

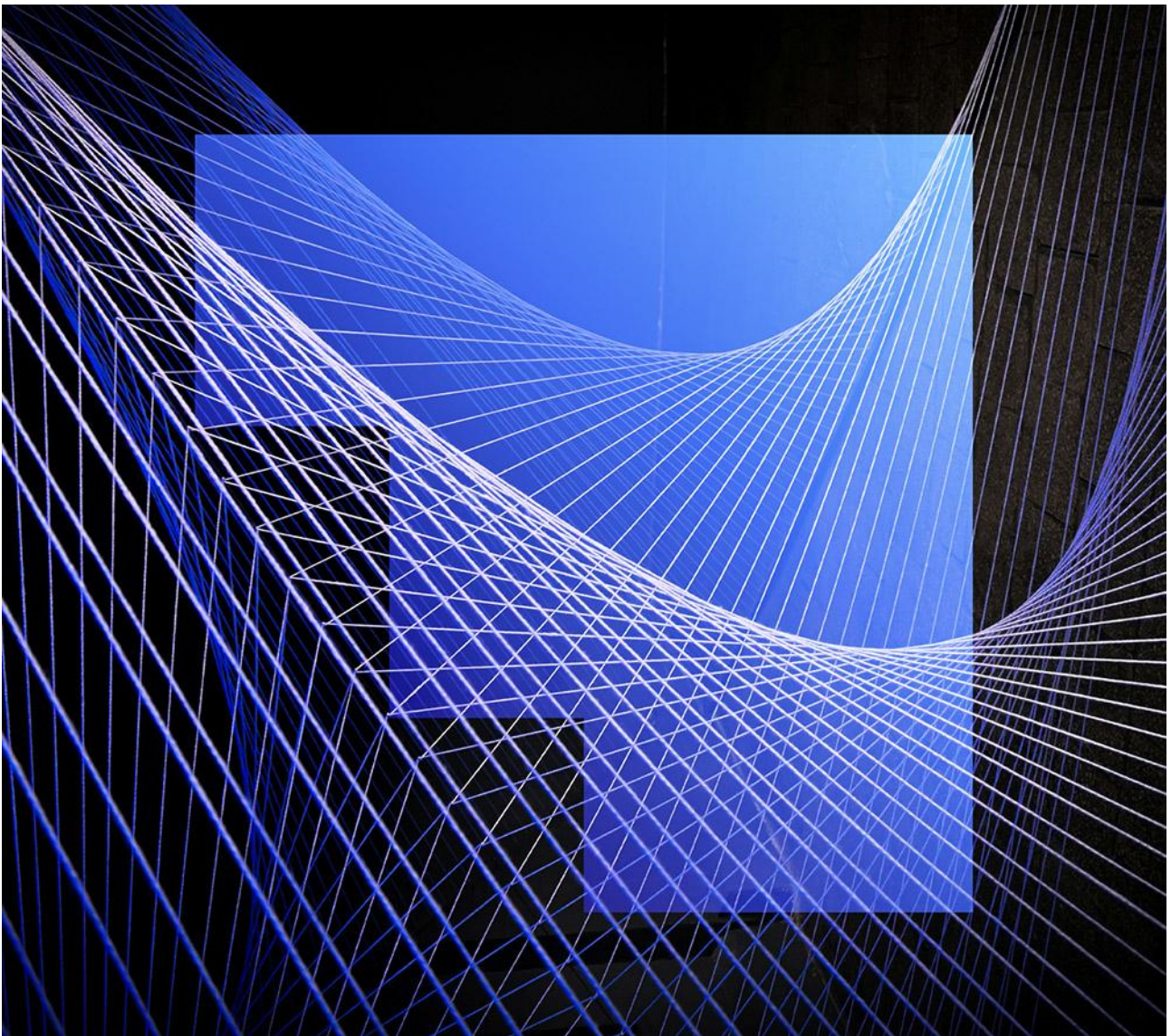
New Primary School in Worrigee

Noise and Vibration Impact Assessment

Revision No: P5

LCE104682

17 March 2026



Document Register

Activity: New Primary School in Worrigee
Document No: LCE104682-009

Revision	Description	Date Issued	Author	Reviewed
P1	Draft issue	16/01/2026	MA	PD
P2	Updated operational impact assessment	28/01/2026	MA	PD
P3	Final Issue	13/02/2026	MA	PD
P4	Updated preamble	17/02/2026	MA	PD
P5	Updated preamble	17/03/2026	MA	PD

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1. Introduction

This Noise and Vibration Impact Assessment (NVIA) has been prepared to accompany a Review of Environmental Factors (REF) for the Department of Education (the department) for the construction and operation of a New Primary School in Worrigee (the activity) under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and *State Environmental Planning Policy (Transport and Infrastructure) 2021* (TI SEPP).

This document has been prepared in accordance with the *Guidelines for Division 5.1 assessments* (DPHI, December 2025) (the Guidelines). This report examines and takes into account the relevant environmental factors in the Guidelines and Section 170 and Section 171 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) as outlined in **Table 1**.

Environmental Factor	Division Factors for school developments Guidelines for Division 5.1 assessments Consideration of environmental factors for health services facilities and schools Addendum	Response	Report Section
a) the environmental impact on the community	(a1) Impact during construction – such as noise, vibration, traffic, construction vehicle routes, access and parking, pollution/dust, water and stormwater flow, sediment and run-off, waste removal, servicing arrangements, bushfire, flooding, contamination, other construction occurring in the area. (a2) impact post-construction (including from any development, activity, public-address systems and sirens, signage, events, hours of operation, or out of hours use of facilities, helicopter facilities, emergency facilities) (a4) other environmental impacts (social, economic or cultural) on the community not mentioned above	Construction noise and vibration impact would be assessed, with mitigation strategies implemented where reasonable and feasible to mitigate impact to the community. Post-construction impact (operational impact) would be assessed and where required, provide mitigation strategies for the ongoing use of the Activity.	Construction Impact – Section 5 Operational Impact – Section 6 Cumulative impact with other nearby Activities – Section 8
(d) reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	(d1) impacts onto adjoining properties and public spaces (particularly in residential areas) such as lighting impacts and light spill, acoustic, visual privacy, noise and vibration (including from helicopters and ambulances), visual amenity, solar access, view loss and view sharing, vistas, overshadowing, local character, streetscape, weather factors such as wind impacts	The construction and ongoing operation would be designed and managed to ensure that the aesthetic, recreational, scientific and overall environmental	Construction Impact – Section 5 Operational Impact – Section 6 Cumulative impact with other nearby

Environmental Factor	Division Factors for school developments Guidelines for Division 5.1 assessments Consideration of environmental factors for health services facilities and schools Addendum	Response	Report Section
	the above should be considered from any proposed development or activity on the development site, public-address system, ambulance siren, flashing signage, event, hours of operation, or out of hours use of school facility, helicopter facility, emergency facility, research centre where hazardous material is being used or stored and any potential incident, etc. (d3) impacts on other aesthetic, recreational, scientific or other environmental quality or value of the locality not mentioned above or in (a) and the cumulative impacts	quality and value of the locality are preserved and not unreasonably With noise and vibration mitigation measures properly implemented, the environmental quality and value of the locality may increase due to the development.	Activities – Section 8
(l) pollution of the environment	(l1) any pollution during construction and post construction e.g. air (including odours and greenhouse gases); water (including runoff patterns, flooding/tidal regimes, water quality health); soil (including contamination, erosion, instability risks); noise and vibration (including consideration of sensitive receptors); light pollution; waste, including hazardous waste	Noise and vibration sensitive receivers would be identified as part of the NVIA with assessment, and mitigation strategies provided in order to minimise impact to the environment.	Noise measurement and identification of sensitive receivers – Section 3 Construction Impact – Section 0 Operational Impact – Section 6 Cumulative impact with other nearby Activities – Section 8

Table 1 - Summary of Relevant Section of the Part 5 Guidelines and EP&A Regulation

The purpose of this document is to assess the preliminary potential environmental noise impact of the Activity in accordance with the relevant legislative requirements, including the NSW EPA's Interim Construction Noise Guideline (ICNG) and Noise Policy for Industry (NPfI).

This report assesses the potential construction and operational noise impacts from the Activity. Potential operational noise impact includes a number of noise generating activities including external mechanical plant/equipment, public address (PA) speakers, and the use of outdoor play areas.

The construction noise and vibration assessment includes a number of construction activities deemed typical for an Activity of this type and size.

This report addresses and provides the noise criteria determined for environmental noise emission based on in-situ noise measurements. Additionally, this report provides criteria for the requirements given in the ICNG based on these same on-site measurements.

The assessment has been undertaken with reference to the concept design stage architectural drawings provided by Bennett and Trimble, as cited and referenced in this report.

1.1 Activity Description

The activity is for the construction and operation of a New Primary School in Worrigee under Chapter 2 and Chapter 3 of TI SEPP comprising:

- permanent classroom buildings including a support learning unit
- hall
- canteen
- covered outdoor learning area
- library
- administration buildings/offices
- sports field
- waste storage facility
- landscaping
- car parking
- public domain works
- infrastructure upgrades
- a capacity of 582 students

The proposed activity does not include the new public preschool or roundabout. The new public preschool is subject to a separate planning pathway and environmental assessment. The roundabout is to be delivered by Council. **Figure 1** shows an indicative site plan and distinguishes the indicative extent of the proposed activity in relation to the new public preschool and roundabout.

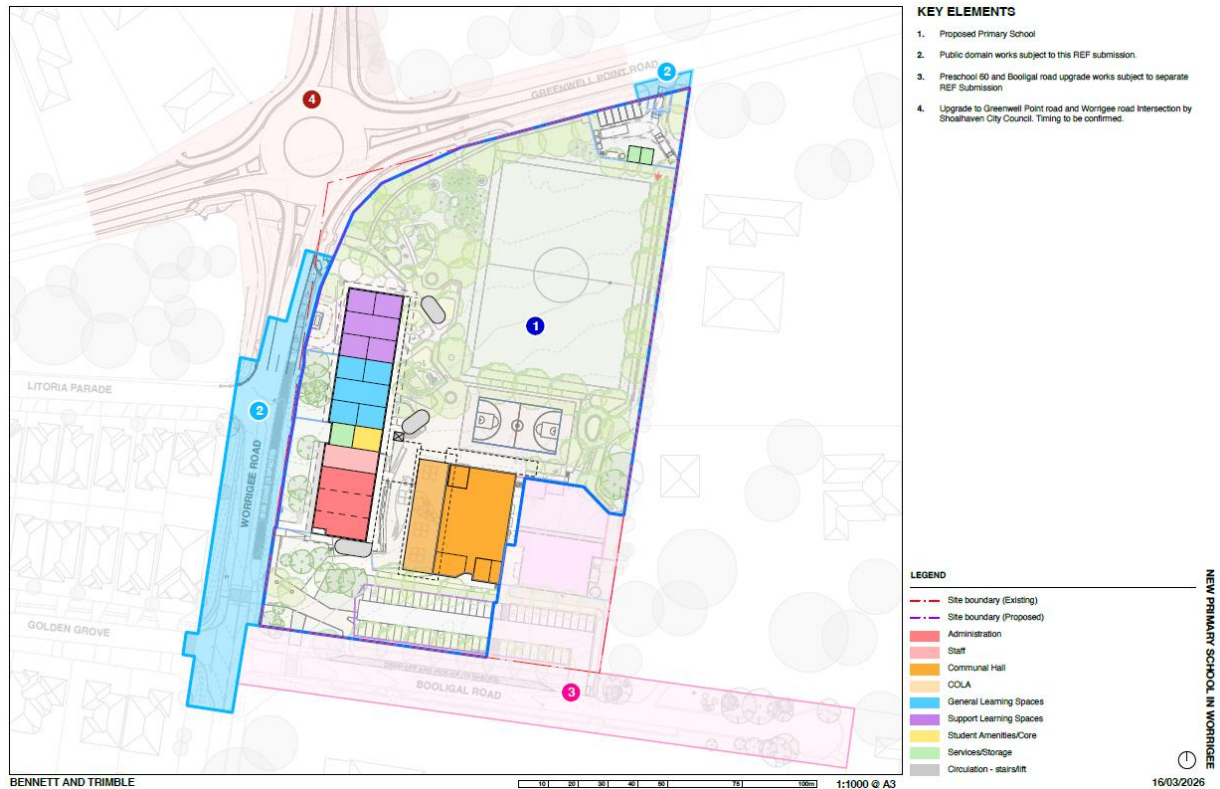


Figure 1 – Indicative Site Plan

1.2 Activity Site

The site is known as 9 Worrigee Road, Worrigee. The site has a frontage of 125.23m to Greenwell Point Road, 149.87m to Worrigee Road and 114.89m to Booligal Road (including the preschool frontage). The site is legally described as Lot 1 in Deposited Plan 576975 and is 2 hectares (by title). Off-site works are also proposed in the adjacent road reserves. **Figure 2** provides an aerial photograph of the site.



Figure 2 - Aerial photograph

The current architectural design is documented in drawings prepared by Bennet and Trimble Architects, with the associated drawing references detailed in **Table 2**.

Author	Reference	Name	Date
Bennet and Trimble Architects	A-1001	GA Plan – Ground Floor	16/03/2026
	A-1002	GA Plan – Level 1	16/03/2026
	A-1003	GA Plan – Level 2	16/03/2026
	A-1004	GA Plan – Roof	16/03/2026
	A-0103	Site Plan - Ground	16/03/2026
	A-0104	Site Plan – Level 1	16/03/2026
	A-0105	Site Plan – Level 2	16/03/2026
	A-0106	Site Plan – Roof	16/03/2026

Table 2 - Drawing references

All calculations and recommendations provided in this report are based on and referenced to the Rev C architectural plans, dated 16th March 2026.

2. The Site/Proposal

Existing ambient noise conditions at the site and surrounding area are primarily influenced by typical environmental sources, including localised traffic and domestic noise sources.

Noise logger locations in relation to the site boundary are provided in **Figure 3**.



Figure 3 - Aerial photo of the subject site and noise logging locations (Vexcel)

2.1 New Primary School in Worrigee Hours of Operation

The standard hours of operation for New Primary School in Worrigee are school days Monday to Friday understood to be as follows:

- Standard hours of operation: 7:00 am – 6:00 pm (including before and after school care).
- School bell times: 8:45 am – 2:50 pm.
- No/ or limited activities during the evening period from 6:00 pm to 10:00 pm.
- No activities during the night period from 10:00 pm to 7:00 am.
- Outside of school hours care (OSHC): 7:00 am – 8:50 am (Before school), 3:00 pm – 6:00 pm (After school).
- School teaching time: 9:00 am – 3:00 pm.

3. Noise Measurements

3.1 Unattended Noise Logging Survey

Outdoor background noise and traffic noise levels were measured using two sound level meter data logger positioned fronting Greenwell Point Road towards the northern part of the site, and along Worrigee Road along the south-western boundary of the site. Both microphones were located approximately 1.5 metres above the natural ground level.

Two Rion NL-43 (S/N 01242266 and 01242267) noise loggers were used to capture both traffic and ambient noise levels in the area over a continuous monitoring period. The measured data informed the assessment of background noise levels and road traffic noise applicable to the Activity. The location of the noise loggers is shown in **Figure 3**.

The instrument was configured to record linear, A-weighted, and C-weighted 'Fast' time-weighted sound pressure levels. Relevant acoustic metrics were derived from these measurements. Noise levels were logged at 15-minute intervals over the entire monitoring period, which extended from Thursday 11th December to Monday 22nd December 2025.

The instruments were calibrated before and after the measurements, with no calibration drift exceeding ± 0.5 dB observed.

Weather conditions during the survey were reviewed using records from the Jervis Bay Airfield Weather Station (ID 068264). Periods of inclement weather, such as rain and/or high winds, were excluded from the dataset in accordance with the NSW EPA's Noise Policy for Industry.

An additional noise logger location was included to determine a more specific noise criteria based on Pulse White Noise Acoustics report *PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0*. Details of the Worrigee Public Preschool noise logging survey can be found in the corresponding REF report. Relevant details have been extracted in this NVIA.

Attended measurements were conducted at each noise logger location to substantiate the noise logger data and provide comments on the existing acoustic soundscape of the area.

A summary of the noise logger results is provided in **Table 3**.

Location	Period, T	Ambient noise level, L_{Aeq}	Rating background level, LA_{90}	Traffic noise level $L_{Aeq, Period}$
NL1 – Worrigee Road	Day	59	48	58
	Evening	56	45	
	Night	48	36	48
NL2 – Greenwell Point Road	Day	59	52	58
	Evening	55	47	
	Night	49	38	49
Worrigee Public Preschool REF Noise Logger	Day	54	39	-
	Evening	50	38	
	Night	47	31	-
The NSW EPA Noise Policy (NPfI) refers to: Daytime: 7am – 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays. Evening: 6pm – 10pm Monday to Sunday				

Night: 10pm – 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

The Roads and Maritime Services (RMS) refers to:

Daytime: 7am – 10pm seven days per week

Night: 10pm – 7am seven days per week

Table 3 – Summary of noise logger results [dB]

Unattended logger graphs and notes on the existing noise environment at each logger location are attached as an **Appendix A** of this report.

3.2 Attended Noise Measurements

Attended noise measurements were undertaken at each of the noise logger locations on Monday 22nd December 2025. Existing noise environment and each noise source was measured over a period considered representative of typical operational conditions. Weather during the monitoring was slightly windy, but of suitable conditions for an environmental noise assessment.

Measurements were carried out using an NtI XL3 sound level meter (S/N: A3A-01662-F0). This is a Type 1 precision instrument, suitable for both laboratory and field applications. The instrument was calibrated before and after the measurements, with no calibration drift exceeding ± 0.5 dB observed.

All acoustic equipment used during the noise survey complied with the requirements of AS IEC 61672.1-2004 – *Electroacoustics – Sound Level Meters – Specifications*. Furthermore, all instruments were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period, having been calibrated within the last two years.

Table 4 presents the attended noise measurements of existing noise sources at the site.

Location	Measured noise level, dB(A)				Comments
	Leq	L10	Lmax	L90	
NL1	60	64	74	52	Car pass-bys dominant noise source. Leaves rustling, light winds, birds chirping. Car pass-by 68 dB(A). Dog roaming around site.
NL2	58	61	65	52	Consistent traffic, mostly light vehicles, some heavy. Light winds, cicadas, birds chirping. Car pass-by 61 dB(A). Truck pass-by 73 dB(A)

Table 4 - Attended noise measurements

3.3 Noise Catchment Areas (NCAs)

The area along and around the project has been divided into two distinct NCAs as shown in **Figure 4**. The NCAs have been identified based on the similarity of the existing noise environment for the sensitive receivers in the NCA, and the unattended background noise monitoring results (refer to **Section 3.1**).

Several receivers within NCA have had a more stringent noise criteria applied based on noise logging conducted for an adjoining project, Worrigee Public Preschool. This noise data has been obtained from Pulse White Noise Acoustics report *PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0* with project trigger levels reflected in the operational noise assessment for relevant receivers provided in Section 6.3.



Figure 4 - Aerial photo of the subject site with NCAs

4. Noise Criteria

4.1 Industrial Noise Emission – EPA’s NPfl

The NSW EPA’s Noise Policy for Industry (NPfl) outlines criteria for assessing potential noise impacts from industrial activities and provides a framework for identifying feasible and reasonable noise mitigation measures. This policy applies to noise emissions generated by mechanical plant and equipment and other operational noise sources that do not fit under a different regulatory framework.

The assessment of industrial noise involves two components:

- Managing intrusive noise impacts on residential receivers in the short term
- Protecting long-term noise amenity for residential and other sensitive land uses

4.1.1 Intrusive Noise Impacts

An industrial noise source is generally considered to be intrusive if its $L_{Aeq,15min}$ level exceeds the background noise level or Rated Background Level (RBL) by more than 5 dB. This intrusiveness criterion applies only to residential receivers; for all other land use types, only amenity noise levels are considered relevant.

The RBLs and intrusive noise criteria for applicable receivers are provided in **Table 5**.

Noise Logger Location	Period ^{1,2,3}	RBL (LA90), dB	Intrusive criteria (RBL + 5), dB(A)
NL1	Day	48	53
	Evening	45	50
	Night	36	41
NL2	Day	52	57
	Evening	47	52
	Night	38	43

Table 5 – Project intrusive criteria

Notes:

1. Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays
2. Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays
3. Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

4.1.2 Noise Amenity

To prevent gradual increases in overall noise levels resulting from reliance on the intrusiveness criterion alone, the cumulative ambient noise from all industrial sources should remain below the amenity levels specified in the Noise Policy for Industry (NPfl) for the relevant land use category.

The project amenity noise level is generally determined by subtracting 5 dB(A) from the recommended amenity noise level. However, if cumulative industrial noise is not a relevant factor at a given receiver location, such as in areas where no other existing or future industrial sources are expected, the recommended amenity level from the NPfl is applied directly as the project amenity noise level.

In some cases, transport noise, particularly road traffic, may be high enough to render industrial noise effectively inaudible, even if the L_{Aeq} level from the industrial source exceeds the project amenity level. When the following conditions are met, the project amenity noise level is adjusted to $L_{Aeq,traffic}$ minus 15 dB:

- Road traffic noise is the dominant environmental noise source.
- Existing noise levels are at least 10 dB(A) above the recommended amenity noise level
- It is highly unlikely that road traffic noise levels will decrease in the foreseeable future.

To align this adjusted value with a 15-minute averaging period, 3 dB(A) is added to determine the final project amenity level.

Receiver	Period ^{1,2,3}	Noise amenity area	Recommended amenity noise level, dB(A)
NL1	Day	Suburban	53
	Evening		43
	Night		38
NL2	Day	Suburban	53
	Evening		43
	Night		38
School Classroom ⁴	Noisiest one-hour period when in use	-	45
Active recreation area	When in use	-	50

Table 6 - Project amenity criteria

Notes:

1. Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays
2. Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays
3. Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays
4. External noise levels are based upon a 10 dB reduction from outside to inside through an open window

4.1.3 Summary of Project Specific Noise Criteria

The project specific noise criteria applies to each residential receiver represents the lower of the intrusive and amenity criteria for each given receiver. For non-residential receivers, the amenity criteria is adopted.

Receiver	Period ^{1,2,3}	Intrusive Criteria $L_{Aeq,(period)}$ dB	Amenity Criteria $L_{Aeq,(period)}$ dB	Project specific noise criteria $L_{Aeq,(period)}$ dB
NL1 (NCA1)	Day	53	53	53
	Evening	50	43	43
	Night	41	38	38

Receiver	Period ^{1,2,3}	Intrusive Criteria $L_{Aeq,(period)}$ dB	Amenity Criteria $L_{Aeq,(period)}$ dB	Project specific noise criteria $L_{Aeq,(period)}$ dB
NL2 (NCA2)	Day	57	53	53
	Evening	52	43	43
	Night	43	38	38
Shielded Receivers ⁴	Day	39	53	44

Table 7 - Project noise trigger levels

Notes:

1. Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays
2. Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays
3. Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays
4. A lower trigger level has been adopted for these receivers based on noise logging conducted for Worrigee Public Preschool, referenced in PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0

4.1.4 Tonality and Modifying Factors

Noise sources that exhibit specific characteristics, such as tonality, intermittency, irregularity, or dominant low-frequency content, are known to cause greater annoyance than other types of noise with the same measured level. Fact Sheet C of the Noise Policy for Industry (NPfI) outlines penalty adjustments that should be applied for these annoying characteristics.

These corrections are determined with consideration of both the contribution noise level from the source, as measured at the receiver location, and the nature and acoustic characteristics of the noise source itself.

Table C1 from Factsheet C of the NPfI has been reproduced as **Table 8**.

Factor	Assessment/ measurements	When to apply	Correction	Comments
Tonal	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007– Annex D)	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz	5 dB ^{2,3}	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g., where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.

Factor	Assessment/ measurements	When to apply	Correction	Comments
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10-160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over the same time period. A correction is to be applied where the C minus A level is 15 dB or more and: where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period, and a 2 dB(A) positive adjustment applies for the daytime period.	2 or 5 dB ²	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalanced spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for the UK Department for Environment, Food & Rural Affairs (DEFRA) fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Table 8 - Modifying factor corrections (NPfI – Factsheet C, Table C1)

Notes:

1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range, that is, at or below 160 Hz.

The low frequency noise thresholds from the NPfI are provided below:

One-third octave $L_{Zeq,15min}$ threshold level													
Freq (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Table 9 - One-third octave low-frequency noise threshold (NPfI – Factsheet C, Table C2)

4.1.5 Maximum Noise Level Assessment

The Noise Policy for Industry (NPfI) requires that the potential for sleep disturbance be evaluated by examining maximum noise level events occurring during the night-time period. A detailed assessment of these events is necessary where predicted or measured night-time noise levels at a residential location exceed either of the following thresholds:

- $L_{Aeq,15min}$ of 40 dB(A) or the existing Rating Background Level (RBL) plus 5 dB(A), whichever is higher, and/or
- L_{AFmax} of 52 dB(A) or the existing RBL plus 15 dB(A), whichever is higher.

As the Activity is not proposed to operate during the night-time period, a maximum noise level sleep disturbance assessment would not be required.

4.2 Outdoor Play Area Noise

In accordance with Section 3.2.1 of the Association of Australasian Acoustical Consultants (AAAC) Guideline, a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (i.e. background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).

Noise Catchment Area	Period ^{1,2,3}	RBL (LA90), dB	Up to 4 hours (total) per day criteria (RBL + 10), dB(A)	More than 4 hours (total) per day criteria (RBL + 5), dB(A)
NCA1	Day	48	58	53
NCA2	Day	52	62	57
Shielded Receivers ⁴	Day	39	49	44

Table 10 - AAAC Guideline Outdoor Play (Area/s) Noise Criteria

Notes:

1. Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays
2. Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays
3. Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays
4. A lower trigger level has been adopted for these receivers based on noise logging conducted for Worrigee Public Preschool, referenced in PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0

4.3 Operational Road Traffic Noise

In accordance with the NSW Road Noise Policy (RNP), to evaluate potential noise impacts from increased operational traffic, an initial screening assessment should determine whether existing road traffic noise levels are expected to rise by more than 2 dB(A). If the predicted increase is 2 dB(A) or less, no further analysis is required.

However, if the increase exceeds 2 dB(A) and the resulting road traffic noise level surpasses the relevant criterion for the specific road category, noise mitigation measures should be considered for the affected receivers. The RNP does not require assessment of traffic noise impacts on commercial or industrial properties.

4.4 Operational Vibration

Operational vibration impacts are not anticipated to be a concern for the Activity, as the operation does not include any vibration-generating processes likely to produce significant vibration levels at nearby sensitive receivers or adjoining properties. As such, a detailed assessment of operational vibration is not required.

4.5 Construction Noise – ICNG

Construction noise in New South Wales is assessed in accordance with the NSW Environment Protection Authority's (EPA) Interim Construction Noise Guideline (ICNG), originally developed by the former Department of Environment & Climate Change.

The ICNG provides a framework for managing construction noise from projects regulated by the EPA and offers guidance for other authorities and stakeholders. As such, it has been adopted as the basis for this construction noise assessment.

The guideline specifies $L_{Aeq,15min}$ Noise Management Levels (NMLs) for noise-sensitive receivers. Where predicted or measured construction noise levels exceed these thresholds, the implementation of all feasible and reasonable noise mitigation measures is required. In such cases, community consultation regarding construction noise impacts must also be undertaken.

The ICNG sets out recommended standard construction hours as follows:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm
- No work is permitted on Sundays or Public Holidays

To promote construction activities during these hours, when the impact on residential amenity is typically lower, the ICNG applies less stringent NMLs for work carried out within these periods.

It is important to note that these Standard Working Hours specifically apply to residential or similar land uses. For other land use types, such as educational or recreational facilities, where sleep or evening amenity is not a concern, construction noise impacts are instead assessed relative to the operating hours of the specific land use. **Table 11** and **Table 12** provide the noise management levels for different land uses during standard hours and out of hours.

Time of day	Management level $L_{Aeq,15min}$ 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 $L_{Aeq,15min}$ 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 a 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:

Time of day	Management level $L_{Aeq,15min}$ ¹	How to apply
		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. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Table 11 - ICNG noise management levels for residential land uses

Notes:

- Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m 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.

Land use ¹	Management level, $L_{eq,15min}$ (applies when properties are being used)
Classrooms at school and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas	External noise level 65 dB(A)
Passive recreation areas	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses

Table 12 - ICNG noise at sensitive land uses (other than residences)

Notes:

- For mixed-use receivers, the more stringent NML of the land uses should be applied.

4.5.1 Construction Noise Management Levels

Project-specific Construction Noise Management Levels (NMLs) for both standard and non-standard construction hours are summarised in **Table 13**.

These NMLs have been determined in accordance with the ICNG, considering potentially noise impacted identified residential dwellings and other noise-sensitive non-residential receptors. NMLs for all time periods are provided for completeness, even though construction activities are expected to be confined to the ICNG's recommended standard working hours.

For residential receivers, the NMLs have been calculated based on the Rating Background Level (RBL) values detailed in this report.

NCA	Noise Logger Location	Location	Receiver type	Construction noise management levels, $L_{eq,15min}$, dB(A)				Highly Noise Affected, $L_{eq,15min}$, dB(A)
				Standard hours	Out of hours			
				Day	Day	Evening	Night	
NCA1	NL1	South	Residential	58	53	-	-	75
			Commercial ¹	70	-	-	-	-
NCA2	NL2	North	Residential	62	57	-	-	75
			Commercial ¹	70	-	-	-	-

Table 13 - Project specific construction noise management levels

Notes:

1. When the facility is operational and in use.

As construction activities are restricted to the standard daytime period, noise impacts will be assessed solely against the daytime noise management levels.

4.6 Construction Vibration

The relevant standards and guidelines typically utilised for the assessment of construction vibration are provided below:

Cosmetic and structural damage

- Heritage structures – German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures
- Non-heritage structures – Evaluation and Measurement for Vibration in Buildings Part 2, (BS 7385:Part 2-1993)

Human comfort (annoyance)

- Assessing Vibration: A Technical Guideline (Based on BS 6472:1992 – “Evaluation of human exposure to vibration in buildings (1-80 Hz))

Excessive levels of vibration can potentially cause structural damage and adversely affect human comfort. The nature of vibration and its impacts are typically categorised into three types:

- **Continuous vibration:** Occurs without interruption over a defined period and typically originates from sources such as operating machinery or ongoing construction processes.

- **Impulsive vibration:** Characterised by a sudden peak followed by rapid decay. It generally lasts less than two seconds and occurs no more than three times within an assessment period. Typical sources include the occasional dropping of heavy items or brief loading activities.
- **Intermittent vibration:** Involves periodic occurrences of either continuous or impulsive vibration, or continuous vibration with fluctuating intensity. Common examples include intermittent construction works, impact pile driving, or jackhammer use.

4.6.1 Cosmetic and Structural Damage

According to DIN 4150, exposure to vibration levels exceeding the recommended limits does not automatically result in structural damage. Vibration criteria for high sensitivity structures are based on DIN 4150, whilst criteria for commercial and residential buildings have been adopted from BS 7385.

Type of structure	< 10 Hz (at foundation)	10 Hz to 50 Hz (at foundation)	50 Hz to 100 Hz ¹ (at foundation)	Vibration at the horizontal plane of the highest floor for all frequencies
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Table 14 - DIN 4150 structural damage safe limits for building vibration

Notes:

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values.

Type of structure	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures	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

Type of structure	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential or light commercial type buildings		

Table 15 - BS 7385-2 transient vibration guide values for cosmetic damage

4.6.2 Human Comfort – Intermittent Vibration

The assessment of intermittent vibration in accordance with Assessing Vibration: A Technical Guideline is based on Vibration Dose Values (VDVs), which quantify the cumulative vibration energy experienced over designated daytime and night-time periods.

Recommended maximum and preferred VDVs for vibration from construction activities are provided in **Table 16**. These criteria are intended to reflect the likelihood of human annoyance resulting from exposure to intermittent vibration throughout the assessment period.

Location	Daytime (m/s ^{1.75})		Night (m/s ^{1.75})	
	Preferred	Maximum	Preferred	Maximum
Critical Areas ¹	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Table 16 - Preferred and maximum vibration dose values for intermittent vibration

Notes:

1. Examples include operating theatres and precision laboratories where sensitive operations may occur.

4.6.3 Human Comfort – Continuous and Impulsive Vibration

Acceptable levels of human exposure to continuous and impulsive vibration vary depending on the time of day and the type of activity occurring within the affected space. Assessing Vibration: A Technical Guideline outlines the preferred and maximum vibration limits for this type of exposure.

Vibration levels below the preferred values are generally associated with a low likelihood of adverse reaction or discomfort among occupants. However, levels exceeding the preferred thresholds may still be acceptable in certain circumstances, particularly when the exposure is temporary, infrequent, or of short duration. In such cases, vibration impacts may be managed through consultation and negotiation with the relevant authority or the affected community.

Location	Assessment period	Preferred	Maximum
Continuous vibration			
Residences	Day	0.28	0.56
	Night	0.20	0.40
Offices, schools, educational institutions, and places of worship	When in use	0.56	1.10
Impulsive vibration			
Residences	Day	8.60	17.0
	Night	2.80	5.60
Offices, schools, educational institutions, and places of worship	When in use	18.0	36.0

Table 17 - Peak particle velocity for continuous and impulsive vibration

5. Construction Noise and Vibration Assessment

5.1 Construction Noise Scenarios

Construction noise modelling scenarios were developed based on proposed equipment and associated sound power levels. To assess the maximum potential noise impact, the most noise generating construction equipment was assumed to be positioned at the closest point of the Activity area boundary to the nearest sensitive receiver representing a worst-case scenario.

Sound power levels for individual construction equipment (assumed), as well as the cumulative sound power level of each construction stage (scenario) and how they have been formulated are provided in **Table 18**. Sound power level data is based on those from the UK Department of Environment, Food and Rural Affairs (DEFRA) - *Update of noise database for prediction of noise on construction and open sites*. Typical overall sound power levels have been provided for each construction stage based on the highest noise generating equipment.

Stage	Construction stage	Equipment	SWL per unit, dB(A) ^{1,2}	Stage SWL, dB(A)
Phase 1	Excavation and Demolition	Excavator (tracked)	110	115
		Dump truck	105	
		Grader	113	
Phase 2	Structural Phase	Excavator (tracked)	110	113
		Dump truck	105	
		Mini piling rig (rock bolt) 250mm auger	102	
		Asphalt truck and sprayer	103	
		Concrete batching plant	108	
Phase 3	Construction & Fit-out works	Concrete saw	110	111
		Generator	101	
		Hand tools	94	

Table 18 - Construction scenarios and equipment

Notes:

1. Equipment with “annoying” characteristics (i.e impulsive, tonal etc.) must include a + 5 dB penalty as per the ICNG.

This methodology is considered reasonably conservative as it the highest noise generating equipment would not be operating concurrently for the entire construction period.

5.2 Noise Modelling Methodology

Construction noise levels at nearby sensitive receivers were predicted using SoundPLAN version 8.2, an industry-standard three-dimensional noise modelling software. The modelling utilises the CONCAWE algorithm within SoundPLAN, which is well-suited for assessing noise propagation over long distances due to its ability to account for varying atmospheric conditions that can significantly affect sound travel.

As per the relevant construction noise assessment guidelines, standard meteorological conditions were taken into account.

The noise model incorporated the following elements:

- Ground topography
- Buildings and structures
- Construction noise sources and heights
- Ground absorption
- Neutral meteorological conditions

All predicted noise levels are presented as free-field levels at a height of 1.5 metres above ground level, measured at the most affected point within a residential property boundary and within 30 metres of the nearest façade.

Assessment of each of the most noise generating equipment for each scenario has been provided to the nearest affected receivers.

For all construction scenarios, it is assumed that the most noise generating piece of equipment would be operating at the closest point of the site to each receiver, 2 metres above the natural ground level, presenting a conservative worst-case scenario. Although it is possible that all equipment within a construction scenario could be operating at any one time, this is highly unlikely and would only occur for a very short amount of time. It is unlikely that all equipment would be operating at the closest distance to the receiver, therefore the assessment of the noisiest equipment at this distance is considered reasonable and conservative.

Variations between predicted and measured noise levels are to be expected due to differences in real-time operating conditions, variability in the specific plant and equipment in use during measurement periods, and the spatial positioning of the plant within the site.

5.3 Predicted Construction Noise Levels

Worst-case predicted construction noise levels for each receiver location and associated construction phase has been provided in **Table 19**. These predictions present a worst-case scenario as all noise generating equipment would be operating along the closest boundary of the Activity site. Additionally, the presented noise levels represent the most highly affected receiver location/façade for each receiver. Construction works are only to occur during standard working hours and therefore only these hours have been assessed.

Receiver locations and noise contours for construction noise are attached as **Appendix B**.

NCA	Receiver ID ³	NML, dB(A)	Worst-case external construction noise levels $L_{Aeq, period} - dB^{1,2}$			HNA (Yes/No)
			Phase 1	Phase 2	Phase 3	
NCA 1	R1	58	86	84	58	Yes
	R2	58	83	81	60	Yes
	R3	58	68	66	62	No
	R4	58	60	58	55	No
	R5	58	58	56	54	No
	R6	58	53	51	49	No
	R7	58	64	62	51	No
	R8	58	60	58	53	No
	R9	58	58	56	52	No
	R10	58	54	52	47	No
	R11	58	55	53	47	No
	R12	58	53	51	47	No
	R13	58	53	51	42	No
	R14	58	75	73	63	No
	R15	58	63	61	48	No
	R16	58	57	55	48	No
	R17	58	53	51	45	No
	R18	58	80	78	72	Yes
	R19	58	80	78	71	Yes
	R20	58	75	73	62	No
	R21	58	67	65	58	No
	R22	58	60	58	53	No
	R23 ⁴	58	74	72	65	No
	R24	58	70	68	63	No
	R25	58	69	67	60	No
	R26	58	63	61	55	No
	R27	58	58	55	52	No
NCA 2	R28	62	66	64	56	No
	R29	62	67	65	60	No
	R30	62	61	59	50	No
	R31	62	62	60	57	No
	R32	62	60	58	55	No

NCA	Receiver ID ³	NML, dB(A)	Worst-case external construction noise levels $L_{Aeq, period} - dB^{1,2}$			HNA (Yes/No)
			Phase 1	Phase 2	Phase 3	
	R33	62	58	56	54	No
	R34	62	57	55	52	No
	R35	62	62	60	55	No
	R36	62	58	56	52	No
	R37	62	57	55	44	No
	R38	62	57	55	48	No
	R39	62	57	55	51	No
	R40	62	57	55	47	No
	R41	62	56	54	47	No
	R42	62	57	55	48	No
	R43	62	55	53	48	No
	C1	70	57	55	48	No

Table 19 - Worst-case external construction noise levels – Standard working hours

Notes:

1. Levels that exceed the respective noise management level are shown in **Bold**.
2. Levels that exceed highly affected criteria are shown in **Red**.
3. Receiver ID column represents receivers as; R (Residential) and C (Commercial).
4. Receiver assessed at upper floor level (where applicable).

Construction noise contours, calculated at 1.5 metres above ground level, are included in **Appendix B**. Noise contours are indicative only, the results in **Table 19** should be prioritised for determination of noise impact at specific receiver locations.

5.3.1 Discussion of Results

This assessment represents a worst-case scenario, based on a 15-minute period of construction activity with equipment operating at the closest point to each noise-sensitive receiver. It does not reflect typical day-to-day noise levels over the duration of the entire construction period.

Activities generating elevated noise levels, such as rock hammering (where applicable), are expected to occur only intermittently and for short durations relative to the overall construction schedule.

Table 19 shows noise levels ranging from 38 dB(A) to 86 dB(A) are predicted at the nearest residential receivers R1 to R43 during different construction stages/activities.

The potentially worst affected residential receivers for construction scenario 1 and 2 are R1 and R2 (located 10-12 metre north-east of the proposal) and R18 and R19 (located 20-22 metres south-west of the proposal), where worst case noise levels are predicted to exceed the highly noise affected level by 3-5 dB(A) at R1 and R2 and 6-11 dB(A) at R18 and R19. These same receivers would experience noise affected levels by 23-28 dB(A) at R1 and R2 and 20-22 dB(A) are R18 and R19. These exceedances are due to these residential receivers being located within the close proximity of the proposal works during phase 1 and phase 2 construction activities. The main contributors to noise levels are excavator, dump truck and grader activities for construction phase 1.

The potentially worst affected residential receivers for construction phase 3 are R18 and R19, due to these residential receivers being located within the close proximity of the proposal works. Worst case noise levels are predicted to exceed the noise affected level by 13-14 dB(A). The main contributors to noise levels are predicted to be concrete saw operations. No highly noise affected receivers were predicted for construction scenario 3.

Noise levels at the receivers are highly dependent on the number, type of plant operating and the location of mobile plant on site. The noise levels presented in **Table 19**, represent a worst-case scenario where mobile plant and equipment operate simultaneously and are located at the closest positions to the receivers within the site boundary.

This is a conservative assessment as it is expected that noise levels from the site would typically be less than these predicted levels when noise sources are either not operated simultaneously or located within other areas of the site, further from the sensitive receivers.

Noise predictions are based on minimum separation distances between plant and sensitive receivers; however, in practice, these distances will vary. For linear works, such as those progressing along a alignment or around a site, noise exposure at individual receivers will generally decrease as the distance from the active work front increases. Typical noise levels in these cases may be 5 to 10 dB(A) lower, depending on site conditions, size of the site, and the nature of the works.

According to the Interim Construction Noise Guideline (ICNG), residential receivers exposed to noise levels exceeding 75 dB(A) are considered 'highly noise affected' and warrant additional mitigation consideration.

There are four highly noise affected receivers (HNA) predicted during the construction phase 1 and phase 2. No receivers are predicted to be highly noise affected during phase 3 activities.

All four highly noise affected receivers predicted (R1, R2, R18, R19) may require additional noise mitigation consideration as per the ICNG. Additional noise mitigation measures are presented in in Section 9.

All feasible and reasonable mitigation measures should be outlined in the Construction Noise and Vibration Management Plan.

5.3.2 Concurrent Construction Activities

Although most construction activities are anticipated to occur at distinct times and locations, there remains the potential for concurrent noisy works to occur in close proximity. In such instances, a cumulative noise increase of up to 3 dB(A) above the highest predicted level for any individual construction phase may occur, assuming equal sound energy contributions from two overlapping activities at a given receiver location.

5.4 Construction Vibration

Minimum working distances for vibration-intensive construction activities are provided in Transport for NSW's (TfNSW) *Construction Noise and Vibration Guideline* (CNVG). These minimum working distances are based on relevant standards and guidelines. These distances are primarily intended to prevent cosmetic (i.e., minor and easily reparable) damage to typical structures under standard geotechnical conditions. Compliance with the minimum working distances for building damage is mandatory at all times. It should be noted that the distances are indicative and may vary depending on the specific plant used and local ground conditions.

Where vibration-intensive works are proposed within these minimum distances, vibration monitoring must be implemented by the building contractor to verify that vibration levels remain within acceptable limits.

For human comfort, the recommended distances pertain to continuous vibration exposure. As most construction activities generate intermittent vibration, exceedances of these levels may be acceptable over short durations.

Recommended minimum working distances for common vibration-intensive plant as reproduced from the CNVG are provided in **Table 20**.

Plant item	Rating/Description	Minimum working distance ¹	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Vibratory roller	< 50 kN (typically 1-2t)	5 metres	15 metres to 20 metres
	< 100 kN (typically 2-4t)	6 metres	20 metres
	< 200 kN (typically 4-6t)	12 metres	40 metres
	< 300 kN (typically 7-13t)	15 metres	100 metres
	> 300 kN (typically 13-18t)	20 metres	100 metres
	> 100 kN (> 18t)	25 metres	100 metres
Small hydraulic hammer	300 kg – 5 to 12t excavator	2 metres	7 metres
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 metres	23 metres
Large hydraulic hammer	1600 kg – 18 to 34t excavator	22 metres	73 metres
Vibratory pile driver	Sheet piles	2 metres to 20 metres	20 metres

Plant item	Rating/Description	Minimum working distance ¹	
		Cosmetic damage (BS 7385)	Human response (OH&E Vibration guideline)
Pile boring	≤ 800 mm	2 metres (nominal)	4 metres
Jackhammer	Hand held	1 metre (nominal)	2 metres
Small hydraulic hammer	300 kg – 5 to 12t excavator	2 metres	7 metres
Medium hydraulic hammer	900 kg – 12 to 18t excavator	7 metres	23 metres

Table 20 - Recommended minimum working distances for vibration intensive plant from sensitive receivers

Notes:

1. More stringent screening criteria may be applicable to heritage or other vibration sensitive structures.

If the above referenced minimum working distances are complied with, no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver.

5.5 Construction Noise and Vibration Management

5.5.1 Construction Noise and Vibration Management Plan (CNVMP)

Before commencing major construction activities, the contractor is required to prepare a Construction Noise and Vibration Management Plan (CNVMP). This document must include:

- Relevant construction noise and vibration criteria, as established in this assessment.
- Identification of surrounding noise and vibration sensitive land uses.
- A summary of key noise and vibration generating construction activities and predicted levels at nearby sensitive receivers.
- Implementation of appropriate measures during construction to minimise noise and vibration impacts, where necessary. These may include restrictions on working hours, sequencing of works, strategic siting and operation of work compounds, parking and storage areas, installation of temporary noise barriers, regular maintenance of haul routes, and careful management of the location and operation of noise and vibration generating equipment.
- Community engagement protocols, including procedures for managing complaints.
- Any other additional CNVMP requirement as captured in the REF Mitigation Measures

The CNVMP must also detail procedures for approval and mitigation for any proposed works outside standard construction hours.

5.5.2 Construction Hours

Wherever practicable, noisy construction activities should be scheduled during standard working hours, defined as:

- Monday to Friday: 7:00 am – 6:00 pm
- Saturday: 8:00 am – 1:00 pm
- No work on Sundays or public holidays

Should high-impact activities be required outside these hours, the CNVMP must outline an approval process and specify additional mitigation strategies. Particular attention will be given to works adjacent to the most noise impacted nearby residences, with consultation to determine appropriate respite periods if construction affects these receivers.

5.5.3 Site Induction Requirements

All employees, contractors and subcontractors must undergo a site induction that specifically details at a minimum:

- Approved construction working hours
- Identification of the closest sensitive receiver locations
- All applicable project specific and standard noise and vibration mitigation measures
- Conditions specified under relevant licences and statutory approvals
- Procedures for managing environmental incidents.
- Restrictions on high-noise activities
- Designated parking areas for construction personnel
- Specified locations and procedures for loading and unloading
- Site operational hours, including delivery timeframes

5.5.4 Screening

For sites with limited buffer zones between construction activities and sensitive receivers, physical screening can often be the most practical, and in some cases, the only method for mitigating noise impacts for equipment located close to ground level. The following outlines a range of screening strategies that can be considered during the planning and site layout phases to help manage construction noise emissions.

Use of temporary structures

Strategically positioning temporary structures such as site offices, material storage containers, stockpiles, or amenities buildings between high-noise work zones and noise sensitive receivers can create effective barriers. These installations can block direct line-of-sight sound transmission, leading to measurable noise reduction at receiver locations. Where such buildings are occupied, internal sound insulation may be required to safeguard the health and comfort of personnel.

Enhanced hoardings

Customised hoardings can provide improved noise attenuation, particularly when designed to integrate site facilities, such as elevated offices or storage modules. A continuous, gap-free barrier with adequate surface density will provide superior acoustic shielding compared to standard hoarding panels. Hoardings located close to on-site noise sources will be most effective.

Utilisation of partial structures

On some projects, incomplete or partially demolished buildings may serve as functional acoustic screens. For instance, fixed noise generating plant may be sited within the shell of a completed basement level, given the reverberation within the space is adequately managed. When equipment such as generators or compressors operates in enclosed or semi-enclosed spaces, exhaust systems must be vented directly to the outside with suitable acoustic treatment (such as mufflers), and adequate ventilation must be maintained to prevent build-up of harmful exhaust gases within internal spaces.

Earth mounds and embankments

Where the construction of barriers is not viable, temporary earth embankments can offer a practical alternative for noise shielding. Placing plant and equipment behind earth mounds can significantly reduce noise propagation to adjacent sensitive areas. These mounds can be incorporated into early site works and later re-used or regraded as part of landscaping. When used along haul routes, long linear earth bunds can provide sustained noise reduction for moving equipment. Dismantling these earthworks should be done with low-noise plant where feasible.

General considerations

For stationary sources, barriers should ideally extend well beyond the line-of-sight path between the source and receiver, by a minimum of ten times the effective height of the barrier. For moving sources, the barrier should continue at least ten times the shortest distance between the receiver and the barrier past the last property to be protected.

If construction is largely contained within enclosed structures, noise breakout through openings such as doors, vents or gaps must be addressed to maximise containment.

5.5.5 Community Engagement and Complaints Management

Effective stakeholder communication is essential. Residents and other potentially affected parties must be notified in advance of activities likely to result in noticeable noise or vibration.

A dedicated complaints management system, including a register and response procedures, must be established and maintained throughout the construction period.

5.5.6 Site Access and Vehicle Movements

To limit disturbance from construction traffic, the design of access routes and the scheduling of vehicle movements must consider the proximity of sensitive receivers. Key measures include:

- Locating access and delivery points as far from residences as practical.
- Prioritising the use of arterial roads and avoiding residential streets where feasible.
- Restricting deliveries during the night-time period, where possible.

Truck movements, even on sealed roads, can contribute to annoyance, and should therefore be managed proactively.

5.5.7 Equipment Use and Site Practices

Site operations should incorporate best-practice approaches to reduce noise emissions, including:

- Using low noise equipment and well-maintained machinery with effective silencers and mufflers.
- Switching off idle plant and throttling equipment down when not in use.
- Positioning noisy plant away from nearby dwellings where feasible.
- Taking advantage of shielding from site topography or structures to reduce propagation of sound.

- Installing temporary noise barriers or hoardings, particularly along the Activity boundary.

Additional on-site behaviours and practices must include:

- Avoiding the use of warning horns as communication tools.
- Limiting the volume of radios and two-way communication devices.
- Minimising noise from, equipment pack up, general worker activity such as shouting or slamming doors, and utilising broadband style reverse alarms when possible.

5.5.8 Equipment Selection and Maintenance

The following measures must be implemented for equipment management:

- Prioritising low-noise models during plant selection.
- Ensuring all machinery is well maintained and fitted with appropriate noise control features.
- Completing tasks using only the necessary power and equipment to avoid excessive emissions.
- Shutting down equipment when not in active use.

5.5.9 Noise Monitoring

Unattended noise monitoring may be conducted along the most noise affected boundaries of the site. Particularly during particularly high impact construction activities where noise sources are located near to receivers.

The monitoring methodology, data reporting, and management responses must be detailed in the CNVMP to ensure compliance with noise criteria and to enable timely adjustments if required.

5.5.10 Vibration Monitoring

Vibration intensive equipment size would be selected to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment would be considered where feasible and reasonable.

Where works must be conducted within the minimum working distances provided in this report, vibration monitoring should be undertaken at the boundaries of the affected receivers with a vibration monitoring methodology outlined in the CNVMP.

6. Operational Noise Assessment

Operational noise sources from the Activity have potential to affect nearby receivers. Noise from mechanical plant/equipment, car parking/drop off areas and outdoor play areas have been assessed as part of the proposal.

6.1 Modelled Operational Scenario

To represent a reasonable worst-case operational scenario, the noise modelling assumes that all proposed equipment within the Site operates at full capacity during the daytime period from 7:00 am – 6:00 pm.

Operational noise impacts at non-residential receivers have also been assessed using the daytime scenario and compared against the applicable trigger levels for non-residential land uses whilst in use (where applicable).

The mechanical plant and equipment proposed is primarily considered steady-state or quasi steady-state noise sources, typically producing continuous and consistent sound levels.

To deliver the required capacity for the Activity, the following equipment/noise sources are expected to be operating and functional for the duration of the Activity's operational lifespan:

- Mechanical plant and equipment platform
- Outdoor play areas
- PA speakers (to be assessed during a more advanced design stage)

6.1.1 Assessment Noise Source Levels

Early stage sound power levels for mechanical plant and equipment have been provided at the Concept Design stage. Sound power levels utilised in the noise modelling for the Activity are provided in **Table 21**. All noise sources were assumed to be operating continuously for the entire 15-minute period unless otherwise stated.

Location	Noise source	Manufacturer	Model	Sound power level, L_{Aeq} , dB(A)	Operating duration (15 min period)
Main Teaching Building (Level 2 Roof)	VRV Unit	Daikin	1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM	77	Continuous

Location	Noise source	Manufacturer	Model	Sound power level, L_{Aeq} , dB(A)	Operating duration (15 min period)
			1 x REYQ16BYM		
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	VRV Unit		1 x REYQ12BYM 1 x REYQ16BYM	77	Continuous
	Split Condenser Unit (CU)	Daikin	1 x RKM71QVMA	53	Continuous
Gym/School Hall (Ground Floor)	Split Condenser Unit (CU)	Daikin	1 x RKM71QVMA	53	Continuous
	VRV		1 x REYQ12BYM	59	Continuous
Outdoor school areas/play areas	Group of 10 children (total 300 children) ³	N/A	N/A	85 (per 10) ¹	Continuous
Carpark	20 vehicle movements with car engine ignition and car doors slamming	N/A	N/A	88	Corrected to one 15 minute period

Table 21 - Operational noise source sound power levels

Notes:

1. Male vocal efforts have been utilised conservatively as on average the male voice is 3-5 dB higher than a female voice. Speech noise levels are based on 'raised vocal effort' of 67 dB(A) at 1 metre as provided in the AAAC Licensed Premises Noise Assessment Technical Guide V3.0.
2. PA speaker locations are not available at this early design stage. Locations and noise impact should be assessed/verified at a more detailed design stage, once installation locations and further information become available.
3. Based on a total of 582 students in outdoor areas, with approximately 50% generating noise at any one time.

Sound power levels provided in this report would be confirmed at the Detailed Design (DD) stage of the Activity.

6.2 Modelling Methodology

Operational noise levels at nearby sensitive receivers were predicted using SoundPLAN version 8.2, an industry-standard three-dimensional noise modelling software. The modelling utilises the CONCAWE algorithm within SoundPLAN, which is well-suited for assessing noise propagation over long distances due to its ability to account for varying atmospheric conditions that can significantly affect sound travel.

Given that the surrounding residential receivers are located within a range from 10 metre to 400 metres from the Site, the use of the CONCAWE method is considered appropriate for this assessment.

Both standard and noise-enhancing meteorological conditions were taken into account, using the following parameters:

- **Standard conditions:** Pasquill-Gifford stability category D with wind speeds up to 0.5 m/s at 10 metres above ground.
- **Noise-enhancing conditions:** Pasquill-Gifford stability category D with wind speeds up to 3 m/s at 10 metres, and/or category F with wind speeds up to 2 m/s at the same height.

The noise model incorporated the following elements:

- Ground topography
- Buildings and structures
- Representation of all sources as either point or moving point sources
- Ground absorption
- Representative operational noise sources

The modelling accounted for all major noise sources and receptor locations, as well as the effects of screening, terrain, and noise attenuation mechanisms such as geometric spreading, air and ground absorption, and meteorological influences. All predicted noise levels are presented as free-field levels at a height of 1.5 metres above ground level, measured at the most affected point within a residential property boundary and within 30 metres of the nearest façade.

It is important to note that the equipment types, quantities, and placement may change during the detailed design phase. As such, this operational noise assessment represents a proof of concept for the Activity's overall noise emissions and proposed equipment. Final operational noise levels should be confirmed during detailed design, once the exact locations of noise-generating equipment are determined.

6.3 Predicted Operational Noise Levels

6.3.1 Operational Noise Levels (excluding outdoor play areas)

Table 22 presents the predicted operational noise levels from proposed mechanical plant/equipment, kiss and ride area and staff parking activities at nearby noise-sensitive receivers, assessed against the evening noise criteria applicable to the operation of the Proposal. Compliance during the evening shoulder periods, where after-school activities may occur, implies compliance to the less stringent daytime period.

Receiver locations and operational noise contours, calculated at 1.5 metres above ground level, are included in **Appendix C**. These contours are indicative only and should not be used to determine noise levels at specific receiver locations.

All predicted operational noise levels and contours have been modelled under standard and adverse weather conditions.

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
NCA1	R1	48	22	23	-	Yes
	R2	48	24	25	-	Yes
	R3	44 ³	25	25	-	Yes
	R4	44 ³	22	24	-	Yes
	R5	44 ³	21	22	-	Yes
	R6	48	14	17	-	Yes
	R7	48	19	21	-	Yes
	R8	48	18	20	-	Yes
	R9	44 ³	19	21	-	Yes
	R10	48	14	16	-	Yes
	R11	48	14	16	-	Yes
	R12	48	15	17	-	Yes
	R13	48	15	17	-	Yes
	R14	44 ³	39	39	-	Yes
	R15	44 ³	21	22	-	Yes
	R16	48	17	19	-	Yes
	R17	48	19	21	-	Yes

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
	R18	48	39	39	-	Yes
	R19	48	34	34	-	Yes
	R20	48	29	30	-	Yes
	R21	48	27	27	-	Yes
	R22	48	21	22	-	Yes
	R23	48	37	37	-	Yes
	R24	48	33	33	-	Yes
	R25	48	29	30	-	Yes
	R26	48	25	26	-	Yes
	R27	48	24	25	-	Yes
NCA2	R28	48	16	17	-	Yes
	R29	48	25	26	-	Yes
	R30	48	22	23	-	Yes
	R31	48	29	30	-	Yes
	R32	48	28	29	-	Yes
	R33	48	29	30	-	Yes
	R34	48	28	29	-	Yes

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
	R35	48	21	22	-	Yes
	R36	48	20	22	-	Yes
	R37	48	19	21	-	Yes
	R38	48	20	22	-	Yes
	R39	48	23	25	-	Yes
	R40	48	23	25	-	Yes
	R41	48	23	24	-	Yes
	R42	48	17	19	-	Yes
	R43	48	16	18	-	Yes
	C1	70	16	18	-	Yes

Table 22 - Predicted operational noise levels – evening (standard and noise-enhancing meteorological conditions)

Notes:

1. Noise enhancing meteorological conditions considers the worst case of 3 m/s winds in the direction of source to the receiver and temperature inversions.
2. The results of the worst affected noise sensitive receivers are presented, indicating compliance at the other less affected sensitive receivers.
3. A lower trigger level has been adopted for these receivers based on noise logging conducted for Worrigee Public Preschool, referenced in PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0

6.3.2 Outdoor Play Areas Operational Noise Levels

Table 23 presents the predicted operational noise levels from proposed school outdoor play area activities at nearby noise-sensitive receivers, assessed against the relevant daytime noise criteria applicable to the operation of the proposal. The scenario considers the entire student population within the school's outdoor play areas with 50% of students generating noise at any one time.

Receiver locations and operational noise contours, calculated at 1.5 metres above ground level, are included in **Appendix C**. These contours are indicative only and should not be used to determine noise levels at specific receiver locations.

All predicted operational noise levels and contours have been modelled under standard and adverse weather conditions.

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
NCA1	R1	58	54	54	-	Yes
	R2	58	56	56	-	Yes
	R3	49 ³	40	40	-	Yes
	R4	49 ³	39	41	-	Yes
	R5	49 ³	38	40	-	Yes
	R6	58	32	35	-	Yes
	R7	58	39	41	-	Yes
	R8	58	40	42	-	Yes
	R9	49 ³	34	36	-	Yes
	R10	58	34	37	-	Yes
	R11	58	34	37	-	Yes
	R12	58	35	38	-	Yes
	R13	58	28	31	-	Yes
	R14	49 ³	46	47	-	Yes
	R15	49 ³	29	31	-	Yes
	R16	58	33	36	-	Yes
	R17	58	29	32	-	Yes

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
	R18	58	27	28	-	Yes
	R19	58	42	42	-	Yes
	R20	58	41	41	-	Yes
	R21	58	39	40	-	Yes
	R22	58	37	39	-	Yes
	R23	58	29	29	-	Yes
	R24	58	29	29	-	Yes
	R25	58	39	39	-	Yes
	R26	58	31	33	-	Yes
	R27	58	30	33	-	Yes
NCA2	R28	62	48	48	-	Yes
	R29	62	44	44	-	Yes
	R30	62	35	36	-	Yes
	R31	62	40	41	-	Yes
	R32	62	39	40	-	Yes
	R33	62	36	38	-	Yes
	R34	62	34	37	-	Yes

Noise Catchment Area (NCA)	Receiver ²	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Predicted $L_{Aeq,15min}$ noise levels, dB(A)		Compliance	
			Standard met. conditions	Noise enhancing met. Conditions ¹	Exceedance, dB(A)	Yes/No
	R35	62	43	44	-	Yes
	R36	62	39	41	-	Yes
	R37	62	32	34	-	Yes
	R38	62	35	37	-	Yes
	R39	62	35	37	-	Yes
	R40	62	36	38	-	Yes
	R41	62	33	35	-	Yes
	R42	62	37	40	-	Yes
	R43	62	36	39	-	Yes
	C1	70	38	41	-	Yes

Table 23 - Outdoor school areas predicted operational noise levels - daytime (standard and noise-enhancing meteorological conditions)

Notes:

1. Noise enhancing meteorological conditions considers the worst case of 3 m/s winds in the direction of source to the receiver and temperature inversions.
2. The results of the worst affected noise sensitive receivers are presented, indicating compliance at the other less affected sensitive receivers.
3. A lower trigger level has been adopted for these receivers based on noise logging conducted for Worrigee Public Preschool, referenced in PWNA report 250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0

6.3.3 Discussion of Results

The predicted operational noise emissions from the Activity, as shown in **Table 22** and **Table 23**, comply with the Activity's operational noise criteria across all locations within both noise catchment areas.

It is understood that the mechanical plant/equipment and PA Speaker selection is not finalised at this early Concept Design stage. A more detailed mechanical plant and equipment noise assessment, including the PA Speakers noise and plant/equipment tonality (characteristics) assessment should be undertaken by a qualified

acoustic engineer at a more advanced detailed design stage in order to verify compliance with the requirements of the relevant standards and guidelines.

6.4 Operational Road Traffic Noise

The Proposal site is bound by the Greenwell Point Road towards north and Worrigee Road to the west. Greenwell Point Road east of Worrigee Road and Worrigee Road north of Golden Grove are both two-way two-lane roads.

In accordance with the traffic survey report conducted by WSP (Ref: *PS222457-WSP-PAM-REP-001-Worrigee-TA/A*), the existing AM and PM peak periods were observed to occur between 8.00 AM to 9.00 AM and 3.00 PM to 4.00 PM respectively, coinciding with typical school operating times. The introduction of school zones are proposed to be implemented along both Greenwell Point Road and Worrigee Road which would reduce traffic noise levels during these peak periods.

Existing traffic volumes (both light and heavy) along Worrigee Road as well as the predicted future traffic volume increase due to the additional traffic from the proposal are presented in **Table 24** for the AM peak period and **Table 25** for the PM peak periods (periods of highest potential impact). This information has been provided in the Transport and Accessibility Impact Assessment. Future traffic counts include traffic associated with the adjoining pre-school.

Table 24 presents the daytime existing traffic volume and future predicted traffic (light and heavy vehicles) volume due to the proposal operation using the peak traffic volume for busy time period from 8 AM to 9 AM.

Existing Vehicles (per hour)		Existing Speed Limit (Km/hr)	Additional Vehicles (per hour)		Future Speed Limit (Km/hr)	Existing Noise Level, dB	Future Noise Level, dB	Increase in Noise Level, dB
Light	Heavy		Light	Heavy				
234	10	60	583	16	40	63.7	63.1	-0.6

Table 24 - Operational Road Traffic Noise – Worrigee Road – AM Peak Hour

Table 25 presents the PM existing traffic volume and future predicted traffic (light and heavy vehicles) volume due to the proposal operation using the peak traffic volume for busy time period from 3 PM to 4 PM.

Existing Vehicles (per hour)		Existing Speed Limit (Km/hr)	Additional Vehicles (per hour)		Future Speed Limit (Km/hr)	Existing Noise Level, dB	Future Noise Level, dB	Increase in Noise Level, dB
Light	Heavy		Light	Heavy				
292	12	60	594	16	40	64.6	63.4	-1.2

Table 25 - Operational Road Traffic Noise – Worrigee Road – PM Peak Hour

For the AM and PM peak periods, increased traffic movement generation is expected as a result of the New Primary School in Worrigee's operation, however these increased volumes coincide with the introduction of lower speed limit school zones resulting in an overall decrease in traffic noise levels due to the Activity. Therefore, no further noise treatment would be required in order to mitigate road traffic noise generation.

Compliance along Worrigee Road for increased traffic due to the Activity implies compliance along Greenwell Point Road where additional traffic impact would be lower.

7. External Noise Intrusion

The level of noise transmitted through a façade into an interior space depends on several key factors: the external noise levels, the sound insulation performance of the building façade, and the reverberation time within the room. At this design stage the external façade noise levels of the main teaching building have been calculated and provided.

7.1 Façade Traffic Noise Levels

Traffic noise levels at each noise logger location for the daytime and night periods were measured to be:

- NL1: Daytime L_{Aeq,15 hours} 58 dB
- NL1: Night L_{Aeq,9 hours} 48 dB
- NL2: Daytime L_{Aeq,15 hours} 58 dB
- NL2: Night L_{Aeq,9 hours} 49 dB

Calculations were conducted in order to determine the future potential noise levels at the external façade of the main teaching building. These predicted noise levels include an increase in traffic noise levels over the next 10-year planning period. Predicted façade noise levels are presented in **Table 26**.

Floor level	Façade direction	Daytime, L _{Aeq,15hr}
Ground Floor (GF)	North	59
	North-west	56
	South-west	56
First Floor (1F)	North	59
	North-west	58
	South-west	57
Second Floor (2F)	North	60
	North-west	58
	South-west	57
Roof	-	46

Table 26 - Calculated predicted façade noise levels

The most noise impacted façade is predicted to be the northern and north-western facade of the first and second floor level directly fronting Greenwell Point Road and Worrigee Road. All future noise shielding structures have been considered in the future case façade noise level prediction where applicable.

The least noise-exposed facade of the building is at the rear of the building where a high level of noise shielding is generated by the subject building and neighbouring structures.

7.2 External Mechanical Plant Noise

The proposed external mechanical plant platform located on the rooftop level 2 (second floor) may potentially impact the subject site including classrooms located directly adjoining these the plant areas. At the current design state it is understood that partitions separating the plant area from adjoining teaching spaces should be of masonry construction, possessing a minimum R_w 55. A complete assessment of noise intrusion from mechanical plant noise should be undertaken by a qualified acoustic engineer at a more advanced detailed design stage to verify façade treatment options.

7.2.1 External Facade Treatment

Based on the proposed location of the mechanical plant deck area, the north-western façade of the building is proposed to be most potentially affected by external mechanical plant noise. Moreover, the walls adjoining the external mechanical plant platform from sensitive areas on the second floor would require treatment in order to mitigate noise from the plant area.

In cases of high mechanical plant area noise, masonry construction would be required for walls separating the plant area from the adjoining classrooms, with a minimum R_w rating of 55-60. Additionally, acoustic louvres may be required along the external facing extent of the plant area to minimise noise egress to the adjoining glazed façade of the noise sensitive classrooms. Specifications of the façade and louvres would be provided at a more detailed design stage.

8. Cumulative Noise Impact

Cumulative effects may arise where the impacts of an Activity combine with those of other Activities, potentially resulting in an overall effect that is greater than the sum of individual Activities. These effects can occur where Activities are delivered at the same time or in sequence, during either construction or operation. Once the New Primary School in Worrigeer becomes operational, interaction with other Activities within the area have the potential to deliver cumulative outcomes.

A review of surrounding Activities was undertaken to identify those with the potential to contribute to cumulative impacts. Activities were screened using the following criteria:

- Spatial proximity, including projects that overlap with, are adjacent to, or are located within one kilometre of the project site
- Temporal overlap, where construction or operational phases coincide with or follow those of the project
- Project status, limited to Activities with sufficient publicly available information to support assessment within this environmental impact statement.

Two activities were identified as meeting these criteria and having the potential to contribute to cumulative impacts:

- R H Boyd & Son Pty Ltd Dairy Farm redevelopment
- Worrigeer Public Preschool

A development application has been submitted to Shoalhaven Council for the R H Boyd & Son Pty Ltd Dairy Farm redevelopment (DA26/1016). The application shows the construction of a number of dairy farm related structures that would house livestock and dairy farming equipment. The site plan shows construction of the project would primarily take place within the northern end of the existing dairy farm site (233 Millbank Road, Terara). As construction and operation of the site would take place approximately 600-700 metres from the New Primary School in Worrigeer activity boundary, cumulative impact is understood to be negligible. Any cumulative traffic impacts from vehicles entering each site from Greenwell Point Road, Worrigeer is also predicted to be insignificant.

The pre-school Activity is located within the same site as New Primary School in Worrigeer. The spatial relationship between the two Activities is shown in **Figure 5**.

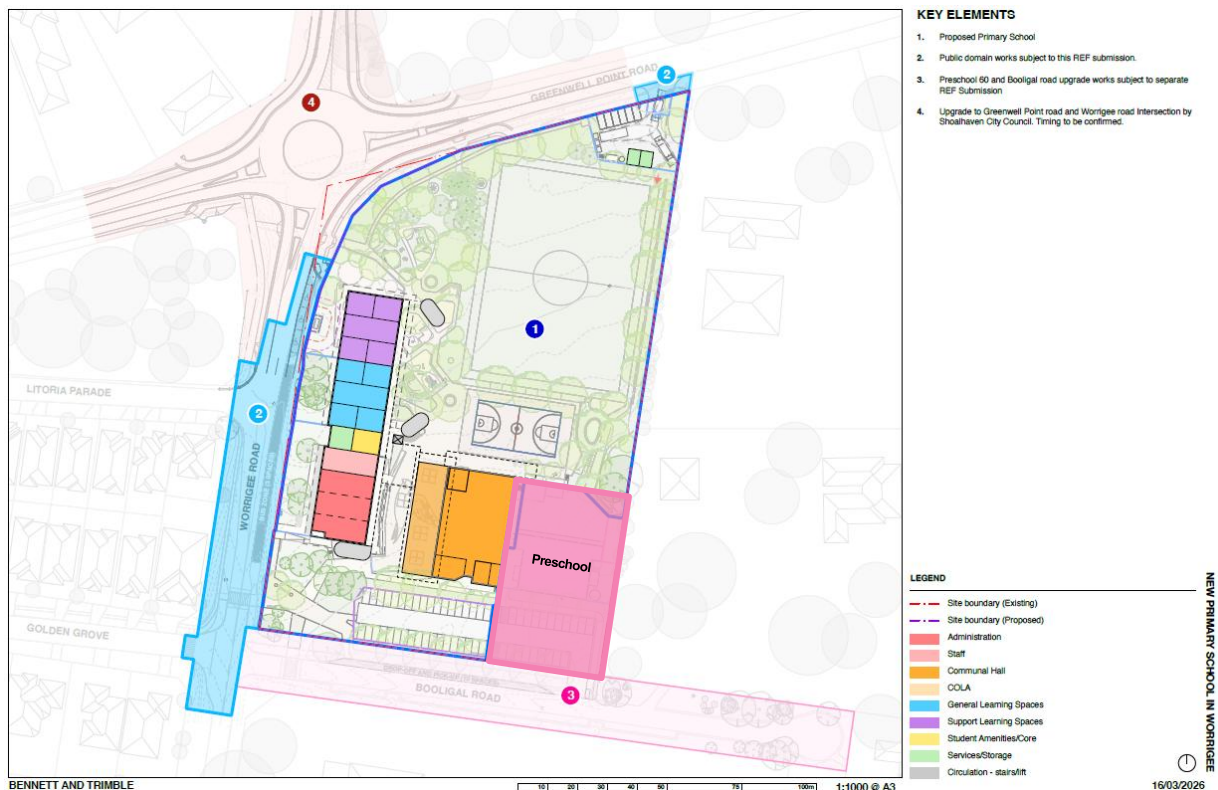


Figure 5 – Location of cumulative projects (preschool)

Indicative construction programs for the works show that there may be some overlap between the two Activities.

8.1 Potential Cumulative Construction Noise Impact

Construction of the New Primary School in Worrigee and the Worrigee Public Preschool is expected to overlap. Where receivers are exposed to construction noise from more than one Activity at the same time, a cumulative increase of up to 3 dB(A) above the highest predicted noise level for any individual Activity may occur, assuming comparable noise levels from concurrent activities.

To reduce overall environmental disturbance, elements of the construction footprints for each Activity would be shared to support construction of each Activity. Activities undertaken within these shared construction areas could include:

- Vegetation clearing
- Levelling and compaction of topsoil
- Establishment of site access tracks
- Installation of water quality and sediment control measures.

The acoustic assessment, prepared by PWNA (250304 – PPS – Worrigee Public Preschool – REF Acoustic Assessment – R0) does not provide a detailed construction noise assessment for the Activity. Based on the conservative construction noise predictions for the New Primary School in Worrigee, it is not anticipated that concurrent construction activities would result in significantly higher construction noise levels based on the scale of each Activity.

The identification of overlapping construction stages and receivers potentially exposed to elevated noise levels would be refined during detailed design, once construction programming is further developed. Any additional mitigation required to manage cumulative construction noise would be implemented through detailed construction planning.

As the areas of highest impact for the proposed preschool are consistent with those of the New Primary School in Worrigeer, it is expected that noise mitigation measures developed as part of ongoing design (such as noise barriers, property treatment etc.) would also provide benefit in reducing cumulative noise from adjoining Activities. Acoustic mitigation measures provided in the REF Acoustic Assessment for Worrigeer Public Preschool should be utilised in conjunction with the mitigation measures provided in this report.

Provided that the minimum working distances identified in this report are maintained, cumulative vibration impacts at receivers near Activity boundaries are considered unlikely. Where working distances cannot be maintained, the mitigation measures as per Section 9 of this report should be implemented.

8.2 Potential Cumulative Operational Noise Impacts

The operational road traffic noise assessment presented in **Section 6.4** incorporates traffic volumes associated with both the New Primary School in Worrigeer and the proposed Worrigeer Public Preschool. Accordingly, the assessed operational noise levels are representative of cumulative operational impacts for road traffic impact.

Concurrent usage of outdoor play areas and the presence of mechanical plant may lead to cumulative operational noise impact to the most affected nearby sensitive receivers. An acoustic assessment has been provided as part of the adjoining Worrigeer Public Preschool's REF submission. The acoustic assessment, prepared by PWNA (250304 – PPS – Worrigeer Public Preschool – REF Acoustic Assessment – R0) provides operational noise levels from the proposed use of the pre-school.

Overall noise impact from the shared carpark would be insignificant when considering the cumulative impact of both areas and on-site vehicular movements associated with both Activities.

8.2.1 Outdoor play areas

The pre-school REF documentation has determined the impact of noise from outdoor play areas at the most potentially impacted receiver, 11 Booligal Road, Worrigeer, which corresponds to residential receiver R3 in the New Primary School in Worrigeer NVIA. A comparison of the operational noise levels at each receiver is provided in **Table 27**.

Receiver	Operational scenario	Pre-school REF $L_{Aeq,15min}$, dB(A)	New Primary School REF $L_{Aeq,15min}$, dB(A)	Cumulative impact at receiver $L_{Aeq,15min}$, dB(A)
11 Booligal Road, Worrigeer	Outdoor play	54	40	54.2
11 Booligal Road, Worrigeer	Noise from classrooms (windows open)	40	40	43

Table 27 – Comparison of operational noise levels due to cumulative Activities.

Impact of outdoor play from the pre-school is significantly higher at the most potentially cumulatively impacted receiver due to operational noise. The pre-school's REF Acoustic Assessment justifies this exceedance via the use of operational management. The contribution of these exceedances from the New Primary School in Worrigeer are insignificant in comparison.

Cumulative impact from noise from Worrigeer Public Preschool classrooms and the New Primary School in Worrigeer is insignificant and compliant.

9. Mitigation Measures

Mitigation measures provided for the Activity are shown in **Table 28**.

Mitigation Number/Name	When is Mitigation Measure to be complied with	Mitigation Measure	Reason for Mitigation Measure
NV1 – Construction Noise and Vibration	During Construction	A Construction Noise and Vibration Management Plan must be implemented in accordance with the NSW EPA Interim Construction Noise Guideline (2009).	To minimise construction noise impact to nearby sensitive receivers.
NV2 – Vibration During Construction	During Construction	Vibration levels induced by demolition activities, or other vibration intensive activities such as rock hammering, must be in accordance with the AS2436 – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites. The operation of plant and equipment must not give rise to the transmission of vibration nuisance or damage to other premises. If high vibration activities are to occur within the minimum working distances provided in this report, prior to commencement of vibration-generating activities, a specific vibration monitor must be set up either at the property boundary or nearest sensitive receiver to monitor and record the vibration levels affecting buildings on adjacent land using the Assessing Vibration: A Technical Guide (DECC, 2009).	To minimise vibration impact to neighbouring properties.
NV3 – Operational Noise	Prior to commencement of Operations	A suitably qualified acoustic engineer must demonstrate that noise associated with the operation of mechanical plant or machinery installed does not exceed the relevant project noise trigger levels.	To minimise operational noise impact from mechanical plant and equipment to nearby sensitive receivers.
NV4 – Operational Noise (Bespoke Mitigation Measure)	Prior to commencement of Operations	A noise limiter should be installed on the public address system in order to limit the maximum noise generated by the school bell and loudspeaker announcements to the noise levels provided in this report.	To minimise noise impact from PA speakers to nearby sensitive receivers.

Mitigation Number/Name	When is Mitigation Measure to be complied with	Mitigation Measure	Reason for Mitigation Measure
NV5 – Construction Noise (Bespoke Mitigation Measure)	During Construction	Highly noise generating work that would result in > LAeq 75 dB noise levels at specific receivers (Highly Affected receivers) should be carried out during standard construction hours only. Work should be undertaken in continuous blocks of no more than three hours of with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receiver.	To minimise high construction noise impact to potentially “Highly Affected” receivers which are located within close proximity to Activity area.

Table 28 - Noise and Vibration mitigation measures.

10. Conclusion

This Noise and Vibration Impact Assessment has been prepared to support the REF submission for the New Primary School in Worrigee, located at 9 Worrigee Road, Worrigee. The purpose of this document is to provide details on the potential environmental noise impact of the Activity in accordance with the relevant REF submission requirements. The NVIA includes an assessment of construction noise/vibration and operational impact.

The construction noise and vibration assessment consists of three construction scenarios utilised to assess the noise and vibration impact of construction to the nearest sensitive receivers to the proposal site. The operational noise assessment includes a number of noise generating activities, including mechanical plant/equipment, school outdoor play areas, as well as car parking and drop-off areas.

The assessment has been based on the architectural drawings provided by Bennet and Trimble Architects, with the associated site plan illustrated in **Figure 1** and drawing references detailed in **Table 2**.

On-site noise monitoring was conducted to quantify prevailing ambient and traffic noise levels. These measurements were used to determine the noise criteria for construction and operational impact.

To assess the potential noise impacts during construction, three representative construction scenarios were developed. Specific construction methodology would be confirmed by the construction contractor, however potential noise impacts associated with an indicative construction staging has been assessed conservatively to facilitate the requirements of community consultation, noise management and mitigation.

The assessment of construction noise impacts indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive residential receivers to the construction boundary during all three construction phases. The worst affected residential receivers towards north-east of proposal (R1/R2) located at 300 Greenwell Point Rd, Worrigee, would experience construction noise levels up to 28 dB and 26 dB above the noise management level during scenario 1 and scenario 2 respectively. Predicted construction noise levels are typical for Activity of this size with such proximity to residential receivers.

The worst affected residential receivers towards the south-west of the proposal (R18/R19) located at 1 Litoria Parade and 2B Golden Grove, Worrigee, would experience construction noise levels up to 22 dB and 20 dB above the noise management level during scenario 1 and scenario 2 respectively.

There are four highly noise affected receivers predicted during the construction phase 1 and phase 2 activities. All four highly noise affected receivers predicted (R1, R2, R18, R19) would require additional noise mitigation consideration as per the ICNG. These additional measures have been captured in Section 9 of this report. All feasible and reasonable mitigation measures should be outlined in the Construction Noise and Vibration Management Plan.

The findings of the operational assessment indicate that the mechanical plant/equipment and other operational sources generally comply with the Activity's operational noise criteria across all locations. It is understood that the mechanical plant/equipment and PA Speaker selection is not finalised at the Concept Design stage. Therefore, a more detailed mechanical plant and equipment noise assessment, including the PA Speakers and plant/equipment tonality should be undertaken by a qualified acoustic engineer at a more advanced design stage.

Noise impact due to increased traffic on local roads due to the Activity is proposed to be in compliance with the screening levels provided in the NSW Road Noise Policy. As the predicted increase in traffic noise is less than 2 dB(A), no further analysis is required at this stage.

An assessment of potential cumulative impact with neighbouring Activities (Worrigee Public Preschool) has been provided in this report. Provided the recommendations and mitigations measures given in this report are properly implemented, environmental effects in regard to noise and vibration would be sufficiently mitigated such that there would be a lessened impact on the environment for the construction and operation of the proposal. Appropriate mitigation measures for nearby Activities should be properly implemented to minimise the risk of cumulative noise impact to the environment

Subject to implementing the mitigation measures set out in Section 9 of this report, the conclusion of this assessment is that the proposed activity is not likely to significantly affect the environment in relation to Noise and Vibration matters.

10.1 Significance of Environmental Impacts

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the Activity, it is determined that:

- The extent and nature of potential impacts are moderate, and are not likely to have significant effects on the environment in relation to noise and vibration.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect.

Appendix A – Noise Logger Report

9 Worrigee Road, Worrigee NSW - Noise Logger Report

Address:

9 Worrigee Road, Worrigee NSW

Logger:

Rion NL-43 (0162466)

Period:

11-12-2025 to 22-12-2025

Location:

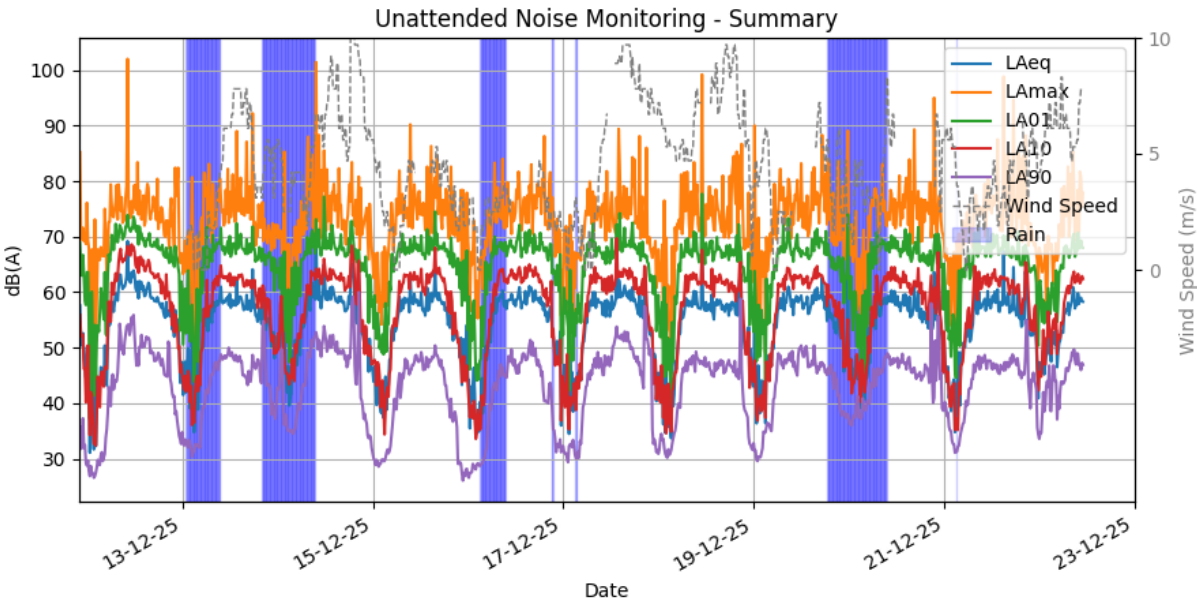
NL1 - Fronting Worrigee Road

Facade/Free Field:

Free Field

Environment:

Car passbys dominant, leaves rustling, light winds, birds chirping. Car passby 68 dBA. Dog roaming around site.



Inclement weather events as observed at Jervis Bay Airfield have been excluded

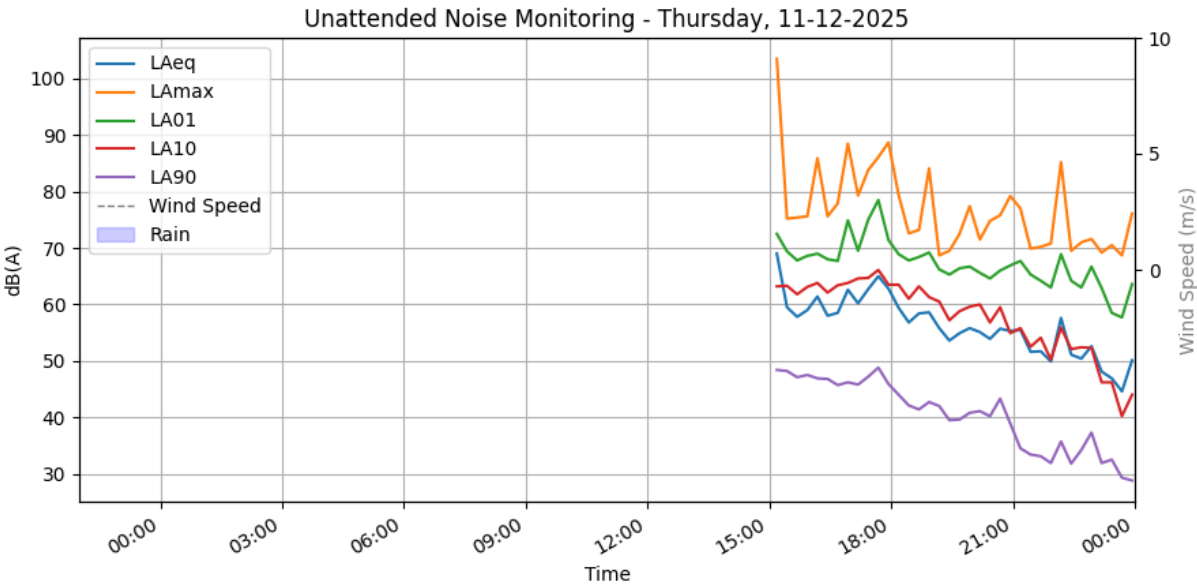
Summary Measurement Results

Date	LAeq Day 7am-6pm	LAeq Evening 6pm-10pm	LAeq Night 10pm-7am	LAeq 15hr 7am-10pm	LAeq 9hr 10pm-7am	LA90 Day 7am-6pm	LA90 Evening 6pm-10pm	LA90 Night 10pm-7am
11-12-2025	61.4	55.1	50.2	57.8	50.2	47.0	39.3	32.7
12-12-2025	61.0	56.0	47.4	59.7	47.4	50.4	45.7	33.6
13-12-2025	58.5	56.1	44.3	58.1	44.3	47.3	46.7	32.9
14-12-2025	59.4	57.5	49.1	58.8	49.1	50.2	47.7	34.0
15-12-2025	58.5	53.9	47.3	57.3	47.3	47.2	37.4	32.3
16-12-2025	58.9	55.4	42.3	57.9	42.3	47.8	40.9	29.9

17-12-2025	58.9	57.0	47.7	58.4	47.7	49.3	48.9	35.5
18-12-2025	57.9	56.8	46.2	57.6	46.2	47.0	45.4	35.9
19-12-2025	58.6	59.3	47.9	58.6	47.9	47.7	45.6	37.2
20-12-2025	58.0	56.3	54.9	57.5	54.9	47.0	45.7	45.2
21-12-2025	58.3	56.6	47.5	57.8	47.5	47.0	46.2	37.6
22-12-2025	58.4	-	50.7	58.4	50.7	47.6	-	42.1
Average	59.0	56.4	48.0	58.2	48.0	48.0	44.5	35.7

Date: Thursday, 11-12-2025

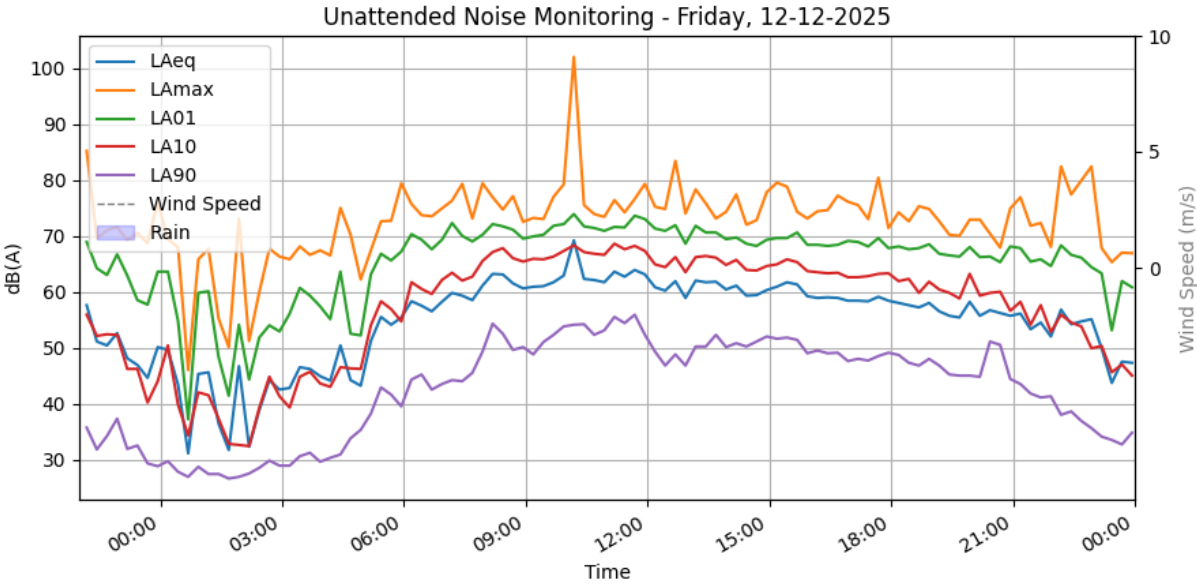
Ambient Noise Metric	Level, dB
LAeq Day	61.4
LAeq Evening	55.1
LAeq Night	50.2
LA90 Day	47.0
LA90 Evening	39.3
LA90 Night	32.7
LAeq 15hr	57.8
LAeq 9hr	50.2



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Friday, 12-12-2025

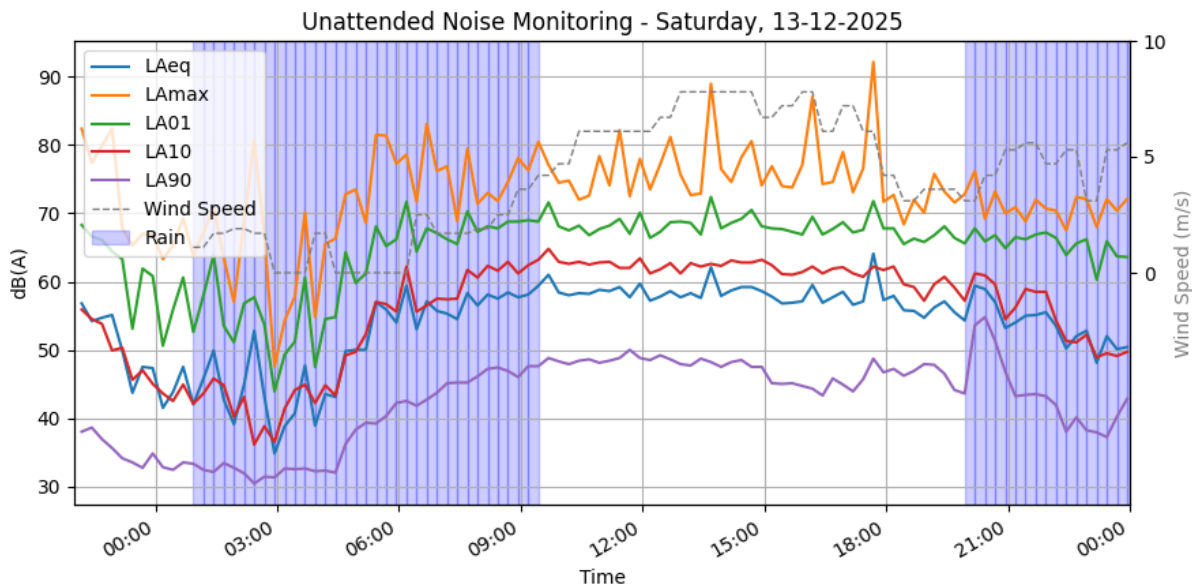
Ambient Noise Metric	Level, dB
LAeq Day	61.0
LAeq Evening	56.0
LAeq Night	47.9
LA90 Day	50.4
LA90 Evening	45.7
LA90 Night	33.4
LAeq 15hr	59.7
LAeq 9hr	47.9



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Saturday, 13-12-2025

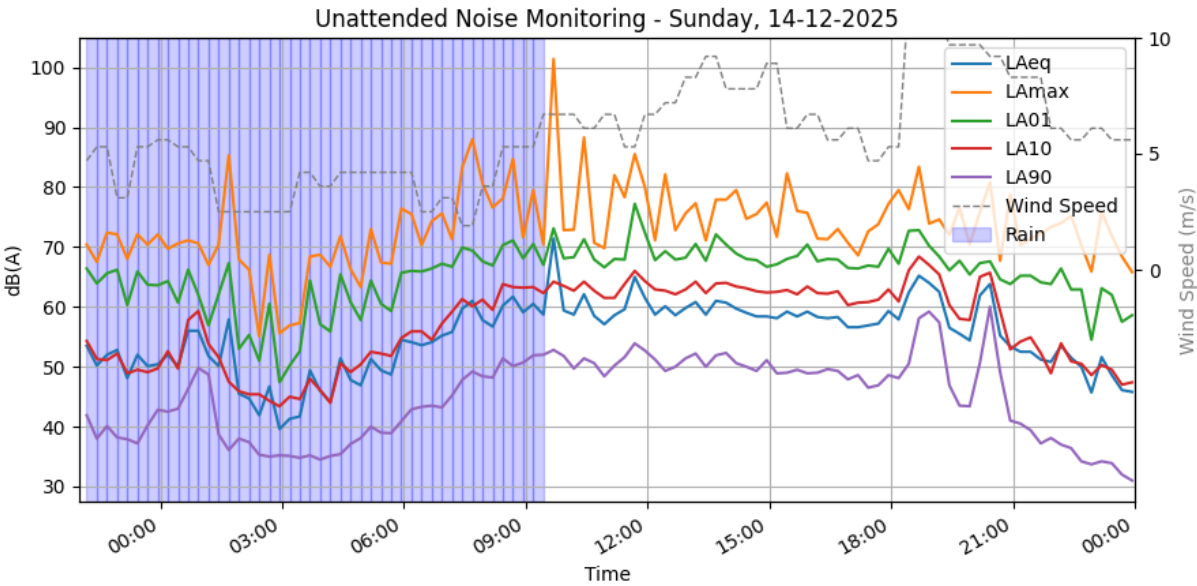
Ambient Noise Metric	Level, dB
LAeq Day	58.5
LAeq Evening	56.1
LAeq Night	49.3
LA90 Day	47.3
LA90 Evening	46.7
LA90 Night	34.8
LAeq 15hr	58.1
LAeq 9hr	49.3



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Sunday, 14-12-2025

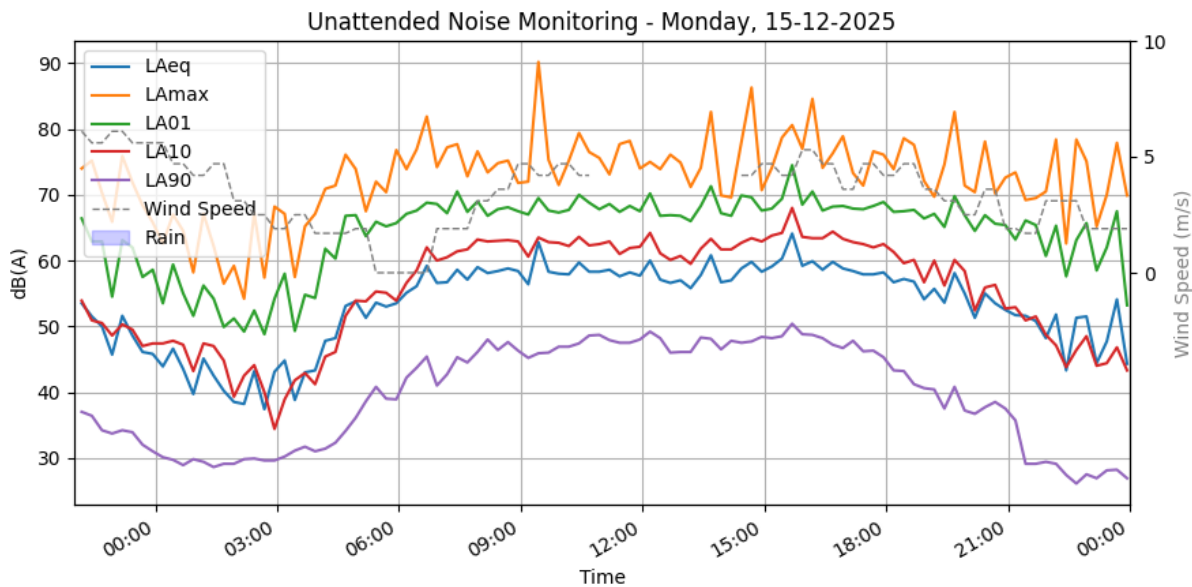
Ambient Noise Metric	Level, dB
LAeq Day	59.4
LAeq Evening	57.5
LAeq Night	49.1
LA90 Day	50.2
LA90 Evening	47.7
LA90 Night	34.0
LAeq 15hr	58.8
LAeq 9hr	49.1



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Monday, 15-12-2025

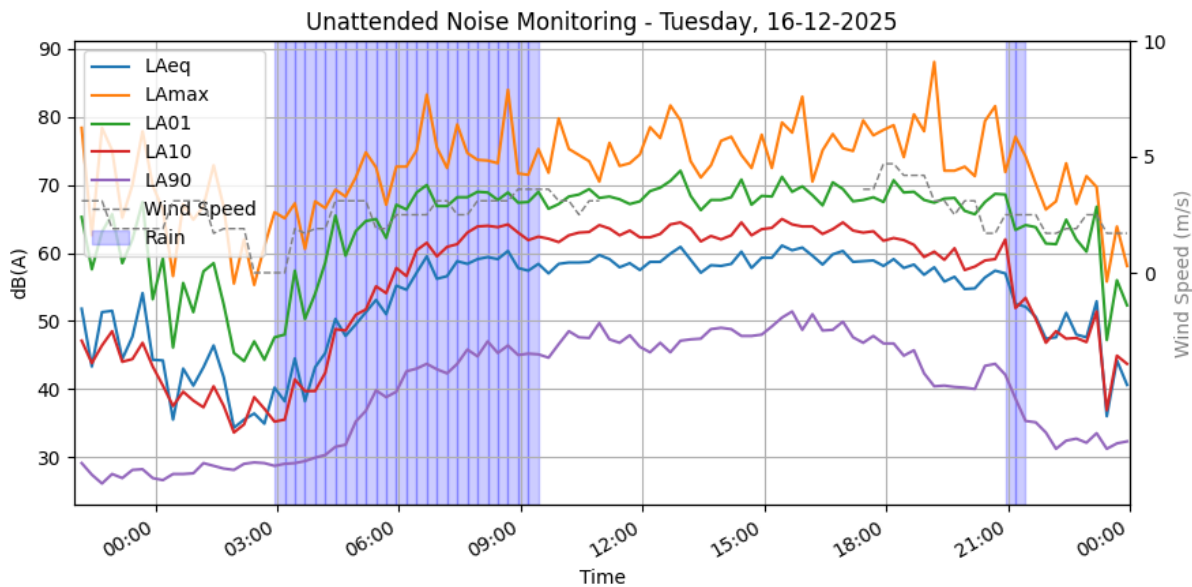
Ambient Noise Metric	Level, dB
LAeq Day	58.5
LAeq Evening	53.9
LAeq Night	47.6
LA90 Day	47.2
LA90 Evening	37.4
LA90 Night	32.6
LAeq 15hr	57.3
LAeq 9hr	47.6



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Tuesday, 16-12-2025

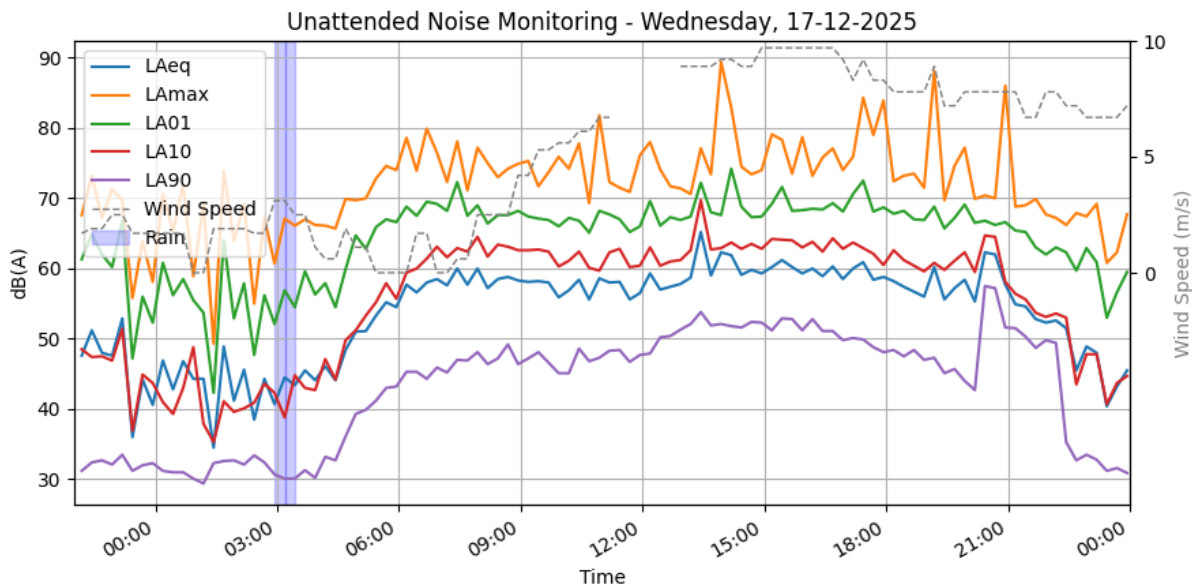
Ambient Noise Metric	Level, dB
LAeq Day	58.9
LAeq Evening	55.4
LAeq Night	44.2
LA90 Day	47.8
LA90 Evening	40.9
LA90 Night	29.2
LAeq 15hr	57.9
LAeq 9hr	44.2



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Wednesday, 17-12-2025

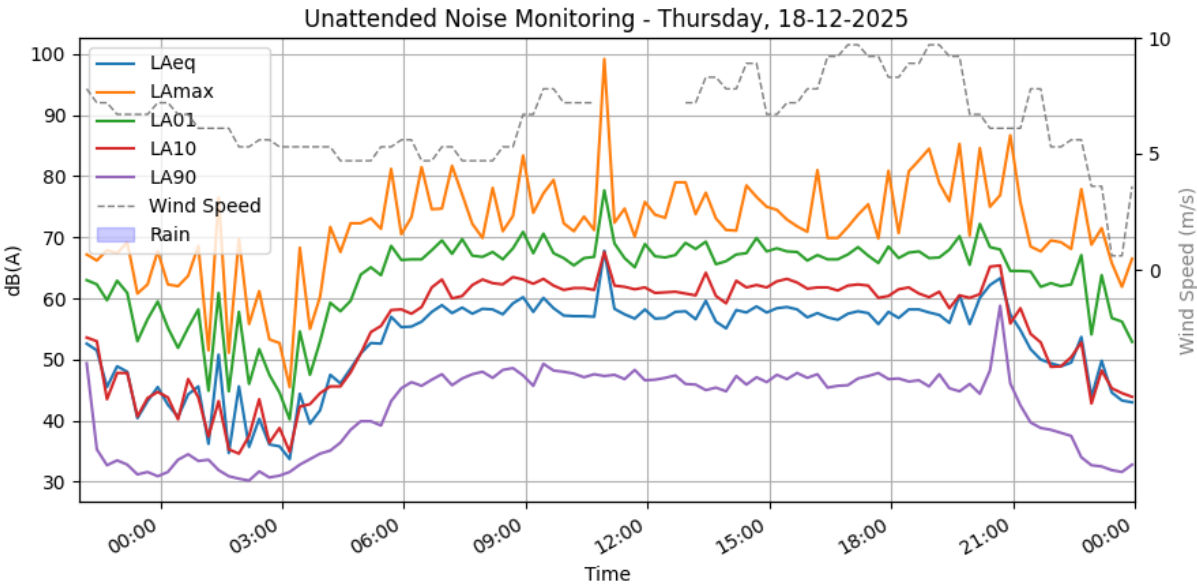
Ambient Noise Metric	Level, dB
LAeq Day	58.9
LAeq Evening	57.0
LAeq Night	47.4
LA90 Day	49.3
LA90 Evening	48.9
LA90 Night	34.9
LAeq 15hr	58.4
LAeq 9hr	47.4



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Thursday, 18-12-2025

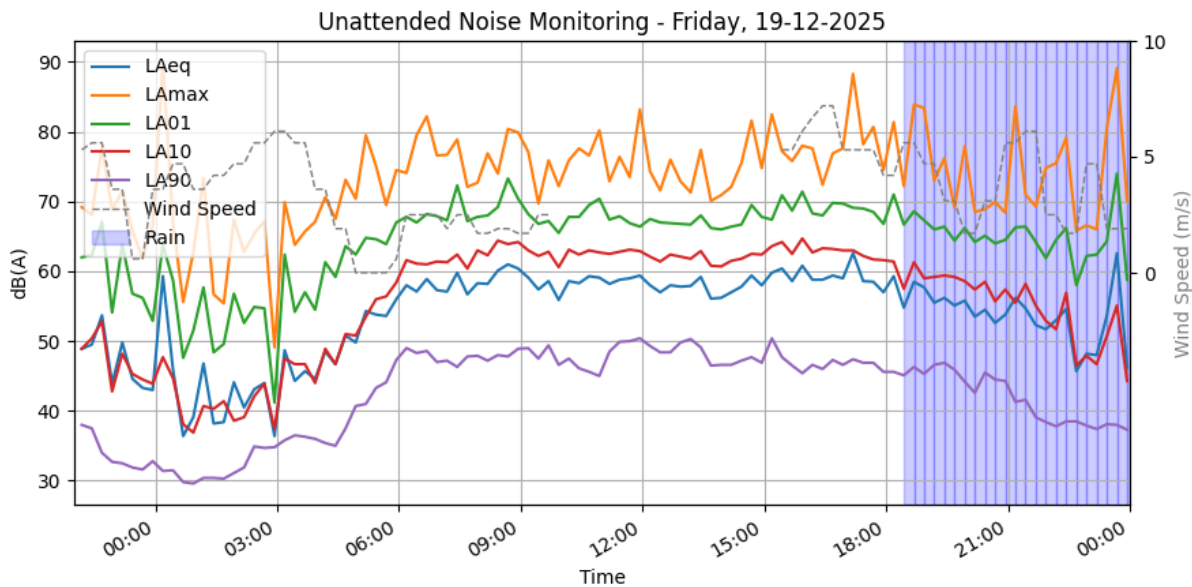
Ambient Noise Metric	Level, dB
LAeq Day	57.9
LAeq Evening	56.8
LAeq Night	46.3
LA90 Day	47.0
LA90 Evening	45.4
LA90 Night	35.6
LAeq 15hr	57.6
LAeq 9hr	46.3



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Friday, 19-12-2025

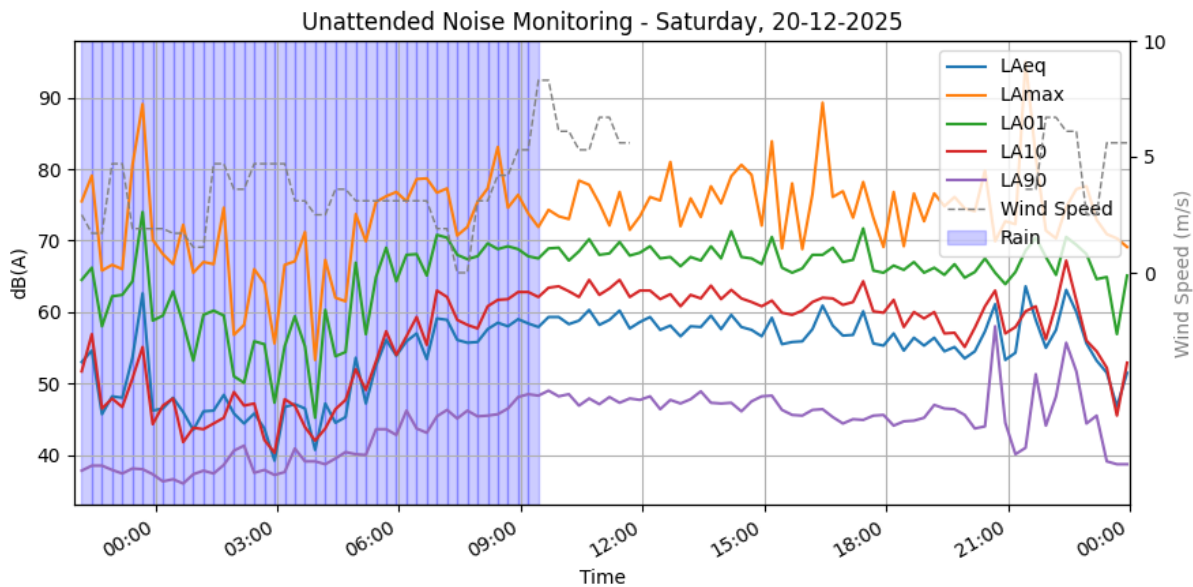
Ambient Noise Metric	Level, dB
LAeq Day	58.6
LAeq Evening	59.3
LAeq Night	47.7
LA90 Day	47.7
LA90 Evening	45.6
LA90 Night	36.5
LAeq 15hr	58.6
LAeq 9hr	47.7



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Saturday, 20-12-2025

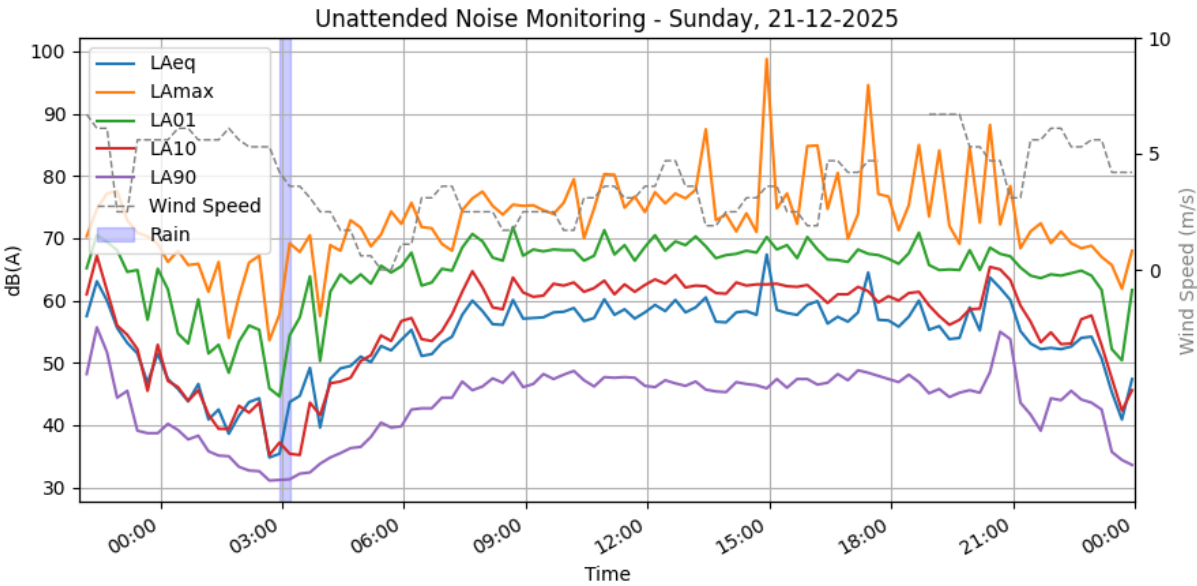
Ambient Noise Metric	Level, dB
LAeq Day	58.0
LAeq Evening	56.3
LAeq Night	54.9
LA90 Day	47.0
LA90 Evening	45.7
LA90 Night	45.2
LAeq 15hr	57.5
LAeq 9hr	54.9



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Sunday, 21-12-2025

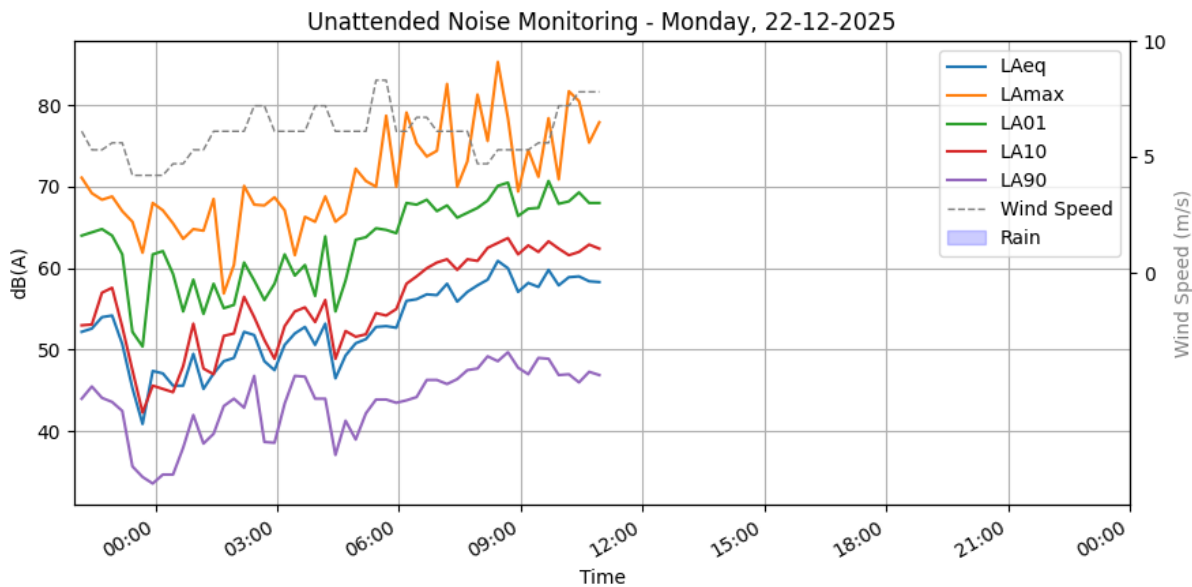
Ambient Noise Metric	Level, dB
LAeq Day	58.3
LAeq Evening	56.6
LAeq Night	48.8
LA90 Day	47.0
LA90 Evening	46.2
LA90 Night	39.1
LAeq 15hr	57.8
LAeq 9hr	48.8



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Monday, 22-12-2025

Ambient Noise Metric	Level, dB
LAeq Day	58.4
LAeq Evening	-
LAeq Night	50.5
LA90 Day	47.6
LA90 Evening	-
LA90 Night	41.7
LAeq 15hr	58.4
LAeq 9hr	50.5



Inclement weather events as observed at Jervis Bay Airfield have been excluded

9 Worrigee Road, Worrigee NSW - Noise Logger Report

Address: 9 Worrigee Road, Worrigee NSW

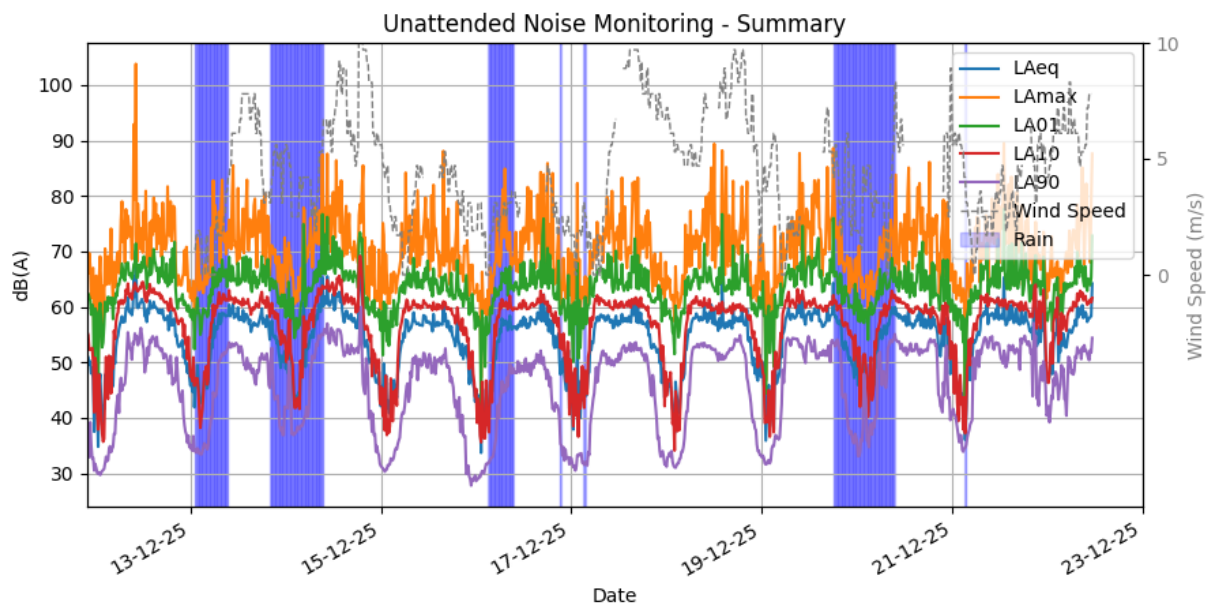
Logger: Rion NL-43 (01242267)

Period: 11-12-2025 to 22-12-2025

Location: NL2 - Fronting Greenwell Point Road

Facade/Free Field: Free Field

Environment: Greenwell Point road location. Consistent traffic, mostly light vehicles, some heavy. Light winds, cicadas, birds chirping. Car passby 61 dBA. Truck passby 73dBA



Inclement weather events as observed at Jervis Bay Airfield have been excluded

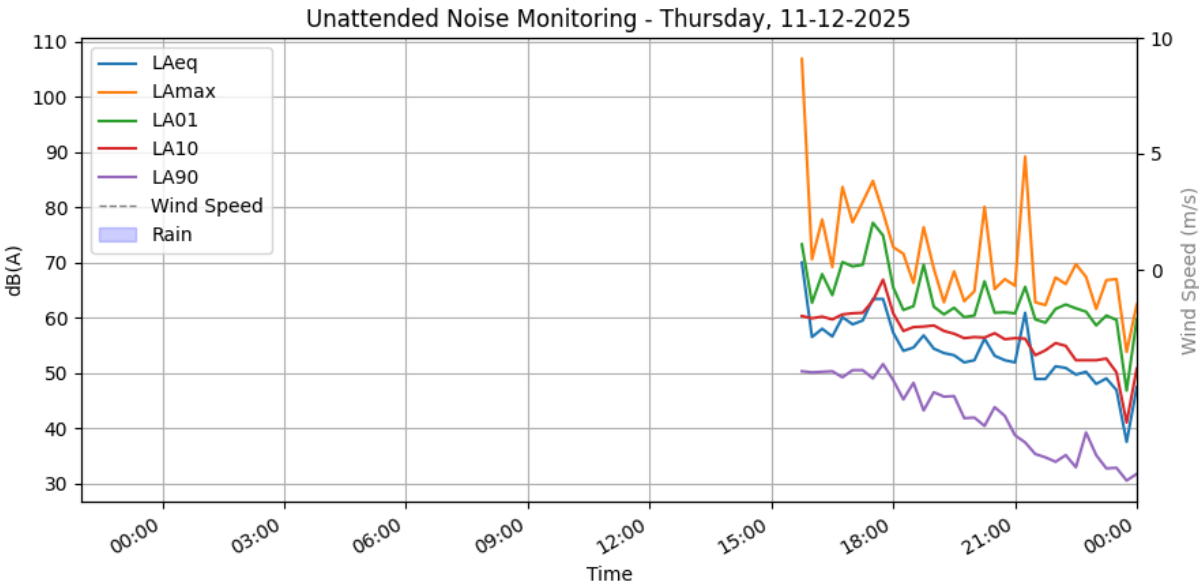
Summary Measurement Results

Date	LAeq Day 7am-6pm	LAeq Evening 6pm-10pm	LAeq Night 10pm-7am	LAeq 15hr 7am-10pm	LAeq 9hr 10pm-7am	LA90 Day 7am-6pm	LA90 Evening 6pm-10pm	LA90 Night 10pm-7am
11-12-2025	60.7	53.8	47.9	56.1	47.9	50.2	42.5	34.0
12-12-2025	59.8	55.8	48.8	58.7	48.8	52.4	47.4	35.9
13-12-2025	58.0	57.7	46.2	57.9	46.2	50.7	50.3	35.0
14-12-2025	59.9	56.0	47.2	58.5	47.2	53.8	48.1	35.3
15-12-2025	57.1	53.2	47.7	56.0	47.7	49.5	39.4	34.0
16-12-2025	57.6	54.4	44.0	56.5	44.0	49.4	42.5	31.2

17-12-2025	58.0	54.5	48.8	57.0	48.8	51.6	46.6	35.8
18-12-2025	57.8	55.9	48.1	57.2	48.1	52.4	48.8	36.7
19-12-2025	58.4	-	48.5	58.4	48.5	52.6	-	38.8
20-12-2025	57.7	55.8	53.6	57.0	53.6	52.6	49.5	45.4
21-12-2025	58.5	56.8	50.0	58.0	50.0	52.5	51.2	42.6
22-12-2025	58.8	-	53.2	58.8	53.2	51.9	-	45.9
Average	58.5	55.4	48.7	57.5	48.7	51.6	46.6	37.6

Date: Thursday, 11-12-2025

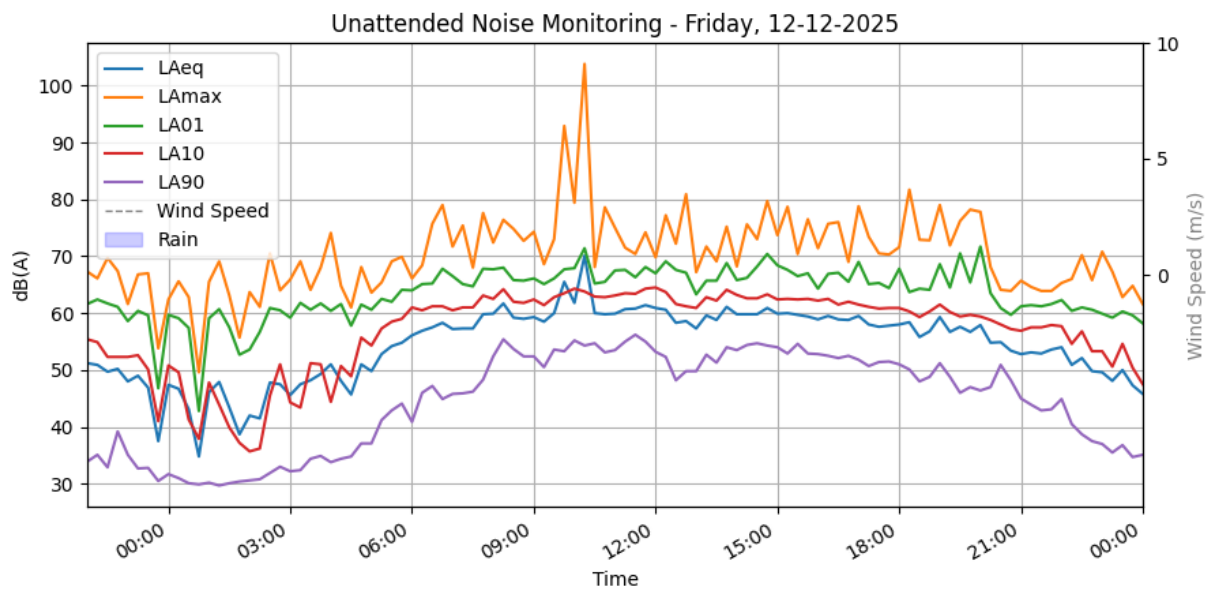
Ambient Noise Metric	Level, dB
LAeq Day	60.7
LAeq Evening	53.8
LAeq Night	47.9
LA90 Day	50.2
LA90 Evening	42.5
LA90 Night	33.8
LAeq 15hr	56.1
LAeq 9hr	47.9



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Friday, 12-12-2025

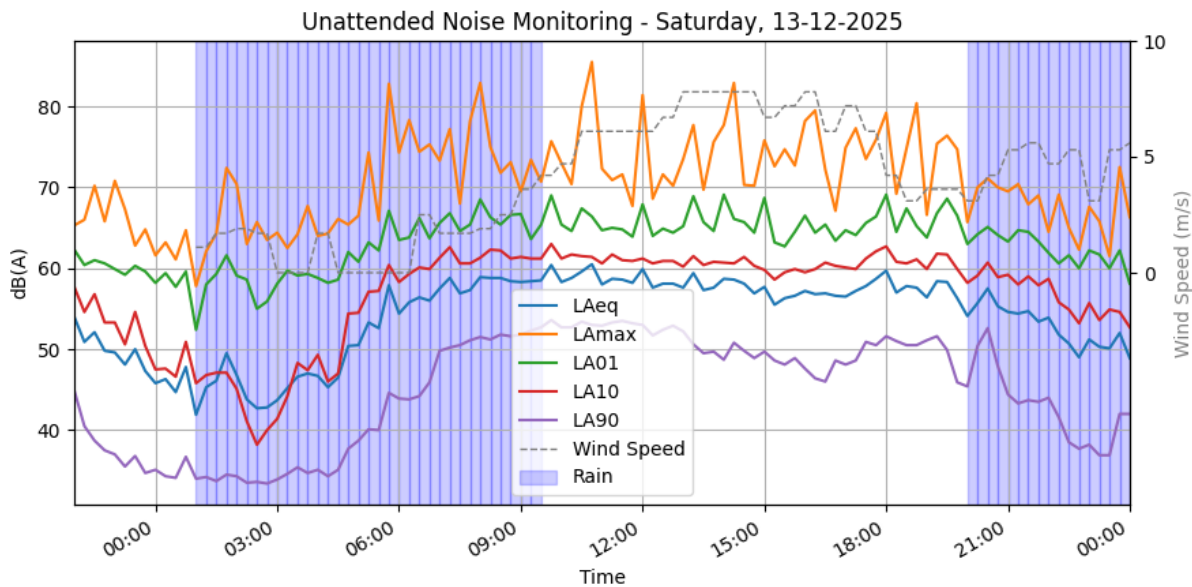
Ambient Noise Metric	Level, dB
LAeq Day	59.8
LAeq Evening	55.8
LAeq Night	48.5
LA90 Day	52.4
LA90 Evening	47.4
LA90 Night	35.6
LAeq 15hr	58.6
LAeq 9hr	48.5



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Saturday, 13-12-2025

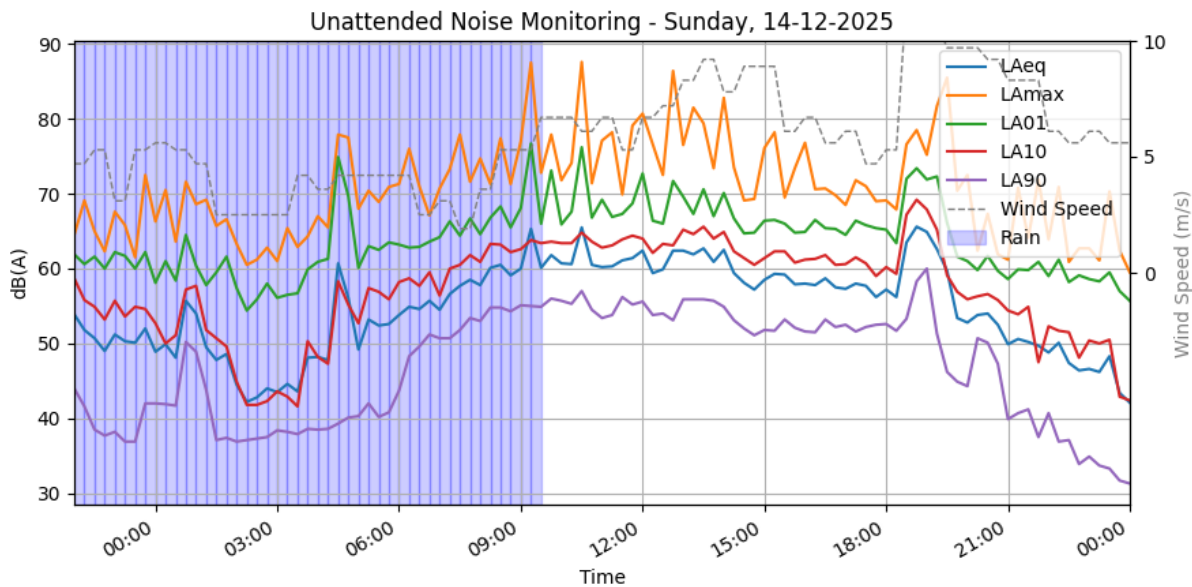
Ambient Noise Metric	Level, dB
LAeq Day	58.0
LAeq Evening	57.7
LAeq Night	48.9
LA90 Day	50.7
LA90 Evening	50.3
LA90 Night	37.2
LAeq 15hr	57.8
LAeq 9hr	48.9



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Sunday, 14-12-2025

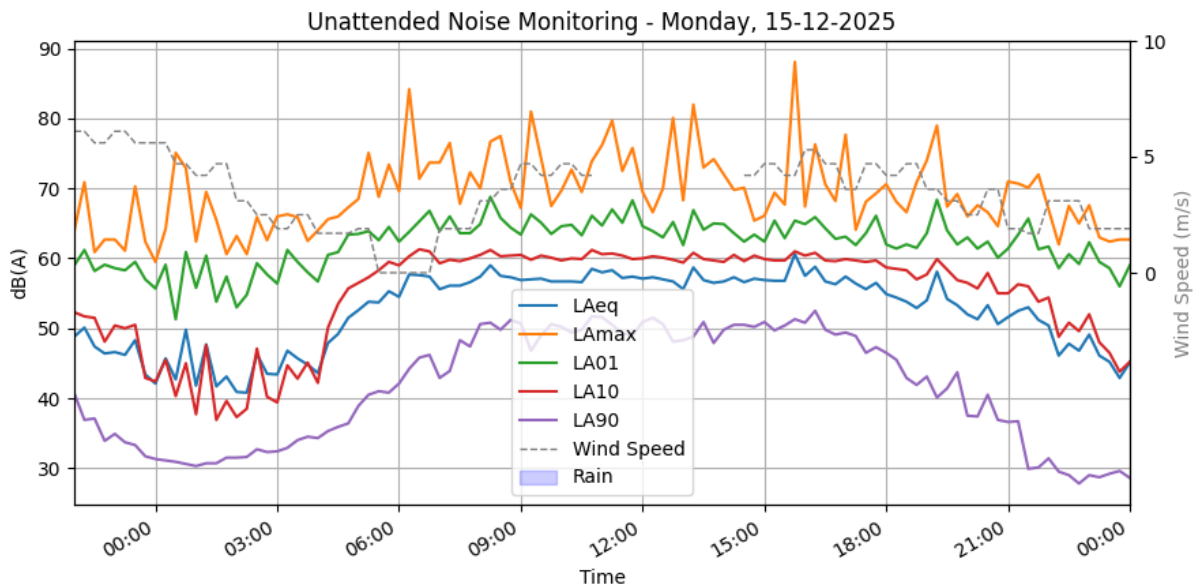
Ambient Noise Metric	Level, dB
LAeq Day	59.9
LAeq Evening	56.0
LAeq Night	46.6
LA90 Day	53.8
LA90 Evening	48.1
LA90 Night	34.8
LAeq 15hr	58.5
LAeq 9hr	46.6



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Monday, 15-12-2025

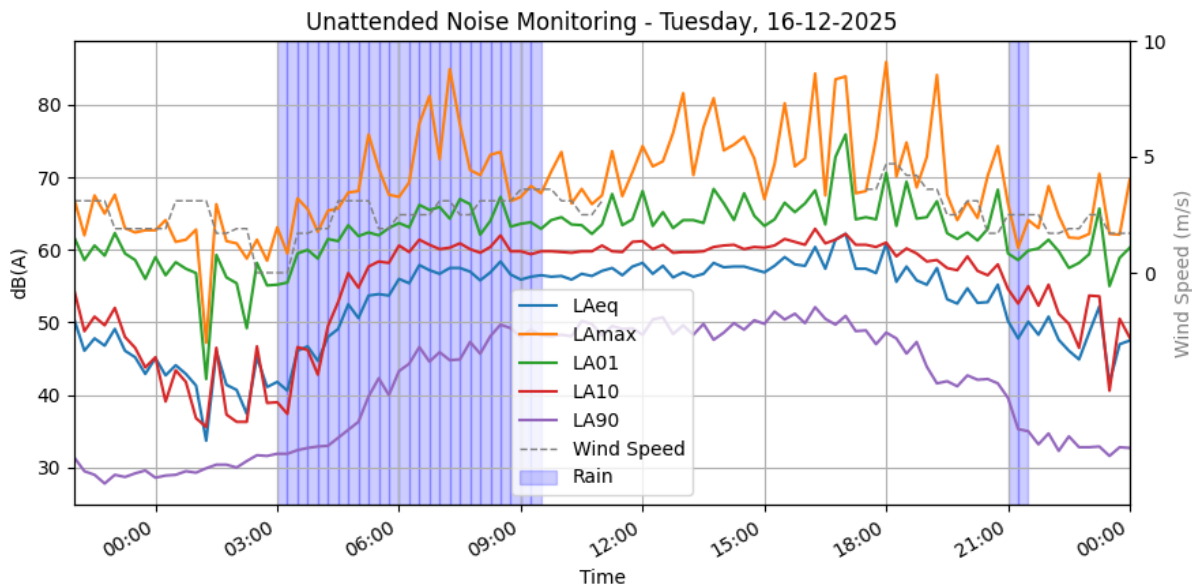
Ambient Noise Metric	Level, dB
LAeq Day	57.1
LAeq Evening	53.2
LAeq Night	47.5
LA90 Day	49.5
LA90 Evening	39.4
LA90 Night	34.1
LAeq 15hr	55.9
LAeq 9hr	47.5



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Tuesday, 16-12-2025

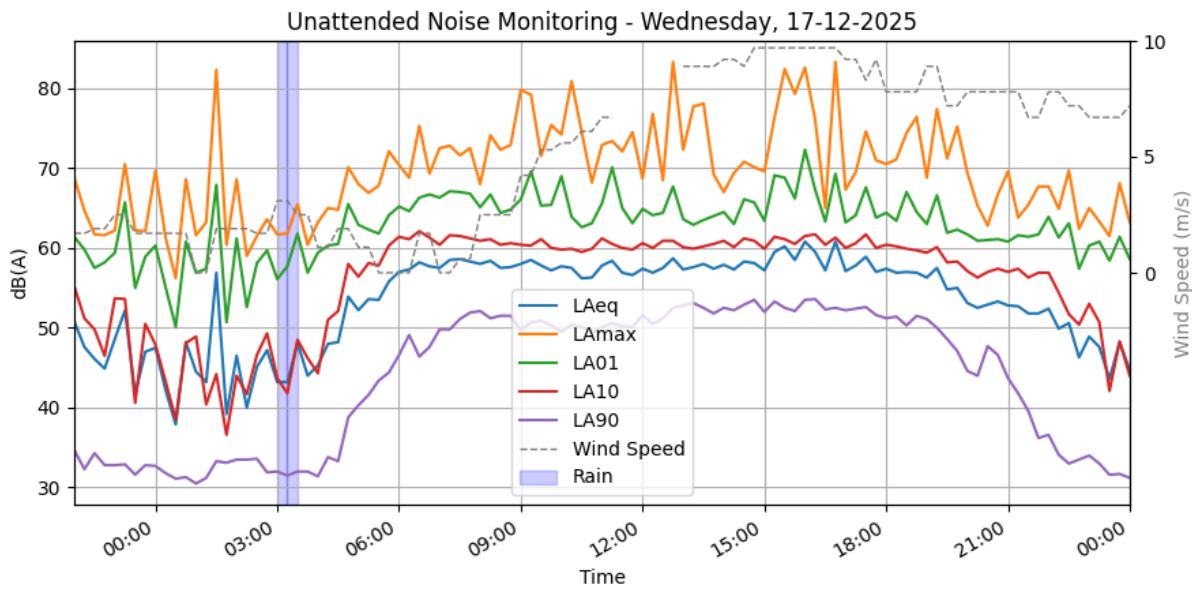
Ambient Noise Metric	Level, dB
LAeq Day	57.6
LAeq Evening	54.4
LAeq Night	44.9
LA90 Day	49.4
LA90 Evening	42.5
LA90 Night	30.7
LAeq 15hr	56.4
LAeq 9hr	44.9



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Wednesday, 17-12-2025

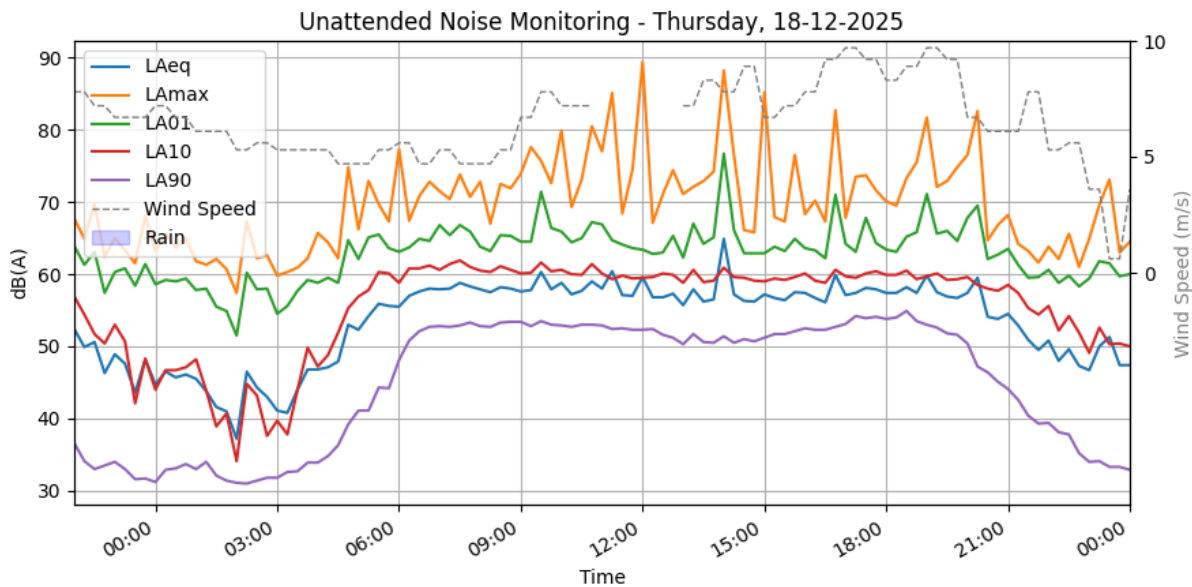
Ambient Noise Metric	Level, dB
LAeq Day	58.0
LAeq Evening	54.5
LAeq Night	48.4
LA90 Day	51.6
LA90 Evening	46.6
LA90 Night	35.1
LAeq 15hr	56.9
LAeq 9hr	48.4



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Thursday, 18-12-2025

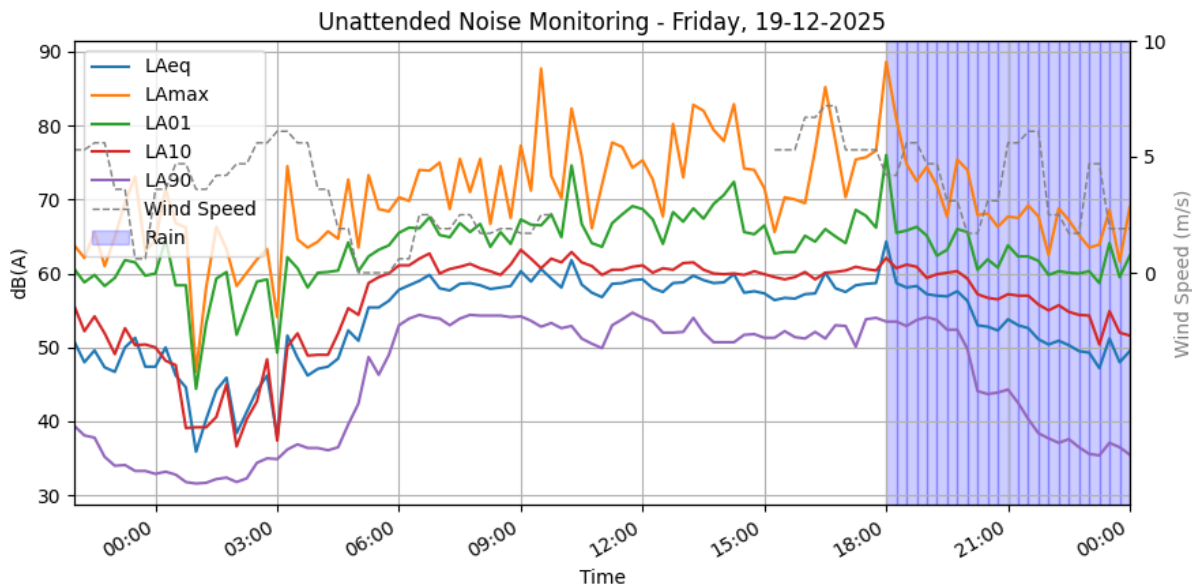
Ambient Noise Metric	Level, dB
LAeq Day	57.8
LAeq Evening	55.9
LAeq Night	48.1
LA90 Day	52.4
LA90 Evening	48.8
LA90 Night	36.0
LAeq 15hr	57.1
LAeq 9hr	48.1



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Friday, 19-12-2025

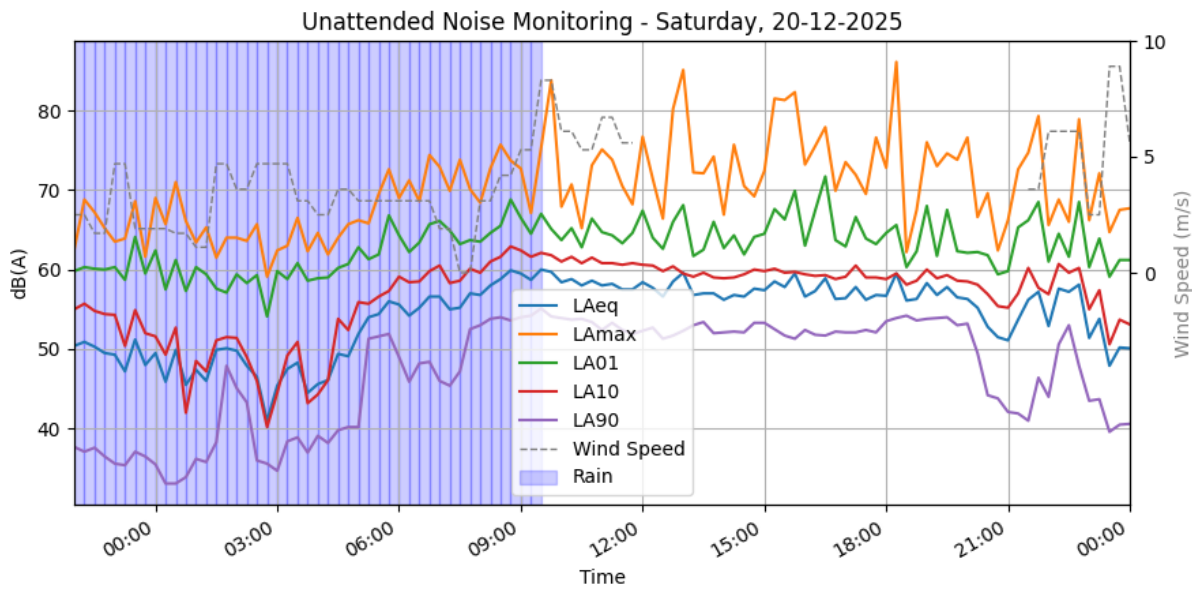
Ambient Noise Metric	Level, dB
LAeq Day	58.4
LAeq Evening	-
LAeq Night	48.6
LA90 Day	52.6
LA90 Evening	-
LA90 Night	38.1
LAeq 15hr	58.2
LAeq 9hr	48.6



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Saturday, 20-12-2025

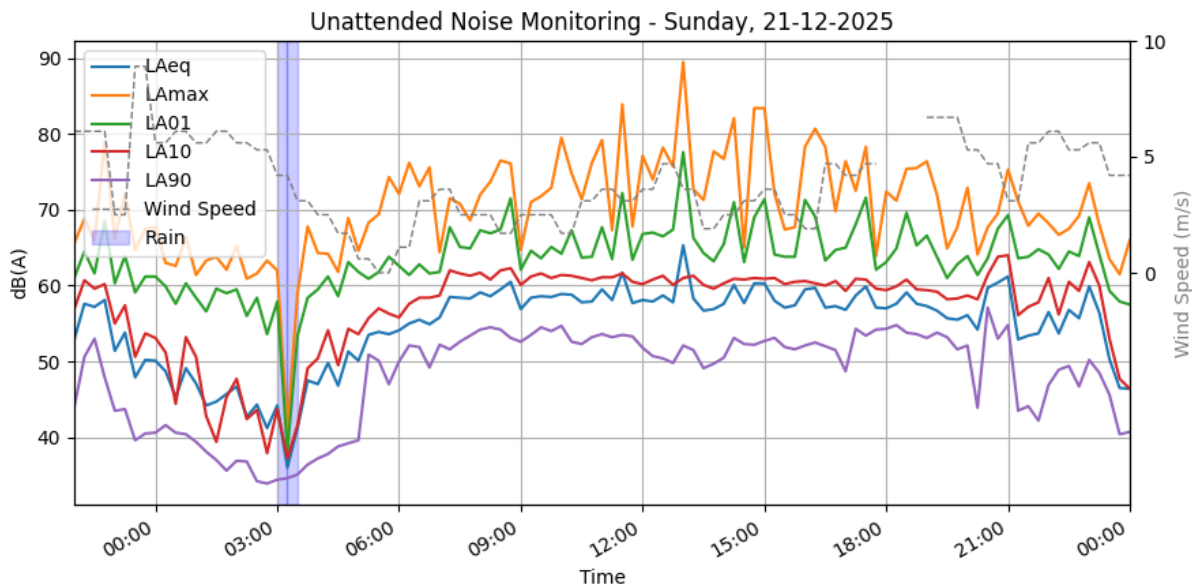
Ambient Noise Metric	Level, dB
LAeq Day	57.7
LAeq Evening	55.8
LAeq Night	53.2
LA90 Day	52.6
LA90 Evening	49.5
LA90 Night	44.8
LAeq 15hr	57.0
LAeq 9hr	53.2



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Sunday, 21-12-2025

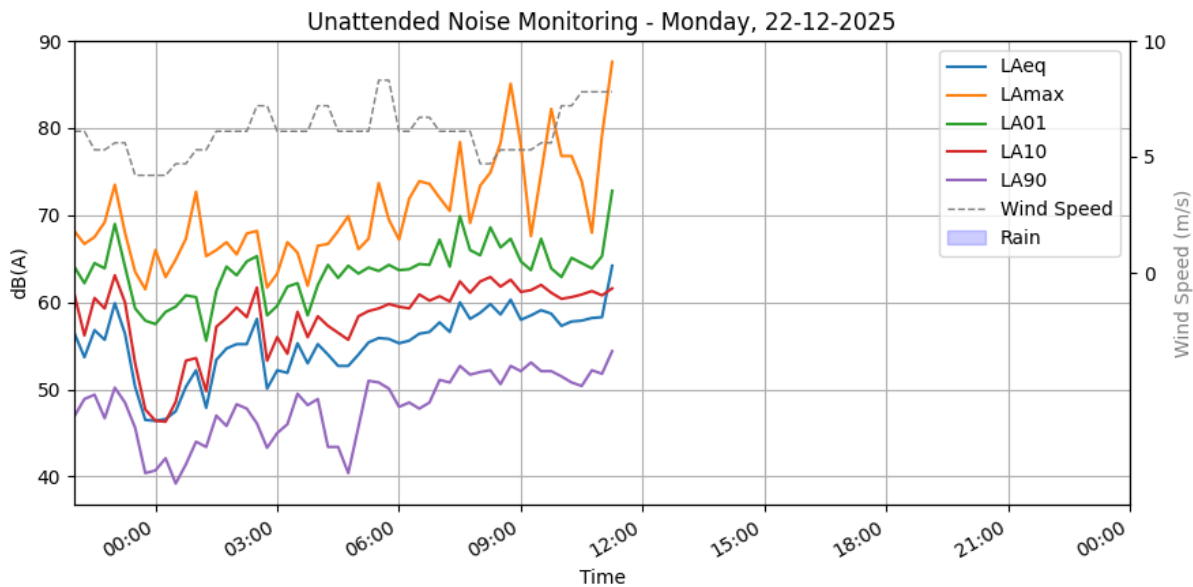
Ambient Noise Metric	Level, dB
LAeq Day	58.5
LAeq Evening	56.8
LAeq Night	50.6
LA90 Day	52.5
LA90 Evening	51.2
LA90 Night	43.0
LAeq 15hr	58.0
LAeq 9hr	50.6



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Date: Monday, 22-12-2025

Ambient Noise Metric	Level, dB
LAeq Day	58.8
LAeq Evening	-
LAeq Night	53.5
LA90 Day	51.9
LA90 Evening	-
LA90 Night	46.1
LAeq 15hr	58.7
LAeq 9hr	53.5



Inclement weather events as observed at Jervis Bay Airfield have been excluded

Appendix B – Construction Noise Contours



Construction Noise - Phase 01

Noise contours are shown 1.5 metres above ground level

Predicted Noise Level $L_{Aeq,15min}$ dB

50 60 70 80

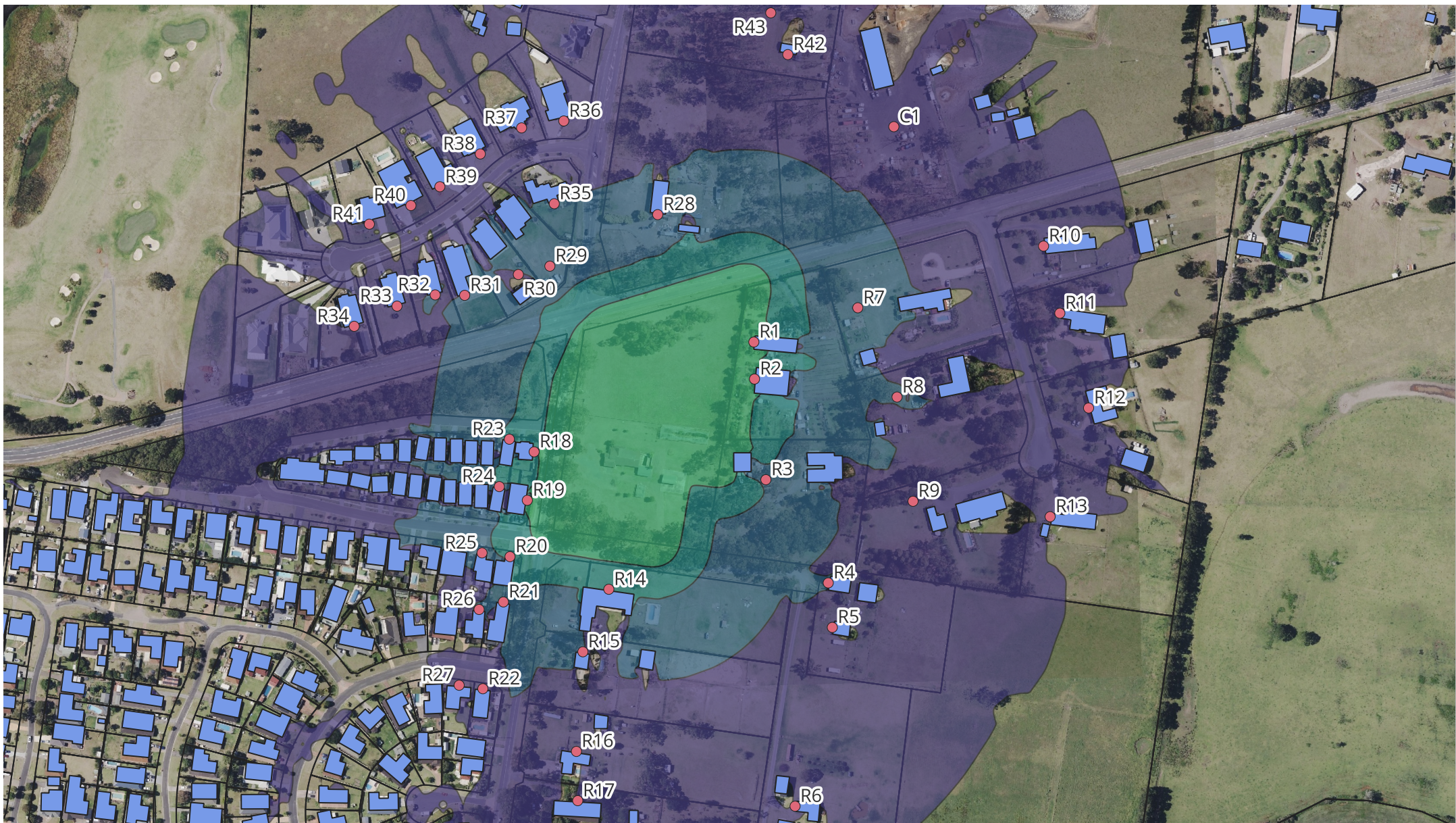
Building Receiver

0 100 200 m



Lucid

Project Number: LCE104682
Project Engineer: MA
Date: 14/01/2026



Construction Noise - Phase 02

Noise contours are shown 1.5 metres above ground level

Predicted Noise Level $L_{Aeq,15min}$ dB

50 60 70 80

Building Receiver

0 100 200 m



Lucid

Project Number: LCE104682
Project Engineer: MA
Date: 14/01/2026



Construction Noise - Phase 03

Noise contours are shown 1.5 metres above ground level

Predicted Noise Level $L_{Aeq,15min}$ dB

50 60 70 80

Building Receiver

0 100 200 m



Lucid

Project Number: LCE104682
Project Engineer: MA
Date: 14/01/2026

Appendix C – Operational Noise Contours



Operational Noise - Mechanical Plant / Car Park

Noise contours are shown 1.5 metres above ground level

Predicted Noise Level $L_{Aeq,15min}$ dB

● Receiver ■ Building ■ Site Buildings

0 100 200 m



Lucid

Project Number: LCE104682
Project Engineer: MA
Date: 28/01/2026

■ 45



Operational Noise - Outdoor Play Areas

Noise contours are shown 1.5 metres above ground level

Predicted Noise Level $L_{Aeq,15min}$ dB

50 60 70 80

Receiver Building Site Buildings

0 100 200 m



Lucid

Project Number: LCE104682
Project Engineer: MA
Date: 28/01/2026