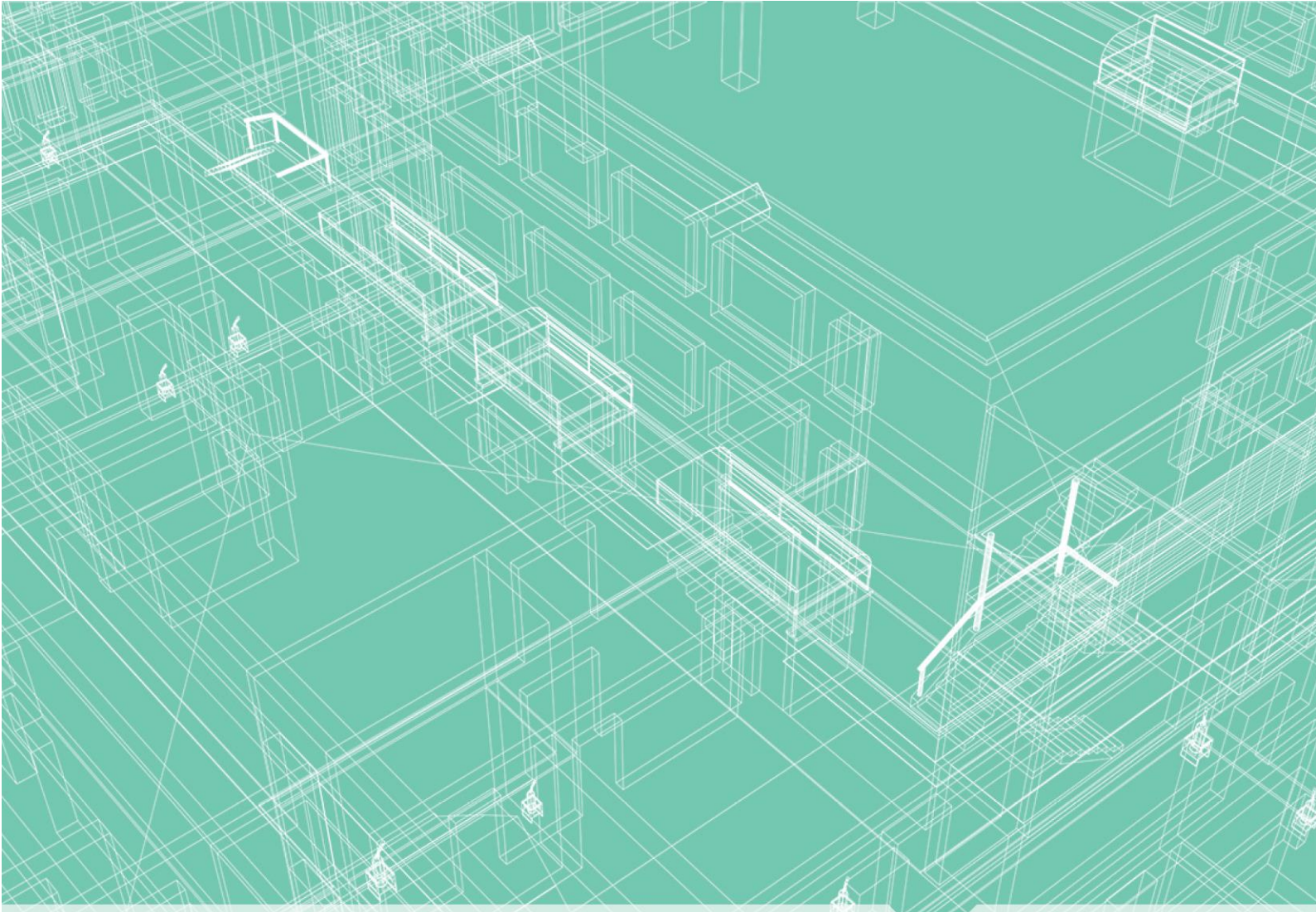

NOISE & VIBRATION IMPACT ASSESSMENT FOR DEVELOPMENT APPLICATION

PORT MACQUARIE PRIVATE HOSPITAL EXTENSION

JHA

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CONTENTS

1 INTRODUCTION

JHA Consulting Engineers has been engaged by Erilyan Pty Ltd to prepare a noise and vibration impact assessment for the proposed extension of Port Macquarie Private Hospital, located at 86-94 Lake Road, Port Macquarie NSW 2444. Consent is sought for proposed expansion of the hospital along with refurbishment of existing space within the hospital. The proposed works are segregated into two phases '*Stage 1*' and '*Stage 2*'. The extension of the hospital will span over two storeys and consist of the following:

- Front entrance
- Medical imaging room
- Café
- Two operating theatres
- Conversion of existing theatres
- Pharmacy
- New Surgery centre and medical suites
- 17 beds in patient units
- Conversion and upgrade of allocated existing rooms
- On-grade car-park

The objectives of this noise and vibration impact assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Establish appropriate noise criteria based on the noise surveys, in accordance with the relevant standards, guidelines and legislation for the following issues:
  - Mechanical plant from the development to the surrounding receivers.
  - Operational noise from the café.
  - Traffic noise generation.
  - Operational noise from new car-park.
  - Sleep disturbance impacts from operational noise of the hospital during night-time period.
  - Traffic noise intrusion.
- Determine whether the relevant criteria can be achieved based on the proposed operations. 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.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

This report shall be read in conjunction with the architectural design drawings and other relevant consultant design reports submitted as part of the application. The following documentation has been used for the preparation of this report:

- Architectural drawings prepared by Health Projects International, dated 23/09/2022.
- Noise data collected on site through the use of a noise logger and a hand-held spectrum analyser.
- Mechanical plant information provided by DSA Consulting.
- Traffic assessment report prepared by Transport and Traffic Planning Associates (TTPA).

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

2 DESCRIPTION OF THE PROPOSAL

2.1 LOCATION AND SITE DESCRIPTION

Port Macquarie is a coastal town in the local government area of Port Macquarie-Hastings. It is located on the mid-north coast of New South Wales, about 390km north of Sydney. The hospital is located at 86-94 Lake Road, Port Macquarie and is legally known as Lot 1 in DP1225449.

The surrounding development is mainly single and two storey detached houses and the surrounding land uses are as follows:

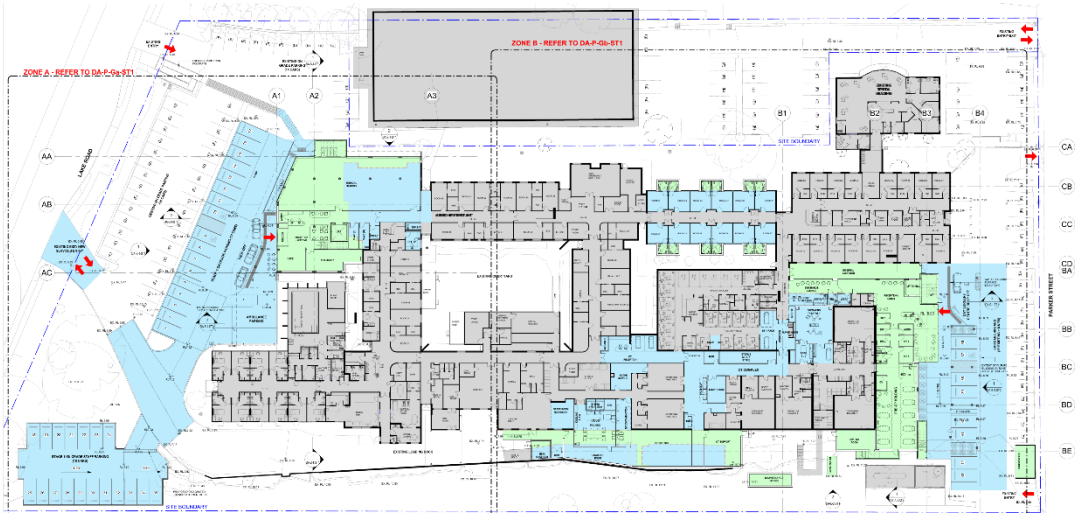
- *North:* Healthcare buildings (Mid North coast Allied health and medical centre) and medium density residential development.
- *East:* Low density Residential development.
- *South:* Healthcare buildings (Private clinics) and low-density Residential development.
- *West:* Healthcare buildings (Private clinics).

Figure 1 shows the site boundary of the hospital (red outline) and the proposed extension within the site boundary (orange shading).

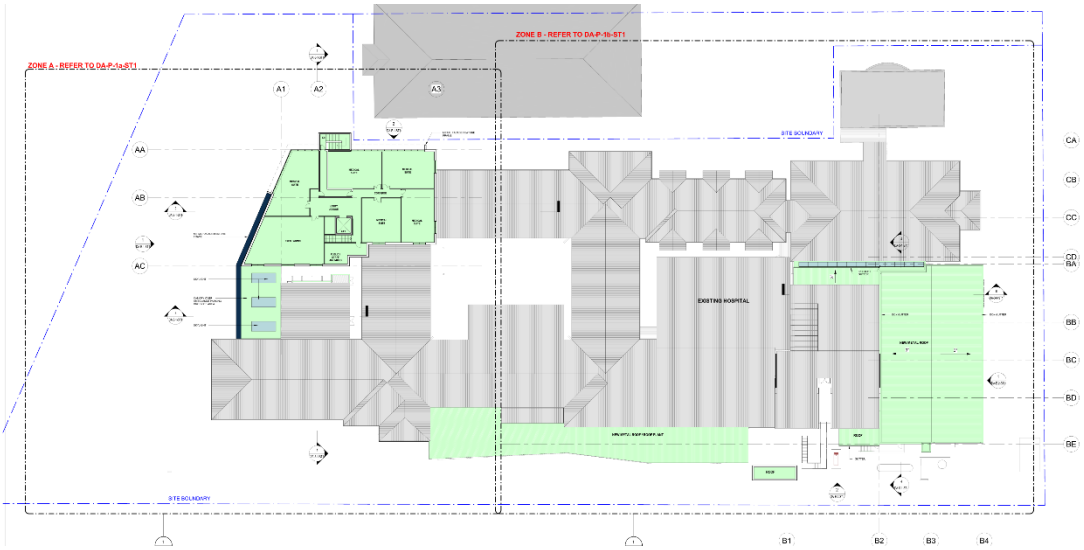
Figure 1: Hospital site boundary (red outline) and proposed extension locations (orange shading).

The proposed extension of the hospital and refurbishment of existing rooms within the building will incorporate the following:

- Front entrance
- Medical imaging
- Café
- Pharmacy
- Two operating theatres
- Conversion of existing theatres
- New Surgery centre and medical suites
- 17 beds in patient units
- Conversion and upgrade of allocated existing rooms
- On-grade car-park located within the north-east section of the site.

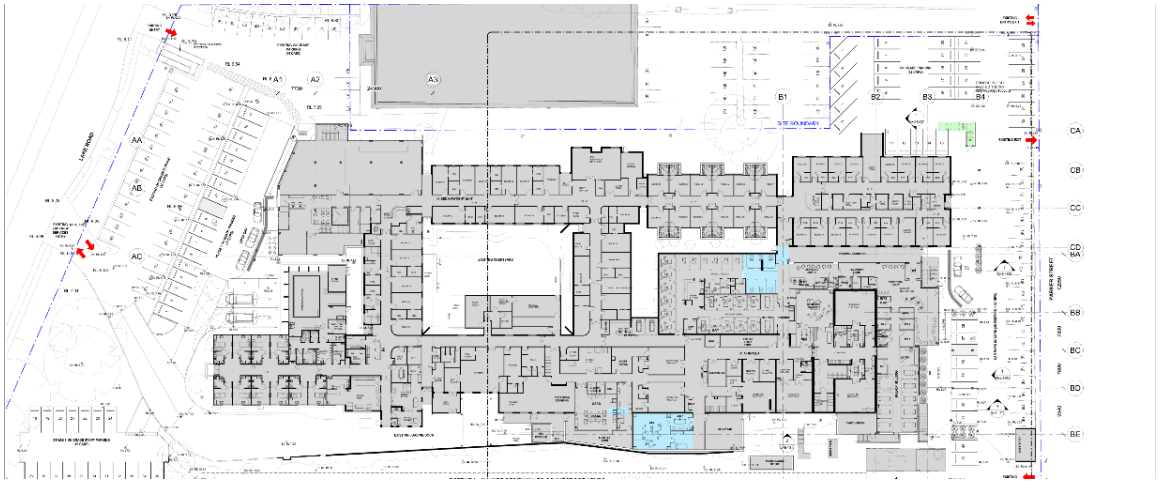


Stage 1 - Ground Floor

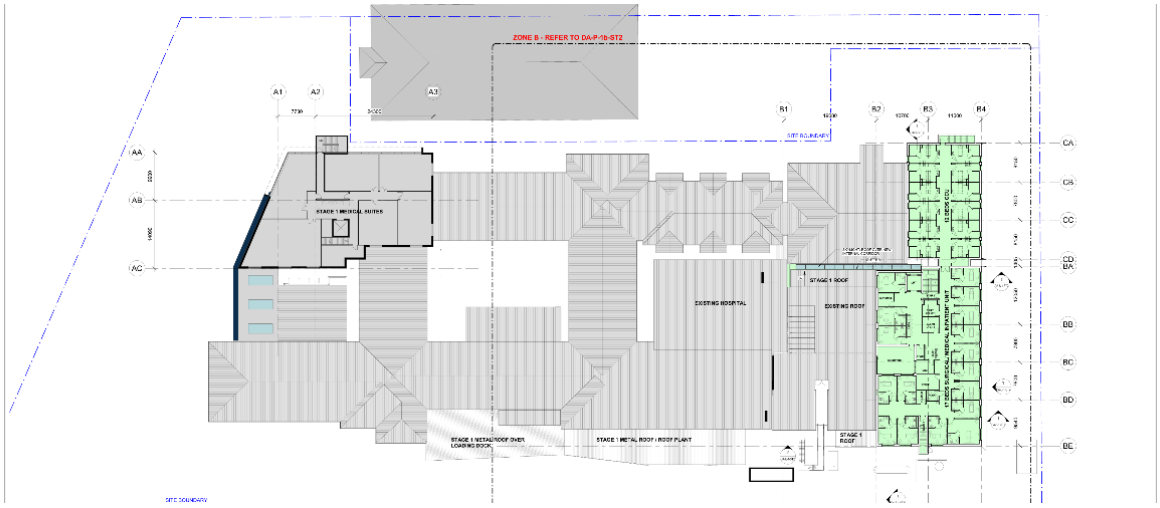


Stage 1 - Level 1

Figure 2: Proposed Stage 1 hospital extension (grey shading is outside proposed scope of works).



Stage 2 - Ground Floor



Stage 2 - Level 1

Figure 3: Proposed Stage 2 hospital extension (grey shading is outside proposed scope of works).

2.2 SURROUNDING RECEIVERS

The location and summary of the nearest noise sensitive receivers surrounding the site are shown in Figure 4 and Table 1 respectively, including assumed approximate distances from the buildings with noise sources to the receiver boundaries, noting the type of noise receiver and if the receiver is existing or future.

Figure 4: Nearest noise sensitive receivers surrounding the site location.

ID	*Sensitive Receiver*	*Receiver Status*	*Receiver Type*	*Approx. Distance, m*
1	72 - 80 Lake Rd	Existing	Healthcare	<5
2	1 - 9 Parker St	Existing	Residential	<5
3	Chelsea Place	Existing	Public recreation	25
4	2 - 6 Parker St	Existing	Residential	30
5	1/8 Parker St	Existing	Commercial	35
6	17 Parker St 25-27 Parker Street	Existing	Residential	20
7	73 Savoy St	Existing	Residential	35
8	98 Lake Rd	Existing	Healthcare	30
9	85 Lake Rd	Existing	Residential	20
10	83 Lake Rd	Existing	Commercial	15
11	77 Parker St	Existing	Healthcare	20

Table 1: Nearest sensitive receivers surrounding the site.

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

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys were conducted in the locations shown in Figure 5 to establish the ambient and background noise levels of the site and surrounds. JHA Consulting Engineers carried out the noise surveys, in accordance with the method described in the AS/NZS 1055:2018 '*Acoustics - Description and measurement of environmental noise*'.

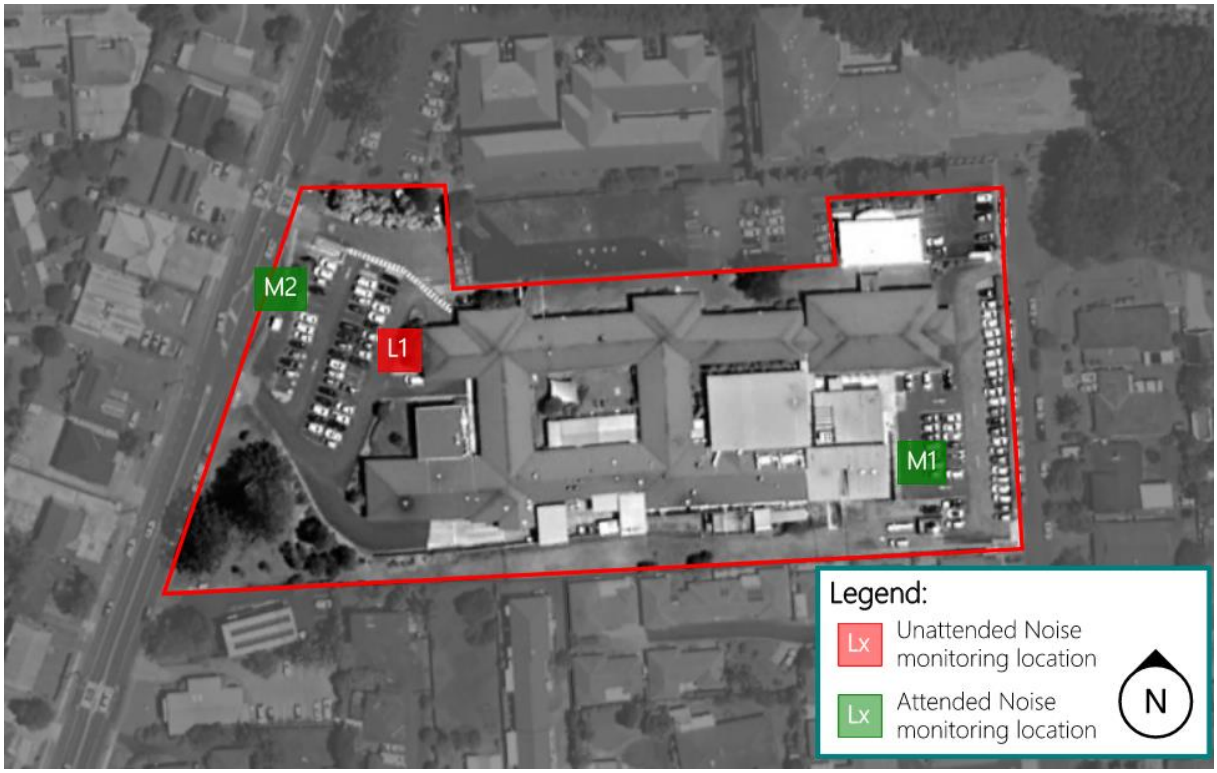


Figure 5: Noise survey locations and boundary of the site.

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site. On Wednesday 18th May 2021, short-term noise measurements were carried out during day-time with a NTI XL-2 hand-held Sound Level Meter (SLM) (Serial Number A2A-13742-E0). 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 calm and dry during the attended noise monitoring.

From observations during the noise survey, it is noted that ambient noise levels are dominated by low activity of car-park and vehicular movement on Lake Road.

A summary of the results of the short-term noise monitoring are shown in Table 2.

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
M1	18/05/2022 1:20pm – 1:35pm	$L_{90,15min}$	40	46	41	39	35	34	31	26	17
		$L_{eq,15min}$	47	55	51	45	43	41	39	36	31
		$L_{10,15min}$	50	56	52	46	45	43	42	39	32
M2	18/05/2022 1:40pm – 1:55pm	$L_{90,15min}$	54	55	51	49	47	49	46	38	26
		$L_{eq,15min}$	66	68	63	60	60	63	60	55	44
		$L_{10,15min}$	68	70	65	62	62	65	61	53	45

Table 2: Results of short-term noise monitoring.

3.3 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out from Wednesday 18th May to Tuesday 31st May 2022 with a Rion NL-52 noise logger (Serial Number 01254316). 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 location is shown in Figure 5. The location was secured and is considered to be representative of the typical ambient and background noise levels. The noise logger microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Weather conditions were monitored during the unattended noise monitoring period with few calm and dry during the unattended monitoring.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW EPA Noise Policy for Industry (NPI) 2017, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

The Rating Background Levels (RBLs) 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 level. The median of these levels is then presented as the RBL for each assessment period.

These RBLs are shown in Table 3 , together with the ambient noise levels (L_{Aeq}) measured for each period.

Location	Rating Background Levels, dB(A)			L_{Aeq} Ambient Noise Levels, dB(A)		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
L1	47	42	38	56	50	50

Table 3: Results of long-term noise monitoring.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 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.
- Planning
  - Port Macquarie-Hastings Council Local Environmental Plan (PMH-LEP) 2011.
  - Port Macquarie-Hastings Council Development Control Plan (PMH-DCP) 2013.
- Noise Emissions and Intrusions
  - NSW EPA Noise Policy for Industry (NPI) 2017.
  - AS/NZS 2107:2016 *'Acoustics - Recommended design sound levels and reverberation times for building interiors'*
- Demolition and Construction Noise and Vibration
  - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DEC Assessing Vibration: A Technical Guideline 2006.
  - Australian Standard AS 2436:2010 '*Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites*'.

4.2 REGULATORY FRAMEWORK

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 use 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 2013).

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.

..."

4.3 PLANNING FRAMEWORK

Relevant planning documents of Port Macquarie-Hastings Council Legislation have been reviewed for any noise requirement or criteria.

The Port Macquarie-Hasting Local Environmental Plan (PMH-LEP 2011) sets the land zoning for the site and surrounds as per land zoning map 6380_COM_LZN_013G_020_20210823. The site boundary and approximate proposed development site location are shown in Figure 6.

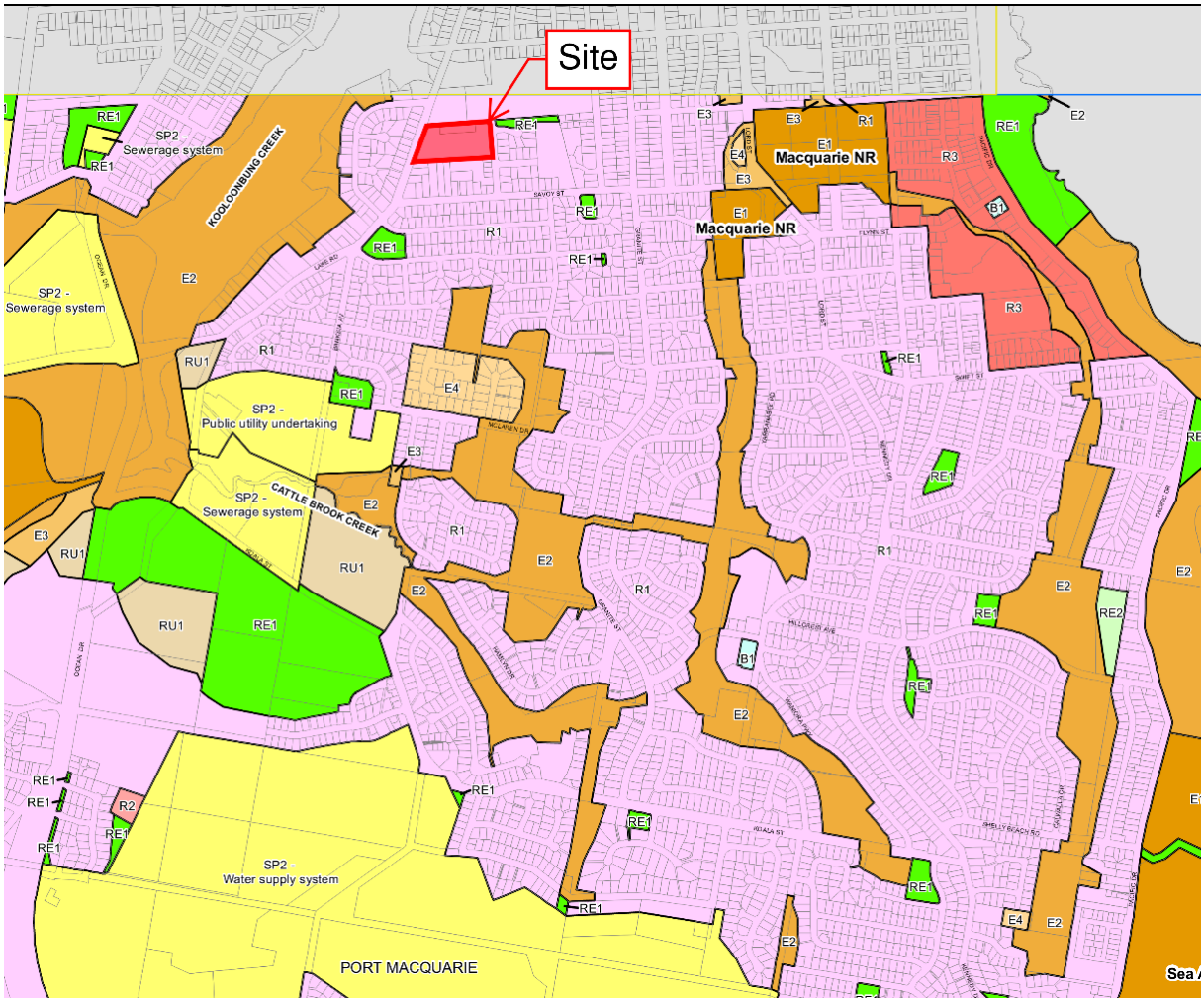


Figure 6: PMH-LEP 2011 land zoning map with the site boundary and location of proposed development.

The Port Macquarie-Hastings Council Development Control Plan (PMH-DCP 2013) has been reviewed and no information that is relevant to the development has been found. There are no specific noise level criteria, but rather sections of the DCP provide general planning strategies.

4.4 OPERATIONAL NOISE

4.4.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry (NPI) 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 use of the noise monitoring procedures and background noise assessment methodology are commonly recommended by other relevant guidelines.

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).

4.4.1.1 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 5dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the estimated background noise levels on site, Table 4 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Rating Background Level $L_{A90,\ period}$ dB(A)*	*Intrusiveness Criteria $L_{Aeq,15min}$ dB(A)*
General Residential (R1)	Day	47	52
	Evening	42	47
	Night	38	43

Table 4: Determination of the intrusiveness criteria for residential noise sensitive receivers.

4.4.1.2 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 land zoning of the noise sensitive receivers plus amenity criteria definition, Table 5 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Amenity Noise Level* $L_{Aeq,period}$ *dB(A)*	*Adjusted Amenity Criteria* $L_{Aeq,15min}$ *dB(A)*
General Residential (R1)	Day	60	58 (60-5+3)
	Evening	50	48 (50-5+3)
	Night	45	43 (45-5+3)
Active Recreation (RE1)	When in use	55	53 (55-5+3)
Commercial	When in use	65	63 (65-5+3)
Hospital ward	Noisiest 1-hour	50	48 (50-5+3)

Table 5: Determination of amenity criteria for noise sensitive receivers.

4.4.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 6 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 Criteria,* $L_{Aeq,15min}$ *dB(A)*	*Amenity Criteria,* $L_{Aeq,15min}$ *dB(A)*
General Residential (R1)	Day	52	58
	Evening	47	48
	Night	43	43
Active Recreation (RE1)	When in use	---	53
Commercial	When in use	---	63
Hospital ward internal (external)	Noisiest 1-hour	---	48

Table 6: Determination of PNTL's (light grey highlight) for noise sensitive receivers.

4.4.1.4 Sleep Disturbance

The NSW NPI defines the sleep disturbance criteria as follows:

"...

The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

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

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

..."

Additionally, NSW NPI states that upon exceedances of the criteria mentioned above that a detailed assessment be conducted in accordance with NSW Road Noise Policy regarding sleep disturbance impact due to noise. Following text is an excerpt from the document:

"...

Further studies by the enHealth Council (2004) and the guidelines published by the World Health Organisation (1999) were reviewed and analysed in terms of the guidance on noise exposure and sleep disturbance. The enHealth report states that:

'as a rule for planning for short-term or transient noise events, for good sleep over 8 hours the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45 dB(A) $_{LA, (Max)}$ more than 10 or 15 times per night'.

..."

"...

From the research on sleep disturbance to date it can be concluded that:

- *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and well-being significantly.*

..."

4.5 TRANSPORT NOISE

4.5.1 NSW ROAD NOISE POLICY

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 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.

4.6 INTERNAL NOISE CRITERIA

AS/NZS 2107:2016 provides recommended internal noise levels for healthcare buildings. Refer to Table 7 for the recommended internal noise goals for the internal spaces, due to external noise from traffic.

Type of occupancy / activity	*Design sound level ($L_{Aeq,t}$) range, in dB(A)*
Café	45-50
Reception	40-50
Executive Office	35-40
Multi-person Office	40-45
General office Areas	35-45

Medical Imaging	45-50
Operation Theatre	40-50
Ward Bedrooms	35-40
Surgeries / treatment / procedure rooms	40-45
Toilets	45-55

Table 7: Internal noise level ($L_{Aeq,t}$) range as per AS2107:2016.

4.7 CONSTRUCTION NOISE AND VIBRATION

4.7.1 NOISE CRITERIA

The DECC's Interim Construction Noise Guideline (ICNG) suggests construction Noise Management Levels (NML) that may minimise the likelihood of annoyance being caused to noise sensitive receivers depending on the works. Table 8 contains the NML's details for residential receivers as per ICNG.

Time of Day	*NML $L_{Aeq,15min}$*	*How to Apply*
Recommended Standard Hours: Mon-Fri 7am-6pm Sat 8am-1pm No work on Sundays or public holidays	Noise affected: RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where predicted or measured $L_{Aeq,15min}$ is greater that the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise affected: RBL + 5dB	▪ A strong justification would typically be required for work outside the recommended standard hours. ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community.

Table 8: ICNG construction airborne noise criteria for residential receivers surrounding the construction site.

ICNG additionally suggests construction noise management levels for noise sensitive land other than residential surrounding construction sites. Refer to Table 9 for the noise management levels of non-residential receivers.

Land use	*Management level, $L_{Aeq\ (15mi`n))}$ (applies when properties are being used)*
Active recreation areas	External noise level 65dB(A)

Table 9: ICNG construction airborne noise criteria for sensitive receivers surrounding the construction 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 with doors and windows closed.

4.7.2 VIBRATION CRITERIA

4.7.2.1 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 10.

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

4.7.2.2 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	Vibration velocity, mm/s (r.m.s.) [dB re 10^{-6}mm/s]			
		Continuous Vibration		Impulsive Vibration	
		Preferred	Maximum	Preferred	Maximum
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]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 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) it 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*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 12: Intermittent vibration criteria applicable to the site.

5 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise break-out from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant.
- Operational noise from new carpark and café outdoor seating.
- Sleep disturbance impacts from operational noise of the hospital during night time period.
- Noise impact of traffic generated by the development.

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

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Worst-case time period assessment.

5.1 EXTERNAL MECHANICAL PLANT

Noise from the proposed development mechanical plant should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

Mechanical plant will operate continuously and at this stage, tentative mechanical selections have been made and shown in Table 13; therefore, a preliminary assessment has been carried out for the external mechanical plant. Figure 7 shows the location of the mechanical plant room.

The following assumptions were made for the preliminary assessment:

- Figure 7 shows the proposed footprint and location of the external mechanical plant locations on the rooftop level.
- Nearest noise sensitive residential receivers with their approximate distances from the two external mechanical plant have been identified as follows:
    - Café condenser unit: 73 Savoy Street at 45m.
    - Chiller plant located adjacent to existing chiller: 25-27 Parker Street at 35m.
- The assumed sound power level of the mechanical plant is based on information provided by DSA Consulting and has been summarised in Table 13.
- A worst-case scenario has been used, considering the noise level criteria during the night-time period.

Mechanical plant selections	*Sound Power Level (dB ref 10^{-12} W)*								
	Overall dB(A)	*Octave Band Centre Frequency, Hz*							
		63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Café condenser unit: Daikin RETQ10YTY1	68	71	73	69	67	61	56	52	42
Chiller plant: Climaveneta NX /SL-K /0702P	83	88	86	84	82	76	73	67	63

Table 13: Mechanical plant Sound Pressure Levels.

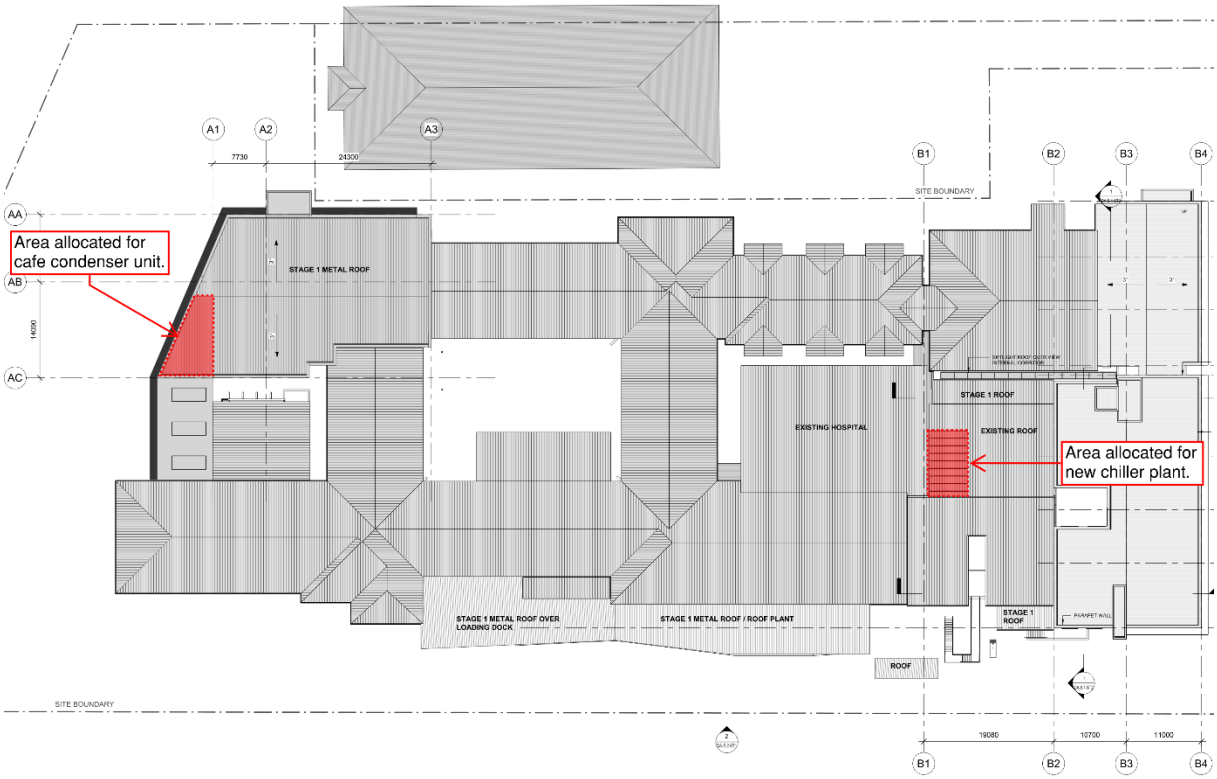


Figure 7: Location of mechanical plant (red shading).

The predicted noise levels from the external mechanical plant at the nearest noise sensitive receivers (73 Savoy Street and 25-27 Parker Street) and the assessment are shown in Table 14.

Calculation	*73 Savoy Street*	*25-27 Parker Street*
Sound Pressure Level of Mechanical Plant, dB(A) @1m	60	75
Distance correction, dB	-31	-33
Predicted noise level at the nearest residential receiver, dB(A)	29	42
Night-time Noise Level Criteria, dB(A) / Complies?	43 / Yes	43 / Yes

Table 14: External mechanical plant assessment to nearest noise sensitive receivers.

The predicted noise levels at the nearest noise sensitive residential receivers from the operation of mechanical plants will comply with the night-time noise level criteria established in section 4.4.1 per NSW EPA Noise Policy for Industry.

Acoustic assessment of the mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures. If additional and / or re-selection external mechanical plant are proposed, then an acoustic assessment of the mechanical plant shall be carried out to comply with noise level criteria and the requirement of additional noise control measures. Acoustic design and certification of mechanical services is recommended to be provided prior to the Construction Certificate.

5.2 CAFÉ - OUTDOOR SEATING OPERATION

The outdoor seating space will be used as part of the café located at the entrance of the hospital. Noise break-out from the use has the potential to impact on nearby receivers. The noise of persons associated with the space will be highly variable as there are several factors which will drive the noise emissions.

The following assumptions have been made to assess the use of the outdoor space:

- The nearest noise sensitive residential receiver is 73 Savoy St, approximately 35m from the outdoor seating area.
- Use of the outdoor seating area will be limited to operating hours – i.e., day and evening time period. As a worst-case scenario situation, evening time criteria is considered for the assessment.
- It is assumed that the vocal effort of persons communicating on the outdoor areas will generally be 'Normal' speech and for every two persons only one person will be speaking at any given time.
- Number of persons in the assessment is 8.

The sound pressure levels used for the assessment are summarised in Table 15.

Noise Source	*Sound Pressure Level, dB re 20µPa*									
	Overall dB(A)	*Octave Band Centre Frequency, Hz*								
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
L_{eq} one person 'Normal' vocal effort @1m	61	---	48	51	52	59	57	53	46	42
L_{eq} 4 persons 'Normal' vocal effort @1m	67	---	54	57	58	65	63	59	52	48

Table 15: Assumed sound pressure levels for people talking with 'Normal' vocal effort in the outdoor seating area.

Based on the above assumptions and estimated sound pressure levels, predicted noise levels from the area to the nearest receiver are shown in Table 16.

Calculation	*73 Savoy St*
Sound Pressure Level of 4 persons @1m, dB(A)	67
Distance correction (35m), dB	-31
Predicted noise level at the nearest residential receiver, dB(A)	36
Evening-time Noise Level Criteria, dB(A) / Complies?	47 / Yes

Table 16: Noise impact assessment of people talking with 'Normal' vocal effort in the outdoor seating.

As per the noise impact assessment results of the operation of café's outdoor seating area for the evening time period, use of the space will meet the noise level criteria for day and evening time period.

5.3 ON-GRADE PARKING ASSESSMENT

A noise assessment has been conducted for the on-grade carpark situated to the east and west of the development. The following has been considered for the assessment:

- On-grade park to the east of the development has 40 vehicle bays proposed. On-grade carpark to the west of the development has 35 vehicle bays proposed.
- Nearest noise sensitive residential receivers were identified as follows:
  - Western on-grade carpark: 1-9 Parker Street.
  - Eastern on-grade carpark: 77 Savoy Street.
- Assessment conducted for night-time period from 10pm up to 7am, using peak hour predicted vehicle movements.
- Assessment period of 15 minutes used with 5 vehicles per hour entering or leaving the on-grade carpark. Note that this is considered to be a conservative assessment.
- 2.2m high acoustic screen / barrier. Refer to Figure 8 for the location of the barrier.
- Typical sound power levels for vehicles as shown in Table 17.

Item	*Sound Power Level (dB ref 1pW), dB(A)*
Vehicle movement	88
Car door slams	95

Table 17: Sound Power Levels of vehicle movement/ activities.

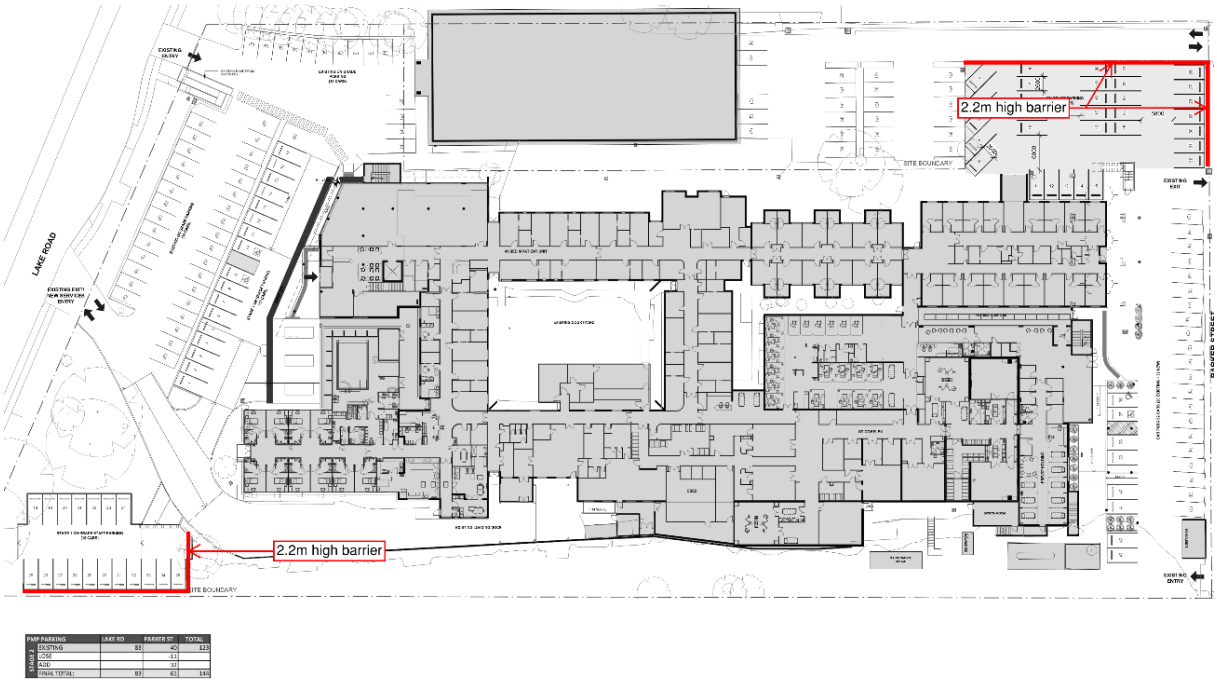


Figure 8: Proposed location of acoustic screen / barrier for the on-grade carparks.

Based on the assumptions above, the predicted noise levels at the nearest noise sensitive receiver from both the carpark movements are shown below in Table 18 and Table 19.

Calculation	*Noise Level, in dB(A)*	
	Ground Level	*First Floor*
Total Sound Pressure Level $L_{Aeq,15min}$ at 1m, dB(A)	72	72
Distance attenuation (9m), dB	-19	-19
Boundary fence Insertion Loss, dB	-15	-11
Predicted Noise Level at Nearest Receiver, $L_{Aeq,15min}$	38	42
Noise Limit Criterion Night-time / Complies?	43 / Yes	43 / Yes

Table 18: Predicted noise levels at 1-9 Parker Street from operation of the eastern carpark with acoustic screen / barrier.

Calculation	*Noise Level, in dB(A)*
Total Sound Pressure Level $L_{Aeq,15min}$ at 1m, dB(A)	72
Distance attenuation (20m), dB	-26
Boundary fence Insertion Loss, dB	-12
Predicted Noise Level at Nearest Receiver, $L_{Aeq,15min}$	34
Noise Limit Criterion Night-time / Complies?	43 / Yes

Table 19: Predicted noise levels at 77 Savoy Street from operation of the western carpark with acoustic screen / barrier.

Based on the results presented in Table 18 and Table 19, operational noise from the on-grade car parking is expected to comply with the night time criteria, provided 2.2m high acoustic screen / barrier is constructed at the proposed location stated in Figure 8 of this report. The barrier shall be constructed from a material with a total surface weight of not less than 12kg/m^2 and shall be continuous with no gaps. The solid section shall be designed for external use and be provided with all bracing and structural support required to comply with loadings and building regulations.

5.4 SLEEP DISTURBANCE

The operational noise during night-time period has a potential to generate sleep disturbance at the nearest noise sensitive residential receivers. It should be noted that the NSW NPI provides noise limits for sleep disturbance from external mechanical plant noise emissions only. However, it is recommended to adopt the sleep disturbance criteria established in section 4.4.1.4 of this report for operational noise from activities other than noise emissions from external mechanical plant.

The maximum noise levels are as per Table 13 and Table 17. Note that the mechanical noise sources are steady state, where as car door slams are instantaneous and represent the dominant potential impact for sleep disturbance.

Refer to Table 20 for the L_{Aeq} 15 minutes assessment based on the source location and type.

Assessment Type	*Predicted noise level at the nearest residential receiver, dB(A) $L_{Aeq, 15min}$*				*Night-time Noise Level Criteria, dB(A) / Complies?*
	73 Savoy Street	*77 Savoy Street*	*25-27 Parker Street*	*1-9 Parker Street*	*$L_{Aeq, 15min}$*
Noise emissions from external mechanical plant	29	---	42	---	43 / Yes
Noise from on-grade carpark (car door slams)	---	34	---	42	43 / Yes

Table 20: Sleep disturbance assessment to the nearest noise sensitive residential receivers - $L_{Aeq, 15min}$.

The predicted noise levels at the nearest noise sensitive residential receivers from the operational noise of the hospital will comply with the sleep disturbance L_{Aeq} 15 minutes noise level criteria established in section 4.4.1.4.

Refer to Table 21 for the results of the L_{AFmax} assessment based on the source location and type. This has been assessed to the most affected façade.

Assessment Type	*Predicted noise level at the nearest residential receiver, dB(A) L_{AFmax}*				*Night-time Noise Level Criteria, dB(A) / Complies?*
	73 Savoy Street	*77 Savoy Street*	*25-27 Parker Street*	*1-9 Parker Street*	*L_{AFmax}*
Noise emissions from external mechanical plant	32	---	45	---	53 / Yes
Noise from on-grade carpark (car door slams)	---	60	---	63	53 / No

Table 21: Sleep disturbance assessment to the nearest noise sensitive residential receivers - L_{AFmax}

The predicted noise levels at the nearest noise sensitive residential receivers from the operational noise of the hospital car park (car door slams) is not expected to comply with the sleep disturbance L_{AFmax} noise level criteria established in section 4.4.1.4. Therefore, detailed sleep disturbance impact assessment has been undertaken based on the methodology stated in NSW NPI.

The following assumptions were made for the assessment:

- The L_{AFmax} noise levels at the nearest noise sensitive residential receivers based on predicted levels in Table 21.
- Considering typical façade construction of the receiver residential building, the sound insulation ratings, and the area of the elements (walls and windows), the composite sound reduction of the façade is assumed to be R_W30 with windows closed.
- NSW Road Noise Policy provides literature regarding sleep disturbance due to noise and recommended noise levels within the bedroom (Refer to section 4.4.1.4).

Based on the assumptions above, the predicted sleep disturbance impact noise levels within sleeping areas of the nearest noise sensitive residential receivers with windows closed will comply with internal noise level criteria of L_{AFmax} 30dB(A). It should be noted that regarding L_{AFmax} car door slam events, there is not expected to be any additional noise impacts on top of the existing operation of the carpark.

5.5 TRAFFIC NOISE GENERATED

A traffic generation noise assessment has been undertaken in order to determine the potential noise impact of traffic generated by the proposed extension of the hospital. Based on the information provided by Transport and Traffic Planning Associates (TTPA), the traffic volumes are shared by Lake Road and Parker Road, the predicted traffic generation by site is presented in Table 22.

	Existing Traffic Volume	*Predicted Traffic Volume*	*dB increase*
AM Peak Traffic Flow (vehicles/hour)	31	35	+0.5
PM Peak Traffic Flow (vehicles/hour)	65	67	+0.1

Table 22: Predicted traffic noise level increase.

As noted in Section 4.4.1.3, when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the NSW Road Noise Policy (RNP) states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant. As shown in Table 22, the increase of traffic noise levels due to extension of the hospital, is less than the maximum allowable increase of 2.1dB(A).

Therefore, the traffic increase due to the extension of the hospital will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy recommendations.

6 NOISE INTRUSSION ASSESSMENT

Traffic noise from Lake Road and Parker Street could affect the proposed development. As the proposed hospital expansion is categorised under private hospital, the criteria set out for internal design levels in NSW Health Infrastructure Engineering Services Guidelines are not mandatory. Therefore, internal design level criteria set out in AS/NZS 2107:2016 '*Acoustics - Recommended design sound levels and reverberation times for building interiors*' for hospital buildings has been used for the assessment to recommend the minimum glazing thickness for the building.

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

- Internal noise levels are predicted based on noise levels incident at the façade of each space, which are based on the noise level measurements as per Section 3.
- External glazing is the weakest elements of the façade with sound reduction index of R_W32, and solid sections of the façade will provide a sound reduction index of R_W50. Based on these sound insulation ratings and the area of the elements, the composite sound reduction of the façade is R_W34.
- An internal noise level of 35dB(A) for indoor spaces.

Based on the above assumptions, the following is recommended:

- External glazing 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.

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:

- Use of ambulance sirens within the Hospital lot and surroundings shall be minimised whenever possible.
- Waste collection shall not operate during night-time period – i.e., 10pm to 7am.
- If possible, Contractor shall maintain garbage trucks to minimise or eliminate noise emissions such squeaky brakes, reversing alarm, bin lifter, etc.
- Educate drivers and collectors to be careful and to implement quiet work practices.

8 SUMMARY AND CONCLUSIONS

A noise and vibration impact assessment has been carried out for the proposed hospital expansion of Port Macquarie Private Hospital, located at 86-94 Lake Rd, Port Macquarie NSW 2444.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development. Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

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.

A preliminary assessment has been carried out for the external mechanical plant. Considering the mechanical plant selections and the distance to the nearest noise sensitive residential receivers, the worst-case scenario has been deemed to be the residential receiver along 73 Savoy Street and 25-27 Parker Street. The predicted noise levels at the nearest noise sensitive residential receivers from the operation of mechanical plants will comply with the night-time noise level criteria established in section 4.4.1 per NSW EPA Noise Policy for Industry. Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures. If new or replacing external mechanical plant is proposed, then an acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

The outdoor seating area for the café will comply with the project noise trigger levels established in Section 4.4 for the day-time and evening-time period.

A noise assessment has been conducted for the on-grade carparks for use during the night-time period, from 10pm to 7am. Based on the results, operational noise from the on-grade parking is expected to comply with the criteria during the night-time period, provided 2.2m high acoustic screen / barrier is constructed as indicated in Section 0 of this report. The barrier shall be constructed from a material with a total surface weight of not less than 12kg/m^2 and shall be continuous with no gaps. The solid section shall be designed for external use and be provided with all bracing and structural support required to comply with loadings and building regulations.

Based on the results of the sleep disturbance assessment, predominantly due to car door slams, a detailed assessment was conducted due to potential exceedances of the aforementioned criteria. The results of the assessment indicate that there will not be any sleep disturbance impacts due to the proposed expansion. It should be noted that there would not be additional noise impacts on top of what there currently is due to the existing carpark within this location.

The future traffic noise impact due to number of vehicles due to the hospital – based on the information provided by the traffic engineers – is anticipated to be meet the NSW Road Noise Policy requirements, as the noise levels will not increase more than 2.0dB at the sensitive noise receivers.

Noise break-in from traffic noise has been assessed for the external glazing of the hospital building. A minimum sound insulation performance of R_W32 for the external glazing is recommended.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modification to the building, or the introduction of any additional noise sources.

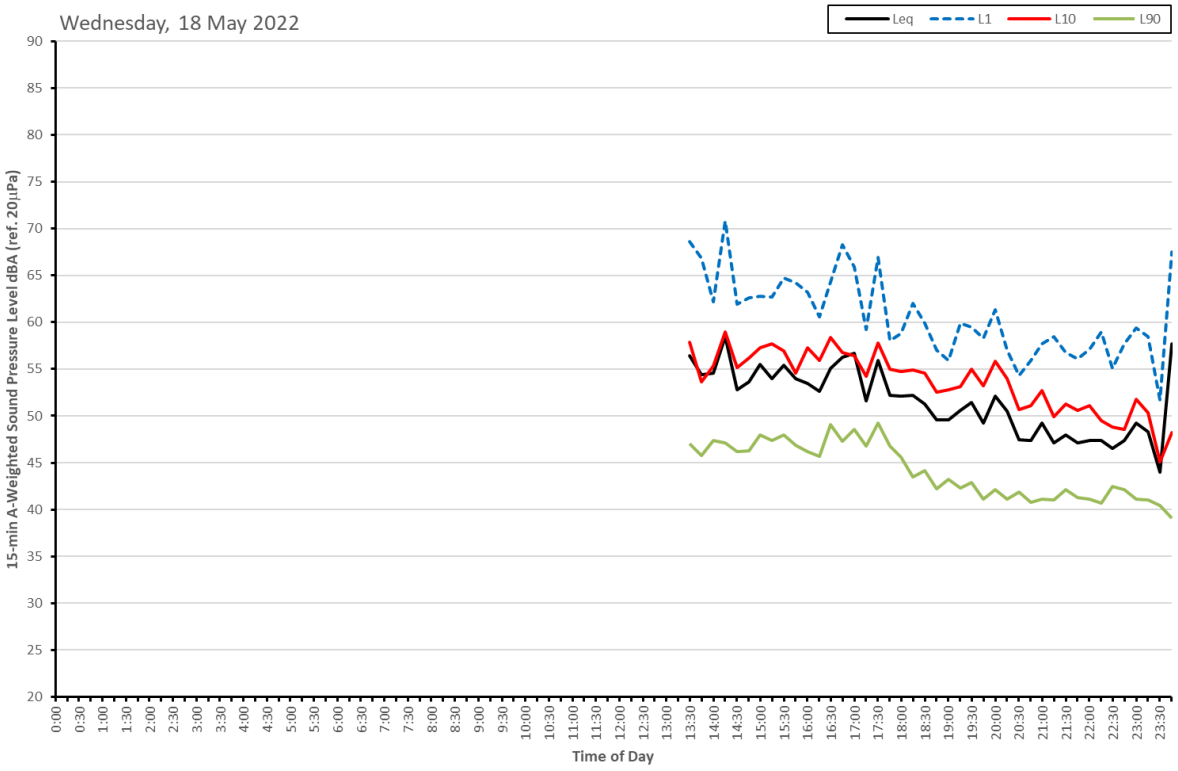
APPENDIX A: LONG-TERM NOISE MONITORING RESULTS

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.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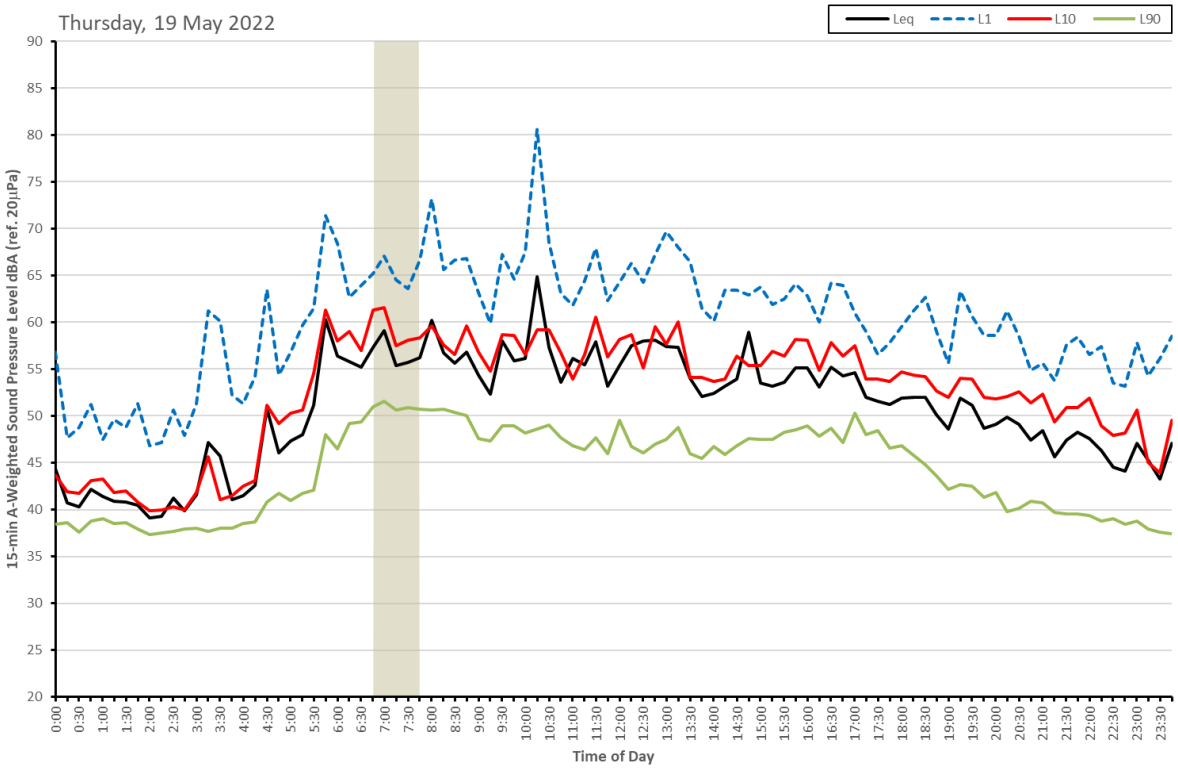
Time of Day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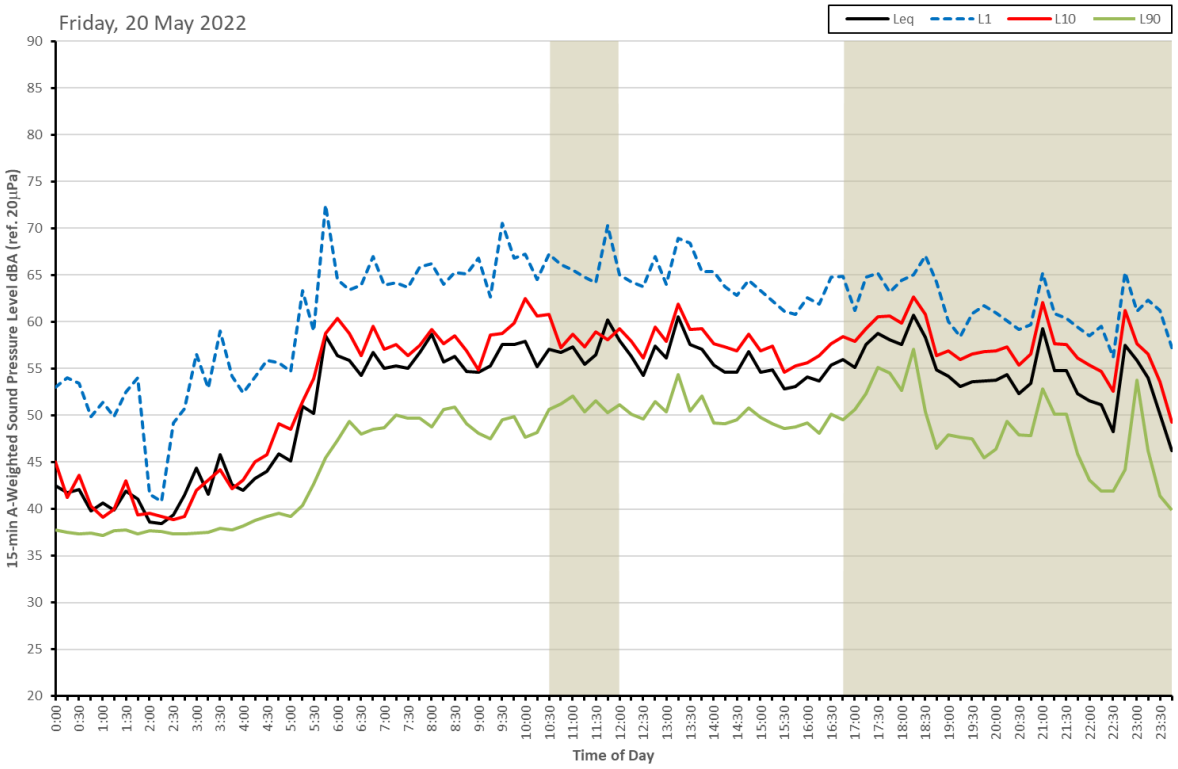
Time of Day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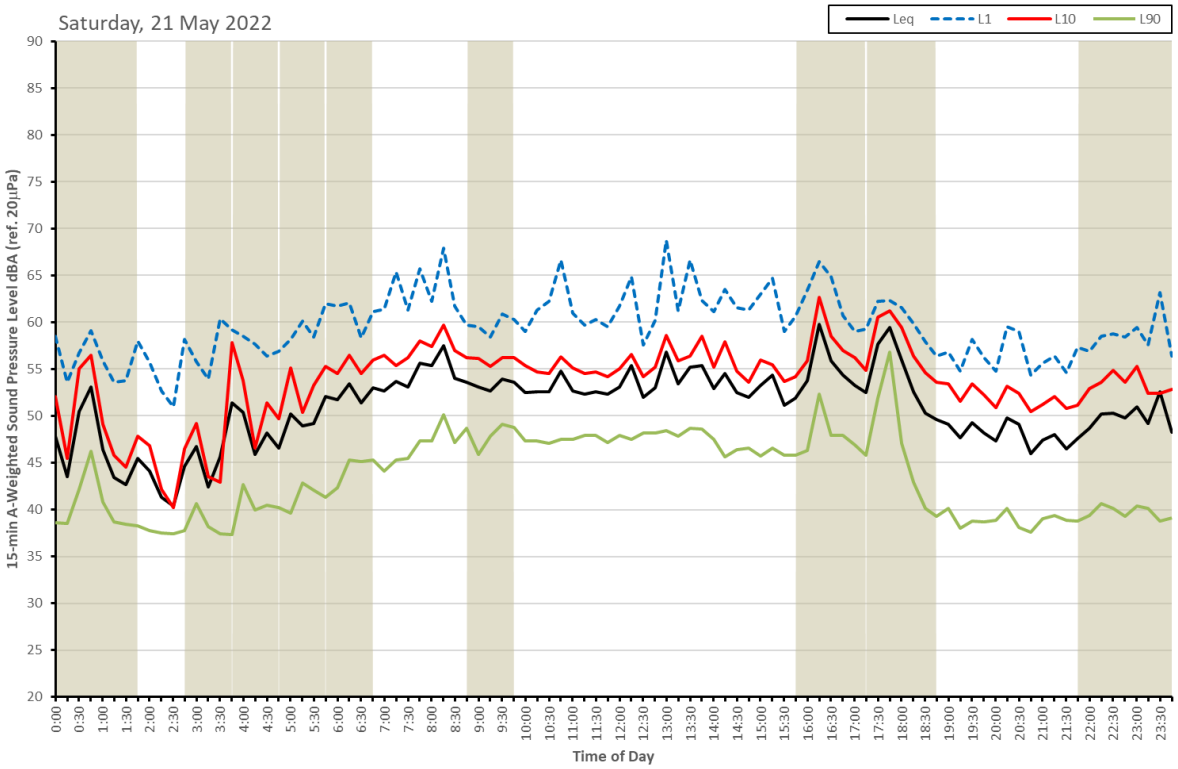
Time of Day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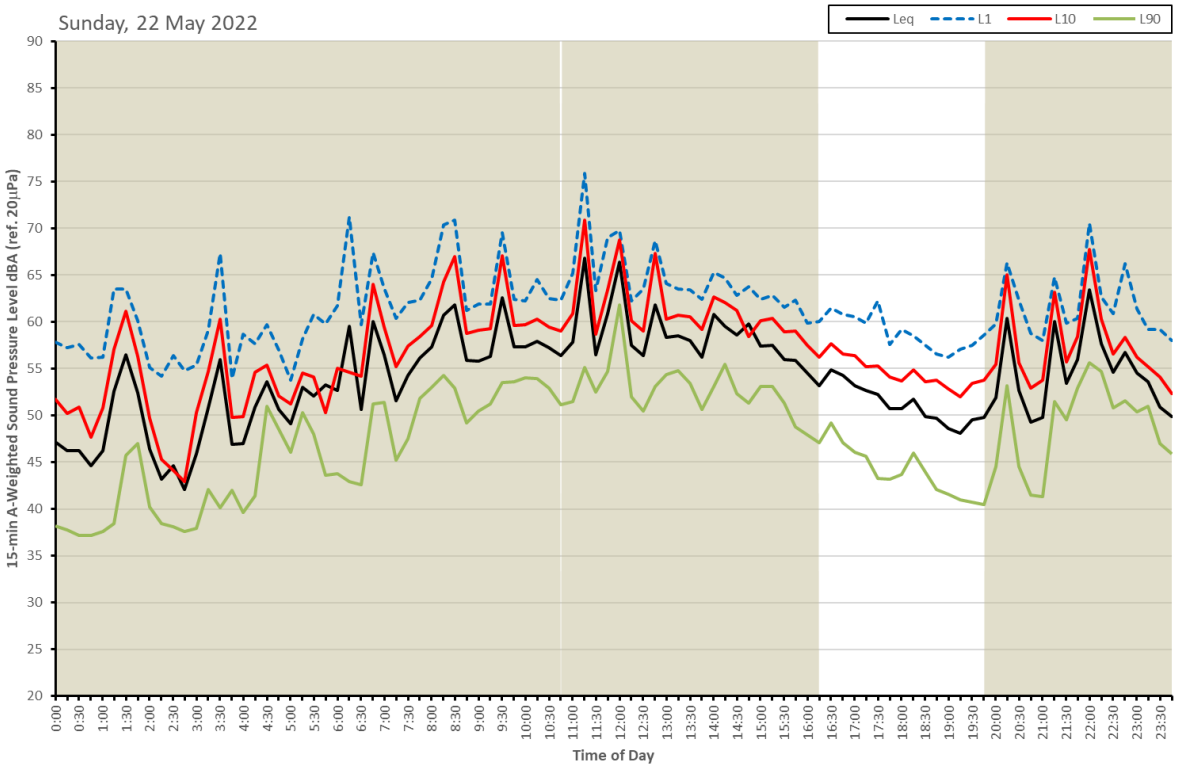
Time of Day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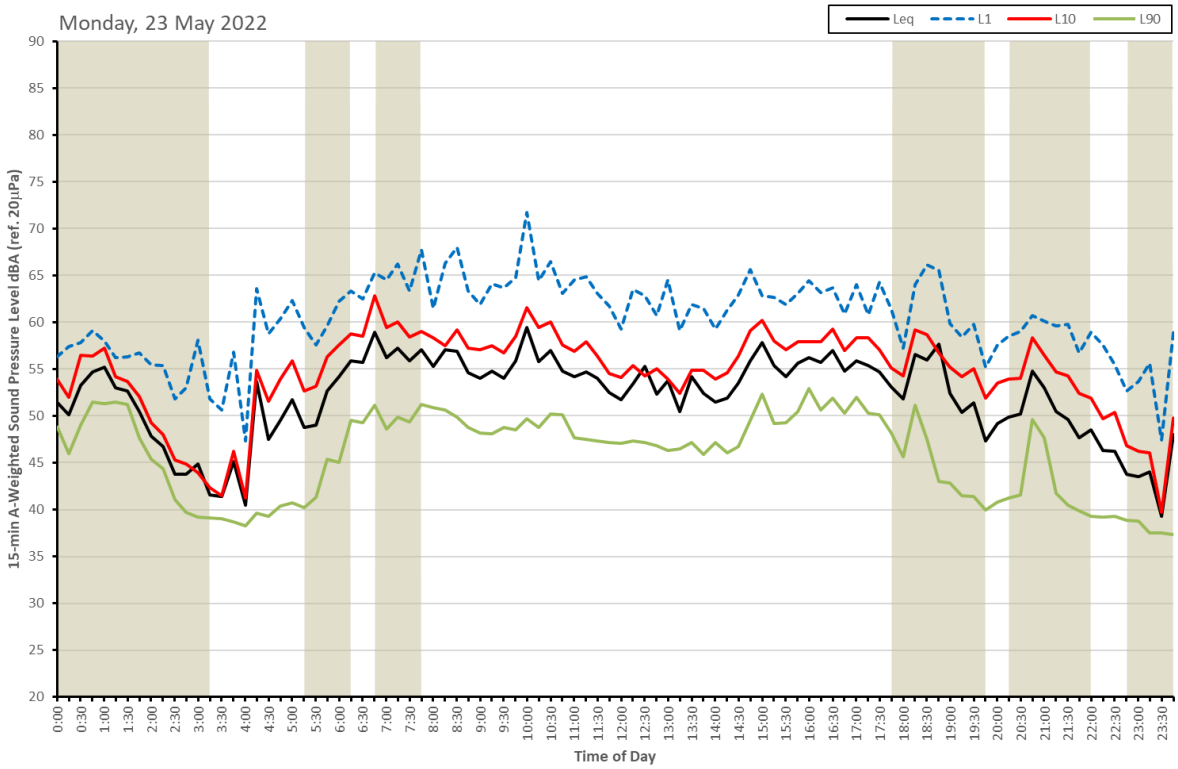
Time of Day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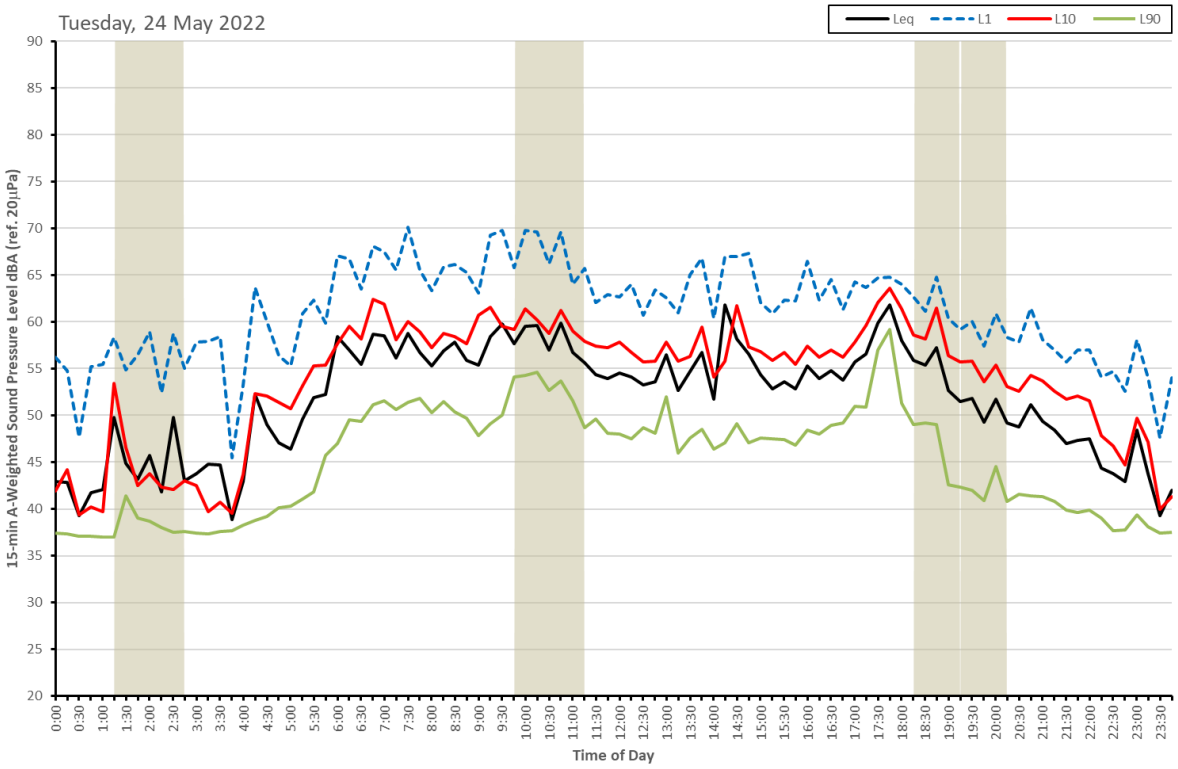
Time of Day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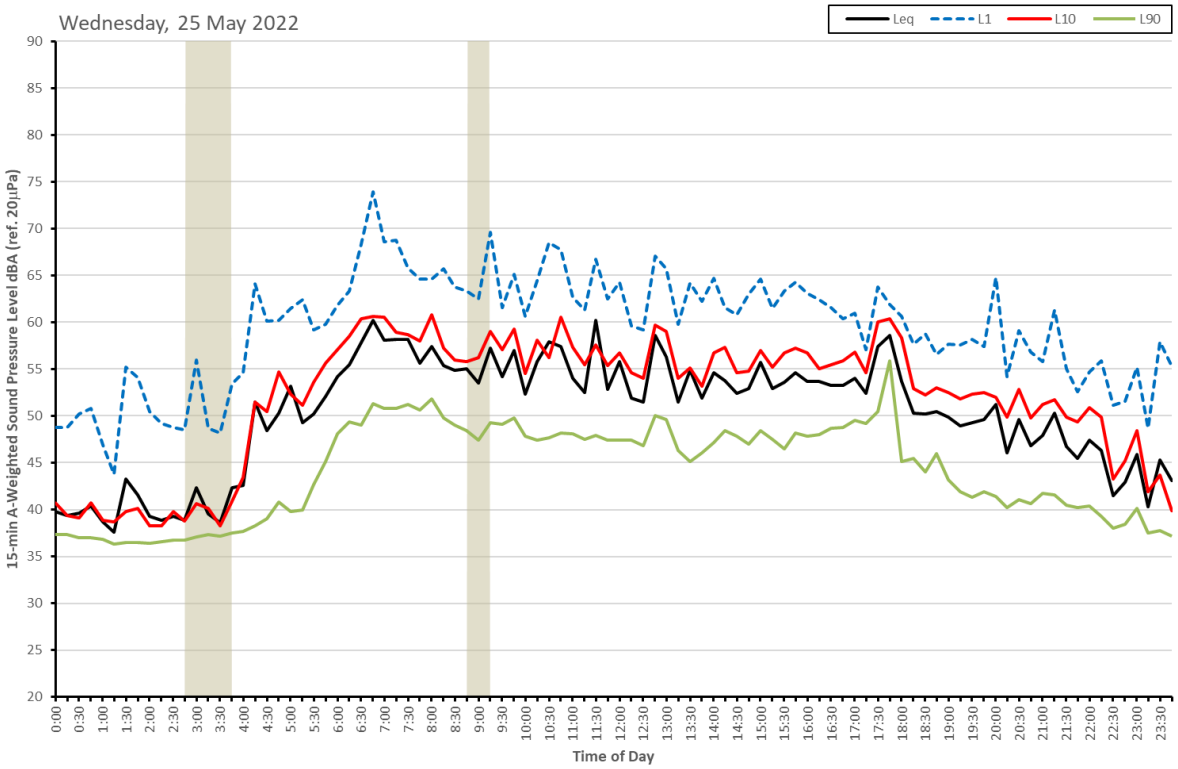
Time of Day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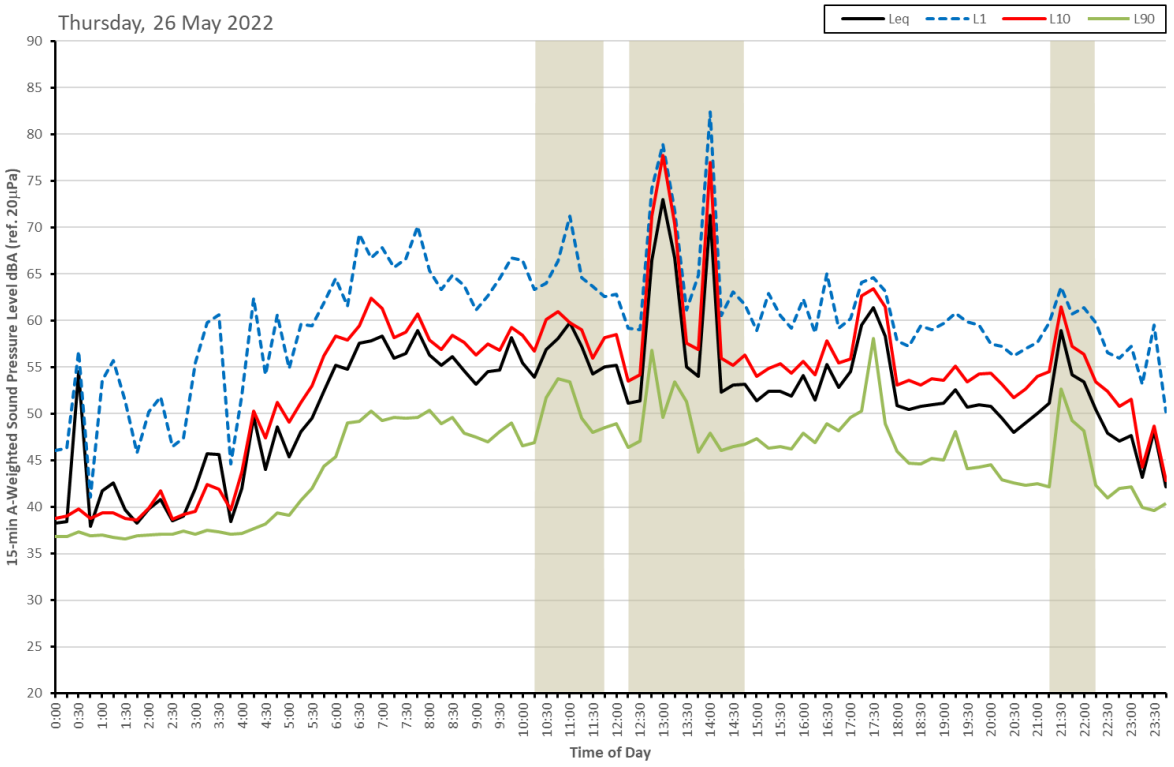
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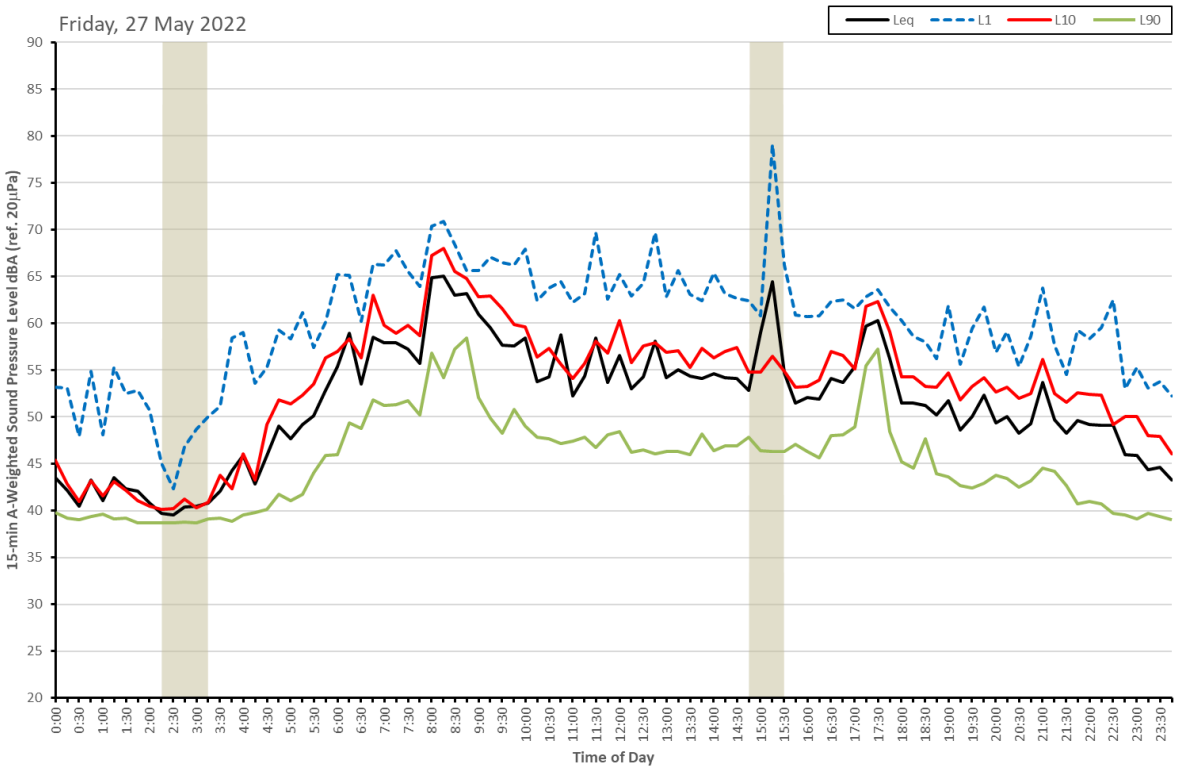
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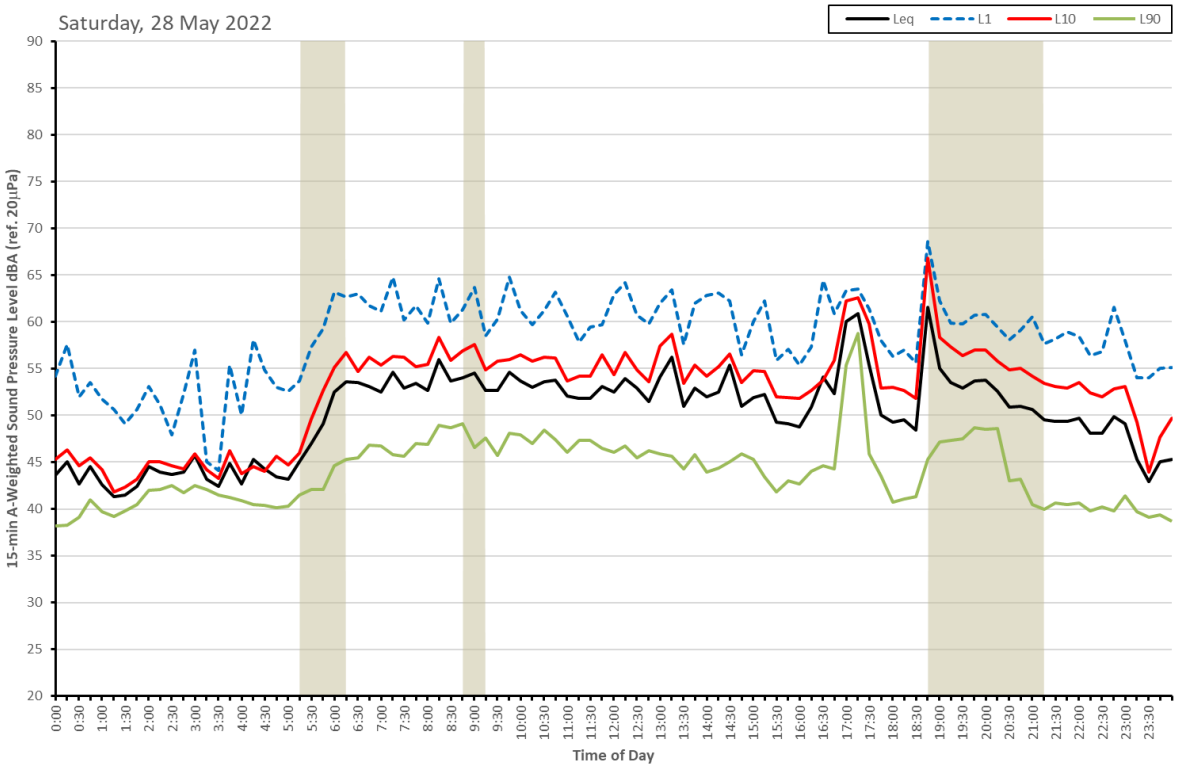
Time of Day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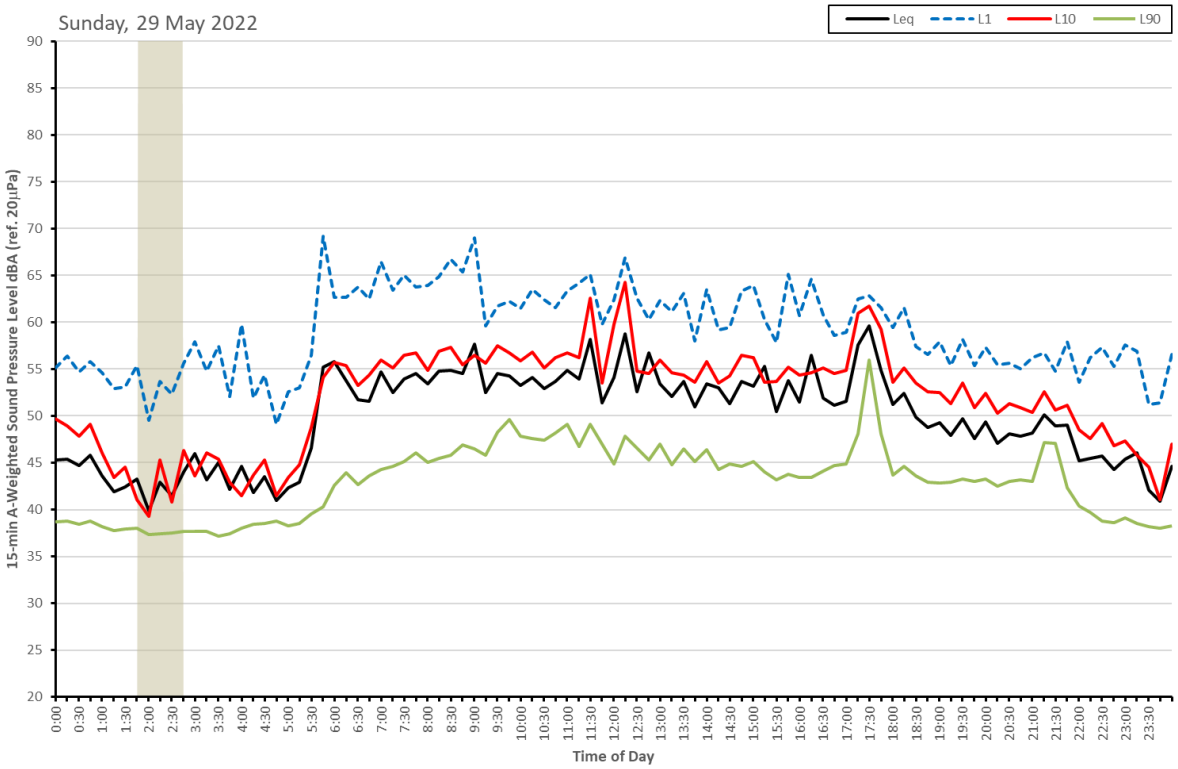
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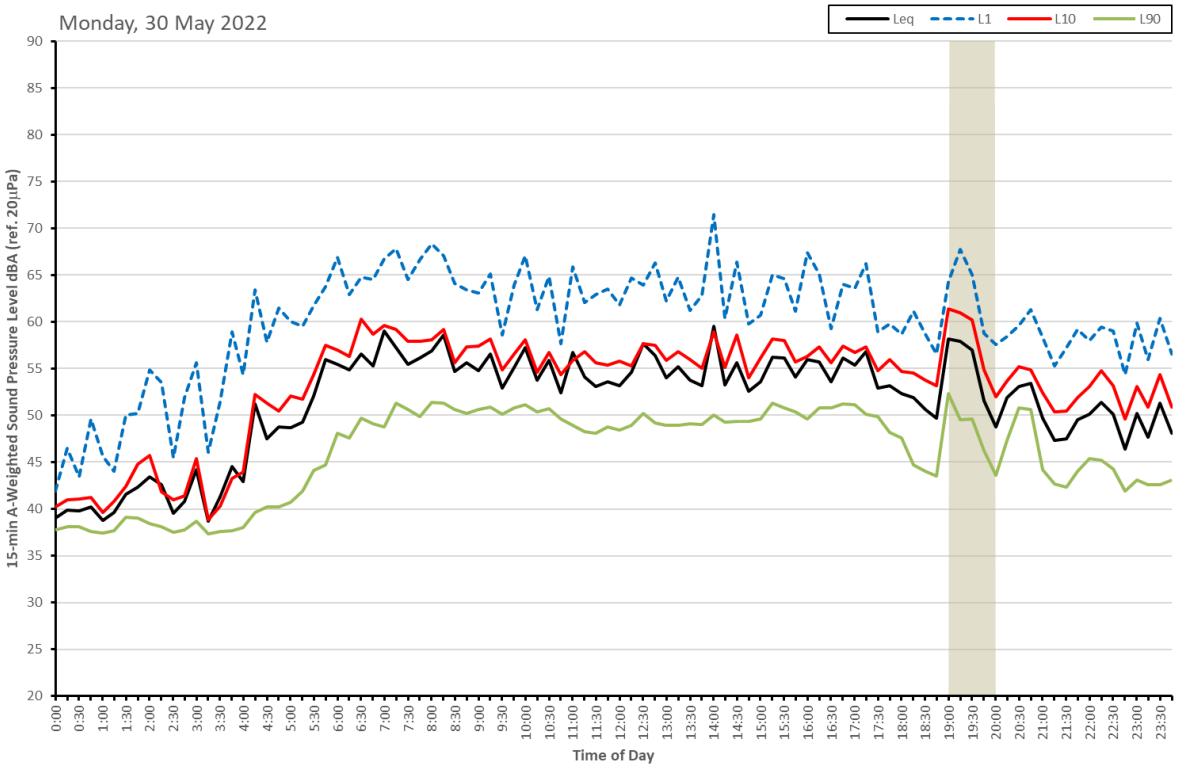
Time of Day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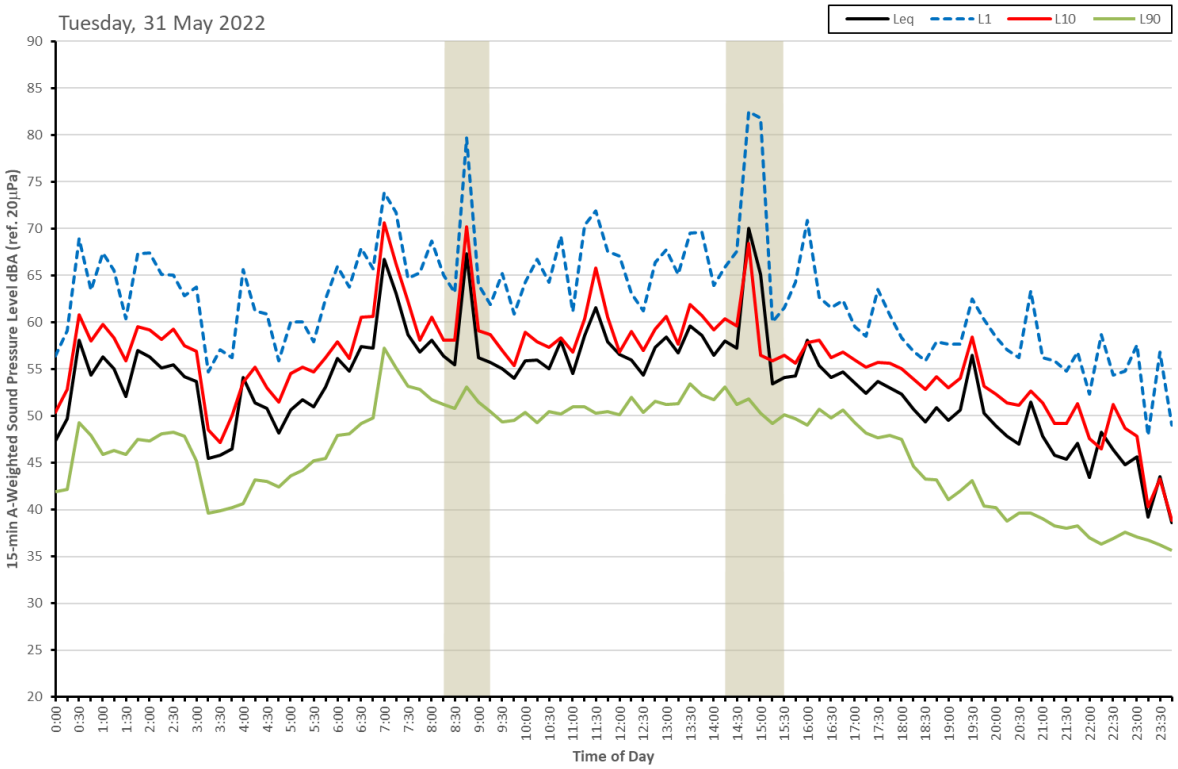
Time of Day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Time of Day