



MARSHALL DAY
Acoustics 

RUAKAKA SERVICE CENTRE
ASSESSMENT OF NOISE EFFECTS
Rp 001 R01 20200434 | 24 February 2021

Project: RUAKAKA SERVICE CENTRE

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1.0 PROJECT SUMMARY

Marshall Day Acoustics has assessed the noise effects of a proposed service centre at the intersection of State Highway One (SH1) and State Highway 15A (SH15A), Ruakaka, Northland.

Based on night-time ambient noise measurements, we recommend a night-time noise limit of 45 dB L_{Aeq} . This limit is five decibels above the relevant District Plan limit and five decibels lower than measured ambient noise levels.

Acoustic mitigation in the form of acoustic screening with earth bunds or a bund/acoustically rated fence combination is recommended as part of the project to reduce noise levels at the nearest receivers.

The proposed service centre is calculated to comply with the District Plan daytime noise limits and with our recommended night-time noise limit with the proposed noise mitigation in place.

The sounds of traffic are already characteristic of the site - and of the area generally - due to the proximity of the site to the two adjacent state highways. Noise from the proposed service centre is calculated to be less than measured ambient levels.

Marshall Day Acoustics considers that the service centre would be reasonable in terms of the Resource Management Act, provided that recommended acoustic mitigation measures are incorporated into the design and operation.

Noise from construction activities is expected to generally comply with the District Plan noise limits.

Conditions of resource consent are recommended.

2.0 INTRODUCTION

Ruakaka Developments Ltd has engaged Marshall Day Acoustics to assess the noise effects of a proposed service centre at the intersection of State Highway One (SH1) and State Highway 15A (SH15A), Ruakaka, Northland.

This report addresses noise from the proposed operation. It is intended to form part of an application for resource consent.

A Glossary of Terminology is included in Appendix A.

3.0 APPLICATION SITE AND SURROUNDING AREA

The application site is an approximately 17-hectare property, currently utilized for stock grazing. Refer to Figure 1.

Figure 1: Application Site



Source: LINZ website <https://data.linz.govt.nz/>

4.0 NEARBY RECEIVERS

Adjacent receivers are also rural and are listed below and depicted in Figure 1:

- 39 SH 15A (distance to boundary ~ 15m)¹
- 45 SH 15A (distance to boundary ~ 80m)
- 63 SH 15A (distance to notional boundary ~ 250m)
- 2531 SH1 (distance to notional boundary ~ 440m)
- 2529 SH1 (distance to notional boundary ~ 700m)
- 19 Heatherlea Dr (distance to notional boundary ~ 170m)
- 33 Heatherlea Dr (distance to notional boundary ~ 130m)

The nearest dwellings at 39 and 45 SH 15A are both single-storey.

¹ Quoted distances are from the edge of the site activity to the compliance boundary of the receiver. Distances were measured off aerial photography.

5.0 PROPOSAL

It is proposed to develop a comprehensive service centre over a 4-hectare section of the 17-hectare site. The service centre would be located adjacent to, and north of, the intersection of SH1 and SH15A. The remainder of the site would be maintained as farmland.

The service centre would include a fuel station for cars and trucks (including B-train articulated trucks), a quick service restaurant, a café, a convenience store, a flexible retail space, a picnic play area, a dog exercise park, and a freedom camping area. It would also include a two-bedroom unit for use by a 24-hour onsite manager.

In general, buildings make up a small proportion of the site. The main source of retail and carparking activity on site will be well removed from adjacent dwellings. Only one of the site accesses (off SH15A) would be located near any dwellings. Refer to the site layouts provided in Figure 1 and Appendix B for further details.

5.1 Facility Description

Purpose-built buildings, covering approximately 2,600 square metres, would be constructed at the centre of the development. The main carpark and car fuel station would be located southwest of the buildings (adjacent to SH1). The truck fuel station / parking area and the dog exercise park would be located on the northeast side of the buildings. The picnic area and freedom camping sites would be located on the north side of the development.

5.1.1 Access

A one-way access would be located off SH1 (southbound). A two-way access would be located off SH15A.

As part of the development of the SH15A access, the driveway for the residence at 39 SH15A would be moved to connect with the service centre access. Refer to the site layout plan in Appendix B.

5.1.2 Mechanical Plant

Mechanical plant (air conditioning / refrigeration units) are expected to be installed but details of units and locations have not been confirmed. For the purpose of this assessment, it is assumed that one external HVAC condenser and one external refrigeration chiller unit could be associated with each of the following buildings: café, drive through restaurant, shop. An HVAC condenser unit has also been assumed for the fuel kiosk.

5.2 Operating Times

The fuel service centre would be open 24-hours a day. The food outlets may also be open 24-hours per day. The peak-hour operating periods would occur during the daytime from 4pm to 5pm and during the night-time from 6am to 7am.

5.3 Written Approvals

To our knowledge, written approvals have not been obtained for any of the nearby properties².

5.4 Acoustic Mitigation

Acoustic mitigation in the form of acoustic screening is required. This may be provided using one of the following methods:

- Earth bunds

² Council must not, when considering the application, have regard to any effect on a person who has given their written approval to the application (Section 104 (3) of the Resource Management Act 1991).

- Earth bund AND acoustically rated fence combination
- Acoustically rated fence

This assessment assumes that a bund or bund/fence combination will be used. To be effective, these bunds/fences would need to be located as follows:

- Two 2.5-metre-high bunds (or a bund/fence combination) along the north side of the SH15A access and on either side of 39 SH15A's realigned driveway. The bunds would be approximately 20 metres and 34 metres long.
- A 2.0-metre-high bund (or a bund/fence combination) adjacent to the shared boundaries of the site with 39 and 45 SH15A. This bund would be approximately 115 metres long and would extend from the new driveway access of 39 SH15A to the end of the shared boundary with 45 SH15A.

Refer to Appendix B for a depiction of the bund (bund/fence) locations. Any acoustic fencing must meet the construction requirements detailed in Appendix F.

Note that alternative layouts to that shown in Appendix B could also be effective. These may be required if the design of the driveway changes though the assessment. Any changes to the proposed mitigation should be approved by a recognised acoustician.

6.0 EXISTING NOISE ENVIRONMENT

6.1 Ambient Measurements

We carried out site visits as follows:

- daytime on Thursday 11 June 2020 between approximately 2:00 pm and 3:30 pm
- night-time on Sunday/Monday 14/15 June 2020 between approximately 11:30 pm and 12:30 am.

During the site visits, ambient noise levels were measured, in accordance with the relevant standards, at the measurement positions (MP), as indicated in Appendix C. Site photographs are given in Appendix D. The measurement positions are considered representative of the existing acoustic environment at nearby sensitive receivers. The weather was within the allowable parameters for measuring outdoor noise.

Table 1 summarises the measurement results.

Table 1: Measured Ambient Noise Levels

Measurement Position	Measurement		Measured Level (dB) ⁽¹⁾			Noise Source ⁽²⁾
	Date Start Finish Times	Duration min:sec	L _{Aeq}	L _{A90}	L _{AFmax}	
MP1 west boundary of 39 SH15A	11 June (DAY) 2:46 pm 3:01 pm	15:02	59	55	68	<u>Traffic on SH1 and SH15A</u> (incl. regular trucks)
MP2 South boundary of 45 SH15A	11 June (DAY) 3:03 pm 3:18 pm	15:02	56	53	68	<u>Traffic on SH1 and SH15A</u> (incl. regular trucks), occasional “moo”
MP3 South boundary of 63 SH15A	11 June (DAY) 3:34 pm 3:49 pm	15:02	57	53	64	<u>Traffic on SH1</u> , traffic on SH 15A (secondary), occasional bird
MP1 west boundary of 39 SH15A	14 June (NIGHT) 11:46 pm 00:01 am	15:03	52	35	65	<u>Intermittent traffic on SH1</u> <u>and occasional traffic SH15A</u> (incl. trucks), electric fence click, bird squawk, residential mechanical unit (distant)
MP1 west boundary of 39 SH15A	15 June (NIGHT) 00:04 am 00:19 am	15:04	50	33	62	<u>Intermittent traffic on SH1</u> <u>and occasional traffic SH15A</u> (incl. trucks), electric fence click, bird squawk, residential mechanical unit (distant)

Notes to Table 1:

(1) An explanation of technical terms is provided in Appendix A

(2) The controlling noise sources are underlined

As given in Table 1, ambient daytime noise levels ranged from 56 to 59 dB L_{Aeq} and background levels were 53 to 55 dB L_{A90}. The controlling noise source was almost continuous traffic on the state highways. The night-time ambient levels were 50 and 52 dB L_{Aeq} and the background levels were 33 and 35 dB L_{A90}. Night-time levels were also controlled by state highway traffic.

These levels are considered high for a rural / residential environment but typical of noise levels that can be expected near state highways.

7.0 NOISE PERFORMANCE STANDARDS

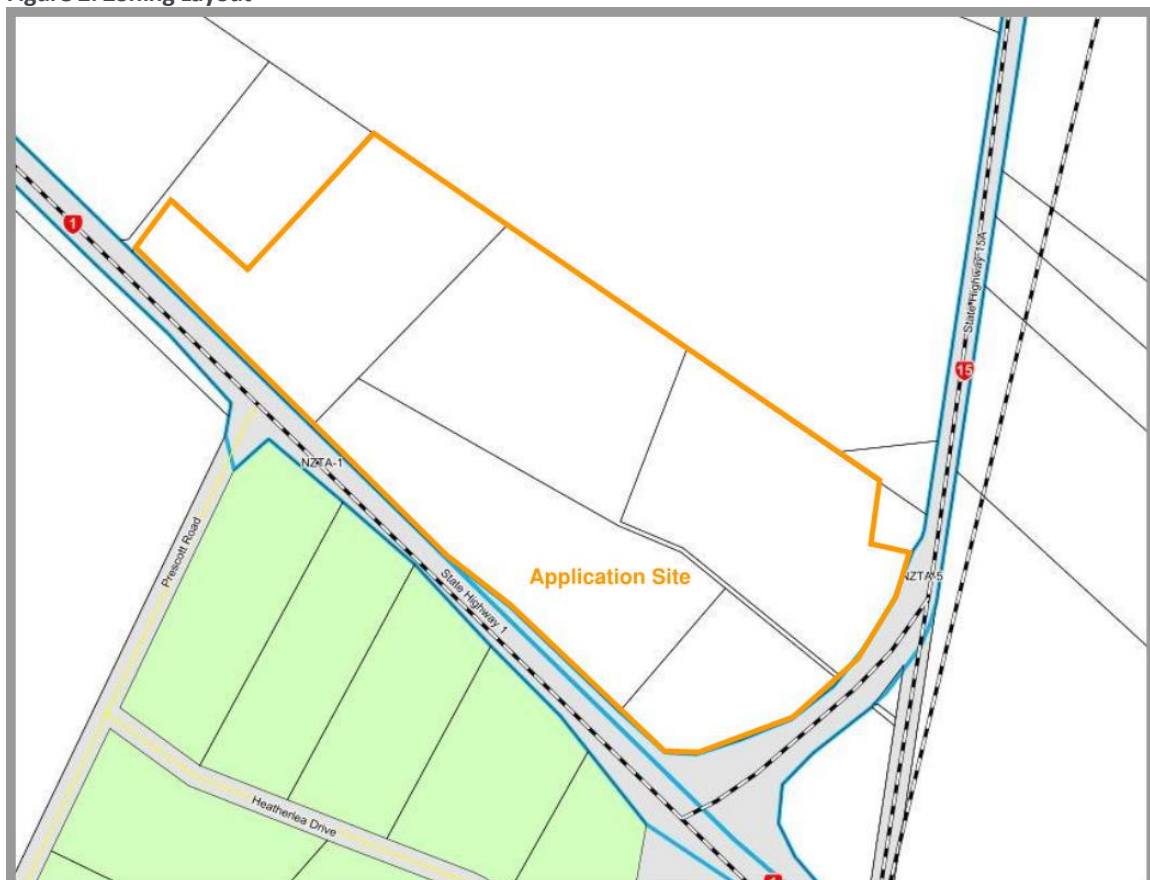
7.1 District Plan zoning

Whangarei District Plan has recently been the subject of a Public Plan Change. The relevant noise and vibration standards of the *Decisions* version are now operative. It is the standards in the *Decisions* version that are referenced here.

The application site is situated on land zoned *Rural Production* as are all surrounding properties on the north side of SH1. Properties across from the site on the south side of SH1 are zoned *Rural Living*.

Figure 2 shows zoning at the application site and neighbouring sites (*Rural Living* zones are illustrated in green; *Rural Production* zones are illustrated in white).

Figure 2: Zoning Layout



(Source: Whangarei District Council Operative Planning Map)

7.2 District Plan Noise Standards

Permitted activity noise standards and policies for the zones are set out in the District Plan Sections NAV.5 and NAV.6. The relevant standards are summarized below and reproduced in Appendix E.

7.3 Operational Noise Limits

Standard NAV 6.1 states that noise emitted from a site in the *Rural Production* zone must comply within the applicable boundary of properties within the *Rural Production* zone as follows:

- 55 dB L_{Aeq} between 0700 and 2200 hours
- 40 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours

The above noise rules apply to noise generated on site when received at the notional boundaries of the dwellings to the north of the site.

Standard NAV 6.1 states that noise emitted from a site in the *Rural Production* zone must comply within the applicable boundary of properties within the *Rural Living* zone as follows:

- 50 dB L_{Aeq} between 0700 and 2200 hours
- 40 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours

The above noise rules apply to noise generated on site when received at the notional boundaries of the dwellings to the south.

7.3.1 Measurement and Assessment Standards

Operational Noise

Standard NAV.5 states that unless specified otherwise, noise shall be measured in accordance with NZS 6801:2008 *Measurement of Environmental Sound* and assessed in accordance with NZS 6802:2008 *Acoustics – Environmental Noise*.

Construction Noise

Standard NAV.6.2 states that noise from construction shall comply with the guidelines and recommendations of NZS 6803:1999 *Acoustics – Construction Noise*.

7.4 Resource Management Act

Under the provisions of the Resource Management Act (RMA) there is a duty to adopt the best practicable option to ensure that noise (including vibration³) from any development does not exceed a reasonable level. Specifically, Sections 16 and 17 reference noise effects as follows.

Section 16 states that “every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level”.

Section 17 states that “every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is in accordance with –

- (a) Any of sections 10, 10A, 10B and 20A; or*
- (b) A national environmental standard, a rule, a resource consent, or a designation”*

8.0 MARSHALL DAY RECOMMENDED NOISE LIMITS

We recommend a night-time limit of 45 dB L_{Aeq} and 70 dB L_{AFmax} at all near *Rural Production* and *Rural Living* zoned sites. Our recommendation is based on the following rationale.

The measured night-time ambient levels at the closest dwelling (39 SH15A) were 50 and 52 dB L_{Aeq} . This shows that noise levels in this area are already elevated due to significant traffic on the state highways. Therefore, it is considered reasonable to provide a higher night-time noise limit than is provided for in the District Plan. Compliance with a 45 dB L_{Aeq} limit is calculated to result in an overall increase in loudness of one decibel. A change of one decibel is considered an imperceptible change in loudness.

In summary, we propose the following noise limits for any consent granted.

For noise from the site received in the *Rural Living* zone:

³ RMA 1991 Part 1 Section 2 Interpretation: Noise includes vibration

- 50 dB L_{Aeq} between 0700 and 2200 hours
- 45 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours

For noise from the site received in the *Rural Production* zone:

- 55 dB L_{Aeq} between 0700 and 2200 hours
- 45 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours

9.0 OPERATIONAL NOISE LEVELS

9.1 Noise Sources and Modelling Methodology

Noise sources from the proposed service centre would be the sounds of traffic (including trucks) accessing the site and manoeuvring on site, mechanical units for refrigeration and air-conditioning, and use of the outdoor facilities: picnic area, dog exercise area, and freedom camping area. Indoor activities are not expected to influence the overall noise level at site boundaries.

Noise emission has been predicted in SoundPLAN® environmental noise modelling software which considers factors such as the terrain, screening by buildings, and ground effect.

9.1.1 Truck Activity

An assessment of the overall noise emission from trucks⁴ accessing the site has been completed based on Marshall Day Acoustics' previous observations and measurements of trucks including B-train articulated trucks. Traffic movement numbers have been based on data provided by Traffic Planning Consultants Ltd. The following assumptions have been made:

- total number of truck trips: 379
- total number of truck trips in the prescribed daytime period: 303
- total number of truck trips in the prescribed night-time period: 76
- total number of truck trips in the peak daytime hour (4pm to 5pm): 34
- total number of truck trips in the peak night-time hour (6am to 7am): 26
- overall average truck sound power level of 103 dB L_w with a source height of 2.5m.

9.1.2 Mechanical Plant

As discussed in Section 4.1.3, for the purpose of this assessment, mechanical plant (air conditioning / refrigeration units) are assumed. External units have been modelled on the north side of the service centre buildings (the worst-case location for the nearest receivers). The following sound power levels were used:

- small scroll chiller: 79 dB L_w
- HVAC: 76 dB L_w .

9.1.3 Car Park Vehicle Activity

Previous measurements of cars moving at car park speed and passenger activity (e.g. doors closing) have been used to predict the noise levels generated by the car park. The following sound power levels were used:

- car park activity: 86 dB L_w
- car door slam: 96 dB L_w .

⁴ Coach buses are accounted for in the truck data.

As advised by Traffic Planning Consultants, vehicle movements in the carpark are predicted as follows:

- 445 trips in the peak daytime hour (4pm to 5pm)
- 202 trips in the peak night-time hour (6am to 7am)
- 3002 daily trips with 2402 occurring during the prescribed daytime period and 600 occurring during the prescribed night-time period.

9.1.4 Outdoor Areas: Freedom Camping; Dog Park; Picnic Area

Activity in the outdoor areas is expected to predominantly take place during the daytime period with occasional activity at night. The following sound power levels have been assumed:

- very loud voice: 75 dB L_w
- raised voice: 70 dB L_w
- normal conversation: 65 dB L_w
- children playing in the picnic area: 87 dB L_w
- dog bark: 114 dB L_w

9.2 Noise Level Calculations

Under reasonable worst-case scenarios, cumulative noise rating levels for the nearest receivers have been calculated taking into consideration acoustic screening by the proposed buildings and acoustic barriers. As the activity will be operational over 24-hours, no duration corrections have been applied, in accordance with NZS 6802:2008.

Results for the day period are given in Table 2. Results for the night period are given in Table 3.

Table 2: Calculated Noise Levels for the DAYTIME Peak Hour Period

Receiver Location	District Plan Zone and [Noise Limit (dB L_{Aeq})]	Calculated Noise Level ⁽¹⁾ DAY (dB L_{Aeq})
39 SH 15A – at new driveway access behind proposed barrier	Rural Production [55]	50 39 - 42
45 SH 15A	Rural Production [55]	39
63 SH 15A	Rural Production [55]	47
2531 SH1	Rural Production [55]	40
2529 SH1	Rural Production [55]	38
19 Heatherlea Dr	Rural Living [50]	46
33 Heatherlea Dr	Rural Living [50]	42

Based on the results in Table 2, the relevant daytime District Plan noise rules would be readily complied with at all nearest dwelling notional boundaries.

The daytime noise levels from the proposed activity are calculated to be at least six decibels less than the measured level of ambient noise (56 to 59 dB L_{Aeq}). The sound generated by the service centre would be within the character of (and quieter than) the existing acoustic environment. Daytime operation is not likely to result in material effects on the existing acoustic amenity of the area.

Table 3: Calculated Noise Levels for the NIGHT-TIME Peak Hour Period

Receiver Location	Receiver Zone [Marshall Day Recommended Noise Limit (dB L _{Aeq})] ¹	Calculated Night-time Noise Level ⁽¹⁾ (dB L _{Aeq})
39 SH 15A – at new driveway access behind proposed barrier	Rural Production [45]	45 34 - 37
45 SH 15A	Rural Production [45]	33
63 SH 15A	Rural Production [45]	39
2531 SH1	Rural Production [45]	34
2529 SH1	Rural Production [45]	32
19 Heatherlea Dr	Rural Living [45]	39
33 Heatherlea Dr	Rural Living [45]	37

Note: 1) A night-time limit of 70 dB L_{AFmax} also applies and is discussed below.

Based on the results in Table 3, our recommended noise limit of 45 dB L_{Aeq} would be met at all adjacent dwellings. A night-time limit of 70 dB L_{AFmax} also applies to the site. It is calculated that this limit would be met by typical use of the service centre. Noise levels are expected to be below 40 dB L_{Aeq} at all dwellings including 39 SH15A.

Night-time noise levels from the proposed activity are calculated to be at least five decibels less than the measured level of night-time ambient noise (50 to 52 dB L_{Aeq}). The sound generated by the service centre would be within the character of (and quieter than) the existing acoustic environment. Night operation is not likely to result in material effects on the existing acoustic amenity of the area.

10.0 CONSTRUCTION NOISE

Construction would be on a commercial scale. It is considered that with normal construction practices and working hours, and provided that any work close to boundaries is undertaken with consideration, construction should generally comply with the relevant limits in NAV6.2.

11.0 NOISE EFFECTS

The proposed service centre is calculated to comply with the District Plan daytime noise limits and with our recommended night-time noise limit.

The sounds of traffic are already characteristic of the site and of the area generally due to the proximity of two state highways.

During the daytime and night-time, noise from the activity at nearby receivers is calculated to be less than measured ambient levels.

Based on the above, Marshall Day Acoustics considers that the service centre would be reasonable in terms of the Resource Management Act, provided that recommended acoustic mitigation measures are incorporated into the design and operation.

12.0 RECOMMENDED NOISE CONDITIONS

It is recommended that the following noise conditions are imposed on any consent granted:

- The noise (rating) level from all activities associated with the site shall not exceed the following noise limits when measured at all *Rural Living* zoned sites:
 - 50 dB L_{Aeq} between 0700 and 2200 hours
 - 45 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours

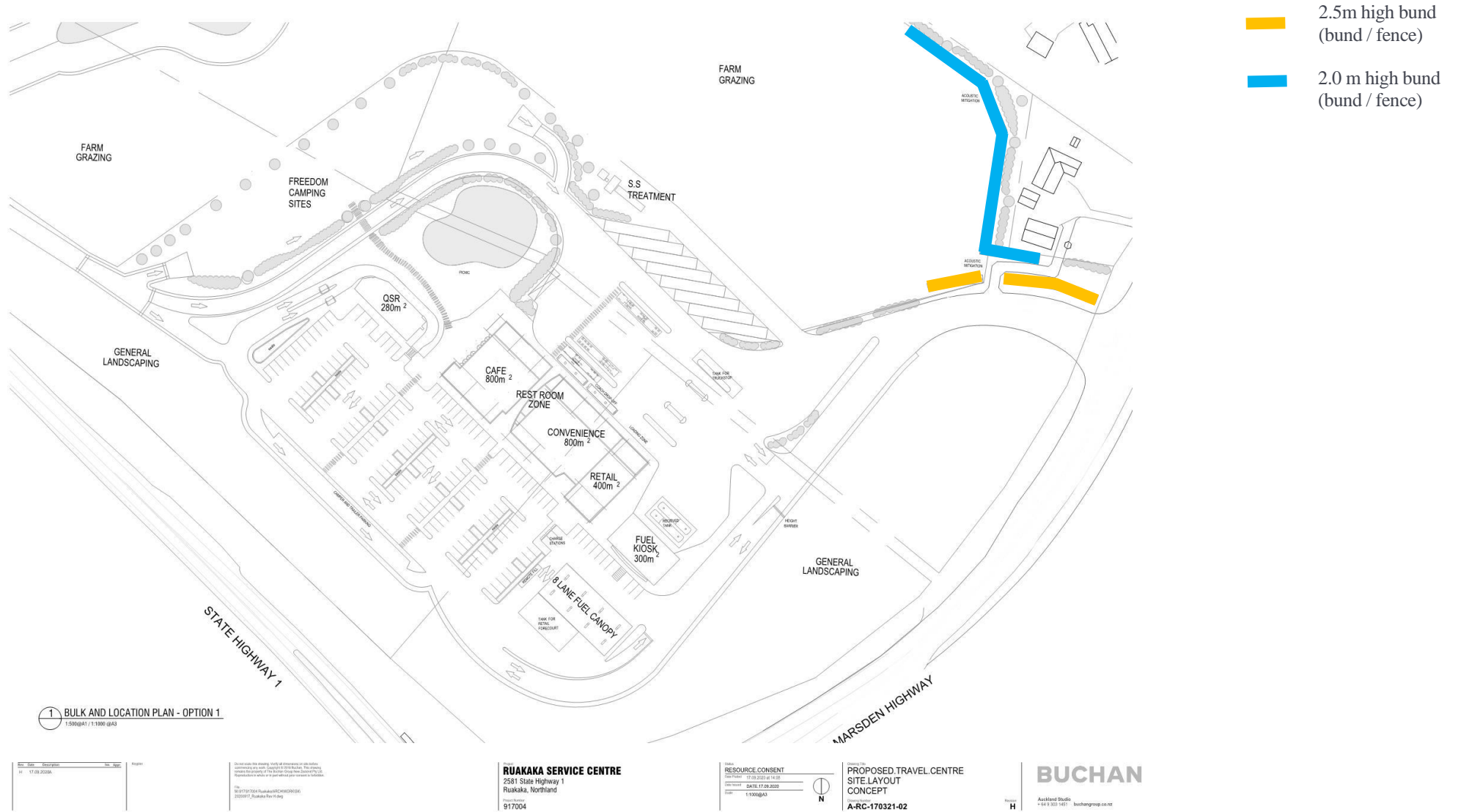
2. The noise (rating) level from all activities associated with the site shall not exceed the following noise limits when measured at all *Rural Production* zoned sites:
 - 55 dB L_{Aeq} between 0700 and 2200 hours
 - 45 dB L_{Aeq} and 70 dB L_{AFmax} between 2200 and 0700 hours
3. Noise levels shall be measured in accordance with the provisions of New Zealand Standard NZS 6801:2008 "*Acoustics – Measurement of environmental sound*" and assessed in accordance with the provisions of New Zealand Standard NZS 6802:2008 "*Acoustics - Environmental Noise*"
4. Noise from construction activities shall not exceed the limits recommended in, and shall be measured and assessed in accordance with, New Zealand Standard NZS 6803: 1999 "*Acoustics - Construction Noise*"

APPENDIX A GLOSSARY OF TERMINOLOGY

Ambient Noise	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
dB(A)	A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
L_{eq}	The time averaged sound level (on a logarithmic/energy basis) over the measurement period (normally A-weighted).
L₉₀	The sound level which is equalled or exceeded for 90% of the measurement period. L ₉₀ is an indicator of the mean minimum noise level and is used in New Zealand as the descriptor for background noise (normally A-weighted).
L₁₀	The sound level which is equalled or exceeded for 10% of the measurement period. L ₁₀ is an indicator of the mean maximum noise level and is used in New Zealand as the descriptor for intrusive noise (normally A-weighted).
L_{AFmax}	The maximum sound level recorded during the measurement period (normally A-weighted).
NZS 6801:2008	New Zealand Standard NZS 6801:2008 " <i>Measurement of Environmental Sound</i> "
NZS 6802:2008	New Zealand Standard NZS 6802:2008 " <i>Assessment of Environmental Noise</i> ".
NZS 6803:1999	New Zealand Standard NZS 6803:1999 " <i>Acoustics – Construction Noise</i> "
Prescribed time frame	'Daytime', 'night-time', 'evening', or any other relevant period specified in any rule or national environmental standard or in accordance with 8.3.2 in NZS 6802:2008.
Rating level	A derived level used for comparison with a noise limit ⁵ .

⁵ Source: Section 3 Definitions in NZS 6802:2008

APPENDIX B PROPOSED SITE PLAN



APPENDIX C MEASUREMENT POSITION (MP) LOCATION



APPENDIX D SITE PHOTOGRAPHS

Photo 1: Measurement position 1



Photo 2: Measurement position 2



Photo 3: Measurement position 3



APPENDIX E WHANGAREI DISTRICT COUNCIL NOISE RULES

NAV

Noise and Vibration



NAV.6.1 Noise Arising from Activities within Environments

The following noise limits shall apply within and between Zones:

Noise emitted from any <u>site</u> in the following Zone	Noise measured within the applicable boundary of any of the following Zones (refer to following table for applicable assessment location)	Daytime 0700 to 2200 hours	Night-time 2200 to 0700 hours		Notes ^{8,9}
		dB <u>L_{Aeq}</u>	dB <u>L_{Aeq}</u>	dB <u>L_{AFmax}</u>	
Light Industrial Commercial Sport and Active Recreation	<u>Residential Zones</u> Neighbourhood Centre Natural Open Space Open Space Rural Production Rural Living Rural Village Residential Rural (Urban Expansion)	55	45	75	
<u>Port [000109]</u> Rural Village Industrial Heavy Industrial	<u>Residential Zones</u> Neighbourhood Centre Natural Open Space Open Space Rural Production Rural Living Rural Village Residential Rural (Urban Expansion)	55	45	75	
All Zones other than: Heavy Industrial Light Industrial Commercial Sport and Active Recreation Rural Village Industrial	<u>Residential Zones</u> Neighbourhood Centre Rural Production Rural Living Rural Village Residential Rural (Urban Expansion)	50	40	70	1, 2, 3
<u>Strategic Rural Industries</u> [All SIRZ]	Open Space Natural Open Space Rural Production City Centre Waterfront	55	40	70	1, 2, 3
All Zones other than: <u>- Strategic Rural Industries</u> [All SIRZ]	City Centre Waterfront	60	55	80	4, 5
	Light Industrial Commercial Sport and Active Recreation Shopping Centre	65	60	80	

The above noise rules shall apply within the relevant boundary assessment location as set out below:

<u>Site boundary</u>	<u>Notional Boundary</u>
<ul style="list-style-type: none"> • Open Space • Airport • Port [000109] • Port Nikau Development Area • Marsden Primary Centre - Noise Zone 1 and 2 • Marsden Primary Centre - Town Centre • City Centre • <u>Mixed Use</u> • Commercial • Local Centre • Shopping Centre • Light Industrial • Heavy Industrial • Sport and Active Recreation • Waterfront 	<ul style="list-style-type: none"> • Any <u>noise sensitive activity</u> not owned or controlled by the quarry owner or operator in a Quarrying Resource area • Rural Production • Rural Living • Rural (Urban Expansion) • Low Density Residential • Large Lot Residential • Natural Open Space

NAV.5 Noise Measurement and Assessment

Unless specified otherwise, noise shall be measured in accordance with New Zealand Standard NZS 6801:2008 "Acoustics – Measurement of environmental sound" and assessed in accordance with New Zealand Standard NZS6802:2008 "Acoustics - Environmental Noise."

APPENDIX F ACOUSTIC SCREEN CONSTRUCTION OPTIONS

Type	Constructions	[Refer Notes (1) to (4) below]
Timber ⁽⁶⁾	Supporting Structure:	Timber, steel or aluminium posts and rails.
	Cladding Option 1:	<i>Plywood</i> panelling ⁽⁵⁾ with a minimum surface mass of 10 kg/m ² (18mm minimum thickness).
	Cladding Option 2:	<i>Timber Palings</i> (minimum thickness of 20-25mm) either overlapped or close-boarded with battens over gaps between palings ⁽⁶⁾ .
Fibre Cement	Supporting Structure:	Timber, steel or aluminium.
	Cladding Option 1:	9mm (min. thickness) <i>Fibre Cement</i> sheet (1 layer)
	Cladding Option 2:	7mm (min. thickness) <i>Compressed Fibre Cement</i> sheet (1 layer)
Acrylic	Supporting Structure:	Steel, aluminium or concrete.
	Infill panels:	12mm thick <i>Acrylic panels</i> .
Glass	Supporting Structure:	Steel, aluminium or concrete.
	Infill Panels:	Laminated glass (6mm minimum thickness).
Brick	Supporting Structure:	Concrete footing.
	Infill:	70mm mortared brick
Concrete	Supporting Structure:	Concrete footing.
	Infill:	Reinforced concrete or mortared concrete block (filled or unfilled).
Earth Bund		Earth or suitable fill material.

Notes:

- (1). Any proposed acoustic screen shall be designed and certified by a suitably qualified structural engineer and relevant consents sought from the local council and other interested parties prior to its construction.
- (2). Acrylic and glass sections can be used to provide an acoustic screen while retaining visual transparency.
- (3). For all fence constructions, ensure that there are no gaps in the screen or between the ground and the bottom of the screen.
- (4). Any proposed acoustic screen shall be designed with input from a suitably qualified acoustic consultant.
- (5). Grooved plywood, manufactured to resemble a timber paling fence design, can be used to achieve a similar look to a close boarded fence design.
- (6). Plywood panelling is preferred to a close boarded fence design for long term durability.