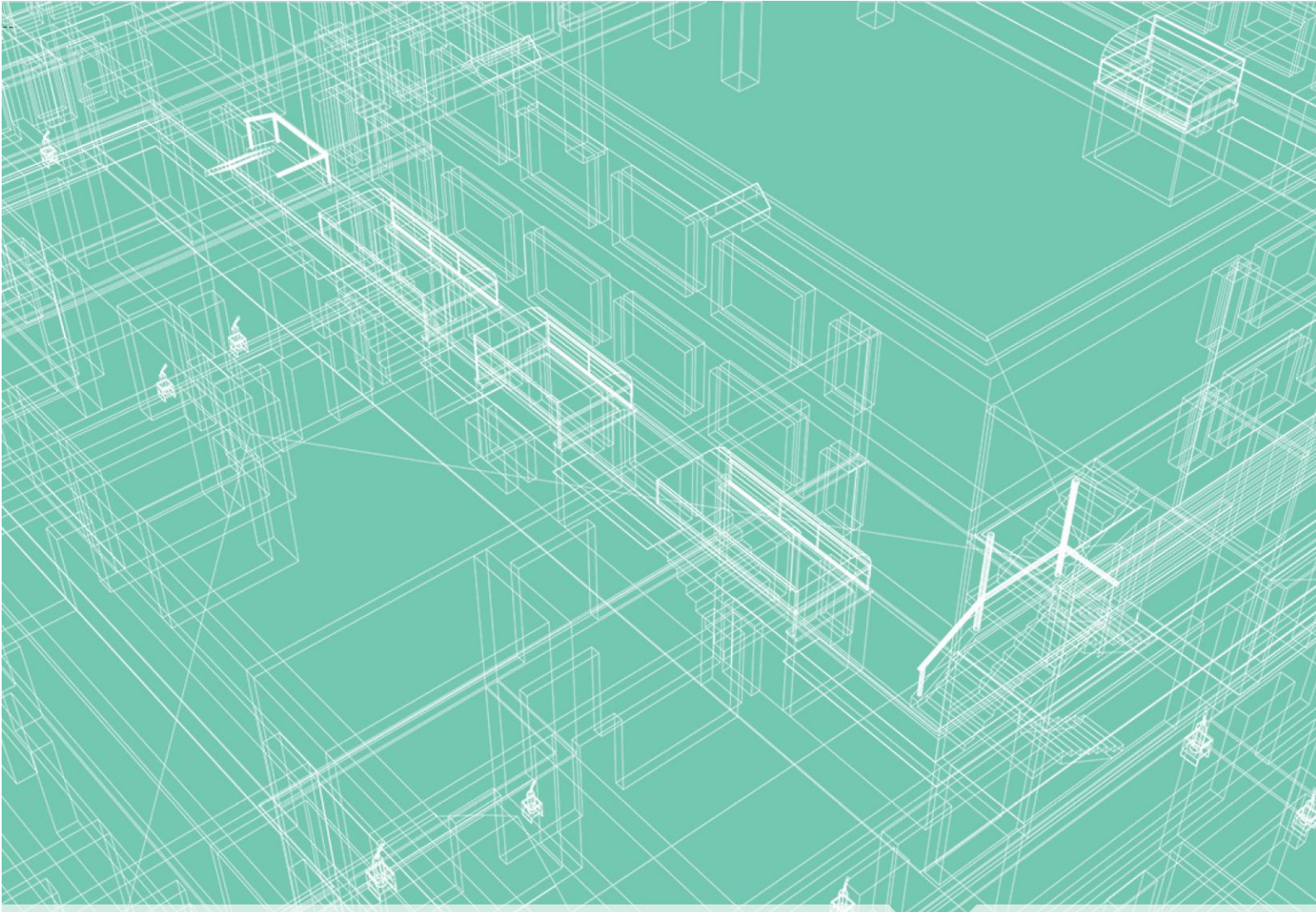

NOISE & VIBRATION IMPACT ASSESSMENT FOR REF

CESSNOCK HOSPITAL REDEVELOPMENT

JHA

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DOCUMENT CONTROL SHEET

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1 INTRODUCTION

1.1 GENERAL

This Noise & Vibration Impact Assessment for Review of Environmental Factors (REF) has been prepared by JHA Consulting Engineers on behalf of Health Infrastructure NSW to assess the potential environmental impacts that could arise from the redevelopment of the Cessnock Hospital health services at 24 View St, Cessnock, NSW 2325.

This report has been prepared to:

- Assess the potential transport noise and vibration impacts on the proposed development.
- Assess the potential noise and vibration impacts that the proposed development may have on nearby sensitive receivers.
- Identify noise and vibration sensitive receivers that will potentially be affected by the operation of the Cessnock Hospital Redevelopment.
- Establish the appropriate noise levels and vibration criteria in accordance with the relevant standards, guidelines and legislations – for operational and construction.
- Carry out noise assessments in order to assess the noise impacts from the operation of the development. Noise assessments consider the following noise sources:
  - Mechanical services noise.
  - Emergency generators.
  - Vehicle noise emissions.
  - Traffic noise intrusion.
- Determine whether the relevant criteria can be achieved based on the anticipated operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide preliminary recommendations for Construction Noise and Vibration Planning.

The following has been considered for the preparation of this report:

- Noise data collected on site through the use of noise loggers and a handheld spectrum analyser.
- Architectural drawings prepared by Fitzpatrick + Partners Architects.

This report shall be read in conjunction with the planning documentation and other consultant design reports submitted as part of the application.

This report accompanies a Review of Environment Factors that seeks approval for the construction and operation of a new two-storey clinical services building including:

- Demolition of select existing structures.
- Construction of a new hospital building on the site's northern portion.
- Realignment of internal roads and a new primary vehicular and pedestrian entrance to the hospital campus from Jurd Street.
- Refurbishment of the existing at-grade car park.
- Installation and realignment of selected services.
- Installation of ancillary development including, but not limited to, lighting and signage.
- Landscaping.

- New kerb, gutter and road resurfacing on Jurd Street.

For a detailed project description, refer to the Review of Environmental Factors prepared by Ethos Urban.

This document and related work have been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, based on AS/NZS ISO 9001:2015 and ISO 14001:2015 respectively.

1.2 SITE DESCRIPTION

The site is located at 24 View Street, Cessnock, in the Cessnock Local Government Area. It is occupied by Cessnock Hospital health service, a district-level hospital in the Hunter New England Local Health District. The site comprises the following lots:

- Lot 2 DP1173784
- Lot 7 DP13203
- Lot 8 DP13203
- Lot 1 DP103663
- Lot 10 DP5442
- Lot B DP103664
- Lot 2 Section 20 DP5442
- Lot 1 DP254743
- Lot 11 DP882585

An aerial image of the site is shown at Figure 1.

Figure 1: Aerial view showing the Cessnock Hospital site (Source: Nearmap).

1.3 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 to moderate 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.

2 SITE MEASUREMENTS

2.1 GENERAL

Attended and unattended noise surveys were conducted in the locations shown in Figure 2 to establish the ambient and background noise levels of the site and surrounds, in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

Figure 2: Noise survey locations and boundary of the site.

From observations during the noise survey, it is noted that ambient noise levels are dominated by road noise from Jurd Street.

2.2 SURROUNDING RECEIVERS

A summary of the nearest noise sensitive receivers surrounding the site is shown in Table 1, including assumed approximate distances from the noise sources on site to the receiver boundaries, noting the type of noise receiver. Due to the number of receivers surrounding the site, they have been grouped into Noise Catchment Areas (NCAs) with the receiver nearest to the site considered for the impact noise assessment.

NCA ID	Sensitive Receiver Address	Receiver Type	Approx. Distance, m
1	36, 38, 40, 42 & 44 Buckland Avenue 18, 20, 22, 24, 26 & 28 Jurd Street	Residential	20
2	15 Jurd Street 20, 20A & 22 Foster Street	Residential	50
3	15 Foster Street, 3 & 5 Leonard Street 16, 18, 20, 22 View Street	Residential	60
4	19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41 & 43 View Street	Residential	150
5	34, 36, 38, 40, 42, 44 & 46 View Street	Residential	80
6	18, 20, 22, 24, 26, 28 & 30 Buckland Avenue	Residential	110
7	41 Jurd Street	Commercial	30

Table 1: Nearest sensitive receivers surrounding the site.

Figure 3: Nearest noise sensitive receivers surrounding the site location.

It is noted that if noise and vibration impacts associated with the proposed development are controlled at the nearest sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers should be achieved.

2.3 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out at L1 from 11th June to 20th June 2024 with a Rion NL-52 noise logger (Serial Number 553892). The noise logger recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded. The noise logger microphone was mounted 1.5 meters above the ground and a windshield was used to protect the microphone.

The noise logger was located on the northern side of the site boundary, approximately 10m from Jurd Street. This location was chosen as it was considered to be representative of the typical ambient and background noise levels at the site boundary and also representative of the levels at the surrounding residential receivers. Furthermore, this location ensured security of the logger and was away from pedestrian areas.

Weather conditions were monitored during the duration of the noise survey. As stated in the NSW NPI methodology, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations. The detailed results of the long-term noise monitoring are presented graphically in Appendix A.

The Assessment Background Levels (ABLs) have been established in general accordance with the methodology described in the NSW NPI, i.e. 10th percentile background noise level (L_{A90}) for each period of each day of the ambient noise survey. The median of these levels is then presented as the RBLs (Rating Background Levels) for each assessment period.

These RBLs are shown in Table 2, together with the ambient noise levels (L_{Aeq}) measured for each time period.

Date	*Assessment Background Levels, dB(A)*			*L_{Aeq} Ambient Noise Levels, dB(A)*		
	Day 0700-1800	*Evening 1800-2200*	*Night 2200-0700*	*Day 0700-1800*	*Evening 1800-2200*	*Night 2200-0700*
Tuesday, 11 June 2024	---	40	35	---	54	50
Wednesday, 12 June 2024	40	34	33	57	52	51
Thursday, 13 June 2024	39	34	31	61	51	49
Friday, 14 June 2024	38	34	31	56	53	48
Saturday, 15 June 2024	38	37	33	55	52	49
Sunday, 16 June 2024	39	35	33	55	54	51
Monday, 17 June 2024	41	35	31	57	51	51
Tuesday, 18 June 2024	38	37	32	57	53	51
Wednesday, 19 June 2024	40	40	36	56	53	51
Rating Background Levels	**39**	**35**	**33**	---	---	---
Ambient Noise Levels	---	---	---	**57**	**53**	**50**

Table 2: Long-term background and ambient noise levels measured on site.

2.4 SHORT-TERM NOISE MONITORING

Short term, attended noise monitoring was carried out to obtain representative third octave band noise levels of the site on Thursday 20th June 2024. The short-term noise measurements were carried out during the day-time using a NTi XL-3 hand-held Sound Level Meter (SML) (Serial Number A3A-00494-D1). The calibration of the SLM was checked before and after each use and no deviations were recorded.

The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free-field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were dry and calm during the attended noise monitoring.

A summary of the results of the short-term noise monitoring are shown in Table 3.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB (re 20µPa)*								
			Overall dB(A)	*Octave Band Centre Frequency, Hz*							
				63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
S1	20/06/2024 08:41 – 08:56	$L_{90,15min}$	**47**	53	49	42	39	42	43	30	18
		$L_{eq,15min}$	**57**	60	57	52	47	53	51	41	31
		$L_{10,15min}$	**60**	62	59	54	50	56	54	44	33
S2	20/06/2024 09:04 – 09:19	$L_{90,15min}$	**40**	48	44	39	37	37	29	18	13
		$L_{eq,15min}$	**61**	64	62	59	56	58	54	46	38
		$L_{10,15min}$	**64**	64	62	60	58	60	57	48	38

Table 3: Results of short-term noise monitoring.

During the attended noise survey, a continuous mechanical noise from the ambulance station at Jurd Street was clearly audible and it can be defined as non-typical for the area. This noise emission level has clearly affected the L_{A90} metric at location S1, and hence will not be used to establish noise level criteria – if applicable.

2.5 TRAFFIC NOISE MONITORING

Based on the long-term noise monitoring results at location L1, the traffic noise levels are summarised below in Table 4.

Location	*Measured Noise Levels, dB(A)*			
	Day period (7am-10pm)	*Day Noisiest 1h*	*Night period (10pm-7am)*	*Night Noisiest 1h*
L1	$L_{Aeq,15hour}$ 57	$L_{Aeq,1hour}$ 60	$L_{Aeq,9hour}$ 50	$L_{Aeq,1hour}$ 54

Table 4: Measured Traffic Noise Levels.

3 RELEVANT NOISE STANDARDS AND GUIDELINES

3.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Regulatory Framework:
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - NSW Environment Protection Authority (EPA), Noise Guide for Local Government (NGLG) 2023.
- Planning Framework:
  - Cessnock Local Environment Plan 2011.
  - Cessnock Development Control Plan 2010.
- Noise Emissions and Intrusive Noise:
  - NSW Environment Protection Authority (EPA) – Noise Policy for Industry (NPI) 2017.
  - NSW Health Infrastructure Engineering Services Guideline (ESG) 2022 – Chapter 13.
- Transport Noise:
  - NSW EPA Road Noise Policy (RNP) 2011.
- Construction Noise and Vibration:
  - NSW Department of Environment and Climate Change (DECC) – Interim Construction Noise Guideline (ICNG) 2009.
  - Australian Standard AS 2436:2010 "*Guide to Noise and Vibration Control on Construction, Demolition & Maintenance Sites*".
  - NSW Road Maritime Service (RMS) – Construction Noise and Vibration Guideline 2016.

3.2 REGULATORY FRAMEWORK

3.2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT (EP&A) ACT 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2023).

3.2.2 PROTECTION OF THE ENVIRONMENTAL OPERATIONS (POEO) ACT 1997

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"...

a) *that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
   i. *is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
   ii. *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

b) *that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.*

..."

3.3 PLANNING FRAMEWORK

3.3.1 CESSNOCK LOCAL ENVIRONMENTAL PLAN

Cessnock Local Environmental Plan (Cessnock LEP 2011) sets the current Land Zoning, shown in Figure 4, as per information extracted from Cessnock LEP map 1720_COM_LZN_006CA_010_20220624. The site is categorised as Infrastructure (SP2) and is surrounded by Low Density Residential (R2) to the north and west, and Medium Density Residential (R3) to the south and east.

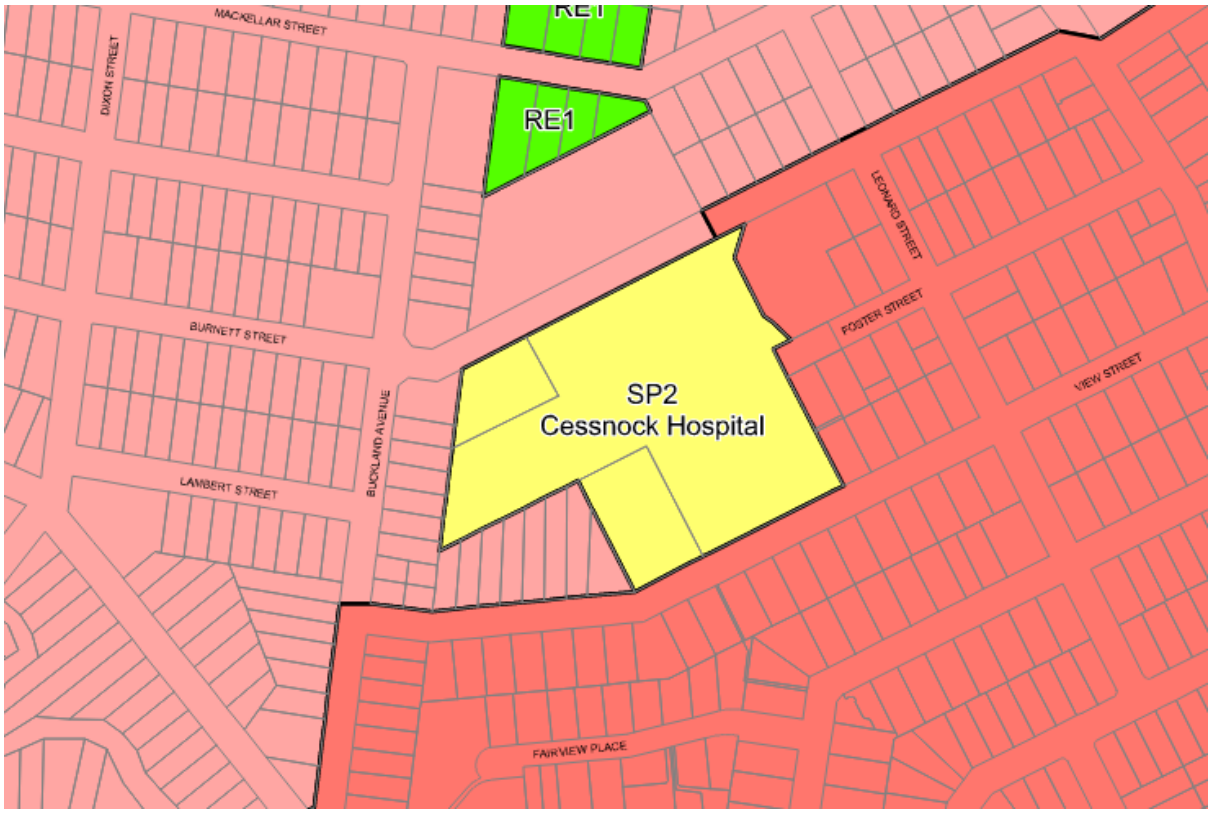


Figure 4: Land Zoning of the existing Cessnock Hosptial site and surroundings from Cessnock LEP map.

3.3.2 CESSNOCK DEVELOPMENT CONTROL PLAN

Cessnock Development Control Plan (Cessnock-DCP 2010) has been reviewed for any relevant noise requirements or criteria for the proposed development. There are no specific noise level criteria, but rather sections of the DCPs provide general planning strategies.

3.4 NOISE EMISSIONS AND INTRUSIVE NOISE

3.4.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent of the two criteria sets the Project Noise Trigger Level (PNTL).

3.4.1.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, and does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the background noise levels on site shown in Table 2, Table 5 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Measured Rating Background Level (L_{A90}), dB(A)*	*Intrusiveness Criterion, $L_{Aeq,15min}$ dB(A)*
Suburban Residential (R2 & R3)	Day (7am – 6pm)	39	44
	Evening (6pm – 10pm)	35	40
	Night (10pm – 7am)	33	38

Table 5: Determination of the intrusiveness criterion for residential noise sensitive receivers.

3.4.1.2 Amenity Criteria

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 6 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level ($L_{Aeq,\ period}$), dB(A)*	*Amenity Criterion, $L_{Aeq,15min}$ dB(A)*
Suburban Residential (R2 & R3)	Day (7am – 6pm)	55	53 (55-5+3)
	Evening (6pm – 10pm)	45	43 (45-5+3)
	Night (10pm – 7am)	40	38 (40-5+3)
Commercial Premises (SP2)	When in use	65	63 (65-5+3)

Table 6: Determination of the amenity criterion for noise sensitive receivers.

3.4.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 7 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion, $L_{Aeq,15min}$ dB(A)*	*Amenity Criterion, $L_{Aeq,15min}$ dB(A)*
Suburban Residential (R2 & R3)	Day (7am – 6pm)	44	53
	Evening (6pm – 10pm)	40	43
	Night (10pm – 7am)	38	38
Commercial Premises (SP2)	When in use	---	63

Table 7: Determination of PNTL's (light grey highlight) for noise sensitive receivers.

3.4.2 NSWHI ESG INTERNAL NOISE LEVELS

The NSW Health Infrastructure Engineering Services Guideline (ESG) provides acoustic criteria for healthcare facilities. For noise intrusion, the ESG states that all elements of the building façade will need to be constructed to control external noise entering the building. Sound insulation performance requirements for each element should be nominated based on external noise levels from all noise sources that surround the building.

External elements including glazing, doors and ventilation openings are generally the weakest elements in an external façade and therefore careful consideration is required in the design and specification to ensure that sufficient sound insulation is provided by the combined sound insulation performance of a façade.

Environmental noise intrusion should be considered in aggregate with the noise from mechanical services to satisfy the maximum noise levels in Column A of Table 15 of the ESG.

3.5 EMERGENCY GENERATOR NOISE LEVEL CRITERIA

It has been proposed to install one emergency generator in Level 2 roof undercroft services area that will operate only during a loss of power supply at the site, plus regular maintenance testing.

There are no current specific criteria regarding emergency generator noise emissions to surrounding receivers; however, the recommended criteria are based on NSW State Pollution Control Commission (SPCC) Environmental Noise Control Manual (ENCM), which was the best industry practice. This guideline has been adopted because more recent guidelines have followed this, even though there is no specific criteria for emergency generators.

"...

Emergency electricity generators which are used in the event of power shortages, should not exceed the following maximum noise levels, in order to minimise disturbance to the community. These criteria are for guidance only and variation may be made where necessary.

Residential Receiving Areas

Daytime and Evening: From 7am to 10pm any day of the week, the L_{A10} sound pressure levels should not exceed the L_{A90} background level by more than 10dB(A) at the residential boundary, and in any case the L_{A10} level should not exceed 55dB(A).

Night-time: From 10pm to 7am the L_{A10} level should not exceed the L_{A90} background level by more than 5dB(A) at the boundary of any nearby affected residence, and in any case the L_{A10} level at the residential boundary should not exceed 45dB(A).

..."

Based on the above, compliance with the most stringent noise level criterion, being the night-time criterion, at the at the most affected noise sensitive receiver will ensure compliance at all other sensitive receivers. The recommended emergency generator criteria are shown in Table 8.

Indicative Noise Amenity Area	*Period*	*Rating Background Level L_{A90} dB(A)*	*Recommended Criteria L_{A10} dB(A)*
Suburban Residential (R2 & R3)	Night-time (10pm to 7am)	33	38

Table 8: Recommended noise level criteria for emergency generators.

HINSW ESG provides the following advice regarding internal noise levels from emergency generators

"The internal noise levels within a healthcare building resulting from the operation of emergency plant should be designed so that undue disturbance does not occur during maintenance / testing procedures and during emergencies, and that statutory requirements are met.

Given the infrequent use of emergency and standby plant, it would be unduly stringent to apply the same noise criteria typically reserved for continuous operation and / or frequent noise generating activities/ sources."

The maximum internal noise levels due to the operation of the emergency generator can be found in column F of Table 15 in the ESG and are typically 5 – 10dB(A) higher than the continuous internal noise levels in column A.

3.6 TRAFFIC NOISE

3.6.1 TRAFFIC GENERATED NOISE

The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited up to 2.0dB (i.e. less than 2.1dB)[1] above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

3.6.2 SLEEP AROUSAL

The potential of sleep disturbance from short-duration noise events from the proposed development – i.e. ambulance movements – during the night-time period needs to be considered. Sleep disturbance occurs through changes in sleep state and awakenings. For continuous traffic flow, L_{Aeq} appears to be acceptably correlated with sleep disturbance.

However, for intermittent traffic flow, which often occurs at night-time ($L_{AFmax} – L_{Aeq}$) or ($L_{AFmax} – L_{A90}$) are better correlated with sleep disturbance.

NSW EPA NPI recommends the following criteria:

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

- *$L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or*
- *L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, 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."

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 as follows:

- Maximum internal noise levels below 50–55dB(A) are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65–70dB(A), are not likely to affect health and wellbeing significantly.

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.

Table 9 summarises the noise level criteria for sleep disturbance based on the NSW EPA NPI recommendations and highlight the criteria to apply.

[1] NSW Roads and Maritime Service. Noise Criteria Guideline 2015. Page 10.

	Sleep Arousal Noise Criteria
Condition 1	$L_{Aeq,15min}$ 40dB(A) || RBL + 5 = 38dB(A)
Condition 2	L_{AFmax} 52dB(A) || RBL + 15 = 48dB(A)

Table 9: Sleep Arousal noise criteria.

These values shall be achieved external to the bedroom window of the residential noise sensitive receivers, as opposed to the receiver boundary – which is applied for most other criteria.

3.7 CONSTRUCTION NOISE AND VIBRATION

3.7.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the Management Level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. Table 10 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Suburban Residential (R2 &R3)	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
Commercial Premises (SP2)	External	70	70

Table 10: ICNG construction airborne noise criteria for noise sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) - internal
- Night: $L_{Aeq,15min}$ 35dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

3.7.2 VIBRATION CRITERIA

3.7.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document '*Assessing Vibration: A Technical Guideline*' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 '*Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting*'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 11 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-9}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Critical Areas (Hospitals)	Day or night time	0.10 [100dB]	0.20 [106 dB]	0.10 [100dB]	0.20 [106dB]
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]

Table 11: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) is recommended to be used. Table 12 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, $m/s^{1.75}$*	
		Preferred	*Maximum*
Critical Areas (Hospitals)	When in use	0.10	0.20
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26

Table 12: Intermittent vibration criteria applicable to the site.

3.7.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 *'Vibration in Buildings – Effects on Structures'* are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 13.

Structural type	*Vibration velocity, mm/s (Peak Particle Velocity - PPV)*				
	Foundation			*Plane of floor uppermost full storey in horizontal direction*	*Floor slabs, vertical direction*
	1Hz to 10Hz	*10Hz to 50Hz*	*50Hz to 100Hz*	*All frequencies*	*All frequencies*
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
Type 2: Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Type 3: Structures that because their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8	20

Table 13: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

4 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise emissions from the proposed hospital redevelopment have the potential to impact on existing noise sensitive receivers. For the purpose of this Noise and Vibration Impact Assessment, the noise sources associated with the hospital are assumed as follows:

- Noise emissions from building services plant to the surrounding receivers.
- Noise emissions from the operation of the emergency generator.
- Vehicle noise emissions from:
  - Ambulance movements
  - Ambulance sirens
  - Traffic generated by the development.

Each of these noise sources has been considered in the noise impact assessment and the assessments have considered the following:

- The premises will operate 24 hours a day, seven days per week. Therefore, the worst-case scenario will be during night-time periods.
- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.

4.1 BUILDING SERVICES

Noise from the proposed development building services plant should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers. The noise emissions from building services must meet the noise limits as set out in accordance with the NSW NPI.

Noise controls may need to be incorporated with the design of the building services to ensure that cumulative noise levels from plant to the nearest noise sensitive receivers meets the noise level criteria. Building services plant will operate continuously during the day, evening and night-time; therefore, night-time operation (10pm to 7am) has been considered for the noise assessment of the building services plant.

At this stage, building services plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the building services plant noise emissions. However, a preliminary assessment has been carried out for the building services plant within the proposed services area.

It is understood that the building services will be located on Level 2 in the roof undercroft. Considering the distance from the proposed location of the building services to the nearest noise sensitive receivers, the worst-case scenario has been deemed to be the residential receivers to the North, along Jurd Street. The approximate distance from the undercroft service area to the boundary of the most affected noise sensitive receiver is 40m. Therefore, the maximum allowable cumulative noise emission levels from the services block have been predicted to be 67dB(A) at 1 meter from the services roof undercroft.

Noise controls will need to be incorporated with the design of the services to ensure that the cumulative noise levels from plant to the nearest noise sensitive receivers meets the NSW NPI noise level criteria – refer to Table 7.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of building services plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation
  - Noise enclosures as required
  - Sound absorptive panels within the undercroft area
  - Acoustic louvres as required
  - Noise barriers as required

Acoustic assessment of all building services plant shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.

4.2 EMERGENCY GENERATORS

One emergency generator will be installed in the Level 2 services area in the undercroft of the roof. A preliminary assessment has been carried out for the noise from the emergency generator to the most affected noise-sensitive receivers to the north of the site along Jurd Street.

Considering the distance from the proposed location of the emergency generator to the nearest noise sensitive receivers, the worst-case scenario has been deemed to be the residential receivers to the North, along Jurd Street. The approximate distance from the proposed location of the emergency generator to the boundary of the most affected noise sensitive receiver is 40m. Therefore, the maximum allowable noise emission level from the emergency generator has been predicted to be 67dB(A) at 1 meter from the roof undercroft.

Noise controls will need to be incorporated with the design of the emergency generator to ensure that the cumulative noise levels from the emergency generator plus building services plant to the nearest noise sensitive receivers meets the recommended noise level criteria as per 3.5.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of the emergency generator to ensure the noise levels at the receiver boundaries is met.
- Selection of appropriate quiet emergency generator.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - Noise enclosures as required.
  - Intake attenuators and exhaust mufflers.
  - Sound absorptive panels within the undercroft area.
  - Acoustic louvres as required.
  - Vibration controls.
  - Noise barriers as required.

Acoustic assessment of the emergency generator plant shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the recommend noise level criteria at the nearest noise sensitive receivers.

4.3 VEHICLE NOISE EMISSIONS

An acoustic assessment of vehicle noise emissions associated with the redevelopment has been undertaken. The potential noise sources associated with the vehicles includes the following:

- Noise generated by vehicle movements, particularly ambulances movements for emergencies during night-time.
- Noise generated by the use of ambulance sirens.
- Noise generated from increased traffic flows associated with the redevelopment.

4.3.1 AMBULANCE MOVEMENTS

Ambulance movements are expected to be slow when within the hospital. It has been assumed that the worst-case scenario will be during an ambulance movement for a Priority One incident during the night-time. The nearest noise sensitive receivers to the proposed ambulance movement path are the residential receivers along Jurd Street.

For the noise assessment purpose, departing ambulances noise levels from the hospital are likely to generate the following noise level range.

Noise Source	*Maximum Sound Power Level dB(A), ref 1pW*
Ambulance vehicle	86 – 91

Table 14: Maximum assumed noise levels emissions for ambulance movements.

The noise assessment has considered the following assumptions:

- The hospital emergency department will operate 24 hours a day 7 days per week. Therefore, there will be ambulance movements at any time period.
- One Ambulance movement event is estimated to be 30 seconds.
- Noise levels have been considered as continuous over a 15-minute assessment period to provide the worst-case scenario.
- Ambulance noise levels are based on the highest value of the maximum sound power level range for a worst-case scenario.
- Noise predictions are based on distance attenuation, ground reflection, building reflections / shielding and directivity of the noise source.
- Noise level criteria are based on the lowest measured background noise level in order to provide a worst-case scenario.

The sleep arousal assessment is provided in the following tables.

Calculation	Ambulance Departure
L_{Aeq} at 1 m	77
Distance attenuation, dB	-27
Duration correction, dB	-15
$L_{Aeq,15min}$ resulting at residential receiver	**35**
NPI Sleep Arousal Night-time / Complies?	**40** / Yes

Table 15: Sleep arousal noise assessment at residential receiver for ambulance departure during night-time. Condition 1.

Calculation	Ambulance Departure
L_{Amax} at 1 m	83
Distance attenuation, dB	-27
L_{Amax} resulting at residential receiver	**56**
NPI Sleep Arousal Night-time / Complies?	**52** / No

Table 16: Sleep arousal noise assessment at residential receiver for ambulance departure during night-time. Condition 2.

Based on the assessment above, the predicted cumulative $L_{Aeq,15min}$ noise level is expected to comply with the Condition 1 of the NPI Sleep Arousal Criteria during the night-time period.

The predicted L_{Amax} noise level at the nearest residential receiver façade exceeds the Condition 2 NPI Sleep Arousal Criteria by 4dB(A). It is generally accepted that internal noise levels in a dwelling with the windows open are 10dB lower than external noise levels – being opened sufficiently to provide adequate ventilation. Based on this, predicted noise levels within the residential receiver with windows opened are equivalent to 46dB(A) for ambulance movements.

Based on guidance from the NSW Road Noise Policy, maximum internal noise levels below 50-55dB(A) are unlikely to cause awakening reactions. Therefore, it can be stated that noise levels are unlikely to affect the health and wellbeing of occupants significantly.

4.3.2 AMBULANCE SIRENS

Regarding the use of ambulance sirens on site, when ambulances travel to attend incidents, it is not specifically addressed in any relevant noise regulations. When in use, noise levels from ambulance sirens will be audible at the nearest residential receivers.

Events identified as Priority One events (Life Threating Emergencies), require that warning devices must be used, including warning lights and sirens. The NSW Ambulance *Emergency Driving and Use of Warning Police Directive 2016-033* states that:

"NSW Ambulance personnel who drive a vehicle under emergency response conditions shall use safety equipment provided by NSW Ambulance for that purpose which includes warning devices: lights and sirens. Lights can be used in isolation without the use of a siren if the driver of the vehicle deems the circumstances are safe to do so and can justify reasonable cause to do so."

Based on the above, we understand that ambulance drivers will make a judgement call on whether to use ambulance sirens on case-by-case basis. We further understand that it is the practice of Paramedics to minimise the use of sirens when it will cause a noise disturbance, and the sirens are deemed unnecessary.

4.3.3 TRAFFIC NOISE GENERATION

As noted in Section 3.6 when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the RNP states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant.

JHA have reviewed the Transport Report[2], prepared by Stantec, dated 30th August 2024. The estimated traffic generation due to the redevelopment is anticipated to result in a minor increase in traffic, with the number of trips during the peak hour expected to increase from 64 vehicles per hour to 82 vehicles per hour. Based on this estimated increase in traffic volume, traffic noise levels are expected to increase by less than 2dB, therefore, traffic noise levels are expected to meet the NSW Road Noise Policy recommendations.

[2] Cessnock Hospital Redevelopment Transport Report Schematic Design [ref. 300304237], prepared by Stantec, dated 30/08/2024.

5 TRAFFIC NOISE INTRUSION

A noise assessment for external noise intrusion from Jurd Street has been undertaken in order to provide preliminary recommendations for the northern façade of the new hospital building.

The following assumptions have been considered for the traffic noise impacts:

- Traffic noise levels for the assessment are as per measured levels on site by JHA Consulting Engineers. Refer to Section 2.5.
- Internal noise levels are predicted based on noise levels incident at the façade of each space, which are based on the measured traffic noise levels.
- External glazing is the weakest elements of the façade, and solid sections of the façade are typically to provide a sound reduction index of R_W50.
- Calculations have been based on achieving the internal noise level targets as per the NSW Health Infrastructure ESG.

To achieve the internal noise levels in accordance with NSW Health Infrastructure ESG, and based on the above assumptions, the following is required:

- External glazing is recommended to provide a minimum sound reduction index of R_W32. A 6.38mm laminated fixed single glazing system achieves the nominated sound reduction index.

Notwithstanding with the glazing recommendations provided above, the acoustic performance of the glazing and building façade shall be reviewed during the detailed design of the project once glazing and façade areas will be defined. The acoustic requirements are to be achieved based on the performance of the framing and glass together.

6 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently the construction methodologies, staging and plant are unknown as the Contractor has not yet been engaged. Therefore, it is not possible to accurately assess construction noise impacts to the nearby noise sensitive receivers. This section provides general preliminary recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known plus any noise mitigation measures required.

Any noise from demolition and construction activities to be carried out on site must not result in *'offensive noise'* to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 3.7 of this report contains the relevant legislation, codes and standards plus construction noise and vibration criteria for this project.

6.2 WORKING HOURS

The standard construction hours as per the NSW EPA ICNG are as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and Public Holidays: No excavation or construction works

It is recommended that high noise level works – i.e. piling, excavation, etc – shall be scheduled to not occur during shoulder periods of the recommended standard hours – i.e., 7am to 8am and 5pm to 6pm. A detailed Construction Noise & Vibration Management Plan (CNVMP) shall further assess the noise impact of construction works and shall include a protocol to minimise any potential noise impacts to identified sensitive receivers and ensure that appropriate noise control measures are defined and implemented to comply with all relevant noise guidelines.

6.3 PRELIMINARY CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

At this stage, there is no information regarding construction plant / equipment plus work activities / duration. However, a preliminary construction noise and vibration assessment has been carried out based on typical plant and machinery in order to identify works that have the potential to impact the amenity of noise sensitive receivers surrounding the site.

We note that the assessment is high-level and the predicted noise levels are considered the worst-case scenario, i.e., construction activities assumed to be carried out at, or within close proximity, to the boundary of the site. Therefore, it has been assumed that generally works are within 5m of affected noise sensitive receiver boundaries. The Contractor will be responsible for preparing a Works Plan and Schedule which includes all relevant noise and vibration information.

A Detailed CNVMP addressing impacts should be conducted during the construction stages when specific information around construction methodology is known, to provide acoustic mitigation measures and management measures based on specific construction works, equipment and locations.

6.3.1 CONSTRUCTION NOISE ASSESSMENT

The expected construction noise sources and the predicted noise levels at the nearest residential receivers are shown in Table 17. The equipment noise levels are based on the database published by the UK Department for Environmental, Food and Rural Affairs (DEFRA) & Australian Standard AS2436:2010 *'Guide to Noise Control on Construction, Maintenance & Demolition Sites'* for a 15-minute period.

Item	*Typical Power Noise Level L_{A10} (dB ref 1pW)*	*Typical Noise Level $L_{A10,15m}$ at 7m (dB ref 20µPa)*	*Predicted Noise Level $L_{Aeq,15m}$ Worst case Residential receiver (NCAs 2, 5 & 6)*	*Complies with Highly Noise Affected Criteria*
Angle grinders	104	76	77 – 82	No
Truck (>20 tonne)	108	80	81 – 86	No
Circular saw	115	87	88 – 93	No
Piling rig	120	92	93 – 98	No
10-40tn Excavator	117	89	90 – 95	No
40-50tn Mobile crane	111	83	84 – 89	No
Concrete pump	114	86	87 – 92	No
Concrete truck	110	82	83 – 88	No
Drill	94	66	67 – 72	Yes

Table 17: Anticipated airborne noise levels for construction equipment / plant used during construction works.

Based on the results of the preliminary assessment as shown above, the noise associated with the construction works – without noise control measures – is expected to exceed the noise limits for highly noise affected receivers within standard hours. This assessment is based on typical noise levels associated with construction sites and machinery.

Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures such as acoustic screening around the site. These noise mitigation measures are to be provided in a detailed Construction Noise & Vibration Management Plan and prepared by a qualified acoustic consultant prior to Construction Certificate.

6.3.2 PRELIMINARY VIBRATION ASSESSMENT

The NSW RMS *'Construction Noise and Vibration Guideline'* provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECC's *'Assessing Vibration: A Technical Guideline'*). The recommended safe working distances for typical construction plant are provided in Table 18.

Plant Item	*Description*	*Cosmetic Damage*	*Human Response*
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Hand held	1m	Avoid contact with structure

Table 18: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

For any vibration intensive plant expected to be within close proximity of the minimum distances described above, the contractor must engage a qualified engineer to carry out a vibration survey in order to assess any potential risks.

The vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria, then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimized as far possible.

6.4 MITIGATION MEASURES

6.4.1 PROJECT SPECIFIC MITIGATION MEASURES

In order to meet the noise and vibration requirements of the site, the Contractor is recommended to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan. The report shall document acoustic measures required to minimise any adverse noise impacts to the nearby affected receivers. The acoustic measures detailed within the CNVMP may include fixed and/or mobile acoustic screens, scheduling of works including any respite periods and identifying noisy works that can be further managed. Further to this, a noise and vibration survey is recommended to be defined for any noisy and/or vibration intensive works.

6.4.2 GENERAL MITIGATION MEASURES

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.
  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Selecting plant and equipment with low vibration generation characteristics.
  - Operate plant in a quietest and most effective manner.
  - Where appropriate, limit the operating noise of equipment.

  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.4.3 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc.) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

7 MANAGEMENT AND COMPLIANCE

Limiting noise nuisance from a premise generally requires management on an ongoing basis. Strategies for the proposed development should consider the following:

- At this stage, final plant selections have not been made. Plant noise associated with the operation of the proposed new hospital building should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of neighbouring receivers. A detailed assessment shall be carried out once the mechanical plant has been selected.
- Use of ambulance sirens within the hospital site and surroundings shall be minimised whenever possible.
- To minimise impact on the surrounding amenity, Waste Collection / Delivery Vehicle movements are recommended to occur during the day-time.

8 CONCLUSIONS

A Noise & Vibration Impact Assessment for Review of Environmental Factors has been carried out for the Cessnock Hospital Redevelopment. This report forms part of the documentation package to be submitted to the Department of Planning as part of the REF.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development.

8.1 SUMMARY

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

Building Services Noise: At this stage the building services plant selections have not been made; therefore, a detailed assessment has not been able to be carried out. A preliminary review has been carried out, and based on the location, distance to noise sensitive receivers and the most restrictive criteria, noise emissions from the services block shall be limited to 67dB(A) SPL at 1 metre from its boundary. Acoustic assessment of all building services plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

Emergency Generator: One emergency generator will be installed in the Level 2 services area in the undercroft of the roof. A preliminary assessment has been carried out for the noise emissions from the emergency generator to the most affected noise-sensitive receivers to the north of the site. Based on this assessment, cumulative noise emissions from the emergency generator plus building services shall be limited to 67dB(A) SPL at 1 metre the boundary of the services undercroft area. Acoustic assessment of the emergency generator shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the recommend noise level criteria at the nearest noise sensitive receivers.

Vehicle Noise Emissions:

Ambulance Movements: The noise level of departing ambulances during the night-time period has been assessed. Based on the assessment, the predicted cumulative $L_{Aeq,15min}$ noise level is expected to comply with the Condition 1 of the NPI Sleep Arousal Criteria during the night time period. The predicted L_{Amax} noise level at the nearest residential receiver façade exceeds the Condition 2 NPI Sleep Arousal Criteria by 9dB(A). However, predicted noise levels within the residential receiver are unlikely to affect the health and wellbeing of occupants significantly and, therefore, would not warrant receiver-based noise treatments or controls.

Ambulance Sirens: For noise from ambulance sirens, it is recommended that their operation within the development and surroundings shall be addressed in the Management Plan and minimised whenever possible.

Traffic Noise Generation: JHA have reviewed the Transport Report prepared by Stantec, dated 30th August 2024. The estimated traffic generation due to the redevelopment is anticipated to result in a minor increase in traffic volume. Based on the estimated increase in traffic volume, traffic noise levels are expected to increase by less than 2dB, therefore, traffic noise levels are expected to meet the NSW Road Noise Policy recommendations.

Traffic Noise Intrusion: An acoustic assessment of the road noise intrusion has been carried out. Based on the results of the assessment, recommendations have been provided for the minimum sound insulation performance of the external glazing likely required to meet the internal noise levels for the spaces.

Construction Noise: A preliminary construction noise assessment has been carried out. Based on the results of the preliminary assessment, noise associated with worst-case scenario construction works is expected to exceed the noise limits in accordance with the ICNG Guideline. Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures. These noise mitigation measures are to be provided in a detailed Construction Noise & Vibration Management Plan prepared by a qualified acoustic consultant prior to Construction Certificate. The detailed CNVMP is to include noise impacts and mitigation measures for the surrounding noise sensitive receivers.

8.2 MITIGATION MEASURES

Project Stage *Design (D)* *Construction (C)* *Operation (O)*	*Mitigation Measures*	*Relevant Section of Report*
D	Building Services Noise –A preliminary review of the external building services has been carried out, and based on the location, distance to noise sensitive receivers and the most restrictive criteria, noise emissions from the services block shall be limited to 67dB(A) SPL at 1 metre from the boundary of the services undercroft area. Acoustic assessment of all building services plant shall continue during the detailed design phase of the project in order to confirm any noise control measures	Section 4.1
D	Emergency Generator Noise – A preliminary assessment has been carried out for the noise emissions from the emergency generator to the most affected noise-sensitive receivers to the north of the site. Based on this assessment, cumulative noise emissions from the emergency generator plus building services shall be limited to 67dB(A) SPL at 1 metre from the boundary of the services undercroft area. Acoustic assessment of the emergency generator shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the recommend noise level criteria at the nearest noise sensitive receivers.	Section 4.2
O	Ambulance Movements – Predicted noise levels within the nearest residential receiver properties are unlikely to affect the health and wellbeing of occupants significantly and, therefore, would not warrant receiver-based noise treatments or controls.	Section 4.3.1
O	Ambulance Sirens – It is recommended that their ambulance sirens within the development and surroundings shall be addressed in the Management Plan and minimised whenever possible.	Section 4.3.2
O	Traffic Noise Generation – Based on the estimated increase in traffic volume, traffic noise levels are expected comply with the NSW Road Noise Policy recommendations.	Section 4.3.3

Project Stage *Design (D)* *Construction (C)* *Operation (O)*	*Mitigation Measures*	*Relevant Section of Report*
D	Traffic Noise Intrusion – Recommendations have been provided for the minimum sound insulation performance of the external glazing likely required to meet the internal noise levels for the spaces.	Section 5
C	Construction Noise – Preliminary predictions indicate that noise associated with the construction works are expected to exceed the noise limits for highly noise affected receivers within standard hours. It is recommended a detailed CNVMP is prepared which includes noise impacts and mitigation measures for the surrounding noise sensitive receivers.	Section 6

The information presented in this report shall be reviewed and developed as plans for the hospital mature, including and not restricted to selection of equipment and plant, and introduction of any additional noise sources.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

APPENDIX A – UNATTENDED NOISE MONITORING

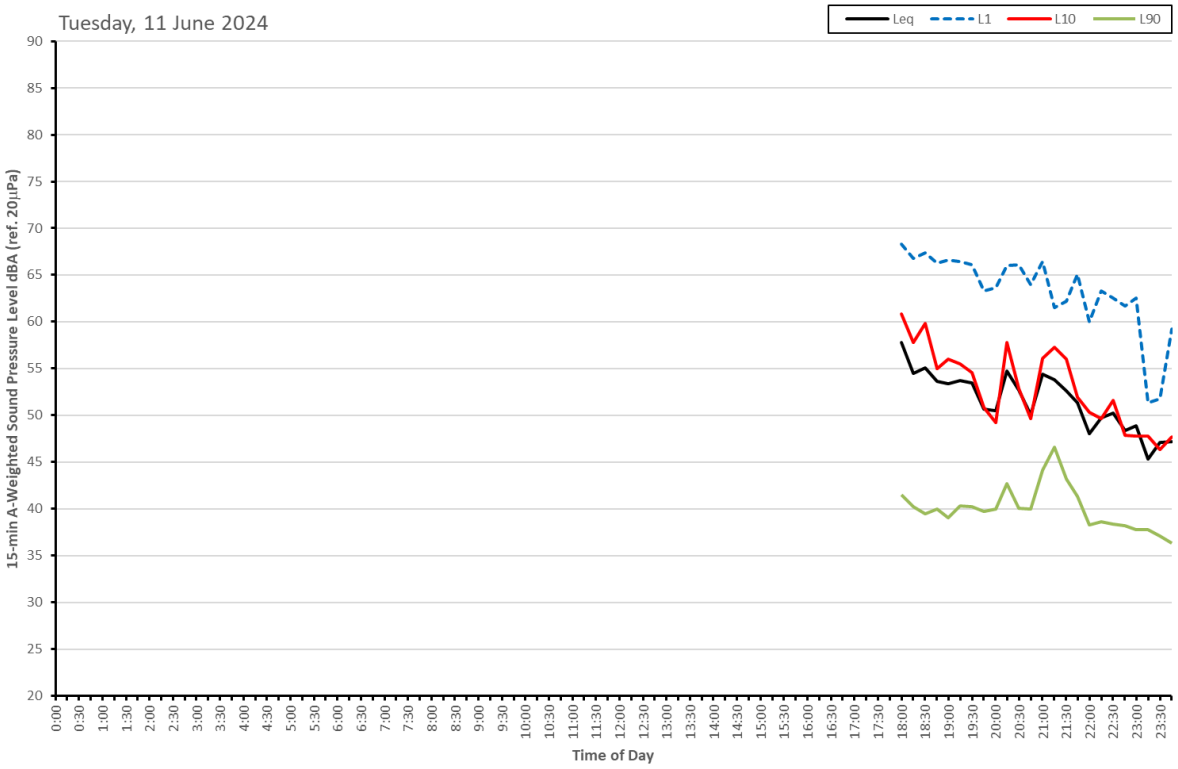
ACOUSTIC TERMS

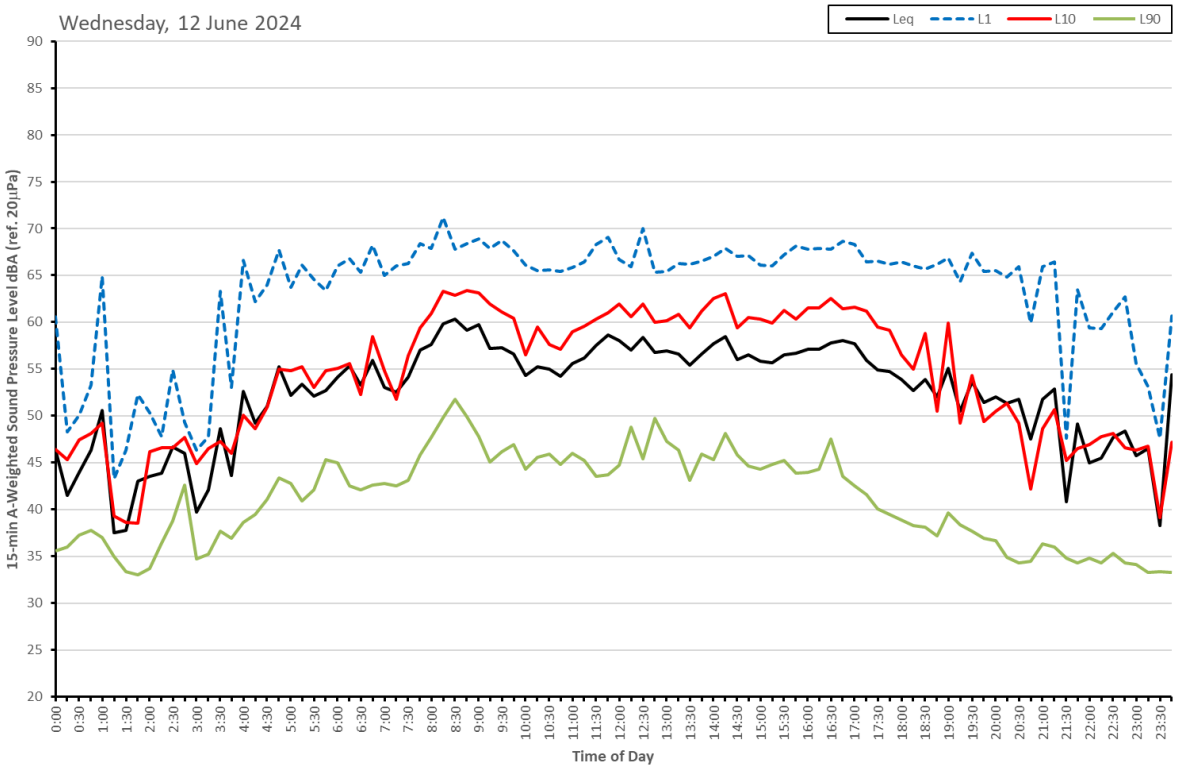
L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

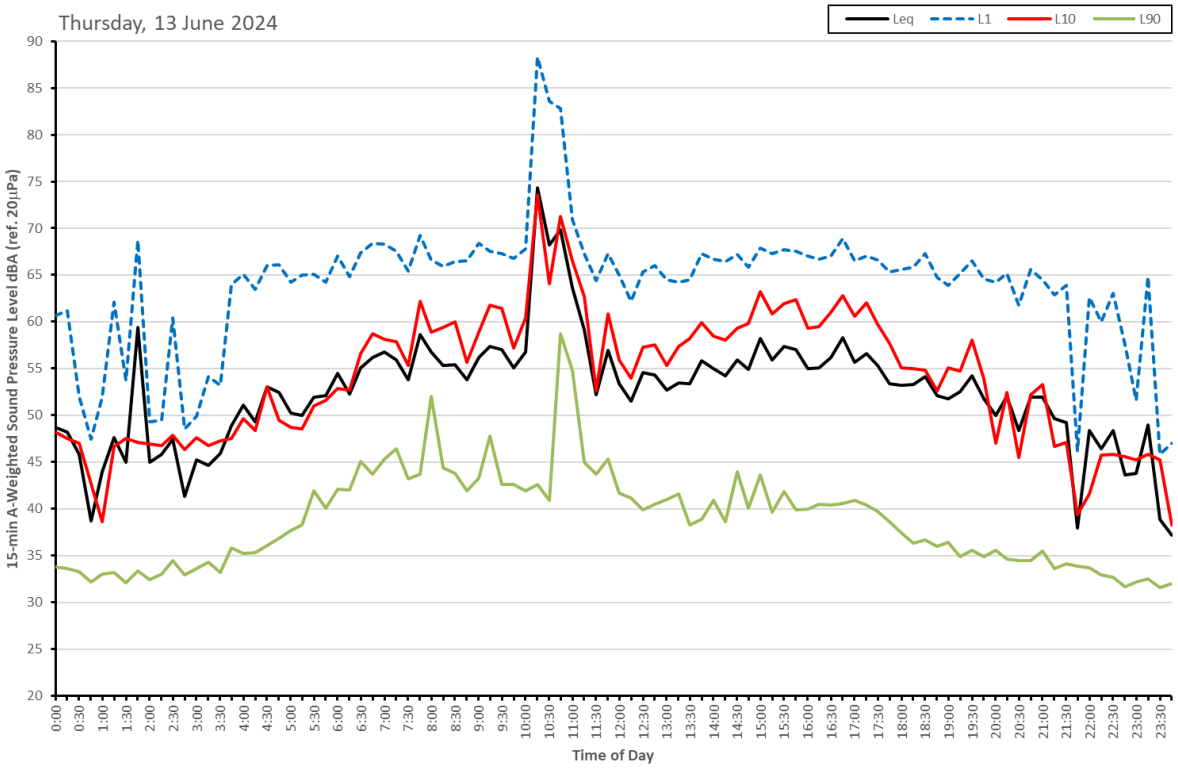
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

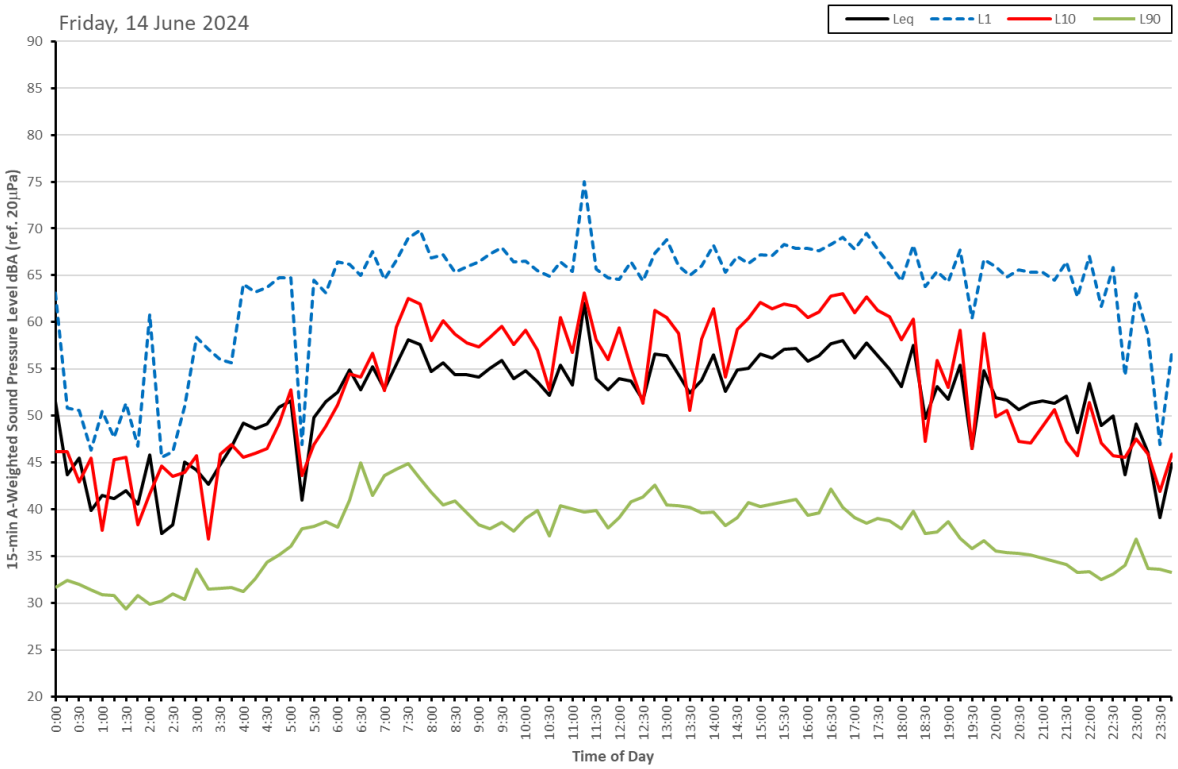
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

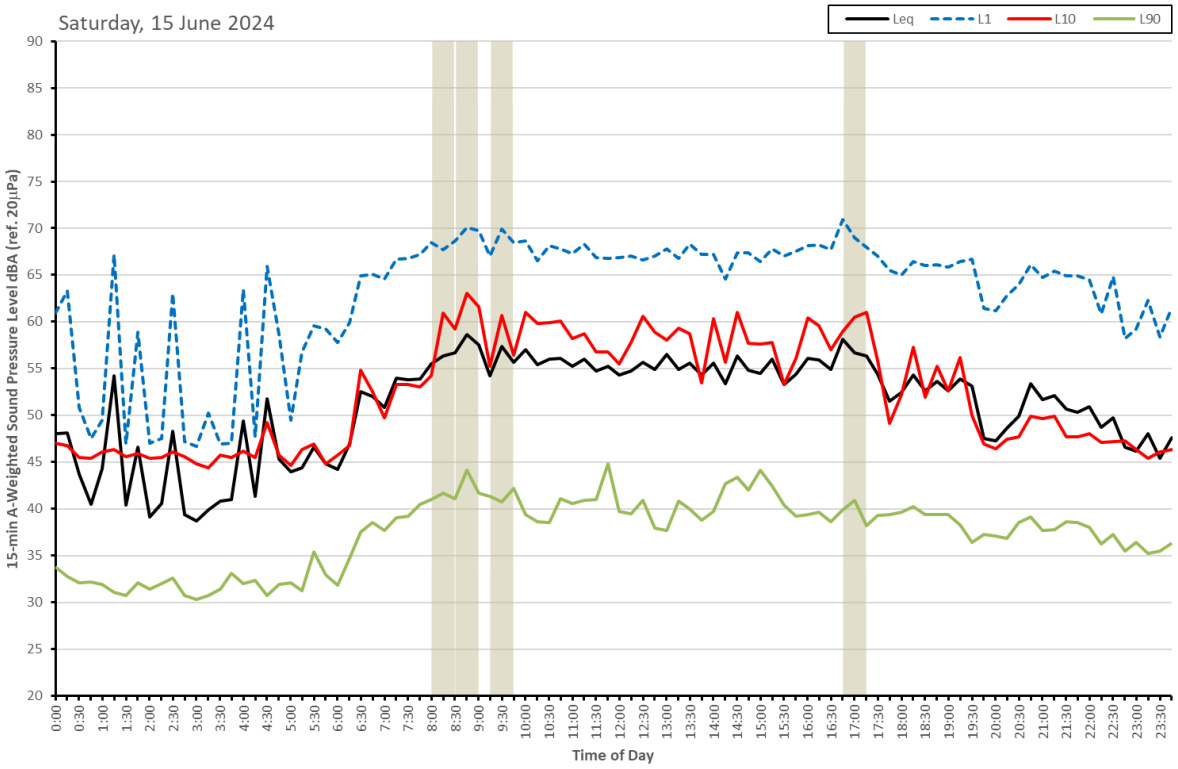
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

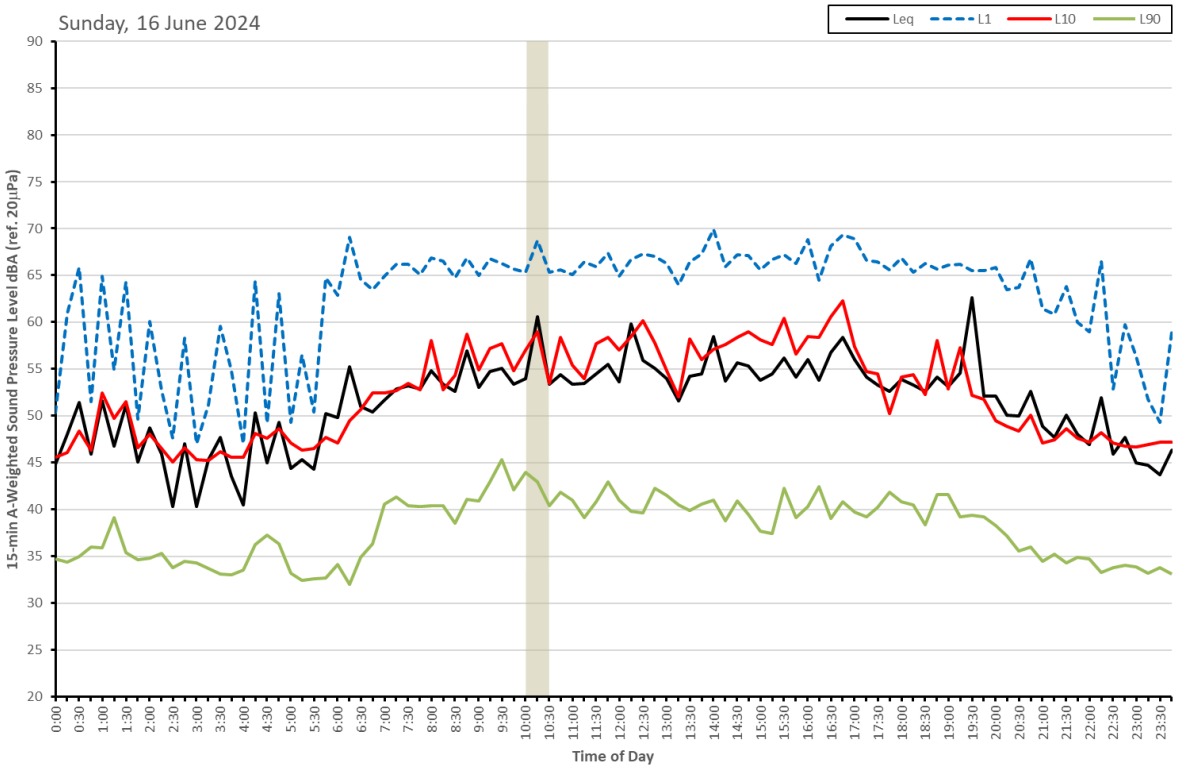

Tuesday, 11 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

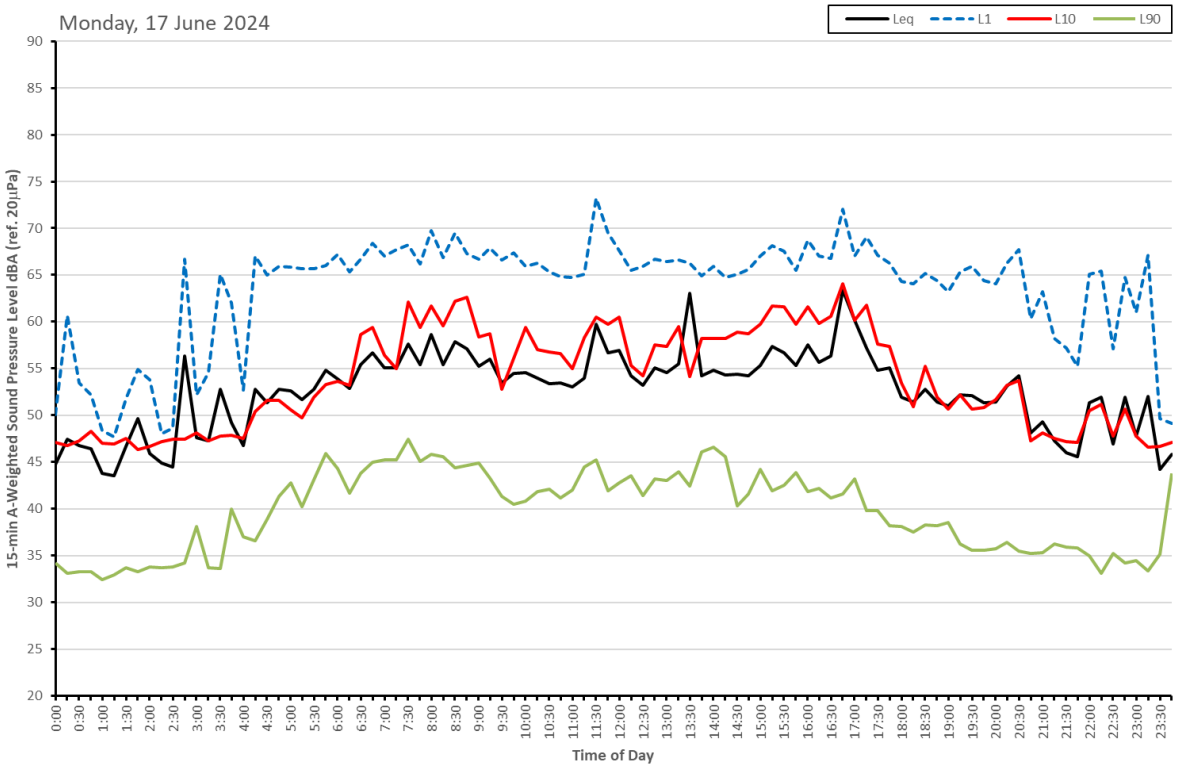

Wednesday, 12 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

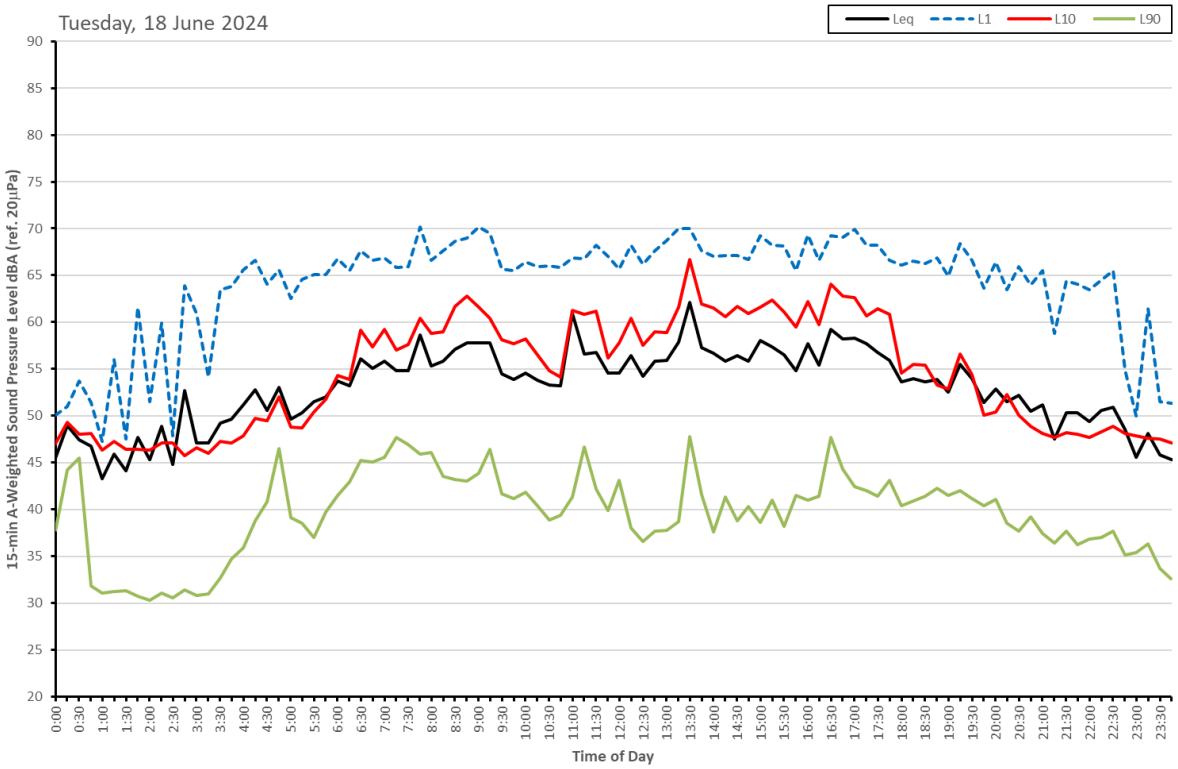

Thursday, 13 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

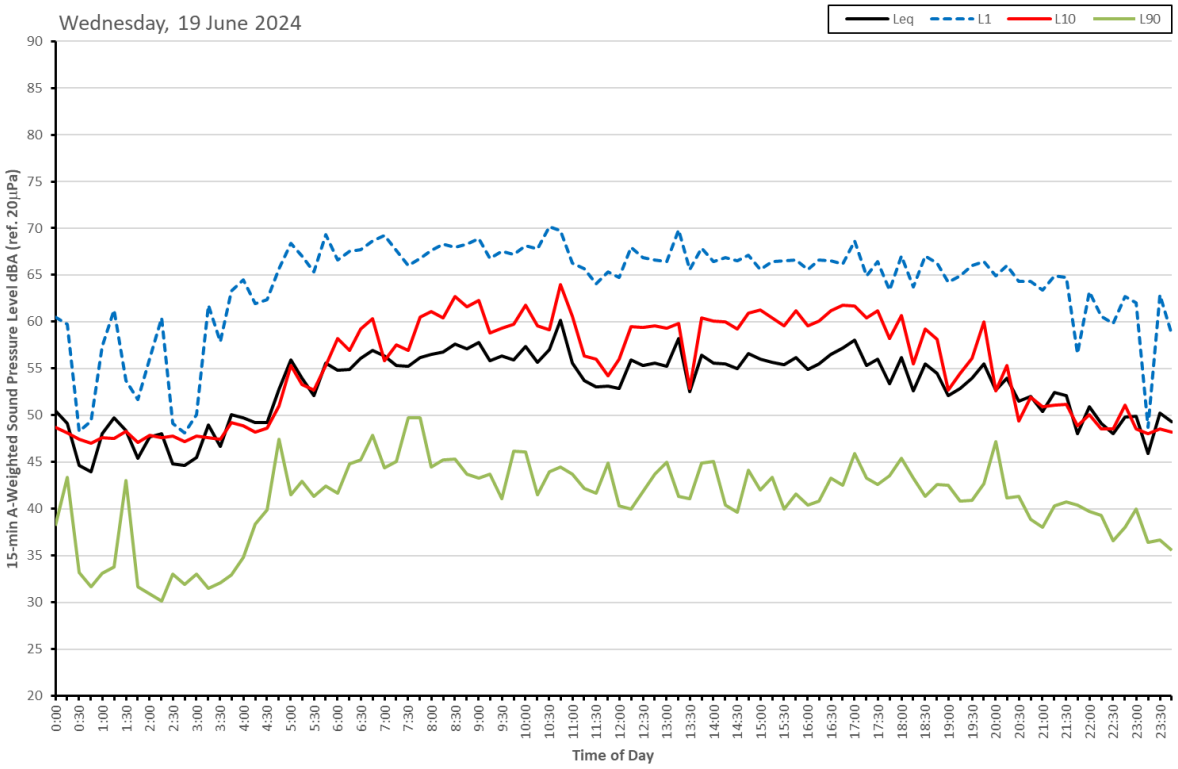

Friday, 14 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

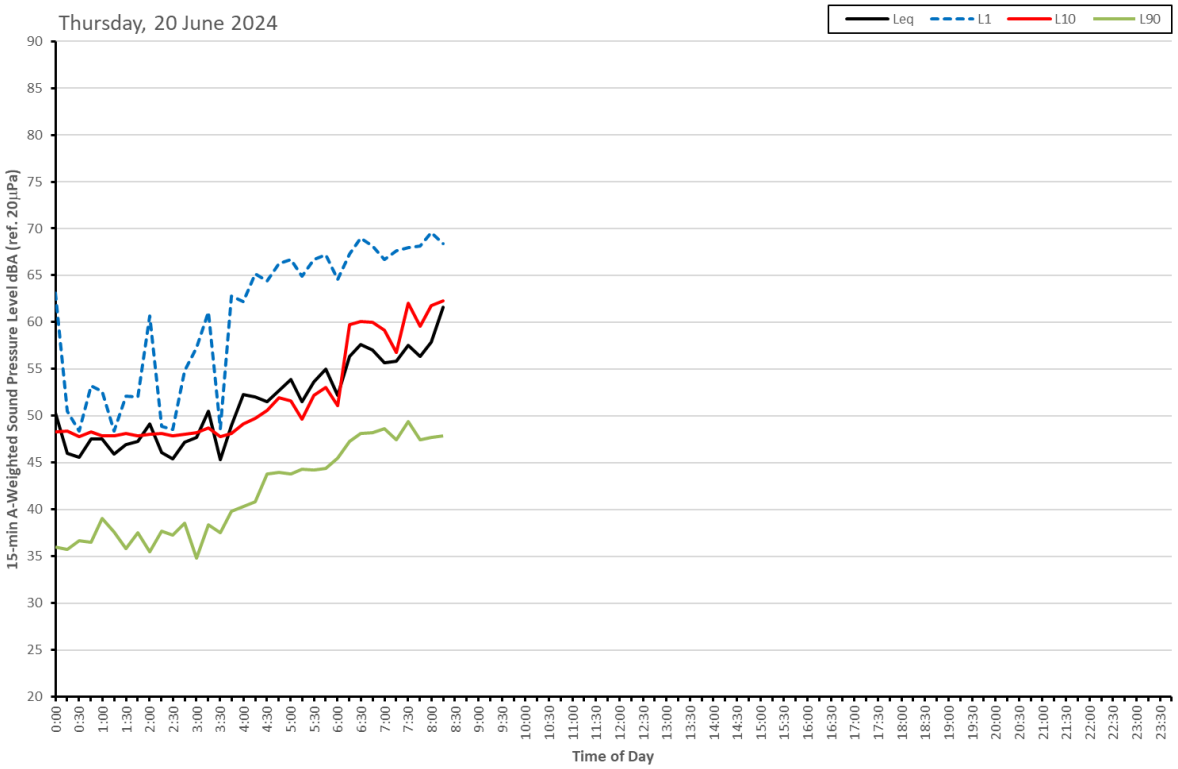

Saturday, 15 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Sunday, 16 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Monday, 17 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Tuesday, 18 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Wednesday, 19 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Thursday, 20 June 2024
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day