include lane arrangement and intersection reconfigurations and changes to the parking arrangement and access to Edgewater Drive Shops. Changes are also proposed to the access arrangements for residential properties along the EB3R alignment. New westbound lanes for general traffic will be established within the land which has been acquired by Auckland Transport and will be vested as road once it becomes operative, as the busway alignment replaces the existing westbound lanes.

1.2.5 Supporting Works

A range of works will be undertaken in support of the EB3R package. This includes the relocation of network utility services, new street lighting, removal of vegetation, earthworks, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

3 Assessment Criteria

Rule E25.6.33 of the Auckland Unitary Plan (Operative in Part) requires that new roads and altered roads which are within the scope of NZS 6806:2010[1] comply with the requirements of that Standard.

NZS 6806 provides criteria and an assessment method for road-traffic noise. It is a tool that provides performance targets and requires assessment of several different options for noise mitigation (often including barriers and low-noise road surfaces). These options are subject to an integrated design process in which the costs and benefits are considered. The performance targets in NZS 6806 are set to achieve reasonable noise levels, taking into account adverse health effects associated with noise on people and communities, the effects of relative changes in noise levels, and the potential benefits of New and Altered roads. NZS 6806 is an appropriate tool to assess traffic noise from EB2/EB3R as it provides a suitable, tested traffic noise assessment and mitigation methodology and appropriate noise criteria.

NZS 6806 is not applicable to New and Altered roads predicted to carry less than an Annual Average Daily Traffic ("AADT") of 2000 at the design year, or where the change in noise level due to a project (i.e. the horizontal or vertical realignment of a road) does not reach certain thresholds of effects (e.g. a change of at least 3 dB for at least one Protected Premises and Facilities (PPFs).

The EB2/EB3R area includes two sections of new road, the Reeves Road Flyover and the William Roberts Road extension, both of which attract lower noise limits than the sections of altered road as they have a predicted traffic volume of less than 75,000 AADT at the design year. However, these new sections of road pass over, through or nearby altered sections of road. There are no PPFs directly affected by the RRF or William Roberts Road extension which are not already affected by altered roads. It is therefore considered appropriate to apply the altered road noise limits across EB2 and EB3R.

We note that the William Roberts Road extension is being consented for in a separate package and does not form part of this assessment.

3.1 Protected Premises and Facilities

NZS 6806 requires noise effects to be assessed at noise sensitive locations within set distances of EB2/EB3R. These locations are known as Protected Premises and Facilities, and include existing houses, schools, marae and various other premises as defined in the NZS 6806. Commercial and industrial premises do not fall within the definition of a PPF. Future (unbuilt) noise sensitive premises are also not PPFs, unless they have already been granted building consent.

As EB2/EB3R is in an urban area, PPFs are assessed if they are within 100 metres from the edge of the nearside traffic lane of the new or altered road.

PPFs located outside of this area do not require assessment under NZS 6806, although potential noise effects are still controlled at receivers beyond 100 metres by virtue of noise criteria applying to the receivers nearest to the road.

[1] New Zealand Standard 6806:2010 Acoustics - Road Traffic Noise

3.2 NZS 6806 noise criteria

NZS 6806 sets out three categories of noise criteria. The Category A criterion should be achieved as the first priority. If this is not practicable, the Category B criterion should be achieved. However, if it is not practicable to comply with Categories A or B, mitigation should be implemented to ensure that the Category C internal criterion is achieved. Category C does not protect outdoor amenity.

The applicable noise criteria are summarised in Table 3-1.

Table 3-1 NZS 6806 noise criteria

Category	Criterion	Altered Road
A	Primary	64 dB $L_{Aeq\ (24\ hr)}$
B	Secondary	67 dB $L_{Aeq\ (24\ hr)}$
C	Internal	40 dB $L_{Aeq\ (24\ hr)}$

The assessment position is the façade most-affected by noise from the road being assessed and is 1.2 to 1.5 m above each floor level of interest within the building.

3.3 Noise prediction scenarios

NZS 6806 specifies noise modelling of multiple scenarios to be undertaken, which include the following:

- The “Existing” noise environment, which is the ambient noise levels at the date of assessment.
- A “Do Nothing” scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road.
- A “Do Minimum” scenario, which represents the traffic noise levels at the PPFs at the design year with EB2/EB3R implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario.
- “Mitigation” scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

NZS 6806 requires the assessment of traffic noise at least 10 years after the opening of a new or altered road. The year of completion of EB2/EB3R has not yet been determined, but due to the availability of traffic modelling data, the year 2048 has been selected as the design year for assessment purposes. This decision was made in conjunction with the Project team.

A roading project only qualifies as an “Altered” road if, at any one or more PPFs:

- The Do-Minimum noise environment would be greater than or equal to 64 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road traffic noise at that assessment position by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do-Nothing noise environment; or
- The Do-Minimum noise environment would be greater than or equal to 68 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road traffic noise at that assessment position by 1 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do-Nothing noise environment.

3.4 Noise mitigation

NZS 6806 requires that noise mitigation options are assessed, and if practicable, noise levels within Category A should be achieved. If this is not practicable then mitigation should be assessed against Category B. However, if it is still not practicable to comply with Categories A or B then mitigation should be implemented to ensure the internal criterion in Category C is achieved. Depending on the external noise level, building modification mitigation to achieve Category C could include ventilation and/or noise insulation improvements ranging from upgraded glazing through to new wall and ceiling linings. Building modification mitigation of Category C should only be implemented after the lowest practicable external noise level has been achieved. This means that structural mitigation such as road surface or barriers may also be implemented.

In circumstances where noise mitigation is warranted, NZS 6806 adopts a "Best Practicable Option" (BPO) approach. BPO considers the extent to which a mitigation option will achieve compliance with the relevant noise criteria and result in a noticeable noise reduction at assessment locations. The value-for-money of the option and the potential for adverse visual, shading and safety effects are also considered, amongst other things.

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation should only be implemented if it achieves the following:

- An average reduction of at least 3 dB $L_{Aeq(24h)}$ at relevant assessment positions of all PPFs which are part of a cluster; or
- A minimum reduction of 5 dB $L_{Aeq(24h)}$ at any assessment position(s) for each PPF not in a cluster.

3.5 Noise from buses

Rule E25.6.33 of the AUP refers to NZS 6806 for assessment of transport noise.

A description of the assessment methodology for noise from buses follows in Section 5.5.

Although noise from bus stops and noise from bus movements during peak hour does not require assessment against any noise criteria set out in the AUP, we have assessed noise from these activities against the existing ambient noise levels.

An ambient noise survey was conducted in 2018 as detailed in Section 4, and showed that noise levels would drop down to a level of approximately 55-60 dB $L_{Aeq(15min)}$ at 5-6am on weekdays at ML6, which was taken at a measurement position adjacent to the future busway along Ti Rakau Drive. Measurements were also taken adjacent to the future busway at ML11, however the noise levels measured at ML6 were generally lower and therefore represent a worse-case scenario for adopting a noise limit.

3.6 Road traffic vibration

Traffic vibration from new or upgraded roading projects is not generally expected to create issues. A key factor with new roads is the uniformity of the basecourse/pavement and the absence of near surface services. This is due to new or upgraded roads being designed to be smooth and even and avoiding vibration generated from passing traffic over uneven surfaces. Therefore, traffic vibration effects arising from operation of EB2/EB3R has not been assessed.

4 Existing Noise Environment

4.1 Noise survey

Due to impacts on traffic from the Covid-19 pandemic in Auckland at the time of writing of this report, we consider that a site survey in the vicinity of EB2/EB3R would not measure noise levels representative of existing traffic. However, it is not considered essential to have carried out this survey, as any measured noise levels will have only served to establish baseline noise levels in the area and would not have impacted the outcomes of this assessment.

Furthermore, a noise survey was carried out across the EB2 and EB3R areas in 2018, which can still be used as a guideline to understand ambient noise levels across the EB2/EB3R area. The following sections detail the outcome of the 2018 survey.

4.2 Noise monitoring procedure

Noise survey equipment, meteorological conditions, data analysis and results are described below.

The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801, 6802 and 6806. This meant the results could adequately inform the road traffic and construction noise assessments, whilst providing a robust baseline dataset for EB2/EB3R.

All measurement positions were selected to avoid reflections from buildings or extraneous factors which could influence the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file by AECOM New Zealand Limited.

Noise monitoring was undertaken at each location for approximately 7 days, where possible.

4.2.1 Meteorological conditions

During the surveys, meteorological data was obtained from Auckland, Mangere Ews (22719) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

The meteorological data from this weather station was used to identify periods when conditions were likely to have been outside the meteorological restrictions given in NZS 6801, and noise data measured during these periods have been excluded from the noise analysis.

4.2.2 Data analysis

There is a natural variation in the noise environment throughout the day, and often significant variation between days. Areas close to traffic sources generally have a more consistent noise profile than locations dominated by natural sounds. Each day's data was analysed, and abnormal events were excluded. Excluded periods are shown on the charts in Appendix C.

For example, events such as a neighbour mowing the lawn will result in a clear "spike" in the noise levels, and while the exact source is not identifiable, it is clearly not road-traffic. The $L_{Aeq(24h)}$ was then calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded. For unattended logger measurements, the energy average $L_{Aeq(24h)}$ over all valid days has been used.

4.2.3 Measurement results

A summary of the measured noise levels has been produced and is presented in the following section. The times in the tables showing the noise measurement results reflect the key periods for road traffic noise. Details of each measurement location are presented in noise monitoring forms, compiled in Appendix B. A map showing the noise measurement locations is presented in Appendix A.

Note that results at ML12 have not been included as this measurement location was taken outside of the EB2/EB3R area.

4.2.3.1 EB2

The EB2 noise environment is generally dominated by road traffic noise from the surrounding network; however, noise from other sources is audible, particularly around the Pakuranga Plaza commercial area. There is a mix of residential, commercial, education and healthcare buildings in the area and some open recreation spaces (Ti Rakau Park). Ambient noise levels are considered typical for a mixed urban environment, close to major arterial roads.

A summary of the measured noise levels is presented in Table 4-1.

Table 4-1 Noise measurement results from 2018 survey around EB2

Location	Address	Observations	Noise level, dB $L_{Aeq(24h)}$
ML1	80 Pakuranga Road	Faint noise present from Pakuranga Road	52
ML2	179 Pakuranga Road	Faint noise present from Pakuranga Road	54
ML3	12 Bolina Crescent	Road traffic noise dominant from Pakuranga Highway	69
ML9	13 Reeves Road	Road traffic noise dominant from Reeves Road	60
ML10	Paul Place Reserve	Road traffic noise dominant from Pakuranga Highway	65
ML11	7 Ti Rakau Drive	Traffic noise dominant from Pakuranga/ Ti Rakau intersection	63
ML13	17 Reeves Road, Pakuranga	Road traffic noise dominant from Reeves Road	60

4.2.3.2 EB3R

The EB3R noise environment is dominated by road traffic noise from Ti Rakau Drive. There is a mix of residential and commercial activities in the area and an open recreation space in Riverhills Park.

The ambient noise levels are typical for a mixed urban environment, close to major arterial roads.

A summary of the measured noise levels is presented in Table 4-2.

Table 4-2 Noise measurement results from 2018 survey around EB3R

Location	Address	Observations	Noise level, dB $L_{Aeq(24h)}$
ML4	47 Ti Rakau Drive	Road traffic noise dominant from Ti Rakau Drive	51
ML5	81 Ti Rakau Drive	Road traffic noise dominant from Ti Rakau Drive	53
ML6	143 Ti Rakau Drive	Road traffic noise dominant from Ti Rakau Drive	61
ML7	187 Ti Rakau Drive	Road traffic noise dominant from Ti Rakau Drive	54
ML8	174 Gossamer Drive	Road traffic noise dominant from Ti Rakau Drive	54

5 Road Traffic Noise Assessment Methodology

To determine the potential change in road traffic noise levels due to EB2/EB3R, the Do Minimum (design year with Project) scenario has been compared with the Do-Nothing (design year without Project) scenario.

Noise mitigation options have been determined based on comparison of the Do Minimum scenario results against the NZS 6806 traffic noise criteria identified in section 3.2.

5.1 Road traffic noise model

The road traffic noise modelling employs the "*Calculation of Road Traffic Noise*" (Corn) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand road surfaces in accordance with LTNZ Report No. 326[2] and the Waka Kotahi NZ Transport Agency *Guide to state highway road surface noise*[3]. The model settings are described in Table 5-1.

Table 5-1 Road traffic noise model settings

Parameter	Setting/source
Software	SoundPLAN 8.2
Algorithm	CoRTN
Order of reflections	1
Parameter	Noise level, dB $L_{Aeq\ (24\ hr)}$
Ground absorption	0.2 at Pakuranga commercial area, 0.6 everywhere else
Receiver height	1.5 m above height of each floor
Noise contour grid	1.5 m height, 5m resolution
Receivers and grid position	Free field

The CoRTN algorithm produces results for noise in terms of $L_{A10(18hr)}$. To convert these results to $L_{Aeq(24hr)}$, a minus 3 dB adjustment has been made. This adjustment has been implemented in the software in conjunction with the road surface adjustment detailed below.

The limitations and uncertainties of the prediction methodology, including input data, are discussed below.

5.2 Input data

5.2.1 Traffic Data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team. The existing scenario has been based on 2017 and 2018 data as provided by the traffic modelling team. 2048 has been selected as the design year, based on the availability of traffic modelling data. Traffic modelling methodology and results are described in the Integrated Transport Assessment.

The CoRTN model has been developed based on 18-hour traffic data. However, in accordance with the requirements of NZS 6806, traffic data has been entered as the 24-hour daily traffic (AADT), which

[2] https://www.nzta.govt.nz/assets/resources/research/reports/326/docs/326.pdf
[3] https://www.nzta.govt.nz/assets/resources/road-surface-noise/docs/nzta-surfaces-noise-guide-v1.0.pdf

results in noise levels in the order of +0.2 dB higher than would have been calculated by CoRTN based on the 18-hour AADT. The CoRTN model assumes that traffic is free-flowing, it does not apply to interrupted vehicle flows, such as at an intersection, and for low volume roads under 5,000 AADT.

5.2.2 Topography

Topographic contours for the Existing and Do-Nothing scenarios have been derived from Auckland Council LiDAR at 1m vertical resolution.

Contours for the Do Minimum and Mitigated scenarios were obtained from the Project team and are derived from LiDAR data at 1m vertical resolution.

5.2.3 Buildings

The footprints and heights for all buildings and other structures were provided by the Project team and are based on building outlines sources from Land Information New Zealand (LINZ).

The Project team has provided details on properties that will be removed to make way for EB2/EB3R. These buildings are included in the Existing and Do-Nothing modelling scenarios but were removed for the remaining scenarios.

5.2.4 Road alignments

Road alignments for the Existing and Do-Nothing scenarios were determined from Auckland Council imagery, where centrelines were drawn along the road lengths. Road alignments for the Do Minimum and Mitigation scenarios were determined from the latest available CAD models provided by the Project team at the time, with centrelines drawn along the road lengths.

We note that the design extents of the RRF abutments were changed after the noise modelling exercise was completed. We have reviewed the final general alignment design for consent lodgement against the alignment used in the noise model, and consider that any discrepancy between the two would have no impact to the outcome of the acoustic assessment.

5.2.5 Road surfaces

The Existing, Do-Nothing and Do Minimum road surface finishes were advised by the EB2/EB3R team.

Road surfaces for all roads in the Existing and Do-Nothing scenarios were modelled as AC14, with the exception of William Roberts Road, which was modelled as chipseal (DG10).

Road surfaces for all roads in the Do Minimum scenario and all Mitigation scenarios (except Mitigation 1) were modelled as AC14, with the exception of local roads around Pakuranga which were modelled as DG10 e.g. William Roberts Road.

Road surfaces for all roads in the Mitigation 1 scenario were modelled as OGPA PA-10.

The procedure used to incorporate different road surfaces in the model is as follows:

- In accordance with Transit Research Report 288, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN.
- Surface corrections relative to asphaltic concrete have been made in accordance with LTNZ Research Report 326 and the Waka Kotahi Guide to state highway road surface noise. The

combination of surface corrections for cars and heavy vehicles has been made using the equation in the Waka Kotahi Guide to state highway road surface noise.

- The combined correction, including the adjustment from $L_{A10(18h)}$ to $L_{Aeq(24hr)}$, has been entered in the modelling software as a total road surface correction.

5.2.6 Safety barriers

Solid (e.g. concrete) safety barriers have been entered in the noise model as 1.0 m high barriers for the Do Minimum scenario, in locations where they are proposed.

5.2.7 Existing noise barriers

No existing noise barriers were identified along the EB2 or EB3R route either by the EB2/EB3R team or during site visits carried out in 2018 and 2021/2022.

Existing boundary fences of private properties have not been included in the noise model as their condition is unknown and they may not provide effective acoustic shielding. This means that for some properties, the predicted traffic noise levels in the model may be slightly higher than would be experienced in reality. However, the assessment process will identify properties which need new noise barriers erected or existing fences upgraded to provide adequate attenuation, as part of the mitigation appraisal.

5.2.8 Bridges

There are no existing bridges along the EB2/EB3R alignment. The RRF has been configured to be a 'self-screening' road, which blocks the noise of the road on the flyover from a given receiver position below the flyover.

5.2.9 Speed limits

Urban speed limit reductions at several roads along the EB2/EB3R alignment (Ti Rakau Drive from 60 to 50 km/h, Pakuranga Highway from 80 to 60 km/h) are expected within the transport model at the time of growth, under the Do-Nothing scenario. NZS 6806 states that the Do-Nothing scenario should include no alterations to the roads assessed. Therefore, in accordance with the standard, the speed limit change has not been included in the modelling for the Do-Nothing scenario. The speed limit change has been included in the Do Minimum scenario.

5.3 Uncertainties and limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above. Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

As stated, the model has been developed by the EB2/EB3R team based on 1m vertical terrain resolution, which provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data has been sourced from the EB2/EB3R team and it is accepted that the forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. The sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening. For example, if all other factors of the traffic data remain unchanged (speed and % of heavy vehicles), then a doubling or halving of the traffic data will only result in a 3 dB change which is only just perceptible by most people. A change in traffic volume data by +25 % or -25% will result in a 1 dB change in predicted noise level, which would be imperceptible.

The accuracy of the model can be quoted to a reasonable degree based on known validations of the CoRTN modelling algorithm and comparisons with measured existing noise levels. Generally, road traffic noise levels are quoted with an accuracy within 2 dB.

5.4 Potential traffic noise mitigation options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled.

Traffic noise mitigation measures can be broadly categorised into three methods: low noise road surfaces, traffic noise barriers, and building modification. The first two methods involve structural mitigation as described in NZS 6806, whilst the third involves building modification mitigation.

5.4.1 Road surfaces

Noise mitigation measures with the largest influence on the generation of road traffic noise is the road surface material. As stated in section 5.2.5, the Project team has stated that the road surface will be AC-14 for the Do Minimum scenario, which is already considered a low noise road surface.

5.4.2 Noise barriers

If low-noise road surfaces do not provide the required level of noise mitigation, traffic noise barriers may be considered alongside road surfaces. Generally, barriers will only mitigate noise if they block the line-of-sight between the noise source and receiver. They are most effective and provide the widest area of mitigation when placed immediately adjacent to traffic lanes. In order to provide the most effective noise level reduction, an acoustic barrier must be of solid material (i.e. have no gaps) and have a minimum surface weight of 15 kg/m^2 (e.g. 17mm ply sheeting, 9 mm fibre cement, concrete, earth bunds etc.).

5.4.3 Building modification

NZS 6806 requires that structural mitigation, such as noise barriers and low-noise road surfaces, should be implemented in preference to building modification mitigation. Building modification can potentially inconvenience residents and does not provide any protection to outdoor amenity. However, if low-noise road surfaces and noise barriers are not practicable or do not provide the required level of noise reduction, building modification to PPFs may be considered.

Depending on the level of reduction required, building modification measures may range from provision of mechanical ventilation only (to allow doors and windows to be closed), to the upgrade or replacement of windows, wall linings, floors and ceiling linings.

5.4.4 Maintenance of structural mitigation measures

The effectiveness of the acoustic performance of noise mitigation measures will need to be maintained over time. NZS 6806 states that "structural mitigation measures should be designed in such a way that they retain the same noise-reduction properties up to the design year".

This means that any barrier proposed for EB2/EB3R should not develop gaps or other openings or material failure. Any damage and vandalism to the barrier will need to be replaced, and asphalt surfaces should be maintained to be smooth and even, in order to achieve the same noise reducing qualities as following initial installation.

Maintenance of structural mitigation measures to the performance standards of NZS 6806 should be undertaken for EB2/EB3R in order to achieve the noise level reductions on which the noise level predictions are based.

5.5 Assessment of noise from buses

To predict noise from the busway with more accuracy than the standard road traffic noise prediction method set out in CoRTN, noise from buses has been assessed separately to regular road traffic noise. Cumulative effects have then been assessed by comparing the predictions of noise from buses against noise from road traffic.

The prediction algorithm set out in ISO 9613-2[4] has been used to predict noise from buses in the Do Minimum scenario. The $L_{Aeq(24h)}$ noise metric was calculated for comparison of noise from buses against road traffic noise determined as part of the NZS 6806 assessment.

The prediction algorithm set out in ISO 9613-2 has been used as an alternative to modelling all traffic types as an aggregated noise source as per the algorithm set out in CoRTN. We consider that separating the buses from all other vehicles for the Do Minimum scenario helps to produce more accurate modelling results for the following reasons:

- The future busway design shows traffic separated into three sections along Ti Rakau Drive; two northbound lanes, two southbound lanes, and the busway running either in the middle or to the north of these two sections. Modelling of the busway as a separate source from the regular traffic allows the model to consider the distribution of traffic across the lanes more accurately, rather than aggregating all of the traffic into the vehicle lanes.
- CoRTN treats buses as heavy vehicles due to their weight. However, we have been advised by the Alliance transport team that the bus fleet will be fully electric by the design year (2048). In line with this, we consider that including buses as part of the heavy vehicle percentage calculation will not give representative results since the character of the noise produced by electric buses travelling at 50 km/h will be different to that of a truck powered by an internal combustion engine travelling at the same speed. The character of noise produced by an electric vehicle travelling at 50 km/h in these conditions would be closer to that of a light vehicle, therefore we do not consider that the CoRTN corrections for heavy vehicles should apply to the electric buses.

[4] ISO 9613-2:1996, *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

Sound power level data were taken from Laib *et al*[5]. This study set out to determine to what extent noise reduction could be achieved in urban areas using electric buses rather than diesel buses. As part of the study, sound power level measurements of an electric bus were taken and compared to sound power level measurements taken of a diesel and hybrid bus. The sound power level data of the electric buses have been adopted for use in this assessment.

Buses will operate 7 days a week, with peak bus movements taking place on weekdays between 6am to 8am.

The following inputs were used in order to determine noise from the busway:

- Buses modelled as moving point sources along a line with sound power level of 104 dBA, travelling at 50 km/h, as per measurements set out in Laib *et al*.
- Bus movements per hour along different sections of the alignment were determined based on 2048 bus timetable provided by EBA transport team, in order to determine the $L_{Aeq(24h)}$ metric.
- Peak bus movements will occur between 6am-8am Monday to Friday according to the 2048 bus timetable. Noise from bus movements during these hours were modelled in order to determine the worst-case $L_{Aeq(1h)}$ metric from the busway.

All other modelling inputs were the same as those set out in Table 5-1 (except for the calculation algorithm).

5.5.1 Noise from bus stops

Bus stops are planned at several locations along the alignment. Figure 2 provides a summary of bus stop locations.

[5] Felix Laib, Andreas Braun, Wolfgang Rid, Modelling noise reductions using electric buses in urban traffic. A case study from Stuttgart, Germany., Transportation Research Procedia, Volume 37, 2019, Pages 377-384, ISSN 2352-1465, https://doi.org/10.1016/j.trpro.2018.12.206.

Figure 2 Bus stops along EB2 and EB3R route (note: bus stops service one direction of the busway each)

Generally, the most significant sources of noise at bus stops are when buses are either in idle or pulling away.

Since the future bus fleet will all be electric, we consider that noise from buses idling and pulling away will be greatly reduced compared to noise produced by diesel buses. As set out in Laib *et al*, an electric bus has a sound power level of approximately 83 dB SWL while idling (or 55 dBA at 10m). Noise from buses has been assessed in Section 6.4.1 based on this sound power level and the closest distance from a bus stop to a PPF.

5.6 Overview of traffic noise effects

Adverse noise effects as a result of high levels of traffic noise may include sleep disturbance, loss of concentration, annoyance, a reduction in speech intelligibility and reduced productivity. The effects are not restricted to PPFs but would also affect future residential and other noise-sensitive developments as well which are not included in the NZS 6806 definition of PPF. Where new noise sensitive developments are established in the vicinity of a road, their design should take account of the potential noise effects and care should be taken to avoid or minimise them.

The magnitude of effects will largely depend on noise levels received in noise-sensitive spaces within buildings, although there are also potential annoyance effects associated with a loss of amenity when high noise levels are received in outdoor living or recreation spaces.

The subjective perception can generally be correlated with the numerical change in noise level. A 3 dB change in noise level is just perceptible to the majority of people. A 10 dB increase in noise level is subjectively considered to be a doubling of loudness resulting in a significant impact.

Table 5-2 Noise level change compared with general subjective perception

Noise level change	General subjective perception	Possible effect
1 – 2 decibels	Insignificant change	Negligible
3 – 4 decibels	Perceptible change	Slight
5 – 8 decibels	Noticeable change	Moderate
9 – 11 decibels	Halving/doubling of loudness	Significant
> 11 decibels	More than halving/doubling of loudness	Substantial

6 Road Traffic Noise Assessment

Predicted road-traffic noise levels at all PPFs for the Existing, Do-Nothing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: Category A – green, Category B – orange, and Category C – red.

Noise contour maps showing indicative levels across a 200m radius from the alignment are provided in Appendix E. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Results are presented for:

- Existing scenario – Noise environment as it currently exists.
- Do Nothing scenario – Noise environment in the design year, assuming that the Project was not built.
- Do Minimum scenario – Noise environment in the design year, assuming that the Project was built, but without implementing any noise mitigation measures as recommended by the acoustic assessment.
- Mitigation scenarios – Noise environment in the design year, assuming that the Project was built, with different noise mitigation options implemented for each Mitigation scenario.

6.1 Road traffic noise model results analysis

For the Existing scenario, predicted noise levels are between 45 dB $L_{Aeq(24hr)}$ and 69 dB $L_{Aeq(24hr)}$ for EB2 and between 47 dB LAeq(24hr) and 69 dB LAeq(24hr) for EB3R.

For the Do-Nothing scenario, predicted noise levels are between 47 dB $L_{Aeq(24hr)}$ and 70 dB $L_{Aeq(24hr)}$ for EB2 and between 47 dB LAeq(24hr) and 70 dB LAeq(24hr) for EB3R.

For the Do Minimum scenario, predicted noise levels are between 44 dB $L_{Aeq(24hr)}$ and 68 dB $L_{Aeq(24hr)}$ for EB2 and between 47 dB LAeq(24hr) and 68 dB LAeq(24hr) for EB3R.

A summary of the results of the assessment for EB2 and EB3R are provided in Table 6-1 and Table 6-2.

Table 6-1 Summary of EB2 PPF categories

Category	Criteria	EB2, Number of PPFs		
		Existing	Do-Nothing	Do Minimum
A	64 dB $L_{Aeq(24h)}$	254	250	256
B	67 dB $L_{Aeq(24h)}$	18	15	20
C	40 dB Internal $L_{Aeq(24h)}$	8	15	4
Total		**280**	**280**	**280**

Table 6-2 Summary of EB3R PPF categories

Category	Criteria	EB3R, Number of PPFs		
		Existing	Do-Nothing	Do Minimum
A	64 dB $L_{Aeq(24h)}$	217	217	218
B	67 dB $L_{Aeq(24h)}$	29	28	52
C	40 dB Internal $L_{Aeq(24h)}$	26	27	2
Total		**272**	**272**	**272**

EB2/EB3R meets the definition of an Altered Road in accordance with NZS 6806, since a noise level above 64 dB $L_{Aeq(24h)}$ is predicted at a number of PPFs, along with an increase greater than 3 dB between the Do-Nothing and Do Minimum scenarios at these same PPFs.

The modelling results show a decrease in the number of PPFs in Category C of 36 between the Do-Nothing and Do Minimum scenarios, with some of these becoming Category B and some becoming Category A. This decrease is due to several factors.

The main factor causing this change is the reduction of speed limits along three key stretches of road around EB2 and EB3R: Pakuranga Highway (80 to 60 km/h), Pakuranga Road (60 to 50 km/h), and Ti Rakau Drive (60 to 50 km/h).

Another factor is the change in road alignment. In the Do Minimum scenario, the westbound lane is moved approximately 15-20m south. This effectively reduces noise from the westbound lane received at the PPFs to the north of Ti Rakau Drive.

The two receivers predicted to move from Category A to Category C are at 23B Dale Crescent and 2B Wheatley Avenue. For 23B Dale Crescent, this is due to the SEART offramp moving much closer to the PPF than the existing offramp and the removal of buildings at 6 Seven Oaks Drive that were providing screening of noise from the offramp. For 2B Wheatley Avenue, this is due to the removal of the building at 2A Wheatley Avenue and the proximity of the new road alignment to the building.

6.2 Mitigation options analysis

NZS 6806 requires development of mitigation options to achieve the noise criteria as set out in Table 3-1.

Although construction of EB2/EB3R will lead to a reduction of noise levels at a large number of PPFs, mitigation must still be considered for those PPFs that remain in Category C and B in the Do Minimum scenario, in accordance with NZS 6806.

In line with this requirement, four mitigation options have been considered across EB2 and EB3R. A summary of the mitigation options is provided in Table 6-3.

Table 6-3 Summary of mitigation options

Mitigation Option	Description
Mitigation Option 1 (Mit1)	Modelling of OGPA PA-10 for all altered roads.
Mitigation Option 2 (Mit2)	Implementation of noise barriers at all PPFs in Categories B and C.
Mitigation Option 3 (Mit3)	Implementation of noise barriers at all PPFs in Category C.
Mitigation Option 4 (Mit4)	Implementation of 1.8m noise barriers at as many single-storey PPFs in Categories B and C as is practicable.

As stated in section 3.4, noise barriers are required to achieve a 3 dB decrease in noise at any cluster of PPFs, or a 5 dB decrease in noise at a single PPF.

We note that of the 5 PPFs in Category C in the Do Minimum scenario, only one of these PPFs (23B Dale Crescent) was not already in Category C in the Do Nothing scenario.

Where noise barriers have been modelled as part of a Mitigation Option, the height used was 1.8m.

Maps showing the predicted Category of each PPF for each Mitigation Option are provided in Appendix E.

The following sections discuss each Mitigation Option.

6.2.1 Mitigation Option 1

While the AC-14 road surface finish being implemented as part of the Do Minimum scenario is already considered to be a low-noise road surface, further noise reductions are possible if an OGPA road surface finish is used instead.

This Mitigation Option implements OGPA PA-10 road surface finish at all locations where roads are altered as part of EB2/EB3R.

Table 6-4 and Table 6-5 summarise the results of the modelling.

Table 6-4 Mitigation option 1, EB2

Category	Criteria	EB2, Number of PPFs		
		Do Min	Mitigation 1	Change
A	64 dB $L_{Aeq(24h)}$	256	263	7
B	67 dB $L_{Aeq(24h)}$	20	17	-3
C	40 dB Internal $L_{Aeq(24h)}$	4	0	-4
Total		**280**	**280**	-

Table 6-5 Mitigation option 1, EB3R

Category	Criteria	EB3R, Number of PPFs		
		Do Min	Mitigation 1	Change
A	64 dB $L_{Aeq(24h)}$	218	234	16
B	67 dB $L_{Aeq(24h)}$	52	38	-14
C	40 dB Internal $L_{Aeq(24h)}$	2	0	-2
Total		**272**	**272**	-

Implementation of Mitigation Option 1 would leave no PPFs in Category C, would move 3 PPFs from Category B to Category A for EB2 and 14 PPFs from Category B to Category A for EB3R.

However, this Mitigation Option involves the use of OGPA road surface finish. We have been advised by the pavements specialist for EB2/EB3R that using OGPA would not be practicable for several reasons:

- Short surfacing life meaning higher ongoing maintenance cost to AT.
- Poor shear resistance, meaning it will deteriorate more quickly where cars start/stop, making it unsuitable in residential areas.
- OGPA would be required to be higher than the channel, which may be difficult for vehicles to traverse at driveways.

In summary, AT has never used OGPA in any residential areas across Auckland, likely due to the challenges listed above. OGPA is generally usually used on motorways, where the points listed above are less relevant. Therefore, this Mitigation Option has not been considered further as it is not considered BPO.

6.2.2 Mitigation Option 2

This Mitigation Option implements 1.8m noise barriers at all PPFs predicted to be in Category B or C. Noise barriers were modelled along the parcel boundary of each affected PPF, without extending onto driveways.

Table 6-6 and Table 6-7 summarise the results of the modelling.

Table 6-6 Mitigation option 2, EB2

Category	Criteria	EB2, Number of PPFs		
		Do Min	Mitigation 2	Change
A	64 dB $L_{Aeq(24h)}$	256	272	16
B	67 dB $L_{Aeq(24h)}$	20	7	-13
C	40 dB Internal $L_{Aeq(24h)}$	4	1	-3
Total		**280**	**280**	-

Table 6-7 Mitigation option 2, EB3R

Category	Criteria	EB3R, Number of PPFs		
		Do Min	Mitigation 2	Change
A	64 dB $L_{Aeq(24h)}$	218	244	26
B	67 dB $L_{Aeq(24h)}$	52	28	-24
C	40 dB Internal $L_{Aeq(24h)}$	2	0	-2
Total		**272**	**272**	-

Implementation of Mitigation Option 2 would leave 1 PPF in Category C for EB2 and none for EB3R. 13 PPFs would move from Category B to Category A for EB2 and 24 PPFs from Category B to Category A for EB3R.

However, this Mitigation Option includes noise barriers that do not meet the noise reduction requirement set out in Section 5.4.2 (3 dB reduction at a cluster of PPFs or 5 dB reduction at a single PPF) of NZS 6806. Therefore, even though 41 PPFs in total are predicted to move to a lower Category, this mitigation option is not considered to be in line with the BPO.

For example, 25 PPFs on the northern side of Ti Rakau Drive from Mattson Road to Gossamer Drive are predicted to move from Category B to Category A. However, these PPFs were only marginally exceeding the Category A criterion. The maximum noise reduction predicted amongst these PPFs is just over 3 dB. Although this would be enough of a reduction in noise to meet the Category A criterion, subjectively the noise difference would only be just perceptible.

Therefore, this Mitigation Option is not considered in line with adoption of the BPO for noise mitigation, and has not been considered further.

6.2.3 Mitigation Option 3

This Mitigation Option implements 1.8m noise barriers at all PPFs that were predicted to exceed the Category C noise criterion for the Do Minimum scenario.

Table 6-8 and Table 6-9 summarise the results of the modelling.

Table 6-8 Mitigation option 3, EB2

Category	Criteria	EB2, Number of PPFs		
		Do Min	Mitigation 3	Change
A	64 dB $L_{Aeq(24h)}$	256	257	1
B	67 dB $L_{Aeq(24h)}$	20	22	2
C	40 dB Internal $L_{Aeq(24h)}$	4	1	-3
Total		**280**	**280**	-

Table 6-9 Mitigation option 3, EB3R

Category	Criteria	EB3R, Number of PPFs		
		Do Min	Mitigation 3	Change
A	64 dB $L_{Aeq(24h)}$	218	220	2
B	67 dB $L_{Aeq(24h)}$	52	51	-1
C	40 dB Internal $L_{Aeq(24h)}$	2	1	-1
Total		**272**	**272**	0

Implementation of Mitigation Option 3 would leave one PPF in Category C for both EB2 and EB3R. 3 PPFs would move out of Category C for EB2 and 1 PPF would move out of Category C for EB3R.

However, the remaining two Category C PPFs would not change category. This is because these two PPFs are two-storeys high. Modelling of 3m barriers at these PPFs shows that they would still remain in Category C. Therefore, implementation of this Mitigation Option is considered impractical and has not been considered further.

It is noted that the PPF at 100 Pakuranga Road (motel building with the reception desk) is considered to be double storey, but was still brought down from Category C to Category B. This is because it only fell into Category C by a margin of 0.3 dB, which is considered a negligible difference in noise. Implementation of 1.8m noise barriers allowed this PPF to move to Category B as they provided the marginal noise reduction required, but the barrier would not meet the minimum reduction required by NZS 6806, as the noise reduction provided is less than 5 dB (and would be imperceptible at the second storey).

6.2.4 Mitigation Option 4

This Mitigation Option is a refinement of Mitigation Options 2 and 3. For this Mitigation Option, noise barriers are implemented at Category B and C receivers that are single-storey only, and that do not require gaps for openings to driveways. This means that noise barriers have only been modelled at locations where it is possible for them to achieve the minimum noise reduction required by NZS 6806.

Noise barriers are modelled at four locations for this mitigation scenario:

- 23B Dale Crescent, along the western and southern parcel boundaries
- 2 Dale Crescent, between the building and Pakuranga Highway
- 4 Edgewater Drive, along the north-eastern parcel boundary
- 2A Wheatley Avenue, along the north-eastern parcel boundary

Table 6-10 and Table 6-11 summarises the results of the modelling.

Table 6-10 Mitigation option 4, EB2

Category	Criteria	Number of PPFs		
		Do Min	Mitigation 4	Change
A	64 dB $L_{Aeq(24h)}$	256	258	2
B	67 dB $L_{Aeq(24h)}$	20	19	-1
C	40 dB Internal $L_{Aeq(24h)}$	4	3	-1
Total		**280**	**280**	-

Table 6-11 Mitigation option 4, EB3R

Category	Criteria	Number of PPFs		
		Do Min	Mitigation 4	Change
A	64 dB $L_{Aeq(24h)}$	218	220	2
B	67 dB $L_{Aeq(24h)}$	52	51	-1
C	40 dB Internal $L_{Aeq(24h)}$	2	1	-1
Total		**272**	**272**	-

Mitigation Option 4 achieves the required noise reductions at the PPFs where noise barriers are implemented, with all four PPFs moving to Category A across both EB2 and EB3R.

6.2.5 Preferred Mitigation Option

Mitigation Option 4 has been chosen as the preferred option because:

- Noise walls are located at PPFs where they will provide the required noise level reductions, unlike Mitigation Options 2 and 3, where noise walls were placed along stretches that required gaps for driveways.
- The noise walls are placed in front of single storey PPFs only, leading to the required noise reductions being met at the identified PPFs.
- The only PPF that was predicted to move from Category A to Category C as a result of EB2/EB3R will now remain in Category A.
- This mitigation option does not involve the use of OGPA. As discussed for Mitigation Option 1, while OGPA would provide reduction in noise if implemented, it is an unsuitable road surface for the EB2/EB3R area as advised by the EBA pavements team.

Images of the proposed noise wall locations are provided in Figure 3, Figure 4, Figure 5 and Figure 6. Note that these noise wall locations are subject to change based on other design requirements.

Figure 3 Proposed noise wall location - 2 Dale Crescent

Figure 4 Proposed noise wall location - 23B Dale Crescent

Figure 5 Proposed noise wall location - 4 Edgewater Drive

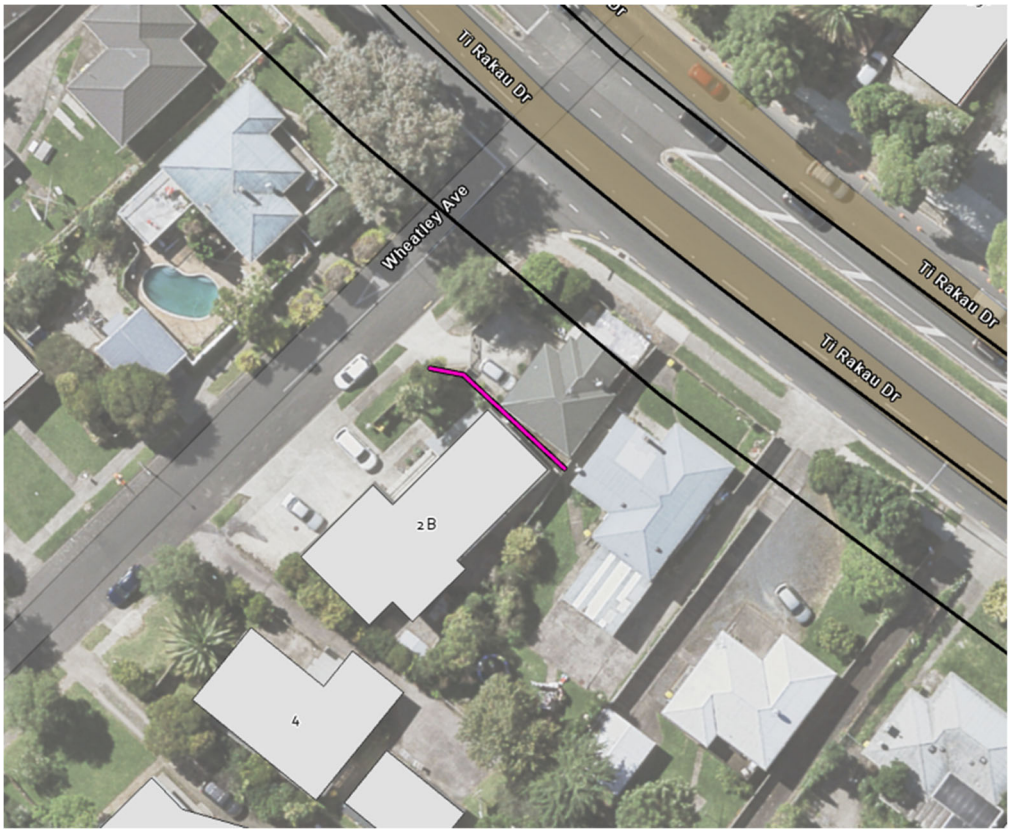


Figure 6 Proposed noise wall location - 2B Wheatley Avenue

6.3 Assessment of road traffic noise effects

NZS 6806 does not consider effects in terms of the change in noise environment at any given PPF. Therefore, the effects associated with the change in noise environment have been considered here in addition to the NZS 6806 assessment.

The Do-Nothing scenario and Mitigation 4 scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of EB2/EB3R. Figure 7 and Figure 8 show the predicted change in noise level at PPFs when comparing the Do-Nothing and Mitigation 4 scenarios, along with the noise effect associated with each range of noise level changes (as summarised in Table 5-2).

Appendix E includes columns showing the predicted change in noise level when comparing the Do-Nothing and Mitigation 4 scenarios, as well as the expected noise effect, at each PPF.

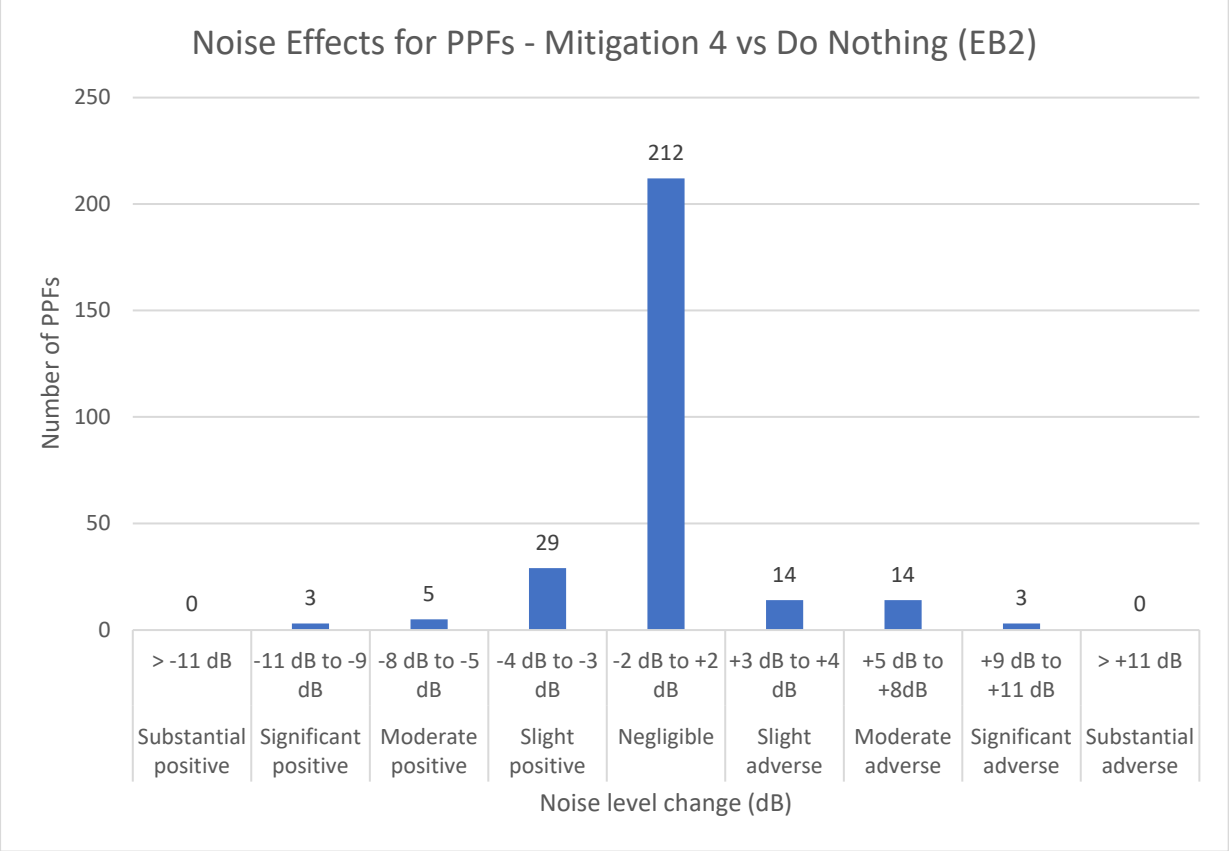


Figure 7 Changes in noise level – Do-Nothing Vs Mitigation 4, EB2

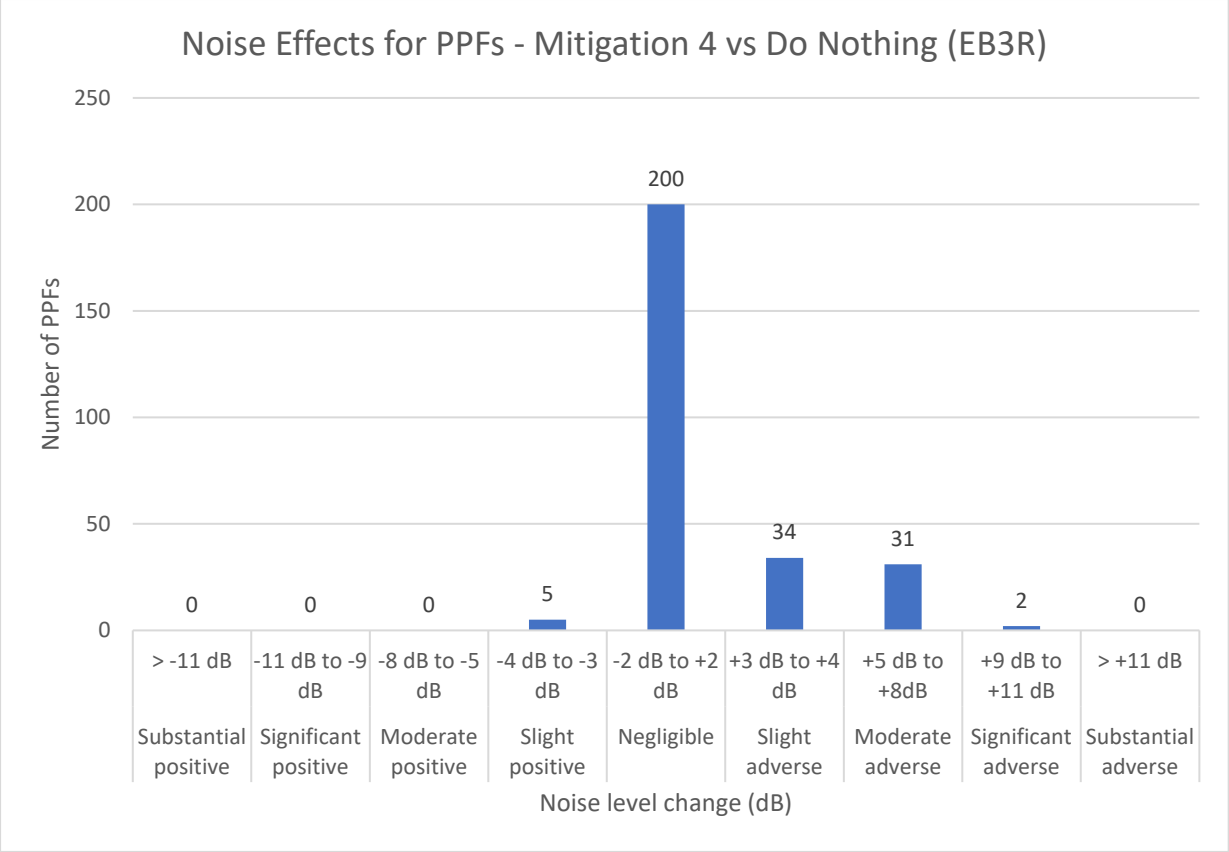


Figure 8 Changes in noise level - Do-Nothing vs Mitigation 4, EB3R

Predictions indicate that noise levels will increase by 3-4 dB at 48 out of 552 PPFs across EB2 and EB3R, resulting in slight adverse effects. This change in noise level would just be perceptible.

Predictions indicate that noise levels will increase by 5-8 dB at 45 out of 552 PPFs across EB2 and EB3R, resulting in moderate adverse effects. This change in noise level would be noticeable.

Predictions indicate that noise levels will increase by 9-11 dB at 5 out of 552 PPFs across EB2 and EB3R, resulting in significant adverse effects. This change in noise level would be perceived as a doubling in loudness. These PPFs are:

- 21 Dale Crescent
- 8 Dolphin Street
- 1/10 Dolphin Street
- 75A Ti Rakau Drive
- 83C Ti Rakau Drive.

These PPFs are at locations along the EB2/EB3R alignment behind houses that will be removed as part of EB2/EB3R, leaving behind residual land. This exposes PPFs along the south side of Ti Rakau Drive, PPFs along Dale Crescent and a small number of PPFs along Ayr Road and Pakuranga Road to additional road traffic noise from the network to varying degrees.

Despite the increase in noise level at these PPFs, the predicted noise levels are not unexpected for an urban environment, especially in proximity to a major urban arterial route. In addition to this, it is expected that the residual land between the exposed houses and the road corridor will be developed following completion of the Project. Although the detail of the expected development is not known at

this stage (as the EBA is not responsible for the development), noise levels at the affected PPFs will likely reduce as buildings are built in the residual land that will once again shield the affected PPFs from noise from the road.

While adverse noise effects are predicted at 98 out of 552 PPFs as outlined above, the majority of PPFs will experience either negligible or positive noise effects.

Predictions indicate that noise levels will decrease by 3-4 dB at 34 PPFs, resulting in slight positive effects. This change in noise level would be just perceptible.

Predictions indicate that noise levels will decrease by 5-11 dB at 8 PPFs, resulting in moderate to significant positive effects. This change in noise level would be noticeable, and in some cases will be perceived as a halving in loudness.

PPFs where positive effects are predicted are primarily located along Pakuranga Highway, William Roberts Road and Pakuranga Road, with a small number at the northern and southern ends of Ti Rakau Drive.

These noise level decreases are due to different factors at different locations:

- Decreased traffic flows and reduction in speed limit (60 to 50 km/h) at the northern end of Ti Rakau Drive.
- Change in road alignment (westbound lane moving further south approximately 15-20m) and reduction in speed limit (60 to 50 km/h) at the southern end of Ti Rakau Drive.
- Change in road surface along William Roberts Road from chipseal to DG-10.
- Change in speed limit along Pakuranga Highway from existing 80 km/h limit to new 60 km/h limit.
- Decreased traffic flows and change in speed limit (60 km/h to 50 km/h) along Pakuranga Road.
- Implementation of noise walls at selected PPFs.

We note that this assessment of effects only considers the PPFs that exist at the time of writing of this assessment. As discussed, it is possible that the future environment may change based on future development in the area, leading to changes in noise from the roads at some PPFs, e.g. development of the residual land between Ti Rakau Drive and the row of houses to the south of the westbound lane.

6.4 Assessment of noise from buses

Noise from buses has been predicted in terms of the $L_{aeq(24h)}$ metric at all PPFs along the alignment in line with the methodology set out in Section 5.5, including the adoption of sound power level data of electric buses given the advice from the Alliance transport team that the bus fleet will be fully electric by the design year (2048).

Noise from buses is included in the noise prediction results in Appendix D. Noise levels have been predicted in terms of two noise metrics, the $L_{Aeq(24h)}$, which quantifies noise across a 24-hour period, and the $L_{Aeq(1h)}$ between 6am and 7am, which quantifies noise during the peak-hour of bus movements in the early morning.

Noise from buses in terms of the $L_{Aeq(24h)}$ metric is predicted to be at least 10 dB below the Do Minimum $L_{Aeq(24h)}$ noise levels. This is due to the lower number of buses travelling along the busway during the day

compared to regular vehicles. Noise from traffic on Ti Rakau Drive will therefore dominate noise from buses travelling along the busway throughout the day is unlikely to be perceptible.

Noise from buses in terms of the $L_{Aeq(1h)}$ metric is predicted to reach up to 56 dB $L_{Aeq(1h)}$ during the peak hour of bus movements from 6am-7am. Existing ambient noise levels in the vicinity of the bus stops drops to 55 - 60 dB during the night-time, meaning that noise emissions during the peak hour of bus movements in the early morning will be similar to existing traffic noise levels at the same time.

When comparing noise from buses and existing traffic cumulatively, this would correspond to a just-perceptible increase in ambient noise levels at most during the 6am-7am peak hour of bus movements.

In summary, the predictions indicate that the noise environment at PPFs is unlikely to change due to bus movements associated with EB2/EB3R, meaning noise effects from buses will be negligible.

6.4.1 Noise from bus stops

The closest PPF to a bus stop is that at 2/2 Chevis Place, which is approximately 25m from the bus stop. By modelling an electric bus idling at the bus stop with a sound power level of 83 dBA SWL, a noise level of 47 dB L_{Aeq} is predicted at 2/2 Chevis Place. This can be taken as a worst-case noise level from buses idling at bus stops, since all other PPFs are greater than 25m from all other bus stops.

Noise from buses idling is predicted to be 7 dB lower than existing ambient levels in the area during the night time period.

In summary, we consider that noise from buses idling at bus stops will be reasonable at PPFs when compared to existing ambient noise levels.

7 Conclusions

Road traffic noise has been assessed for EB2 and EB3R in accordance with the requirements of the AUP and NZS 6806.

The noise modelling has been carried out in line with the requirements of NZS 6806, and noise predictions have been carried out for the Existing, Do Nothing, Do Minimum and four Mitigation scenarios.

The number of Category C PPFs will generally reduce between the Do Nothing and Do Minimum scenarios, however mitigation options have been investigated and assessed for those PPFs remaining in Category B and C.

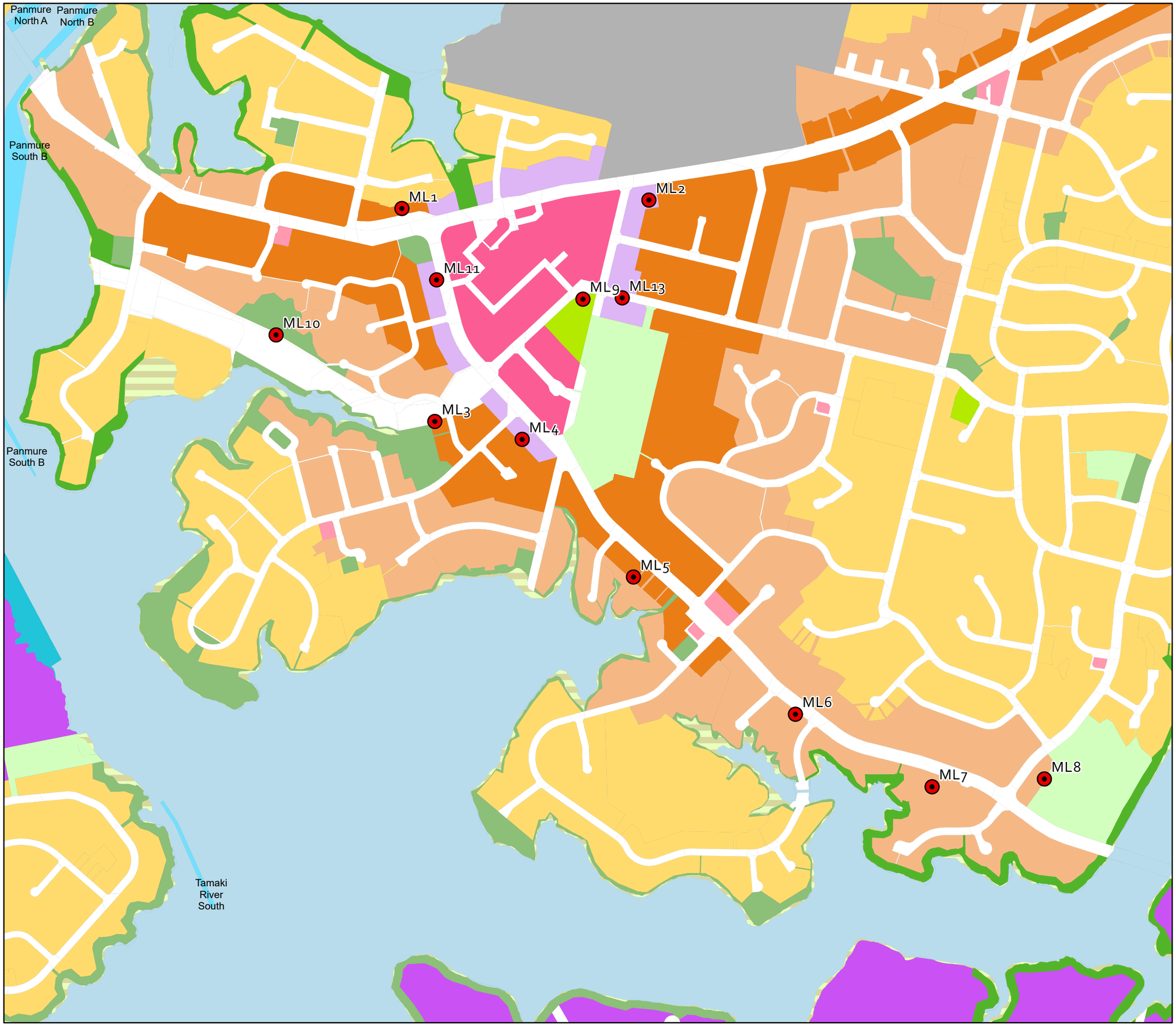
Mitigation Option 4 has been chosen as the preferred mitigation option since this option is in line with the BPO as set out in NZS 6806. In line with the preferred mitigation option, noise walls have been proposed at 23B Dale Crescent, 2 Dale Crescent, 2A Wheatley Avenue and 4 Edgewater Drive. These noise walls will be required by the conditions of consent and will achieve the required noise reductions set out in NZS 6806. All four PPFs will move to Category A, thus reducing noise effects at these PPFs.

Although 97 PPFs are predicted to experience noise level increases of more than 2 dB as a result of EB2/EB3R, almost all of these PPFs will remain in Category A with noise levels below 64 dB $L_{Aeq(24h)}$. PPFs in Category A do not qualify for structural noise mitigation under the requirements of NZS 6806. However, as discussed in Section 6.3, the predicted noise levels are considered to be typical of an urban environment, and noise levels may decrease at some PPFs following development of residual land.

Noise from buses travelling along the busway and stopping/pulling away from bus stops is unlikely to be perceptible above existing traffic noise levels along Ti Rakau Drive. Noise effects from buses are therefore considered to be negligible.

We consider that, following construction of EB2 and EB3R, the resulting noise levels from road traffic will be reasonable as they are typical for an urban environment.

Appendix A – Noise Monitoring Locations



Zones

- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing Urban Zone
- Residential -Terrace Housing and Apartment Buildings Zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Open Space - Sport and Active Recreation Zone
- Open Space - Community Zone
- Business - Town Centre Zone
- Business - Neighbourhood Centre Zone
- Business - Mixed Use Zone
- Business - Light Industry Zone
- Special Purpose Zone
- Coastal - General Coastal Marine Zone [rcp]
- Coastal - Mooring Zone [rcp]
- Coastal - Minor Port Zone [rcp/dp]
- Coastal - Coastal Transition Zone
- Road

Measurement Locations

N

Map Creation Date: 3/8/2022

Author:

Eastern Busway Alliance

Fletcher | acciona | AECOM | Jacobs

Appendix B – Noise Monitoring Forms

NOISE MONITORING FORM				
ML1 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	7/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.5441679	Y	174.52676
Address	80 Pakuranga Road, Pakuranga, New Zealand			
Equipment				
Manufacturer	SVAN			
Type	958			
Serial number	20892			
Date of last calibration	08/12/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓		NZTA Road Noise	
Are you more than 10m from an existing road kerb?	Yes ✓		No	
Away from trees	Yes ✓		No	
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Pakuranga Road			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3 m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	10-15 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	40 m			
Height of noise source(s)				
Distance from any reflective surfaces	7 m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

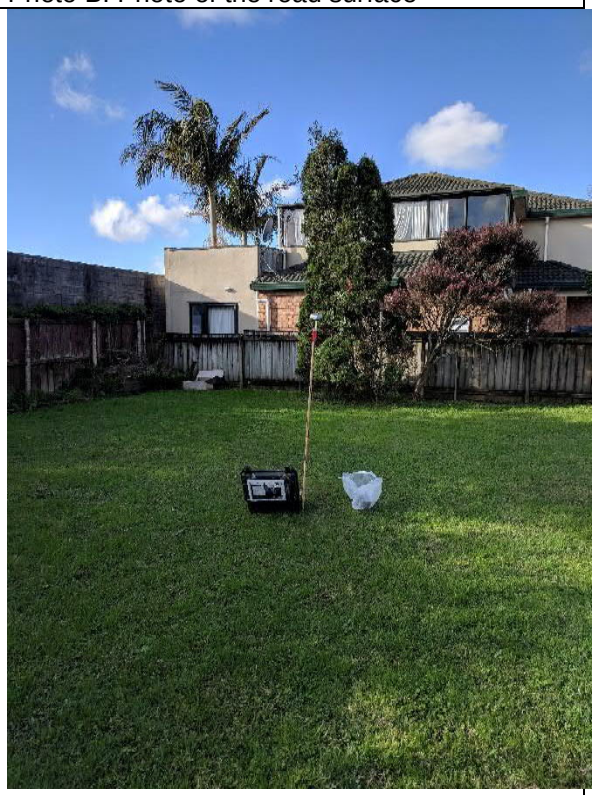


Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML2 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	7/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.543932	Y	174.523061
Address	179 Pakuranga Road, Pakuranga, New Zealand			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00865768			
Date of last calibration	20/03/2018			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓		NZTA Road Noise	
Are you more than 10m from an existing road kerb?	Yes ✓		No	
Away from trees	Yes ✗		No	
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Pakuranga Road			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3 m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	10-15 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	45 m			
Height of noise source(s)				
Distance from any reflective surfaces	20 m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

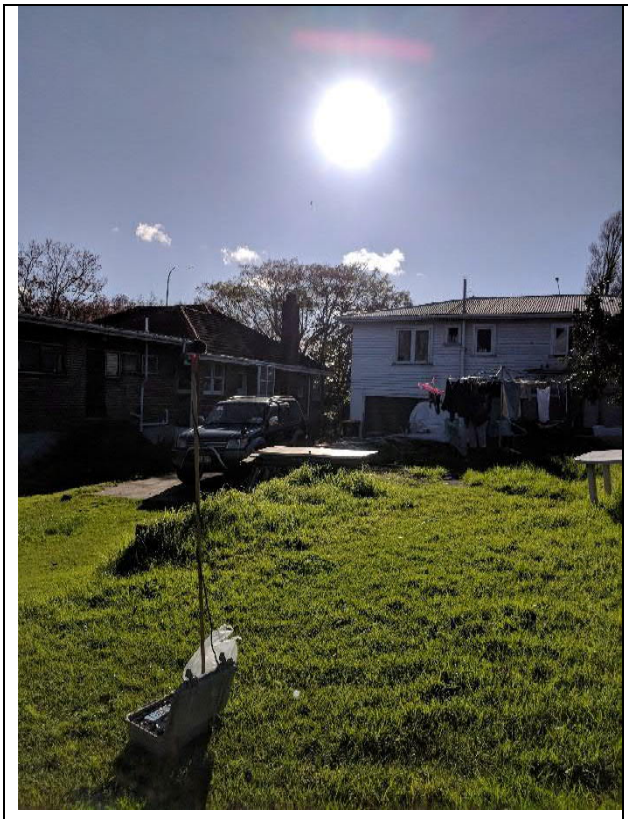


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

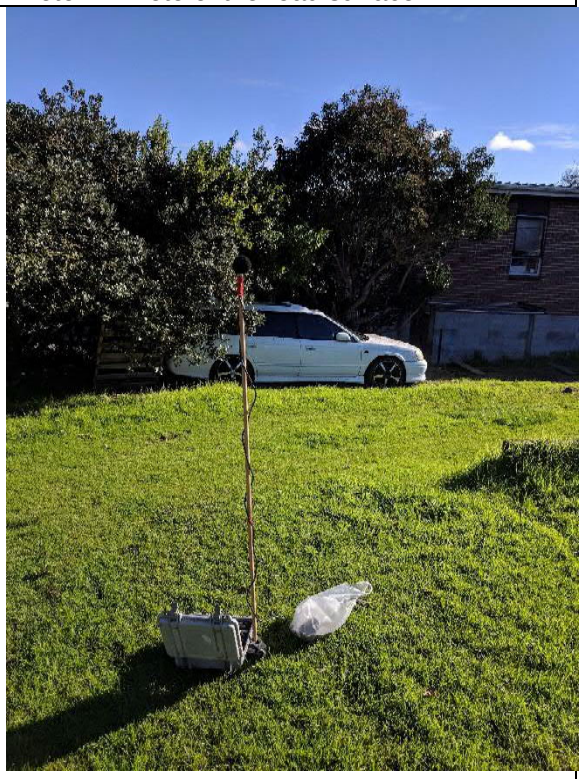
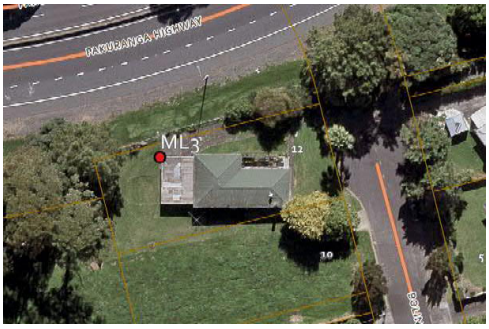


Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML3 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	7/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.916068	Y	174.869720
Address	12 Bolina Cres, Paukuranga, Auckland 2010			
Equipment				
Manufacturer	SVAN			
Type	957			
Serial number	20164			
Date of last calibration	18/07/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes ✓	No		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	~150m from intersection. Traffic frequently backed up 150m to intersection on far lane.			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Pakuranga Highway.			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	< 3m/s			
Wind speed and direction at dominant source(s)	SW			
Precipitation	None			
Fog	No			
Temperature	10 -15 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	15 m			
Height of noise source(s)				
Distance from any reflective surfaces	n/a			
Intervening topography	Flat			
Hard, mixed or soft ground	Soft			
Barriers between source(s) and microphone	n/a			
General comments and sketches				



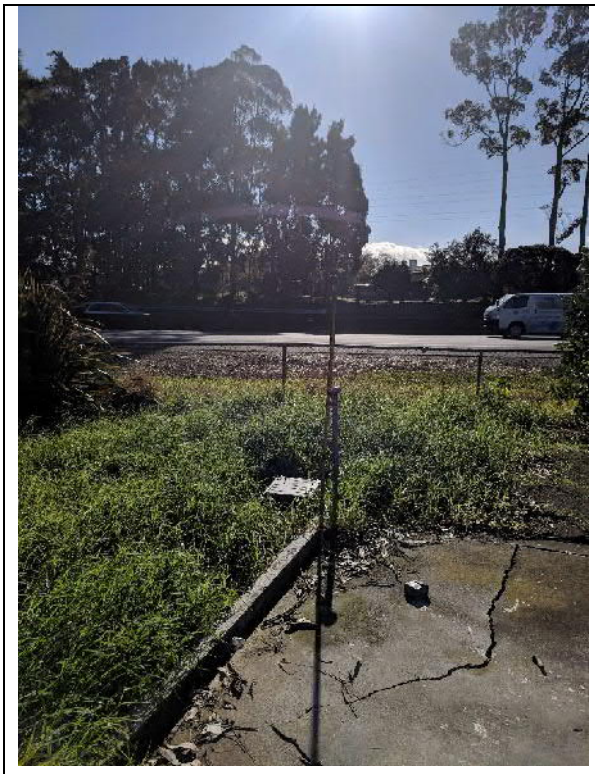


Photo A: View toward the source

Photo B: Photo of the road surface

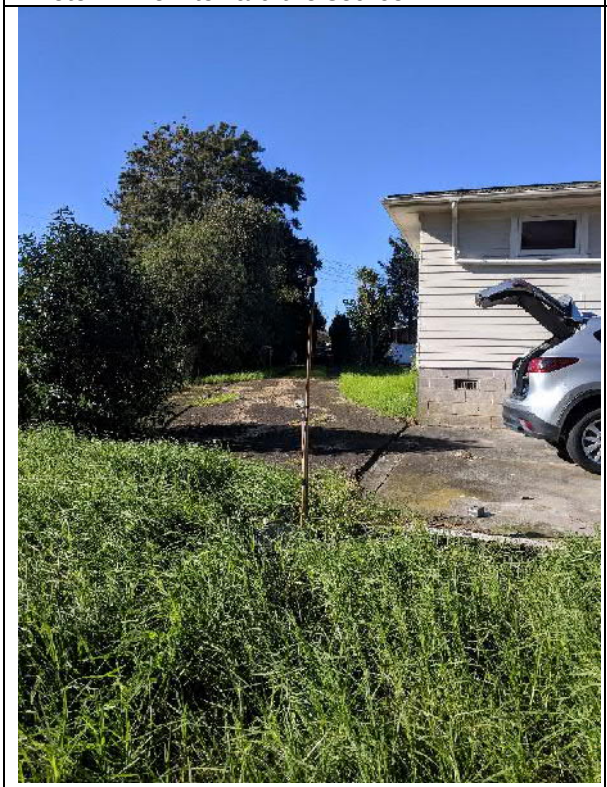


Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML4 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	7/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.545894	Y	174.5218109
Address	47 Ti Rakau Drive, Paukuranga, Auckland 2010			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00187447			
Date of last calibration	13/06/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes ✓	No		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3m/s			
Wind speed and direction at dominant source(s)	SW			
Precipitation	None			
Fog	No			
Temperature	10 -15 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	41 m			
Height of noise source(s)				
Distance from any reflective surfaces	10m to house (NE) ~5m to fence (NW, SW & SE)			
Intervening topography	Flat			
Hard, mixed or soft ground	Hard			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

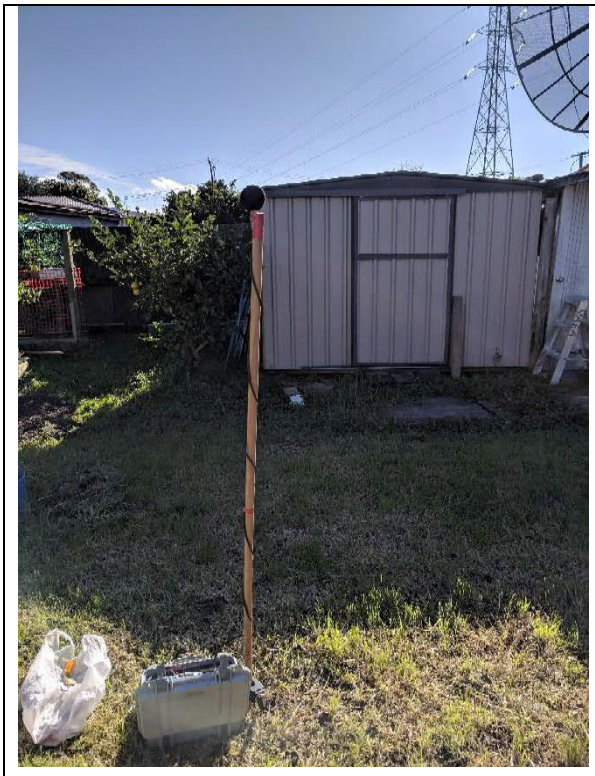


Photo A: View toward the source

Photo B: Photo of the road surface

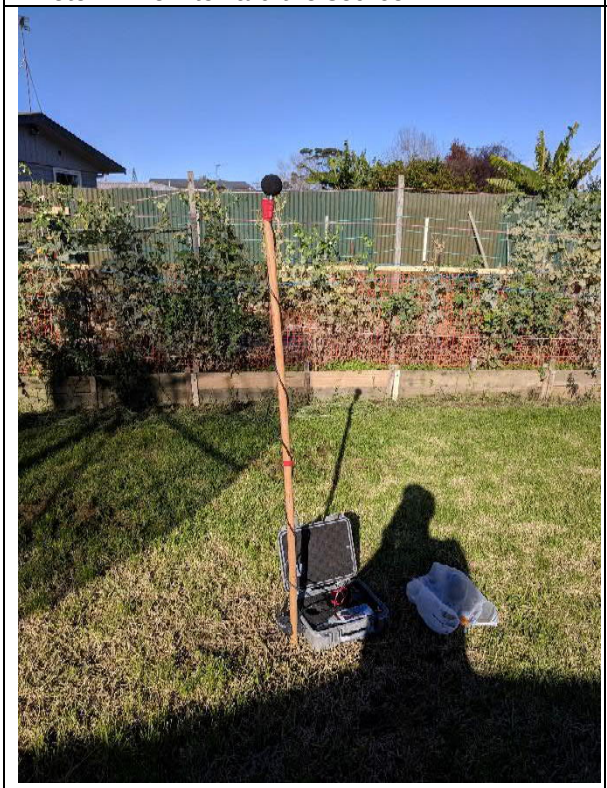


Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML5 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	20/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.5525079	Y	174.528030
Address	81 Ti Rakau Drive, Pakuranga, New Zealand			
Equipment				
Manufacturer	ACOEM			
Type	01dB Cube			
Serial number	11097			
Date of last calibration	27/07/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes ✗	No		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3 m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	Light shower			
Fog	No			
Temperature	18 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	45 m			
Height of noise source(s)				
Distance from any reflective surfaces	5 m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

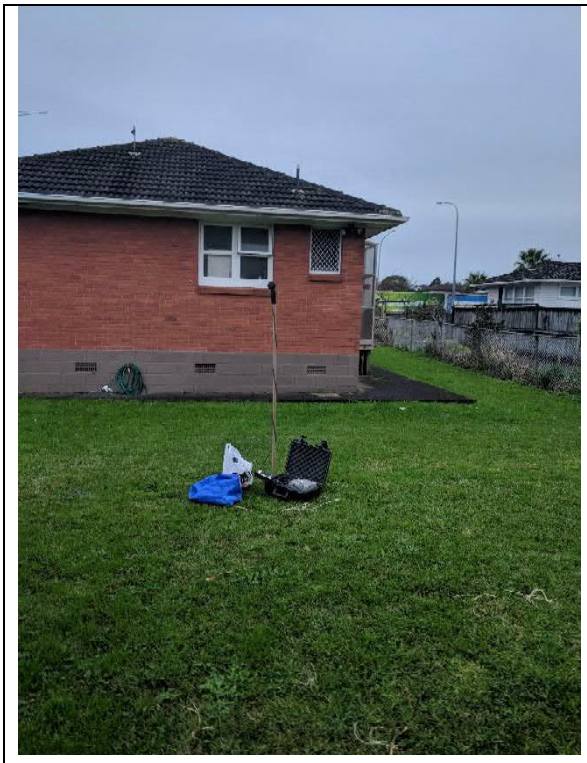


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML6 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	20/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.5518579	Y	174.5244170
Address	81 Ti Rakau Drive, Paukuranga, Auckland 2010			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00187447			
Date of last calibration	13/06/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes	No ✓		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	18°C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	20 m			
Height of noise source(s)				
Distance from any reflective surfaces	1m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

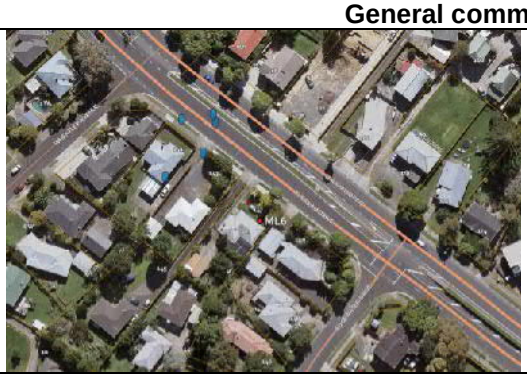


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML7 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	20/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.5525079	Y	174.528030
Address	187 Ti Rakau Drive, Pakuranga, New Zealand			
Equipment				
Manufacturer	SVAN			
Type	958			
Serial number	20892			
Date of last calibration	08/12/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes	No ✓		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3 m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	18 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	40 m			
Height of noise source(s)				
Distance from any reflective surfaces	10 m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

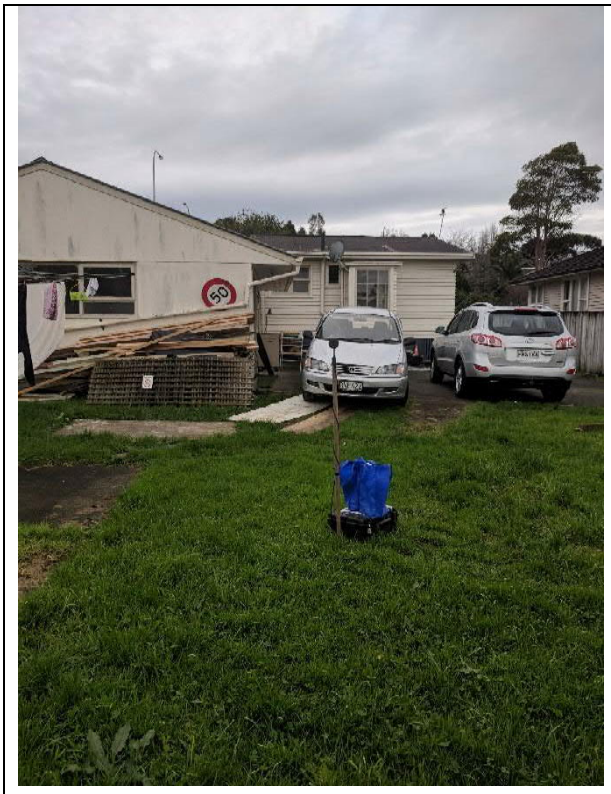


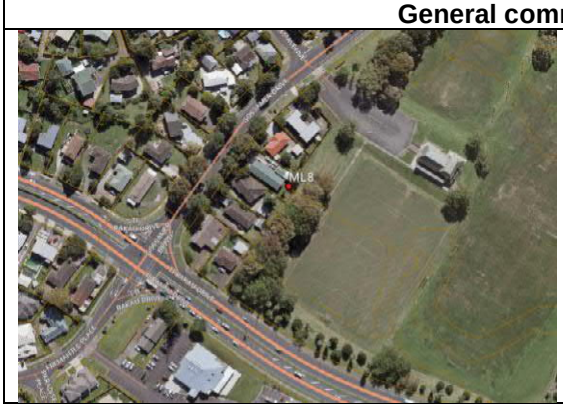
Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML8 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	20/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.5523790	Y	174.53956
Address	174 Gossemer Drive, Paukuranga, Auckland 2010			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00865768			
Date of last calibration	20/03/2018			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes	No ✓		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	-			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	18°C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	86 m			
Height of noise source(s)				
Distance from any reflective surfaces	4m to house and shed			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				



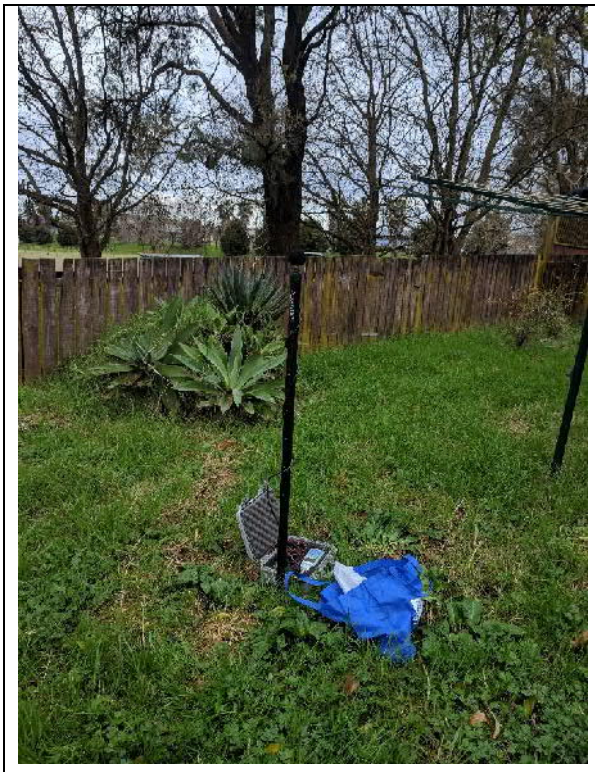


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML9 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	28/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.913359	Y	174.873464
Address	13 Reeves Road, Paukuranga, Auckland 2010			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00865768			
Date of last calibration	20/03/2018			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes ✓	No		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Reeves Drive			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	-			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	18°C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	15 m			
Height of noise source(s)	-			
Distance from any reflective surfaces	12m to Art gallery building			
Intervening topography	Flat			
Hard, mixed or soft ground	Soft			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

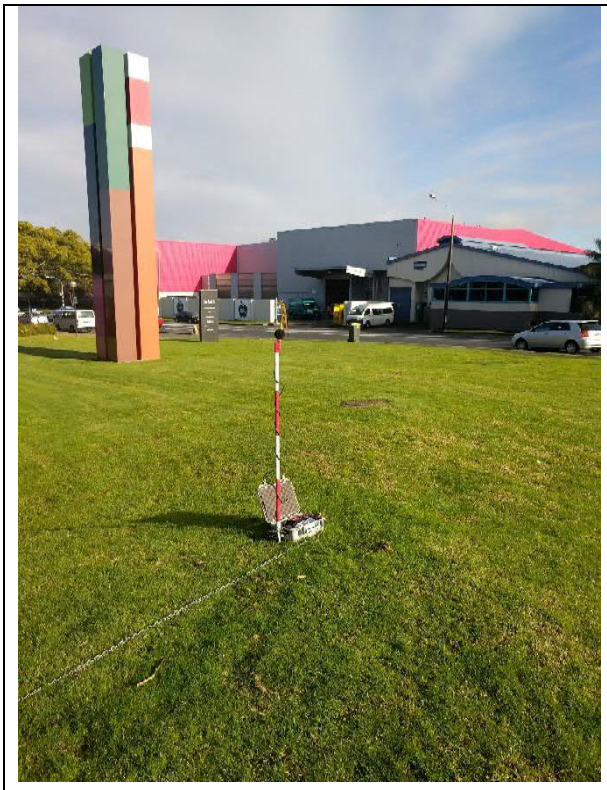


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

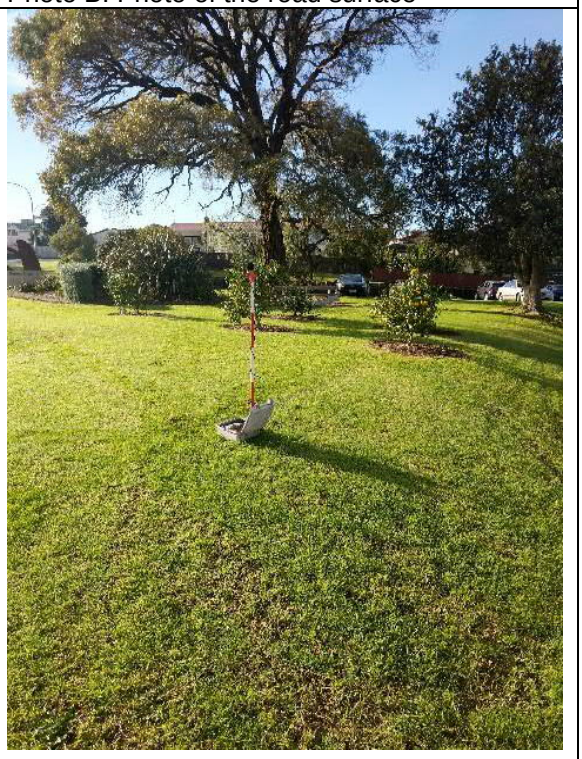


Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML10 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	28/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.914271	Y	174.865243
Address	Park area adjacent to Pakuranga Highway, Auckland 2010			
Equipment				
Manufacturer	Rion			
Type	NL-21			
Serial number	00187447			
Date of last calibration	13/06/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes ✓	No		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Pakuranga Highway			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	-			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	15°C			
Humidity	Medium			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	11 m			
Height of noise source(s)	-			
Distance from any reflective surfaces	> 50 m			
Intervening topography	Road elevated by approx. 2m from ground			
Hard, mixed or soft ground	Soft			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

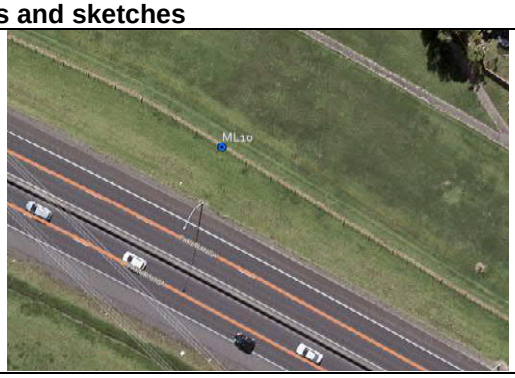


Photo A: View toward the source

Photo B: Photo of the road surface

Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML11 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	28/6/2018			
Engineer(s)	Kieran Hill			
Location (NZTM2000) or	X	-36.912989	Y	174.869494
Address	Park area adjacent to Pakuranga Highway, Auckland 2010			
Equipment				
Manufacturer	01dB			
Type	Cube			
Serial number	11097			
Date of last calibration	27/7/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓	NZTA Road Noise		
Are you more than 10m from an existing road kerb?	Yes ✓	No		
Away from trees	Yes	No ✓		
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Ti Rakau Drive & Pakuranga Road intersection			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	-			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	15°C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	7 m			
Height of noise source(s)	-			
Distance from any reflective surfaces	3.5m to building façade			
Intervening topography	Fence (non-acoustic rated) between road and slm			
Hard, mixed or soft ground	Soft			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

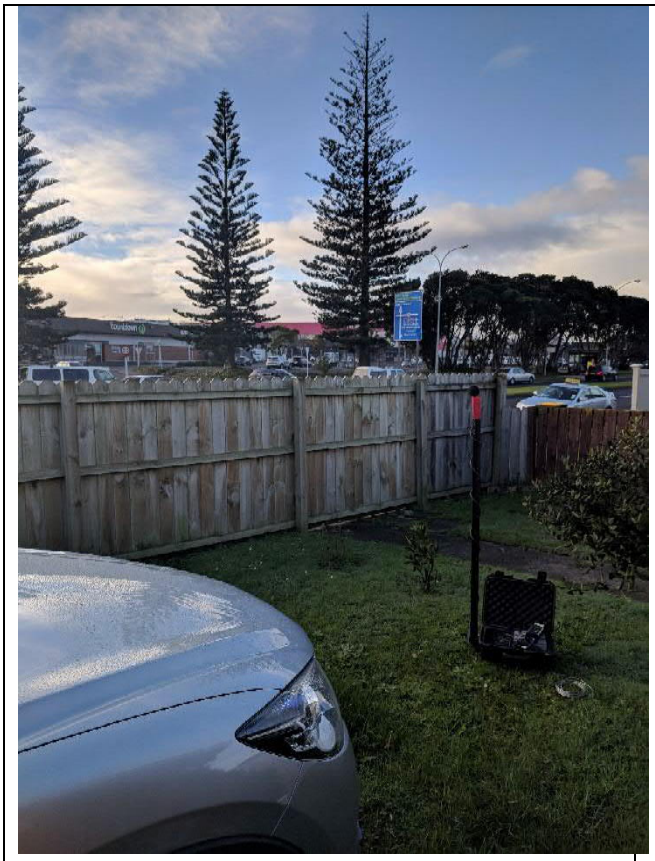


Photo A: View toward the source

Photo B: Photo of the road surface

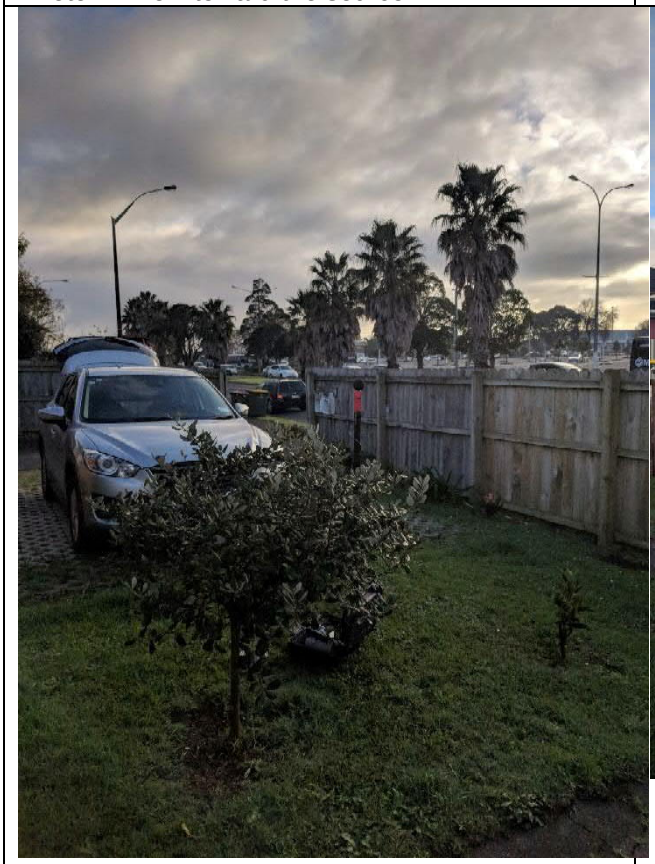


Photo C: Photo of the SLM (angle 1)

Photo C: Photo of the SLM (angle 2)

NOISE MONITORING FORM				
ML13 Summary				
Project name	AMETI EB 2&3			
Project number	60563280			
Date / time	27/7/2018			
Engineer(s)	James Wright			
Location (NZTM2000)	X	1766967	Y	5913098
Address	17 Reeves Road, Pakuranga, New Zealand			
Equipment				
Manufacturer	SVAN			
Type	958			
Serial number	20892			
Date of last calibration	08/12/2017			
Calibration drift pre/post	TBC			
Noise Environment				
What assessment are you doing?	NZS: 6806 ✓		NZTA Road Noise	
Are you more than 10m from an existing road kerb?	Yes ✓		No	
Away from trees	Yes		No ✓	
Are there any pot-holes, speed bumps, old surfaces, expansion joints, special surfacing etc?	n/a			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise was from traffic on Pakuranga Road			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	n/a			
Meteorological Conditions				
Wind speed and direction at microphone	< 3 m/s			
Wind speed and direction at dominant source(s)	-			
Precipitation	None			
Fog	No			
Temperature	10-15 °C			
Humidity	Low			
Percentage cloud cover	None			
Site Conditions				
Microphone height	1.5 m			
Distance to dominant noise source(s)	40 m			
Height of noise source(s)				
Distance from any reflective surfaces	7 m to house			
Intervening topography	Flat			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	n/a			
General comments and sketches				

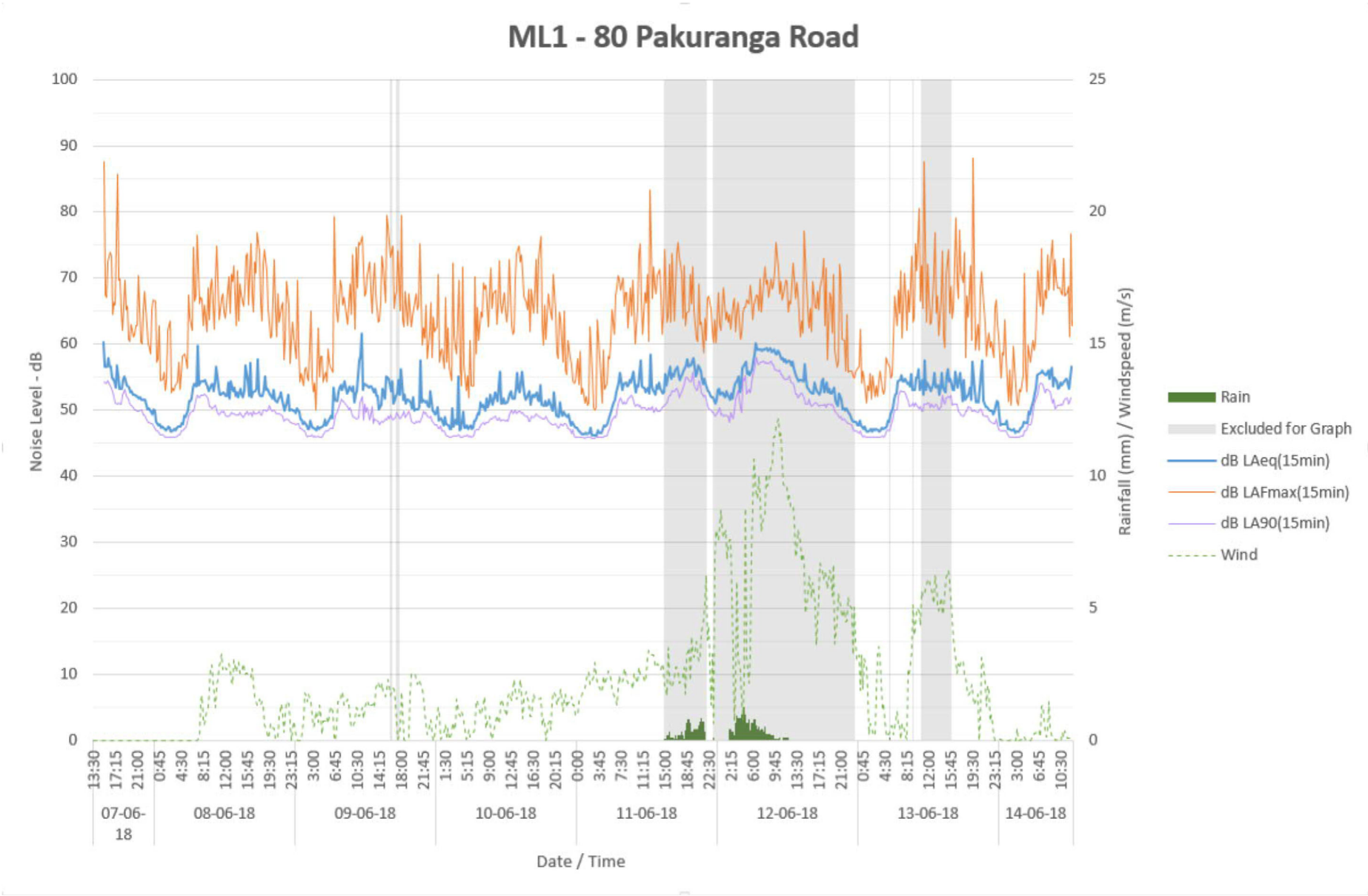
Photo A: View toward the source

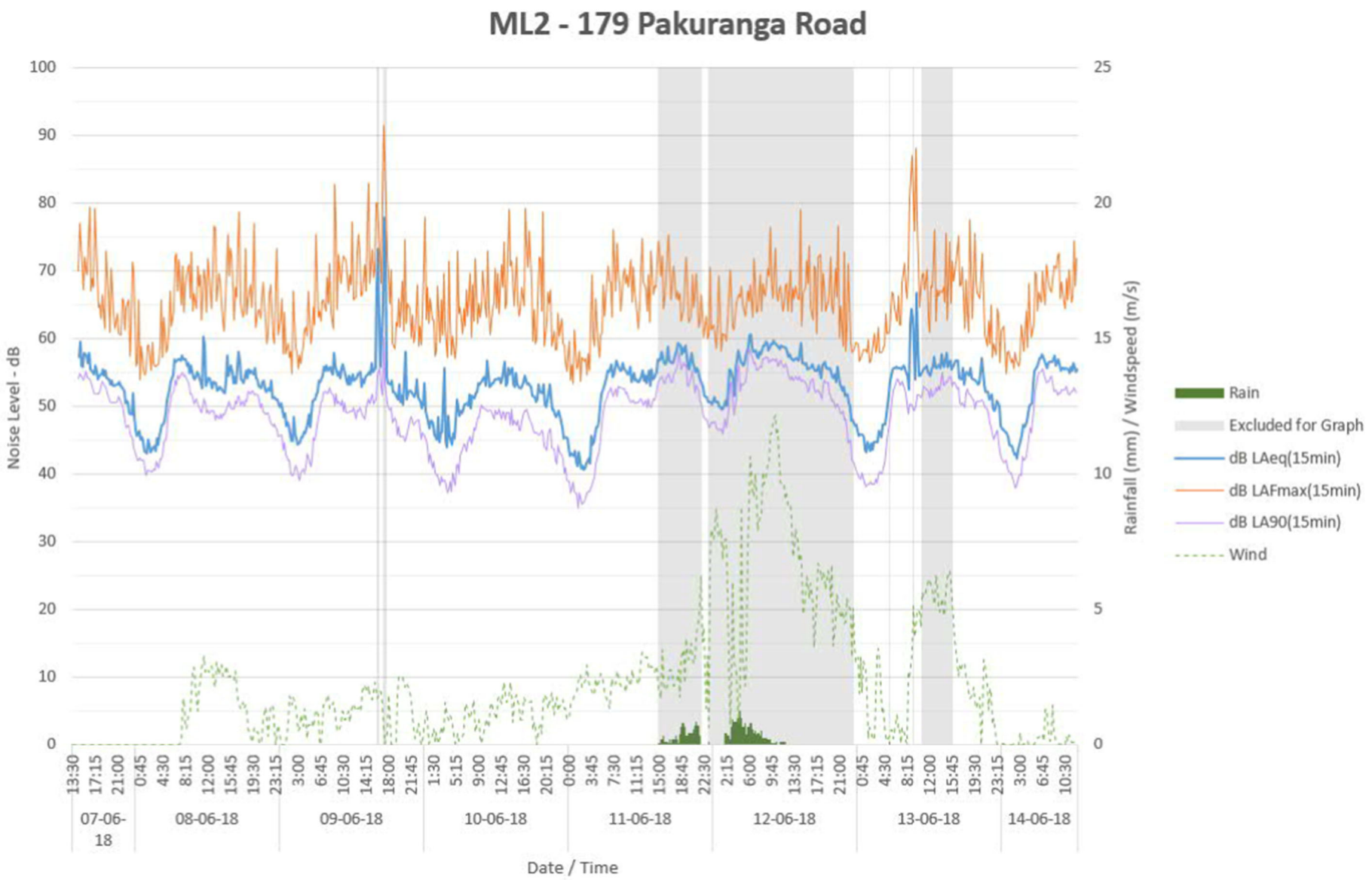
Photo B: Photo of the road surface

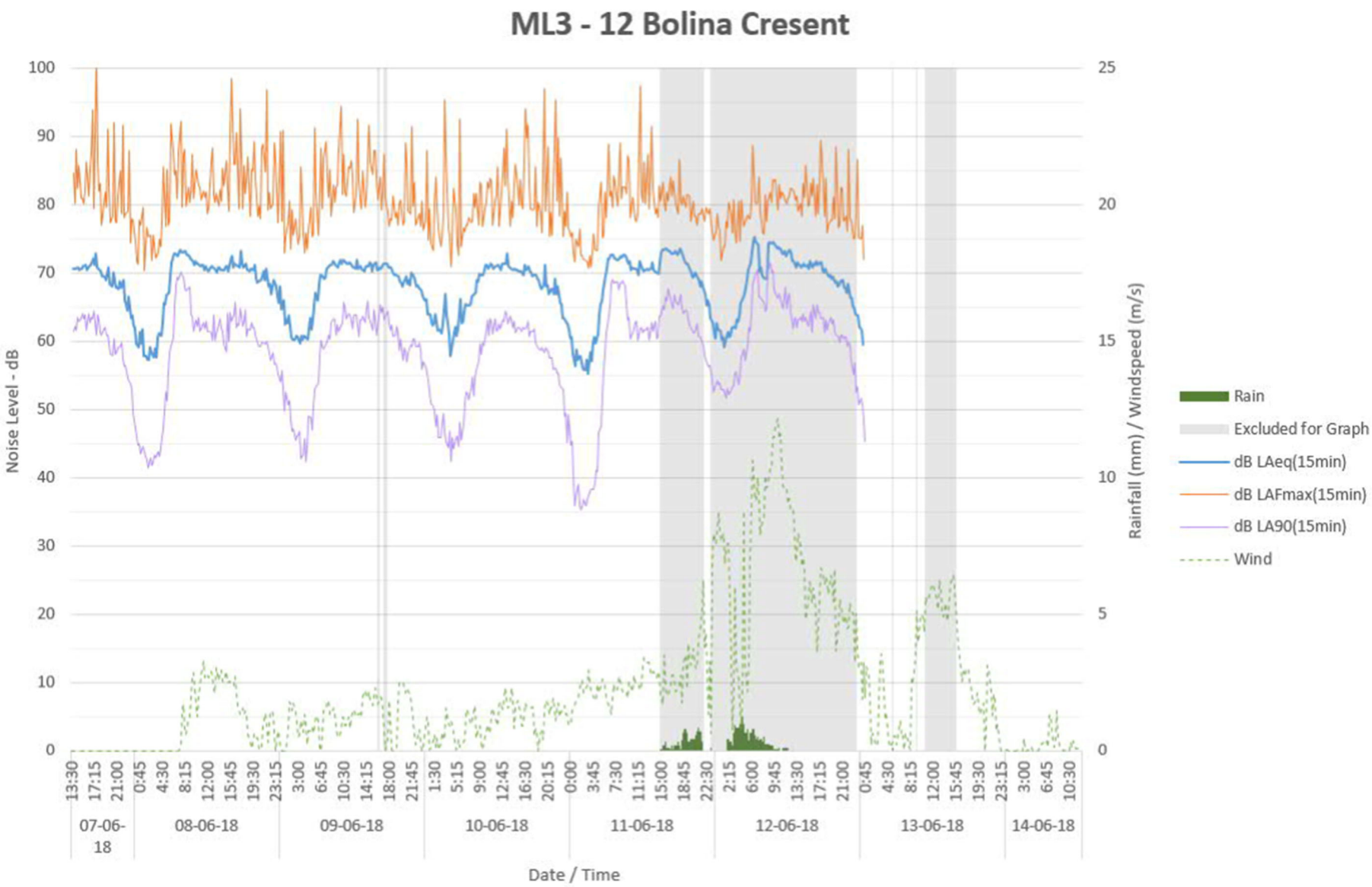
Photo C: Photo of the SLM (angle 1)

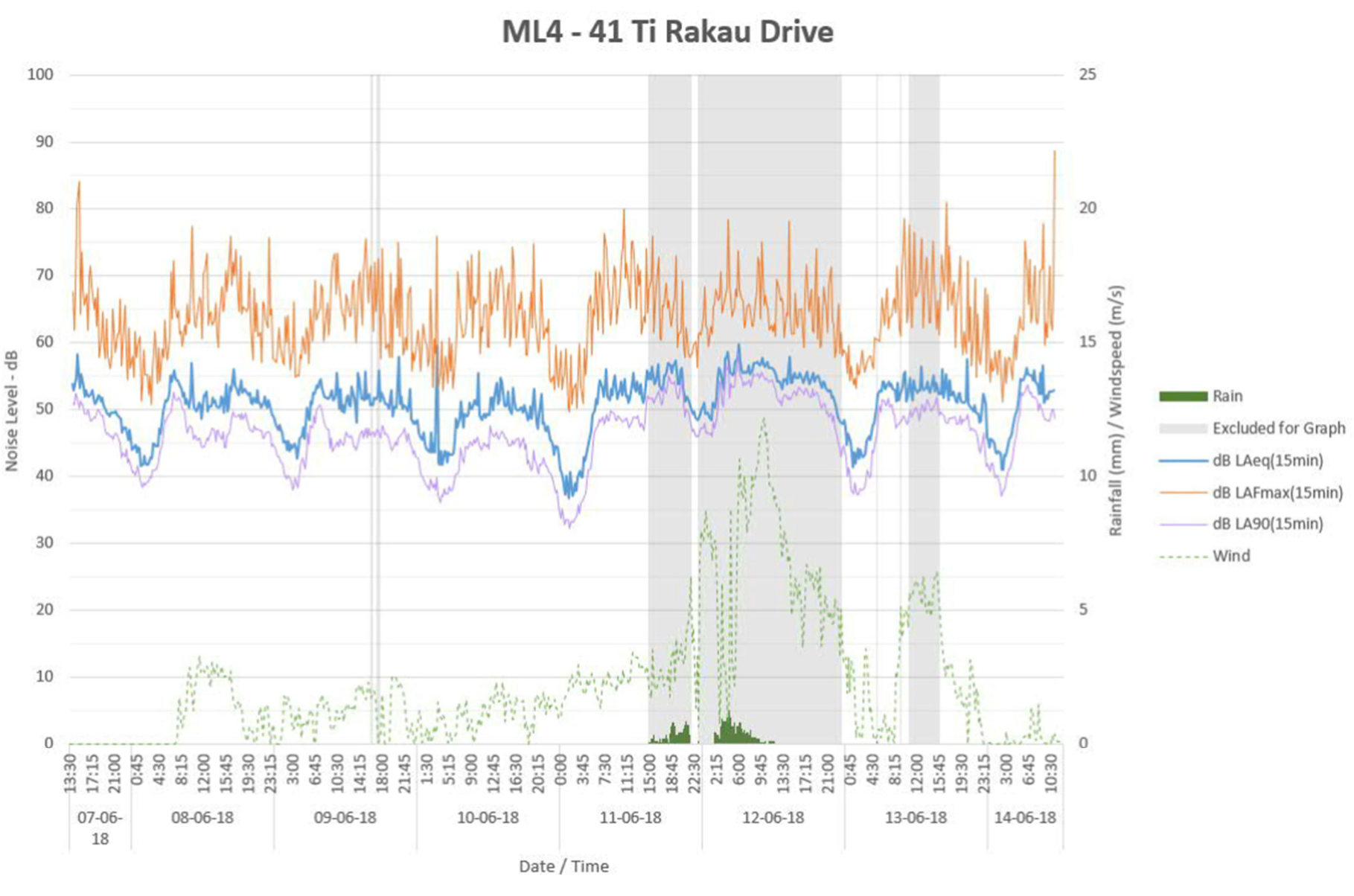
Photo C: Photo of the SLM (angle 2)

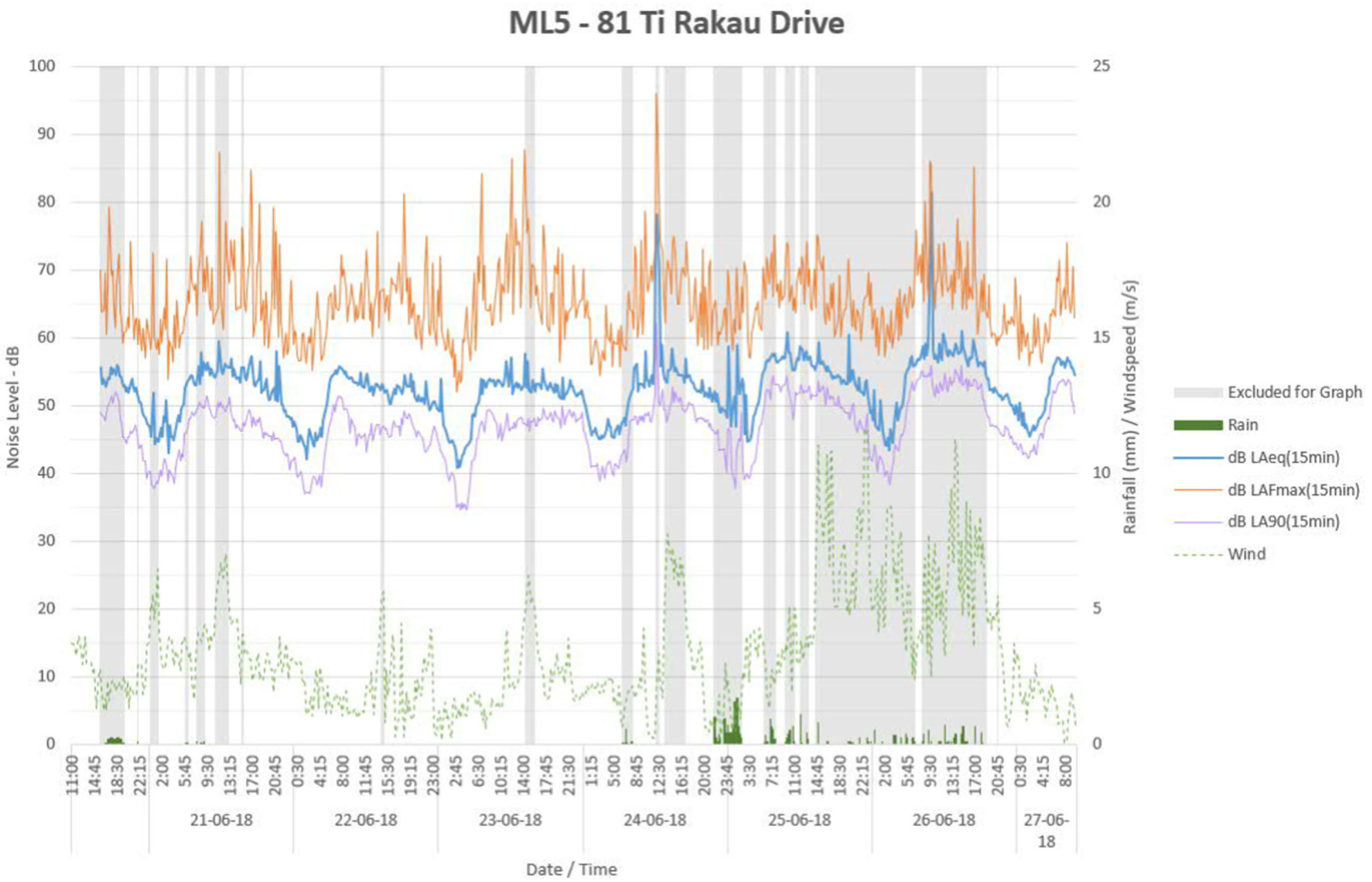
Appendix C – Noise Monitoring Results

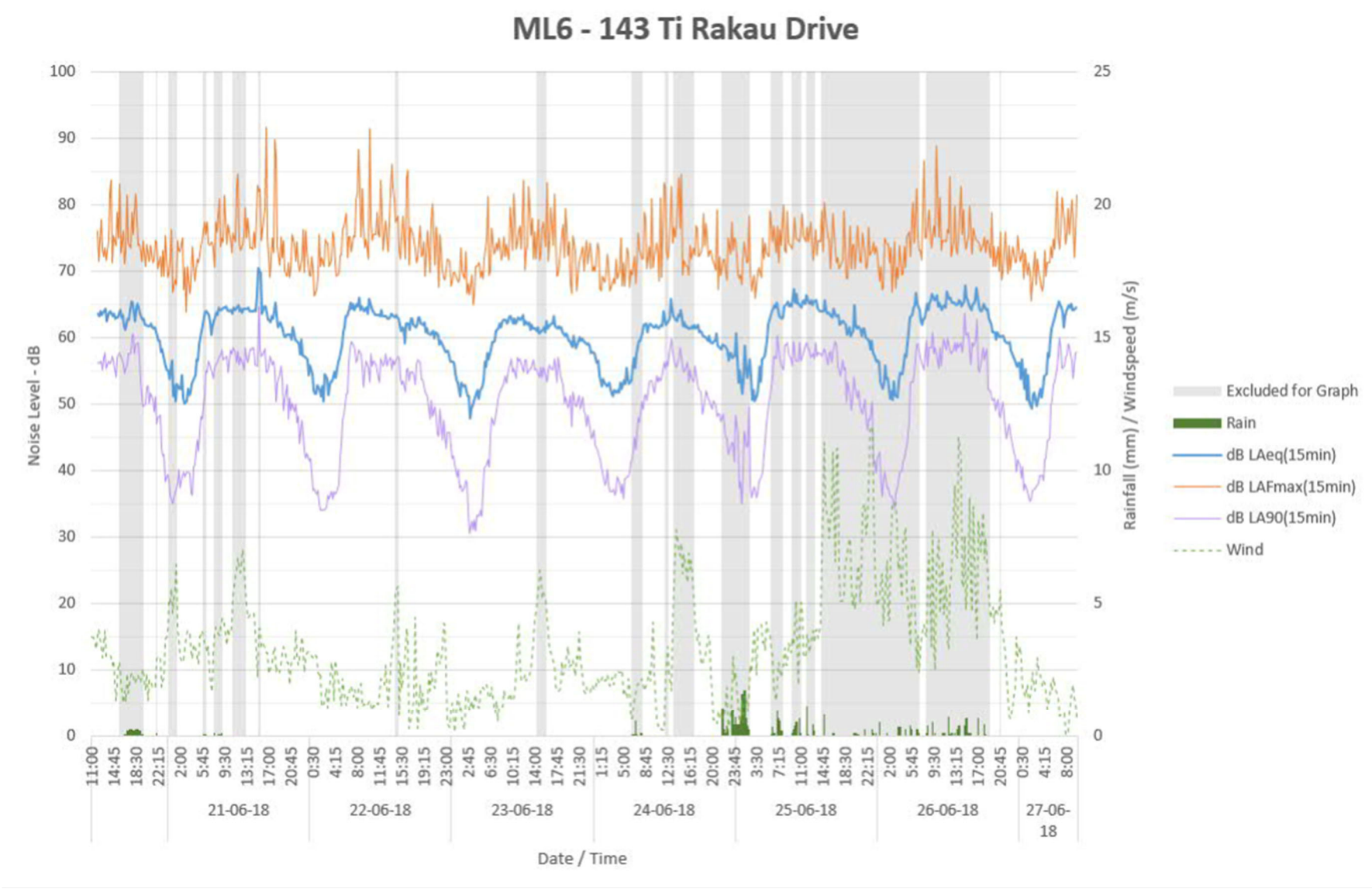

ML1 - 80 Pakuranga Road
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
07-06-18
08-06-18
09-06-18
10-06-18
11-06-18
12-06-18
13-06-18
14-06-18
Rain
Excluded for Graph
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

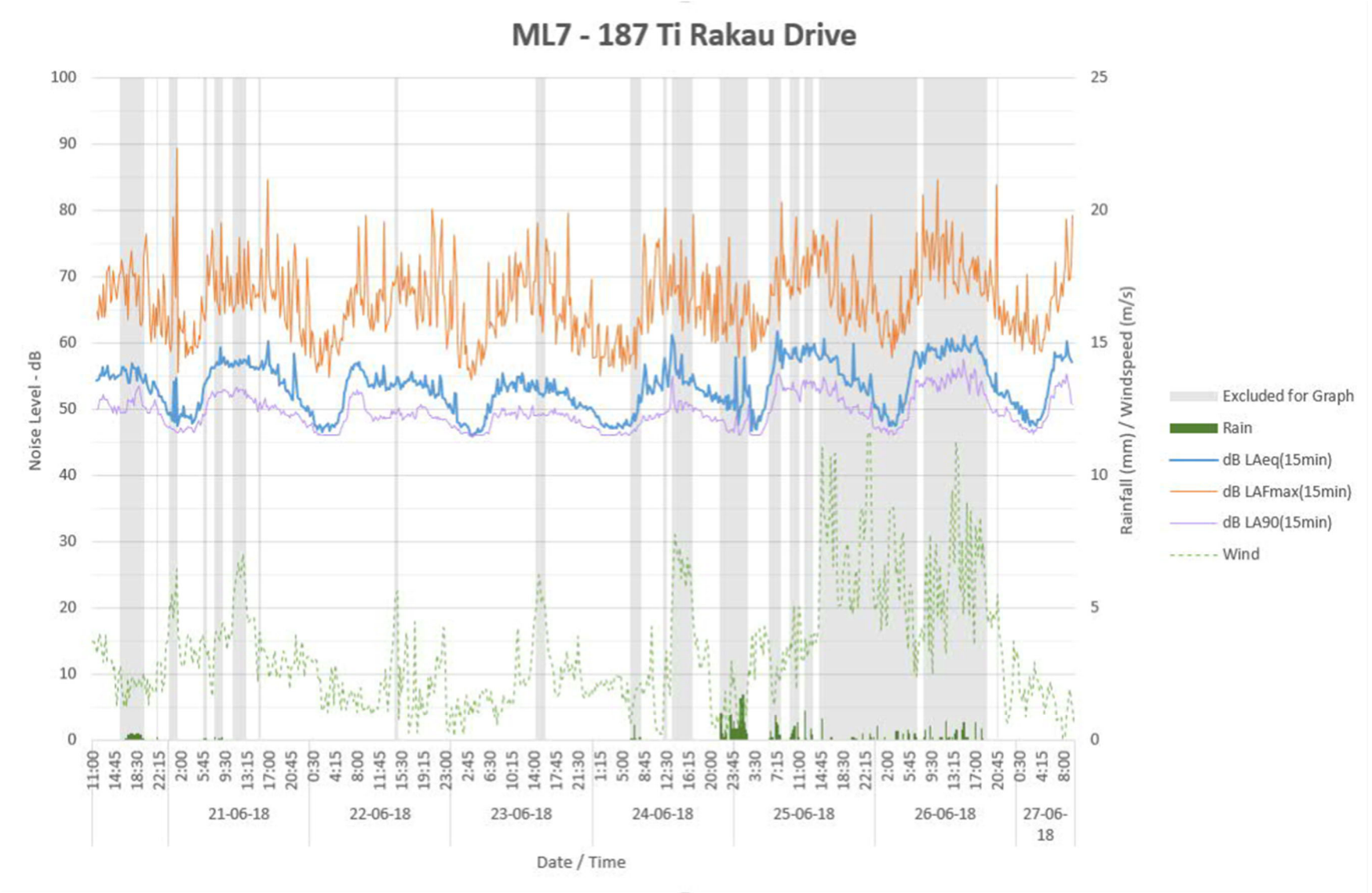

ML2 - 179 Pakuranga Road
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
07-06-18
08-06-18
09-06-18
10-06-18
11-06-18
12-06-18
13-06-18
14-06-18
Rain
Excluded for Graph
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

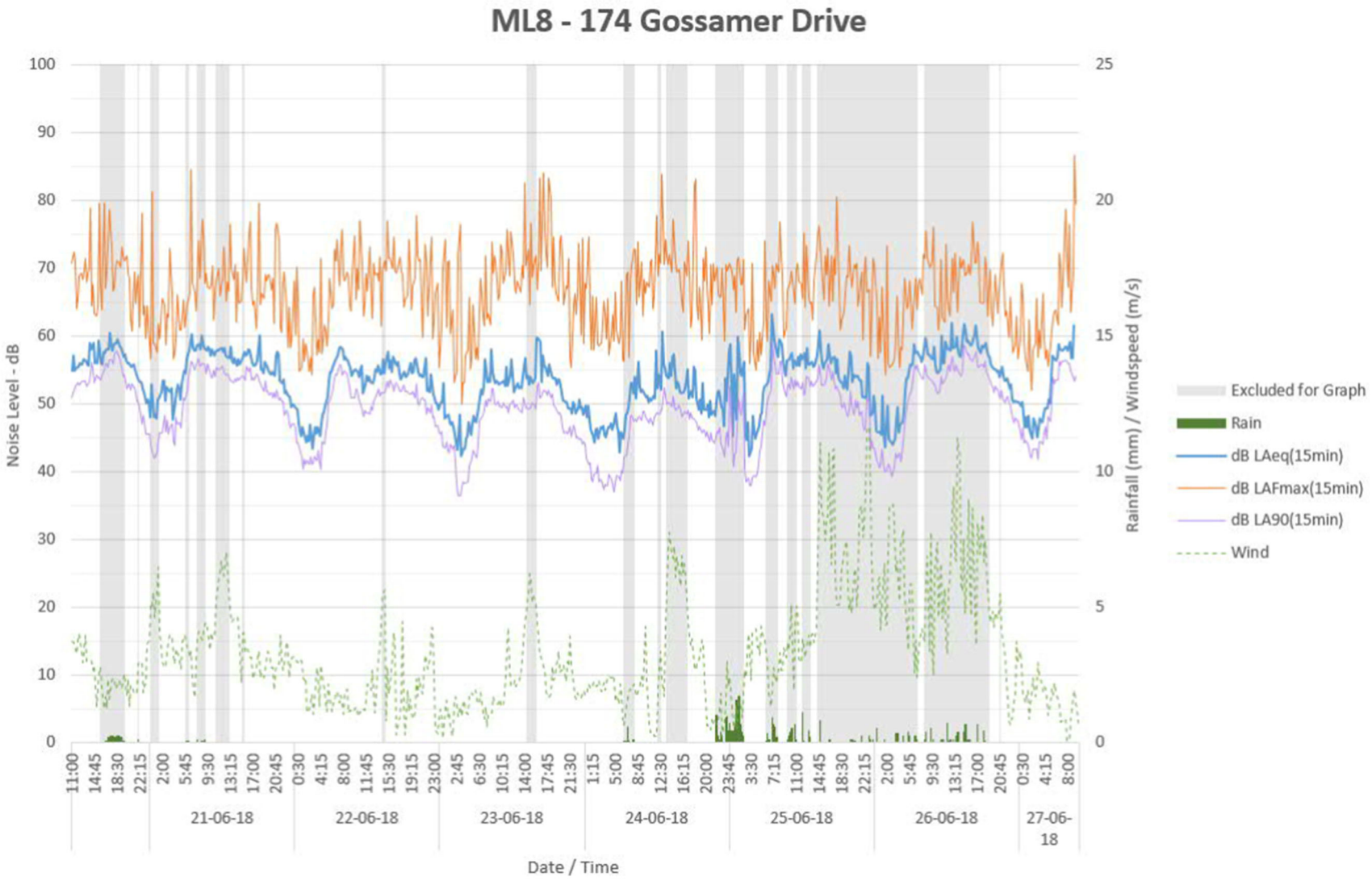

ML3 - 12 Bolina Cresent
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
07-06-18
08-06-18
09-06-18
10-06-18
11-06-18
12-06-18
13-06-18
14-06-18
Rain
Excluded for Graph
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

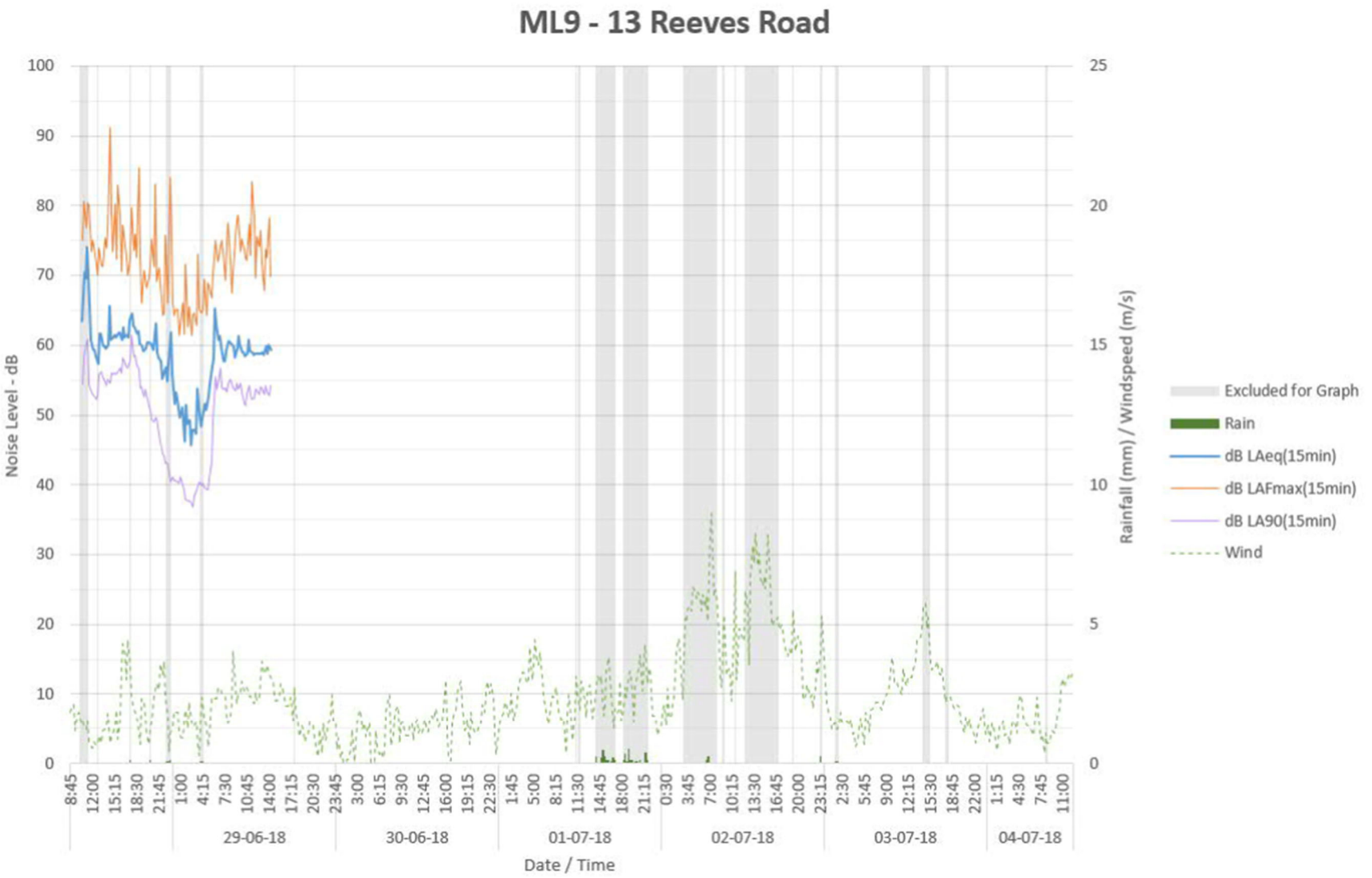

ML4 - 41 Ti Rakau Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
07-06-18
08-06-18
09-06-18
10-06-18
11-06-18
12-06-18
13-06-18
14-06-18
Rain
Excluded for Graph
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

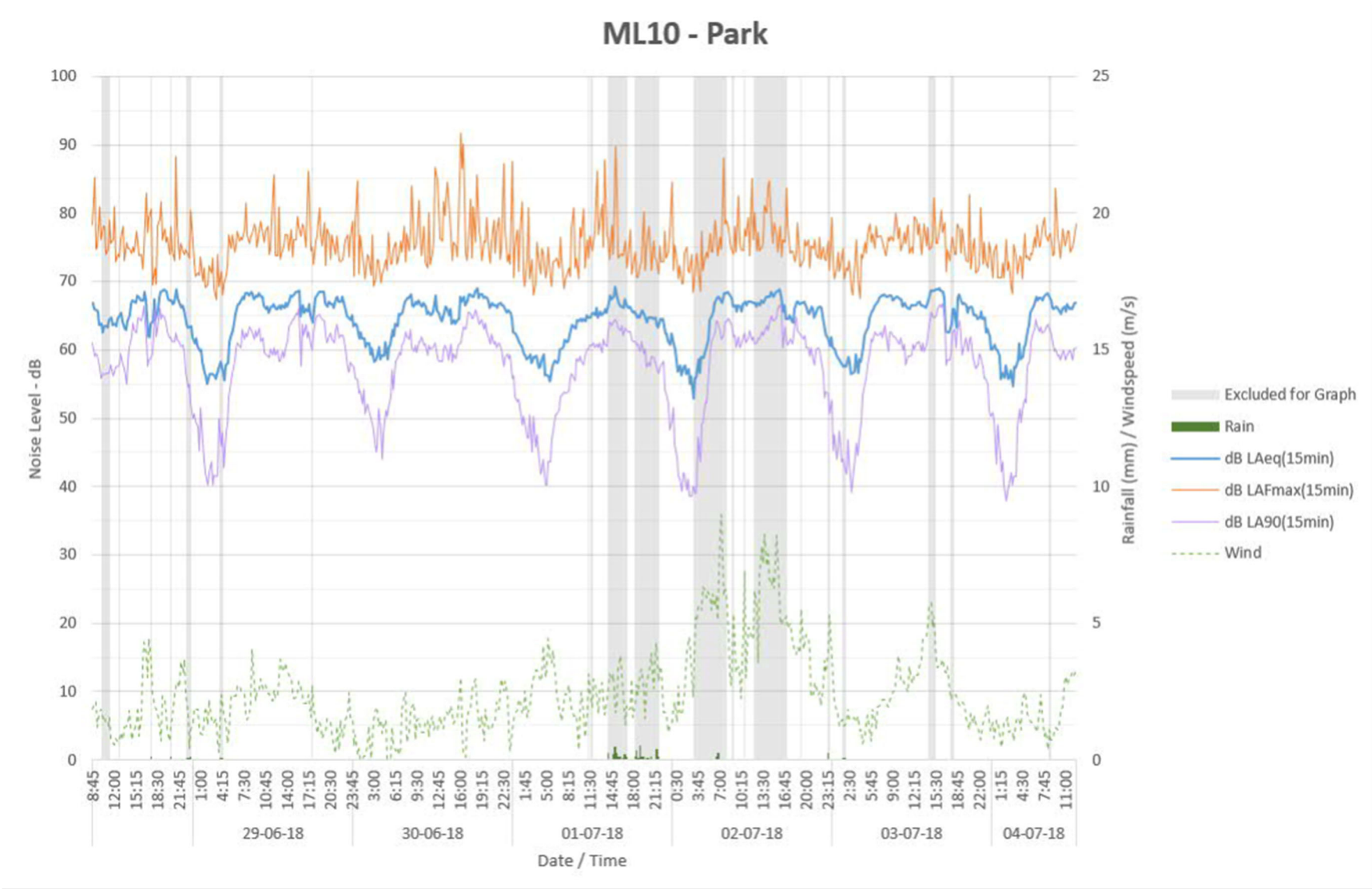

ML5 - 81 Ti Rakau Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
21-06-18
22-06-18
23-06-18
24-06-18
25-06-18
26-06-18
27-06-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

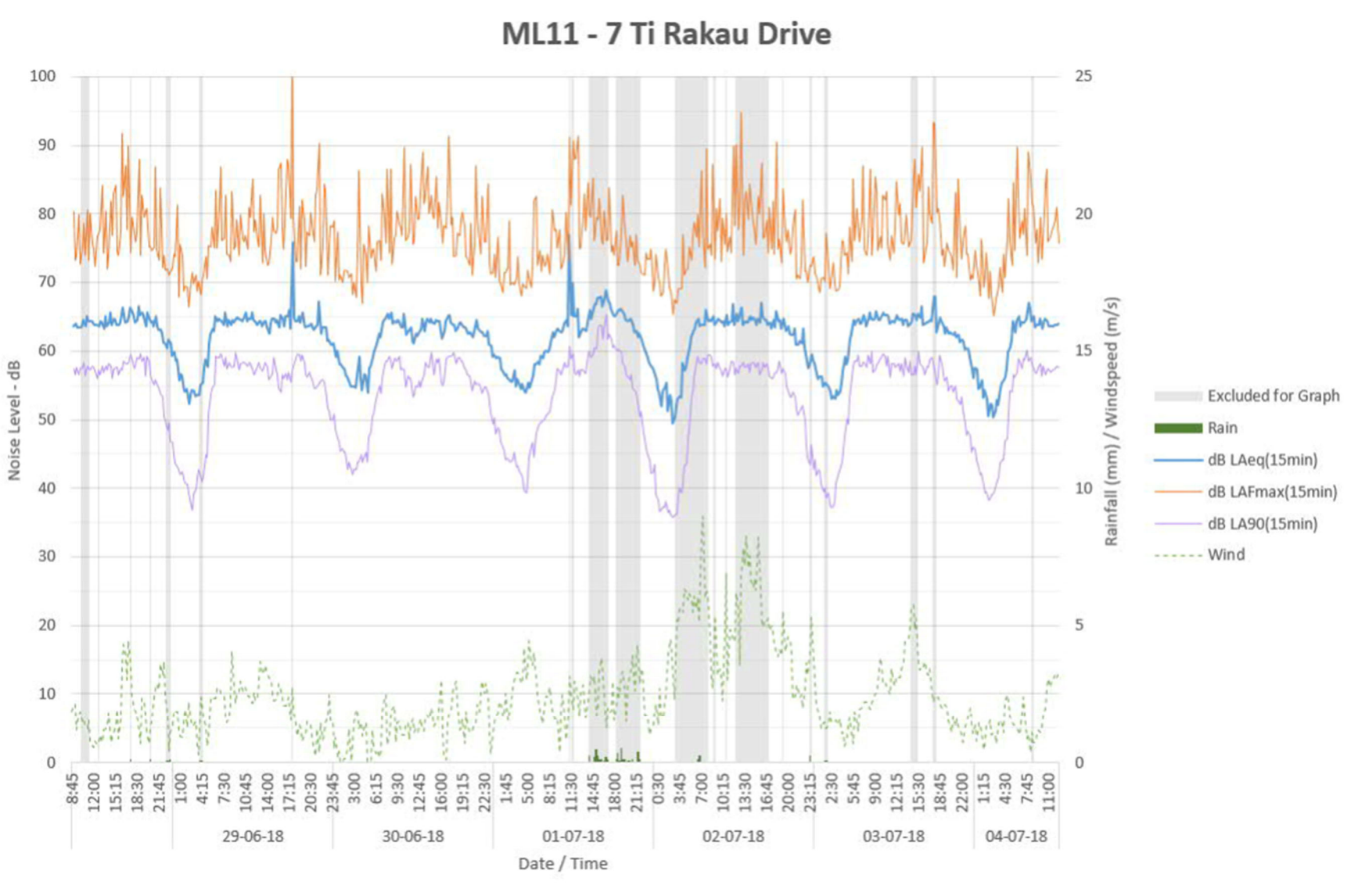

ML6 - 143 Ti Rakau Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
21-06-18
22-06-18
23-06-18
24-06-18
25-06-18
26-06-18
27-06-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

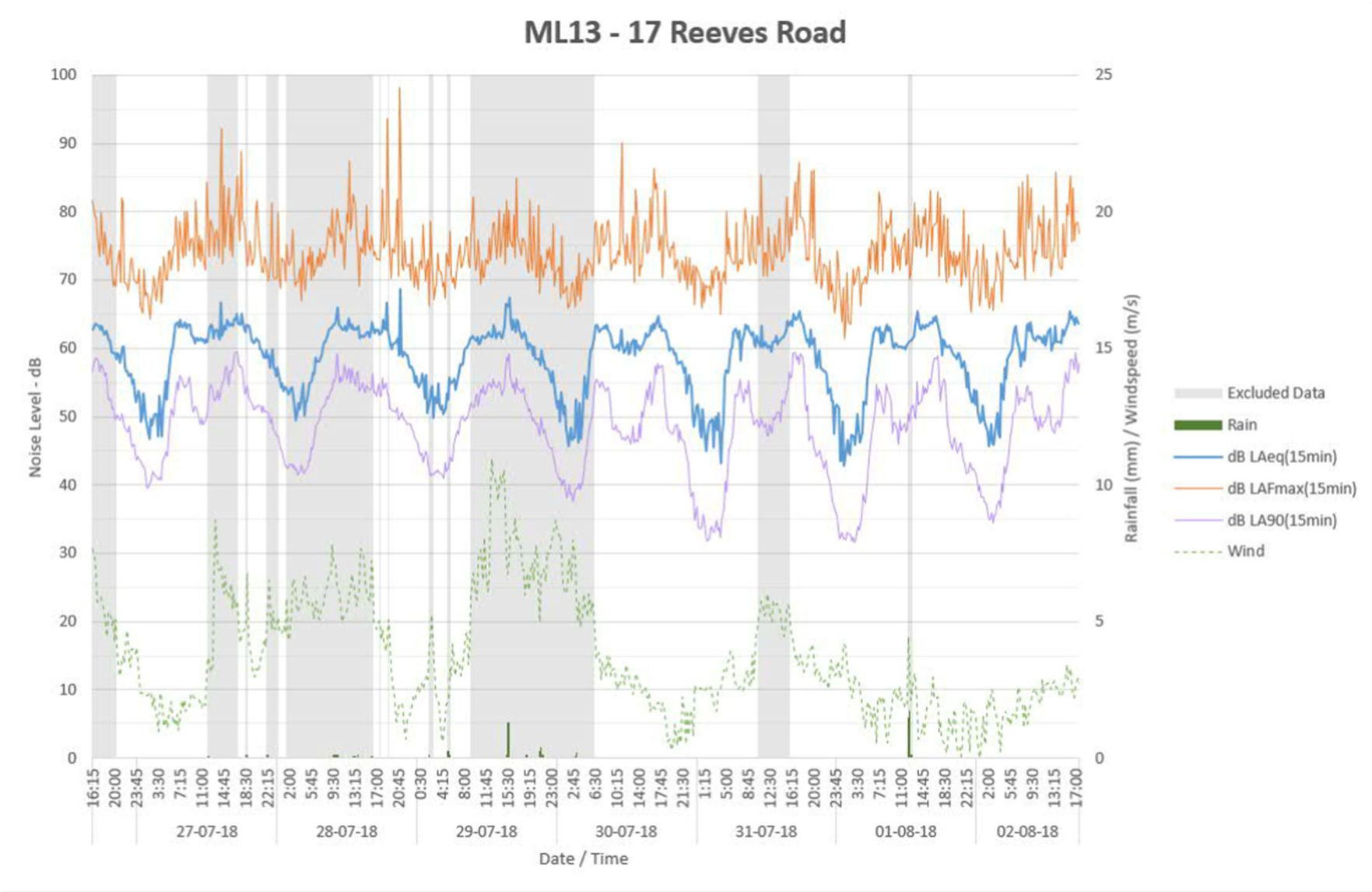

ML7 - 187 Ti Rakau Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
21-06-18
22-06-18
23-06-18
24-06-18
25-06-18
26-06-18
27-06-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind


ML8 - 174 Gossamer Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
21-06-18
22-06-18
23-06-18
24-06-18
25-06-18
26-06-18
27-06-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind


ML9 - 13 Reeves Road
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
29-06-18
30-06-18
01-07-18
02-07-18
03-07-18
04-07-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind


ML10 - Park
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
29-06-18
30-06-18
01-07-18
02-07-18
03-07-18
04-07-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind


ML11 - 7 Ti Rakau Drive
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
29-06-18
30-06-18
01-07-18
02-07-18
03-07-18
04-07-18
Excluded for Graph
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind


ML13 - 17 Reeves Road
Noise Level - dB
Rainfall (mm) / Windspeed (m/s)
Date / Time
27-07-18
28-07-18
29-07-18
30-07-18
31-07-18
01-08-18
02-08-18
Excluded Data
Rain
dB LAeq(15min)
dB LAFmax(15min)
dB LA90(15min)
Wind

Appendix D – Noise Modelling Results

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
4a - 4b Palm Avenue	EB2	56	57	55	OutsideBusCalcArea	54	54	55	55	-2	-
10 Anthony Place	EB2	50	51	52	OutsideBusCalcArea	51	51	51	51	1	-
12 Anthony Place	EB2	50	51	50	OutsideBusCalcArea	50	50	50	50	-1	-
14 Anthony Place	EB2	51	52	51	OutsideBusCalcArea	51	51	51	51	-1	-
15 Anthony Place	EB2	50	50	50	OutsideBusCalcArea	49	50	50	50	-1	-
15b Anthony Place	EB2	53	53	52	OutsideBusCalcArea	52	52	52	52	-2	-
15c Anthony Place	EB2	57	57	56	OutsideBusCalcArea	56	56	56	56	-1	-
1 Ayr Road	EB2	52	54	55	OutsideBusCalcArea	55	55	55	55	1	-
2 Ayr Road	EB2	50	51	53	OutsideBusCalcArea	53	53	53	53	2	-
3 Ayr Road	EB2	51	52	53	OutsideBusCalcArea	53	53	53	53	2	-
4 Ayr Road	EB2	50	51	53	OutsideBusCalcArea	52	53	53	53	2	-
6 Ayr Road	EB2	51	52	55	OutsideBusCalcArea	55	55	55	55	3	Slight Adverse
1a Ayr Road	EB2	54	55	57	OutsideBusCalcArea	57	57	57	57	2	-
6a Ayr Road	EB2	52	53	57	OutsideBusCalcArea	57	57	57	57	5	Moderate Adverse
1/6 Bennett Road	EB2	49	50	51	OutsideBusCalcArea	50	51	51	51	1	-
2b Bennett Road	EB2	48	49	50	OutsideBusCalcArea	50	50	50	50	1	-
2c Bennett Road	EB2	49	50	50	OutsideBusCalcArea	50	50	50	50	0	-
4a Bennett Road	EB2	50	50	53	OutsideBusCalcArea	52	53	53	53	3	Slight Adverse
4b Bennett Road	EB2	49	50	53	OutsideBusCalcArea	53	53	53	53	3	Slight Adverse
4c Bennett Road	EB2	49	50	53	OutsideBusCalcArea	53	53	53	53	3	Slight Adverse
2 Dale Crescent	EB2	66	66	65	OutsideBusCalcArea	65	63	65	63	-4	-
4 Dale Crescent	EB2	60	61	60	OutsideBusCalcArea	60	59	60	59	-2	-
6 Dale Crescent	EB2	60	61	60	OutsideBusCalcArea	60	59	60	59	-1	-
8 Dale Crescent	EB2	62	63	62	OutsideBusCalcArea	62	62	62	62	-1	-
10 Dale Crescent	EB2	51	51	50	OutsideBusCalcArea	50	50	50	50	-1	-
12 Dale Crescent	EB2	59	61	61	OutsideBusCalcArea	61	61	61	61	0	-
14 Dale Crescent	EB2	59	60	60	OutsideBusCalcArea	60	60	60	60	0	-
16 Dale Crescent	EB2	56	57	59	OutsideBusCalcArea	58	59	59	59	2	-
21 Dale Crescent	EB2	55	56	65	OutsideBusCalcArea	65	65	65	65	9	Significant Adverse
22 Dale Crescent	EB2	51	52	53	37	53	53	53	53	2	-
25 Dale Crescent	EB2	52	53	57	34	57	57	57	57	4	Slight Adverse
26 Dale Crescent	EB2	51	52	52	40	51	51	52	52	0	-
27 Dale Crescent	EB2	52	53	58	34	57	58	58	58	5	Moderate Adverse
33 Dale Crescent	EB2	53	54	57	OutsideBusCalcArea	56	57	57	57	4	Slight Adverse
33 Dale Crescent	EB2	52	53	59	OutsideBusCalcArea	59	59	59	59	6	Moderate Adverse
33 Dale Crescent	EB2	53	53	60	OutsideBusCalcArea	59	60	60	60	6	Moderate Adverse
33 Dale Crescent	EB2	53	53	60	OutsideBusCalcArea	59	60	60	60	6	Moderate Adverse
33 Dale Crescent	EB2	53	53	54	OutsideBusCalcArea	53	54	54	54	1	-
33 Dale Crescent	EB2	54	54	60	OutsideBusCalcArea	59	60	60	60	5	Moderate Adverse
41 Dale Crescent	EB2	52	52	50	39	50	51	51	50	-2	-
45 Dale Crescent	EB2	52	52	50	38	50	51	50	50	-2	-
52 Dale Crescent	EB2	51	51	50	OutsideBusCalcArea	50	50	50	50	-1	-
54 Dale Crescent	EB2	53	53	52	OutsideBusCalcArea	52	52	52	52	-1	-
55 Dale Crescent	EB2	56	56	56	41	55	56	56	56	-1	-
56 Dale Crescent	EB2	54	54	52	OutsideBusCalcArea	52	51	52	51	-3	-
60 Dale Crescent	EB2	58	59	57	OutsideBusCalcArea	57	57	57	57	-2	-
62 Dale Crescent	EB2	67	68	65	OutsideBusCalcArea	65	65	65	65	-2	-
64 Dale Crescent	EB2	67	67	64	OutsideBusCalcArea	64	64	64	64	-3	-
66 Dale Crescent	EB2	64	64	62	OutsideBusCalcArea	62	62	62	62	-2	-
68 Dale Crescent	EB2	62	63	60	OutsideBusCalcArea	60	60	60	60	-2	-
70 Dale Crescent	EB2	60	60	58	OutsideBusCalcArea	58	58	58	58	-2	-
81 Dale Crescent	EB2	53	53	52	OutsideBusCalcArea	52	52	52	52	-1	-
83 Dale Crescent	EB2	54	54	53	OutsideBusCalcArea	52	53	53	53	-1	-
2/39 Dale Crescent	EB2	52	53	52	41	52	52	52	52	0	-
1-2/43 Dale Crescent	EB2	52	53	51	40	51	51	51	51	-2	-
1-2/18 Dale Crescent	EB2	53	55	56	35	56	56	56	56	2	-
1-2/20 Dale Crescent	EB2	51	52	54	35	54	54	54	54	2	-
10a Dale Crescent	EB2	60	61	61	OutsideBusCalcArea	61	61	61	61	-1	-
1-26/33 Dale Crescent	EB2	52	53	54	OutsideBusCalcArea	54	54	54	54	2	-
23a Dale Crescent	EB2	54	54	57	33	56	57	57	57	3	Slight Adverse
23b Dale Crescent	EB2	57	58	68	35	67	61	61	61	2	-
47c Dale Crescent	EB2	56	56	55	43	54	55	55	55	-2	-
81a Dale Crescent	EB2	64	64	61	OutsideBusCalcArea	61	61	61	61	-2	-
81b Dale Crescent	EB2	62	63	60	OutsideBusCalcArea	60	60	60	60	-2	-
2/2 Dillimore Avenue	EB2	51	51	50	OutsideBusCalcArea	49	50	50	50	-2	-
3/2 Dillimore Avenue	EB2	53	53	51	OutsideBusCalcArea	51	51	51	51	-1	-
1 Dowling Place	EB2	55	55	54	39	53	54	54	54	-1	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
7 Dowling Place	EB2	54	54	53	40	52	53	53	53	-1	-
9 Dowling Place	EB2	57	57	54	38	53	54	54	54	-3	-
13 Dowling Place	EB2	59	59	58	43	57	58	58	58	-2	-
19 Dowling Place	EB2	55	55	54	38	53	54	54	54	-1	-
1-2/3 Dowling Place	EB2	55	55	54	39	53	54	54	54	-1	-
1-2/5 Dowling Place	EB2	57	57	55	39	54	55	55	55	-2	-
1-2/11 Dowling Place	EB2	58	58	56	40	55	56	56	56	-2	-
1-2/15 Dowling Place	EB2	55	55	54	39	53	54	54	54	-1	-
1-2/17 Dowling Place	EB2	52	53	51	38	51	51	51	51	-1	-
6 Kentigern Close	EB2	54	55	55	30	54	55	55	55	0	-
7 Kentigern Close	EB2	50	51	52	OutsideBusCalcArea	51	52	52	52	0	-
9 Kentigern Close	EB2	49	50	49	OutsideBusCalcArea	48	49	49	49	-1	-
12 Kentigern Close	EB2	51	52	51	27	50	51	51	51	-1	-
1/10 Kentigern Close	EB2	52	53	52	34	51	52	52	52	0	-
20 Latham Avenue	EB2	60	60	59	OutsideBusCalcArea	58	59	59	59	-2	-
24 Latham Avenue	EB2	58	59	57	OutsideBusCalcArea	57	57	57	57	-1	-
26 Latham Avenue	EB2	57	57	56	OutsideBusCalcArea	55	56	56	56	-1	-
28 Latham Avenue	EB2	52	53	51	OutsideBusCalcArea	51	51	51	51	-1	-
50 Latham Avenue	EB2	61	61	60	OutsideBusCalcArea	59	60	60	60	-2	-
1-2/30 Latham Avenue	EB2	65	65	63	OutsideBusCalcArea	62	63	63	63	-2	-
1/32 Latham Avenue	EB2	59	60	59	OutsideBusCalcArea	58	59	59	59	-1	-
2/32 Latham Avenue	EB2	64	65	63	OutsideBusCalcArea	63	63	63	63	-2	-
1-3/34 Latham Avenue	EB2	58	58	57	OutsideBusCalcArea	57	57	57	57	-1	-
1-3/36 Latham Avenue	EB2	58	58	57	OutsideBusCalcArea	57	57	57	57	-1	-
1-3/38 Latham Avenue	EB2	57	58	57	OutsideBusCalcArea	56	57	57	57	-1	-
1-6/40 Latham Avenue	EB2	63	64	63	OutsideBusCalcArea	62	63	63	63	-1	-
1-3/44 Latham Avenue	EB2	55	55	54	OutsideBusCalcArea	54	54	54	54	-1	-
1-3/46 Latham Avenue	EB2	63	63	62	OutsideBusCalcArea	61	62	62	62	-2	-
1-3/48 Latham Avenue	EB2	62	62	60	OutsideBusCalcArea	60	60	60	60	-2	-
1/52 Latham Avenue	EB2	56	56	55	OutsideBusCalcArea	55	55	55	55	-1	-
2/52 Latham Avenue	EB2	53	53	52	OutsideBusCalcArea	52	52	52	52	-1	-
2/21 Latham Avenue	EB2	55	55	54	OutsideBusCalcArea	54	54	54	54	-1	-
2/23 Latham Avenue	EB2	53	54	52	OutsideBusCalcArea	52	52	52	52	-1	-
20a Latham Avenue	EB2	59	59	58	OutsideBusCalcArea	58	58	58	58	-1	-
26a Latham Avenue	EB2	61	61	60	OutsideBusCalcArea	59	60	60	60	-2	-
6,1/6 Mattson Road	EB2	56	57	61	45	60	61	61	61	4	Slight Adverse
8 Millen Avenue	EB2	50	50	49	OutsideBusCalcArea	49	49	49	49	-1	-
14 Millen Avenue	EB2	56	57	55	OutsideBusCalcArea	54	55	55	55	-2	-
21 Millen Avenue	EB2	50	50	48	OutsideBusCalcArea	48	48	48	48	-2	-
23 Millen Avenue	EB2	51	52	50	OutsideBusCalcArea	50	50	50	50	-2	-
27 Millen Avenue	EB2	52	52	50	OutsideBusCalcArea	50	50	50	50	-2	-
29 Millen Avenue	EB2	52	52	50	OutsideBusCalcArea	50	50	50	50	-2	-
30 Millen Avenue	EB2	58	59	58	OutsideBusCalcArea	58	58	58	58	-1	-
30 Millen Avenue	EB2	57	58	56	OutsideBusCalcArea	56	56	56	56	-2	-
30 Millen Avenue	EB2	52	52	50	OutsideBusCalcArea	50	50	50	50	-2	-
30 Millen Avenue	EB2	57	58	56	OutsideBusCalcArea	56	56	56	56	-1	-
30 Millen Avenue	EB2	54	54	52	OutsideBusCalcArea	52	52	52	52	-2	-
34 Millen Avenue	EB2	49	49	48	OutsideBusCalcArea	47	48	48	48	-2	-
1-2/32 Millen Avenue	EB2	54	54	52	OutsideBusCalcArea	52	52	52	52	-2	-
3/32 Millen Avenue	EB2	54	54	52	OutsideBusCalcArea	52	52	52	52	-2	-
1/12 Millen Avenue	EB2	53	53	52	OutsideBusCalcArea	51	52	52	52	-1	-
2/12 Millen Avenue	EB2	56	56	55	OutsideBusCalcArea	55	55	55	55	-1	-
1/25 Millen Avenue	EB2	52	52	50	OutsideBusCalcArea	50	50	50	50	-2	-
23a Millen Avenue	EB2	53	54	52	OutsideBusCalcArea	51	52	52	52	-2	-
34a Millen Avenue	EB2	50	51	49	OutsideBusCalcArea	49	49	49	49	-2	-
34b Millen Avenue	EB2	57	57	56	OutsideBusCalcArea	55	56	56	56	-2	-
15 Osprey Street	EB2	59	60	58	OutsideBusCalcArea	57	58	58	58	-2	-
17 Osprey Street	EB2	59	60	58	OutsideBusCalcArea	58	58	58	58	-2	-
24 Osprey Street	EB2	60	61	59	OutsideBusCalcArea	59	59	59	59	-2	-
94 Pakuranga Road	EB2	68	69	68	46	67	68	68	68	-1	-
100 Pakuranga Road	EB2	68	69	68	39	67	67	67	68	-1	-
100 Pakuranga Road	EB2	67	68	67	38	66	62	67	67	-1	-
103 Pakuranga Road	EB2	56	56	55	36	54	55	55	55	-1	-
105 Pakuranga Road	EB2	57	58	57	42	56	57	57	57	-1	-
106 Pakuranga Road	EB2	69	70	68	OutsideBusCalcArea	67	65	65	69	-1	-
108 Pakuranga Road	EB2	57	58	58	OutsideBusCalcArea	57	58	58	58	0	-
110 Pakuranga Road	EB2	51	52	52	OutsideBusCalcArea	51	52	52	52	0	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
118 Pakuranga Road	EB2	57	58	56	OutsideBusCalcArea	55	56	56	56	-2	-
124 Pakuranga Road	EB2	59	60	59	OutsideBusCalcArea	58	59	59	59	0	-
130 Pakuranga Road	EB2	46	47	44	OutsideBusCalcArea	43	44	44	44	-4	-
130 Pakuranga Road	EB2	56	57	54	OutsideBusCalcArea	54	55	55	54	-3	-
130 Pakuranga Road	EB2	49	50	49	OutsideBusCalcArea	48	49	49	49	-2	-
130 Pakuranga Road	EB2	61	62	59	OutsideBusCalcArea	58	59	59	59	-3	-
130 Pakuranga Road	EB2	65	66	62	OutsideBusCalcArea	62	62	62	62	-3	-
183 Pakuranga Road	EB2	67	68	66	OutsideBusCalcArea	66	66	66	66	-2	-
191 Pakuranga Road	EB2	61	62	58	OutsideBusCalcArea	58	58	58	58	-4	-
193 Pakuranga Road	EB2	49	50	50	OutsideBusCalcArea	50	50	50	50	0	-
1-2/90 Pakuranga Road	EB2	67	67	66	46	65	63	66	66	-1	-
1-2/92 Pakuranga Road	EB2	67	68	67	45	66	63	67	67	-1	-
112a Pakuranga Road	EB2	51	52	52	OutsideBusCalcArea	51	52	52	52	0	-
112b Pakuranga Road	EB2	51	52	51	OutsideBusCalcArea	50	51	51	51	-1	-
114a Pakuranga Road	EB2	58	59	59	OutsideBusCalcArea	58	59	59	59	-1	-
114b Pakuranga Road	EB2	53	54	54	OutsideBusCalcArea	53	54	54	54	-1	-
116a Pakuranga Road	EB2	53	54	53	OutsideBusCalcArea	52	53	53	53	0	-
116b Pakuranga Road	EB2	67	68	67	OutsideBusCalcArea	66	64	66	67	-1	-
1-2/104 Pakuranga Road	EB2	66	67	66	OutsideBusCalcArea	65	66	66	66	-1	-
1-3/189 Pakuranga Road	EB2	63	64	60	OutsideBusCalcArea	60	60	60	60	-4	-
191a Pakuranga Road	EB2	51	52	54	OutsideBusCalcArea	54	54	54	54	2	-
193a Pakuranga Road	EB2	57	58	56	OutsideBusCalcArea	56	56	56	56	-2	-
3/183 Pakuranga Road	EB2	55	56	61	OutsideBusCalcArea	60	61	61	61	5	Moderate Adverse
3-4/104 Pakuranga Road	EB2	58	59	58	OutsideBusCalcArea	57	58	58	58	0	-
4/183 Pakuranga Road	EB2	53	54	56	OutsideBusCalcArea	56	56	56	56	2	-
E/104 Pakuranga Road	EB2	55	56	55	OutsideBusCalcArea	54	55	55	55	0	-
5 Palm Avenue	EB2	53	54	53	43	53	53	53	53	-1	-
6 Palm Avenue	EB2	53	54	52	OutsideBusCalcArea	51	52	52	52	-2	-
8 Palm Avenue	EB2	52	53	52	OutsideBusCalcArea	52	52	52	52	-1	-
1-2/3 Palm Avenue	EB2	57	57	56	38	55	55	56	56	-2	-
31 Pandora Place	EB2	58	59	58	OutsideBusCalcArea	58	58	58	58	0	-
31b Pandora Place	EB2	58	59	59	OutsideBusCalcArea	58	59	59	59	0	-
1-3/8 Paul Place	EB2	55	56	54	OutsideBusCalcArea	54	54	54	54	-1	-
4a Paul Place	EB2	56	57	56	OutsideBusCalcArea	55	56	56	56	-1	-
4 Reeves Road	EB2	46	47	47	OutsideBusCalcArea	46	47	47	47	0	-
6 Reeves Road	EB2	47	48	49	OutsideBusCalcArea	48	49	49	49	0	-
12 Reeves Road	EB2	54	55	54	OutsideBusCalcArea	54	54	54	54	-1	-
15 Reeves Road	EB2	57	58	57	OutsideBusCalcArea	57	57	57	57	-6	-
17 Reeves Road	EB2	57	58	51	OutsideBusCalcArea	51	51	51	51	-7	-
19 Reeves Road	EB2	54	55	51	OutsideBusCalcArea	51	51	51	51	-4	-
21 Reeves Road	EB2	51	53	50	OutsideBusCalcArea	49	50	50	50	-3	-
23 Reeves Road	EB2	53	54	53	OutsideBusCalcArea	53	53	53	53	-1	-
25 Reeves Road	EB2	45	47	47	OutsideBusCalcArea	46	47	47	47	0	-
1/19 Reeves Road	EB2	49	50	51	OutsideBusCalcArea	51	51	51	51	1	-
1/2 Reeves Road	EB2	49	50	52	OutsideBusCalcArea	51	52	52	52	1	-
17a Reeves Road	EB2	51	53	53	OutsideBusCalcArea	52	53	53	53	0	-
23a Reeves Road	EB2	48	49	50	OutsideBusCalcArea	49	50	50	50	1	-
4a Reeves Road	EB2	51	52	54	OutsideBusCalcArea	53	54	54	54	2	-
3 Steeple Rise	EB2	47	47	47	OutsideBusCalcArea	46	47	47	47	-1	-
5 Steeple Rise	EB2	50	51	51	OutsideBusCalcArea	50	51	51	51	0	-
7 Steeple Rise	EB2	48	49	49	OutsideBusCalcArea	48	49	49	49	0	-
9 Steeple Rise	EB2	49	49	49	OutsideBusCalcArea	48	49	49	49	-1	-
11 Steeple Rise	EB2	49	50	49	OutsideBusCalcArea	48	49	49	49	-1	-
13 Steeple Rise	EB2	48	49	48	OutsideBusCalcArea	47	48	48	48	-1	-
19 Steeple Rise	EB2	52	53	50	OutsideBusCalcArea	49	50	50	50	-3	-
21 Steeple Rise	EB2	54	55	53	OutsideBusCalcArea	53	53	53	53	-2	-
1/15 Steeple Rise	EB2	52	53	51	OutsideBusCalcArea	50	51	51	51	-2	-
1/26 Steeple Rise	EB2	53	54	52	OutsideBusCalcArea	52	52	52	52	-2	-
2/26 Steeple Rise	EB2	50	51	49	OutsideBusCalcArea	49	49	49	49	-2	-
15b Steeple Rise	EB2	49	50	50	OutsideBusCalcArea	49	50	50	50	0	-
3 Ti Rakau Drive	EB2	67	67	65	52	64	62	65	65	-2	-
21 Ti Rakau Drive	EB2	66	66	64	OutsideBusCalcArea	63	61	64	64	-3	-
84 Ti Rakau Drive	EB2	67	67	66	50	65	64	66	66	-1	-
86 Ti Rakau Drive	EB2	57	57	56	41	55	56	56	56	-1	-
1-2/5 Ti Rakau Drive	EB2	68	68	66	52	65	62	66	66	-3	-
1-2/7 Ti Rakau Drive	EB2	67	68	65	52	64	62	65	65	-2	-
1-2/13 Ti Rakau Drive	EB2	68	68	66	52	65	61	66	66	-3	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
1-2/17 Ti Rakau Drive	EB2	68	69	65	OutsideBusCalcArea	64	62	65	65	-4	-
1/23 Ti Rakau Drive	EB2	60	60	60	OutsideBusCalcArea	59	60	60	60	0	-
2/23 Ti Rakau Drive	EB2	68	68	65	OutsideBusCalcArea	64	62	65	65	-3	-
1/11,11 Ti Rakau Drive	EB2	67	68	65	52	64	62	65	65	-3	-
1/15,15 Ti Rakau Drive	EB2	67	67	65	49	64	62	65	65	-3	-
1/19,19 Ti Rakau Drive	EB2	68	69	65	OutsideBusCalcArea	65	65	65	65	-3	-
1/9,9 Ti Rakau Drive	EB2	67	67	65	52	64	62	65	65	-2	-
9 Undine Street	EB2	59	59	57	OutsideBusCalcArea	56	57	57	57	-3	-
12 Undine Street	EB2	54	55	53	OutsideBusCalcArea	53	53	53	53	-2	-
14 Undine Street	EB2	59	60	58	OutsideBusCalcArea	58	58	58	58	-2	-
15 Undine Street	EB2	56	58	55	OutsideBusCalcArea	55	55	55	55	-3	-
7a Undine Street	EB2	56	57	55	OutsideBusCalcArea	54	55	55	55	-2	-
9a Undine Street	EB2	59	60	57	OutsideBusCalcArea	57	57	57	57	-3	-
6 William Roberts Road	EB2	57	60	60	OutsideBusCalcArea	59	60	60	60	0	-
16 William Roberts Road	EB2	59	62	53	OutsideBusCalcArea	53	53	53	53	-8	-
18 William Roberts Road	EB2	57	58	52	OutsideBusCalcArea	52	52	52	52	-6	-
20 William Roberts Road	EB2	60	61	53	OutsideBusCalcArea	53	53	53	53	-8	-
24 William Roberts Road	EB2	55	57	59	OutsideBusCalcArea	58	59	59	59	-6	-
1/14 William Roberts Road	EB2	62	66	56	OutsideBusCalcArea	56	56	56	56	-10	-
2/14 William Roberts Road	EB2	49	51	51	OutsideBusCalcArea	50	51	51	51	0	-
3/14 William Roberts Road	EB2	49	50	51	OutsideBusCalcArea	50	51	51	51	0	-
1/4 William Roberts Road	EB2	59	62	62	OutsideBusCalcArea	62	62	62	62	0	-
2/4 William Roberts Road	EB2	51	53	59	OutsideBusCalcArea	58	59	59	59	6	Moderate Adverse
1/8 William Roberts Road	EB2	55	57	58	OutsideBusCalcArea	58	58	58	58	1	-
2/8 William Roberts Road	EB2	51	53	52	OutsideBusCalcArea	52	52	52	52	-1	-
10,2/10 William Roberts Road	EB2	60	63	58	OutsideBusCalcArea	58	58	58	58	-5	-
12,12a William Roberts Road	EB2	63	66	57	OutsideBusCalcArea	57	57	57	57	-9	-
12b William Roberts Road	EB2	49	50	50	OutsideBusCalcArea	50	50	50	50	0	-
18a William Roberts Road	EB2	64	67	57	OutsideBusCalcArea	56	57	57	57	-11	-
24r William Roberts Road	EB2	53	55	58	OutsideBusCalcArea	57	58	58	58	-6	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
6, 1/6 Edgewater Drive	EB3R	54	54	58	43	57	57	58	57	3	Slight Adverse
17a, 17b Te Anau Place	EB3R	57	57	58	42	57	58	58	58	1	-
2a, 2b, 2c Marriott Road	EB3R	68	68	66	50	65	65	66	66	-2	-
1 Aurea Avenue	EB3R	50	51	52	37	51	52	52	52	2	-
3 Aurea Avenue	EB3R	49	49	49	34	48	49	49	49	0	-
5 Aurea Avenue	EB3R	52	52	53	38	52	53	53	53	1	-
7 Aurea Avenue	EB3R	49	49	49	33	48	49	49	49	0	-
5a Aurea Avenue	EB3R	48	48	48	33	47	48	48	48	0	-
3 Bolina Crescent	EB3R	55	56	54	OutsideBusCalcArea	53	54	54	54	-3	-
4 Bolina Crescent	EB3R	55	56	53	37	52	53	53	53	-3	-
6 Bolina Crescent	EB3R	58	59	57	37	56	57	57	57	-2	-
7 Bolina Crescent	EB3R	64	64	61	OutsideBusCalcArea	60	61	61	61	-3	-
1/5 Bolina Crescent	EB3R	55	55	54	OutsideBusCalcArea	54	54	54	54	-1	-
2/5 Bolina Crescent	EB3R	58	59	55	OutsideBusCalcArea	55	55	55	55	-3	-
1/9 Bolina Crescent	EB3R	62	62	62	OutsideBusCalcArea	62	62	62	62	0	-
2/9 Bolina Crescent	EB3R	61	62	60	OutsideBusCalcArea	59	59	60	60	-2	-
3/9 Bolina Crescent	EB3R	55	56	55	OutsideBusCalcArea	54	55	55	55	-1	-
55 Cardiff Road	EB3R	50	51	50	35	49	50	50	50	-1	-
61 Cardiff Road	EB3R	51	51	50	36	49	50	50	50	-1	-
65 Cardiff Road	EB3R	52	52	51	38	50	51	51	51	0	-
67 Cardiff Road	EB3R	49	49	49	35	48	48	49	49	-1	-
71 Cardiff Road	EB3R	50	50	49	36	48	49	49	49	-1	-
75 Cardiff Road	EB3R	53	53	53	40	52	53	53	53	0	-
77 Cardiff Road	EB3R	51	51	50	37	49	50	50	50	-1	-
1-3/51 Cardiff Road	EB3R	51	52	51	37	50	51	51	51	-1	-
1-2/53 Cardiff Road	EB3R	51	51	50	36	49	50	50	50	-1	-
1-3/57 Cardiff Road	EB3R	54	54	53	40	52	53	53	53	-1	-
1-3/59 Cardiff Road	EB3R	52	52	52	39	51	52	52	52	-1	-
1-2/63 Cardiff Road	EB3R	51	51	51	38	50	51	51	51	-1	-
1/67 Cardiff Road	EB3R	52	52	51	39	51	51	51	51	-1	-
1-2/73 Cardiff Road	EB3R	50	50	50	36	49	50	50	50	-1	-
1/79 Cardiff Road	EB3R	49	49	48	34	47	48	48	48	-1	-
2/79 Cardiff Road	EB3R	53	53	52	40	51	52	52	52	0	-
1-2/81 Cardiff Road	EB3R	52	52	52	39	51	51	52	52	0	-
69a,69b Cardiff Road	EB3R	50	50	50	36	49	50	50	50	-1	-
3 Chevis Place	EB3R	57	57	57	43	56	57	57	57	0	-
4 Chevis Place	EB3R	56	56	53	40	52	53	53	53	-3	-
5 Chevis Place	EB3R	55	55	55	41	54	55	55	55	0	-
6 Chevis Place	EB3R	57	57	56	42	55	56	56	56	-1	-
7 Chevis Place	EB3R	51	51	51	37	50	51	51	51	1	-
8 Chevis Place	EB3R	57	57	57	41	56	57	57	57	0	-
10 Chevis Place	EB3R	57	57	57	42	56	57	57	57	0	-
12 Chevis Place	EB3R	55	55	55	40	54	55	55	55	0	-
14 Chevis Place	EB3R	57	57	57	42	56	56	57	57	0	-
1-2/1 Chevis Place	EB3R	68	68	67	49	66	64	67	67	-1	-
1-2/2 Chevis Place	EB3R	69	70	67	49	66	63	67	67	-3	-
3 Dolphin Street	EB3R	50	51	51	38	51	51	51	51	1	-
5 Dolphin Street	EB3R	50	50	51	38	50	51	51	51	1	-
6 Dolphin Street	EB3R	51	51	53	39	52	53	53	53	1	-
7 Dolphin Street	EB3R	50	50	51	38	51	51	51	51	1	-
8 Dolphin Street	EB3R	53	53	62	46	61	62	62	62	9	Significant Adverse
12 Dolphin Street	EB3R	51	51	53	39	52	53	53	53	2	-
14 Dolphin Street	EB3R	51	52	55	42	54	55	55	55	4	Slight Adverse
15 Dolphin Street	EB3R	49	49	50	37	49	50	50	50	1	-
16 Dolphin Street	EB3R	51	51	53	39	52	53	53	53	2	-
17 Dolphin Street	EB3R	50	50	51	37	50	51	51	51	1	-
1/10 Dolphin Street	EB3R	52	53	62	47	62	63	62	62	10	Significant Adverse
2/10 Dolphin Street	EB3R	52	52	60	46	59	60	60	60	8	Moderate Adverse
14a Dolphin Street	EB3R	52	52	60	45	59	60	60	60	8	Moderate Adverse
14b Dolphin Street	EB3R	51	52	58	44	58	58	58	58	7	Moderate Adverse
4,4a Dolphin Street	EB3R	51	51	53	38	52	53	53	53	2	-
4 Edgewater Drive	EB3R	57	57	65	50	64	59	64	58	1	-
5 Edgewater Drive	EB3R	47	47	47	34	46	48	47	47	1	-
10 Edgewater Drive	EB3R	50	50	53	39	52	53	53	53	3	Slight Adverse
14 Edgewater Drive	EB3R	49	49	52	38	51	53	52	52	3	Slight Adverse
14 Edgewater Drive	EB3R	56	56	63	48	62	64	63	63	7	Moderate Adverse

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
14 Edgewater Drive	EB3R	47	47	48	33	47	49	48	48	1	-
14 Edgewater Drive	EB3R	57	57	63	47	62	63	63	63	6	Moderate Adverse
14 Edgewater Drive	EB3R	49	49	50	37	49	51	50	50	1	-
134 Edgewater Drive	EB3R	48	48	50	36	49	51	50	50	2	-
136 Edgewater Drive	EB3R	49	49	51	38	50	52	51	51	2	-
138 Edgewater Drive	EB3R	50	50	52	38	51	52	52	52	2	-
140 Edgewater Drive	EB3R	51	51	52	39	52	53	52	52	2	-
142 Edgewater Drive	EB3R	52	52	53	39	52	53	53	53	2	-
146 Edgewater Drive	EB3R	57	57	60	45	59	60	60	60	3	Slight Adverse
148 Edgewater Drive	EB3R	58	58	62	47	61	62	62	62	4	Slight Adverse
161 Edgewater Drive	EB3R	50	50	53	39	53	54	53	53	3	Slight Adverse
163 Edgewater Drive	EB3R	50	50	54	40	53	54	54	54	4	Slight Adverse
165 Edgewater Drive	EB3R	52	52	53	39	52	53	53	53	2	-
1-2/8 Edgewater Drive	EB3R	52	52	56	41	55	56	56	56	3	Slight Adverse
1/144 Edgewater Drive	EB3R	51	51	57	43	56	57	57	57	6	Moderate Adverse
165a Edgewater Drive	EB3R	58	58	63	48	62	64	63	63	5	Moderate Adverse
165b Edgewater Drive	EB3R	59	59	64	48	63	64	64	64	5	Moderate Adverse
2/144 Edgewater Drive	EB3R	48	49	52	38	51	53	52	52	4	Slight Adverse
2 Ellesmere Crescent	EB3R	49	49	50	35	49	50	50	50	0	-
6 Ellesmere Crescent	EB3R	52	53	52	36	51	52	52	52	-1	-
8 Ellesmere Crescent	EB3R	56	56	57	40	56	57	57	57	1	-
10 Ellesmere Crescent	EB3R	57	58	58	42	57	58	58	58	0	-
12 Ellesmere Crescent	EB3R	59	59	59	43	58	59	59	59	0	-
14 Ellesmere Crescent	EB3R	55	55	55	40	54	55	55	55	0	-
16 Ellesmere Crescent	EB3R	54	54	55	40	54	55	55	55	1	-
18 Ellesmere Crescent	EB3R	54	55	55	41	54	54	55	55	0	-
20 Ellesmere Crescent	EB3R	50	51	51	37	50	51	51	51	1	-
22 Ellesmere Crescent	EB3R	55	55	55	39	54	55	55	55	0	-
24 Ellesmere Crescent	EB3R	55	55	56	40	55	56	56	56	1	-
26 Ellesmere Crescent	EB3R	55	56	55	41	55	55	55	55	0	-
28 Ellesmere Crescent	EB3R	55	55	56	40	55	56	56	56	0	-
30 Ellesmere Crescent	EB3R	53	54	56	40	55	56	56	56	3	Slight Adverse
32 Ellesmere Crescent	EB3R	54	54	55	41	54	55	55	55	0	-
34 Ellesmere Crescent	EB3R	55	56	56	40	55	56	56	56	1	-
36 Ellesmere Crescent	EB3R	55	55	56	40	55	56	56	56	1	-
38 Ellesmere Crescent	EB3R	54	54	55	40	54	55	55	55	1	-
40 Ellesmere Crescent	EB3R	59	60	60	44	59	60	60	60	0	-
44 Ellesmere Crescent	EB3R	52	52	53	38	52	53	53	53	1	-
1/4 Ellesmere Crescent	EB3R	48	49	49	33	48	49	49	49	0	-
2/4 Ellesmere Crescent	EB3R	52	53	54	36	53	54	54	54	1	-
18a Ellesmere Crescent	EB3R	57	57	57	43	57	57	57	57	0	-
42,42 Ellesmere Crescent	EB3R	57	57	58	43	57	58	58	58	1	-
3 Fremantle Place	EB3R	56	56	61	45	60	61	61	61	5	Moderate Adverse
5 Fremantle Place	EB3R	52	52	53	39	52	53	53	53	1	-
7 Fremantle Place	EB3R	53	53	62	47	61	62	62	62	8	Moderate Adverse
9 Fremantle Place	EB3R	53	53	61	46	60	61	61	61	8	Moderate Adverse
11 Fremantle Place	EB3R	49	50	51	37	50	51	51	51	1	-
12 Fremantle Place	EB3R	50	51	51	37	50	51	51	51	0	-
13 Fremantle Place	EB3R	49	49	49	35	48	50	49	49	0	-
15 Fremantle Place	EB3R	50	50	52	38	51	52	52	52	1	-
17 Fremantle Place	EB3R	54	54	62	47	61	62	62	62	8	Moderate Adverse
19 Fremantle Place	EB3R	53	53	61	46	61	62	61	61	8	Moderate Adverse
21 Fremantle Place	EB3R	50	51	53	41	52	53	53	53	2	-
23 Fremantle Place	EB3R	50	51	51	38	51	52	51	51	1	-
25 Fremantle Place	EB3R	48	48	49	35	48	49	49	49	1	-
27 Fremantle Place	EB3R	48	48	48	34	48	49	48	48	0	-
29 Fremantle Place	EB3R	50	50	50	37	50	51	50	50	1	-
31 Fremantle Place	EB3R	54	54	57	42	56	58	57	57	3	Slight Adverse
33 Fremantle Place	EB3R	52	52	54	39	53	54	54	54	2	-
35 Fremantle Place	EB3R	48	48	48	36	47	49	48	48	0	-
167 Gossamer Drive	EB3R	59	62	60	38	59	60	60	60	-2	-
169 Gossamer Drive	EB3R	61	63	62	40	62	62	62	62	-1	-
171 Gossamer Drive	EB3R	61	64	64	41	63	64	64	64	0	-
172 Gossamer Drive	EB3R	59	61	60	39	60	60	60	60	0	-
173 Gossamer Drive	EB3R	60	61	62	42	61	62	62	62	0	-
175 Gossamer Drive	EB3R	61	62	63	47	62	63	63	63	1	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
176 Gossamer Drive	EB3R	60	63	62	44	62	62	62	62	0	-
7 Marriott Road	EB3R	53	53	51	37	50	51	51	51	-2	-
1-2/4 Marriott Road	EB3R	53	54	54	40	53	53	54	54	0	-
3r Marriott Road	EB3R	54	54	54	41	54	54	54	54	0	-
3r Marriott Road	EB3R	52	52	52	39	51	52	52	52	0	-
8 Mattson Road	EB3R	54	55	59	45	58	59	59	59	5	Moderate Adverse
9 Mattson Road	EB3R	54	55	58	43	58	59	58	58	4	Slight Adverse
10 Mattson Road	EB3R	52	53	59	44	58	59	59	59	6	Moderate Adverse
11 Mattson Road	EB3R	50	51	53	40	52	53	53	53	3	Slight Adverse
13 Mattson Road	EB3R	50	51	52	38	52	52	52	52	1	-
14 Mattson Road	EB3R	51	51	55	41	54	55	55	55	4	Slight Adverse
1-3/12 Mattson Road	EB3R	52	52	58	43	57	58	58	58	6	Moderate Adverse
1/18 Mattson Road	EB3R	48	49	50	34	49	50	50	50	1	-
2/18 Mattson Road	EB3R	50	51	54	41	54	55	54	54	4	Slight Adverse
7a Mattson Road	EB3R	51	51	56	42	55	56	56	56	5	Moderate Adverse
7b Mattson Road	EB3R	49	49	52	38	52	52	52	52	3	Slight Adverse
7c Mattson Road	EB3R	49	49	50	35	49	50	50	50	1	-
7d Mattson Road	EB3R	49	49	50	34	49	50	50	50	0	-
7e Mattson Road	EB3R	48	48	48	34	47	48	48	48	0	-
7f Mattson Road	EB3R	48	48	48	33	48	48	48	48	0	-
7g Mattson Road	EB3R	49	49	50	36	50	51	50	50	1	-
7h Mattson Road	EB3R	49	49	50	35	49	50	50	50	1	-
9a,9b Mattson Road	EB3R	57	59	61	44	60	61	61	61	2	-
A-C/16 Mattson Road	EB3R	49	50	50	35	50	50	50	50	1	-
25 Miramar Place	EB3R	55	56	57	42	56	57	57	57	1	-
27 Miramar Place	EB3R	54	54	56	41	55	56	56	56	1	-
31 Miramar Place	EB3R	56	56	57	42	56	57	57	57	1	-
35 Miramar Place	EB3R	57	58	57	41	56	57	57	57	-1	-
19a Miramar Place	EB3R	48	48	47	33	46	47	47	47	-1	-
1 Paradise Place	EB3R	53	54	53	39	53	54	53	53	0	-
2 Paradise Place	EB3R	58	58	59	43	59	60	59	59	1	-
6 Paradise Place	EB3R	55	56	57	41	56	57	57	57	1	-
8 Paradise Place	EB3R	54	55	55	38	54	55	55	55	0	-
10 Paradise Place	EB3R	50	50	50	35	50	51	50	50	0	-
36 Riverhills Avenue	EB3R	51	52	52	36	51	52	52	52	0	-
38 Riverhills Avenue	EB3R	54	55	55	37	54	55	55	55	0	-
40 Riverhills Avenue	EB3R	59	61	58	37	58	58	58	58	-3	-
3 Roseburn Place	EB3R	54	54	59	43	58	59	59	59	5	Moderate Adverse
5 Roseburn Place	EB3R	52	52	55	39	54	55	55	55	3	Slight Adverse
7 Roseburn Place	EB3R	52	52	55	40	54	55	55	55	3	Slight Adverse
8 Roseburn Place	EB3R	50	50	51	37	50	52	51	51	2	-
11 Roseburn Place	EB3R	48	48	48	35	47	48	48	48	0	-
1-2/4 Roseburn Place	EB3R	52	52	57	41	56	58	57	57	6	Moderate Adverse
1-2/6 Roseburn Place	EB3R	51	51	55	40	54	55	55	55	4	Slight Adverse
1-2/9 Roseburn Place	EB3R	51	51	53	39	52	53	53	53	2	-
1-2/10 Roseburn Place	EB3R	50	50	52	38	51	52	52	52	2	-
5a Roseburn Place	EB3R	48	48	51	36	50	51	51	51	3	Slight Adverse
2 Snell Place	EB3R	49	49	53	39	52	53	53	52	3	Slight Adverse
3 Snell Place	EB3R	50	50	56	42	55	57	56	56	7	Moderate Adverse
4 Snell Place	EB3R	49	49	52	40	51	52	52	52	3	Slight Adverse
5 Snell Place	EB3R	52	52	59	44	58	59	59	59	7	Moderate Adverse
7 Snell Place	EB3R	53	53	57	42	56	57	57	57	4	Slight Adverse
9 Snell Place	EB3R	55	55	60	44	59	60	60	60	5	Moderate Adverse
10 Snell Place	EB3R	48	48	49	37	49	50	49	49	1	-
11 Snell Place	EB3R	53	54	57	42	56	57	57	57	3	Slight Adverse
12 Snell Place	EB3R	50	51	51	38	50	52	51	51	1	-
13 Snell Place	EB3R	52	52	55	40	54	55	55	55	3	Slight Adverse
14 Snell Place	EB3R	50	50	51	38	50	52	51	51	1	-
13 Te Anau Place	EB3R	57	57	58	43	57	58	58	58	1	-
15 Te Anau Place	EB3R	58	58	59	43	58	59	59	59	1	-
17 Te Anau Place	EB3R	49	49	50	36	49	50	50	50	1	-
19 Te Anau Place	EB3R	52	53	52	37	51	52	52	52	-1	-
21 Te Anau Place	EB3R	50	51	51	38	50	51	51	51	1	-
23 Te Anau Place	EB3R	62	62	62	46	61	62	62	62	0	-
28 Te Anau Place	EB3R	49	49	50	37	49	50	50	50	1	-
30 Te Anau Place	EB3R	51	51	52	39	51	52	52	52	1	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
32 Te Anau Place	EB3R	55	55	53	41	53	53	53	53	-2	-
19a Te Anau Place	EB3R	59	59	58	44	57	58	58	58	-1	-
19b Te Anau Place	EB3R	60	60	61	46	60	61	61	61	0	-
19c Te Anau Place	EB3R	56	56	56	42	56	56	56	56	0	-
26a Te Anau Place	EB3R	48	48	49	36	48	49	49	49	1	-
83 Ti Rakau Drive	EB3R	53	53	61	44	60	61	61	61	7	Moderate Adverse
87 Ti Rakau Drive	EB3R	50	50	54	39	53	54	54	54	3	Slight Adverse
88 Ti Rakau Drive	EB3R	53	53	53	40	52	52	53	53	0	-
89 Ti Rakau Drive	EB3R	49	49	51	38	50	52	51	51	2	-
90 Ti Rakau Drive	EB3R	67	67	65	49	64	63	65	65	-1	-
91 Ti Rakau Drive	EB3R	52	52	58	42	57	58	58	58	6	Moderate Adverse
92 Ti Rakau Drive	EB3R	68	68	67	51	66	63	67	67	-1	-
94 Ti Rakau Drive	EB3R	68	69	67	51	66	67	67	67	-1	-
96 Ti Rakau Drive	EB3R	64	64	64	49	63	60	64	64	0	-
97 Ti Rakau Drive	EB3R	55	55	60	44	59	60	60	60	5	Moderate Adverse
98 Ti Rakau Drive	EB3R	65	65	64	50	63	61	64	64	0	-
100 Ti Rakau Drive	EB3R	67	67	66	50	65	63	66	66	-1	-
102 Ti Rakau Drive	EB3R	67	67	66	50	65	63	66	66	-1	-
104 Ti Rakau Drive	EB3R	66	66	65	50	64	62	65	65	-1	-
106 Ti Rakau Drive	EB3R	69	69	67	51	66	67	67	67	-2	-
108 Ti Rakau Drive	EB3R	69	69	67	51	66	67	67	67	-2	-
110 Ti Rakau Drive	EB3R	67	67	65	50	64	62	65	65	-2	-
112 Ti Rakau Drive	EB3R	66	66	65	50	64	63	65	65	-2	-
114 Ti Rakau Drive	EB3R	64	64	63	47	62	62	63	63	-1	-
116 Ti Rakau Drive	EB3R	67	67	65	50	64	64	65	65	-2	-
118 Ti Rakau Drive	EB3R	67	67	65	50	64	64	65	65	-2	-
120 Ti Rakau Drive	EB3R	66	66	65	50	64	63	65	65	-2	-
122 Ti Rakau Drive	EB3R	68	68	66	50	65	65	66	66	-2	-
128 Ti Rakau Drive	EB3R	68	68	66	49	66	64	66	66	-2	-
129 Ti Rakau Drive	EB3R	53	53	61	46	61	62	61	61	8	Moderate Adverse
136 Ti Rakau Drive	EB3R	67	67	66	49	65	62	66	66	-2	-
138 Ti Rakau Drive	EB3R	68	68	66	49	65	64	66	66	-2	-
140 Ti Rakau Drive	EB3R	68	68	66	49	65	64	66	66	-2	-
142 Ti Rakau Drive	EB3R	58	58	58	42	57	58	58	58	-1	-
144 Ti Rakau Drive	EB3R	67	67	65	48	64	65	65	65	-2	-
145 Ti Rakau Drive	EB3R	50	50	55	41	54	55	55	55	4	Slight Adverse
146 Ti Rakau Drive	EB3R	66	66	64	48	63	64	64	64	-2	-
148 Ti Rakau Drive	EB3R	66	66	65	48	64	65	65	65	-1	-
150 Ti Rakau Drive	EB3R	66	66	65	48	64	65	65	65	-2	-
152 Ti Rakau Drive	EB3R	67	67	65	49	64	64	65	65	-2	-
154 Ti Rakau Drive	EB3R	68	68	67	50	66	66	67	67	-2	-
156 Ti Rakau Drive	EB3R	69	69	67	50	66	65	67	67	-3	-
158 Ti Rakau Drive	EB3R	69	69	68	50	67	67	68	68	-2	-
160 Ti Rakau Drive	EB3R	69	69	67	50	66	65	67	67	-3	-
166 Ti Rakau Drive	EB3R	68	68	66	50	65	65	66	66	-2	-
170 Ti Rakau Drive	EB3R	68	68	67	50	66	67	67	67	-2	-
172 Ti Rakau Drive	EB3R	67	67	65	49	65	64	65	65	-2	-
174 Ti Rakau Drive	EB3R	67	67	66	50	65	64	66	66	-2	-
176 Ti Rakau Drive	EB3R	68	68	67	51	66	66	67	67	-2	-
177 Ti Rakau Drive	EB3R	58	58	63	48	62	63	63	63	6	Moderate Adverse
178 Ti Rakau Drive	EB3R	67	67	66	49	65	66	66	66	-1	-
180 Ti Rakau Drive	EB3R	68	68	67	50	66	67	67	67	-1	-
183 Ti Rakau Drive	EB3R	54	54	61	45	60	61	61	61	7	Moderate Adverse
184 Ti Rakau Drive	EB3R	68	68	67	50	67	67	67	67	-1	-
185 Ti Rakau Drive	EB3R	53	53	61	45	60	61	61	61	8	Moderate Adverse
186 Ti Rakau Drive	EB3R	68	68	67	50	66	67	67	67	-1	-
188 Ti Rakau Drive	EB3R	67	67	66	50	65	66	66	66	-1	-
190 Ti Rakau Drive	EB3R	68	68	67	50	66	67	67	67	-1	-
192 Ti Rakau Drive	EB3R	68	68	67	50	66	67	67	67	-1	-
194 Ti Rakau Drive	EB3R	67	67	66	49	65	66	66	66	-1	-
196 Ti Rakau Drive	EB3R	67	67	65	49	64	65	65	65	-1	-
198 Ti Rakau Drive	EB3R	66	66	64	49	63	63	64	64	-1	-
200 Ti Rakau Drive	EB3R	68	68	67	50	66	66	67	67	-2	-
202 Ti Rakau Drive	EB3R	64	64	63	47	62	63	63	63	-1	-
206 Ti Rakau Drive	EB3R	67	67	66	50	65	66	66	66	-1	-
208 Ti Rakau Drive	EB3R	66	67	65	49	64	64	65	65	-2	-

Address	Section	Existing	DoNoth	DoMin	DoMin - Buses Only	Mit1	Mit2	Mit3	Mit4	(Δ)Mit - DoNothing	Noise effect
210 Ti Rakau Drive	EB3R	66	66	65	49	64	64	65	65	-1	-
212 Ti Rakau Drive	EB3R	67	67	66	49	65	66	66	66	-1	-
214 Ti Rakau Drive	EB3R	66	66	65	49	64	64	65	65	-1	-
219 Ti Rakau Drive	EB3R	61	61	61	44	60	61	61	61	0	-
1/164 Ti Rakau Drive	EB3R	57	57	57	42	56	56	57	57	0	-
1/168 Ti Rakau Drive	EB3R	54	54	53	40	52	53	53	53	-1	-
114a Ti Rakau Drive	EB3R	59	59	58	44	58	58	58	58	-1	-
1-2/130 Ti Rakau Drive	EB3R	68	68	67	50	66	64	67	67	-2	-
1-2/204 Ti Rakau Drive	EB3R	67	68	66	50	65	66	66	66	-2	-
126-2/126 Ti Rakau Drive	EB3R	68	68	66	50	65	64	66	66	-2	-
162a Ti Rakau Drive	EB3R	64	64	62	47	61	62	62	62	-2	-
162b Ti Rakau Drive	EB3R	59	59	57	42	57	57	57	57	-1	-
162c Ti Rakau Drive	EB3R	54	54	54	40	53	54	54	54	0	-
162d Ti Rakau Drive	EB3R	52	52	52	38	51	52	52	52	0	-
166a Ti Rakau Drive	EB3R	57	57	56	43	55	56	56	56	0	-
175a-1/175a Ti Rakau Drive	EB3R	54	54	60	43	59	60	60	60	5	Moderate Adverse
177a Ti Rakau Drive	EB3R	55	55	58	43	57	59	58	58	4	Slight Adverse
177b Ti Rakau Drive	EB3R	54	54	57	42	56	58	57	57	3	Slight Adverse
184b Ti Rakau Drive	EB3R	64	64	64	48	63	64	64	64	0	-
2/164 Ti Rakau Drive	EB3R	50	50	50	37	49	50	50	50	0	-
2/168 Ti Rakau Drive	EB3R	52	52	52	40	51	52	52	52	0	-
2/183 Ti Rakau Drive	EB3R	51	51	53	40	53	54	54	53	2	-
2/200 Ti Rakau Drive	EB3R	64	64	63	47	62	63	63	63	-1	-
3/168 Ti Rakau Drive	EB3R	52	52	52	39	51	52	52	52	0	-
75a Ti Rakau Drive	EB3R	53	53	64	47	63	61	64	64	11	Significant Adverse
83a Ti Rakau Drive	EB3R	55	55	61	45	60	61	61	61	6	Moderate Adverse
83b Ti Rakau Drive	EB3R	51	51	54	38	53	54	54	54	3	Slight Adverse
83c Ti Rakau Drive	EB3R	52	52	61	43	60	61	61	61	9	Significant Adverse
4 Tiraumea Drive	EB3R	57	59	64	OutsideBusCalcArea	63	60	64	64	5	Moderate Adverse
5 Tiraumea Drive	EB3R	56	58	63	OutsideBusCalcArea	63	63	63	63	6	Moderate Adverse
6 Tiraumea Drive	EB3R	54	55	58	OutsideBusCalcArea	57	57	58	58	2	-
7 Tiraumea Drive	EB3R	54	55	58	OutsideBusCalcArea	57	58	58	58	3	Slight Adverse
8 Tiraumea Drive	EB3R	53	54	56	OutsideBusCalcArea	56	56	56	56	2	-
9 Tiraumea Drive	EB3R	52	53	55	OutsideBusCalcArea	54	55	55	55	2	-
10 Tiraumea Drive	EB3R	52	53	54	OutsideBusCalcArea	54	54	54	54	1	-
11 Tiraumea Drive	EB3R	51	52	53	OutsideBusCalcArea	53	53	53	53	1	-
12 Tiraumea Drive	EB3R	51	52	53	38	52	53	53	53	1	-
13 Tiraumea Drive	EB3R	50	50	50	OutsideBusCalcArea	50	50	50	50	0	-
15 Tiraumea Drive	EB3R	54	55	52	36	52	52	52	52	-2	-
1/17 Tiraumea Drive	EB3R	49	49	49	34	49	49	49	49	0	-
2/17 Tiraumea Drive	EB3R	56	57	54	33	54	54	54	54	-3	-
13a Tiraumea Drive	EB3R	57	58	57	OutsideBusCalcArea	56	57	57	57	-1	-
5a Tiraumea Drive	EB3R	56	56	64	OutsideBusCalcArea	63	59	64	59	3	Slight Adverse
3 Wheatley Avenue	EB3R	53	53	60	43	59	60	60	60	7	Moderate Adverse
4 Wheatley Avenue	EB3R	53	53	58	43	58	59	58	58	5	Moderate Adverse
5 Wheatley Avenue	EB3R	50	51	54	39	53	55	54	54	4	Slight Adverse
6 Wheatley Avenue	EB3R	51	51	54	40	53	54	54	54	3	Slight Adverse
7 Wheatley Avenue	EB3R	54	54	59	43	58	59	59	59	5	Moderate Adverse
8 Wheatley Avenue	EB3R	52	52	55	42	54	55	55	55	3	Slight Adverse
9 Wheatley Avenue	EB3R	50	50	53	38	52	53	53	53	3	Slight Adverse
11 Wheatley Avenue	EB3R	48	48	49	36	49	50	49	49	1	-
13 Wheatley Avenue	EB3R	47	48	49	35	48	49	49	49	1	-
1/7 Wheatley Avenue	EB3R	53	53	59	44	58	60	59	59	7	Moderate Adverse
1/10 Wheatley Avenue	EB3R	50	50	53	39	52	53	53	53	3	Slight Adverse
2/10 Wheatley Avenue	EB3R	50	50	52	39	52	53	52	52	3	Slight Adverse
3/10 Wheatley Avenue	EB3R	48	48	49	35	48	49	49	49	3	Slight Adverse
2B Wheatley Avenue	EB3R	61	61	68	46	66	62	62	62	3	Slight Adverse