Acoustic Assessment

Quick Service Restaurant Development
69a Main Road, Tirau

Tahua Partners Limited

Prepared by:

SLR Holdings NZ

201 Victoria Street West, Auckland 1010, New Zealand

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Revision Record

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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 Tahua Partners Limited (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

Term	Description
Ambient noise level	The all-encompassing sound associated with an environment or area.
dB	Decibel
dBA	'A' weighted decibel.
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.
ISO 9613-2	International Standards Organisation ISO 9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation".
L90 , L10 , etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
LAeq	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.
LAmax	The A' weighted maximum sound pressure level of an event.
Low frequency	Noise containing energy in the low frequency range.
Lp or SPL	Sound Pressure Level.
Lw or SWL	Sound Power Level.
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
NZS 6801	New Zealand Standard NZS 6801:2008 "Acoustics – Measurement of Environmental Sound".
NZS 6802	New Zealand Standard NZS 6802:2008 "Acoustics – Environmental Noise".
NZS 6803	New Zealand Standard NZS 6802:2008 "Acoustics – Construction Noise".
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Offensive noise	Noise that is considered harmful or which interferes unreasonably with affected receivers.
SAC	Special Audible Characteristics
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Time weighting	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.
Tonality	Noise containing a prominent frequency.

1.0 Introduction

SLR has been engaged by Tahua Partners Limited (the **applicant**) to assess potential acoustic effects from the proposed development containing two quick service restaurants (**QSRs**) at 69a Main Road in Tirau.

This assessment details the activities associated with the proposal, assumptions and predicted levels compared against the relevant noise rules set out in the South Waikato District Plan (the **Plan**). Where appropriate, management measures and mitigation have been identified to control the noise to achieve compliance.

2.0 Site and Project Description

The subject site and immediate surrounding properties are on land zoned "Tirau Residential". Opposite the site and across Main Road (SH1) is the Tirau BP Service Station on land zoned "Tirau Town Centre".

Figure 1 shows the subject site and surrounding receivers (detailed in **Table 1**). The proposed site layout of the development is show in **Figure 2**.

Figure 1 Subject Site and Identified Surrounding Receivers

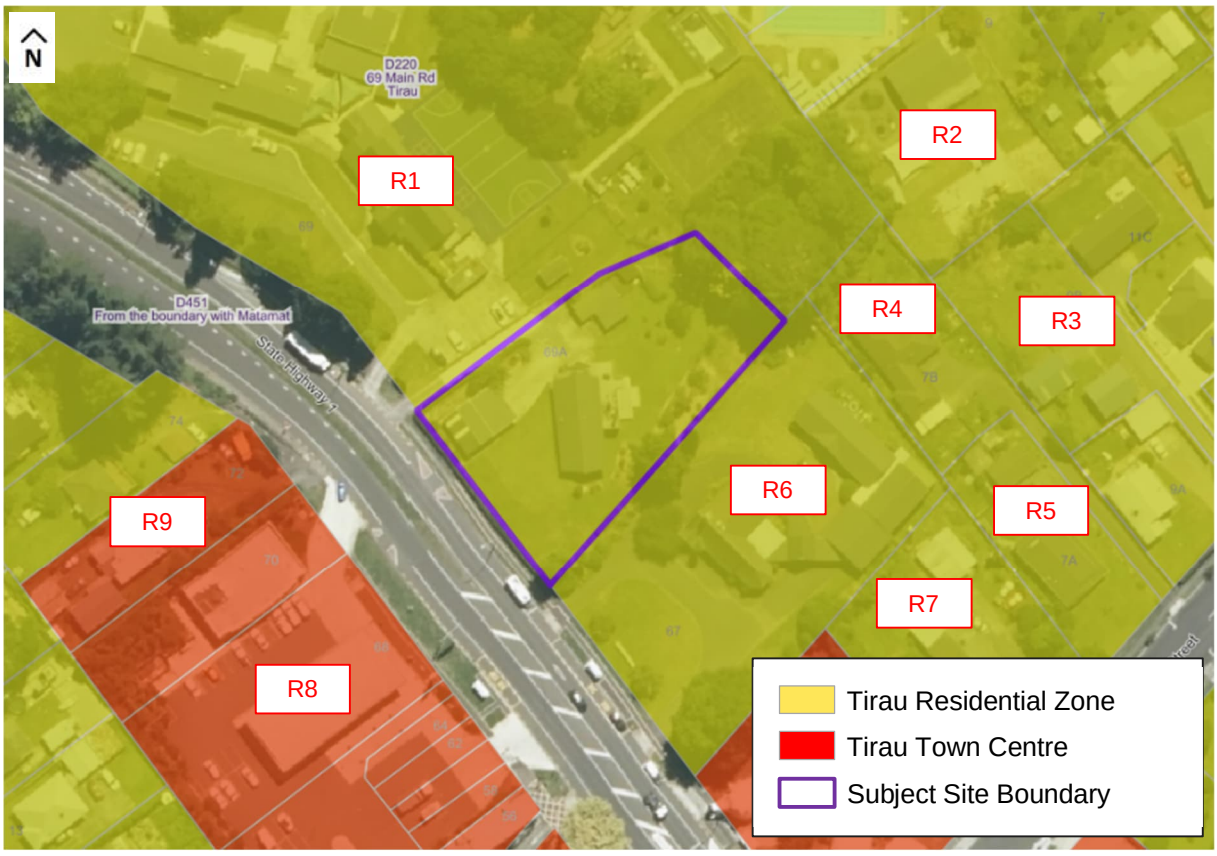


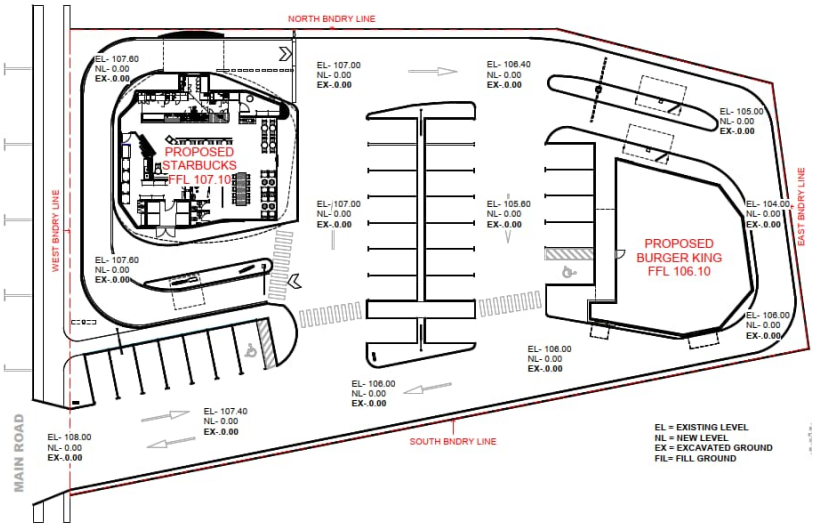
Table 1 List of Identified Surrounding Receivers

Receiver	Address	Zoning	Comment
R1	69 Main Road	Tirau Residential	*Tirau Primary School* Nearest school building (teaching space is approximately 15 m from the subject site boundary)
R2	9 Goodwin Street	Tirau Residential	*Tirau Playcentre* Single storey building with Outdoor Play Area.
R3	9B Okoroire Street	Tirau Residential	Single Storey Dwelling
R4	7B Okoroire Street	Tirau Residential	Single Storey Dwelling
R5	7A Okoroire Street	Tirau Residential	Single Storey Dwelling
R6	67 Main Road	Tirau Residential	*Tirau Community Church* Church and hall with offices.
R7	5 Okoroire Street	Tirau Residential	Single Storey Dwelling
R8	58-70 Main Road	Tirau Town Centre	*BP Service Station* Large parking and courtyard with shop building located in northern section.
R9	72 Main Road	Tirau Town Centre	Raised dwelling assumed double storey dwelling.

The proposal seeks to develop a Starbucks and a Burger King purpose-built building on the subject site. Both QSR's would include a drive-through lane, flowing around the building in a clockwise direction, with shared parking planned between the QSRs. The only site access is from Main Road (SH1).

The site layout is shown in **Figure 2**. It is proposed that both QSR's would operate between 5:00 am and 2:00 am, seven days a week, with deliveries scheduled outside of the operating hours.

Figure 2 Proposed Development's Site Layout



3.0 Performance Standards

3.1 Construction Noise

Construction works are expected to occur between 7:30 am and 6:00 pm, Monday to Saturday, and last no more than 20 weeks.

Section 15.3.2 of the Plan requires that all construction noise should be managed and controlled in accordance with New Zealand Standard NZS 6803:1999 "Acoustics - Construction Noise" (**NZS6803**). The standard provides construction noise limits at 1 m from the façade of any dwellings occupied during the works, reproduced in **Table 2**.

Table 2 Recommended Upper Limits for Construction Noise – Table 2 of NZS 6803

Time of Week	Time of Period	Long-term duration (more than 20 weeks)	
		dB L_{Aeq}	dB L_{max}
Weekday	6:30am to 7:30am	60	75
	7:30am to 6:00pm	75	90
	6:00pm to 8:00pm	70	85
	8:00pm to 6:30am	45	75
Saturdays	6:30am to 7:30am	45	75
	7:30am to 6:00pm	75	90
	6:00pm to 8:00pm	45	75
	8:00pm to 6:30am	45	75
Sundays and public holidays	6:30am to 7:30am	45	75
	7:30am to 6:00pm	55	85
	6:00pm to 8:00pm	45	75
	8:00pm to 6:30am	45	75

In general accordance with the guidance in NZS6803, it is common to permit higher noise limits during short-term high noise generating activities such as excavation 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

Section 15.6 of the Plan requires the measurement and assessment of vibration in accordance with three standards, two of which relate to operational vibration (AS2670.1-2001 and AS2670.2-1990) and the German Standard DIN4150-3 ""Structural Vibrations – Part 3: Effects of vibration on structures" (**DIN4150-3**). We have based our assessment of potential construction vibration effects on the DIN4150-3 guideline which is commonly used in New Zealand to assess the vibration received from construction activities at any building on any other site.

DIN4150-3 provides guideline vibration levels which "when complied with, would not result in damage that could have an adverse effect on the structure's serviceability." For residential type buildings, the standard considers serviceability to have been reduced if:

- Cracks form in plastered surfaces of walls.
- Existing cracks in the building become enlarged.
- Partitions become detached from load bearing walls or floors.

These effects are deemed “minor damage”. The DIN 4150-3 guideline values for evaluating short-term and long-term vibration on structures are given in **Table 3**. *Short-term* vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and *Long-term* vibrations are all the other types of vibration. The vibration levels from construction activities should be assessed against the “Long-term Vibration” limits.

Table 3 Guideline Values for Vibration to be Used when Evaluating the Effects of Short-term and Long-term Vibration on Structures (DIN 4150-3)

Line	Type of Structure	Guideline values for v_i in mm/s				
		Short-term Vibration				Long-term Vibration
		Vibration at the foundation at a frequency of:			Vibration at horizontal plane of highest floor at all frequencies	Vibration at horizontal plane of highest floor at all frequencies
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz		
1	Commercial type building	20	20-40	40-50	40	10
2	Residential type buildings	5	5-15	15-20	15	5
3	Listed buildings and sensitive to vibrations	3	3-8	8-10	8	2.5

3.3 Operational Noise

Section 15.3.1 of the Plan provides zone-based noise limits that should not be exceeded by any activity at or within sites located in Tirau Residential and Tirau Town Centre zones. The relevant noise limits are summarised in **Table 4**.

Table 4 Summary of Relevant Operational Noise Limits

Receiving Zone	Time Period	Noise Limit
Tirau Residential	Daytime (7:00am to 10:00pm)	50 dB L_{Aeq}
	Night-time (At all other times)	40 dB L_{Aeq} 70 dB L_{Amax}
Tirau Town Centre[(A)]	Daytime (7:00am to 10:00pm)	60 dB L_{Aeq}
	Night-time (At all other times)	55 dB L_{Aeq} 70 dB L_{Amax}

4.0 Construction Assessment

4.1 Construction Noise

At the time of writing, a detailed programme of construction works, hours and likely plant items to be used onsite are not available. Therefore, the assessment of construction noise has been based on information and data from SLR's experience working on similar projects.

The proposed development is expected to include clearing and levelling the site with some rotary bored piling anticipated for retaining elements. Works are conservatively assumed to be required across the entire site. The project team has advised that the works involving large equipment is anticipated to take approximately three-four weeks.

A summary of typical equipment and reference sound pressure levels (**SPL's**) are provided in **Table 5**. These SPL's are based on in-house measurements undertaken by SLR of other similar activities at comparable sites. The noted approximate setback distances to compliance have been calculated in accordance with the methodology in NZS 6803 and include facade corrections.

Table 5 Plant Items and Typical Noise Emission Levels

Activity	Plant Item	Sound Pressure Level at 10 m	Approximate setback distance to compliance(A)	Approximate setback distance to compliance(A) with mitigation(B)
Excavation	Excavator (5-20 t) fitted with bucket attachment	70 dB L_{Aeq}	8m	3m
Compaction	Vibratory Roller (5-10 t)	75 dB L_{Aeq}	14m	4m
Piling	Excavator (5-20 t) fitted with rotary piling attachment	70-75 dB L_{Aeq}	8-14m	3-4m

Notes to **Table 5**:

(A) Compliance level is representative of the daytime (7:30 am to 6:00 pm) limit – 75 dB L_{Aeq}.

(B) Based on acoustically effective screening between the noise source and a ground floor receiver.

Based on the distance to surrounding receivers, compliance with the construction noise limits can be achieved with the installation of temporary acoustic screening blocking the line of sight from noise sources to receivers (expected to be required along the north-eastern and south-eastern boundaries as shown in **Figure 3**) during excavation, compaction, and piling works.

Noise from other construction activities, assuming they are quieter than the activities mentioned above, is expected to be controlled in a way that generally achieves the typical construction noise limits of 70 dB L_{Aeq} at the surrounding receivers. For most of the construction period, noise levels are expected to be lower than the permitted noise limit.

Figure 3 Expected Construction Stage Acoustic Screening Locations

4.2 Construction Vibration

The highest level of construction vibration is expected to be associated with compaction works. **Table 6** identifies the approximate distance to compliance during such works.

These distances should be considered indicative only due to the potential difference in machinery and ground conditions etc.

Table 6 Reference Vibration Levels from Proposed Vibration Generating Works

Activity	Plant Item	Approximate setback distance to compliance with thresholds (DIN4150-3) 5.0 mm/s PPV
Excavation	Excavator (5-20ton) fitted with bucket attachment	<0.5 m
Compaction	Vibratory Roller (<7t single drum)	4 m
Piling	Excavator (5-20 t) fitted with rotary piling attachment	<0.5 m

The nearest building is approximately nine meters away from the site boundary, it is therefore expected that compliance with the nominated project criteria (**Section 3.2**) will be easily achieved.

Other Activities

There is a possibility of intermittent vibration occurring due to activities such as dropping heavy objects, running over ledges, or impacting unexpected items. It is difficult to predict the frequency or levels of vibration generated by these individual events due to their arbitrary nature. However, these events can be effectively minimized or avoided through careful management practices.

It is important to note that vibration can be felt at levels as low as 0.3 mm/s PPV, which is significantly lower than the cosmetic damage guideline threshold values. As good practice, it is recommended that advice is provided to the neighbours before commencing construction activities. This can be done through methods such as letter drops to ensure that any unexpected perceivable vibration which may cause concern about property damage are avoided.

5.0 Operational Noise Assessment

5.1 Noise Modelling Methodology and Assumptions

Operational noise generated by the activities of the proposed project has been predicted using the calculation algorithms outlined in ISO 9613-2:1996. This standard provides a general method of calculation for the attenuation of sound outdoors, considering various factors such as source sound power levels, distances, ground reflection, air absorption, and meteorological conditions.

The assessment is based on the following information:

- Addresses, building footprints, and property boundaries were obtained from the LINZ Open Data Portal (https://data.linz.govt.nz/).
- The proposed site layout and building heights based on the drawings prepared by GMC Architects Limited, specifically the "69a Main Road, Tirau - Burger King & Starbucks" drawings dated 5 October 2023.
- Traffic movement numbers as provided by the project team and based on SLR's experience working on similar drive-thru restaurant projects. The total number of vehicles accessing the site per day is approximately 2,800 vehicles, with an anticipated 1,800 vehicles per day for Starbucks and approximately 1,000 vehicles per day for Burger King.
- The assessment assumes that delivery trucks would arrive outside the operational hours as not to overlap with customer vehicles onsite.

The noise source levels associated with the proposal are summarised in **Table 7**. The sound power levels used in our assessment are based on measurements conducted by SLR across New Zealand, published guidance, and information provided by the project team.

According to SLR measurements, the characteristic L_{Amax} noise levels produced by light vehicles are equivalent to the sound of car doors slamming, with an approximate level of 70 dB at a distance of 10 m. The maximum event noise level is expected to occur within the parking area. Similarly, the characteristic L_{Amax} noise levels associated with typical delivery trucks at QSR range between 80-85 dB at a distance of 10 m.

Table 7 List of Noise Source

Noise Source	Total A-weighted Sound Power Level	Typical Operational Scenario	
		Daytime (7:00 am to 10:00 pm)	**Evening (10:00 pm to 7:00 am)**
Light Vehicle Movements(A)	87 dB L_{WA} (98 dB L_{Amax})	**Starbucks**	
		A peak of 102 vehicles in the busiest hour (arriving and departing the site). An average of 71 vehicles per hour (arriving and departing the site).	Eight vehicles arriving and departing during the busiest 15-minute period.
		Burger King	
		A peak of 56 vehicles in the busiest hour (arriving and departing the site). An average of 40 vehicles per hour (arriving and departing the site).	Eight vehicles arriving and departing during the busiest 15-minute period.
		Walk-in Customers	
		A peak of 75vehicles in the busiest hour (arriving and departing). An average of 60 vehicles per hour (arriving and departing the site).	Four vehicles arriving and departing during the busiest 15-minute period.
Delivery Vehicle Movements(A)	98 dB L_{WA} (113 dB L_{Amax})	One truck per hour, arriving and departing the site.	One truck either entering or exiting within a 15-minute period.
Drive-through Speaker Box *(Speaker active for between 20 and 30 seconds per customer.* *Five minutes of speaker noise expected per 15 minutes during the busiest period)*	75 dB L_{WA}	A five 5 dB duration adjustment has been applied during the daytime in accordance with Standard NZS 6802:2008 to account for off-peak hours.(B)(C)	No duration adjustment applied.(B)(C)
Mechanical Plant	See **Section 5.2**		

Notes to **Table 7**:

(A) Vehicles traveling <20 km/hr.

(B) A special audible characteristics (**SAC**) correction was applied in addition to the referenced L_{WA} in column 2 **Table 7** in our calculations.

(C) Modelled as two speaker boxes at the Starbucks drive-through and two speaker boxes at Burger King.

5.2 Mechanical Ventilation

Heating, ventilation, and air conditioning (**HVAC**) plant serving the restaurant (including the kitchen extraction services) is likely to be the principal source with the potential to generate noise at nearby receivers. At the time of writing, the specific plant items and locations are not known. However, HVAC plant of the type and size expected to be used at the proposed restaurants can be readily controlled using standard mitigation measures (noise reduction screening, in-duct attenuators, careful plant selection and positioning, etc) to meet the established criteria.

It is recommended that a comprehensive acoustic review be undertaken as part of the building consent/detailed design process when the HVAC plant selection, location and design has been finalised to ensure compliance with the relevant requirements.

5.3 Mitigation

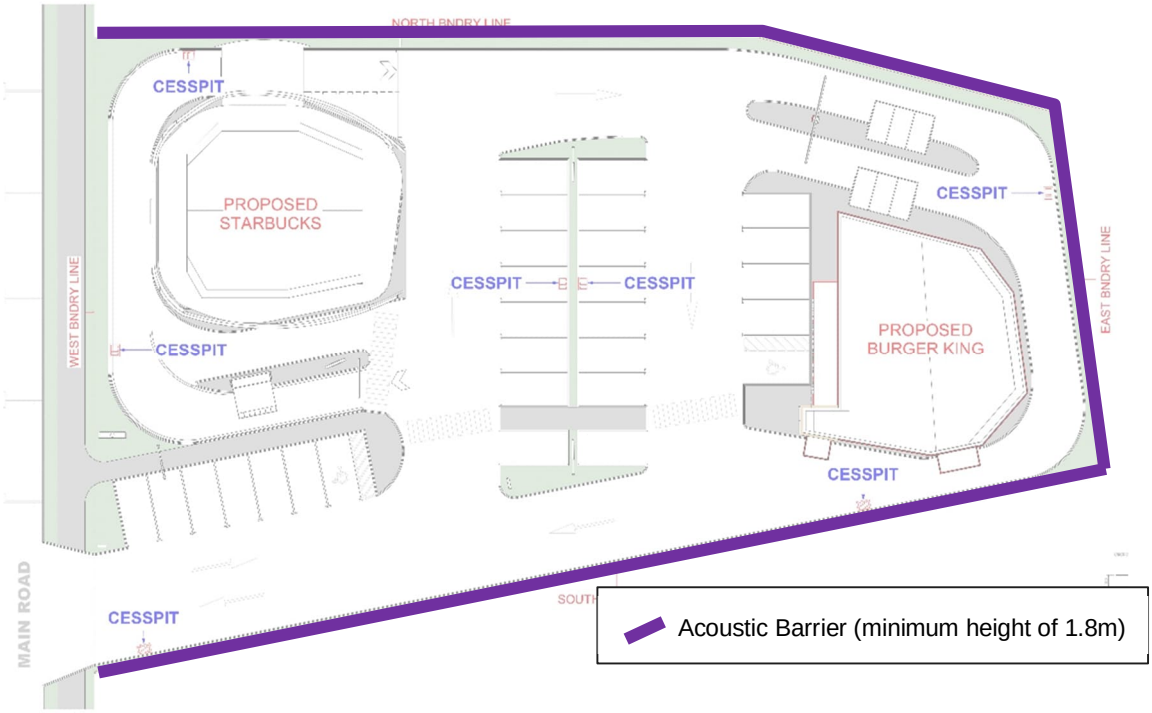
The following mitigation measures are recommended to be included and have been accounted for in the predicted levels presented below:

- An acoustically effective barrier (minimum 1.8 m in height) installed along the property boundary shared with the adjacent properties, **Figure 4**.

  Note for an acoustic barrier to be effective, it must have no gaps between panels or planks or between the barrier and the ground. The barrier material must be a minimum of 10 kg/m^2, such materials can be timber with a thickness of more than 21 mm or 7 mm fibre cement.

- A comprehensive acoustic review as part of the building consent/detailed design process when the HVAC plant selection, location and design is finalised.

Figure 4 Permanent Acoustic Screening Locations



5.4 Predicted Rating Noise Levels

The predicted rating noise levels associated with the proposal are presented in **Table 8**. These represent the most exposed location at or within the site boundary of the receivers.

Table 8 Predicted Noise Rating Levels

Receiver	Predicted Rating Noise Level (dB $L_{Aeq,T}$)				Predicted Maximum Event Noise Level		Expected Outcome
	Daytime	Criteria	Night-time	Criteria	L_{Amax}	Criteria	
R1	44	50	**42**	40	69	70	Daytime compliance. 2 dB night-time infringement - *see discussion*
R2	34	50	36	40	48	70	Compliance
R3	31	50	32	40	46	70	Compliance
R4	39	50	38	40	53	70	Compliance.
R5	<25	50	<25	40	43	70	Compliance
R6	45	50	**42**	40	69	70	Daytime compliance, 2 dB night-time infringement – *see discussion*
R7	27	50	26	40	46	70	Compliance
R8	46	60	45	55	70	70	Compliance
R9	45	60	44	55	52	70	Compliance

Notes: Predicted infringements highlighted in **bold**.

Based on the operational noise sources (**Section 5.1** and **Section 5.2**) and recommended mitigation measures (**Section 5.3**), the development can comply with the relevant daytime and night-time noise limits at receivers in *Tirau Town Centre Zone* and the daytime noise limits at receivers in the *Tirau Residential Zone*.

Night-time infringements of up to 2 dBA is predicted at the two immediately neighbouring sites (the *Tirau Primary School* and *Tirau Community Church*). These infringements are predicted to occur during the conservative worst-case peak 15-minute period of night-time activity, coinciding with peak night-time customer vehicles accessing the site.

5.5 Assessment of Effects

The predicted peak 15-minute night-time noise level exceeds the night-time (10:00 pm and 7:00 am) limit of 40 dB $L_{Aeq(15minute)}$ at the boundary of 67 and 69 Main Road by up to 2 dBA.

The effect of these infringements could be considered negligible as a difference of 1-2 dBA in noise levels is considered to be imperceptible. A number of relevant documents support this statement in an environmental noise context. For example, Section 4 (Table 4.1) of the New South Wales 'Noise Policy for Industry' 2017 (NPfI), defines a residual noise impact of < 2 dBA as 'negligible'. Table 4.2 within the NPfI goes on to describe negligible as '…would not be discernible by the average listener…'.

Furthermore, it is understood that *Tirau Primary School* and *Tirau Community Church* are unoccupied during the night-time period (10:00 pm to 7:00 am) and the infringements would therefore have no practical effect. On this basis the noise effects are considered reasonable.

6.0 Recommended Conditions of Consent

The following conditions of consent are recommended to be included in the resource consent:

1. The consent holder shall advise occupants of the immediate neighbouring sites, in writing, no less than three days prior to construction 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. The consent holder shall construct and maintain temporary acoustically effective screening during construction works as necessary to meet the noise limits in Condition [3].
3. Noise arising from construction activity on site shall meet the guideline limits in NZS 6803:1999 “Acoustics – Construction Noise” and shall be measured and assessed in accordance with the same standard, 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.
4. Noise generated by the operation of the site shall not exceed the following noise limits:

Receiving Site	Assessment Location	Time Period	Noise Limit
All Tirau Town Centre Zoned receivers	At or within the boundary	Daytime (7:00am to 10:00pm)	60 dB L_{Aeq}
		Night-time (At all other times)	55 dB L_{aeq} 70 dB L_{amax}
Tirau Residential zone receivers (Except 67 and 69 Main Road)	At or within the boundary	Daytime (7:00am to 10:00pm)	50 dB L_{aeq}
		Night-time (At all other times)	40 dB L_{aeq} 70 dB L_{amax}
67 and 69 Main Road	At or within the boundary	Daytime (7:00am to 10:00pm)	50 dB L_{aeq}
	At or within the boundary	Night-time (At all other times)	42 dB L_{aeq} 70 dB L_{amax}

5. Operational noise shall be measured in accordance with NZS 6801:2008 ‘Acoustics – Measurement of environmental sound’ and assessed in accordance with NZS 6802:2008 ‘Acoustics – Environmental Noise’.

7.0 Conclusion

SLR has assessed the construction and operational impacts associated with the proposed development of two quick service restaurants on 69a Main Road in Tirau.

Based on the setback distances of the surrounding buildings, construction noise levels can be managed with temporary acoustic screening along the property boundary and kept within the limits prescribed by the Plan. Construction vibration levels are expected to meet the relevant guideline values for avoiding cosmetic damage to structures.

Operational noise levels, with proposed boundary acoustically effective screening in place, are predicted to comply with the Tirau Town Centre zone noise limits during the day and night, and with the Tirau Residential zone daytime noise limits. Two sites on Tirau Residential zoned land may receive noise levels at the site boundary that exceed the Plan's night-time limit by up to 2 dB.

An infringement of the night-time limit of up to 2 dB is predicted at the most exposed location within Tirau Primary School and Tirau Community Church. An infringement of this magnitude is typically considered negligible as it would be imperceptible when compared to fully compliant levels. Furthermore, it is understood that both these sites are not likely to be occupied at night (10:00 pm to 7:00 am), meaning that the predicted negligible night-time exceedances would have no practical effect.

Therefore, the effects of the predicted infringements can be considered reasonable.

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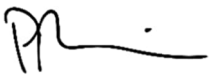

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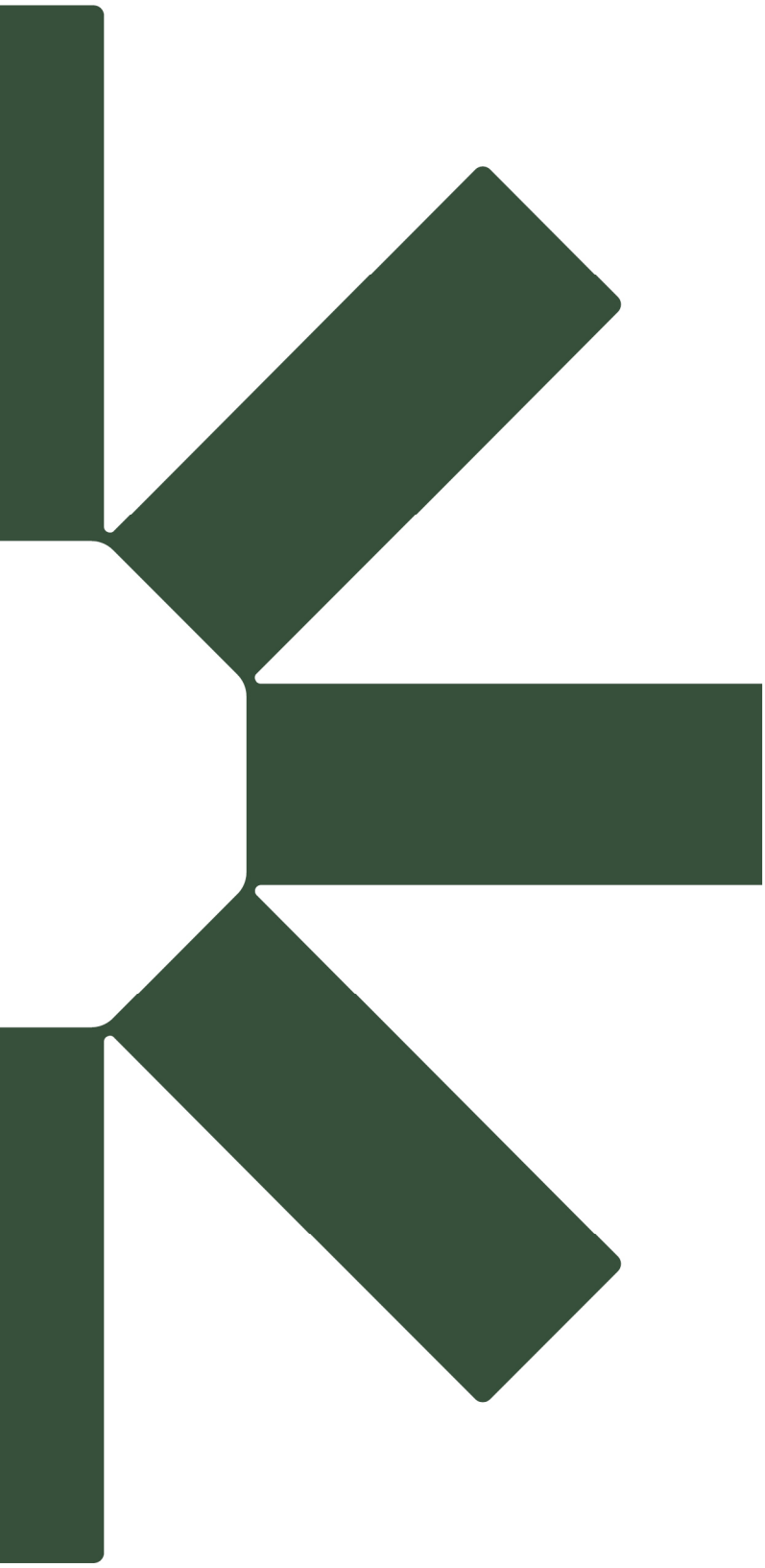

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