Pre-Commissioning Noise Report

HAI-MTM A & B Transmission Line Realignment Project

August 2017

Keeping the energy flowing




TRANSPOWER

Prepared By:

Malcolm Hunt Associates

Noise and Environmental Consultants
Second Floor Arco House
47 Cuba Street
PO Box 11-294
Wellington

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Document Sign off:	**Lindsay Hannah** MASNZ. MNZEIH Consultant Bachelor of Building Science [BBSc.] Post Graduate Diploma Sci [Acoustics [dist]] Master of Phil [Sc] [Acoustics] [Hons]] **Malcolm Hunt** MASNZ. MNZEIH Principal Acoustic Consultant. Bachelor of Science [B.Sc.] Master of Engineering[mech] Diploma in Public Health RSH Diploma Noise Control Engineering

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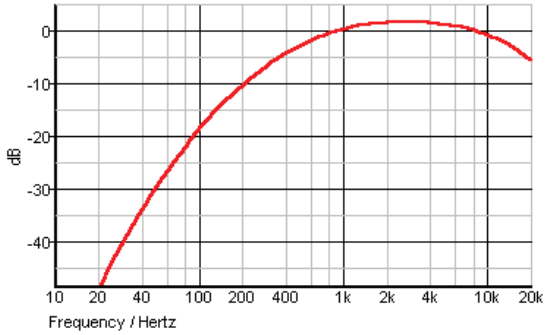
Acoustic Nomenclature

dB[A]

A weighted Decibel. A measurement of sound which has its frequency characteristics modified by a filter [A-weighted] so as to more closely approximate the sensitivity of the human ear. The A-weighting curve applies a correction to measured values which increases in the low frequency region, reflecting that humans are relatively insensitive to sounds below about 200 Hz. The A-weighting curve is summarised as follows;



L_{Aeq} dB

The time-averaged sound level [or equivalent sound level] that has the same mean square sound pressure level as the time-varying sound level under consideration. Commonly referred to as an "energy average" measure of sound exposure. The L_{Aeq} is an A weighted sound pressure level over the measurement period.

$$L_{Aeq(t_3)} = 10 \lg \left(\frac{1}{t_3} \int_{t_1}^{t_2} p_A^2(t)\, dt / p_0^2 \right) dB$$

where:

t_3 is the measurement time interval between start and finish times t_1 and t_2

$L_{Aeq(t_3)}$ is the LEQ over time period t_3

$p_A^2(t)$ is the square of the A-frequency-weighted sound pressure as a function of time

p_0 is the reference value of 20 μPa

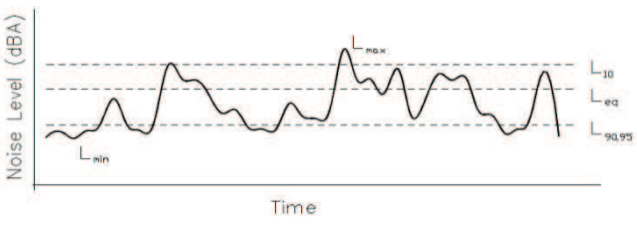
L_{AFmax} dB

A weighted sound pressure level. The single highest sampled level of sound over the measurement period.

L_{A90} dB

The 'Background Sound Level' equating to the level of sound exceeded for 90% of the monitoring period. The background sound level is influenced by constant sound sources. Noise emission limits are not generally specified in terms of an L_{90} level, but it is used as a guide to the general amenity of an area. The L_{A90} is used to portray the human perception of aural amenity and generally reflects the noise level in the lulls between individual noise events, for example noise present during car by pass or voices yelling. The L_{A90} is always presented as an A weighted sound level.

L_X as function of Time



Sound Power

Or "Sound Power Level". The 'energy' created by a sound is defined as its sound power. The ear cannot hear sound power nor can it be measured directly. Sound power is not dependent upon its surrounding environment. Sound power is the rate per unit time at which airborne sound energy is radiated by a source. It is expressed it watts [W]. Sound power level or acoustic power level is a logarithmic measure of the sound power in comparison to the reference level of 1 pW [picowatt]. The sound power level is given the letter Lw or SWL, it is not the same thing as sound pressure [L_p]. Any L_p value is dependent of the distance from the noise source and the environment in which it was measured. Lw values are preferred for noise prediction purposed as their value is independent of distance or environment. There are recognised formulas for converting L_w to L_p. A-weighted sound power levels are usually denoted L_{wA} [dB] or sometimes L_w [dBA] or SWL [dBA].

Sound Pressure

Sound Pressure Level is defined as varying pressure fluctuations caused by sound waves. The ear converts these fluctuations into what we call audible sound, which is the sensation [as detected by the ear] of very small rapid changes in the air pressure above and below a static value. This "static" value is atmospheric pressure.

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MalcolmHuntAssociates
noise and environmental consultants

1 Introduction / Purpose of Study

Malcolm Hunt Associates [MHA] have been commissioned by **Transpower New Zealand** [Transpower] to carry out a pre-commissioning noise assessment for a project which entails partially relocating the HAI-MTM-A overhead circuit onto the existing HAI-MTM-B transmission line support structures located along part of State Highway 29 [SH29], Tauranga.

This acoustic report describes potential noise effects that may occur in the surrounding environment due to the proposed re-located transmission line. Apart from the emission of temporary construction noise during the proposed works, this noise assessment has identified small increases in noise where the new conductors from Line A are added to the support structures already supporting the B Line, as well as expected minor decreases where Line A is shifted away from existing dwellings and other noise sensitive sites.

This acoustic report assesses the potential for noise to increase in some areas already affected by transmission lines, and the reduction of noise effects where the transmission line is removed from near dwellings. This report assesses noise effects on the local environment in taking into account the sensitivity of the receiving environment as per the requirements of the Forth Schedule to the Resource Management Act [RMA].

2 Project Location and Surrounding Sites

The project involves partially relocating the Hairini-Mount Maunganui A [HAI-MTM-A] 110kV transmission line onto the existing HAI-MTM-B transmission line support structures located along part of State Highway 29, Tauranga.

The HAI-MTM A&B 110kV transmission lines are both Single Circuit lines on Poles. The A line was commissioned in 1958, while the B line was commissioned in 1995. Due to the wishes of the landowners and the potential for erosion to threaten Pole 117, Transpower wishes to investigate options for the realignment of HAI-MTM-A away from the Ngati Hei Marae.

The relocation of the A line is proposed to follow the following route:

- *From Pole 28 to Pole 32 on the vacant side of the existing B Line;*
- *A new single circuit line from HAI-MTM B Pole 32 to Pole 37 via the following new structures 33A-33B-33C-33D-33E;*
- *From Pole 37 to Pole 47 on the vacant side of the existing B Line; and*
- *A new single circuit from HAI-MTM B Pole 47 to HAI-MTM A Pole 128 via the following new structures 126A-126B-126C-126D-127A.*

Following consideration of overloading and/or clearance issues Transpower has decided the relocation project will require some specific existing structures to be replaced with higher rated poles.

Map 0 below depicts the section of A & B line proposed to be realigned which is located either side of Rangataua Bay, Tauranga.

Map 0: Summary of project works – Blue = lines & structures removed, Red & turquoise = new and altered structures. Map not to scale.

In summary, the proposal will consist of the following components:

- Realign transmission line A from the point where the two transmission lines currently converge in the State Highway 29A road reserve in Maungatapu at Pole 28, to Pole 128 which lies north of the estuary at Matapihi. From there, the A and B lines continue on existing poles beyond the project area to the Mount Maunganui Substation. The most noise-sensitive works are related to the realignment on the B-line alignment along the State Highway 29A corridor. This will involve a number of replacement and additional poles to manage structural loads and line swing and will take place close to residentially zoned sites in Maungatapu Road and Whikitoria Street.
- Install two steel monopoles on either side of Rangataua Bay to enable the A-line to span the estuary in a single span. This activity is unlikely to result in significant noise affecting sensitive receiver sites, including the marae.
- The removal of the A-line including 5 existing structures from Te Ariki Park and residential areas on the Maungatapu side, and removal of this line including 9 structures from pastoral/horticultural land on the Matapihi Side. Noise effects may arise due to some works needed to retrieve the conductors and extract existing poles and structures near to existing dwellings[1].

[1] These works will in some cases take place within 20 metres of residences however the effects will be of short duration, during daytime hours, and not take place without prior notification to the householders. The proposed Construction Noise & Vibration Management Plan (CNVMP) referred to within consent conditions recommended to be attached to the resource consent will require all works to be undertaken in a noise-aware manner and that temporary noise effects of works conducted close to dwellings are especially mitigated and managed at all times.

- Removal of Tower 118 from the CMA and replacement of suspension Pole 128 with a new 'strain' replacement structure immediately adjacent to it. Works associated with the removal, replacement and installation of pole structures and the removal of Tower 118 from the CMA are located at reasonable buffer distances (> 200 metres) from any noise sensitive site and will not be likely to generate adverse environmental noise effects.

In overall terms, this report investigates construction noise effects arising from the removal of 27 existing poles (and one tower in the CMA) and installing 27 new poles (including 13 replacement poles) being installed. As indicated within the assessment below, the location of the proposed works in some cases will result in moderate (temporary) noise effects being received at existing dwellings and noise-sensitive locations (which includes marae). The extent of these effects are quantified within this report, indicating the maximum worse-case noise levels would not exceed the relevant guideline for assessing construction noise, NZS6803:1999 *Acoustics – Construction Noise*, a Standard referred to within the Tauranga City Plan.

As far as we are aware, none of the works will be required to be conducted over the more sensitive night time period. The findings below support the assessment that construction activities will generate acceptable levels of temporary noise effects that can be fully assimilated into the surrounding environment without causing any significant adverse effects. Construction noise effects are proposed to be subject to control and management via specialised conditions recommended to be attached to the resource consent, if granted.

Noise effects associated with the on-going operation of transmission assets within the project area are also considered within the assessments outlined below. The expected low-level noise effects associated with typical operation of the A & B Lines is typical of most 110 kV transmission lines in New Zealand, and is also consistent with the results of field measurements set out below (which have confirmed the low-noise operation of the existing transmission equipment installed in the project area.

2.1 Method of Investigation

A site visit and a sound level measurement survey has conducted on the 9th of November 2016 by Malcolm Hunt Associates for the purposes of inspecting the project area and measuring current ambient [background] sound levels near residential boundaries adjacent to the HAI-MTM Line B Pole 28 to Pole 33. As set out within the project description, this area is where the new section will be added to the existing or replacement poles and thus, any operational noise effects of the new infrastructure (if any) would be most noticeable.

The overall aim was to undertake the measurements during night time under calm and quiet conditions to ascertain whether sound levels associated with normal operation of the new lines and structures would represent a noticeable noise effect in the context of the existing ambient [background] noise environment. The results of measurements of the current "quiet night time" ambient sound levels are set out below. Section 6 below contains the comparison of the existing (night time) sound levels with predicted 'worse case' noise due to normal operation of both Line A and B.

The methods and procedures used to predict noise (separately) from construction activities and operation of the transmission lines are set out in detail below. The prediction of noise due to 'corona discharge' sound levels under normal operation of all transmission assets within the project area (once the project is completed) is based on calculations carried out by AECOM Consultants, as set out in Section 6. Noise levels have been estimated for receiving sites defined as any location within residentially zoned sites, or within the 20 metre notional boundary to dwellings in the rural zone (Matapihi).

Details of the methods used to predict noise from construction activities based on the recommendations of NZS6803:1999 *Acoustics – Construction Noise* are set out below in Section 7. These predictions have adopted published 'sound power levels' for a wide range of construction equipment, with the actual emission level determined according to the "percent use" and other source factors, as recommended be taken into account within NZS6803:1999. For construction noise the effects of distance and screening by fences and buildings has been taken into account. Under NZS6803:1999 the relevant assessment point is a location 1 metre from the most exposed outside wall or a dwelling or a building housing a noise sensitive activity.

2.2 Measurement Standards

Sound level monitoring was carried out in accordance with the procedures set down in the technical New Zealand Standard, *NZS6801:2008 Acoustics - Measurement of Sound [NZS6801:2008]*. This Standard provides guidance on the technical aspects of noise measurement. Field calibration was checked before and after the field measurements.

2.3 Measurement Equipment and Weather Details

Sound level measurements were conducted using a Bruel and Kjaer 2260 Investigator Type 1 Sound Level Meter. ***Appendix A*** attached sets out the calibration details for the sound level meter employed for the survey.
Sound Level Meters comply with IEC 651 Type 1 specifications for precision grade sound level meters. In all cases the microphone was positioned approx. 1.2 metres above local ground. The microphone was fitted with a dual layer [with separate inner and outer] windshields during all measurements. Measurements were conducted by Malcolm Hunt.

As above, these settings are in accordance with technical guidance set down in *NZS6801:2008 Acoustics - Measurement of Sound.* All measurement conditions attempted to be within the recommended met window as set out within *NZS6801:2008 Acoustics - Measurement of Sound.* It is noted that there was nil wind gusts and nil precipitation during the survey period. The cloud cover ranged from overcast to scattered cumulus cloud. The average temperature was around 9 degrees Celsius.

3 Measurement Locations

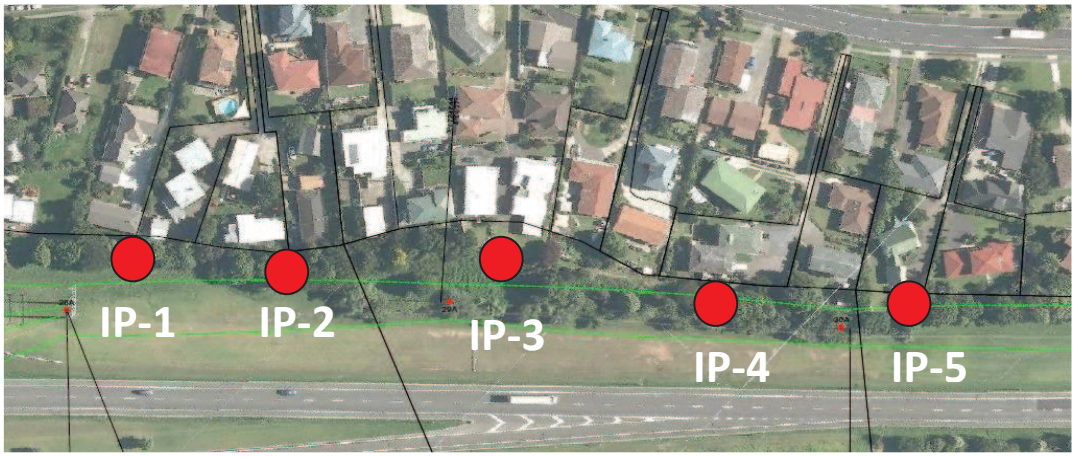
The aim was to measure the existing ambient [background] noise levels during periods of low activity. Measurements took place late at night [under calm conditions] at the locations shown in **Map 1**, **Map 2** and **Map 3** as solid red dots, with the sample locations referred to IP-1 through to IP-10. Noise assessment locations were near existing dwellings in all cases.

3.1 Overview Map

The following is an overview map showing the extent of the survey work and surrounding areas. Further details of actual assessment locations are set out in **Map 1**, **Map 2** and **Map 3** below.

Overview Map: Summary of approx. measurement sample locations. Map not to scale.

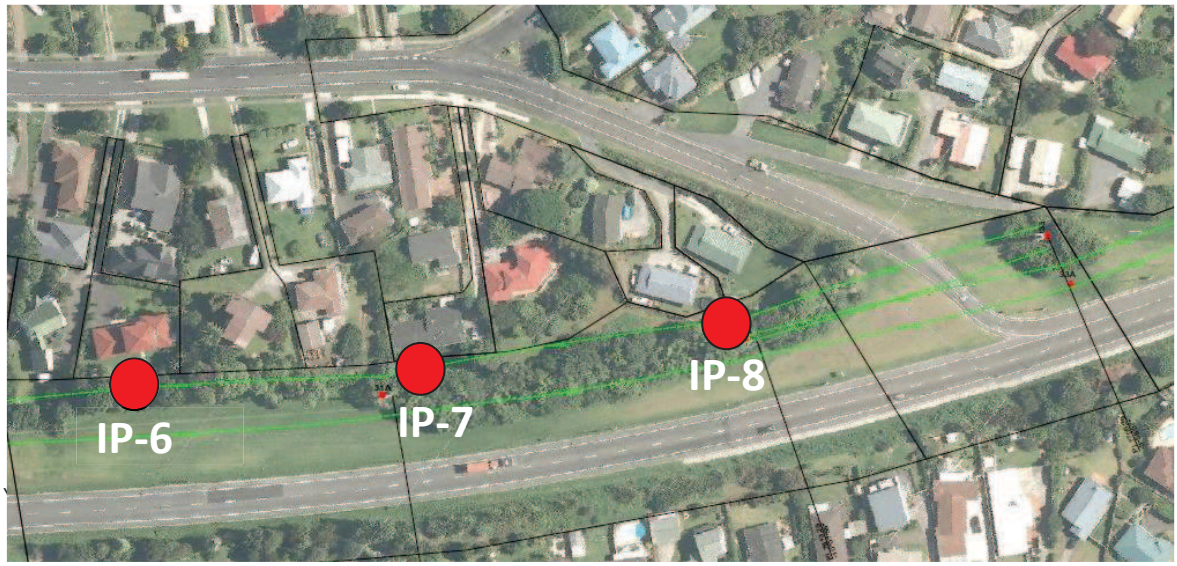
3.2 Map 1: IP-1 to IP-5



Map 1: Measurement locations **IP-1 to IP-5**. Map not to scale.

Measurement Position	Address
IP-1/Map 1	Rear boundary adjacent 327**B Maungatapu Road**
IP-2/Map 1	Rear boundary adjacent 333**/337 Maungatapu Road**
IP-3/Map 1	Rear boundary adjacent **353 Maungatapu Road**
IP-4/Map 1	Rear boundary adjacent **371 Maungatapu Road**
IP-5/Map 1	Rear boundary adjacent **379 Maungatapu Road**

3.3 Map 2: IP-6, IP-7 and IP-8



Map 2: Measurement locations **IP-6, IP-7** and **IP-8**. Map not to scale.

Measurement Position	Address
IP-6/Map 2	Rear boundary adjacent **381 and 387 Maungatapu Road**
IP-7/Map 2	Rear boundary adjacent **399 Maungatapu Road**
IP-8/Map 3	Rear boundary adjacent **409A Maungatapu Road**

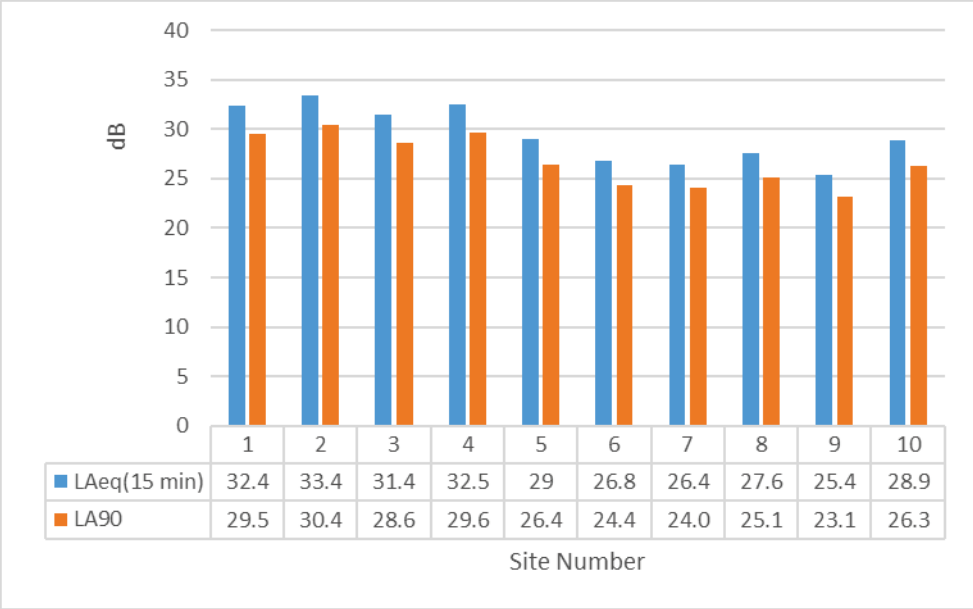
3.4 Map 3: IP-9 and IP-10

Map 3: Measurement locations **IP-9** and **IP-10.** Map not to scale.

Measurement Position	Address
IP-9/Map 3	Front boundary adjacent **411 Maungatapu Road**
IP-10/Map 3	**=Whikitoria Street Reserve/ Ngati Hei Marae.**

4 Ambient Sound Levels

A major objective of the study was to measure existing ambient noise levels to enable an assessment of potential operational noise levels at night to assist in fully assessing noise associated with this realignment project. The LAeq (residual sound level) and LA90 (background sound level) measured as an overall A-weighted sound level at sites IP-1 to IP- 10 are summarised in the following graph in **Figure 1.**



	1	2	3	4	5	6	7	8	9	10
LAeq(15 min)	32.4	33.4	31.4	32.5	29	26.8	26.4	27.6	25.4	28.9
LA90	29.5	30.4	28.6	29.6	26.4	24.4	24.0	25.1	23.1	26.3

Figure 1: Overall results of night time measurements [L_{Aeq} and L_{A90}] of the existing ambient noise environment undertaken adjacent to the boundary of the closest existing residential sites under calm, late night conditions.

These survey results indicate the existing environment is relatively quiet. Passage through the area by vehicles travelling at the posted speed limit of 80 km/hr generates significant and noticeable individual noise events.

Figure 2 below sets out a typical example of the night time sound levels measured at IP-9 monitoring location under calm conditions. These results are affected to a large extent by intermittent sounds of vehicles passing the site on the state highway. The assessment below considers the potential noise effects of conductor noise at times of low background sound levels, such as that evident between the times when vehicles are passing the site.

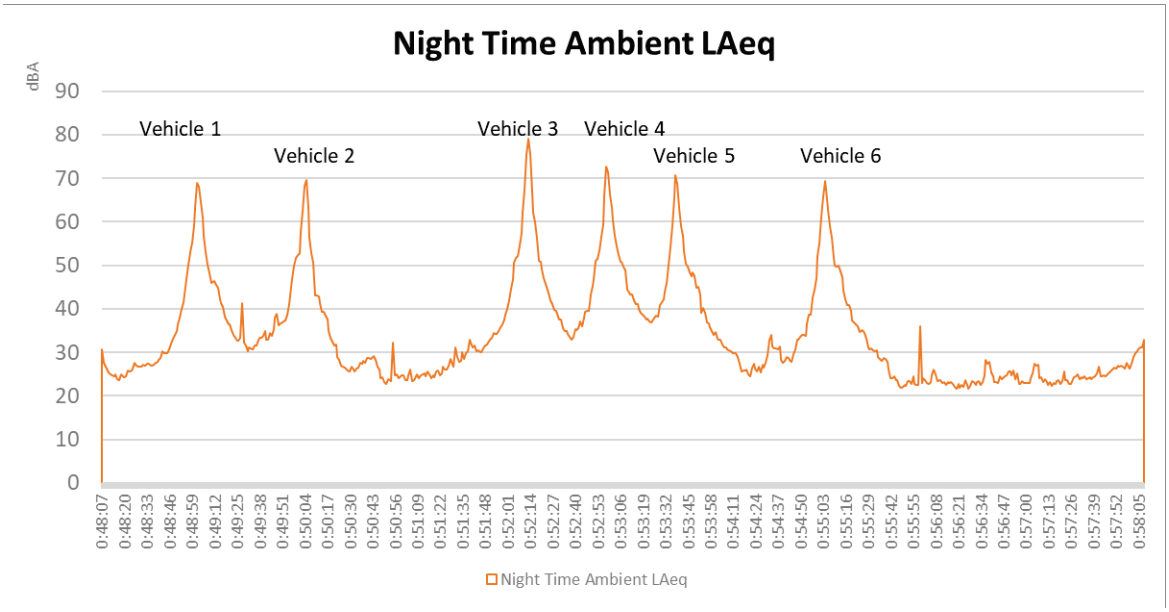


Figure 2: Typical late night ambient sound levels under calm conditions adjacent rear residential boundaries to 411 Maungatapu Road.

The frequency content of the sound levels measured at each of the 10 monitoring sites described above and summarised in **Figure 1** is presented in **Figure 3.**

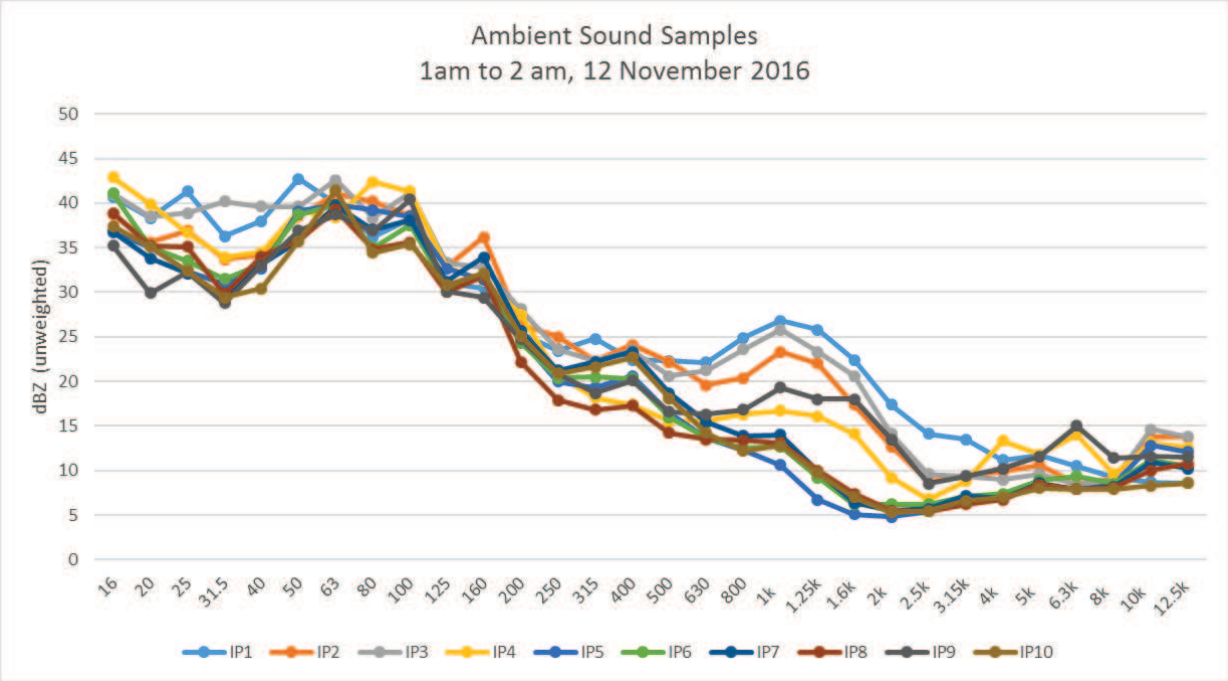


Figure 3: Sound level spectra measured at each of the monitoring sites IP-1 to IP-10.

Figure 3 shows the sound energy present across the audible sound spectrum (16 Hz to 12.45 kHz) as measured at sites IP-1 to IP 10. To properly interpret the above frequency analysis one needs to take into account the relative insensitivity of the human ear in the low frequency region[2]. Elevated sound levels measured in the frequencies below about 100 to 200 Hz are normally expected when measuring environmental sound outdoors. None of the measured sound levels appear related to the operation of the existing transmission line which, while live and operating at the time, did not emit any measurable sound.

There should be no mistake that compared to typical urban sound levels, the above samples are remarkably low. This is due to there being no sound from passing vehicles included within the samples taken.

The low sound levels observed during these periods enables useful conclusions to be drawn around the lack of any audible transmission line noise from the existing Line B. Also, the low sound levels recorded during the site visit enables a worst-case assessment of the impact that any additional transmission sounds generated by the project would have on the environment. This is because as any increases noted would be benchmarked against the low ambient sound levels recently measured in the project area.

5 Operational Noise

Based on field measurements and published research reports on noise from various 110kV conductors, conductor noise arising from the upgraded section of the HAI-MTM-A&B Transmission Line has been investigated. The results below indicate a minor (and likely unnoticeable) amount of additional sound may be generated due to residual electrical discharge from the conductor referred to as 'corona discharge'. Some additional sound occurring under windy conditions referred to as 'Aeolian Noise' may also be generated, however as these sounds are only present under windy conditions, high ambient sound levels at these times tends to render such sounds as inaudible.

[2] See definition of 'dBA' within the '*Acoustic Nomenclature'* set out on pages 4 and 5 of this report.

5.1 Aeolian Noise

This form of noise occurs under well-defined wind conditions and is caused by the wind impinging on the different components of a line, e.g. the steel towers, conductors and insulators. The two meteorological factors that affect the level and frequency of this noise are the wind speed and direction. The different line components give rise to different types of noise. The noise is not dependent on whether or not the line is energised. The occurrence of aeolian noise from the various components of a high voltage line is uncommon, since the conditions under which the noise occurs are very specific, though in particular localities it may occur more frequently.

Aeolian noise may occasionally occur when wind blows through a steel tower of an overhead voltage line. More important, however, is the noise that is sometimes produced under rather specific conditions by the wind blowing over conductors and insulators. Two types of aeolian noise may arise;

A. Conductors:

The regular shedding of air vortices as the wind flows across the conductor causes the noise. At relatively low wind speeds, i.e. below approximately 10 m/s a "swish-ing" noise may occur but at a low level that is seldom troublesome. At higher wind speeds, the noise is similar to the "rumbling" sound of aircraft flying overhead in the distance.

B. Insulators:

This noise occurs for only specific high wind speeds and angles of incidence and only for certain designs and arrangements of insulators. The occurrence of this type of noise is difficult to anticipate but it is usually possible to reduce or eliminate it by ensuring that sufficient acoustic resonance does not occur. In practice, this means replacing some units in the insulator string with ones that have a completely different "rib" profile or installing composite insulators. The number and location of the units in the string to be replaced must be determined for each particular design of insulator string.

By its nature aeolian noise is hard to predict. It also occurs quite infrequently. Depending on wind speed, maximum noise levels of more than 50 dBA can be expected however this would be for very windy conditions when ambient sound levels themselves would register above 50 dBA. Based on experience and the structures involved, aeolian noise is not likely to be detectable within any residentially zoned site or within the notional boundary to any rural dwelling located in the vicinity of the proposed works.

5.2 Electrical Noise

Electric fields around a transmission line conductor wire can become concentrated enough to create an electric discharge. This is termed corona discharge which is a process that causes some sound to be released due to electrical energy 'leaking' from the conductor which ionizes the air around the conductor. Typical corona discharge sound is subjectively described as a crackling or humming sound and is often caused by water drops that collect on the conductor when it rains or when there is sufficient moisture in the air. In some rare instances, using some conductors, the corona discharge sound is also accompanied by a significant tone at 100Hz when wet.

In reality, there are few conductors that significant tonal issues are associated with normal operation. In the past, noise issues have arisen with one type of conductor [ACSR/AC Zebra] which is not proposed to be used on this project. The existing conductor on HAI-MTM-A is Simplex ACSR/GZ Wolf. The existing conductor on HAI-MTM-B is Simplex ACSR/GZ Coyote. None of the known 'noisy' conductor types are proposed to be used in this project.

It is proposed that both the realigned HAI-MTM-A and B lines will be re-strung with ACSR/AC Coyote Conductor, with the exception of the harbour crossing as well as its adjacent spans [i.e. spans 33B-33C and 33D-33E] which will be will be strung with ACSR/AC Goat conductor. All these conductor types are expected to be 'low noise' under normal 110 kV operation.

The following design factors have been taken into account:

(a) Conductor noise levels have been predicted by AECOM consultants. The results are tabulated below are for 'worst case' sound levels predicted beneath the conductor. These levels have been used as the basis for predicting conductor noise received within all adjacent residential sites, thus making the assessment ultra-conservative;

(b) ACSR/AC Goat conductor used on spans 33B-33C and 33D-33E and ACSR/AC Coyote conductors have similar low-noise noise emission qualities based on the line configuration;

(c) Maximum 'wet' conductor noise emissions [5% wet], but no significant tones[3];

(d) The AECOM values set out below are for "aged" conductors. Transpower have conducted measurements under controlled conditions in a laboratory which show low noise conductors such as ACSR/AC Goat or the ACSR/AC Coyote conductor emit a slightly higher noise level when first installed. The laboratory measurements indicate these conductors (when wet) typically emit slightly higher sound (approximately 2 dB higher) compared to conductors exposed to the elements for 6 to 36 months. The prediction of sound levels at sensitive receiver locations have been based on the AECOM values set out below plus 2 dB to reflect the noise levels expected upon first operation.

(e) The AECOM values presented below are for the audible noise expected at a central location beneath lines A and B. A small downward correction adjustment has been made to account for extra distance sound must carry to representative receiver locations, which are locations 1.2 metres above ground level, within the closest;

1) residentially zoned sites and other sensitive sites (e.g. the marae) in the Maungatapu Sector
2) 20 metre notional boundary to any dwelling located in the rural zone, on the Matapihi side

The AECOM results provided to Malcolm Hunt Associates indicates the highest expected conductor sound levels arise in relation to structures 30A, 33, 37, and 127A. These expected (wet) conductor noise emission levels are summarised in the following table, as measured at 1.2 m above local ground level. These form the basis of the 'worst case' values used to estimate the scale of conductor noise effects:

Structure	Configuration	Predicted Sound Level (LAeq dB)	
30A	Double Circuit	26.4 dB at structure 31.3 dBA at span mid-point	*This noise level is the worst-case for any double circuit structure in the Maungatapu Sector
33	Single Circuit Vertical	26.8 dB	
37	Double Circuit	30.7 dB	*This noise level is the worst-case for any double circuit structure anywhere on the line.
127A	Single Circuit Flat Top	21.4 dB	

As a 'worst case' situation, a mid span value of 31.3 dB has been assumed to be emitted from all conductor spans in the Maungatapu Sector. A conductor noise emission value of 30.7 dBA has been assumed to be emitted by conductors spans in the Matapihi sector of the project. The AECOM noise levels are cumulative for both lines of the double circuit and are relevant to a receiver centrally located under the circuits. A small downward adjustment has therefore been made to account for the distance from the conductor alignment to each receiver site. As above, a small +2 dBA adjustment has also been made to account for extra sound produced by a wet 'new' conductor.

5.3 Audible Noise at Residential Sites

The following table (Table 1) sets out expected 'worse case' audible conductor noise levels for representative receiver locations in the Maungatapu Sector (closest residential boundary) and at the notional boundary to rural residences in rural area (Matapihi side):

[3] Should the audible noise (unexpectedly) contain a tone (as defined within Appendix B of NZS6802:2008), then the predicted sound level shall be increased by 5 dB, in accordance with NZS6802:2008. As both proposed conductors are not known to generate significant tones, no correction is considered necessary within this assessment.

Spans	Residential Address of Receiver Property	$L_{Aeq(15\ min)}$ dB
Maungatapu Sector – Zone: City Living Residential		
28A-29A	rear boundary adjacent **327B Maungatapu Road**	21.9 dB
29A-30A	rear boundary adjacent **333/337 Maungatapu Road**	26.6 dB
30A-31A	rear boundary adjacent **353 Maungatapu Road**	29.7 dB
31A-32A	rear boundary adjacent **371 Maungatapu Road**	29.8 dB
32A-33	rear boundary adjacent **379 Maungatapu Road**	32.2 dB
32A-33A	front boundary adjacent **411 Maungatapu Road**	29.6 dB
33A-33B	**Whikitoria Street Reserve/ Ngati Hei Marae**	23.6 dB
33B-33C	Font boundary **411 Maungatapu Road**	28.6 dB
33C-33D	**Whikitoria Street Reserve/ Ngati Hei Marae**	<20 dB
Matapihi Side – Zone: Rural		
120-119	Notional boundary of **41 Puwhkiri Road**	<20 dB
123 - 124	Notional boundary of **311 Matapihi Rd**	<20 dB
126 127	Notional boundary of **303 Matapihi Rd**	<20 dB

Table 1: Predicted conductor noise (re-aligned A line plus sound from the existing B Line) as received within the closest part of the nearest residentially zoned sites, or within the notional boundary to rural dwellings on the Mataphihi side.

Comparing expected cumulative conductor noise levels with measured existing ambient sound levels under calm conditions during night time, we see that conductor noise will remain less than measured ambient sound levels which were noted above as being quiet. It is therefore reasonable to expect noise from both A + B transmission lines to remain at or below the ambient sound level measured in the area.

Importantly, the results show no dwelling or sensitive receiver site is expected to receive noise levels approaching the L_{Aeq} 40 dB District Plan guideline standard for night time noise received within residentially zoned sites, or within the notional boundary to any rural residential sites. For the reasons set out below this assessment has not included an adjustment for tonality under *NZS6802:2008 Acoustics – Environmental Noise* [NZS6802:2008]. It is therefore evident that no residential site is in fact likely to receive cumulative conductor noise exceeding L_{Aeq} 32.2 dB which is a worst case for wet conductor that has slightly elevated noise emissions when new (which will reduce with age).

Readings taken during calm night time periods indicate the added noise from Line A is relatively insignificant. The overall change in ambient noise levels at a worst case location adjacent to Highway 29A is shown below in **Figure 4**.

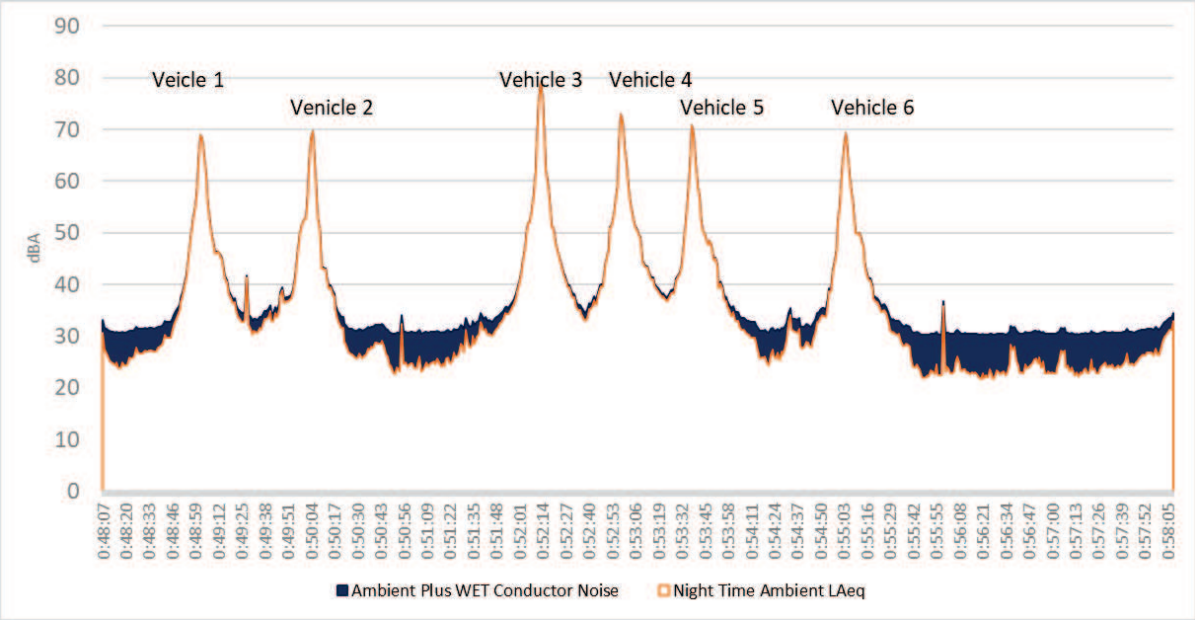


Figure 4: Typical late night ambient sound levels under calm conditions [rear boundary 411 Maungatapu Road] with additional maximum (wet) conductor noise shown added as the dark areas.

5.4 Noise Reductions

The proposed re-location of the A Line will reduce existing conductor noise for some residences, in particular:

- *41 Puwhkiri Road, rurally zoned site with span 120-119 located at around 100 metres which will increase to around 200 metres;*
- *Currently spans 123 – 124 lie within about 85 metres of the notional boundary of a rural dwelling 311 Matapihi Rd which will increase to around 140 metres once Line A is re-located;*
- *Currently spans 126 – 127 lie within about 50 metres of the notional boundary of a rural dwelling 303 Matapihi Rd which will increase to around 100 metres once Line A is re-located; and*
- *Around 39 dwellings between about 327 and 448 Maungatapu Road, the Rangataua Rugby & Sports Club, and Ariki Park lie under or adjacent to the existing Line A corridor. With the removal of the A-line (including 5 poles crossing residential land and Te Ariki Park) a minor noise reduction is expected in the area once the works are completed. The re-located Line A will lie at least 50 to 100 metres further from any of these dwellings.*

Consistent with the small degree of additional noise predicted to arise at adjacent sites due the proposed new Line A, the relief in noise level reduction terms due to removing Line A from its current alignment will not be great. The removal of the Line A is expected to reduce noise at a small number of residential sites closely located to the current Line A alignment. However, as the current Line A conductor is not expected to be noisy, only a minor lowering of ambient sound levels can be expected [e.g. 1 to 2 dB]. The dark banding in **Figure 4**indicates the small amount by which ambient sound levels may reduce once the Line A conductor and poles are removed from their existing alignment in the Maungatapu Road residential area.

6 Construction Noise

6.1 Activities & Noise Sources

The effects of construction noise have been investigated by undertaking predictions of noise from the proposed construction works, as received at dwellings or other noise sensitive sites in the area. There has been a focus on assessing construction noise effects associated with the following key locations;

- Construction activities including earthworks required to install new poles each side of the Rangataua estuary. Specifically we have investigated the potential for ground vibration and noise effects associated with drilling the deep foundation piles and earthworks (involves vibro-piling methods) to enable preparation of the foundations.
- Pole extractions and new poles and structural elements being installed along the rear of around 25 residential properties in the Maungatapu area. This includes removal of the A-line including 5 poles crossing residential land and Te Ariki Park.
- Noise from pole removals and installation on the Matapihi side, albeit undertaken at far greater buffer distances compared to works on the Maungatapu.

The works required to be undertaken to remove pole 118 from the CMA, although involving equipment on a barge and works within the sensitive seabed environment, are not considered likely to result in adverse noise effects on the environment given its remote location in the estuary and available buffer distances to the closest sensitive receiver sites.

6.2 Ground Works for Poles 33C and 33D

The construction activity at locations 33C and 33D will involve vibro-piling to sink large steel casings into the substrate to enable earthworks to take place and pole foundations to be formed. The noise from the vibro-driving activity comes from the engine noise of the excavator or 55 tonne crane which is supporting the vibrator, and the operation of this unit itself (including noise emitted from the steel casing itself). Annex 2 to NZS6803:1999 indicates such works may give rise to LAeq sound levels of 88 to 91 dB measured at 10 metres. Noise from all aspects of vibro-piling of steel casings and earthworks at locations 33C and 33D are included within the predictions of construction relevant receiver sites set out within Section 6.3 below.

Concerning vibration effects due to vibro-piling, there are no relevant NZ Standards that deal with the perception of ground borne vibration. International Standard ISO 2631-2:1989 *Evaluation of human exposure to whole-body vibration -- Part 2: Continuous and shock-induced vibrations in buildings (1 to 80 Hz*) refers to vibration assessment criteria based on vibration peak velocity limits across the sensitive spectrum of between 0.1 and 1.0 mm/sec for protecting people and buildings.

We have investigated the expected vibration levels and obtained research results of similar steel piling and provide the following forecasts of peak vibration velocity (mm/sec) for typical pile driving, as received at distances up to 100 metres from this activity.

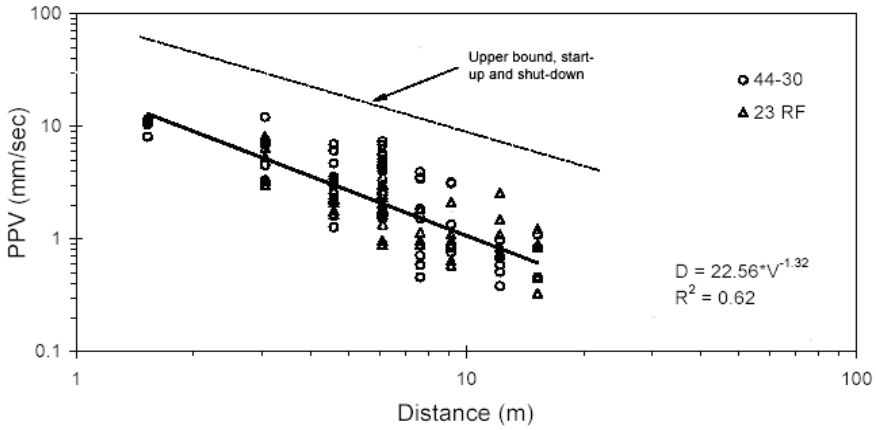


Figure 5: Peak particle velocity versus distance, of vibro-piling of steel casings. Sources: Abdel-Rahman, S.M. (2002) "*Vibration associated with pile driving and its effects on nearby historical structures*." Proceedings of SPIE, 475311, 1251-1258. Athanasopoulos G.A., and Pelekis P.C. (2000) "*Ground vibrations from pile driving in urban environment: measurements, analysis and effects on buildings and occupants*." Soil Dynamics and Earthquake Engineering, 19, 371-387.

The above representative measurements show that, at site 33C, vibrations at the closest dwelling (29 Whikitoria St) located at 15 metres to the works will receive <1mm/sec with vibrations compliant with *ISO2631 – Part 2*. The following diagram indicates the area within 10 metres of the works where we consider temporary construction vibration effects would not be acceptable for sensitive receiver sites.

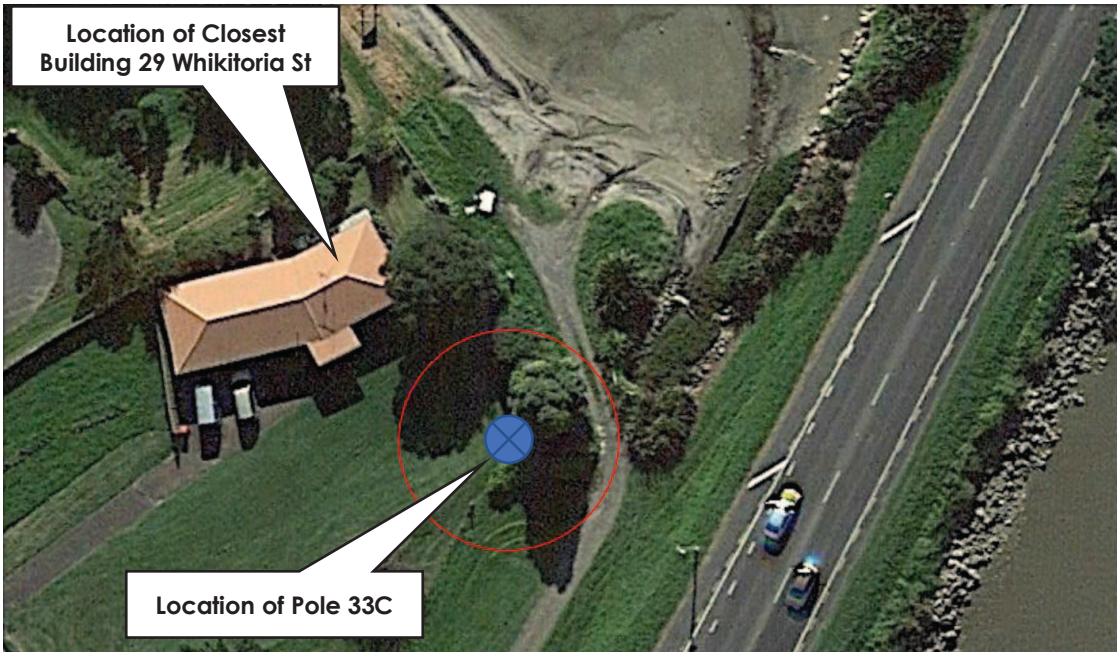


Figure 6: Location of 10 metre radius of location 33C within which ground vibrations maybe unacceptable (peak particle velocity > 1 mm/sec) due to vibro-piling at site 33C.

Vibro-piling undertaken at the location of pole 33D on the north side of the estuary will take place at over 300 metres from the closest dwelling and will not be likely to cause any noticeable vibration effects at sensitive receiver sites. Ground vibrations will reduce rapidly with distance in typical soil conditions. In fact, it is likely no detectable vibration effects will occur beyond about 50 metres from the source however it is difficult to assess the ability of the subsoil geology to transmit vibrations and to predict the transmission of vibrations through the ground to buildings.

The current worst case vibration assessment is that, in general no noise sensitive receiver sites will receive detectable ground vibrations associated with the works, except at the location of the dwelling at 29 Whikitoria Street where some piling-induced vibrations are likely be noticeable for limited periods due to the limited buffer distance available.

The proposed Construction Noise & Vibration Management Plan recommended in Section 8 below is designed to mitigate potential effects (such as those that may occur at 29 Whikitoria Street) and will ensure the 'best practicable option' is adopted for dealing with construction noise and vibration effects such as those outlined above.

6.3 Construction Noise Throughout Project Area

Predictions have been undertaken of expected levels of construction noise received at nearby sensitive receiver sites, at 1 metre from the dwelling or building housing a noise sensitive activity. The predictions are based on the use of a wide range of tools, hand operated equipment, heavy vehicles, 55 tonne crane, excavator-mounted boring equipment, vibro-piling unit and the use of a 20 tonne excavator. The predictions have been based on the generic methodology set out within NZS6803:1999 with sound propagation being based on the methods set out within the ISO standard *'ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation'*[4][5].

The prediction method utilises various input variables including octave band sound power levels at source, air absorption values based on temperature and humidity. Sound power data used within the model are the sound power levels presented with the appendices to NZS6803:1999 or measurement data published by the equipment manufacturer.

[4] *ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors -- Part 2: General method of calculation.* International Organisation for Standardisation 1996, Geneva.

[5] ISO 9613-2:1996 predicts equivalent continuous A-weighted sound level under meteorological conditions favourable to propagation. These meteorological conditions equate to slight downwind conditions, or propagation under a well-developed moderate ground-based temperature inversion which are considered worst case conditions.

The methods adopted to predict construction noise conform with the prediction recommendations of *NZS6801:2008 Acoustics – Measurement of Environmental Sound* which states, at *Clause 7.1.2*, that slightly enhanced sound propagation conditions should be adopted for predictions of environmental sound.

Information used within the predictions of noise from the operation of construction equipment is set out in **APPENDIX B**. The equipment employed in the calculations have been based on discussions with earthworks contractors and information from a powerline construction company. The table provided in **APPENDIX B** includes a generic description of the various equipment items assumed to be used within the project, and the expected noise emission level from each equipment item, when measured at 10 metres. The above ISO Standard ISO 9613- Part 2 has been used to calculate the propagation effects as well as the screening effects of fences and buildings (where these are present).

Predicted sound levels are provided as both L_{Aeq} dB and LAFmax sound level for each residential receiver location assessed. These sites are listed within the table entitled "Construction Noise Levels Predicted for Each Dwelling" located within **APPENDIX B** to this report. This table presents results for 67 dwellings located in the wider area (which includes some distant sites unlikely to be affected by construction activities). In all cases the predicted levels relate to noise levels expected at the location of 1 metre from the dwelling, for dwellings located at the addresses provided.

The results indicate LAeq sound levels falling between 51.2 dB and 68.7 dB. The most significant predicted levels are found at dwellings in the Maungatapu area. **Figure 7** sets out the distribution of predicted LAeq sound levels across all 57 dwellings assessed in the Maungatapu area.

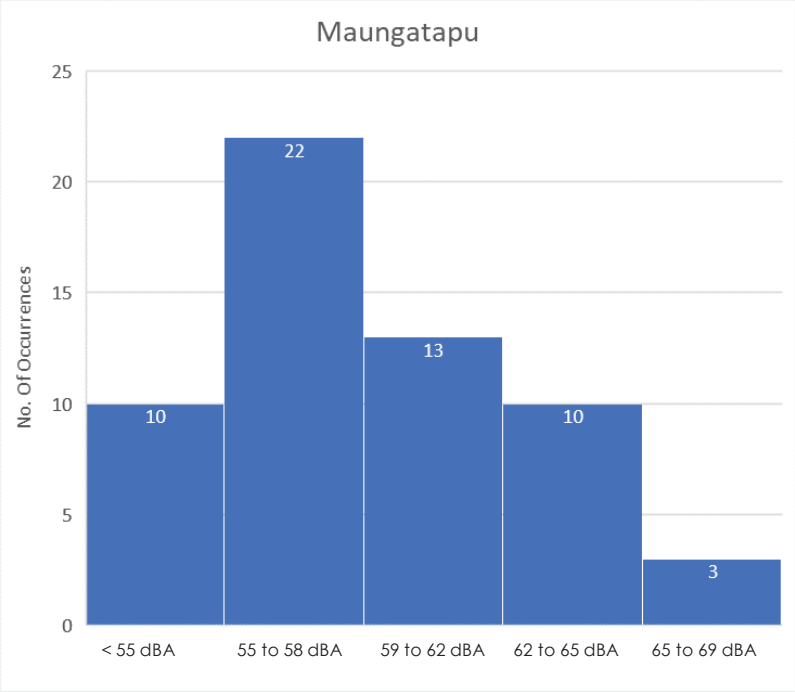


Figure 7 Distribution of predicted LAeq construction noise levels across all 57 dwellings assessed in the Maungatapu area.

Predicted LAFmax sound levels due to temporary construction activity have been predicted to fall between 60 and 72 dB, which are not unusual levels to experience outdoors around dwellings near to state highways in New Zealand.

It is possible that a helicopter may be used provide aerial lift during stringing of conductors, for example in stringing the conductor across the estuary. The use of a helicopter (if any) would be for short duration, daytime time periods. Most likely the helicopter tasks would not require the helicopter to land or take-off within the project area. Rather, the machine would fly into the area, hover briefly to connect to the slung objects, and transport such objects to other parts of the project area. Thus, such noise effects are expected to be temporary for any particular receiver site. Temporary sounds associated with airborne operations of helicopters are not usually assessed under NZS6803:1999 (see Section 7.4 below) however it is likely that such sounds would comply at all times with the guideline limits for construction noise set out within NZS6803:1999.

Construction noise effects are assessed below in **Section 8**.

7 Noise Criteria

The following sets out a discussion of the relevant assessment criteria and conformance of this project with these guideline performance standards;

7.1 Tauranga District Plan Noise Criteria

The Tauranga District Plan, Chapter 10 [Network Utilities] contains objectives, policies and rules which govern the development and use of land, including installation and operation of network utilities. In managing the effects of network utilities, the District Plan recognises the essential role that electricity networks play and the services they provide in the existing and future functioning of the City and the sub-region. This section of the District Plan also recognises that the nature of some network utilities and associated works need to be managed to ensure they do not adversely affect amenity, landscape character, streetscape, heritage values, or public health and safety.

It is noted that at Chapter 10A of the District Plan that the relevant provisions of Chapter 4 [*General Rules*] through to Chapter 12 – *Subdivision, Services and Infrastructure* are to apply to network utilities and are to be assessed in accordance with these rule requirements. The relevant District Plan zoning for the area is set out within the following extract from the Tauranga District Plan maps

The District Plan noise criteria applying to the adjacent residentially zoned sites include 4E.1.1.1 Policy [Noise from Non-Residential Activities] which states that by ensuring non-residential activities and roadside cabinets do not generate noise levels normally considered unacceptable in sensitive zones, or create noise levels which are unreasonable for occupiers of adjoining or adjacent properties.

The zoning of the project area is shown below in **Figure 8**. The specific noise performance standards for residentially zoned sites are set out as follows;

4E.2.1 Residential Zones and Rural Residential Zone

a) *Activities* on *sites* within these zones, excluding a *residential activity* or helicopter landing and takeoff associated with hospital emergencies, shall not exceed the following noise levels within the *boundary* of any other *site* in any zone other than a *Commercial Zone* or *Industrial Zone:*

Control Hours	Noise Level
daytime:	50 dBA L_{eq}
night-time:	40 dBA L_{eq} and 70 dBA L_{max}

b) Sound levels shall be measured in accordance with NZS 6801:2008 Acoustics - Measurement of Sound and assessed in accordance with NZS 6802:2008 Acoustics - Environmental Noise, or any superseding codes of practice and/or standards.

However, we note the poles and new infrastructure will be located within the road zone except in the Matapihi side (where the alignment is generally well setback from any noise sensitive site. The relevant rule for the Road Zone is:

4E.2.12 Road Zone

a) *Activities* in the *Road Zone* are not subject to any noise restrictions except where *Rule 4E.2.11 – Cabinets within the Road Zone* applies;

Note: The definition of "road Zone" = Covers any public road, regardless of the underlying zoning on the Plan Maps [Part B] including a State Highway and any service lane.

4E.2.14 Construction Noise

a) *Construction* noise from a *site* in any zone within *the City* shall not exceed the limits recommended in, and shall be measured and assessed in accordance with, NZS 6803:1999 Acoustics Construction Noise;

As explained below, owing to the nature of the project and provisions of the National Environmental Standards for Electricity Transmission Activities [NESETA], the above provisions of the District Plan dealing with noise are not considered relevant to the assessment of noise effects for this project.

Zoning Across Inlet:

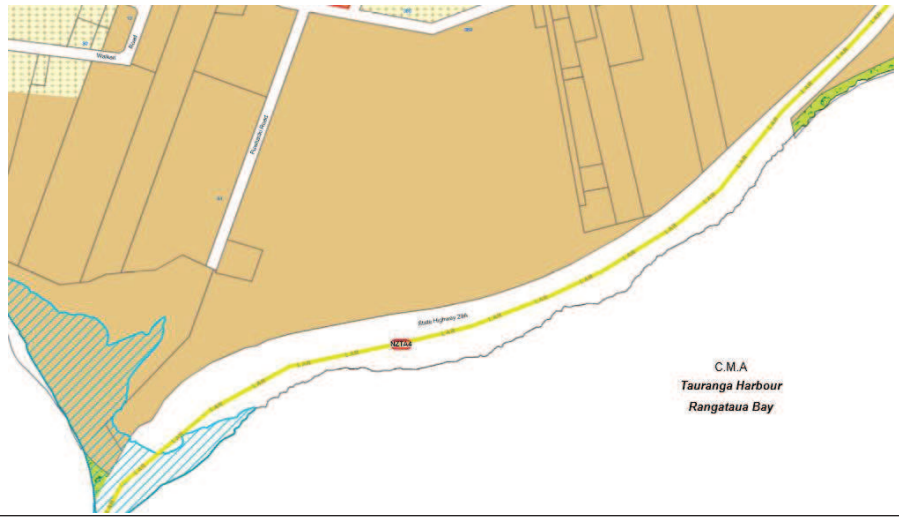


Figure 8 Tauranga District Planning Map. Map not to scale.

7.2 National Environmental Standard

The assessment takes into full account the provisions of the National Environmental Standards for Electricity Transmission Activities [NESETA] which came into effect on 14 January 2010. The NESETA sets out a national framework of permissions and consent requirements for activities on existing electricity transmission lines in the National Grid. Activities covered in the NESETA include the operation, maintenance, upgrading and removal of existing transmission lines.

The NESETA applies to "existing transmission lines". Regulation 3 of the NESETA defines 'existing transmission line' as "a transmission line that was operational, or was able to be operated, at the commencement of these regulations". The existing HAI-MTM A line and HAI-MTM B line fall within the definition of "existing transmission line" as the lines were operated, or able to be operational, on 14th January 2010. As set out below, Regulation 37 of the NESETA provides for construction activities associated with line re-location as permitted activities providing noise emissions comply with the limits set out within New Zealand construction noise standard *NZS6803:1999 Acoustics – Construction Noise*.

The NESETA confirms the District Plan noise performance standards do not apply to the proposed works. Instead, operational noise assessment is guided by the "general duty" provisions of the resource Management Act 1991 and guidance from *NZS6802:2008 Acoustics – Environmental Noise*. Within the above range of guideline noise standards, the potential for adverse effects due to operational noise is minimised providing noise at any dwelling or noise sensitive site is not greater than L_{Aeq} 40 dB within any adjacent residential site during the sensitive night-time period.

7.3 NZ Standards

The District Plan refers to assessment of noise using New Zealand Standard *NZS6802:2008 Acoustics – Environmental Noise* which requires sounds (other than sounds from construction activity) to be assessed for the presence of "special audible characteristics". This correction is intended to be applied where the sound under investigation possesses certain attributes that make the sound more annoying than it would be without such a characteristic.

Sound emitted from transmission lines under normal circumstances are not known for commonly possessing strong tonal components. The assessment is to be solely based on sounds experienced within the noise-*sensitive receiver site.* Where the sound in question does possess a "special audible characteristic", the level of this sound is adjusted [penalised] to reflect the added annoyance likely to be caused by such a sound when received at sensitive locations. *Appendix B* to *NZS6802:2008 Acoustics – Environmental Noise* sets out recommendations for evaluating whether significant tonality is present by comparing the levels of adjacent one-third octave bands in the results of provided by frequency analysis.

An adjustment for tonality shall be applied if the L_{eq} in a one-third octave band exceeds the arithmetic mean of the sound level in both adjacent bands by more than the values given as follows in **Table 3.**

One-third octave band [Hz]	Sound Level difference [dB]
25 – 125 Hz	15 dB
160 – 400 Hz	8 dB
500 – 10000 Hz	5 dB

Table 3: Adjustment for tonality under *NZS6802:2008 Acoustics Environmental Noise*.

As set out above, available conductor noise level information indicates the conductors proposed to be employed on this project do NOT emit sound with tonal character, even under wet conditions, sufficient to warrant application of the tonal adjustment under NZS6802:2008. On this basis, the assessment set out below does not include a tonal penalty under *NZS6802:2008 Acoustics – Environmental Noise*

7.4 Construction Noise

Regarding construction noise associated with the transmission line realignment works, the Resource Management NESETA Regulations incorporate by reference New Zealand Standard *NZS6803:1999 Acoustics – Construction Noise*. Regulation 37 of the NESETA stipulates that construction activities associated with line re-location are permitted activities under the District

Plan, providing noise emissions comply with New Zealand Standard *NZS6803:1999 Acoustics – Construction Noise*.

During the construction period, we have assessed the works on the basis that they take place within the maximum hours of between 7:00am – 6:00pm Monday to Saturday. *NZS6803:1999 Acoustics – Construction Noise* adopts the limits set out within Tables 2 and 3 of that standard for any construction activity. Those limits within Tables 2 and 3 of the standard are set out as follows:

Time of week	Time period	Typical duration (dBA)		Short term duration		Long term duration	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Weekdays	0630-0730	60	75	65	80	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	80	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

Where:

- *"Short-term" means construction work at any one location for up to 14 calendar days;*
- *"Typical duration" means construction work at any one location for more than 14 calendar days but less than 20 weeks; and*
- *"Long-term" means construction work at any one location with a duration exceeding 20 weeks.*

The above limits are set out in the Standard as applying to any particular project according to the project duration. We understand the overall construction time frame for the proposed work is in the order of 3 months. However, depending on the time of year/weather, this may be undertaken in stages within an overall construction window of 9 months. Thus, we have for the purposes of this assessment adopted the 'Long term' noise limit recommendations of NZS6803:1999 and have also referred to these limits within the recommended conditions of consent (if granted) at Section 9 of this report.

7.5 Criteria Summary

For construction noise, as above, the NESETA Regulations incorporate by reference New Zealand Standard *NZS6803: 1999 Acoustics – Construction Noise*.

For operational noise, Regulation 4[1] of the NESETA sets out that activities which are covered by the NESETA and specifically provides for the relocation of an existing transmission line including activities that relate to construction, use of land and an activity relating to an access track to an existing transmission line. On the basis that the above NESETA requirements are fulfilled, the operational noise from the proposed re-location activity is not subject to assessment in accordance with the Operative Tauranga District Plan noise requirements.

Instead, the over-riding duty under the Resource Management Act [RMA] is to avoid the emission of unreasonable noise [s.16]. Case law and best practice indicate for the vast majority of situations the s.16 duty is met where noise levels comply with the generic recommendations of New Zealand Standard *NZS6802:2008 Acoustics – Environmental Noise*. This Standard recommends a night time limit of L_{Aeq} 40 to 45 dBA. This would include any correction [penalty] for special audible characteristics (if present) however we have set out above that the operational noise emissions are not assessed as likely to exhibit any significant tonality.

8 Overall Assessment

The following is an overall assessment of noise effects associated with the proposed project:

- Noise associated with construction works (which includes establishing new structures, replacing some existing structures and removal of structures) have been predicted in accordance with the relevant Standards and guidelines assuming equipment and procedures representative of this project. Predicted noise levels are at dwellings or buildings housing noise sensitive activities are not likely to exceed the current levels of traffic noise currently experienced in the area. The highest levels predicted to be received at any dwellings are LAeq 69 dB and LAFMax 72 dB. Being a daytime activity, these construction noise levels comply in all respects with the 'Long Term' construction noise limits recommended within NZS6803:1999.
- Based on the Electric Power Research Institute noise prediction approach and results of laboratory testing, operational noise due to electrical discharge (corona discharge) from the new and altered transmission lines is predicted to be low and well within guideline limits. The most affected site will receive noise from this source not greater than 32.2 dB when measured at 1.2 m above ground level. This is the highest level expected of any residentially zoned site or notional boundary to any dwelling in the rural area.
- Vibration effects of ground works associated with establishing Poles 33C and 33D have been specifically investigated with respect to expected effects at the closest dwelling (29 Whikitoria Street). Being located at least 15 metres from the location of the groundworks, this dwelling may be affected for a limited (daytime) periods. We have examined generic vibro-piling vibration results to inform our assessment of the likely effect of vibro-piling steel casings into the sub soil at the Pole 33C location. The threshold of peak particle velocity <1mm/sec referred to within ISO standards are not predicted to be exceeded at the closest dwelling.

The highest potential for adverse noise or vibration effects associated with this project are those likely to arise during the temporary construction phase. These potential noise or vibration effects are most effectively avoided by implementing practical management methods. Thus, recommended conditions set out below include a requirement for a Construction Nosie & Vibration Management Plan (CNVMP) to be prepared for the project and provided to Tauranga City Council for certification. The conditions require the project to be operated in accordance with the certified CNVMP.

There are a small number of Maungatapu residential properties and the Ngati Hei Marae and rugby club that may gain a small marginal noise benefit of having the old Line A transmission line removed, however we have not been able to establish that this line generates any audible sound. This means no changes in noise from this source will be detectable.

For construction noise, taking into account the limited duration of the works, the proposed re-location of Line A and de-commissioning of the old infrastructure, noise from construction or demolition activities is expected to be detectable at times over significant areas, but received at dwellings at only moderate levels, during daytime only. Daytime construction noise (worst case) ranging from L_{Aeq} 52 to 69 dB and L_{AFmax} 69 to 72 dB at sensitive receiver sites will not be likely to exceed the recommendations of *NZS6803:1999 Acoustics – Construction Noise*, the noise performance standard for construction activities set out within the NESETA.

The assessment of potential noise effects of the operation of the transmission assets present within the project area (once constructed) are considered to be *di minimus*. Currently no transmission noise effects are detectable under either Line A or Line B. The acoustic effect of these two lines operating together on the same support structures has been fully analysed with a worse case received sound level of 32.2 dB predicted. On this basis, there is no recommended noise-related condition governing the operation of the transmission assets in the project area fallowing completion of the project.

9 Proposed Conditions

The following are recommended to be attached to the consent sought (if granted):

Noise

a) The consent holder shall submit a Construction Vibration Noise Management Plan (CNVMP) to the to the Tauranga City Council **[insert relevant TCC delegation**] for certification at least 15 working days prior to construction work commencing. The consent holder shall ensure the following minimum requirements are met;

i. The CNVMP shall be prepared by a suitably qualified independent acoustic specialist acceptable to Council and shall provide a framework to manage construction noise/vibration appropriately for the variety of circumstances along the route by outlining the methods, procedures and standards for mitigating the effects of noise and vibration during construction of the Project.

ii. The CNVMP shall identify mitigation methods so that noise from construction or demolition activities do not exceed the noise limits specified in (b) below and the vibration limits in (c) below at the relevant receiver locations.

iii. Work shall not commence until the consent holder has received the Council's written certification for the CNVMP.

iv. The consent holder shall implement the certified CNVMP throughout the entire construction period of the Project.

b) Unless works are being undertaken in accordance with a SSCNMP certified by Council, no construction or demolition activities shall be undertaken which exceeds the following limits when measured and assessed in accordance with NZS6803:1999 *Acoustics – Construction Noise*:

Day of week	Time period	dB LAeq(15 min)	dB LAmax
Weekdays	0630-0730	55	75
	0730-1800	70	85
	1800-2000	65	80
	2000-0630	45	75
Saturdays	0630-0730	45	75
	0730-1800	70	85
	1800-2000	45	75
	2000-0630	45	75
Sundays and	0630-0730	45	75
public holidays	0730-1800	55	85
	1800-2000	45	75
	2000-0630	45	75

c) The consent holder shall implement the vibration management and mitigation measures identified in the certified CVNMP. Construction vibration shall be made to comply with the following criteria:

Receiver	Details	Vibration Limit
Occupied dwellings	Daytime 0630h - 2000h	1 mm/s PPV
Other occupied buildings	Daytime 0630h - 2000h	2 mm/s PPV

Measurements of construction vibration shall be undertaken in accordance with German Standard DIN 4150-3:1999 "Structural Vibration Part 3: Effects of vibration on structures".

10 Summary

Malcolm Hunt Associates have carried out a pre-commissioning noise assessment for a project which involves partially relocating the HAI-MTM-A overhead circuit onto the existing HAI-MTM-B transmission line using new, replacement supporting structures located along part of State Highway 29, Tauranga and into a rural area of Matapihi.

The assessment is based on the relevant New Zealand acoustic standards and other relevant noise and vibration guidelines including the District Plan provisions, where appropriate. Measurements of the current ambient noise environment during calm night time periods has established there is little or no noise from existing transmission lines. Predictions indicate the new and altered transmission assets are not expected to acoustically affect any rural or urban residential site by more than L_{Aeq} 32.2 dB which is a very low noise level. Such low sound levels are only readily detected within the existing environment during calm night time periods after midnight when all other activities cease, thus mostly no change will be experienced at the closest sensitive receivers. Overall, noise from transmission assets will result in a *di minimus* effect on the environment.

There are number of residential properties, Ariki Park, the Ngati Hei Marae and the rugby & sport club that may gain a marginal acoustic benefit (of having the old Line A transmission line removed) but, as no existing noise from the transmission line can be measured, mostly these changes would not be noticeable.

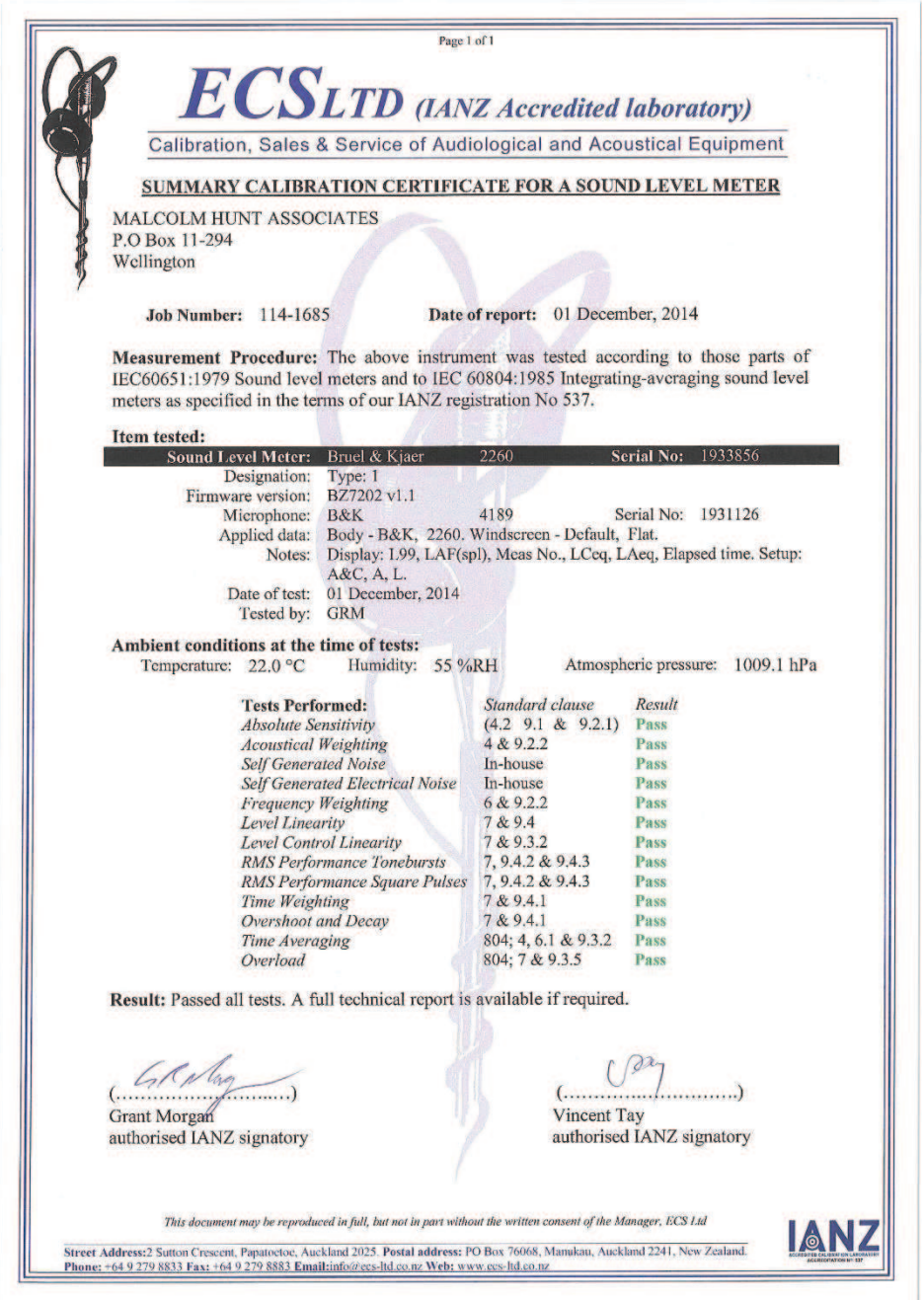
Our assessment has confirmed reasonably significant temporary daytime noise will arise from time to time during the construction period. It is proposed to manage these effects using a certified Construction Noise & Vibration Management Plan. Construction activities will, in some cases, take place quite close to dwellings giving rise to moderate levels of daytime construction, however these noise effects can be effectively managed through the additional assessment, mitigation and prior notification measures referred to within the CNVMP. In all cases, construction noise emissions are expected to fully comply with limits set out within the recommended conditions of consent, being based on the 'Long Term' limits of table 2 of *NZS6803:1999 Acoustics – Construction Noise.*

Overall, provided noise and vibration effects are managed according to the recommend CNVMP, construction effects of the proposed works are expected to be less than minor.

Malcolm Hunt Associates
August 2017

Appendix A - Sound Level Measurement

Calibration Certification



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ECS LTD *(IANZ Accredited laboratory)*

Calibration, Sales & Service of Audiological and Acoustical Equipment

SUMMARY CALIBRATION CERTIFICATE FOR A SOUND LEVEL METER

MALCOLM HUNT ASSOCIATES
P.O Box 11-294
Wellington

Job Number: 114-1685 **Date of report:** 01 December, 2014

Measurement Procedure: The above instrument was tested according to those parts of IEC60651:1979 Sound level meters and to IEC 60804:1985 Integrating-averaging sound level meters as specified in the terms of our IANZ registration No 537.

Item tested:

Sound Level Meter:	Bruel & Kjaer	2260	**Serial No:**	1933856
Designation:	Type: 1			
Firmware version:	BZ7202 v1.1			
Microphone:	B&K	4189	Serial No:	1931126
Applied data:	Body - B&K, 2260. Windscreen - Default, Flat.			
Notes:	Display: L99, LAF(spl), Meas No., LCeq, LAeq, Elapsed time. Setup: A&C, A, L.			
Date of test:	01 December, 2014			
Tested by:	GRM			

Ambient conditions at the time of tests:

Temperature: 22.0 °C Humidity: 55 %RH Atmospheric pressure: 1009.1 hPa

Tests Performed:	*Standard clause*	*Result*
Absolute Sensitivity	(4.2 9.1 & 9.2.1)	Pass
Acoustical Weighting	4 & 9.2.2	Pass
Self Generated Noise	In-house	Pass
Self Generated Electrical Noise	In-house	Pass
Frequency Weighting	6 & 9.2.2	Pass
Level Linearity	7 & 9.4	Pass
Level Control Linearity	7 & 9.3.2	Pass
RMS Performance Tonebursts	7, 9.4.2 & 9.4.3	Pass
RMS Performance Square Pulses	7, 9.4.2 & 9.4.3	Pass
Time Weighting	7 & 9.4.1	Pass
Overshoot and Decay	7 & 9.4.1	Pass
Time Averaging	804; 4, 6.1 & 9.3.2	Pass
Overload	804; 7 & 9.3.5	Pass

Result: Passed all tests. A full technical report is available if required.

(.....)
Grant Morgan
authorised IANZ signatory

(.....)
Vincent Tay
authorised IANZ signatory

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Street Address: 2 Sutton Crescent, Papatoetoe, Auckland 2025. **Postal address:** PO Box 76068, Manukau, Auckland 2241, New Zealand.
Phone: +64 9 279 8833 **Fax:** +64 9 279 8883 **Email:** info@ecs-ltd.co.nz **Web:** www.ecs-ltd.co.nz

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Calibration, Sales & Service of Audiological and Acoustical Equipment

MICROPHONE CALIBRATION CERTIFICATE

01 December 2014

MALCOLM HUNT ASSOCIATES
P.O Box 11-294
Wellington

IANZ Registered Laboratory 537

Measurement results reported are traceable to SI units via recognised National Standards.
Tested using ECS procedure; Proc_Microphone_Calibration.

Test Date: 1 December 2014 **Job No**: 114-1686 **Type**: B&K 4189 **Serial No**: 1931126

Ambient Temperature: **22.5**°C ± 1°C **Ambient Pressure**: **1008.6** hPa

Visual Check: OK

Open Circuit Sensitivity by Insert Voltage Method: OK

Value: **-26.18** dB re 1 volt/Pa (**49.11** mV/Pa) at **1000.0** Hz

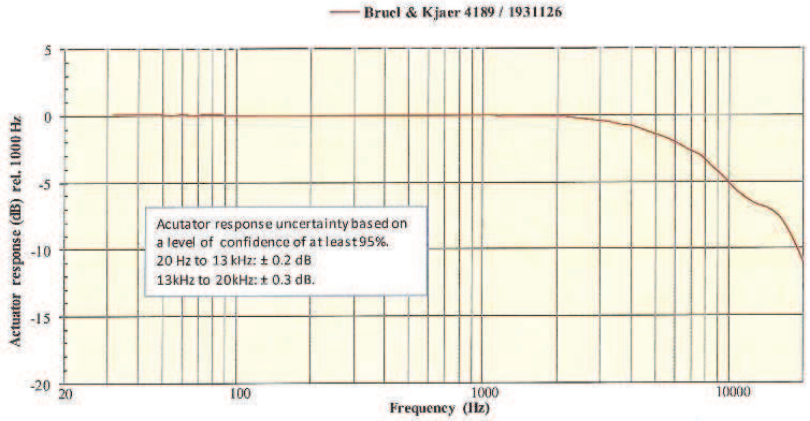
Reference Calibrator: Bruel and Kjaer Type 4226 **Serial No**: 2623634

Uncertainty in this result is estimated to be ±0.06 dB with a confidence level of 95% using a coverage factor of 2.02.

Relative Frequency Response (Electrostatic Actuator): OK

See attached plot of the pressure response of the microphone.

Test performed by: G Morgan (IANZ Signatory) Checked and approved: V Tay



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IANZ ACCREDITED CALIBRATION LABORATORY ACCREDITATION No: 537

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Calibration, Sales & Service of Audiological and Acoustical Equipment

ACOUSTIC CALIBRATOR CALIBRATION CERTIFICATE

30 November 2015

MALCOLM HUNT ASSOCIATES
2nf Floor,
47 Cuba Street
Lower Hutt

IANZ Registered Laboratory 537

Make: B&K Type: 4230 Serial No: 622678
Date Tested: 30 November 2015 By: GRM Job No: SO004111-622678

A measurement of the output sound pressure level of the calibrator was made by the insert voltage method, using a microphone of known sensitivity. Testing has been conducted in accordance with IEC60942 (2003) Annex B - Periodic Verification Tests. Tested using ECS procedure; Proc_Sound_Calibrators.

Results
Measurement results reported are traceable to SI units via recognised National Standards.

Reference Microphone: Bruel & Kjaer 4134 **Serial No:** 1094890 fitted with protection grid.

Ambient Temperature: 22.0°C ± 1°C **Ambient Pressure: 1024.3** hPa

Calibrator frequency was **989.6** Hz
Distortion was **0.79** % THD

The sound pressure level measured **94.08** dBSPL re 20 µPa.

The expanded uncertainty was calculated using a coverage factor of 2.04 and is estimated to be ±0.05 dB with a confidence level of 95%. The sound calibrator was tested with the ½ inch aperture.

The sound calibrator was tested against Class 2 tolerance limits of the standard and has been shown to meet periodic verification criteria described in IEC60942:2003 for the sound pressure level(s), distortion and frequency(ies) stated, for the environmental conditions under which tests were performed.

Note: - The manufacturer of this model of calibrator does not claim type approval conformance to IEC60942 (2003 edition) as it was manufactured before this standard was written.
- A replacement battery was fitted for calibration purposes only.
- The battery connector was fiddly to position for reliable contact.

(Grant Morgan)
authorised IANZ signatory

(Robert Jaques)
Report Checked

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Appendix B – Construction Noise Predictions

Construction Noise Levels

											
		Hand tools, etc.	Drills, hand operated kango hammers. Small concrete mixers, grinders, and	50 kW Wheeled Loader @ 10 m	Kobelco 7045 55 tonne Crawler Crane @ 10 m	Typical concrete mixing transport truck. 8 cubic yards (6.1 m^3) @ 10 m	Truck @ 10 m	APE 150 Vibo Piling @ 10 m	Volvo EC140 with hydraulic drill head	Soilmec SR30 self-mounting, hydraulic drilling rig	20 tonne excavator
Leq @ 10 m (100% use)	LAeq @ 10 metres from works	61	71	78	86	84	85	89	82	81	80
	Percentasge Of Time Each Equipment Item Operated Drung daylight hours										
Removal of 5 poles crossing residential land and Te Ariki Park	79	20%	35%	10%	0%	5%	10%	0%	0%	0%	20%
REMOVE Poles between P28A and P33A	82	5%	15%	20%	15%	0%	15%	0%	0%	0%	30%
NEW Poles between P28A and P33A	82	5%	15%	20%	15%	10%	5%	0%	0%	15%	15%
New Poles 33 C and 33 D	84	5%	10%	5%	20%	15%	5%	10%	5%	15%	10%

Construction Noise Levels Predicted for Each Dwelling

	Closest works	ResidenceaAddress	Preicted LAeq(15 min) dB	Preicted LAFmax dB
Maungatapu				
	28, 28A and 28T	315 MAUNGATAPU ROAD	54.3	< 60 dB
	28, 28A and 28T	317 MAUNGATAPU ROAD	60.5	65.7
	28, 28A and 28T	319 MAUNGATAPU ROAD	62.2	67.3
	28, 28A and 28T	32 WIKITORIA STREET	61.8	67.0
	28, 28A and 28T	323 MAUNGATAPU ROAD	61.2	66.3
	28, 28A and 28T	327A MAUNGATAPU ROAD	56.2	61.3
	28, 28A and 28T	327B MAUNGATAPU ROAD	62.2	67.3
	28, 28A and 28T	331A MAUNGATAPU ROAD	58.9	64.0
	28, 28A and 28T	331B MAUNGATAPU ROAD	60.9	66.0
	28, 28A and 28T	333 MAUNGATAPU ROAD	58.9	64.0
	28, 28A and 28T	335 MAUNGATAPU ROAD	57.2	62.4
	29, 29A	337 MAUNGATAPU ROAD	55.1	60.2
	29, 29A	337A MAUNGATAPU ROAD	56.6	61.7
	29, 29A	34 WIKITORIA STREET	61.8	67.0
	29, 29A	343 MAUNGATAPU ROAD	56.8	61.9
	29, 29A	345A MAUNGATAPU ROAD	56.4	61.5
	29, 29A	345B MAUNGATAPU ROAD	62.6	67.7
	29, 29A	351A MAUNGATAPU ROAD	66.7	71.8
	29, 29A	351B MAUNGATAPU ROAD	59.4	64.5
	29, 29A	353A MAUNGATAPU ROAD	59.4	64.5
	29, 29A	353B MAUNGATAPU ROAD	57.9	63.0
	29, 29A	359 MAUNGATAPU ROAD	56.0	61.2
	29, 29A	361 MAUNGATAPU ROAD	54.1	< 60 dB
	29, 29A	361A MAUNGATAPU ROAD	53.2	< 60 dB
	30.30A,	369 MAUNGATAPU ROAD	55.1	60.2
	30.30A,	371 MAUNGATAPU ROAD	58.1	63.3
	30.30A,	371A MAUNGATAPU ROAD	56.8	61.9
	30.30A,	373 MAUNGATAPU ROAD	58.9	64.0
	30.30A,	373A MAUNGATAPU ROAD	64.8	69.9
	30.30A,	377 (rear) MAUNGATAPU ROA	56.0	61.2
	30.30A,	379 MAUNGATAPU ROAD	62.6	67.7
	30.30A,	381 MAUNGATAPU ROAD	59.1	64.3
	30.30A,	383B MAUNGATAPU ROAD	55.3	60.4
	30.30A,	385 MAUNGATAPU ROAD	51.6	< 60 dB
	31, 31A	387 MAUNGATAPU ROAD	57.7	62.8
	31, 31A	389 MAUNGATAPU ROAD	60.9	66.0
	31, 31A	391 MAUNGATAPU ROAD	54.1	< 60 dB
	31, 31A	393B MAUNGATAPU ROAD	56.8	61.9
	31, 31A	395 MAUNGATAPU ROAD	54.7	< 60 dB
	31, 31A	397 MAUNGATAPU ROAD	58.1	63.3
	31, 31A	399 MAUNGATAPU ROAD	67.9	73.0
	31, 31A	401 MAUNGATAPU ROAD	57.7	62.8
	32A, 32	405 MAUNGATAPU ROAD	52.0	< 60 dB
	32A, 33	409A MAUNGATAPU ROAD	64.6	69.7
	32A, 34	409B MAUNGATAPU ROAD	64.2	69.3
	33, 33B, 33A	411A MAUNGATAPU ROAD	62.6	67.7
	33, 33B, 33A	411B MAUNGATAPU ROAD	61.2	66.3
	33, 33B, 33A	413 MAUNGATAPU ROAD	55.8	61.0
	33, 33B, 33A	413A MAUNGATAPU ROAD	61.2	66.3
	33, 33B, 33A	413B MAUNGATAPU ROAD	57.7	62.8
	33, 33B, 33A	413C MAUNGATAPU ROAD	54.1	< 60 dB
	33, 33B, 33A	14A WIKITORIA STREET	57.9	63.0
	33, 33B, 33A	14B WIKITORIA STREET	53.2	< 60 dB
	33, 33B, 33A	16A WIKITORIA STREET	55.1	60.2
	33, 33B, 33A	16B WIKITORIA STREET	59.4	64.5
	33, 33B, 33A	26 WIKITORIA STREET	52.7	< 60 dB
	33C	29 WIKITORIA STREET	65.6	70.7
	33C	25 WIKITORIA STREET Marae)	51.2	< 60 dB
Matapihi				
	33D, 34	44 Puwhariki Road	36.7	< 60 dB
	33D, 34, 35, 33E, 37,38	41 Puwhariki Road	44.5	< 60 dB
	33D, 34, 35, 33E, 37,39	44 Puwhariki Road	44.6	< 60 dB
	38A, 39, 39A, 40, 40A, 41 41A, 42, 42A	351B Matapihi Road	36.8	< 60 dB
	43, 43B, 44A, 44B, 45, 45A, 46	351B Matapihi Road	39.0	< 60 dB
	47A, 47, 48, 48A, 48B, 48C, 49A 48D, 50, 48E,	315 Matapihi Road	41.1	< 60 dB
	47A, 47, 48, 48A, 48B, 48C, 49A 48D, 50, 48E,	311 Matapihi Road	42.3	< 60 dB
	127A, 99X, 48F	303 Matapihi Road	47.3	< 60 dB
	128A, 128	259 Matapihi Rpad	47.2	< 60 dB
	128A, 129	267 matapihi Road	45.2	< 60 dB