

Eastern Busway EB2 and EB3 Residential

Construction Noise and Vibration Effects Assessment

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Terms and Definitions

Table 1. Terms and definitions.

Term	Definition
EB2	Eastern Busway 2
EB3R	Eastern Busway 3 Residential
AUP(OP)	Auckland Unitary Plan Operative in Part
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AMETI	Auckland Manukau Eastern Transport Initiative
RRF	Reeves Road Flyover

Executive Summary

An assessment of noise and vibration from construction of the EB2 and EB3R Project has been carried out.

Construction noise has been assessed against the noise criteria set out in rule E.25.6.27 of the Auckland Unitary Plan, with a 5 dB penalty applied for construction works with a duration longer than 20 weeks. Construction vibration criteria have been taken from both the Auckland Unitary plan and the German standard DIN 4150-3:1999 standard and are summarised in terms of “Category A” and “Category B” criteria for the daytime and night-time.

Where works cannot practicably be carried out during the daytime, works during the night-time will be carried out. Reasons for night-time works include traffic requirements, safety requirements, and quality requirements.

Measures to avoid, remedy or mitigate noise and vibration from the works have been considered. Measures include (but are not limited to) implementation of a Construction Noise and Vibration Management Plan (CNVMP) and Schedules, advance communication of works with affected receivers, implementation of noise barriers, and building condition surveys.

The noise predictions indicate that:

- 15 commercial and 34 residential receivers could experience intermittent noise levels above the daytime noise criterion of 70 dB during typical construction activities at EB2.
- 1 commercial and 38 residential receivers could experience intermittent noise levels above the daytime noise criterion of 70 dB during typical construction activities at EB3R.

However, with effective mitigation in place, noise levels are predicted to comply with the 70 dB L_{Aeq} noise criterion at surrounding receivers for the majority of the construction works. Where the noise criteria are predicted to be exceeded, the effects will be mitigated and managed through the CNVMP.

Night works have the potential to create significant noise effects if not managed appropriately, therefore they must be mitigated and managed through the CNVMP. Schedules will also be prepared for the night works.

Vibration from the works has been predicted and assessed. At a minimum, we recommend that a pre-construction building condition survey be carried out at all receivers where the Category B vibration criteria are predicted to be exceeded. The vibration amenity criteria are predicted to be exceeded at a number of properties during both daytime and night-time works. However, we note that the vibration predictions are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project. The measures set out in the draft CNVMP must be implemented for the duration of the works to mitigate and manage effects from construction vibration.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers so that the BPO is implemented throughout the duration of construction. A draft CNVMP has been prepared and is included EB2 AEE Appendix 31 and EB3R AEE Appendix 22.

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 south-east 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); and
- 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.

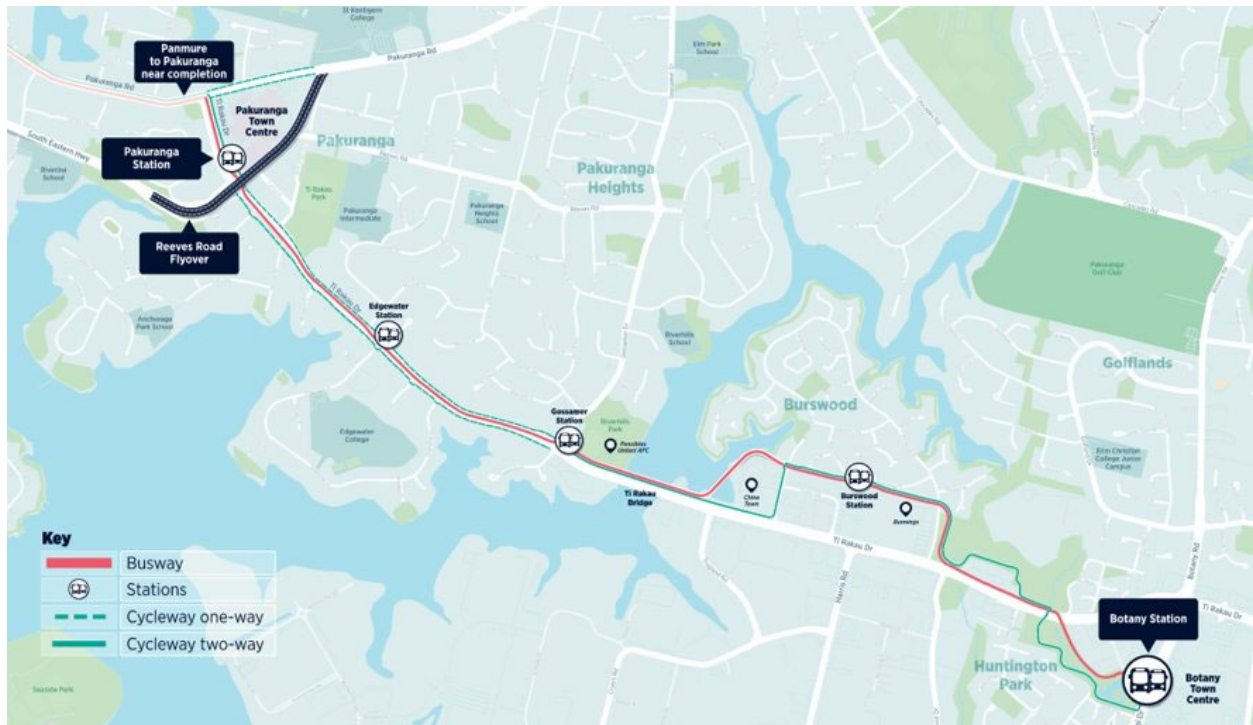


Figure 1. Project alignment

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.

1.1 Specialist assessment

This report describes our assessment of the construction noise and vibration effects.

This noise and vibration assessment assesses whether, and to what extent, EB2/EB3R can be constructed so that adverse noise and vibration effects can be avoided or mitigated.

This construction noise and vibration assessment involves:

- Considering relevant noise and vibration criteria
- Measuring existing noise and vibration levels
- Predicting and assessing construction noise and vibration levels from EB2/EB3R

- Determining the areas that may be affected by EB2/EB3R
- Considering the measures required to avoid, remedy or mitigate potential construction noise and vibration 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.

1.3 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.

1.3.1 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.

1.3.2 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.

1.3.3 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.

1.3.4 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.

1.4 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.

1.4.1 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.

1.4.2 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.

1.4.3 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.

1.4.4 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.

1.4.5 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

3.1 Construction noise

Potential construction noise effects have been assessed in accordance with the applicable Auckland Unitary Plan (AUP(OP)) noise rules. Rule E25.6.1(3) of the AUP(OP) states that “The noise from any construction activity must be measured and assessed in accordance with the requirements of New Zealand Standard NZS6803:1999 Acoustics – Construction noise”. Rules E.25.6.27(1) and E.25.6.27(2) contain construction noise limits for sensitive and all other receivers. The criteria are applicable 1m from the building façade.

The applicable construction noise criteria are detailed in Table 2 for sensitive receivers and in Table 3 for non-sensitive receivers.

As the works will take place over a time period longer than 20 weeks, a 5 dB penalty has been applied to the daytime dBA L_{eq} noise limits for weekdays and Saturdays, in line with NZS 6803:1999.

Table 2 Construction noise criteria for sensitive receivers

Time of week	Time Period	Maximum noise level (dBA) > 20 weeks	
		L_{eq}	L_{max}
Weekdays	6:30am – 7:30am	55	70
	7:30am – 6:00pm	70	85
	6:00pm – 8:00pm	65	80
	8:00pm – 6:30pm	45	75
Saturdays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	70	85
	6:00pm – 8:00pm	45	75
	8:00pm – 6:30am	45	75
Sundays and public holidays	6:30am – 7:30am	45	75
	7:30 am – 6:00pm	55	85
	6:00pm – 8:00pm	45	75
	8:00pm – 6:30am	45	75

Table 3 Construction noise criteria for non-sensitive receivers

Time period	Maximum noise level L_{Aeq} dB > 20
07:30 – 18:00	70
18:00 – 07:30	75

The works area extends through the road corridor, various Business and Residential zones and the Open Space Informal Recreation zone, as shown in Appendix A. For the works that take place in the road corridor, rule E.25.6.29(1) of the AUP(OP) applies, meaning that noise from construction works within the road corridor must comply with the limits set out in Table 2 and Table 3 to be considered a permitted activity.

We note that since noise from the works are expected to exceed the limits at some receivers for longer 3 nights rules E.25.6.29(2), (4) and (4A) do not apply.

However, as per rule E25.6.29(3)(b) the noise criteria specified in Table 2 and Table 3 above do not apply to planned construction works that occur in the road between the hours of 7am and 10pm, and which because of the nature of the works and the proximity of receivers the noise generated cannot practicably be made to comply with the relevant noise levels. This is provided that a Construction Noise and Vibration Management Plan (CNVMP) is provided to council no less than five days prior to works commencing.

As set out in 8.1, a draft CNVMP has been prepared for these works as a means to mitigate and manage construction noise and vibration effects. This is a requirement to qualify for the exemptions from compliance with the limits as allowed for in rule E25.6.29(3), as well as a requirement of rules E.25.6.29(2), (4) and (4A) had the Project not been disqualified because of the expected durations of exceedances.

3.2 Construction vibration

The main objective of controlling construction vibration is to avoid vibration-related damage to buildings, structures, and services, in the vicinity of the works. Any adverse effects of construction vibration on human comfort would typically only be experienced for short durations, for most types of construction work.

3.2.1 Auckland Unitary Plan (Operative in Part)

The AUP(OP) contains rules relating to construction vibration that cover both building damage and amenity. Rule E25.6.30 states that construction activities must be controlled to ensure any resulting vibration does not exceed:

- a. The limits set out in German Industrial Standard DIN 4150-3 (1999): Structural vibration – Part 3 Effects of vibration on structures when measured in accordance with that Standard on any structure not on the same site; and
- b. The limits set out in Table 4 in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building.

Table 4 AUP:OP Table E25.6.30.1 Vibration limits in buildings

Receiver	Period	Peak Particle Velocity (PPV) mm/s
Occupied activity sensitive to noise or vibration	Night-time 10pm to 7am	0.3
	Daytime 7am to 10pm	2.0
Other occupied buildings	At all times	2.0

Works generating vibration for three days or less between the hours of 7am to 6pm may exceed the limits in Table 4, but must comply with a limit of 5 mm/s peak particle velocity in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground floor level at the foundation of a single storey building, where:

- All occupied buildings within 50m of the extent of the works generating vibration are advised in writing no less than three days prior to the vibration-generating works commencing; and
- The written advice must include details of the location of works, the duration of works, a phone number for complaints and the name of the site manager.

3.2.2 DIN 4150-3:1999 – Structural Vibrations: Effects of Vibrations on Structures

DIN 4150 contains guidelines on vibration limits for buildings which, when complied with “will not result in damage that will have an adverse effect on the structure’s serviceability”. These limits are set out in Table 5.

Different criteria are given for “short-term” (transient) vibration sources such as blasting and impact piling, and “long-term” sources such as vibrocompaction. Note that the definition of “short-term” and “long-term” in DIN 4150-3:1999 differ from those in NZS 6803:1999 and do not strictly relate to the duration of the works, but rather how a building responds to the construction vibration. Short term vibration does not excite a structure (which would result in a significant increase in vibration), therefore vibration limits are higher than for long-term vibration.

Table 5 Vibration velocity guideline values for structures

Type of structure	Short term vibration			Vibration at horizontal plane of highest floor at all frequencies (mm/s)	Long Term Vibration PPV at horizontal plane of highest floor (mm/s)
	PPV at foundation, frequency of:				
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*		
Buildings used for commercial purposes, industrial buildings, and buildings of similar design and/or use	20	20 to 40	40 to 50	40	10
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15	5
Structures that because of their sensitivity to vibration, do not correspond to those listed in lunes 1 and 2 and are of great intrinsic value	3	3 to 8	8 to 10	8	2.5

* At frequencies above 100 Hz, the values given in this column may be used as minimum values

** The Standard defines short-term vibration as “vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance in the structure being evaluated”. Long-term vibration is defined as all other vibration types not covered by the short-term vibration definition.

Clause 5.1 of DIN 4150-3 notes that a vibration level in excess of the DIN criterion does not necessarily result in building damage. The definition of ‘damage’ in DIN 4150-3 is: “any permanent effect of vibration that reduces serviceability of a structure or one of its components”.

Examples of a ‘reduction of serviceability’ include:

- the impairment of stability of the building and its components;
- a reduction in the bearing capacity of floors.

For dwelling type buildings (Table 5 – line 2) and structures sensitive to vibration (Table 5 – line 3), the serviceability is considered to have been reduced if:

- cracks form in plastered surfaces of walls;
- existing cracks in the building are enlarged;
- partitions become detached from loadbearing walls or floors.

These effects are deemed ‘minor damage’.

3.2.3 British Standard 5228-2

British Standard (BS) 5228-2: 2009 “Code of practice for noise and vibration control on construction and open sites” provides additional guidance on the human response to vibration, which is widely used in the assessment of effects of construction vibration. The vibration levels against perception as found in BS5228-2:2009 have been replicated in Table 6.

Table 6 Human perception of vibration levels

Vibration Level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might just be perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaints but can be tolerated if warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

3.2.4 Recommended Construction Vibration Criteria

The following criteria are the recommended project construction vibration criteria for both building damage and amenity for EB2 and EB3R.

The two category criteria, detailed in Table 7, are designed to facilitate a progressive management response to the increasing risks and effects during construction. These criteria have been included in the proposed conditions, and they have also been set out in the draft CNVMP.

Category A sets the criteria for the amenity effects where vibrations may be perceived by occupants within a building, as adopted from the AUP, and can be used as an indicator of when communication and consultations should be initiated to manage effects. Category B are based on DIN 4150 building damage criteria for daytime.

Table 7 Recommended construction vibration criteria

Vibration Level	Time	Category A	Category B
Occupied activities sensitive to noise	Night-time 2000h – 0700h	0.3mm/s ppv	2mm/s ppv
	Daytime 0700h – 2000h.	2mm/s ppv	5mm/s ppv
Other occupied buildings	All other times	2mm/s ppv	5mm/s ppv
All other buildings	Daytime 0630h – 2000h	Tables 1 and 3 of DIN4150-3:1999	

Where compliance with the vibration standards set out in Table 7 is not practicable, and unless otherwise provided for in the CNVMP (refer 8.1), a Schedule (refer Section 8.2) will be required. The purpose of a Schedule is to set out the BPO for the management of noise and/or vibration effects from construction for specific activities or at specific receivers beyond the measures set out in the CNVMP.

It should be noted that the level of vibration perceived by humans, and the level of vibration that is likely to result in annoyance for some people, are magnitudes lower than the level of vibration capable of damaging structures. This means that vibration levels which readily comply with the Category A criteria may cause annoyance and adverse reaction from building occupants who mistakenly believe that their building is sustaining damage.

It is therefore recommended that the Category A criteria only be investigated, and applied, upon receipt of a complaint from an occupant of the building. The procedure for advance notice of works is set out in Section 8.5 and this is addressed in the proposed conditions and draft CNVMP.

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 seven days, where possible. At locations ML3 and ML9, the duration was reduced to five days and one day respectively, due to vandalism. Note that results for ML12 have been excluded as this measurement location was outside of the EB2 and EB3R project areas.

Error! Reference source not found. shows the monitoring locations across the EB2/EB3R alignment. The measurement positions are shown on the map in Appendix A and are summarised in Appendix B.

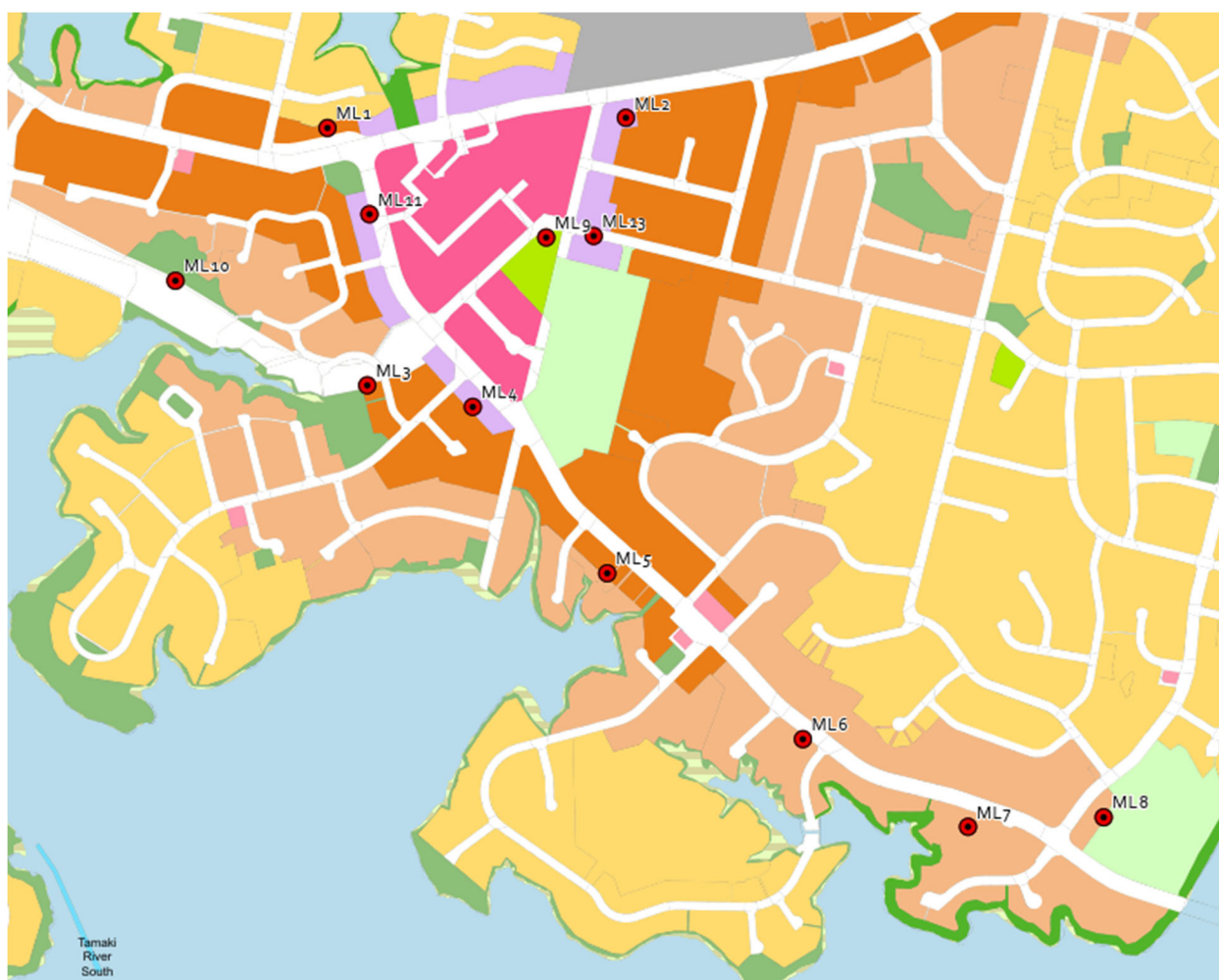


Figure 2 Noise monitoring locations

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 sampling rate or better.

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.

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 construction as assessed against the criteria in section 3. The ranges are based on measurements taken over week-long periods. Details of each measurement location are presented in noise monitoring forms, compiled in Appendix B.

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

Table 8 summarises the averaged 24-hour noise measurements taken at the measurement locations. A summary of the measured noise levels is presented in Appendix C **Error! Reference source not found.**

Table 8 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	Park off Pakuranga Highway	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 uses in the area and an open recreation space in Riverhills Park and Ti Rakau Park.

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

Table 9 summarises the averaged 24-hour noise measurements taken at the measurement locations. A summary of the measured noise levels is presented in Appendix C **Error! Reference source not found.**

Table 9 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 Construction Noise and Vibration Assessment Methodology

5.1 Assessment methodology

Predictions of construction noise has been undertaken in accordance with NZS 6803. Noise levels were predicted using the ISO 9613-2:1996 “Acoustics – Attenuation of sound outdoors – Part 2: general method of calculation” prediction algorithm, implemented in SoundPLAN 8.2 computational modelling software.

The following factors were incorporated in the model:

- shielding and reflections from buildings;
- attenuation from noise barriers;
- site topography; and
- worst-case downwind conditions.

The construction methodology that this assessment is based on was provided by the Alliance construction team¹.

The proposed construction boundary was provided by the Alliance construction team. As a worst-case approximation, construction equipment has been assumed to be working along the edge of this construction area, at the closest position possible to adjacent receivers. We note that this is unlikely to be the case for the majority of the works, as equipment will operate over the whole footprint of the works and will move in a linear fashion as the works progress.

The construction works area used in the modelling is shown in the maps in Appendix A.

Predicted levels at existing receivers have been assessed against the applicable construction noise and vibration criteria. Potential effects of construction noise and vibration have then been considered and construction management and mitigation measures identified where appropriate. To avoid and/or minimise exceedances of the construction noise criteria, it is vital that Best Practicable Option (BPO) mitigation and management measures are utilised.

This report provides a framework for construction noise and vibration management such that the most effective and practicable methods for mitigation will be planned and implemented, taking into account the extent of predicted effects. At the core of this framework is the Construction Noise and Vibration Management Plan (CNVMP) as described in section 8.1. The final version will be confirmed and certified in accordance with the proposed conditions of consent prior to commencement of construction. It will be updated as necessary during construction.

We note that the assessment considers existing receivers. If there are any changes in land use or density in the environment surrounding the construction areas, this will need to be considered in the CNVMP at the time of construction.

5.2 Construction methodology

The information in this section has been taken from the draft construction methodology. The construction works will generally follow the sequence set out in this section for both EB2 and EB3R.

¹ EB234 – Construction Methodology Draft Rev1, provided on 25th March 2022

5.2.1 Site establishment works

Site establishment works include, but are not limited to:

- Traffic/ public management including, but not limited to:
 - Footpath closures/ deviations
 - Pedestrian crossing closures
- Existing Utility services location
- Site Access Points (SAP's) & Fencing:
- Compounds and offices

5.2.2 Protection and/ or relocation of existing network services

EB2/EB3R traverses key networks/services located within the proposed alignment. The key services within EB2/EB3R that require protection and relocation include:

- High voltage transmission lines²;
- High pressure gas transmission pipelines;
- Bulk water supply and wastewater infrastructure;
- Local fibre optic communication cables;
- Fibre optic communication cables and telephone lines; and
- Electricity and gas distribution.

5.2.3 Earthworks

Earthworks involve clearing obstructions and vegetation, and then carrying out earthworks within the construction footprint.

5.2.4 Civil Works

The construction of EB2/EB3R will involve the installation of new civil infrastructure including but not limited to:

- Stormwater drainage/outfalls
- Utilities relocation (water, wastewater, electrical, communication, gas etc.)
- Utilities protection (water, wastewater, electrical, communication, gas etc.)
- ITS ducting
- Street lighting
- Shared paths
- Traffic services
 - Barriers
 - Signals
 - Signage
 - Lighting
 - CCTV
- Bus stations
- Urban design
 - Artwork

² Transpower will apply for the necessary consents to relocate their transmission lines.

- Open spaces
- Seating
- Landscaping
 - Planting & grassing.

5.2.5 Pavement works

The construction of EB2/EB3R will involve the construction of new pavements, widening and upgrading of the existing carriageway.

Construction of new pavements will involve:

- Subgrade preparation, including subgrade improvement works after civils activities and site access use, plus final trimming ready for granular layers
- Installation of geogrids and or geotextiles
- Placement of the subbase granular layer, or alternatively, placement of lean mix concrete as subbase layer

- Installation of pavement drains and kerbing
- Placement of the basecourse granular layer
- Membrane chip-seal sealing of the basecourse
- Placement of structural asphalt layers.

Widening and upgrading of pavements will involve:

- Removal and reconstruction of edge kerbing and pavement drainage as required
- Construction of new widened pavement areas, as detailed above
- Removal of existing carriageway running surface, through use of a road planer (miller)
- Removal and replacement of existing carriageways structural asphalt, through 'mill & fill' operations.

5.2.6 Bridge construction works (Reeves Road Flyover - RRF)

The RRF will be constructed from reinforced in-situ and precast concrete components. In-situ decks will be poured on top of precast concrete girders, supported on in-situ concrete piers and columns, which will be positioned above reinforced concrete bored piles. Abutments will be mechanically stabilized earth walls (MSE) with deck end spans resting on them.

Bridge construction will involve:

- Temporary traffic management, including changes to existing lane configurations and walking routes, plus safe entry and exit points into the work zone for construction traffic
- Relocation and / or protection of existing network utility services
- De-construction of existing structures, full or part thereof
- Temporary works, including amongst others, crane pads, course ways (access routes), staging (across public walkways / traffic lanes)
- Mechanically stabilized earth walls (MSE), abutment and approach ramp construction
- Bored piles at each pier position with access routes to each pier for piling rigs and cranes
- Concrete pile caps, followed by columns and pier headstocks, constructed at each pier location, and abutment beams on top of each MSE abutment

- Bridge beam erection, one span at a time and installed at night to allow for lane closures for beam delivery and crane positioning for lifting.
- Installation of new ducts for new services and ITS network
- In-situ deck pours, followed by ancillary works, including amongst others, barriers, movement joints, drainage, services and surfacing works

As space is constrained along the alignment, retaining walls are proposed to contain cut and / or fill batters. These retaining walls generally fall into (but are not limited to) three categories:

- Mechanically stabilised earth walls (MSE), mainly for approach embankments to bridge and flyover structures
- L shaped walls, (e.g. precast segments), tending to retain small heights
- Gravity walls, (e.g. mass blocks or components of), tending to retain small heights

5.2.7 Disestablishment

As zonal works are completed, dis-establishment of construction support facilities will commence.

These activities include, but are not limited to:

- Dismantling and uplifting of site compounds, satellite offices and SAP egress points
- Making good temporary occupied land, through either landscape planting, grassing or agreed usage
- Re-installation of facilities and traffic services temporarily removed or relocated
- Uplifting and removal off site of construction plant and equipment, surplus materials and spoil, temporary works items and perimeter fencing, lighting and signage
- Uplifting, removal and making good temporary traffic management and pedestrian / cyclist deviations

5.3 Night works

The Alliance construction team have advised that night works will be intermittent at each location they take place and will occur for a maximum of one month in any one area, with the exception of night works associated with the RRF which will take place intermittently over the course of three years.

Night works will only take place when works cannot practicably take place during the day. Reasons why night works must take place include traffic constraints, safety constraints, and quality assurance requirements, depending on the activity.

The night-time works for which sufficient detail is known to carry out noise predictions along with their durations are:

- Reeves Road Flyover construction (concrete pours and lifting) – 2 weeks per section of works, staged intermittently over 3 years in total
- Vegetation clearance – 2 weeks
- Pavement construction – removal of islands and grass medians – 2 weeks
- Relocation of existing houses – 1 week

Worst-case equipment that will be used during these works are:

- Pavement works:

- Concrete saw
- Paver
- Compaction equipment
- Excavator
- Reeves Road Flyover construction:
 - Concrete truck
 - Concrete pump
 - Cranes
- Vegetation clearance:
 - Chainsaw
 - Trucks

The results of the night works noise predictions are summarised and discussed in Section 9.

Other night-time works are proposed, but sufficient detail is not known at this stage to carry out noise predictions. These works are:

- Utility works within the road corridor
- Pavement works within the road corridor
- Site clearance works

Where sufficient detail is not currently known around other night-time works, noise predictions will be carried out in advance of those works once sufficient detail is available. If the predictions indicate that the night-time noise criteria will be exceeded at surrounding receivers, then a Schedule will be prepared for those works. Further details around Schedules are provided in Section 8.2.

Night works have the potential to create significant noise effects if not managed appropriately; therefore they must be mitigated and managed through the CNVMP.

6 Equipment Source Levels

6.1 Construction noise source levels

Construction for both EB2 and EB3R is expected to take place over a time period greater than 20 weeks. Predictions have been assessed against the noise criteria for greater than 20 weeks “long-duration” under NZS6803:1999 as presented in Table 2 and Table 3. It is expected that the majority of the works will be carried out between 7am – 6pm Monday to Saturday. It is also likely that night works will take place for works that cannot practicably take place during the day as set out in Section 5.3.

Table 10 details the sound power levels³ from the likely significant noise sources as provided by the Alliance construction team. Noise levels at varying distances have also been provided, assuming 100% on-time over the assessment time period. The noise data has been taken from British Standard 5228-1:2009 “Code of practice for noise and vibration control on construction and open sites”, manufacturers data or the AECOM database of noise measurements. Equipment selection at detailed design stage may include equipment with different sound power levels than those presented. The equipment list will be reassessed nearer the time of construction and updated in the CNVMP.

Table 10 Construction equipment noise levels

Site Activity	Equipment	Sound power level (dBA SWL)	Noise level dB L _{Aeq}			
			5m	10m	20m	50m
Site establishment (including utility works, demolition and clearing)	6-Wheeler trucks	107	85	79	73	65
	10Tn Excavator with rock breaker attachment	116	94	88	82	74
	Handheld concrete saw / chainsaw	115	93	87	81	73
	10Tn Excavator	107	85	79	73	65
	20Tn Excavator	107	85	79	73	65
	500kg Plate compactor	110	88	82	76	68
Earthworks and civil works	12Tn Steel roller compactor	107	85	79	73	65
	6-Wheeler trucks	107	85	79	73	65
	20T Excavator	107	85	79	73	65
	Mobile crane	106	84	78	72	64
Pavement Construction (including surfacing)	6-Wheeler trucks	107	85	79	73	65
	Plate compactor, 500 kg	110	88	82	76	68
	Roller compactor, 12T	107	85	79	73	65
	Handheld concrete saw / chainsaw	115	93	87	81	73
	Bitumen sprayer	101	79	73	67	59
	Grader	99	77	71	65	57
	12Tn Double Drum Steel Roller	107	85	79	73	65
	Concrete mixer truck	107	85	79	73	65

³ Sound power levels correlate to the energy emitted by the sound source.

Bridge Construction (Reeves Road Flyover)	Gantry crane	95	73	67	61	53
	Large crawler crane	103	81	75	69	61
	Bored piling rig	111	89	83	77	69
	20T Excavator	107	85	79	73	65
	Concrete pump	103	81	75	69	61
	Concrete mixer truck	107	85	79	73	65
	6-Wheeler trucks	107	85	79	73	65

6.2 Construction vibration source levels

Vibration generation and propagation is highly site specific. The generation of vibration is dependent on the local site geology, the equipment being used, the nature of the works, and even the operator.

To account for the inaccuracy in the prediction of vibration, the likely worst-case vibration has been calculated based on the equipment and hard ground geology to provide vibration emission radii. The offset distance that complies with the applicable criterion is considered to be the safe working distance. At this offset distance we consider it likely that compliance with the building damage vibration criteria would be achieved.

Vibration from a source transmits in a spherical pattern and reduces with distance. There will be a particular distance from each source at which the vibration level equals the relevant vibration criteria. This distance is called the 'emission radius'.

The vibration emission radii are presented in Table 11.

Table 11 Vibration sources and indicative emission radii

Equipment	DIN 4150 short-term emission radii			Daytime amenity criterion (2 mm/s)	Night-time amenity criterion (0.3 mm/s)
	Commercial (20 mm/s)	Residential (5 mm/s)	Historic/Vibrations on sensitive (3 mm/s)		
Roller Compactor (12T)	2m	8m	14m	21m	N/A
Roller Compactor (7T)	1m	6m	8m	12m	45m
20T Excavator	1m	5m	8m	12m	N/A
Tipper Truck	1m	1m	2m	2m	16m
Vibratory Plate Compactor	1m	1m	2m	3m	21m
Excavator with rock	2m	7m	12m	18m	N/A

breaking attachment					
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We recommend that vibration measurements are undertaken at specific locations as identified through the CNVMP and schedules at the commencement of construction activities to establish vibration propagation site laws for vibration generating equipment. This approach will confirm the emission radii used in this assessment and ensure the applicable criteria are complied with. It has been found on other major construction projects, that the measured vibration levels for a particular activity are much lower than those predicted during the assessment stage.

7 Overview of Potential Effects

7.1.1 Construction noise effects

Table 12 gives examples of the potential effects on receivers at different noise levels based on NZS6803 with the most exposed façades providing a 20 dB reduction. Depending on the construction of the house, facades may provide up to a 25 – 30 dB reduction, therefore assumptions and effects provided below are based on a conservative approach.

Table 12 Potential construction noise effects on receivers

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
65 dB L_{Aeq}	Conversation becomes strained, particularly over longer distances	45 dB L_{Aeq}	Noise levels would be noticeable but unlikely to interfere with residential or office daily activities.
65 to 70 dB L_{Aeq}	People would not want to spend any length of time outside, except when unavoidable through workplace requirements	45 to 50 dB L_{Aeq}	Concentration would start to be affected. TV and telephone conversations would begin to be affected.
70 to 75 dB L_{Aeq}	Businesses that involve substantial outdoor use would experience considerable disruption.	50 to 55 dB L_{Aeq}	Phone conversations would become difficult. Personal conversations would need slightly raised voices. Office work can generally continue, but 55 dB is considered by the experts to be a tipping point for offices. For residential activity, TV and radio sound levels would need to be raised.
75 to 80 dB L_{Aeq}	Some people may choose protection for long periods of exposure. Conversation would be very difficult, even with raised voices.	55 to 60 dB L_{Aeq}	Continuing office work would be extremely difficult and become unproductive. In a residential context, people would actively seek respite.
80 to 90 dB L_{Aeq}	Hearing protection would be required for prolonged exposure (8 hours at 85 dB) to prevent hearing loss.	60 to 70 dB L_{Aeq}	Untenable for both office and residential environments. Unlikely to be tolerated for any extent of time.

With effective management of construction activities, which includes consultation and communication with affected parties and scheduling noisy works (such as concrete sawing), during the daytime rather than night-time period, noise levels can be controlled so that the effects on the nearest residential receivers are reduced. Barriers will not be effective at all locations, particularly where receivers are

more than one storey. Where barriers are not going to be effective, the use of enclosures or local screening of equipment should be considered and implemented, where practicable. If noisy activities must take place during the night-time, and screening or other mitigation measures do not provide sufficient attenuation to meet the night-time noise criteria or are not practicable, it may be necessary to offer temporarily relocation to affected residents. Temporary relocation should only be considered on a case-by-case basis and as a last resort after all other measures are exhausted.

7.1.2 Construction vibration effects

The vibration effects associated with construction of EB2/EB3R has been considered in terms of human response to varying vibration magnitudes and building damage. However, in our experience the main concern for building occupants during construction is damage to the building itself.

Humans can generally perceive vibrations at a much lower level than when building damage is likely to occur. The adverse effects of construction vibration on building occupants may be significant in some buildings adjacent to the areas of works. Adverse effects may range from annoyance to loss of amenity or inability to carry out work. Vibration effects will reduce with distance from the source, and the level of vibration transmission into a building will depend on a number of factors, such as the foundation type and building construction.

Potential effects and human perception of the vibration levels found within the AUP (OP), and DIN criteria described above have been combined and presented in Table 13 and adopted for this assessment.

Table 13 Potential vibration effects on human perception summary against AUP and DIN criteria

External Noise Level	Potential Daytime Effects Outdoors
0.14 mm/s	The threshold of perception for stationary people. Just perceptible in particularly sensitive environments.
0.3 mm/s	<p>Can be just perceptible during normal residential activities, particularly for more sensitive receivers. Levels above may wake most people from their sleep.</p> <p>This is the AUP(OP) limit for construction vibration generated at night-time for sensitive receivers.</p>
1 mm/s	Is typically tolerable with prior notification. Complaint or adverse reaction is likely in office or residential environments, particularly if there is no prior warning. What people actually feel would be subject to the source but could include a steady vibration from sources such as vibratory compaction, or a small jolt such as from the movement of a large digger either of which could rattle crockery and glassware. Sleep disturbance would be almost certain for most people.
2 mm/s	<p>Vibration would clearly be felt. However, it can typically be tolerated in indoor environments such as offices, houses and retail if it occurs intermittently during the day and where there is effective prior engagement. Effects experienced would be somewhere between levels of 1 and 5 mm/s.</p> <p>This is the AUP(OP) limit for large construction projects generating vibration.</p>
5 mm/s	Unlikely to be tolerable in a workplace. Highly unsettling for both workplaces and dwellings. If exposure is prolonged, some people may want to leave the building

	<p>Computer screens would shake and items could fall off shelves if they are not level.</p> <p>This is the threshold below which no cosmetic damage will occur in the DIN standard.</p>
10 mm/s	Likely to be intolerable for anything other than a very brief exposure.

The AUP(OP) sets the criteria for amenity at 0.3mm/s for night-time and 2 mm/s during the day. Based on the worst-case source of a roller compactor, any receiver within a 21m radius of the construction area may experience vibration of 2 mm/s inside their property. Whilst at this level building damage is highly unlikely to occur, human perception may result in slight concerns but can generally be tolerated if activity occurs intermittently and with prior notice.

At 0.3 mm/s the emission radii could be up to 140m from construction areas, and at this level people could feel slight vibrations especially during the night-time, which may cause sleep disturbance. High vibratory activities should therefore be avoided during the night-time and careful management of the type of equipment used at night is included in the draft CNVMP (refer Section 8.1).

Construction vibration effects generally have a short timeframe, typically a few days at a time. The use of high vibratory equipment, such as a roller compactor, will be controlled through the CNVMP to limit potential vibration effects, and alternative equipment with lower vibratory effect should be used where practicable.

8 Recommended Measures to Avoid, Remedy or Mitigate Effects

8.1 Construction noise and vibration management plan (CNVMP)

Implementing noise management and mitigation measures via a CNVMP is the most effective way to control construction noise and vibration impacts. The objective of the CNVMP is to provide a framework for the development and implementation of best practicable options to avoid, remedy or mitigate the adverse effects on receivers of noise and vibration resulting from construction.

E25.6.29(5) sets out the minimum level of information that must be provided in the CNVMP. Accordingly, a draft CNVMP is attached in EB2 AEE Appendix 31 and EB3R AEE Appendix 22, and includes the following content:

- Description of the works and anticipated equipment/processes;
- Hours of operation, including times and days when construction activities would occur;
- The construction noise and vibration standards for EB2/EB3R;
- Identification of receivers where noise and vibration standards apply;
- Management and mitigation options, including alternative strategies adopting the BPO where full compliance with the relevant noise and/or vibration standards cannot be achieved;
- Methods and frequency for monitoring and reporting on construction noise and vibration, including:
 - Updating the predicted noise and vibration levels based on the final methodology and construction activities;
 - Confirming which buildings will be included in a pre and post building condition survey;
 - Identifying appropriate monitoring locations for receivers of construction noise and vibration;
 - Procedures to respond to complaints received on construction noise and vibration, including methods to monitor and identify noise and vibration sources;
 - Procedure for responding to monitored exceedances; and
 - Procedures for monitoring construction noise and vibration and reporting to the Auckland Council Consent Monitoring officer.
 - Procedures for maintaining contact with stakeholders, notifying of proposed construction activities, the period of construction activities, and handling noise and vibration complaints;
 - Contact details of the site supervisor or Project manager and the Requiring Authority's Project Liaison Person (phone, postal address, email address);
- Procedures for the regular training of the operators of construction equipment to minimise noise and vibration as well as expected construction site behaviours for all workers;
- Identification of areas where compliance with the noise and/or vibration standards will not be practicable and where a Schedule will be required;
- Procedures for how remedial works will be undertaken, should they be required as a result of the building condition surveys; and
- Procedures and timing of reviews of the CNVMP.

A draft CNVMP is provided in EB2 AEE Appendix 31 and EB3R Appendix 22. The draft CNVMP utilises all relevant information available at the time of writing of this assessment, as provided by the EBA construction team. It also includes the record of consultations and outcomes/actions of the consultations taken up to the date of writing of this assessment. The draft CNVMP will be finalised prior to commencement of construction and will be updated as necessary during construction.

8.2 Schedules

In addition to a CNVMP, it may be necessary to produce Site Specific or Activity Specific Construction Noise and Vibration Management Schedules (“Schedules”) where noise and/or vibration limits are predicted to be exceeded for a more sustained period or by a large margin. A Schedule to the CNVMP provides a specific assessment of an activity and/or location and will include details such as:

- Activity location, start and finish dates
- The nearest neighbours to the activity
- A location plan
- Predicted noise/vibration levels and BPO mitigation for the activity and/or location
- Communication and consultation with the affected neighbours
- Location, times and type of monitoring
- Any pre-condition survey of buildings predicted to receive vibration levels approaching the Category B vibration limits, which document their current condition and any existing damage.

Schedules are likely to be required for (but not limited to):

- Te Tuhi
- Pakuranga Medical Centre
- Night-time works

Schedules will be prepared prior to the start of the construction works where sufficient detail about the works is known. Schedules will also be prepared prior to any works after construction has started where the construction methodology changes such that they are required.

8.3 Noise mitigation measures

A hierarchy of mitigation measures will be adopted through the CNVMP and Schedules (where produced), as follows:

- Managing times of activities to avoid night works and other sensitive times where practicable;
- Liaising with neighbours (including providing advance notice of works where the noise criteria are predicted to be exceeded) so they can work around specific activities;
- Selecting equipment and methodologies to restrict noise;
- Using screening/enclosures/barriers (as discussed in section 8.4); and
- Offering neighbours temporary relocation.

By following this hierarchy, the BPO for mitigation will be implemented, whilst avoiding undue disruption to the community. In particular, temporary relocation of neighbours can cause significant inconvenience and should only be offered where other options have been exhausted and noise levels still require mitigation.

Some activities are likely to be set back a considerable distance from the nearest receivers and require very little or no mitigation to achieve compliance with the relevant Project noise limits. Alternative methodologies, careful equipment selection and use of noise barriers or localised screening (e.g. for concrete cutting) would be suitable management and mitigation measures and should be implemented where they are practicable or effective.

8.4 Noise barriers

Temporary noise barriers can be used as an effective tool to reduce noise from site at the source and may reduce noise levels from the works by up to 10 dB at the ground floor.

Noise barriers or enclosures will be used where practicable in areas where the noise limits are predicted to be exceeded, and where they provide effective mitigation.

For a noise barrier to be effective it must physically obstruct line of sight between the noise source and receiver. Receivers on the first floor and above will be able to see over the noise barrier and it will provide little attenuation. Noise barriers would typically be in the form of fences lined with acoustic mats 1.8 metres high.

The noise barrier should be:

- Positioned to physically obstruct line of sight between the construction work and receiver; where this is practicable;
- Positioned as close as practicable to the noisy construction activity; and
- Abutted or overlapped to provide a continuous screen with no gaps at the base or between panels.

8.5 Vibration mitigation

Similarly to noise, a hierarchy of vibration mitigation measures will be adopted through the CNVMP, and Schedules (where produced) as follows:

- Managing times of activities to avoid night works and other sensitive times where practicable;
- Liaising with neighbours (including providing advance notice of works where the vibration criteria are predicted to be exceeded) so they can work around specific activities;
- Operating vibration generating equipment as far from sensitive sites as possible;
- Selecting equipment and methodologies to minimise vibration;
- Offering neighbours temporary relocation; and
- In specific situations, a cut-off trench may be used as a vibration barrier if located close to the source.

In general, there are less options available to mitigate vibration propagation and insulate receiver buildings, compared to noise. Mitigation will therefore focus on the scheduling of high-vibration activities, effective communication with neighbours, and selection of appropriate equipment and methods, where practicable.

The draft CNVMP sets out a procedure to provide advance notice of works to receivers where they are predicted to fall within the vibration emission radii for amenity.

Appropriate vibration mitigation measures for each activity are listed in the CNVMP and Schedules (where produced).

8.6 Building condition survey

A detailed building precondition survey should be undertaken by a suitably qualified engineer prior to the start of construction at all buildings where the daytime Category B criteria may be exceeded. This is

a requirement of the proposed conditions of consent. The survey shall include, but not be limited to, the following:

- Determination of building classification: commercial, industrial, residential or a historic or sensitive structure;
- Determination of building specific vibration damage risk thresholds; and
- Recording (including photographs) the major features of the buildings including location, type, construction (including foundation type), age and present condition, including existing levels of any aesthetic damage or structural damage.

A post-construction condition survey of the same buildings shall be conducted when construction is completed, and any damage shown to have been caused by the works rectified by the Alliance construction team.

8.7 Night works

Night works have the potential to cause the greatest disturbance to residents and should be avoided where practicable. However, as per section 5.3 the Alliance construction team have noted that night works will be required for a number of activities when works cannot practicably take place during the day.

Before night works are programmed, it is important to determine if there are alternative options that would avoid working at night and, if so, whether those options are technically and practicably feasible.

Where there are no practicable alternative options to night works, it may be necessary to implement enhanced noise and vibration management measures, but this will depend on the location of the worksite and the proposed activities.

When work must be carried out at night, it may be necessary to:

- Increase the frequency of communications with stakeholders.
- Carry out regular noise and vibration monitoring to confirm noise and vibration levels.
- Offer temporary relocation to neighbours if unreasonable noise and/or vibration levels cannot be avoided. This will be a last-resort option only to be explored when all other measures have been exhausted.

Noise predictions have been carried out based on information provided by the EBA construction team. The results of the predictions are summarised and discussed in Section 9.

As the predictions indicate that the night-time noise criteria will be exceeded at surrounding receivers, a Schedule will be prepared for the night-time works as per Section 8.2.

9 Predicted Levels and Effects

9.1 Predicted construction noise levels and associated effects

Predictions of noise from construction activities have been carried out for sensitive receivers across both EB2 and EB3R, during worst-case construction activities for each major stage of construction.

Table 14 sets out the minimum set-back distances required from the works to comply with the daytime construction noise criteria for each stage of the works, for both a reasonable worst-case scenario (e.g. concrete saw in use, 30% on-time with noise barriers, near edge of construction footprint) and a typical scenario (e.g. excavator in operation with noise barriers around the working site).

Table 14 Required set-back distances for compliance with daytime noise criterion

Construction works stage	Worst-case equipment	Typical equipment	Required set-back distance for compliance with 70 dB L _{Aeq} daytime noise criterion during reasonable worst-case scenario	Required set-back distance for compliance with 70 dB L _{Aeq} daytime noise criterion during typical scenario
Site establishment (including utility works, demolition and clearing)	Handheld concrete saw/chainsaw, concrete breaker, 30% on-time, noise barriers around working site	20T Excavator, noise barriers around working site	13m	9m
Earthworks and civil works	20T Excavator, noise barriers around working site	20T Excavator, noise barriers around working site	9m	9m
Pavement construction (including surfacing)	Concrete saw, 30% on-time, noise barriers around working site	Roller compactor, noise barriers around working site	13m	9m
Bridge construction works (RRF)	Bored piling rig	20T Excavator, noise barriers around working site	45m	9m

As can be seen in Table 14, for the worst-case scenarios, sensitive receivers up to 45m away from the works will potentially be exposed to construction noise levels above the daytime construction noise criterion during use of the piling rig for construction of the RRF, if no mitigation measures are in place.

Appendix D presents tables summarising predicted levels at receivers where the daytime noise limits are predicted to be exceeded for typical and worst-case construction activities across the wider EB2 and EB3R construction works. These levels are predicted for the scenario where works take place at the closest possible location to each receiver. The noise levels at receivers will reduce compared to those presented in Appendix D as the works progress. This is discussed in detail further below.

High noise generating activities, such as use of the concrete saw, will not take place for the entire duration of the works. For example, the construction team have advised that the concrete saw will be used for one week in total during demolition works and two days in total for pavement works at each works location.

Moreover, operation of construction equipment will be intermittent in nature at a given location. Construction will be linear so as the equipment moves away from receivers, noise levels will reduce.

During typical construction activities, the set-back distance for compliance with the daytime noise criterion reduces to 9m, assuming noise barriers are erected effectively around construction works. We consider this to be a more realistic and common scenario for works on site (compared to the modelled worst-case scenario) for assessing construction noise from the works.

In line with the above, we consider that during typical construction activities, noise from the works will be compliant with the daytime noise criterion for the majority of the daytime works at all locations.

For this to be true, it is important that mitigation is implemented effectively at working sites. Erection of noise barriers around working sites can reduce noise levels up to 10 dB at the ground floor. The effectiveness of the barriers is dependent on how the barriers are set up, i.e., no gaps. However, it should be noted that construction works will take place in the vicinity of a number of two storey dwellings across the project alignment. While noise barriers are effective at reducing noise at the ground floor, they will provide little to no attenuation to receivers above the ground floor, as line-of-sight to the works will be easily maintained.

It is also possible that the works may come within the set-back distance for compliance with the daytime noise criterion (9m) at some receivers intermittently, also exposing them to noise levels above the daytime criterion. For these situations, it is important that noise effects are managed through communication with affected receivers, for example by scheduling noisy works when nearby buildings are unoccupied and providing advance notice as mentioned above.

There will be times when construction works that are noisier than the typical works must take place, and implementation of mitigation may be restricted, leading to exceedances of the noise criteria at some receivers. For these scenarios, noise effects must be managed through effective communication with the affected receivers which will be managed by the CNVMP. In particular, scheduling of noisy activities when nearby buildings are unoccupied should be done when practicable and advance notice should be provided of these works.

As night-time works are required in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where possible to prevent sleep disturbance. If the use of noisy equipment cannot be avoided during the night-time and the required reductions in noise cannot be achieved with noise barriers or other mitigation, it may be necessary to offer temporary relocation to the most affected residential receivers to manage and mitigate adverse effects. This will be determined on a case-by-case basis through consultation with the affected parties during production of any Schedules.

The most effective method to manage noise effects will be through implementation of the CNVMP. A draft CNVMP has been prepared. The CNVMP will be the primary method to ensure that the Best Practicable Options to mitigate noise and vibration are implemented, and that community engagement

is managed effectively. A CNVMP that is implemented effectively can significantly reduce the magnitude and frequency of adverse effects, while reducing the likelihood of complaints.

9.1.1 EB2

High noise-generating activities may not occur on the edges of the construction area modelled, but if they do, 18 commercial and 43 residential receivers could experience noise levels above 70 dB L_{Aeq} during a worst-case scenario, i.e. when the concrete saw is in use with noise barriers placed around the working site while in use at the edge of the construction boundary. At the corresponding internal noise level, effects could include loss of concentration, annoyance, and reduction in speech intelligibility inside dwellings.

However, as noted above, this does not represent a typical scenario. During a typical scenario, i.e. use of the excavator with noise barriers around construction sites, 15 commercial and 34 residential receivers could experience intermittent noise levels above the daytime noise criterion of 70 dB L_{Aeq} . We note that these levels are predicted while works take place at the closest possible location at each receiver; in reality, noise levels will quickly reduce as the works progress and high noise generating activities are completed. Noise at this level can be tolerated provided that prior notification is given before high noise generating activities take place.

Appendix D sets out the noise levels predicted at receivers during both worst-case works and typical construction works. Effects at different noise levels are set out in Table 12.

Commercial receivers, such as Countdown and The Warehouse, have solid façades which could provide a reduction in noise levels up to 50 dB. Noise may be audible inside during high noise generating activities, but due to the nature of these businesses (busy retail with background music playing), construction noise levels should not impact business operations.

Other commercial receivers adjacent to the works, such as the Howick Local Board office and Caci Pakuranga, have glazed facades that are expected to reduce noise levels by 20 to 30 dB. Noise effects from worst-case construction activities adjacent to these receivers can include loss of concentration, annoyance, and reduction in speech intelligibility. However, as with the residential dwellings adjacent to the works, the worst-case levels are predicted while works take place at the closest possible location at each receiver; in reality, noise levels will quickly reduce as the works progress and high noise generating activities are completed. Noise at this level can be tolerated for short durations provided that prior notification is given before high noise generating activities take place.

With effective mitigation in place, noise levels are predicted to comply with the 70 dB L_{Aeq} noise criterion at surrounding receivers for the majority of the construction works. Where the noise criteria are predicted to be exceeded, the effects will be mitigated and managed through the CNVMP.

9.1.2 Reeves Road Flyover Construction

Construction of the Reeves Road Flyover will involve use of the bored piling rig. Noise levels were predicted based on the piling rig operating at each pile location. Receivers where the modelling results indicated an exceedance of the daytime noise criteria are presented in Table 15.

Table 15 Piling noise modelling results

Address	Name	Use	Noise Level, dB L _{Aeq}
2r Ti Rakau Drive	The Warehouse	Commercial	86
11 Reeves Road	Bread of Life Christian Church	Commercial	80
13r Reeves Road	Te Tuhi	Commercial	78
3 Reeves Road	Gull	Commercial	74
2 Cortina Place	Pita House	Commercial	71

As shown in Table 15, exceedances of the noise criteria are predicted at 5 commercial receivers during use of the piling rig. Of these receivers, the most sensitive to noise are the Bread of Life Christian Church (during services and other occupied hours) and Te Tuhi.

During consultation, it was identified that the façade of Te Tuhi would only provide an estimated reduction of approximately 15 dB at the lobby/café area, due to the construction of the façade at the café and windows being left open for ventilation along the side of the lobby facing Reeves Road. Concerns around noise were also raised by Te Tuhi around the social room at the south-western corner of the building facing Reeves Road (where tai chi and yoga classes are occasionally held), and the offices at the north-western side of the building facing Reeves Road. Te Tuhi also flagged exhibitions coming up that will incorporate sound, for which they would require advanced notice of any noisy works.

Construction works must be mitigated and managed through the CNVMP at both the Bread of Life Christian Church and Te Tuhi.

9.1.3 EB3R

High noise-generating activities may not occur on the edges of the construction area modelled, but if they do, 2 commercial and 61 residential receivers could experience intermittent noise levels above 70 dB L_{Aeq} during a worst-case scenario, i.e. when the concrete saw is in use with noise barriers placed around the working site while in use at the edge of the construction boundary. At this level, effects could include loss of concentration, annoyance, and reduction in speech intelligibility inside dwellings.

However, as noted above, this does not represent a typical scenario. During a typical scenario, i.e. use of the excavator with noise barriers around construction sites, 1 commercial and 38 residential receivers could experience intermittent noise levels above the daytime noise criterion of 70 dB L_{Aeq}. We note that these levels are predicted while works take place at the closest possible location at each receiver; in reality, noise levels will quickly reduce as the works progress and high noise generating activities are completed. Noise at this level can be tolerated provided that prior notification is given before high noise generating activities take place.

Appendix D sets out the noise levels predicted at receivers during both worst-case works and typical construction works. Effects at different noise levels are set out in Table 12.

There are a number of residential receivers along the EB3R route that are two or more storeys in height; noise barriers will provide little to no attenuation of noise at the upper levels of these properties. Therefore, construction noise effects must be managed at these properties through communication and consultation, including scheduling of noisy activities while buildings nearby are unoccupied.

With effective mitigation in place, noise levels are predicted to comply with the 70 dB L_{Aeq} noise criterion at surrounding receivers for the majority of the construction works. Where the noise criteria are predicted to be exceeded, the effects will be mitigated and managed through the CNVMP.

9.1.4 Night works

Night works anticipated during the EB2 and EB3R construction works are summarised in Section 5.3.

Noise predictions have been undertaken for works where sufficient detail was provided by the EBA construction team.

For the night-time vegetation clearance and pavement works, the noise predictions included a duration correction of 25% for use of the chainsaw and concrete saw respectively. For the night-time RRF works, a duration correction was not applied to the predicted noise levels. The predictions include noise barriers during use of the chainsaw and concrete saw but are not included during concrete pours due to practicability issues as indicated by the EBA construction team.

In summary, the night-time noise criteria are predicted to be exceeded at:

- 162 residential properties in EB2 during night-time RRF construction works
- 125 residential properties in EB2 and 164 residential properties in EB3R during night-time vegetation clearance works
- 127 residential properties in EB2 and 16 residential properties in EB3R during night-time pavement works.

The results of the predictions are summarised in Appendix D.

Relocation of existing houses will also be undertaken during the night-time. This activity involves a truck being loaded with the house to be relocated. The main noise source during this activity will be the truck engine. As the truck will need to enter private land, it cannot be counted as an activity taking place within the road corridor and must be assessed alongside the other night-time activities. However, we consider a truck engine to be a noise source that is regularly heard on roads during the night-time (unlike sources for the other night-time works). We understand that house removals typically only occur during the night-time in Auckland. Moreover, this is an activity that will progress along the entire EB2/EB3R alignment within only two weeks. Therefore, we consider noise from this activity to be acceptable.

Although exceedances of the night-time noise criteria are predicted, the location, duration and management of the works must also be considered when assessing noise effects.

All the predictions assume that the works are taking place at the closest possible location within the site footprint for each receiver. In reality, noise levels will reduce as the works progress.

The predictions are taken along the façade that is closest to the works. However, some parts of a given house will be less sensitive to noise than others, for example, garages fronting towards the road, and unoccupied living rooms.

Predictions are for noise on the external façade of the building since this is where the night-time noise criteria are applicable. However, it is internal noise that will be of most concern to residents during the night-time. The extent of the reduction of noise from outside to inside will depend on a range of factors, including the construction of the façade, the amount of glazing, and whether windows are left open or shut.

Possible effects that may arise from night works include disturbance, annoyance, and disruption of sleep. The extent of adverse effects will depend on the proximity of the works to each receiver on the night, the scheduling and duration of the works, and the plant items used on the night.

Careful scheduling of activities will be important to minimise noise effects at residential receivers during the night-time period. If noisy activities must take place during the night-time, if screening does not provide sufficient attenuation to meet the night-time noise criteria, and no other mitigation measures are practicable, it may be necessary to offer temporary relocation to affected residents. Temporary relocation should be considered on a case-by-case basis and as a last resort.

We note that the predictions that have been carried out for the worst-case night works are in terms of the L_{Aeq} noise descriptor, which effectively quantifies the average noise received in a given time period. For typical works during the night-time, it is more likely that residents will be disturbed by short-term peaks in noise from site, for example an excavator striking the ground, or metal being dropped from a height. Noise of this type is dependent on factors that are difficult to predict like the specific activity at the time and the way that equipment is operated. It is therefore important that the noise management measures around site operations set out in the CNVMP are followed by all staff working during the night-time.

As set out in Section 8.7, Schedules for the night works should be prepared prior to the start of the night works.

Night works have the potential to create significant noise effects if not managed appropriately, therefore they must be mitigated and managed through the CNVMP and Schedules.

9.2 Predicted construction vibration levels and effects

Maps showing the predicted vibration emission contours during the worst-case daytime and night-time activities are provided in Appendix F. The activities modelled were:

- Use of 12T vibratory roller at the edge of the construction footprint during the daytime
- Use of 7T vibratory roller for the night-time pavement works

The construction footprint provided indicates that daytime construction activities will take place within 2m of commercial and residential structures for both EB2 and EB3R.

Use of the 7T vibratory roller is expected within 19m of residential receivers for EB2 and will not be used in the EB3R area. In line with this, no predictions of the night-time Category B criterion are predicted at any residential receivers.

At a minimum, we recommend that a pre-construction building condition survey be carried out at all receivers where the Category B vibration criteria are predicted to be exceeded. This has been addressed in the proposed conditions of consent.

A list of receivers where either the Category A or B criteria are predicted to be exceeded during daytime and night-time works is provided in Appendix E.

9.2.1 EB2

32 residential dwellings may experience vibration levels above the Category B vibration criteria if the roller compactor is used on the construction boundary in the closest position. Once the compactor is 8m away from the dwellings the Category B criterion will be met.

13 commercial buildings may experience vibration levels above 20 mm/s PPV, exceeding the DIN 4150 commercial building criterion if the roller compactor is used within 2m of the building.

9.2.2 EB3R

49 residential dwellings may experience vibration levels above the Category B vibration criteria if the roller compactor is used on the construction boundary in the closest position. Once the compactor is 8m away from the dwellings the Category B criterion will be met.

1 commercial building (Edgewater Shopping Centre) may experience vibration levels above 20 mm/s PPV, exceeding the DIN 4150 commercial building criterion if the roller compactor is used within 2m of the building .

9.2.3 Vibration amenity

The daytime vibration amenity criteria could be exceeded in buildings that are occupied during the works and are within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 10. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from an excavator which could rattle crockery and glassware.

As per section 3.2.1, the AUP (OP) states that works generating vibration for three days or less between the hours of 7am to 6pm may exceed the amenity limits, but prior notice must be given at least three days in advance, and the vibration must comply with the limit of 5 mm/s. This is set out in the draft CNVMP.

During the night-time pavement works, the night-time 0.3 mm/s amenity criteria may be exceeded at 30 residential properties during use of the 7T roller. Maps showing the vibration emission contours for night-time works are provided in Appendix F.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance.

The measures set out in the draft CNVMP must be implemented for the duration of the works to mitigate and manage effects from construction vibration.

10 Conclusions

Construction noise and vibration has been assessed for EB2 and EB3R in accordance with the requirements of the AUP and NZS 6803:1999.

Construction noise during the daytime is predicted to exceed the applicable criteria at a number of receivers along the EB2/EB3R alignment if high noise generating equipment (e.g. concrete saw) is used in the closest position to the receivers, even if mitigation measures are put in place. Should these exceedances occur, they will be intermittent and over a limited duration. The effects from these exceedances have been discussed in Section 9.1. Construction noise during the daytime is predicted to comply with the relevant criteria at surrounding receivers for the majority of the works. Where the noise criteria are predicted to be exceeded, effects will be managed through the mitigation and management measures set out in the CNVMP.

Construction noise during the night-time is predicted to exceed the relevant criteria at a number of properties. The extent of noise effects will be dependent on the location, duration and type of works taking place, as well as the construction of the affected buildings and locations of receivers within the buildings. Night-time works must be mitigated and managed appropriately through the CNVMP. Schedules should be prepared prior to the start of the night works.

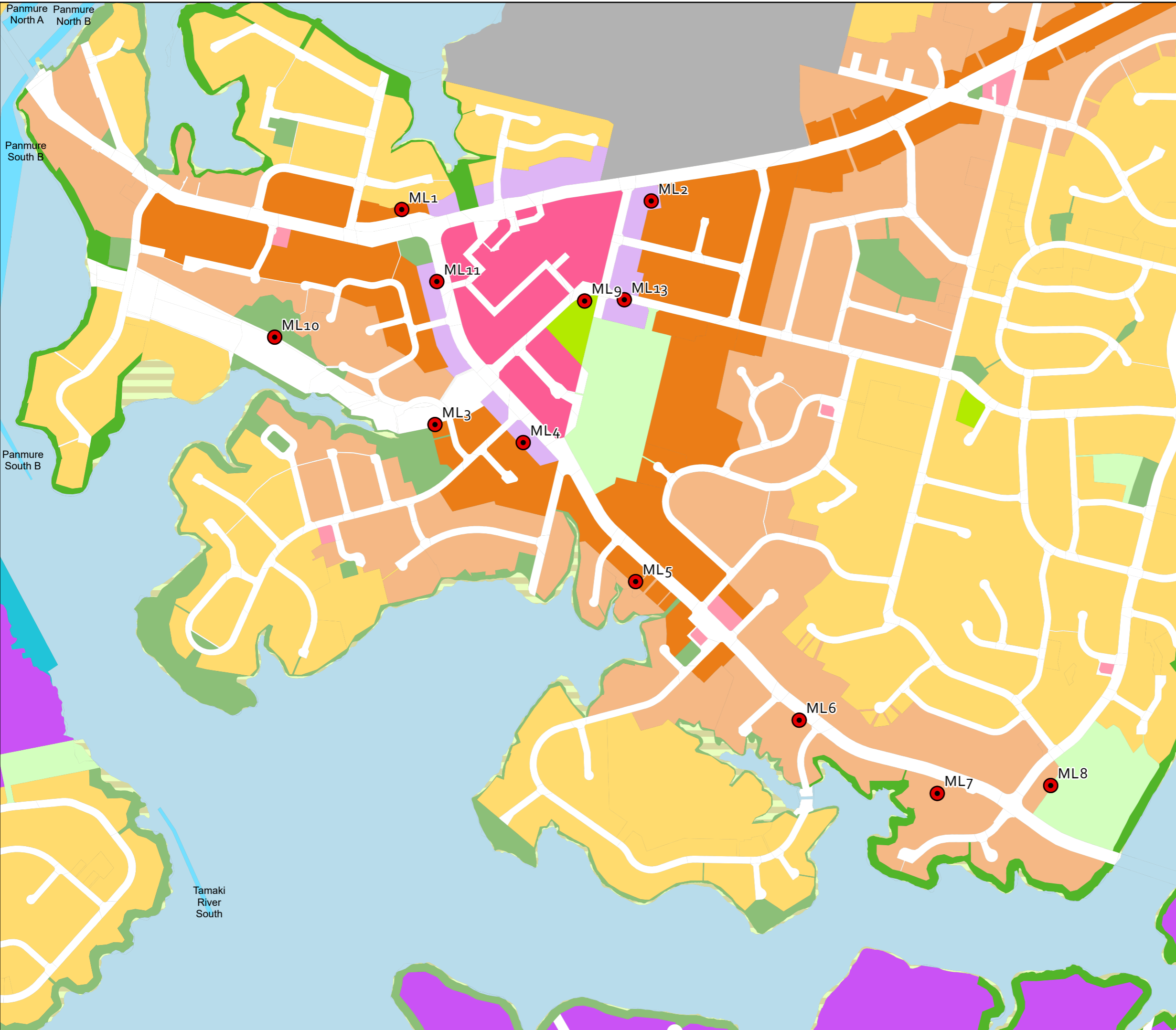
Construction vibration is predicted to exceed the DIN 4150 criteria at a number of commercial and residential buildings around EB2/EB3R if high vibration generating equipment is used on the construction boundary in the closest position to the receivers.

The daytime vibration amenity criterion is predicted to be exceeded at a number of buildings if high vibration generating equipment is used on the construction boundary in the closest position to the receivers and if they are occupied during the works. Use of the vibratory roller during the night-time is predicted to generate vibration that may exceed the night-time amenity criterion. Effects from these potential exceedances have been discussed in Section 9.2; vibration amenity effects must be managed through communication with affected stakeholders.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 8, to generally comply with the applicable limits as defined in the AUP. Where an exceedance is predicted at any receiver the effects will be mitigated and managed through a CNVMP.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers so that the BPO is implemented throughout the duration of construction.

Appendix A – AUP Zoning



- ### 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

Measurement Locations




Service Layer Credits: newzealand: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Map Creation Date: 3/8/2022
 Author:

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Appendix B – Noise Monitoring Forms

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

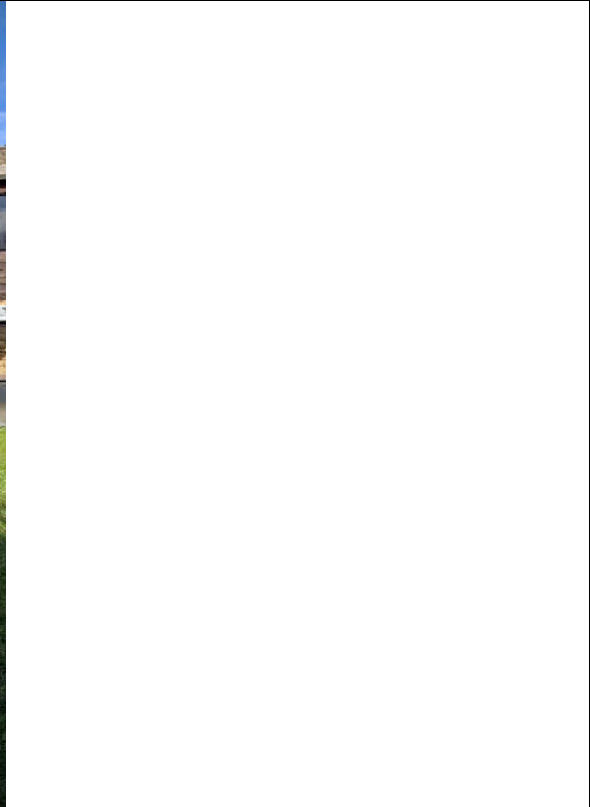


Photo B: Photo of the road surface




Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise

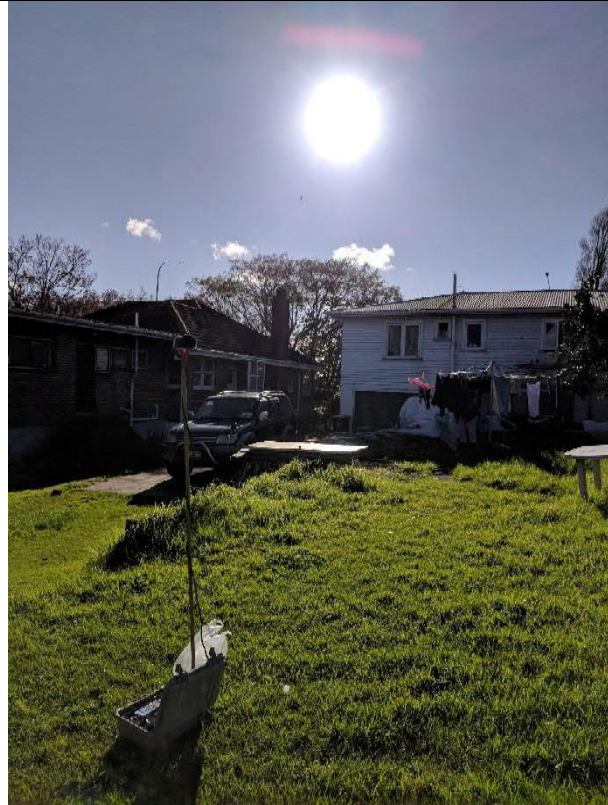


Photo A: View toward the source

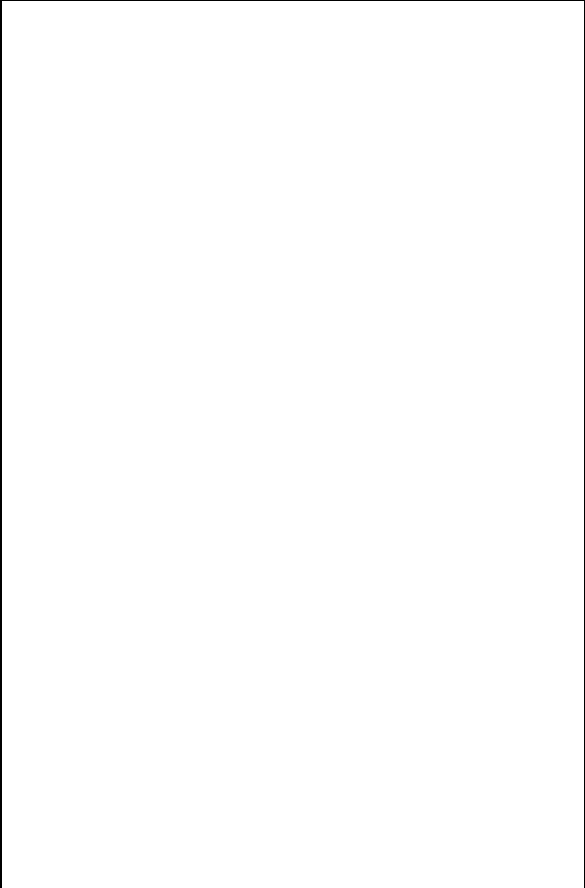


Photo B: Photo of the road surface



Photo C: Photo of the SLM (angle 1)

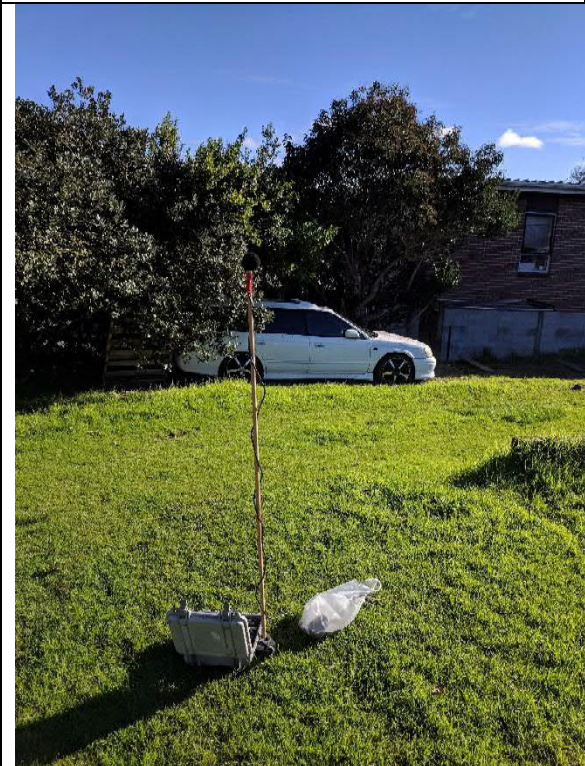



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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 Address	X	-36.916068	Y 174.869720
12 Bolina Cres, Pakuranga, 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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

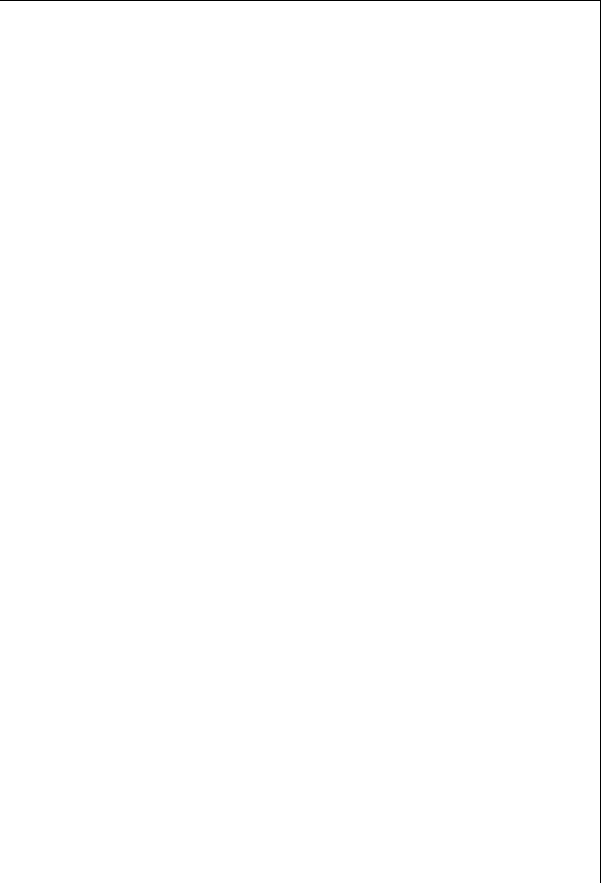


Photo B: Photo of the road surface




Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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 Address	X	-36.545894	Y 174.5218109
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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

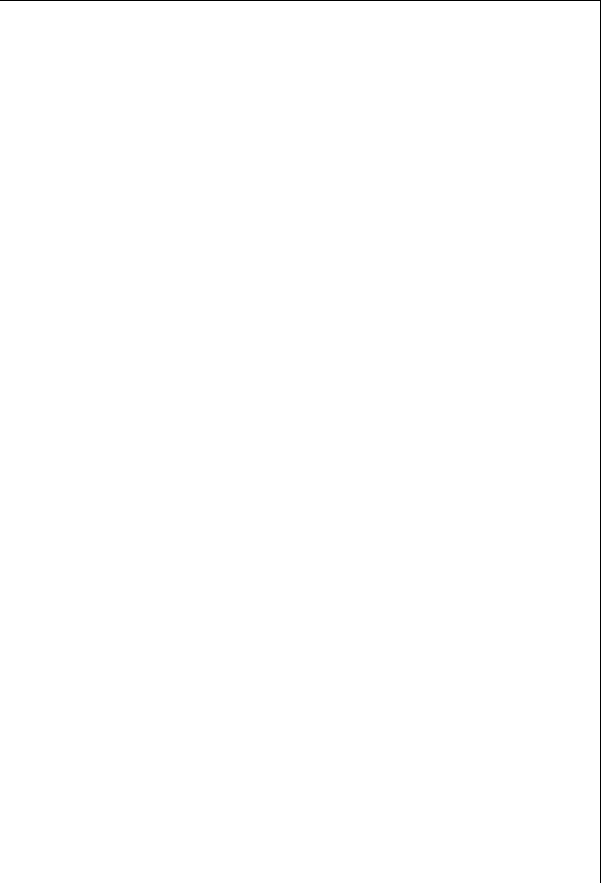


Photo B: Photo of the road surface





Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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 <input checked="" type="checkbox"/>		NZTA Road Noise
Are you more than 10m from an existing road kerb?	Yes <input checked="" type="checkbox"/>		No
Away from trees	Yes <input checked="" type="checkbox"/>		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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

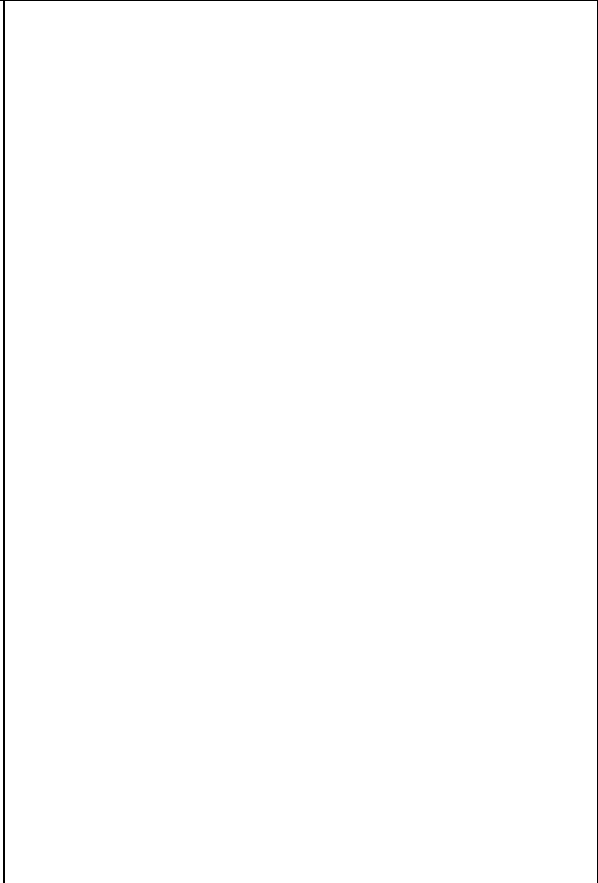


Photo B: Photo of the road surface





Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

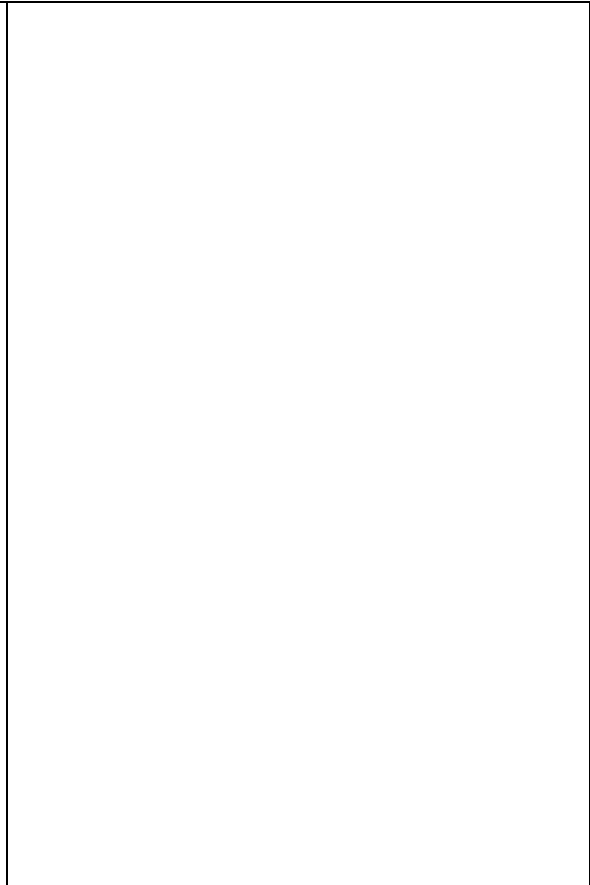


Photo B: Photo of the road surface


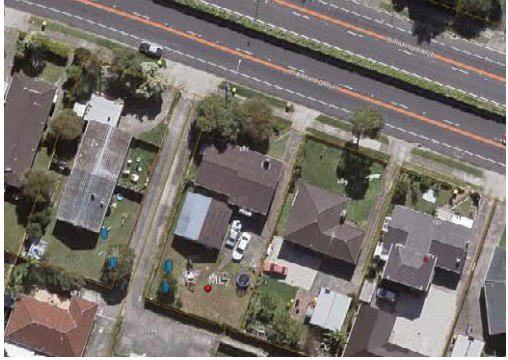


Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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 Address	X	-36.5525079	Y 174.528030
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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

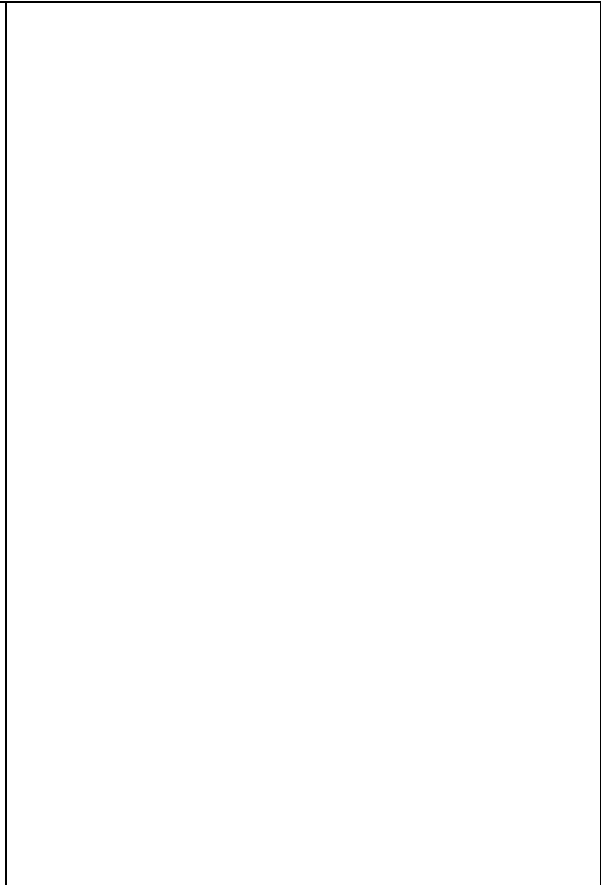


Photo B: Photo of the road surface





Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

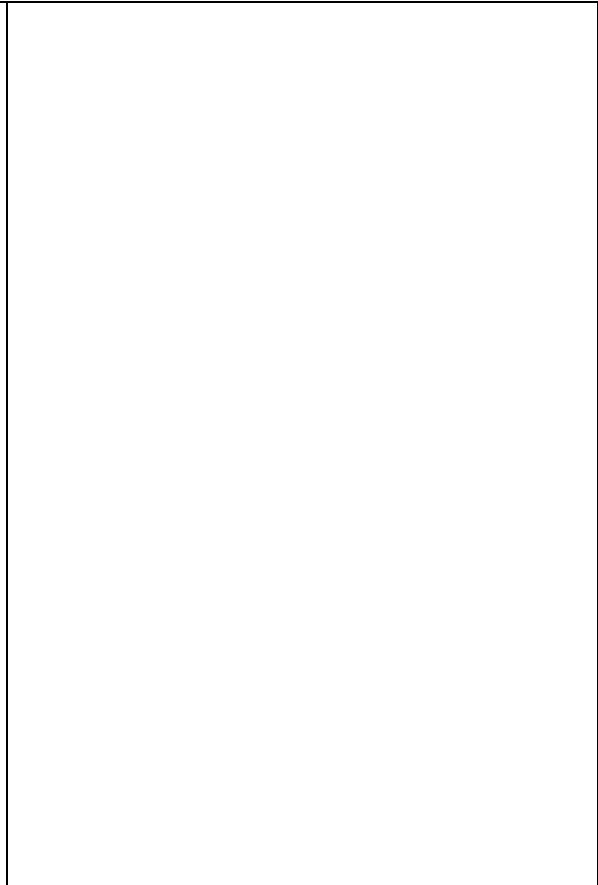


Photo B: Photo of the road surface

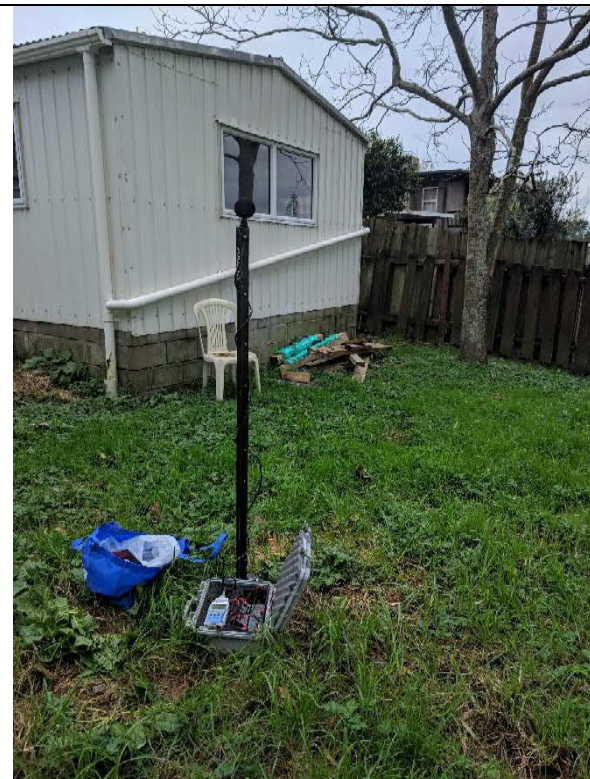


Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

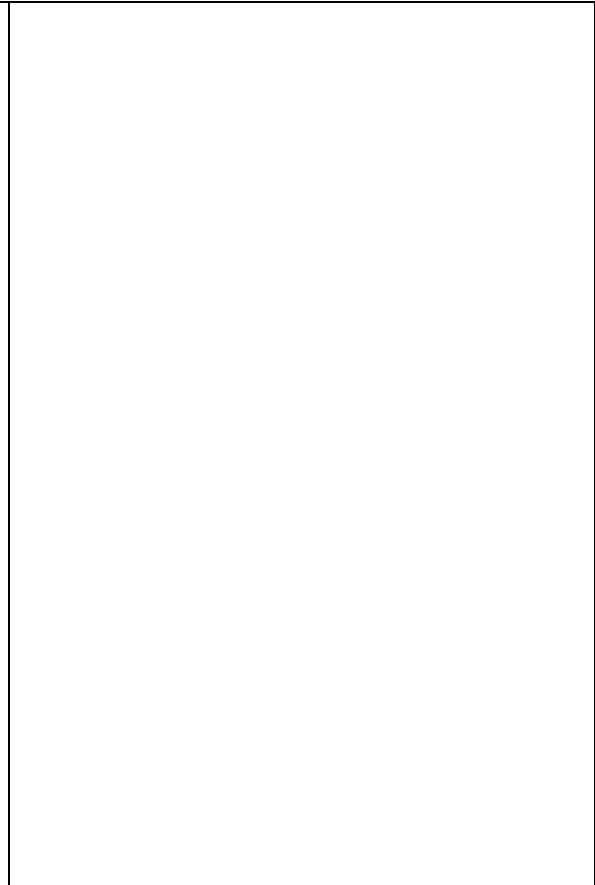


Photo B: Photo of the road surface

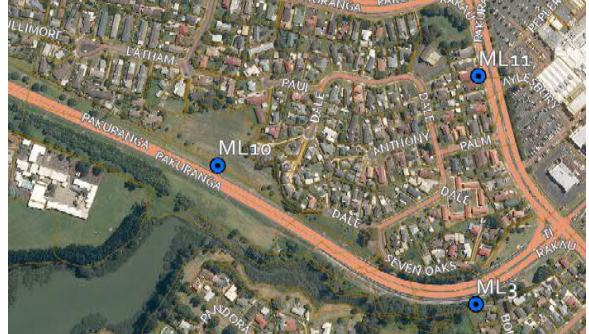



Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source

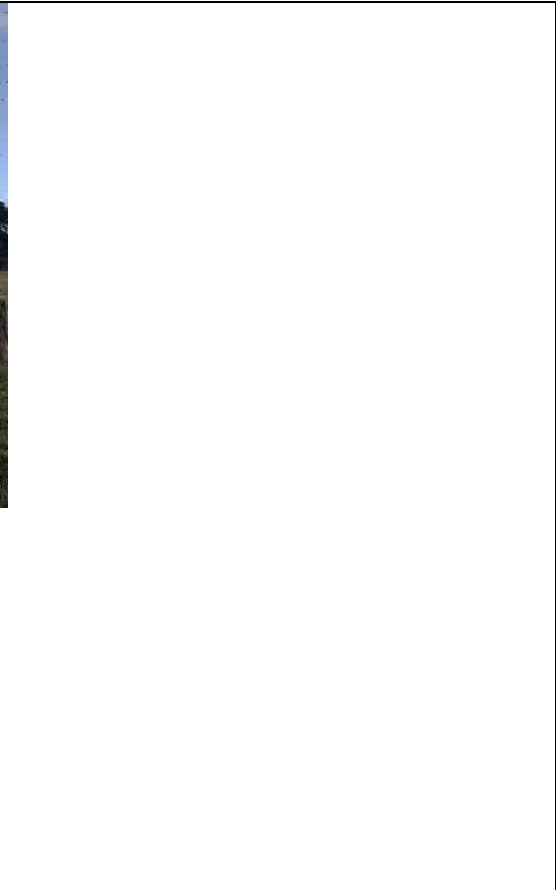


Photo B: Photo of the road surface


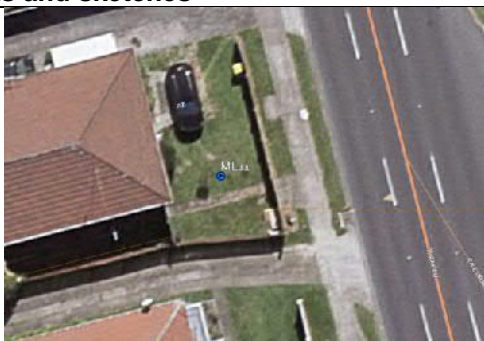


Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise

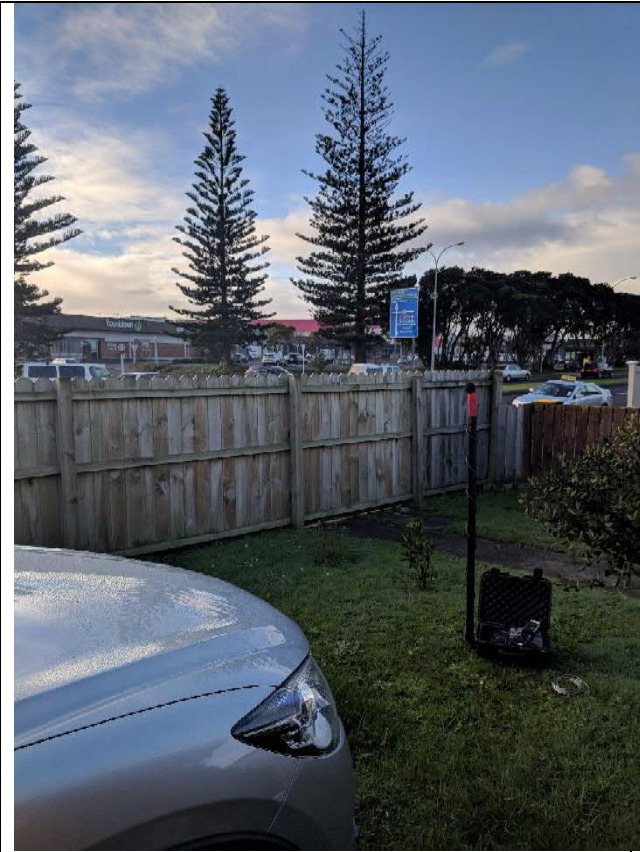


Photo A: View toward the source

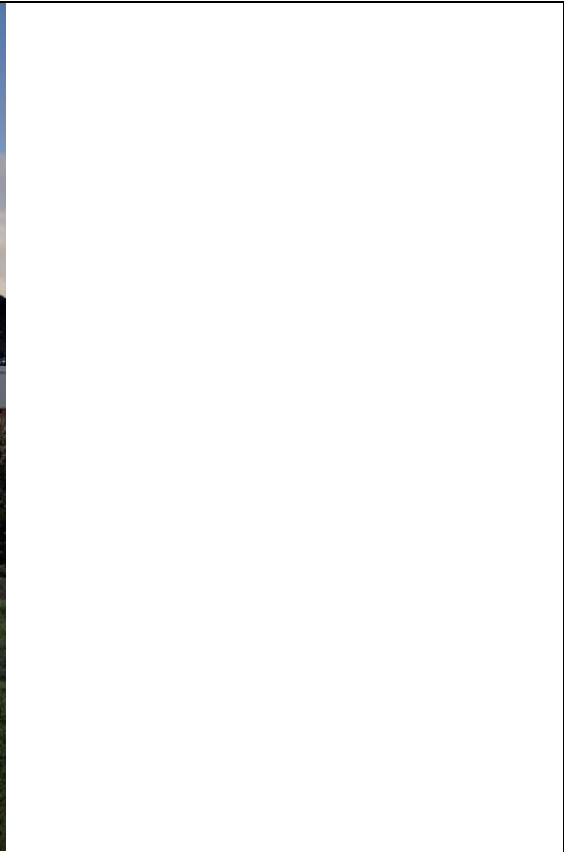


Photo B: Photo of the road surface

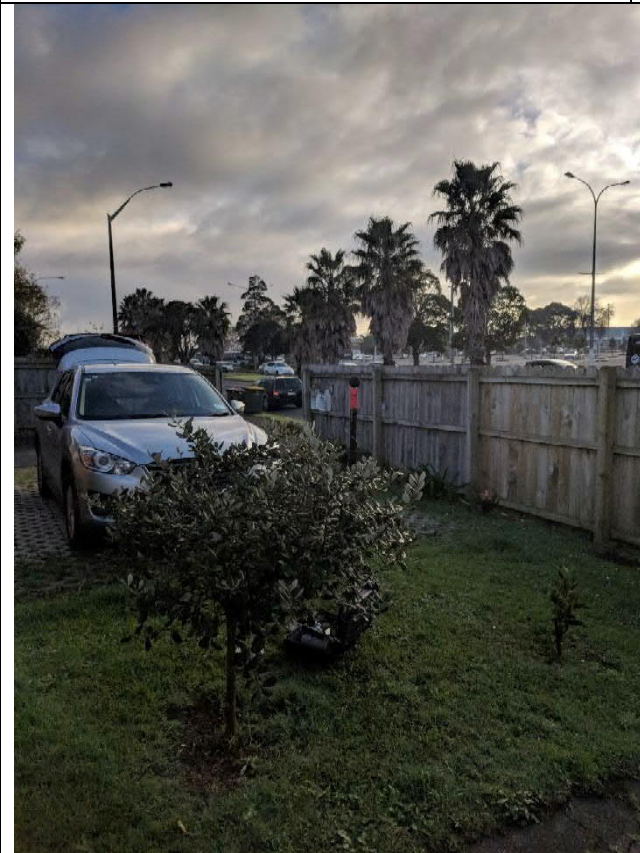




Photo C: Photo of the SLM (angle 1)



Photo C: Photo of the SLM (angle 2)

Environmental Noise Survey – Road Traffic Noise

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			
			

Environmental Noise Survey – Road Traffic Noise



Photo A: View toward the source



Photo B: Photo of the road surface



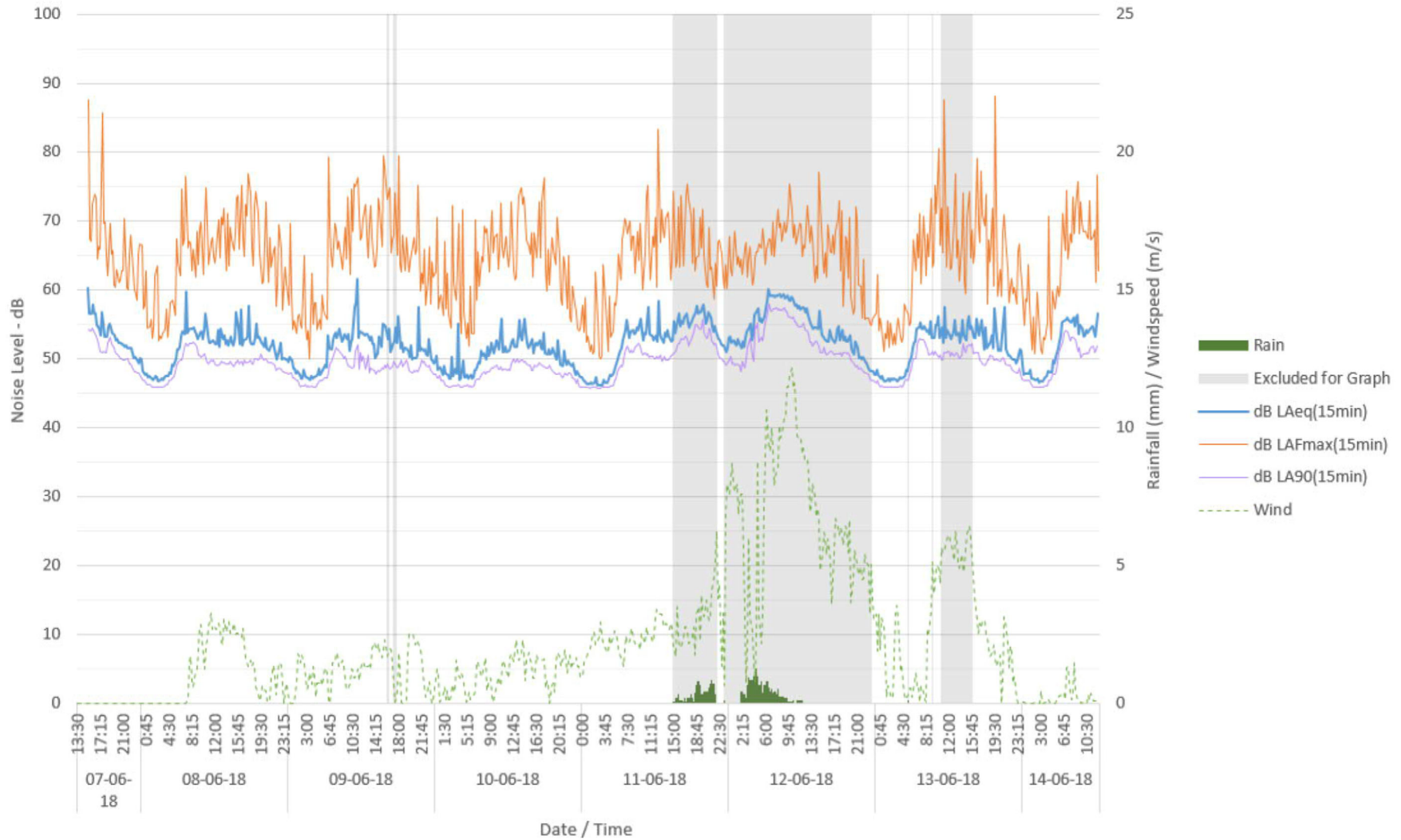
Photo C: Photo of the SLM (angle 1)



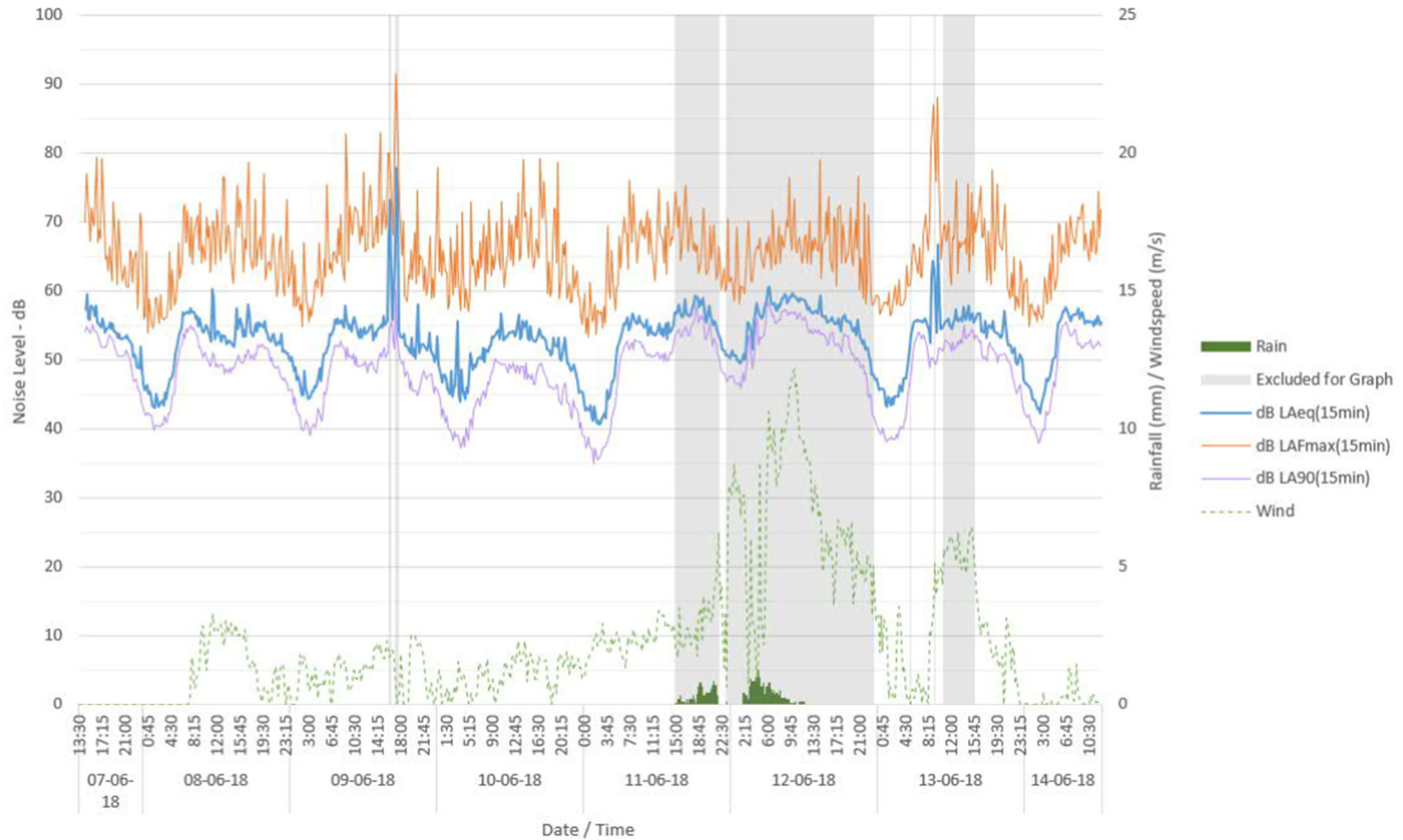
Photo C: Photo of the SLM (angle 2)

Appendix C – Noise Monitoring Results

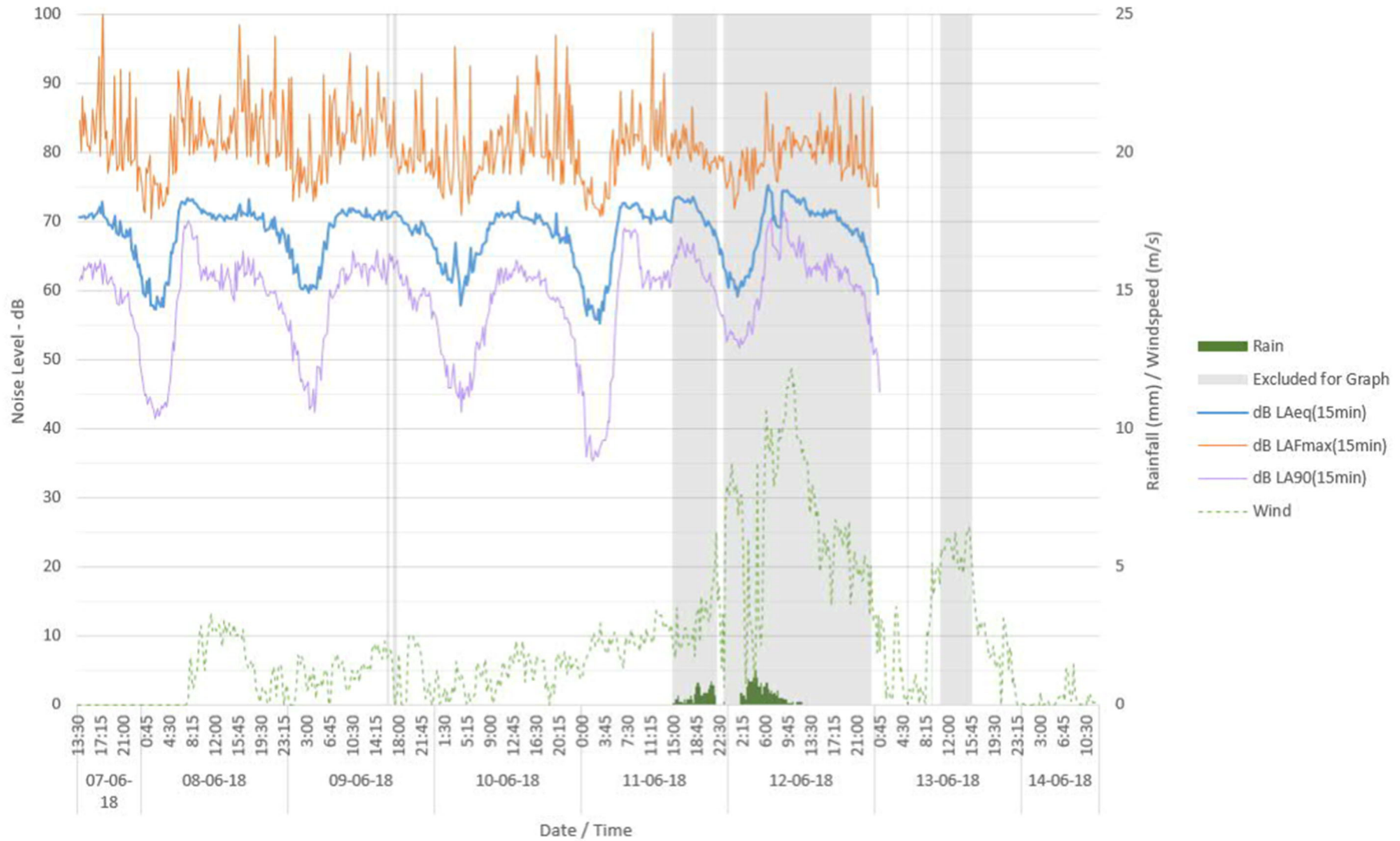
ML1 - 80 Pakuranga Road



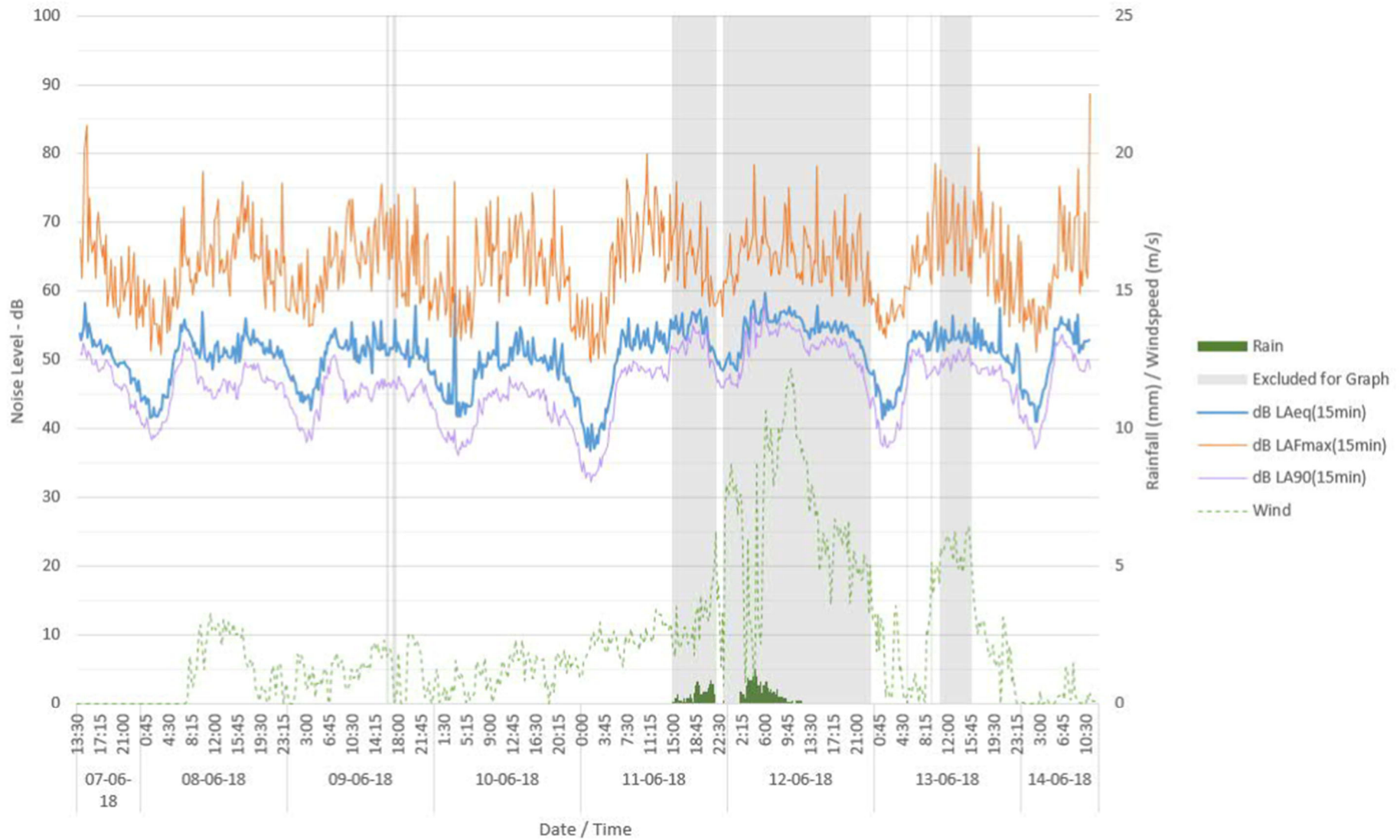
ML2 - 179 Pakuranga Road



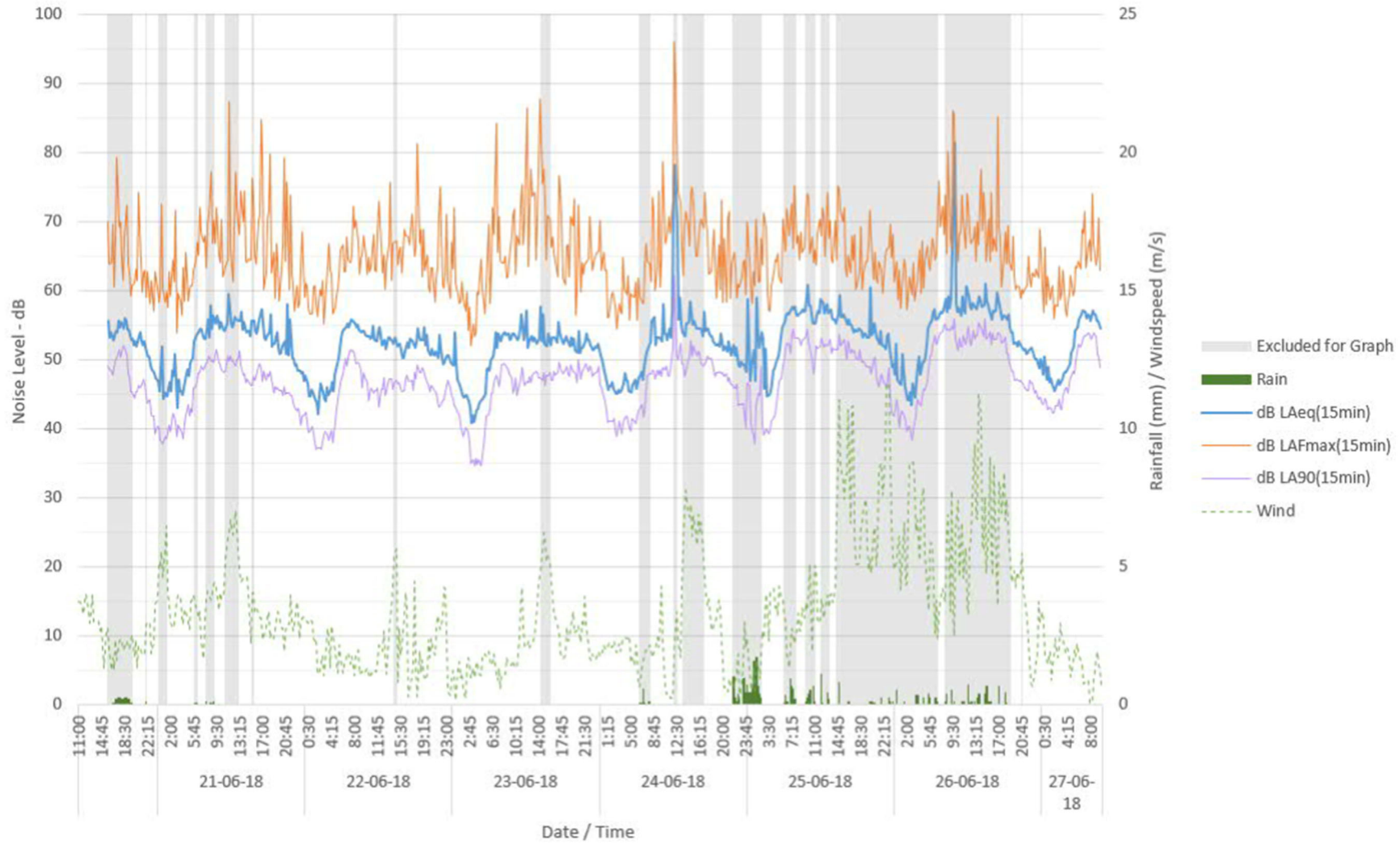
ML3 - 12 Bolina Crescent



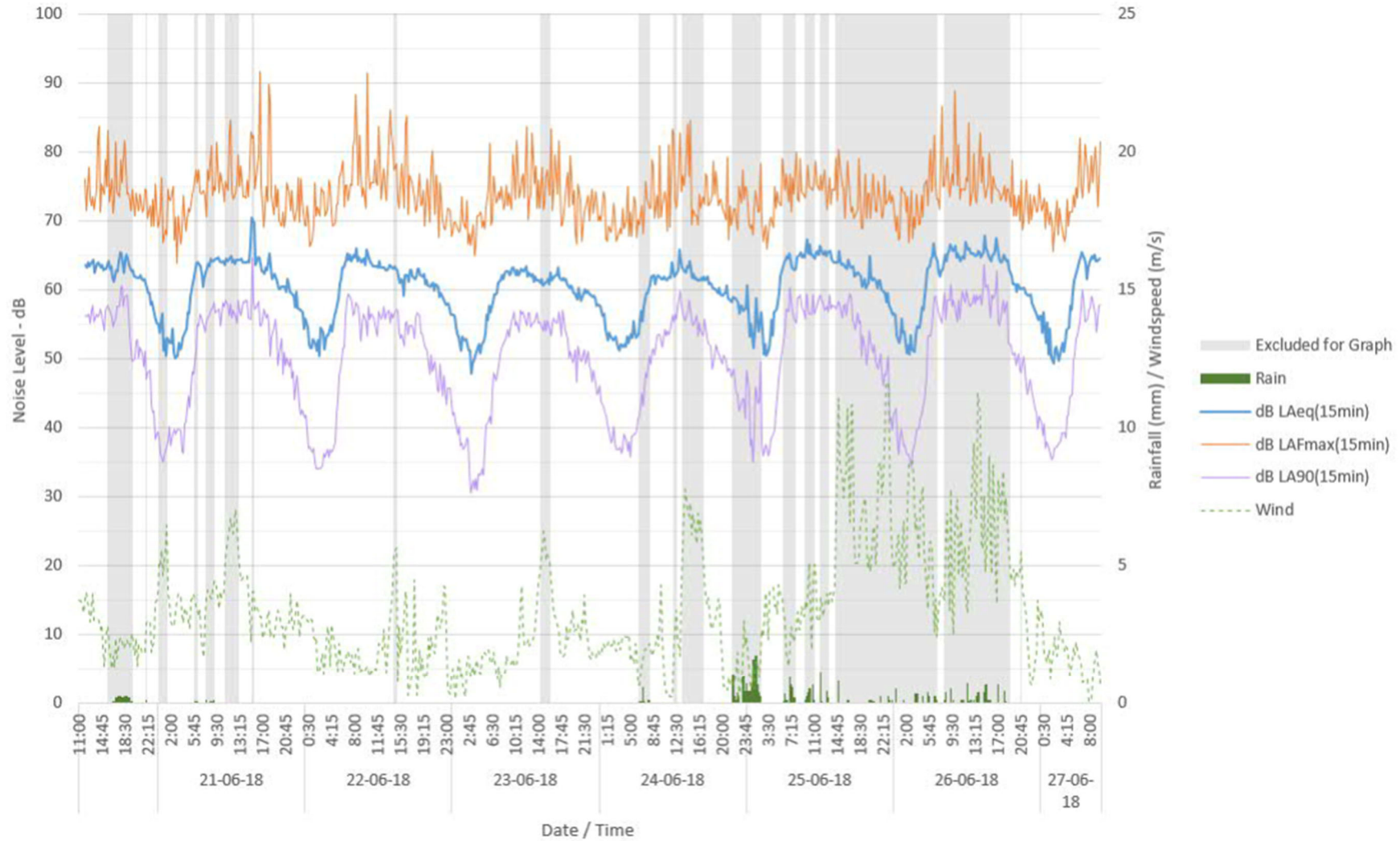
ML4 - 41 Ti Rakau Drive



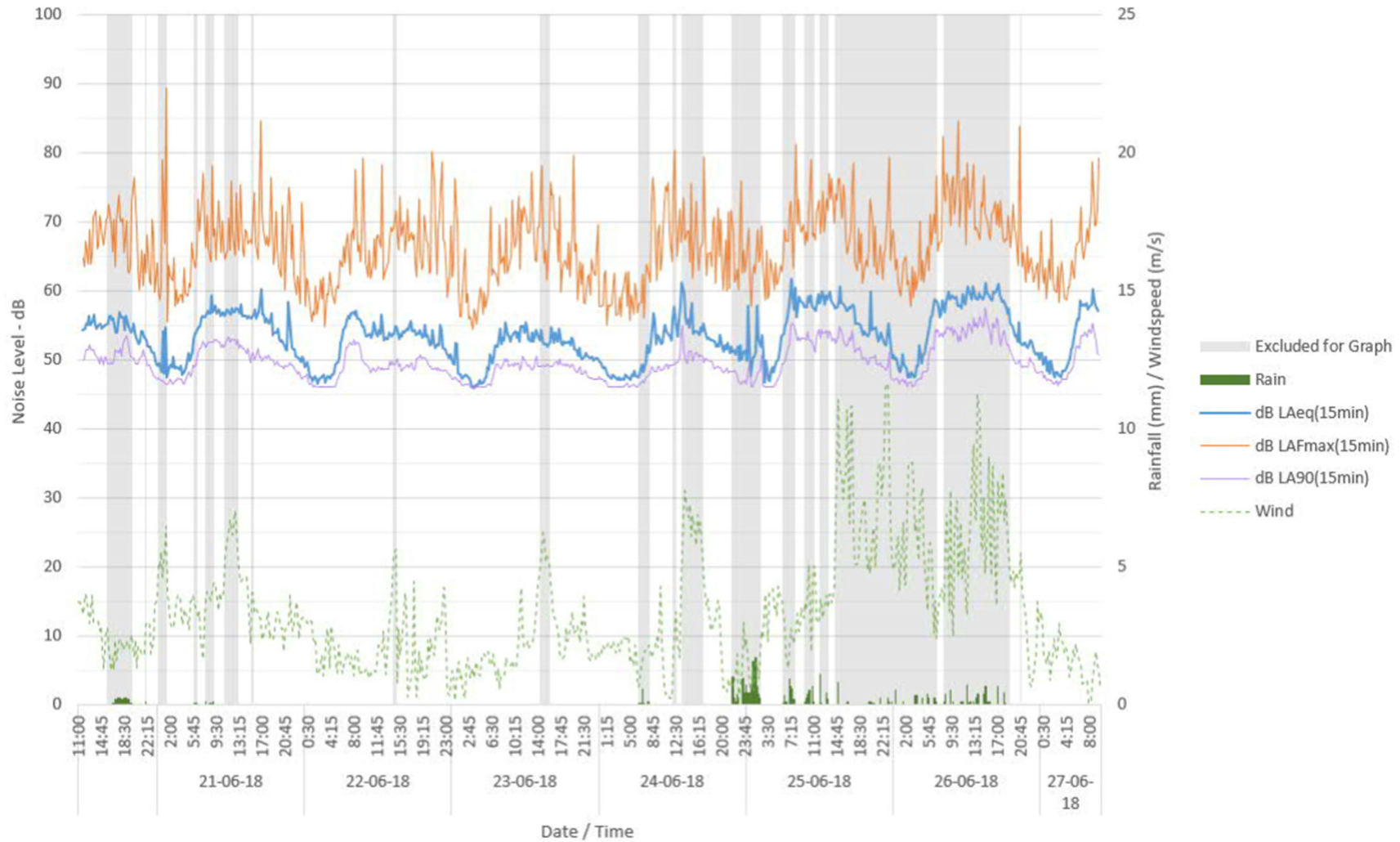
ML5 - 81 Ti Rakau Drive



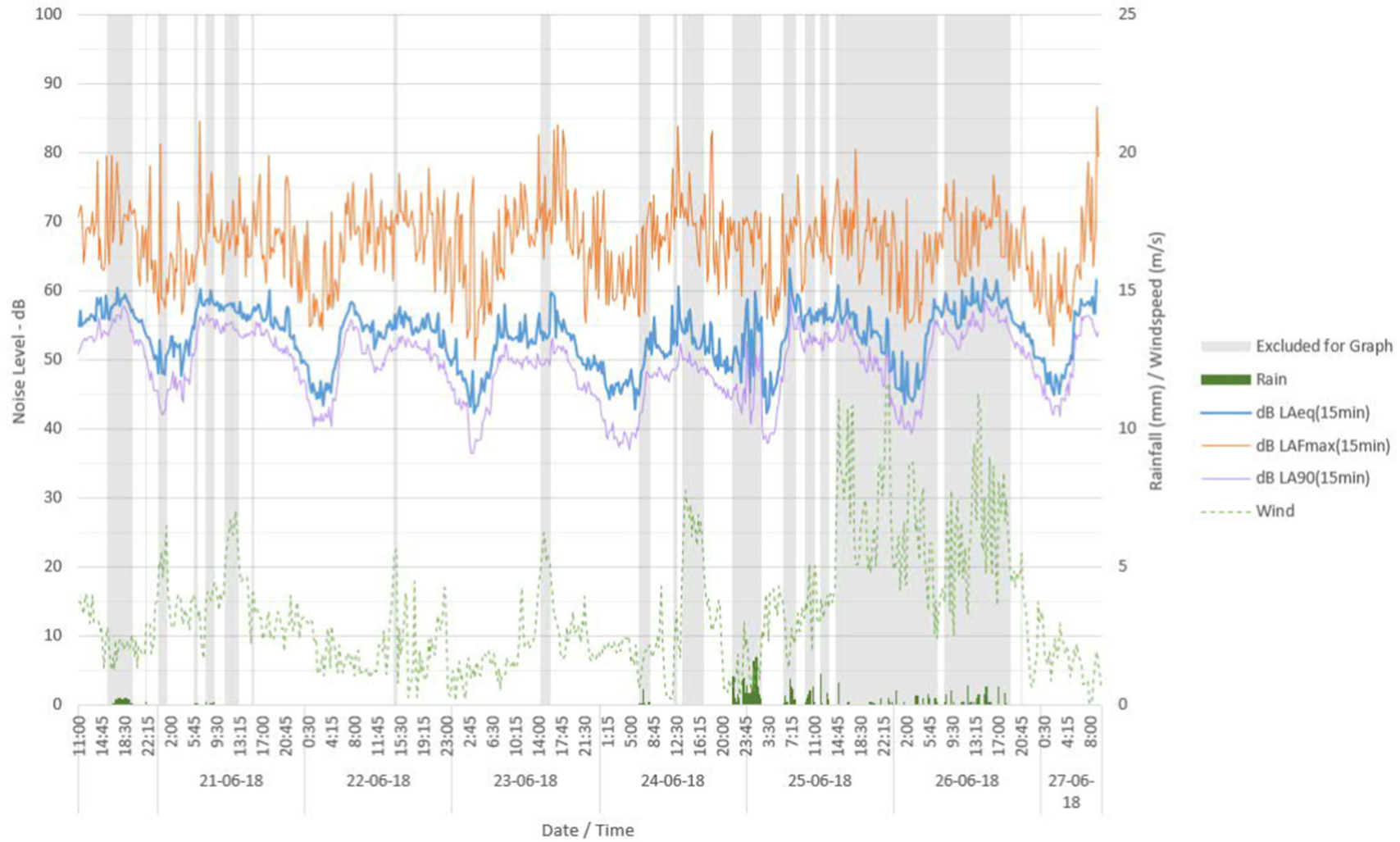
ML6 - 143 Ti Rakau Drive



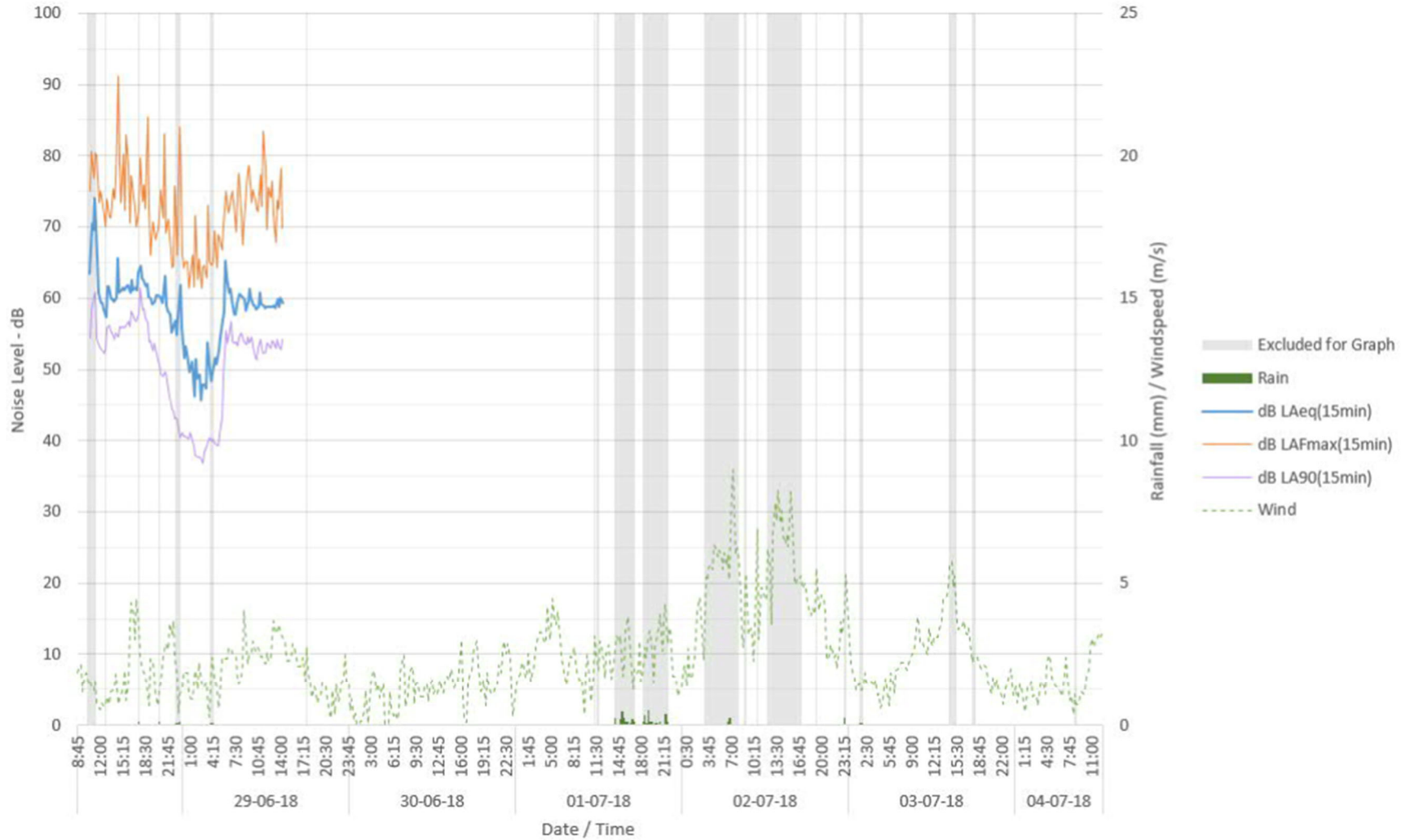
ML7 - 187 Ti Rakau Drive



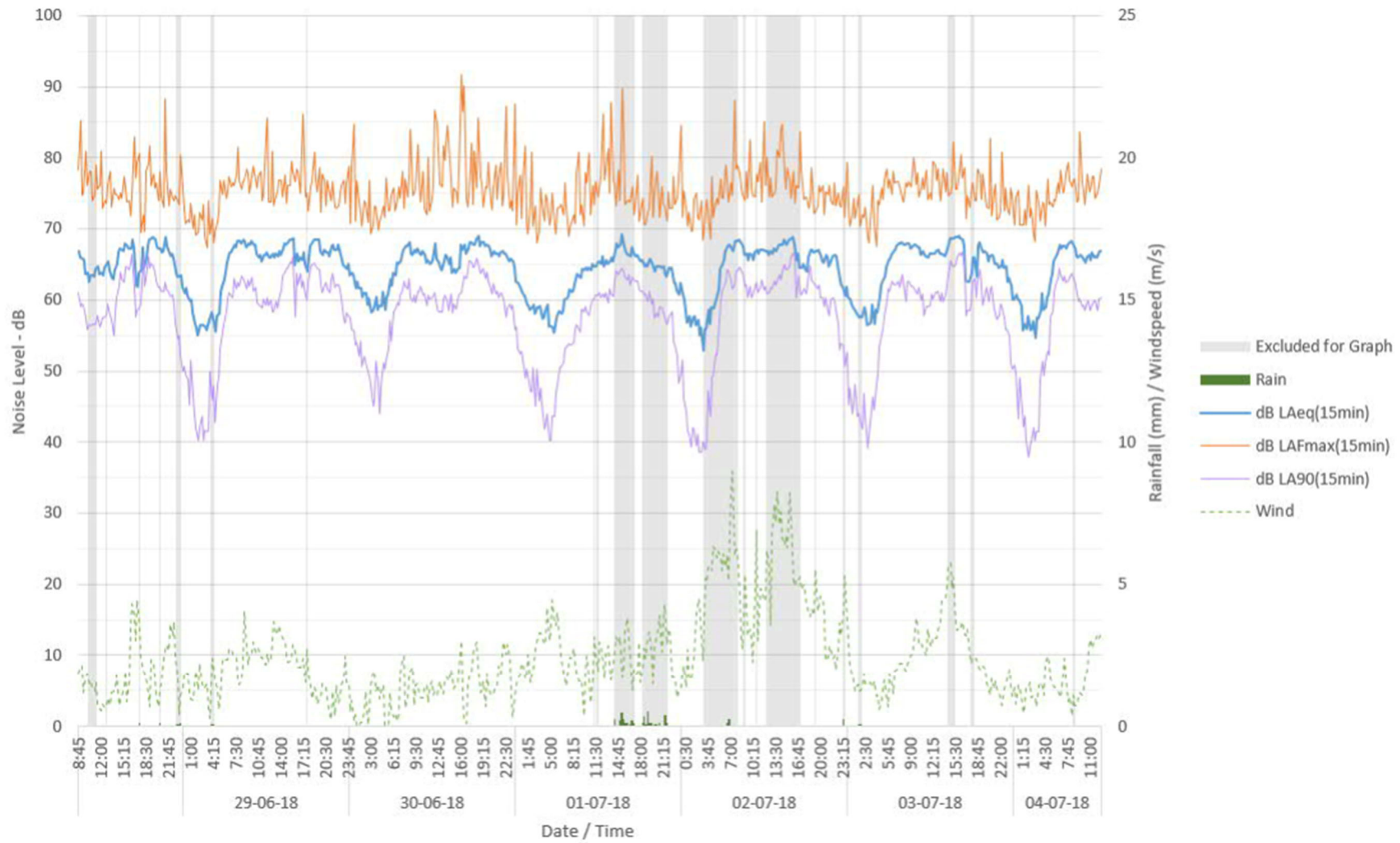
ML8 - 174 Gossamer Drive



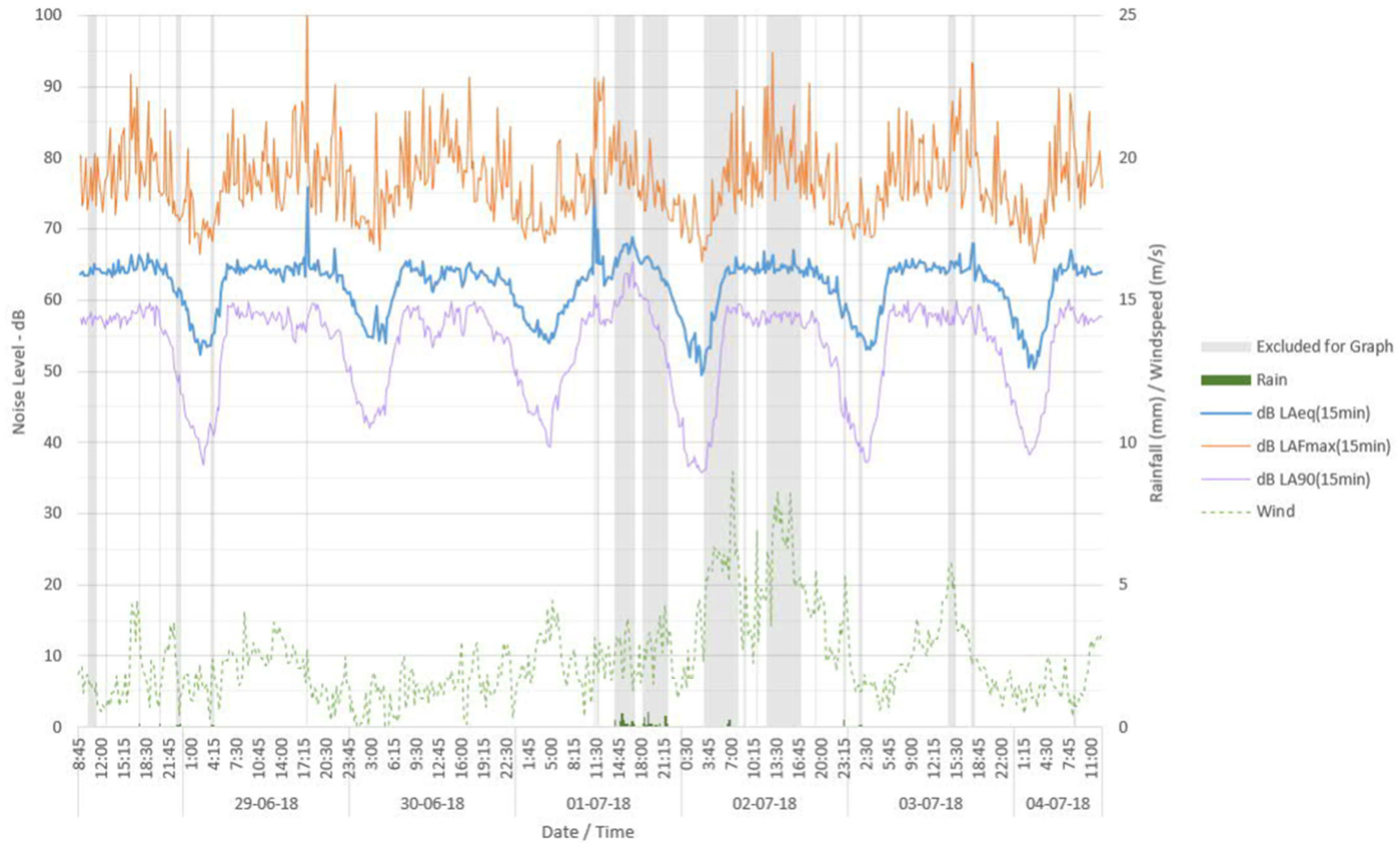
ML9 - 13 Reeves Road



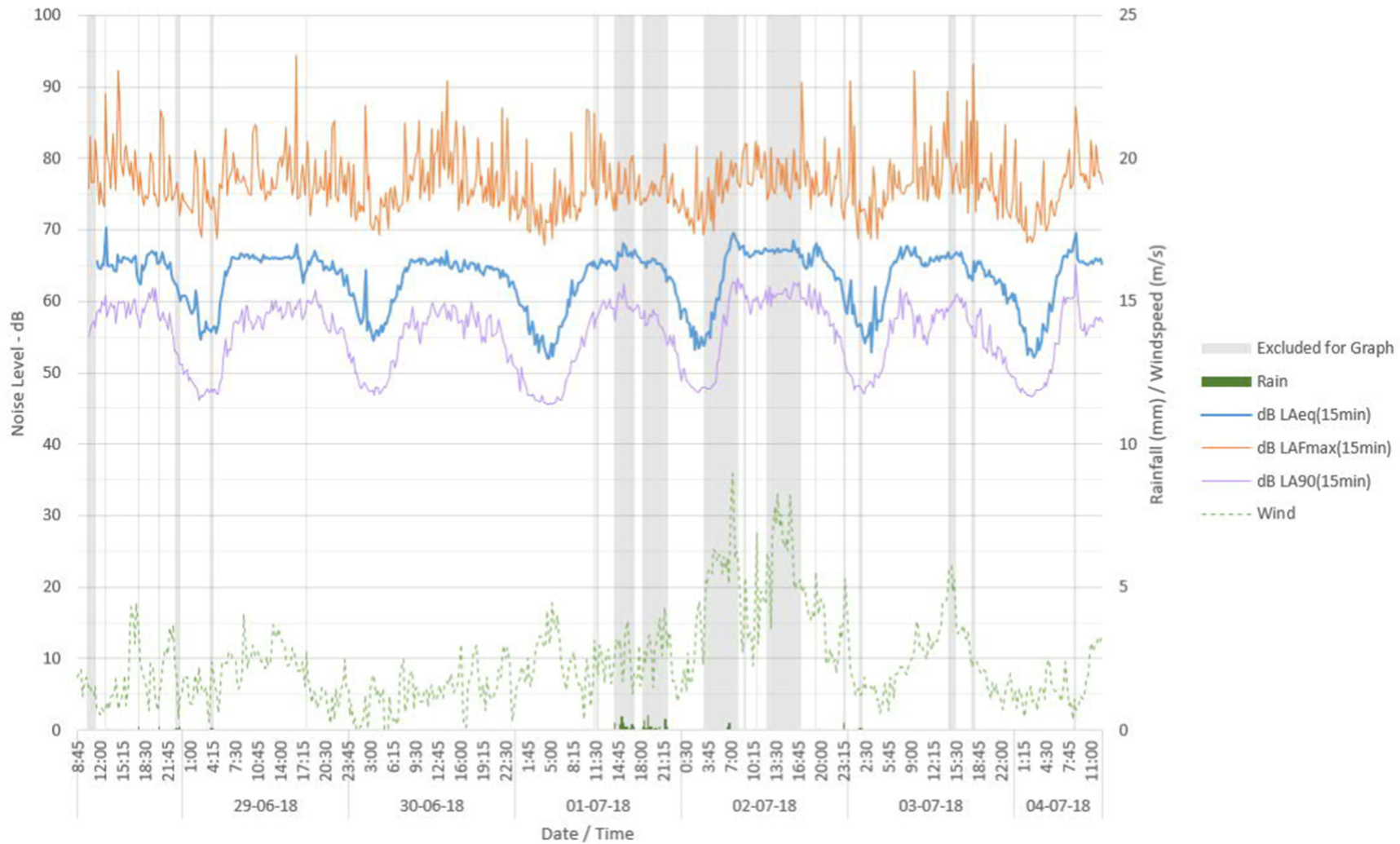
ML10 - Park



ML11 - 7 Ti Rakau Drive



ML12 - 76 Tiger Drive



ML13 - 17 Reeves Road



Appendix D – Noise Predictions

EB2			
Address	Building Use	Noise Level, dB LAeq	
		Worst Case Scenario (Concrete Saw, 30% On-Time, With Mitigation)	Typical Scenario (Excavator, With Mitigation)
141 Pakuranga Road	Commercial	>90	>90
2r Ti Rakau Drive	Commercial	>90	>90
11 Cortina Place	Commercial	>90	>90
11 Reeves Road	Commercial	>90	88
5 Reeves Road	Commercial	>90	87
23b Dale Crescent	Residential	>90	87
1-2/17 Ti Rakau Drive	Residential	89	86
10 7 Aylesbury Street	Commercial	89	86
1/15,15 Ti Rakau Drive	Residential	89	86
1/9 Cortina Place	Commercial	89	86
7a Cortina Place	Commercial	89	86
10 Aylesbury Street	Commercial	88	85
10-14 Cortina Place	Commercial	86	83
1-2/5 Ti Rakau Drive	Residential	81	78
1-2/13 Ti Rakau Drive	Residential	81	77
1-2/92 Pakuranga Road	Residential	80	77
126 Pakuranga Road	Commercial	80	77
120 Pakuranga Road	Commercial	79	76
100 Pakuranga Road	Residential	79	76
3 Reeves Road	Commercial	79	76
21 Dale Crescent	Residential	78	75
3 Ti Rakau Drive	Residential	78	75
1-2/7 Ti Rakau Drive	Residential	78	75
94 Pakuranga Road	Residential	78	75
116b Pakuranga Road	Residential	78	75
2/23 Ti Rakau Drive	Residential	78	74
13r Reeves Road	Commercial	78	74
1/11,11 Ti Rakau Drive	Residential	77	74
12,12a William Roberts Road	Residential	77	74
18a William Roberts Road	Residential	77	74
1/9,9 Ti Rakau Drive	Residential	77	74
106 Pakuranga Road	Residential	77	73
1-2/90 Pakuranga Road	Residential	77	73
1/14 William Roberts Road	Residential	76	73
24 William Roberts Road	Residential	76	73
1/19,19 Ti Rakau Drive	Residential	76	73
64 Dale Crescent	Residential	76	73
24r William Roberts Road	Residential	76	73
7 Cortina Place	Commercial	75	72
2 Dale Crescent	Residential	75	72
15 Reeves Road	Residential	75	72
100 Pakuranga Road	Residential	75	72
2 Cortina Place	Commercial	75	72
183 Pakuranga Road	Residential	74	71
21 Ti Rakau Drive	Residential	74	71
191 Pakuranga Road	Residential	73	70
84 Ti Rakau Drive	Residential	73	70
62 Dale Crescent	Residential	73	69
1/4 William Roberts Road	Residential	72	69
5 Cortina Place	Commercial	72	69
3 Reeves Road	Commercial	72	69
27r William Roberts Road	Commercial	72	69
26 Ti Rakau Drive	Commercial	72	68
10,2/10 William Roberts Road	Residential	71	68
193a Pakuranga Road	Residential	70	67
16 William Roberts Road	Residential	70	67
1-2/3 Palm Avenue	Residential	70	67

EB3R			
Address	Building Use	Noise Level, dB LAeq	
		Worst Case Scenario (Concrete Saw, 30% On-Time, With Mitigation)	Typical Scenario (Excavator, With Mitigation)
148 Edgewater Drive	Residential	>90	89
165b Edgewater Drive	Residential	>90	88
176 Gossamer Drive	Residential	>90	88
6,1/6 Mattson Road	Residential	>90	87
4 Edgewater Drive	Residential	>90	87
9a,9b Mattson Road	Residential	89	86
165a Edgewater Drive	Residential	87	84
212 Ti Rakau Drive	Residential	86	83
5a Tiraumea Drive	Residential	82	79
75a Ti Rakau Drive	Residential	81	78
1-2/2 Chevis Place	Residential	80	77
1-2/130 Ti Rakau Drive	Residential	79	76
128 Ti Rakau Drive	Residential	79	76
158 Ti Rakau Drive	Residential	79	76
214 Ti Rakau Drive	Residential	79	75
92 Ti Rakau Drive	Residential	79	75
1-2/1 Chevis Place	Residential	78	75
160 Ti Rakau Drive	Residential	78	75
5 Tiraumea Drive	Residential	78	75
176 Ti Rakau Drive	Residential	78	75
156 Ti Rakau Drive	Residential	78	75
138 Ti Rakau Drive	Residential	78	75
172 Gossamer Drive	Residential	77	74
207 Ti Rakau Drive	Commercial	77	74
4 Tiraumea Drive	Residential	77	74
184 Ti Rakau Drive	Residential	77	74
94 Ti Rakau Drive	Residential	77	74
171 Gossamer Drive	Residential	77	74
126-2/126 Ti Rakau Drive	Residential	76	73
146 Edgewater Drive	Residential	76	73
169 Gossamer Drive	Residential	76	73
108 Ti Rakau Drive	Residential	76	73
136 Ti Rakau Drive	Residential	76	73
210 Ti Rakau Drive	Residential	76	73
2a, 2b, 2c Marriott Road	Residential	75	72
174 Ti Rakau Drive	Residential	75	72
102 Ti Rakau Drive	Residential	75	72
106 Ti Rakau Drive	Residential	75	72
100 Ti Rakau Drive	Residential	75	72
140 Ti Rakau Drive	Residential	75	72
186 Ti Rakau Drive	Residential	74	71
166 Ti Rakau Drive	Residential	74	71
170 Ti Rakau Drive	Residential	74	71
1/9 Bolina Crescent	Residential	74	71
90 Ti Rakau Drive	Residential	74	71
114 Ti Rakau Drive	Residential	74	70
200 Ti Rakau Drive	Residential	73	70
116 Ti Rakau Drive	Residential	73	70
122 Ti Rakau Drive	Residential	73	70
110 Ti Rakau Drive	Residential	73	70
172 Ti Rakau Drive	Residential	73	70
180 Ti Rakau Drive	Residential	73	70
112 Ti Rakau Drive	Residential	73	70
192 Ti Rakau Drive	Residential	73	70
175 Gossamer Drive	Residential	73	70
190 Ti Rakau Drive	Residential	73	70

104 Ti Rakau Drive	Residential	73	70
154 Ti Rakau Drive	Residential	72	69
167 Gossamer Drive	Residential	72	69
2 Paradise Place	Residential	72	69
118 Ti Rakau Drive	Residential	72	69
219 Ti Rakau Drive	Commercial	72	69
3 Fremantle Place	Residential	72	69
98 Ti Rakau Drive	Residential	72	69
188 Ti Rakau Drive	Residential	72	69
120 Ti Rakau Drive	Residential	71	68
1-2/204 Ti Rakau Drive	Residential	71	68
8 Mattson Road	Residential	71	68
206 Ti Rakau Drive	Residential	71	68
9 Mattson Road	Residential	71	68
96 Ti Rakau Drive	Residential	70	67
208 Ti Rakau Drive	Residential	70	67

Building Removal, Night-time, EB2	
Address	Noise Level, dB LAeq
23b Dale Crescent	81
176 Gossamer Drive	77
1/4 William Roberts Road	74
5 Tiraumea Drive	73
21 Dale Crescent	73
5a Tiraumea Drive	71
9a,9b Mattson Road	71
2/4 William Roberts Road	70
17 Fremantle Place	69
12,12a William Roberts Road	69
183 Pakuranga Road	69
14a Dolphin Street	68
1/14 William Roberts Road	68
8 Mattson Road	68
2/23 Ti Rakau Drive	68
177 Ti Rakau Drive	68
175a-1/175a Ti Rakau Drive	67
14b Dolphin Street	67
4 Tiraumea Drive	67
8 Dolphin Street	67
9 Fremantle Place	67
7 Fremantle Place	67
3 Fremantle Place	67
10,2/10 William Roberts Road	67
6,1/6 Mattson Road	67
10 Mattson Road	67
1/23 Ti Rakau Drive	67
19 Fremantle Place	67
1/10 Dolphin Street	66
1/9 Bolina Crescent	66
185 Ti Rakau Drive	66
183 Ti Rakau Drive	66
16 William Roberts Road	66
23a Dale Crescent	66
6 William Roberts Road	66
18a William Roberts Road	66
2/10 Dolphin Street	65
7a Mattson Road	65
200 Ti Rakau Drive	65
94 Ti Rakau Drive	65
3/183 Pakuranga Road	65
1/8 William Roberts Road	65
212 Ti Rakau Drive	65
1-2/204 Ti Rakau Drive	65
9 Mattson Road	65
196 Ti Rakau Drive	64

Building Removal, Night-time, EB2	
Address	Noise Level, dB LAeq
190 Ti Rakau Drive	64
175 Gossamer Drive	64
100 Ti Rakau Drive	64
194 Ti Rakau Drive	64
214 Ti Rakau Drive	64
206 Ti Rakau Drive	64
92 Ti Rakau Drive	64
188 Ti Rakau Drive	64
96 Ti Rakau Drive	64
192 Ti Rakau Drive	64
198 Ti Rakau Drive	64
84 Ti Rakau Drive	64
6a Ayr Road	64
14 Dolphin Street	64
177a Ti Rakau Drive	64
98 Ti Rakau Drive	64
16 Dale Crescent	63
14 Dale Crescent	63
210 Ti Rakau Drive	63
90 Ti Rakau Drive	63
208 Ti Rakau Drive	63
173 Gossamer Drive	63
33 Dale Crescent	63
171 Gossamer Drive	63
21 Fremantle Place	62
15 Fremantle Place	62
6 Tiraumea Drive	62
12 Dale Crescent	62
2 Paradise Place	62
202 Ti Rakau Drive	62
31 Fremantle Place	62
2/183 Ti Rakau Drive	62
177b Ti Rakau Drive	62
2/200 Ti Rakau Drive	61
7b Mattson Road	61
140S Pakuranga Road	61
1a Ayr Road	61
2/8 William Roberts Road	61
8 Tiraumea Drive	61
7 Tiraumea Drive	61
169 Gossamer Drive	60
5 Fremantle Place	60
12b William Roberts Road	60
6 Ayr Road	60
1-2/18 Dale Crescent	60
18 William Roberts Road	60

Building Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
33 Dale Crescent	80
75a Ti Rakau Drive	73
4 Edgewater Drive	72
97 Ti Rakau Drive	71
27 Dale Crescent	70
165b Edgewater Drive	69
91 Ti Rakau Drive	69
165a Edgewater Drive	69
25 Dale Crescent	69
148 Edgewater Drive	69
83c Ti Rakau Drive	69
5 Snell Place	69
129 Ti Rakau Drive	68
1/144 Edgewater Drive	68
156 Ti Rakau Drive	67
14 Edgewater Drive	67
176 Ti Rakau Drive	66
154 Ti Rakau Drive	66
158 Ti Rakau Drive	66
83 Ti Rakau Drive	66
83a Ti Rakau Drive	65
1-2/2 Chevis Place	65
174 Ti Rakau Drive	65
136 Ti Rakau Drive	65
146 Edgewater Drive	65
140 Ti Rakau Drive	65
4 Wheatley Avenue	65
108 Ti Rakau Drive	65
166 Ti Rakau Drive	65
170 Ti Rakau Drive	65
184 Ti Rakau Drive	65
106 Ti Rakau Drive	65
138 Ti Rakau Drive	65
2a, 2b, 2c Marriott Road	65
172 Ti Rakau Drive	65
3 Snell Place	65
1-2/4 Roseburn Place	65
186 Ti Rakau Drive	65
116 Ti Rakau Drive	65
1/7 Wheatley Avenue	65
114 Ti Rakau Drive	65
102 Ti Rakau Drive	65
122 Ti Rakau Drive	65
110 Ti Rakau Drive	64
3 Roseburn Place	64
1-3/12 Mattson Road	64

Building Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
145 Ti Rakau Drive	64
112 Ti Rakau Drive	64
180 Ti Rakau Drive	64
104 Ti Rakau Drive	64
87 Ti Rakau Drive	64
9 Snell Place	64
1-2/6 Roseburn Place	64
178 Ti Rakau Drive	64
118 Ti Rakau Drive	64
152 Ti Rakau Drive	64
120 Ti Rakau Drive	64
162a Ti Rakau Drive	64
3 Wheatley Avenue	64
150 Ti Rakau Drive	63
1-2/1 Chevis Place	63
144 Ti Rakau Drive	63
146 Ti Rakau Drive	63
160 Ti Rakau Drive	63
184b Ti Rakau Drive	63
126-2/126 Ti Rakau Drive	63
148 Ti Rakau Drive	63
165 Edgewater Drive	62
7 Wheatley Avenue	62
163 Edgewater Drive	62
128 Ti Rakau Drive	61
1-2/130 Ti Rakau Drive	61
11 Snell Place	61
6, 1/6 Edgewater Drive	61
161 Edgewater Drive	61
83b Ti Rakau Drive	61
14 Mattson Road	61
19b Te Anau Place	61
2/144 Edgewater Drive	61
23 Te Anau Place	61
19a Te Anau Place	60
5 Roseburn Place	60
7 Snell Place	60
166a Ti Rakau Drive	60
142 Edgewater Drive	60
7 Roseburn Place	59
19c Te Anau Place	59
13 Snell Place	59
32 Te Anau Place	59
3 Chevis Place	58
1-2/9 Roseburn Place	58
4 Chevis Place	58

Building Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
162b Ti Rakau Drive	58
3r Marriott Road	58
2/18 Mattson Road	58
1-26/33 Dale Crescent	58
1/164 Ti Rakau Drive	58
114a Ti Rakau Drive	58
1-2/8 Edgewater Drive	58
14 Snell Place	58
1/168 Ti Rakau Drive	58
8 Roseburn Place	58
2/79 Cardiff Road	57
17a, 17b Te Anau Place	57
5a Roseburn Place	57
6 Chevis Place	57
8 Wheatley Avenue	57
5 Wheatley Avenue	57
89 Ti Rakau Drive	57
1-2/4 Marriott Road	57
2/10 Wheatley Avenue	57
1-2/10 Roseburn Place	57
10 Edgewater Drive	56
6 Wheatley Avenue	56
9 Wheatley Avenue	56
1/10 Wheatley Avenue	56
2/168 Ti Rakau Drive	56
3/10 Wheatley Avenue	55
35 Miramar Place	55
140 Edgewater Drive	55
1 Aurea Avenue	55
21 Te Anau Place	54
19 Te Anau Place	54
1-2/81 Cardiff Road	54
A-C/16 Mattson Road	53
138 Edgewater Drive	53
10 Snell Place	52
1/67 Cardiff Road	52
12 Snell Place	51
13 Wheatley Avenue	51
1/18 Mattson Road	50
8 Snell Place	50
1-2/73 Cardiff Road	49
A/8 Snell Place	47

Pavement Works, Night-time, EB2	
Address	Noise Level, dB LAeq
1-2/5 Ti Rakau Drive	71
1-2/13 Ti Rakau Drive	71
3 Ti Rakau Drive	71
1-2/17 Ti Rakau Drive	71
1/11,11 Ti Rakau Drive	70
1-2/7 Ti Rakau Drive	70
1/15,15 Ti Rakau Drive	70
1/19,19 Ti Rakau Drive	70
2/23 Ti Rakau Drive	70
1/9,9 Ti Rakau Drive	70
21 Ti Rakau Drive	70
1/23 Ti Rakau Drive	67
1-2/90 Pakuranga Road	63
1-2/3 Palm Avenue	62
4a - 4b Palm Avenue	62
1-2/92 Pakuranga Road	61
5a Tiraumea Drive	61
1/10 Dolphin Street	61
4 Tiraumea Drive	61
5 Tiraumea Drive	60
2/10 Dolphin Street	60
47c Dale Crescent	60
1/9 Bolina Crescent	59
5 Palm Avenue	59
8 Dolphin Street	59
94 Pakuranga Road	59
13 Dowling Place	59
33 Dale Crescent	59
105 Pakuranga Road	58
6 Palm Avenue	58
1-2/43 Dale Crescent	58
1-2/11 Dowling Place	58
14a Dolphin Street	58
1-2/15 Dowling Place	58
1-2/5 Dowling Place	57
7 Tiraumea Drive	57
6 Tiraumea Drive	57
14 Dolphin Street	56
9 Dowling Place	56
8 Palm Avenue	56
9a,9b Mattson Road	56
14b Dolphin Street	56
2/39 Dale Crescent	56
7 Dowling Place	55
2/9 Bolina Crescent	55
8 Tiraumea Drive	55

Pavement Works, Night-time, EB2	
Address	Noise Level, dB LAeq
12 Dolphin Street	55
7a Mattson Road	55
55 Dale Crescent	55
1-26/33 Dale Crescent	54
1-2/3 Dowling Place	54
84 Ti Rakau Drive	54
9 Tiraumea Drive	54
7 Bolina Crescent	54
10 Tiraumea Drive	54
45 Dale Crescent	54
11 Tiraumea Drive	54
13a Tiraumea Drive	53
1-2/24 Dale Crescent	53
41 Dale Crescent	53
1 Dowling Place	53
9 Mattson Road	53
103 Pakuranga Road	52
6,1/6 Mattson Road	52
24r William Roberts Road	52
26 Dale Crescent	52
1 Anthony Place	52
6 Dolphin Street	52
4,4a Dolphin Street	51
10 Dowling Place	51
12 Tiraumea Drive	51
3 Tamaki Bay Drive	51
24 William Roberts Road	50
100 Pakuranga Road	50
7g Mattson Road	50
3/9 Bolina Crescent	50
16 Dowling Place	50
5 Tamaki Bay Drive	50
1/5 Bolina Crescent	50
1 Tamaki Bay Drive	50
86 Ti Rakau Drive	50
19 Dowling Place	49
38 Dale Crescent	49
1-2/30 Dale Crescent	49
16 Dolphin Street	48
2/5 Bolina Crescent	48
7b Mattson Road	48
13 Dolphin Street	48
1-2/20 Dowling Place	48
93 Pakuranga Road	48
1-2/32 Dale Crescent	48
15 Dolphin Street	48

Pavement Works, Night-time, EB2	
Address	Noise Level, dB LAeq
1-2/17 Dowling Place	47
3 Dolphin Street	47
5 Dolphin Street	47
6 Bolina Crescent	47
2/34 Dale Crescent	47
17 Dolphin Street	47
1-2/101 Pakuranga Road	47
7h Mattson Road	46
13 Tiraumea Drive	46
11 Dolphin Street	46
97 Pakuranga Road	46
36 Dale Crescent	46
7c Mattson Road	46
15a Dolphin Street	46
4 Anthony Place	46
1/34 Dale Crescent	46
11a Dolphin Street	46
3 Bolina Crescent	46
1/9 Dolphin Street	46
4 Dowling Place	45
7 Dolphin Street	45
4 Bolina Crescent	45
95 Pakuranga Road	45
25 Dale Crescent	45
22 Dale Crescent	45
15 Tiraumea Drive	45
5 Anthony Place	44
1/14 Dowling Place	44
7 Anthony Place	44
23b Dale Crescent	44
40 Dale Crescent	44
1-2/9 Anthony Place	44
1a Dowling Place	44
59 Dale Crescent	44
1-2/2b Dowling Place	44

Pavement Works, Night-time, EB3R	
Address	Noise Level, dB LAeq
90 Ti Rakau Drive	51
92 Ti Rakau Drive	50
1-3/12 Mattson Road	49
10 Mattson Road	48
13 Mattson Road	48
94 Ti Rakau Drive	48
8 Mattson Road	47
1 Aurea Avenue	46
2/6 Cindy Place	45
1/6 Cindy Place	45
14 Mattson Road	45
5 Aurea Avenue	45
8 Cindy Place	45
1-3/57 Cardiff Road	44
7 Cindy Place	44
88 Ti Rakau Drive	44

RRF Works, Night-time	
Address	Noise Level, dB LAeq
18a William Roberts Road	68
12,12a William Roberts Road	67
1/14 William Roberts Road	67
23b Dale Crescent	67
1/9 Bolina Crescent	66
7 Bolina Crescent	65
16 William Roberts Road	65
2/9 Bolina Crescent	65
25 Dale Crescent	64
5a Tiraumea Drive	64
21 Dale Crescent	64
20 William Roberts Road	63
27 Dale Crescent	63
3/9 Bolina Crescent	63
18 William Roberts Road	62
15 Reeves Road	62
33 Dale Crescent	62
33 Dale Crescent	62
2/23 Ti Rakau Drive	62
1/5 Bolina Crescent	62
33 Dale Crescent	62
33 Dale Crescent	62
2/5 Bolina Crescent	62
1/23 Ti Rakau Drive	61
24 William Roberts Road	61
10,2/10 William Roberts Road	61
17 Reeves Road	61
19 Reeves Road	60
6 Bolina Crescent	60
4 Bolina Crescent	60
33 Dale Crescent	60
23a Dale Crescent	60
24r William Roberts Road	60
7 Tiraumea Drive	60
5 Tiraumea Drive	60
21 Ti Rakau Drive	59
17a Reeves Road	59
12 Reeves Road	59
1a Ayr Road	59
2/14 William Roberts Road	59
1-2/18 Dale Crescent	59
1/19,19 Ti Rakau Drive	59
3 Bolina Crescent	59
13a Tiraumea Drive	59
1-2/17 Ti Rakau Drive	58
15 Tiraumea Drive	58

RRF Works, Night-time	
Address	Noise Level, dB LAeq
9a Undine Street	58
1 Ayr Road	58
1-26/33 Dale Crescent	58
9 Tiraumea Drive	58
21 Reeves Road	58
9 Undine Street	58
11 Tiraumea Drive	57
4a Reeves Road	57
1-2/20 Dale Crescent	57
33 Dale Crescent	57
1/2 Reeves Road	57
22 Dale Crescent	57
14 Dale Crescent	57
23 Reeves Road	57
12b William Roberts Road	57
15 Undine Street	57
6 Palm Avenue	57
1/19 Reeves Road	57
12 Dale Crescent	56
4 Tiraumea Drive	56
16 Dale Crescent	56
2/17 Tiraumea Drive	56
3 Ayr Road	56
7a Undine Street	56
8 Palm Avenue	56
14 Undine Street	56
3/14 William Roberts Road	55
1-2/24 Dale Crescent	55
6 Tiraumea Drive	55
13 Tiraumea Drive	55
10a Dale Crescent	55
4a - 4b Palm Avenue	55
1/8 William Roberts Road	55
8 Tiraumea Drive	55
12 Undine Street	55
1/15,15 Ti Rakau Drive	55
10 Tiraumea Drive	55
6 William Roberts Road	54
2/8 William Roberts Road	54
10 Anthony Place	54
8 Dale Crescent	54
17 Osprey Street	54
15 Osprey Street	54
1-2/3 Palm Avenue	54
13 Osprey Street	54
14 Tiraumea Drive	54

RRF Works, Night-time	
Address	Noise Level, dB LAeq
26 Dale Crescent	54
12 Tiraumea Drive	54
2/39 Dale Crescent	54
10 Undine Street	54
8 Undine Street	54
11 Ayr Road	54
8 Anthony Place	53
8 Dolphin Street	53
6 Dale Crescent	53
18 Tiraumea Drive	53
23a Reeves Road	53
29 Tiraumea Drive	53
2/9 Ayr Road	53
2 Ayr Road	53
16 Tiraumea Drive	53
25 Reeves Road	53
1/4 William Roberts Road	53
31 Tiraumea Drive	53
1-2/13 Ti Rakau Drive	52
4 Dale Crescent	52
5 Palm Avenue	52
5 Ayr Road	52
24 Tiraumea Drive	52
5 Undine Street	52
24 Osprey Street	52
8 Ayr Road	52
6 Undine Street	52
2 Dale Crescent	52
4 Anthony Place	52
8 Reeves Road	51
7 Undine Street	51
7 Ayr Road	51
6 Reeves Road	51
14 Reeves Road	51
15c Anthony Place	51
10 Reeves Road	51
1/17 Tiraumea Drive	51
1/12 Reeves Road	51
7 Dolphin Street	51
3 Dolphin Street	50
116b Pakuranga Road	50
5 Dolphin Street	50
29 Reeves Road	50
3 Undine Street	50
4 Ayr Road	50
4,4a Dolphin Street	49

RRF Works, Night-time	
Address	Noise Level, dB LAeq
6 Anthony Place	49
14a Reeves Road	49
1 Undine Street	48
6 Ayr Road	48
2/13 Ayr Road	48
31 Reeves Road	48
10 Ayr Road	48
3/183 Pakuranga Road	48
12 Ayr Road	48
6 Dolphin Street	47
15 Anthony Place	47
12 Anthony Place	47
4 Undine Street	47
1/13 Ayr Road	47
14 Ayr Road	46
4 Reeves Road	46
6a Ayr Road	46
1/9 Ayr Road	46
10 Dale Crescent	46
11 Osprey Street	45
14 Anthony Place	44
4c Bennett Road	44
2c Bennett Road	44
2/12 Reeves Road	44

Tree Removal, Night-time, EB2	
Address	Noise Level, dB LAeq
1-2/5 Ti Rakau Drive	71
3 Ti Rakau Drive	70
1-2/7 Ti Rakau Drive	68
1/9,9 Ti Rakau Drive	64
21 Dale Crescent	64
23b Dale Crescent	62
1-2/90 Pakuranga Road	62
1/11,11 Ti Rakau Drive	61
1-2/92 Pakuranga Road	60
25 Dale Crescent	60
23a Dale Crescent	60
16 Dale Crescent	59
14 Dale Crescent	59
12 Dale Crescent	59
1-2/13 Ti Rakau Drive	58
7 Bolina Crescent	58
33 Dale Crescent	58
105 Pakuranga Road	57
10a Dale Crescent	57
94 Pakuranga Road	57
2/5 Bolina Crescent	57
27 Dale Crescent	56
1-2/11 Dowling Place	56
13 Dowling Place	56
1-2/15 Dowling Place	56
1/15,15 Ti Rakau Drive	56
6 Bolina Crescent	56
1-2/18 Dale Crescent	55
15 Undine Street	55
1-2/5 Dowling Place	55
8 Dale Crescent	55
1/9 Bolina Crescent	55
2/9 Bolina Crescent	55
14 Undine Street	54
9 Dowling Place	54
3 Bolina Crescent	54
7 Dowling Place	54
1-26/33 Dale Crescent	53
6 Dale Crescent	53
9a Undine Street	53
1-2/3 Dowling Place	53
15 Osprey Street	53
17 Osprey Street	53
1/23 Ti Rakau Drive	53
1-2/17 Ti Rakau Drive	53
1-2/20 Dale Crescent	53

Tree Removal, Night-time, EB2	
Address	Noise Level, dB LAeq
2 Dale Crescent	52
2/17 Tiraumea Drive	52
22 Dale Crescent	52
1/20 Osprey Street	52
24 Osprey Street	52
47c Dale Crescent	52
9 Undine Street	52
100 Pakuranga Road	52
103 Pakuranga Road	52
15 Tiraumea Drive	52
4 Dale Crescent	52
12 Undine Street	52
7a Undine Street	51
10 Undine Street	50
5 Tamaki Bay Drive	50
8 Undine Street	50
8 Palm Avenue	50
3/9 Bolina Crescent	50
4 Bolina Crescent	50
2/23 Ti Rakau Drive	50
55 Dale Crescent	50
1-2/101 Pakuranga Road	49
7 Undine Street	49
13 Osprey Street	49
1-2/24 Dale Crescent	49
1 Tamaki Bay Drive	49
1-2/30 Dale Crescent	49
10 Anthony Place	49
5a Tiraumea Drive	49
14 Tiraumea Drive	49
21 Ti Rakau Drive	49
6 Undine Street	49
95 Pakuranga Road	48
25 Pandora Place	48
12 Tiraumea Drive	48
2/39 Dale Crescent	48
6 Anthony Place	47
5 Undine Street	47
62 Dale Crescent	47
13 Tiraumea Drive	47
1 Dowling Place	47
60 Dale Crescent	46
29 Tiraumea Drive	46
1/5 Bolina Crescent	46
16 Dowling Place	46
1/19,19 Ti Rakau Drive	46

Tree Removal, Night-time, EB2	
Address	Noise Level, dB LAeq
1-2/32 Dale Crescent	46
45 Dale Crescent	46
10 Dowling Place	46
1-2/17 Dowling Place	46
4 Dowling Place	46
1/34 Dale Crescent	46
8 Anthony Place	46
31 Tiraumea Drive	46
9 Tiraumea Drive	46
1-2/20 Dowling Place	46
22 Osprey Street	45
36 Dale Crescent	45
1-2/2b Dowling Place	45
1-2/3 Palm Avenue	45
40 Dale Crescent	45
4a - 4b Palm Avenue	45
61 Dale Crescent	44
8 Dowling Place	44
97 Pakuranga Road	44
3 Undine Street	44
41 Dale Crescent	44
11 Tiraumea Drive	44
16 Osprey Street	44
3 Dolphin Street	44
40a Dale Crescent	44
65 Dale Crescent	44
10 Dale Crescent	44
1-2/43 Dale Crescent	44
38 Dale Crescent	44
16 Tiraumea Drive	44
12 Anthony Place	44
2a Dowling Place	44
18 Tiraumea Drive	44

Tree Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
176 Gossamer Drive	79
172 Gossamer Drive	77
138 Ti Rakau Drive	70
108 Ti Rakau Drive	69
106 Ti Rakau Drive	69
114 Ti Rakau Drive	69
112 Ti Rakau Drive	69
116 Ti Rakau Drive	68
140 Ti Rakau Drive	68
120 Ti Rakau Drive	68
110 Ti Rakau Drive	68
169 Gossamer Drive	68
118 Ti Rakau Drive	67
122 Ti Rakau Drive	67
136 Ti Rakau Drive	67
171 Gossamer Drive	67
104 Ti Rakau Drive	67
144 Ti Rakau Drive	66
175 Gossamer Drive	66
146 Ti Rakau Drive	65
167 Gossamer Drive	65
173 Gossamer Drive	65
148 Ti Rakau Drive	65
102 Ti Rakau Drive	64
1-2/2 Chevis Place	64
40 Riverhills Avenue	63
2a, 2b, 2c Marriott Road	62
150 Ti Rakau Drive	62
129 Ti Rakau Drive	61
75a Ti Rakau Drive	61
4 Edgewater Drive	61
83 Ti Rakau Drive	61
152 Ti Rakau Drive	61
8 Ellesmere Crescent	60
100 Ti Rakau Drive	60
14 Edgewater Drive	60
1/7 Wheatley Avenue	60
3 Wheatley Avenue	59
126-2/126 Ti Rakau Drive	59
1-2/6 Roseburn Place	59
83c Ti Rakau Drive	58
1-2/1 Chevis Place	58
36 Riverhills Avenue	57
2/79 Cardiff Road	57
9 Snell Place	57
91 Ti Rakau Drive	57

Tree Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
114a Ti Rakau Drive	57
10 Ellesmere Crescent	56
83b Ti Rakau Drive	56
65 Cardiff Road	56
6 Chevis Place	56
142 Ti Rakau Drive	56
154 Ti Rakau Drive	56
98 Ti Rakau Drive	56
156 Ti Rakau Drive	56
7 Wheatley Avenue	56
11 Snell Place	56
1/67 Cardiff Road	56
1-2/8 Edgewater Drive	56
87 Ti Rakau Drive	56
1-2/63 Cardiff Road	56
96 Ti Rakau Drive	55
5 Snell Place	55
1-2/130 Ti Rakau Drive	55
83a Ti Rakau Drive	55
128 Ti Rakau Drive	55
6, 1/6 Edgewater Drive	55
94 Ti Rakau Drive	55
14 Ellesmere Crescent	55
67 Cardiff Road	54
61 Cardiff Road	54
14 Chevis Place	54
7 Fremantle Place	54
13 Snell Place	54
2/4 Ellesmere Crescent	53
3 Fremantle Place	53
69a,69b Cardiff Road	53
1-2/4 Roseburn Place	53
12 Ellesmere Crescent	53
97 Ti Rakau Drive	53
2 Paradise Place	52
4 Wheatley Avenue	52
1-2/10 Roseburn Place	52
6 Paradise Place	51
89 Ti Rakau Drive	51
1-2/81 Cardiff Road	51
1 Paradise Place	51
6 Wheatley Avenue	51
158 Ti Rakau Drive	51
8 Roseburn Place	51
10 Chevis Place	50
14 Snell Place	50

Tree Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
3 Roseburn Place	50
39 Miramar Place	50
1-2/73 Cardiff Road	50
75 Cardiff Road	50
92 Ti Rakau Drive	50
17 Fremantle Place	50
9 Fremantle Place	50
1-2/4 Marriott Road	50
6 Ellesmere Crescent	50
9 Wheatley Avenue	49
71 Cardiff Road	49
5 Wheatley Avenue	49
8 Wheatley Avenue	49
88 Cardiff Road	49
35 Miramar Place	49
38 Riverhills Avenue	48
16 Ellesmere Crescent	48
92, 1/92 Cardiff Road	48
94 Cardiff Road	48
1-3/59 Cardiff Road	48
96 Cardiff Road	48
7 Paradise Place	48
148 Edgewater Drive	48
166 Ti Rakau Drive	48
7 Snell Place	48
8 Chevis Place	48
4 Chevis Place	48
210 Ti Rakau Drive	48
1-2/82 Cardiff Road	47
77 Cardiff Road	47
19 Fremantle Place	47
1-2/9 Roseburn Place	47
7 Ellesmere Crescent	47
3 Paradise Place	47
5 Fremantle Place	47
12 Fremantle Place	47
8 Paradise Place	47
2 Ellesmere Crescent	46
13 Wheatley Avenue	46
14 Mattson Road	46
1/79 Cardiff Road	46
10 Edgewater Drive	46
22 Miramar Place	46
7 Chevis Place	46
5 Ellesmere Crescent	46
7 Roseburn Place	46

Tree Removal, Night-time, EB3R	
Address	Noise Level, dB LAeq
98 Cardiff Road	46
13 Roseburn Place	46
12 Paradise Place	45
100 Cardiff Road	45
78 Cardiff Road	45
3 Chevis Place	45
12 Roseburn Place	45
1-2/14 Roseburn Place	45
24 Ellesmere Crescent	45
20 Ellesmere Crescent	45
1-2/11 Chevis Place	45
4 Snell Place	45
33 Miramar Place	45
9 Ellesmere Crescent	45
15 Fremantle Place	45
145 Ti Rakau Drive	45
3 Ellesmere Crescent	45
7 Marriott Road	45
102 Cardiff Road	44
2 Snell Place	44
18 Chevis Place	44
1-3/12 Mattson Road	44
5 Chevis Place	44
18a Ellesmere Crescent	44
214 Ti Rakau Drive	44
1/4 Ellesmere Crescent	44

Appendix E – Receivers Within DIN 4150-3 Vibration Contours

EB2, Daytime

Address	Distance to Works	Building Type/Structure	Exceeds Category A?	Exceeds Category B?
123 -135 Pakuranga Road	1	Commercial	Yes	Yes
2r Ti Rakau Drive	1	Commercial	Yes	Yes
1-2/17 Ti Rakau Drive	1	Residential	Yes	Yes
141 Pakuranga Road	1	Commercial	Yes	Yes
1/15,15 Ti Rakau Drive	1	Residential	Yes	Yes
26 Ti Rakau Drive	1	Commercial	Yes	Yes
10-14 Cortina Place	1	Commercial	Yes	Yes
23b Dale Crescent	1	Residential	Yes	Yes
120 Pakuranga Road	1	Commercial	Yes	Yes
3 Reeves Road	1	Commercial	Yes	Yes
10 7 Aylesbury Street	1	Commercial	Yes	Yes
10 Aylesbury Street	1	Commercial	Yes	Yes
11 Reeves Road	1	Commercial	Yes	Yes
11 Cortina Place	2	Commercial	Yes	Yes
1/9 Cortina Place	2	Commercial	Yes	Yes
7a Cortina Place	2	Commercial	Yes	Yes
1-2/92 Pakuranga Road	3	Residential	Yes	Yes
126 Pakuranga Road	3	Commercial	Yes	No
1-2/90 Pakuranga Road	4	Residential	Yes	Yes
1-2/5 Ti Rakau Drive	4	Residential	Yes	Yes
1-2/13 Ti Rakau Drive	4	Residential	Yes	Yes
2/23 Ti Rakau Drive	4	Residential	Yes	Yes
116b Pakuranga Road	5	Residential	Yes	Yes
21 Dale Crescent	5	Residential	Yes	Yes
106 Pakuranga Road	5	Residential	Yes	Yes
18a William Roberts Road	5	Residential	Yes	Yes
100 Pakuranga Road	5	Residential	Yes	Yes
3 Ti Rakau Drive	5	Residential	Yes	Yes
1-2/7 Ti Rakau Drive	5	Residential	Yes	Yes
24 William Roberts Road	6	Residential	Yes	Yes
94 Pakuranga Road	6	Residential	Yes	Yes
12,12a William Roberts Road	6	Residential	Yes	Yes
64 Dale Crescent	6	Residential	Yes	Yes
118 Pakuranga Road	6	Residential	Yes	Yes
3 Cortina Place	6	Commercial	Yes	No
1/11,11 Ti Rakau Drive	6	Residential	Yes	Yes
1/14 William Roberts Road	6	Residential	Yes	Yes
1/19,19 Ti Rakau Drive	6	Residential	Yes	Yes
1/9,9 Ti Rakau Drive	6	Residential	Yes	Yes
100 Pakuranga Road	6	Residential	Yes	Yes
2 Dale Crescent	6	Residential	Yes	Yes

13r Reeves Road	7	Commercial	Yes	No
24r William Roberts Road	7	Residential	Yes	Yes
15 Reeves Road	7	Residential	Yes	Yes
21 Ti Rakau Drive	8	Residential	Yes	Yes
183 Pakuranga Road	8	Residential	Yes	Yes
8 Cortina Place	8	Commercial	Yes	No
1/4 William Roberts Road	8	Residential	Yes	Yes
1-2/3 Palm Avenue	8	Residential	Yes	Yes
5 Cortina Place	8	Commercial	Yes	No
7 Cortina Place	8	Commercial	Yes	No
84 Ti Rakau Drive	9	Residential	Yes	No
27r William Roberts Road	9	Commercial	Yes	No
191 Pakuranga Road	9	Residential	Yes	No
62 Dale Crescent	9	Residential	Yes	No
4a - 4b Palm Avenue	10	Residential	Yes	No
1 Reeves Road	11	Commercial	Yes	No
102 Pakuranga Road	11	Commercial	Yes	No
10,2/10 William Roberts Road	12	Residential	Yes	No
1-2/30 Latham Avenue	12	Residential	Yes	No
193a Pakuranga Road	12	Residential	Yes	No
20 William Roberts Road	12	Residential	Yes	No
17 Reeves Road	13	Residential	Yes	No
16 William Roberts Road	14	Residential	Yes	No
1-2/104 Pakuranga Road	14	Residential	Yes	No
23a Dale Crescent	14	Residential	Yes	No
1/23 Ti Rakau Drive	15	Residential	Yes	No
140s Pakuranga Road	16	Residential	Yes	No
1-3/189 Pakuranga Road	16	Residential	Yes	No
140s Pakuranga Road	17	Commercial	Yes	No
66 Dale Crescent	17	Residential	Yes	No
2/32 Latham Avenue	19	Residential	Yes	No
118 Pakuranga Road	19	Residential	Yes	No
108 Pakuranga Road	19	Residential	Yes	No
2/4 William Roberts Road	19	Residential	Yes	No
6 William Roberts Road	20	Residential	Yes	No
1/8 William Roberts Road	20	Residential	Yes	No

EB3R, Daytime

Address	Distance to Works	Building Type/Structure	Exceeds Category A?	Exceeds Category B?
107-109 Ti Rakau Drive	1	Commercial	Yes	Yes
9a,9b Mattson Road	1	Residential	Yes	Yes
4 Edgewater Drive	1	Residential	Yes	Yes
148 Edgewater Drive	1	Residential	Yes	Yes
165a Edgewater Drive	1	Residential	Yes	Yes
165b Edgewater Drive	1	Residential	Yes	Yes
6,1/6 Mattson Road	1	Residential	Yes	Yes
212 Ti Rakau Drive	1	Residential	Yes	Yes
176 Gossamer Drive	1	Residential	Yes	Yes
5 Tiraumea Drive	3	Residential	Yes	Yes
3 Fremantle Place	3	Residential	Yes	Yes
5a Tiraumea Drive	4	Residential	Yes	Yes
176 Ti Rakau Drive	4	Residential	Yes	Yes
210 Ti Rakau Drive	4	Residential	Yes	Yes
75a Ti Rakau Drive	4	Residential	Yes	Yes
214 Ti Rakau Drive	4	Residential	Yes	Yes
1-2/2 Chevis Place	4	Residential	Yes	Yes
160 Ti Rakau Drive	4	Residential	Yes	Yes
4 Tiraumea Drive	4	Residential	Yes	Yes
1-2/130 Ti Rakau Drive	5	Residential	Yes	Yes
92 Ti Rakau Drive	5	Residential	Yes	Yes
158 Ti Rakau Drive	5	Residential	Yes	Yes
156 Ti Rakau Drive	5	Residential	Yes	Yes
207 Ti Rakau Drive	5	Commercial	Yes	No
128 Ti Rakau Drive	5	Residential	Yes	Yes
1-2/1 Chevis Place	5	Residential	Yes	Yes
180 Ti Rakau Drive	5	Residential	Yes	Yes
94 Ti Rakau Drive	5	Residential	Yes	Yes
146 Edgewater Drive	5	Residential	Yes	Yes
184 Ti Rakau Drive	5	Residential	Yes	Yes
172 Gossamer Drive	5	Residential	Yes	Yes
169 Gossamer Drive	6	Residential	Yes	Yes
138 Ti Rakau Drive	6	Residential	Yes	Yes
171 Gossamer Drive	6	Residential	Yes	Yes
126-2/126 Ti Rakau Drive	6	Residential	Yes	Yes
186 Ti Rakau Drive	7	Residential	Yes	Yes
219 Ti Rakau Drive	7	Commercial	Yes	No
108 Ti Rakau Drive	7	Residential	Yes	Yes
136 Ti Rakau Drive	7	Residential	Yes	Yes
2a, 2b, 2c Marriott Road	7	Residential	Yes	Yes
174 Ti Rakau Drive	7	Residential	Yes	Yes

100 Ti Rakau Drive	7	Residential	Yes	Yes
102 Ti Rakau Drive	7	Residential	Yes	Yes
106 Ti Rakau Drive	7	Residential	Yes	Yes
8 Mattson Road	7	Residential	Yes	Yes
1/9 Bolina Crescent	8	Residential	Yes	Yes
140 Ti Rakau Drive	8	Residential	Yes	Yes
200 Ti Rakau Drive	8	Residential	Yes	Yes
166 Ti Rakau Drive	8	Residential	Yes	Yes
172 Ti Rakau Drive	8	Residential	Yes	Yes
2 Paradise Place	8	Residential	Yes	Yes
170 Ti Rakau Drive	8	Residential	Yes	Yes
90 Ti Rakau Drive	9	Residential	Yes	No
192 Ti Rakau Drive	9	Residential	Yes	No
190 Ti Rakau Drive	9	Residential	Yes	No
167 Gossamer Drive	9	Residential	Yes	No
122 Ti Rakau Drive	9	Residential	Yes	No
116 Ti Rakau Drive	9	Residential	Yes	No
110 Ti Rakau Drive	9	Residential	Yes	No
175 Gossamer Drive	9	Residential	Yes	No
154 Ti Rakau Drive	9	Residential	Yes	No
104 Ti Rakau Drive	10	Residential	Yes	No
112 Ti Rakau Drive	10	Residential	Yes	No
120 Ti Rakau Drive	10	Residential	Yes	No
188 Ti Rakau Drive	10	Residential	Yes	No
114 Ti Rakau Drive	10	Residential	Yes	No
118 Ti Rakau Drive	10	Residential	Yes	No
1-2/204 Ti Rakau Drive	11	Residential	Yes	No
98 Ti Rakau Drive	11	Residential	Yes	No
9 Mattson Road	11	Residential	Yes	No
173 Gossamer Drive	11	Residential	Yes	No
206 Ti Rakau Drive	11	Residential	Yes	No
96 Ti Rakau Drive	12	Residential	Yes	No
208 Ti Rakau Drive	12	Residential	Yes	No
178 Ti Rakau Drive	12	Residential	Yes	No
194 Ti Rakau Drive	12	Residential	Yes	No
196 Ti Rakau Drive	12	Residential	Yes	No
4 Wheatley Avenue	12	Residential	Yes	No
3 Wheatley Avenue	13	Residential	Yes	No
6, 1/6 Edgewater Drive	13	Residential	Yes	No
144 Ti Rakau Drive	14	Residential	Yes	No
198 Ti Rakau Drive	14	Residential	Yes	No
152 Ti Rakau Drive	14	Residential	Yes	No
165 Edgewater Drive	14	Residential	Yes	No
129 Ti Rakau Drive	15	Residential	Yes	No

17 Fremantle Place	16	Residential	Yes	No
40 Riverhills Avenue	16	Residential	Yes	No
142 Edgewater Drive	16	Residential	Yes	No
177 Ti Rakau Drive	16	Residential	Yes	No
1/10 Dolphin Street	16	Residential	Yes	No
175a-1/175a Ti Rakau Drive	17	Residential	Yes	No
184b Ti Rakau Drive	17	Residential	Yes	No
1/144 Edgewater Drive	17	Residential	Yes	No
6 Tiraumea Drive	17	Residential	Yes	No
150 Ti Rakau Drive	18	Residential	Yes	No
146 Ti Rakau Drive	18	Residential	Yes	No
8 Dolphin Street	18	Residential	Yes	No
14 Edgewater Drive	18	Residential	Yes	No
148 Ti Rakau Drive	19	Residential	Yes	No
7 Tiraumea Drive	19	Residential	Yes	No
14 Edgewater Drive	19	Residential	Yes	No
7 Fremantle Place	19	Residential	Yes	No
19 Fremantle Place	19	Residential	Yes	No
7 Bolina Crescent	19	Residential	Yes	No
9 Fremantle Place	19	Residential	Yes	No
183 Ti Rakau Drive	20	Residential	Yes	No

Pavement Works, Night-time, EB3R

Address	Distance to works	Building Type/Structure	Exceeds Category A?	Exceeds Category B?
1-2/13 Ti Rakau Drive	19	Residential	Yes	No
1-2/5 Ti Rakau Drive	19	Residential	Yes	No
1-2/17 Ti Rakau Drive	19	Residential	Yes	No
3 Ti Rakau Drive	20	Residential	Yes	No
1/15,15 Ti Rakau Drive	20	Residential	Yes	No
1-2/7 Ti Rakau Drive	21	Residential	Yes	No
1/11,11 Ti Rakau Drive	21	Residential	Yes	No
1/19,19 Ti Rakau Drive	21	Residential	Yes	No
2/23 Ti Rakau Drive	21	Residential	Yes	No
1/9,9 Ti Rakau Drive	22	Residential	Yes	No
21 Ti Rakau Drive	23	Residential	Yes	No
1/23 Ti Rakau Drive	32	Residential	Yes	No
1-2/3 Palm Avenue	39	Residential	Yes	No
4a - 4b Palm Avenue	41	Residential	Yes	No
1-2/90 Pakuranga Road	44	Residential	Yes	No

Appendix F – Vibration Maps



Legend

Vibration category

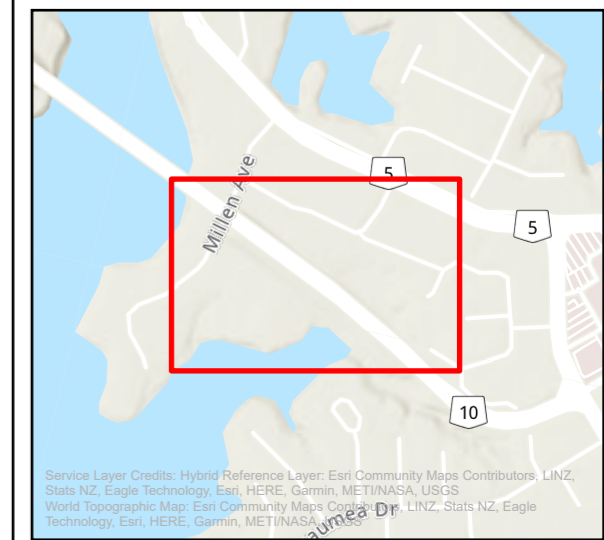
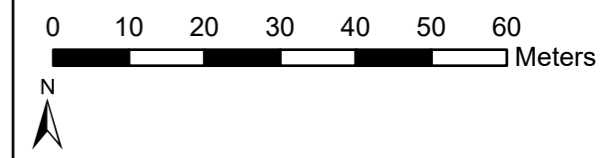
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

Page 1 of 19



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 World Topographic Map: Esri Community Maps Contributors, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS

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Legend

Vibration category

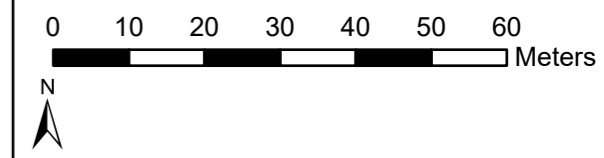
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- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

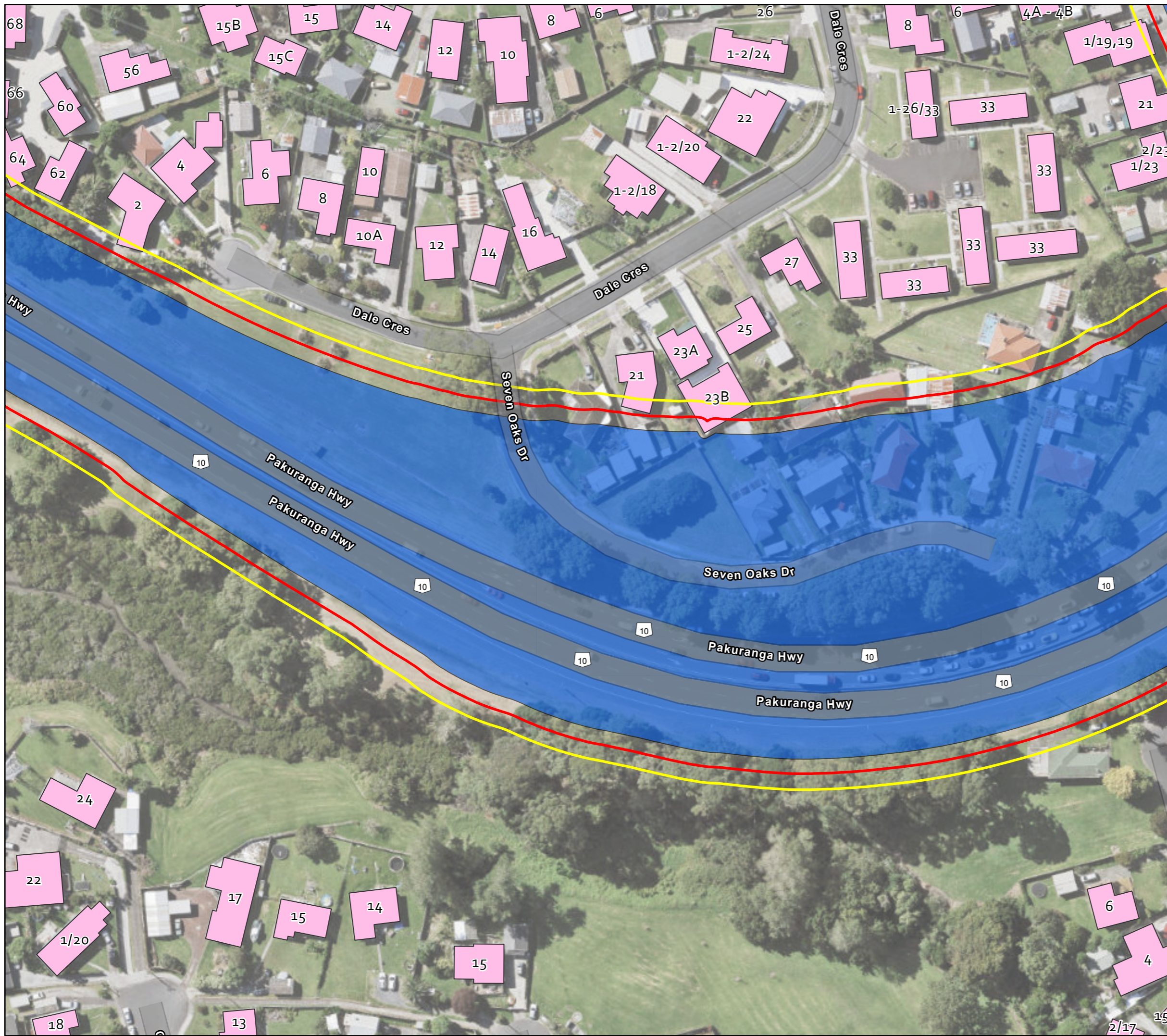
- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

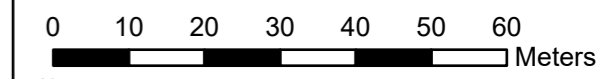
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- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

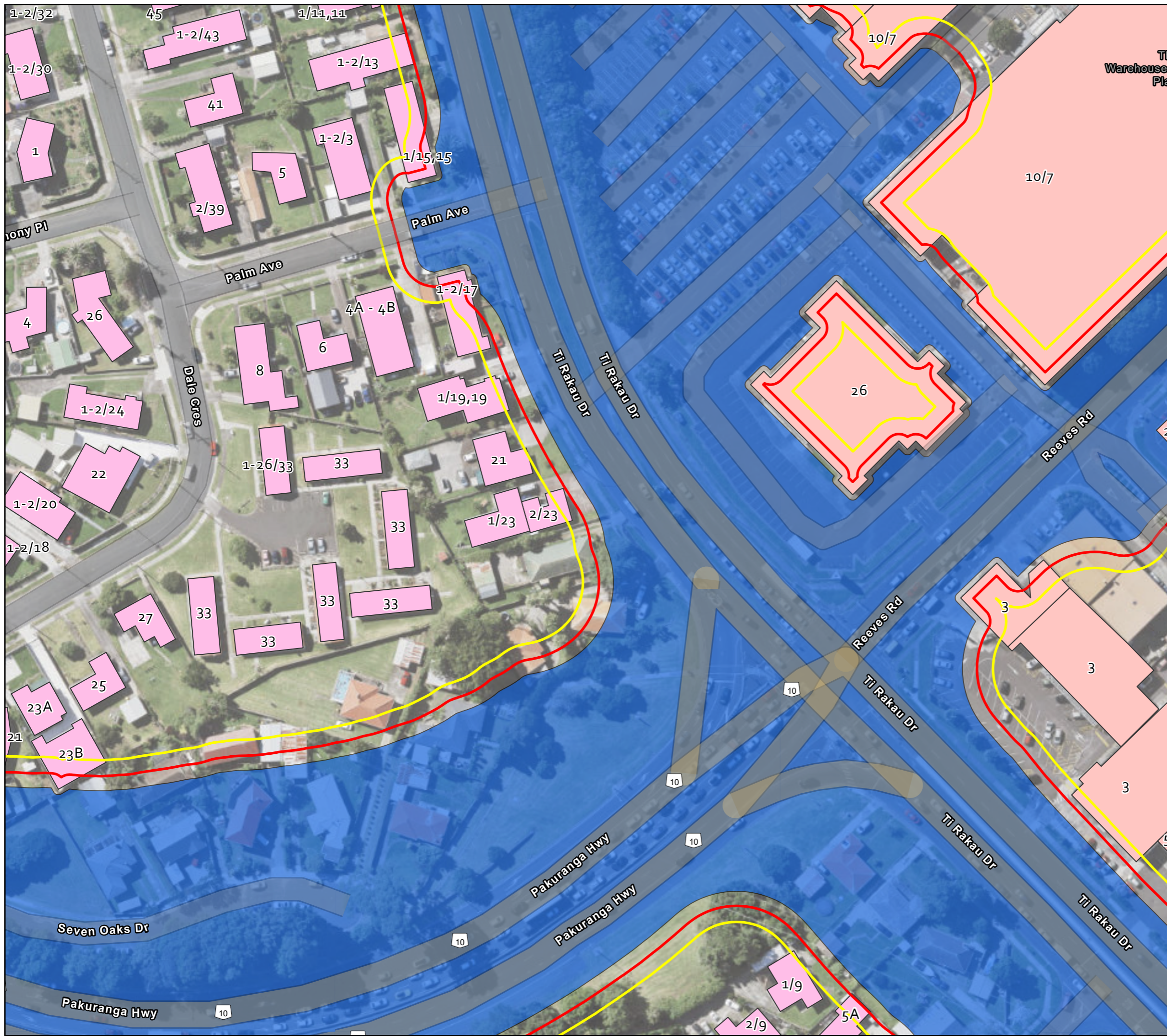
- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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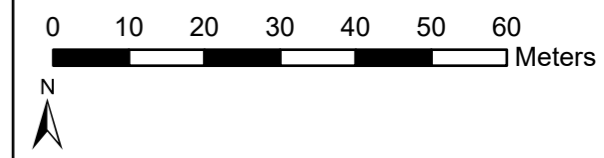


Legend
Vibration category
 5 mm/s PPV Category B Vibration Criterion
 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification
 Commercial
 Residential
 Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

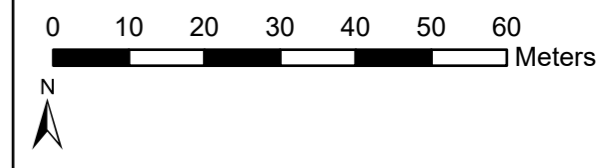
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- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

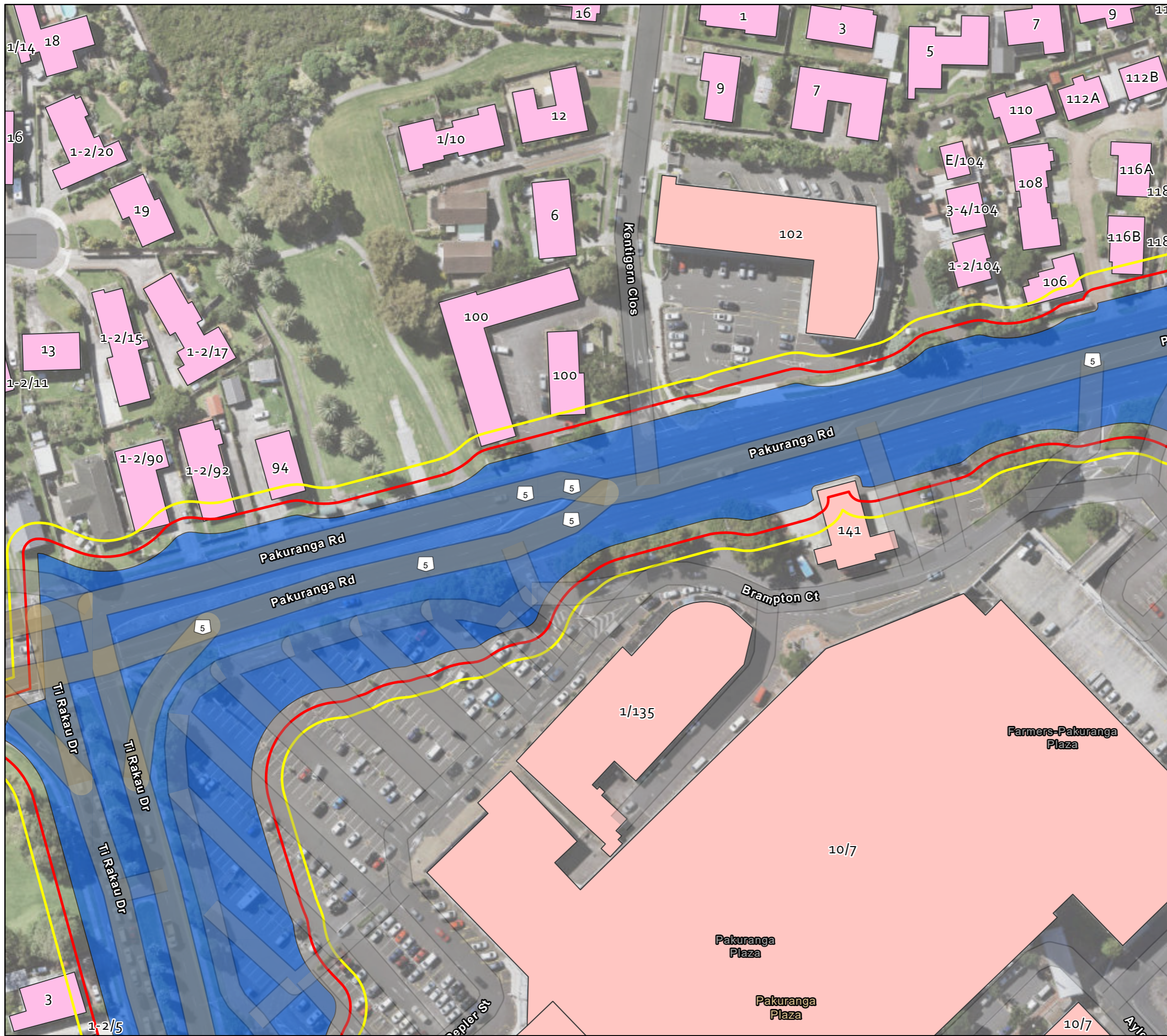
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Legend

Vibration category

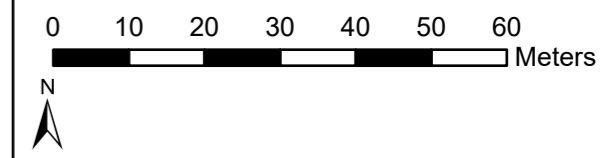
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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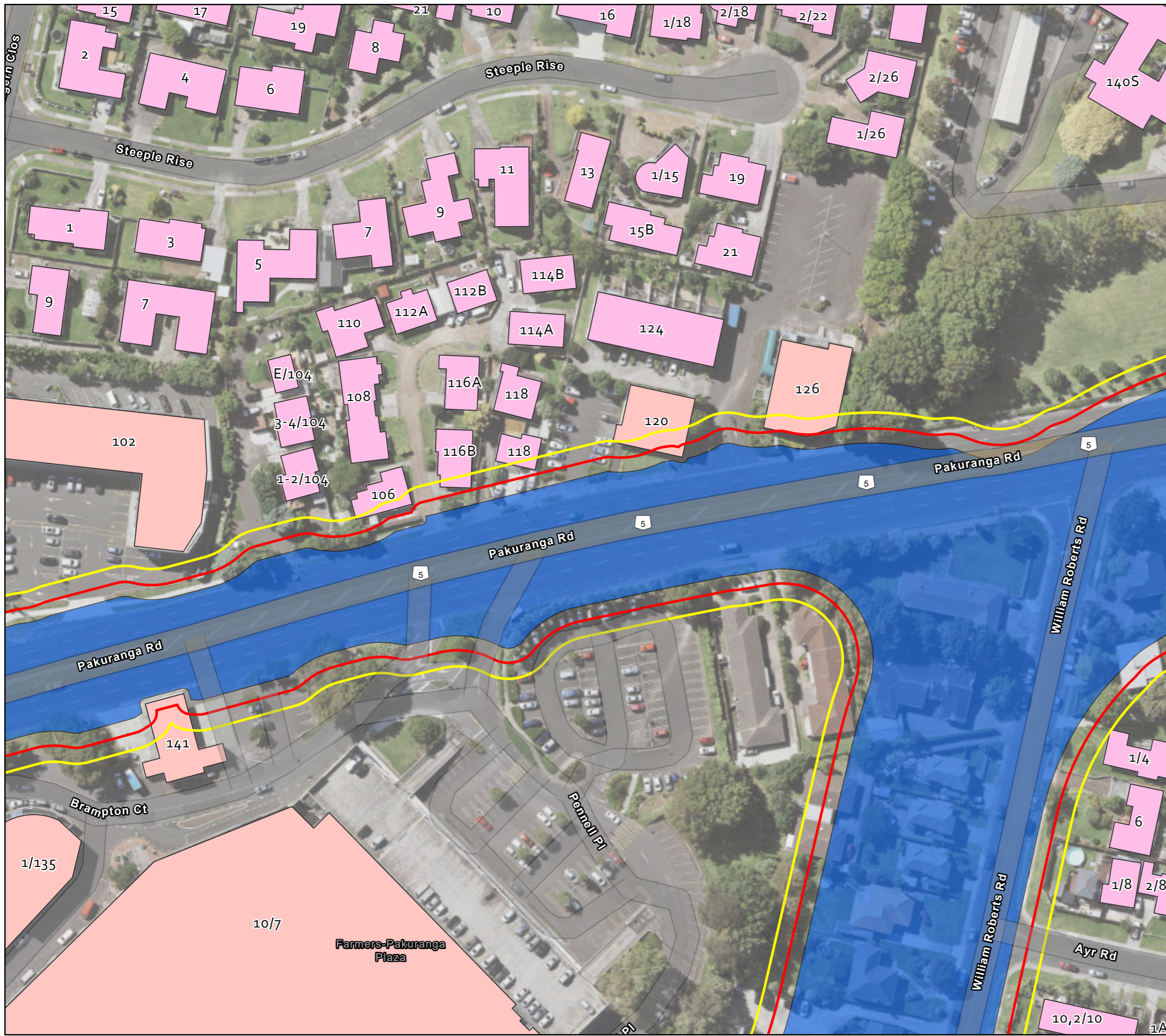
Service Layer Credits: Hybrid Reference Layer: Esri Community Maps Contributors, LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, newzealand: Eagle Technology, Land Information New Zealand, CEBCO, Community maps contributors

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Legend

Vibration category

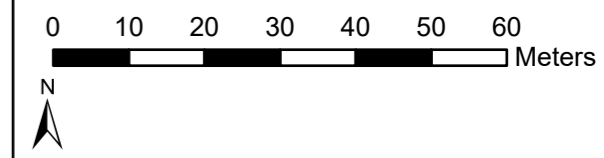
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

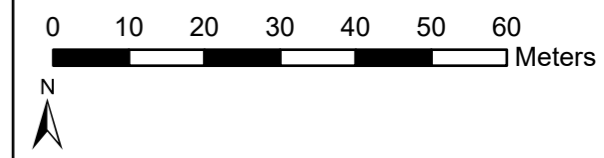
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

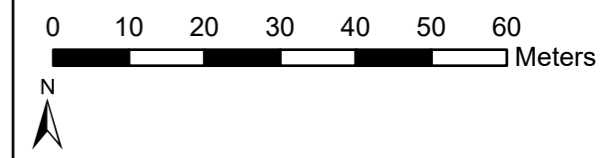
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

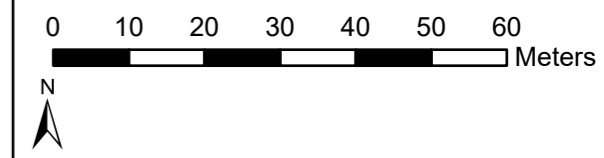
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- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

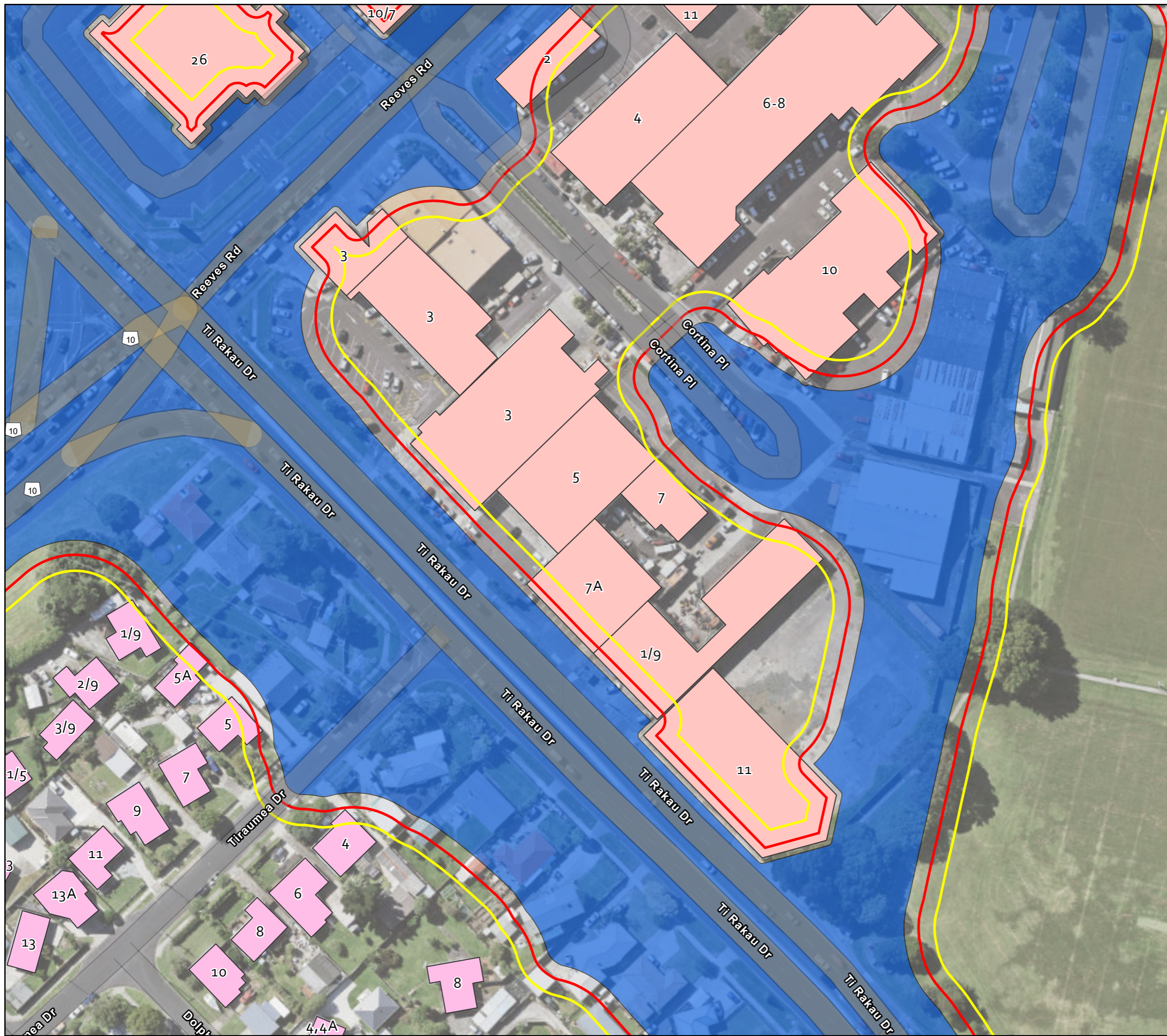
EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

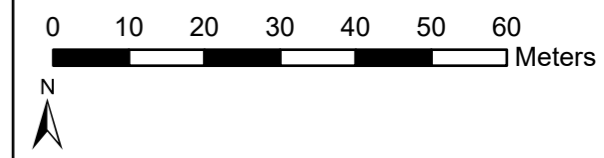
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- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

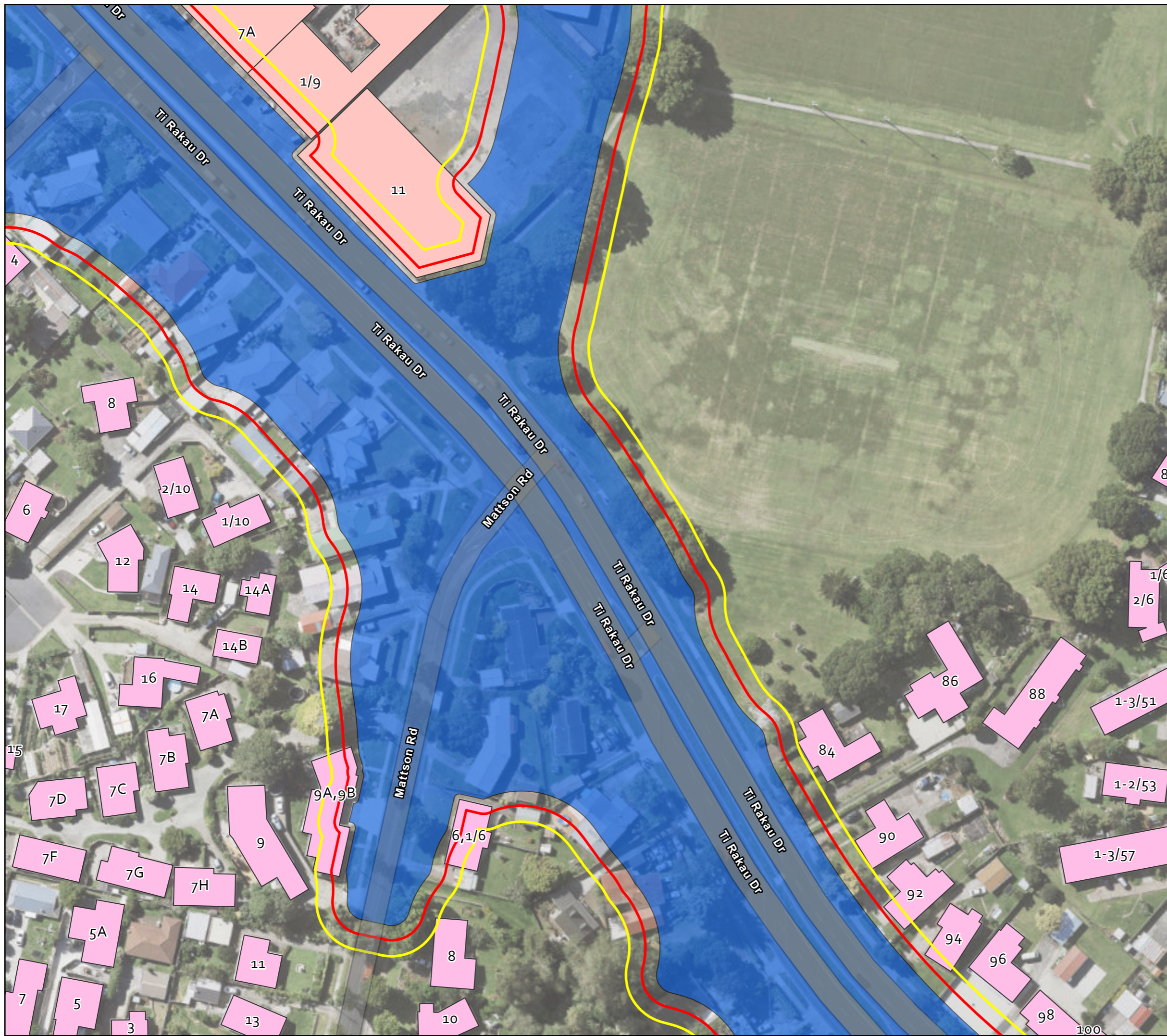
EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

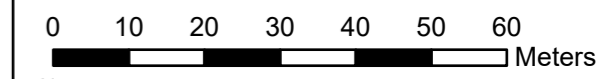
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

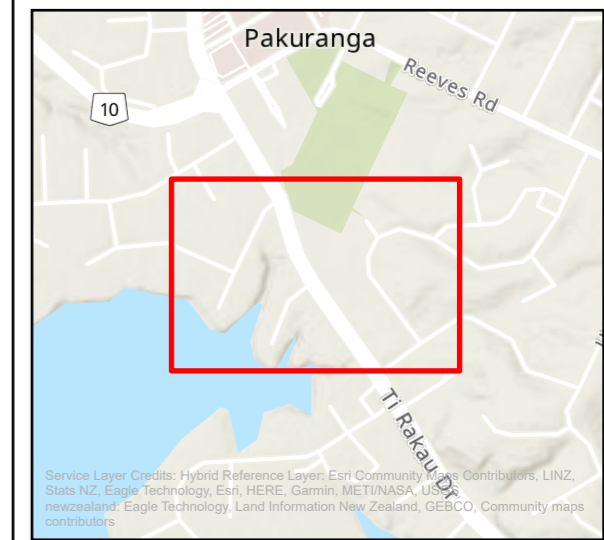
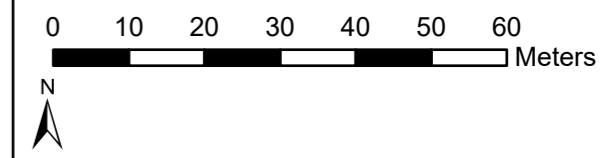
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration category

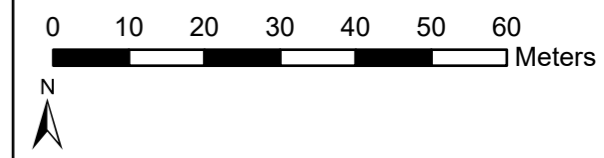
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

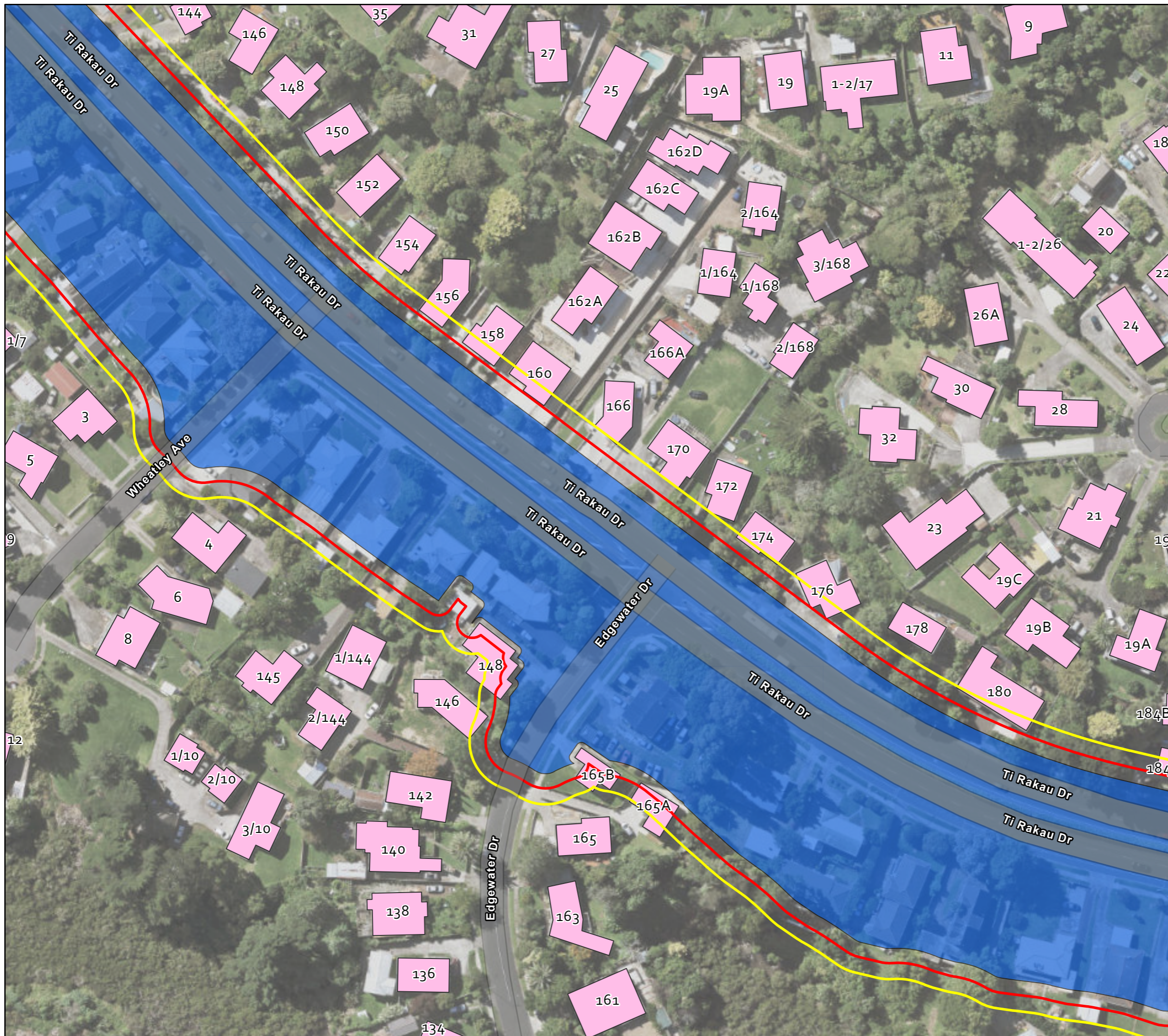
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Legend

Vibration category

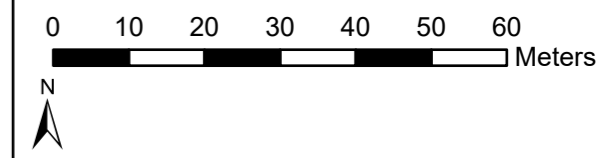
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

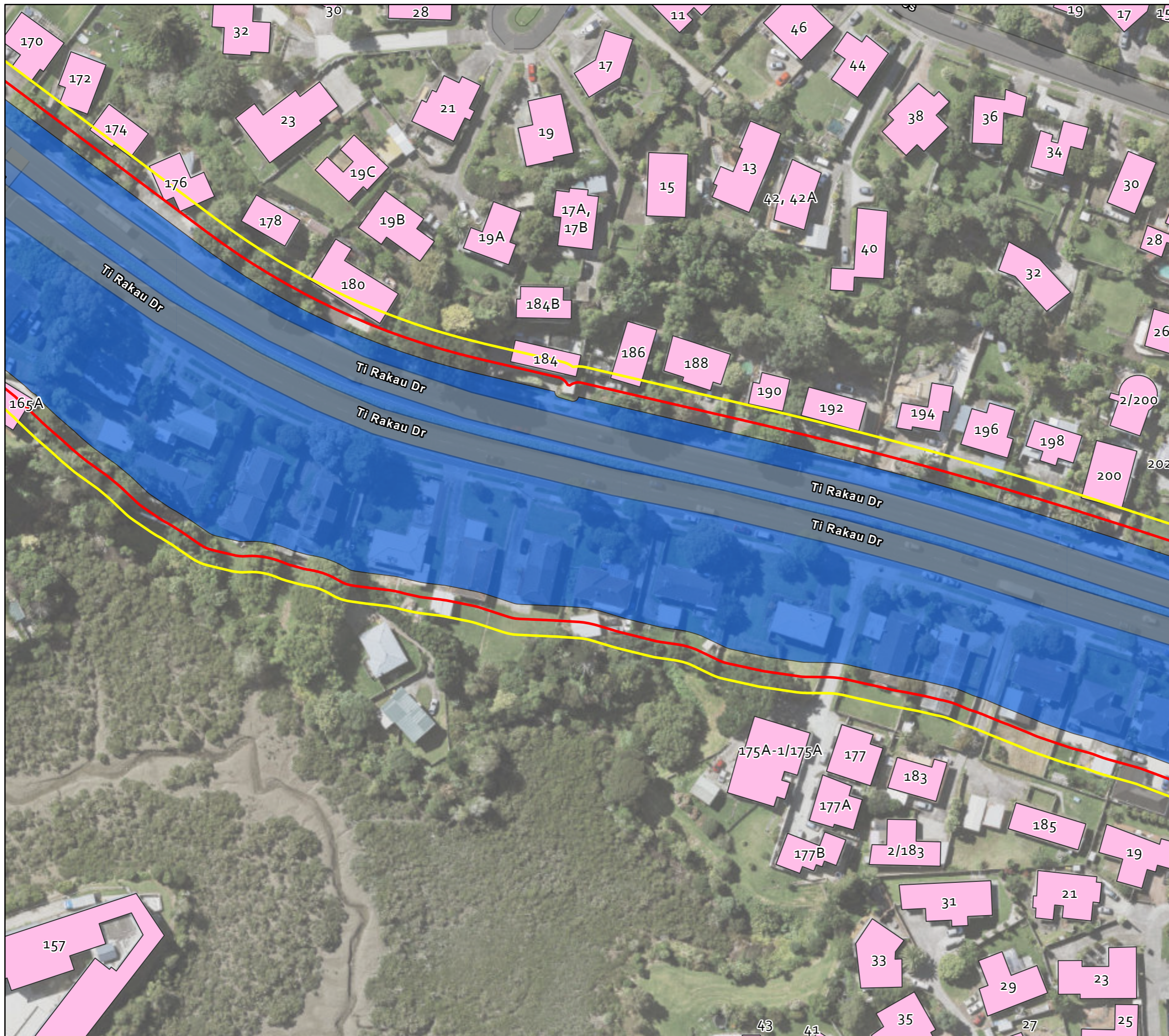
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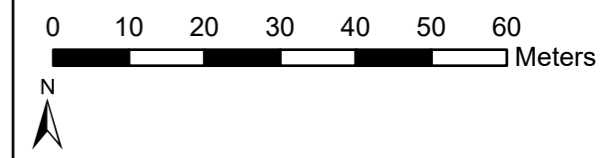
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- Legend**
- Vibration category**
- 5 mm/s PPV Category B Vibration Criterion
 - 20 mm/s PPV DIN 4150 Commercial Vibration Criterion
- Vibration Classification**
- Commercial
 - Residential
 - Works area

EB2EB3R Predicted Construction Vibration

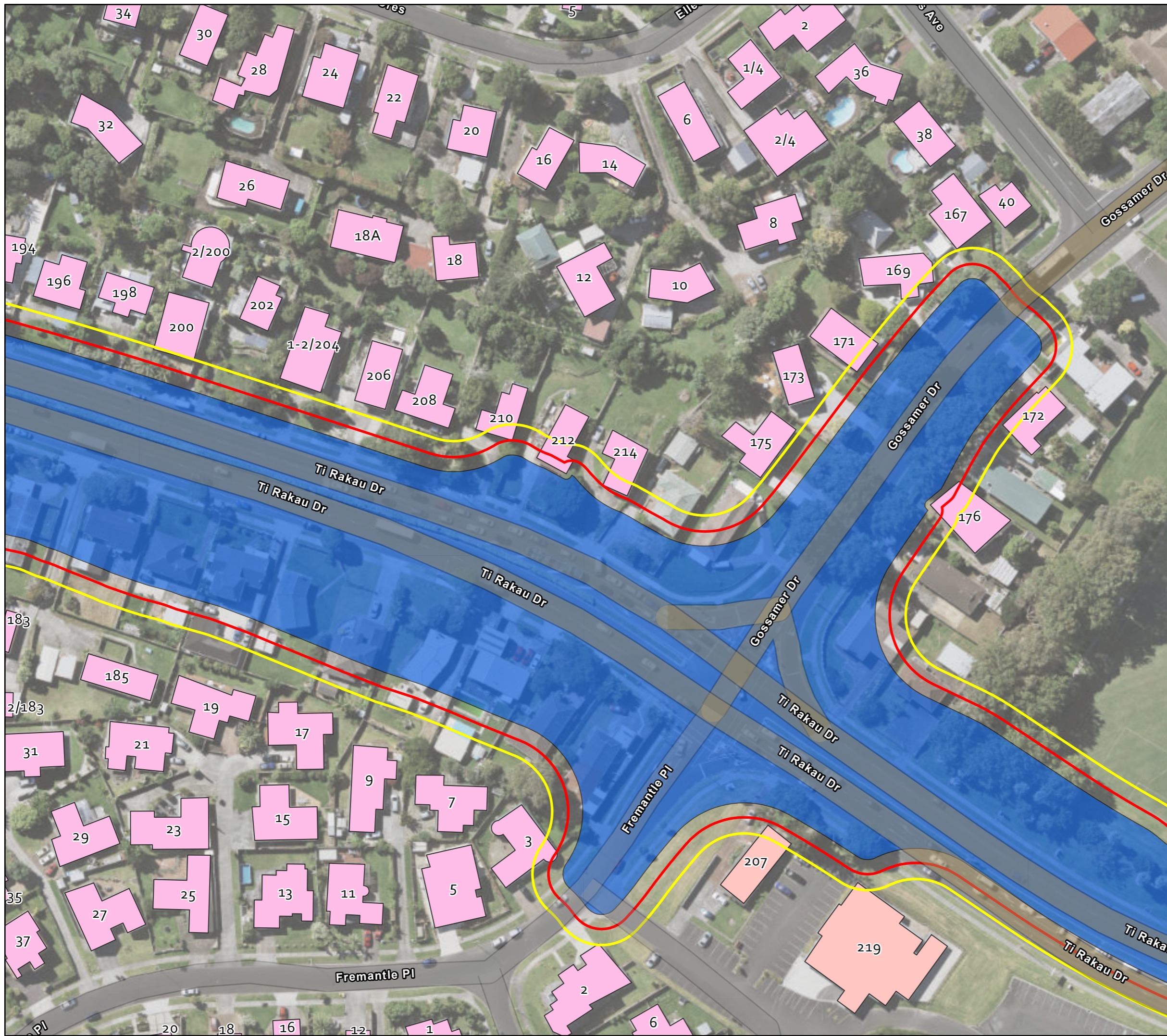
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Legend

Vibration category

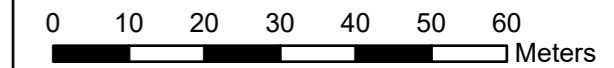
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

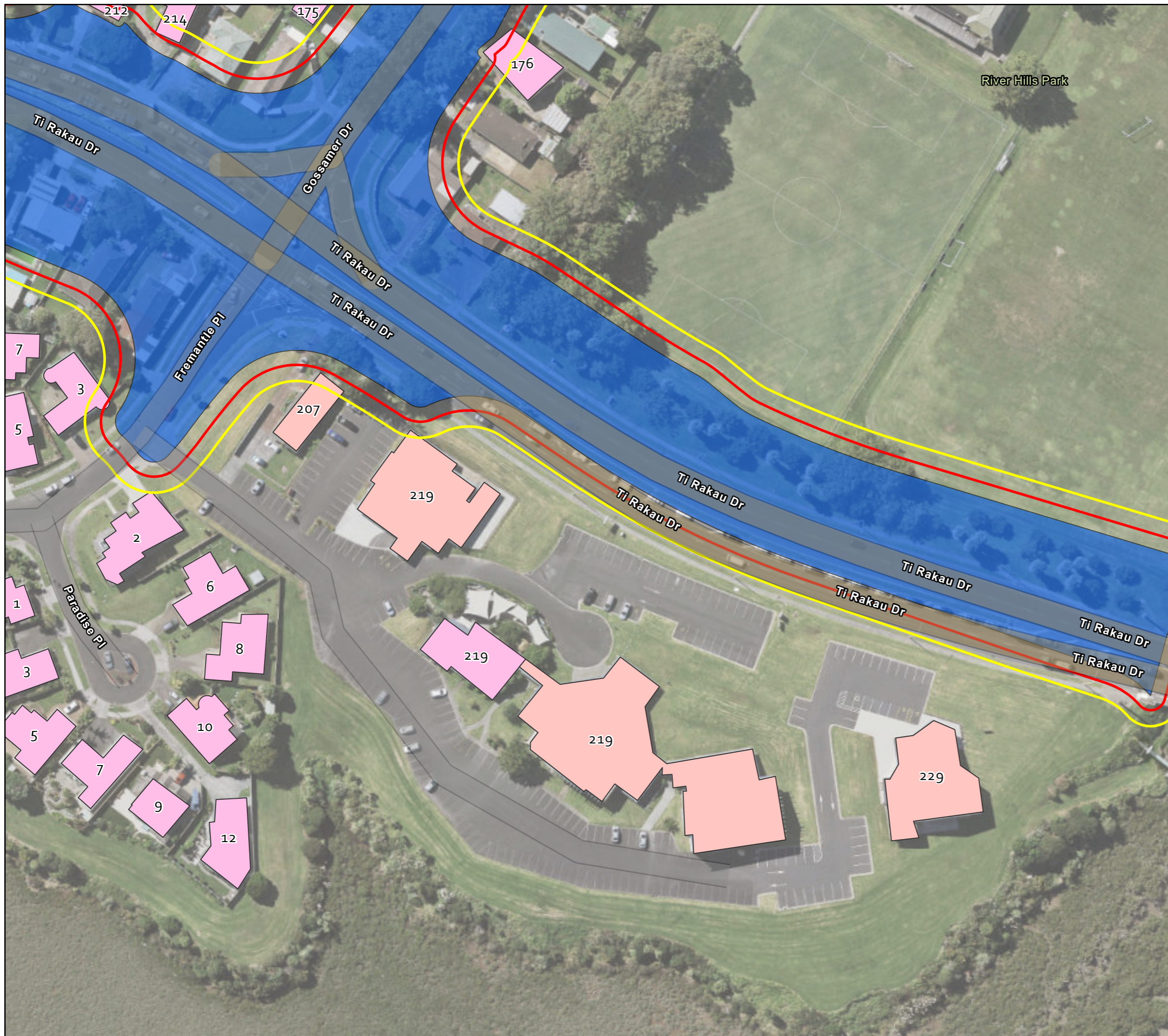
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Legend

Vibration category

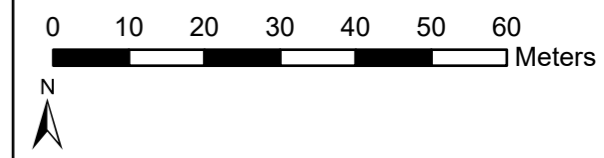
- 5 mm/s PPV Category B Vibration Criterion
- 20 mm/s PPV DIN 4150 Commercial Vibration Criterion

Vibration Classification

- Commercial
- Residential
- Works area

EB2EB3R Predicted Construction Vibration

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Legend

Vibration Category

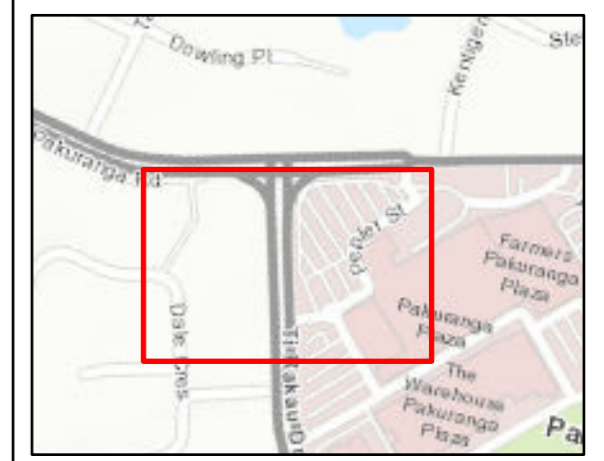
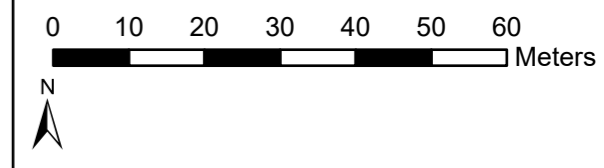
- 2 mm/s PPV Category B Vibration Criterion
- 0.3 mm/s PPV Category A Vibration Criterion

Vibration Use

- Commercial
- Residential
- Works Area

**Night-Time Pavement Works
Predicted
Construction Vibration**

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Author:

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Legend

Vibration Category

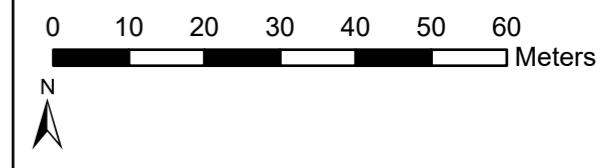
- 2 mm/s PPV Category B Vibration Criterion
- 0.3 mm/s PPV Category A Vibration Criterion

Vibration Use

- Commercial
- Residential
- Works Area

**Night-Time Pavement Works
Predicted
Construction Vibration**

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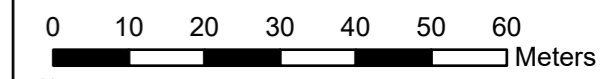


Legend
Vibration Category
 2 mm/s PPV Category B Vibration Criterion
 0.3 mm/s PPV Category A Vibration Criterion

Vibration Use
 Commercial
 Residential
 Works Area

**Night-Time Pavement Works
 Predicted
 Construction Vibration**

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Legend

Vibration Category

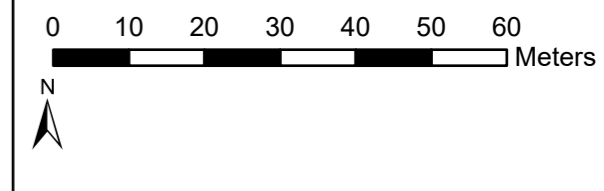
- 2 mm/s PPV Category B Vibration Criterion
- 0.3 mm/s PPV Category A Vibration Criterion

Vibration Use

- Commercial
- Residential
- Works Area

**Night-Time Pavement Works
Predicted
Construction Vibration**

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