Acoustic Report for a Proposed Adaptive Reuse of the former Berrima Gaol

State Significant Development Application

Prepared for the Blue Sox Group

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1 Introduction

1.1 Overview and Purpose of Report

Renzo Tonin & Associates was engaged by Blue Sox Group to undertake an acoustic assessment for a State Significant Development Application (SSDA) for the adaptive reuse of the former Berrima Gaol at 2-4 Argyle Street, Berrima NSW.

In this report we will:

- Identify noise emission goals applicable to the site.
- Identify nearby noise sensitive development.
- Provide advice with respect to building shell construction of the mixed-use building to address operational noise emission to existing neighbours
- Provide advice with respect to building shell construction of the hotel to address potential road traffic noise impacts on the development.
- Provide advice on acoustic separation of food/beverage, entertainment and communal spaces from hotel guest rooms
- Provide advice with respect to treatment of plant and equipment noise/vibration to ensure compliance with relevant EPA noise guidelines.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

1.2 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements relating to the project are detailed in the Industry-specific SEARs (Seniors Housing). The key issues with respect to noise and vibration from are extracted below:

"12. Noise and Vibration

• Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented."

1.3 Assessment Objectives

As part of preparing this assessment, the following policies, guidelines and standards have been considered:

- NSW EPA Noise Policy for Industry (NPfI) 2016
- NSW EPA Interim Construction Noise Guideline (ICNG) 2009
- State Environmental Planning Policy (Transport & Infrastructure) 2021 (the SEPP (T&I))
- Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
- State Environmental Planning Policy No 65 – Design Qualify of Residential Flat Development (Amendment No. 3)"
- SEPP 65 Apartment Design Guide 2015
- Australian Standard AS2107:2016 "Recommended Design Sound Levels and Reverberation Times for Building Interiors"

1.4 Reference Material

This report is prepared based on:

- Architectural drawings prepared by Turner Architects

2 Project Description

2.1 Site Description

The site is bounded by cul-de-sac roads to the north (Wilshire Street) and the south (Wingecarribee Street), the Wingecarribee River to the west and Argle Street to east as indicated in Figure 2-2 below.

The proposal includes the retention of existing correctional centre cells and ancillary buildings inside the gaol including the guard tower, retention of the main perimeter sandstone walls and entrance gate house, the removal of a two storey building inside the gaol to the north-east corner, the retention of existing dwellings and ancillary buildings outside the gaol and construction of a new mixed-use venue that will include a function centre, restaurant/bar, gym & wellness centre inside the 5.9m gaol perimeter wall. The proposal also includes construction of new hotel on the western side of the site and a new multi-level below ground carpark on the southern side of the site as indicated in Figure 2-1 below.

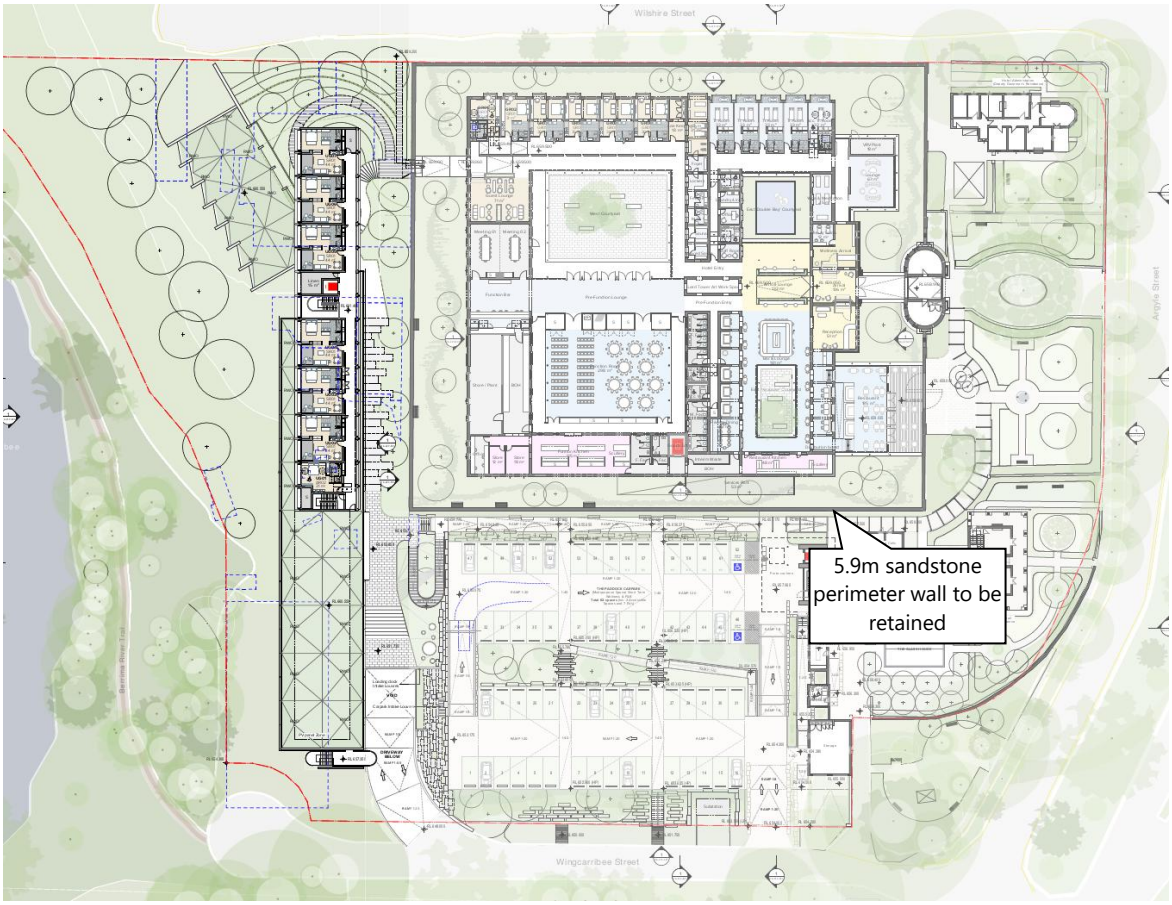


Figure 2-1: Proposed Mixed-Use Development

Long-term noise monitoring has been undertaken on site and at nearest southern neighbour to determine the existing acoustic environment as shown in Figure 2-2 below.

2.2 Noise Sensitive Receivers

The noise sensitive receivers surrounding the subject development have been identified as follows and indicated in Figure 2-2 below.

Table 2-1: Location of Noise Sensitive Receivers

Receiver ID	Address	Description
Residential Receivers		
R1	15 Wingecarribee Street, Berrima	Single storey house south of development across Wingecarribee Street
R2	2-20 Jellore Street, Berrima	Single storey houses to the far south of development
R3	1-5 Wilshire Street, Berrima	Single storey houses north of the development across Wilshire Street
R4	37-47 Oxley Street, Berrima	Single storey houses to the far north-west of the development
R5	24 Wingecarribee Street, Berrima	Single storey houses to the far west of the development across the Wingacarribee river
R6	25-33 Wingecarribee Street, Berrima	Single storey houses to the far west of the development across the Wingacarribee river
Non-residential Receivers		
C1	26 Old Hume Highway, Berrima	The Surveyor General Inn/Pub across Wingecarribee Street
C2	17-21 Old Hume Highway, Berrima	Commercial/retail buildings southwest of site across Old Hume Highway
C3	11-15 Old Hume Highway, Berrima	Retail buildings west of site across Old Hume Highway
C4	24 Old Hume Highway, Berrima	Restaurant building west of site across Argyle Street
C5	Corner of Argyle and Wilshire Steet, Berrima	Courthouse/Museum north of site across Wilshire Street

Figure 2-2: Noise Monitoring Locations and Site Surrounds

2.3 Hours of Operation

For the purposes of this report we have assumed the operating hours for the site will be between 7:00am and mid-night from Monday to Sunday.

2.4 Potential Noise Issues

Potential noise emission from operational usages of the development impacting upon surrounding noise-sensitive neighbours include,

2.4.1 Function Centre

The proposed function centre consists of indoor spaces (function and pre-function) and a connected outdoor space (West Quarter Courtyard).

- Patron noises (conversations & chatter) in the outdoor area of the function centre
- Loud music during a music performance inside the internal space of the function centre breaking out through the building facade

2.4.2 Restaurant/Bar

The proposed restaurant also includes an outdoor dining outside the gaol perimeter wall.

- Patron noises (conversations & chatter) in the outdoor dining area located outside the gaol perimeter wall
- Patron noises and background music in the indoor seating areas of the restaurant/bar breaking out through the building façade

2.4.3 Multilevel Carpark

The ground and lower basement levels of the carpark are for general visitors and guests of the precinct, and the upper basement level is reserved for staff and guests staying overnight.

- The driveway into and out of the basement parking is located at end of Wingecarribee Street on southern boundary of the site. Noise generated from function guest vehicles departing the premise after an event has potential to impact on the residence on Wingercarribee Street.

2.4.4 Guests on Balconies Outside Gaol Perimeter Wall

- Hotel guest conversations and chatter on private balconies of the hotel guest rooms facing the river.

2.4.5 Mechanical Plant Noise

- External noise emission from mechanical plant equipment such as air-conditioning outdoor units and basement ventilation fans.

3 Ambient and Background Noise Surveys

3.1 Noise Surveys

Environmental noise loggers were installed on Wilshire Street and Wingecarribee Street as indicated in Figure 2-2 from 30/10/2024 to 07/11/2024 to measure the existing ambient and background noise surrounding the site.

The noise logger records noise levels on a continuous basis and stores data every fifteen minutes. The noise logger was calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

The results of the background and ambient noise monitoring conducted on site are presented in APPENDIX B.

3.2 Measured Traffic Noise Levels

The design traffic noise levels are taken from the representative L_{Aeq} for the week for both the day time (7am to 10pm) and night time (10pm-7am) periods. The design external traffic noise levels are presented Table 3-1 below.

Table 3-1: Day and Night Traffic Noise Levels

Monitoring Location	Survey Period	Measured Traffic Noise Levels over Day (15 hour) and Night (9 hour) Periods in dB(A)	
		$L_{Aeq, 15hour}$ [1]	$L_{Aeq, 9hour}$ [1]
L1 – Front of existing building on site at Wilshire Street, Berrima	Day (7am to 10pm) 30/10/2024 to 07/11/2024	58	-
	Night (10pm to 7am) 30/10/2024 to 07/11/2024	-	51
L2 – Front yard of 15 Wingecarribee Street, Berrima	Day (7am to 10pm) 30/10/2024 to 07/11/2024	50	-
	Night (10pm to 7am) 30/10/2024 to 07/11/2024	-	47

Notes:

1. Noise levels presented are facade values.

3.3 Site Ambient and Background Noise Levels

The results of the long-term noise monitoring have been summarised in accordance with Noise Policy for Industry requirements published by NSW Environmental Protection Authority (EPA) and are presented in Table 3-2.

Table 3-2: Measured Site Ambient (L_{Aeq}) & Background Noise Levels (L_{A90})

Noise Monitoring		Noise Descriptor	Representative Ambient & Background Noise Levels in dB(A)		
Location	**Period**		**Day[1]**	**Evening[2]**	**Night[3]**
L1 – Front of existing building on site at Wilshire Street, Berrima	30/10/2024 to 07/11/2024	L_{Aeq} Ambient	56	47	48
		L_{A90} Background	36	35	32
L2 – Front yard of 15 Wingecarribee Street, Berrima	30/10/2024 to 07/11/2024	L_{Aeq} Ambient	48	46	44
		L_{A90} Background	36	36	34

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's Noise Policy for Industry as follows.

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

The measured overall background (L_{A90}) and ambient (L_{Aeq}) noise levels obtained from location L1 and outlined in Table 3-2 are representative of surrounding neighbours and are used in defining external noise emission criteria from the development such as mechanical ventilation and air-conditioning, carpark activities in accordance with EPA Noise Policy for Industry (NPfI).

4 Acoustic Criteria & Noise Emission Targets

4.1 Internal Noise Criteria

Table 4-1 below presents internal noise criteria recommended for this development which were based on the following documentations.

- State Environmental Planning Policy (Transport & Infrastructure) 2021
- Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
- Australian Standard AS2107:2016 "Recommended Design Sound Levels and Reverberation Times for Building Interiors"

Table 4-1: Recommended Maximum Internal Noise Levels

Type of Occupancy	Windows & Doors Condition	Maximum Design Noise Levels	
		Day, L_{Aeq} (15hour)	Night, L_{Aeq} (9hour)
Sleeping areas	Closed	-	35dB(A)
	Open	-	45dB(A)
All other habitable rooms	Closed	40dB(A)	40dB(A)
	Open	-	50dB(A)
Lobbies, public corridors, and communal areas [1]	Closed	50dB(A)	50dB(A)
Cafeterias / restaurants / coffee shops [1]	Closed	50dB(A)	50dB(A)
Bars / Function areas [1]	Closed	50dB(A)	50dB(A)
Meeting room / offices [1]	Closed	45dB(A)	

Notes:

1. Design sound pressure levels for these spaces not coved in the SEPP were based on Australian Standard AS2107

Relevant sections of the State Environment Planning Policy, Australia Standard AS2107 are presented in APPENDIX A of this report. Results and location of the background and ambient noise monitoring conducted on site are presented in APPENDIX B.

4.2 Licensed Premised - Liquor & Gaming NSW

Noise emissions from licensed premises in NSW such as the proposed bar / restaurant and function centre should aim to comply with the standard noise criteria set by the L&GNSW. The L&GNSW, through the Liquor Act 2007, is the regulatory authority that deals with noise pollution issues pertaining to licensed premises. The L&GNSW criteria apply to noise emission associated with activities from the licensed area of the premises, including music and patron noise but excludes mechanical plant.

Noise emissions are assessed in terms of the noise limits set out in the L&GNSW's 'Standard Noise Condition' which states as follows:

"The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) by more than 5dB between 7:00am and 12:00 midnight at the boundary of any affected residence.*

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in an Octave Band Centre Frequency (31.5Hz – 8kHz inclusive) between 12:00 midnight and 7:00am at the boundary of any affected residence.*

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00am.

Interior noise levels which still exceed safe hearing levels are in no way supported or condoned by the Liquor Administration Board.

This is a minimum standard. In some instances, the Board may specify a time earlier than midnight in respect of the above condition.

**For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises."*

Based on the site background noise levels (L_{A90}) presented in Table 3-2 and assumed operating time of the bar/restaurant and function centre, the octave band noise goals in accordance with L&GNSW standard noise criteria have been established and presented in below.

Table 4-2: L&G NSW Residential Receiver Noise Goals (L_{10}) – From Patron & Music

Assessment Locations	Period	Overall	Octave band centre frequency – Hz (dB)								
		L_{A10} dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
R1 to R6 - Outside residential windows and external doors	Day 07:00 to 18:00	41	44	42	40	36	38	39	30	23	22
	Evening 18:00 to 22:00	40	42	41	37	35	37	37	28	23	23
	Night 22:00 to 24:00	40	41	42	39	35	38	37	29	22	23

Notes:

1. Criteria is determined by adding 5dB to L90 across the octave band frequencies as per L&GNSW

4.3 Other Operational Noises (Carpark Activities, Hotel Guests, Mechanical Plant)

Other operational noise from the development such as carpark activities, hotel guest usage of the private balconies shall be controlled to comply with EPA requirements outlined below.

4.3.1 EPA Requirements

The NSW Environment Protection Authority (EPA) sets out noise criteria in its Noise Policy for Industry (NPfI) to control the noise emission from industrial sources.

The NPfI sets project noise trigger level to protect noise amenity for residential receivers. The project noise trigger level is set as the lower value of the following two assessment components:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

Noise intrusiveness ensures that industrial noise does not exceed the background noise level by an excessive margin, preventing significant changes in the noise characteristic pertinent to the development site and surrounds. This is commonly referred to as the 'background plus 5' criterion. That is, the noise level from new industrial development, assessed in periods of 15 minutes, should not exceed the existing background noise level (measured in the absence of that development) by more than 5dB(A).

Noise amenity ensures that industrial noise levels do not increase without limit, for if a number of industrial noise sources are permitted to increase the background noise level by 5dB(A), in turn there would be a point where the ultimate noise level is unacceptable. A limit on the ultimate acceptable noise level is therefore included in the NPfI as a way of ensuring that cumulative noise impact from industrial growth is curtailed. This limit is referred to as the project amenity noise level. The appropriate limit in any circumstance relates to the land use category, for example, there are different limits for rural, suburban and urban areas.

The table below presents the recommended amenity noise level relevant to the receivers surrounding the proposed development site. The project amenity noise level is defined as the recommended amenity noise level minus 5dB(A).

Table 4-3: NPfI Amenity Noise Levels - Recommended L_{Aeq} Amenity Noise Levels from Industrial Noise Sources [EPA NPfI Table 2.1]

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
			Recommended amenity noise level
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
			Recommended amenity noise level
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See Column 4	5dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom - internal	All	Noisiest 1-hour period when in use	35
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65

Notes:

- Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
- On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
- The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

In accordance with Section 2.4 of the NPfI, the following **exceptions** to the above method to derive the project amenity noise level apply:

1. In areas with high traffic noise levels (see Section 2.4.1 of the NPfI).
2. In proposed developments in major industrial clusters (see Section 2.4.2 of the NPfI).
3. Where the resultant project amenity noise level is 10dB, or more, lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
4. Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

The following table below presents the site-specific noise production criteria from industrial noise sources, namely mechanical plant noise to neighbouring residential properties identified in Section 2.

Table 4-4: Project noise trigger levels for noise emission from mechanical plant and carpark activities to residential neighbours (EPA NPfI)

Time of Day	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
	Rating Background Level (RBL) L_{A90}	Intrusiveness Trigger Level, $L_{Aeq, 15minute}$ (RBL+5)	Recommended Amenity Noise Level (RANL), $L_{Aeq, period}$	Project Amenity Noise Level (PANL), $L_{Aeq, period}$	Measured $L_{Aeq, period}$ existing noise levels	Traffic noise exceed RANL by more than 10dB?	Existing noise level likely to decrease in future?	Exceptions to PANL $L_{Aeq, period}$?	Project Noise Trigger Level, $L_{Aeq, 15minute}$
Day (7am to 6pm)	36	41	50	45	56	No	No	None	41
Evening (6pm to 10pm)	35	40	45	40	47	No	No	None	40
Night (10pm to 7am)	32	37	40	35	48	No	No	None	37

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in the results of the long-term noise monitoring has been summarised in accordance with NPfI requirements and are presented in The results of the long-term noise monitoring have been summarised in accordance with Noise Policy for Industry requirements published by NSW Environmental Protection Authority (EPA) and are presented in Table 3-2.

Table 3-2 above. Where the evening time criterion is greater than the daytime criterion, the evening time goal is amended to be the same as the daytime criteria.

Column 4 – Project Amenity Noise Level determined based on 'Residential - Rural' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB

Column 5 – Measured in accordance with the NPfI

Column 8 - Determined in accordance with Section 2.4 of the NPfI.

Column 9 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level. In accordance with Section 2.2 of the NPfI, $L_{Aeq, 15minute}$ is calculated as $L_{Aeq, period}$ + 3dB(A)

Notes: Intrusiveness noise level for Evening must be set at no greater than the intrusiveness level for daytime in accordance with NPfI Section 2.3.

The following table below presents the site-specific noise production criteria from industrial noise sources, namely mechanical plant noise to neighbouring commercial properties identified in Section 2.

Table 4-5: Project noise trigger level for noise emission from mechanical plant to commercial neighbours (EPA NPfI)

Assessment / Receiver location	Intrusiveness[5] criteria, $L_{Aeq,15min\ dB(A)}$			Amenity[4] criteria, $L_{Aeq, period}$ dB(A)		
	Day[1]	Evening[2]	Night[3]	Day	Evening	Night
Commercial premises surrounding the development	N/A	N/A	N/A	65 (when in use)		

Where necessary, noise amelioration treatment to mechanical plant such as carpark exhaust fans and air conditioning systems will be incorporated in the design to ensure that noise levels comply with the recommended NPfI noise emission criteria defined in Table 4-4 and Table 4-5 above.

5 Noise Intrusion Assessment

5.1 External Noise Sources

This section addresses external noise impacts on the proposed development being.

- Road traffic noise from Old Hume Highway to the east of the subject development

The target interior noise levels from ingress of the above external sources have been defined in Table 3-1 in accordance with the applicable noise guidelines.

To meet the internal noise levels outlined Table 3-1 in the recommendations for glazing and façade are provided in Section 5.2 and 5.4 below.

5.2 Glazing Recommendations

Table 5-1 below presents recommended glazing treatment for the building facades to achieve compliance with the maximum noise levels nominated in Table 3-1 above.

Table 5-1: Recommended Glazing Treatment

Levels	Facades	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness, Type and Configuration	Laboratory Test Reference
Restaurant with External Glazed Doors in Gaol Perimeter Wall facing Argyle Street					
-	East facade	Restaurant	Rw35[16]	10.35mm laminated glass or double glazing with minimum acoustic rating of Rw35	ESTIMATE
Hotel Guest rooms (Outside Gaol Perimeter Wall)					
All	All facades	Sleeping area	Rw28	6mm monolithic glass or double glazing with minimum acoustic rating of Rw28	ESTIMATE
		Ensuite	Rw25	4mm monolithic glass or double glazing with minimum acoustic raring Rw25	ESTIMATE

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

Levels	Facades	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness, Type and Configuration	Laboratory Test Reference

LEGEND where no appropriate test certificate exists:

1. ESTIMATE: The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
2. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the Rw rating as soon as practicable. In the case of impact rating for floor systems, no particular impact rating is guaranteed to comply with either the Building Code of Australia or Strata Scheme Management Act and hence carpet runners may still be required.
3. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The STC/Rw of the form of construction exceeds the project requirements.
4. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

5. The information in this table is provided for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
6. The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
7. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.
8. The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.
9. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.
10. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

11. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
12. Check design of all junction details with acoustic consultant prior to construction.
13. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
14. The information provided in this table is subject to modification and review without notice.
15. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.
16. Predominately for control breakout noise from restaurant

5.3 Building Ventilation

Table 5-2 below shows the assessment of external noise intrusion to the "Windows Open" noise criteria nominated in Table 3-1 above.

Table 5-2: Noise Assessment to Windows Open Criteria

Period	Room/Occupancy	Predicted Noise Level in dB(A)		Windows Open Internal Noise Criteria $L_{Aeq,}$	Compliance (Yes/No)
		At facade	Inside Apartment with Windows Open, L_{Aeq}		
Day	Sleeping areas	58	48	50	Yes
Night	Sleeping areas	51	41	45	Yes

Based on results of our long-term noise surveys, our calculations have shown the internal noise levels will comply with the "Windows Open" scenario outlined in Table 3-1 for all hotel guestrooms. Therefore, all hotel guestrooms within development can be naturally ventilated and achieving compliance with internal noise levels outlined in Table 3-1 above.

5.4 Facade & Roof Sound Insulation

In principle advice is provided below for the acoustic requirements of the roofs and external walls.

5.4.1 External Walls

All external walls shall have sound isolation ratings, $R_{w,}$ of at least 15dB higher acoustic performance than that of the acoustic glazing specified in Table 5-1 above.

This will typically be achieved for external walls having masonry elements. Detailed acoustic design of light weight cladding systems to be conducted at CC stage.

5.4.2 Roof and Ceiling

Roof/ceiling construction shall have a sound isolation rating, $R_{w,}$ at least 10dB higher than that of the acoustic glazing on its facade walls.

This will typically be achieved for roof systems consisting of concrete slab without need for further acoustic upgrade.

5.4.3 Glazing Assembly Requirements

The following acoustic measures should also be incorporated into the building design:

s1. All operable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the R_w rating performance of the glazing to not be reduced.

s2. The glazing thicknesses outlined in Table 5-1 should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

s3. The glazing supplier shall ensure that installation techniques will not diminish the R_w performance of the glazing when installed on site. Sliding door meeting stiles should form an airtight seal when closed and locked.

s4. The perimeter of all window and door frames are to be sealed airtight in the external facade using the following methods:

- For gaps less than 10mm - Fill all gaps around the window perimeter with an acoustic mastic sealer (minimum specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width of the gap.
- If the gap is greater than 10mm, fill the cavity with polyester insulation and a backing rod. Seal the gap airtight an acoustic mastic sealer (min specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width of the gap. The gaps between frames shall also be sealed using aluminium angle brackets (approximately 25 x 25 x 3mm).

6 Noise Emission Assessment

Operational noise emissions from usage development were predicted by modelling the individual noise sources, receiver locations, building facades, topographical features of the intervening area and possible noise control treatments using the internationally recognised environmental noise prediction computer program CadnaA (version 2025 MR1). The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models take into account:

- Location of noise sources and receiver locations;
- Height of sources and receivers;
- Separation distances between sources and receivers;
- Shielding from building and intervening structures;
- Shielding from solid fences
- Land topography and ground absorption
- Implementation of recommended noise mitigation measures in Section 6.1below

Based on the noise source sound power/pressure levels presented in Section 6.1.3 below operational noise emission from the development to each residential and commercial receivers are calculated using modelling software for a worst-case scenario during the night periods and are presented below.

6.1 Recommendations

The following recommendations and assumptions are made in the acoustic modelling of noise emission from the development.

6.1.1 Function Space

- Ceiling of the function room consists of 2 layers of 13mm fire-rated plasterboard with minimum 100mm insulation above plasterboard ceiling or an alternative system with equivalent acoustic performance

- Windows and external sliding doors of constructed of minimum 10.38mm laminated glass with full perimeter seals or an alternative system with equivalent acoustic performance

- A maximum 172 patronage in the Outdoor function area

6.1.2 Restaurant/Bar

- Ceiling of the restaurant/bar consists of 1 layer of 13mm standard plasterboard with minimum 50mm insulation above plasterboard ceiling or an alternative system with equivalent acoustic performance

- Windows and external sliding doors of constructed of minimum 10.38mm laminated glass with full perimeter seals or an alternative system with equivalent acoustic performance

- Outdoor dining area of restaurant has maximum seating capacity of 45

6.1.3 Mechanical Plant

Carpark Exhaust Fan:

- Provide sound attenuator to discharge side of fan with equivalent insertion loss to a Fantech 1.8m long podded circular silencer C2P-100. Refer to silencer insertion loss in Table 6-1 below.

- Fan shall be vibration isolated off slab soffit using neoprene/spring hangers having a minimum static deflection of 25mm

- Fans shall be isolated from duct work on inlet and discharge side of fan with flexible connectors

Table 6-1: Octave Band Insertion Loss of Recommended Silencer

Recommended Attenuator	OCTAVE BAND CENTRE FREQUENCY (Hz)							
	63	125	250	500	1K	2K	4K	8K
1.8m long Fantech C2P-100 podded circular attenuator or approved equivalent	8	11	19	27	29	27	23	19

Packaged Air Conditioners:

- Unit shall be vibration isolated off concrete plenum or floor slab with neoprene mounts equivalent to Mason ND mounts

A/C Condensers:

- Unit shall be vibration isolated off concrete plenum or floor slab with neoprene mounts or pads

6.2 Operational Noise Sources

6.2.1 Function Space

The sources of noise from usage of the function space will predominately be voices from patrons engaging in conversations in the outdoor courtyard and music breakout from internal spaces during a

music performance such as a live band. Music and patron noise source levels used in our modelling are shown in Table 6-2below.

Table 6-2: Function Space Noise Sources

Area	Applicable noise source	Overall Sound Power/ Pressure Level in dB(A)	Sound Power/Pressure Level in Octave Band Frequency (Hz) in dB								
			32	64	125	250	500	1k	2k	4k	8k
Indoor space	Amplified music sound pressure level [1] (reverberant space) in L_{10}	95	78	95	104	95	91	88	85	86	81
Outdoor space – West Quarter Courtyard (Maximum 172 patrons)	Male raised voice sound power level (L_W per person)[2]	76	-	-	66	72	75	71	67	61	56
	Female raised voice sound power level (L_W per person)[2]	74	-	-	52	67	72	70	66	61	55

Source:

1. Renzo Tonin & Associates past project files & database
2. Based on empirical sound data from Klark Teknik

6.2.2 Restaurant/Bar

The source of noise from operation of the proposed restaurant will predominately be voices from patrons engaging in conversations in the outdoor seating area, background music breakout from the internal spaces. Music and patron noise source levels used in our modelling are shown in Table 6-3 below.

Table 6-3: Restaurant Noise Sources

Area	Applicable noise source	Overall Sound Power/ Pressure Level in dB(A)	Sound Power/Pressure Level in Octave Band Frequency (Hz) in dB								
			32	64	125	250	500	1k	2k	4k	8k
Indoor seating areas	Internal patron noises and background music sound pressure level [1] (reverberant space) in L_{10}	84	69	72	81	77	82	80	76	69	61
Outdoor seating area (Maximum 45 patrons)	Male normal voice sound power level (L_W per person)[2]	69	-	-	57	67	69	62	58	54	49
	Female normal voice sound power level (L_W per person)[2]	66	-	-	52	63	65	60	56	55	51

Source:

1. Renzo Tonin & Associates past project files & database
2. Based on empirical sound data from Klark Teknik

6.2.3 Hotel Guests

The source of noise from usage of the hotel guestrooms outside the gaol perimeter wall that could potentially impact the surrounding environment would be voices from guests engaging in conversions on the private balconies facing the Wingecarribee river. Guest source levels used in our modelling are shown in Table 6-4 below.

Table 6-4: Hotel Guest Noise Source

Area	Applicable noise source	Overall Sound Power Level in dB(A)	Sound Power Level in Octave Band Frequency (Hz) in dB								
			32	64	125	250	500	1k	2k	4k	8k
Guestroom balconies	Male normal voice sound power level (L_W per person)[1]	69	-	-	57	67	69	62	58	54	49
	Female normal voice sound power level (L_W per person)[1]	66	-	-	52	63	65	60	56	55	51

Source:

1. Based on empirical sound data from Klark Teknik

6.2.4 Carpark

Noise generated from function guest vehicles departing the premise after an event has potential to impact on nearby residences. To assess this noise, the L_{Aeq} noise level was determined based on the maximum of number of vehicle activities expected to occur during night peak hour periods at the nearest affected residences. Sound Exposure Level (SEL) measurements from our database and library files were used for the assessment and are presented in Table 6-5.

Table 6-5: Carpark Noise Levels

Noise Source Description	Noise Descriptor	Sound Power Level in dB(A)	Octave band centre frequency (Hz) - dB								
			31.5	63	125	250	500	1k	2k	4k	8k
Vehicle moving (10km/h), L_W	SEL	78	92	93	81	76	75	71	72	67	63

Source:

1. Renzo Tonin & Associates past project files & database. All measurements were conducted in the free field.

6.2.5 Mechanical Plant

Table 6-6 below is a preliminary schedule of the major mechanical plant and equipment for the development.

Table 6-6: Proposed Mechanical Plant

Item / Description	Make, Model & Dimensions	Location of Plant / Discharge	Quantity	Sound Pressure Level in dB(A)
Air-conditioning outdoor units	Daikin REYQ12BYM	Plant compound behind back-of-house	6	59
Air-conditioning outdoor units	Daikin REYQ20BYM	Plant compound behind back-of-house	6	65
Packaged Air Conditioners	Generic	Plant compound behind back-of-house	2	67
Basement carpark exhaust fan	Generic	Fan an installed inside plantroom in basement with discharge on ground floor carpark	1	90

Notes.

1. Fan sound pressure levels rated at 3m
2. Condensers and Chillers are rated at 1m

6.3 Licensed Premises Noise Assessment (Function Centre & Restaurant)

The worst-case scenario for noise emitted from the licensed premises would be when the outdoor courtyard of the function centre and outdoor seating area of the restaurant are both fully occupied ie. 172 and 45 patrons respectively during the night period (10pm to mid-night).

Based on sound power levels outlined in Table 6-2 and Table 6-3 operational noise emitted from function centre and restaurant are calculated using modelling software at each residential receivers for the worst-case scenario and shown in Figure 6-1 below and compared to the L&GNSW octave band noise criteria in Table 6-7 below.

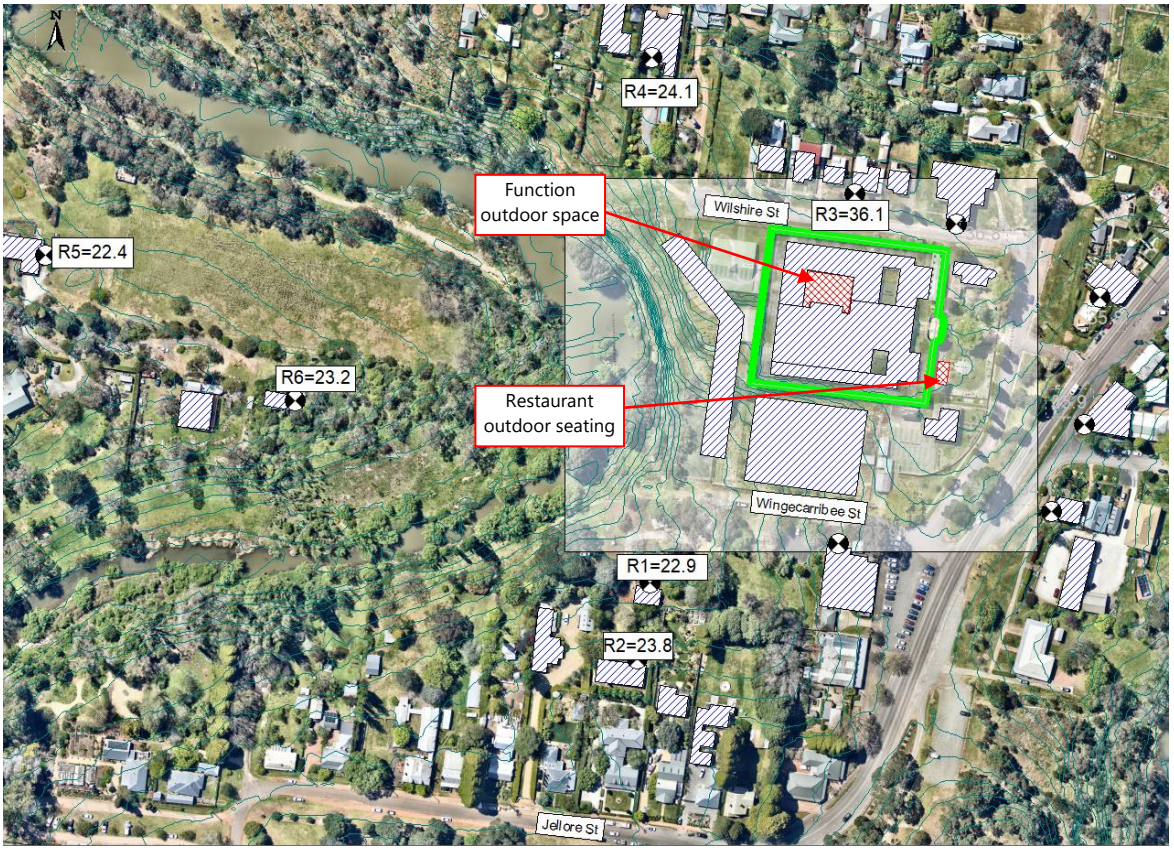


Figure 6-1: Predicted L_{10} Noise Levels from Function Space & Restaurant

Table 6-7 : Predicted L_{10} Noise Levels Assessment

Description	Assessment		Overall Noise Level in dBA	Octave band centre frequency - Hz (dB) in dB								
	ID	Address		31.5	63	125	250	500	1k	2k	4k	8k
Predicted noise levels L_{10} from the function centre and restaurant	R1	15 Wingecarribee Street – residence to the immediate south	23	18	18	15	22	23	18	12	2	0
	R2	2-20 Jellore Street – residences to the far south	24	18	18	15	22	23	20	13	0	0
	R3	1-5 Wilshire Street – residences to the immediate north	36	29	30	30	34	36	32	25	16	5
	R4	37-47 Oxley Street – residence to the far north-west	24	18	19	18	22	24	20	14	4	0
	R5	24 Wingecarribee Street – residence across Wingecarribee river	22	14	16	15	19	21	19	12	0	0
	R6	25-33 Wingecarribee Street - residences across Wingecarribee river	23	16	18	15	21	22	19	12	0	0

Description	Assessment		Overall Noise Level in dBA	Octave band centre frequency - Hz (dB) in dB								
	ID	Address		31.5	63	125	250	500	1k	2k	4k	8k
L10 Noise Criteria [2] at receiver between 10pm and mid-night (Table 4-2)			40	41	42	39	35	38	37	29	22	23
Comply with night criteria in all octaves at all receivers?				Yes								

Notes:

1. Red numbers indicate octave band criteria that has been exceeded by the predicted noise level
2. Measured background noise level + 5 dB as per L&GNSW

The above assessment in Table 6-7 have demonstrated that night operational noise emission from usage of the proposed function centre and restaurant/bar to complies with the established noise goals at all the identified residential receivers with implementation of the noise mitigation measures recommended in Section 6.1.

6.4 Mechanical Plant, Carpark Activities & Hotel Guests Noise Assessment

Operational noises from usage of the mechanical plant, carpark and hotel guests conversing on private balconies is required to comply with the EPA noise goals established for the development in Table 4-3 and Table 4-4.

For this assessment the following worst-case scenario is considered,

- All major mechanical plant outlined in Table 6-6 operating concurrently over a 15-minute period include the carpark exhaust

- Preliminary traffic study has indicated that peak usage of the multi-level carpark is likely to occur after an event at the function centre with an estimate of a maximum of 30 vehicles departing the lower basement carpark over a 15-minute period, and

- 34 hotel rooms each with a private balcony has been proposed along the Wingecarribee river. It would be unreasonable to assume there would be more than a dozen of guests out on balconies talking after 10pm at the same time. For a worst-case scenario we have assume 12 guests are engaged in conversations on their private balconies (2 guests per room) concurrently after 10pm for 15minute.

Based on sound power and pressure levels outlined in Table 6-6, Table 6-4 and Table 6-5 and operational noise emitted from usage of the mechanical plant, carpark and hotel guest rooms are calculated using modelling software at each residential and commercial receivers for the worst-case scenario described above and shown in Figure 6 1 below and compared to the EPA noise trigger levels in Table 15 below.

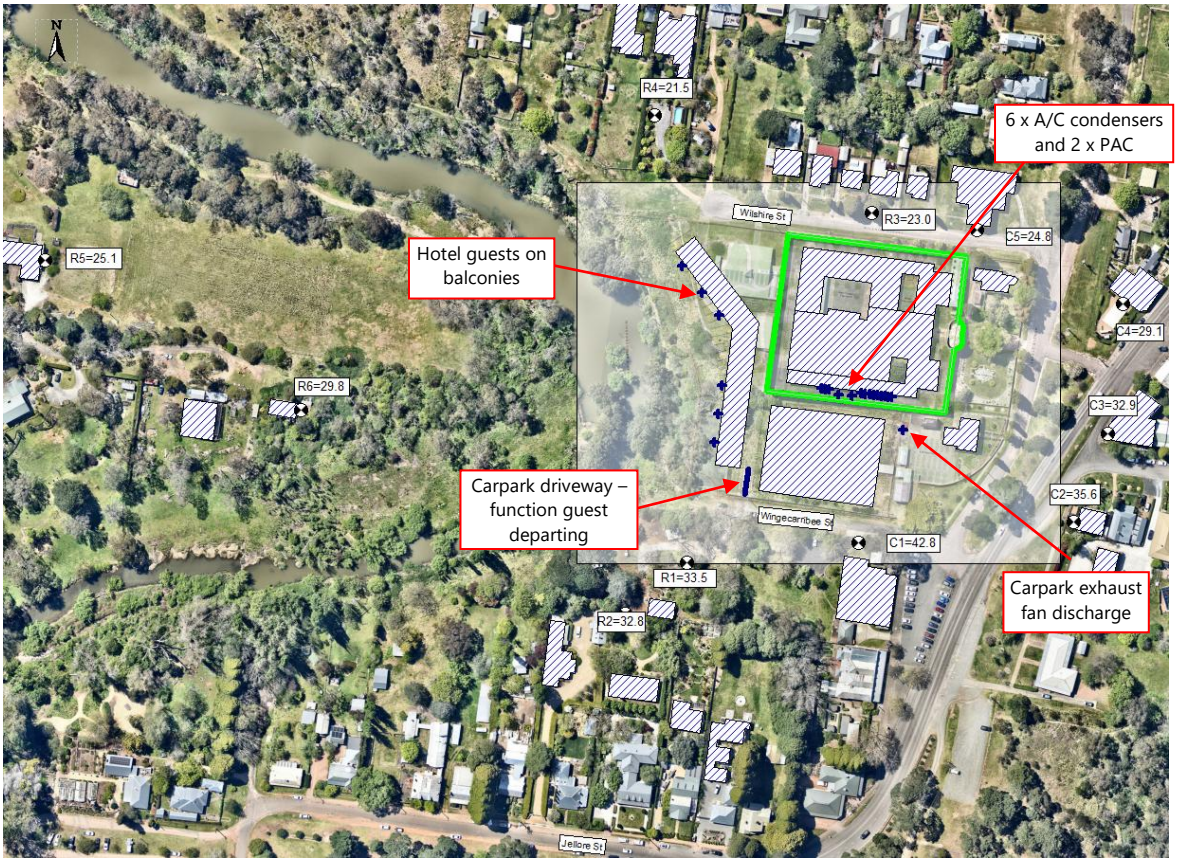


Figure 6-2: Predicted Total Noise Level at Receivers

Table 6-8 shows comparison of predicted cumulative noise levels to EPA noise emission goals defined in Table 4-4 and Table 4-5.

Table 6-8: Predicted Cumulative Noise at Nearest Affected Receivers

Assessment/Receiver Location	Predicted Maximum Sound Pressure Level[1,2] L_{Aeq} dB(A)	EPA NPfI Noise Emission Limit, L_{Aeq} dB(A)	Comply with EPA Criteria (Yes/No)
R1: 15 Wingecarribee Street – residence to the immediate south	34	37	Yes
R2: 2-20 Jellore Street – residences to the far south	33	37	Yes
R3: 1-5 Wilshire Street – residences to the immediate north	23	37	Yes
R4: 37-47 Oxley Street – residence to the far north-west	22	37	Yes
R5: 24 Wingecarribee Street – residence across Wingecarribee river	25	37	Yes
R6: 25-33 Wingecarribee Street - residences across Wingecarribee river	30	37	Yes
C1: 26 Old Hume Highway, Berrima	43	65	Yes
C2: 17-21 Old Hume Highway, Berrima	36	65	Yes

Assessment/Receiver Location	Predicted Maximum Sound Pressure Level[1,2] L_{Aeq} dB(A)	EPA NPfI Noise Emission Limit, L_{Aeq} dB(A)	Comply with EPA Criteria (Yes/No)
C3: 11-15 Old Hume Highway, Berrima	33	65	Yes
C4: 24 Old Hume Highway, Berrima	29	65	Yes
C5: Corner of Argyle and Wilshire Steet, Berrima	25	65	Yes

Notes:

1. Predicted external noise levels are 1m from façade or window.
2. Night operation is the more stringent assessment period

The above assessment in Table 6-7 have demonstrated that night operational noise emission from usage of the major mechanical plant, carpark and private balconies of the hotel guestrooms to complies with the EPA noise goals at all the identified commercial and residential receivers with implementation of the recommendations made in Section 6.1.

6.5 Other Operational Noises

6.5.1 Hotel Gym

The usage of the hotel gym (weight drops, music/TV sounds) has potential to impact adjoining hotel guestrooms within the development, the following mitigation measures are recommended.

- Floor covering throughout the gym shall be a minimum 25mm thick acoustic rubber tiles or matts.
- Install coil springs beneath the weight stacks in the pin-weight machines to prevent the sudden impact of weights falling on the supporting steel frame.
- Wall separating the gym and adjoining guestroom shall have minimum sound reduction of R_w55 and shall be of a discontinuous construction

7 Internal Sound Insulation

Internal walls, floors and risers of the sole occupancy units of the hotel buildings (Class 3) shall comply with the National Construction Code of Australia 2022 (formally Building Code of Australia). All services and doors shall comply with the requirements of the NCC 2022. APPENDIX B presents a summary of acoustic provisions outlined in Part F7 of the NCC 2022.

Detailed acoustic design of internal walls, floor/ceiling system, riser walls, treatment of pipework is to be undertaken after development approval ie. at Construction Certificate stage. Acoustic design of internal walls, floors, risers and services treatments is a routine part of acoustic design and is typically undertaken at CC stage.

8 Construction Noise and Vibration Assessment

8.1 Construction noise objectives

8.1.1 Noise management levels (NMLs)

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.
- Application of reasonable and feasible noise mitigation measures.
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods described for the assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement and prediction of noise levels and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification. Given the scale and duration of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 8-1 reproduces from the ICNG, sets out the airborne noise management levels and how they are to be applied for residential receivers.

Table 8-1: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq\ (15\ min)}$ *	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Time of day	Management level $L_{Aeq\ (15\ min)}$ *	How to apply
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before/ after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see *ICNG* section 7.2.2.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence.

The table below sets out the ICNG noise management levels for other noise sensitive receiver locations.

Table 8-2: Noise management levels at other noise sensitive land uses

Land use	Time of day	Where objective applies	Management level $L_{Aeq\ (15\ min)}$
Classrooms at schools and other educational institutions	When in use	Internal noise level	45 dB(A) internally
Hospital wards and operating theatres	When in use	Internal noise level	45 dB(A)
Places of worship	When in use	Internal noise level	45 dB(A) internally
Active recreation areas	When in use	Outdoor noise level	65 dB(A)
Passive recreation areas	When in use	Outdoor noise level	60 dB(A)
Commercial premises	When in use	Outdoor noise level	**70 dB(A)**
Industrial premises	When in use	Outdoor noise level	75 dB(A)

Notes: 1. Outdoor noise level based on internal noise level in ICNG and assumes 10 dB loss through an open window

8.1.2 Summary of construction noise management levels

A summary of construction noise management levels is presented below.

Table 8-3: Construction noise management levels (NML)

Receiver ID	Location description	Noise management level $L_{Aeq(15min)}$ [1, 2]
		Monday to Fridays (7:00am to 6:00pm) **Saturdays (8:00am to 1:00pm)**
R1 to R6	Residential premises to the north, south and west of site	36 [3] +10 = 46
C1 to C5	Commercial premises to west and south of the site	70

Receiver ID	Location description	Noise management level $L_{Aeq(15min)}$ [1, 2]
		Monday to Fridays (7:00am to 6:00pm) Saturdays (8:00am to 1:00pm)

Notes:
1. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.
2. Noise management levels apply when receiver areas are in use only.
3. Based on 36dB(A) daytime background noise level in Table 3-2

8.2 Proposed construction noise sources

The schedule of items of plant and equipment likely to be used during the construction phases of the development is presented in the table below.

Table 8-4: Typical construction equipment & sound power levels, dB(A) re 1pW

Plant item	Plant description	Sound power levels
Demolition		
1.	Truck - Dump	104
2.	20 tonne Excavator with bucket	106
3.	Bobcat	102
Excavation		
4.	30 tonne excavators with bucket	107
5.	Truck - Dump	109
6.	Delivery trucks	108
Construction		
7.	Concrete pump truck	108
8.	Concrete agitator	109
9.	Hand tools	105

The sound power levels for the majority of construction plant and equipment presented in the above table are based on maximum noise levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the Interim Construction Noise Guideline (ICNG), information from past projects and/or information held in our library files.

8.3 Construction noise assessment

Noise levels at any receiver locations resulting from construction works would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 8-5 presents noise levels likely to be experienced at the nearby affected receivers based on the construction activities, and plant and equipment associated with the proposed site compound at a range from the furthest to the closest proximity to each receiver location. Noise levels were calculated taking into consideration attenuation due to distance between the construction works and the receiver locations and any intervening structures.

Table 8-5: Predicted $L_{Aeq(15min)}$ noise levels for typical construction plant, dB(A)

Plant description	Predicted $L_{eq(15min)}$ construction noise levels										
	R1	R2	R3	R4	R5	R6	C1	C2	C3	C4	C5
Noise Management Levels	*46*	*46*	*46*	*46*	*46*	*46*	*70*	*70*	*70*	*70*	*70*
Demolition											
Truck - Dump	30-52	30-52	30-61	22-55	24-44	24-45	26-63	24-52	25-46	25-48	29-52
20 tonne Excavator with Bucket	32-54	32-54	32-63	24-57	26-46	26-47	28-65	26-54	27-48	27-50	31-54
Bobcat	28-50	28-50	28-59	20-53	22-42	22-43	24-61	22-50	23-44	23-46	27-50
Excavation											
30 tonne excavators with bucket	49-59	45-57	26-60	27-59	37-47	35-49	38-70	28-51	27-46	26-49	22-47
Truck - Dump	51-61	47-59	28-62	29-61	39-49	37-51	40-72*	30-53	29-48	28-51	24-49
Delivery trucks	50-60	46-58	27-61	28-60	38-48	36-50	39-71*	29-52	28-47	27-50	23-48
Construction											
Concrete pump trucks	34-60	34-58	27-61	28-60	28-48	28-50	39-71*	29-52	28-47	27-50	23-52
Concrete agitator	35-61	35-59	28-62	29-61	29-49	29-51	40-72*	30-53	29-48	28-51	24-53
Hand tools	31-57	31-55	24-58	25-57	25-45	25-47	36-68	26-49	25-44	24-47	20-49

Notes:

* 1 to 2dB exceedance is not discernible by human ear (Refer to Table 4.1 of EPA Noise Policy for Industry) and is deemed compliance

Based on results of the assessment in Table 8-5 above the predicted construction noise levels are compliance with the management noise levels at all commercial receivers. However, management noise levels at the residential neighbours would be exceeded when the demolition, excavation and construction works are conducted in close proximity to the corresponding receiver location.

Furthermore, construction noise levels are not expected to be greater than the highly noise affected level of 75dB(A) when noisiest plant and equipment items are used in close proximity to the following receiver locations.

Table 8-6: Receivers predicted to be highly noise affected

Site Activity	Receiver locations exceeding highly affected noise level of 75dB(A)
Demolition	None
Excavation	None

Site Activity	Receiver locations exceeding highly affected noise level of 75dB(A)
Construction	None

In light of the predicted noise levels above, it is recommended that a feasible and reasonable approach towards noise management measures be applied to reduce noise levels as much as possible to manage the impact from construction noise.

Further details on construction noise mitigation and management measures are provided in Section 8.4 below.

8.4 Construction noise mitigation and management measures

The following recommendations provide in-principle feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

8.4.1 General engineering noise controls

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 8-7 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 8-7: Relative effectiveness of various forms of noise control, dB(A)

Noise control method	Practical examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Associates	AS 2436	Renzo Tonin & Associates
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	5 to 10	5 to 10	15	15

Noise control method	Practical examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Associates	AS 2436	Renzo Tonin & Associates
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 25	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436.

Table 8-8 below identifies possible noise control measures, which are applicable for the construction plant likely to be used on site.

Table 8-8: Noise control measures for likely construction plant

Plant description	Screening	Acoustic enclosures	Silencing	Alternative process
Truck - dump	✔	✖	✔	✖
Excavator with bucket	✔	✖	✔	✖
Bobcat	✔	✖	✔	✖
Piling drilling rig	✔	✖	✔	✖
Machine mounted hydraulic drill	✔	✖	✔	✖
Concrete trucks	✔	✖	✔	✖
Delivery trucks	✔	✖	✔	✖
Mobile crane	✔	✖	✔	✖
Concrete pump	✔	✖	✔	✖
Concrete vibrator	✔	✖	✔	✖
Hand tools	✔	✖	✔	✖

8.4.2 Physical noise controls

Physical noise control measures are recommended for implementation at the worst affected neighbouring receiver locations. The following in-principal noise mitigation measure is provided to reduce noise impacts to the neighbouring receivers.

- Erect solid hoarding/ noise screens around the perimeter of the construction site to break the line of site between the high noise generating activities and the windows of the receiver locations.

8.4.3 Regular periodic noise monitoring

The following approach would be adopted with regard to noise monitoring procedures during the construction works.

- Where potential noise impacts are predicted to be within 10 to 15dB(A) of the noise management level, the potential construction noise nuisance is considered to be moderate. Noise monitoring should be carried out to confirm predicted noise impacts within two weeks of commencement of construction. Reasonable and feasible noise reduction measures would be investigated, where necessary.
- Where potential noise impacts are predicted to be more than 15dB(A) above the noise management levels, the potential construction noise nuisance is considered to be high. All reasonable and feasible noise control measures should be implemented prior to the commencement of construction works. Noise compliance monitoring for all major equipment and activities on the site should be undertaken prior to their commencement of work on site. Finally, noise levels during construction should be monitored and where exceeded, further noise reduction measures (where reasonable and feasible) should be implemented eg. restrict working hours, use silencing equipment, etc.

8.4.4 General noise management measures

In addition to physical noise controls, the following general noise management measures should be followed:

- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. See Appendix D for an example of a complaint handling procedure and form.

- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during business hours.

Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable and to be negotiated with Council and the residents. For example, between 10am and 3pm (with one-hour break for lunch between 12pm and 1pm), noisy activities could occur with no noise level restrictions over a limited time period. Residents would be notified of the potential noise impact during this time period so that they can organise their day around the noisy period. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.

8.5 Vibration management plan

8.5.1 Vibration criteria

Construction vibration is associated with three main types of impact:

- disturbance to building occupants
- potential damage to buildings, and
- potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

Vibration amplitude may be measured as displacement, velocity, or acceleration.

- Displacement (x) measurement is the distance or amplitude displaced from a resting position. The International System of Units (SI unit) for distance is the metre (m), although common industrial standards include mm.
- Velocity ($v=\Delta x/\Delta t$) is the rate of change of displacement with respect to change in time. The SI unit for velocity is metres per second (m/s), although common industrial standards include mm/s. The Peak Particle Velocity (PPV) is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis (x, y, and z) then the resultant PPV is

the vector sum (i.e. the square root of the summed squares of the maximum velocities) regardless of when in the time history those occur.

- Acceleration ($a=\Delta v/\Delta t$) is the rate of change of velocity with respect to change in time. The SI unit for acceleration is metres per second squared (m/s^2). Construction vibration goals are summarised below.

Construction vibration goals are summarised below.

8.5.2 Disturbance to buildings occupants

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the DECC '*Assessing Vibration; a technical guideline*' (DECC, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)*'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 8-9 provides definitions and examples of each type of vibration.

Table 8-9: Types of vibration

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

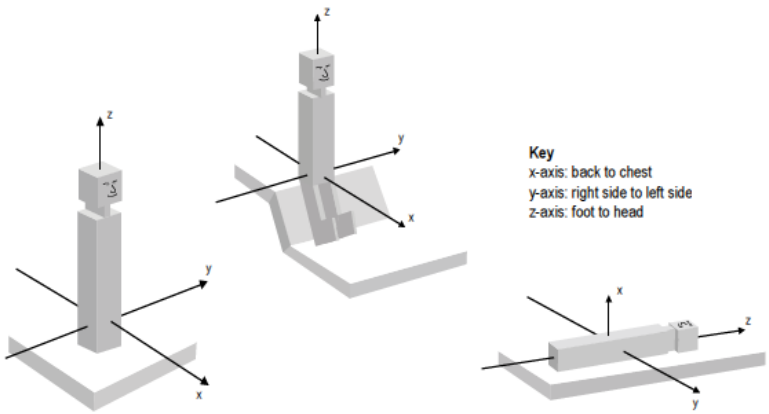
The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *'Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472).'*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application

of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 8-1. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 8-1:Orthogonal axes for human exposure to vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 8-10.

Table 8-10: Preferred and maximum levels for human comfort

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Critical areas[2]	Day- or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes:
1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 8-11.

Table 8-11: Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$)

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

Notes: 3. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

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

8.5.3 Building damage

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 and German Standard DIN4150-3. Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

Within British Standard 7385 Part 1: 1990, different levels of structural damage are defined:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

The vibration limits in Table 1 of British Standard 7385 Part 2 (1993) are for the protection against cosmetic damage, however guidance on limits for minor and major damage is provided in Section 7.4.2 of the Standard:

> *"7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*

Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values."

Within DIN4150-3, damage is defined as "*any permanent effect of vibration that reduces the serviceability of a structure or one of its components*" (p.2). The Standard also outlines:

"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if

- *cracks form in plastered surfaces of walls;*
- *existing cracks in the building are enlarged;*
- *partitions become detached from loadbearing walls or floors.*

These effects are deemed 'minor damage. " (DIN4150.3, 1990, p.3)

While the DIN Standard defines the above damage as 'minor', based on the definitions provided in BS7385, the DIN standard is considered to deal with cosmetic issues rather than major structural failures.

British Standard

British Standard 7385: Part 2 '*Evaluation and measurement of vibration in buildings*', can be used as a guide to assess the likelihood of building damage from ground vibration. BS7385 suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur.

The cosmetic damage levels set by BS 7385 are considered 'safe limits' up to which no damage due to vibration effects has been observed for certain particular building types. Damage comprises minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4Hz to 250Hz, being the range usually encountered in buildings. At frequencies below 4Hz, a maximum displacement value is recommended. The values set in the Standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50%.Table 8-12 sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 8-12: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity[1], mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures	Cosmetic	50		

Group	Type of structure	Damage level	Peak component particle velocity[1], mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
	Industrial and heavy commercial buildings	Minor[2]		100	
		Major[2]		200	
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor[2]	30 to 40	40 to 100	100
		Major[2]	60 to 80	80 to 200	200

Notes: 1. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

2. Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

German Standard

German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure*' (DIN 4150-3), also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative.

DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure. The vibration limits increase as the frequency content of the vibration increases. The criteria are presented in Table 8-13.

Table 8-13: DIN 4150-3 structural damage criteria

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (eg buildings under a preservation order)	3	3 to 8	8 to 10	8

8.5.4 Potential vibration impacts to residential and commercial uses

Based on the proposed plant items presented in Section 8.2, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 8-14 below. The assessment is relevant to the identified buildings and other similar type structures in the project area.

Table 8-14: Potential vibration for residential and non-residential properties

Receiver Location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts		
			Structural damage risk	Human disturbance - risk of adverse comment	Vibration monitoring
R1	56m	Residential	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
R2	95m	Residential	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
R3	31m	Residential	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
R4	97m	Residential	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
R5-R5	>200m	Residential	Very Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
C1	20m	Commercial	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
C2, C3	58m	Commercial	Very Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required
C4	25m	Commercial	Low risk of structural damage from construction works	Low risk of adverse comment as a result of construction works	Vibration monitoring not required

Based on the above assessment neighbouring receivers surrounding the site are unlikely to be impacted by vibration generated from activities during demolition, excavation, and constructions works.

8.5.5 Vibration management measures

The following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort and building damage vibration limits:

1. A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.

2. Where vibration is found to be excessive, management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones as

mentioned above, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

3. Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.

4. Dilapidation surveys should be conducted at all residential and other sensitive receivers within 50 metres of the construction site. Notification by letterbox drop would be carried out for all occupied buildings within 100m of the construction site. These measures are to address potential community concerns that perceived vibration may cause damage to property.

8.6 Complaints management

Noise and vibration levels generated by construction activities associated with the construction of the development must aim to comply with the noise and vibration goals set by the relevant regulations and guidelines.

The contractor is responsible for implementing this Demolition and Excavation Noise and Vibration Management Plan (DENVMP) and ensuring that all reasonable measures are implemented such as the provision of a Noise and Vibration Complaints Program (which forms part of the DENVMP), to minimise the generation of excessive noise and/or vibration levels from the site to nearby sensitive areas. This should be continued as part of the building construction and building fit-out stages.

Owners and occupants of nearby affected properties are to be informed by direct mail of a direct telephone line and contact person where any noise and/or vibration complaints related to the operation of the construction activities are to be reported.

9 Conclusion

Renzo Tonin & Associates have completed an assessment of the potential noise impacts to and from the proposed adaptive reuse of the former Berrima Gaol at 2-4 Argyle Street, Berrima NSW.

The study of external noise intrusion into the subject development has found that appropriate controls can be incorporated into the building design to achieve a satisfactory accommodation environment consistent with the intended quality of the building and relevant standards. Recommendations on control of external noise intrusion are presented in Section 5.

The report has quantified operational noise emission from the proposed development and has assessed noise at the nearest sensitive receivers. Based on the assumptions and inputs within this report, it has been established that operation of the site is capable of complying with relevant NSW EPA and Liquor & Gaming NSW noise emission requirements. Recommendations with respect to operational noise control are presented in Section 6.

In addition, an assessment of construction noise and vibration impacts to the surrounding noise sensitive neighbours have been undertaken in accordance with EPA Interim Construction Noise Guideline (ICNG) 2009. Construction noise mitigations measures have been provided in Section 7 of the report.

APPENDIX A Criteria and design methodology

A.1 State Environmental Planning Policy (Transport & Infrastructure) 2021

The NSW State Environmental Planning Policy (Infrastructure) 2007 (known as 'ISEPP') came into force in NSW on 1 January 2008 to facilitate the effective delivery of infrastructure across the State. This has since been superseded by the State Environment Planning Policy (Transport & Infrastructure) 2021, effective 1 March 2022. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

The main variation of the SEPP (T&I) 2021 from the ISEPP 2007 is the inclusion of a mandatory assessment on road with an AADT of greater than 20,000 vehicles per day. Previously an assessment was recommended for roads having an AADT of more than 20,000 but less than 40,0000 and mandatory for roads having an AADT or more than 40,0000.

Pertinent to noise assessment, the SEPP includes the following clauses:

"2.120 Impact of road noise or vibration on non-road development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

(3A) Subsection (3) does not apply to a building to which State Environmental Planning Policy (Housing) 2021, Chapter 3, Part 7 applies.

(4) In this section, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993."

A.1.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the SEPP applies only to roads with an AADT greater than 20,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

A.1.2 Clarification of SEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the SEPP apply to internal noise levels with windows and doors closed. However, as the preliminary noise assessment is based on measurements/predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the SEPP. The equivalent external goals have been determined on the following basis:

- The SEPP states: "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*." The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the SEPP.
- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 9-1 presents the SEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 9-1: SEPP noise criteria for new residential development

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 20,000 AADT Roads only under SEPP 2021.

^ SEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the NCC/BCA requirements.

A.2 Australian/New Zealand Standard AS/NZS 2107:2016

As traffic noise levels are not constant, an L_{eq} noise level descriptor is used when assessing this type of noise source. The L_{eq} is the mean energy level of the noise being measured, and has been found to accurately describe the level of annoyance caused by traffic noise.

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and industrial noise. The noise levels recommended in AS/NZS 2107:2016 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.

This standard recommends the following noise levels for residential buildings.

Table 9-2: Design sound levels and reverberation times for different areas of occupancy in buildings

Item	Type of occupancy/activity	Design sound level (LAeq,t) range	Design reverberation time (T) range, s
7	**RESIDENTIAL BUILDINGS (see Note 5 and Clause 5.2)**		
	Houses and apartments in inner city areas or entertainment districts or near major roads -		
	Apartment common areas (e.g. foyer, lift lobby)	45 to 50	-
	Living areas	35 to 45	-
	Sleeping areas (night time)	35 to 40	-
	Work areas	35 to 45	-
	Houses and apartments in suburban areas or near minor roads -		
	Apartment common areas (e.g. foyer, lift lobby)	45 to 50	-
	Living areas	30 to 40	-
	Sleeping areas (night time)	30 to 35	-
	Work areas	35 to 40	-

Item	Type of occupancy/activity	Design sound level (LAeq,t) range	Design reverberation time (T) range, s
	Houses in rural areas with negligible transportation -		
	Sleeping areas (night time)	25 to 30	-
	Hotels and motels -		
	Bars and lounges	< 50	0.6 to 1.0
	Conference areas -		
	Without sound reinforcement -		
	Up to 50 persons	35 to 40	Curve 1*
	From 50 to 250 persons	30 to 35	Curve 1*
	With sound reinforcement	35 to 45	Curve 1*
	Dining rooms	40 to 45	See Note 1
	Enclosed carparks	< 65	-
	Foyers and recreation areas	45 to 50	See Note 1
	Kitchen, laundry and maintenance areas	< 55	-
	Sleeping areas (night time) -		
	Hotels and motels in inner city areas or entertainment districts or near major roads	35 to 40	-
	Hotels and motels in suburbs or near minor roads	30 to 35	-
	Washrooms and toilets	45 to 55	-
	Hostels, residential halls and barracks -		
	Cafeterias	45 to 50	< 1.0
	Common rooms	40 to 45	< 1.0
	Games rooms	45 to 50	< 1.0
	Kitchens and service areas	45 to 55	-
	Sleeping areas (night time) -		
	Hostels, residential halls and barracks in inner city areas or entertainment districts or near major roads	35 to 40	-
	Hostels, residential halls and barracks in suburbs or near minor roads	30 to 35	-
	Mining camps -		
	Sleeping areas	35 to 40	-
	Other facilities	See Item 3 or Item 5 in this Table	
	Retirement homes/villages	See Houses and apartments; and Clause 5.2	
* See Appendix A for all references to 'Curve' in this Table.			

Item	Type of occupancy/activity	Design sound level (LAeq,t) range	Design reverberation time (T) range, s

NOTES:

1. Reverberation time should be minimized for noise control.
2. Certain teaching spaces, including those intended for students with learning difficulties and students with English as a second language, should have reverberation times at the lower end of the range.
3. Specialist advice should be sought for these spaces.
4. A very wide range of noise levels can occur in the occupied state in spaces housing manufacturing processes, and the levels are primarily subject to control as part of a noise management program (see AS/NZS 1269.2). The possibilities for segregating very noisy processes from quieter ones by partitioning vary between particular industries and plants. For reasons such as these, it is difficult to make generalized recommendations for desirable, or even maximum, design levels for the unoccupied state, but one guiding principle may still be observed- when the activity in one area of a manufacturing plant is halted, it is desirable that the local level should if possible drop to 70 dB(A) or lower to permit speech communication without undue effort.
5. In situations where traffic noise levels may vary widely over a 24 h period, measurement to assess compliance with this Standard should be taken at the relevant time and for an appropriate measurement period according to the area of occupancy or activity in the building. Where traffic noise fluctuates rapidly with the passage of individual vehicles, the community reaction may not correlate well with the equivalent continuous noise level as measured.
6. The overall sound pressure level in dB(A) should conform to the recommended design sound level given in Table 1. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C.
7. In spaces in which high quality sound recordings are to be made, the levels set for low frequency octave bands should not be exceeded (see Appendix C). Subsequent replay of the recordings might cause an amplification of the low-frequency sound resulting in an overemphasis of its low-frequency components. Specialist advice should always be sought when these spaces are being designed. In some circumstances, for purposes of very high quality recording, lower levels than those in Table 1 may be necessary.
8. Health requirements for hygiene and infection control may preclude achieving these recommended reverberation times.

APPENDIX B Internal Sound Insulation

B.1 National Construction Code of Australia 2022

The National Construction Code of Australia (NCC) outlines minimum requirements for inter-tenancy (party) walls and ceiling/ floors to maintain privacy. This includes the incorporation of penetration of a service through a floor or through more than one sole-occupancy unit.

NCC nominates required Weighted Sound Reduction Indexes (R_w) and spectrum adaptation factor (C_{tr}) for partition constructions, of different space/ activity types in adjoining units. The R_w and $R_w + C_{tr}$ are single number descriptors for quantifying the attenuating performance of partitions for typical intrusive noises produced inside residences. The higher the rating, the greater the isolation provided by the partition.

Spectrum adaptation factors are commonly used to compensate for the fact that certain kinds of sounds are more readily transmitted through insulating materials than others insulate.

The adaptation factor C_{tr} has now been introduced for most building elements which require an airborne sound insulation rating. The only exception is a wall which separates a dwelling from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification. Therefore, both the C_{tr} factor and the R_w of the building element will need to be considered in most cases.

The C_{tr} factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and music reproduction equipment.

The Deemed-to-Satisfy Provisions also have impact sound insulation requirements for floors. The terms to describe the impact sound insulation of the floor is the weighted normalised impact sound pressure level ($L_{n,w}$). The lower the $L_{n,w}$ of the floor, the better the performance of the floor in terms of impact sound insulation.

The following section represents a summary of acoustic provisions outlined in the Part F7 of the NCC.

B.2 Sound Insultion Provision of NCC of Australia

The acoustic provisions for inter-tenancy walls in Class 2 & 3 and Class 9c buildings are outlined in the National Construction Code of Australia and the following is an extract from the NCC:

F7D3 Determination of airborne sound insulation ratings

A form of construction required to have an airborne sound insulation rating must –

(a) have the required value for weighted sound reduction index (Rw) or weighted sound reduction index with spectrum adaptation term (Rw + Ctr) determined in accordance with AS/NZS ISO 717.1 using results from laboratory measurements; or

(b) comply with Specification 28.

F7D4 Determination of impact sound insulation ratings

(1) A floor in a building required to have an impact sound insulation rating must –

(a) have the required value for weighted normalised impact sound pressure level (Ln,w) determined in accordance with AS ISO 717.2 using results from laboratory measurements; or

(b) comply with Specification 28

(2) A wall in a building required to have an impact sound insulation rating must –

(a) for a Class 2 or 3 building be of discontinuous construction and

(b) for a Class 9c building, must—

(i) for other than masonry, be two or more separate leaves without rigid mechanical connection except at the periphery; or

(ii) be identical with a prototype that is no less resistant to the transmission of impact sound when tested in accordance with Specification 29 than a wall listed in S28C4 to S28C7.

(3) For the purposes of this Part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

(a) for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

(b) for other than masonry, there is no mechanical linkage between leaves except at the periphery.

F7D5 Sound insulation rating of floors

(1) A floor in a Class 2 or 3 building must have an Rw + Ctr (airborne) not less than 50 and an Ln,w (impact) not more than 62 if it separates –

(a) sole-occupancy units; or

(b) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

(2) A floor in a Class 9c building separating sole-occupancy units must have an Rw not less than 45

F7D6 Sound insulation rating of walls

(1) A wall in a Class 2 or 3 building must –

(a) have an Rw + Ctr (airborne) not less than 50, if it separates sole-occupancy units; and

(b) have an Rw (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

(c) comply with F7D4(2) if it separates:

(i) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

(ii) a sole-occupancy unit from a plant room or lift shaft.

(2) A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an Rw not less than 30.

(3) A wall in a Class 9c building must have an Rw not less than 45 if it separates—

(a) sole-occupancy units; or

(b) a sole-occupancy unit from a kitchen, bathroom, sanitary compartment (not being an associated ensuite), laundry, plant room or utilities room.

(4) In addition to (3), a wall separating a sole-occupancy unit in a Class 9c building from a kitchen or laundry must comply with F7D4(2).

(5) Where a wall required to have sound insulation has a floor above, the wall must continue to –

(a) the underside of the floor above; or

(b) a ceiling that provides the sound insulation required for the wall.

(6) Where a wall required to have sound insulation has a roof above, the wall must continue to –

(a) the underside of the roof above; or

(b) a ceiling that provides the sound insulation required for the wall.

F7D7 Sound insulation rating of internal services

(1) If a duct or soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an Rw+Ctr (airborne) not less than –

(a) 40 if the adjacent room is a habitable room (other than a kitchen); or

(b) 25 if the adjacent room is a kitchen or non-habitable room.

(2) If a stormwater pipe passes through a sole-occupancy unit, it must be separated in accordance with (1)(a) and (b).

F7D8 Sound isolation of pumps

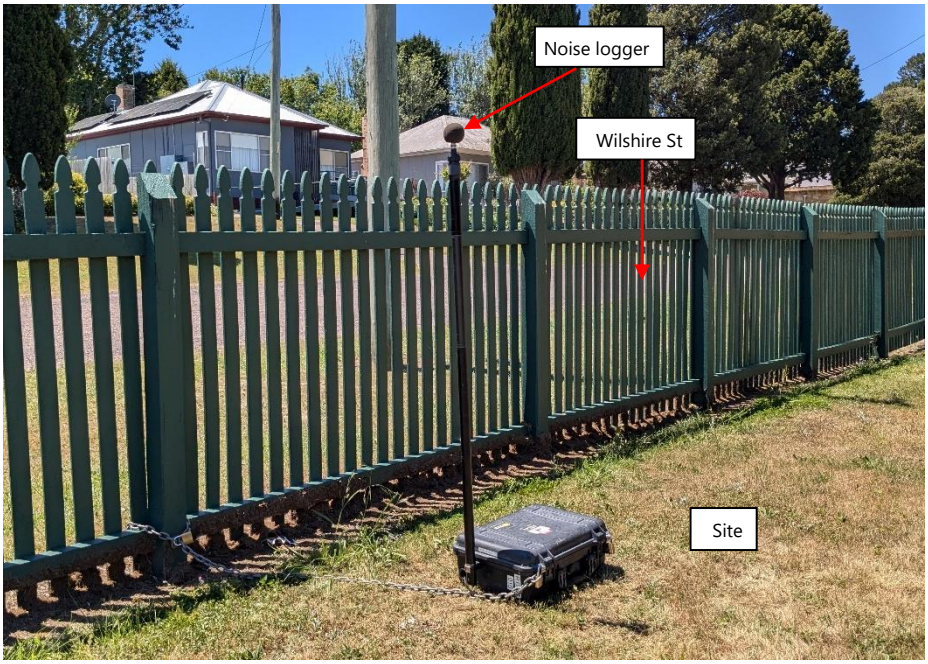
A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating or other pump.

APPENDIX C Location and Results of Noise Surveys

C.1 Ambient and Background Noise Survey

Unattended Noise Monitoring Location L1: Front of existing building on site at Wilshire Street, Berrima.

Survey Period: 30/10/2024 to 07/11/2024



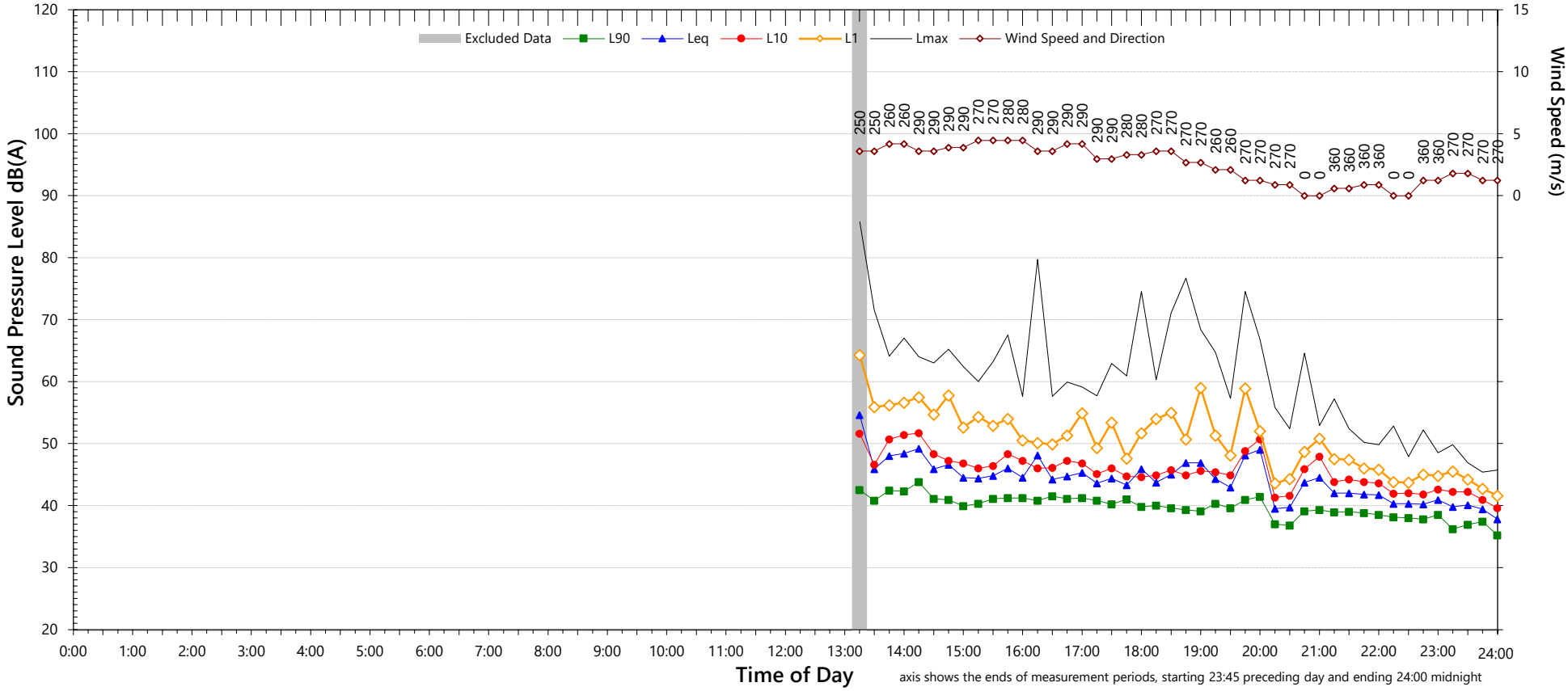
Unattended Noise Monitoring Location L2: Front yard of 15 Wingecarribee Street, Berrima.

Survey Period: 30/10/2024 to 07/11/2024

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Wednesday, 30 October 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	38	35
L_{Aeq}	-	45	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	82	to	82
L_{AFMax} - L_{Aeq} (Range)	29	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	49
$L_{Aeq\ 1hr}$ upper 10 percentile	-	53
$L_{Aeq\ 1hr}$ lower 10 percentile	-	42

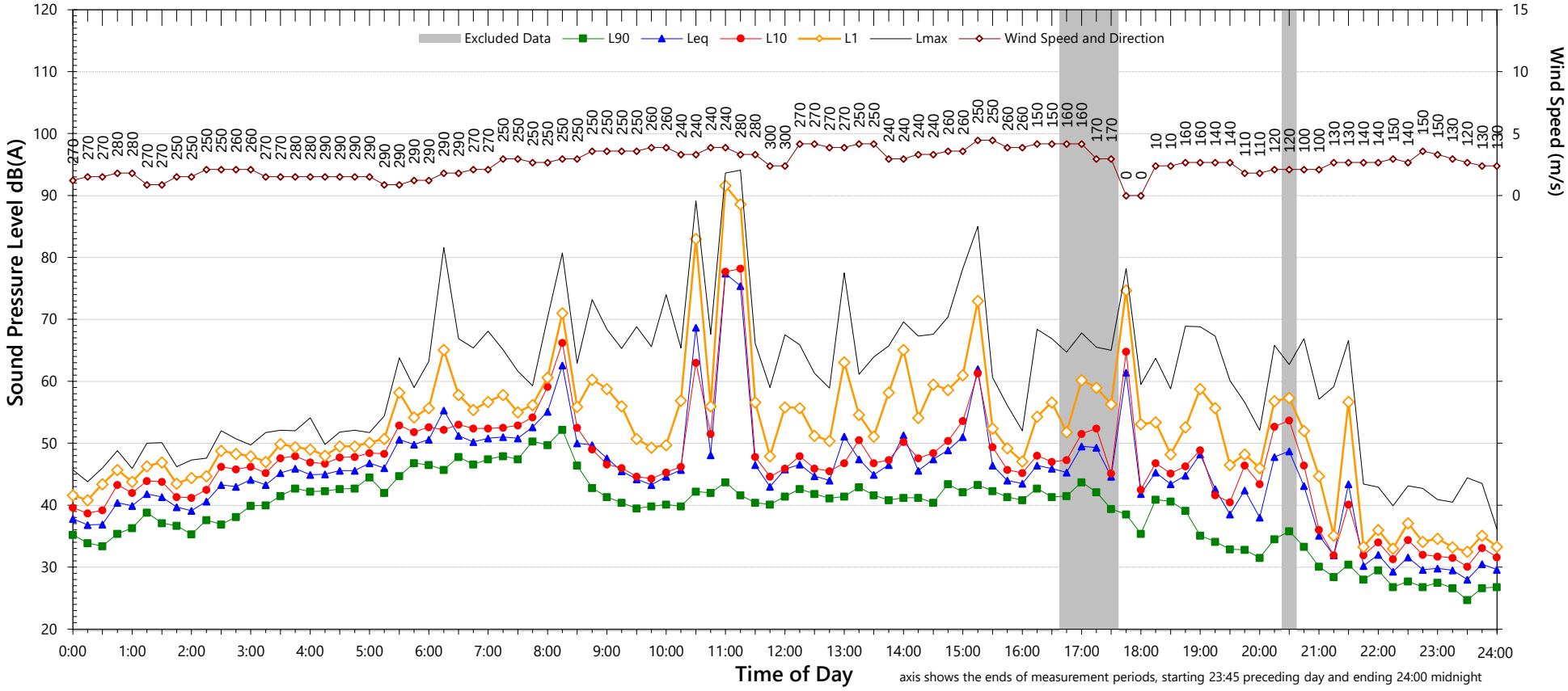
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Thursday, 31 October 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	40	29	25
L_{Aeq}	64	43	44

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	79	to	80
L_{AFMax} - L_{Aeq} (Range)	17	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	65	46
$L_{Aeq\ 1hr}$ upper 10 percentile	68	53
$L_{Aeq\ 1hr}$ lower 10 percentile	45	30

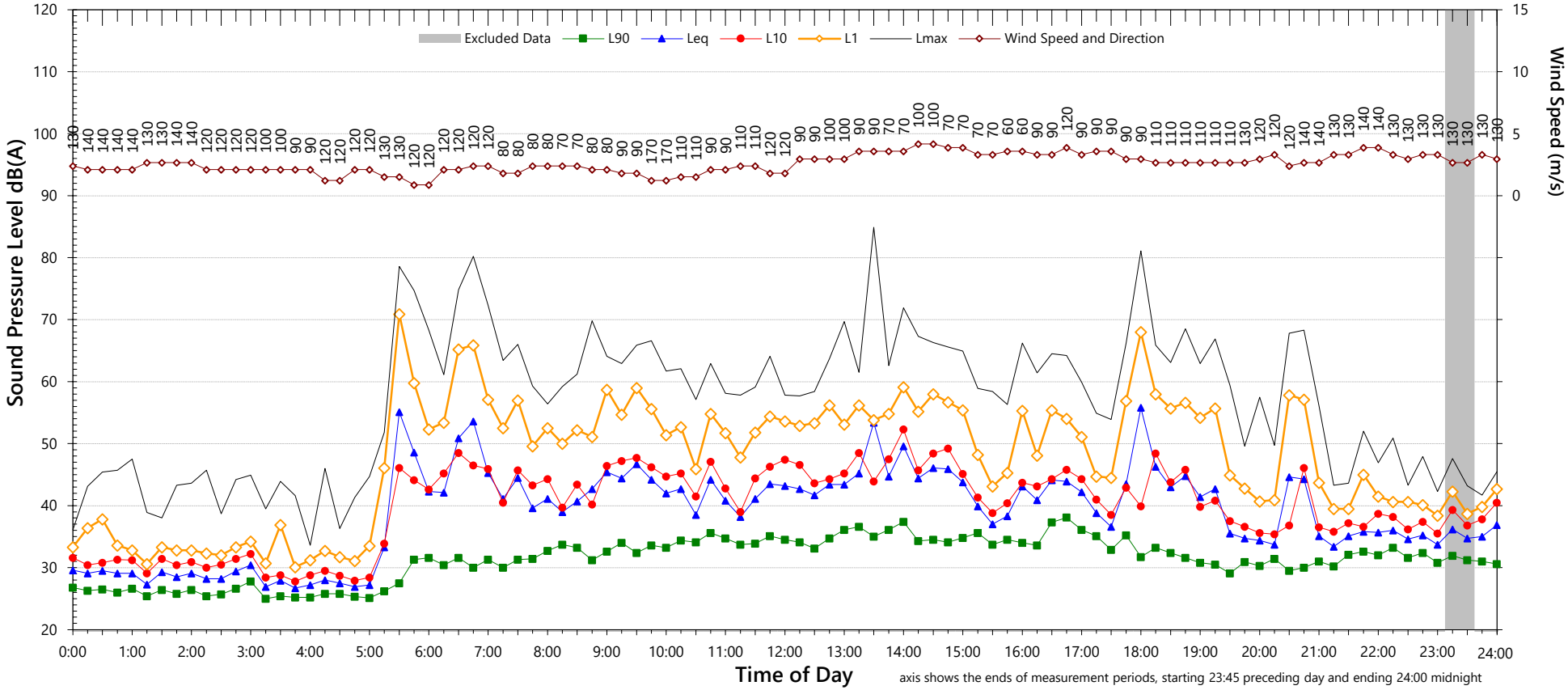
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Friday, 1 November 2024



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	32	30	26
L_{Aeq}	45	41	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	77	to	83
L_{AFMax} - L_{Aeq} (Range)	16	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	47	47
$L_{Aeq\ 1hr}$ upper 10 percentile	50	51
$L_{Aeq\ 1hr}$ lower 10 percentile	42	32

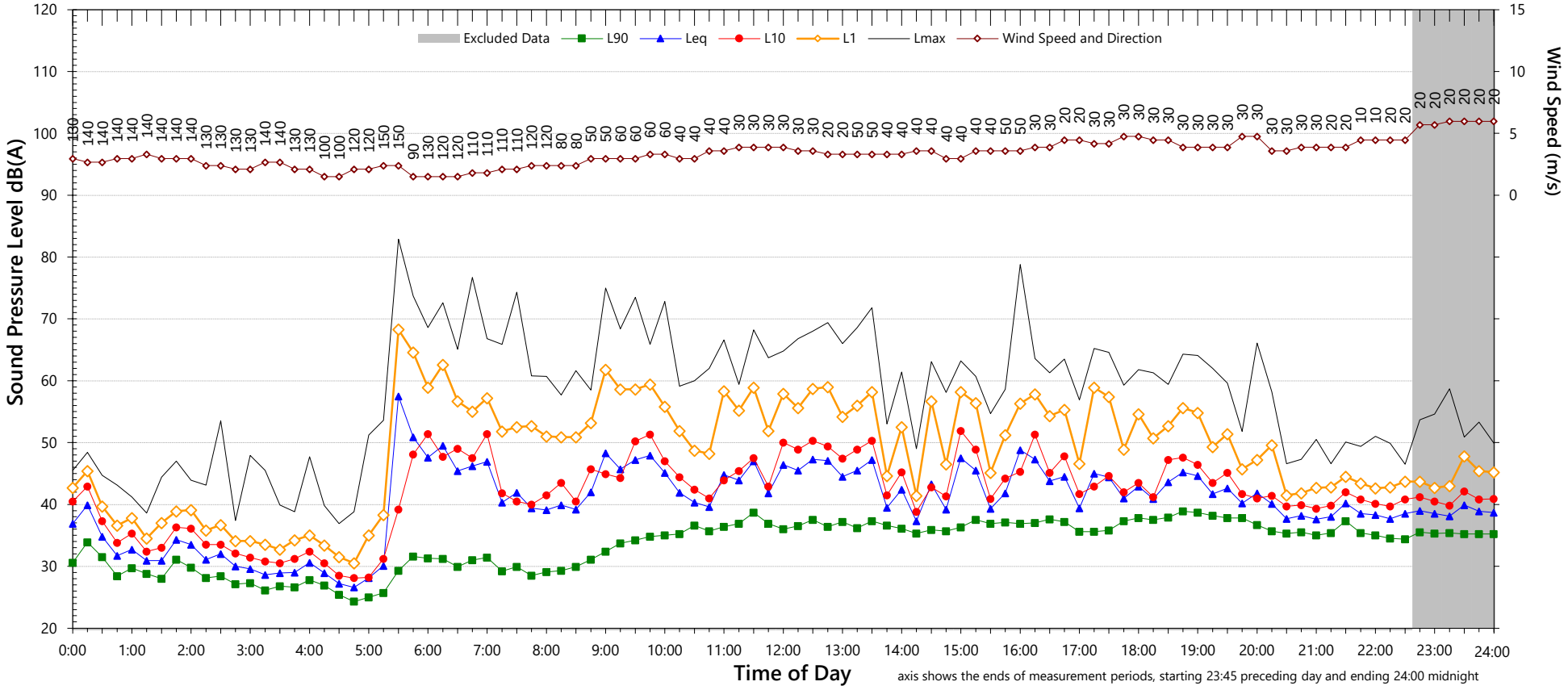
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Saturday, 2 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	30	35	-
L_{Aeq}	45	41	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	78	to	85
L_{AFMax} - L_{Aeq} (Range)	16	to	35

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	46	47
$L_{Aeq\ 1hr}$ upper 10 percentile	48	51
$L_{Aeq\ 1hr}$ lower 10 percentile	42	39

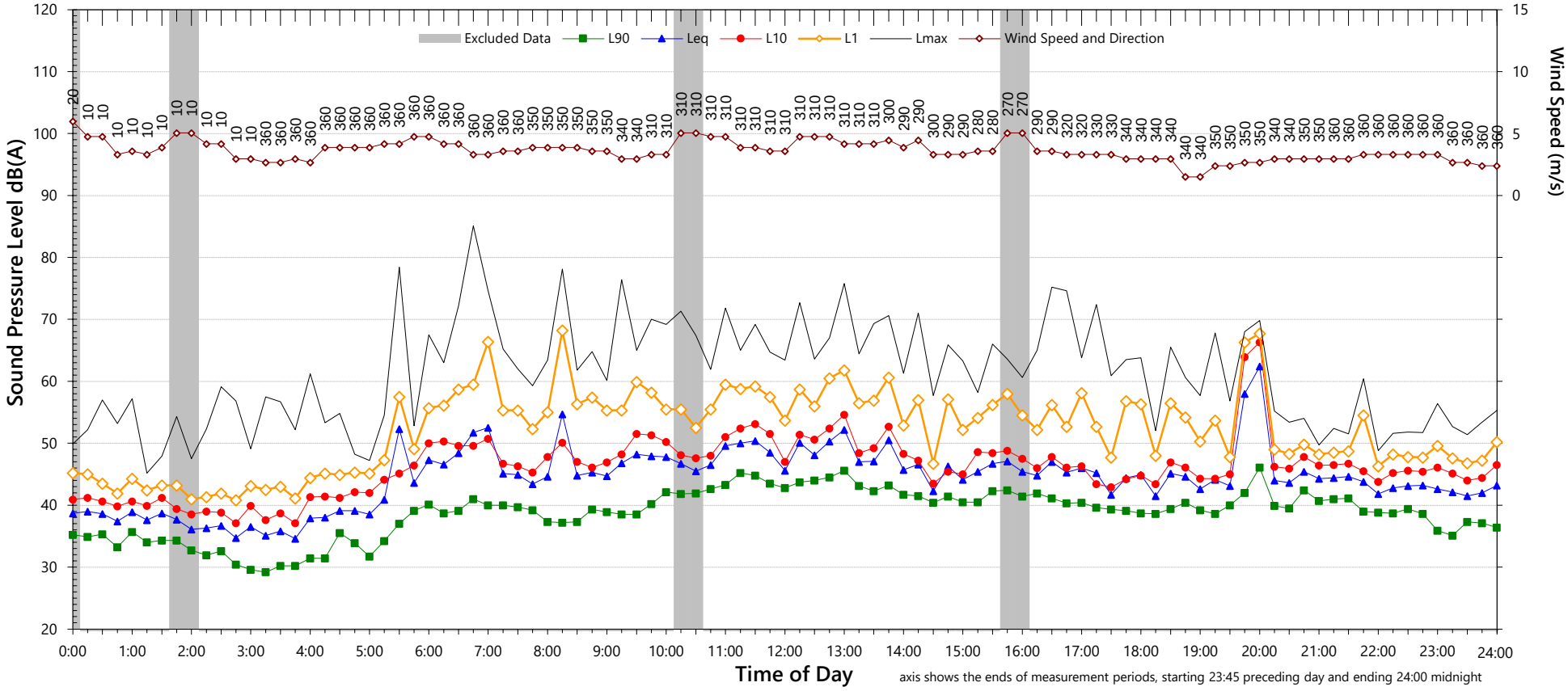
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Sunday, 3 November 2024



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	39	39	36
L_{Aeq}	48	52	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	75	to	88
L_{AFMax} - L_{Aeq} (Range)	25	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	52	51
$L_{Aeq\ 1hr}$ upper 10 percentile	53	53
$L_{Aeq\ 1hr}$ lower 10 percentile	46	45

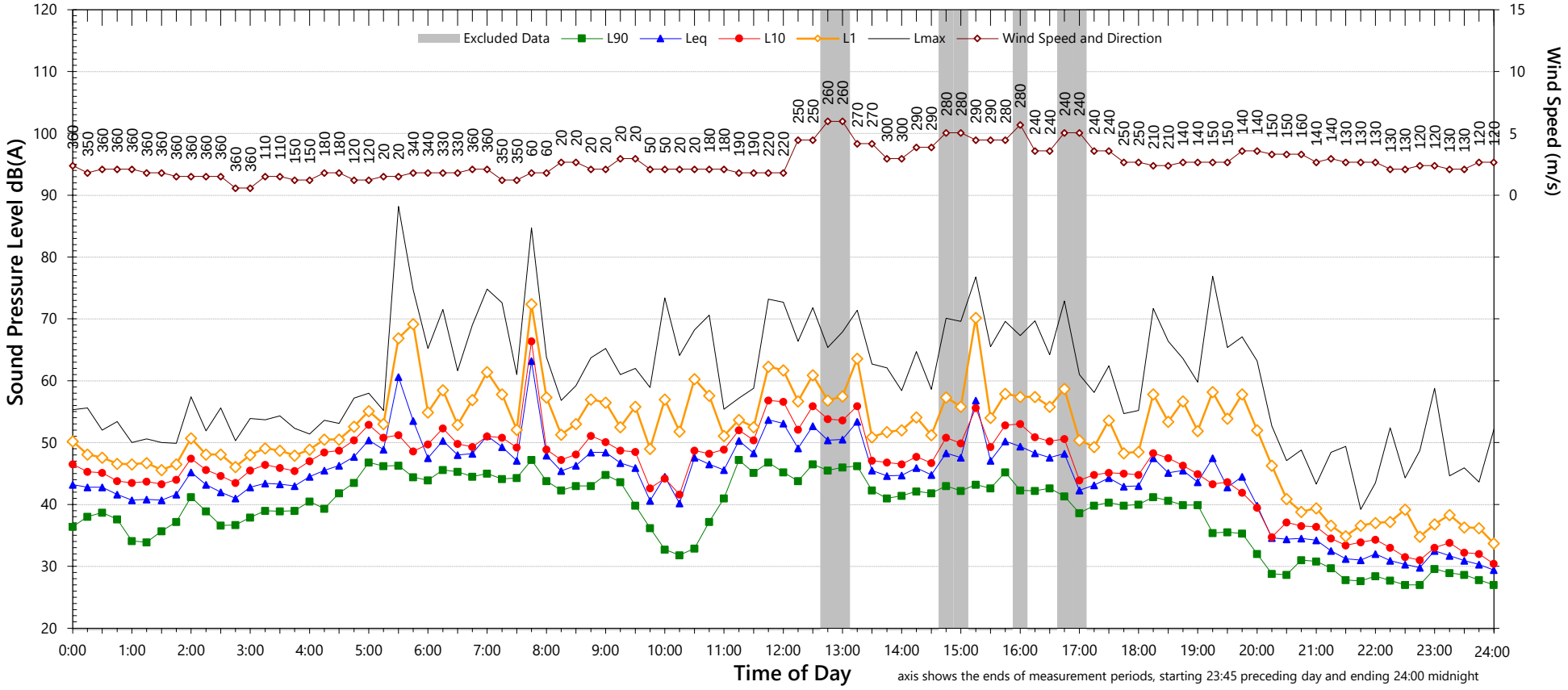
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Monday, 4 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	37	28	24
L_{Aeq}	51	42	54

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	73	to	94
L_{AFMax} - L_{Aeq} (Range)	19	to	33

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	52	56
$L_{Aeq\ 1hr}$ upper 10 percentile	55	50
$L_{Aeq\ 1hr}$ lower 10 percentile	41	29

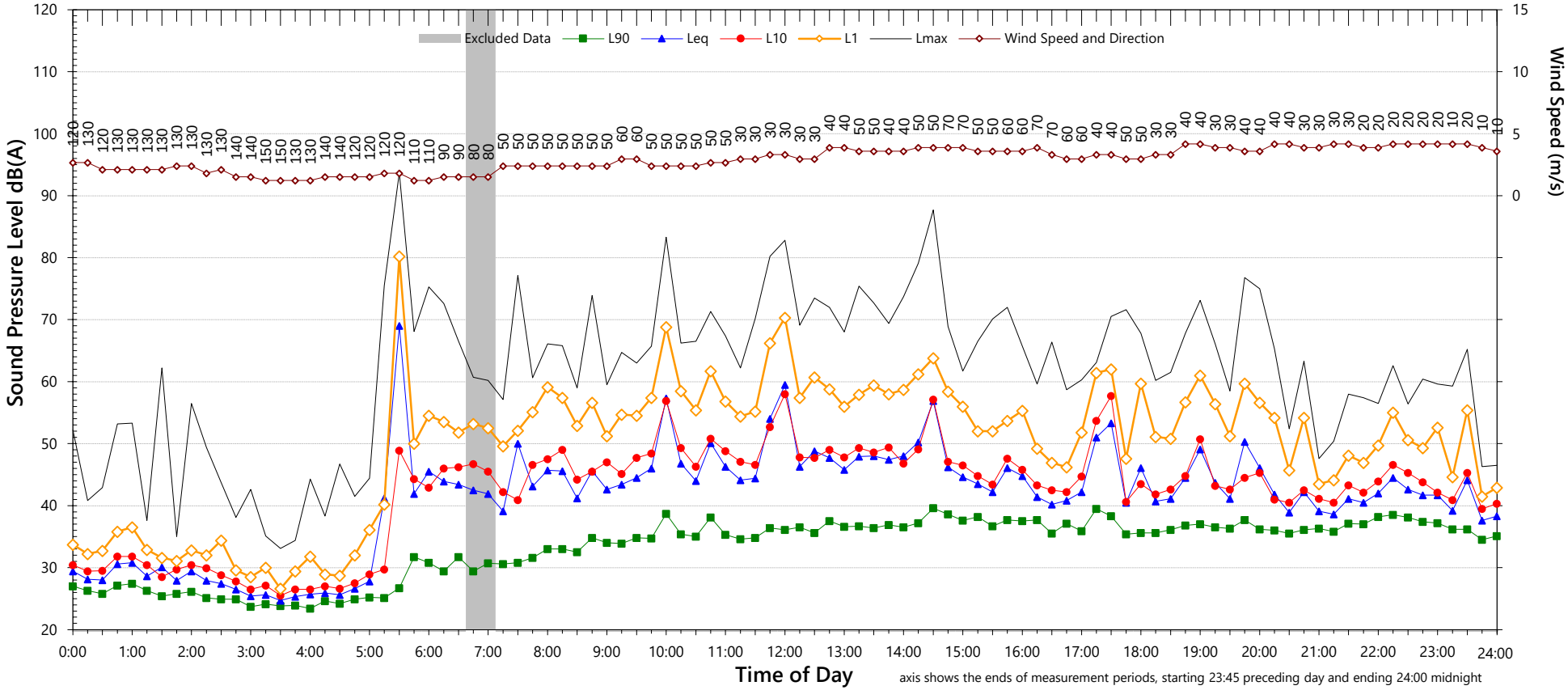
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Tuesday, 5 November 2024



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	33	36	33
L_{Aeq}	50	44	43

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	81
L_{AFMax} - L_{Aeq} (Range)	19	to	33

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	46
$L_{Aeq\ 1hr}$ upper 10 percentile	55	50
$L_{Aeq\ 1hr}$ lower 10 percentile	43	40

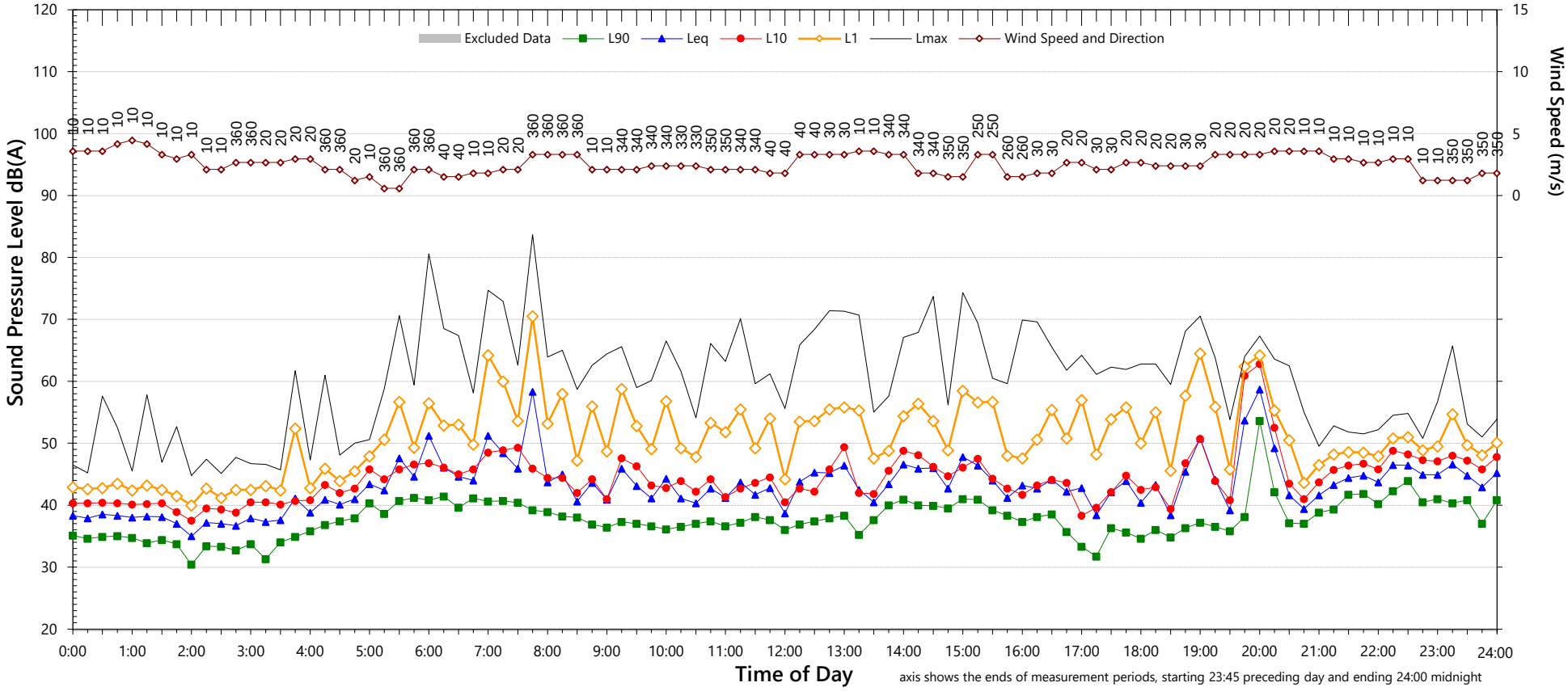
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Wednesday, 6 November 2024



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	36	36	37
L_{Aeq}	46	49	51

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	88
L_{AFMax} - L_{Aeq} (Range)	18	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	50	54
$L_{Aeq\ 1hr}$ upper 10 percentile	53	54
$L_{Aeq\ 1hr}$ lower 10 percentile	44	45

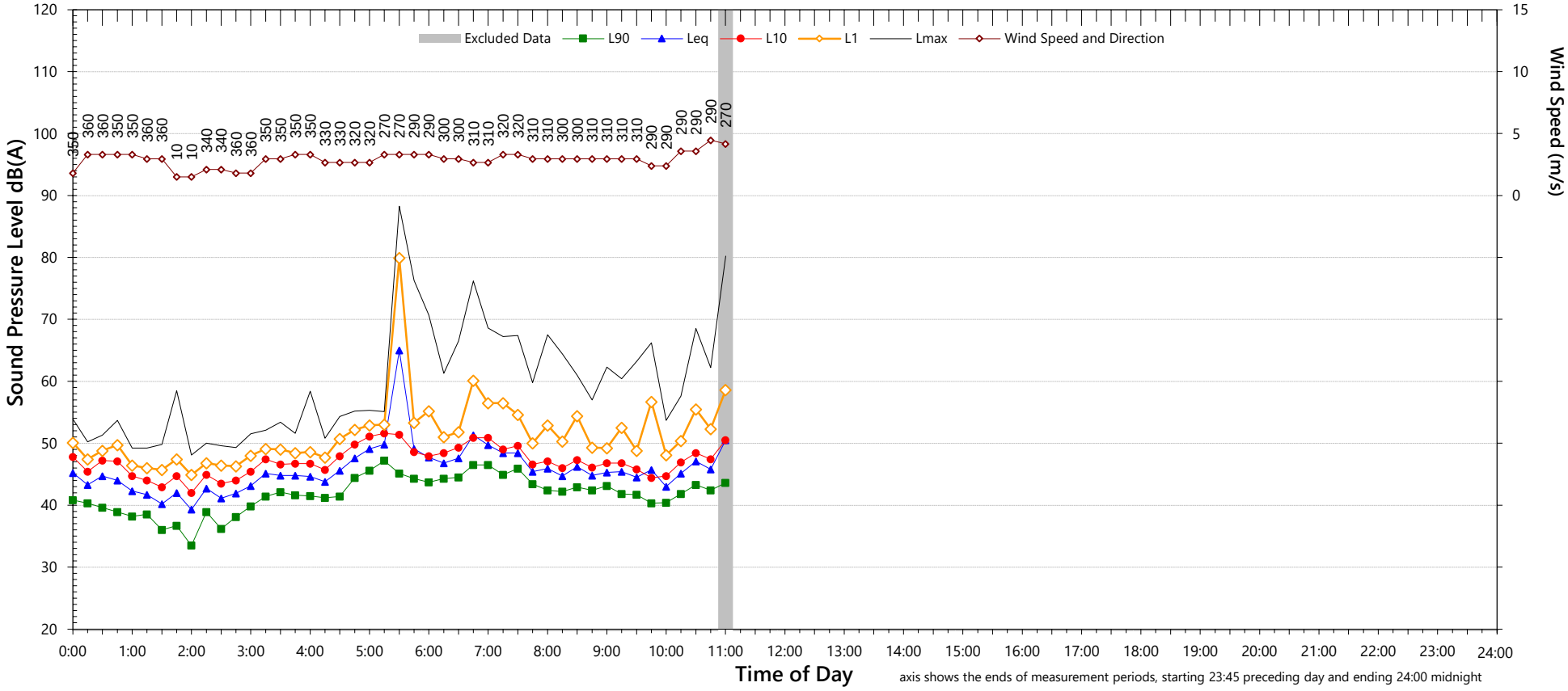
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

Wilshire Street, Berrima - Front of building at rear of site

Thursday, 7 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

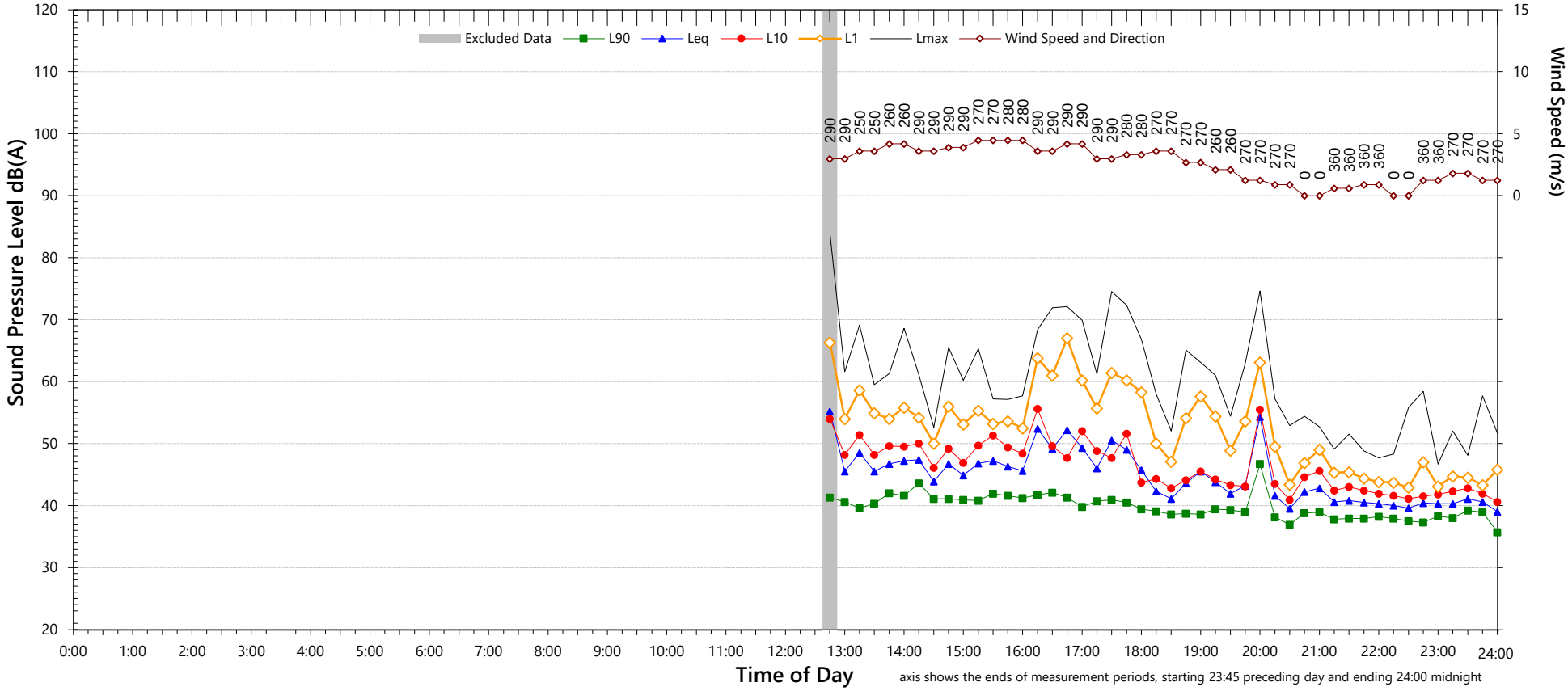
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Wednesday, 30 October 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	38	36
L_{Aeq}	-	45	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	71	to	71
L_{AFMax} - L_{Aeq} (Range)	17	to	21

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	48
$L_{Aeq\ 1hr}$ upper 10 percentile	-	53
$L_{Aeq\ 1hr}$ lower 10 percentile	-	42

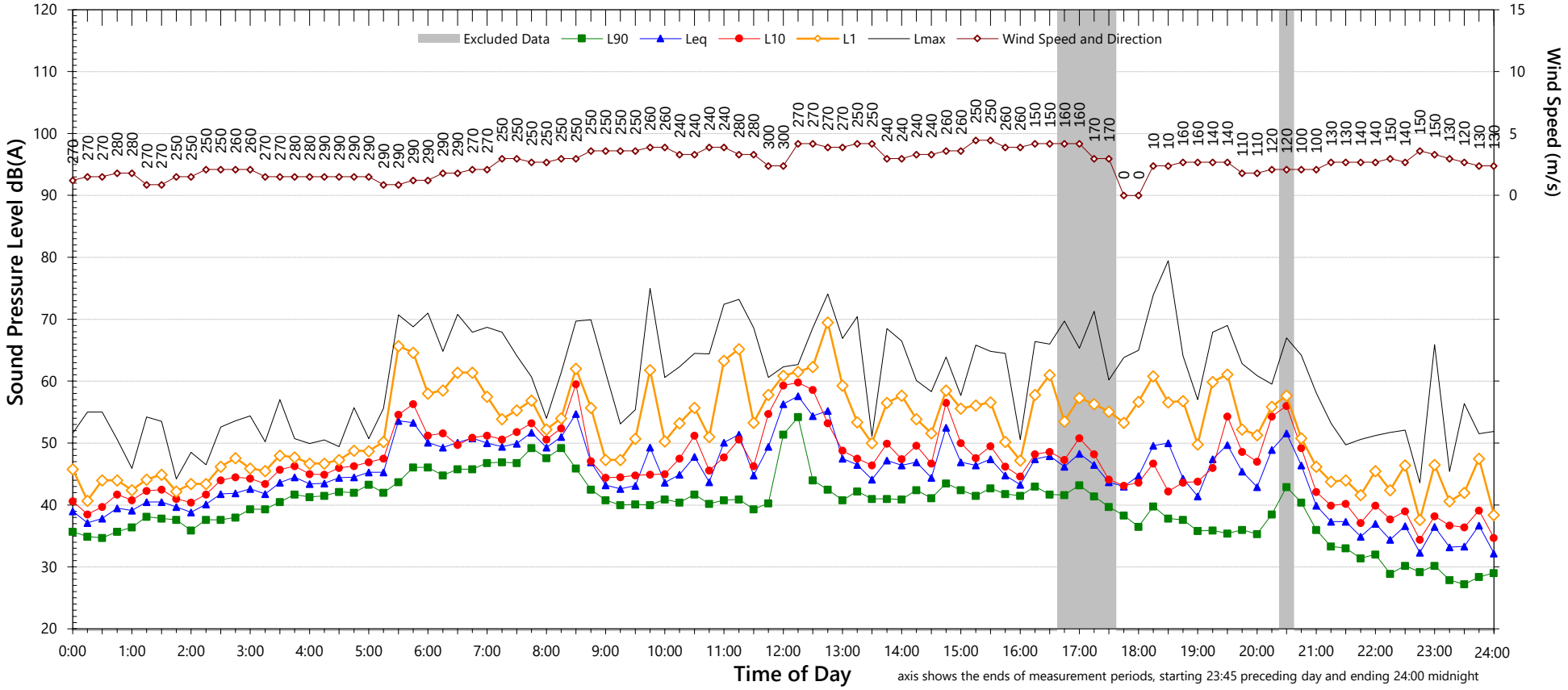
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Thursday, 31 October 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	40	32	27
L_{Aeq}	50	46	40

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	76
L_{AFMax} - L_{Aeq} (Range)	18	to	33

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	52	43
$L_{Aeq\ 1hr}$ upper 10 percentile	54	47
$L_{Aeq\ 1hr}$ lower 10 percentile	47	34

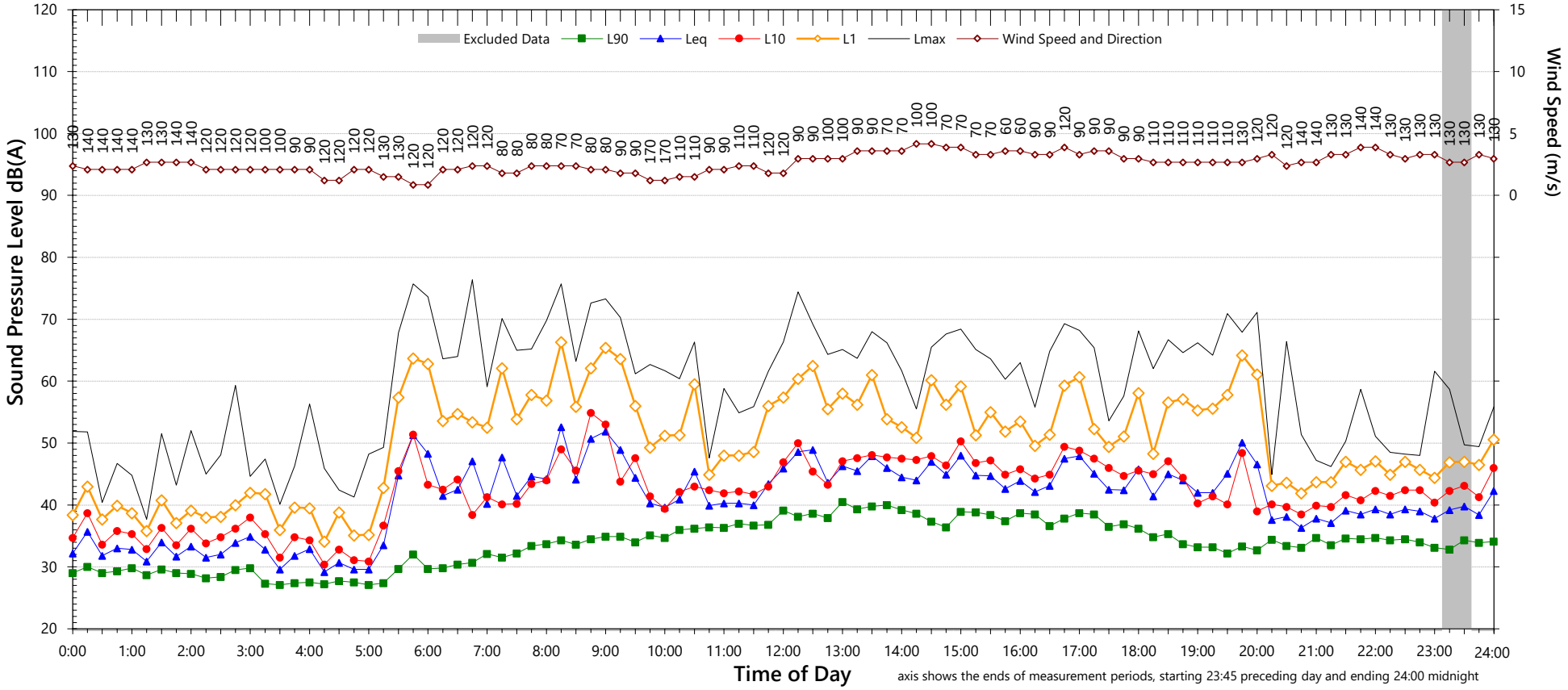
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Friday, 1 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	34	33	28
L_{Aeq}	46	43	43

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	68	to	72
L_{AFMax} - L_{Aeq} (Range)	15	to	24

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	48	46
$L_{Aeq\ 1hr}$ upper 10 percentile	50	49
$L_{Aeq\ 1hr}$ lower 10 percentile	43	34

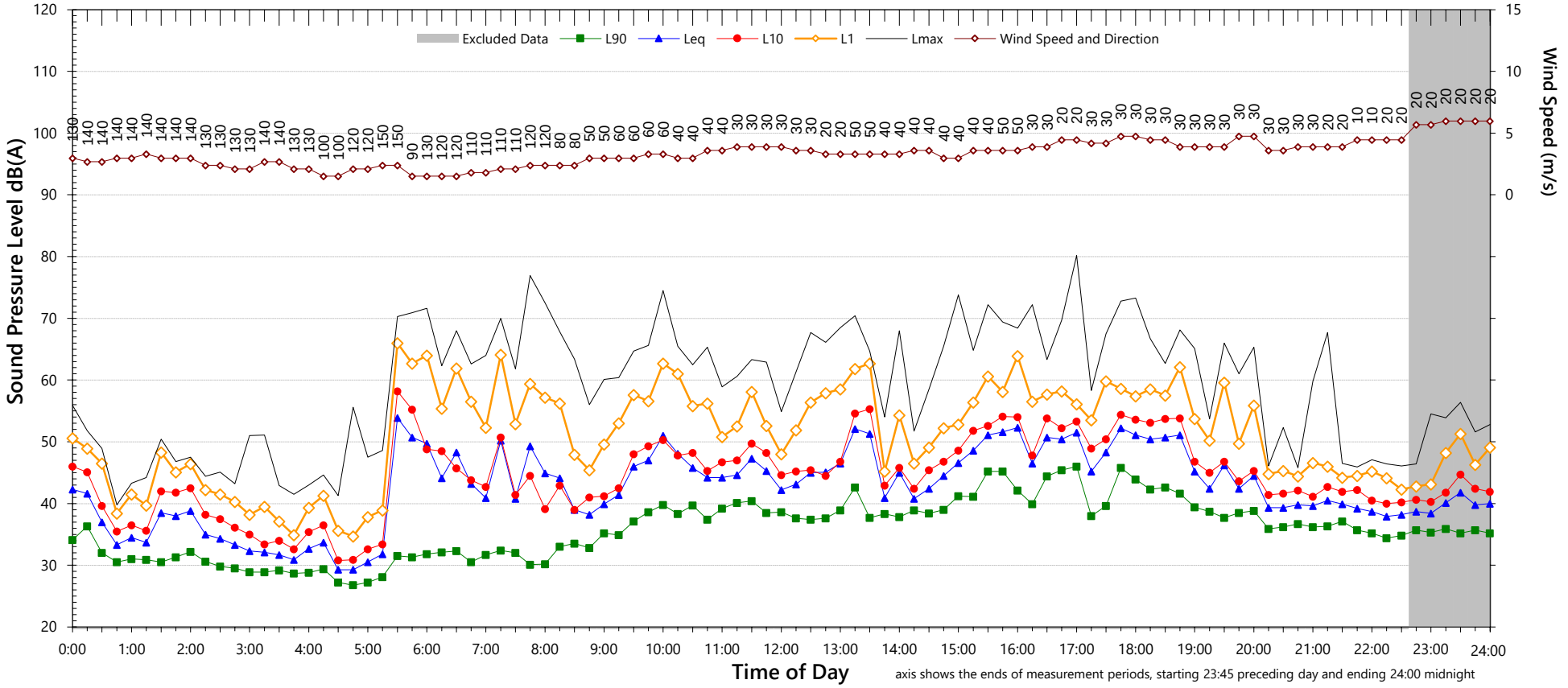
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Saturday, 2 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	33	36	-
L_{Aeq}	48	45	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	71	to	77
L_{AFMax} - L_{Aeq} (Range)	21	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	50	47
$L_{Aeq\ 1hr}$ upper 10 percentile	53	49
$L_{Aeq\ 1hr}$ lower 10 percentile	43	39

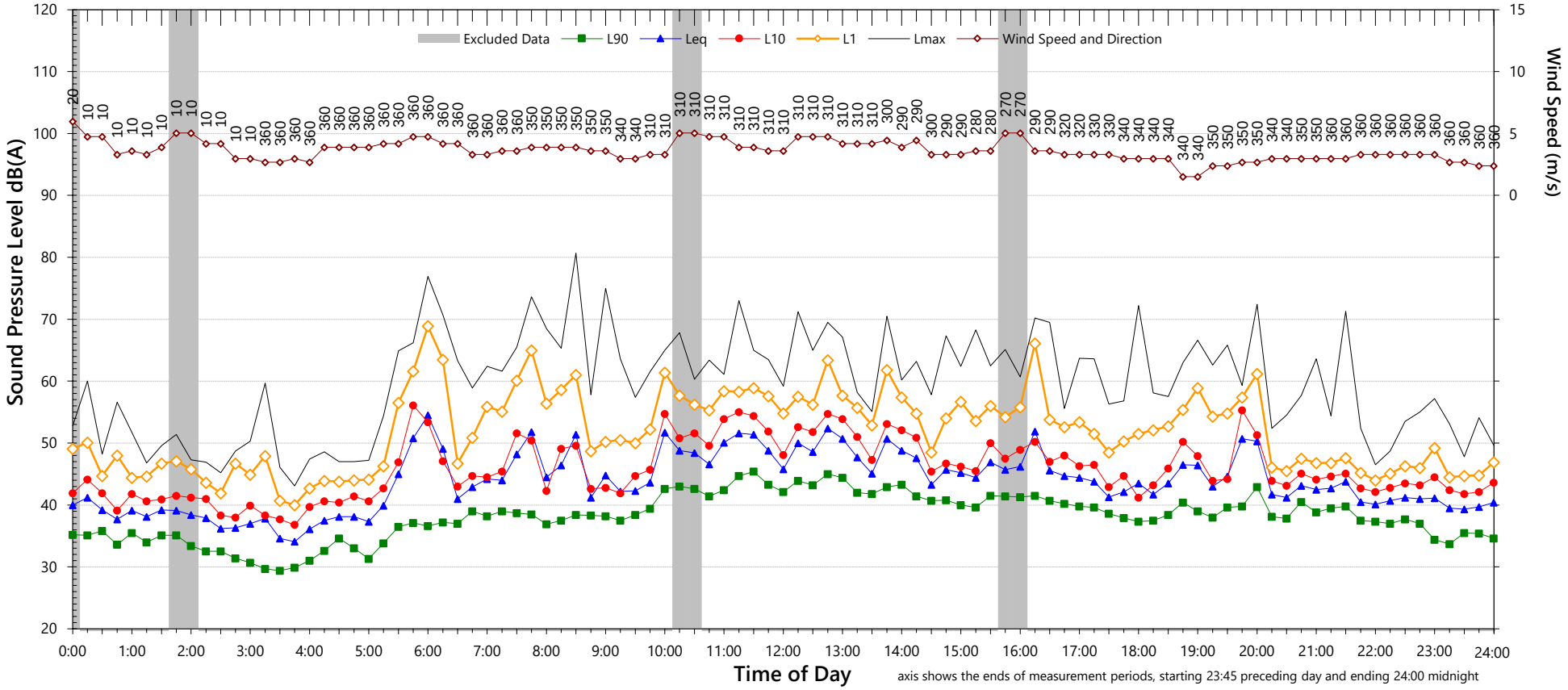
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Sunday, 3 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	38	38	35
L_{Aeq}	48	45	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	73	to	76
L_{AFMax} - L_{Aeq} (Range)	16	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	50	48
$L_{Aeq\ 1hr}$ upper 10 percentile	52	52
$L_{Aeq\ 1hr}$ lower 10 percentile	45	42

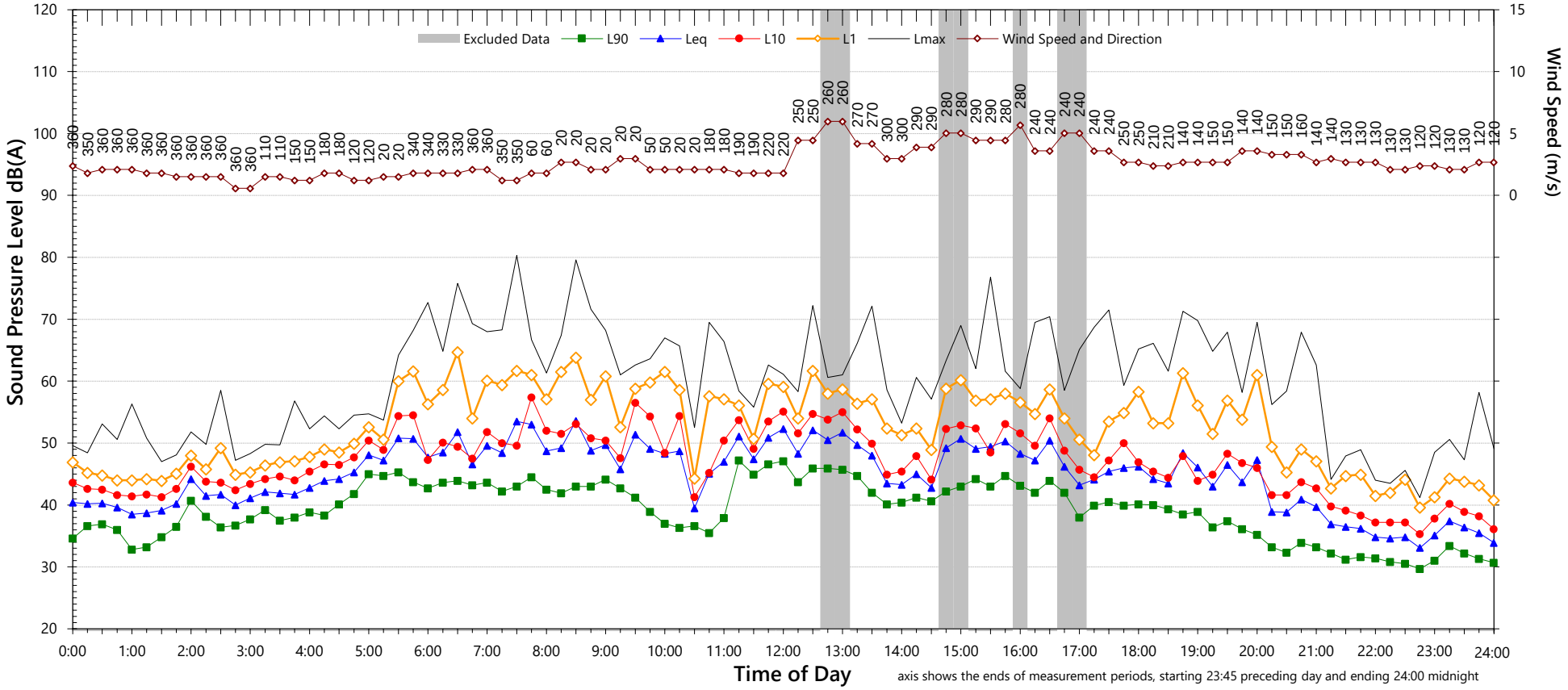
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Monday, 4 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	38	32	29
L_{Aeq}	49	43	38

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	73	to	73
L_{AFMax} - L_{Aeq} (Range)	15	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	40
$L_{Aeq\ 1hr}$ upper 10 percentile	53	45
$L_{Aeq\ 1hr}$ lower 10 percentile	44	33

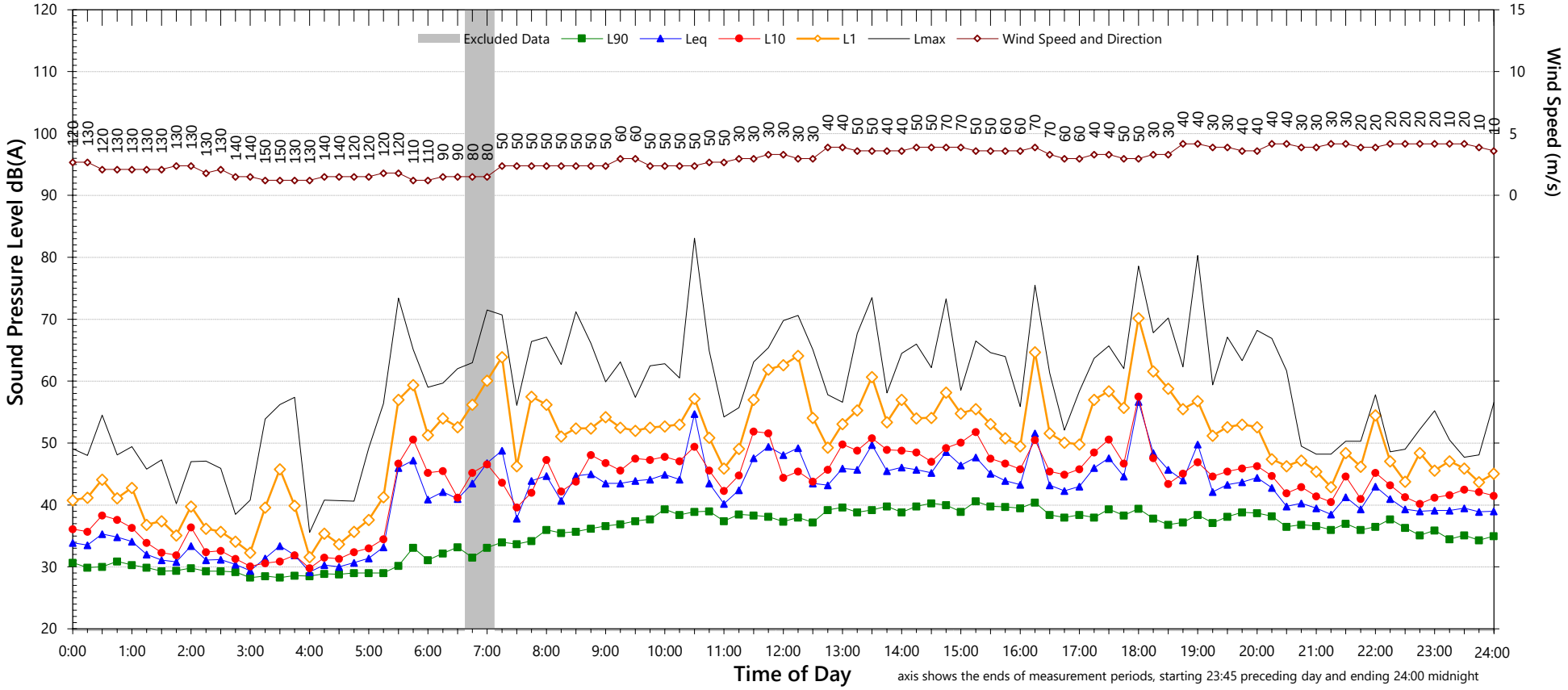
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Tuesday, 5 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	36	36	34
L_{Aeq}	47	44	47

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	73	to	75
L_{AFMax} - L_{Aeq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	49	49
$L_{Aeq\ 1hr}$ upper 10 percentile	51	54
$L_{Aeq\ 1hr}$ lower 10 percentile	44	40

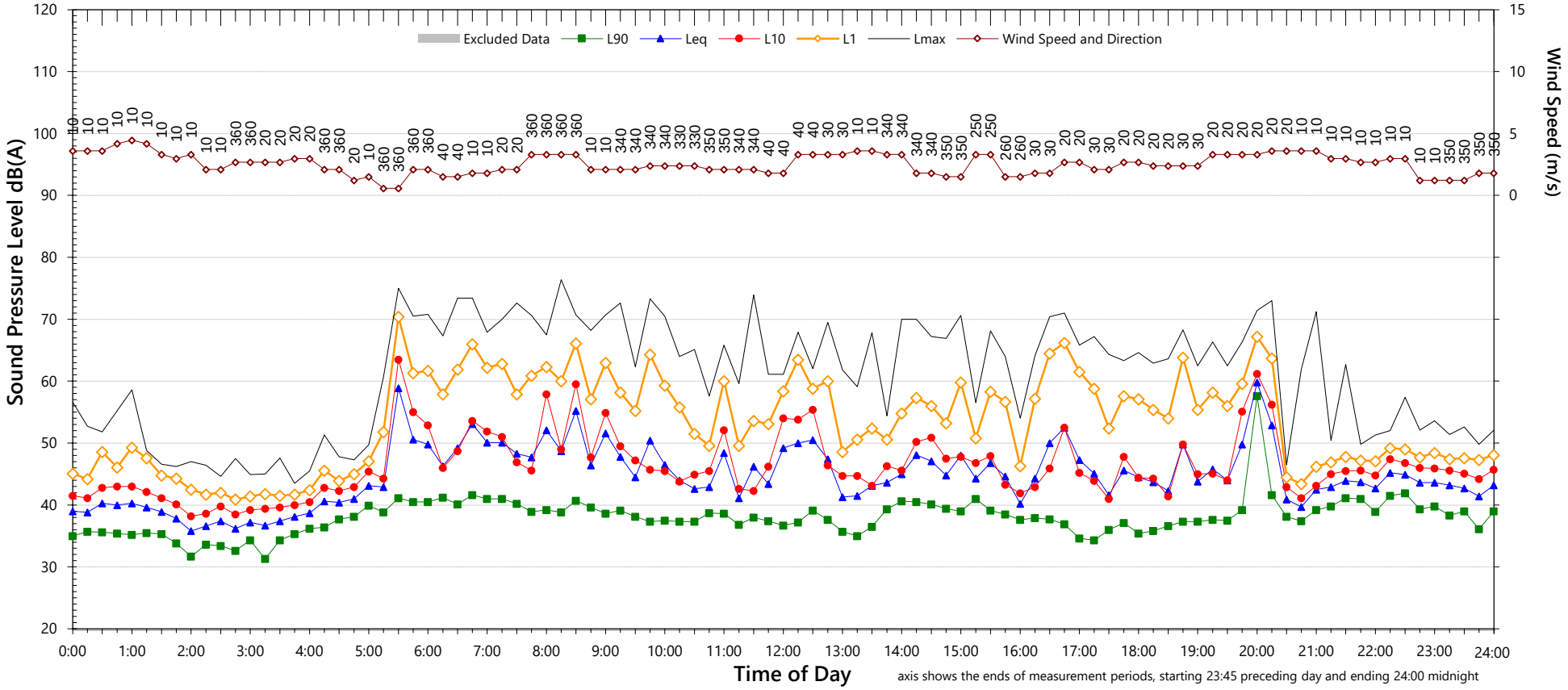
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Wednesday, 6 November 2024



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	36	37	36
L_{Aeq}	48	50	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	72
L_{AFMax} - L_{Aeq} (Range)	20	to	21

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	48
$L_{Aeq\ 1hr}$ upper 10 percentile	53	50
$L_{Aeq\ 1hr}$ lower 10 percentile	46	43

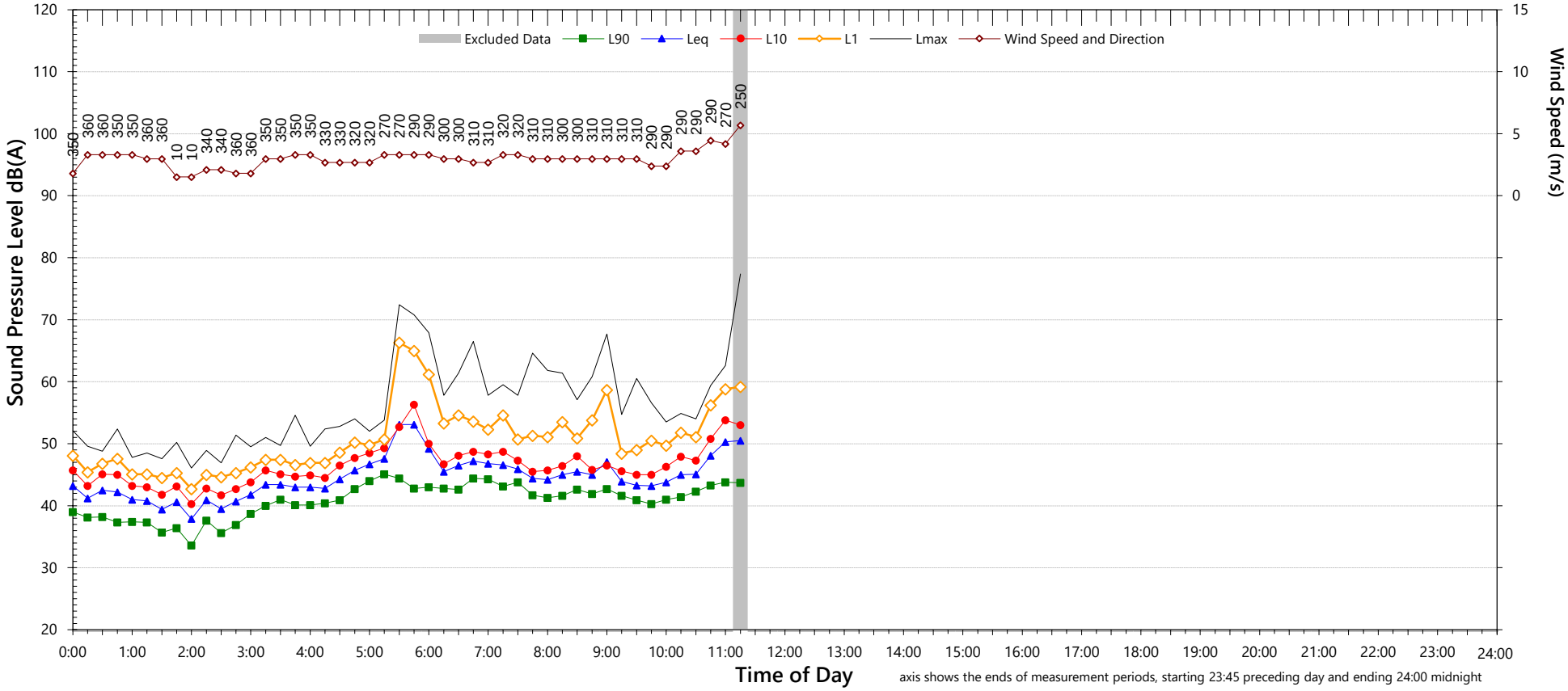
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

15 Wingecarribee St, Berrima - Frontyard

Thursday, 7 November 2024



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)