2-6 Girawah Place, Matraville – Noise Impact Assessment

Spirecorp Pty Ltd

Report number: 220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment - R4
Date: 19 October 2023
Version: Issue 5

PULSE WHITE NOISE ACOUSTICS Level 5, 73 Walker Street, North Sydney NSW 2060
P 1800 4 PULSE (1800 478 573) **E** info@pwna.com.au **pwna.com.au** ABN 95 642 886 306

DOCUMENT CONTROL

Project Name	2-6 Girawah Place, Matraville – Noise Impact Assessment
Project Number	220213
Report Reference	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment - R4
Client:	Spirecorp Pty Ltd

Rev	Description	Reference	Date	Prepared	Checked	Authorised
0	Issue 1	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment - R0	27 May 2022	Alex Danon	Ben White	Ben White
1	Issue 2	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment – R1	22 August 2022	Alex Danon	Ben White	Ben White
2	Issue 3	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment – R2	22 August 2022	Alex Danon	Ben White	Ben White
3	Issue 4	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment – R3	16 September 2022	Alex Danon	Ben White	Ben White
4	Issue 5	220213 - 2-6 Girawah Place, Matraville - Noise Impact Assessment - R4	19 October 2023	Alex Danon	Ben White	Ben White

PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
ABN 95 642 886 306
Level 5, 73 Walker Street, North Sydney, 2060
1800 4 PULSE

TABLE OF CONTENTS

TABLES

FIGURES

1 INTRODUCTION

Bennett Murada Architects have been engaged to develop three new mixed commercial use buildings to be located at 2-6 Girawah Place, Matraville NSW 2036.

Pulse White Noise Acoustics Pty Ltd (PWNA) been engaged to provide a Noise Impact Acoustic Assessment to address the noise impact of existing road traffic on the amenity of internal spaces, as well as to set criteria for noise emissions from the development with respect to mechanical plant and operation of the facility, with reference to relevant statutory regulations and guidelines.

A glossary of acoustic terminology used throughout this report is included in Appendix A.

1.1 Site Location

The commercial development is proposed to be located at 2-6 Girawah Place, Matraville NSW 2036. The site is located in the Randwick City Council local government area and is zoned IN1 (General Industrial).

The closest residential receivers are located on the neighbouring properties to the north-east of the site.

Industrial receivers bound the site to the west, and across Botany Road to the south. The site location and surrounding receivers are shown in Figure 1-1.

Figure 1-1 Site Location – 2-6 Girawah Place, Matraville

1.2 Proposed Development

The proposed development is located at 2-6 Girawah Place, Matraville. The development is to include three new mixed commercial use buildings featuring the following major areas:

- 2 basement levels with parking spots and a loading dock.
- A food and drink premises
- An outdoor plaza area
- Various retail and commercial areas
- A pool area, with outdoor terraces
- A childcare centre, featuring outdoor playground areas
- A gym

It is assumed that the childcare centre within Lot 1 of the development will operate during the day-time period only, i.e., operating hours are assumed to fall between 7:00 am – 6:00 pm for Monday to Saturday, and 8:00 am – 6:00 pm on Sundays and Public Holidays.

Primary noise generating sources are expected to include the childcare centre, swimming pool area, and mechanical equipment and plant items.

Our assessment has been based on the architectural drawings by Bennett Murada Architects, job number 2104, dated 16/9/2022.

Selected drawings of the proposed development are shown in the below figures.

Figure 1-2 Proposed Site Overall Plan

2 NEAREST SENSITIVE RECEPTORS

A number of sensitive receivers are located in the vicinity of the proposed development. As shown in Figure 2-1, residential receivers are located to the north-east of the project site, while industrial receivers bound the site to the west and across Botany Road to the south. The receivers utilised for noise predictions in this report are listed in Table 2-1 and presented in Figure 2-1.

Figure 2-1 Location of Considered Receivers

Table 2-1 Nearest Potentially Affected Receivers

Receptor ID	Address	Type of Receiver
R1	32 Moorina Avenue, Matraville NSW 2036	Residential
R2	30 Moorina Avenue, Matraville NSW 2036	Residential
R3	28 Moorina Avenue, Matraville NSW 2036	Residential
R4	26 Moorina Avenue, Matraville NSW 2036	Residential
R5	1891 Botany Road, Matraville NSW 2036	Industrial
R6	8 Military Road, Matraville NSW 2036	Industrial

3 EXISTING ACOUSTIC ENVIRONMENT

3.1 Noise Descriptors and Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure noise in terms of quantifiable time periods with statistical descriptors. Typically, environmental noise is measured over 15 minute periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' linear arithmetic does not apply, e.g., adding two sound sources of equal values result in an increase of 3 dB (i.e., 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included in Appendix A.

3.2 Unattended Noise Monitoring

3.2.1 Monitoring Details

To determine the background noise levels at nearby receivers, long term unattended noise monitoring was conducted at a representative location on the project site. As per Table A1 of the Noise Policy for Industry, the noise logger was placed in the vicinity of the reasonably most or potentially most affected residence. The location of the noise logger is shown in Figure 2-1.

3.2.2 Monitoring Instrumentation

Instrumentation used for the noise survey comprised of one RION NL-42 type sound level meter (serial number 01000231) fitted with a microphone windshield. Calibration of the logger was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. These charts, representing each 24 hour period, show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels measured over 15 minute time periods.

Logging was conducted from Friday 6 May 2022 to Wednesday 18 May 2022. The measurement results have been filtered to remove data affected by adverse weather conditions, such as excessively windy or rainy time periods, as recorded by the nearest Bureau of Meteorology weather station at Sydney Airport (AWS 066037). Detailed noise logging results are shown in Appendix B.

The measured background noise data of the logger was processed in accordance with the recommendations contained in the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (NPI).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and the night. The RBL $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in Table 3-1 for the unattended logging. The measured noise levels are considered to be representative of the levels to be expected at the nearest and most affected residence to the proposed development.

Table 3-1 Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]	L_{A90}[2]	L_{Aeq}[3]
Logger Location (2-6 Girawah Place, Matraville) – see Figure 2-1	39	49	37	51	35	44

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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

Note 2: The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The LAeq is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

4 APPLICABLE GUIDELINES AND RECOMMENDED CRITERIA

This section contains noise criteria on the operational criteria, construction criteria and vibration criteria.

The following criteria are relevant for the assessment of noise and vibration emissions from the proposed development:

- For the assessment of the predicted operational noise emissions from the development: The criteria have been derived in accordance with the *Noise Policy for Industry* (EPA, 2017). Refer to Section 4.1.
- The assessment of the noise impacts of the construction noise on the sensitive receivers: The criteria have been derived in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). See Section 4.2.
- For the assessment of vibration impacts from the development: The criteria have been derived in accordance with Assessing Vibration: A Technical Guideline (DEC, 2006), BS 7385-2: 1993 and BS 6472: 1992. Refer to Section 4.4.

4.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Government and the NSW Environment Protection Authority (NSW EPA). In October 2017, the NSW EPA released the *Noise Policy for Industry* (NSW NPI). The purpose of the policy is to ensure that noise impacts associated with particular industrial developments are evaluated and managed in a consistent and transparent manner. The policy aims to ensure that noise is kept to acceptable levels in balance with the social and economic value of industry in NSW.

The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residential receivers in the short-term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

The project noise trigger level is derived from the more stringent value out of the project intrusiveness noise level and the project amenity noise level.

4.1.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

4.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

Project amenity noise level for industrial developments is specified as the recommended amenity noise level (Table 2.2 of the NPI) minus 5 dB(A). To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the $L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq,period}$ + 3 decibels (dB).

4.1.3 Area Classification

The NSW NPI characterises the "Suburban Residential" noise environment as an area that has the following characteristics:

> *An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.*

For the considered receptors in the suburban area, the recommended amenity noise level is shown in Table 4-1 below. When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given below, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

Table 4-1 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2] (dBA)
Residence	Suburban	Day	55
		Evening	45
		Night	40
Commercial		When in use	65
Industrial		When in use	70

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 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.

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

4.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in Table 4-2. The amenity and intrusive criterion are nominated for the purpose of determining the operational noise limits for noise sources associated with the development which can potentially affect noise sensitive receivers.

For each assessment period, the project trigger noise levels are the lower (i.e., the more stringent) of the amenity or intrusive criteria. The project trigger noise levels are shown in bold text in Table 4-2.

Table 4-2 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [3]	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [3, 4]
Residential Receiver	Day	50	39	49	**44**	53
	Evening	40	37	51	**42**	43
	Night	35	35	44	40	**38**
Industrial Receiver	When in use	65	-	-	-	**68**

Note 1: Project Amenity Noise Levels corresponding to "suburban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA

Note 2: L_{A90} Background Noise or Rating Background Level

Note 3: Project Noise Trigger Levels are shown in bold

Note 4: According to Section 2.2 of the NSW NPI, the LAeq, 15 minutes is equal to the LAeq, period + 3 dB

4.1.5 Sleep Disturbance

An accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during night periods).

Section 2.5 of the EPA NPI provides the following criteria:

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

As outlined in Table 4-2 above, the measured rating background noise level during the night hours (10:00pm to 7:00am) is 35 dBA L_{A90}. Therefore, the resultant RBL + 15dB is 50dBA, which is below the minimum 52 dBA L_{AFmax}. As such, the 52dBA minimum recommended by the NSW EPA NPU will be adopted for this assessment at all surrounding receivers.

4.2 Road Traffic Noise Criteria

In March 2011, the Department of Environment Climate Change and Water NSW (now the EPA) released the NSW 'Road Noise Policy' (RNP) (DECCW, 2011). The NSW RNP aims to identify the strategies that address the issue of road traffic noise from:

- existing roads
- new road projects
- road redevelopment projects
- new traffic generating developments

The NSW RNP defines the criteria to be used in assessing the impact of such noise. Although it is not mandatory to achieve the noise assessment criteria in this NSW RNP, proponents will need to provide justification if it is not considered feasible or reasonable to achieve them.

4.2.1 Road classification

Botany Road can be classified as an arterial road while the proposed internal roads for the development can be classified as local roads. The proposed development is best described as a new traffic generating development.

4.2.2 Noise assessment criteria

Table 3 of the NSW RNP outlines the road traffic noise assessment criteria for residential land uses. The applicable section is reproduced in Table 4-3.

Table 4-3 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Arterial roads – residential receivers	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)

4.3 Interim Construction Noise Guideline

The DECC *Interim Construction Noise Guideline* (ICNG, July 2009) provides guidelines for the assessment and management of construction noise. The NSW EPAs Road Noise Policy (RNP) refers to the use of the ICNG for the assessment of construction noise impacts.

The ICNG focuses on applying a range of work practices and management strategies to minimise construction noise impacts rather than focusing on achieving numeric noise levels which is not always practical on large infrastructure projects.

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts
- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours
- Reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts

4.3.1 Quantitative Noise Assessment Criteria

Construction noise assessment goals presented in the ICNG are referenced to Noise Management Levels (NMLs) for residential, sensitive land uses and commercial/industrial premises.

Residential premises

Table 4-4 sets out NMLs for noise at residences and how they are to be applied.

In Table 4-4 the rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW *Noise Policy for Industry* (EPA, 2017).

As a guide, the difference between the internal noise level and the external noise level is typically 10 dB with windows open for adequate ventilation.

Table 4-4 Noise at Residents Using Quantitative Assessment

Time of day	Management Level $L_{Aeq\ (15\ min)}$[1]	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.
	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: ▪ times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences ▪ 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 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Time of day	Management Level $L_{Aeq\ (15\ min)}$[1]	How to apply

Note 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 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Pulse White Noise Acoustics are of the understanding that construction hours for the proposed development will only fall under the recommended standard hours outlined in the ICNG.

Table 4-5 NMLs as basis for the acoustic assessment

Receiver Types	Noise management level ($L_{Aeq,15min}$) dB(A) Standard Hours Monday to Friday: 7 am to 6 pm Saturday: 8 am to 1 pm
Residential Receivers	49

As no construction is expected to occur outside of standard hours, a sleep disturbance assessment for construction noise is not required.

4.4 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself

4.4.1 Vibration Criteria – Human Comfort

The first of these vibration effects relating specifically to the human comfort aspects of the project are taken from the *Assessing Vibration – A Technical Guideline*. This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (see Table 4-6)
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (see Table 4-7)
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (see Table 4-8)

Table 4-6 Continuous Vibration Acceleration Criteria (m/s^2) 1-80Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
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
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058
Note 1: From Assessing Vibration – A Technical Guideline DEC (2006)					

Table 4-7 Impulsive Vibration Acceleration Criteria (m/s^2) 1-80Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
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
Note 1: From Assessing Vibration – A Technical Guideline DEC (2006)					

Table 4-8 Intermittent Vibration Impacts Criteria (m/s$^{1.75}$) 1-80Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
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
Note 1: From Assessing Vibration – A Technical Guideline DEC (2006)				

4.4.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration"* (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

4.4.2.1 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Figure 4-1 and illustrated in Figure 4-1.

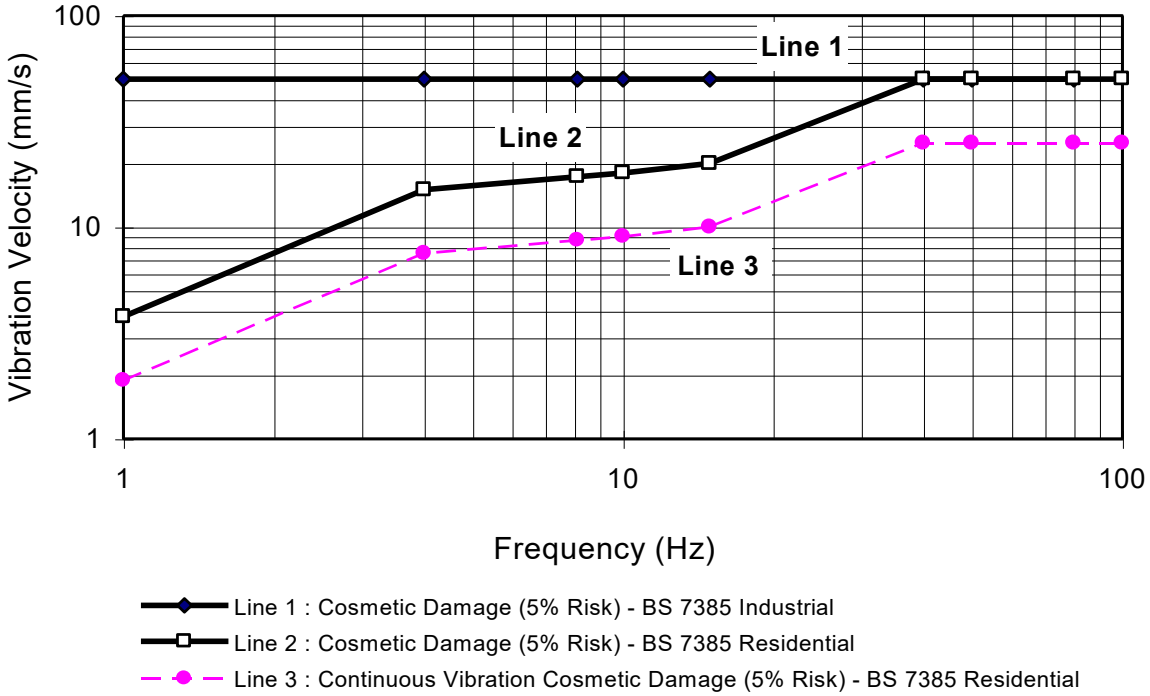
Table 4-9 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in below figure	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 4-9 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 4-9 need to be reduced by up to 50% (refer to Line 3 in Figure 4-1).

Figure 4-1 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 4-9. Major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 4-9 should not be reduced for fatigue considerations.

5 OPERATIONAL ACOUSTIC ASSESSMENT

Predictive noise modelling was carried out using the ISO 9613 algorithm within iNoise 2021. The iNoise software package allows a 3D computational model of the site and surrounding area to be created. Inputs into the noise model included terrain, ground absorption, buildings, fences, receiver locations and noise sources.

5.1 Noise Generating Scenarios

This Noise Assessment includes an assessment of the potential uses within the buildings and exterior noise sources. Noise in the development that would impact the nearest residential receivers to the north would primarily be generated by the swimming pool area on Level 1 and the childcare centre on Level 3 and Level 4 of the Lot 1 building.

It is assumed that the childcare centre within Lot 1 of the development will operate during the day-time period only, i.e., operating hours are assumed to fall between 7:00 am – 6:00 pm for Monday to Saturday, and 8:00 am – 6:00 pm on Sundays and Public Holidays.

- Day Scenario
    - Noise from the two outdoor play areas associated with the childcare centre to the north of Lot 1;
    - Noise breakout from the two glazed terrace areas connected to the indoor swimming pool area to the north of Lot 1.
- Evening/Night Scenario
    - Noise breakout from the two glazed terrace areas connected to the indoor swimming pool area to the north of Lot 1.

Note that the noise from mechanical units has not been modelled as information regarding the location and type of units to be installed is unknown at this stage of the project. It is anticipated that the equipment to be installed will be able to be treated with standard acoustic treatments (see Section 5.2.3).

Noise emissions from the gym will be controlled via the documented constructions, in addition to operational controls such as limiting the music noise levels within the spaces, closing of openable façade elements at certain times, etc. Details of these operational controls will be developed in future acoustic assessments once specific details of the use of the gym are known. We note that the compliance with the noise emissions criteria can be achieved by implementing operational controls and typical building constructions.

Flooring to be installed will include standard rubber matting (e.g., Regupol Sonusfit). The specific product should be selected following on-site testing conducted after the base build has been constructed. Details of the flooring treatments will be developed in future acoustic assessments once specific details of the use of the gym are known, including the location of specific types of equipment, weights areas and the like.

5.2 Noise Sources

Details of the noise sources used in this assessment are contained in this section.

5.2.1 Childcare Centre – Activity Noise Assessment

This section of the report details the assessment of activity noise levels generated from the proposed childcare centre in Lot 1 of the development.

The assessment has been undertaken based on the following:

1. Both proposed outdoor play areas of the childcare centre have been modelled to be in use simultaneously, with 40 children outside in each of the areas at any given time.
2. A 1.8m solid barrier has been modelled for the outdoor play areas on Level 3 and Level 4.
3. Noise level generated are based on the source noise levels of the AAAC for external play areas. Details of the source noise levels used in this assessment are detailed in the following table.

4. The external play areas have been modelled with all children (assumed to be 3 – 5-year-olds) partaking in 'Active Play' as a worst case scenario.

Table 5-1 Activity Source Noise Levels

Location	Play Type	Age Group	Source Noise Level
External Play Areas	Active Play[1] For groups of 10 children	0-2	78 dB(A) Sound Power Level
		2-3	85 dB(A) Sound Power Level
		3-5	87 dB(A) Sound Power Level
	Passive Play[2] For groups of 10 children	0-2	77 dB(A) Sound Power Level
		2-3	83 dB(A) Sound Power Level
		3-5	84 dB(A) Sound Power Level

Note 1 – Active play include areas where children can actively play and generate noise levels such as running, playing with movable items (scooters and the like). Active play noise levels are based on the medium noise level presented in the AAAC guideline.

Note 2 – Passive play includes areas where play will include less active play such as a sand pit, use of tables and the like where play includes activities do not include moving around and hence a lower noise level results. Passive play noise levels are based on the lower range detailed within the AAAC guideline.

The AAAC *Guideline for Child Care Centre Acoustic Assessment Version 3* includes the effective sound power levels of children which have been used in this report (as detailed above), including the following:

Table 1 provides recommended sound power levels for lots of 10 children, within the different age groupings, along with a recommended source height.

Table 1 – Effective Sound Power Levels ($L_{Aeq,\ 15min}$) for Groups of 10 Children Playing

Number and Age of Children	Sound Power Levels [dB] at Octave Band Centre Frequencies [Hz]								
	dB(A)	63	125	250	500	1k	2k	4k	8k
10 Children - 0 to 2 years	78	54	60	66	72	74	71	67	64
10 Children - 2 to 3 years	85	61	67	73	79	81	78	74	70
10 Children - 3 to 5 years	87	64	70	75	81	83	80	76	72

Notes:
1 If applicable, an adjustment to the above sound power levels of -6 dB could be applied in each age group for children involved in passive play.
2 For simplicity, based upon a review of World Health Organization (WHO) data, a single recommended source height of 1metre is suggested as the source heights.

5.2.2 Swimming Pool Area

Noise levels within indoor swimming pool areas can reach 85 dBA when events are occurring, such as structured classes with a number of patrons, school swimming carnivals, etc. For the purpose of this assessment, an internal noise level of 85 dBA has been assumed. Should the windows/doors to the terraces on Level 1 be open during operation, exceedances of the criteria are predicted at the nearest residential receivers. Therefore, for the purpose of our assessment, 12.38mm laminated glazing is assumed to be installed to these terraces. Our modelling therefore accounts for the sound transmission loss due to the windows, together with the free field correction and distance attenuation.

5.2.3 Mechanical Plant

Selections and locations of the proposed mechanical plant and equipment to be used on the site are not available at this time. As such, a detailed assessment of noise associated from engineering services cannot be undertaken.

All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicated that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:

- Basement Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
- General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flexible ducting or internal lined ducting.

Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

Experience with similar projects indicates that the acoustic treatment of the proposed mechanical equipment to be installed on the project is both possible and practical.

5.3 Modelling Assumptions

The following modelling assumptions are utilised in this noise impact assessment:

- The noise generating scenario is modelled for a worst case 15 minute period;
- Terrain has been sourced from the NSW Land and Property Information database Six Maps;
- Ground Absorption has been included in the model with the surrounding grass areas having an absorption factor of 1.0 and the site itself, and surrounding hard surfaces, having a ground absorption factor of 0;
- Buildings and fences have been included in the model where relevant. Recommended minimum heights for acoustic screens which are incorporated into the modelling are shown below:
    - 1.8m solid barriers to the north of the external Childcare play areas on Level 1 and Level 2 of the Lot 1 building (see Figure 5-1 and Figure 5-2).
- The noise sources and sound power levels have been modelled with respect to the information presented in Section 5.2;
- For the childcare centre within Lot 1 of the development, the following is assumed in our modelling:
    - The centre will operate during the day-time period only, i.e., operating hours are assumed to fall between 7:00 am – 6:00 pm for Monday to Saturday, and 8:00 am – 6:00 pm on Sundays and Public Holidays.
    - Both proposed outdoor play areas of the childcare centre have been modelled to be in use simultaneously, with 40 children outside in each of the areas at any given time.
    - The external play areas have been modelled with all 80 children (assumed to be 3 – 5-year-olds) partaking in 'Active Play' as a worst case scenario.
- An internal noise level of 85 dBA has been assumed for the Swimming Pool area on Level 1 of the Lot 1 building. 12.38mm laminated glazing is assumed to be installed to the northern façade. Our modelling assumes that the windows/doors to the terraces on Level 1 will be closed when the Swimming Pool area is being used for high noise generating events such as swim classes with a large number of patrons, school swimming carnivals, etc.
- The conditions considered within the ISO 9613-2:1996 algorithm hold equivalently, for average propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights.

Figure 5-1 Recommended Acoustic Treatments to the Lot 1 Building – Childcare Centre

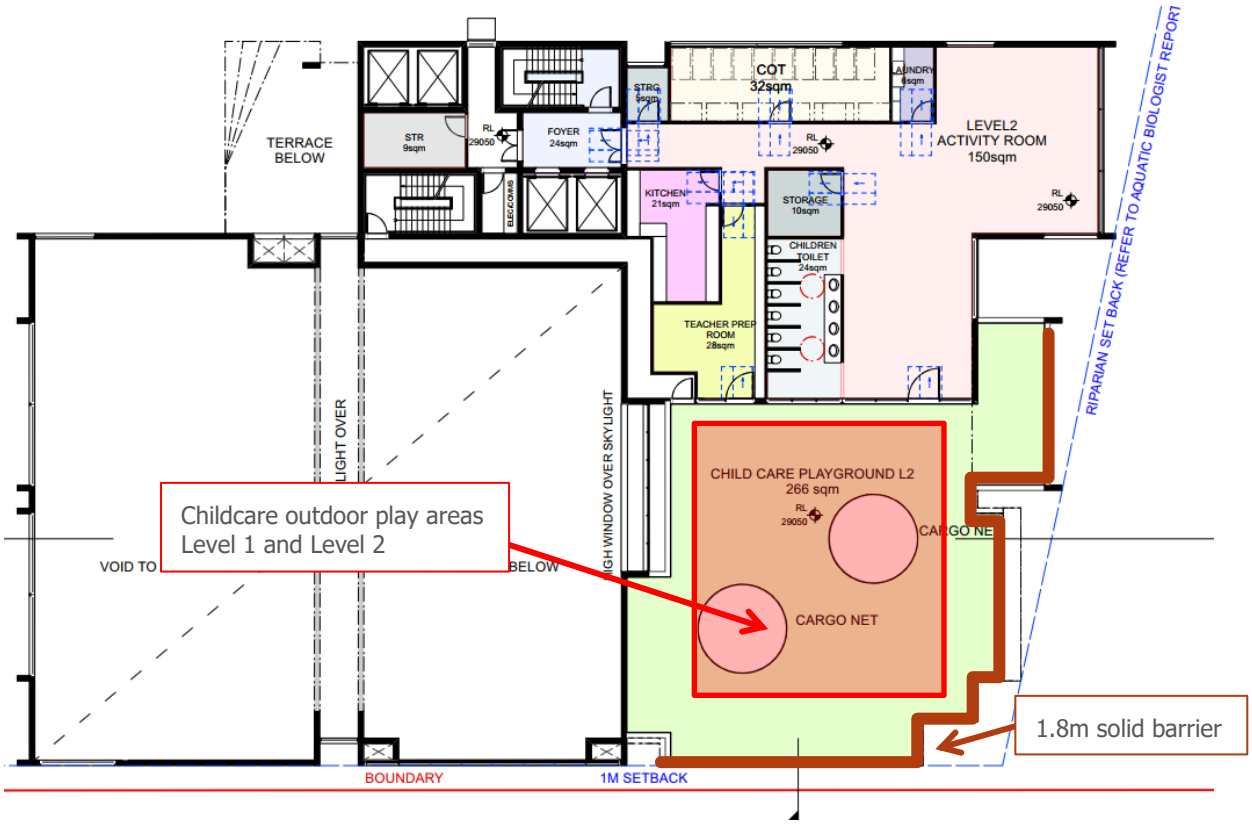
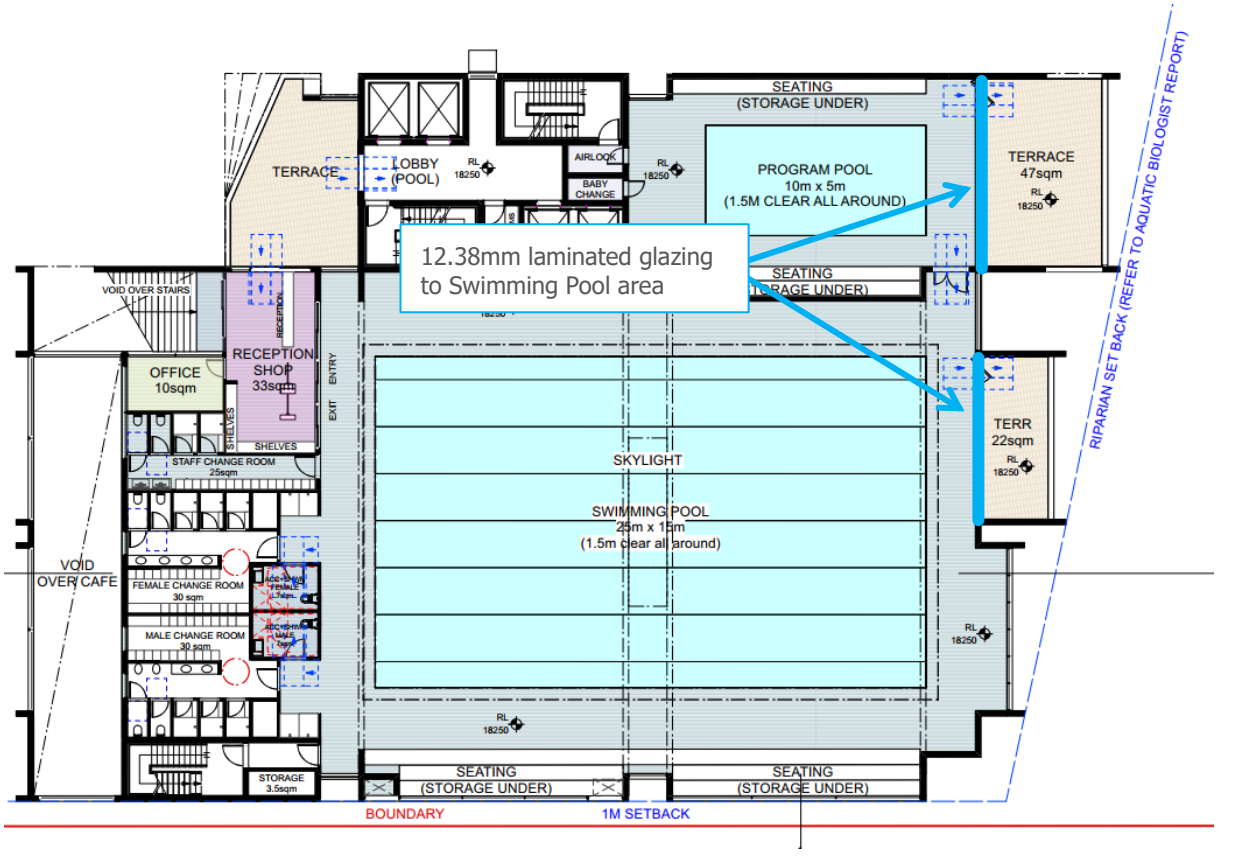


Figure 5-2 Recommended Acoustic Treatments to the Lot 1 Building – Swimming Pool Area



5.4 Predicted $L_{Aeq, 15\ min}$ Noise Levels

The predicted $L_{Aeq, 15\ min}$ results of the modelled day, evening and night operational scenarios are presented below in Table 5-2. Noise contours of the modelled $L_{Aeq, 15\ min}$ operational scenarios are shown in the below figures. It is shown that, if the modelling assumptions in Section 5.3 are carried out, then the resulting noise levels are predicted to comply with the criteria at all considered receivers.

Table 5-2 Predicted Noise Levels, Operational Scenario, $L_{Aeq\ (15\ minute)}$

Receiver	Criteria			Predicted Noise Levels		
	Day	Evening	Night	Day Scenario	Evening Scenario	Night Scenario
R1	44	42	38	35	<20	<20
R2	44	42	38	35	<20	<20
R3	44	42	38	33	20	20
R4	44	42	38	33	21	21
R5	68	68	68	23	<20	<20
R6	68	68	68	23	<20	<20

Figure 5-3 Predicted Noise Contours – Operational Scenario Day, $L_{Aeq\ (15\ minute)}$

Figure 5-4 Predicted Noise Contours – Operational Scenario Evening/Night, $L_{Aeq\ (15\ minute)}$

5.5 Operational Noise Control Measures

Given the predicted operational noise levels in Section 5, the following noise control measures are therefore recommended for the subject site:

- 1.8m minimum-height solid barriers with no perforations should be installed to the north of the external Childcare play areas on Level 1 and Level 2 of the Lot 1 building (see Figure 5-5 and Figure 5-6). The solid barrier can include constructions made from glass, Perspex, solid metal, masonry, or the like.
- The two outdoor play areas associated with the childcare centre on Level 1 and Level 2 should have a maximum of 40 children outside within each of the areas at any given time.
- 12.38mm laminated glazing is assumed to be installed to the northern façade of the Swimming Pool area on Level 1 of the Lot 1 building.
- The windows/doors to the terraces connected to the Level 1 Swimming Pool area should be closed when the Swimming Pool area is being used for high noise generating events including, but not limited to, swim classes with a large number of patrons, school swimming carnivals, events where music is being played, etc. Note that the doors should not need to be closed during periods when the pools are being used for passive recreation, e.g., patrons swimming laps independently with minimal conversation occurring within the area.
- External windows to the Level 1 Swimming Pool area are to be closed between 6pm and 7am.

Figure 5-5 Recommended Acoustic Treatments to the Lot 1 Building – Childcare Centre

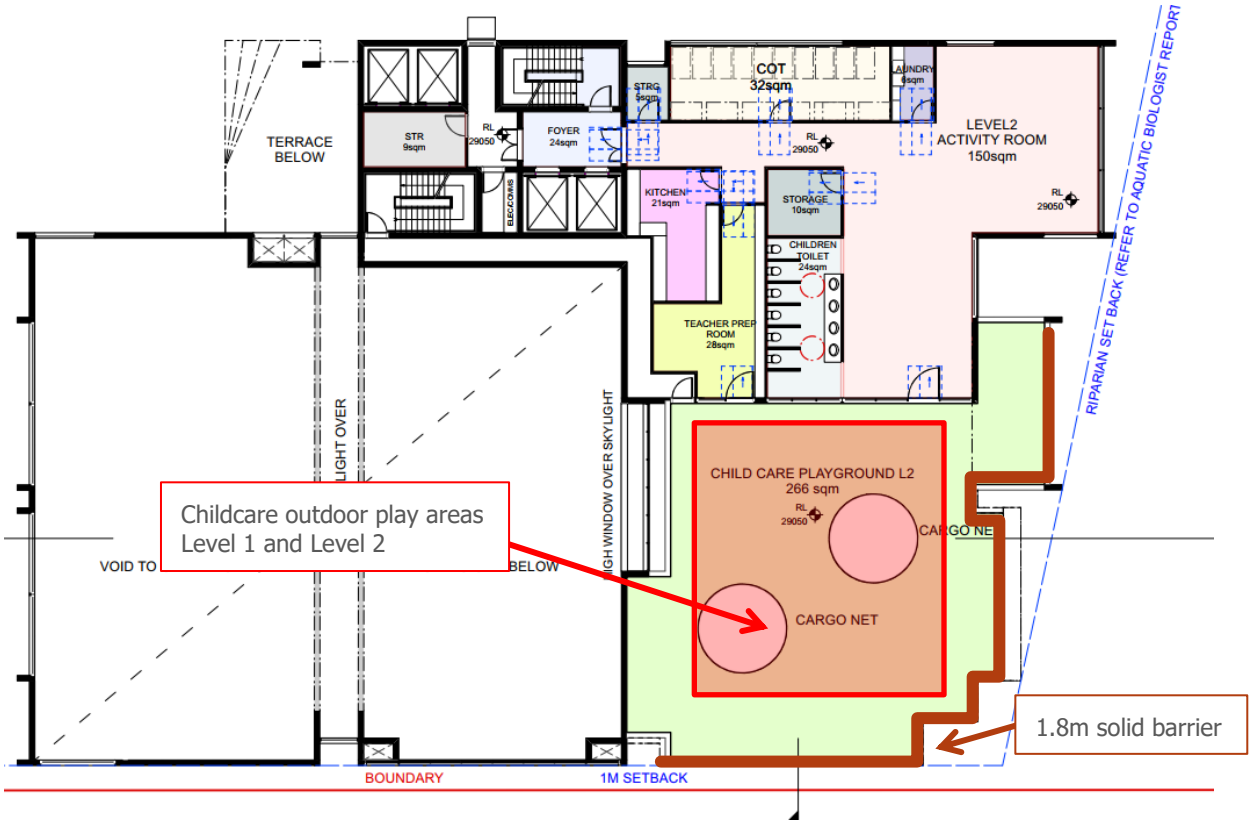
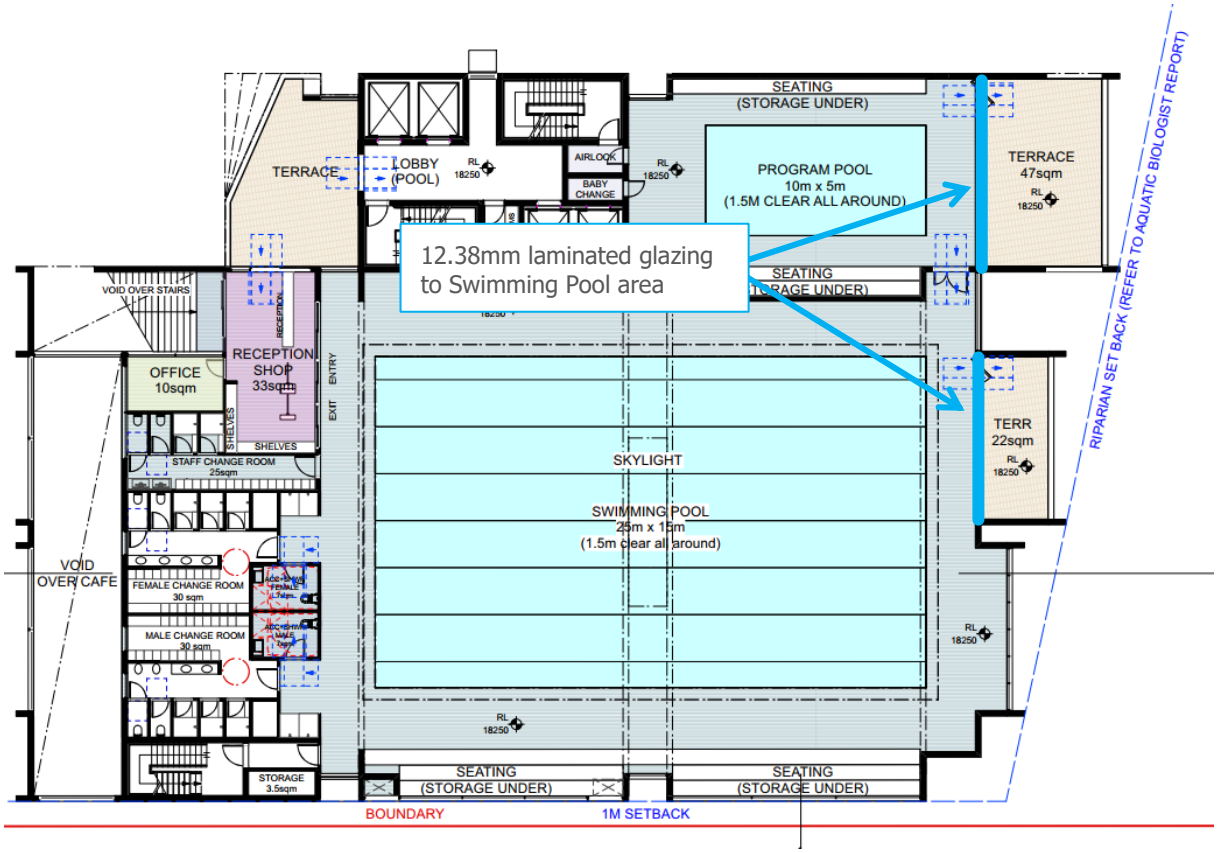


Figure 5-6 Recommended Acoustic Treatments to the Lot 1 Building – Swimming Pool Area



5.6 Carpark Noise Emissions

It is noted that the carpark will be fully enclosed and mechanically ventilated. As a result, it is expected that noise emissions from the car park will have a negligible impact onto the nearest affected receivers.

5.7 Loading Bays

The proposed development includes loading bays located in the Level 1 Basement. Since the loading bay areas are internal to the building, noise emission issues associated with this potential source are unlikely; therefore, it has not been considered further in this report.

6 ROAD TRAFFIC NOISE ASSESSMENT

As part of the development at 2-6 Girawah Place, Matraville, additional vehicle movements are expected on Botany Road. Botany Road has been selected for this road noise assessment as it is the road that will have the highest proportion of site traffic travelling to/from the site. For other surrounding roadways, the proportion of traffic from the development will be lower, and, therefore, road traffic noise is not proposed to be assessed.

Under section 3.4.1 of the Road Noise Policy "for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'".

A 2 dB increase equates to approximately a 60% increase in total traffic along the subject road. Any proportional traffic increase along Botany Road from the development is predicted to be far smaller than this amount. Therefore, it is predicted that road traffic noise levels will not increase by 2 dB or more. The proposed road movements are thus predicted to comply with the Road Noise Policy and no further noise mitigation measures are recommended.

7 NOISE INTRUSION CRITERIA

This section of the report details the assessment of noise intrusion into the proposed development from surrounding noise sources, to ensure compliance with the relevant Australian Standard and the AAAC Guideline for Child Care Centre Acoustic Assessment Version 3, as detailed in the sections below.

7.1 AS/NZS 2107:2016

Recommended ambient noise levels for office spaces are given in a number of publications including Table 1 of Australian Standard AS/NZS 2107:2016 "*Acoustics - Recommended design sound levels and reverberation times for building interiors*". This document recommends design sound levels and reverberation times for building interiors based on room designation and location of the development relative to external noise sources.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in Table 7-1 below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for noise intrusion. In this report we will confine our recommendations to dBA levels.

Table 7-1 Design Sound Levels and Reverberation Times for Different Areas of Occupancy in Buildings

Type of Occupancy/Activity	Recommended Design Sound Level range, AS/NZS 2107:2016, dBA	Project Design Noise Level [1], dBA	Design Reverberation Time Range, s
Office Buildings			
Corridors and Lobbies	45 to 50	50	<1.0
General Office Areas	40 to 45	45[2]	0.4 to 0.6
Retail Outlets	45 to 55	50	See Note[3]

Note 1: Recommended level for mechanical services noise and intrusive noise, combined.

Note 2: It is often desirable to design office areas to the maximum noise levels recommended in AS/NZS 2107:2016 to help improve the acoustic privacy conditions between spaces, particularly open plan areas and areas adjoining meeting rooms/consultation rooms.

Note 3: Reverberation time should be minimized for noise control.

For most of these areas, the design noise levels should be considered as the noise target, as noise levels that are too low can be just as problematic (through creating poor speech privacy) as noise levels that are too high (poor intelligibility and annoyance).

Generally, where the final noise levels are within +/- 2 dB of the specified level given below, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion is to be avoided.

7.2 AAAC Guideline for Child Care Centre Acoustic Assessment Version 3

The applicable noise intrusion criteria associated with the use of the Cot Room within the proposed Childcare Centre is stipulated in the AAAC Guideline for Child Care Centre Acoustic Assessment Version 3. It includes recommendations for the assessment of external noise impact on children. The AAAC Guideline includes the following.

5.0 EXTERNAL NOISE IMPACT ON CHILDREN

For proposals that are located within 60 metres of an arterial road, railway line, industry or within close proximity to an airport, a noise intrusion assessment should be submitted with the development application.

5.1 Road, Rail Traffic and Industry

The predictions of noise levels from road traffic on a child care centre can be calculated using basic formula as given, for example, in the Calculation of Road Traffic Noise from the UK Department of Transport, Welsh Office (1988).

The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).

The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (ie with doors and / or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas.

5.2 Aircraft

The L_{ASmax} noise level from aircraft at any location within the indoor play or sleeping areas of the centre during the hours when the Centre is operating shall not exceed 50 dB(A) in accordance with Australian Standard AS 2021.

8 NOISE INTRUSION ASSESSMENT

Indicative glazing recommendations for the southern, eastern and western façades, in order to meet the internal noise level criterion, are given in Table 8-1 below.

Table 8-1 Indicative Glazing Recommendations

Internal Space	Glazing type	Indicative glazing thickness
LOT 1		
Southern Façade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Eastern Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Western Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Cot Room (Childcare Centre)	Single glazed	6.38 mm laminate
LOT 2		
Southern Façade		
Open plan office areas, reception areas, etc.	Single glazed	10.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Eastern Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Western Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
LOT 3		
Southern Façade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Eastern Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate
Western Facade		
Open plan office areas, reception areas, etc.	Single glazed	6.38 mm laminate
Warehouse	Single glazed	6.38 mm laminate

Detailed design of the glazing will be conducted during design development and detailed design stages of the project to identify any special requirements for the internal spaces that will be located along the building perimeter.

These recommendations will be considered together with other factors such as thermal insulation and structural requirements in the final façade glazing design.

9 CONCLUSIONS

Bennett Murada Architects have been engaged to develop three new mixed commercial use buildings to be located at 2-6 Girawah Place, Matraville NSW 2036.

Pulse White Noise Acoustics Pty Ltd (PWNA) been engaged to provide a Noise Impact Acoustic Assessment to address the noise impact of existing road traffic on the amenity of internal spaces, as well as to set criteria for noise emissions from the development with respect to mechanical plant and operation of the facility, with reference to relevant statutory regulations and guidelines.

Given the predicted operational noise levels in Section 5, the following noise control measures are recommended for the subject site: It is shown that, if the modelling assumptions in Section 5.3 are carried out, then the resulting noise levels are predicted to comply with the criteria at all considered receivers.

- 1.8m minimum-height solid barriers with no perforations should be installed to the north of the external Childcare play areas on Level 3 and Level 4 of the Lot 1 building (see Figure 5-5 and Figure 5-6). The solid barrier can include constructions made from glass, Perspex, solid metal, masonry, or the like.
- The two outdoor play areas associated with the childcare centre on Level 3 and Level 4 should have a maximum of 40 children outside within each of the areas at any given time.
- 12.38mm laminated glazing is assumed to be installed to the northern façade of the Swimming Pool area on Level 1 of the Lot 1 building.
- The windows/doors to the terraces connected to the Level 1 Swimming Pool area should be closed when the Swimming Pool area is being used for high noise generating events including, but not limited to, swim classes with a large number of patrons, school swimming carnivals, events where music is being played, etc. Note that the doors should not need to be closed during periods when the pools are being used for passive recreation, e.g., patrons swimming laps independently with minimal conversation occurring within the area.
- External windows to the Level 1 Swimming Pool area are to be closed between 6pm and 7am.

Based upon the findings of this assessment, the development as proposed is suitable on the basis of acoustics. Acceptable internal noise levels can be achieved with appropriate façade glazing installation. Indicative glazing selections are provided in Section 8.

The glazing specification must be reviewed at the detailed design stage to optimise glass selection and will be based on the combined requirements of acoustics, thermal and structural considerations.

Mechanical services design information is unavailable at this stage of the development, as plant selection and design, where required, will take place during the detailed design phase of the project.

It is likely that the criteria set out in Section 4 will be met through conventional noise control methods and the selection of equipment on the basis of quiet operation.

Any mechanical plant associated with the development should be reviewed for acoustical compliance at the detailed design stage when the mechanical services design is finalised and plant selection has been made.

Regards,

Alex Danon

Acoustic Engineer

PULSE WHITE NOISE ACOUSTICS PTY LTD

APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

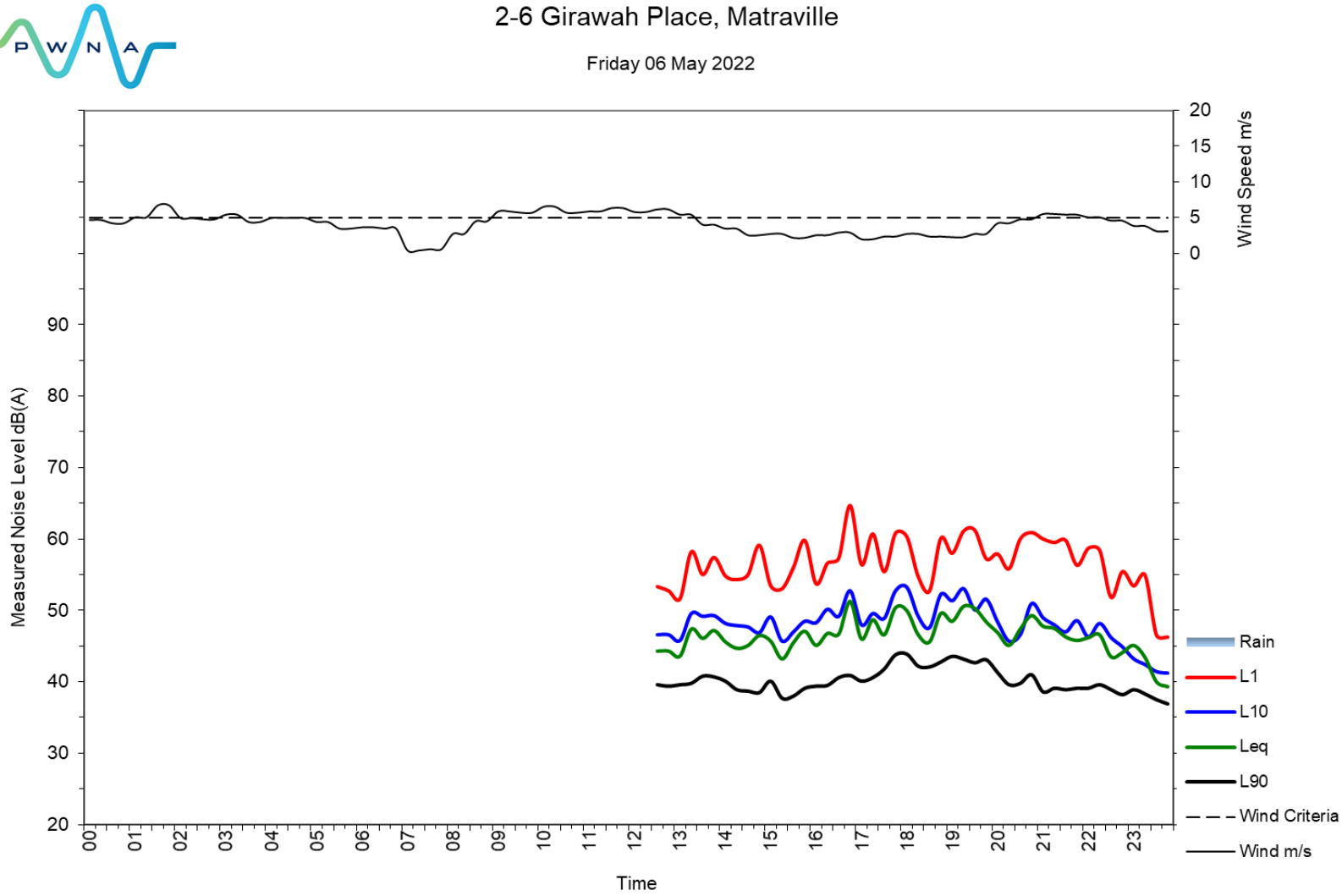
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

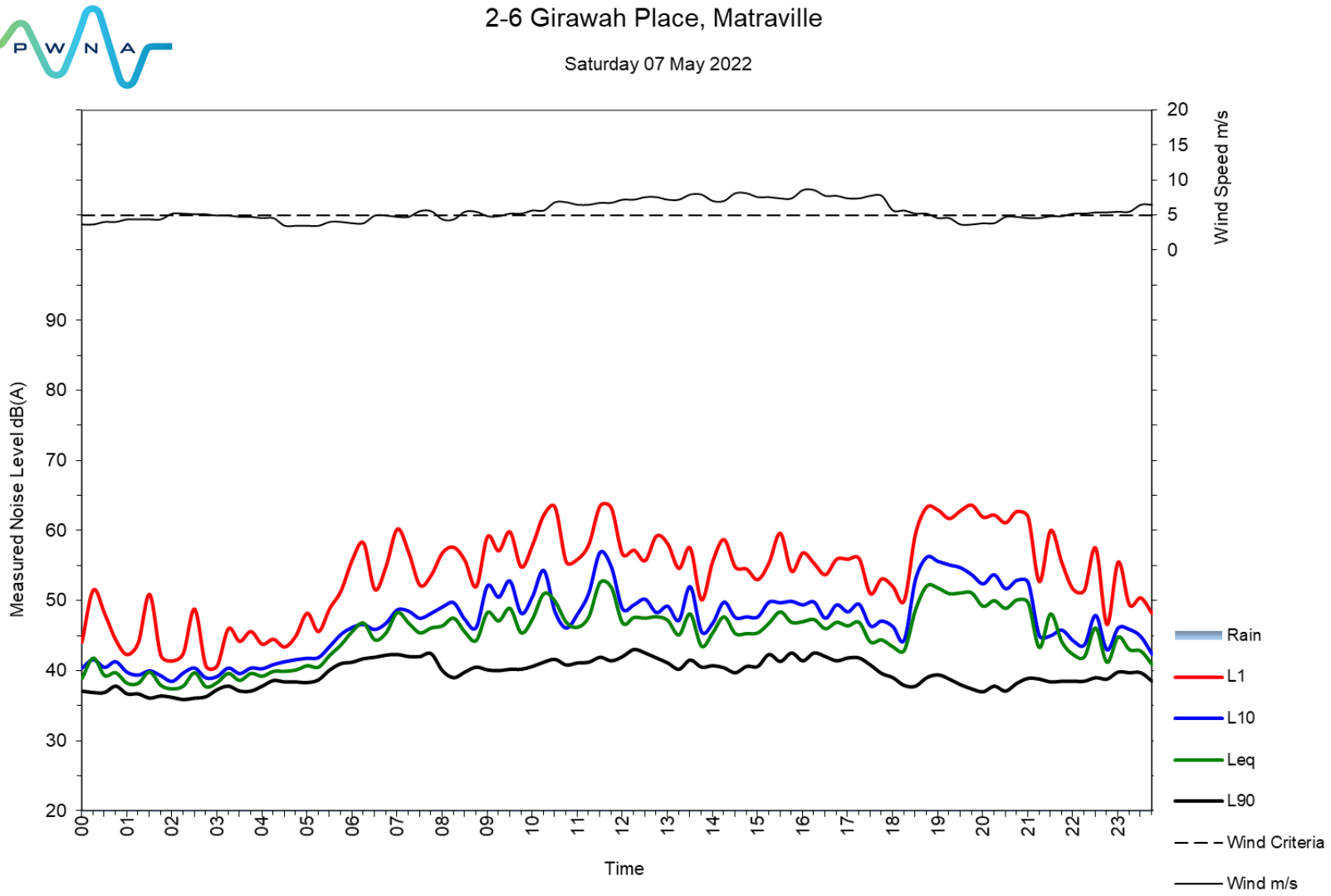
APPENDIX B: UNATTENDED NOISE LOGGING

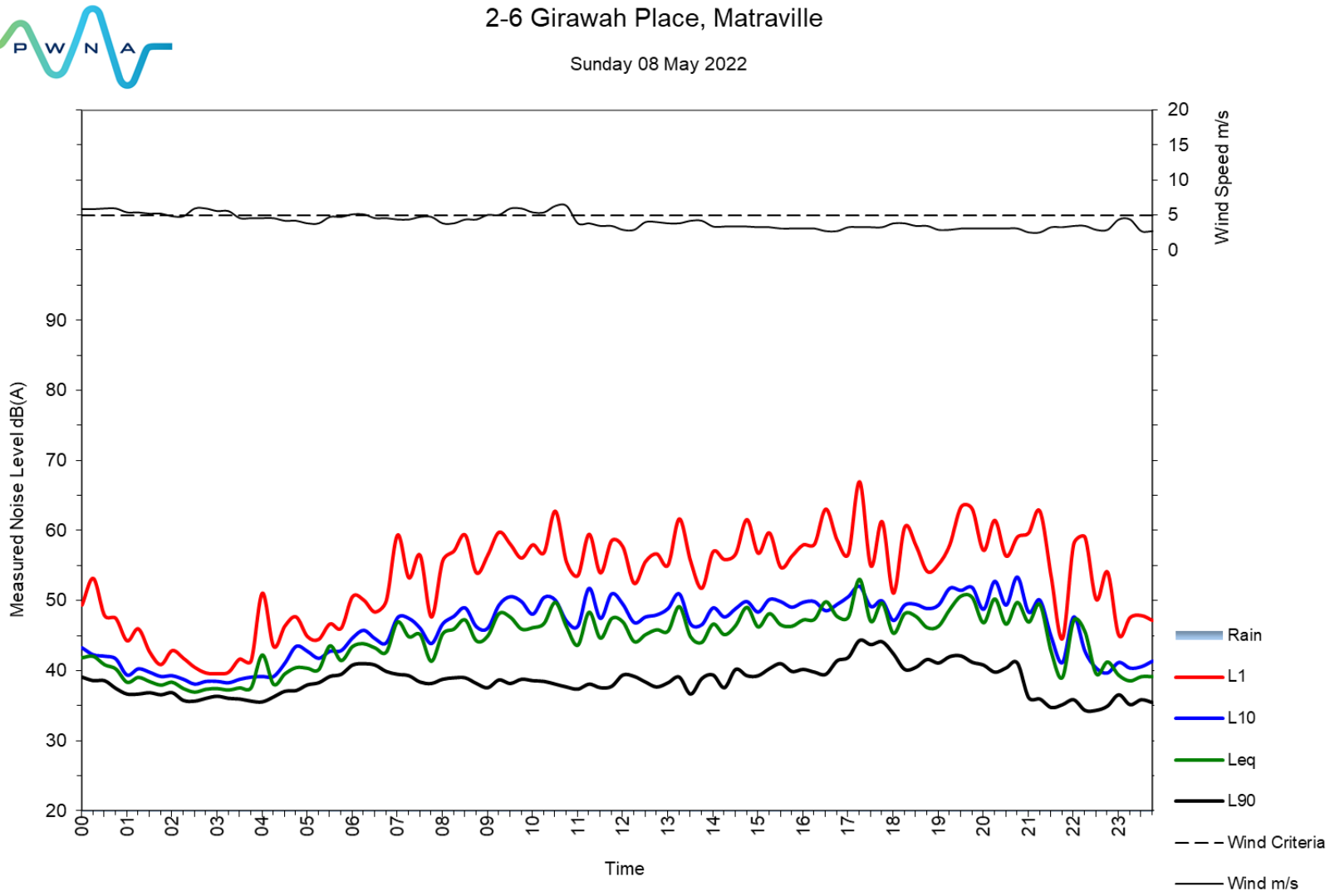
Weather Station: Sydney Airport

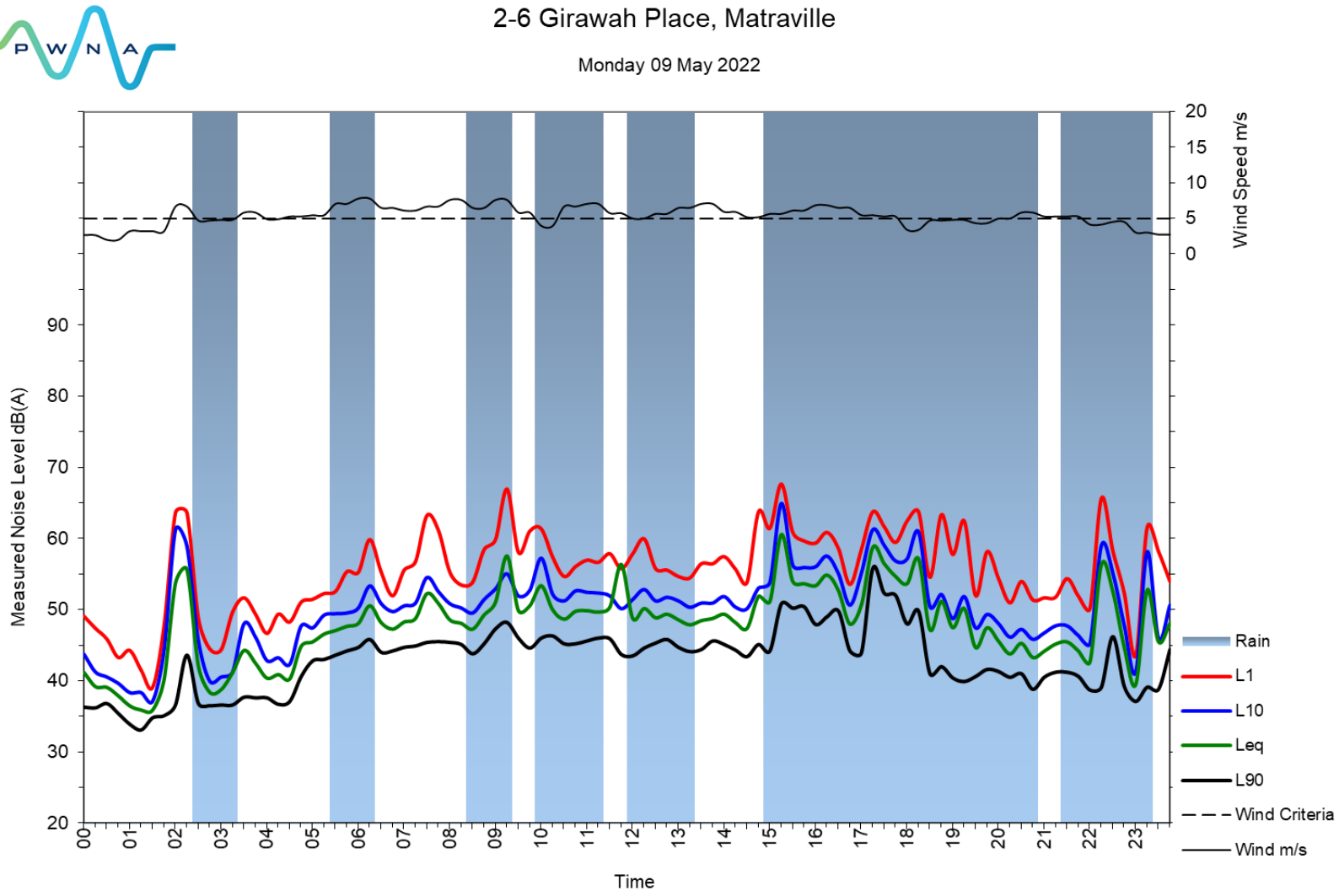
Weather Station ID: 066037

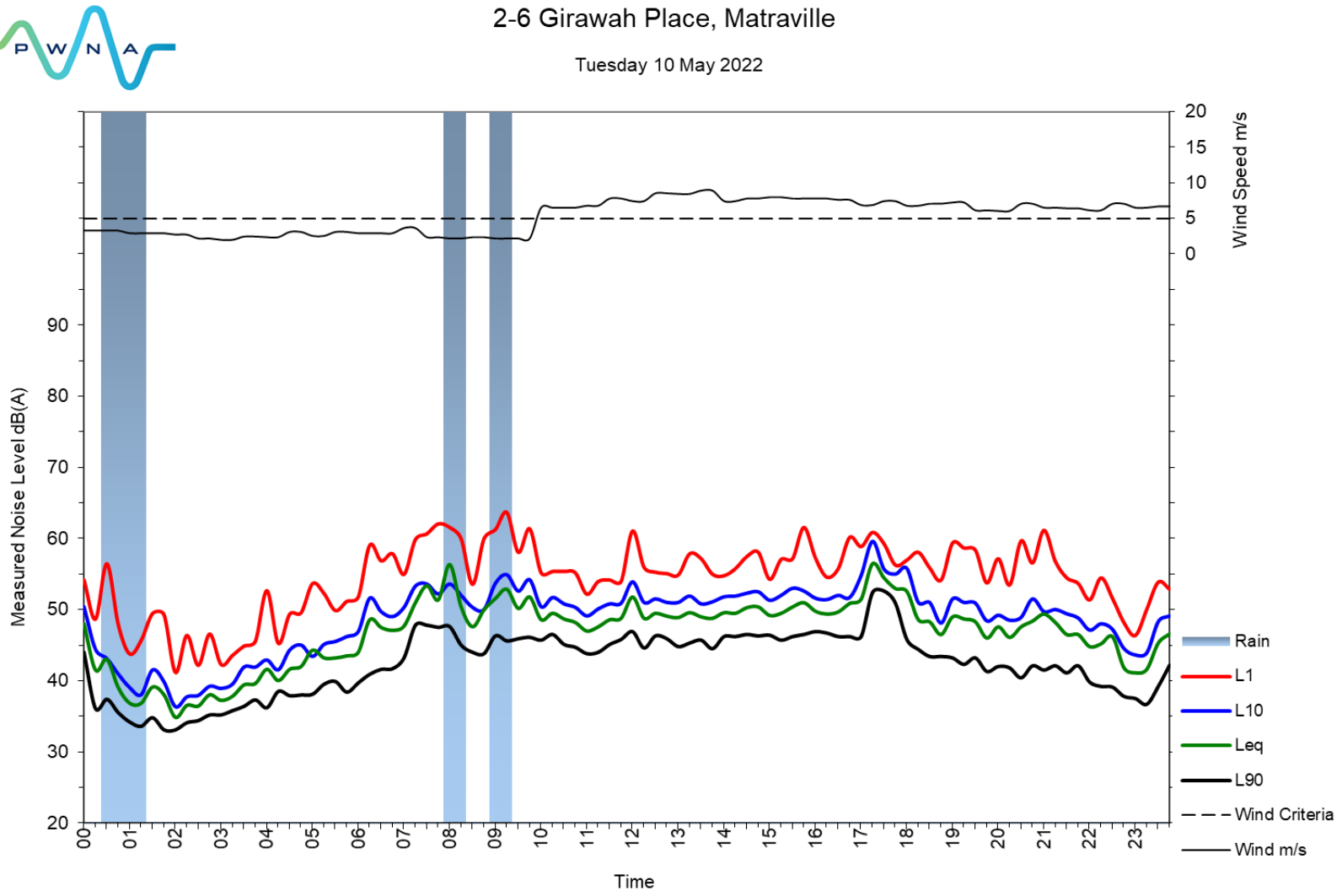
Coordinates: Lat: -33.95, Lon: 151.17, Height: 6.0 m

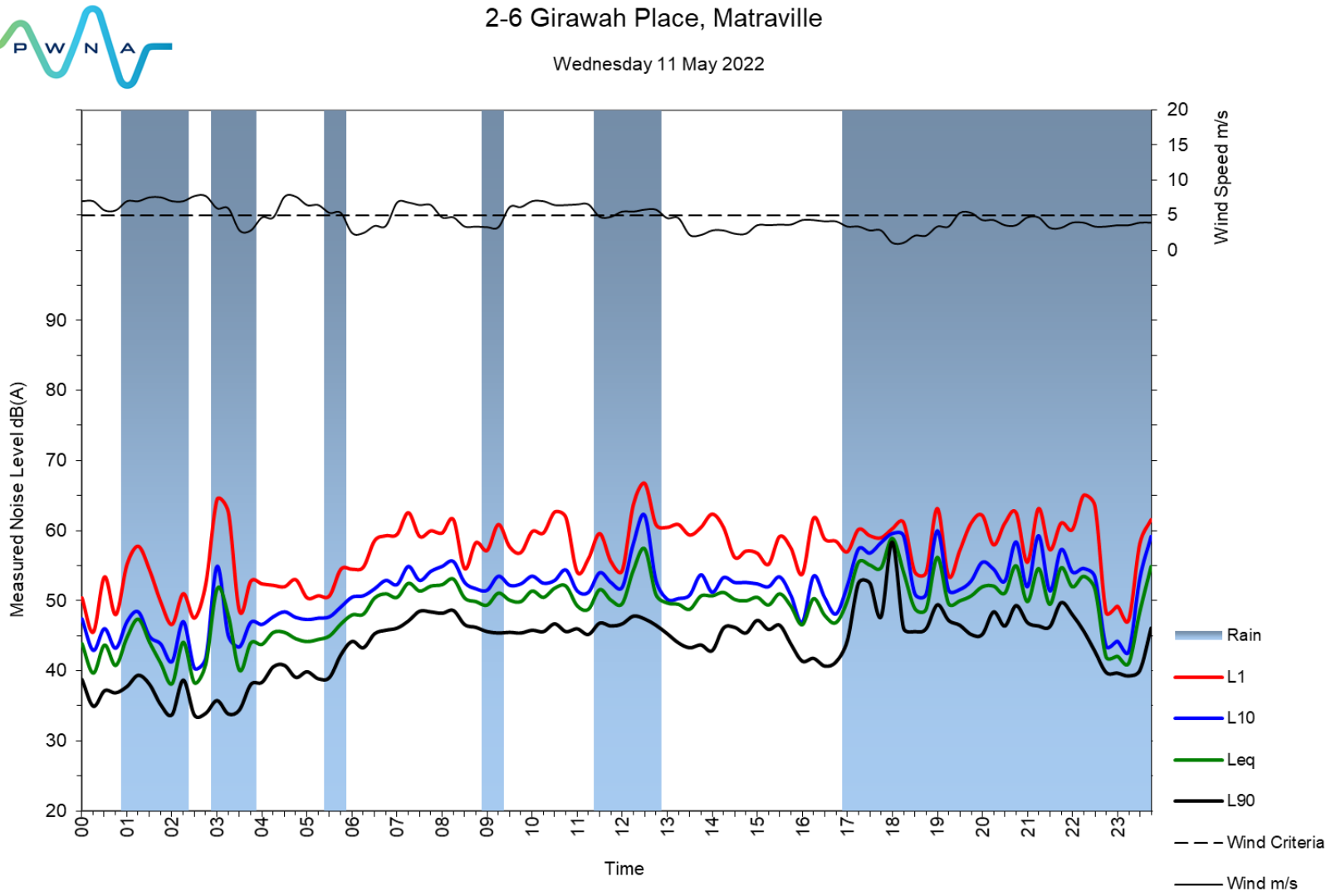

2-6 Girawah Place, Matraville
Friday 06 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

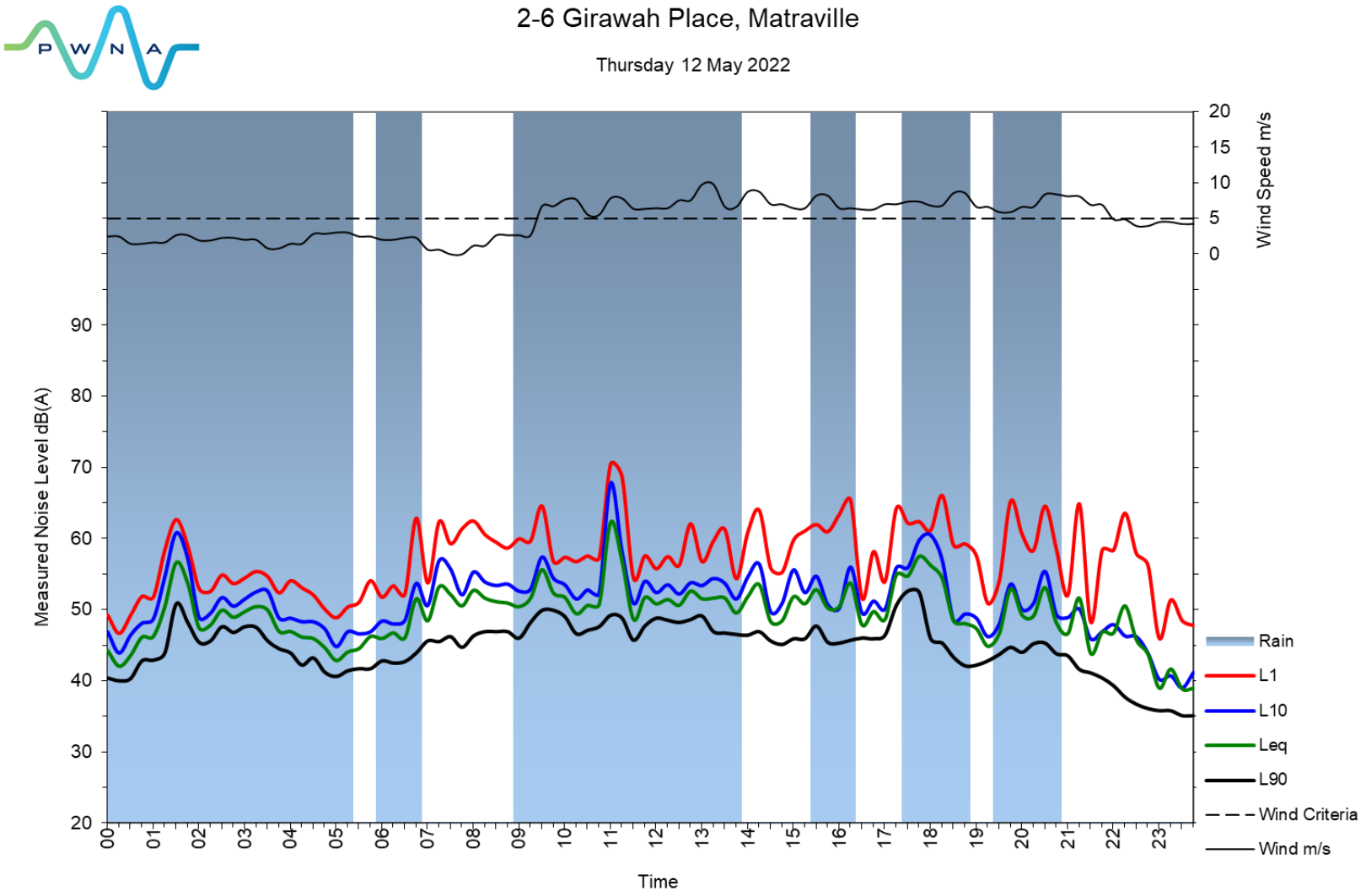

2-6 Girawah Place, Matraville
Saturday 07 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

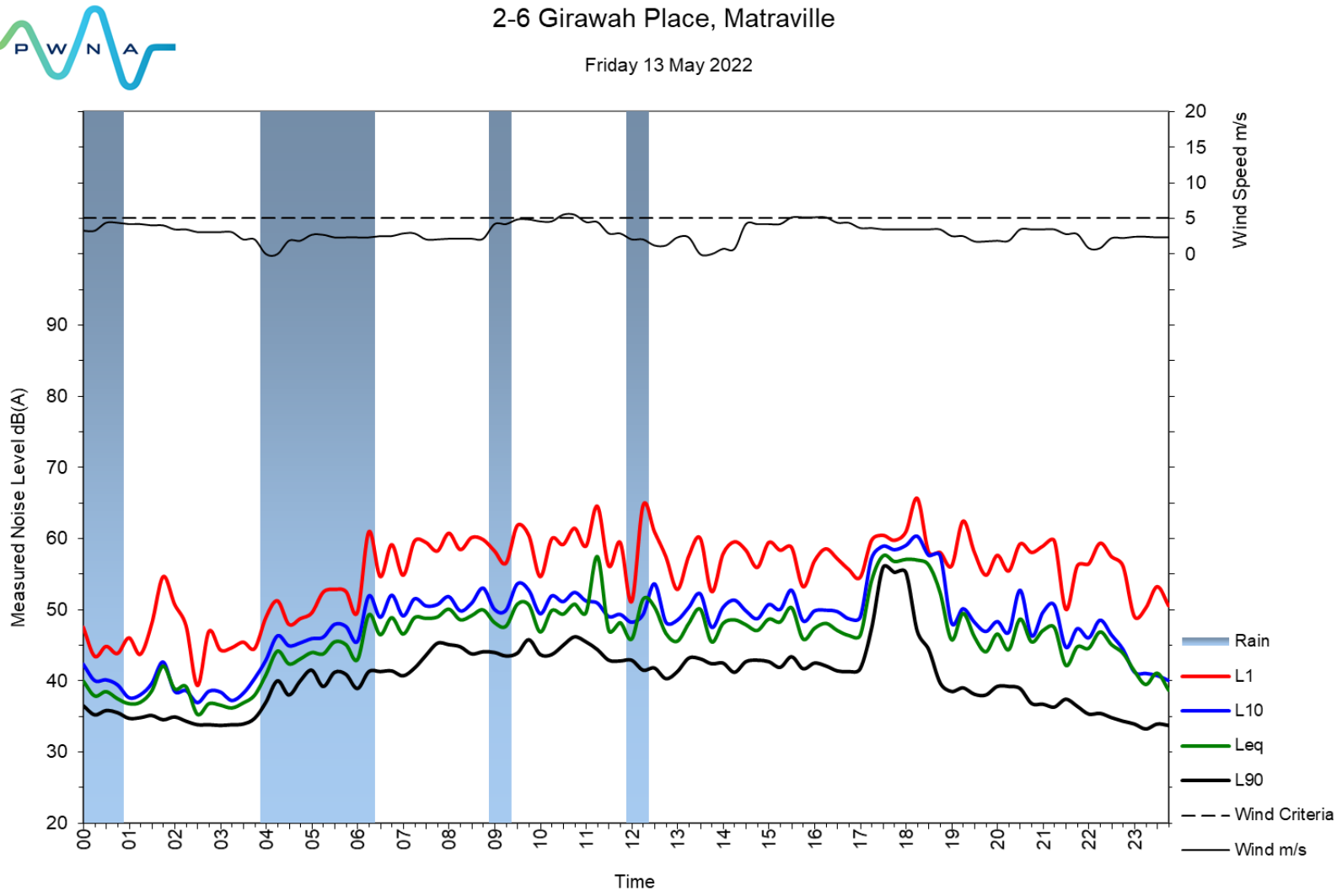

2-6 Girawah Place, Matraville
Sunday 08 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

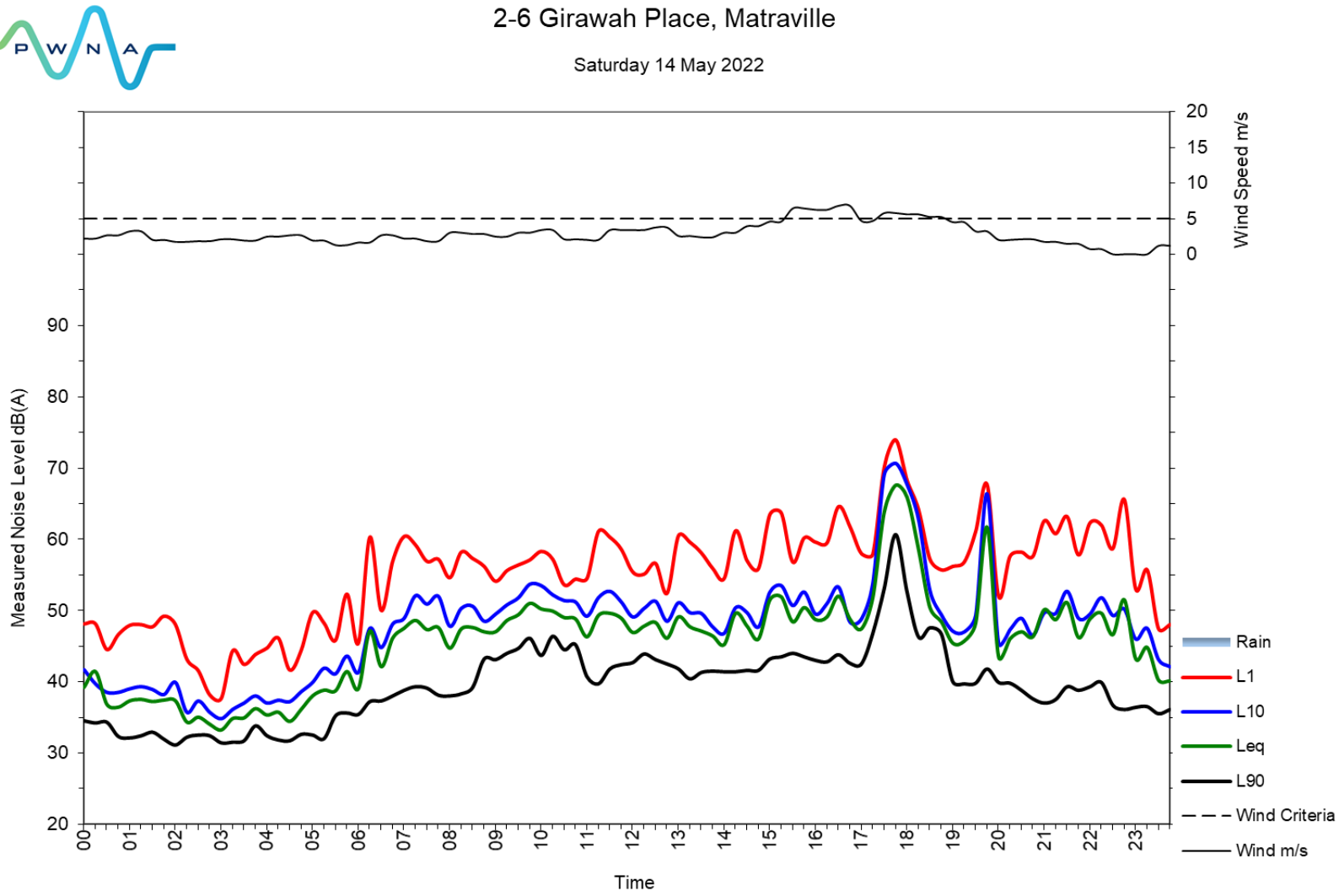

2-6 Girawah Place, Matraville
Monday 09 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

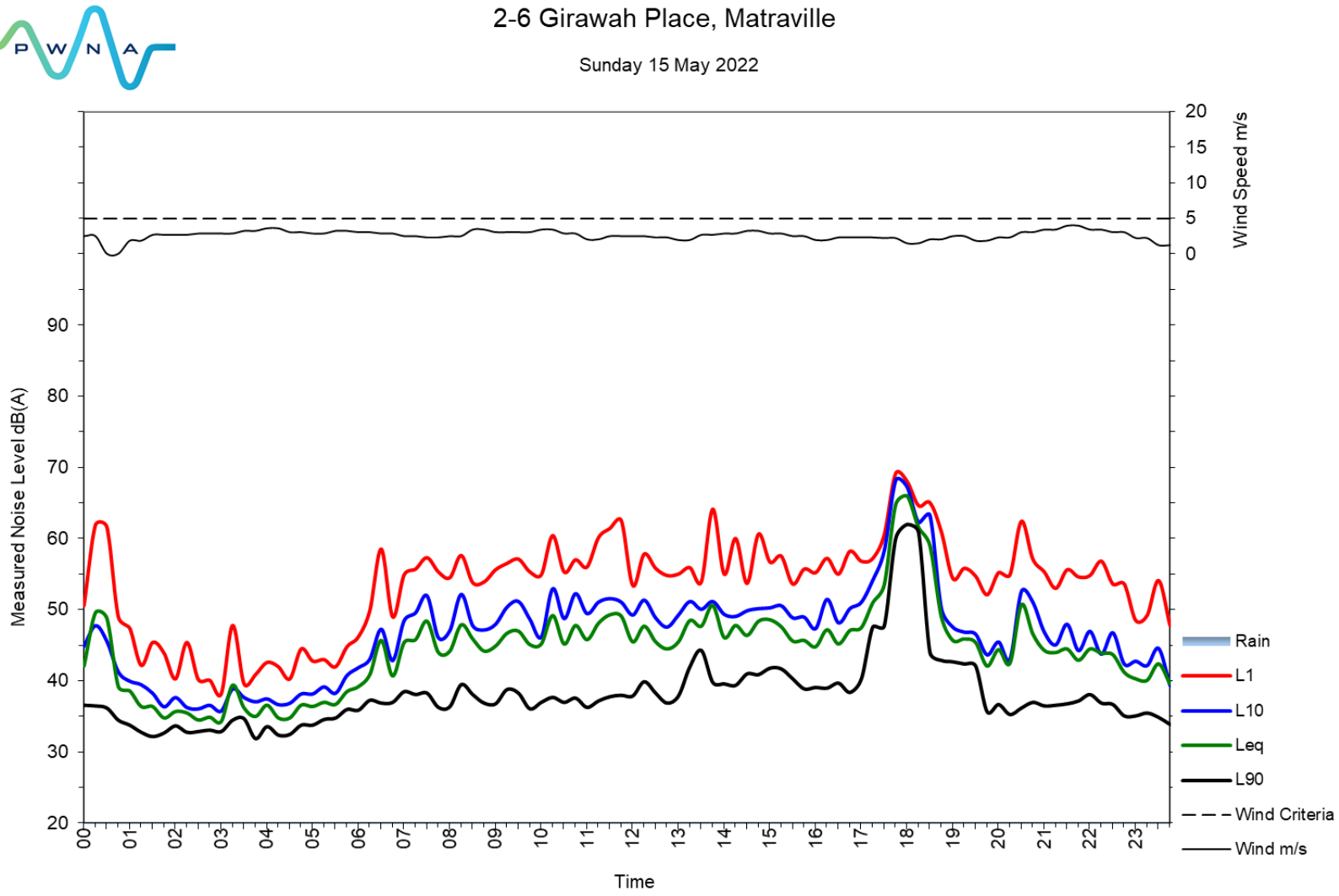

2-6 Girawah Place, Matraville
Tuesday 10 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

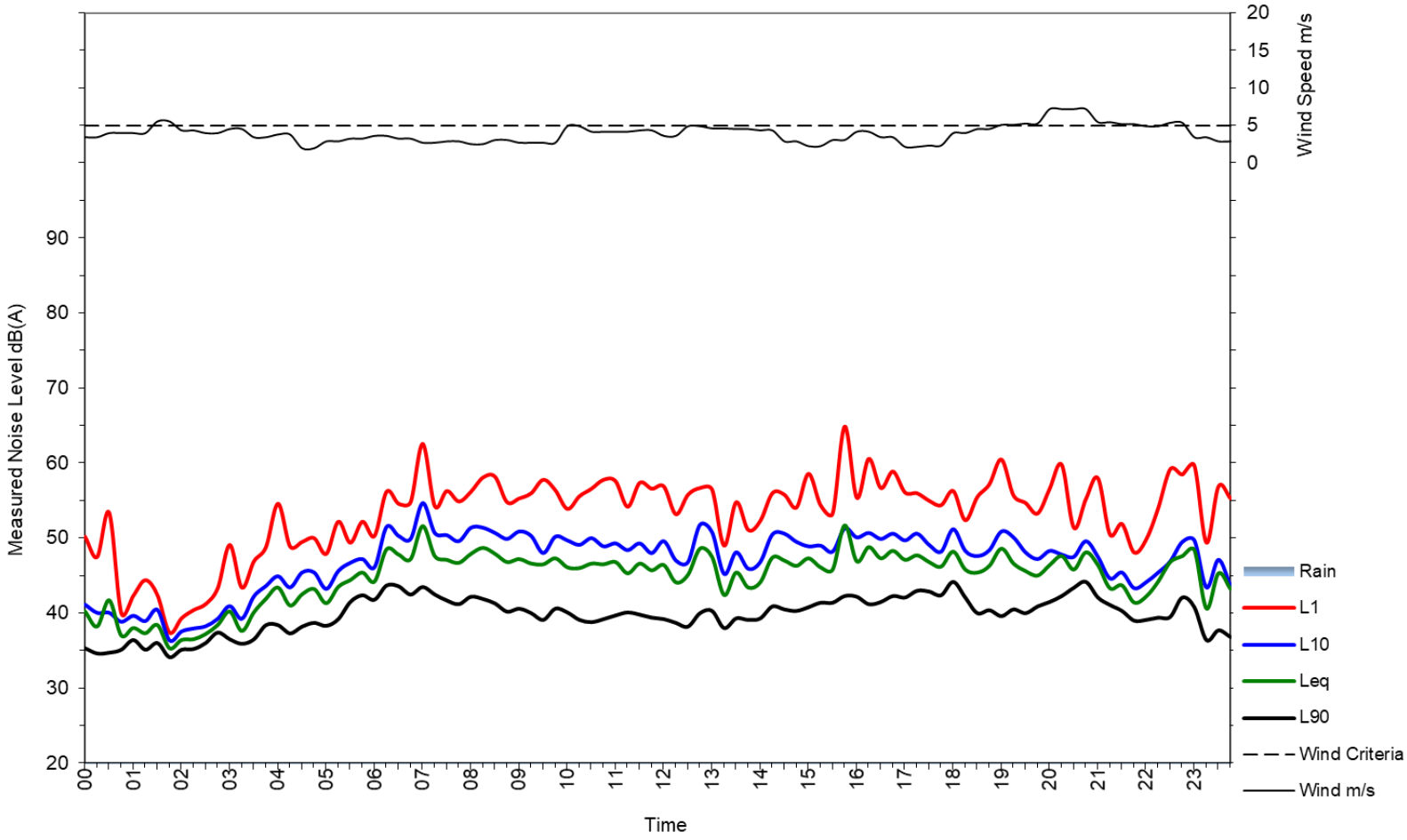

2-6 Girawah Place, Matraville
Wednesday 11 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

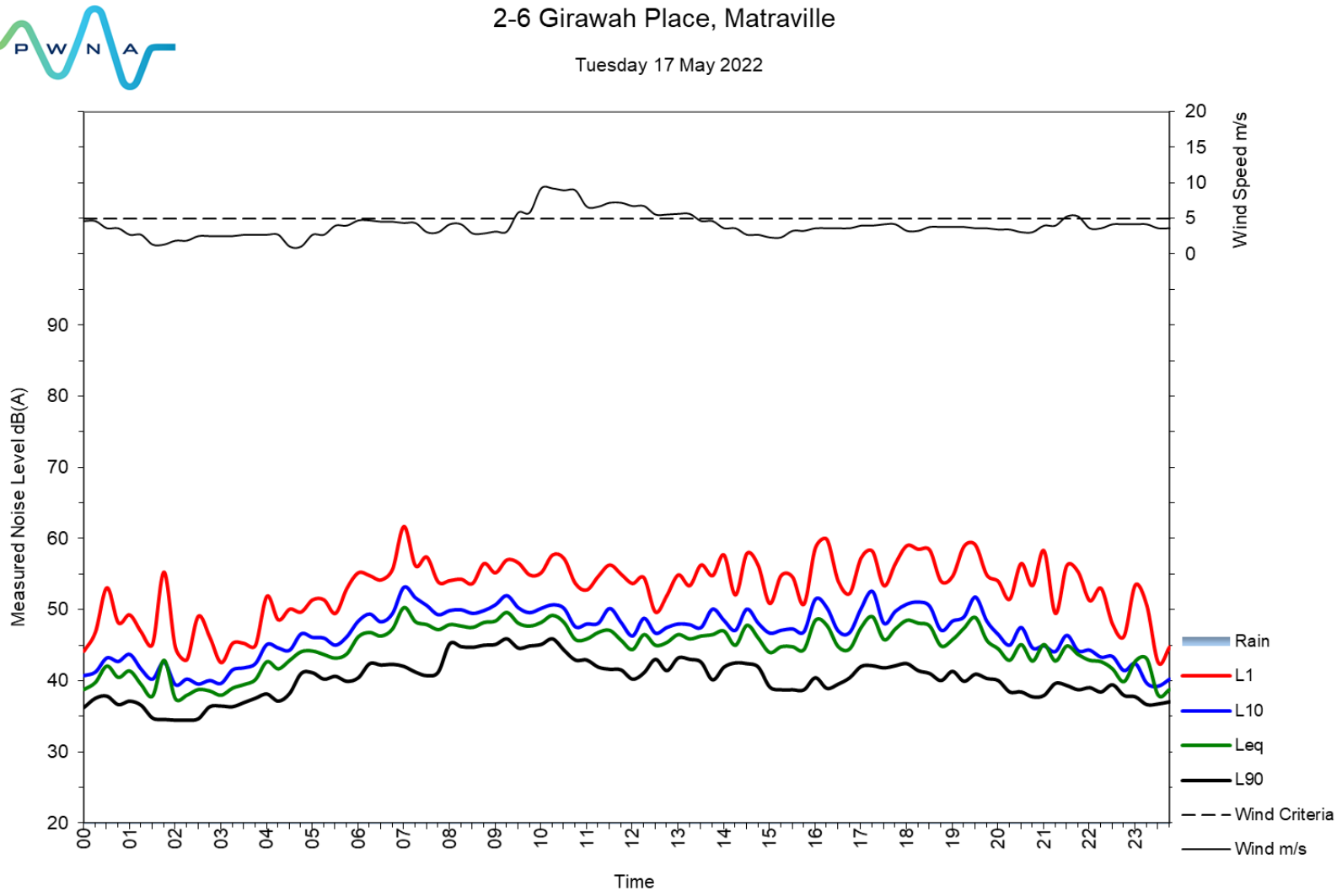

2-6 Girawah Place, Matraville
Thursday 12 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

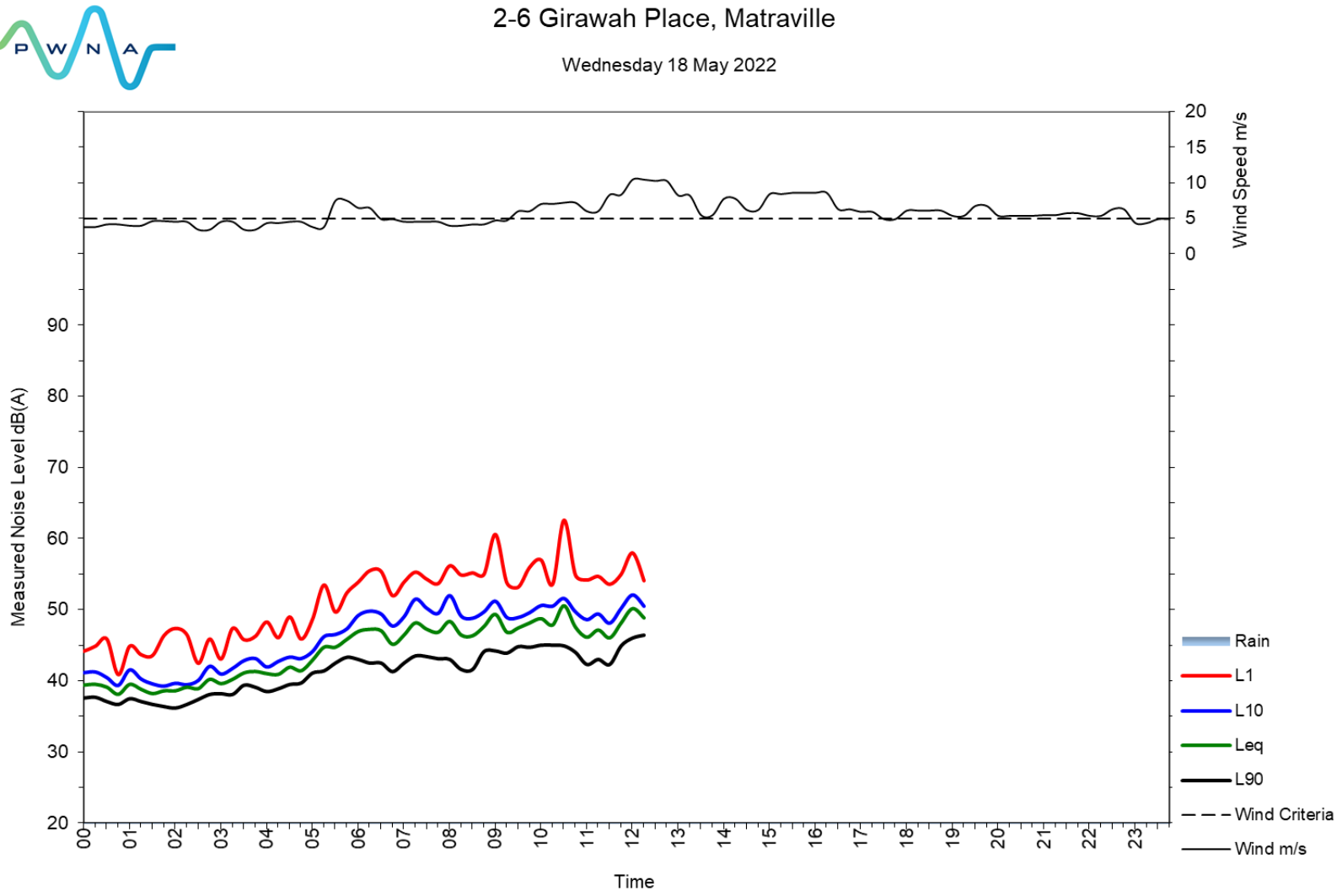

2-6 Girawah Place, Matraville
Friday 13 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


2-6 Girawah Place, Matraville
Saturday 14 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


2-6 Girawah Place, Matraville
Sunday 15 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


2-6 Girawah Place, Matraville
Monday 16 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


2-6 Girawah Place, Matraville
Tuesday 17 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


2-6 Girawah Place, Matraville
Wednesday 18 May 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s