MARSHALL DAY Acoustics

ORUKU LANDING CONFERENCE & EVENTS CENTRE
ASSESSMENT OF NOISE EFFECTS

Rp 001 20181328 | 21 Jan 2020

84 Symonds Street
PO Box 5811 Wellesley Street
Auckland 1141 New Zealand
T: +64 9 379 7822 F: +64 9 309 3540
www.marshallday.com

Project: **ORUKU LANDING CONFERENCE & EVENTS CENTRE**

Prepared for: **Northland Development Corporation**
C/- Griffiths Project Management
Mansfield House
127 Bank Street
Whangarei
Northland 0110
New Zealand

Attention: **Marc Forrester**

Report No.: **Rp 001 20181328**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Approved	-	-	27 Sept 2019	Peter Ibbotson Richard Deane	Joanne Valentine James Bell-Booth
Issue	01	Name and other revisions	21 Jan 2020	Peter Ibbotson	External

MARSHALL DAY Acoustics

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by the Northland Development Corporation to provide an assessment of environmental noise effects of the Oruku Landing project.

It is proposed to redevelop an existing industrial area to provide an accommodation and entertainment venue precinct. The site is located across the Hatea River from the Whangarei CBD. The precinct would include a multifunctional event facility that caters for events such as conferences, conventions, expo, events, and performances. In addition, a hotel is proposed on the site to provide additional accommodation in the region. Commercial and residential units are proposed to be attached to a multi-storey carpark.

This report provides an assessment of the potential environmental noise effects of the proposed entertainment precinct, including its construction and ongoing operation. The report also considers noise issues around the operation of the hotel and apartments.

Marshall Day Acoustics (MDA) has been involved with the concept acoustical design of the multi-purpose use Events Centre which has included indicative sound insulation and space planning to minimise the transmission of noise to the surrounds. A glossary of acoustic terminology is attached as Appendix A.

2.0 PROPOSED FACILITY

2.1 Site Description

The Oruku Landing site is an area of reclaimed land adjacent on the north bank of the Hatea River. The site currently contains a range of industrial and commercial buildings that are broadly associated with marine services and chandlery. The existing industrial and commercial buildings would be demolished as part of the project and the existing businesses would relocate elsewhere.

The following summarises the site details:

- The area is bound to the north, east and west by Riverside Drive (a busy road) and to the south by the Hatea River.
- Land across Riverside Drive rises moderately and is used for residential purposes.
- Hihiaua Park is located directly across the Hatea River. This is a strip of urban parkland that forms park of the Hatea Loop. The park separates the Hatea Riverbank from the Hihiaua Industrial area which is used for a mixture of light industrial and commercial activities.
- The Town Basin and Whangarei CBD are also located across the Hatea River to the south-west. These areas are located at a greater distance than the industrial area to the south. The Town Basin consists of a mix of museums, shops, cafes, galleries and playgrounds.

The dominant ambient noise source in the Riverside Drive and Punga Grove Avenue area is local traffic on Riverside Drive. Riverside Drive carries 12,412 vehicles per day on average with peak hourly flows of 1,392 vehicles (morning) and 1,317 vehicles (evening)[1]. This road generates significant noise.

Ambient noise levels in the Town Basin area is not dominated by a single source, instead it is set by distant and local traffic as well as people and distant city noise.

The site is shown on Figure 1 overleaf. This figure summarises the predominant surrounding land uses

[1] Based on advice from Engineering Equilibrium

Figure 1: Site and Surrounding Land Use

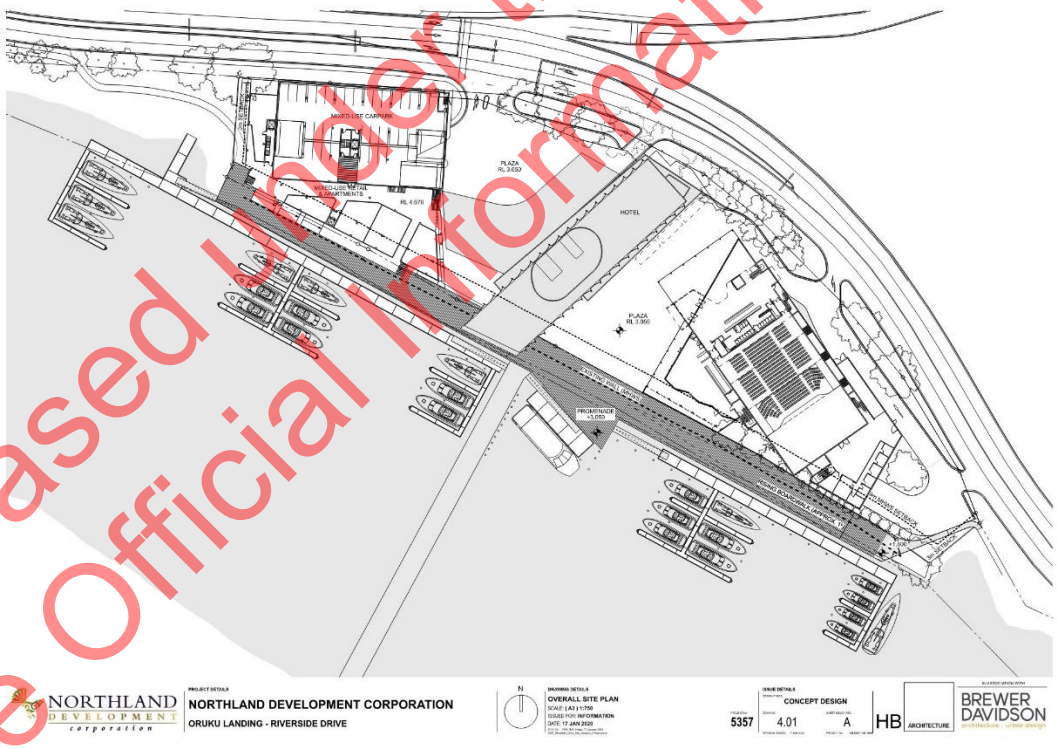
2.2 Proposed Facility

It is proposed to redevelop the area construct four main buildings: a multi-performance space, a hotel and a mixed use are that will include apartments and retail. The proposed redevelopment includes the following:

- A new "Oruku Landing" **conference and events centre** building including a foyer, amenities areas, tiered seating, stage, back of house area, loading bay, and café and terrace. The events centre would be located at the eastern end of the site;
- A four-star **hotel** (central-east) is proposed in the approximate middle of the site. The hotel would be linked outdoors by a green area and a network of paths;
- A **mixed-use commercial / residential and multi-storey carpark** building is proposed to the west of the site;
- A **plaza area** between the events centre and the four-star hotel. It is expected that this area may be used for outdoor community events or small festivals at times;
- A **boardwalk** at the foreshore;
- A **jetty and boat mooring** area; and
- Site landscaping and car-parking areas.

Site Plans are copied in Appendix B and reproduced below.

Figure 2: Concept Design



2.3 Proposed Operation

It is expected that the predominant day-to-day use of the building will be for conferences and seminars, however it is proposed to provide for a multi-use space that can accommodate music and theatre performances.

The Events Centre is expected to operate between 7:00 am and 11:00 pm, seven days a week. On occasions where events conclude at 11:00 pm, traffic is anticipated to egress the site between 11:00 – 11:30 pm. For events with amplified music, it is expected that events would conclude on

weeknights and Sundays at 10:30 pm. Events on Friday and Saturdays are expected to conclude around 11:00pm. However, it is anticipated that on occasion, up to 12 times per year, these events would conclude at 11:00 pm on week-nights and Sundays and 11:30 pm on Friday and Saturdays. The potential effects of this are examined in this report and conditions of consent are proposed.

It is expected that the setup of conferences and concerts will happen inside the venue or inside the loading dock / back of house area during the night or early morning.

2.4 Noise Generating Activities

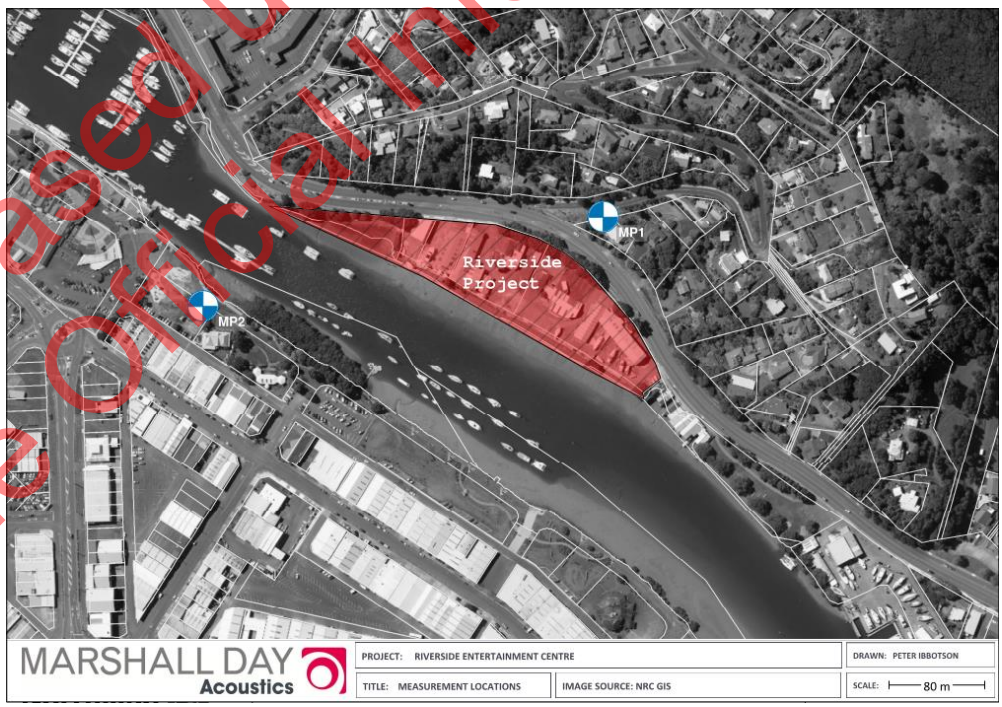
This assessment considers noise from the use of construction and operation of the site. This assessment will consider the following activities on site as generating noise that requires assessment:

- Noise emission from the Events Centre during concerts;
- Traffic noise generation on site and on local roads;
- Event setup and breakdown noise in loading dock;
- External noise events (e.g. outdoor festivals);
- Noise from on-site hospitality;
- Mechanical services noise; and
- Construction noise.

3.0 EXISTING NOISE ENVIRONMENT

To assist with the assessment of adverse noise effects, an ambient noise survey was carried out on the 12th and 13th September 2019. Ambient noise level measurements were carried out at two locations: at the residential area to the north of the proposed development and in the town basin area across the Hatea River to the south. Measurements were carried out generally in accordance with New Zealand Standard New Zealand Standard NZS 6802:2008 *"Acoustics - Environmental Noise"*

Figure 1: Measurement Locations



The measurements were typically of 15 minutes duration and were measured during neutral weather conditions in general accordance with the Standard noted above. The survey measurement locations are shown below on Figure 1, with the results summarised in Table 1.

Table 1: Ambient Noise Measurements

Meas. Position	Date Start Time	Dur	Measured Sound Levels (dB)				Sound Sources and Comments
	hh:mm	mm:ss	L_{AFmax}	L_{Aeq}	L_{A90}	L_{A90} @ 63 Hz	Bold text indicate dominant sources
'LATE DAYTIME'							
MP1 Punga Grove Ave	12 Sept 2019 1818 hours	15:02	76	64	57	57	At c. 27m from Riverside Drive **Regular vehicle pass-bys on Riverside Drive with few gaps in traffic** Four local traffic vehicles pass on Punga Grove Avenue. Minor noise from industrial area audible once, dog barks.
MP2 Town Basin	12 Sept 2019 1842 hours	15:11	71	49	45	54	Distant traffic on Riverside Drive and local city roads. Children playing in playground. Pedestrians on cycle path. Insects (mainly crickets)
'LATE EVENING'							
MP1 Punga Grove Avenue	12 Sept 2019 2217 hours	15:01	80	58	40	48	At c. 27m from Riverside Drive **Traffic on Riverside Drive.** Occasional gaps in traffic. Crickets. Distant music audible likely from live venue (drums and vocals just audible). Ducks.
MP2 Town Basin	12 Sept 2019 2238 hours	15:01	66	42	36	46	**Distant traffic on Riverside Drive** and local city roads. Large truck drives past at one point. Few people in area, wait staff closing venue generate audible conversation. Dog barks. Distant music noise from live venue audible at times.
'MORNING'							
MP1 Punga Grove Avenue	13 Sept 2019 0908 hours	15:03	77	64	57	56	At c. 27m from Riverside Drive **Regular traffic on Riverside Drive, few gaps in traffic.** Birds. Local traffic regular, one to two movements per minute at times
MP2 Town Basin	13 Sept 2019 0848 hours	02:20	69	62	58	62	**Lawnmower**, police siren in distance. Measurement curtained due to rain.

4.0 NOISE PERFORMANCE STANDARDS

The Oruku Landing site is zoned *Town Basin* in the operative District Plan. The majority of land adjacent to the Hatea River is also zoned *Town Basin*. The land across Riverside Drive to the north is zoned *Living 1*.

4.1 Whangarei Operative District Plan Noise Rules

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

The following table summarises the noise limits with regard to the nearest zones surrounding the proposed activity. The noise limits apply at the site or zone boundaries.

Table 2: Summary of Operative Noise Rules

	Zone				
	Living 1	**Town Basin Business 1**	**Business 2**	**Business 3**	**Open space**
Daytime 0700 to 2200 hours	50 dB L_{Aeq}	60 dB L_{Aeq}	65 dB L_{Aeq}	60 dB L_{Aeq}	55 dB L_{Aeq}
Night-time 2200 to 0700 hours	40 dB L_{Aeq} 70 dB L_{AFmax}	55 dB L_{Aeq} 80 dB L_{AFmax}	60 dB L_{Aeq} 80 dB L_{AFmax}	50 dB L_{Aeq} 75 dB L_{AFmax}	40 dB L_{Aeq} 70 dB L_{AFmax}

The operative District Plan also contains the following rule:

6.1.5 Noise generated by temporary activities in the Town Basin Environment may exceed the noise rules in any Environment for 12 days every calendar year provided that noise does not exceed a level of 65 dB L_{Aeq} between 0900 and 2300 hours at the boundary of any Living Environment.

This rule acknowledges that civic and community events can generate higher levels of noise from time but provided the number of instances are limited then significant noise effects will not arise. The establishment of an entertainment precinct within the Town Basin was the type of activity that was envisaged when this rule was drafted.

NAV 6.5 also sets out sound insulation measures that are required for habitable spaces that establish in the *Town Basin* zone. Dwellings are required to achieve the following noise limits based on specific incident design noise levels as contained in the District Plan:

- Bedrooms and sleeping areas (2200 – 0700 hours): 30 dB L_{Aeq}
- Other habitable spaces within dwelling or units (0700 to 2200 hours): 40 dB L_{Aeq}

This rule and the incident design levels are summarised in Appendix C.

4.2 Whangarei Proposed District Plan Noise Rules

A proposed Urban and Services Plan change is proposed by Whangarei District Council. This would see the zoning of the site changed to a *Waterfront zone*. Much of the remaining parkland in the *Town Basin* land would be rezoned to *Open Space*. The *Business* 1 and *2* land would be rezoned to a *mixed-use* zone.

The proposed plan change is yet to be heard. Notwithstanding this, the proposed plan change revisions require consideration.

Potential consequential amendments to the noise and vibration chapter have been notified as part of the proposed plan change. The relevant amendments are summarised below and reproduced in Appendix D.

The following table summarises the noise limits with regard to the nearest proposed zones surrounding the proposed activity. The noise limits apply at the site or zone boundaries.

Table 3: Summary of Proposed Noise Rules

	Zone			
	Living Zones	**Waterfront**	**Mixed Use**	**Open Space**
Daytime 0700 to 2200 hours	50 dB L_{Aeq}	60 dB L_{Aeq}	60 dB L_{Aeq}	55 dB L_{Aeq}
Night-time 2200 to 0700 hours	40 dB L_{Aeq} 70 dB L_{AFmax}	55 dB L_{Aeq} 80 dB L_{AFmax}	50 dB L_{Aeq} 75 dB L_{AFmax}	40 dB L_{Aeq} 70 dB L_{AFmax}

The amendments to the plan change also contain the following rule:

6.1.5 Noise generated by temporary activities in the Waterfront Zone may exceed the noise rules in any zone for 12 days every calendar year provided that noise does not exceed a level of 65 dB L_{Aeq} between 0900 and 2300 hours at the boundary of any Living Zone

The proposed change to the rule does not alter the way it would be applied.

4.3 Summary of Potential District Plan Changes

The proposed Plan Change does not significantly alter the noise rules that will apply at the Living zone to the north of the site across Riverside Drive. The noise rules that would apply here under the proposed Plan Change would still be 50 dB L_{Aeq} during the daytime and 40 dB L_{Aeq} and 70 dB L_{AFmax} during the night-time. As this area receives high noise levels from traffic on Riverside Drive, these noise rules are overly conservative. Based on the high levels of ambient noise levels measured on site, it is considered that a noise limits of 55 dB L_{Aeq} between 0700 and 2300 hours would represent a level of noise emission that would not appreciably reduce the level of amenity of the area.

The main change that would potentially affect the operation of the events centre is the change in zoning from *Town Basin* to *Open Space* on the south side of the Hatea River. This would have the consequence of changing noise rules from 60 to 50 dB L_{Aeq} during the daytime and 50 to 40 dB L_{Aeq} during the night-time. Night-time L_{AFmax} noise rules would also reduce from 80 to 70 dB L_{AFmax}. It is considered that such noise rules are overly conservative in this location. The Town Basin, Hatea Loop and associated parks are urban in nature, they already receive noise from urban activity such as groups of people conversing, distant and local traffic, aircraft and local industry noise. It is considered that noise from the use of the entertainment precinct during events or concerts will form part of the amenity of the downtown Whangarei urban area and will not unreasonably detract from the tranquillity that visitors might expect in the area where the level of noise does not breach the Operative plan noise limits.

4.4 Proposed Noise Limits

Normally, for an events facility such as this, where several major high noise events may occur per year, a relaxed noise limit would apply for these events. The Town Basin noise limit (and proposed waterfront zoning) already allows for this on up to 12 days per year. On these days, noise levels of up to 65 dB L_{Aeq} would apply at the adjacent dwellings across Riverside Drive. Such levels of noise would

be audible at this location but are unlikely to be significantly louder than generated by traffic noise for the majority of the daytime.

For outdoor music events, it is anticipated that the 65 dB L_{Aeq} noise limit could be met by local entertainers using large but non-touring sound systems[2] for festival stages that faced south across the plaza (i.e. directed music away from the residential site). If larger acts with touring type sound systems are located on the south side of the plaza and face the residential area the 65 dB L_{Aeq} noise limit is likely to be exceeded to the north of Riverside Drive. In order to provide for some events to face north across the plaza, a noise limit of 75 dB L_{Aeq} would be necessary. It is recommended that an allowance be made for up to three festival events to occur at a noise level of 75 dB L_{Aeq}.

Having reviewed the existing District Plan noise limits together with the existing ambient noise levels in the area, the following noise limits are recommended:

1. Noise from General Activities within the Events Centre.

i) Activities within the Oruku Landing Entertainment Precinct site boundary, other than Special Events, Extended Events and excluding crowd noise and traffic noise, shall not exceed the following noise levels when measured at the notional boundary of any dwelling to the north of Riverside Drive or in any Open Space zone.

Morning	*0600 – 0700 hrs*	*45 dB L_{Aeq}*
Daytime	*0700 – 2300 hrs*	*55 dB L_{Aeq}*
Night-time	*2300hr – 0600 hrs*	*45 dB L_{Aeq}* *75 dBA L_{AFmax}*

ii) In addition to the above limits, noise from amplified music shall not exceed the following limits when measured at the notional boundary of any dwelling to the north of Riverside Drive.

Sunday to Thursday	*2230 – 0700 hrs*	*55 dB $L_{Zeq\ @\ 63\ Hz}$*
Friday and Saturday	*2300 – 0700 hrs*	*55 dB $L_{Zeq\ @\ 63\ Hz}$*

*iii) **Extended Events:** For 12 events per year, the change over time from Daytime to Night-time may be extended by 30 minutes. The Council shall be notified of which events intend to use this extended cut-off time. The public will be notified of each extended event not less than 7 days prior to the event".*

2. Noise from Special Events

The noise from Special Events excluding crowd noise but including testing or practice involving the use of electronic sound amplification are not required to comply with the above noise limits. Instead, these events shall not exceed the following noise limits when measured at any point at or within the boundary of any site to the north of Riverside Drive:

i) 0900 hr – 2100 hr — 75 dB L_{Aeq} (3 events per year)

65 dB L_{Aeq} (9 events per year)

ii) The L_{AFmax} noise level for all activities shall not exceed 90 dBA when measured over any 15 minute period between 0900 hr – 2100 hr.

[2] e.g. jazz bands on a truck stage with horns, keys and drums amplified via a large PA with low frequency crossovers

iii) *Testing or practice involving the use of electronic sound amplification shall be limited to a maximum duration of 3 hours. The combined duration of Special Event including testing and practice shall be limited to 8 hours in duration.*

iv) *The public will be notified of each Special Event not less than 14 days prior to the event"…*

3. *Monitoring and Noise Management Plan*

Noise levels 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." No correction for special audible characteristic shall be applied to the noise limits or the measured noise levels for Special Events or to the low frequency noise controls. Time averaging or duration corrections may be applied up to, but not after, 2300 hours (unless a special event is occurring in which case up to 2330 hours).

The consent holder shall monitor noise levels for the first two large scale music events to be held in the Events Centre. Copies of the monitoring reports shall be submitted to the Council within four weeks of the event. If the relationship between internal noise levels and external noise levels can be established, then internal sound levels can be used for any monitoring carried out at any other time.

A Noise Management Plan shall be prepared by the applicant and approved by the Council prior to the first event being held.

4. *Construction Noise and Vibration*

Rules applying to general operation shall not apply to construction noise or vibration. The following conditions shall apply:

1. *Where practicable, construction shall comply with the noise rules contained in Whangarei District Plan Section NAV6.2 'Construction Noise'.*
2. *Vibration from construction activity shall comply with the relevant vibration guideline values in Table 1 or Table 3 of DIN 4150-3:1999 "Structural Vibration - Effects of Vibration on Structures".*

5. *Construction Noise and Vibration Management*

A Construction Noise and Vibration Management Plan ("CNVMP"), prepared by an appropriately qualified acoustic engineer, must be submitted to the Council's compliance monitoring officer for approval prior to the commencement of any physical works on the site. The purpose of the CNVMP is to provide a framework for the development and implementation of measures to avoid, remedy or mitigate adverse construction noise effects.

The CNMP should include the following matters:

a) Construction and vibration noise criteria;

b) Identification of the dwellings where potential for noise and vibration effects exist;

c) Description and duration of the works, anticipated equipment and the processes to be undertaken;

d) Hours of operation, including specific times and days when construction activities causing noise and vibration would occur;

e) Mitigation options where noise and vibration levels are predicted or demonstrated to approach or exceed the relevant limits. Specific noise mitigation measures must be implemented which may include, but not limited to, acoustic screening, time

management procedures and alternative demolition/excavation/construction/piling method technologies;

f) Where vibration is confirmed as likely to exceed levels of 2.5mm/s PPV during piling at specific dwellings for more than three days, the CNVMP shall detail specific noise mitigation measures for each dwelling to avoid further effects on amenity;

g) The erection of temporary construction noise barriers where appropriate;

h) Schedule and methods for monitoring and reporting on construction noise and vibration;

i) Details of noise and vibration monitoring to be undertaken or in the event of any complaints received or for any activity where there is a risk that the noise or vibration limits will be exceeded. The results of such monitoring must be submitted to the Council within one week of the measurements being carried out;

j) Implementation of a complaint management system with contact numbers for key construction staff responsible for the implementation of the CNMP and complaint investigation. This system is to include procedures for maintaining contact with stakeholders, notification of proposed construction activities and handling noise complaints;

k) Notification is to be provided to the owners and occupiers of adjacent buildings prior to demolition and construction activities commencing on the site; and

l) *Construction operator training procedures.*

5.0 ASSESSMENT OF EFFECTS

5.1 Indoor Entertainment Noise

The level of entertainment noise that reaches the surrounding residences is determined by the sound insulation of the events centre façade, the distance to the residents, and the level of sound inside the building.

There is a large variation in the level of sound generated by the different functions likely to occur in this facility. During conferences or functions, internal noise levels of 60 to 90 dB L_{Aeq} may occur depending on the activity occurring at the time. Unamplified concerts may generate noise levels of between 80 to 90 dB L_{Aeq}. For amplified music concerts, noise levels in the order of 105 dBA could be expected with significant bass energy content. The highest sound levels are likely to be generated by the loud bands, with lower levels for 'middle of the road' bands, and much lower levels for most activity occurring in the events centre.

Marshall Day Acoustics has measured noise levels at a number of large music concerts over many years. Based on these measurements and a review of international literature, MDA is of the opinion that the L_{eq} noise levels in Table 4 are a realistic design basis. The level is typical of a loud band and dance party and have thus been used as the internal design noise level within the Events Centre.

Table 4: Events Centre Internal Design Noise Levels (L_{Aeq})

Event	Octave Band Centre Frequency (Hz)							Overall
	63	125	250	500	1000	2000	4000	dBA
Loud band	112	108	108	102	97	97	92	105

The above levels have an overall A-weighted sound level of 105 dB L_{Aeq}. The A-weighted level however does not control the design – it is the sound level at 63 Hz and 125 Hz (low frequency bass beat) that determines the construction requirements.

There are also a large number of concert events involving more moderate activity which will have reduced bass energy content or generate negligible levels of noise. Ballet, orchestra, jazz, rock quests and other smaller scale acts are expected to generate lower levels of noise.

5.1.1 Compliance with Noise Limits

The construction of the Events Centre has been assessed to ensure that the day to day noise limits (up to 11 pm) will not be exceeded based on the internal noise levels given in Table 4. This assessment is based upon an indicative design of the Events Centre with assumptions made as to the potential construction of the walls and ceilings of the building (see Appendix G). Due to the large radiating area of the roof, the transmission of entertainment noise to boundary will be largely determined by the roof construction of the Conference and Events Centre.

The assessment has included a five-decibel penalty for the tonal and impulsive nature of amplified music and an allowance for the contribution of noise from other sources such as mechanical services. The time-averaging provisions of NZS 6802 have also been taken into consideration as proposed in the consent rules.

Noise levels of 45 dBA or less are predicted at the nearest dwellings on Riverside Drive. The A-weighted sound levels (dBA) emitted from the building are illustrated graphically in the SoundPLAN noise contours shown in Figure 3 overleaf.

5.1.2 Bass Beat

Compliance with the A-weighted noise limits does not necessarily ensure that there will be no adverse noise effects on the surrounding properties. The use of the overall A-weighted sound level specified in the District Plan, can under-estimate the noise effects from low frequency impulsive sound such as 'bass beat'.

Building materials generally provide much greater sound insulation at high frequencies than they do at low frequencies. This means that it may only be the low frequency bass beat that the residents will hear.

To quantify the noise effects of the bass beat on neighbouring properties, Marshall Day Acoustics has modelled the noise break-out from the Events Centre using sophisticated sound insulation calculations and the sound propagation software SoundPLAN. This model uses the following assumptions and information:

- Internal noise level of 112 dB $L_{Zeq\ @\ 63\ Hz}$ (section 5.1);
- Roof construction outlined in Appendix G or similar system determined during detailed design;
- 6 metre wide solid core timber or steel operable doors behind stage (minimum surface mass 24 kg/m^2) to back of house area;
- Other acoustic measures such as acoustic lobbies at entry/exit points as shown on drawings;

To assess the potential effects of the bass beat on neighbouring properties, the low frequency noise emissions (at 63 Hz) have been modelled. These noise levels are shown Figure 4 overleaf.

It is important to note that the bass beat contours shown in Figure 4 are for the loudest bands likely to play. A reduced bass beat effect (5 – 10 dB less) can be expected from more moderate bands which would be much more likely to regularly perform.

Figure 3: Predicted Loud Band Noise Emission (Broadband dBA noise levels)

Figure 4: Predicted Low Frequency (L_{Zeq} at 63 Hz) Loud Band Noise Emission

To assist with interpreting the predicted levels 'above' in Figure 3, Table 5 below provides a subjective description of the likely effects of the bass beat on neighbouring properties for the different 'levels above background'.

Table 5: Potential Noise Effects of Events Centre Bass Beat during Loud Amplified Concert

Low Frequency Noise level above background	Audibility / Subjective reaction
Less than 0 dB	Bass beat unlikely to be audible – no adverse effects
0 - 5 dB	Bass beat faintly audible - unlikely to be annoying to most residents.
5 – 10 dB	Bass beat noticeable and annoying to some residents.
10 - 15 dB	Bass beat clearly audible, and likely to be annoying during the event.

Background noise levels in the Riverside Drive area are around 56 to 57 dB $L_{Z90\ @\ 63\ Hz}$ during the daytime until around 7pm. Between 7pm and 11pm, background noise levels progressively reduce to around 48 dB $L_{Z90\ @\ 63\ Hz}$ at 11:00pm.

Low frequency noise levels may be between 52 to 58 dB $L_{Zeq\ @\ 63\ Hz}$ at the four closest dwellings to the events centre on Punga Grove Avenue. Based on the existing backgrounds, the low frequency noise is likely to either not be audible or possibly faintly audible at the four dwellings closest to the Events Centre during the majority of the day period. Such noise levels are unlikely to be annoying.

Bass beat may become more audible towards 10pm, as loud concerts conclude and environmental background noise levels reduce. At this time, low frequency noise levels may be 4 to 10 dB above the background. Depending on the level of resilience achieved in the events centre ceiling construction, it is possible that the noise level could be only faintly audible and unlikely to be annoying. However if low resilience is achieved, it is possible that the noise level could be noticeable and annoying to residents in the four dwellings towards the conclusion of large events. This would not be the case during more typical events with reduced bass.

Low frequency noise levels from large events at the remainder of dwellings on Punga Grove Avenue will range between 45 and 50 dB $L_{Zeq\ @\ 63\ Hz}$. For the majority of dwellings on Punga Grove Avenue (and beyond), noise levels are unlikely to be audible over most of the day period. On still evenings, noise levels may become faintly audible towards the end of large concert events. It is considered that the majority of dwellings on Punga Grove Avenue (and beyond) will not experience annoyance from low frequency noise

Section 16 of the Resource Management Act states: *"Every occupier of land…..shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level."* It is considered that noise from the Events Centre will be reasonable if it is designed to comply with the recommended noise limits and constrained in general to finish by 10:30 pm week days and Sundays and 11 pm Friday and Saturdays. Low frequency noise limits are proposed to control the bass beat to the low frequency background noise level so that after the 'cut-off' time, the bass beat is inaudible. It is noted that the proposed low frequency noise limits are more stringent than the current District Plan controls which does not include low frequency noise emission limits.

On occasions, events will need to run slightly longer than the above times. It is proposed by management that 12 events per year could run beyond these times. It is considered by Marshall Day Acoustics that the noise effects would be reasonable if this extension is constrained to half an hour on 12 occasions per year. A condition to this effect is proposed.

Considering these restrictions, and with the implementation of a Noise Management Plan (Section 6) which includes liaison with the neighbouring properties, noise mitigation measures, and controlled

hours of operation, Marshall Day Acoustics considers that the effects of noise from the operation of the Events Centre are reasonable.

5.1.3 Crowd Noise

Crowd noise is often specifically excluded in noise controls for these facilities. In this case, maximum crowd noise levels in the Events Centre are predicted to be less than the design internal loud band noise levels, based on previous crowd noise measurements. Crowd noise can therefore, also comply with the District Plan noise limits.

5.2 Festivals and Outdoor Concerts

It is anticipated that festivals may occur on the site from time to time. It is anticipated that these 'festivals may include markets, food and wine events, information days, or other such gatherings'. It is noted that the area available in the plaza for such festivals is relatively small (approximately 2000m^2) in comparison to sites where other food and wine type festivals occur in the district and nearby regions. As such, it is expected that the site will not become the predominant destination for large food and wine festivals or outdoor music festivals, notwithstanding that smaller events could occur on the site that involve live music.

An assessment of noise from smaller 'festivals' where live music may occur has been carried out. While it is expected that most 'festivals' will not involve touring acts, an analysis of this type of event has been carried out to assess noise from the worst case. The analysis has considered the following:

- Sound stage with flown line array loudspeakers;
- 3D directivity modelled using curvilinear line array directivity.
- Sound power level of 128 dB L_{WA} per loudspeaker (two loudspeaker arrays modelled). This is representative of the noise levels from a stage where the audience are in relatively close-proximity during a smaller music event[3]
- Screening provided by the proposed buildings.
- Ground effect, air absorption and calculated spreading of the sound source as modelled using ISO9613-2.

Noise levels from two stage configurations (north and south ends of the plaza) are shown in the figures overleaf.

[3] The level used is lower than what would occur from a main act at a major food and wine festival such as the Fritter Festival or the Takapuna Food and Wine Festival where sites and audiences are larger. The sound power level used is considered representative of a minor stage at a large festival, or the main stage at a smaller festival. The sound power level would provide coverage of the plaza at levels of above 95 dB L_{Aeq} with potential noise levels of up to 100 dB L_{Aeq} closer to the stage. This is considered to be readily sufficient for an event, many smaller events would generate lower levels of noise.

Figure 5: Outdoor Festival Function (Stage at North of Plaza)

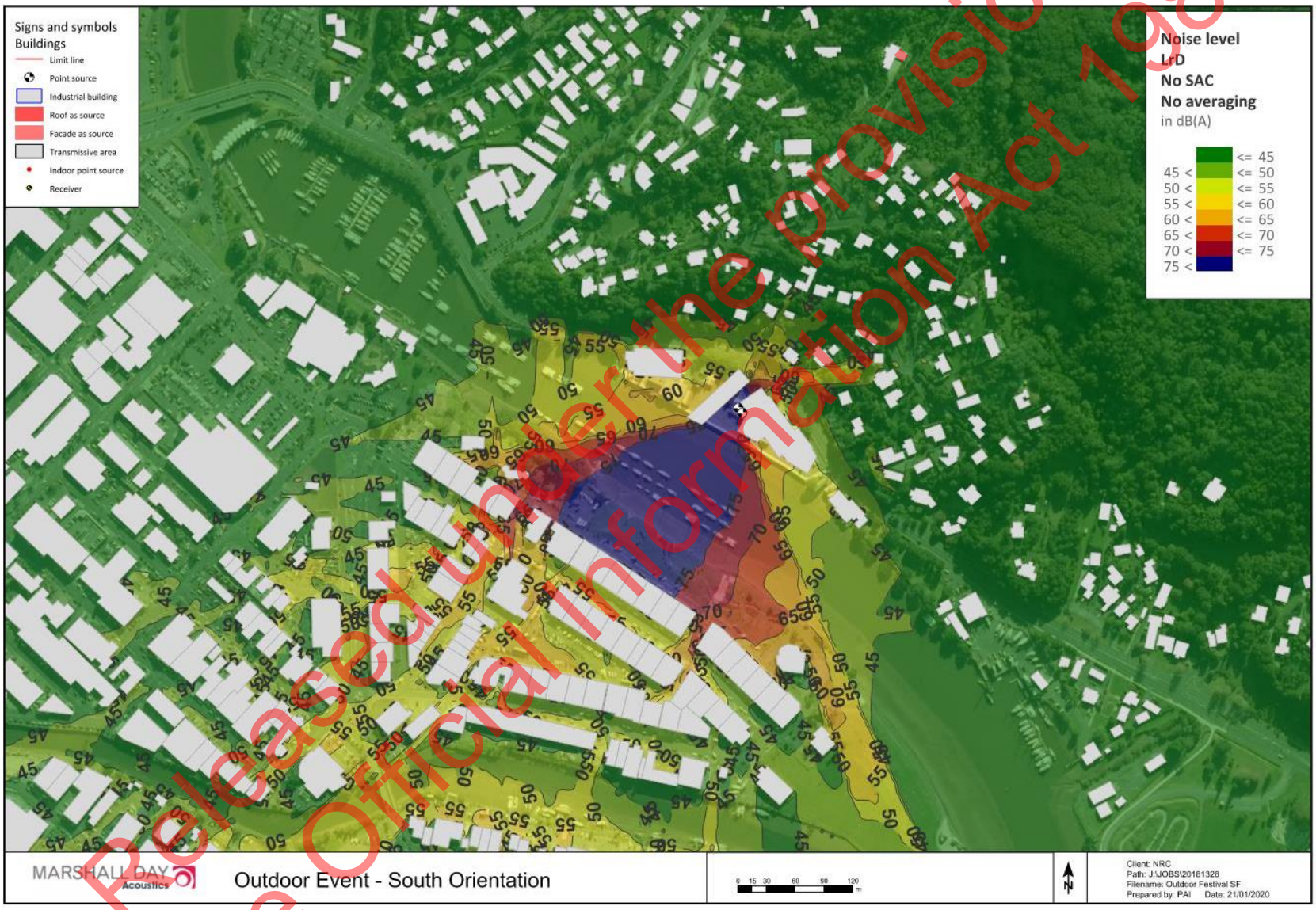
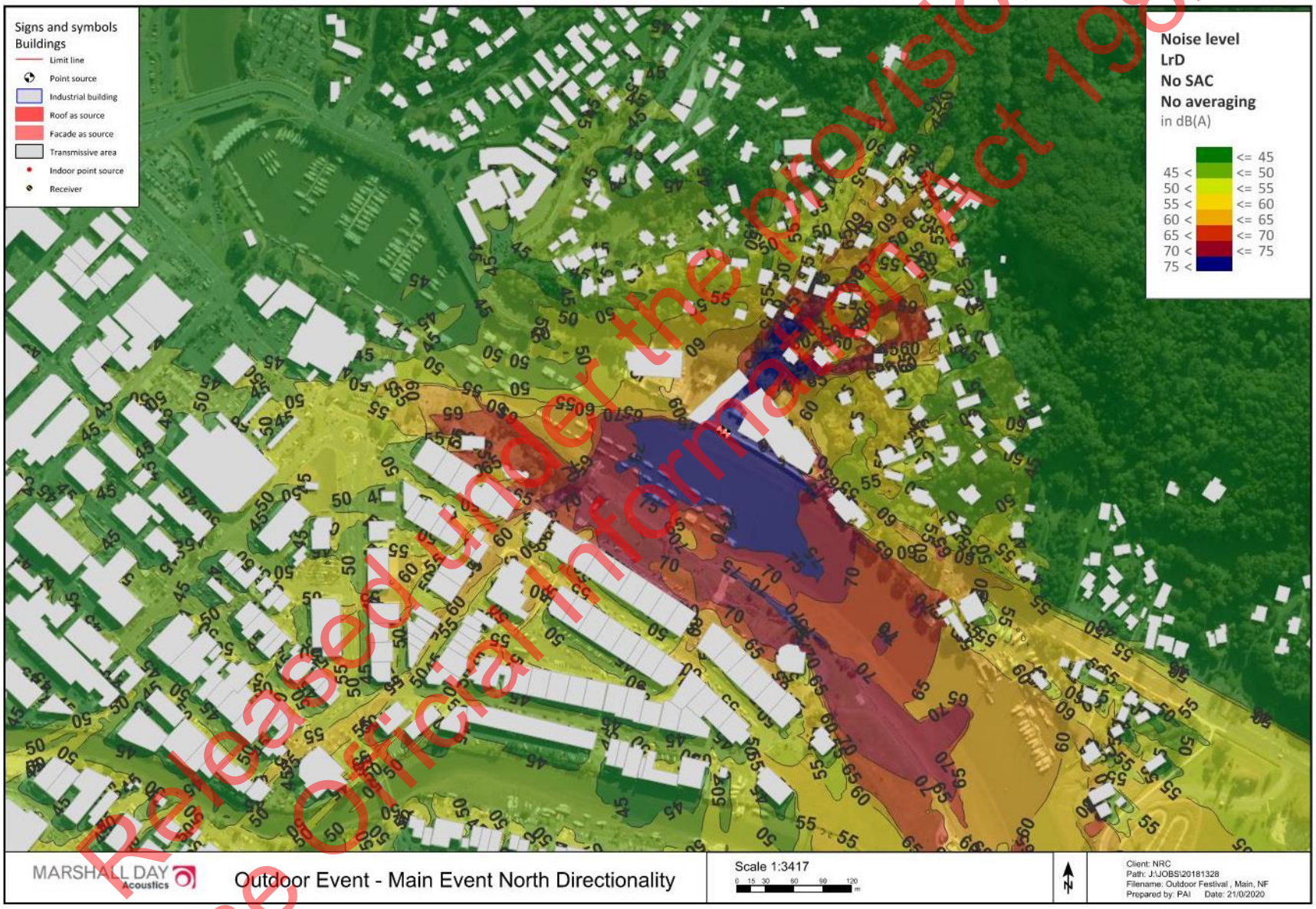


Figure 6: Outdoor Festival Function (Stage at South of Plaza facing North)



The figures illustrate that for festivals where the stage is at the north end of the plaza facing south, noise levels at the residential area to the north of Riverside Drive will be below 55 dB L_{Aeq}. The majority of dwellings in the Punga Grove Avenue area would receive noise levels of below 50 dB L_{Aeq}. It is expected that concerts that are well located with respect to the residential area (or involve smaller acts with lower powered loudspeakers) would be able to comply with the proposed daytime noise limit of 55 dB L_{Aeq}.

It is expected that it would be most desirable to locate touring acts on the southern side of the plaza orientated northward. If the stage is located and orientated this way, noise levels in the residential area will be below 75 dB L_{Aeq} at most Punga Grove Dwellings when live music is occurring. However calculations show that dwellings at 29 and 31 Punga Grove Avenue will potentially receive noise levels of 5 to 7 dB above 75 dB L_{Aeq}. In order to meet the noise limits, the volume from the loudspeakers will need to be controlled (or the speakers oriented southward). It is expected that music noise levels of around 95 dB L_{Aeq} near the stage will still be possible while meeting the proposed noise limits.

A noise level of 75 dB L_{Aeq} is not unreasonable provided there are limits on the numbers of concerts that can generate this noise level per annum and the festivals do not occur past 2300 hours. For this site, it is proposed that up to three festival-type activities could occur per annum with noise levels of up to 75 dB L_{Aeq} until only 2100 hours. It is proposed that a further nine concerts could occur at up to 65 dB L_{Aeq} until 2100 hours. The proposed consent condition is somewhat similar to the noise rule in the District Plan that permit up to twelve amplified music events per annum at noise levels of up to 65 dB L_{Aeq}, however the proposed consent condition allows for three concerts to be appreciably louder than the District Plan provision (75 dB L_{Aeq} vs. 65 dB L_{Aeq}) but with an earlier finish time of 9pm.

It is expected that there will be a temporary effect on amenity at 29 and 31 Punga Grove Avenue if three concerts generate noise levels of up to 75 dB L_{Aeq}. The music noise level would be around 10 dBA higher than the existing level of traffic noise over the majority of the day period and is expected to be clearly audible when concerts occur. The noise level at these dwellings may affect (but not preclude) easy communication, as well as affecting relaxation outdoors.

Whether residents become annoyed by the amenity effects of these short duration concerts will depend on their personal attitude towards hearing live music. Research into attitudes to environmental noise from concerts show that annoyance with noise levels vary widely[4]. The referenced research shows that for ten concerts in the UK at noise levels of above 70 dB L_{Aeq}, around 8% of people *"could not hear music"*, 23% were *"not at all annoyed"*, 38% of people were *"not very annoyed"* and 33% of people were *"annoyed to some extent"*.

It is considered that the effects on amenity of outdoor concert noise (and resulting annoyance) can be reduced by adopting a noise management plan for the site. This management plan would require the following:

- Residents receiving noise levels of above 65 dB L_{Aeq} during concerts would be advised at least fourteen days prior to the event occurring;
- The duration of live music will be limited and live music will not occur past 9pm; and
- The venue would liaise with the residents after each concert to identify opportunities to reduce the impact of noise from each concert;

As the music noise level will be significantly lower at other dwellings on Punga Grove Avenue, the amenity of the wider neighbourhood would not be significantly affected.

[4] *UK Building Performance Centre, Research into Attitudes to Environmental Noise from Concerts NANR 292, September 2011*

5.3 Pedestrian Noise

People activity in the street before and after events, creates noise within the residential area. This is a noise that is generally associated with any event during the daytime or evening. Noise from this activity cannot be controlled by noise limits because it takes place on public footpaths. A resource consent application has to consider whether this noise is reasonable in the location and context it is to be experienced.

It is expected that the vast majority of pedestrians exiting the venue will travel into the city via the Hatea Loop walkway. The majority of this walkway is well separated from dwellings to the north of Riverside Drive.

It is expected that pedestrian noise could be audible in the area after large events finish. It is considered likely that concert goers will converse with each other enthusiastically at times, but that this noise will be transitory in nature. It is expected that noise levels during pedestrian egress from large events will be below 50 dB $L_{Aeq\,(15\,min)}$ at adjacent dwellings on Riverside Drive. Such levels of noise will be audible, but will likely be well below the existing level of road traffic noise that is already received at dwelling façades. Given the infrequent and transitory nature of the source, it is considered that the level of noise will have limited effects on amenity.

5.4 Concert Breakdown Activity

After a major concert event a significant amount of equipment has to be dismantled and moved out. When this involves a touring act, this has to be done immediately after the show between 12:00 pm and 3:00 am. Breakdown activities typically include:

- Large truck movements;
- Smaller rental van movements;
- Truck loading activities and trolley movements;
- Forklift movements;
- Road crew talking;
- Waste management activities (clearing rubbish, recycling etc).

Breakdown activities after a concert event have potential to cause disturbance to neighbouring residents if conducted outside. In order to avoid ongoing noise effects in the Riverside Drive area to the north of the back-of-house area, Marshall Day Acoustics has proposed that the breakdown and loading area be enclosed. This enclosure has been agreed to by the development corporation and is shown on the architectural drawings. All truck movements will use the vehicle entry/exit on Riverside Drive.

Concert breakdown activity noise levels are known to have a sound power level of around 103 dB L_{WA}. In order to reduce noise emission from the breakdown activity to below 45 dB L_{Aeq} in the adjacent environment, the loading bay area will be required to include the sound insulation measures set out in Appendix G.

As the loading of trucks will need to occur within the loading dock with doors closed, it is recommended that effective doors be procured. This is proposed to be achieved by hinged industrial doors with effective seals. Such doors represent the most reliable way to reduce noise emissions from the loading dock.

Trucks will depart the site in the early hours of the morning. It is expected that trucks will not have to idle for protracted periods outside as once they are loaded in the loading dock it is expected that they will be able to drive out of the loading dock and directly onto Riverside Drive. Calculations of noise from up to four trucks departing the site in a one-hour period (one truck per 15-minute period) shows that the proposed noise limit of 45 dB L_{Aeq} can be achieved at all dwellings adjacent to the site.

It is noted that if multiple trucks departed over the same 15-minute period there could be a technical breach of the District Plan noise limit from on-site truck activity. However if this occurred, it is expected that there would be few or no truck movements over the remainder of the night period. To avoid the site technically breaching the noise limits during isolated 15-minute periods, it is proposed that on-site truck noise is not assessed against the night--time consent noise limit.

Subject to provision of the internal loading dock and back of house area it is considered that noise from the breakdown of large events can occur during the night-period and the night-time noise limit can typically be achieved in the adjacent Living zone.

5.5 Traffic Generation

While traffic generated on the surrounding roads is not required to comply with the District Plan noise limits, it is considered appropriate to assess the potential noise effects of increased traffic on neighbouring properties as this is an effect that is directly as a result of the proposed redevelopment.

For the purposes of this assessment, traffic generation from the proposed redevelopment has been separated into the following three traffic flow scenarios:

- Scenario 1: Typical day-to-day activity
- Scenario 2: Conferences & Events Centre events ("typical events")
- Scenario 3: Large performing arts events ("maximum events")

Scenario 1: Typical Day-to-Day Activity

The majority of movements are expected to occur from the carpark which will be accessed via a ramp on the eastern façade of the building

Peak hour traffic due to the hotel and apartment guests during a typical day is expected to be around **195 trips per hour**[5]. By comparison, the peak number of vehicle movements on Riverside Drive is currently **1,392 vehicles per hour**.

The total average number of vehicle trips per day from the precinct is expected to be **1193 trips per day**. By comparison, Riverside Drive currently carries **12,412 vehicles per day**.

Based on the above, it is expected that day-to-day activity from the proposed hotel and apartments would result in an increase in traffic noise level from Riverside Drive of around **half a decibel**, even at peak times. This increase in traffic noise level would not be perceptible at dwellings and would not result in a material effect on residential amenity.

Scenario 2: Conferences & Events Centre Events ('Typical Events')

Conference and meeting activity at the Events Centre are expected to generate peak hour movements of **245 vehicle trips** from the site (including peak trips from the hotel and apartments). It is assumed that peak movements from daytime use of the Events Centre would occur around existing peak times on Riverside Drive. The overall number of trips from the site is expected to be **1293 trips per day.**

The expected additional vehicles on Riverside Drive on days when 'typical' conferences and events occur will result in noise level increases of **less than one decibel**. As with the day-to-day activity, the increase in noise level from the additional traffic on Riverside Drive is not expected to be perceptible and would not result in a material effect on residential amenity.

[5] 50th percentile value as provided by Engineering Equilibrium

Scenario 3: ***Large Events Centre Events ('Maximum Events')***

Under the worst-case traffic modelling scenario when maximum vehicle activity occurs at the site, it is expected that the total peak hour traffic may be **489 vehicles per hour** with up to **1970 vehicles per day**[6]. In this situation, the peak traffic noise level on Riverside Drive would increase by around **1.5 decibels**. An increase in traffic noise level of 1.5 decibels would not be perceptible.

Marshall Day Acoustics expect that at the conclusion of a concert or large meeting there might be a period where around 200 vehicles[7] depart the site (or use Riverside Drive). Measurements show that there are still regular traffic movements on Riverside Drive after 10pm: ambient noise levels in Punga Grove Avenue was measured at 58 dB L_{Aeq} around this time.

It is expected that an additional 200 vehicles on Riverside Drive at the conclusion of a large event has the potential to generate noise levels of around 57 dB $L_{Aeq,\,1\,hr}$ at dwellings adjacent to Riverside Drive. This would be similar to the current ambient noise levels from traffic. It is therefore possible that the overall ambient noise level may be increased by around 3 decibels over the hour after large events conclude. A three-decibel increase is only a 'just perceptible' increase in noise level.

While a possible 'just perceptible' increase in noise represents a potential slight reduction in amenity over this hour, this will only occur at the conclusion of large evening events. The remainder of the traffic associated with the Oruku Landing Events Centre are not considered to result in material effects on amenity.

5.6 Hospitality Noise

It is proposed to include a restaurant in the lobby of the four-star hotel as well as a café and pre-function area on the southern side of the Events Centre.

It is anticipated that outdoor tables would be provided outside within the plaza. A dining terrace is proposed to the south of the hotel restaurant and Events Centre. These areas would be screened from dwellings by the hotel building envelope. The outdoor areas where patrons may dine are around 100 metres from dwellings on Riverside Drive / Punga Grove Avenue.

Typical casual dining in these areas represents little risk that daytime or night-time noise limits could be exceeded. It is calculated that even when the alfresco areas are operating busily for dinner or lunch service, noise levels received at the dwellings to the north of the site will be below 40 dB L_{Aeq}. Such levels of noise will be around 15 to 20 decibels lower than the daytime ambient and background noise levels. It is anticipated that noise from dining would normally be inaudible and even if occasionally audible would not affect the existing level of residential amenity.

It is anticipated that patrons attending concerts may visit the restaurant and cafés to have a pre-concert drink and/or meal and to socialise with others prior to the event. It is anticipated that the number of people in the alfresco areas may be significantly higher at these times than it would be during normal dinner service. Over the hour leading up to the concert it is calculated that noise levels at the notional boundary of dwellings to the north may increase to 54 dB L_{Aeq} when patrons are socialising enthusiastically. This level of noise would be below the existing level of ambient traffic noise in the area and is likely to be below the level of background noise where concerts begin before 7:00pm.

It is not anticipated that the restaurant and cafes would operate as 'bars' after 10pm. Noise from the use of the plaza and terrace as 'outdoor bars' would inevitably result in sleep disturbance effects on guests at the hotel in rooms that overlook these areas and as such it would not be in the interest of

[6] The 85th percentile values from the traffic assessment have been used for the maximum activity assessment

[7] It is proposed to provide for 183 vehicles in the basement carparking area. Many of these vehicles will be associated with hotel guests and vehicles will not depart the venue after the concert. Nonetheless, around 200 vehicles have been used for this assessment on the basis that concert goers may park on Riverside Drive elsewhere.

the hotel operators to allow such activity. It is anticipated that the use of these areas will primarily be for meal service during the daytime and evening.

It is considered that hospitality noise in the alfresco areas would not risk breaching the proposed noise limits. Noise levels during daytime operation will be well below the existing level of ambient noise in the area and as such material effects on residential amenity are not expected to arise.

5.7 Building Services Plant

The events centre, hotel and apartments will be air-conditioned, and this will require mechanical plant to be installed in and on the building. Based on experience with similar venues, Marshall Day Acoustics expect that the following plant will be required:

- **Events Centre:** chillers and air-handling units (or packaged air-conditioning plant), rooftop fans
- **Hotel:** chillers, small refrigeration condenser units, rooftop fans
- **Apartments:** outdoor variable refrigeration volume condenser units or outdoor AC units, minor extract fans

Mechanical services plant can be a source of noise nuisance if it is not properly sited and controlled. Noise from all mechanical services plant must achieve compliance with the proposed consent conditions at all times.

Marshall Day Acoustics is of the opinion that mechanical plant on the Oruku Landing development can be designed to ensure mechanical services plant complies with the noise limits with standard noise control treatment methods. Noise control treatment for mechanical plant is likely to involve the use of conventional measures such as proprietary silencers on the outlet side of extract fans, acoustic screening, positioning of plant away from noise sensitive boundaries and using acoustic screens if required. MDA would review the building services design during the detailed design phase of the project to ensure compliance with the District Plan noise limits at all times.

6.0 OPERATIONAL NOISE MANAGEMENT

6.1 Noise Management Plan

The attitude of the noise producer and the involvement of the noise receiver have been found to have a significant effect on the level of community response. Community liaison is an important measure.

It is important to ensure the noise levels are controlled during loud events to ensure compliance with the District Plan rules. The recommended consent conditions require that the operator of the venue prepares and implements a noise management plan. The noise management plan would include issues such as:

Overall communication outcomes:

— Ensure widespread awareness of the outcome and long-term benefits of the development;

— Explain the likely environmental impacts of the operation of the facility, and the noise mitigation measures incorporated in the design to reduce these effects;

— Provide opportunities before construction for neighbours to communicate their needs and expectations to enable these to be taken into account when planning construction;

— Establish working relationships with neighbouring properties;

— Establish regular channels of communication to ensure the community and the Council is kept informed of project progress and has the opportunity to express their concerns.

— On-going communication with residents so they are informed as to when special events and extended events are to occur.

Specific Noise Management Measures to be included:

- Notification to potential hirers/promoters of the noise rules and an indication of internal sound levels that are likely to achieve compliance;
- A standard agreement to be signed by the hirer/promoter that they will be responsible for complying with the noise limits;
- A procedure for monitoring the first two major events or the first loud band concert, to confirm compliance with the District Plan noise limits and determine the internal noise levels required to achieve compliance;
- Requiring that concerts with amplified music conclude by 10:30 pm on week-nights (or extended as required);
- A procedure for events with amplified music which extend to 11:00 pm on week-nights and 11.30 pm on Friday and Saturdays;
- Procedures for notifying neighbouring properties of upcoming events;
- A letter drop notifying those within the 55 dB $L_{Zeq\ @\ 63\ Hz}$ contour (Figure 4) of the type of event and hours of operation/finishing times etc.

7.0 CONSTRUCTION NOISE AND VIBRATION

7.1 Noise

Because the effects of construction activity are fairly short-term, the community generally has a greater tolerance for construction noise than for permanent or long-term continuous noise. This is reflected in noise limits for construction or demolition work generally being higher than for continuous noise as recommended in New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*"

The proposed construction period is considered long duration, being longer than 20 weeks. Therefore, the following noise limits apply (Table 1 of NZS6803:1999, attached as Appendix H):

- Weekday and Saturday daytime (0730-1800) - 70 dB L_{Aeq} at residential properties across Riverside Drive
- Daytime (0730-1800) - 70 dBA L_{Aeq} at commercial properties adjacent to the site and across the Hatea River

Earthworks will include:

- Removal of 18,700 m3 of earth, requiring excavators and loading trucks
- Retaining walls, requiring vibration driven sheet piles
- Dredging of 6700 m3 of earth from the river bed.

Foundation work will include:

- Construction of a 200 mm concrete block retaining wall at the perimeter of the podium and basement. The podium and basement will be a 400 mm thick pre cast concrete slab and 500 mm2 precast concrete columns.
- Beneath each column location (116) steel piles will be driven to 23 m below ground. These will be driven by a combination of vibro hammer and impact hammer.

At this stage, details of other construction activities are not available. However, the noise sources are expected to include demolition work, excavators, cranes, general construction and traffic.

Table 6 lists the anticipated noise levels from the equipment expected to contribute the most to noise emissions from this project. The noise levels in the table below do not include any shielding or other mitigation. This is considered appropriate since the majority of receivers are located on the hill to the north of the site and as such would overlook the site and not benefit from screening.

Table 6 Predicted noise levels from construction equipment

Equipment	Sound Power	Façade Noise Level (dB L_{Aeq})				Limit Setback (m)
	(dB L_{wA})	5	10	20	50	70
Vibratory sheet piling	116	97	91	85	76	83
Impact piling (casing & dolly)	114	95	89	83	74	69
Plate compactor	108	89	83	77	68	40
Paving machine	103	84	78	72	63	25
Excavator (20T)	103	84	78	72	63	25
Mobile Crane (35T) operating	98	79	73	67	58	14
Generator (150kVA)	93	74	68	62	53	8
Truck idling	91	72	66	60	51	6

As most construction activities will be at least 40 metres from dwellings, only piling works have the potential to exceed the Construction Noise Limits. Table 7 presents an assessment of the dwellings where piling will result in noise limits being exceeded. **Note that an "X" represents where the noise limit is likely to be exceeded.**

Table 7: Predicted limit exceedances for high noise level equipment/activities

Property	Noise limit predicted to be exceeded by:	
	Sheet piling	Impact piling
3 The Bluff	X	-
5 The Bluff	X	-
7 The Bluff	X	X
9 The Bluff	X	-
1 Punga Grove Ave	X	X
1A Punga Grove Ave	X	X
4 Punga Grove Ave	X	-
18 Punga Grove Ave	X	-
29 Riverside Drive	X	X
31 Riverside Drive	X	-
33 Riverside Drive	X	-
35 Riverside Drive	X	-
35A Riverside Drive	X	-
50 Riverside Drive	X	-
52 Riverside Drive	X	X

The following provides a summary of noise emissions:

- Retaining walls will be required at the extents of the site for earthworks. This proximity to receivers, and a high source noise level mean sheet piling is predicted to exceed noise limits at 15 properties.
- Impact piling of piles closest to Riverside Drive is predicted to exceed noise limits at 5 properties.
- Other construction activities would generally comply with the limit

Note that the levels in Table 6 are for continuous operation of the equipment. In practice, equipment does not operate continuously in one location for the duration of the works. Therefore, breaches of the noise limits will occur at specific dwellings only at specific times of the earthworks.

Short term exceedances of the construction noise limits are common (and typically unavoidable) for urban construction activities. Such exceedances are often considered reasonable if they are of a limited duration and best practicable option measures are implemented to avoid, remedy and mitigate the noise emissions as far as practicable.

The proposed consent conditions require that a Construction Noise and Vibration Management Plan be prepared which would outline appropriate liaison with neighbouring properties and an appropriate noise monitoring programme. The Construction Noise and Vibration Management Plan would also set out the required noise mitigation measures to be applied to the site, such as the use of sound reducing shrouds, noise barriers and impact dollies. Consultation with neighbouring properties would assist in establishing a working relationship with the residents, ensuring that they are well informed of the proposed activities and have an opportunity to express their concerns. The scope and implementation of the proposed management plan is outlined in the proposed conditions.

The Contractor will need to prepare a construction noise and vibration management plan prior to beginning works.

7.2 Vibration

The main vibration producing activities will be vibro-piling sheet / steel piles for retaining walls and drop hammer piling of foundation piles.

While the primary vibration concern is cosmetic building damage, people may be disturbed at lower vibration levels. The Whangarei District Plan sets out vibration limits in terms of both annoyance and building damage (refer to Appendix E). The operative District Plan permitted standard for annoyance in occupied dwellings is intentionally low (1 mm/s PPV) between 0700 and 2200 hours to ensure that construction activities permitted during daytime hours do not result in annoyance.

Table 8 presents the set-back distances for these activities in order to meet the vibration limits.

Table 8 Indicative vibration levels at building foundations

Equipment	Vibration setback distance (m)		
	Annoyance	Cosmetic Building Damage	
		Residential	Commercial
	1 mms^{-1}	5 mms^{-1}	10 mms^{-1}
Impact piling	150	19	8
Sheet piling	122	11	4

Piling for this construction project will occur around 40 to 50 metres from any dwelling foundation. As such, piling vibration is predicted to:

- exceed annoyance limits
- remain below the cosmetic building damage limits
- result in vibration levels of below 2.5mm/s PPV within adjacent dwellings

It should be noted that the cosmetic building damage thresholds are much lower than those that would result in structural damage. The appropriate vibration control for building damage is that vibration must not exceed the relevant limits in German Standard DIN 4150-3:1999 *"Structural Vibration - Effects of Vibration on Structures"*. The DIN4150-3 values for "long-term" construction vibration (DIN4150-3) are also referenced in the Operative District Plan however these limits are applied to *unoccupied buildings* as permitted standards.

A consent condition is recommended to manage vibration. The consent condition requires that the DIN4150-3 vibration limits are complied with at all times and that where vibration is found to exceed 2.5mm/s PPV for a period of more than three days that specific vibration management measures be implemented to reduce the effect on residential amenity.

Subject to these measures it is considered that the section 16 duties imposed by the Resource Management Act will be met and that unreasonable noise and vibration generated by construction will be avoided.

8.0 APARTMENT AND HOTEL SOUND INSULATION

The WDC District Plan requires that noise sensitive activities (such as accommodation) within the *Town Basin* zone are required to include sound insulation measures in the design of the buildings. The intention of this rules was to reduce reverse sensitivity on commercial activities, such as the restriction on music venues and restaurant / bars by the development of apartments in the town basin.

In the proposed Oruku Landing precinct, the only hospitality noise sources will be the events centre and the hotel themselves. As there is significant traffic noise in the area it is anticipated that the level of sound insulation required by the apartments and hotel will likely be greater than the WDC requirements.

An assessment of sound insulation has been carried out to determine the likely minimum sound insulation measures required for the hotel and apartments. These are based on assumptions made on glazing areas and will need to be refined once the design is progressed. The conclusions should be considered indicative only at this stage.

Table 9: Outline Construction Requirements to Meet WDC Minimum Sound Insulation Rules

Space	Room	Construction that will achieve WDC requirements		
		Glazing	**Façade Wall**	**Roof/Ceiling**
Apartments	Bedrooms	DGU: 8mm thick float glass 12mm airgap 6mm thick float glass	Precast construction with internal plasterboard lining	Steel roofing with ply sarking and 13mm thick dense plasterboard Or: Steel roofing and two layers of 13mm thick dense plasterboard
Apartments	Living Rooms	DGU: 6mm thick float glass 12mm airgap 6mm thick float glass		

Space	Room	Construction that will achieve WDC requirements		
		Glazing	**Façade Wall**	**Roof/Ceiling**
Hotel	Bedrooms	DGU: 6mm thick float glass 12mm airgap 6mm thick float glass	Proposed precast construction with internal plasterboard lining	Steel roofing with ply sarking and 13mm thick dense plasterboard Or: Steel roofing and two layers of 13mm thick dense plasterboard
Note: Other construction designs may meet or exceed the WDC limits. The above should not form the basis for a consent rule.				

It can be seen that the construction details that can be used to meet the noise limits are not onerous. It is concluded that there are practical measures available to meeting the District Plan sound insulation rules within the precinct. It is expected that the final design of the building will exceed the minimum sound insulation requirements of the District Plan to reduce traffic noise to appropriate levels.

9.0 CONCLUSIONS

An assessment of the environmental noise effects of the proposed Oruku Landing project has been carried out.

The assessment has recommended a suite of consent conditions that would control noise and vibration from operation on site. The proposed noise limits are higher than the noise rules within the operative and proposed District Plan. This is considered appropriate given the high levels of traffic noise on Riverside Drive.

The potential noise sources which may have an effect on neighbouring properties from the operation of the hotel, apartments and events centre have been identified as amplified music, festivals, traffic generation, and mechanical services plant. The potential noise effects of each of these noise sources have been assessed and have been shown to comply with the proposed consent conditions. A Noise Management Plan would be prepared prior to holding the first event in the Events Centre.

The Oruku Conference and Events Centre envelope has been designed to ensure 'typical' loud bands comply with the proposed 'broadband' noise limits and stringent low frequency controls at the nearest residential properties. It is expected that reasonably heavy wall and roof constructions will be required to achieved compliance with these noise limits and have been allowed for in the design.

Due to the audibility of the bass beat from loud indoor concerts, low frequency noise limits and cut-off times have been proposed to ensure the effects on the neighbouring properties are reasonable. Twelve events per year are proposed to extend 30 minutes beyond the regular cut-off times. This is considered reasonable given the infrequency of these events and the proposed implementation of an effective Noise Management Plan

On site traffic movements are predicted to comply with the proposed consent noise limits when individual trucks depart within 15-minute periods. This allows for trucks departing the site after packing down large events. Traffic movements on main roads are not generally expected to result in perceptible increases in overall noise levels for the majority of operation in site, however it is expected that a 'just perceptible' increase in noise level may occur at the conclusion of large events. The remainder of the traffic associated with the Oruku Landing precinct are not considered to result in material effects on amenity.

Hospitality noise can comply with the proposed consent conditions. Patrons dining during busy periods of service will generate noise levels that are well below the existing level of ambient and background noise. Material effects on residential amenity from hospitality noise are not expected to arise.

Mechanical services plant can be designed to achieve compliance with the consent conditions.

Noise and vibration from construction has the potential to breach the District Plan noise and vibration rules. Conditions are recommended to ensure that noise and vibration from the site do not result in unreasonable effects on amenity or result in cosmetic building damage to dwellings. To ensure the Section 16 duties imposed by the Resource Management Act are met, a noise and vibration management methodology is proposed.

The hotel and apartments can comply with the sound insulation rules contained in the District Plan without onerous constructions being required. It is expected that the final design of the building will exceed the minimum sound insulation requirements of the District Plan to reduce traffic noise to appropriate levels.

The proposed conditions of consent for the Events Centre development are included in Appendix I of this document.

APPENDIX A GLOSSARY OF ACOUSTIC TERMINOLOGY

Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.
Noise	A sound that is unwanted by, or distracting to, the receiver.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
Special Audible Characteristics	Distinctive characteristics of a sound which are likely to subjectively cause adverse community response at lower levels than a sound without such characteristics. Examples are tonality (e.g. a hum or a whine) and impulsiveness (e.g. bangs or thumps).
SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)
dBA	The unit 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.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A90\,(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15

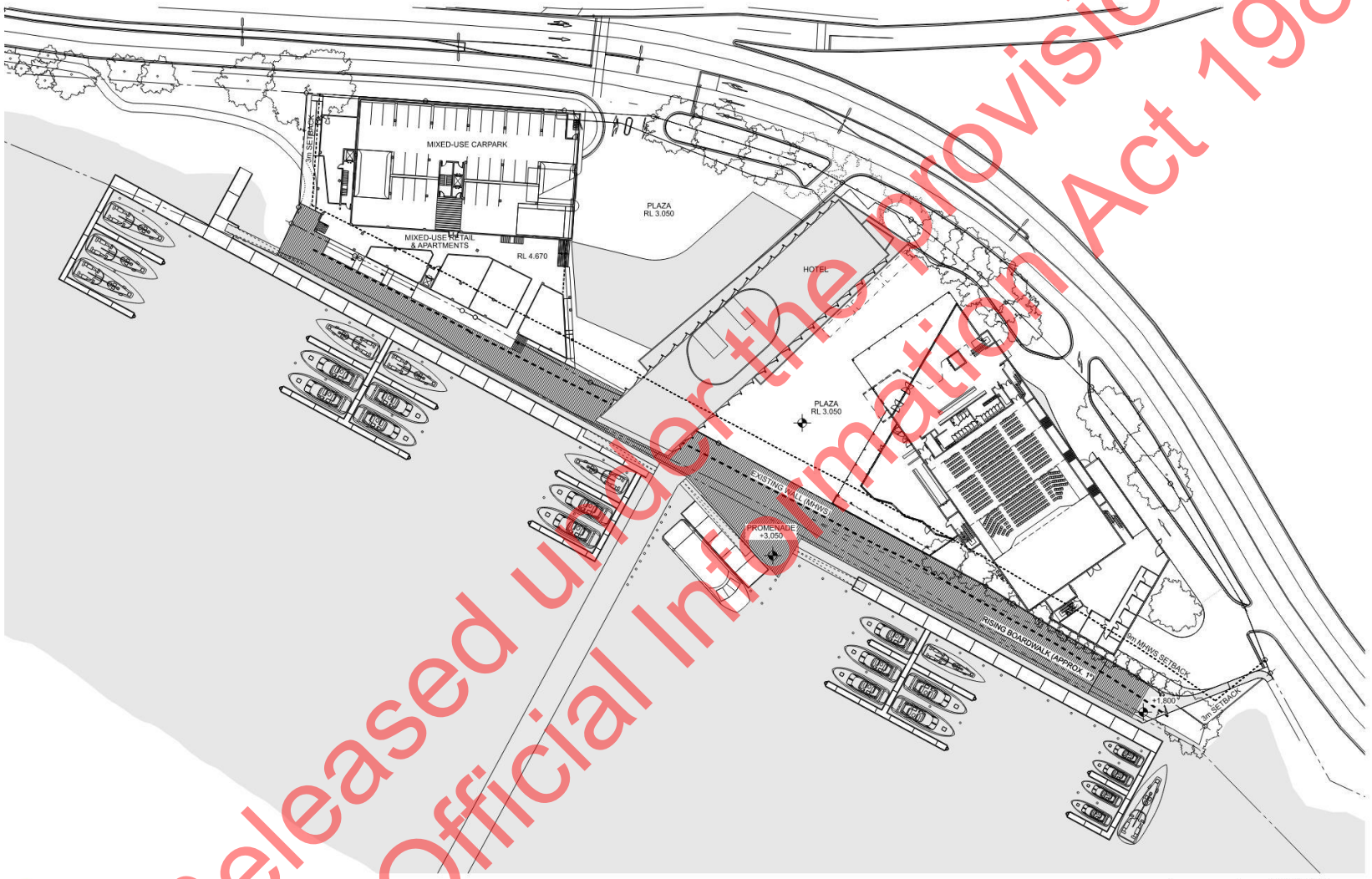
minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

$L_{A10\,(t)}$ The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.

The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

L_{AFmax} The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.

APPENDIX B SITE PLANS



APPENDIX C WDC OPERATIVE DISTRICT PLAN NOISE RULES

WHANGAREI DISTRICT COUNCIL

NAV

Noise and Vibration

NAV.6.1 Noise Arising from Activities within Environments

The following noise limits shall apply within and between Environments:

Noise emitted from any site in the following Environment	Noise measured within the applicable boundary of any of the following Environments (refer to following table for applicable assessment location)	Daytime 0700 to 2200 hours	Night-time 2200 to 0700 hours		Notes 8,9
		dB L_{Aeq}	dB L_{Aeq}	dB L_{AFmax}	
Business 2	Living 1, 2, 3 Open Space Rural Production Rural Living Rural Village Residential Rural (Urban Expansion) Urban Transition Kamo Low/Medium Density Living	55	45	75	
Business 4 Marsden Point Port Rural Village Industrial	Living 1, 2, 3 Urban Transition Rural Production Rural Living Rural Village Residential Rural (Urban Expansion)	55	45	75	
All Environments other than: -Business 2 -Business 4 -Marsden Point Port -Rural Village Industrial -Strategic Rural Industry [All SIRE]	Living 1, 2, 3 Rural Living Rural Village Residential Rural (Urban Expansion) Urban Transition Kamo Low/Medium Density Living	50	40	70	1, 2, 3
	Open Space Rural Production	55	40	70	1, 2, 3
All Environments other than: -Strategic Rural Industry [All SIRE]	Business 1 Town Basin	60	55	80	4, 5
	Business 2 Airport Bulk Format Retail	65	60	80	
	Business 3 Kamo Activity Precinct Rural Village Centre	60	50	75	

NAV.6.5 Sound Insulation Requirements

1. Any noise sensitive activity established within a Business 1, 2, 3, Town Basin, Rural Village Centre, Port Nikau Noise Zone 1 or 2, or Marsden Primary Centre Noise Zone 1 or 2 Environments or within the [Kauri Milk Processing Site] – Noise Control Boundary shall be designed and constructed to ensure the following internal design noise levels:

Environment	Bedrooms and sleeping areas within dwellings or units 2200 – 0700 hours	Other habitable spaces within dwellings or units 0700 - 2200 hours	Teaching spaces, places of religious assembly, health and veterinary service buildings 0700 – 2200 hours
Business 1 Business 2 Business 3 Kamo Activity Precinct Town Basin Rural Village Centre [Kauri Milk Processing Site, Crofts Timber, GBC] – Noise Control Boundary	30 dB L_{Aeq}	40 dB L_{Aeq}	35 dB L_{Aeq}
Port Nikau and Marsden Primary Centre Noise Zone 1 and Noise Zone 2A	35 dB L_{Aeq}	45 dB L_{Aeq}	35 dB L_{Aeq}

2. For design purposes, the following external L_{eq} noise levels shall be used. These noise levels shall be assumed to be incident on the façade.

Environment	Design noise level (dB L_{eq}) - incident							
	63	125	250	500	1k	2k	4k	dBA
Bedrooms and Sleeping Areas	Hz	Hz	Hz	Hz	Hz	Hz	Hz	
Business 1 Town Basin	66	65	55	54	49	42	38	55
Business 2 Port Nikau and Marsden Primary Centre Noise Zone 2A	67	64	61	58	55	52	49	60
Business 3	57	54	51	48	45	42	39	50
Port Nikau and Marsden Primary Centre Noise Zone 1	72	69	66	63	60	57	54	65
Kauri Milk Processing Site – Noise Control Boundary	65	6-	53	45	40	38	35	50
Other Habitable Rooms								
Business 1 Town Basin Business 3	71	70	60	59	54	47	43	60
Business 2								

APPENDIX D PROPOSED PLAN CHANGE NOISE RULES

NAV.6.1 Noise Arising from Activities within ~~Zones~~Environments

The following noise limits shall apply within and between ~~zones~~Environments:

Noise emitted from any site in the following ~~zone~~Environment	Noise measured within the applicable boundary of any of the following ~~zones~~Environments (refer to following table for applicable assessment location)	Daytime 0700 to 2200 hours	Night-time 2200 to 0700 hours		Notes [8,9]
		dB L_{Aeq}	dB L_{Aeq}	dB $L_{AF(max)}$	
~~Business 2~~ Light Industry Commercial Sport and Active Recreation	~~Living 1, 2, 3~~ Living Zones Neighbourhood Commercial Conservation Open Space Rural Production Rural Living Rural Village Residential Rural (Urban Expansion) ~~Urban Transition~~ ~~Kamo Low/Medium Density Living~~	55	45	75	
~~Business 4~~ ~~Maroden Point~~ Port Rural Village Industrial Heavy Industrial	~~Living 1, 2, 3~~ ~~Urban Transition~~ Living Zones Neighbourhood Commercial Conservation Open Space Rural Production Rural Living Rural Village Residential Rural (Urban Expansion)	55	45	75	
All ~~Environments~~Zones other than: ~~Business 2~~ ~~Business 4~~ ~~Maroden Point~~ Port Heavy Industrial Light Industrial Commercial Sport and Active Recreation -Rural Village Industrial -Strategic Rural Industries~~y~~ [All SIRZ~~S~~]	~~Living 1, 2, 3~~ Living Zones Neighbourhood Commercial Rural Living Rural Village Residential Rural (Urban Expansion) ~~Urban Transition~~ ~~Kamo Low/Medium Density Living~~	50	40	70	1, 2, 3
	Open Space Rural Production Conservation	55	40	70	1, 2, 3
	~~Business 1~~ ~~Town Basin~~	60	55	80	4, 5

All ~~Environments~~Zones other than: -Strategic Rural Industries~~.~~ [All SIRZs]	City Centre Waterfront				
	Light Industrial Commercial Sport and Active Recreation Shopping Centre Hospital ~~Business 2~~ Airport ~~Bulk Format Retail~~	65	60	80	
	~~Business 3~~ ~~Kama Activity Precinct~~ Mixed-use Local Commercial Rural Village Centre	60	50	75	

APPENDIX E OPERATIVE DISTRICT PLAN VIBRATION LIMITS

2. Construction Vibration

Vibration from construction and demolition activity is a permitted activity if it does not exceed the following levels when measured at the point of effect.

a. For human annoyance, vibration should be assessed at the location of the affected person inside the building, typically on the appropriate floor. Vibration should be measured in three orthogonal directions orientated to the axes of the building and assessed in the single axis in which vibration is greatest.

b. For building damage, vibration should be assessed at the horizontal plane of the highest floor of the building. Vibration should be measured in two horizontal orthogonal directions orientated to the axes of the building and assessed in the single axis in which vibration is greatest. Note that for the building damage criteria in NAV 6.15.2 Note 2 an alternative measurement location is defined.

Effect	Affected occupied building	Activity	Time	Maximum vibration level mm/s ppv	Notes
Annoyance	Occupied noise sensitive activity or visitor accommodation in any Environment	General construction activity	2200 to 0700	0.3	1
			0700 to 2200	1	1
	Occupied commercial or industrial activity in any Environment	General construction activity	2200 to 0700	5	
			0700 to 2200	1	
Building damage	Unclassified structures of great intrinsic value such as historic buildings	All activity	All times	2.5	
	Non-occupied dwellings and buildings of similar design	All activity	All times	5	
	Non-occupied commercial and industrial buildings	All activity	All times	10	

[1] Except that in surgery rooms of hospital facilities, maximum vibration levels from construction and demolition activities shall not exceed 0.1mm/s rms between 8 and 80Hz.

[2] NAV.6.15.2 shall not apply to permitted maintenance or utility works undertaken within the road carriageway where the following levels are achieved:

APPENDIX F DISTRICT PLAN OBJECTIVES AND POLICIES SUMMARY

Whangarei District Plan Objectives, Policies & Assessment Criteria

Section 5 of the Whangarei District Plan discusses amenity values. The plan recognises that:

> *"the environmental effects of incompatible or inappropriate activities can compromise the characteristic amenity values of a locality, particularly where activities are in close proximity"*; and
>
> *"Activities can be unduly restricted by other activities that demand a higher level of amenity."*

The Plan also states that *"Land uses can produce noise…which adversely affect the amenity values of the surrounding environment.*

The Plan recognises that *Living* zones tend to be passive areas where people relax and interact with each other and that a *"low levels of noise"* is one factor that results in *"high levels of amenity"*. One key matter that the Plan states with regard to non-residential activities in adjacent zones is:

"Some areas of Living Environments are compromised by the effects of activities located in other environments. Where there are conflicts between existing legitimate land use activities, a balance is required to be struck between the achievement of high levels of amenity in living environments, and the efficient use of existing resources."

The plan discusses the amenity required in *business* zones. It notes that the use of business zones vary but that as some people spend significant proportions of their day in business zones a level of amenity is still important.

The plan notes that *Open Space* environments usually have high amenity values. The plan notes that they can be areas that are busy with human activity but that they offer a sense of tranquillity which is important. The plan relates the amenity of these areas to the tranquillity offered within them.

The plan states the following with regard to the interface between sites:

> *"The interface between the different Environments is often an area of conflict, due to activities affecting the amenity values of adjoining sites. Activities in such areas should therefore be carried out in a manner that seeks to maintain the amenity of adjoining sites."*

The relevant *Objectives* of the plan include :

- The characteristic amenity values of each Environment are maintained and, where appropriate enhanced.
- Adverse effects on amenity values do not result in a reduction of amenity value below that which is desirable for people's health and safety
- Activities that demand a high level of amenity do not unduly compromise other land uses.
- The amenity values of open space are maintained and enhanced

APPENDIX G EVENTS CENTRE ROOF AND HIGH-LEVEL WALL CONSTRUCTIONS

Events Centre Roof Construction

The following roof constructions have been considered to reduce noise breakout from the proposed building:

Recommended System (or similar as determined during detailed design)

- Torch on membrane
- 75 - 100mm polyiso insulation
- 50mm S50 Ortech panel supported on purlins over the trusses which also form part of the cat-walk system
- 800mm max ceiling cavity with polyester or similar non-fibreglass insulation (insulation is preferred for acoustic reasons notwithstanding it is included outside the system in the warm roof design)
- Ceiling system/panels - 50mm S50 Ortech panel ideally fixed resiliently or with minimal contact to the overall structure.

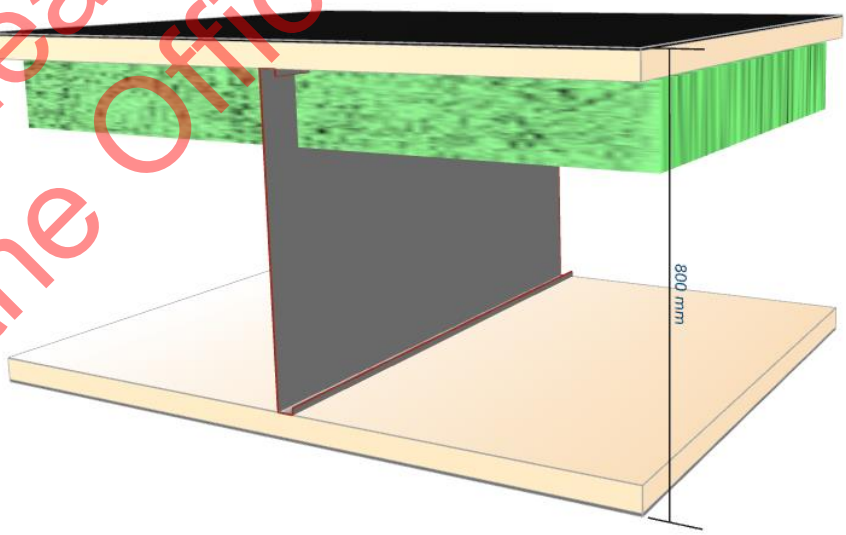
It is likely that the underside of the ceiling lining will be absorptive treated for room acoustic reasons in some areas.

It will be possible to construct similar roof constructions that would meet the required sound insulation using alternative measures or products. **The final system will be confirmed in building design**. The expected performance and modelled system is shown below for reference:

Table 10: Sound Transmission Loss (dB)

	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1000	2000	4000
Some resilience (via steelwork)	38	45	51	56	56	65	77
Solid fixings (Calculation basis)	34	41	48	52	54	66	78

Figure 7: High Performance Warm Roof Construction (c. 800mm cavity or overall depth of system)



Events Centre Main Wall Construction

The architect proposes that the walls of the core events centre will be constructed using 150mm dense concrete or greater thickness

Loading Dock Construction

The loading dock is proposed as a masonry wall with a weathered exterior. The design of the loading dock will need to include the following:

- Well sealed door sets. These are proposed to be large hinged industrial doorsets with appropriate perimeter and door bottom seals.
- Roof / ceiling construction to include a mass layer such as insulated panel (e.g. Metecno) or a warm roof with suitable mass lining as required to achieve the necessary attenuation.

The above construction will allow for a high level of internal activity. Light weight construction areas are likely to be acceptable, any required alternative sound insulation solutions will be considered during detailed design.

APPENDIX H NZS6803:1999 CONSTRUCTION NOISE STANDARD

NAV 6.2 of the operative and proposed Whangarei District Plan requires that construction noise comply with the provisions of The New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise."*. Clause 7.2.1 of NZS6803:1999 defines construction work that occurs for more than 20 weeks as being of 'long term duration'. The relevant construction noise limits tabled below are those set down in the standard for works of long-term duration. Table 1 outlines the upper limits for construction noise received in residential zones. Table 2 outlines the recommended upper limits for construction noise received in industrial or commercial areas.

Table 1: NZS6803:1999 Construction Noise Limits for Residential Areas

Time Period	Noise Level (dBA)					
	Weekdays		Saturdays		Sundays and public holidays	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
0630-0730	55	75	45	75	45	75
0730-1800	70	85	70	85	55	85
1800-2000	65	80	45	75	45	75
2000-0630	45	75	45	75	45	75

See attached Appendix A for an explanation of technical terms.

Table 2: NZS6803:1999 Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year.

Time Period	Noise Levels (dBA)
	L_{eq}
0730 – 1800	70
1800 – 0730	75

The noise limits of Tables 1 and 2 are to be measured at one metre from the most exposed façade of affected buildings and 1.2 to 1.5 m above the relevant floor level.

APPENDIX I PROPOSED CONDITIONS OF CONSENT

Noise from General Activities within the Events Centre.

iv) Activities within the Oruku Landing Entertainment Precinct site boundary, other than Special Events, Extended Events and excluding crowd noise and traffic noise, shall not exceed the following noise levels when measured at the notional boundary of any dwelling to the north of Riverside Drive or in any Open Space zone.

Morning	*0600 – 0700 hrs*	*45 dB L_{Aeq}*
Daytime	*0700 – 2300 hrs*	*55 dB L_{Aeq}*
Night-time	*2300hr – 0600 hrs*	*45 dB L_{Aeq}* *75 dBA L_{AFmax}*

v) In addition to the above limits, noise from amplified music shall not exceed the following limits when measured at the notional boundary of any dwelling to the north of Riverside Drive.

Sunday to Thursday	*2230 – 0700 hrs*	*55 dB $L_{Zeq\ @\ 63\ Hz}$*
Friday and Saturday	*2300 – 0700 hrs*	*55 dB $L_{Zeq\ @\ 63\ Hz}$*

*vi) **Extended Events:** For 12 events per year, the change over time from Daytime to Night-time may be extended by 30 minutes. The Council shall be notified of which events intend to use this extended cut-off time. The public will be notified of each extended event not less than 7 days prior to the event".*

2. Noise from Special Events

The noise from Special Events excluding crowd noise but including testing or practice involving the use of electronic sound amplification are not required to comply with the above noise limits. Instead, these events shall not exceed the following noise limits when measured at any point at or within the boundary of any site to the north of Riverside Drive:

i) 1000hr – 2200hr — 75 dB L_{Aeq} (3 events per year)
65 dB L_{Aeq} (9 events per year)

ii) The L_{AFmax} noise level for all activities shall not exceed 90 dBA when measured over any 15 minute period between 1000hr – 2200hr.

iii) Testing or practice involving the use of electronic sound amplification shall be limited to a maximum duration of 3 hours. The combined duration of Special Event including testing and practice shall be limited to 8 hours in duration.

iv) The public will be notified of each Special Event not less than 14 days prior to the event".

3. Monitoring and Noise Management Plan

Noise levels 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." No correction for special audible characteristic shall be applied to the noise limits or the measured noise levels for Special Events or to the low frequency noise

controls. Time averaging or duration corrections may be applied up to, but not after, 2300 hours (unless a special event is occurring in which case up to 2330 hours).

The consent holder shall monitor noise levels for the first two large scale music events to be held in the Events Centre. Copies of the monitoring reports shall be submitted to the Council within four weeks of the event. If the relationship between internal noise levels and external noise levels can be established, then internal sound levels can be used for any monitoring carried out at any other time.

A Noise Management Plan shall be prepared by the applicant and approved by the Council prior to the first event being held.

4. Construction Noise and Vibration

Rules applying to general operation shall not apply to construction noise or vibration. The following conditions shall apply:

3. *Where practicable, construction shall comply with the noise rules contained in Whangarei District Plan Section NAV6.2 'Construction Noise'.*
4. *Vibration from construction activity shall comply with the relevant vibration guideline values in Table 1 or Table 3 of DIN 4150-3:1999 "Structural Vibration - Effects of Vibration on Structures".*

5. Construction Noise and Vibration Management

A Construction Noise and Vibration Management Plan ("CNVMP"), prepared by an appropriately qualified acoustic engineer, must be submitted to the Council's compliance monitoring officer for approval prior to the commencement of any physical works on the site. The purpose of the CNVMP is to provide a framework for the development and implementation of measures to avoid, remedy or mitigate adverse construction noise effects.

The CNMP should include the following matters:

m) Construction and vibration noise criteria;

n) Identification of the dwellings where potential for noise and vibration effects exist;

o) Description and duration of the works, anticipated equipment and the processes to be undertaken;

p) Hours of operation, including specific times and days when construction activities causing noise and vibration would occur;

q) Mitigation options where noise and vibration levels are predicted or demonstrated to approach or exceed the relevant limits. Specific noise mitigation measures must be implemented which may include, but not limited to, acoustic screening, time management procedures and alternative demolition/excavation/construction/piling method technologies;

r) Where vibration is confirmed as likely to exceed levels of 2.5mm/s PPV during piling at specific dwellings for more than three days, the CNVMP shall detail specific noise mitigation measures for each dwelling to avoid further effects on amenity;

s) The erection of temporary construction noise barriers where appropriate;

t) Schedule and methods for monitoring and reporting on construction noise and vibration;

u) Details of noise and vibration monitoring to be undertaken or in the event of any complaints received or for any activity where there is a risk that the noise or vibration limits will be exceeded. The results of such monitoring must be submitted to the Council within one week of the measurements being carried out;

v) *Implementation of a complaint management system with contact numbers for key construction staff responsible for the implementation of the CNMP and complaint investigation. This system is to include procedures for maintaining contact with stakeholders, notification of proposed construction activities and handling noise complaints;*

w) *Notification is to be provided to the owners and occupiers of adjacent buildings prior to demolition and construction activities commencing on the site; and*

x) *Construction operator training procedures.*