



# Acoustic Assessment

## Underground Infrastructure Removal and Rehabilitation

### Land Information New Zealand

Christchurch Office, 112 Tuam Street  
Private Bag 4721, Christchurch 8140  
New Zealand

Prepared by:

#### SLR Holdings NZ

201 Victoria Street West, Auckland 1010, New  
Zealand

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## Basis of Report

This report has been prepared by SLR Holdings NZ (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Land Information New Zealand (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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## Acronyms and Abbreviations

<b>dB</b>	Decibel
<b>Ambient noise level</b>	The all-encompassing sound associated with an environment or area.
<b>dBA</b>	'A' weighted decibel.
<b>Free field</b>	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
<b>LAeq</b>	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.
<b>LAmx</b>	The 'A' weighted maximum sound pressure level of an event.
<b>LINZ</b>	Land Information New Zealand
<b>Lp or SPL</b>	Sound Pressure Level.
<b>NZS 6803</b>	New Zealand Standard NZS 6802:2008 "Acoustics – Construction Noise".
<b>Time weighting</b>	Sound level meters can be set to 'fast' or 'slow' response. 'Fast' corresponds to a 125 ms time constant and 'slow' corresponds to a 1 second time constant.



## 1.0 Introduction

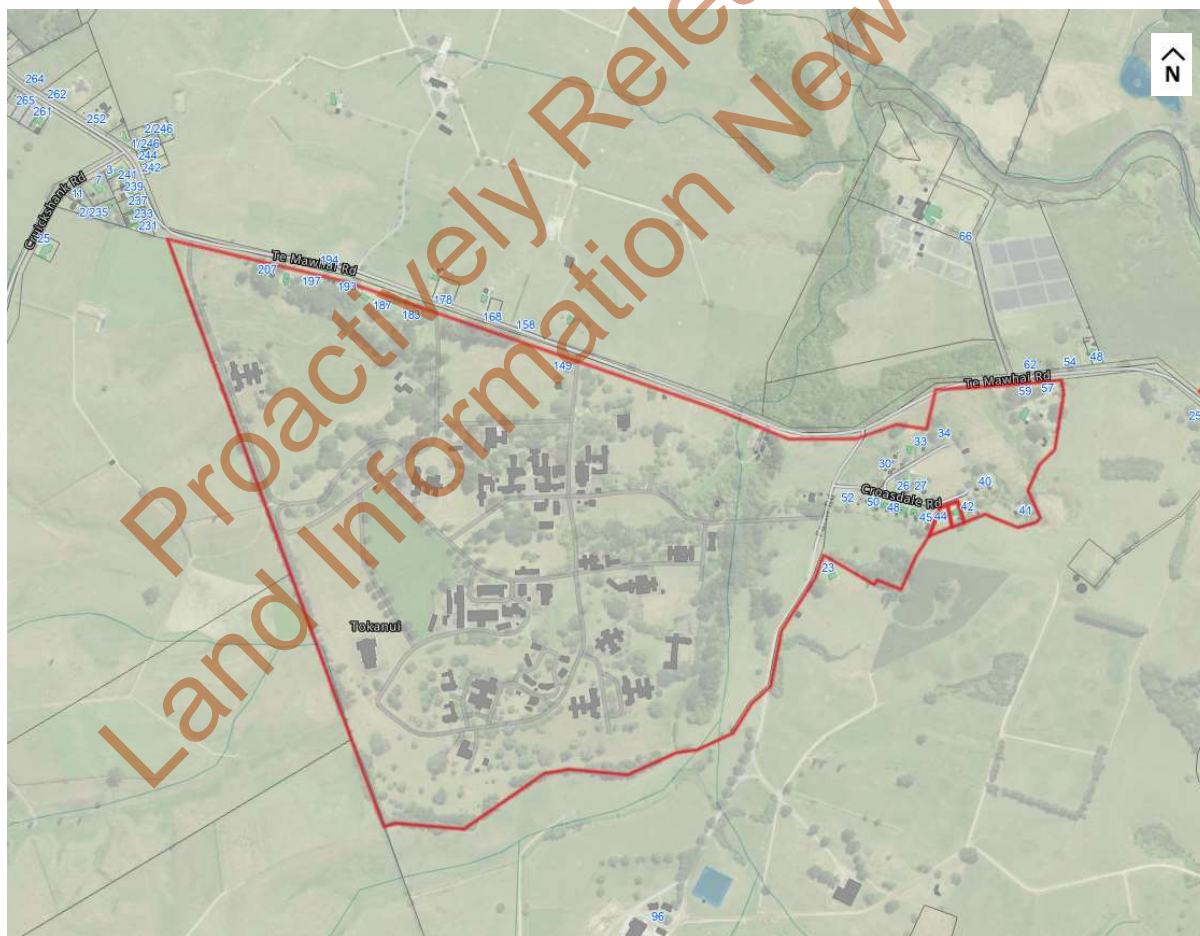
SLR has been engaged to assess the potential acoustic effects associated with the planned removal of the underground services and rehabilitation of the Tokanui Hospital Complex in Kihikihi, New Zealand.

The methodology and performance of the underground services removal and rehabilitation works have been evaluated against the relevant noise limits outlined in Operative Waipa District Plan (the **Plan**) requirements and the New Zealand Standard NZS 6803:1999 “Acoustics - Construction Noise”. This report outlines the scope of the works, the relevant acoustic criteria, and a noise assessment of the proposed works.

## 2.0 Site and Project Description

The Tokanui Hospital Complex is located south of Kihikihi and comprises of several abandoned buildings. The subject site (see **Figure 1**) and surrounding properties are on *Rural* zoned land. Te Mawhai Road form the subject site’s northern boundary, with some residences located across the road. The dwellings in the north-western corner of the subject site are occupied. The mentioned dwellings and other nearest surrounding residences are detailed in **Table 1**.

**Figure 1 Site location**



**Table 1 List of Nearest Dwellings**

Receiver	Address	Approximate distance to nearest below ground structure/element to be removed or area of remediation	Comments
R1	183 Te Mawhai Road	55 m	Single storey dwelling – located on the subject site
R2	187 Te Mawhai Road	45 m	Single storey dwelling – located on the subject site
R3	193 Te Mawhai Road	55 m	Single storey dwelling – located on the subject site
R4	197 Te Mawhai Road	45 m	Single storey dwelling – located on the subject site
R5	203 Te Mawhai Road	25 m	Single storey dwelling – located on the subject site
R6	207 Te Mawhai Road	25 m	Single storey dwelling – located on the subject site
R7	158 Te Mawhai Road	70 m	Single storey dwelling
R8	168 Te Mawhai Road	70 m	Single storey dwelling
R9	178 Te Mawhai Road	120 m	Single storey dwelling
R10	231 Te Mawhai Road	>200 m	Single storey dwelling
R11	233 Te Mawhai Road	>200 m	Single storey dwelling

## Project Description

The underground services including the road and paving removal and rehabilitation works are a crucial aspect of the project to return the land to its original state. These works involve the removal of various types of surface paving material, underground infrastructure, including pipelines, manholes, and other related structures. Although the methodology of the works is not finalised at this stage and will depend on the contractor appointed, SLR anticipate that the following activities would be associated with this project:

- Remove all surface pavement utilising excavators and/or milling plant. The excavated surface material would be stockpiled until sufficient volumes are generated to fill trucks for offsite disposal. In some identified areas where material has been removed would be “topped up” with basecourse to form rural farm tracks for ongoing use, with other identified locations the area would be reinstated with soil and returned to grazing land use.
- Excavation of trenches and pits required to access and remove the underground structures. The size and depth of the trenches will depend on the specific infrastructure being removed. The excavation process may involve the use of heavy machinery such as excavators or backhoes, which can generate noise during operation.
- Once the underground structures are exposed, they would be removed from the site. This process may involve loading the structures onto trucks or other transportation vehicles. The loading process can generate noise as the equipment and structures are moved and secured for transportation.



- After the removal of the underground structures, the excavated trenches and pits are to be backfilled with soil or other suitable materials. The backfilling process typically involves the use of compactors to ensure the stability and levelness of the ground surface. The operation of compactors can generate noise during the compaction process, with vibratory compactors generating the highest levels of noise.
- SLR has been informed by the project team, that it is anticipated that the crusher plant used during the above-ground structure removal stage, would also be used in the same location for this stage to crush up roading surfaces. The mobile concrete crusher plant would be in the centre of the site and material would be brought to the location for sorting and processing.
- Truck movements are anticipated, moving excavated and demolition material from the site to the onsite disposal or stockpiling locations. Some material would be removed off site.

Overall, the removal of underground infrastructure and the associated rehabilitation works require careful planning, coordination, and execution to ensure the successful restoration of the land to its original state while minimising potential impacts on the surrounding environment.

## 3.0 Performance Criteria

### 3.1 Construction Noise

In accordance with Rule 4.4.2.19 of the Plan, it is necessary to measure and assess construction noise on site to ensure that it meets the relevant noise limits outlined in the New Zealand Standard NZS 6803:1999 "Acoustics - Construction Noise" (**NZS6803**).

This Standard provides comprehensive guidelines for measuring and assessing noise from both existing and proposed construction work, including activities such as maintenance and demolition. Therefore, the noise limits in NZS 6803 are relevant and reasonable for this project, allowing that noise from demolition and/or removal of underground structures are assessed and managed in accordance with regulations and to minimise disruptions to the surrounding area.

NZS 6803 provides noise limits (at 1 m from the facade of any dwellings occupied during the works) to control and manage noise. The recommended noise limits for works, with an expected duration exceeding 20 weeks, are reproduced in **Table 2**.

**Table 2 Recommended Upper Noise Limits – Table 2 of NZS 6803**

Time of Week	Time Period	Long-term duration (more than 20 weeks)	
		LAeq, dB	LAm <sub>ax</sub> , dB
Weekdays	6:30 am – 7:30 am	55	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturdays	6:30 am – 7:30 am	45	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75



Time of Week	Time Period	Long-term duration (more than 20 weeks)	
		LAeq, dB	LAmx, dB
Sundays and public holidays	6:30 am – 7:30 am	45	75
	7:30 am – 6:00 pm	55	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75

## 3.2 Construction Vibration

Rule 4.4.2.18 of the Plan states that the Vibration emanating from a site shall not exceed the limits recommended in and be measured and assessed in accordance with New Zealand Standard NZS 4403:1996 “Code of Practice for Storage, Handling, and Use of Explosives”. The mentioned standard is not considered applicable as it relates to the vibration from blasting which does not form part of the project.

However, the principal concern of receivers regarding vibration relates to the potential damage to property, rather than impact on amenity. A certain level of amenity impact is expected and common during construction/demolition (as is the case with noise) and is commonly accepted with prior advice, such as letter drop and to make occupants aware ahead of the works beginning.

The nearest dwelling is approximately 25 m from any works. The anticipated setback distance for a large compactor to achieve compliance with the relevant DIN 4150-3 vibration threshold (5mm/s PPV), is less than 15m. Therefore, compliance with DIN4150-3 would be readily expected at all receivers.

## 4.0 Underground Services Removal and Rehabilitation Assessment

### 4.1 Proposed Works Methodology

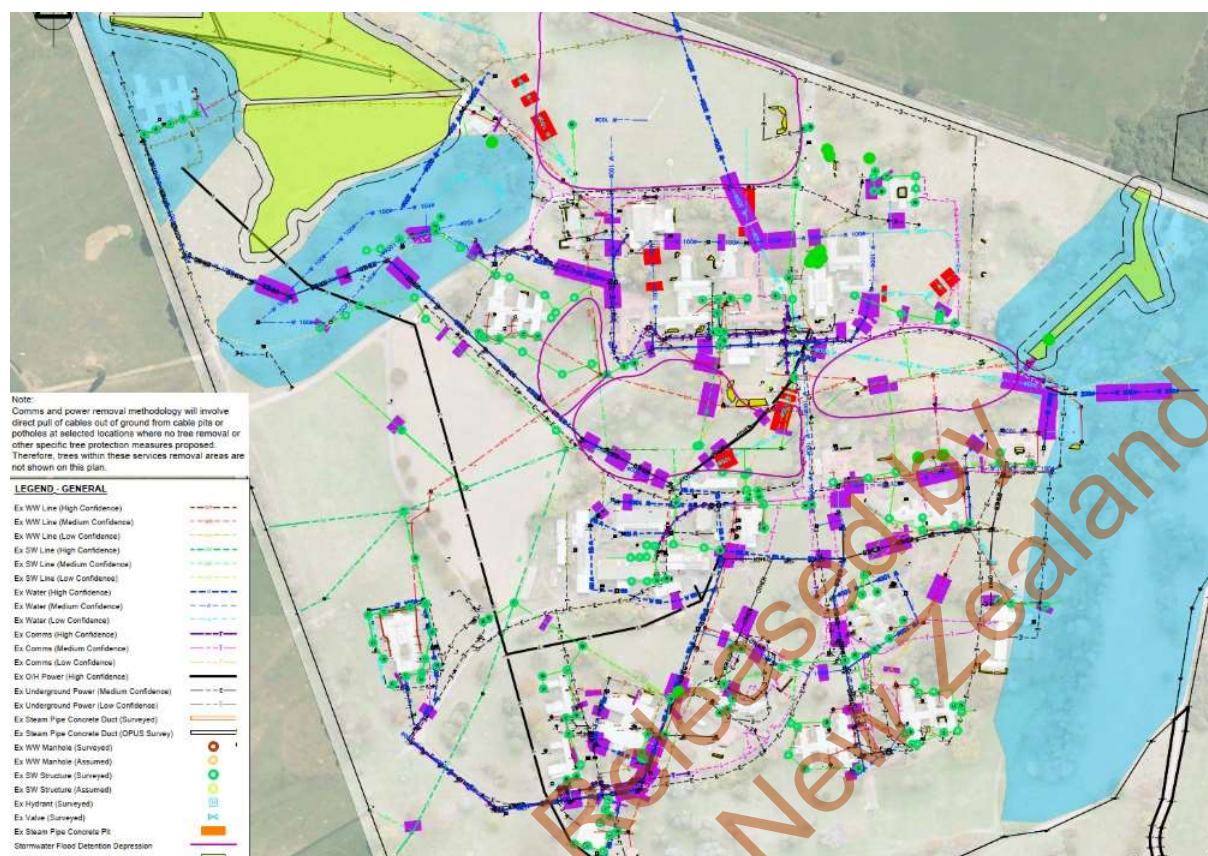
As mentioned before, the specific details of plant and methodology are not available at the time of writing. Based on the information provided by LINZ, SLR understands that the underground structures (shown on **Figure 2**) are expected to be removed over an 18-24 month period.

### 4.2 Noise Assessment

During this stage of the project, the most significant noise levels would be produced by the operation of large machinery. Specifically, this would occur during activities such as excavation, material removal, and compaction. **Table 3** provides a summary of the equipment used and their corresponding reference sound pressure levels. These levels have been determined based on measurements taken by SLR and are representative of the typical activities associated with this project.



**Figure 2 Underground infrastructure to be removed**



**Table 3 Plant Items and Typical Noise Emission Levels**

Plant Item	Sound Pressure Level at 10m	Approximate setback distance to compliance <sup>(A)</sup>
Concrete breaker	85 dB LAeq	80 m
Excavator (5-20 t) fitted with bucket attachment	70 dB LAeq	15 m
Excavator (20-30 t) fitted with bucket attachment	75 dB LAeq	25 m
Compaction Roller (15 t non-vibratory) moving across the site <sup>(B)</sup>	65 dB LAeq	10 m
Vibratory compaction	75-80 dB LAeq	25-45 m
Chainsaw <sup>(C)</sup>	75-80 dB LAeq	25-45 m
Wood chipper mulcher	85 dB LAeq	80 m
Tracked Concrete and Building Waste Crusher Plant	85-90 dB LAeq	80-140 m

**Notes to Table 3:**

- (A) Compliance level is 70 dB LAeq, representative of the day-time limit (7:30 am to 6:00 pm),
- (B) Based on 6 movements (passing by an individual receiver) in a 15-minute period as the plant is expected to be moving across the site and not idling/stationary at one location.
- (C) Chainsaw operations would be likely to occur for no more than 5 minutes in a 15-minute period (the smallest assessment period), resulting in 15-minute levels 5 dB lower than if continuously operated.



Based on typical noise levels (**Table 3**) and distances to surrounding receivers (**Table 1**), compliance with the relevant NZS6803 noise criteria can generally be achieved at surrounding properties during excavation of underground structures and removal of road surface material.

Concrete breaking using either an excavator fitted with a breaker or a jackhammer, is likely to comply with the noise limit of 70 dB LAeq at a setback distance of approximately 80m away. It is understood that the likely concrete or hard surface breaking is more than 100m away from any dwelling.

Compaction work can be managed and controlled to achieve compliance by selecting the appropriate plant (vibratory or non-vibratory) when works are required to be within 25-45m of any occupied dwelling. In instances where a noise-sensitive building is within 45m of compaction work, it is recommended that the vibratory function is switched off.

The location of the crusher plant is approximately 150 m away from the nearest dwelling and compliance with the noise limit of 70 dB LAeq is likely to be achieved.

The sole exception to this would be if tree removal is required. SLR recommend that the wood chipper / mulcher be located more than 80m from any occupied dwelling. The use of chainsaws may be required near 203 and 207 Te Mawhai Road (within 45m).

Noise levels arising from potential tree removal works at these dwellings could exceed the permitted limit of 70 dB LAeq intermittently during the activity, by up to 5 dB. This infringement would likely only occur for short periods over one to two days. The permitted noise limit for construction that can be completed within 20 weeks is 75 dB LAeq. It is common for construction/demolition works to generate high noise levels and SLR note that the predicted noise levels represent the period when these works are closest to the most exposed receivers.

It is not feasible to reduce chainsaw noise via methods such as acoustic screening. Therefore, it is recommended that effects are mitigated by scheduling the chainsaw works during periods when the adjacent dwellings are unoccupied (such as when occupants are at work), where practicable to do so. This should be arranged via consultation with occupants prior to commencing the works.

It is reasonable to expect that typical residential buildings (with windows closed) can reduce external noise by 20-25 dB. Thus the internal noise level in rooms facing the works, could range between 50-55 dB LAeq. At these levels face to face conversations would need slightly raised voices and general office type work would not be affected.

On this basis, the effects of the potential Stage 2 work is considered reasonable.

Noise from other activities such as loading dump trucks and dump truck movements (on the basis that they would be quieter or at a similar level than those discussed above) would be expected to either comply or controlled to achieve compliance with the relevant noise limit 70 dB LAeq, at surrounding receivers.



### 4.3 Management and Mitigation of Noise 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:

- Excavators no greater than 30 t.
- Compaction works to be undertaken using a compaction roller no greater than 15 t.
- No vibratory compaction allowed within 45 m of any occupied dwelling.
- Woodchipper / mulcher plant should be located more than 80m away from any occupied dwelling.
- Consultation with occupants shall be undertaken to determine the most suitable time for chainsaw work (when the building is unoccupied) for planned tree removal using a chainsaw within 45m of any dwelling.
- Advise the immediate neighbours in writing, no less than three (3) days prior to works commencing. The written advice should 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.
- 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 Waipā District Plan. To provide suitable control of construction noise and vibration levels SLR recommend the following conditions:

- 1 The consent holder shall advise occupants of the immediate neighbouring sites, in writing, no less than three 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.
- 2 Noise arising from construction activity on site shall not exceed the following limits when measured or assessed at any building on any other site that is occupied during the works (between 7:30 am and 6:00 pm Monday to Saturday), where affected party approval has not been obtained.

#### **203 and 207 Te Mawhai Road**

75 dB LAeq during tree removal works

Noise limits in Rule 4.4.2.19 of the Plan at all other times.

#### **All other receivers**

Noise limits in Rule 4.4.2.19 of the Plan at all times.



- 3 Verification noise monitoring shall be undertaken at the first instance of tree removal works. The results of this monitoring shall be used to identify appropriate mitigation measures to ensure compliance with Condition [2] is achieved.

## 6.0 Conclusion

SLR has assessed the noise effects associated with the proposed underground structure removal and land rehabilitation at the Tokanui Hospital Complex in Kihikihi, New Zealand.

Predicted noise levels are expected to remain below the relevant NZS6803 construction noise limits for the majority of the works, with the exception of limited periods (days) when tree removal is within 45m of 203 and 207 Te Mawhai Road, where the potential use of chainsaws could reach up to 75 dB LAeq at the most exposed façade of the dwellings. The effects of such an infringement are considered reasonable due to the internal levels being within the NZS 6803 guidelines, the temporary and intermittent nature of the potential infringement and following the adoption of best practicable mitigation measures and management.

SLR anticipates that the vibration levels generated by works is unlikely to impact on the amenity and would avoid cosmetic damage at surrounding buildings.

SLR has provided recommended conditions of consent related to noise in **Section 5.0**.

### SLR Holdings NZ



**LJ Jansen**  
Associate – Acoustics & Vibration



**Juan Esteban Restrepo**  
Principal – Acoustics & Vibration





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