MARSHALL DAY Acoustics

ASHBY'S BOAT YARD, OPUA
NOISE ASSESSMENT

Rp 001 20190467 | 13 June 2019

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Project: **ASHBY'S BOAT YARD, OPUA**

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1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by Far North Holdings via Bay of Islands Planning to undertake a noise assessment in relation to a proposal to expand the hardstand of the existing Ashby's Boat Yard, Opua, Far North District.

This report addresses noise and vibration from the proposed construction works, and noise from the proposed expanded operation. This report is intended to form part of an application for resource consent.

A glossary of terminology is included in Appendix A

2.0 PROJECT DESCRIPTION

2.1 Overview

It is proposed to extend the existing boat yard to the south over an area of approximately 2500 square metres, as depicted in Figures 1 and 2. Facilities to be added include: a boat ramp, loading dock, barge dock, dock, and a berth for The Minerva Kerikeri Steamship Trust. The project would also include extension of the access road and realignment of a 300-metre section of the Pou Herenga Tai - Twin Coast Cycle Trail.

Figure 1: Project Site and Surrounds

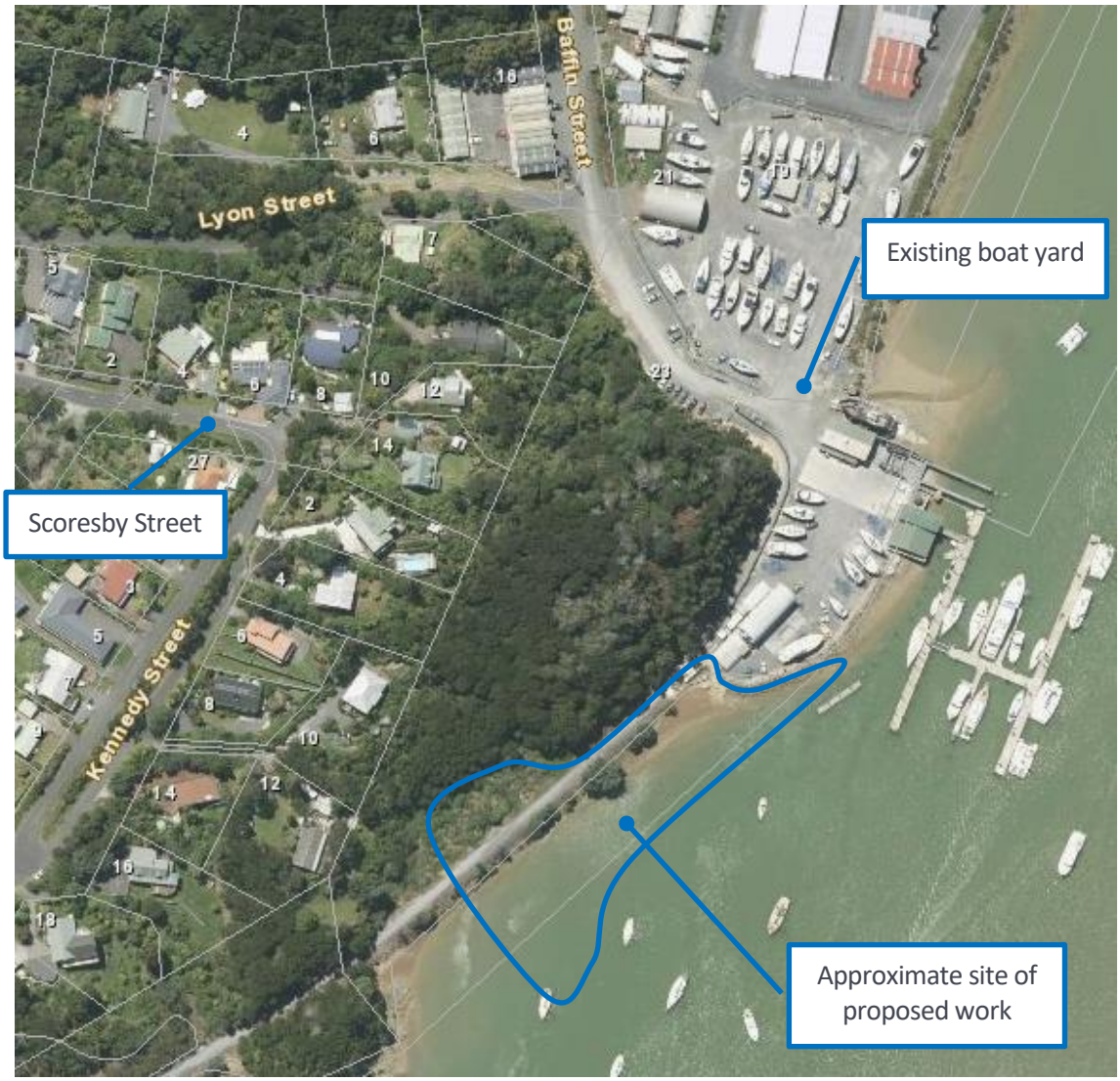
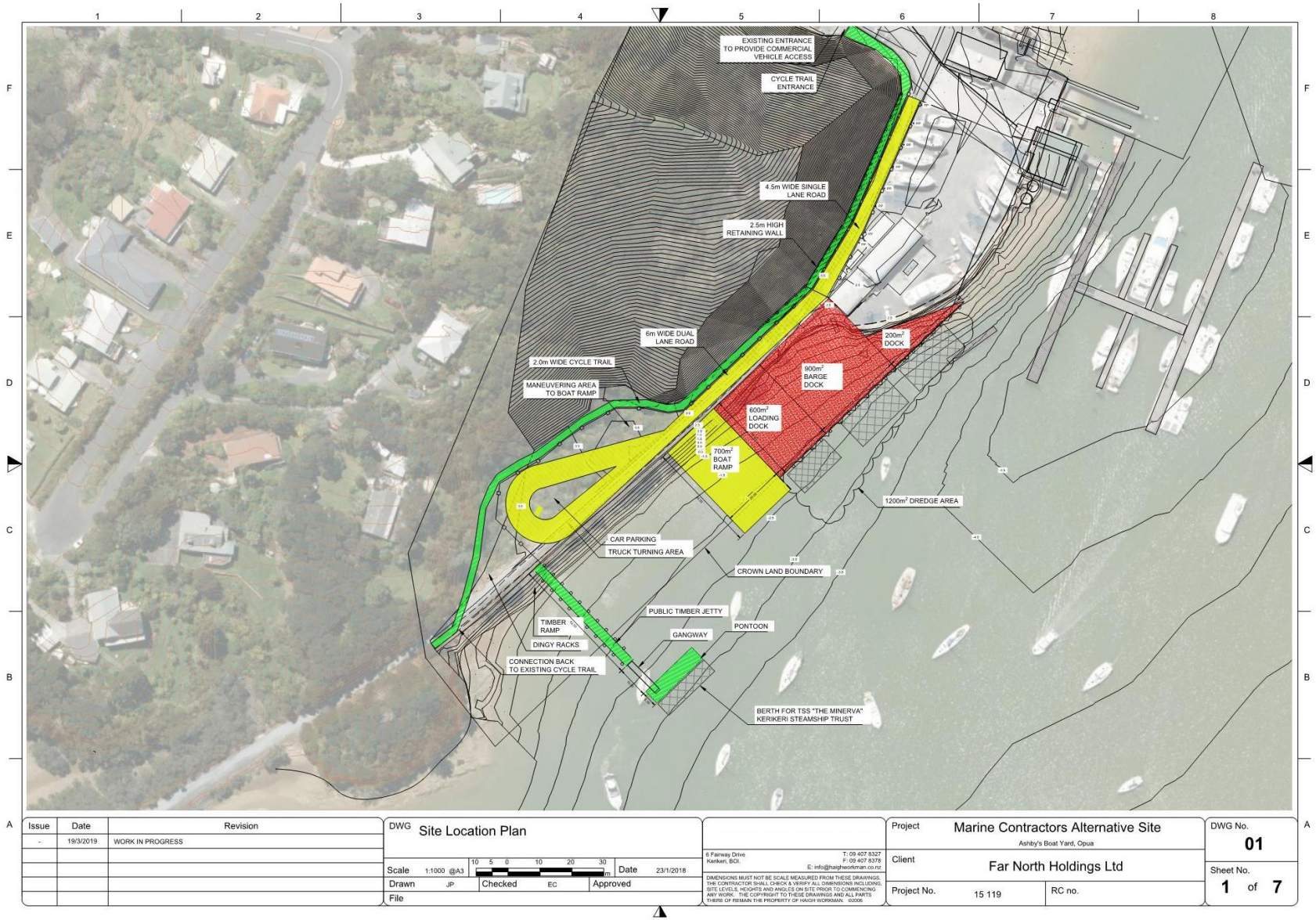


Figure 2: Site Plan



2.2 Key Construction Activities and Timeline

Marshall Day Acoustics understands that construction would take place in the 2019 / 2020 construction season, over a period greater than twenty weeks. Impact pile driving would take place over a six-hour work day. It is estimated that pile driving would take place over 31 days.

Key construction equipment would be a pile driving barge, large (20 – 30 tonne excavator), and a dredging barge. Other construction equipment would likely include: haulage trucks, a vibratory roller for compaction, and concrete trucks.

Key construction activities would include:

- Impact sheet piling for the reclamation wall over a distance of 90 metres. Sheet widths are likely to be 450mm and would be laid at a rate of approximately 1 metre / hour;
- Twenty-six Deadman steel piles impact driven to resistance in the loading dock / barge dock / dock area. These would be driven at a rate of four / day;
- Twenty-two timber (350mmSED) piles associated with the jetty. These would be drilled and driven at a rate of four / day; and
- Four steel piles (470mmSED) associated with the steamship berth. These would be impact driven at a rate of two per day.

2.3 Key Operational Activities

Marshall Day Acoustics understands that key operational activities in the existing boat yard are: water blasting (using commercial and domestic grade machinery), sand/garnet blasting, the use of a travel lift machine, general maintenance involving the use of hand-held power tools such as grinders, sanders and drills, tractor use, and general traffic. It is our understanding that water / sand blasting takes place in defined locations whereas the other activities take place throughout the yard.

As advised by the client, key operational activities for the proposed extension would be: use of a Hiab crane, forklift, tractor, general traffic including launching of boats at the boat ramp, and hand-held power tools. In general, the proposed hardstand extension is not proposed to contain the noisier activities that currently occur on the site. Water blasting, sandblasting, and travel lift activities will continue to occur in the existing area of the boatyard while the main use of the proposed hardstand extension will be for less noisy activities.

2.4 Receivers

Residential receivers are located to the north of the project on Kennedy Street, Scoresby Street, and Lyon Street. Two receivers (10 and 12 Scoresby Street) appear to have line-of-sight to the existing boat yard but not to the proposed extension. Two receivers (10 and 12 Kennedy Street) are likely to have increased line-of-sight due to the proposed extension. Refer to Figure 1 for an aerial showing the nearest receivers.

Receivers potentially affected by construction noise and / or vibration, identified based on Google Maps and Far North District Council websites, are listed in Table 1 and indicated in Figure 1. All identified receivers are assumed to be dwellings.

Table 1: Nearest Receivers

Address	Approximate distance to dwelling from impact / vibro pile driving (m)	Approximate distance to dwelling from drilled piling (m)	Approximate distance to dwelling from general construction / general operation (m)
12 Kennedy Street	94	49	37
10 Kennedy Street	90	80	44
4 Kennedy Street	120	-	100
2 Kennedy Street	120	-	100
14 Scoresby Street	130	-	100
12 Scoresby Street	140	-	120

A range of commercial and light industrial land uses are located adjacent to the boatyard. These include: Bluefix Boats (boat manufacture and service), Cater Marine (chandlery), Seapower (marine services), Northland Regional Council offices, and NZ Stainless. These businesses are located on the same site as the boatyard; there is no cadastral boundary between the activities.

There are also commercial marine services activities located on the west side of Baffin Street (17 – 21 Baffin Street). These include Total Marine Services, Total Floating, and Open Ocean (Water Makers).

Businesses adjacent to the site generally provide marine services and are unlikely to be particularly sensitive to noise from adjacent boatyard activity.

3.0 AMBIENT SOUND MEASUREMENTS

Marshall Day Acoustics undertook a site visit on Saturday 11 May 2019. Measurements of ambient and background noise were undertaken at two locations proximal to the boatyard to establish existing levels. Measurement positions (MP) were located on Baffin Street (MP 1) and on the cycle trail (MP 2). Measurement positions are shown in Appendix B.

Measurements were undertaken in accordance with the relevant standards. Weather conditions were acceptable for sound measurement. At the time of measurement, little activity was taking place at the boatyard.

The measured noise levels are summarised in Table 2.

Table 2: Summary of Sound Level Measurements

Measurement Position	Date / Start Time	Duration	Measured Sound Levels (dB)				Sound Sources and Comments
	hh:mm	mm:ss	L_{AFmax}	L_{Aeq}	L_{A10}	L_{A90}	
MP 1 Baffin St	11 May 2019 14:00	8:00	58	39	42	29	No dominant noise sources; secondary sources: boat work, distant chainsaw; intermittent sources: dropping noises from work on boats, rummaging
MP 2 cycle trail	11 May 2019 14:40	6:40	53	37	40	27	Dominant sources: boats, birds, sea noises Secondary sources: boat yard, voices (distant)

As given in Table 1, measured noise levels were fairly low with ambient levels of 42 and 40 dB L_{A10} and background levels of 27 and 29 dB L_{A90}. Activity at the boatyard was not dominant at the time of measurement.

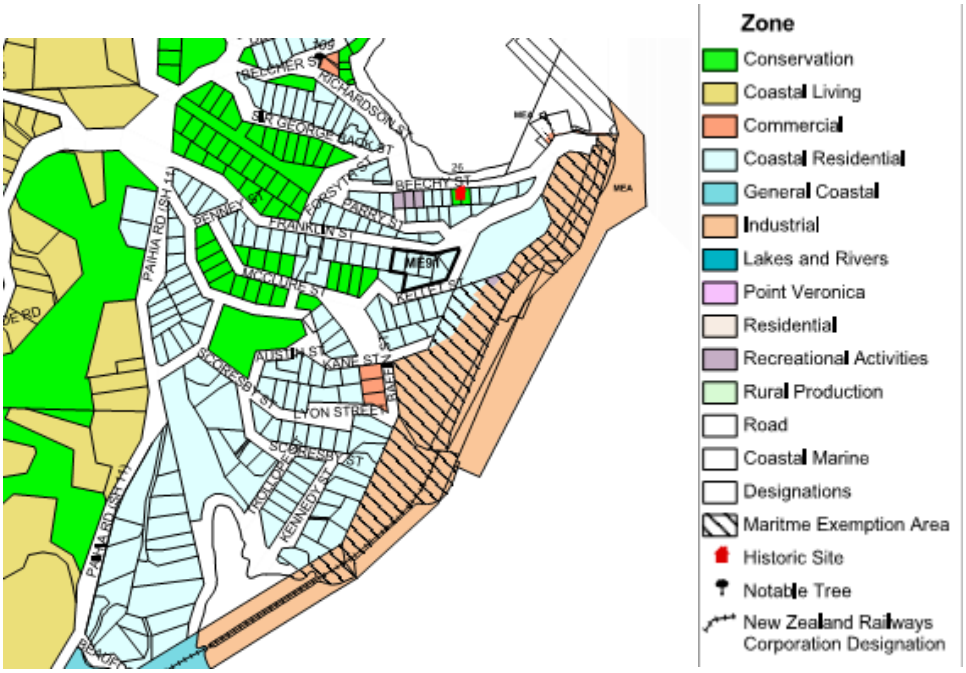
Based on the types of noisy activity (such as water / sand blasting) known to take place at the boatyard, it is likely that ambient levels vary greatly in area, depending on the level and type of activity taking place at the boatyard. Although noisy activities are known to occur, the measurements given in Table 1 demonstrate noise levels during low periods of boatyard activity.

4.0 PERFORMANCE STANDARDS

4.1 District Plan Zoning

The application site is situated on land zoned *Industrial* and *Coastal Marine* in the Far North District Plan – Operative Version (District Plan). It is also within the *Maritime Exemption Area*. Most properties adjacent to the proposed development are zoned *Coastal Residential*. Properties zoned *Commercial* are located on the west side of Baffin Street. Figure 2 shows zoning at the application site and neighbouring sites.

Figure 2: Far North District Plan Zone Map 92



4.2 Operational Noise Standards

Permitted activity noise standards and policies for the *Industrial Zone* are set out in the District Plan in Chapter 7.8. No permitted activity noise standards are provided for the *Coastal Marine* zone. The relevant standards are summarized below and reproduced in Appendix C.

Standard 7.8.5.1.6 specifies that all activities within the *Industrial Zone* shall be conducted to ensure that noise measured at any point within any site in the zone shall not exceed: 65 dB L_{A10} between 0700 to 2200 hours ; 55 dB L_{A10} and 80 dB L_{Amax} between 2200 to 0700 hours. Standard 7.8.5.1.6 also specifies that all activities within the *Industrial Zone* shall be conducted to ensure that noise measured at any point within any site in the *Coastal Residential Zone* shall not exceed 55 dB L_{A10} from 0700 to 2200 hours; and 45 dB L_{A10}, 70 dB L_{Amax} from 2200 to 0700 hours.

The standard does not specify a limit received at *Commercial* zoned sites from activities in the *Industrial* zone. However, Standard 7.7.5.1.8 specifies that all activities within the *Commercial* zone

shall be conducted to ensure that noise measured at any point within any site in the zone shall not exceed: 65 dB L_{A10} between 0700 to 2200 hours; 55 dB L_{A10} and 80 dB L_{Amax} between 2200 to 0700 hours. Marshall Day Acoustics considers this limit appropriate for noise received in the *Commercial* zone from activities in the *Industrial* zone.

4.3 Construction Noise and Vibration Standards

4.3.1 Construction Noise

The District Plan states that construction noise should meet the limits recommended in and be measured and assessed in accordance with NZS 6803P:1984 *'The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work'*.

However, the 1984 version of the New Zealand Standard NZS 6803 (a provisional release) has been replaced by version NZS 6803:1999 'Acoustics – Construction Noise'. The 1999 Standard is similar in effect to the previous version. It is recommended that the criteria of the 1999 version be substituted and applied to this project. Note, however, that compliance with the NZS6803:1999 standard will typically result in compliance with NZS6803:1984P.

NZS6803:1999 sets out the following noise limits. The standard provides two tables, one for 'residential zones and dwellings in rural areas' and one for 'industrial and commercial areas'. The works are likely to take longer than 20 weeks and therefore the 'long-term' guidelines would apply. As construction work is likely to occur between 0730- and 1800-hours Monday to Saturday, the noise guideline for all receivers would be 70 dB L_{Aeq}.

Residential zones and dwellings in rural areas:

Table 3: ***Recommended upper limits for construction noise received in residential zones and dwellings in rural areas***

Time of week	Time period	Duration of work					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Weekdays	0630-0730	60	75	65	75	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	85	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

Industrial or commercial areas:

Table 4: Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year

Time period	*Duration of work*		
	Typical duration	***Short-term duration***	***Long-term duration***
	L_{eq} *(dBA)*	L_{eq} *(dBA)*	L_{eq} *(dBA)*
0730-1800	*75*	*80*	*70*
1800-0730	*80*	*85*	*75*

4.3.2 Construction Vibration

This vibration assessment addresses potential cosmetic building damage and amenity. Structural and settlement related vibration effects are not addressed.

The District Plan does not contain any rules for construction vibration. However, the limits outlined in German Standard DIN 4150-3:1999 *'Structural Vibration - Part 3: Effects of Vibration on Structures'* are considered appropriate limits for construction vibration and their effect on structures. This is the standard most commonly used in New Zealand to address building damage risk from vibration.

Note that DIN 4150-3 relates to the avoidance of cosmetic building damage, such as cracking in paint or plasterwork. Cosmetic building damage effects are deemed 'minor damage' in DIN 4150-3 that can be repaired. The cosmetic building damage thresholds are much lower than those that would result in structural damage. DIN 4150-3 states: "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur*."

The relevant limits are shown graphically in the following figure and numerically in Table 5.

Figure 2: Short-term (transient)[1] vibration at building foundations (DIN 4150-3 1999: Figure 1)

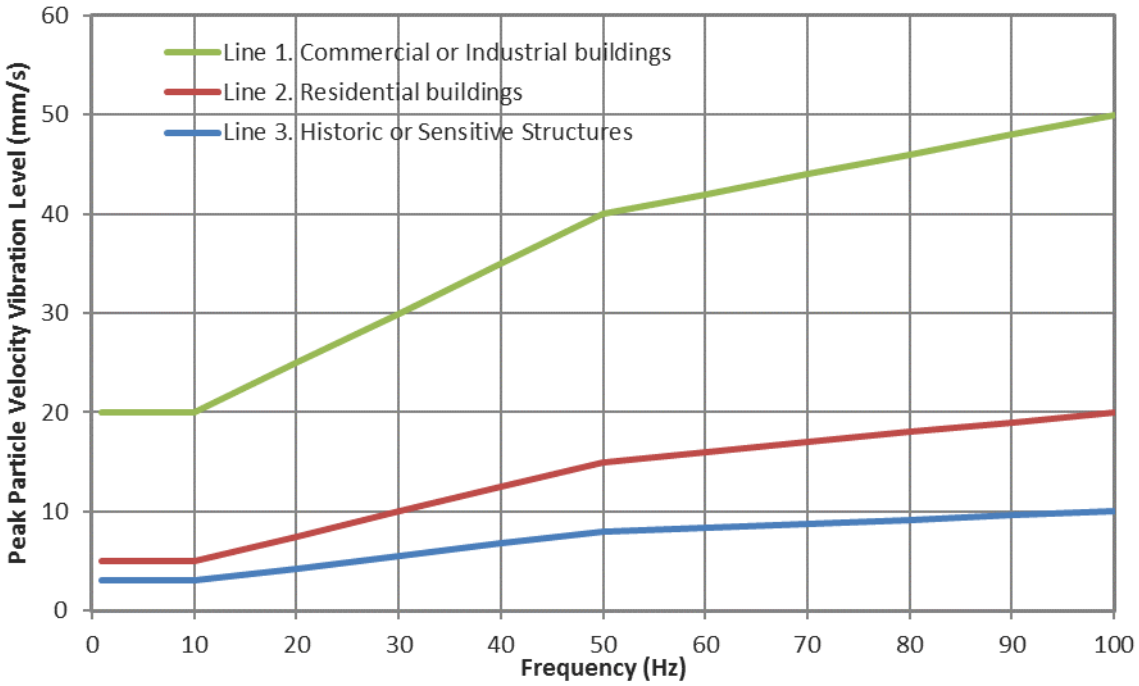


Table 5: Short-term (transient) vibration (DIN 4150-3 1999: Table 1)

Type of structure	PPV at the foundation at a frequency of (mm/s)			PPV at horizontal plane of highest floor (mm/s)
	1 - 10Hz	1 - 50 Hz	50 - 100 Hz	
Commercial/Industrial	20	20 – 40	40 – 50	40
Dwellings	5	5 – 15	15 – 20	15
Historic or sensitive	3	3 – 8	8 – 10	8

The vibration limits given above are appropriate for transient vibration sources (such as could occur during impact piling, as proposed for this project). However, the short-term vibration limits may not be acceptable for continuous vibration (such as may occur during vibro-piling). If a continuous vibration generating activity is required, the long-term vibration limits given in DIN 4150 should be adopted. The long-term limits are presented below in Table 6.

Table 6: Long-term vibration (DIN 4150-3 1999: Table 3)

Type of structure	PPV at horizontal plane of highest floor, all frequencies (mm/s)
Commercial/Industrial	10
Dwellings	5
Historic or sensitive	2.5

4.3.3 Vibration Amenity

There are no amenity vibration limits given in the District Plan. However, Marshall Day Acoustics consider it prudent that this is considered. The threshold of perception for vibration is significantly below that for cosmetic damage.

While the primary vibration concern is cosmetic building damage, people may be disturbed at lower vibration levels. British Standard BS 5228-2:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*" provides the following guidance on the amenity effects of vibration:

- 0.14mm/s PPV Just perceptible in the particularly sensitive environments
- 0.3 mm/s PPV Just perceptible in normal residential environments
- 1 mm/s PPV Typically acceptable with prior notification
- 10 mm/s PPV Likely to be intolerable for any more than a very brief period

An amenity limit given of 2 mm/s between 0700 – 2200 is recommended in some District Plans[1]. There is an allowance for up to three days of higher vibration levels received (5mm/s) only if prior notification is given (at least three days in advance) to all occupied buildings within 50m of the works. This is a reasonable approach in the absence of vibration standards within the Far North District Plan.

This approach is useful in considering whether an adjacent resident or occupant is likely to have their amenity reasonably affected by vibration. These limits should not be used as the construction

[1] When measured in the corner of the floor of the storey of interest for a multi-storey building or at the foundation

vibration limits. Rather, the amenity limits should be used to determine the legitimacy of a complaint and to determine who should be communicated to prior to any vibration generating works occurring.

4.3.4 Underwater Noise and Vibration

The District Plan does not provide noise or vibration standards for underwater activities. However, Marshall Day Acoustics consider it prudent that this is considered. There are no New Zealand noise / vibration standards or guidance for assessing underwater noise effects on marine mammals. Although, the Auckland Unitary Plan includes objectives and policies relating to the management of adverse effects of underwater noise on marine mammals. The US Department of Commerce National Oceanic and Atmospheric Administration has provided guidance for assessing the effects of anthropogenic (human-made) sound on marine mammals[2] (referred to as the 'NOAA Guidelines'). This US statute does not apply in New Zealand, but the NOAA Guidelines are provided to give context to the underwater noise assessment.

Marine Mammals – Hearing Effects

The NOAA Guidelines identify the received levels above which individual marine mammals are predicted to experience changes in hearing sensitivity. These changes are either temporary ('Temporary Threshold Shift' or TTS), or permanent ('Permanent Threshold Shift' or PTS)[3]. Auditory threshold shifts can be caused from peak exposure (high-level impulsive events such as pile strikes) or from cumulative exposure (lower noise levels over an extended period such as from vibro-piling or multiple pile strikes).

The NOAA Guidelines provide TTS and PTS onset thresholds for mid-frequency cetaceans using 'peak' and 'SEL_{cum}' assessment descriptors[4]. The criteria are summarised in Table 7.

Table 7: Summary of NOAA TTS and PTS thresholds

		Thresholds[5]
Species	**Threshold Type**	**Impulsive (e.g. impact piling)**
Mid-Frequency Cetaceans	TTS	224 dB L_{peak} 170 dB $SEL_{cum\ (mf)}$
	PTS	230 dB L_{peak} 185 dB $SEL_{cum\ (mf)}$
Otariid Pinnipeds	TTS	226 dB L_{peak} 188 dB $SEL_{cum\ (ow)}$
	PTS	232 dB L_{peak} 203 dB $SEL_{cum\ (ow)}$

Marine Mammals – Behavioural Effects

Behavioural responses to underwater noise can vary significantly depending on species, the noise environment, and the frequency content of the noise source. These effects can range from

[2] National Oceanic and Atmospheric Administration: 'Technical Guidance for Assessing the Effects on Anthropogenic Sound on Marine Mammal Hearing' (July 2016)

[3] TTS in humans can be likened to the 'muffled' effect on hearing after being exposed to high noise levels such as at a concert. The effect eventually goes away, but the longer the exposure, the longer the threshold shift lasts. Eventually, the TTS becomes permanent

[4] The peak level is the highest un-weighted instantaneous pressure level recorded during the measurement period, whereas SEL_{cum} is the species-weighted cumulative sound exposure level over a 24-hour period.

[5] SEL thresholds are in dB re 1 μPa^2s and peak SPL thresholds are in dB re 1 µPa

temporary avoidance of the noisy area to disorientation or impeded communication. Relatively little is known about the thresholds above which there are likely to be behavioural impacts. As interim guidance, NOAA states that behavioural impacts can occur at levels of 160 dB re. 1 μPa rms for impact piling. However, it should be noted that these thresholds are recognised by NOAA to be conservative and are only interim criteria until formal guidance is available.

5.0 CONSTRUCTION NOISE

5.1 Airborne

An overview of the key construction activities is given in Section 2.2 of this report. All significant equipment likely to be used on the project is listed in Table 8. The sound levels given are based on measurements made by Marshall Day Acoustics of similar plant or from BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites* Part 1: Noise.

Table 8: Activity Specific Noise Levels at 1m from a building façade (without screening)

	Item/Activity	Operating Sound Power Level (dB L_{WA})	Noise Level (dB L_{Aeq}) @30m	@40m	@50m	@90m	@120m	70dBA Limit Setback (m)
1	Impact piling (with casing and dolly)	114	79	76	74	67	64	69
2	Drilled piling	111	76	73	71	64	61	52
3	Vibro piling (if required)	116	81	78	76	69	66	83
4	Dredging (20-30T excavator)	107	72	69	67	60	57	36
5	General works / trucks	106	71	68	66	59	56	33

Table 8 shows setback distances to meet the construction noise limit of 70 dB L_{Aeq}. The nearest identified receiver (10 Kennedy Street) to impact pile driving is at 90 metres which will be sufficiently far from the activity to ensure compliance with the limit.

The nearest identified receiver to drilled piling (12 Kennedy Street) is at 49 metres, just within the setback distance of 52 metres. The predicted noise level from drilled piling at this receiver is 71 dB L_{Aeq}, one decibel over the limit. This one decibel exceedance is expected to only occur for the drilled piles nearest the shore. All other identified receivers are beyond the setback distance for drilled piling. It is considered that the best practicable option for managing this minor calculated exceedance is the implementation of a Construction Noise and Vibration Management Plan (CNVMP) as discussed in Section 9 of this report. The CNVMP should include a recommendation for piling activities nearest the shore to take place during the least sensitive time of day.

All identified receivers are beyond the setback distances for dredging and general construction works.

5.2 Underwater

Piling is predicted to produce the highest levels of underwater construction noise.

Impact piling (utilizing mitigation in the form of a casing / dolly) can generate peak noise levels of between 180 and 250 dB re 1µPa peak at 1m depending on the pile type (e.g. timber pile, concrete pile, steel H pile, sheet pile), size of pile, piling rig, and the piling method and mitigation employed.

For steel impact driven piles 300mm, 500mm and 600mm in diameter, marine mammal behavioural response zones are predicted to extend 30m, 140m and 300m respectively.

Based on communications with the client, Marshall Day Acoustics understands that there are no species of concern resident near the project and therefore underwater noise modelling has not formed a detailed part of this assessment.

However, Section 9.4 of this report, specifies specific measures are recommended, where practicable and appropriate, to reduce or manage the effects of underwater noise.

6.0 CONSTRUCTION VIBRATION

Key activities and details of equipment likely to generate vibration are detailed in Table 9. Estimates of vibration have been included.

Table 9: Key Vibration Sources

Activities	Vibration data
Impact piling	5mm/s @ 19m; 1.5mm/s @90 m
Sheet piling	5mm/s @ 5m; 1.2mm/s @90 m
Bored / drilled piling	5mm/s @ 1m; 0.1mm/s @50 m
Excavation	5mm/s @ 5m; 1.5mm/s @40 m

As detailed in Table 9, construction vibration for all adjacent receivers is anticipated to be within the range of 1mm/s and 5mm/s PPV. The level of vibration is expected to be below the limit for cosmetic building damage but at a level expected to result in some amenity effects. It is considered that there is a low to negligible risk of building damage arising, but that all identified receivers within 120 metres of the project activities should be given at least three days notification prior to the proposed works occurring.

It is noted that the above vibration levels are not certain and relate to the way in which the activity is carried out as well as the soil conditions. Often there is negligible ground borne vibration from hydraulic excavator works. The above vibration levels contain a 100% safety factor and thus the actual level of vibration perceived is likely to be lower.

7.0 OPERATIONAL NOISE

7.1 Noise Measurements

As reported in Section 3.0 of this report, measured ambient noise measurements near the boatyard were 40 and 42d B L_{A10}. At the time the measurement was taken, ready compliance with the District Plan noise limit of 55 dB L_{A10} at nearby receivers would have been achieved. However, during the time of the measurements, activity at the boatyard was not a dominant sound source. The measurements do not show that noise from the boatyard would always comply with the noise limits.

7.2 Times of Operation

It is understood that most activity at the boatyard takes place during the prescribed daytime period, 0700 to 2200 hours. However, it is likely that during summer boat launching activity may take place prior to 0700 hours.

7.3 Calculated Noise Levels and Compliance

A comparison of calculated reasonable worst-case noise levels has been made for the existing and proposed operation. Predictions have been made at the façades and boundaries of nearest residential receivers and for the commercial receivers on the west side of Baffin Street.

7.3.1 Prescribed Daytime Period (0700 to 2200)

For the reasonable worst-case cumulative daytime scenario, the following noise sources and sound power levels were used:

Existing Site

- Travel-lift activity, the use of power hand tools (such as grinders), a tractor, and general traffic over the existing site (105 dB L_W).
- A commercial grade water blaster located at the water blasting location identified as 'W' in Appendix B (114 dB L_w)
- A commercial grade sand blaster located at the identified sandblasting location indicated as 'S' in Appendix B (120 dB L_w)

Proposed Site

- For the dock, barge dock, loading dock and boat ramp: the use of power hand-tools (such as grinders), a tractor, general traffic including traffic using the boat ramp, electric forklift, Hiab, and people talking (90 dB L_w)
- For the steamship berth / dock: people talking (65 dB L_w)

Calculated daytime noise levels for the existing and proposed operation are given in Table 10. Noise levels were calculated at both façade and boundary locations for residential receivers and at the façade of the commercial receivers. For most receivers, only the worst-case result is reported.

Table 10: Calculated Noise Levels

Receiver	Noise Limit (Day 0700 – 2200) [dB L_{A10}]	Existing Boat Yard (without extension) [dB L_{A10}]	Proposed Site (existing plus hard stand extension) [dB L_{A10}]	Change in noise level
2 Kennedy Street	55	50	50	0
4 Kennedy Street	55	50	50	0
10 Kennedy Street	55	50	50	0
12 Kennedy Street	55	55	55	0
10 Scoresby Street	55	55	55	0
12 Scoresby Street	55	48	48	0
14 Scoresby Street	55	46	46	0
7 Lyon Street	55	49 (at façade)	49 (at façade)	0
	55	59 (at boundary)	59 (at boundary)	0
17-21 Baffin Street	65	49	49	0

As shown Table 10, there is no calculated difference between reasonable worst-case noise levels for the existing and proposed conditions. This is due to all noisiest activities (travel lift, water blasting, and sand blasting) continuing to take place only on the existing site.

At all sites, other than the boundary of 7 Lyon Street, the calculated levels achieve compliance with the District Plan noise limit of 55 dB L_{A10}. The calculated level at the boundary of 7 Lyon Street exceeds the limit by four decibels. Note that the calculated level at the dwelling of 7 Lyon Street is 49 dB L_{A10}, readily meeting the noise limit. This is because the site boundary is at the foot of a steep heavily vegetated cliff whereas the façade of the dwellings is elevated and set a considerable distance from the site boundary. In terms of noise effects, it is considered that the noise level assessed at the façade of the dwelling is most relevant as the noise received at the cliff face would not result in any effects on the resident's amenity.

7.3.2 Prescribed Night Time Period (2200 to 0700)

As discussed in Section 7.2, it is considered likely that during summer boat launching activity at the new dock may take place prior to 0700 hours. Calculations of predicted noise levels have been made for nearest receivers based on the assumption of a maximum of six boats launched in a 15-minute period and a maximum noise level of 90 dB L_w during vehicle acceleration. Based on this assumption, compliance with the night-time *Residential* zone limit of 45 dB L_{A10} is achieved at all receivers. For the nearest receiver (12 Kennedy Street), the calculated noise level is 34 dB L_{A10}.

8.0 RESOURCE MANAGEMENT ACT EFFECTS ASSESSMENT

Construction noise and vibration calculated levels generally meet the relevant limits, with minor exceptions. Construction would take place over a relatively short time frame. Therefore, any potential adverse effects would be temporary. Nonetheless, as discussed in detail in Section 9, further mitigation measures can be implemented to manage and minimise potential adverse effects of construction.

Operational noise levels are calculated to remain the same as the existing noise levels. However, it is calculated that during times of high activity (i.e. travel lift, water blasting, and sand blasting occurring

simultaneously) the District Plan noise limit is currently exceeded by four decibels at the boundary of one receiver (7 Lyon Street). The site boundary is not considered a good location for the assessment of effects as the site boundary is at the foot of a steep, heavily-vegetated cliff where the residents will not be present. Amenity effects are considered better assessed at the façade of 7 Lyon Street (the calculated level at the façade is 49 dB L_{A10}). This is a more reasonable level of noise and is six decibels lower than the District Plan performance standard.

At all other receivers, the operational noise limit is met.

The proposal is expected to increase line-of-sight to the boat yard for two receivers, 10 and 12 Kennedy Street. However, no change in loudness during the daytime period is calculated for these receivers.

During periods of high use of the boat ramp (e.g. summer holidays), early morning revving of ute engines during boat launching, are calculated to comply with the prescribed night-time noise limit.

Overall, noise and vibration is considered reasonable in terms of the Resource Management Act. The noise effects on amenity of the residential area will not change perceptibly with the proposed extension to the boat yard. While technical exceedances of the District Plan noise limits are likely to currently occur at the foot of the cliff, noise from operation of the existing (and extended) boat yard is likely to be below the level of noise anticipated by the District Plan within the outdoor living spaces of residential sites.

9.0 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

Noise and vibration are calculated to generally comply with the standards with one minor exception. Marshall Day Acoustics considers it appropriate for the contractor to generally manage noise and vibration through their Construction Noise and Vibration Management Plan (CNVMP).

9.1 Construction Noise and Vibration Management Plan

As part of good practice, Marshall Day Acoustics recommends that the contractor develop a CNVMP for the project. A CNVMP should generally include information set out in NZS6803:1999 in Section 8 and Annex E, such as:

- Summary of project noise limits contained within this assessment
- Summary of assessments/predictions contained within this assessment
- General construction practices, management and mitigation
- Noise management and mitigation measures specific to activities and/or receiving environments
- Monitoring and reporting requirements
- Procedures for handling complaints
- Procedures for review of the CNVMP throughout the project

9.2 General Mitigation Measures

The following general noise mitigation measures should be implemented throughout the construction of the project:

- Training of personnel with regard to quiet and low vibration operating procedures.
- Maintenance of equipment to ensure noise and vibration levels remain as low as practicable.
- Noise barriers, temporary or otherwise, considered where necessary.
- Low noise and vibration plant should be selected wherever practical. Noisy plant shall have noise mitigation measures (such as silencers or enclosures) fitted. Where practicable, plant that generates low levels of vibration shall be used in preference to vibration intensive plant.

- Night-time operation shall only occur when noise limits can be complied with or where all practicable measures have been implemented to reduce noise emissions as per the CNVMP.
- Tonal reversing alarms shall be deactivated or replaced with a suitable alternative such as a visual or broadband alarm if required for night-time works. This approach has been successfully implemented on several NZTA projects.
- Piling activities nearest the shore should take place during the least sensitive time of day.

Refer to http://acoustics.nzta.govt.nz/construction-and-maintenance-noise for further discussion regarding the management of construction noise.

If an exceedance of the project construction noise limits is identified as likely due to a specific activity or in a specific area, and the general mitigation measures as discussed above are not sufficient to achieve full compliance, further mitigation should be investigated and implemented where practicable.

9.3 Construction Vibration Mitigation

Vibration monitoring is not required to be implemented as part of general practice, however can be considered in response to a compliant or justified concern regarding building damage or ongoing effects on amenity.

Typical measures for mitigating and managing construction vibration effects include:

- Liaison with affected parties.
- Monitoring of building condition prior to construction and in response to complaints.
- Monitoring of vibration levels received by buildings during the first use of high-vibration activities in their vicinity and in response to complaints.
- Using low-vibration techniques and managing the timing of activities where practicable to avoid disturbance.

9.4 Underwater Pile Driving

The following specific measures are recommended, where practicable and appropriate, to reduce or manage the effects of underwater noise from pile driving:

- Use ‘soft starts’ (gradually increasing the intensity of impact piling) and minimise duty cycle.
- Undertake visual monitoring during piling operations to identify any marine mammals in the area.
- Do not start piling if a marine mammal is identified within the predicted behavioural response zones as discussed in Section 5.2 of this report.
- Implement low power or shut down procedures when a marine mammal is identified within the behavioural response zones discussed in Section 5.2 of this report.

10.0 CONCLUSION

Marshall Day Acoustics has undertaken a noise assessment for a proposal to expand the hardstand of the existing Ashby's Boat Yard, Opua, Far North District

Six sensitive receivers (dwellings) have been identified between 40 to 130 metres of the project area. Construction noise and vibration is calculated to generally comply with the relevant limits at all nearest receivers where it occurs between 0730 to 1800 hours Monday to Saturday. An exceedance of one decibel is calculated to occur at one dwelling for drilled piles near the foreshore. It is recommended that this exceedance (and construction noise and vibration) be managed by the contractor using the management measures outlined in this report.

Operational noise levels are calculated to remain the same as existing noise levels. However, it is calculated that during times of high activity (i.e. travel lift, water blasting, and sand blasting occurring simultaneously) the District Plan noise limit is currently exceeded by four decibels at the boundary of one receiver (7 Lyon Street). The site boundary is not considered a good location for the assessment of effects as it is at the foot of a steep, heavily-vegetated cliff where humans will not be present. Amenity effects are considered better assessed at the façade of 7 Lyon Street, where the calculated noise level is six decibels lower than the District Plan performance standard. No change in amenity effects are expected to occur at the dwelling and calculated noise levels are considered reasonable.

The proposal is expected to increase line-of-sight to the boatyard for two receivers, 10 and 12 Kennedy Street. However, no change in loudness during the daytime period is calculated for these receivers.

During periods of high use of the boat ramp (e.g. summer holidays), early morning revving of ute engines during boat launching are calculated to comply with the prescribed night-time noise limit.

Overall, noise and vibration effects of the project are considered reasonable in terms of the Resource Management Act. It is recommended that noise and vibration management be used to ensure that airborne and underwater effects are managed and mitigated as far as practicable. Noise and vibration management procedures can be detailed in a Construction Noise and Vibration Management Plan.

APPENDIX A GLOSSARY OF TERMINOLOGY

Term	Description
dB	A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
$L_{Aeq(t)}$	The A-weighted time averaged sound level (on a logarithmic/energy basis) over the measurement period. 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_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{peak}	The peak instantaneous pressure level recorded during the measurement period (normally not A-weighted).
SEL or L_{AE}	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
Noise	A sound that is unwanted by, or distracting to, the receiver.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of Environmental Sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
NZS 6803P:1984	New Zealand Standard NZS 6803P:1984 *"The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work"*
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 *"Acoustics - Construction Noise"*
Ambient Noise	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
Vibration	When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity. Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).
PPF	Protected premises and facilities
PPV	Peak Particle Velocity For Peak Particle Velocity (PPV) is the measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.

APPENDIX B – MAP OF RECEIVERS AND MEASUREMENT POSITIONS

APPENDIX C – PERFORMANCE STANDARDS

7.8 INDUSTRIAL ZONE

7.8.5.1.6 NOISE

(a) All activities within the zone shall be conducted so that noise measured at any point within any other site in the zone shall not exceed:

0700 to 2200 hours 65 dBA L_{10}

2200 to 0700 hours 55 dBA L_{10} and

80 dBA L_{max}

(b) All activities within the zone shall be conducted so as to ensure that noise measured at any point within any site in the Residential, Coastal Residential or Russell Township Zone or at and within the notional boundary of any other dwelling in any other rural or coastal zone shall not exceed:

0700 to 2200 hours 55 dBA L_{10}

2200 to 0700 hours 45 dBA L_{10} and

70 dBA L_{max}

Noise Measurement and Assessment:

Sound levels shall be measured in accordance with *NZS 6801:1991 "Measurement of Sound"* and assessed in accordance with *NZS 6802:1991" Assessment of Environmental Sound"*.

The notional boundary is defined in *NZS 6802:1991 "Assessment of Environmental Sound"* as a line 20m from any part of any dwelling, or the legal boundary where this is closer to the dwelling

Construction Noise:

Construction noise shall meet the limits recommended in, and shall be measured and assessed in accordance with, *NZS 6803P:1984 "The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work"*.

MARITIME EXEMPTION AREA

Means an area identified on the Plan maps exempt from the setback provisions to enable development that is functionally related to the coastal marine area. Maritime Exemption Areas are provided along parts of the coastal marine area where riparian margins are not required.

7.7 COMMERCIAL ZONE

7.7.5.1.8 NOISE

(a) All activities within the zone shall be conducted so that noise measured at any point within any other site in the zone shall not exceed:

0700 to 2200 hours 65 dBA L_{10}

2200 to 0700 hours 55 dBA L_{10} and

80 dBA L_{max}