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Maitland Mental Health Rehabilitation Project

Noise and Vibration Impact Assessment

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1 EXECUTIVE SUMMARY

A noise and vibration impact assessment has been prepared on behalf of Health Infrastructure in support of a development without consent application for the new mental health services building to be located at Maitland Hospital Campus at 51 Metford Rd, Metford NSW 2323.

The proposed development consists of 2 storey mental health facility, and is described in Section 2.1 of the report.

The assessment addresses the following noise and vibration impacts, including:

- Operational noise and vibration emissions.
- Construction noise and vibration impacts.

Ambient noise and vibration levels have been measured at the site using EPA recommended methodologies to establish rating background noise levels at residential receivers, and typical noise/ground vibration levels from the local sources identified as potentially impacting the site.

Assessment criteria for noise and vibration impacts have been established based on EPA guidelines, and other standards relevant to the potential impacts identified. The predicted likely impacts have been assessed against those criteria.

Construction noise and vibration assessment criteria has been developed and assessment has been conducted to predict potential impacts.

Based on the outcomes of the assessment, controls and mitigation have been proposed to prevent adverse environmental noise and vibration impacts at the surrounding properties, and to maintain acceptable hospital occupant amenity.

The assessment indicates that the adoption of the recommended controls and mitigation will:

- adequately mitigate impacts at the surrounding receivers from construction and operational noise emissions.
- prevent adverse impacts on occupant amenity from local environmental noise and vibration sources.

2 STANDARD INTRODUCTION AND DECLARATION

2.1 STANDARD INTRODUCTION

This Noise and Vibration Impact Assessment has been prepared by Acoustic Logic on behalf of Health Infrastructure (**HI**) to assess the potential environmental impacts that could arise from infrastructure works at 51 Metford Rd, Metford NSW 2323 (the **site**). The project is seeking approval for a Development Without Consent (REF) application under Part 5 of the EP&A Act.

This report has been prepared to assess noise and vibration impact associated with the proposed Mental Health Rehabilitation (MHR) building. This report accompanies a Review of Environmental Factors (**REF**) for the construction and operation of a new mental health services building within the Maitland Hospital campus, including:

- Site establishment;
- Site preparation including earthworks;
- Construction of internal roads and addition of at-grade car parks;
- Construction of 2 storey mental health facility;
- 20 Medium Secure Forensic beds; 24 Low Secure Forensic beds; 20 rehabilitation and recovery (64 beds total);
- Inground building services works and utility adjustments, including service diversions;
- Building foundation works;
- Tree removal;
- Associated landscaping, and
- Bioretention basin.

Refer to the Review of Environmental Factors prepared by Ethos Urban for a full description of works.

2.2 SITE DESCRIPTION

The site is located at the Maitland Hospital Campus on Metford Road, Maitland, approximately 6.4km from the CBD of Maitland. The project site is located within the development parcel, legally described as Lot 73 DP 1256781, as identified in **Figure 1** below. The site is located to the east of the recently constructed Maitland Hospital.

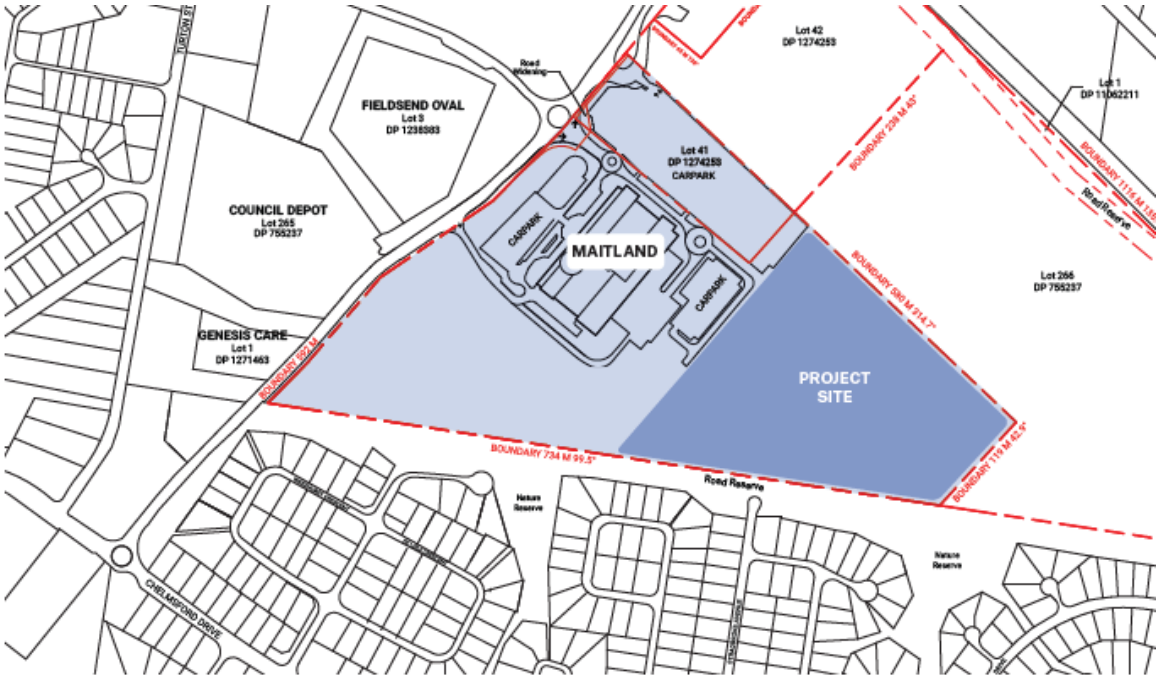


Figure 1 – Project locational diagram (*Source: Bates Smart*)

2.3 STATEMENT OF SIGNIFICANCE

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed development, it is determined that:

- The extent and nature of potential impacts are low, and will not have significant adverse effects on the locality, community and the environment;
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community.

3 CONSULTANT INTRODUCTION

This report has been prepared to assess noise and vibration impacts associated with the proposed development located at Maitland Mental Health Rehabilitation Project.

Impacts assessed include:

- Construction noise and vibration emissions
- Operational noise and vibration emissions

The report has been prepared for the sole purpose of a Development Without Consent (REF) application assessment and should not be used or relied on for any other purpose.

The REF acoustic requirement and relevant content of this report addressing each requirement are summarised in the table below.

Table 1 – Sections in This Report Addressing REF

Item	REF Requirement	Relevant Section of Report
1.0	Assessment prepared in accordance with the relevant NSW Environment Protect Authority (EPA) guidelines.	Section 4.2, Section 7.2
2.0	The assessment must detail construction noise and vibration impacts on nearby sensitive receivers and structures.	Section 8
3.0	The assessment must detail operational noise and vibration impacts on nearby sensitive receivers and structures.	Section 7
4.0	Outline the proposed management and mitigation measures that would be implemented.	Section 7.3, Section 9, Section 10,

4 REFERENCED DOCUMENTS

4.1 BACKGROUND INFORAMTION USED

The assessment is based on the following drawings, reports and other information:

- *SWMHIP New Maitland Hospital Mental Health Architectural drawings* prepared by Bates Smart Architects Pty Ltd.
- *Maitland Mental Health Rehabilitation Project Preliminary Construction Management Plan* (dated 11 October 2024) prepared by Turner & Townsend.
- *Maitland Mental Health Rehabilitation State Significant Infrastructure Report* (300304036, dated 23 May 2024) prepared by Stantec.
- *New Maitland Hospital (NMH) – Construction Noise and Vibration Management Plan* (Ref: 20181544.2/0204B/R2/JM, dated 02/04/2019) prepared by Acoustic Logic.

4.2 GUIDELINES

The following planning instruments and guidelines have been used in the assessment:

- NSW EPA *Noise Policy for Industry* (**NPI**) October 2017.
- NSW EPA *Interim Construction Noise Guideline* (**IGNG**) July 2009.
- Australian Standard *AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites* (**AS2436:2010**).
- BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz).*
- German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.*
- American Society of Heating, Refrigerating and Air-conditioning Engineers (**ASHRAE**) Handbook.

5 SITE DESCRIPTION AND THE PROPOSAL

5.1 DESCRIPTION OF THE PROPOSAL

The project site is located at east of the Maitland Hospital Building, and proposed construction works consists of:

- Construction of a new 2 storey mental health facility,
- Car parking,
- Internal access roads,
- Infrastructure works and services augmentation,
- Landscaping; and
- Tree Removal.

5.2 SENSITIVE RECEIVERS

The following table lists the nearest/potentially most impacted sensitive receivers surrounding the site. An aerial photo of the site indicating nearby noise sensitive receivers and measurement locations is presented in Figure 2.

Table 2 – Sensitive Receivers

Receiver (Refer Figure 2)	Receiver Type	Comment
R1	Residential	Single-storey residential houses along southern boundary of the site
I1	Industrial	Industrial receiver to the southwestern corner of the project site
AR1	Active recreation area	Fieldsend Oval to the west of the project site
H1	Healthcare	Existing New Maitland Hospital building

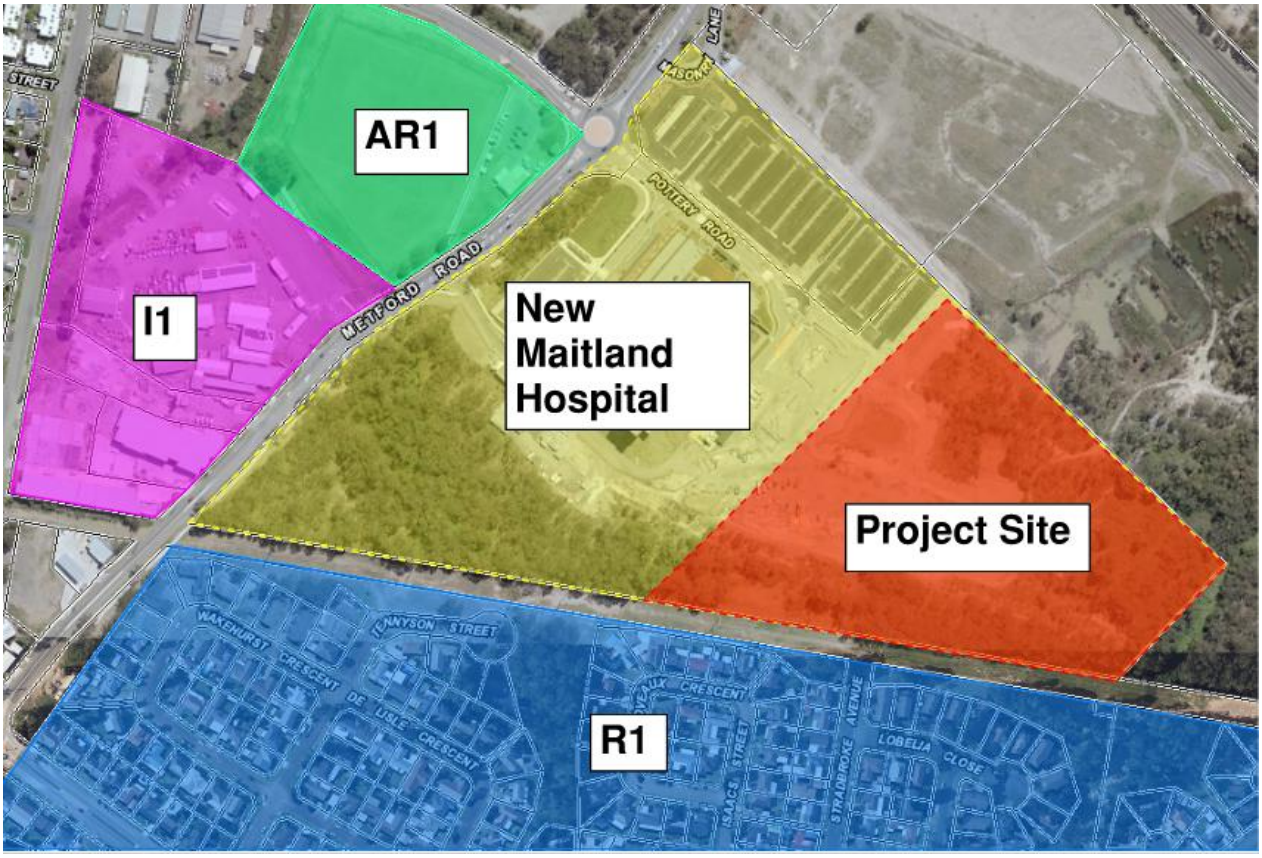


Figure 2 – Project Site Location and Nearby Receivers (*Source: Six Map*)

6 ABBREVIATIONS AND DEFINITIONS

The following Abbreviations and definitions are used in this noise impact assessment.

dB	Decibels - unit for the measurement of sound
dB(A)	A-weighted decibels. Unit of measurement for broadband sound with the A-frequency weighting applied to approximate human loudness perception to sounds of different pitch.
L_{eq}	Energy, time averaged sound level
L_{max}	Maximum sound pressure level, fast response
L_{90}	Sound level exceeded for 90% of the measurement period
R_w	Frequency weighted sound reduction index.
NRC	Average absorption co-efficient for the octave bands with centre frequencies of 250Hz to 2 kHz inclusive.
Day*	The period from 7 am to 6 pm (Monday to Saturday) and 8 am to 6 pm(Sundays and public holidays).
Evening*	Refers to the period from 6 pm to 10 pm.
Night*	The period from 10 pm to 7 am (Monday to Saturday), and 10 pm to 8 am(Sundays and public holidays).
Project Trigger Level	Target noise levels for a particular noise-generating facility.
Assessment Background Level (ABL)	Background noise level representative of a single period.
Rating Background Level (RBL)	The overall, single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. (Calculated in accordance with NPfI unless noted otherwise)

* Unless nominated otherwise.

7 SITE OPERATIONAL NOISE EMISSIONS ASSESSMENT

7.1 OPERATIONAL NOISE AND VIBRATION SOURCES

The following significant noise and vibration sources have been identified as requiring assessment:

- Vehicle movements on site using external car park.
- Sleep disturbance events due to use of car door slam and truck air brake.
- Air conditioning and ventilation plant.

7.2 OPERATIONAL NOISE ASSESSMENT CRITERIA

Criteria to assess noise emissions from the operation of the proposed development have been developed using the NPfI. This policy was primarily developed to assess noise impacts from industrial development, but can also be adapted to assess other types of development such as commercial buildings and air conditioning plant.

For each receiver type:

- Receivers have been grouped into "catchments". These are receivers that have been assessed as having similar characteristics (receiver type and ambient noise level). These are shown in Figure 2 and Table 2.
- For each catchment, representative noise assessment trigger levels have been determined based on NPfI guidelines. The trigger levels have been adopted in this assessment as criteria. These will be used to indicate whether additional mitigation is needed to manage noise emissions.
- For each catchment, noise emissions have been assessed to the most impacted receiver. This means that impacts at all other receivers within that catchment will be less. Compliance at the most impacted receiver will therefore also result in compliance at all other receivers within the catchment.

For residential receivers, three criteria are assessed:

- Intrusive assessment– that is, how audible is the emitted noise compared to ambient, background noise). Criteria are determined relative to the measured rating background noise level.
- Amenity assessment – that is, how loud is the absolute level of industrial noise, including cumulative noise from other industrial sources. The NPfI nominates appropriate amenity noise levels depending on the receiver type and prevailing noise environment/zoning.
- Maximum Noise assessment – will high level, short term noise events cause adversely impact sleep at night? Trigger levels are determined relative to the measured night rating background, and assessed outside rooms where sleep is likely to occur.

For residential receivers, noise emissions are assessed against the trigger levels to determine the likely extent of impacts. The lower of the relevant intrusiveness and amenity trigger levels are adopted. Noise emissions lower than the trigger levels indicate there is no adverse impact. A maximum noise level assessment is separately undertaken if night time emissions occur.

For other receiver types, only an "amenity" assessment is required.

APPENDIX B summarises the results of ambient noise monitoring. APPENDIX C provides the derivation of NPfI trigger levels for each of the receivers. These are summarised in the following table.

Table 3 – Project Specific Trigger Levels

Location/Receiver Type	Time	RBL dB(A) L_{90}	Trigger Noise Level (dB(A) $L_{eq,15min}$)		
			Intrusiveness	Amenity	Max Event
R1 – Residential (Urban)	Day	45	**50**	60	N/A
	Evening	43	**48**	50	N/A
	Night	37	**42**	45	**42** L_{eq} **52** L_{max}
I1 – Industrial	When in use	N/A	N/A	68	N/A
AR1 – Active recreation	When in use	N/A	N/A	53	N/A
H1 – Hospital	Noisiest 1hr	N/A	N/A	35 (internal) 50 (external)	N/A

7.3 OPERATIONAL NOISE EMISSION ASSESSMENT

This section addresses operational noise emission impacts associated with the following:

- Vehicle movements on site using external car park.
- Sleep disturbance events due to use of external car park and truck air break.
- Air conditioning and ventilation plant.

7.3.1 Noise of Vehicle Movements on Site

This section of the report examines the potential noise impacts from staff/passenger vehicles using ground level car park.

7.3.1.1 Acoustic Data

The following noise level data for potential noise source has been used for the assessment. The noise level has been taken from measurements conducted by this office.

Table 4 – Sound Power Levels of Typical Automotive Movements Within the Site

Noise Source	Noise Level, dB(A)	Noise Characteristic	Applied Noise Source
Automobile Manoeuvring @ 10km/h	84 L_{eq} SWL	Quasi-steady	Staff/Passenger Vehicles to Carpark

7.3.1.2 Assessment Assumption

Assessment of the carpark/loading dock noise emissions has been undertaken based on the Traffic Assessment report *Maitland Mental Health Rehabilitation State Significant Infrastructure Report* (300304036, dated 23 May 2024) prepared by Stantec. The site is to have 106 new ground level parking spaces in total. The following assumptions have been made in relation to the traffic movements during each period:

- Daytime and evening period (7am – 10pm): a conservative assumption of 71 automobile movements per hour. (This is to say that 2/3 of the 106 parking spaces are to be occupied in the worst 1-hour period.) This is equivalent to 17 car movements in any 15-minute period.
- Nighttime period (10pm – 7am): a conservative assumption of 35 automobile movements per hour. (This is to say that 1/3 of the 220 parking spaces are to be parked in the worst 1 hour period). This is equivalent to 8 car movements in any 15-minute period.

Sound power level of automobile manoeuvring at 10 km/h as defined in Table 4 will be adopted for the modelling.

7.3.1.3 Prediction Results

Noise emission levels are predicted based on the following procedures:

- Determining noise emission levels for each significant noise source.
- Correcting for any attenuation between the noise source including enclosures, distance, directivity and barrier effects, where present.
- Adding the contribution from multiple noise sources at each receiver to determine the L_{eq} noise level.

Table 5 – Predicted Noise Emission

Receiver	Time Period	Noise Source	Predicted Noise Levels	Noise Emission Criteria	Compliance?
R1	Day & Evening	71 car movements in 1 hour period (17 car movements in 15min period)	35 dB(A)$L_{eq,\ 15min}$	D50 dB(A)$L_{eq,\ 15min}$ E48 dB(A)$L_{eq,\ 15min}$	Yes
I1			27 dB(A)$L_{eq,\ 15min}$	68 dB(A)$L_{eq\ 15min}$	Yes
AR1			25 dB(A)$L_{eq,\ 15min}$	53 dB(A)$L_{eq\ 15min}$	Yes
H1			44 dB(A)$L_{eq,\ 15min}$	50 dB(A)L_{eq} (External)	Yes
R1	Night	35 car movements in 1 hour period (8 car movements in 15min period)	32 dB(A)$L_{eq,\ 15min}$	42 dB(A)$L_{eq\ 15min}$	Yes
I1			24 dB(A)$L_{eq,\ 15min}$	68 dB(A)$L_{eq\ 15min}$	Yes
AR1			22 dB(A)$L_{eq,\ 15min}$	53 dB(A)$L_{eq\ 15min}$	Yes
H1			41 dB(A)$L_{eq,\ 15min}$	50 dB(A)L_{eq} (External)	Yes

7.3.2 Sleep disturbance Events Assessment

This section examines the potential sleep disturbance events caused by the use of ground level car park and loading dock during night time (10pm-7am). The major potential noise source is car door slam in the parking area as well as the truck air break at loading dock.

7.3.2.1 Acoustic Data

The following noise level data for potential noise source has been used for the assessment. The noise level has been taken from measurements conducted by this office.

Table 6 – Sound Power Levels for Sleep Disturbance Event

Noise Source	Noise Level, dB(A)	Noise Characteristic	Applied Noise Source
Car door slam	96 L_{max} SWL	Instantaneous	Passenger Vehicles to Carpark
Truck air brake	114 L_{max} SWL	Instantaneous	Loading dock

7.3.2.2 Prediction Results

Assessment of the sleep disturbance events has been conducted using the sound power levels presented above. Results are presented in the table below:

Table 7 – Sleep Disturbance Events

Receiver	Time Period	Noise Source	Predicted Noise Levels	Noise Emission Criteria	Compliance?
R1	Night	Car Door Slam/Truck air brake	45 dB(A)L_{Fmax}	52 dB(A)L_{Fmax}	Yes

The predictions indicate that night time noise events will not exceed the NPfI maximum noise trigger levels no adverse impact on sleep will occur.

7.3.3 MECHANICAL PLANT NOISE

Detailed plant selection has not been undertaken at this stage, as plant selections have not been determined. Detailed acoustic review should be undertaken at DD stage to determine acoustic treatments to control noise emissions to satisfactory levels. Satisfactory levels will be achievable through appropriate plant selection and location and, if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services plant to the closest residential receiver should comply with the noise emission criteria in Section 7.2.

Indicative mechanical noise emission assessment has been conducted in this section based on preliminary mechanical drawings provided to us.

7.3.3.1 Preliminary Mechanical Treatment Advice

An assessment of initial design of primary plant items is presented below.

- Major fans (typically with a sound power over 80dB(A) – such as major toilet exhaust and major relief air fans) may require acoustic treatment if located externally near sensitive receivers. It is recommended that axial (as opposed to roof mounted fans) are to be used as this will enable acoustic treatment to be incorporated within ductwork running to atmosphere and with attenuators if necessary. In addition to the location of the equipment, acoustic treatments to the major plant items may include silencers, treatment to ducting, time control, operational limitations, and vibration isolation.

- Supply and exhaust fans may be located within plant rooms or in rooftop plant areas. These units typically emit high noise levels and require acoustic treatment such as silencers and internal lined ductwork. Silencer requirements would be determined once fan selections have been completed.

- Other minor plant items, such as bathroom or kitchen exhaust fans, may also be required. These items typically emit relatively low noise levels and may require minimal acoustic treatment of a standard nature, such as internally lining of ductwork.

7.3.3.2 Condenser Units

Two condenser enclosure are proposed on ground level of the project building. See Figure 3 below. Noise emission assessment has been conducted based on proposed unit PURY-M500YNW-A1 (-BS) with sound pressure level of 63.5dB(A) at 1m distance. Noise predictions show that no additional acoustic attenuation methods are required for the proposed condenser unit locations given units are running at standard speed during day and evening period, while running at low noise mode during nighttime between 10pm and 7am.

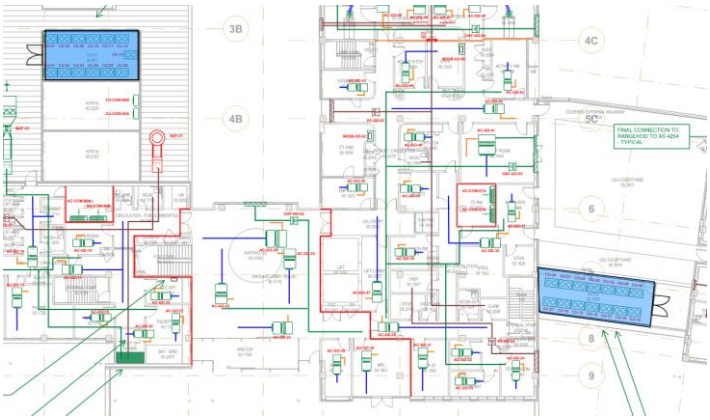


Figure 3 – Proposed Outdoor Condenser Unit Locations

7.3.3.3 Emergency Generators

Emergency generators are proposed to be located on lower ground floor facing southern façade of the proposed development. Refer to layout markup below. The generator will provide power to the site only in the event of mains power loss.

We note that the NSW EPA *Noise Policy for Industry* applies to *industrial noise sources from activities listed in Schedule 1 of the POEO Act and regulated by the EPA.* Section 17 of Schedule 1 of the Protection of the Environment Operations Act (POEO) 1997 states the following:

17 Electricity Generation

(1) This clause applies to the following activities:

***metropolitan electricity works (internal combustion engines**), meaning the generation of electricity by means of electricity plant*

(a) That is based on, or uses, an internal combustion engine, and

(b) That is situated in the metropolitan area or in the local government area of Port Stephens, Maitland, Cessnock, Singleton, Wollondilly or Kiama.

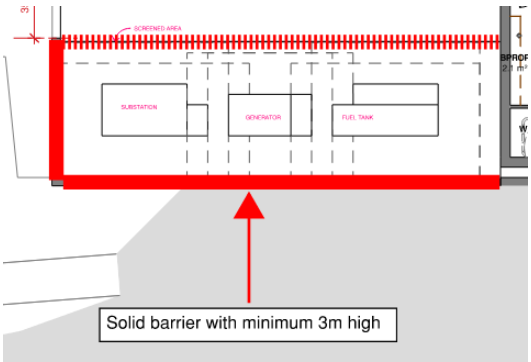
(1A) However, this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year.

Based on the above, noise associated with the use of emergency backup power would be considered to be excluded from the assessment criteria of the NSW EPA *Noise Policy for Industry*. Given the intermittent and generally short duration of any potential power outages within a metropolitan area, it is highly unlikely that the 200-hour threshold would be met for emergency power operation.

Periodic maintenance will be required for the generator, which is likely to include both monthly checks and yearly servicing. As this would be outside of the typical operations for the site (where generators would not be expected to run), it is proposed that this be assessed with reference to amenity levels of the NSW EPA NPI (i.e., 60dB(A) for **R1**). Further, time restrictions may be placed on these activities to ensure that they occur at less noise sensitive times, such as during the day (7am – 6pm).

Noise emission assessment has been conducted for maintenance activity based on provided product TJ1400PE with a sound pressure level of 91dB(A) at 7 m distance. Noise prediction indicates that noise emission to surrounding receiver **R1** will comply with the amenity levels of 60dB(A) given the following acoustic attenuation methods are adopted:

- **Option 1**: build solid acoustic barrier with 3 m height. Refer to mark up below.



- **Option 2**: reselect the generator with a sound pressure level of 85dB(A) at 7m.

8 CONSTRUCTION NOISE AND VIBRATION IMPACT ASSESSMENT

8.1 NOISE MANAGEMENT CRITERIA

Noise emissions associated with construction activities on the project site to external areas of receivers will be assessed in with reference to the following:

- NSW EPA *Interim Construction Noise Guideline* (**IGNG**) July 2009.
- Australian Standard *AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites* (**AS2436:2010**).
- American Society of Heating, Refrigerating and Air-conditioning Engineers (**ASHRAE**) Handbook.

8.1.1 NSW DECC Interim Construction Noise Guideline

Noise associated of construction activities on the site will be assessed in accordance with the NSW *DECC Interim Construction Noise Guideline* (ICNG, 2009).

The "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used. The quantitative assessment method requires: Determination of noise generation goals (based on ambient noise monitoring); Prediction of operational noise levels at nearby development; and if necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

DECC guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.
- "*Highly noise affected level"*. Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

Long term unattended background noise measurements were undertaken by Wood and Grieves, dated 8 May 2018. Additional attended noise measurements were taken by this office in March and May 2022. Refer to APPENDIX B for the results of ambient noise monitoring.

A summary of the recommended noise levels from the ICNG is presented below in Table 8.

Table 8 – Noise Management Levels – Residential Receivers

Location	Period / Time	Background Noise Level dB(A) L_{90}	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
R1 Residential Receiver	Day (7am to 6pm)	45	55	75

Table 9 – Noise Management Levels – Other Receivers

Location	Noise Management Level - dB(A)$L_{eq(15min)}$
Industrial Development	75 (external)*
Active Recreation	65 (external)*
Hospital wards and operating theatres	45 (internally)

*** Noise levels apply at the most affected occupied point of the premises. For other occupancies, noise levels are applied at the most affected point within 50m of the area boundary.**

If noise levels exceed the management levels identified in the tables above, reasonable and feasible noise management techniques will be reviewed.

8.1.2 Australian Standard AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites

Australian Standard AS2436 does not provide specific noise management targets. The guideline focuses on strategies for developing feasible and reasonable mitigation methodologies, management controls and community liaison to reach realistic compromises between the needs of construction activities and potentially affected receivers.

For the control and regulation of noise from construction sites AS2436:2010 *Guide to noise control on construction, maintenance and demolition sites* nominates the following:

- That reasonable suitable noise management objectives are established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating demolition hours, and

8.2 VIBRATION CRITERIA

Vibration associated with demolition and excavation activities on the site will be assessed in conjunction with the following guidelines:

For human exposure to vibration - Department of Environment and Conservation *NSW Assessing Vibration: A Technical Guideline* (Feb 2006) is based on the guidelines contained in BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

For structural damage vibration - German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.*

8.2.1 Assessing Amenity (Human Comfort Guidelines)

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline.* These levels are presented below:

Table 10 – (Table 2.2 Assessing Vibration: A Technical Guideline) – Preferred and Maximum Weighted RMS Values for Continuous and Impulsive Vibration Acceleration (m/s^2) 1-80Hz

Location	Assessment Period [1]	Preferred values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Critical Working Areas (e.g. Hospital Operating Theatres)	Daytime	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.02	0.014
Impulsive Vibration					
Critical Working Areas (e.g. Hospital Operating Theatres)	Daytime	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g. continuous construction or maintenance activity. (DECC, 2006).

Note 2: Impulsive vibration relates to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g. occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006).

8.2.2 Structure Borne Vibration (Damage Criteria)

German Standard DIN 4150-3 (2016) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (2016) is shown in the below table.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 11 – (Table 1 – DIN 4150-3 (2016)) – Guideline Values for Vibration Velocity, $v_{i,max}$, for Evaluating the Effects of Short-Term Vibration on Structures

	TYPE OF STRUCTURE	Guideline values for $v_{i,max}$ in mm/s				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz [a]	All Frequencies	All Frequencies
L/C	1	2	3	4	5	6
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 **and** are of great intrinsic value (e.g. listed buildings) buildings that are under a preservation order)	3	3 to 8	8 to 10	8	20[b]

NOTE Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

a At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.

b It may be necessary to lower the guideline value markedly to prevent minor damage

All surrounding residential dwellings are to be assessed as 'Type 2'.

8.2.3 Sensitive Equipment within Hospital Buildings

Where sensitive equipment is located within nearby New Maitland Hospital buildings, criteria are to be determined based on data provided by the manufacturer/supplier/operator. These are to be determined prior to the commencement of any works. When setting vibration limits for sensitive medical equipment for vibration generated by construction activities, the appropriate vibration curve from the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Handbook based on the equipment type is typically applied.

The ASHRAE Handbook provides specific vibration levels associated with potential disruption to the use of sensitive equipment within the clinic. The maximum vibration velocities (mm,s^{-1}) recommended from 1-100Hz is given in Figure 37 of the Handbook, used in conjunction with the recommended equipment requirement curves given in Table 46. Figure 37 and Table 46 of the Handbook are reproduced below in Figure 4 and Table 12 respectively.

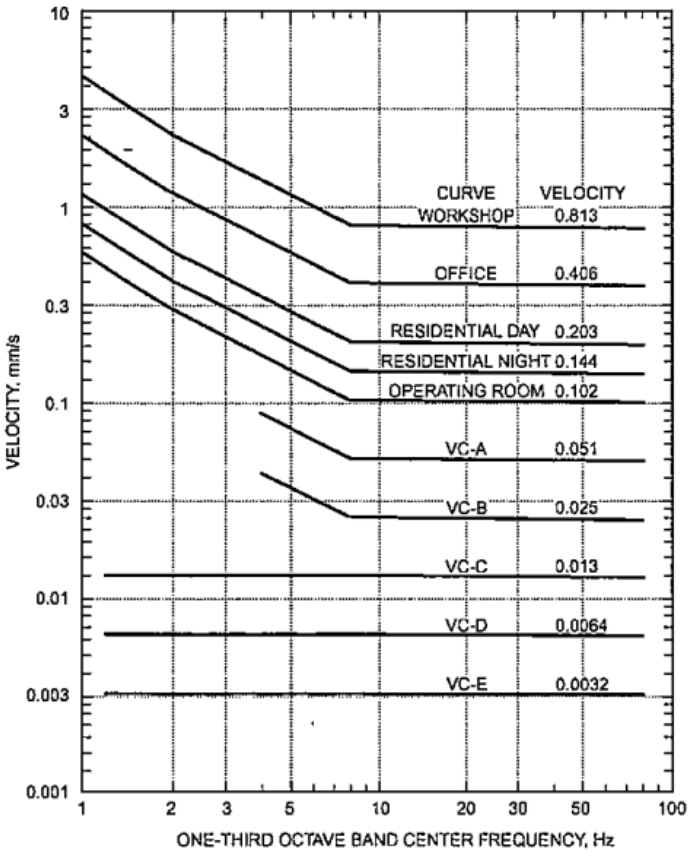


Fig. 37 Building Vibration Criteria for Vibration Measured on Building Structure

Figure 4 – Vibration Curves as per Figure 37 of ASHRAE Handbook (2007)

Table 12 – Equipment Vibration Criteria – ASHRAE Handbook (2007)

Equipment Requirements	Curve
Adequate for computer equipment, probe test equipment, and microscopes less than 40x magnification	0.203 (Residential – day)
Bench Microscopes up to 100x magnification; laboratory robots	0.102 (Operating Room)
Bench microscopes up to 400x magnification; optical and other precision balances; coordinate measuring machines; metrology laboratories; optical comparators; microelectronics manufacturing equipment; proximity and projection aligners, etc.	0.051 (VC – A)
Microsurgery, eye surgery, neurosurgery; bench microscopes at magnification greater than 400x magnification; optical equipment on isolation tables; microelectronic manufacturing equipment, such as inspection and lithography equipment (including steppers) to 3mm line widths	0.025 (VC – B)
Electron microscopes up to 30,000x magnification; microtomes; magnetic resonance imagers; microelectronics manufacturing equipment, such as lithography and inspection equipment to 1mm detail size	0.013 (VC – C)
Electron microscopes at magnification greater than 30,000x magnification; mass spectrometers; cell implant equipment; microelectronic manufacturing equipment such as, aligners, steppers and other critical equipment for photolithography with line widths of 1/2μm; includes electron beam systems	0.0064 (VC – D)
Un-isolated laser and optical research systems; microelectronics manufacturing equipment, such as aligners, steppers and other critical equipment for photolithography with line widths of 1/4μm; includes electron beam systems	0.0032 (VC – E)

Table Notes:

- Refer to Figure 2 for corresponding vibration curve

We note that the sensitive equipment vibration requirements may already be exceeded under ambient conditions. As such, AL recommends ambient vibration monitoring be undertaken prior to the commencement of construction works so that a baseline vibration level may be established for comparison to vibration generated by the works.

8.3 CONSTRUCTION NOISE EMISSION ASSESSMENT

The proposed construction works consists of the following stages (reproduced from the Construction Management Plan):

- Bulk earthworks (0-4 months).
- Structure Facade (2-8 months).
- Internal fit-out and finishes (6-12 months).
- External landscaping works (10-12 months).
- Handover and commissioning (12-14 months).

8.3.1 Construction Source Noise Data

In this section, typical equipment/processes anticipated to be used during the construction of the project site are outlined in the table below with A-weighted sound power levels. The equipment list is prepared based on our experience with similar projects. Typically, the most significant sources of noise or vibration generated during a construction project will be demolition and excavation.

Table 13 – Sound Power Levels of Equipment

Equipment /Process	Typical Sound Power Level dB(A)	Duty
6T excavators	115	75%
Cranes	113	50%
Air compressors	109	25%
Electric generators jack hammers	113	75%
10T excavators with hydraulic jacks	118	75%
Oxy-acetylene (gas cutting/welding)	110	50%
Concrete saw	118	75%
Grinders	105	50%
20T Truck	103	10%

The noise levels presented in the above table are derived from the following sources, namely:

- On-site measurements.
- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary).

8.3.2 Construction Noise Prediction Methodology

Noise from the loudest typical construction activities for all stages of works have been predicted to the nearest most affected sensitive receivers.

Predictions take into account:

- The distance between the noise source and the receiver.
- The screening effect provided by any building structure or building shell, if applicable. In particular, noise from works proposed during the fit-out stages when the building shell will screen these activities from the surrounding sensitive receivers.

8.3.3 Proposed Hours of Work

As recommended in Section 8.12 of the *Preliminary Construction Management Plan* (dated 11 October 2024), the following hours of operation will be applied to all construction activities on site:

- Monday to Friday – 7:00am to 6:00pm.
- Saturdays – 8:00am to 1:00pm.
- Sundays and Public Holidays – No works.

8.3.4 Predicted Noise Levels

Maximum noise impacts from the construction equipment listed above have been predicted to the nearest noise receivers and presented below. Given the size of the site predicted noise levels will change significantly depending on where the noise source is located. As such, a noise level range has been presented, giving expected noise levels for activities 'farthest from' to 'nearest to' the receiver.

Table 14 – Predicted Construction Noise Levels – R1

Activity	Predicted Noise Level	Criteria	Comment
6T excavators	64-68	Noise Affected Level (NML)-**55** dB(A)$L_{eq(15min)}$ Highly Noise Affected Level (HNML)-**75**dB(A)$L_{eq(15min)}$	Exceed NML 55dB but below HNML
Cranes	60-61		
Air compressors	53-56		Exceed NML 55dB when work close to southern boundary. Below HNML
Electric generators jack hammers	63-64		Exceed NML 55dB but below HNML
10T excavators with hydraulic jacks	68-69		
Oxy-acetylene (gas cutting/welding)	58-61		
Concrete saw	67-68		
Grinders	53-56		Exceed NML 55dB when work close to southern boundary. Below HNML
20T Truck	46-48		Below Noise affected level

Table 15 – Predicted Construction Noise Levels – I1

Activity	Predicted Noise Level	Criteria	Comment
6T excavators	51-53	Noise Affected Level (NML) - **75 dB(A)$L_{eq(15min)}$**	Below Noise affected level for all equipment
Cranes	47-49		
Air compressors	40-42		
Electric generators jack hammers	49-51		
10T excavators with hydraulic jacks	55-58		
Oxy-acetylene (gas cutting/welding)	44-46		
Concrete saw	54-56		
Grinders	39-41		
20T Truck	30-32		

Table 16 – Predicted Construction Noise Levels – AR1

Activity	Predicted Noise Level	Criteria	Comment
6T excavators	51-53	Noise Affected Level (NML) - **65 dB(A)$L_{eq(15min)}$**	Below noise affected level for all equipment
Cranes	47-49		
Air compressors	40-42		
Electric generators jack hammers	49-51		
10T excavators with hydraulic jacks	55-58		
Oxy-acetylene (gas cutting/welding)	44-46		
Concrete saw	54-56		
Grinders	39-41		
20T Truck	30-32		

Table 17 – Predicted Construction Noise Levels – H1

Activity	Predicted Noise Level*	Criteria	Comment
6T excavators	37-41	Noise Affected Level (NML) - **45 dB(A)$L_{eq(15min)}$** (Internally)	Below noise affected level for all equipment
Cranes	30-33		
Air compressors	23-30		
Electric generators jack hammers	32-35		
10T excavators with hydraulic jacks	37-40		
Oxy-acetylene (gas cutting/welding)	27-30		
Concrete saw	37-40		
Grinders	22-29		
20T Truck	16-20		

*Assumes a 30dB(A) façade noise reduction

8.4 GENERAL DISCUSSION

Noise

Construction noise emission to nearby industrial **I1** and active recreation receivers **AR1** are predicted to be below noise management level during the entire construction period due to distance attenuation and barrier effected provided by the existing Maitland hospital.

For residential receivers **R1**, noise levels are predicted within HNML for all equipment while exceedances to the NML will occur when certain equipment are used such as excavator, hydraulic hammer, concrete saw, etc. These equipment are expected to be used for a short duration during bulk earthworks (excavation) stage only or able to be effectively scheduled to minimise impact.

For existing new Maitland hospital building **H1**, noise levels are predicted within NML for all equipment given a 1.8m height solid acoustic barrier is installed along the western boundary of the proposed site. Refer to Figure 5.

Once excavation works have been completed, general construction works are expected to generally be of a lower noise level with many activities below the ICNG noise management levels.

Specific recommendations are detailed in Section 9.

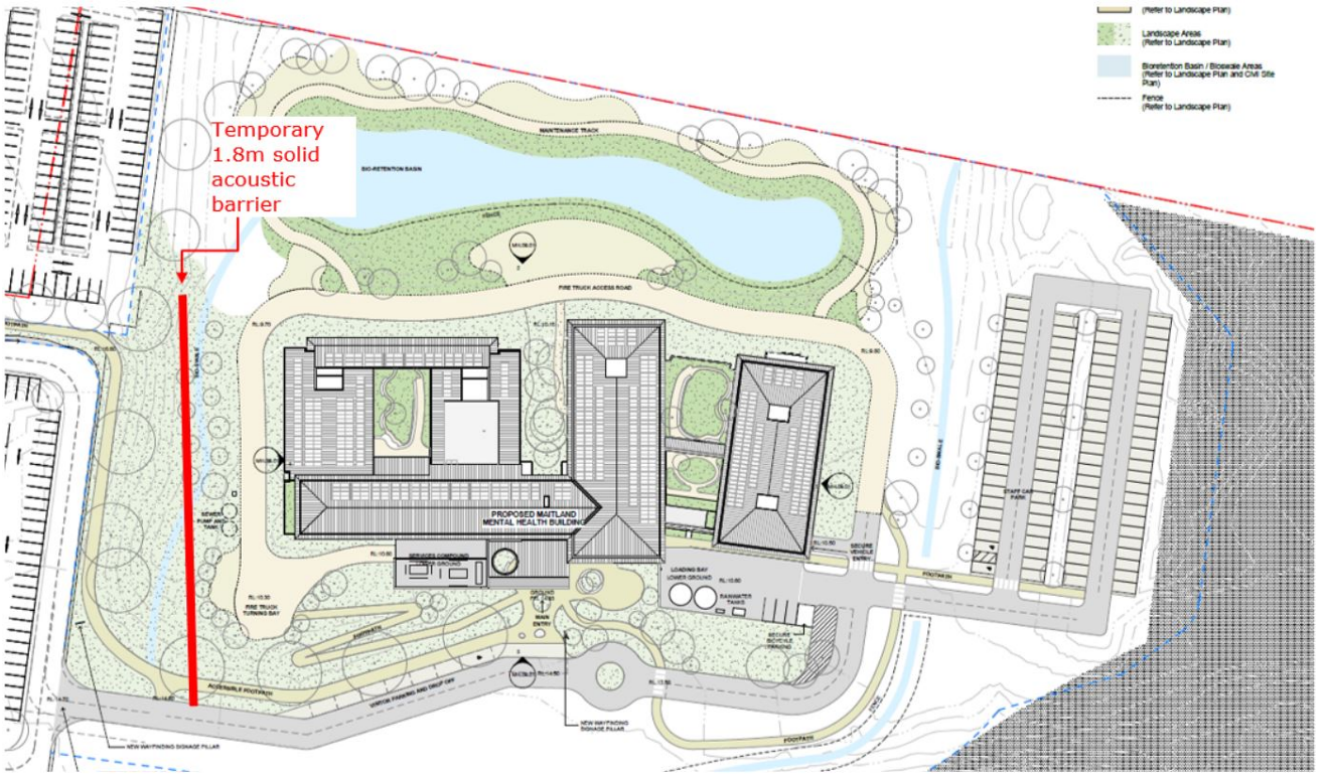


Figure 5 – Acoustic Barrier During Construction Stage

Vibration

The highest levels of vibration are likely to be produced when excavation activities are undertaken. This activity would only produce a moderate level of vibration close to the work site. Given the closest residential receiver **R1** is approximately 100m away from the site, the impact at the surrounding properties is moderate considering amenity and structure damage.

The greatest risk of vibration to nearby buildings within the hospital site will occur from (in order of likely significance):

- Excavation using excavator mounted hydraulic hammers.
- Ground compaction.
- Interface works with other buildings.
- Piling.

The prediction of actual vibration levels is difficult because receiver vibration levels are affected by a number of factors including the vibration force imparted, sub-soil propagation conditions, building footings and building structural design.

Vibration monitoring of these activities is recommended for the hospital receiver in the event of complaints or concern for structural damage to nearby buildings or vibration sensitive equipment is identified close the working area. The specific location and quantity of vibration monitors to monitor residential houses are to be determined in consultation with the builder and structural engineer

All other construction items are also not expected to generate vibration exceeding building damage or amenity acoustic criteria.

9 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT AND CONTROL

Notwithstanding that the assessment indicates noise and vibration emissions to residential receiver will generally comply with the noise and vibration management levels, emissions should be minimised as part of best practice endeavours, and contingency measures should be put into place to respond to complaints or if it is found the processes needed to complete the tasks vary from those envisaged in this assessment.

The recommended measures are provided below.

9.1 NOISE AND VIBRATION MONITORING, REPORTING AND RESPONSE PROCEDURES

Vibration monitoring is recommended for areas in the hospital where sensitive equipment is located or in the event of complaints or concern of operation of the sensitive equipment.

The monitors are proposed to be fitted with GSM modem and remotely signal up to five mobile phones indicating any exceedance of the prescribed vibration criteria to enable immediate notification to be sent to the contractor when vibration thresholds are approached.

Whilst it is impossible to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers, the total vibration emissions are to be limited with real-time alarm notification given to the plant operators. Based on feedback from the real-time monitoring system, the plant operators will be able to modify their operations to ensure the vibrations are kept within acceptable limits.

9.1.1 Vibration Monitoring Download

Downloading of the vibration logger will be conducted on a regular basis. In the event exceedance of vibration criteria or alarms occur, downloading of the logger will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph format and will be forwarded to the client for review. It is proposed that reports are provided fortnightly with any exceedance in the vibration criteria reported as detailed in this report.

9.1.2 Vibration Monitoring Reports

A fortnightly report will be submitted to the client via email summarising the vibration events. The vibration exceedance of limit is recorded the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in fortnightly reports including graphs of collected data.

9.1.3 Reporting Requirements

The following is an example of reporting which may be kept on site:

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed below.

2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.

3. Any noise exceedances occurring including, the actions taken and results of follow up monitoring.

4. A report detailing complaints received and actions taken shall be presented.

5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

9.1.4 Response Procedures

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the site manager and the general public and their contact telephone number.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form may list:

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

The flow chart that follows illustrate the process followed to assess construction activities prior to the start of work on site and well as the ongoing investigation into noise during the construction period.

9.2 GENERAL NOISE CONTROL METHODS

The determination of appropriate additional noise control measures will be dependent on the particular activities and the construction equipment and plant identified as requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

9.2.1 Selection of Alternate Appliance or Process

Where a particular activity or plant and equipment is found to generate noise levels that exceed the management levels, it may be possible to select an alternative approach or plant and equipment. For example, the use of excavator mounted hydraulic hammers of the site may potentially generate high levels of noise. By carrying this activity by using concrete saws or smaller plant here practical, construction noise levels and/or length of exposure to construction noise levels may be reduced.

9.2.2 Acoustic Barriers

The placement of barriers at the source is generally only effective for static plant. Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

The degree of noise reduction provided by barriers is dependent on the amount by which the line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

Barriers are used to provide shielding and do not act as an enclosure. The material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier screening. In this case, the use of a material such as 15mm plywood (or equivalent material) would be acceptable for the barriers.

9.2.3 Silencing Devices

Where construction methodologies or plant and equipment permit, investigate the use of silencing devices. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts, for example.

9.2.4 Treatment of Specific Equipment

In certain cases, it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

9.2.5 Establishment of Site Practices

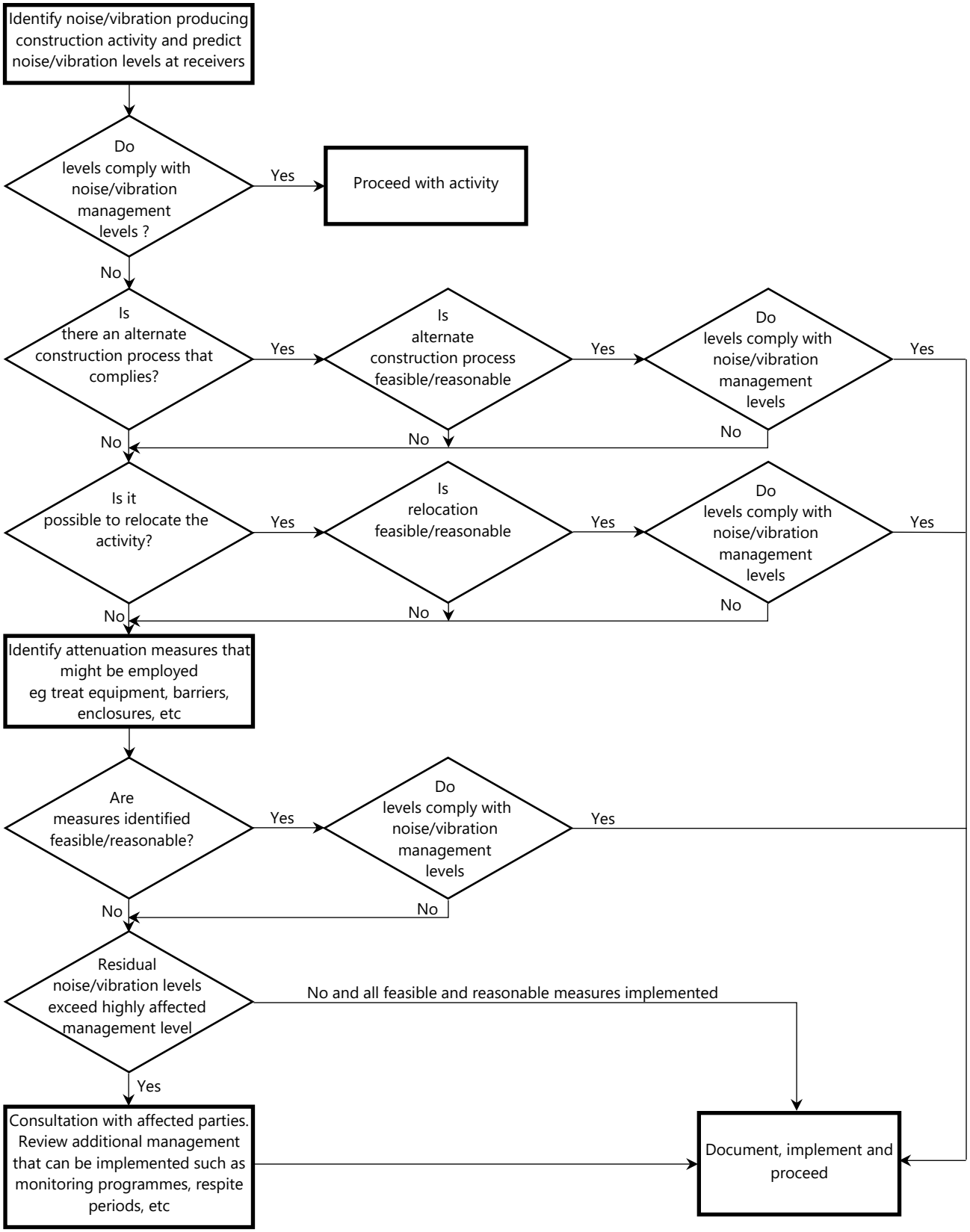
This involves the formulation of work practices to reduce noise generation. This includes investigating the possibility of locating fixed plant items as far as possible from residents as well as rotating plant and activities to provide respite to receivers.

9.2.6 Notification

Notification of affected receivers of the progress of works, particularly when short-term activities likely to create higher noise levels occur, can in many cases minimise community reaction.

10 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



11 CONCLUSION

This report presents an acoustic assessment of the potential noise and vibration impacts associated with the operation and construction of the proposed new mental health services building to be located at Maitland Hospital Campus at 51 Metford Rd, Metford NSW 2323.

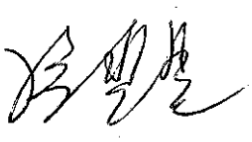
Noise and vibration impacts assessed within this document have been assessed with reference to the requirements of the following documents:

- NSW EPA *Noise Policy for Industry* (**NPI**) October 2017.
- NSW EPA *Interim Construction Noise Guideline* (**IGNG**) July 2009.
- Australian Standard *AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites* (**AS2436:2010**).
- BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz).*
- German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.*
- American Society of Heating, Refrigerating and Air-conditioning Engineers (**ASHRAE**) Handbook.

Based on our assessment, the proposal is able to achieve all relevant acoustic (noise and vibration) requirements of the above documents.

Please contact us should you have any further queries.

Yours faithfully,



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APPENDIX A MTIGATION MEASURES TABLE

This section provides a summary of the mitigation measures identified to ensure compliance with operational and construction noise emission.

It is noted that potential impacts can be appropriately mitigated or managed to ensure minimal effect on the locality or community.

Project Stage ***Design (D)*** ***Construction (C)*** ***Operation (O)***	**Mitigation Measures**	**Relevant Section of Report**
D	*Mechanical plant noise emission will be reviewed during detail design stage to ensure compliance with noise emission criteria*	*Section 7.3.3*
C	*Construction noise emissions are predicted to be within HNML. Mitigation measures presented in Section 9 are to be adopted where required.*	*Section 9*
O	*General operation of the development will comply with relevant noise emission criteria. No additional mitigation measures are required*	*Section 7.3.1 & Section 7.3.2*

APPENDIX B AMBIENT NOISE MONITORING SUMMARY

Long term unattended background noise measurements were undertaken by Wood and Grieves, dated 8 May 2018. Detailed of noise monitoring conditions can be found in Sections 3 and 4 of the report. This has been reproduced as below.

Additional attended noise measurements were taken by this office in March and May 2022.

Adopted background noise levels for this assessment have been presented below:

Table 18 – Adopted Background Noise Levels

Measurement Location	Measurement Time	Measured Background Noise Level
Southern boundary of Maitland Hospital Campus	Day	45dB(A) L_{90}
	Evening	43dB(A) L_{90}
	Night	37dB(A) L_{90}

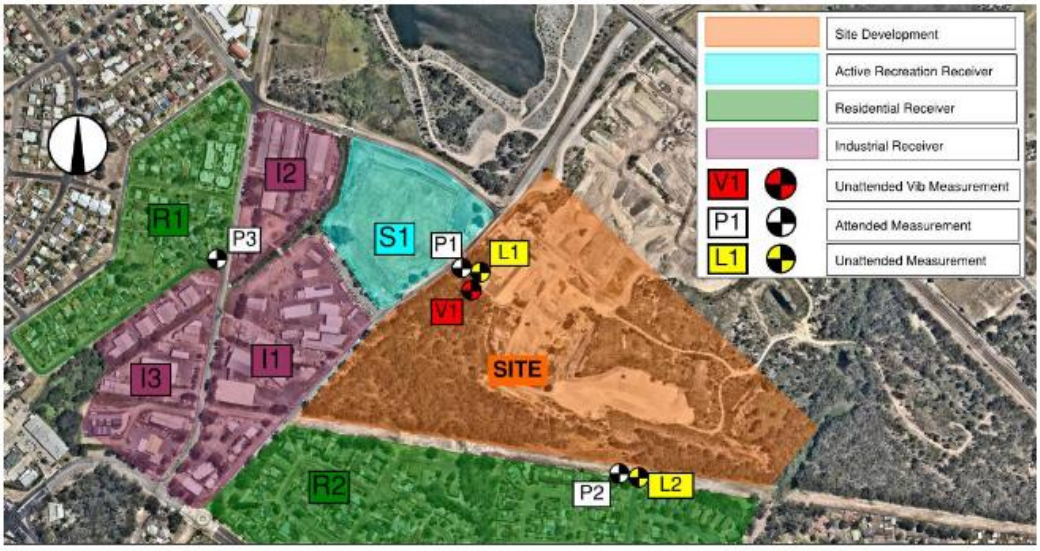
3. Project Overview

3.1 Site description

The development site is located on Lot 7314 DP 1162607 and Part Lot 401 DP 755237 within the Metford Triangle located on the eastern side of Metford Road. The site is bound by industrial development and active recreation facilities to the West, an existing CSR rehabilitation site to the North, residential developments to the South and land to the East.

The site location, measurement positions and surrounding residential, industrial and active recreation receivers are shown in Figure 1.

Figure 1: Site map and locations of measurements



Source: nearmap.com

3.2 Acoustic Issues

The acoustic issues relating to the development are as follows:

- Noise and vibration intrusion from vehicle movements along Metford Road
- Noise emissions from mechanical plant from the development to the surrounding receivers
- Noise emissions from the construction and operation of the development
- Traffic noise generated on roads in proximity to the development as a result of traffic flow in and out of the development

4. Noise Survey

4.1 Instrumentation

The following equipment was used for the noise surveys:

- ARL Environmental Noise Logger EL-316 S/N, 16-707-038;
- Environmental Noise Logger CASELLA CEL-63X, S/N 4257387;
- Environmental Vibration Logger VIBRA, S/N VIB01720
- Hand-held sound spectrum analyzer B&K 2250, S/N 2709742;
- Sound Calibrator B&K Type 4231, S/N 2709826;

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

4.2 Attended Noise Monitoring

Attended noise measurements of 15-minute duration were conducted on site to characterise the acoustic environment for noise intrusion into the development and to determine any noise impact on the surrounding receivers. A summary of the attended noise measurements taken at site are shown in Table 1. Refer to Figure 1 for measurement locations.

Table 1: Attended noise measurements

Measurement Location	Measurement Time	$L_{Aeq,\ 15mins}$ dB(A)	L_{A90} dB(A)	L_{A10} dB(A)	Comments
P1	3/07/17 – 12:15pm	73.1	58.9	77.5	Dominated by traffic movements along Metford Road
P2	15/06/17 – 12:41pm	42.3	40.2	43.8	General environmental noise
P3	15/06/17 – 1:14pm	59.3	47.3	60.8	General environmental noise as well as intermittent traffic along Turton Street

4.3 Unattended Noise Monitoring

This assessment will consider the method for determining the RBL background for each period of the day in accordance with the NSW OE&H Noise Policy for Industry (NPI). The NPI defines background and ambient noise for the daytime, evening and night time periods as follows:

Day: is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
Evening: is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
Night: is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

4.3.1 Background and Ambient Noise Monitoring

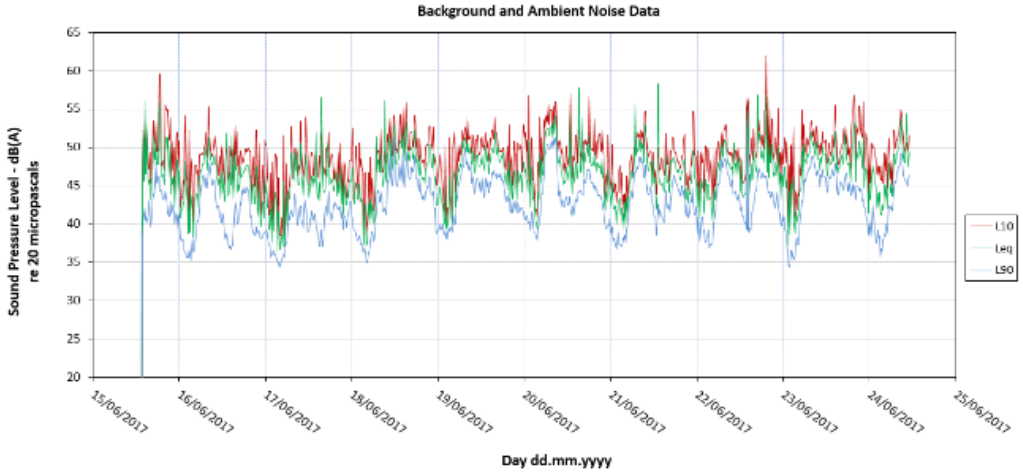
A noise monitor was placed at position L2 as shown in Figure 1 to measure the background and ambient noise of the nearest sensitive residential receiver (R2). Monitor L2 was installed from the 15th June to the 24th June 2017 The results for the unattended background noise survey is shown in Table 2 below (for the day, evening and night periods). Note than any rain affected data during the period of logging has been excluded from the calculations.

Table 2: Unattended background noise monitoring – L2

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L2	49	48	45	42	42	37

The local ambient noise environment is dominated by noise from the surrounding nature (characteristic of bushland and the natural environment) throughout the majority of the day, evening and night periods. Refer to Figure 2 for the noise data.

Figure 2: Unattended background noise monitor data – L2



4.3.2 Traffic Noise Monitoring

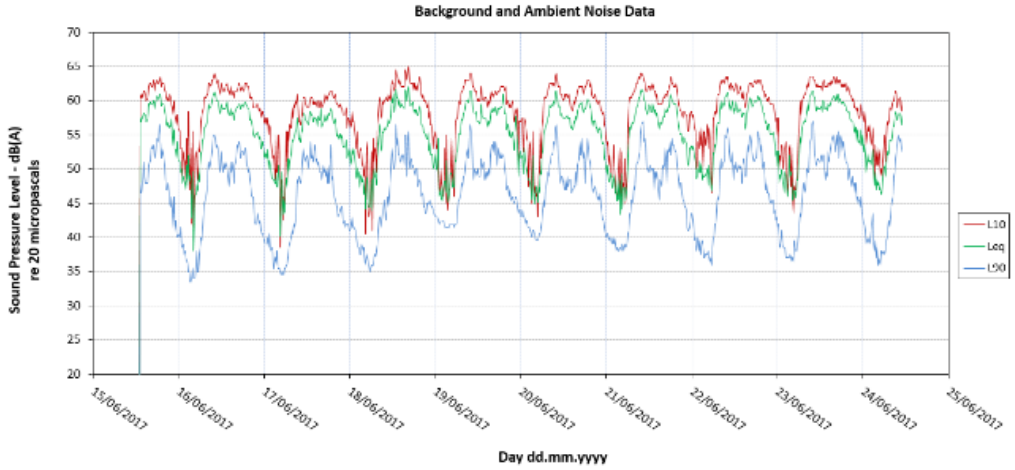
A noise monitor was installed in Location L1 as shown in Figure 1 in order to measure the traffic noise from Metford Road. The noise monitor was installed from the 15th June to the 24th June 2017. The results for the traffic noise survey from L1 are shown are shown in Table 3 for the day and night time periods. Day and night time periods are typically implemented to demonstrate traffic noise impacts in accordance with the DoP "Development Near Rail Corridors and Busy Roads – Interim Guideline".

Table 3: Unattended traffic noise monitoring – L1

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)		Noisiest 1 Hour $L_{Aeq,1hour}$ - dB(A)	
	Day (15hr)	Night (9hr)	Day	Night
L1	58	51	61	55

Refer to Figure 3 for a graphical representation of the noise data.

Figure 3: Unattended traffic noise monitor data – L1



4.4 Unattended Site Vibration Monitoring

The purpose of the vibration measurements was to measure the magnitude of the existing ground vibration that will be transmitted to the structure at ground level. The vibration measurements were conducted in accordance with Australian Standard (AS) 2187.2 – 2006.

A vibration monitor was placed at position V1 as shown in Figure 1 to measure the background vibration that is representative of the site location. Logger V1 was installed from the 15th June to the 25th June 2017. The results of the unattended vibration monitoring have been collated using the median vibration levels for daytime and night time (in accordance with the NSW DEC Assessing Vibration: a technical guideline) and are shown in Table 4 below.

Table 4: Unattended background vibration monitoring – V1

Location	Median Background Acceleration (m/s²)					
	Daytime (7:00am – 10:00pm)			Night time (10:00pm – 7:00am)		
	x-axis	y-axis	z-axis	x-axis	y-axis	z-axis
V1	0.003	0.004	0.003	0.002	0.002	0.001

Figure 1 – Site Map and Measurement location (Sourced from: Six Map NSW)

Figure 6 – Attended Background Noise Measurement Location 2022

APPENDIX C EPA NOISE POLICY FOR INDUSTRY TRIGGER LEVELS

Project specific assessment trigger levels have been determined for each noise source applying at the identified potentially most impacted receivers.

C.1 NPFI TRIGGER LEVELS

The NPfI requires noise impacts at residential receivers to be assessed in 3 ways:

- Whether the emitted noise is unreasonably loud relative to ambient background noise. (which the EPA calls the "intrusiveness" trigger level).
- Whether the noise emitted is unreasonably loud in an absolute sense, and consistent with surrounding land use and environment. ("amenity" trigger level)
- For night noise emissions, whether discrete noise events are likely to adversely impact sleep ("maximum noise level" trigger levels).

For other receiver types only the amenity trigger level is relevant.

C.1.1 INTRUSIVENESS

The $L_{eq,15min}$ descriptor is used for the intrusiveness trigger level, and is set at a level that is 5dB(A) above the rating background noise level.

C.1.2 AMENITY

Table 2.2 of the NPfI (repeated below) sets out acceptable noise levels for various receiver types.

There are 3 categories of residential receivers - rural, suburban, urban. The nearest residential receivers to the subject site are categorised as "urban" receivers. Categories for non-residential uses are also indicated in the table.

The NPI typically requires project amenity noise levels to be calculated in the following manner:

$$L_{Aeq,15min} = \textit{Recommended Amenity Noise Level} - 5\ dB(A) + 3\ dB(A)$$

Section 2.4 of the NPfI states:

Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

Given there are no other nearby "industrial" noise sources, and nor are any likely in the future, the applicable amenity $L_{Aeq,15min}$ trigger level can be calculated without the 5 dB(A) adjustment.

The NfPI permits the project specific amenity level to be increased in areas where ambient noise levels already significantly exceed the levels in Table 2.2 of the NPfI.

NPfI Table 2.2: Amenity Noise Levels			
Receiver	***Noise Amenity Area***	***Time of Day***	***Recommended Amenity Noise Level L_{Aeq}***
Residential	*Rural*	*Day*	*50*
		Evening	*45*
		Night	*40*
	Suburban	*Day*	*55*
		Evening	*45*
		Night	*40*
	Urban	*Day*	*60*
		Evening	*50*
		Night	*45*
Hotels motels caretakers' quarters holiday accommodation permanent resident caravan parks	*See column 4*	*See column 4*	*5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day*
School classroom – internal	*All*	*Noisiest 1-hour period when in use*	*35 (see notes for table)*
Hospital ward internal external	*All* *All*	*Noisiest 1-hour* *Noisiest 1-hour*	*35* *50*
Place of worship – internal	*All*	*When in use*	*40*
Area specifically reserved for passive recreation (e.g. national park)	*All*	*When in use*	*50*
Active recreation area (e.g. school playground golf course)	*All*	*When in use*	*55*
Commercial premises	*All*	*When in use*	*65*
Industrial premises	*All*	*When in use*	*70*
Industrial interface (applicable only to residential noise amenity areas)	*All*	*All*	*Add 5 dB(A) to recommended noise amenity area*

Notes: The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as follows:

• rural residential – see Table 2.3

• suburban residential – see Table 2.3

• urban residential – see Table 2.3

• industrial interface – an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies. This category may be used only for existing situations (further explanation on how this category applies is outlined in Section 2.7)

• commercial – commercial activities being undertaken in a planning zone that allows commercial land uses

• industrial – an area defined as an industrial zone on a local environment plan; for isolated residences within an industrial zone the industrial amenity level would usually apply.

Time of day is defined as follows:

• day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays

• evening – the period from 6 pm to 10 pm

• night – the remaining periods.

(These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.

C.2 MAXIMUM NOISE LEVEL ASSESSMENT

The purpose of this assessment is to identify whether discrete, night time noise events have the potential to produce adverse sleep impacts.

Section 2.5 of NPfI recommends the following procedure to assess the potential for adverse sleep disturbance.

Where the subject development/ premises night -time noise levels at a residential location exceed:

- *$L_{eq(15min)}$ 40 dB(A) or the prevailing RBL (L_{90}) plus 5 dB, whichever is the greater, and/or*
- *L_{max} 52 dB(A) or the prevailing RBL (L_{90}) plus 15 dB, whichever is the greater,*

a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.

Other factors that may be important in assessing the extent of impacts on sleep include:

- *how often high noise events will occur*
- *the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development*
- *whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)*
- *current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.*

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

C.3 PROJECT SPECIFIC TRIGGER LEVELS

The following table summarises the trigger levels applying at each of the identified "most impacted" receivers. These have been determined based on the NPfI methodology described above and the measured rating background noise levels.

The trigger levels in bold indicate the most stringent trigger level at each location.

Table 19 – Project Specific Trigger Levels

Location/Receiver Type	Time	RBL dB(A) L_{90}	Trigger Noise Level (dB(A) $L_{eq,15min}$)		
			Intrusiveness	Amenity	Max Event
R1 – Residential (Urban)	Day	45	**50**	60	N/A
	Evening	43	**48**	50	N/A
	Night	37	**42**	45	**42** L_{eq} **52** L_{max}
I1 - Industrial	When in use	N/A	N/A	68	N/A
AR1 – Active recreation	When in use	N/A	N/A	53	N/A
H1 – Hospital	Noisiest 1hr	N/A	N/A	35 (internal) 50 (external)	N/A