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# BEACHLANDS SOUTH PRECINCT

# 110 JACK LACHLAN ROAD, BEACHLANDS

# ASSESSMENT OF NOISE AND VIBRATION EFFECTS

**Report No 26032**

**Prepared for:**
Russell Group

**Prepared by:** ……
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# 1. INTRODUCTION

## 1.1. Experience and Qualifications

My full name is Rhys Leonard Hegley. I am a partner at Hegley Acoustic Consultants. I hold a Bachelor of Engineering from the University of Auckland (1993) and have attended specialist courses in acoustics in Australia and America. I am a member of the Institution of Professional Engineers New Zealand.

For the last 25 years, I have specialised in the measurement and assessment of noise. This work has included the preparation of reports and compliance monitoring for resource consent applications and notices of requirement and attendance at council hearings, the District and Environment Court hearings and Boards of Inquiry.

I have advised on a wide range of projects from the development of business activities such as childcare centres, service stations and workshops through large scale industrial activities such as petrochemical plants, power stations, dairy factories and roading projects. Included in this work has been an involvement in a number of plan change applications.

## 1.2. Code of conduct

I confirm that I have read the Code of Conduct for Expert Witnesses (Environment Court Practice Note 2023) and have complied with it when preparing this report. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that the work presented in this report is within my area of expertise, except where I state that I am relying on the evidence of another person.

## 1.3. Description of the Project

The Beachlands South Precinct project (the Project) will provide for the development of live zoned land at Beachlands into a comprehensively planned

and public transport focussed community to achieve a well-functioning urban environment. The Project will comprise of residential dwellings, a hotel and conference venue, community and commercial activities, protected ecological restoration areas, walking and cycling networks, and community facilities, and enable the potential development of two schools. The Project requires earthworks and all associated infrastructure, including transport facilities, intersection upgrades and roading, telecommunications, power, and water supply and stormwater, and wastewater infrastructure, which includes an outfall some 2km off the Project's coast. A portion of the Future Urban zoned land will be will be used for wastewater management purposes.

This report provides an assessment of the noise and vibration effects anticipated from the construction of the Project, considering the effects on land based receivers separately from those in the marine environment. This report also discusses suitable operational noise and vibration rules for the Project.

## 2. SCOPE OF THE PROJECT

Figure 1 below shows the Project through both the proposed zoning map and the anticipated cut and fill plan, which describes the necessary earthworks. While both plans show the entire area that will ultimately be developed, resource consents[1] have already been obtained to undertake the earthworks for a significant portion of the site, and which is identified on the cut fill plan (noting that the Project includes the work proposed for Jack Lachlan Drive). For the consideration of construction effects, this assessment excludes the earthworks permitted by the existing consents. In terms of the appropriate operational noise rules, this report addresses the uses across the entire Project, as shown by the proposed zoning map.

[1] LUC60453761 and LUS60459682

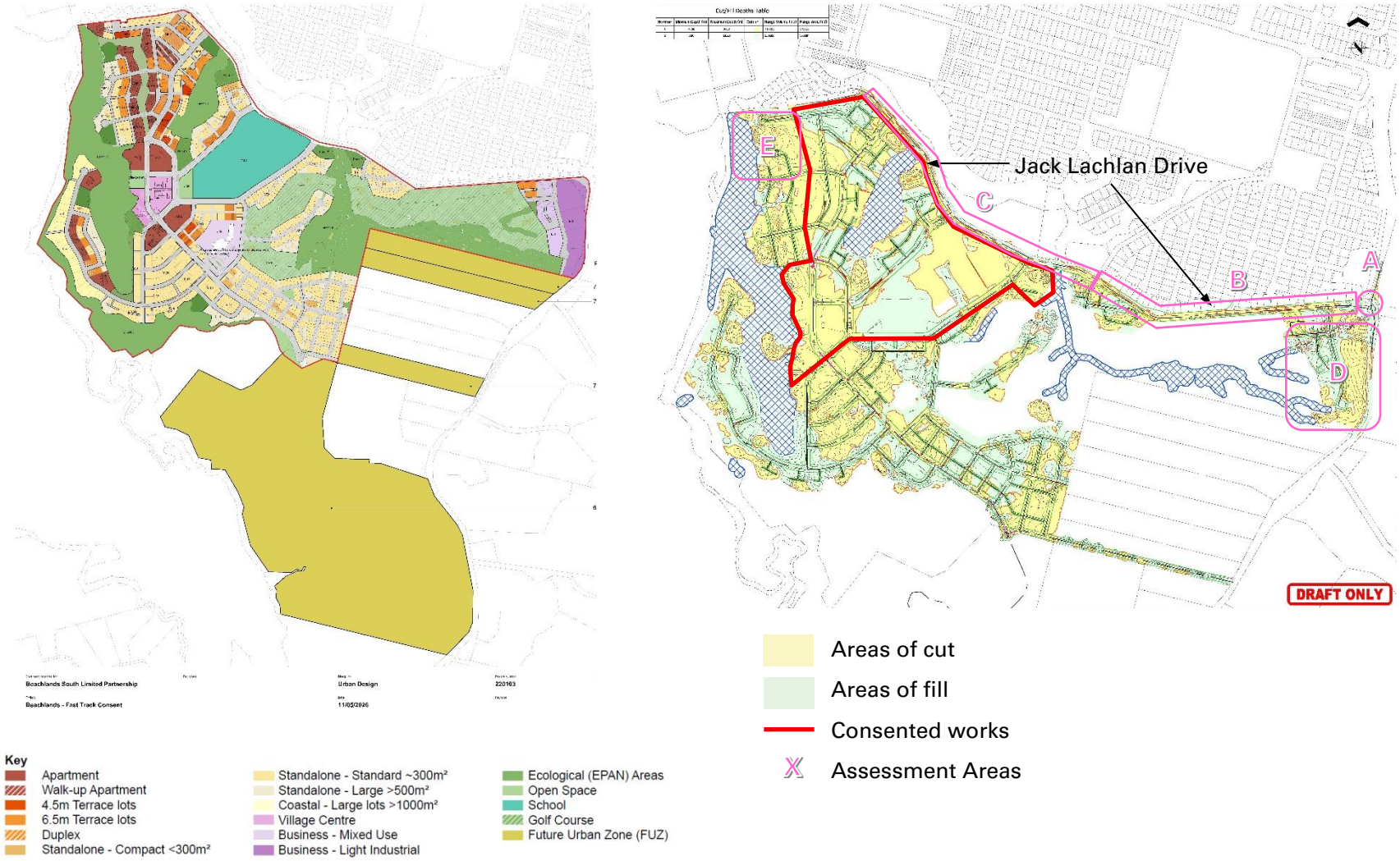


**Figure 1. Project Master Plan and the Cut Fill Plan** (source: Harrison Grierson)

## 3. CONSTRUCTION EFFECTS – TERRESTRIAL

The terrestrial construction effects considered are those relating to the development of the Project, or its earthworks component. The effects from any subsequent construction activities within the Project, such as the development of buildings, will be addressed through consent conditions. On this basis, the construction effects considered are:

a. The construction of a new roundabout at the intersection of Jack Laucklan Drive and Whitford-Maraetai Road (Area A, Figure 1);

b. The minor upgrades proposed to Jack Lachlan Drive between Whitford-Maraetai Road and Kahawairahi Drive (Area B, Figure 1);

c. The roadworks proposed to Jack Lachlan Drive west of Kahawairahi Drive (Area C, Figure 1);

d. The bulk earthworks proposed for the Project at the intersection of Jack Lachlan Drive and Whitford-Maraetai Road (Area D, Figure 1); and

e. The bulk earthworks proposed for the northern part of the Project to the west of the area described by the existing resource consents (Area E, Figure 1).

The noise and vibration effects from each of the above construction activities are addressed separately below.

### 3.1. Construction Noise

#### 3.1.1. AUP Rules

Rule E25.6.27 of the Auckland Unitary Plan Operative in Part (AUP) provides the construction noise limits for the Project. These are based on the provisions of the

New Zealand construction noise standard[2] (NZS 6803), which is widely adopted throughout New Zealand and is considered best practice. E25.6.27 requires:

a. Construction noise shall be measured 1m from the most exposed façade of a dwelling;

b. On the basis that the construction activities of the Project will exceed 20 weeks' duration, the limits are:

| Time of week | Time Period | Maximum noise level (dBA) | |
|---|---|---|---|
| | | $L_{eq}$ | $L_{max}$ |
| Weekdays | 6:30am–7:30am | 55 | 70 |
| | 7:30am–6:00pm | 70 | 85 |
| | 6:00pm-8:00pm | 65 | 80 |
| | 8:00pm-6:30am | 40 | 70 |
| Saturdays | 6:30am–7:30am | 40 | 70 |
| | 7:30am–6:00pm | 70 | 85 |
| | 6:00pm-8:00pm | 40 | 70 |
| | 8:00pm-6:30am | 40 | 70 |
| Sundays and public holidays | 6:30am–7:30am | 40 | 70 |
| | 7:30am–6:00pm | 50 | 80 |
| | 6:00pm-8:00pm | 40 | 70 |
| | 8:00pm-6:30am | 40 | 70 |

The AUP provides both an $L_{eq}$ and $L_{max}$ criteria. Generally, compliance with the $L_{eq}$ limit ensures compliance with the $L_{max}$ limit. For this reason, this report is based on the $L_{eq}$ metric with the assumption that the same conclusion will apply for the $L_{max}$.

[2] NZS 6803:1999 Acoustics – Construction Noise

The following guidance for assessing the day time effects of construction noise is based on the AAAC construction noise Guidelines[3]. The indoor effects are based on closed windows.

**Table 1. Guidelines for Construction Noise**

| Noise Level (external) | Potential Day Time Effects | |
|---|---|---|
| | **Outdoors** | **Indoors** |
| $\geq$ 80dBA $L_{eq}$ | Unlikely to be tolerated for more than a brief exposure. People will leave the area or seek respite indoors. | Likely to be untenable for any extended period. |
| 75 – 80dBA $L_{eq}$ | Conversation will be difficult even with raised voices. People will likely leave the area or seek respite indoors. | Concentration likely to be affected and phone conversations may become difficult. Television, and radio levels would need to be raised. If noise continues for extended periods, people are likely to seek respite by moving to another room. |
| 70 – 75dBA $L_{eq}$ | Conversation will require raised voices. People are unlikely to spend time outside. | Annoyance for some occupants. Concentration may be affected but residential and office activities can generally continue. Sound levels for television, radio, and phone conversations would need to be slightly raised. |

[3] Association of Australasian Acoustic Consultants, Guideline for interpreting and applying NZS 6803:1999 Acoustics – Construction Noise, Version 1.0

| Noise Level (external) | Potential Day Time Effects | |
|---|---|---|
| | **Outdoors** | **Indoors** |
| 65 – 70dBA $L_{eq}$ | Conversation will require raised voices. People are unlikely to spend time outside. | Will be audible within the building. Concentration may be affected. |
| 55 – 65dBA $L_{eq}$ | Conversations may require raised voices. Construction noise may be dominant (depending on existing ambient level). | Likely audible within the building but should not result in meaningful effects on daily activities. |

| | |
|---|---|
| | Levels comply with the AUP |
| | Levels exceed the AUP |

### 3.1.2. Prediction of Construction Noise

Construction noise was calculated for the surrounding neighbours using the Predictor noise modelling software. The model takes into account all factors that influence the transmission of noise. These were obtained from plans of the Project, Auckland Council's GIS information, and the base sound power data of the various activities (Appendix A).

Given that the construction methodology for the Project will be finalised during detailed design, the base noise data required by Predictor has been based on historic measurements of similar activities. This results in a range of possible noise levels from each activity. For this reason, rather than report noise levels to the nearest whole number, it is considered more appropriate to report, and subsequently assess, a range of possible noise levels for each of the activities at each of the surrounding sites. As a result, noise levels are reported using 5dB bandwidths.


X - Assessment sites

**Figure 2. Assessment Sites Considered for Roundabout Construction**

**Table 2. Noise Levels from the Construction of the Roundabout**

| Receiver, Fig 2 | Address | Construction Noise Level, dBA $L_{eq}$ | | | | |
|---|---|---|---|---|---|---|
| | | Excavator | Grader | Roller | Miller | Paver |
| 1 | 824 Whitford Maraetai Rd | ≤55 | ≤55 | ≤55 | ≤55 | ≤55 |
| 2 | 49 Jack Lachlan Drive | 71 - 75 | 61 - 65 | 61 - 65 | 61 - 65 | 61 - 65 |
| 3 | 51 Jack Lachlan Drive | 71 - 75 | 61 - 65 | 61 - 65 | 61 - 65 | 61 - 65 |
| 4 | 53 Jack Lachlan Drive | 71 - 75 | 61 - 65 | 61 - 65 | 61 - 65 | 61 - 65 |

| Receiver, Fig 2 | Address | Construction Noise Level, dBA $L_{eq}$ | | | | |
|---|---|---|---|---|---|---|
| | | Excavator | Grader | Roller | Miller | Paver |
| 5 | 55 Jack Lachlan Drive | 71 - 75 | 61 - 65 | 61 - 65 | 61 - 65 | 61 - 65 |
| 6 | 57 Jack Lachlan Drive | 71 - 75 | 61 - 65 | 61 - 65 | 61 - 65 | 56 - 60 |
| 7 | 59 Jack Lachlan Drive | 71 - 75 | 56 - 60 | 56 - 60 | 56 - 60 | ≤55 |
| | Level complies with AUP | | | | | |
| | Level Exceeds AUP | | | | | |

Table 2 shows that noise levels from the construction of the roundabout are predicted to comply with the 70dBA $L_{eq}$ AUP limit to the neighbours. In such cases, effects are considered reasonable.

There are six houses (49 – 59 Jack Lachlan Drive) where construction noise levels are predicted to extend into the 71 – 75dBA $L_{eq}$ range while the excavator is working in the most expose locations. From Table 1 above, it can be seen that this will likely result in adverse effects on occupants. Barrier mitigation was discounted to these residents as their vehicular access is through this boundary, meaning the required openings in the barrier would render it ineffective.

Experience shows that such effects can be managed through consultation with neighbours to inform them of the upcoming work, its duration, and likely effects, and a Construction Noise and Vibration Management Plan (CNVMP) is proposed for this purpose. On this basis, it is concluded that the effects are appropriate for a construction activity.

### 3.1.4. Noise Assessment from the Minor Upgrades to Jack Lachlan Drive

Between Kahawairahi Drive and Whitford-Maraetai Road, minor upgrades are proposed for Jack Lachlan Drive (Area B, Figure 1) over an estimated six month

period. These upgrades include formalising the existing gravel footpath, the completion of kerbs and berms, and the construction of a cycle path. In terms of construction activities, these activities are not particularly intensive, with the loudest being a small (6 – 12t) excavator and a plate compactor.

With the adjacent houses being in the order of 5 – 10m from the roadside boundary, the resulting noise levels from the small excavator would range between 70 – 75dBA $L_{eq}$. Such levels are reasonably common from construction projects, with experience showing communities can typically accommodate it, provided they understand the activity. This finding is consistent with the effects described in Table 1 and the recommendation that the work is undertaken under a CNVMP.

Noise from a plate compactor would be louder, and within the range of 85 – 90dBA $L_{eq}$ when working in the most exposed location These levels are higher than desirable, but there is the expectation that the resulting effects could be managed due to the short nature of the work that plate compactors are usually required to undertake (larger areas of compaction would be better suited to larger, but quieter, ride on rollers). For this reason, it is concluded that effects can be adequately addressed through a CNVMP and, specifically, the required consultation with neighbours about suitable times to complete this work.

Barrier mitigation was considered to screen the adjacent residents as they would likely be effective. However, given the expected short duration of the effects, the use of barriers will be developed by the CNVMP.

### 3.1.5. Noise Assessment from the Major Upgrades to Jack Lachlan Drive

West of Kahawairahi Drive (Area C, Figure 1), significant upgrades are proposed to Jack Lachlan Drive that will include conventional earthmoving equipment such as motor scrapers, excavators, compactors and pavers. This work is expected to take 18 months to complete.

Noise has been calculated for the closest dwellings (Figure 3) using the Predictor noise modelling software and is reported in Table 3.


X - Assessment sites

**Figure 3. Assessment Sites Considered for Road Major Construction**

**Table 3. Construction Noise Levels from Major Road Works**

| Receiver, Fig 3 | Address | Construction Noise Level, dBA $L_{eq}$ | | | | |
|---|---|---|---|---|---|---|
| | | Excavate | Scrape | Grade | Compact | Pave |
| 13 | 83 Jack Lachlan D | 57 | 57 | 49 | 47 | 46 |
| 14 | 85 Jack Lachlan Dr | 60 | 59 | 51 | 49 | 48 |
| 15 | 87 Jack Lachlan Dr | 65 | 63 | 55 | 53 | 52 |
| 16 | 3 Kahawairahi Rd | 61 | 61 | 53 | 51 | 50 |
| | Level complies with AUP | | | | | |
| | Level Exceeds AUP | | | | | |

Table 3 shows that noise from the construction of the easternmost portion of the Project is predicted to comply with the 70dBA $L_{eq}$ limit of the AUP. From this, construction noise levels are considered reasonable.

### 3.1.6. Noise Assessment of the Eastern Bulk Earthworks

Earthworks to develop the Project are proposed immediately southwest of the intersection between Jack Lachlan Drive and Whitford-Maraetai Road (Area D, Figure 1). This work will include an estimated three months of bulk earthworks with a further six months of infrastructure work, which will include the likes of services installation. The major noise sources will be the same plant that is described in the section above for the major road works.

Again, construction noise levels have been predicted using Predictor to the adjacent neighbours, which are shown in Figure 4. The calculated noise levels are reported in Table 4.


X - Assessment sites

**Figure 4. Assessment Sites Considered for Eastern Earthworks**

**Table 4. Construction Noise Levels from Eastern Earthworks**

| Receiver, Fig 4 | Address | Construction Noise Level, dBA $L_{eq}$ | | | |
|---|---|---|---|---|---|
| | | Excavator | Scraper | Grader | Compactor |
| 1 | 824 Whitford-Maraetai | ≤55 | 56 - 60 | ≤55 | ≤55 |
| 2 | 49 Jack Lachlan Drive | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 3 | 51 Jack Lachlan Drive | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 4 | 53 Jack Lachlan Drive | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 5 | 55 Jack Lachlan Drive | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 6 | 57 Jack Lachlan Drive | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 7 | 59 Jack Lachlan Drive | 61 - 65 | 66 - 70 | 56 - 60 | 56 - 60 |
| 8 | 61 Jack Lachlan Drive | 56 - 60 | 66 - 70 | 56 - 60 | 56 - 60 |
| 9 | 1 Karo Road | 56 - 60 | 66 - 70 | 56 - 60 | 56 - 60 |
| 10 | 2 Karo Road | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 11 | 32 Doidge Street | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |
| 12 | 34 Doidge Street | 66 - 70 | 66 - 70 | 56 - 60 | 56 - 60 |

Level complies with AUP

Level Exceeds AUP

Table 4 shows that noise from the construction of the easternmost portion of the Project is predicted to comply with the 70dBA $L_{eq}$ limit of the AUP. From this, construction noise levels are considered reasonable.

### 3.1.7. Noise Assessment of the Northern Bulk Earthworks

The bulk earthworks proposed for the northernmost part of the Project, which is to the west of the area described by the existing resource consents (Area E, Figure 1), will also require similar plant to that described above. It differs from the assessment above of the eastern earthworks in that, in this instance, the earthmoving equipment will be required to operate almost to the boundary with

the existing northern neighbours, which are shown in Figure 5. In that respect, it will be a continuation of the consented earthworks.

The above assessments indicate that construction noise will exceed the AUP limit and, for this reason, barrier mitigation has been discussed with the design team. The conclusion was that while such mitigation would provide acoustic benefits, there is concern that it would not be practicable to remain in place while the site was cut or filled behind it. For this reason, it is proposed that its implementation will be managed through the CNVMP. However, on the basis that it may not be in place at times, all analysis excludes its use.


X - Assessment sites

**Figure 5. Assessment Sites Considered for Northern Earthworks**

The calculated noise levels are reported in Table 5.

**Table 5. Construction Noise Levels from Northern Earthworks**

| Receiver, Fig 5 | Address | Construction Noise Level, dBA $L_{eq}$ | | | |
|---|---|---|---|---|---|
| | | Excavator | Scraper | Grader | Compactor |
| 17 | 6 Tui Brae | ≤55 | 56 - 60 | ≤55 | ≤55 |
| 18 | 8 Tui Brae | 56 - 60 | 61 - 65 | ≤55 | ≤55 |
| 19 | 16 Tui Brae | 66 - 70 | 61 - 65 | 56 - 60 | ≤55 |
| 20 | 18 Tui Brae | 76 - 80 | 71 - 75 | 61 - 65 | 61 - 65 |
| 21 | 22 Tui Brae | 61 - 65 | 66 - 70 | 56 - 60 | 56 - 60 |
| 22 | 24 Tui Brae | 76 - 80 | 71 - 75 | 61 - 65 | 61 - 65 |
| 23 | 13 Tui Brae | 61 - 65 | 61 - 65 | ≤55 | ≤55 |
| 24 | 15 Tui Brae | 66 - 70 | 56 - 60 | 56 - 60 | 56 - 60 |
| 25 | 17 Tui Brae | 66 - 70 | 56 - 60 | 56 - 60 | 56 - 60 |
| 26 | 19 Tui Brae | 66 - 70 | 71 - 75 | 61 - 65 | 61 - 65 |
| 27 | 23 Tui Brae | 76 - 80 | 71 - 75 | 61 - 65 | 61 - 65 |

Level complies with AUP

70 < Level ≤75

76 < Level ≤80

Table 5 shows general compliance with the 70dBA $L_{eq}$ limit of the AUP. In such instances, the effects are considered reasonable. Levels will extend into the 71 – 75dBA range for the motor scraper and 76 – 80dBA range for the excavator when each piece of equipment is working close to receivers 20, 22, 26 and 27. From the effect described by Table 1, the conclusion to these sites is that the levels are higher than desirable and that there will be adverse effects. However, such levels are not uncommon for construction projects where the experience is that they can be managed, and a CNVMP is proposed for this purpose.

### 3.2. Construction Vibration

#### 3.2.1. AUP Rules

Part (a) of Rule E25.6.30 requires that vibration from construction must comply with the limits set out in the German Industrial Standard DIN 4150-3 (1999): "Structural Vibration – Part 3 Effects of Vibration on Structures". The criteria of this Standard are shown below:

**Table 6. Criteria of DIN 4150**

| Type of structure | Guideline values for velocity, $v_i$, in mm/s | | | |
|---|---|---|---|---|
| | Vibration at the foundation at a frequency of | | | Vibration at horizontal plane of highest floor at all frequencies |
| | 1Hz to 10Hz | 10Hz to 50Hz | 50Hz to 100Hz* | |
| Buildings used for commercial purposes, industrial buildings, and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| Dwellings and buildings of similar design and/or occupancy | 5 | 5 to 15 | 15 to 20 | 15 |
| Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 above and are of great intrinsic value (e.g. listed buildings under preservation order) | 3 | 3 to 8 | 8 to 10 | 8 |
| *) At frequencies above 100 Hz, the values given in this column may be used as minimum values. | | | | |

Part (b) of Rule E25.6.30 goes on to require that the following limits be met when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building.

**Table 7. Additional AUP Vibration Criteria**

| **Receiver** | **Period** | **Peak Particle Velocity Limit** millimetres/ second |
|---|---|---|
| Occupied activity sensitive to noise | Night-time 10pm to 7am | 0.3 mm/s |
| | Daytime 7am to 10pm | 2mm/s |
| Other occupied buildings | At all times | 2mm/s |

The rule goes on to require:

> *Works generating vibration for three days or less between the hours of 7am to 6pm may exceed the limits in Table E25.6.30.1 Vibration limits in buildings above, but must comply with a limit of 5mm/s peak particle velocity in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building, where:*
>
> *(i) all occupied buildings within 50m of the extent of the works generating vibration are advised in writing no less than three days prior to the vibration-generating works commencing; and*
>
> *(ii) 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.*

The effect of Tables 6 and 7 is to provide two different criteria for the same activity. When assessing effects, it is useful to note that the DIN limits are for the protection against cosmetic structural damage, such as cracks forming in

plasterboard walls. The more stringent limits of Table 7 are for the amenity of occupants.

To provide further understanding as to the amenity effects of vibration, BS 5228-2: 2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites- Part 2: Vibration' provides the following descriptions:

**Table 8. Vibration Effects**

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

### 3.2.2. Vibration Levels from All Construction

Vibration generally attenuates quickly with distance, meaning the low intensity activities, such as the excavator or paver, are readily expected to comply with the vibration limits of the AUP, and are not considered further. The equipment that is likely to produce the highest levels of vibration would be a vibrating roller.

Figure 6 shows a measurement of a vibrating roller at a distance of 3.5m, including startup, four passes and shutdown.

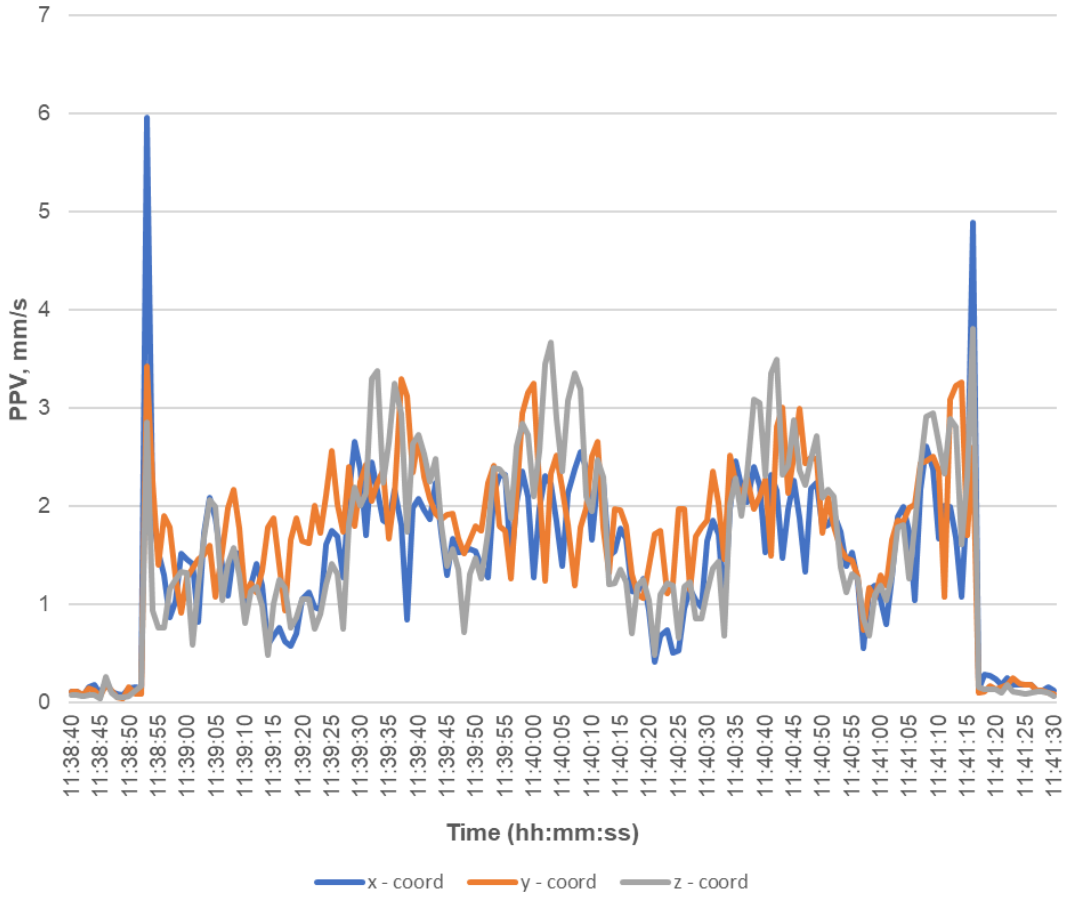


**Figure 6. Vibrating Roller Makes Four Passes at 3.5m (include startup and shutdown)**

Even at 3.5m, the vibrating roller is expected to comply with the 5mm/s cosmetic damage protection criteria of the AUP, provided the location of the startup and shutdown is managed. This distance coincides with the closest neighbour to the Project (Receiver 19, Figure 5), meaning that it would be practicable to undertake compaction work close to the boundary. From Table 8, it can be seen that such a level will be apparent to occupants, but any concerns can be addressed through consultation with residents via a CNVMP. As a backup, a static roller could be used close to neighbours for lower levels of vibration, albeit with an increased number of passes.

Of the remaining neighbours, receivers 23 and 24 are the next closest at 8m. At this distance, vibration is predicted to reduce to 2mm/s, which complies with the limits of the AUP and is therefore considered reasonable.

## 4. CONSTRUCTION EFFECTS – MARINE

Considering the marine environment, the majority of the construction works, as described above, will have a negligible effect and are not considered further. The one potential exception would be if the proposed wastewater plant progresses with the option of an outfall some 2km offshore from the Project. Should the outfall be required, it would be drilled horizontally beneath the sea floor, which again would result in negligible underwater noise effects. Two options are currently being considered for the construction of the actual outfall. The first is underwater divers, which is expected to have a negligible noise effect. The alternative requires the construction of a coffer dam, the underwater effects of which are considered below.

### 4.1. Coffer Dam Construction

The outfall would be located approximately 2km offshore in water that is approximately 5m deep (low tide). Initially, sheet piles would be vibrated through the mud seafloor before being bedded into the underlying stiffer materials with a percussion rig. Due to the small size on the coffer dam, it is anticipated that this process would take less than one week. The design team estimates that there will be up to 200 hammer strikes per day from the piling rig using a sacrificial timber dolly to both protect the pile and reduce noise.

Once dewatered, the outfall would be constructed over an estimated six month period. On completion, the sheet piles would be pulled out with a crane, which would likely require a vibrating head to loosen them. The removal could be completed within one week.

### 4.2. Marine Mammal Criteria

With respect to underwater noise, the AUP provides the following policies:

*F2.18.3 (1) Require underwater blasting, impact and vibratory piling, and marine seismic surveys in the coastal marine area to adopt the best practicable option to manage noise so that it does not exceed a reasonable level.*

*(2) Assess the following matters for underwater blasting, impact and vibratory piling, and marine seismic surveys:*

*a) the health and well-being of marine fauna (including threatened and at-risk species) and people from the noise associated with the proposal;*

*b) the practicability of being able to control the noise effects;*

*c) the social and economic benefits to the community of the proposal;*

*d) and the extent to which the adverse effects of the noise will be mitigated.*

With respect to criteria against which the policies can be assessed, the 2024 update of the 'Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0)' from the US Department of Commerce National Oceanic and Atmospheric Administration (NOAA Guidelines) is typically used for underwater noise assessments in New Zealand and has been adopted for this project.

For marine mammals, the criteria are presented in terms of threshold shift, or changes to the threshold of hearing. Elevated levels of noise can result in Temporary Threshold Shift (TTS), with recovery over time, while prolonged exposure (or very high levels) can result in Permanent Threshold Shift (PTS).

The metrics used are the cumulative energy per day from an activity ($SEL_{cum}$) and the uppermost level ($L_{peak}$).

The criteria vary by the species of marine mammal, which the Project's marine ecologist has identified[4] as:

a. A range of whale species;
b. Leopard and fur seals;
c. A range of dolphin species; and
d. Orca.

The kororā/little penguin has also been identified and has been included in the assessment.

The criteria adopted for the Project are:

[4] Appendix F of 'Marine Ecological Impact Assessment', 1014538.2501 v1, June 2026 by Tonkin + Taylor.

**Table 9. NOAA Guideline Thresholds**

| Species Group | Project Species | Impulsive Criteria (Precussive Piling) | Non-Impulsive Criteria (Vibration) |
|---|---|---|---|
| Low-Frequency (LF) Cetaceans | Baleen whales (Bryde's) | 183 $SEL_{cum}$<br>222 dB $L_{peak}$ | 197 $SEL_{cum}$ |
| High-Frequency (HF) Cetaceans | Beaked whales Bottlenose and common dolphin | 193 $SEL_{cum}$<br>230 dB $L_{peak}$ | 201 $SEL_{cum}$ |
| Very High-frequency (VHF) Cetaceans | Orca, Hector's dolphin | 159 $SEL_{cum}$<br>202 dB $L_{peak}$ | 181 $SEL_{cum}$ |
| Phocid Pinnipeds (PCW) | Leopard seal | 183 $SEL_{cum}$<br>223 dB $L_{peak}$ | 195 $SEL_{cum}$ |
| Otariid Pinnipeds (OCW) | Fur seals Kororā/little penguin | 185 $SEL_{cum}$<br>230 dB $L_{peak}$ | 199 $SEL_{cum}$ |

There are no published criteria for the kororā/little penguin. As a proxy, the OCW thresholds provided in Table 9 above have been adopted based on Southall et al. (2019) findings of the similarity to this group.

### 4.3. Predicted Safe Zones

Using measurements of a pile driver and piles being vibrated, the distances from the activity required to meet the criteria of Table 9 have been calculated and are reported in Table 10. These distances include the use of a soft dolly between the pile and hammer (which will reduce noise) and the use of a bubble curtain.

Given that the criteria for the vibrated piles exceed those of the percussive piling, and that percussive piling is louder, the results for the critical percussive piling only are reported.

**Table 10. Minimum Distance from Piling to Meet the Thresholds**

| Species Group | LF Cetaceans | HF Cetaceans | VHF Cetaceans | Phocid Pinnipeds | Otariid Pinnipeds |
|---|---|---|---|---|---|
| $SEL_{cum}$ threshold (m) | 320 | 200 | 610 | 270 | 200 |
| $L_{peak}$ threshold (m) | NA | NA | 200 | NA | NA |

NA – $L_{peak}$ noise level is less than the threshold for the species group

From the above Table, mitigation and/or management will be required if mammals or penguins are observed within the nominated distances.

### 4.4. Mitigation and Management Procedures

The minimum distances between the piling and marine mammals and penguins provided above are not, in themselves, mitigation. Instead, it is proposed to address potential effects from the piling on the marine mammals and penguins by:

a. Selecting the most appropriate method of constructing the outfall;

b. Controlling noise at source through the use of a soft, sacrificial dolly on top of the pile;

c. Using a bubble curtain about the piling, such as Bubble Tubing from Canadian Pond, if this is found to be practicable;

d. Limiting piling to day light hours to allow for observations of marine mammals and penguins. Seasonal limitations have been discussed with the marine ecologist and are not considered necessary;

e. Use of an observer, or observers, during the piling to watch for marine mammals and penguins entering the safe piling zones. Should marine mammals or penguins be identified, work shall stop until the all clear is given;

f. Observations shall start a minimum of 30 minutes prior to the commencement of piling.

g. Piling shall adopt a soft start procedure that is 30 minutes in duration followed by a gradual increase to maximum intensity.

The above procedures are best detailed and implemented via a CNVMP.

## 5. OPERATIONAL NOISE AND VIBRATION RULES

The Project contains a suite of zones that provide for a range of residential, business and open space uses as well as schools and Future Urban zoning. The Project is surrounded by sites in the Residential – Single House zone. The Rural – Countryside Living zone, or the Open Space- Informal Recreation zone.

For each zone, the noise provisions contained in Chapter E25 of the AUP provide suitable controls, and it is proposed that they be adopted in full.

## 6. CONCLUSIONS

Predictions of noise from the construction of the Project show that, in general, levels will comply with the 70dBA $L_{eq}$ limit of the AUP. In such instances, the effects are considered reasonable.

There will be times when noise levels exceed the AUP limit by extending into the 71 – 75dBA $L_{eq}$ range for short periods and the 76 – 80dBA $L_{eq}$ range for shorter periods. These levels will result in adverse effects. However, experience with other projects has shown that such levels are both common and typically accepted by the community on the basis that they are informed of the works and

the expected duration. A CNVMP is proposed for this purpose. On this basis, the construction works are considered appropriate.

Analysis of construction vibration shows that the AUP's criteria for the protection from cosmetic structural damage will not be exceeded. There is the potential for the amenity criterion of the AUP to be exceeded to the neighbours closest to the earthworks for short periods. It is proposed to manage these effects through consultation via a CNVMP.

An option being considered is the installation of a coffer dam to allow for the construction of a wastewater outfall. For the protection of marine mammals and penguins, a number of mitigation methods and management techniques have been proposed that will be implemented via a CNVMP.

The overall conclusion is that while some adverse effects are predicted from the construction of the Project, those effects are typical of most large construction activities and that it will be practical to manage those effects using current best practices.

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## APPENDIX A - BASE SOUND POWER NOISE DATA

**Sound Power Data of Construction Equipment**

| Equipment | Sound Power Level. dBA |
|---|---|
| Excavator 20T | 106 |
| Excavator 11T | 98 |
| Grader | 102 |
| Scraper | 109 |
| Compactor | 100 |
| Plate Compactor | 113 |
| Miller | 107 |
| Paver | 99 |