1-3 Gondola Road, North Narrabeen - DA Acoustic Report – R1

DA Acoustic Assessment Report

Brett Crowther c/o Mackenzie Architects International

Report number: 230697 - 1-3 Gondola Road, North Narrabeen - DA Acoustic Report - R1
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1 INTRODUCTION

Pulse White Noise Acoustics Pty Ltd (Pulse White Noise Acoustics) has been engaged to undertake an acoustic assessment for the proposed mixed-use development to be located at 1-3 Gondola Street, North Narrabeen NSW 2101.

This assessment will address the following:

- Potential surrounding environmental noise intrusion on the development (i.e., traffic noise from Gondola Road, Minarto Lane, Verona Street, and Pittwater Road.
- Noise emissions to nearby receivers from the operation of the base building services (i.e., electrical, and mechanical services.) and noise of vehicles associated with the development.
- Traffic noise generation from the operation of the proposed development.

This report will discuss the relevant acoustic criteria which has been adopted as well as the outcome of the noise impact assessment.

A glossary of acoustic terminology used in the acoustic assessment, is included in Appendix A.

1.1 Project Description

The proposed mixed-use development at 1-3 Gondola Road, North Narrabeen, comprises the following:

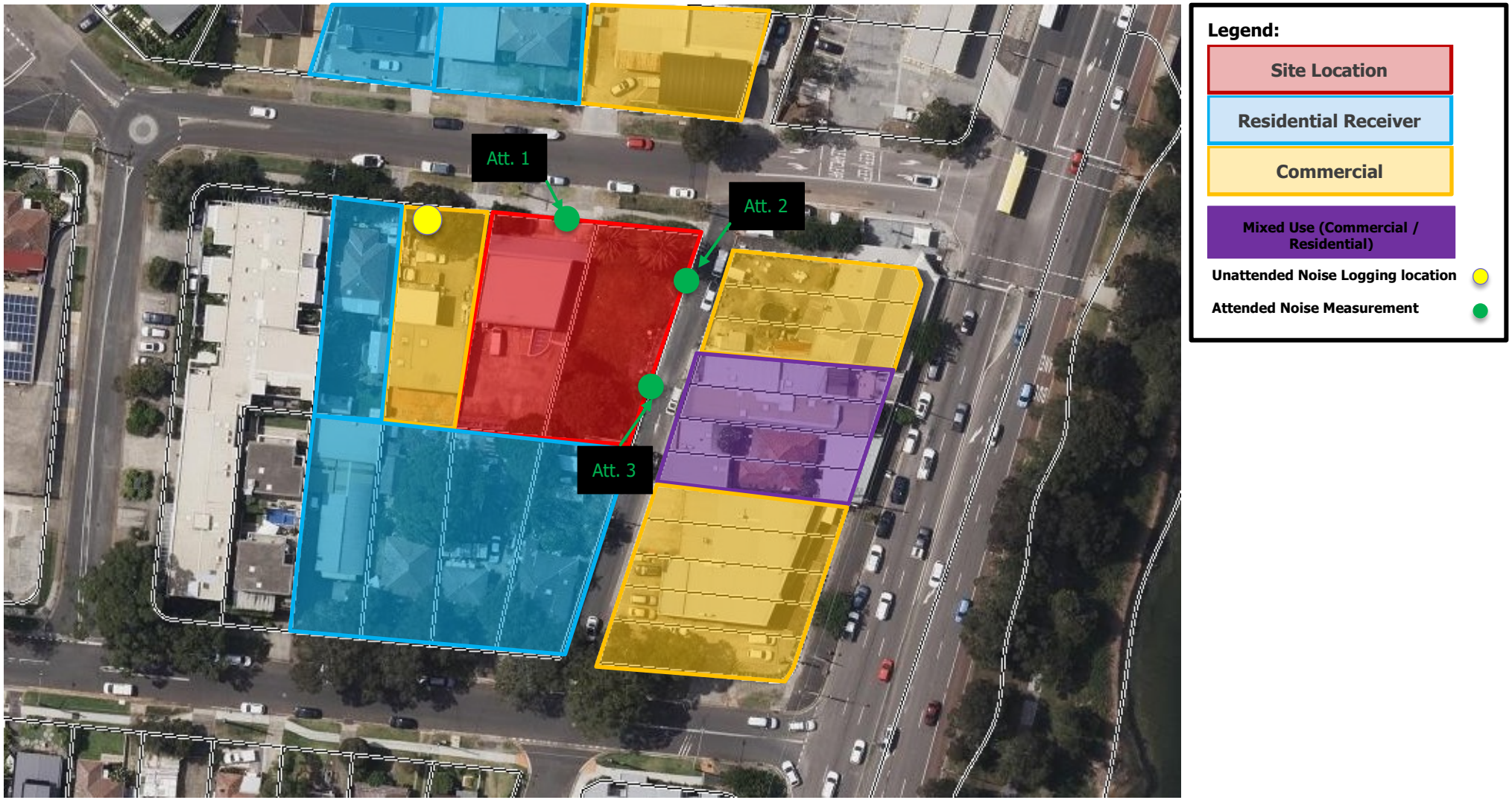
- Basement Level: Carpark, storage, plant rooms, and garbage storage.
- Ground Level: Carpark and 2 x commercial tenancies.
- Levels 1 and 2: Multiple residential apartments.
- Roof top level: Communal open space.
- Roof top level: Communal open space, amenities. It is also proposed that the communal space will be used for occasional social and casual gatherings by the tenants (such as weekend barbeques).

1.2 Site Layout

The project site is surrounded by the following premises (refer to Figure 1 below):

- Residential and commercial properties located along Gondola Road, north from the project site. Residential buildings are typically 1-2 storey buildings.
- Commercial premise located along western project site boundary, with residential buildings situated further west along Gondola Road.
- Existing 1 storey residences located along southern site boundary.
- Beyond No. 1 Gondola Road, east from the project site, commercial and mixed-use premises are situated between Minarto Lane and Pittwater Road. The mixed-use properties comprise commercial tenancies at Ground Level with residential unit on floor level above.

Figure 1 Site Map, measurement locations and surrounding receivers – Sourced from SixMaps.



2 EXISTING ACOUSTIC ENVIRONMENT

2.1 Unattended Noise Monitoring

Unattended noise logging data has been acquired from a previous assessment, detailed below. Additional unattended measurements were conducted on the 6th of December 2023 to verify that the unattended noise measurements are similar to current conditions and are therefore still relevant and appropriate for use in this assessment. These attended noise measurements are detailed in Section 2.4 below.

To determine the existing noise environment, an unattended noise survey was undertaken. This unattended noise monitoring was conducted between Friday 11 March and Friday 18 March 2022.

The logger location is shown in Figure 1. The logger was installed within the project site, at 4m from the northern site boundary, facing Gondola Road and within line of sight of local road traffic along Pittwater Road.

The instrumentation for the survey comprised one Rion NL-42 noise logger (serial number 998081). Calibration of the logger was checked prior to and following measurements using a Bruel & Kjaer Type 4230 sound calibrator (serial number 1275644). The calibrator emitted a calibration tone of 94 dB at 1 KHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24 hour period and show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods. This data has been filtered to remove periods affected by adverse weather conditions, based on weather information obtained from Terrey Hills AWS with weather station (ID 066059).

2.2 Noise Descriptors & Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure environmental noise in terms of quantifiable time periods and 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' arithmetic does not apply, e.g. adding two sound sources of equal values result in an increase of 3dB (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 as Appendix A.

2.3 Noise Monitoring Results

The noise levels measured at the logger location have been used to assess the noise impact of the development to the nearest noise affected receivers identified in Section 1.2. The time periods used are in accordance with those recommended in the NSW Environment Protection Authority's (EPA) Noise Policy for Industry (NSW NPI). The measurement results are presented in Table 1 below.

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

Measurement Location	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	
	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Logger Location: 3 Gondola Road, North Narrabeen	51	60	49	57	46	56

Notes:

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*
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*
3. *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.*

The noise measurements obtained at the logger location have also been used to determine existing road traffic noise levels closest to the project site. This information has been processed into the time periods discussed in the NSW Road Noise Policy (NSW RNP). The results are presented in Table 2 below.

It is noted from site observations that the existing ambient noise levels are mostly influenced by local road traffic, mostly from that commuting through Pittwater Road which is within line of sight of the project site.

Table 2 Measured L_{Aeq} noise levels for assessment of noise intrusion

Period	Measured Noise Levels (dBA)	
	Daytime/Night Time Periods	Max. 1 Hour Levels
Daytime: 7:00 am – 10:00 pm	60 L_{Aeq} (15 hrs)	61 L_{Aeq} (1 hr)
Nighttime: 10:00pm – 7:00 am	55 L_{Aeq} (9 hrs)	60 L_{Aeq} (1 hr)

The $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ descriptors represent the logarithmic average noise energy during the measurement period. The "15 hour" represents the daytime period between 7:00 am to 10:00 pm and the "9 hour" represents the night-time period between 10:00 pm to 7:00 am.

2.4 Attended Noise Measurements

The survey included attended noise level measurements which were undertaken on 6th December 2023. Testing was conducted during a period when there was no inclement weather. This allowed the existing noise levels at the site to be quantified. The purpose of the attended noise measurements to verify that the existing unattended noise logging data from March 2022 is still valid and suitable for use for this development. As evident in Table 3, the measured L_{Aeq} noise levels are in line with the worse 1-hour period from the unattended noise logger, which occurred during the morning peak hour period. As such, it is deemed that the existing unattended noise logger data from March 2022 is suitable for use at this project.

The attended noise measurements were conducted using a SVANTEK 958A sound level meter (serial number 69812). Calibration of the sound level meter was checked prior to and following the measurements using a Brüel & Kjær Type 4231 sound calibrator (serial number 3009148). The calibrator emitted a calibration tone of 94 dB at 1 kHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

Table 3 Results of attended noise survey.

Measurement Location	Time of Measurement [1]	Measured Noise Level $L_{Aeq, 15min}$ dB(A) [2]	Comments
Attended Location 1: 3 Gondola Road, Northern boundary of project site (refer to Figure 1)	8:30 am – 9:15 am 6th December 2023	60	Noise levels dominated by road traffic noise resulting from Gondola Road / Pittwater Road.
Attended Location 2: North-eastern corner of project site (refer to Figure 1)		62	Noise levels dominated by road traffic noise resulting from Gondola Road / Pittwater Road. Additional mechanical noise resulting from exhaust grill located across Minarto Lane.
Attended Location 2: Eastern boundary of project site (refer to Figure 1)		60	Noise levels dominated by road traffic noise resulting from Gondola Road / Pittwater Road. Additional mechanical noise resulting from exhaust grill located across Minarto Lane.

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 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.

3 OPERATIONAL ACOUSTIC CRITERIA

3.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

Consequently, the NSW EPA has prepared a document titled Noise Policy for Industry (NSW NPI) which provides a framework and process for determining external noise criteria and subsequent assessments. The NSW NPI criteria for industrial noise sources have two components:

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

3.1.1 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 minutes period, does not exceed the background noise level measured in the absence of the source by more than 5 dBA. 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.

3.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase 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.

3.1.3 Area Classification

The NSW NPI characterises the "urban" noise environment as an area with the following acoustical environment:

- It is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources.
- It has through-traffic with characteristically heavy and continuous traffic flows during peak periods.
- It is near commercial districts or industrial districts.
- It has any combination of the above.

The nearest residences surrounding the proposed development falls under the "urban" area classification in accordance with the zoning maps obtained from NSW Government's ePlanning Spatial Viewer (refer to Figure 2 below). Residential areas that are located within E1 zones, are classified as "urban" in accordance with Table 2.3 of the NSW NPI. This concurs with the measured range of background noise levels (refer to Table 1). This range is representative of an urban residential zone in accordance with the same Table 2.3 of the NSW NPI (i.e. daytime L_{A90} > 45 dBA, evening L_{A90} > 40 dBA, night L_{A90} > 35 dBA).

Figure 2 Zoning at and around project site

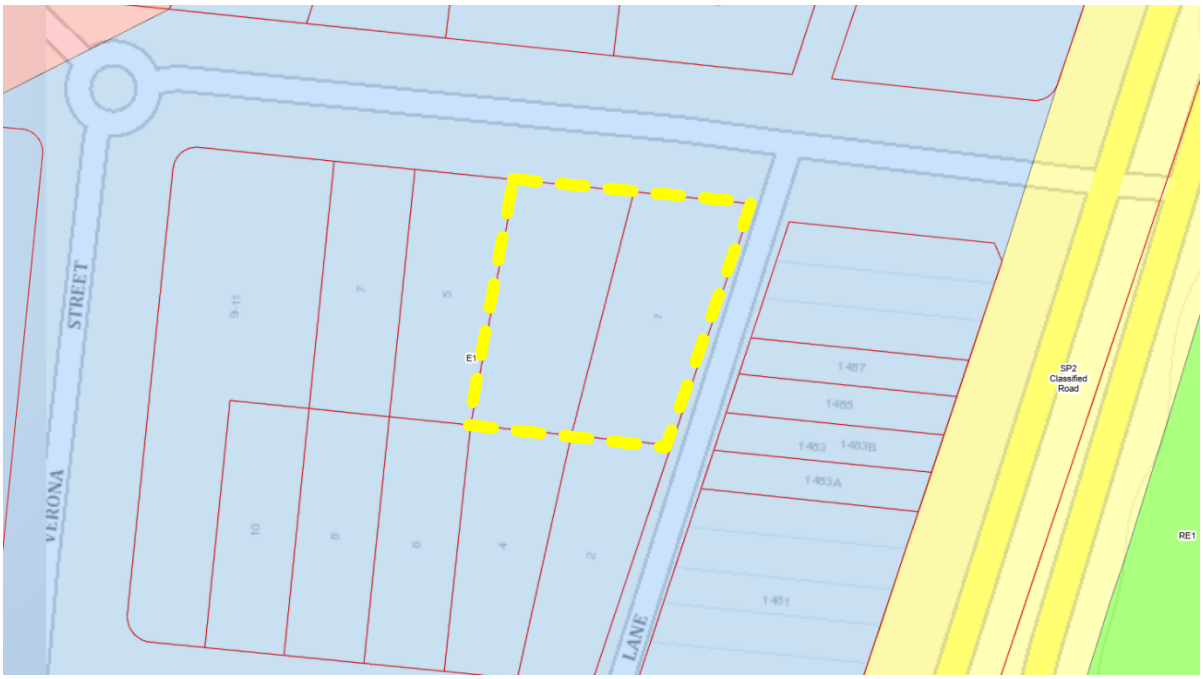


Table 4 NSW NPI – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residences within E1 zone	Urban	Day	60
		Evening	50
		Night	45
Commercial premises	All	When in use	65

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.

When the existing noise level from industrial noise sources is close to the recommended "Amenity Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the NSW NPI.

Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels.

3.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in Table 5. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the commercial components of the development to potentially affected noise sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 5.

Table 5 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)	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [4]
Residences within E1 zone	Day	55	51	60	**56**	58
	Evening	45	49	57	54	**48**
	Night	40	46	56	51	**43**
Commercial premises	When in use	60	-	60	-	**63**

Note 1: Project Amenity Noise Levels corresponding to "Urban" areas, equivalent to the Recommended Amenity Noise Levels (Table 4) 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: This is based on the assumption that the existing noise levels are unlikely to decrease in the future

Note 5: Minimum project intrusiveness noise level as per Table 2.1 of the NSW NPI

Note 6: Based on criteria discussed in Section 3.1.2.2.

3.1.5 Sleep Disturbance

In accordance with the NSW NPI, sleep disturbance is to be assesses in two stages addressing the likelihood of sleep disturbance and sleep awakening.

For the criterion addressing the likelihood of sleep disturbance, the NSW NPI recommends that the maximum noise level event should not exceed the following:

- 40 dB $L_{Aeq, 15\ minutes}$ or the prevailing RBL plus 5 dB, whichever is the greater; and / or
- 52 dB L_{AFmax} or the prevailing RBL plus 15 dB, whichever is the greater

As a result, the criterion of 61 dB L_{AFmax} is adopted as the criterion for the likelihood of sleep disturbance at all residences.

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, 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 early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause an awakening from a sleep state.
- One or two noise events per night with maximum internal noise levels of 65–70 dBA are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50 - 55 dB L_{AFmax}. This criterion is applicable for noise emissions generated by short term events occurring during the nighttime period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60 - 65 dB L_{AFmax} external noise level at residential properties.

3.2 Noise Emissions from Carpark

It is proposed to assess car park noise impacts with reference to the NSW NPI. Therefore, the criteria used for the assessment of carpark noise emissions should be as discussed in Section 3.1 (refer to Table 5).

3.3 Internal Noise Level Criteria

The following sub-sections address the criteria for the assessment of internal noise levels. These are summarised as follows:

- Section 3.3.1 discusses the criteria applicable to the assessment of noise intrusion generated by local road external to the site.
- Section 3.3.2 discusses the criteria for the assessment of noise emissions generated by steady state noise sources such as mechanical services.

3.3.1 The State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) was introduced to assist the delivery of necessary infrastructure by improving regulatory certainty and efficiency. The Infrastructure SEPP has specific planning provisions and development controls for various types of infrastructure, and also for developments located adjacent to infrastructure. In order to provide guidelines for this type of assessment (noise intrusion from road and rail traffic noise), the Department of Planning of the NSW Government has prepared a document titled *"Developments Near Rail Corridors and Busy Roads – Interim Guideline"* (DNRC & BR-IG).

The DNRC & BR-IG applies to development adjacent to rail corridors and busy roads. It can also provide a useful guide for all development that may be impacted by, or may impact on, rail corridors or busy roads. According to this document, busy roads are defined as follows:

- Roads specified in Clause 102 of the Infrastructure SEPP: Freeway, tollway or a transitway or any other road with an average annual daily traffic (AADT) volume of more than 40,000 vehicles.
- Any other road is defined as roads with an average annual daily traffic (AADT) volume of more than 20,000 vehicles.
- Any other road with a high level of truck movements or bus traffic.

Based on Map 12 of the "*Traffic Volume Maps for Noise Assessment for Building on Land Adjacent to Busy Roads*", it is noted that the nearest major road corridor to the project site is Pittwater Road. This has a traffic volume of more than 40,000 AADT. It is also observed that the development site is within line of sight of the intersection between Pittwater Road and Gondola Road.

Furthermore, the DNRC & BR-IG, in Section 1.3, recommends that the noise intrusion criteria discussed in the Infrastructure SEPP, be considered as a guideline for any residential development which might be impacted road or rail traffic.

According to Clauses 87 (rail) and 102 (road) of the Infrastructure SEPP, if the development is for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded (with windows and doors closed):

- In any bedroom in the building – 35 dBA $L_{Aeq(9hour)}$ between 10:00 pm and 7:00 am
- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dBA L_{Aeq} at any time (i.e. $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$).

If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the National Construction Code (NCC).

Where windows must be kept closed, the adopted ventilation systems must meet the requirements of the national Construction Code and Australian Standard 1668 – *The use of ventilation and air conditioning in buildings*.

3.3.2 Standard AS/NZS 2107:2016

In relation to design internal noise levels, standard AS/NZS 2107:2016 recommends a range with lower and upper levels (rather than "satisfactory" and "maximum" internal noise levels) for building interiors based on room designation and location of the development relative to external noise sources. This change has occurred due to the fact that sound levels below 'satisfactory' could be interpreted as desirable, but the opposite may in fact be the case. Levels below those which were listed as 'satisfactory' can lead to inadequate acoustic masking resulting in loss of acoustic isolation and speech privacy.

The levels for areas relevant to this development are given in Table 6 below. In this report we will confine our recommendations to dBA levels, however, where the background noise appears to be unbalanced, standard AS/NZS 2107:2016 provides direction in terms of suitable diagnostic tools that can be used to assess the spectrum distribution of the background noise.

Section 6.18 of standard AS/NZ 2107:2016 notes that the presence of discrete frequencies or narrow band signals may cause the sound level to vary spatially within a particular area and be a source of distraction for occupants. Where this occurs, the sound level shall be determined as the highest level measured in the occupied location(s).

Table 6 Recommended design sound levels as per standard AS/NZS 2107:2016

Type of Occupancy/Activity	Design sound level range	Project Design Noise Level ($L_{Aeq,15\ hour}$)
Residential Buildings		
Houses and apartments in inner city areas, entertainment districts or near major roads		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	50
Living areas	35 to 45	40
Sleeping areas (night time)	35 to 40	35 (LAeq,9 hour)
Work areas	35 to 45	40
Miscellaneous areas		
Undercover carparks	< 65	65
Toilets	45 to 55	55
Small retail stores	< 50	50

Generally, where the final noise levels are within +/- 2 dB of the specified level given above, 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.

3.4 Noise Impact on Local Roads

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

3.5 Sound Insulation Requirements - Residential Areas

The accommodation areas are subject to the sound insulation requirements stated in the National Construction Code 2019 (NCC 2019) for class 2 or 3 accommodation. These requirements are summarised in Table 7 below.

Table 7 NCC 2019, sound insulation requirements (Class 2 and 3)

Construction	NCC 2019	
	Laboratory performance requirements	Verification method
Walls between sole occupancy units	$R_w + C_{tr}$ not < 50	$D_{nT,w} + C_{tr}$ not < 45
Walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit	$R_w + C_{tr}$ not < 50 and Must have a minimum 20 mm cavity between two separate leaves	$D_{nT,w} + C_{tr}$ not < 45 "Expert Judgment" Comparison to the "Deemed to satisfy" Provisions
Walls between sole occupancy units and a plant room or lift shaft	R_w not < 50 and Must have a minimum 20 mm cavity between two separate leaves[1]	$D_{nT,w}$ not < 45
Walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification	R_w not < 50	$D_{nT,w}$ not < 45

Construction	NCC 2019	
	Laboratory performance requirements	**Verification method**
Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like	R_w not < 30 [2]	$D_{nT,w}$ not < 25
Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	$R_w + C_{tr}$ not < 50 $L_{n,w}$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w}$ not > 62
Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms	$R_w + C_{tr}$ not < 40	N/A
Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms	$R_w + C_{tr}$ not < 25	N/A
Intra-tenancy Walls	There is no statutory requirement for airborne isolation via intra-tenancy walls.	

Note 1: A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20 mm cavity between two separate leaves with no mechanical linkage except at the periphery.

Note 2: Clause FP5.3(b) in the 2016 BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.

Note 3: Masonry walls must be laid with all joints filled solid, including those between the masonry and any adjoining construction

4 OPERATIONAL ACOUSTIC ASSESSMENT

4.1 Building Envelope – Treatments for Noise Intrusion

As discussed in Section 2, it is found that the most dominant external noise source is local road traffic. This is evident from observing that Pittwater Road is considered a major road corridor (refer to discussion in Section 3.3.1).

Therefore, preliminary calculations of noise intrusion levels from external noise sources have been undertaken at typical residential areas in the development. These calculations and their assessment outcomes are summarised as follows:

- For the northern and eastern façade: Refer to Table 8 below.
- For the southern and western façade: Refer to Table 9 below.

4.1.1 Northern & Eastern Facade

From Table 8 it is noted that noise intrusion through slightly open doors and windows in the northern and eastern façade, will not satisfy the noise intrusion criteria. Therefore, it is advised that provisions for mechanical ventilation should be implemented in the residential apartments which are adjacent to these facades.

Furthermore, façade glazed elements such as windows, doors (including hinged and sliding doors), should achieve the minimum sound insulation performance stated in Table 10. The recommended performance is representative of laminated glass components (such as 10.38 mm laminated glass). For external doors and windows, these typically should comprise:

- Laminated glass elements with sound insulation performance as mentioned above.
- Solid non-hollow frames: Either metal frames fully packed with insulation or grout; or solid timber frames.
- Rubber acoustic seals implemented to window/door frames (such as Q-Lon seals), or fin rubber seals with deep C channels as part of the window track.

Additionally, non-glazed façade elements should achieve a minimum sound insulation performance of Rw 45. This typically could comprise masonry elements. If a lightweight construction is opted, this should comprise a non-rigid, open and porous insulation such as rockwool (rigid insulation panels such as Kingspan Kooltherm are not acceptable). Number of wall cavities should also be reduced to one which is to be filled with the aforementioned insulation.

4.1.2 Southern & Western Facade

From Table 9 it is noted that compliance is achieved for slightly open door and windows. Therefore, natural ventilation can be considered for apartments which are adjacent to the southern and western facades. However, coordination with the mechanical consultant is advised to define the required façade opening for natural ventilation and how this will impact the overall sound insulation performance of the building envelope.

Furthermore, if windows and doors were to be closed, these should achieve the minimum sound insulation performance stated in Table 10. The recommended performance is representative of laminated glass components (such as 8.38 mm laminated glass). External door and windows should be treated as discussed in Section 4.1.1.

Finally, non-glazed façade elements should achieve a minimum sound insulation performance of Rw 45. Recommendations discussed in Section 4.1.1 for non-glazed façade elements, are also applicable for the southern and western façade.

Table 8 Preliminary predictions of noise intrusion levels, typical for northern and eastern facade

Parameter	$L_{Aeq(15\ hour)}$	$L_{Aeq(9\ hour)}$
Measured facade incident noise levels (free-field)	60 dBA	55 dBA
Noise Criteria		
Windows closed	40 dBA (elsewhere)	35 dBA (bedrooms) 40 dBA (elsewhere)
Windows open	50 dBA (elsewhere)	45 dBA (bedrooms) 50 dBA (elsewhere)
Calculation assuming: • **Min. sound insulation performance for glazed and window / door components: Rw 35 (0; -3) and as per Table 13** • **Min. sound insulation performance for non-glazed façade element: Rw 45**		
Typical Bedroom		
- Windows closed	38 - 40 (compliance)	33 - 35 (compliance)
- Windows open[1]	50 - 54 (non-compliance)	45 - 49 (non-compliance)
Typical Living Room		
- Windows closed	36 - 38 (compliance)	31 - 33 (compliance)
- Windows open[1]	50 - 54 (non-compliance)	45 - 49 (compliance)
Note 1: The outside to inside noise levels with windows open assumes a noise reduction of 6 – 10 dB for very slightly open windows or doors		

Table 9 Preliminary predictions of noise intrusion levels, typical for southern and western facade

Parameter	$L_{Aeq(15hour)}$	$L_{Aeq(9hour)}$
Estimated facade incident noise levels (free-field)	55 dBA	50 dBA
Noise Criteria		
Windows closed	40 dBA (elsewhere)	35 dBA (bedrooms) 40 dBA (elsewhere)
Windows open	50 dBA (elsewhere)	45 dBA (bedrooms) 50 dBA (elsewhere)
Calculation assuming: • **Min. sound insulation performance for glazed and window / door components: Rw 31 (0; -3) and as per Table 13** • **Min. sound insulation performance for non-glazed façade element: Rw 45**		
Typical Bedroom		
- Windows closed	37-40 (compliance)	32-35 (compliance)
- Windows open[1]	45-49 (compliance)	40-44 (compliance)
Typical Living Room		
- Windows closed	32-35 (compliance)	30-32 (compliance)
- Windows open[1]	45-49 (compliance)	40-44 (compliance)
Note 1: The outside to inside noise levels with windows open assumes a noise reduction of 6 – 10 dB for very slightly open windows or doors		

Table 10 Sound insulation performance for glazed façade elements

Façade Location	Overall Sound Insulation Performance Rw (C; Ctr)	Indicative Construction
Northern & eastern facade	35 (0; -3)	10.38 mm Laminated **OR** 6 mm float / 12 mm airgap / 10 mm float
Southern & western facade	31 (0; -3)	6.38 mm Laminated

4.1.3 General Comments

Roof construction should comprise a concrete slab with 200 mm minimum thickness and 2400 kg/m^3 minimum density.

Skylights on the roof should achieve a minimum sound insulation performance of Rw 30.

Please note sound insulation performance of external windows and doors is not only subject to the glazing selection but also to the construction of the window/door frame and frame seal selection. Therefore, it is advised the manufacturer should confirm that the required sound insulation can be achieved.

4.2 NCC 2019 Requirements - Internal Architectural Elements

Internal architectural elements which are subject to the sound insulation requirements discussed in the NCC 2019 (as mentioned in Section 3.5), should be designed and constructed to achieve compliance with these requirements. These internal architectural elements comprise the following:

- Floor and partitions separating single occupancy units.
- Floor and partitions separating single occupancy units from areas which correspond to other classifications (other than class 2 or 3 in accordance with the NCA 2019), plant rooms, lift shafts, stair way, public corridor, public lobby, or equivalent space.
- Doors separating single occupancy units from stairway, public corridor, public lobby or equivalent space.
- Structures separating habitable rooms and other rooms within a single occupancy unit from building services (i.e. soil & waste pies, water supply pipes, stormwater pipes, ductwork).

4.3 External Noise Emissions – Mechanical Plant

At this stage, no detailed design has been developed for mechanical services. Therefore, no detailed acoustic assessment has been conducted.

Nevertheless, it is advised the mechanical plant design and equipment selection should be made so that the aggregate noise level from all external emissions, comply with the external noise level criteria discussed in Section 3.1.

This should be conducted as part of the detailed assessment of mechanical noise emissions which is required to be undertaken during the later design stages.

The following design measures could be considered as part of the detailed design stage in order to achieve compliance:

- Mechanical plant installation locations and the positioning of external air duct paths (such as inlets and outlets) near the property boundary should be limited, as far as practicable.

- Plant room walls should achieve a minimum airborne sound insulation performance of Rw 45 -50. Whenever possible, the plant rooms should only be accessible from inside the building.

- If airflow paths are required to/from outside (such as outside air, exhaust air, relief air, etc) these paths should be fully ducted and include minimum 50 mm thick internal insulation; and / or include acoustic louvres. When the extent of ductwork is not sufficient for treatment, then rectangular silencers may be required (this especially applies to fans and AHUs).

- Ornamental louvres should generally only be considered if they are blanked off with FC sheeting or plant room external walls (subject to further Detailed Design acoustic assessment).

- All plant room walls and roof / ceiling to be internally lined with insulation, which in combination with insulation facing, should achieve a minimum noise reduction coefficient (NRC) rating of 0.8.

- AHUs and FCUs should include return air / outside air plenums which are in internally lined with minimum 50 mm thick insulation.

- Variable speed drives should be implemented whenever possible.

- Reduce the number of operational plant items between 6:00 pm and 7:00 am (and during the night-time period generally).

- Outdoor units and other plant items to be screened from direct line of sight to the affected residences (depending on their locations).

The above recommendations should be considered as in-principle, best practice acoustic treatment that will need to be confirmed during detailed design stages.

Finally, it is recommended that mechanical services should be designed to achieve compliance with external noise level criteria discussed in Section 3.1.

4.4 External Noise Emissions – Roof Communal Garden

Table 11 and Table 12 summarise the noise emissions related to the use of the roof communal garden. These predictions are undertaken at the nearest affected residences. The estimations are conducted based on the assumption that 50% of the patrons are talking simultaneously with a normal to raised vocal effort (69 - 75 dBA L_W).

Table 11 corresponds to typical noise emissions by 40 patrons in the roof communal garden, and Table 12 corresponds to 16 patrons. These noise emissions are assessed against the daytime and evening period criteria respectively (criteria are obtained from Table 5). Additionally, the commercial receiver located along the western façade of the proposed development has also been considered.

Table 11 External noise emissions from roof communal garden – 40 patrons

Residential Receiver Location	Predicted L_{Aeq} Noise Level	Daytime Criteria (dB $L_{Aeq, 15\ min}$)	Assessment Outcome
No. 4 Gondola Road	42	56	**Compliance**
No. 7 Gondola Road	47	56	**Compliance**
No. 2-8 Rickard Road	48	56	**Compliance**
No. 5 Gondola Road	49	63	**Compliance**
1483 Pittwater Road (residential)	42	56	**Compliance**
1485 Pittwater Road (residential)	41	56	**Compliance**
1487 Pittwater Road	42	63	**Compliance**
1493 Pittwater Road	42	63	**Compliance**

Table 12 External noise emissions from roof communal garden – 16 patrons

Residential Receiver Location	Predicted L_{Aeq} Noise Level	Evening Criteria (dB $L_{Aeq, 15\ min}$)	Assessment Outcome
No. 4 Gondola Road	40	50	**Compliance**
No. 7 Gondola Road	43	50	**Compliance**
No. 2-8 Rickard Road	45	50	**Compliance**
No. 5 Gondola Road	46	63	**Compliance**
1483 Pittwater Road (residential dwelling)	40	56	**Compliance**
1485 Pittwater Road (residential dwelling)	41	56	**Compliance**
1487 Pittwater Road	41	63	**Compliance**
1493 Pittwater Road	41	63	**Compliance**

From noise predictions presented in Table 11 and Table 12, the following is advised to maintain compliance:

- During the daytime period (i.e. between 7:00 am and 6:00 pm), the maximum number of patrons in the roof communal garden should be limited to 40 people.
- For the evening period (i.e. between 6:00 pm and 10:00 pm), the maximum number of patrons should be limited to 16 people.

4.5 Waste Collection

It is our understanding that residential waste collection will be undertaken by the local council. Therefore, the times this collection will be undertaken is at the discretion of the local council.

Regarding waste collection from commercial tenancies, this will be conducted by private contractors. Therefore, to minimise noise impact to local residences, it is advised that the commercial waste collection should only be conducted between 7:00 am and 10:00 pm.

4.6 Internal Noise Emissions – Building Services

The mechanical ventilation design is still ongoing at the time of issuing this report. Nevertheless, it is advised that this should be designed to achieve the internal noise level criteria discussed in Section 3.3.

4.7 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 nearest affected receivers. However the mechanical ventilation serving the carpark should be designed to achieve compliance with the external noise level criteria discussed in Section 3.1.

4.8 Noise Impact on Local Roads

According to traffic report titled *"Proposed Shop Top Housing Development - 3 Gondola Road, North Narrabeen – Traffic and Parking Assessment Report"* (issued on 11 May 2022 by Terraffic Pty Ltd, referenced herein as the *"DA Traffic Report"*), it is estimated that the existing development generates 11 vehicles/hour during peak hour traffic. During the same period, it is also estimated that the proposed residential development will generate 6 vehicles/hour. This is less than the vehicular traffic generated by the current development. Therefore, it is expected that vehicular traffic noise levels from local roads (such as Gondola Road) will be less than what is currently emitted.

It is also noted from Section 3.4, that any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. Hence, to maintain compliance with this criterion, the traffic generated by the proposed development cannot exceed 60% of the existing traffic volume on impacted roads.

From discussion in Section 3.3.1 it is observed that Pittwater Road is a major road corridor with a traffic flow higher than 40,000 AADT. Therefore, it is noted that the traffic generation estimated for the proposed development represents much less than 60% of the existing traffic volume.

As a result, it is expected that the noise impact on local roads and major road corridors, due to the proposed development, will be negligible.

5 CONCLUSIONS

Pulse White Noise Acoustic (PWNA) has been engaged to undertake an acoustic assessment for the proposed mixed-use development at 1-3 Gondola Road, North Narrabeen, NSW.

From the operational acoustic assessment, the following has been found:

- Sound insulation performance for façade glazing elements should be as listed in Table 10. Furthermore, treatment to sliding door and windows should comprise conceptual recommendations discussed in Section 4.1.
- Sound insulation performance for non-glazed façade elements should be Rw 45.
- Roof construction should comprise a concrete slab with 200 mm minimum thickness and 2400 kg/m^3 minimum density. Additionally, skylights should achieve a minimum sound insulation performance of Rw 30.
- Internal architectural elements which are subject to the sound insulation requirements discussed in the NCC 2019 (as mentioned in Section 3.5), should be designed and constructed to achieve compliance with these requirements.
- Mechanical plant design and equipment selection should be made so that the aggregate noise level from all external emissions, comply with the external noise level criteria discussed in Section 3.1 and internal noise level criteria discussed in Section 3.3.
- Number of patrons using the roof communal garden should be limited to the following:
    - Between 7:00 am and 6:00 pm: Maximum of 40 people.
    - Between 6:00 pm and 10:00 pm: Maximum of 16 people.

- Commercial waste collection should only be conducted between 7:00 am and 10:00 pm.
- Since the carpark will be fully enclosed and mechanically ventilated, it is expected that noise impact from the car park will be negligible.
- Due to low traffic generation by the proposed development, it is expected that the noise impact on local roads and major road corridors, will also be negligible.

Based on the findings from the acoustic assessment, it is our opinion that the proposed development can achieve compliance with the operational acoustic criteria required by local authorities, provided the conceptual recommendations discussed herein are implemented and further developed at the later detailed design stages.

Regards,

Nikolaj Drydale-Cech

Acoustic Engineer

PULSE WHITE NOISE ACOUSTICS PTY LTD

APPENDIX A: ACOUSTIC TERMINOLOGY

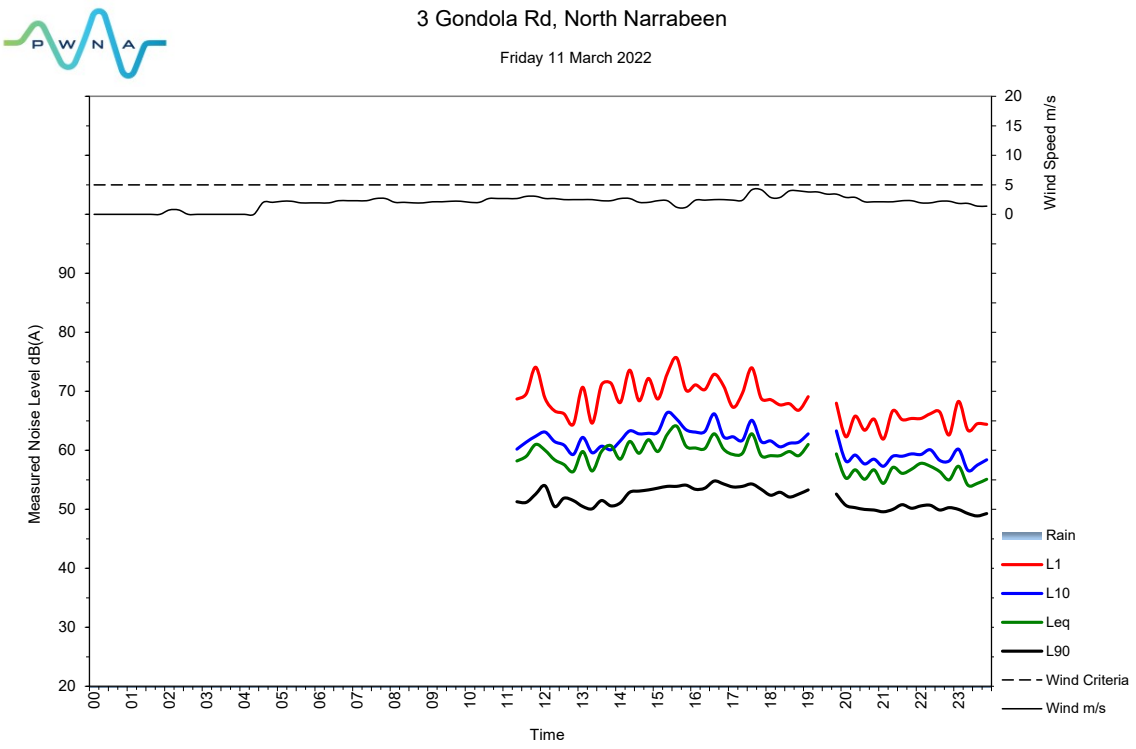
The following is a brief description of the acoustic terminology used in this report.

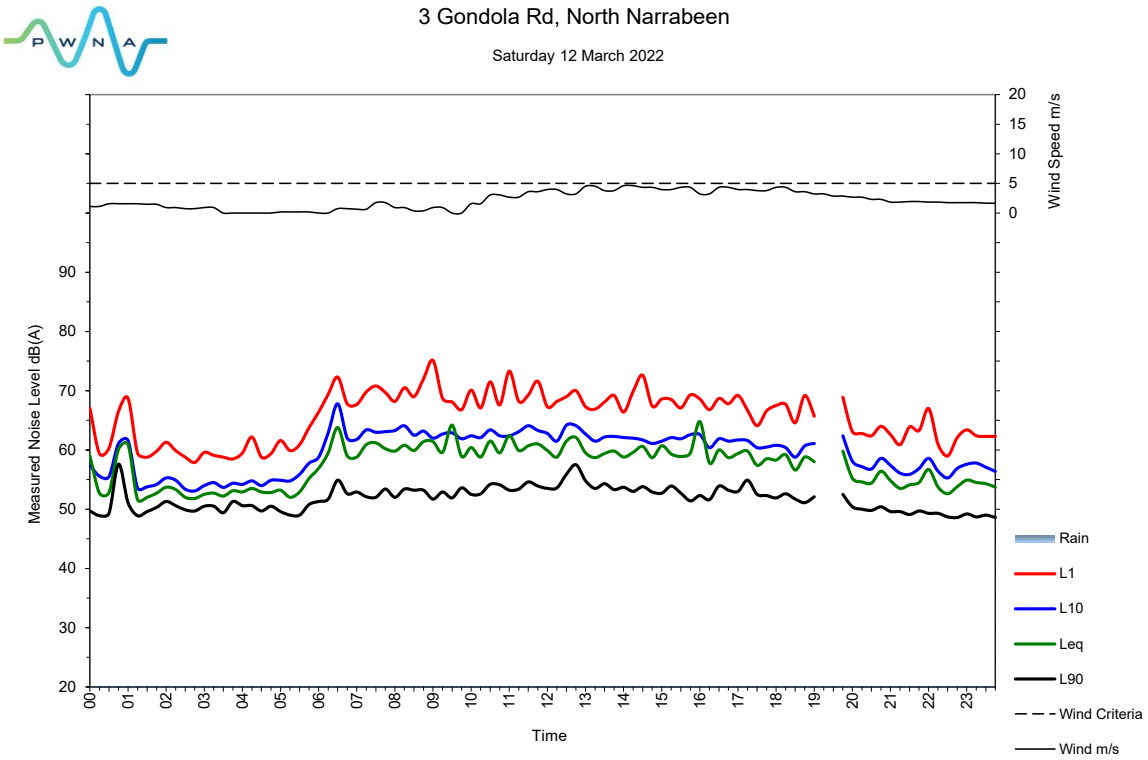
Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting 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:
	0 dB(A) Threshold of human hearing 30 dB(A) A quiet country park 40 dB(A) Whisper in a library 50 dB(A) Open office space 70 dB(A) Inside a car on a freeway 80 dB(A) Outboard motor 90 dB(A) Heavy truck pass-by 100 dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115 dB(A) Limit of sound permitted in industry 120 dB(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.

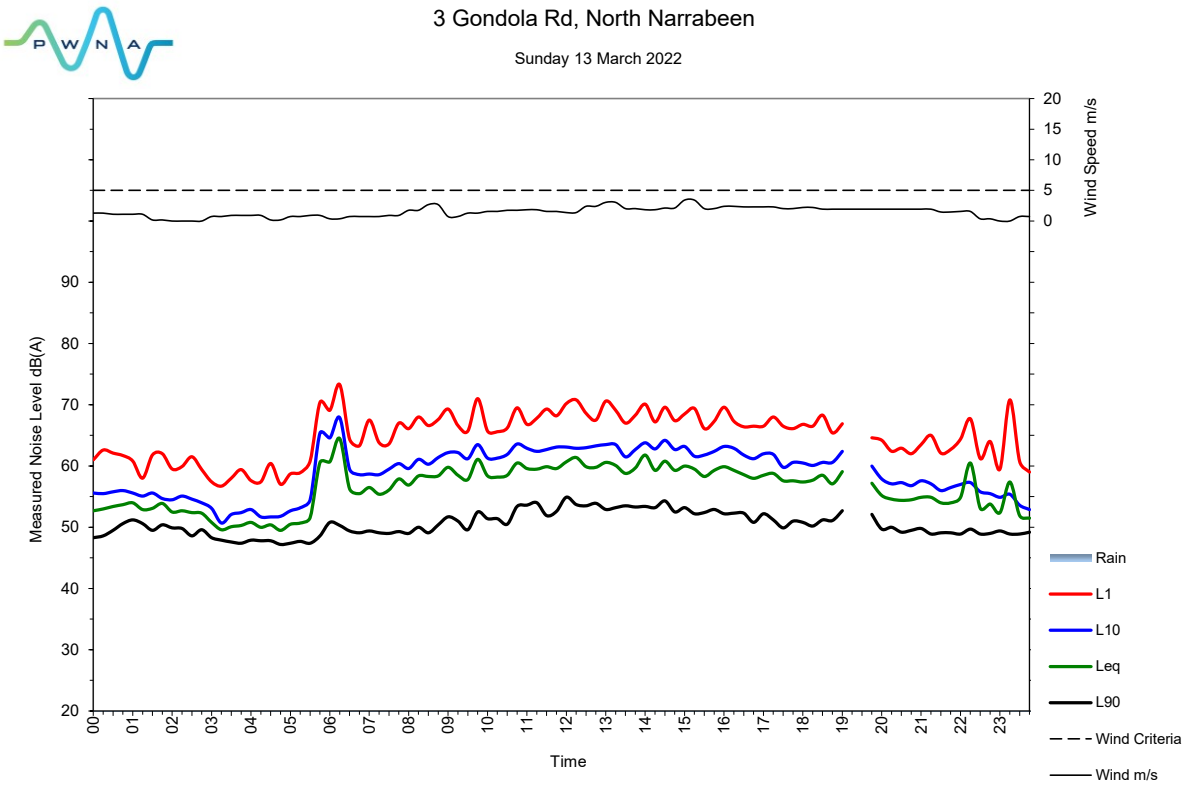
Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
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.

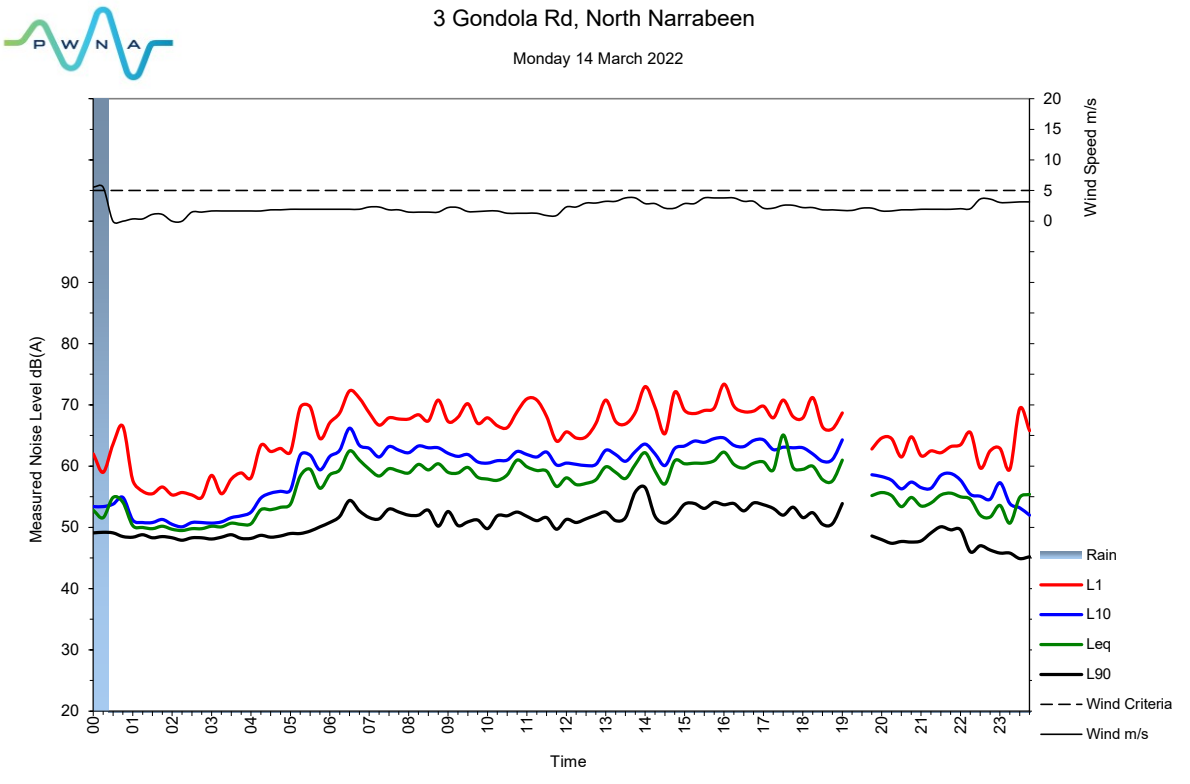
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

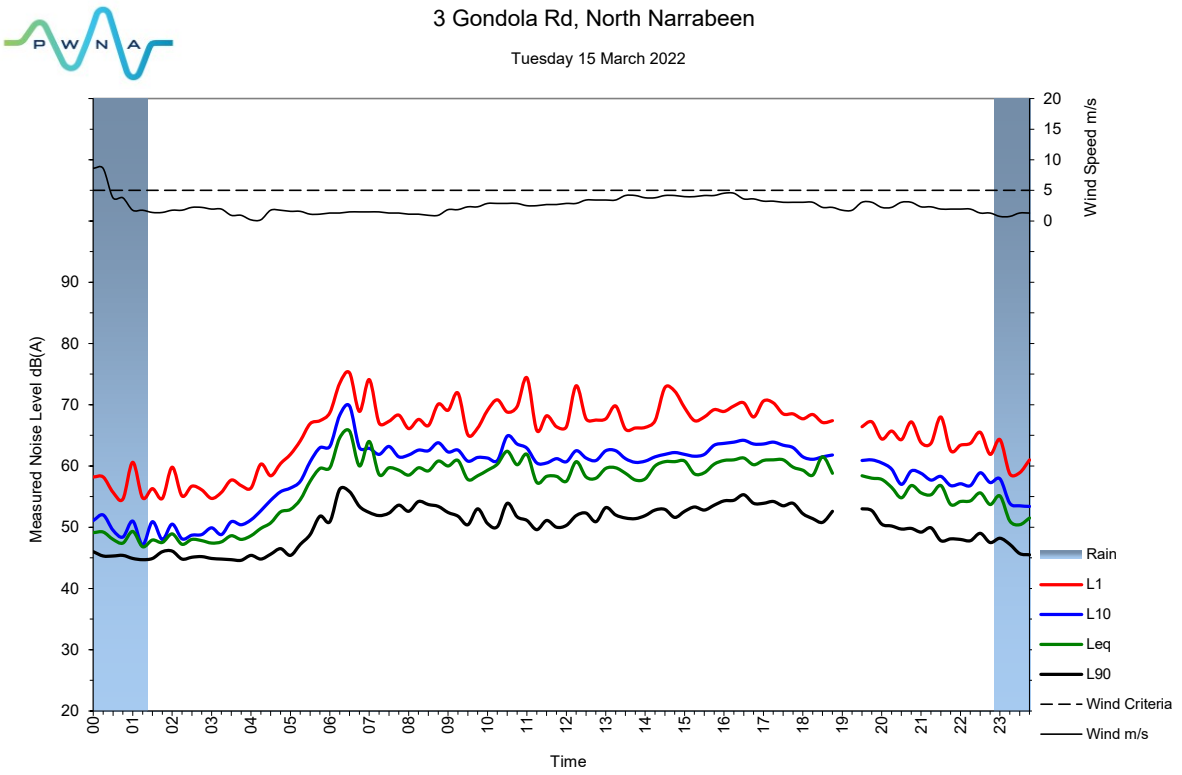
APPENDIX B: UNATTENDED NOISE MEASUREMENTS

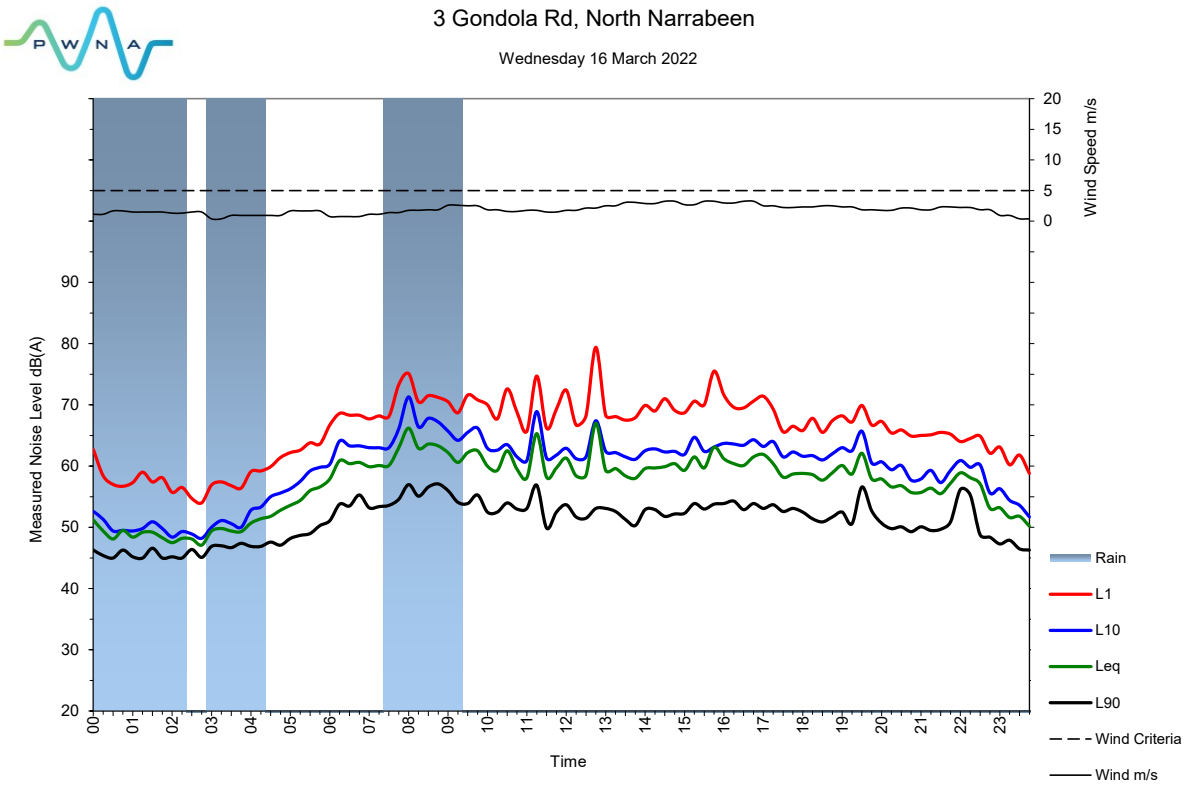


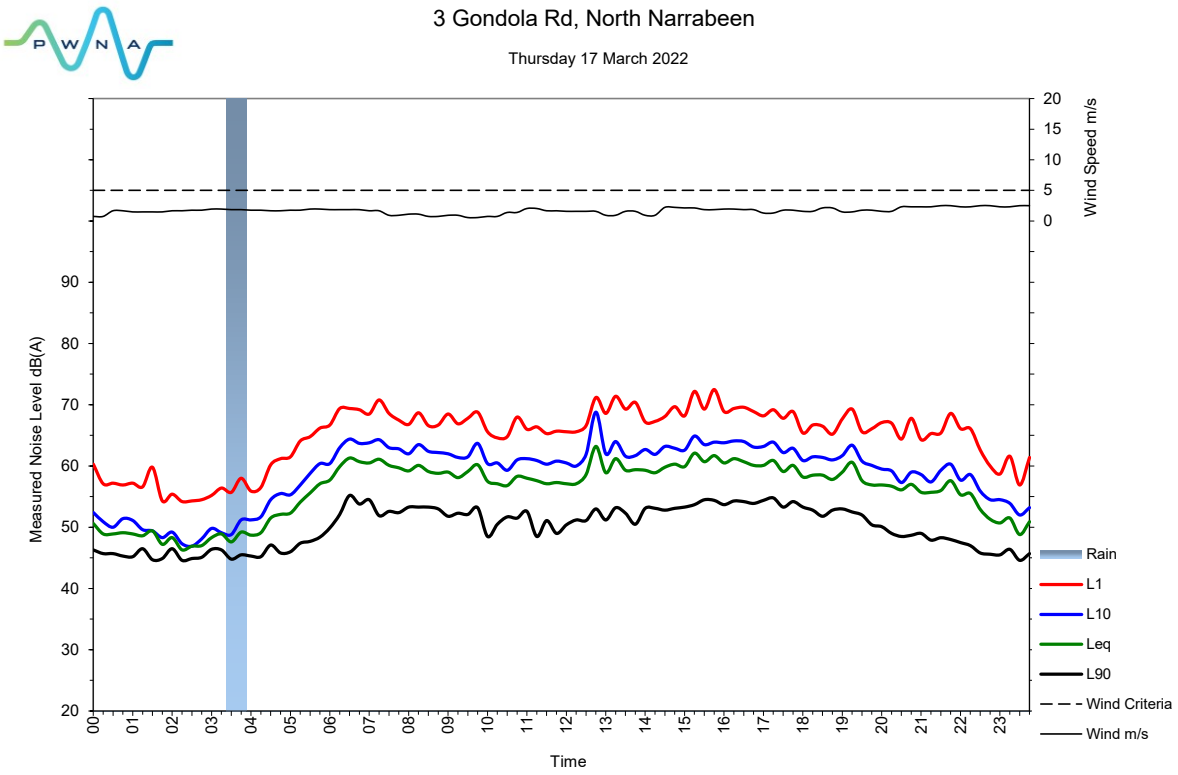


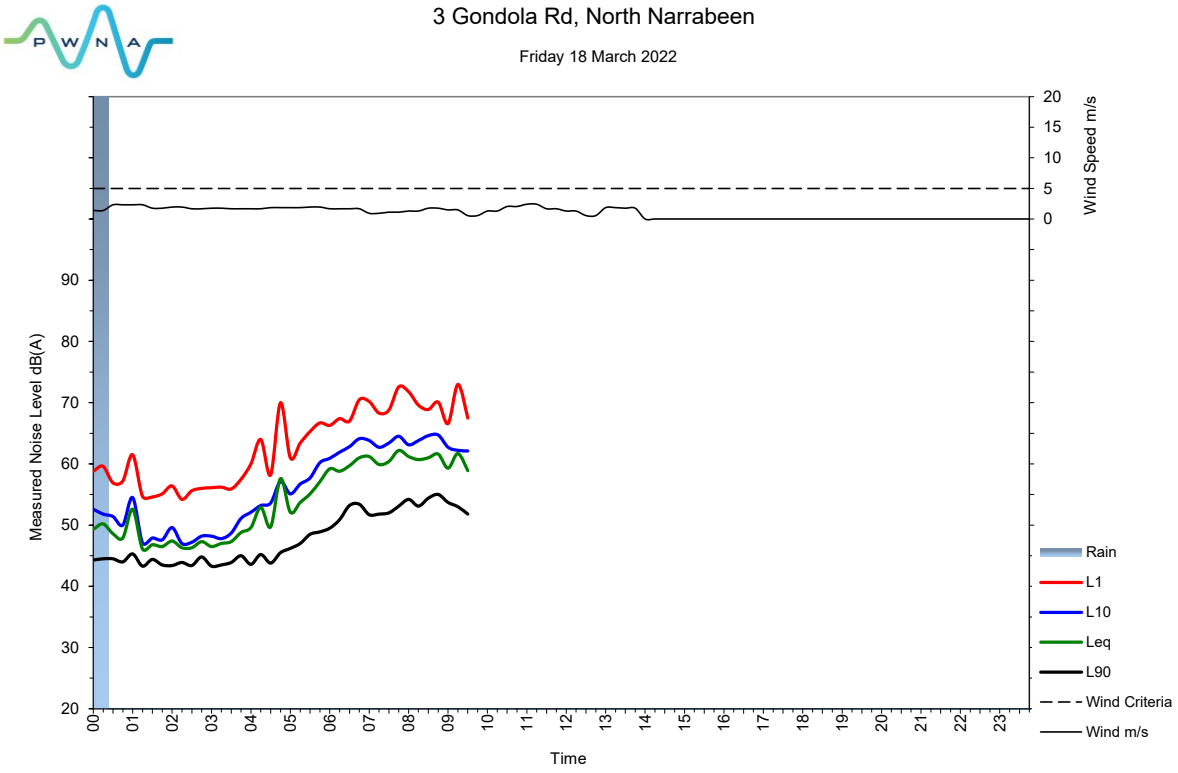

3 Gondola Rd, North Narrabeen
Sunday 13 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


3 Gondola Rd, North Narrabeen
Monday 14 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


3 Gondola Rd, North Narrabeen
Tuesday 15 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


3 Gondola Rd, North Narrabeen
Wednesday 16 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


3 Gondola Rd, North Narrabeen
Thursday 17 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


3 Gondola Rd, North Narrabeen
Friday 18 March 2022
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s