



Construction Noise and Vibration Assessment

3 Pigeon Mountain Road, Half Moon Bay, Auckland 2012

HND HMB LTD

Prepared by:

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Basis of Report

This report has been prepared by SLR Consulting NZ Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with HND HMB LTD (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Table of Contents

Basis of Report	i
Acronyms and Abbreviations.....	iii
1.0 Introduction.....	1
2.0 Project Description and Site Location.....	1
3.0 Performance Standards.....	4
3.1 Construction Noise.....	4
3.2 Construction Vibration.....	5
4.0 Construction Assessment	5
4.1 Proposed Construction Works.....	5
4.2 Construction Noise.....	8
4.3 Construction Vibration.....	12
4.4 Management and Mitigation of Construction Noise and Vibration Effects.....	13
5.0 Recommended Conditions of Consent	14
6.0 Conclusion	15

Tables in Text

Table 1	Summarised list of identified receivers.....	2
Table 2	Construction Noise Levels For Activities Sensitive to Noise in a Residential Zone	4
Table 3	Construction Vibration Human Amenity Limits	5
Table 4	Plant Items and Typical Noise Emission Levels	8
Table 5	Plant Items and Typical Vibration Levels	12

Figures in Text

Figure 1	Proposed Site Layout.....	1
Figure 2	Aerial Showing Site and Surrounding	3
Figure 3	Demolition Areas.....	6
Figure 4	Excavation and Piling Locations	7
Figure 5	Compaction Locations.....	7
Figure 6	Minimum Recommended Temporary Acoustic Screening Locations	10
Figure 7	Example of Localised Acoustic Screening.....	10
Figure 8	Example Acoustic Shroud Around Breaker.....	11



Acronyms and Abbreviations

Term	Description
'A' weighted	A frequency adjustment which represents how humans hear sounds.
Ambient noise level	The all-encompassing sound associated with an environment or area.
AUP	Auckland Unitary Plan Operative in part
dB	Decibel
dBA	'A' weighted decibel
DIN 4150-3	German Industrial Standard DIN 4150-3 (1999): Structural vibration – Part 3 Effects of vibration on structures.
Free field	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
Hz	Hertz
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible.
L₉₀, L₁₀, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
LA_{eq}	The 'A' weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
LA_{max}	The A' weighted maximum sound pressure level of an event.
Low frequency	Noise containing energy in the low frequency range.
L_p or SPL	Sound Pressure Level.
L_w or SWL	Sound Power Level.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 "Measurement of Environmental Sound".
NZS 6802:2008	New Zealand Standard NZS 6802:2008 "Assessment of Environmental Noise".
NZS 6803:1999	New Zealand Standard NZS 6803:1999 "Acoustics – Construction Noise".
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Rating level	A derived level used for comparison with a noise limit.
R_w	Weighted Sound Reduction Index of a building element. That is, the laboratory tested (or theoretically calculated) sound insulation performance of a single element.
Tonality	Noise containing a prominent frequency.



1.0 Introduction

HND HMB LTD (the **applicant**) proposes to construct a residential development at 3 Pigeon Mountain Road in Half Moon Bay, Auckland.

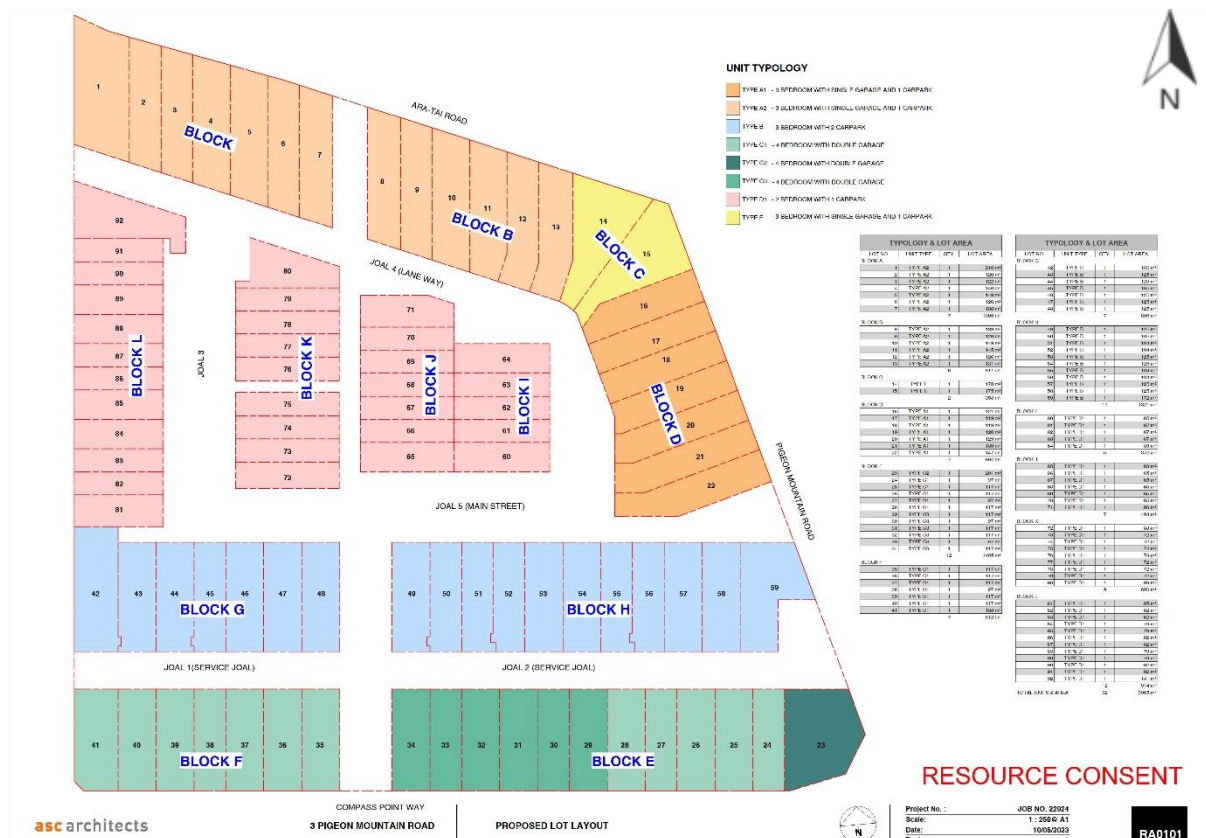
SLR Consulting NZ Ltd (**SLR**) has been commissioned to undertake an assessment of acoustic effects associated with the proposal, to evaluate compliance with relevant rules and, if necessary, to identify appropriate additional noise control measures to achieve compliance with the Auckland Council requirements.

2.0 Project Description and Site Location

The proposal comprises construction of 92 residential units (terrace houses) identified as blocks A to L. The proposed layout is shown in **Figure 1** for reference. The construction associated with the proposal is expected to involve the following activities:

- Demolition;
- Excavation;
- Pilling; and
- Compaction

Figure 1 Proposed Site Layout



Based on the Auckland Unitary Plan Operative in Part (**the AUP**), the subject site and sites on the western, southern and eastern sides are located on land zoned *Residential – Mixed Housing Suburban*. To the north across Ara-Tai Road are commercial activities linked to the Half Moon Bay Marina (see **Figure 2**).

Table 1 below outline the surrounding receivers and their approximate distances from the nearest expected construction activities.

Table 1 Summarised list of identified receivers

Fig 2 ref.	Address	Approximate Distance to Closest Activity				Comment
		Demolition	Excavation	Piling	Compaction	
R01	14 Poseidon Place	35	35	29	48	Two-storey dwelling
R02	12 Poseidon Place	31	34	30	52	Two-storey dwelling
R03	10 Poseidon Place	28	33	28	55	Two-storey dwelling
R04	8 Poseidon Place	36	40	38	37	Two-storey dwelling
R05	6A Poseidon Place	45	46	41	43	One-storey dwelling
R06	4 Poseidon Place Half	60	58	48	54	Two-storey dwelling
R07	11 Pigeon Mountain Road	38	40	28	43	Two-storey dwelling
	2 Compass Point Way	31	35	28	42	Two-storey dwelling
R08	4 Compass Point Way	30	35	31	46	One-storey dwelling
R09	2/9 Tuscan Place	24	28	23	39	One -storey dwelling
	9 Tuscan Place	45	49	43	47	Two-storey dwellings
R10	11 Tuscan Place	27	30	28	25	Two-storey dwellings
R11	8 Compass Point Way	34	34	30	30	Two dwelling
R12	8A Compass Point Way	36	35	30	45	Two-storey dwelling
R13	16 Indus Place	32	30	26	43	Two-storey dwelling
	16A Indus Place	37	36	32	48	Two-storey dwelling



Fig 2 ref.	Address	Approximate Distance to Closest Activity				Comment
		Demolition	Excavation	Piling	Compaction	
R14	14 Indus Place	46	44	42	53	Two-storey dwelling
R15	10 Compass Point Way	34	32	31	39	Two-storey dwelling
R16	84 Compass Point Way	6	10	7	5	Three - storey dwelling
R17	82 Compass Point Way	16	11	8	25	One-storey dwelling
R18	80 Compass Point Way	14	9	7	25	Three - storey dwelling
R19	78 Compass Point Way	19	10	7	6	Three - storey dwelling
R20	76 Compass Point Way	33	11	7	10	Three - storey dwelling

Figure 2 Aerial Showing Site and Surrounding



3.0 Performance Standards

3.1 Construction Noise

The total construction duration for the proposed development is expected to exceed 20 weeks. Standard E25.6.27 of the AUP states that noise from construction activities for more than 20 weeks in a *Residential Zone* must not exceed the limits in **Table 2**.

The limits apply 1 m from the façade of any building occupied during the works, which contains an activity sensitive to noise. The AUP defines “*activities sensitive to noise*” as:

Any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility.

Table 2 Construction Noise Levels For Activities Sensitive to Noise in a Residential Zone

Time of Week	Time Period	Long-term duration of Construction work	
		LAeq	LAmx
Weekdays	6:30 am – 7:30 am	55	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	40	70
Saturdays	6:30 am – 7:30 am	40	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	40	70
	8:00 pm – 6:30 am	40	70
Sundays and public holidays	6:30 am – 7:30 am	40	70
	7:30 am – 6:00 pm	50	80
	6:00 pm – 8:00 pm	40	70
	8:00 pm – 6:30 am	40	70

AUP Objective E25.2 (4) provides that “*Construction activities that cannot meet noise and vibration standards are enabled while controlling duration, frequency and timing to manage adverse effects*”.

In general accordance with the guidance in NZS 6803 (as referenced in the AUP) and the objectives of the AUP, it is common in Auckland to permit higher noise limits during short-term high noise generating activities such as demolition, excavation, piling and compaction provided these are subject to implementation of the best practicable options (**BPO**) to control effects of those activities. This is due to the limited duration of such effects and the limited available options to mitigate associated noise effects from necessary construction activities.



3.2 Construction Vibration

AUP Standard E25.6.30 states that construction activities must be controlled to ensure resulting vibration does not exceed:

- a) the limits set out in DIN 4150-3 when measured in accordance with that Standard on any structure not on the same site; and
- b) the limits in **Table 3** (as transcribed from Table 1 of E25.6.30) in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500 mm of ground level at the foundation of a single storey building.

Table 3 Construction Vibration Human Amenity Limits

Receiver	Period	Peak Particle Velocity Limit ¹
Occupied building containing activity sensitive to noise ²	Night-time 10:00 pm to 7:00 am	0.3 mm/s
Other occupied buildings	Daytime 7:00 am to 10:00 pm	2.0 mm/s
	At all times	2.0 mm/s

¹ In any axis direction.

² As defined in the AUP

Standard E25.6.30 also states that works generating vibration for three days or less between the hours of 7:00 am to 6:00 pm may exceed the limits above, but must comply with a limit of 5 mm/s peak particle velocity in any axis when measured at the corner of the floor/level of interest within a multi-storey building, or within 500 mm of ground level at the foundation of a single storey building, where:

- All occupied buildings within 50 m 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 the works, the duration of the works, a phone number for complaints and the name of the site manager.

4.0 Construction Assessment

4.1 Proposed Construction Works

Details of the specific construction plant and methodology are not available at the time of writing. However, based on the information available, SLR has identified locations for excavation, piling, and compaction works across the site based on the earthworks plan (Airey Consultants LTD: Proposed earthworks plan, drawing No. 220571-1, final, dated 22 May 2023) and accessway plan (Airey Consultants LTD: Site Plan Accessway, drawing No. 220571-1, Final, dated 22 May 2023) reproduced in **Figure 4** and **Figure 5**.



Based on the information provided by the client, SLR understands that demolition is envisaged at the locations highlighted on **Figure 3**. Excavation and piling are envisaged at the locations highlighted on **Figure 4** and compaction works are envisaged at the locations highlighted on **Figure 5**.

Figure 3 Demolition Areas



Figure 4 Excavation and Piling Locations

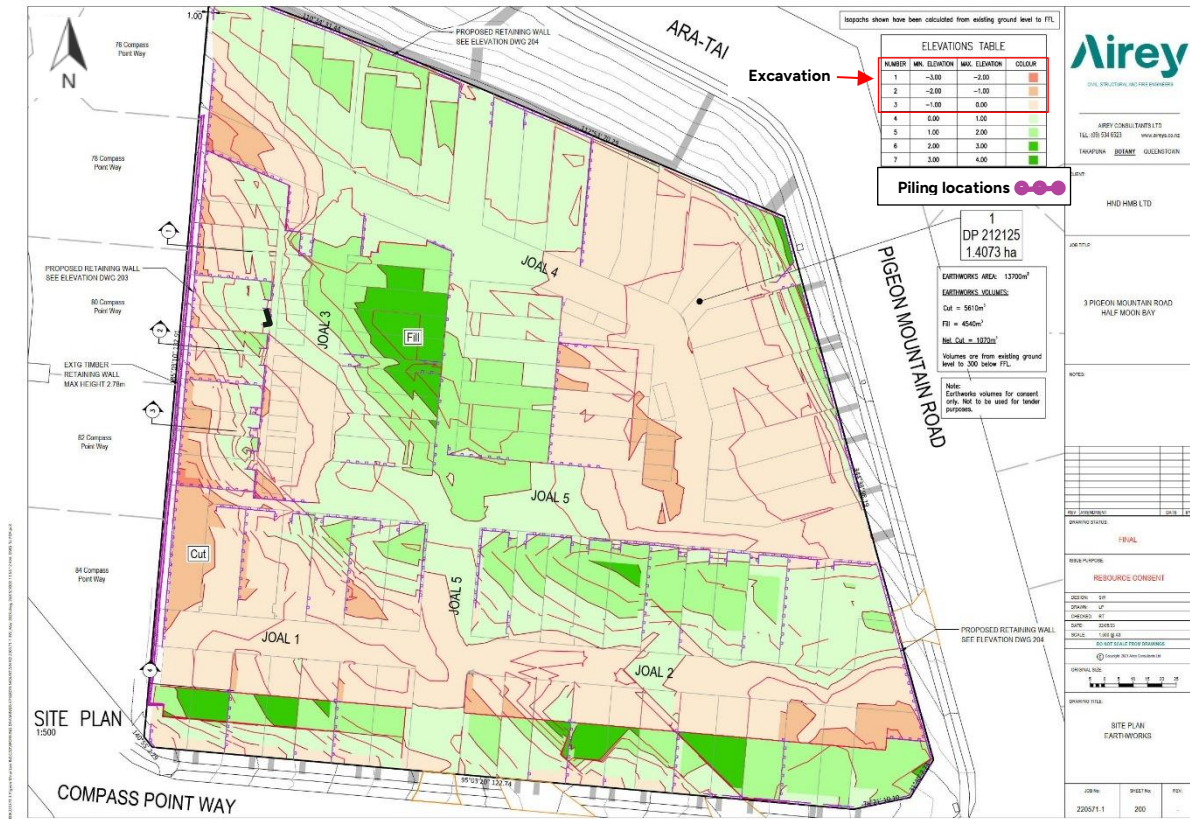
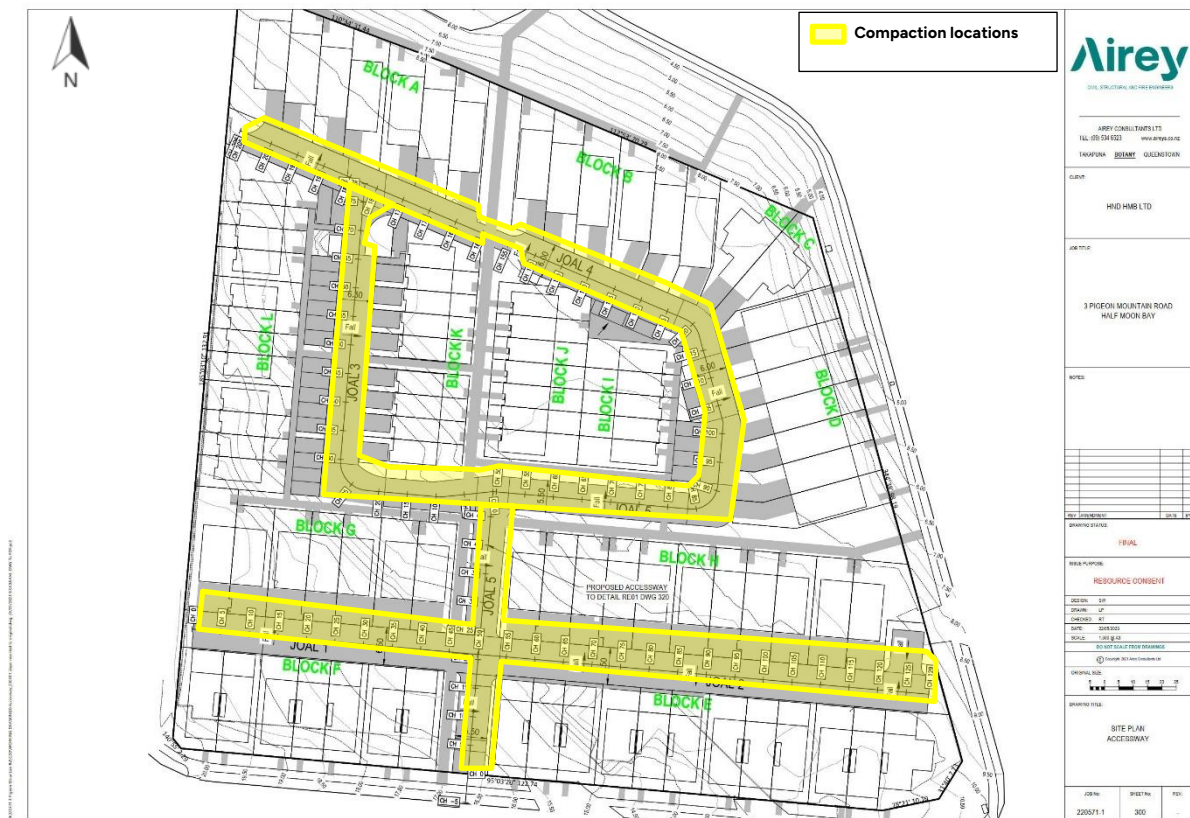


Figure 5 Compaction Locations



SLR has been advised of the following approximate timeframe for the proposed construction activities:

- Demolition – four to six weeks.
- Excavation – two to three weeks.
- Piling – two to three weeks.
- Compaction – two to three weeks.

4.2 Construction Noise

The highest levels of construction noise during the project are expected to be associated with operation of large machinery – in this case demolition, excavation, piling, and compaction works. A summary of equipment and reference sound pressure levels has been provided in **Table 4**. These sound pressure levels are based on SLR measurements and published data (*BS 5228-1: 2009 'Code of practice for noise and vibration control on construction and open sites – Part 1; Noise'*).

The noted setback distances to compliance have been calculated in accordance with the methodology in NZS 6803 and include façade corrections.

The expected hours of construction works are between 7:30 am to 6:00 pm Monday to Saturday. SLR recommend that there is no operation of high noise-generating, motorised equipment on the site outside of these hours, including on Sundays and public holidays.

It should be noted that the principal noise source associated with excavation (the engine) is typically located 5 m (and as much as 10 m) away from the area being excavated due to the available reach of plant. A similar principle applies to bored piling using an attachment on an excavator but with smaller distances (more commonly in the order of 2 – 3 m from the engine to the pile location). These distances are in addition to the noted distances in **Table 1**.

Table 4 Plat Items and Typical Noise Emission Levels

Activity	Plan Item	Plant Noise Level at 10 m, dB LAeq	Approximate Setback Distance to Compliance ^(A) (Without Mitigation), m	Approximate Setback Distance to Compliance (With Mitigation), m ^{(B)(C)}
Demolition	Excavator (≤30t) with pulveriser attachment	75 dB LAeq	20	5
	Excavator (≤5t) with a breaker attachment with shroud	75 dB LAeq	22	5



Activity	Plan Item	Plant Noise Level at 10 m, dB LAeq	Approximate Setback Distance to Compliance ^(A) (Without Mitigation), m	Approximate Setback Distance to Compliance (With Mitigation), m ^{(B)(C)}
Excavation	Excavator ($\leq 20t$) with bucket attachment	70 dB LAeq	12	4
Piling	Excavator ($\leq 20t$) With bored piling attachment	70 dB LAeq	12	4
Compaction	Vibratory Compactor ($< 20t$) ^(D)	80 dB LAeq	38	10
	Vibratory plate compactor ($< 100Kg$)	70 dB LAeq	12	2

Notes:

- (A) Compliance level is 70 dB LAeq, representative of the day-time limit (7:30 am to 6:00 pm).
- (B) Based on single storey receiver and acoustically effective screening between the noise source and receiver.
- (C) Calculations are based on the following source heights above the ground level:
Demolition: 0.5m, excavation and piling 1.5m and Compaction 1m and 0.5m (plate compactor).
- (D) The setback distance is based on six movements (passing by an individual receiver) within 15-minutes as the plant is expected to be moving across the site and not idling/stationary at one location.

A 2-metre high temporary and localised acoustically effective screen is recommended at the locations shown in **Figure 6** during demolition, excavation, piling, and compaction works. This mitigation measure, in combination with selection of quieter construction equipment and advising neighbours prior to commencing works, can assist in achieving acceptable construction noise and vibration outcomes.



Figure 6 Minimum Recommended Temporary Acoustic Screening Locations



Figure 7 Example of Localised Acoustic Screening



Figure 8 Example Acoustic Shroud Around Breaker



With temporary acoustically effective screening (at the locations shown in **Figure 6**) general compliance during construction works is expected at the majority of the surrounding receivers.

However, due to close proximity and overlooking nature of some of the neighbouring buildings, temporary noise exceedances are anticipated to occur when construction works are required to be undertaken within close proximity to these receivers. The temporary noise exceedances expected are discussed below.

During Demolition Works

Noise levels of up to 75 dB L_{Aeq} are anticipated to occur at the upper floor level at **84 Compass Point Way (R16)**. It is anticipated that this exceedance would last for an approximate period of three to four days.

During Piling Works

Noise levels of up to 75 dB L_{Aeq} are anticipated to occur at the upper floor levels at **84 Compass Point Way (R16), 80 Compass Point Way (R18), 78 Compass Point Way (R19) and 76 Compass Point Way (R20)**. It is anticipated that this exceedance would last for an approximate period of two to three days per receiver.

During Compaction Works

Noise levels of up to 75 dB L_{Aeq} are anticipated to occur at the upper floor level at **84 Compass Point Way (R16)**. It is anticipated that this exceedance would last for an approximate period of four to five days. This is on the basis of using a plate compactor for works required within 5m of neighbouring receivers.



Construction Noise Effects

For context, SLR notes that 75 dB LAeq is the AUP permitted noise limit for construction of up to 20 weeks. In SLR’s experience, common residential façade elements can typically reduce external noise by 20-25 dB.

At external levels of 75 dB LAeq we would expect internal noise levels in the range of 50-55 dB LAeq. At these levels personal conversations would need slightly raised voices, and TV and radio sound levels would need to be raised, at these levels office type work can generally continue. For reference, an internal level of 55 dB LAeq is the recommended internal reasonable noise limit in NZS 6803: 1999 *Acoustics - Construction Noise* for construction activities lasting between 15 days and 20 weeks, in this instance this level may be anticipated for the following periods.

- Up to 12 days at 84 Compass Point Way (R16).
- Up to 3 days at 80 Compass Point Way (R18), 78 Compass Point Way (R19) and 76 Compass Point Way(R20).

Higher noise levels are not uncommon for concrete-breaking, piling and compaction works, and we note that the predicted noise levels represent the time period when these works are closest to the most exposed receivers. This is expected to be for short periods (total durations of approximately up to ten days at any one receiver with quieter periods between as activities change on site), as noted above.

Section 4.4 outlines management and mitigation options to reduce noise effects to reasonable levels – these include consultation with neighbours and installing boundary and localised acoustic screening. The resultant effects of the predicted exceedances, being limited in duration and managed as outlined below, can therefore be considered reasonable.

4.3 Construction Vibration

Table 5 below presents the predicted setback distances to comply with the vibration criteria during the construction works, to avoid cosmetic damage to buildings. These reference levels should be considered indicative only due to the potential difference in machinery and ground conditions etc.

Table 5 Plant Items and Typical Vibration Levels

Activity	Plan Item	Approximate distance to compliance with 2 mm/s PPV limit	Approximate distance to compliance with 5 mm/s PPV limit	Comment
Demolition	Excavator (≤5t) with a breaker attachment	3-4	<2	Closest receiver 6m. Compliance with the human amenity vibration limits and DIN 4150-3 cosmetic damage limit would therefore be expected.



Activity	Plan Item	Approximate distance to compliance with 2 mm/s PPV limit	Approximate distance to compliance with 5 mm/s PPV limit	Comment
Piling	Excavator (≤20t) With bored piling attachment	2 m	<1 m	Closest receiver 7m. Compliance with the human amenity vibration limits and DIN 4150-3 cosmetic damage limit would therefore be expected.
Compaction	Vibratory Compactor (<20t)	10-15 m	7-8m	Closest receiver 5m. To achieve compliance with performance requirements SLR recommend no use of this equipment within 15 m of receivers.
	Vibratory plate compactor (<100Kg)	4-5 m	<2m	Closest receiver 5m. Compliance with the human amenity vibration limits and DIN 4150-3 cosmetic damage limit would therefore be expected.

Other Activities

There is also potential for the generation of intermittent vibration by dropping heavy objects, running over ledges, or impacting unexpected items. It is not feasible to predict how regularly these events may occur, or what levels of vibration may be generated from these individual events, due to their arbitrary nature. They can, however, be readily minimised or avoided through considered management practices.

4.4 Management and Mitigation of Construction Noise and Vibration Effects

Standard and routinely employed measures shall be implemented to mitigate noise effects. Such measures may include the selection of plant which generates less noise, careful maintenance of plant, controlling 'on-time' of plant and verification monitoring of noise and vibration levels.

SLR has identified the following site-specific mitigation measures which, in combination with advising neighbours prior to commencing works, can be considered BPO and can assist in achieving acceptable construction noise outcomes:

- Temporary acoustic screening to block the line of sight between activities and receivers during demolition, excavation, piling, and compaction works as per **Figure 6**. The temporary acoustic screening should be constructed of solid material such as plywood or mass loaded 'acoustic blankets' with a surface mass of at least 7 kg/m².



- Using a <30-ton excavator with pulveriser for demolition works, where practicable.
- Using a <5-ton excavator (breaker wrapped with an acoustic shroud) and localised screening for demolition works.
- Using a <20-ton excavator for excavation and piling works.
- Using a <20-ton vibratory compactor and <100 Kg plate compactor for compaction works.
- Compaction within 15m of neighbours only undertake with a <100 Kg plate compactor **and** the recommended acoustic screening described above or within 20m of neighbours, no screening required.
- Complete all work as quickly as possible and control the on-time of plant when onsite.
- Where practicable, scheduling of the works closest to the neighbouring properties to avoid periods where the buildings are occupied.

5.0 Recommended Conditions of Consent

SLR recommends that specific conditions of consent (if considered necessary) should reflect the standard requirements as set out in the AUP. SLR recommend the following conditions to provide suitable control of construction noise and vibration effects:

- a) The consent holder shall advise all occupants of the immediate neighbouring sites of the construction works, in writing, no less than three (3) days prior to the works commencing on the site. The written advice shall include a brief description of the works, the expected duration of the works, the mitigation to be implemented, the working hours, and contact details for any concerns regarding noise and vibration.
- b) The consent holder shall construct and maintain acoustically effective localised screening throughout the construction works as necessary to meet the noise limits in Conditions [c] below.
- c) Noise arising from construction activities on-site shall not exceed the following limits when measured or assessed at any building on any other site, where affected party approval has not been obtained, that is occupied during the works.

84 Compass Point Way

- 75 dB LAeq during demolition, piling and compaction works.
- AUP Standard E25.6.27 noise limits at all other times.

80 Compass Point Way, 78 Compass Point Way and 76 Compass Point Way

- 75 dB LAeq during piling works.
- AUP Standard E25.6.27 noise limits at all other times.

At all other properties

- AUP Standard E25.6.27 noise limits at all other times.
- d) Vibration from construction activities shall meet the requirements of AUP Standard E25.6.30(1).



- e) Verification vibration monitoring shall be undertaken at the first instance of compaction works to confirm site specific vibration levels meet the requirements of Condition [d].

6.0 Conclusion

SLR has assessed construction noise and vibration effects associated with the proposed residential development at 3 Pigeon Mountain Road in Half Moon Bay, Auckland. Noise and vibration associated with the construction of the proposed development has been considered with regard to the Auckland Unitary Plan requirements. The findings of the assessment are summarised as follows:

- 1 Noise and vibration levels, generated by construction works, are expected to generally comply with identified permitted construction noise and vibration limits (with reference to Standards referenced in the Auckland Unitary Plan).
- 2 Temporary acoustic screening (minimum height of 2.0m) and limiting the size of equipment used is recommended to control noise at receivers during demolition, excavation, piling, and compaction works.
- 3 Standard E25.6.27 of the AUP relating to long-term construction noise limits may be exceeded temporarily by 5 dB at the following properties:
 - At 84 Compass Point Way during demolition, piling and compaction works for an approximate duration of less than two weeks.
 - At 80 Compass Point Way, 78 Compass Point Way and 76 Compass Point Way during piling works for a total period of up to three days at any receiver.
- 4 The exceedances are predicted to occur for short durations and in some instances are likely to be able to be scheduled at times to avoid when neighbouring properties are occupied.
- 5 Standard E25.6.30(1) relating to construction vibration levels is expected to be complied with at neighbouring properties through managing activities and equipment sizes relative to distance from receivers.
- 6 With consideration of the limited duration of these works and the identified mitigation measures (see **Section 4.4**), the associated noise and vibration effects are considered to be reasonable and acceptable.
- 7 Recommended conditions of consent related to noise and vibration have been included in **Section 5.0**.

SLR Consulting NZ Ltd

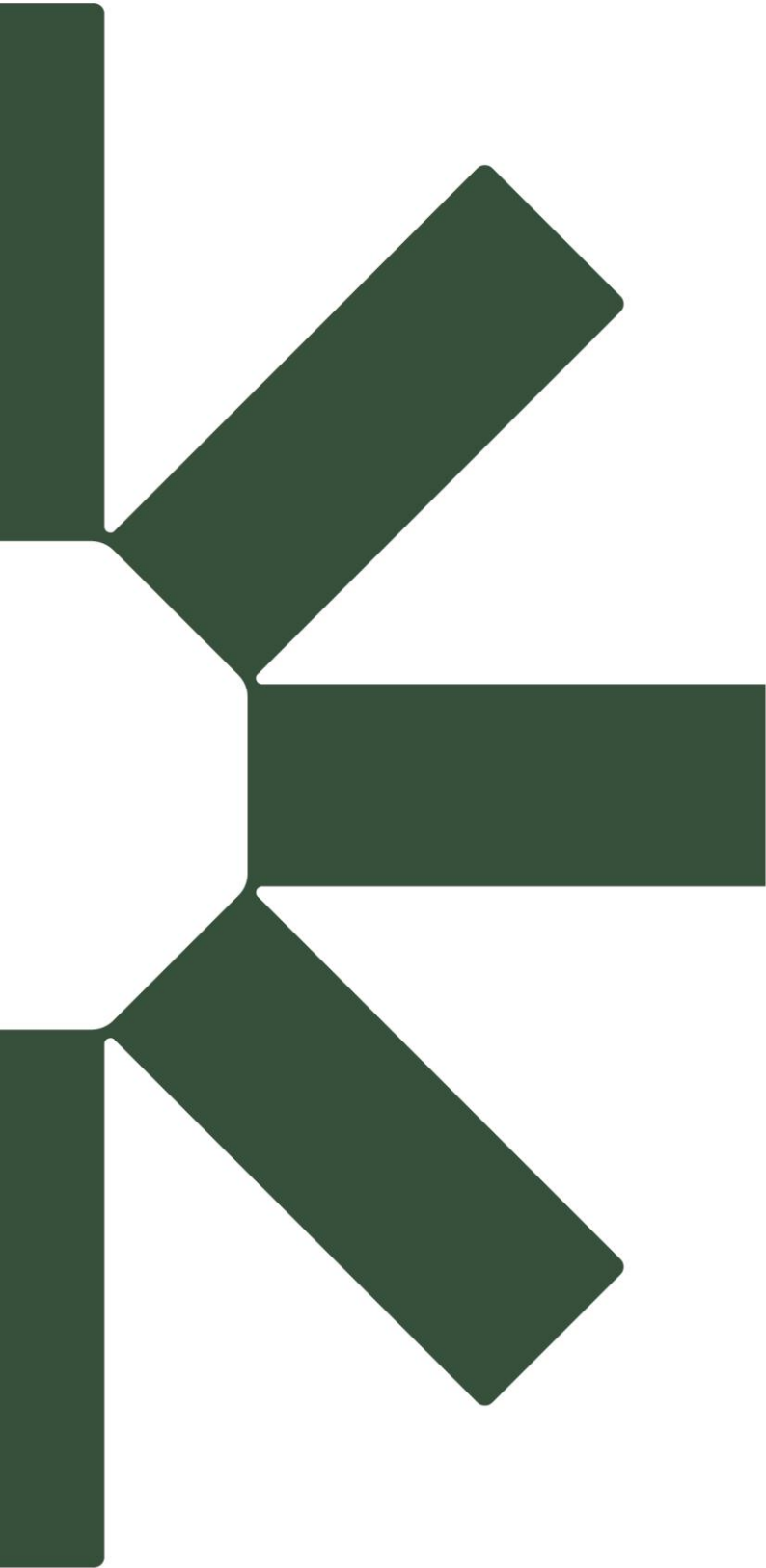


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Making Sustainability Happen