Noise Management Plan

Demolition of Hanson's Blackwattle Bay Concrete Batching Plant

18 October 2018

Project No: 0475529

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Noise Management Plan

Demolition of Hanson's Blackwattle Bay Concrete Batching Plant

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1. INTRODUCTION

ERM Australia Pacific Pty Ltd (ERM) has been commissioned by Hanson Construction Materials (Hanson) to prepare a Noise & Vibration Management Plan (NVMP) for the demolition of their Blackwattle Bay concrete batching plant at 1/1A Bridge Road, Glebe.

The NVMP provides a framework for the management of potential noise impacts associated with the proposed construction processes, as a sub-plan to the Demolition Management Plan for the project.

1.1 Background

A Statement of Environmental Effects (SEE) was submitted to the NSW Department of Planning and Environment, which refers to a Demolition Management Plan (DMP) and includes a brief summary of the potential environmental impacts that may arise during the demolition process.

The Site is owned by Roads and Maritime Service (RMS) and Hanson currently operate a concrete batching plant located on a wharf deck structure over the bed of Blackwattle Bay. The term of the lease agreement for the use of the site as a concrete batching plant is coming to an end. Accordingly, Hanson is required to carry out works required to make good the site for vacant possession.

As part of the Bays Precinct Urban Transformation Program the NSW Government seeks to rejuvenate the Sydney Fish Market, creating a world-class Bays Market District connected to the water. The Bays Market District is identified as an immediate priority and is subject to imminent master planning. The existing Hanson concrete batching plant at Blackwattle Bay is located within the Bays Market Precinct and needs to be removed to make way for the Bays Market District.

A statement of Environmental Effects (SEE) was submitted to the NSW Department of Planning and Environment, which refers to a Demolition Management Plan (DMP) and includes a brief summary of the potential environmental impacts that may arise during the demolition process

A Development Application (DA) was submitted by Hanson for decommissioning and demolishing of the Concrete Batching Plant at 1/1A Bridge Road, Glebe. This includes the following:

- Demolition of all the buildings and structures associated with the plant which are fixed to, on or suspended above the existing wharf deck structure (the wharf deck structure will remain).
- Works to the site to make it good and safe, including the removal of hazardous materials and potentially contaminating residual concrete batching plant materials from the wharf deck structure (if necessary).

1.2 Objectives and purpose

The objectives of the Noise Management Plan are:

- Quantify the existing noise environment and establish noise and vibration management levels.
- Predict potential noise and vibration impacts associated with the demolition of the batch plant
- Provide a management framework and mitigation measures to minimise impacts where possible.
- To ensure workers are aware of noise and vibration generating activities and any required control methods to minimise impacts

This plan applies to all activities and personnel, contractors and visitors at the site during the demolition.

2. PROJECT SETTING

2.1 Location and sensitive receptors

The location of the site is shown in Figure 2.1, adjacent to the Blackwattle Bay marina. The site is bordered by a number of different land uses, with some sensitive receptors nearby. The nearest of these are the Sydney Fish Markets, The Boathouse restaurant and Sydney Secondary College, as shown in Figure 2.1.

Figure 2.1: ***Site boundary, nearby sensitive receptors and logging locations***

3. PROJECT WORKS

This section provides a brief overview of demolition works, with potential to generate noise emissions.

3.1 Overview

The main construction works associated with the project consist of the following.

- Establishment of site office facilities including construction of environmental controls such as hay bales and diversion drains.
- All structures and materials however fixed to, on or suspended above the wharf deck structure will be demolished and removed. The building and structures to be demolished consist of the following:
  - Office, switch room and amenities building;
  - Aggregate bin and conveyors;
  - Quarry depot building;
  - Overhead bins and silos;
  - Batch room;
  - Washout pits;
  - Acid and admixture storage areas; and
  - Ground bins.

3.2 Key activities

Brief descriptions of the proposed works are provided in the following sections, these are indicative and may be modified by the selected demolition contractor.

3.2.1 Site establishment

Site sheds will be established on west elevation and to the left of site entrance on terra firma. All inductions, training and risk assessments will be conducted during this first week on site. All services to the site shall be disconnected by prior to commencement of demolition. Power for the contractor's works will be utilised from a generator and water will be tapped via a temporary connection.

3.2.2 Office, switch room, amenities removal

Hazardous materials that have been identified in the Environmental Site & Hazardous Materials Assessment provided will be removed by qualified and trained asbestos removal personnel, all offices, amenities and weighbridges etc. will be soft stripped of loose furnishings prior to mechanical demolition.

3.2.3 Aggregate bin and conveyer removal

Demolition personnel working from elevated working platforms will prepare conveyor C1 & C2 for dual mobile crane lift. Documentation such as lift studies and structural engineering certificates of approval will be provided with every crane lift performed during the works. Once the structure has been lowered to ground level it will then be processed by a hydraulic excavator with shear attachment. The combined offices, amenities and switch room will also be mechanically demolished with the hydraulic excavator. All waste materials will be sourced separated to ensure waste minimisation and maximum recycling is achieved.

3.2.4 Hoarding and protective scaffolding

Concurrently to the above tasks, subcontractors will be utilised to tiger tail power lines on Bridge Road, erect a gantry hoarding and erect protective scaffolding including mesh to the south elevation, east and west returns of the concrete aggregate storage bin structure.

3.2.5 Quarry depot demolition

A mobile crane will be situated on the west of the structure to assists in the dismantling of the steel roof structure. The roof structure will initially be prepared for lifting by demolition personnel working from EWP's and within the structure subject to further on site investigation.

A long reach excavator and hydraulic excavator with pulveriser attachments will work in tandem to demolish the structure. The long reach will be utilised for the safe demolition of the southern wall, working from a rubble mound created by the excavator. This will ensure maximum safety and control during demolition. As the demolition progresses scaffolding will be removed level by level until the precast section of wall has been reached.

This section of wall along with scaffolding protection and hoarding will be utilised as an environmental barrier while an excavator with concrete cracker attachment demolishes the remainder of the aggregate bin storage structure. Another excavator will assist in processing the concrete, removing the reinforcement and loading trucks as demolition progresses.

3.2.6 Overhead bins, silos, batch room and washout pits

Depending on the loading limitations on the wharf it may be necessary to utilise a crane mounted barge to demolish the batching plant tanks, silos and associated infrastructure. Demolition personnel working from EWP's will carry out preparation works to the structures including the C1 conveyor. The batching plant infrastructure will be rigged, cut, lifted and lowered to ground level in pre-engineered lift sections and transferred to the processing area for downsizing and load out.

3.2.7 Acid storage, admixture storage, ground bins, slump stands

The last phase of the works involves the demolition of the Acid Storage, Admixture Storage, Fine Sand & Man Sand Ground Bins, Slump Stands, bund walls, ramps, pits, plinths and any remaining structures down to slab level, this will be carried out by a hydraulic excavator with hammer & pulveriser attachment.

3.3 Plant and equipment

Demolition plant and equipment are listed below. Noise and vibration impacts will result from a

- Concrete Saw
- Crane
- Elevated Working Platform
- Excavator
- Excavator w/ concrete cracker
- Excavator
- Excavator w/ pulveriser
- Jackhammer
- Long Reach Excavator
- Mobile Crane

- Trucks

3.4 Hours of operation

Demolition hours including the removal of materials from the site, will only be carried out between the following hours:

- Between 7:00am and 6:00pm Monday to Friday
- Between 7:30am and 3:30pm Saturdays

No work is permitted on Sunday or Public Holidays.

4. EXISTING ENVIRONMENT

4.1 Noise Sensitive Land uses

The nearest residential sensitive receivers are located to the South and North West of the site. The closest residence is located approximately 40 metres south of the entrance to the batch plant. To the North West, Sydney Secondary College (Blackwattle Bay) is approximately 100 metres away from the boundary of the batch plant. The nearest potentially impacted receivers are presented in Table 4.1 and Figure 2.1

Table 4.1: *Noise Sensitive Receivers, MGA Zone 56*

Location ID	Address	Suburb	Easting (m)	Northing (m)	Separation Distance (m)	Receiver Type
R1	109 Ferry Road	Glebe NSW 2037	332381	6250358	180	Residential
R2	103 Ferry Road	Glebe NSW 2037	332359	6250327	185	Residential
R3	Sydney Secondary College – Blackwattle Bay Campus	Glebe NSW 2037	332430	6250288	105	School
R4	4 Bridge Road	Glebe NSW 2037	332544	6250113	30	Residential
R5	84-86 Wentworth Park Road	Glebe NSW 2037	332602	6250131	40	Residential
R6	78 Wentworth Park Road	Glebe NSW 2037	332683	6250061	150	Residential
R7	6-10 Wattle Street	Pyrmont NSW 2009	332868	6250327	200	Residential
R8	2-26 Wattle Crescent	Pyrmont NSW 2009	332893	6250297	235	Residential
R9	10A Wattle Street	Glebe NSW 2037	332899	6250277	240	Residential

4.2 Existing Acoustic Environment

The existing acoustic environment was characterised by short term (attended) noise monitoring and a review of historical data for the broader project area. The nearest residential areas are apartment buildings located on Wattle Street and Bridge Road, just south of the batch plant. During attended noise monitoring the primary influence on ambient noise profiles included continuous traffic on Wattle Street and Bridge Road, distant traffic from the Western Distributer (Anzac Bridge), operational noise from the batch plant and intermittent aeroplane and light rail noise.

4.2.1 Monitoring Methodology

Attended noise monitoring was undertaken in the area surrounding the batch plant in the suburbs of Glebe and Pyrmont on 2nd October 2018. Attended measurements was carried out at the four locations shown in Figure 2.1 and detailed in Table 4.2**.**

The sound level meter used was an NTi XL2. Measurements were undertaken over 15 minute intervals with consideration to AS1055:1997 Description and Measurement of Environmental Noise. Field calibration was checked before and after each measurement occasion with no significant drift (±0.5 dB) observed.

Table 4.2: *Noise Monitoring Locations, MGA Zone 56*

Location ID	Address	Suburb	Easting (m)	Northing (m)
L1	Taylor Street Glebe (Sydney Secondary College – Blackwattle Bay)	Glebe NSW 2037	332430	6250288
L2	84 Wentworth Park Road	Glebe NSW 2037	332602	6250131
L3	78 Wentworth Park Road	Glebe NSW 2037	332684	6250061
L4	6-10 Wattle Street	Pyrmont NSW 2009	332868	6250327

4.2.2 Monitoring Results

Attended monitoring indicated the noise environment at all the monitoring locations were primarily influenced by traffic noise and operational noise from the batch plant. Background noise levels were observed to range from 59 to 61 dB(A). A summary of the attended noise measurements is shown in **Table 4.3** below.

Table 4.3: *Short Term Attended Noise Monitoring Results*

Date and Time	Location	Measured Noise Level dB(A)				Comments
		LA1	LA10	LA90	LAeq	
02/10/2018 14:14	L1	66	62	59	61	Batch plant hum – 58-60 dB(A), plane pass by – 60-62 dB(A), batch plant announcement tone – 72 dB(A), Anzac Bridge road noise – 55 dB(A), scooter pass by (on gravel) – 70-74 dB(A), batch plant hum and white noise reversing bleeper – 60-64 dB(A).
02/10/2018 13:50	L2	76	71	61	68	Batch plant load dump – 75 dB(A), batch plant general noise – 60-70dB(A), light rail pass by – 55 dB(A), constant traffic road 60-70dB(A), truck pass by – 75 dB(A), batch plant hum 58-60 dB(A), motorbike pass by – 79 dB(A).
02/10/2018 14:37	L3	76	73	59	69	Traffic (constant) – 68-74 dB(A), truck pass by – 78 dB(A), batch plant hum and trees rustling – 58 dB(A), light rail pass by – 60-64 dB(A), birds 68 dB(A).
02/10/2018 15:00	L4	78	73	61	69	Distant traffic (constant) – 60-66 dB(A), birds – 58 dB(A), traffic pass by (constant) – 65-75 dB(A), traffic idling – 60 dB(A), truck brakes – 77 dB(A), motorbike pass by – 84dB(A).

4.2.3 Historical Noise Monitoring in Project Area

Historical noise monitoring data from the project area is presented in Table 4.4.

Table 4.4: Historical noise logging data (2010)

Location	Time Period	$L_{Aeq, period}$ Level, dBA	Rating Background Level, dBA
Bulwarra Road (east of receivers R7-R9)	Daytime (7.00am-6.00pm)	62	59
	Evening (6.00pm-10.00pm)	60	55

	Night time (10.00pm-7.00am)	58	49
Griffin Place (receivers R1, R2)	Daytime (7.00am-6.00pm)	57	52
	Evening (6.00pm-10.00pm)	56	59
	Night time (10.00pm-7.00am)	53	48

Source: Sydney Fish market Redevelopment Noise Assessment Wilkinson Murray 2010

4.3 Recommended Background Noise Levels (RBL)

As historical long term logging data indicated lower background noise levels than the short term attended noise monitoring it is recommended that a conservative approach is adopted in applying the background noise level.

In the case of receivers to the north west (R1-R3) previous monitoring (Wilkinson Murray, 2010) indicated background noise levels of 52 dB(A), and as such this RBL has been adopted for receivers North West of the site.

At receivers directly to the south (R4-R6) and East (R7 – R9) noise levels were influenced by current batch plant operations and road traffic noise. Without a directly comparable previous long term noise monitoring record it is recommended that the adopted RBL at these receivers considers *Australian Standard AS1055.2:1997 Acoustics – Description and Measurement of Environmental Noise*.

The standard provides estimated background levels dependant on the time of day and activities that take place within an area. The area surrounding Blackwattle Bay is most closely aligned to by noise area category R4 as 'Areas with dense transportation or with some commerce or industry'. The recommended background noise level of 55 dB($L_{A90,T}$) for the Monday to Saturday period of 0700-1800 will be adopted as an RBL for locations L2-L4.

A summary of the adopted project RBLs is provided in Table 4.5 below

Table 4.5. *Summary of Adopted RBLs*

Location	Adopted RBL	Relevant Receivers
L1	52	R1-R2
L2	55	R4-R5
L3	55	R6
L4	55	R7-R9

5. CRITERIA

5.1 Construction Noise

The Interim Construction Noise Guideline (ICNG) (DECCW, 2009) provides noise management levels for the control of noise from construction. In general, these criteria state that the construction noise should not exceed the background noise level by more than 10 dB during standard hours, and by more than 5 dB outside of standard hours. The criteria for residential receivers are reproduced in Table 5.1.

Table 5.1. *Construction Noise Targets at Residences using Quantitative Assessment*

Time of Day	Management Level LAeq,15min	How to Apply
Recommended Standard Hours: Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. ■ Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ■ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ■ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dBA	■ A strong justification would typically be required for works outside the recommended standard hours. ■ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ■ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Source: ICNG (**DECCW, 2009**).

The proposed construction activity would be limited to normal construction hours during the day and as such a noise goal of RBL + 10dB(A) would apply at residential receivers.

Sensitive receivers also include commercial receivers and a school. As the closest receivers are residential, management of noise impacts at the nearest residential receivers will ensure noise impacts are managed for other receivers.

Noise Criteria (L_{Aeq} 15 minute) for other landuses are applied as follows in the ICNG (DECCW, 2009):

- School classrooms – 45 dB(A) internal noise level
- Places of worship – 45 dB(A) internal noise level
- Active recreation areas – 65 dB(A) external noise level
- Commercial premises – 70 dB(A) external noise level

The project specific construction noise management levels for sensitive receivers are presented in Table 5.2. These levels are based on the background noise levels described in Section 4.

As demolition will be limited to normal day time construction hours, sleep disturbance impacts are not anticipated.

Table 5.2. *Construction Noise Criteria dB(A)*

Location	R1-R2	R3 (school)	R4	R5-R9
Background Noise Level dB(A) LAeq, 15 minute	52	52	55	55
Construction Noise Management Level dB(A) LAeq, 15 minute	62	45 (internal noise level) 55 (equivalent external)	65	65

Notes: 1. Construction noise criteria calculated as Leq,15min = RBL+ 10 dB for day and Leq,15min = RBL + 5 dB for evening and night.

2. Standard hours: Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm.

To meet the internal noise level of 45 dB(A) an external noise level of 55 dB(A) has been adopted, based on a 10dB noise transmission loss assuming windows are partially open.

5.2 Construction Vibration

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

5.2.1 Human Comfort

The EPA administered guideline entitled *Assessing Vibration: A Technical Guideline* (DEC 2004) provides acceptable values for continuous and impulsive vibration in the range 1-80Hz.

Where vibration is intermittent, such as for construction sources, a vibration dose is calculated and acceptable values are shown in Table 5.3 For continuous and impulsive vibration, the guideline levels are presented in Table 5.4.

Table 5.3. ***Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)***

Location	Daytime[1] Preferred Value	Daytime[1] Maximum Value	Night time[1] Preferred Value	Night time[1] Maximum Value
Critical areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1. Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.

Table 5.4. ***Preferred and Maximum Peak Particle Velocity (PPV) Values for Continuous and Impulsive Vibration (mm/s)***

Location		Maximum Value	Preferred Value
Continuous Vibration			
Critical areas [2]	Day or night time	0.14	0.28
Residences	Daytime	0.28	0.56
Offices, schools, educational institutions and places of worship	Night time	0.20	0.40
Workshops	Day or night time	0.56	1.1
Impulsive Vibration			
Critical areas [2]	Day or night time	0.14	0.28
Residences	Daytime	8.6	17.0
Offices, schools, educational institutions and places of worship	Night time	2.8	5.6
Workshops	Day or night time	18.0	36.0

Notes: 1. Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.

5.2.2 Building Damage

German Standard *DIN 4150-3-1999 "Structural Vibration – Part 3 Effects of vibration on structures"* provides methods for evaluating the effects of vibration on structures.

The recommended limits (guide values) from DIN 4150 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 5.5.

Table 5.5. *Guideline Vibration Values for Short Term Vibration on Structures (mm/s)*

Type of Building	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Commercial and Industrial Building	20	20-40	40-50	40
Dwellings and buildings of similar occupancy or design	5	5-15	15-20	15
Structures that, because of their particular sensitivity to vibration cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3-8	8-10	8

Notes: 1. Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

6. NOISE AND VIBRATION ASSESSMENT

6.1 Noise Assessment

The demolition has been assessed in four stages as per information provided by Hanson.

1. Site Establishment
2. Office, Switch Room and Amenities Removal
3. Aggregate Bin and Conveyor Removal
4. Hoarding and Protective Scaffolding
5. Quarry depot Demolition
6. Overhead Bins, Silos, Batch Room and Washout Pits

It is anticipated that demolition would be limited to standard hours in accordance with the ICNG.

The scenarios assessed are as follows:

1. Site Establishment & Office, Switch Room and Amenities Removal
2. Aggregate Bin and Conveyer Removal & Hoarding and Protective Scaffolding
3. Quarry Depot Demolition
4. Overhead Bins, Silos, Batch Room and Washout Pits

6.1.2 Modelling methodology

Noise modelling has been undertaken using the ISO 9613 *Acoustics – Attenuation of sound during propagation outdoors* (ISO, 1996), as implemented within the CadnaA 4.5 acoustic modelling package. The noise modelling takes into consideration the sound power level of the proposed site operations, activities and equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography, ground effect, meteorological effects and atmospheric absorption.

Sound power levels for plant used in each construction phase have been sourced from the UK DEFRA construction noise database and the British Standard 5228 Code of practice for noise and vibration control on construction and open sites. Levels have also been considered with regard to the Construction Noise Strategy (TfNSW, 2017) and Construction Noise and Vibration Guideline (RMS, 2016).

The indicative numbers of construction equipment for each phase are presented in Table 6.1

Table 6.1. ***Indicative Demolition Fleet***

Phase	Equipment	Sound Power Level dB(A)
Site Establishment & Office, Switch Room Amenities Removal	Excavator	115
	Truck	109
	Concrete Saw	123*
	Jackhammer	118*
Aggregate Bin and Conveyer Removal & Hoarding and Protective Scaffolding	Mobile Crane	110
	Hydraulic Excavator	115
	Elevated Working Platform	95
Quarry Depot Demolition	Mobile Crane	110
	Elevated Working Platform	95
	Long Reach Excavator	115
	Hydraulic Excavator w/ pulveriser	123*
	Excavator	115
	Excavator w/ concrete cracker	123*
	Truck	109
Overhead Bins, Silos, Batch Room and Washout Pits	Crane Mounted Barge	110
	Elevated Working Platform	95
	Excavator	110
	Truck	109
	Concrete Saw	123*
	Jackhammer	118*

*Notes: * 5dB penalty applied as per ICNG*

6.1.3 Modelling Results

Table 6.2 presents the noise modelling predictions during all stages. Modelling has assumed continuous plant operation at full utilisation.

Table 6.2. *Noise Modelling Results*

Receiver	Noise Management Level	SCN 1	SCN 2	SCN 3	SCN 4
R1	62	47	47	53	48
R2	62	48	45	55	54
R3 School	45 (internal noise level) 55 External	**61**	**58**	**65**	**63**
R4	65	**66**	62	65	62
R5	65	**68**	63	**66**	62
R6	65	59	52	60	56
R7	65	51	47	54	48
R8	65	53	48	54	49
R9	65	52	47	54	51

Notes: Noise levels exceeding the NML are shown in **Bold.** Results are indicative of average impacts and may increase or decrease depending on equipment location, orientation and intensity of works.

Noise impacts are expected to result in exceedance of the noise management level at R3 (school) during all scenarios, with greatest impacts up to 10 dB above the NML during Scenario 3, Quarry Depot Demolition. Compared with the background noise levels at this location, demolition noise impacts are expected from 5 – 13 dB(A) above background.

At R4 and R5 directly to the south, demolition works are expected to result in noise impacts up to 3 dB above the noise management level.

Noise management measures are discussed in Section 7.

6.2 Demolition Vibration

Plant used during demolition activities which are anticipated to generate vibration impacts at nearby receivers include a jackhammer and excavators with rockbreaker/hydraulic hammer. Locations within the project area and approximate distances to receivers are shown in *Table 6.3*.

Table 6.3. Location of Vibration Equipment and Distances to Receivers

Item	Approximate Distance to Nearest Receiver
Excavator w/ Rockbreaker Excavator w/ Pulveriser	30
Jackhammer	30

The Construction Noise and Vibration Guideline (Roads and Maritime 2016) provides recommended safe working distances for a range of construction activities. These are presented in Table 6.4 and provide for minimum safe working distances to prevent cosmetic damage and human response, and must be complied with at all times, unless additional assessment or monitoring is completed to determine site specific safe working distances.

As vibration inducing equipment is generally located at suitable offsets from the nearest receivers, it is not anticipated that vibration will be an issue. *Table 6.4* outlines safe working distances for the use of this equipment

No residential buildings are located within the safe working distances for structural damage for key plant.

If a Large (1600kg) hydraulic hammer is used within the safe work distances for sensitive receivers or buildings it is recommended that vibration monitoring trials are undertaken to confirm vibration impacts are satisfactory.

Table 6.4 Recommended safe working distances for vibration intensive plant

Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385)	Human Response (OH&E Vibration Guideline)
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Note: 1. Construction Noise and Vibration Guideline (Roads and Maritime, 2016).

7. NOISE AND VIBRATION MANAGEMENT

Noise and Vibration are to be managed at the Site through a combination of the following:

- Staff awareness
- Application of noise and vibration mitigation measures
- Review of performance

A summary of these measures is provided in the following sections.

7.1 Planning of demolition activities

All demolition activities should be planned with noise and vibration mitigations measures in place appropriate to the nature of the activity and time of day when the activity takes place, considering that early morning and late afternoon, evening and night time periods are more sensitive.

Staff awareness

Employees and contractors will be inducted to the site and informed of noise and vibration management requirements including:

- The need to manage noise and vibration impacts on nearby sensitive receivers and structures.
- An outline of responsibilities for controls including the need for all personnel to maintain an awareness of noise and vibration impacts.
- An overview of controls to be applied.

Hanson will maintain a record of personnel inducted to the Site in accordance with CEMP protocols. For the duration of the process, employees are to maintain awareness of the potential for noise and vibration impacts to occur, such that the appropriate mitigation measures can be applied to the source of interest.

7.2 Control measures

Activity	Potential Impacts	Mitigation Measure
General Operations	All stages	Awareness: Induction of all employees and contractors. Daily toolbox talk with review of potential noise and vibration impacts from demolition activities and management measures implemented.
Demolition of structures and buildings	General Demolition Noise	• Mitigation of specific noise sources using portable temporary screens, on site structures or other items, where possible • Maximising the offset distance between noisy plant items and sensitive receivers. • Orienting equipment away from sensitive receivers • Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including cranes, excavators and trucks • Using lower powered or reduced size equipment where noise benefits are available, where practical • Using spotters, "smart" reversing alarms, or broadband reversing alarms in place of traditional beeper reversing alarms • Operating machinery in a manner which reduces maximum noise level events including shaking excavator bucket, loading trucks • Turning off machinery when not in use
Hauling of materials/Equipment and Plant Delivery	Road Transport Noise	• Ensure haulage contractors are instructed to minimise excessive use of engine brakes, horns when accessing the site. • Access to the site would be via the approved transport route to minimise road transport noise impacts on local roads around the project area.
Jackhammering and Excavator Hydraulic Hammering	Vibration	Where activities using significant sources of vibration (i.e hydraulic hammers and vibratory rollers) occur within close proximity to structures and identified receivers, potential impacts are likely to be increased. In this case, the following mitigation measures are recommended for consideration: • Substitution of methods of high vibration/impact emission to lower vibration/impact methods i.e use smaller machine or lower mode. • Preparation and implementation of a CNVMP to identify detailed assessment methods for high risk works, identify affected receivers, complaints handling and consultation protocols. • Undertaking trial measurements to establish the site specific vibration propagation from high risk activities to establish site specific offset distances required. • Alternatives to high vibration source plant and equipment should be used where reasonable and feasible.

7.2.1 Additional Mitigation Measures

Where exceedances are still expected to occur after standard mitigation measures (Table 6.2) have been applied, the implementation of additional mitigation measures is recommended. These mitigation measures are presented in Table 7.1.

Mitigation measures are based on the predicted exceedances above RBLs and the time of these exceedances.

Table 7.1 *Triggers for Additional Mitigation Measures – Airborne Noise*

Perception	dB(A) above RBL	dB(A) above NML	Additional Mitigation Measures Type [1]	Mitigation Levels [2]
All Hours				
75dBA or greater			N, V	HA
Standard Hours: Mon - Fri (7am – 6pm), Sat (8am – 1pm), Sun/Pub Hol (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly Audible	10 to 20	<10	-	NML
Moderate Intrusive	20 to 30	20 to 30	N/V	NML+10
Highly Intrusive	>30	>20	N/V	NML+20

Notes: Source: *Construction Noise and Vibration* Guideline (RMS, 2016).

V = Verification

N = Notification

Perception = relates to level above RBL

2. NML = Noise Management Level

HA = Highly Affected (> 75 dB(A) - applies to residences only)

The guideline states that these mitigation measures are more applicable to short term construction activities, as these measures may become less effective with increasing durations of works.

Nonetheless, where works are predicted to result in highly noise affected noise levels at residences for extended periods, at receiver mitigation measures may be appropriate, including temporary window and door screens, temporary localized shielding, or permanent mitigation.

These measures should be assessed based on whether they are feasible and reasonable, in consideration to the following factors:

- time of day of the noise increase and exceedence of criteria
- time of use of affected receivers
- how many decibels the noise levels are to increase
- how long the mitigation will provide benefit to the receiver during the project

7.3 Noise Monitoring

The following noise monitoring will be undertaken:

- Periodic noise monitoring at nominated sensitive receiver locations (refer to section 4.1 of this plan) to determine the effectiveness of mitigation measures against predicted impacts
- Where complaints are received, additional noise monitoring may be undertaken at sensitive receivers to determine if the actual construction noise generated exceeds the predicted 'worst case' construction noise levels identified in Section 7.2 of this Plan
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise
- Ongoing spot checks of noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with manufactures specifications

Where actual noise levels are found to exceed the predicted worst case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers.

Details of site activity and equipment usage will be noted during construction noise monitoring.

Acoustic instrumentation employed in the noise monitoring surveys will comply with the requirements of *Australian Standard AS1259.2-1990 Acoustics – Sound Level Meters, Part 2: Integrating – Averaging* and carry appropriate NATA (or manufacturer) calibration certificates.

7.4 Vibration Monitoring

The following vibration monitoring will be undertaken:

- For the protection of buildings, monitoring will be carried out at the commencement of vibratory compaction work within 70 metres of buildings to ensure that safe vibration levels specified in Section 7.8 are not exceeded and to confirm safe working distances
- When vibration intensive activities are required, vibration monitoring will be carried out within the established buffer zones, or where there is considered to be a risk that levels may exceed the relevant structural damage goals
- Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of refining construction methods or techniques to minimise vibrations
- Vibration monitoring may be conducted during construction, where appropriate, at nominated sensitive receiver locations to determine the effectiveness of mitigation strategies

Where vibration is found to exceed safe levels, impacts will be avoided by changing work methods and/or equipment, or through the provision of building protection measures where possible. In the event a complaint relating to property damage is received, an inspection of the property would be undertaken and an interim building condition survey prepared.

Any vibration monitoring will be carried out in accordance with:

- For structural damage vibration – German Standard DIN 4150 and BS 7385: Part 2 – 1993.
- For human exposure to vibration – the evaluation criteria presented in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC 2006).

7.5 Complaints management

Any complaints relating to noise and vibration are to be recorded and addressed promptly. Where relevant, noise monitoring should be undertaken to confirm impacts and the effectiveness of strategies applied within the NVMP should be reviewed.

The following procedure will be followed to manage complaints:

- Details of the Hanson contact number will be displayed and clearly visible from the street.
- A Complaints Register will be set up to record details of individual complaints as they occur. The Register will include:
  - Details of the date and time of the complaint and the staff member who logged the complaint.
  - Details of the incident(s) that led to the complaint, including any observations if available, perceived source of the noise and/or vibration and the location where the impacts were observed.
  - Demolition activities at the time of the complaint.
  - Details of any action taken in relation to the complaint.
  - If no action was taken, any reasons why this was the case.
  - Any proposed follow up including a timeframe.
  - Sign off from the Site manager once action has been taken.
- The Site manager will advise of any additional action or further control measures which may need to be undertaken to prevent the same incident from reoccurring.
- The Site manager will sign off on the relevant complaint in the Register once all action has been taken.

7.6 Roles and responsibilities

This NVMP is to be implemented with the following assignment of responsibility.

Task	Responsibility	Timing
NVMP Implementation	Site Manager	Ongoing
Noise and Vibration Monitoring	Site Manager	Ongoing
Inducting staff on the requirements within the NVMP	Site Manager	As required
Recording and responding to complaints	Site Manager	As required

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