MARSHALL DAY Acoustics

BAYSWATER MARITIME PRECINCT
ACOUSTIC ASSESSMENT

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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: **BAYSWATER MARITIME PRECINCT DEVELOPMENT – Acoustic Assessment**

Prepared for: **Bayswater Marina Holdings Limited**
c/- Apache Management

Auckland

Attention: **Brady Nixon**

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1.0 INTRODUCTION

Marshall Day Acoustics ('MDA') has been engaged by Bayswater Marina Holdings Limited to provide an assessment of acoustic effects for the proposed development of the Bayswater Maritime Precinct located on Sir Peter Blake Parade in Bayswater, Auckland.

The proposal is to develop the marina area to allow mixed use activities including residential living as well as commercial and marine based activities. MDA has been requested to review the proposed development and provide recommendations, where necessary, to ensure that the amenity values of the dwellings are protected to a reasonable level from noise sources associated with the marina.

The key matters addressed in this report are as follows:

- Airborne noise from the construction works
- Underwater construction noise from the proposed piling activities
- Operational noise from the proposed permitted activities within the development

A glossary of acoustic terminology used throughout this report is included in Appendix A.

2.0 PROJECT AND SITE DESCRIPTION

2.1 Description

It is proposed to prepare a site plan for a combination of marine commercial/retail buildings, 94 lots for terraced housing and 3 lots for small, boutique apartment buildings along the southern peninsular of the Bayswater marina (Figure 1).

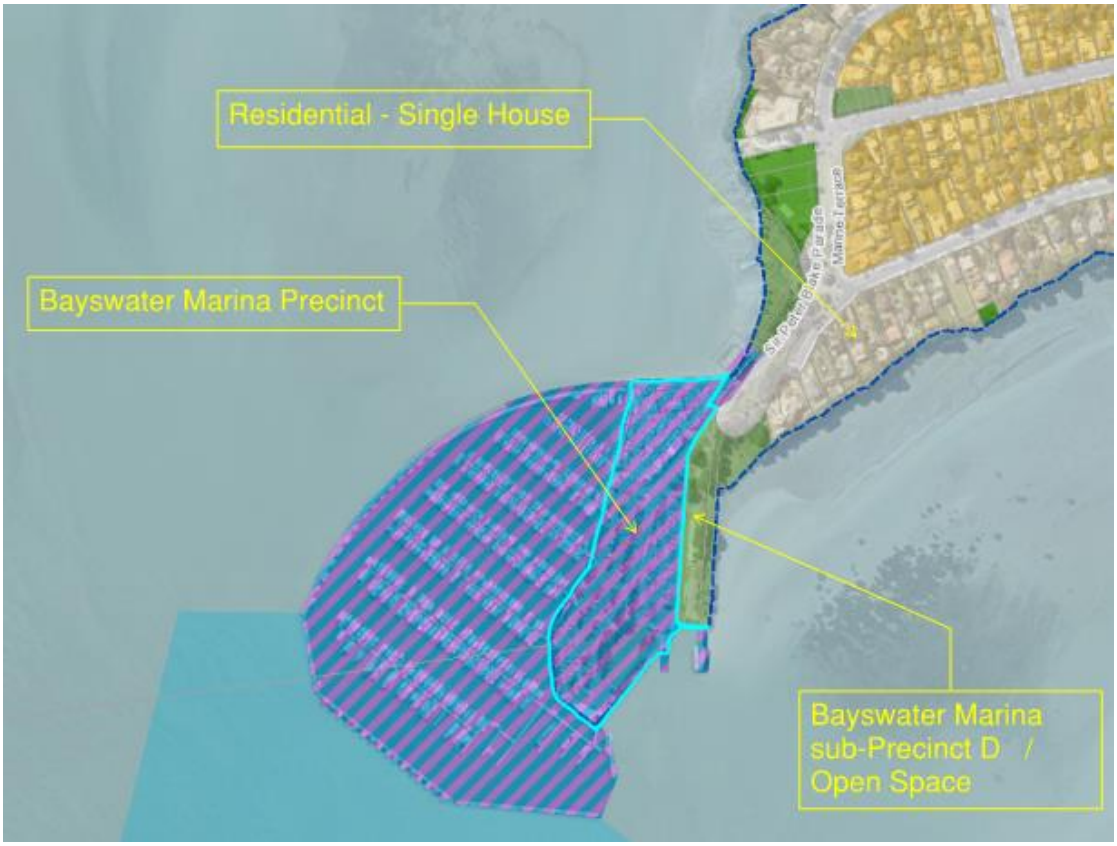
Figure 1: Proposed Bayswater Marina Precinct Design – *courtesy of Boffa Miskell*

The dwellings range from approximately 20 to 50 metres from the marina edge. Noise sources would include boating activities, such as boat engine noise; halyard slap and deck activities, as well as the commercial ferry operation in the south-east corner of the marina.

2.2 Precincts, Zone and Noise Areas

The project site is within the Bayswater Marina Precinct in the Auckland Unitary Plan (I.504). Land based activities are in the Bayswater Marina Sub-Precinct A to D, and some construction activities such as construction of retaining walls and a timber boardwalk will be in the Coastal Marine Area (CMA).

Figure 2: Bayswater Marina Precinct and Auckland Unitary Plan Zoning



2.3 Nearest Receivers

The closest dwellings are located approximately 100 m to the north along Marine Terrace and are zoned as Residential – Single House in the Unitary Plan.

The Bayswater ferry terminal would be located approximately 50 m from the nearest construction activity.

2.4 Existing Ambient Noise Levels

A noise measurement was undertaken of the Fullers ferry leaving the marina (Figure 3). The ferry reversing and changing direction was the loudest section of the ferry journey, measuring 61 dB L_{Aeq} at 40 metres. This level, with a distance correction applied, is predicted to be below the AUP 60 decibel noise limit at the façade of the proposed development.

Figure 3: Noise logger location

3.0 NOISE PERFORMANCE STANDARDS – CONSTRUCTION

3.1 Airborne Construction Noise

Construction activities undertaken within the sub-precincts are subject to AUP Rule E25.6.27 *Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone.* The relevant noise limits for construction works which are longer than 20 weeks in duration are summarised in Table 1.

Construction activities undertaken over water are within the Coastal – General Marine Zone and are also subject to AUP(OP) rule E25.6.27.

Table 1: Construction noise limits at 1m from the façade of an occupied building

Day	Time	$L_{Aeq\ (30min)}$	L_{AFmax}
Monday to Friday	6:30 am – 7:30 am	55	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturday	6:30 am – 7:30 am	45	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 6:30 am	45	70
Sunday and Public Holidays	6:30 am – 7:30 am	45	70
	7:30 am – 6:00 pm	55	80
	6:00 pm – 6:30 am	45	70

3.2 Vibration

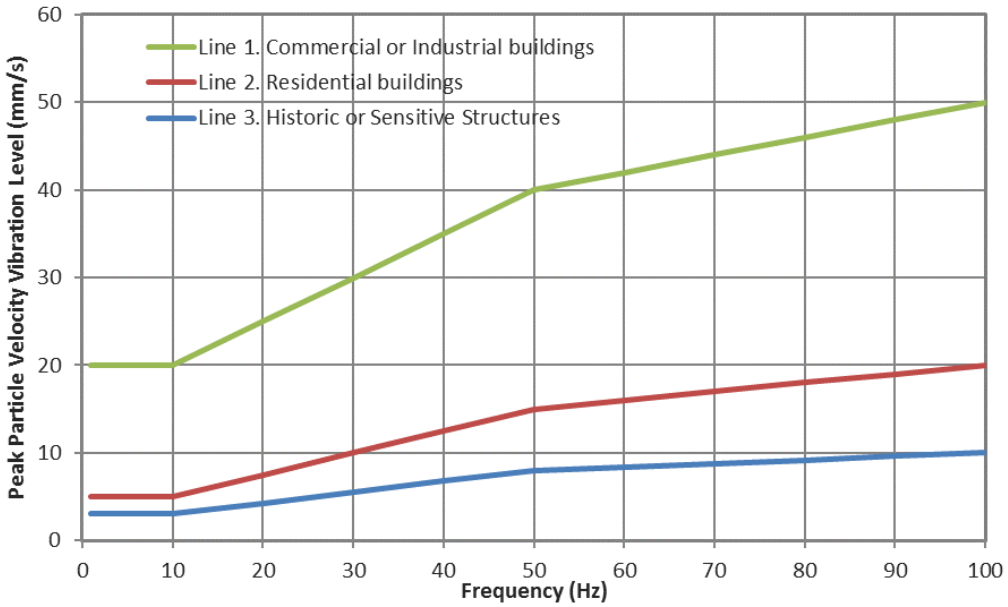
3.2.1 Cosmetic Building Damage

AUP(OP) rule E25.6.30 (1)(a) requires construction vibration to be measured and assessed in accordance with German Standard DIN 4150-3:1999 "Structural vibration – Part 3: Effects of vibration on structures". The short-term (transient)[1] vibration limits in table 2apply at building foundations in any axis. The vibration limits in all other cases are summarised in Table 2.

Table 2: Vibration at horizontal plane of highest floor (DIN 4150-3 1999: Tables 1 and 3)

Structure Type	Peak Particle Velocity Vibration Level (mm/s)	
	Short-term (transient)[1]	Long-term (continuous)[2]
Line 1. Commercial or Industrial buildings	40	10
Line 2. Residential buildings	15	5
Line 3. Historic or Sensitive Structures	8	2.5

Figure 4: Short-term (transient)[1] vibration at building foundations (DIN 4150-3 1999: Figure 1)



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

[1] Short-term (transient) vibration is "*vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated*".

[2] Long-term (continuous) vibration includes types not covered by the short-term vibration definition.

3.2.2 Amenity

AUP(OP) rule E25.6.30 (1)(b) requires construction vibration to comply with the limits in Table 3 in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building. However, where construction vibration from daytime works (7am to 6pm) is predicted to exceed 2mm/s PPV for up to three (3) days, the occupants of all buildings within 50m must be advised of the works at least three (3) days prior to the works commencing and the vibration level must not exceed 5mm/s.

Table 3: Vibration amenity at horizontal plane of floor level of interest (AUP(OP) E25.6.30.1)

Receiver	Peak Particle Velocity Vibration Level (mm/s)	
	0700 - 2200	2200 - 0700
Occupied activity sensitive to noise	2	0.3
Other occupied buildings	2	2

4.0 NOISE PERFORMANCE STANDARDS - OPERATIONS

4.1 External noise criteria

The development is located within the Coastal – Marina Zone. Section E25.6.11 of the Auckland Unitary Plan (Operative in Part) sets out the following noise rules:

E25.6.11 Noise levels in the Coastal – Marina Zone

The noise (rating) level arising from any activity in the Coastal – Marina Zone measured within the boundary of any other site in this zone must not exceed the levels in Table 25.6.7.1…

Table 25.6.7.1 Noise levels in the Coastal – Marina Zone

Time	Coastal – Marina Zone
All times	60 dB L_{Aeq}

4.2 Noise received at the Coastal – Marina Zone interface

Noise received by activities in another zone such as the Residential area to the north of the site are controlled by Rule E25.6.10 which restricts noise emission from any activity within the site within the boundary of a site in a residential zone to:

Table 25.6.20.1 Noise levels at the Coastal – Marina Zone Interface

Time		Noise Limit
Monday to Saturday Sundays	7 am to 10 pm 9 am to 6 pm	55 dB L_{Aeq}
All other times		45 dB L_{Aeq} 60 dB L_{eq} at 63 Hz 55 dB L_{eq} at 125 Hz 75 dB L_{Amax}

4.3 Recommended internal noise criteria

The *Coastal – Marina Zone* noise criteria do not consider residential living within the zone. However, the 60 dB limit at all times is comparable to the envisaged noise in urban living areas. In these areas, the residential acoustic amenity is protected with façade noise controls to achieve a maximum internal level within habitable areas. It is recommended that a similar rule be applied to these dwellings:

Noise sensitive spaces must be designed and or/insulated so that the internal noise levels do not exceed the limits in the following table based on the maximum level of noise permitted for the Bayswater Coastal – Marina Zone

Unit affected	Level
Bedrooms and sleeping areas	35 dB L_{Aeq} 45 dB L_{eq} at 63 Hz 40 dB at 125 Hz
Other noise sensitive spaces	40 dB L_{Aeq}

Where a new room is constructed that is subject to the internal acoustic insulation requirement can only be complied with when doors or windows to those rooms are closed, those rooms must, as a minimum be mechanically ventilated to achieve Rule E25.6.10.3 of the Auckland Unitary Plan.

In effect, bedroom and sleeping areas will require a façade with 25 decibel noise reduction and other noise sensitive spaces 20 decibels.

With the application of this internal noise control standard MDA considers:

- That the marina activities would be able to continue in its current state with respect to maintenance and storage of boats without giving rise to significant noise levels during the day.
- That the daytime internal acoustic amenity within habitable spaces would be reasonable with the living space façade noise control. It is noted that there is little activity in the surrounding areas at night and, therefore, the amenity during this time would be excellent for sleeping, even with windows open.

5.0 CONSTRUCTION ASSESSMENT

5.1 Methodology

Table 4 summarises the anticipated demolition and construction methodology based on the preliminary information provided within the Draft Construction Management Plan[3]. Works are proposed to commence after granting of Consent.

It is anticipated that the proposed works would be undertaken within daytime hours, i.e. 7:30am – 6pm Monday – Saturday.

Table 4: Summary of construction methodology

Activity	Duration	Description	Likely Equipment
Demolition of existing infrastructure	x	Demolition of some small buildings and other minor infrastructure, anticipated to require concrete breaking and general excavator works	Excavator mounted concrete breaker, concrete saw, truck movements
Bulk Earthworks & Civil Works	x	Excavation to form sediment pond and then cut to fill. Construction of drainage and utilities services. Construction of pavements	Excavator, trucks
Structural Works		Construction of perimeter retaining walls and boardwalk Construction of foundations for buildings	Large piling rig (70 tonnes) Excavator fitted with auger attachment Crane
Construction of new buildings	x	Construction of foundations for buildings and constructions of buildings	Crane, hand tools, truck deliveries

5.2 Airborne Construction Noise

5.2.1 Predicted Levels

Indicative construction noise levels are presented in Table 5. They are considered representative of the activities proposed; however, in practice, construction noise levels are inherently variable due to factors such as equipment selection, methodology and operator skill and care.

The shaded cells in Table 5 overleaf show where noise levels above the daytime construction noise limit of 70 dB L_{Aeq} are predicted.

5.2.2 Demolition Works

The only receiver in close proximity to the demolition works is the Bayswater Ferry jetty and waiting area. Demolition works would be required around the car park area approaching the jetty but the nearest activities are likely to be more than 50 m from the jetty and waiting area itself.

Noise levels are predicted to exceed the 70 decibel standard for non-mitigated concrete breaking and cutting within 76 m of the ferry waiting area. Compliance can be achieved using temporary acoustic screening for concrete activities occurring within 75 m of the waiting area on the jetty.

[3] Airey Consultants *"12582-01 Construction Management Plan"* August 2020

Table 5: Indicative noise levels at 1m from a building façade

Activity	Equipment	Sound power level (dB L_{wA})	Noise level (dB L_{Aeq}) at distance of			Setback to achieve compliance with 75 dB L_{Aeq}
			10m	20m	50m	
Demolition	Large concrete breaker	115	90	84	75	76 m
	Concrete cutting	115	90	84	75	76 m
	Concrete cutting (with noise barrier*)		80	74	65	30 m
	Small concrete breaker	111	86	80	71	52 m
	Small concrete breaker (with noise barrier*)		76	70	61	20 m
Bulk Excavation	Excavator 20T	103	78	72	63	25 m
	Excavator 20T (with noise barrier*)		68	62	53	<10 m
Piling	Impact piling (with casing and dolly)	114	89	83	74	69 m
	Vibro piling	116	91	85	76	83 m
	Bored/screw/drill rig	111	86	80	71	52 m
General	Concrete truck and pump discharging	103	78	72	63	25 m
	Mobile crane (35t) operating	98	73	67	58	14 m
	Mobile crane (35t) idling	88	63	57	48	<10 m

* Includes mitigation from a 2.4m high noise barrier around the activity area (assuming a 10-decibel reduction in level)

In addition, it is recommended that temporary acoustic screening be erected for access routes/pathways that lead from the jetty to the car park/bus-stop for any concrete breaking works that is located closer than 50 m to these areas.

Demolition works are predicted to readily comply at the nearest residential dwellings.

5.2.3 Bulk Excavation Works

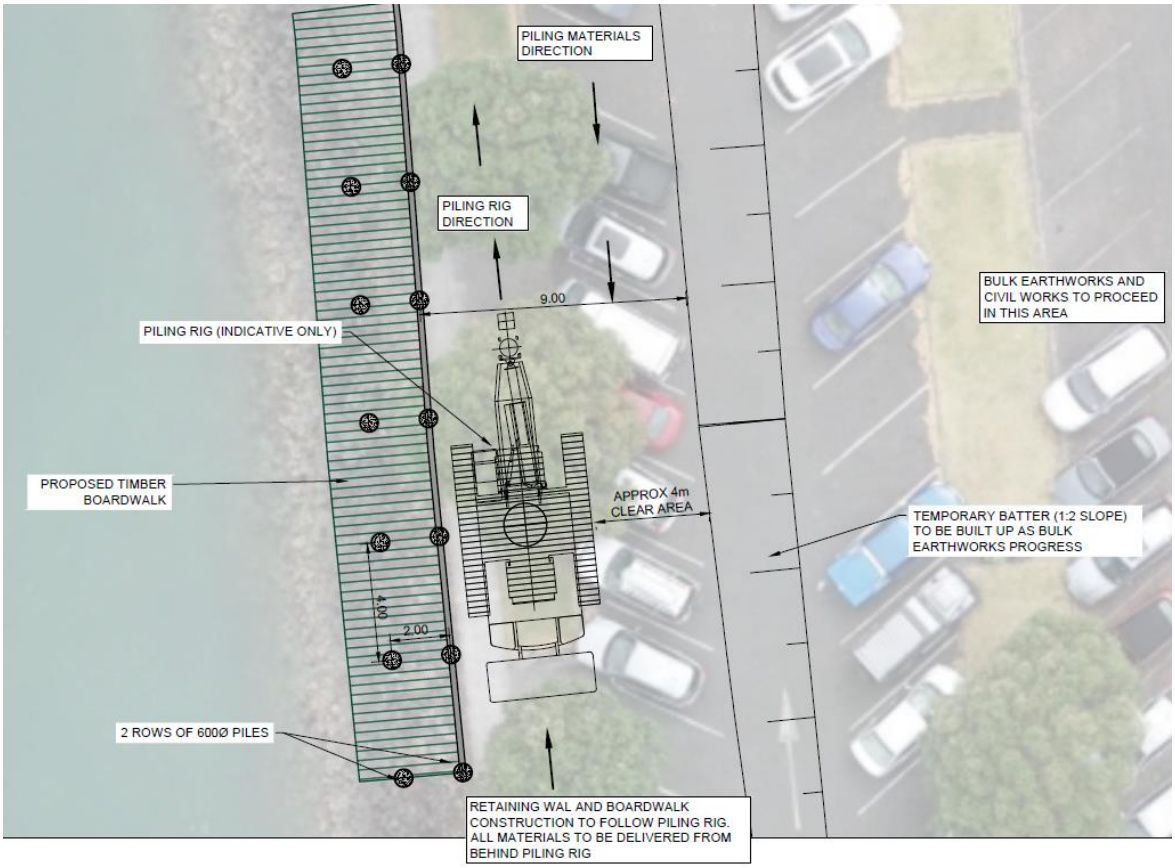
Bulk excavation works are predicted to readily comply at the ferry jetty and residential dwellings.

5.2.4 Structural Works

A new boardwalk will be constructed around the perimeter of most of the site. The boardwalk will be supported on concrete blockwork with the outer reinforced piles founded in the existing bedrock underlying the site.

The foundation will be formed with approximately 300 piles which can be installed at a rate of approximately 6 per day (50 working days or 2.5 months). The outer piles would be located above the water line so underwater noise is not considered to be an issue for this construction activity.

Figure 5: Proposed board walk construction methodology (courtesy of Airey Consultants)



The proposed piling works for the board walk would be approximately 50 m away from the ferry jetty and over 100 m away from the nearest residential dwellings. Using a dolly/hammer cushion is between the impact hammer and pile would ensure that compliance would occur at a distance of 70 m for vibro piling. Temporary acoustic screening could be erected at the ferry waiting area during any piling located closer than 70 m to the waiting area.

With temporary acoustic screening the piling works would comply at the ferry jetty. The pilling activities would readily comply at the residential dwellings.

5.2.5 Building Construction Works

Works associated with the new buildings would utilise standard construction procedures for steel framed structures (i.e. crane operations, concrete pouts, hand tools etc.). These activities are predicted to readily comply with the daytime Project Standard at all nearby receivers.

5.3 Construction Vibration

Table 6 overleaf provides indicative construction vibration levels for vibratory piling and impact piling. These activities have the potential to generate high vibration levels at receivers within short distances.

Vibration levels are predicted to readily comply at all nearest receivers.

Table 6: Indicative distances for piling to comply with vibration limits at building foundations [4]

		Cosmetic Building Damage Setback (m)		
Activity	Amenity Setback (m) AUP(OP)	Heritage & Sensitive Structures	Residential	Commercial
Impact piling	61	36	19	3
Vibro piling	19	15	6	3

5.4 Construction Noise Management Plan (CNMP)

A CNMP should identify practicable noise mitigation measures and ensure effective communication between contractors and neighbours. This should include:

- The performance standards that must, as far as practicable, be complied with
- Predicted noise levels for relevant equipment and/or activities
- Construction noise mitigation and management strategies
- Noise monitoring requirements, with triggers and feedback mechanisms
- Communication, consultation and complaints response procedures

These recommendations should be included in the CNMP, which is recommended as a condition of any consent granted. The draft CNMP must be updated by the consent holder prior to works to reflect any changes in methodology proposed by the contractor and submitted to Auckland Council for certification.

[4] Based on regression analysis of available vibration measurements.

6.0 OPERATIONAL NOISE ASSESSMENT

Operational activities associated with the development that may give rise to an acoustic effect are:

- Mechanical services noise
- Vehicle movements to and from the site
- Café/restaurant activities on the lower floors

Each activity is addressed overleaf.

6.1 Mechanical Services

A mechanical services schedule has not yet been provided. Given the proximity to the nearest sensitive receiver, it is considered that the mechanical plant can be designed to readily comply using standard equipment.

6.2 Vehicle Movements

Stantec has undertaken a Transportation Assessment for the proposed Precinct[5]. Their calculations show that the vehicle movements accessing the new development would only increase total traffic volume by 6% at peak. This would give rise to a less than 1 decibel increase in noise generated by traffic and would not be perceptible.

There would be no acoustic impact due to increased vehicle movements associated with the Bayswater Maritime Precinct.

6.3 Cafés and commercial activities

Cafes with outdoor areas and other commercial activities associated with a marina are proposed on the lower levels at the north and west ends of the development. Given the lenient noise limits and setback distance of more than 100m to the closest adjacent site, noise from these activities is predicted to be readily compliant and comparable to the existing environment.

[5] Stantec *"Bayswater Maritime Precinct – Transportation Assessment"* February 2021

7.0 INTERNAL NOISE ASSESSMENT

The design of buildings and dwellings would be the responsibility of the developer/owner for each lot. Building Consent documentation will be required to be issued for the building design and a façade design would be required to be submitted that can comply with the proposed internal limit.

MDA has undertaken a number of façade design assessments for buildings to meet similar noise performance standards. A façade construction as summarised below would achieve the noise criteria. Other façade designs would also comply with acoustic specialist input and it is recommended that an acoustic report is prepared as part of the Building Consent documentation to demonstrate compliance.

7.1 Bedrooms

Element	Proposed Construction
Roof construction	7mm thick bitumus membrane roofing / 15mm plywood sarking / 75mm thick fibreglass or polyester insulation in ceiling cavity / 1x 13mm high density (12.5kg/m^2) plasterboard on a suspended light steel grid in habitable rooms, or 0.55mm thick Zinc seamed metal tray roofing/ building wrap / 15mm plywood sarking / 75mm thick fibreglass or polyester insulation in ceiling cavity / 1x 13mm high density (12.5kg/m^2) plasterboard on a suspended light steel grid in habitable rooms
External wall	External Precast concrete cladding 125-150mm thickness/ 10mm nominal air gap / 65mm steel stud framing with 65mm fibreglass or polyester insulation / 1 layer of 13 mm high density (Noiseline) plasterboard or External cladding with minimum surface mass 14 kg/m2 with 75mm thick fibreglass or polyester insulation on a minimum 100 mm framing / 1 layer of 13 mm high density (Noiseline) plasterboard
Glazing	6.38mm laminated glass / 10 mm air gap / 6 mm glass

7.2 Other habitable spaces

Element	Proposed Construction
Roof construction	7mm thick bitumus membrane roofing / 15mm plywood sarking / 75mm thick fibreglass or polyester insulation in ceiling cavity / 1x 13mm high density (12.5kg/m^2) plasterboard on a suspended light steel grid in habitable rooms, or 0.55mm thick Zinc seamed metal tray roofing/ building wrap / 15mm plywood sarking / 75mm thick fibreglass or polyester insulation in ceiling cavity / 1x 13mm high density (12.5kg/m^2) plasterboard on a suspended light steel grid in habitable rooms
External wall	External Precast concrete cladding 125-150mm thickness/ 10mm nominal air gap / 65mm steel stud framing with 65mm fibreglass or polyester insulation / 1 layer of 13 mm high density (Noiseline) plasterboard or External cladding with minimum surface mass 14 kg/m2 with 75mm thick fibreglass or polyester insulation on a minimum 100 mm framing / 1 layer of 13 mm standard plasterboard
Glazing	6 mm glass / 12 mm air gap / 6 mm glass

Light commercial businesses will operate on the ground floor generally associated with the marina or café facilities. These activities must comply with the 60 dB noise limit to the apartments located above. As such, the type of activity must be controlled to ensure that the acoustic amenity of the living space above remains reasonable.

8.0 CONDITIONS OF CONSENT

The following conditions are recommended for any consent granted:

1. Construction noise shall comply with the following noise limits unless otherwise provided for in the CNMP (refer condition 2).

Day	Time	$L_{Aeq\ (30min)}$	L_{AFmax}
Monday to Friday	6:30 am – 7:30 am	55	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturday	6:30 am – 7:30 am	45	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 7:30 am	45	70
Sunday and Public Holidays	7:30 am – 6:00 pm	55	80
	6:00 pm – 6:30 am	45	70

2. The consent holder shall prepare a Construction Noise Management Plan (CNVMP).

   The objectives of the CNMP are:

   a) Identify and adopt the Best Practicable Option (BPO) for the management of construction noise;

   b) Define the procedures to be followed when construction activities cannot meet the noise standards in Condition 1;

   c) Inform the duration, frequency and timing of works to manage disruption;

   d) Require engagement with affected receivers and timely management of complaints,

3. The noise (rating) level arising from any activity in the Coastal – Marina Zone measured within the boundary of any other site in this zone must not exceed:

Time	Coastal – Marina Zone
All times	60 dB L_{Aeq}

4. The noise (rating) level arising from any activity in the Coastal – Marina Zone measured within the boundary of any site in a residential zone must not exceed:

Time		Noise Limit
Monday to Saturday Sundays	7 am to 10 pm 9 am to 6 pm	55 dB L_{Aeq}
All other times		45 dB L_{Aeq} 60 dB L_{eq} at 63 Hz 55 dB L_{eq} at 125 Hz 75 dB L_{Amax}

5. Noise sensitive spaces must be designed and or/insulated so that the internal noise levels do not exceed the limits in the following table based on the maximum level of noise permitted for the Bayswater Coastal – Marina Zone

Unit affected	Level
Bedrooms and sleeping areas	35 dB L_{Aeq} 45 dB L_{eq} at 63 Hz 40 dB at 125 Hz
Other noise sensitive spaces	40 dB L_{Aeq}

6. Where a new room is constructed that is subject to the internal acoustic insulation requirement can only be complied with when doors or windows to those rooms are closed, those rooms must, as a minimum be mechanically ventilated to achieve Rule E25.6.10.3 of the Auckland Unitary Plan.

9.0 CONCLUSION

Marshall Day Acoustics has reviewed the proposed Bayswater Marina Precinct development. We consider that, provided the external façades for any noise sensitive activities are designed to reduce external sound to the noise limits given in the AUP, the internal acoustic amenity in habitable areas would be reasonable during the daytime and excellent at night.

MDA consider that the existing marina activities adjacent to the development could continue whilst still meeting the noise performance standards for the zone. Furthermore, any buildings constructed that include noise sensitive spaces would be designed to achieve a reasonable acoustic amenity within the sensitive areas. This would ensure that all activities within the marina would be suitably protected from noise and, therefore, reverse sensitivity would be suitably managed.

In conclusion MDA consider that the proposed noise performance standards would enable the acoustic effects of the existing activities at the proposed development to be reasonable and the acoustic amenity within any proposed dwellings to be acceptable. The proposed Noise Conditions would ensure that any acoustic effect would be less than minor and that the risk of any reverse sensitivity effects would be minimised.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
dB	Decibel (dB) is the unit of sound level. Expressed as a logarithmic ratio of sound pressure (P) relative to a reference pressure (Pr), where dB = 20 x log(P/Pr). The convention is a reference pressure of Pr = 20 μPa in air.
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) to more closely approximate the frequency bias of the human ear. A-weighting is used in airborne acoustics.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level commonly referred to as the average level. The suffix (t) represents the period, 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.
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 "Acoustics - Construction Noise"
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 vertical (up and down vibration), horizontal transverse (side to side) and horizontal longitudinal direction (front to back) components.