Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

1-11 Hayes Road, Rosebery NSW 2018

Prepared by:

SLR Consulting Australia Pty Ltd

SLR Project No.: 610.032285.00003

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
v2.0	16 February 2026	Joshua Ridgway	Steven Luzuriaga	Steven Luzuriaga
v1.0	29 September 2025	Joshua Ridgway	Steven Luzuriaga	Steven Luzuriaga

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Goodman Property Services (Aust) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Tables

Figures

Appendices

1.0 Introduction

A State Significant Development Application (SSDA) has been prepared in support of a proposed data centre at 12 Mars Road, Lane Cove West (Project Mars Data Centre). The proposed development (SSD-82052708) will seek approval to demolish existing structures on the site, construct, fit out and the operation of a data centre, with associated works.

The proposal will include the following:

- Site preparation works including demolition, bulk excavation and removal of existing structures on the site, tree and vegetation clearing, and bulk earthworks.
- Construction, fit out and operation of a three-storey data centre with a total gross floor area of approximately 21,832 m^2 comprising:
  - 24 car parking spaces
  - 2 loading dock spaces
  - 2 levels of technical data hall floor space
  - 3 level office and amenities building
- Provision of required utilities, including:
  - diesel storage tanks
  - water storage tanks
  - substations onsite
- Vehicle and pedestrian access provided via Mars Road.
- Associated landscaping and site servicing.
- Installation of site services and drainage infrastructure.
- A floor space ration of approximately 0.65:1.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) and accompanying cover letter issued for the proposed development (SSD-82052708) dated 10 April 2025.

Specifically, this report has been prepared to respond to the SEARs requirement shown in **Table 1**.

Table 1 Secretary's Environmental Assessment Requirements

Item	Description of Requirement	Section Reference (this report)
12. Noise and Vibration	Provide a noise and vibration assessment prepared in accordance with the relevant EPA guidelines and Australian/International Standards. The assessment must detail construction and operational noise and vibration impacts (including testing of any back-up power system) on nearby sensitive receivers and structures, and outline the proposed mitigation, management and monitoring measures that would be implemented.	**Construction:** **Sections 3.1**, **3.2**, **4.1**, **5.1** and **5.2** **Operation:** **Sections 3.3**, **4.2** and **5.3** **Mitigation:** **Section 7.0**
Cover Letter – Operational noise	The EIS must include an operational noise assessment, which: • Provides details of noise monitoring surveys, background noise levels and amenity noise levels at the potentially most-affected residential receptors (i.e. not necessarily the nearest residential receptor).	**Sections 2.0** and **3.3**
	• Includes details of manufacturer specifications for plant and equipment and the noise source inventory (demonstrating worst-case modelling of plant and equipment for each assessment period, including testing of any back-up power system and a critical power failure scenario).	**Sections 4.2** and **5.3**, and **Appendix G**
	• Evaluates data centre operational noise for any potential annoying noise characterises, such as tonality and dominant low-frequency content.	**Section 4.2.4**

SLR is suitably qualified and endorsed by the Planning Secretary to produce SSDA noise impact assessments. SLR staff are members of the Australian Acoustical Society (AAS) and SLR is a member firm of the Association of Australasian Acoustical Consultants (AAAC).

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

1.1 The Site

The proposal is located on land known as 12 Mars Road, Lane Cove West, legally described as Lot 22 DP732062, and is zoned E4 General Industrial. The site is located on Country of the Gadigal people within the local government area of Bayside Council.

The site is located in the Lane Cove West Business Park which is a ley economic and employment precinct in the Lane Cove Local Government Area (LGA). The site comprises one individual allotment totalling 33,559 m^2. It is currently occupied by four warehouse buildings with ancillary office spaces.

Surrounding land uses in the immediate vicinity of the site include:

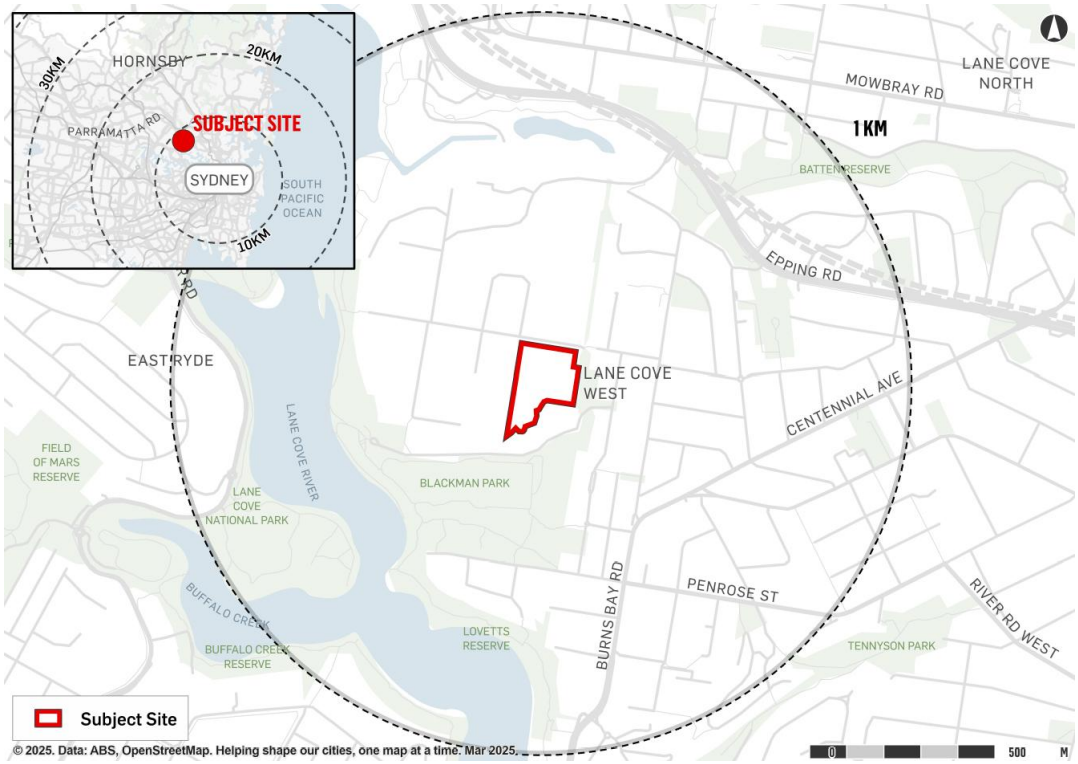
- North and west: Industrial and commercial uses within the Lane Cove West Business Park.
- Northeast, east and southeast: Residential uses adjacent to Banksia Close and Wood Street.
- South: Blackman Park (primarily outdoor active recreation), with residential uses beyond adjacent to Penrose Street.

Site location and local context are shown in **Figure 1** and **Figure 2**. The proposed layout of the data centre is shown in **Figure 3** to **Figure 8**.

Figure 1 Site Aerial

Source: Urbis, 2025

Figure 2 Local Context



Source: Urbis, 2025

Figure 3 Proposed Development – Lower Ground Floor Layout

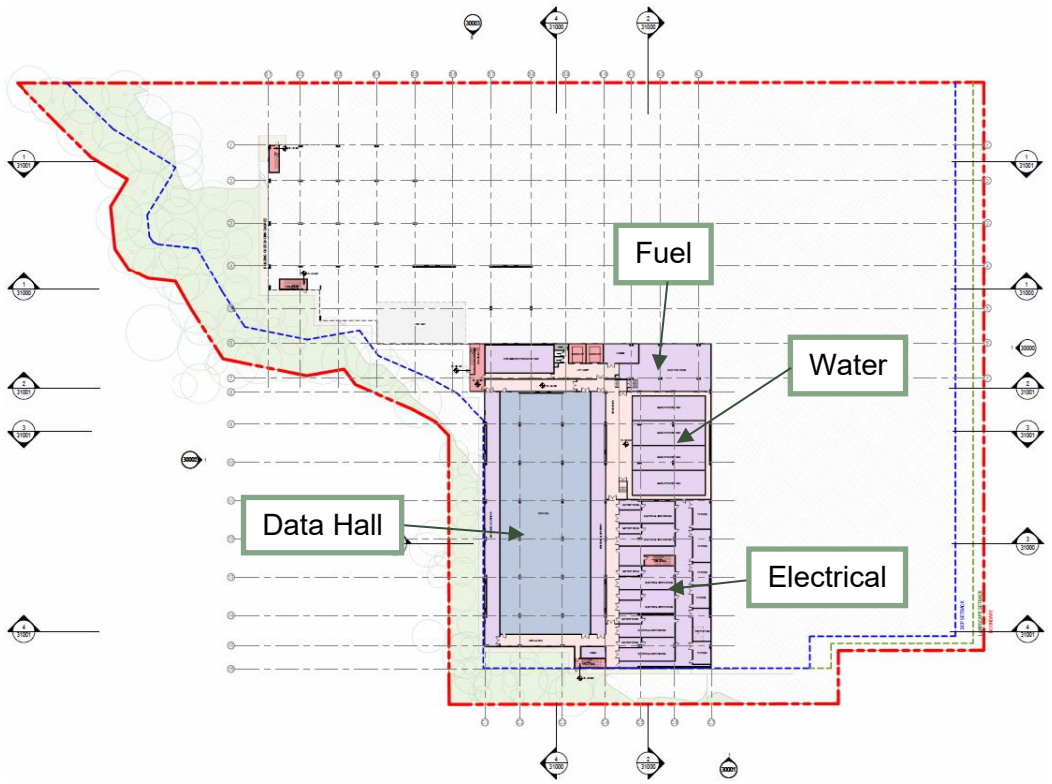


Figure 4 Proposed Development – Ground Floor Layout

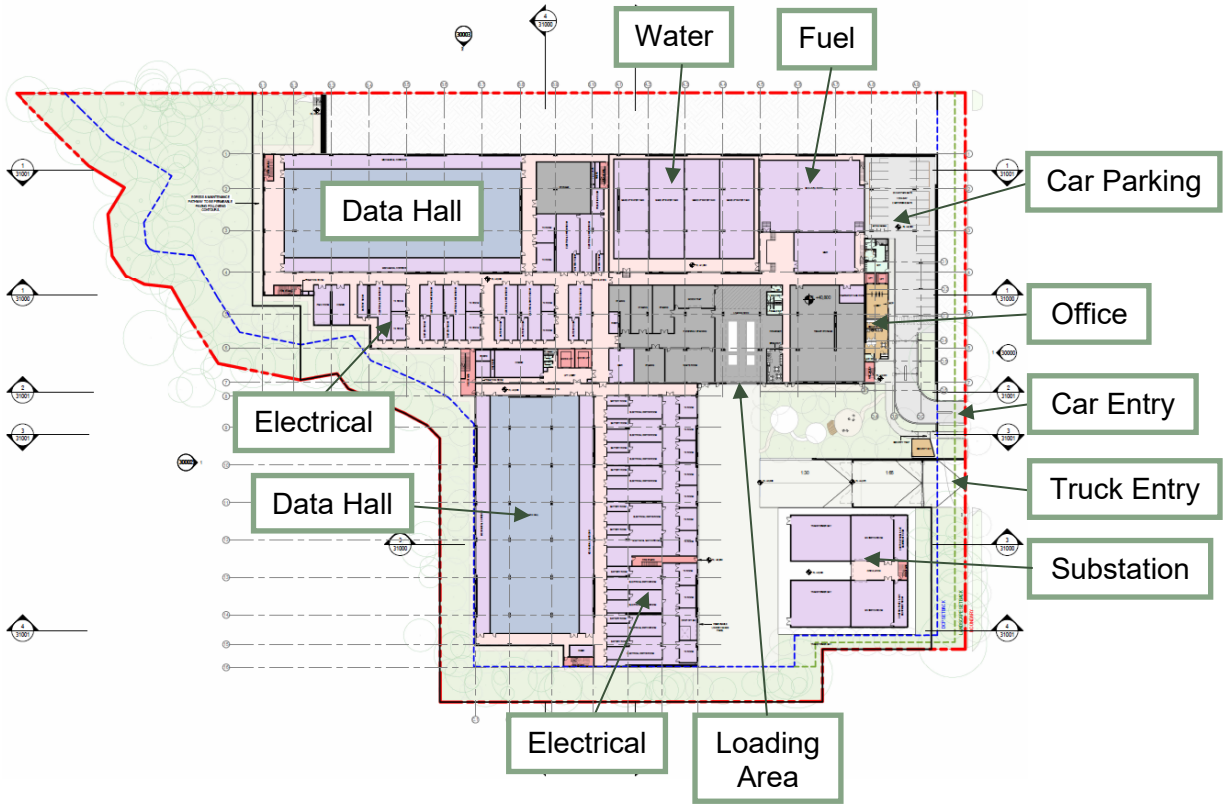


Figure 5 Proposed Development – Level 1 Floor Layout

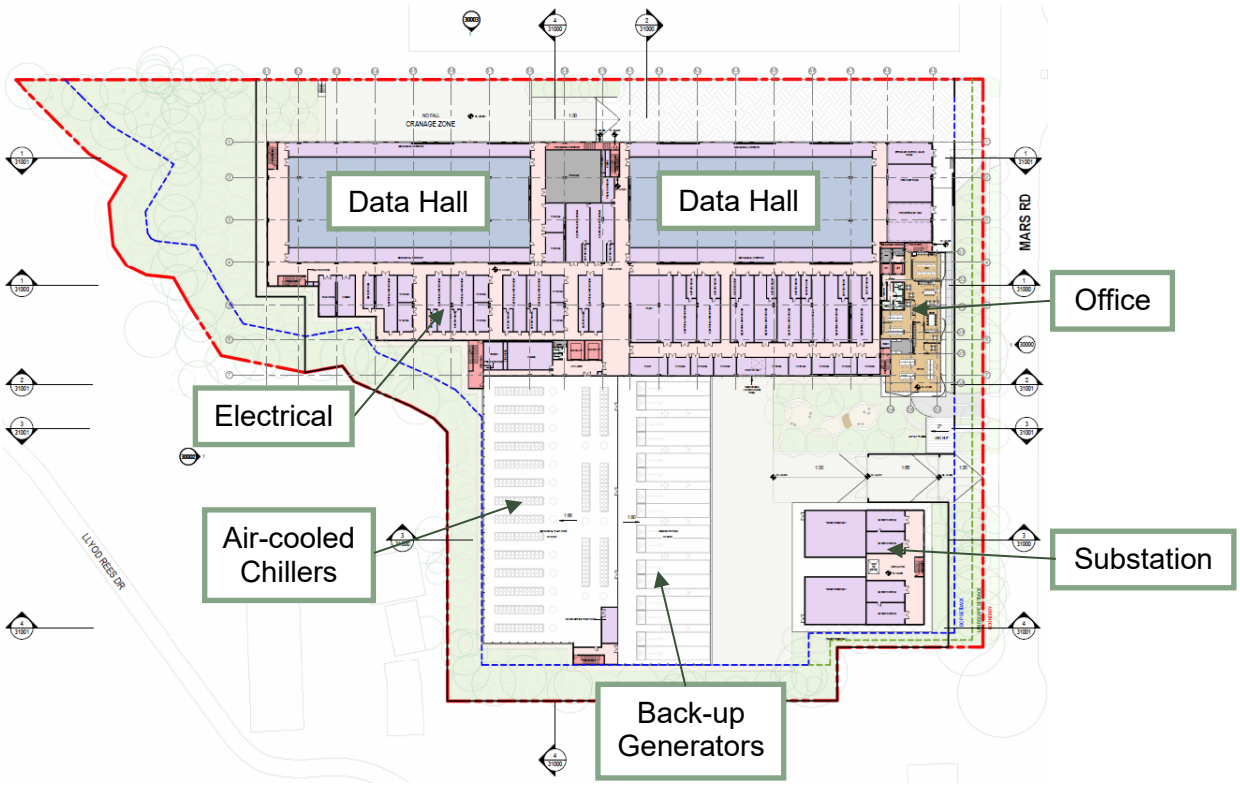


Figure 6 Proposed Development – Level 2 Floor Layout

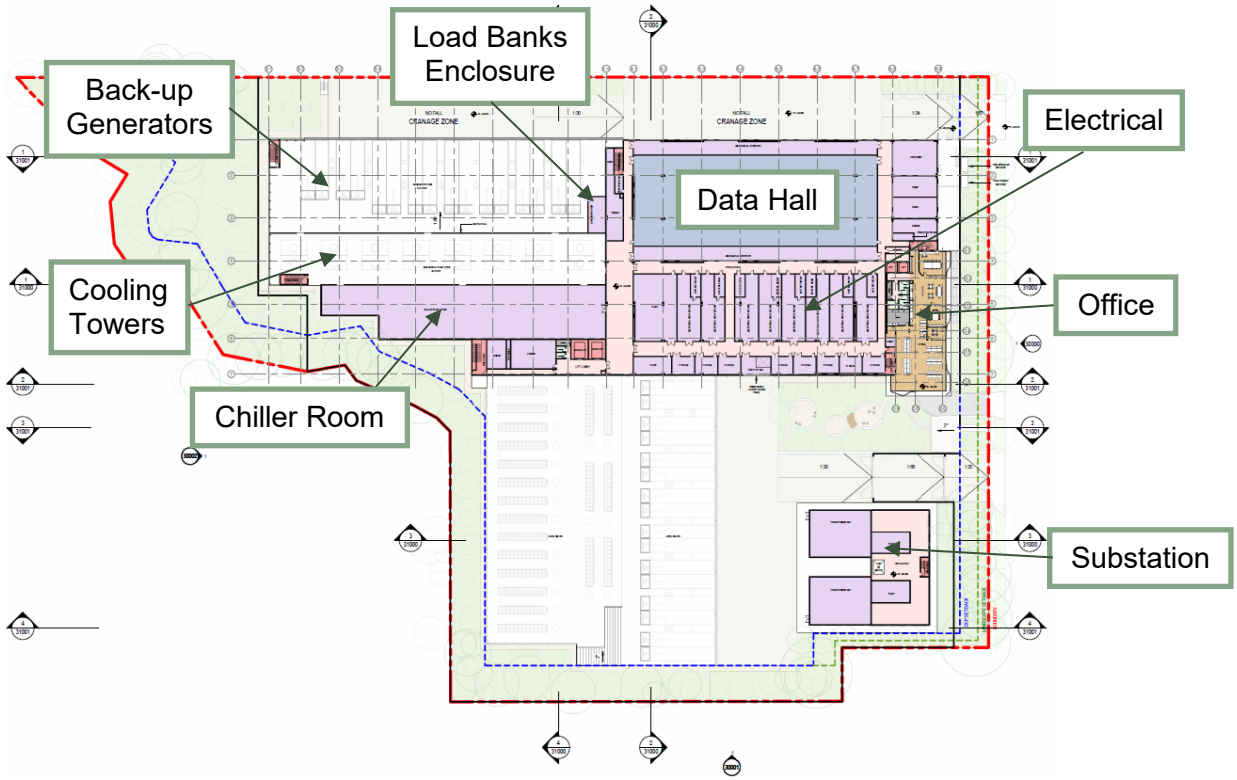


Figure 7 Proposed Development – Roof Layout

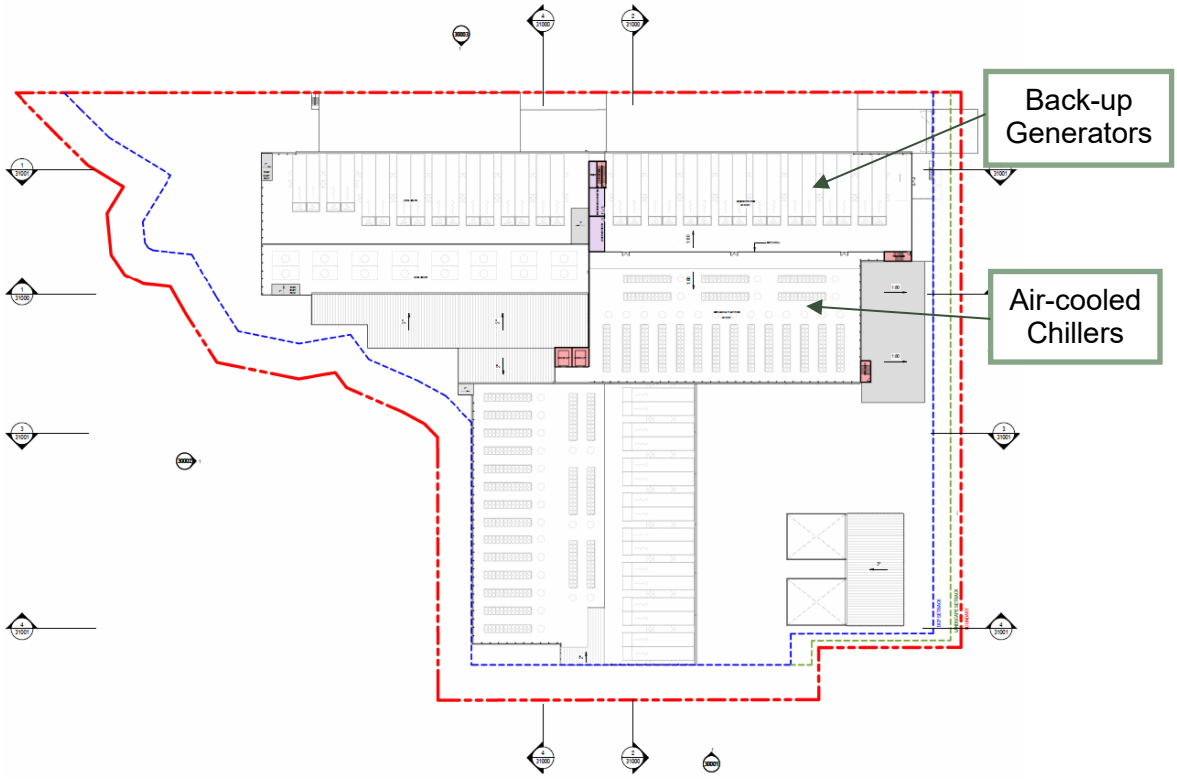
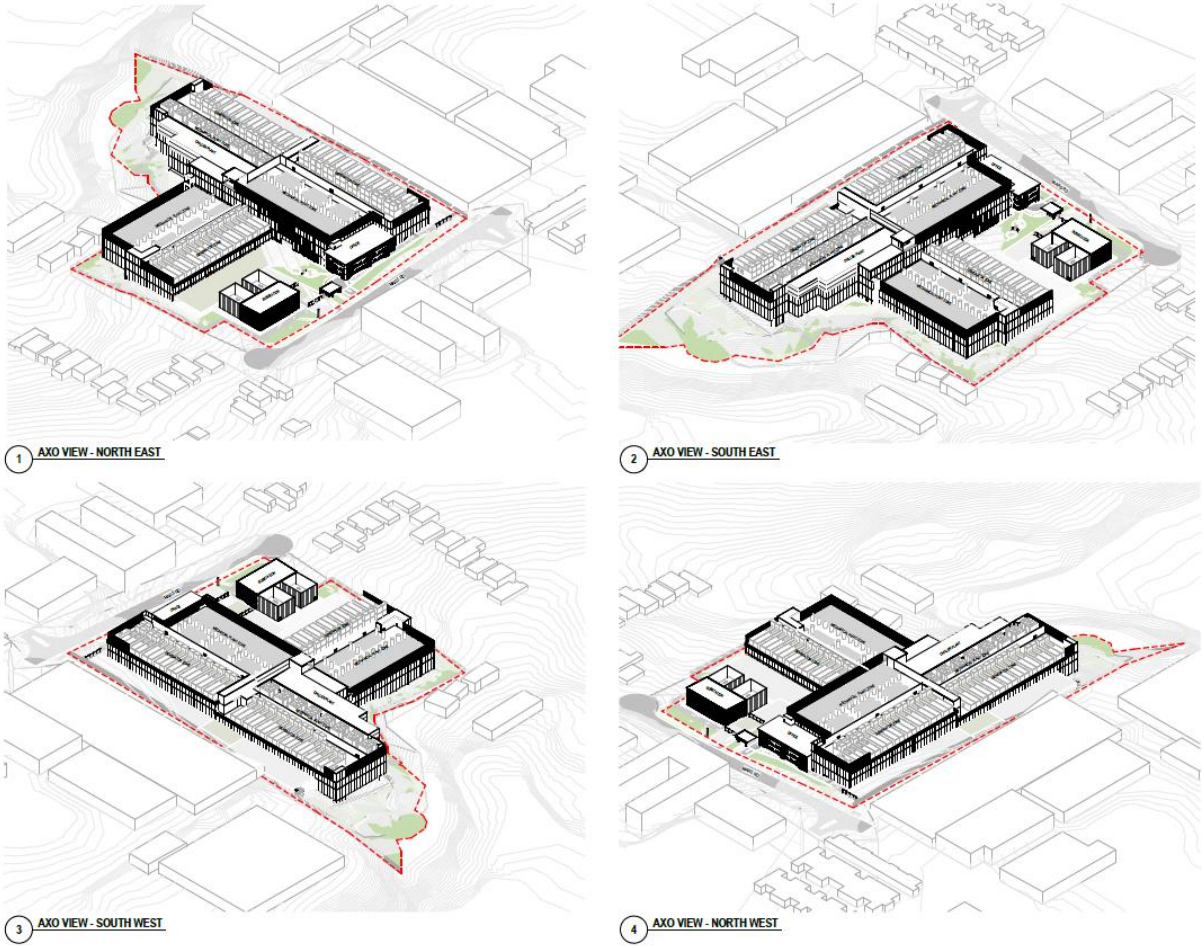


Figure 8 Proposed Development – 3D View



1.2 Nearest Receivers

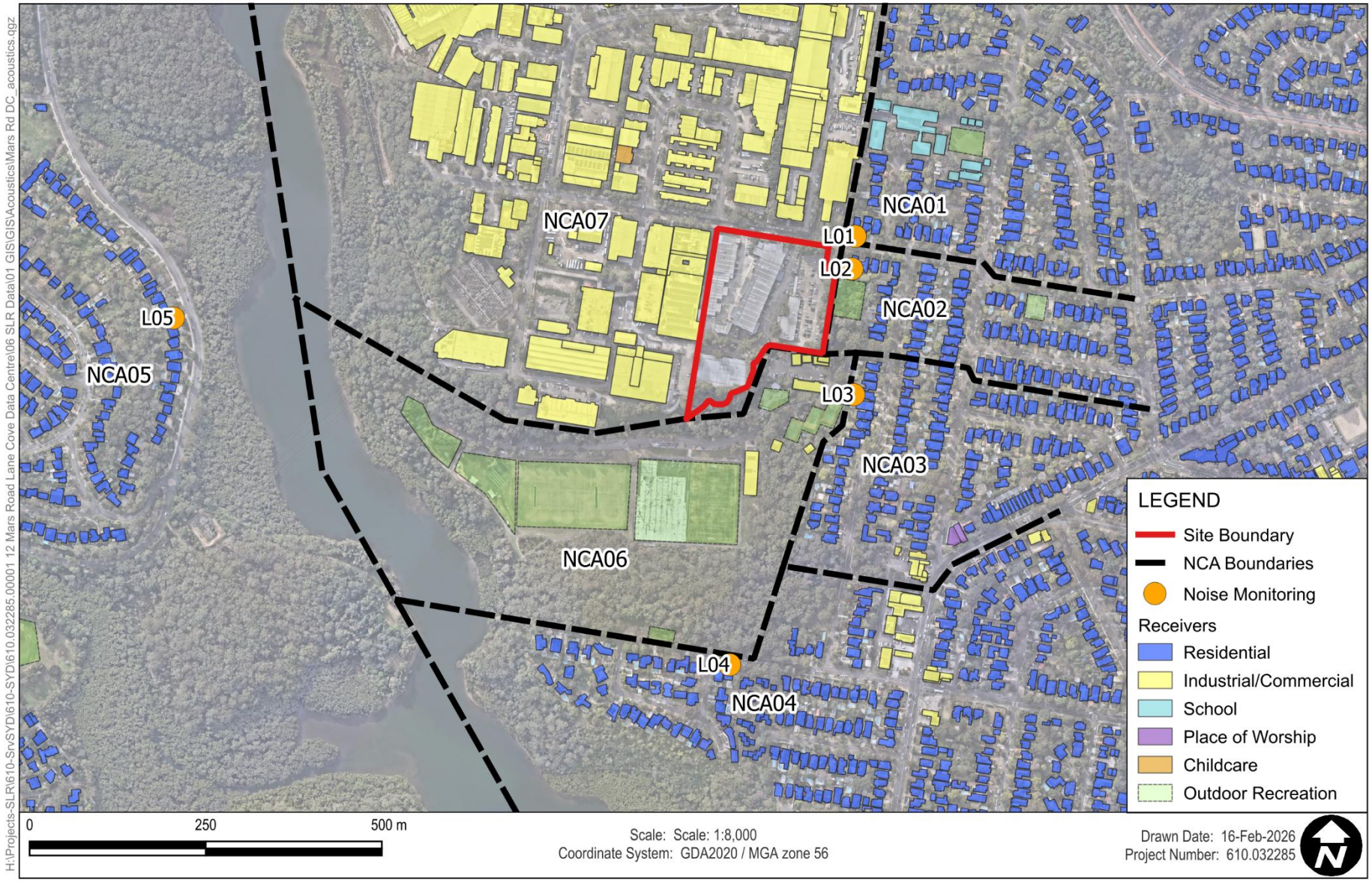
Residential areas are located adjacent to the site to the northeast, east and southeast. Distant residential is also located to the south (across Blackman Park), and the west and southwest (west of Lane Cove River). Blackman Park is located adjacent to the site to the south which consists primarily of active recreation areas (playing fields, skatepark, tennis courts, etc). Isolated childcare, school and places of worship receivers are distant to the northwest, northeast and southeast, respectively. Industrial uses are located to the west and north of the site within the Lane Cove West Business Park.

The nearest receivers are shown in **Figure 9** and detailed in **Table 2**.

Table 2 Surrounding Sensitive Receivers

ID	Receiver Area	Type	Distance (m)[1]	Direction
NCA01	Residential receivers to the north of Banksia Close	Residential	40 m	Northeast
	Lane Cove West Public School	Educational	150 m	Northeast
NCA02	Residential receivers between Banskia Close and Lloyd Rees Drive	Residential	25 m	East
	Lane Cove Community Nursery	Active Recreation	15 m	East
NCA03	Residential receivers between Lloyd Rees Drive and Beatrice Street	Residential	65 m	Southeast
	Metropolitan Baptist Church	Place of Worship	300 m	Southeast
NCA04	Residential south of Beatrice Street and Penrose Street	Residential	325 m	South
NCA05	Residential to the west of Lane Cove River	Residential	720 m	West, southwest
NCA06	Blackman Park (playing fields, skatepark, tennis courts, etc)	Active Recreation	25 m	South, southwest
NCA07	Lane Cove West Business Park	Industrial	5 m	North, northwest, west
	MindChamps Early Learning and Preschool	Childcare	150 m	Northwest

Note 1: Distance to nearest receiver in the NCA.


H:\Projects-SLR\610-Srv\SYD\610-SYD\610.032285.00001 12 Mars Road Lane Cove Data Centre\06 SLR Data\01 GIS\GIS\Acoustics\Mars Rd DC_acoustics.qgz
NCA01
NCA02
NCA03
NCA04
NCA05
NCA06
NCA07
L01
L02
L03
L04
L05
LEGEND
Site Boundary
NCA Boundaries
Noise Monitoring
Receivers
Residential
Industrial/Commercial
School
Place of Worship
Childcare
Outdoor Recreation
0
250
500 m
Scale: Scale: 1:8,000
Coordinate System: GDA2020 / MGA zone 56
Drawn Date: 16-Feb-2026
Project Number: 610.032285

2.0 Existing Noise Environment

2.1 Unattended Noise Monitoring

Unattended noise monitoring was completed in the study area in February, March, April, November and December 2025. The measured noise levels have been used to determine the existing noise environment and to set the criteria used to assess the potential impacts from the proposal.

The monitoring equipment was positioned to measure existing noise levels that are representative of receivers potentially most-affected by the proposal, within constraints such as accessibility, security and landowner permission.

The noise monitoring equipment continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time. All equipment carried current National Association of Testing Authorities (NATA) or manufacturer calibration certificates and equipment calibration was confirmed before and after each measurement.

The measured data has been processed to exclude noise from extraneous events and periods affected by adverse weather conditions, such as strong wind or rain (measured at the Sydney Olympic Park Bureau of Meteorology (BOM) weather station), to establish representative existing noise levels in the study area.

The noise monitoring locations are shown in **Figure 9** and the results are summarised in **Table 3**. Details of the monitoring locations together with graphs of the measured daily noise levels are provided in **Appendix B**. All unattended noise monitoring was captured and processed in accordance with the NSW EPA *Noise Policy for Industry* (NPfI), including Fact Sheets A and B of the NPfI.

Table 3 Summary of Unattended Noise Monitoring Results

ID	Address	Measured Noise Levels (dBA)[1]					
		Background Noise (RBL)			Average Noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L01	NCA01 – 17 Banksia Close, Lane Cove West	43	40	31	58	53	47
L02	NCA02 – 10 Banksia Close, Lane Cove West	43	40	31	55	54	49
L03	NCA03 – 50 Wood Street, Lane Cove West	40	38	30	55	53	47
L04	NCA04 – 86 Penrose Street, Lane Cove West	38	38[3] (actual 40)	33	55	55	46
L05	NCA05 – 292 Pittwater Road, East Ryde[2]	46	43	35	66	63	54

Note 1: The assessment periods are the daytime which is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and public holidays, the evening which is 6 pm to 10 pm, and the night-time which is 10 pm to 7 am on Monday to Saturday and 10 pm to 8 am on Sunday and public holidays. See the NSW EPA Noise Policy for Industry.

Note 2: Measured noise levels at this location have a -2.5 dB adjustment applied to account for facade reflections.

Note 3: Where the evening RBL is higher than the day RBL, it has been reduced to be equal to the day RBL, as detailed in Section 2.3 of the NPfI.

2.2 Attended Noise Monitoring

Short-term attended noise monitoring was also completed at each monitoring location during the unattended monitoring surveys. The attended measurements allow the contributions of the various noise sources at the monitoring location to be determined. Additional attended noise monitoring during the night-time was undertaken at several locations adjacent to receivers to the east and south of the site in September 2025 to provide an indication of the various noise sources during the night-time. Additional attended noise monitoring in NCA02 was undertaken during the unattended monitoring survey at L02, to compare background noise levels at various locations within NCA02. Detailed observations from the attended measurements are provided in **Appendix B**. All attended noise monitoring was captured and processed in accordance with the NSW EPA *Noise Policy for Industry* (NPfI), including Fact Sheets A and B of the NPfI.

Table 4 Summary of Attended Noise Monitoring Results

ID	Address	Measured Noise Levels (dBA)			Notes
		LAmax	LAeq(15min)	LA90(15min)	
L01	NCA01 – 17 Banksia Close, Lane Cove West	66	51	47	Daytime measurement. LA90 was typically dominated by distant traffic. LAeq was typically influenced by birds and local traffic. LAmax during the measurement was a motorbike on Mars Road.
L02	NCA02 – 10 Banksia Close, Lane Cove West	77	58	47	Daytime measurement. LA90 was typically dominated by insects and distant traffic, with some industrial noise. LAeq was typically influenced by birds, aircraft and local traffic. LAmax during the measurement was aircraft flying overhead.
L03	NCA03 – 50 Wood Street, Lane Cove West	72	51	45	Daytime measurement. LA90 was typically dominated by distant traffic. LAeq was typically influenced by birds, local traffic and activity in Blackman Park (tennis). LAmax during the measurement was noise from a bird.
L04	NCA04 – 86 Penrose Street, Lane Cove West	77	57	40	Daytime measurement. LA90 was typically dominated by distant. LAeq was typically influenced by birds, local traffic and aircraft flyovers. LAmax during the measurement was a car on Penrose Street.
L05	NCA05 – 292 Pittwater Road, East Ryde2	77	65	51	Daytime measurement. LA90 was typically dominated by local and distant traffic. LAeq was typically influenced by local traffic and aircraft flyovers. LAmax during the measurement was a truck on Pittwater Road.

ID	Address	Measured Noise Levels (dBA)			Notes
		LAmax	LAeq(15min)	LA90(15min)	
A01	End of Mars Road / Banksia Close, Lane Cove West (NCA01/02 – near L01)	80	55	41	Night-time measurement. L_{A90} was typically dominated by distant traffic and insects. L_{Aeq} was typically influenced by local traffic, bats and aircraft flyovers. L_{Amax} during the measurement was a car on Mars Road.
A02	Behind Wood Street (near Blackman Park tennis courts), Lane Cove West (NCA03 – near L03)	56	40	38	Night-time measurement. L_{A90} was typically dominated by distant traffic and insects. L_{Aeq} was typically influenced by local traffic and bats, with intermittent wind noise in the trees. L_{Amax} during the measurement was a car leaving Blackman Park.
A03	North side of Penrose Street, opposite Myee Crescent, Lane Cove West (NCA04 – near L04)	61	43	40	Night-time measurement. L_{A90} was typically dominated by distant traffic and insects. L_{Aeq} was typically influenced by local traffic and bats. L_{Amax} during the measurement was a car on Penrose Street.
A04	NCA02 – Behind 64 Wood Street (adjacent to southern entrance of Community Nursery), Lane Cove West	74	56	47	Daytime measurement. L_{A90} was typically dominated by insects and distant traffic, with some industrial noise. L_{Aeq} was typically influenced by birds and aircraft. L_{Amax} during the measurement was aircraft flying overhead.
A05	NCA02 – South of 62 Wood Street (adjacent to Lloyd Rees Drive), Lane Cove West	68	53	46	Daytime measurement. L_{A90} was typically dominated by insects and distant traffic. L_{Aeq} was typically influenced by birds, aircraft and local traffic. L_{Amax} during the measurement was aircraft flying overhead.
A06	NCA02 – In front of 8 Banksia Close (adjacent to Banksia Close), Lane Cove West	78	59	47	Daytime measurement. L_{A90} was typically dominated by insects and distant traffic, with some industrial noise. L_{Aeq} was typically influenced by birds, aircraft and local traffic. L_{Amax} during the measurement was aircraft flying overhead.

Note 1: Daytime measurements at L01 to L05 were undertaken during the unattended monitoring survey at these locations. Night-time measurements were undertaken on 3 September 2025. NCA02 measurements were undertaken on 24 November 2025 during the unattended monitoring survey at L02.

The attended measurements in NCA02 undertaken during the unattended monitoring at L02 (A04-A06) show similar L_{A90} noise levels across the various locations, along with similar noise source influences (typically, distant traffic, birds, insects, aircraft and local traffic, with some industrial noise at times). As such, the noise monitoring undertaken at L02 is considered to be representative of the noise levels at receivers across NCA02.

3.0 Assessment Criteria

3.1 Construction Noise Criteria

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a proposal are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the proposal.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

3.1.1 Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

Table 5 ICNG NMLs for Residential Receivers

Time of Day	NML $L_{Aeq(15minute)}$	How to Apply
Standard Construction Hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL[1] + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise • Where the predicted or measured $L_{Aeq(15minute)}$ 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 dBA	• The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: o 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 o If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Standard Construction 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 practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1: RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW *Industrial Noise Policy* (INP). The INP has been superseded by the NSW EPA *Noise Policy for Industry* (NPfI).

3.1.2 Other Sensitive' Land Uses and Commercial Receivers

Non-residential land uses have been identified in the study area. The NMLs for 'other sensitive' receivers are shown in **Table 6**.

Table 6 Construction NMLs for ICNG 'Other Sensitive' Receivers

Land Use	Noise management level $L_{Aeq(15minute)}$ (dBA) (applied when the property is in use)	
	Internal	External
ICNG 'other sensitive' receivers		
Classrooms at schools and other educational institutions	45	55[1]
Places of worship	45	55[1]
Active recreation areas (characterised by sporting activities and activities which generate noise)	-	65
Industrial	-	75
Non-ICNG 'other sensitive' receivers		
Child care centres – sleeping areas[3]	40	60[2]

Note 1: It is assumed that these receivers have operable windows, which conservatively results in internal noise levels being around 10 dB lower than the external noise level with the windows open.

Note 2: It is assumed that these receivers have fixed windows due to their location within the Lane Cove West Business Park, which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

Note 2: Taken from Association of Australian Acoustical Consultants *Guideline for Child Care Centre Acoustic Assessment*.

3.1.3 NML Summary

The construction NMLs for the proposal have been determined using the results from the unattended noise monitoring and are shown in **Table 7**.

Out of hours NMLs would be applicable should works be required to be undertaken outside ICNG standard construction hours.

Table 7 Project Specific Noise Management Levels

Receiver Type	Monitoring Location	Noise Management Level ($L_{Aeq(15minute)}$ – dBA)			
		Standard Construction (RBL +10 dB)[1]	Out of Hours (RBL +5 dB)		
		Daytime	Daytime[2]	Evening	Night-time
NCA01 Residential	L01	53	48	45	36
NCA02 Residential	L02	53	48	45	36
NCA03 Residential	L03	50	45	43	35
NCA04 Residential	L04	48	43	43	38
NCA05 Residential	L05	56	51	48	40

Receiver Type	Monitoring Location	Noise Management Level ($L_{Aeq(15minute)}$ – dBA)			
		Standard Construction (RBL +10 dB)[1]	Out of Hours (RBL +5 dB)		
		Daytime	Daytime[2]	Evening	Night-time
Child care centres	n/a	60	60	60	-
School classrooms	n/a	55	55	55	-
Places of worship	n/a	55	55	55	-
Active recreation	n/a	65	65	65	-
Industrial	n/a	75	75	75	75

Note 1: RBL = Rating Background Level.

Note 2: Daytime out of hours is 7 am to 8 am and 1 pm to 6 pm on Saturday, and 8 am to 6 pm on Sunday and public holidays.

In addition to the above NMLs, residential receivers are considered to be 'highly noise affected' if the predicted level exceeds 75 dBA $L_{Aeq(15minute)}$.

3.2 Construction Vibration Criteria

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

3.2.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort impacts are shown in **Table 8**.

Table 8 Vibration Dose Values for Intermittent Vibration

Building Type	Assessment Period	Vibration Dose Value[1] ($m/s^{1.75}$)	
		Preferred	Maximum
Critical Working Areas (eg operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

3.2.2 Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, are located in buildings near to construction works. No such items of equipment have been identified in the proposal area.

3.2.3 Structural and Cosmetic Damage Vibration

If vibration from construction works is sufficiently high it can cause damage to structural elements of affected buildings. The levels of vibration required to cause cosmetic damage tend to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Examples of damage that can occur includes cracks or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. Structural damage vibration limits are contained in British Standard BS 7385 and German Standard DIN 4150.

BS 7385

British Standard BS 7385 recommends vibration limits for transient vibration judged to give a minimal risk of vibration induced damage to affected buildings. The limits for residential and industrial buildings are shown in **Table 9**.

Table 9 BS 7385 Transient Vibration Values for Minimal Risk of Damage

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

Note 1: Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%.

For heritage buildings, the standard states that "*a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*".

DIN 4150

German Standard DIN 4150 also provides guideline vibration limits for different buildings. Damage is not expected to occur where the values are complied with and the values are generally recognised to be conservative. The DIN 4150 values for buildings and structures are shown in **Table 10**.

Table 10 DIN 4150 Guideline Values for Short-term Vibration on Structures

Group	Type of Structure	Guideline Values Vibration Velocity (mm/s)				
		Foundation, All Directions at a Frequency of			Topmost Floor, Horizontal	Floor Slabs, Vertical
		1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 **and** are of great intrinsic value (eg heritage listed buildings)	3	3 to 8	8 to 10	8	20[1]

Note 1: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

3.2.4 Minimum Working Distances for Vibration-intensive Works

Minimum working distances for typical vibration-intensive construction equipment are provided in the Transport for NSW (TfNSW) *Construction Noise and Vibration Guideline* (CNVG) and are shown in **Table 11**. The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from the NSW EPA Vibration Guideline). They are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

Table 11 Recommended Minimum Working Distances from Vibration-intensive Equipment

Plant Item	Rating/Description	Minimum Distance		
		Cosmetic Damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	13 m	20 m
	<200 kN (4–6 tonne)	12 m	25 m	40 m
	<300 kN (7–13 tonne)	15 m	31 m	100 m
	>300 kN (13–18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	15 m	23 m

Plant Item	Rating/Description	Minimum Distance		
		Cosmetic Damage		Human Response (NSW EPA Guideline)
		Residential and Light Commercial (BS 7385)	Heritage Items (DIN 4150, Group 3)	
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	44 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Hand held	1 m (nominal)	3 m	2 m

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

3.3 Operational Noise Criteria

The NSW *Noise Policy for Industry* (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

The NPfI defines how to determine 'trigger levels' for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise-sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses:

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the L_{Aeq} noise level of the source, measured over a period of 15-minutes, does not exceed the representative background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

Intrusive and amenity noise levels are not used directly as regulatory limits. They are used to assess the potential impact of noise, assess feasible and reasonable mitigation options and subsequently determine achievable noise requirements.

The NPfI provides guidance on assigning residential receiver amenity noise categories based on the site-specific features shown in **Table 12**.

Table 12 Residential Receiver Amenity

Receiver Category	Typical Planning Land Use Zoning	Typical Existing Background Noise Levels (RBL)	Description
Rural	RU1 – primary production RU2 – rural landscape RU4 – primary production small lots R5 – large lot residential E4 – environmental living	Daytime <40 dBA Evening <35 dBA Night <30 dBA	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	RU5 – village RU6 – transition R2 – low density residential R3 – medium density residential E2 – environmental conservation E3 – environmental management	Daytime <45 dBA Evening <40 dBA Night <35dBA	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.
Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime >45 dBA Evening >40 dBA Night >35 dBA	Urban – an area with an acoustical environment that: • Is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • Has through-traffic with characteristically heavy and continuous traffic flows during peak periods • Is near commercial districts or industrial districts • Has any combination of the above.

Amenity noise categories for the surrounding receivers have been determined with reference to the NPfI. The assessment is shown in **Table 13**.

Table 13 Residential Receiver Amenity Category Assessment

Area	Land Use Zoning	Existing Background Noise Levels RBL (dBA)			Resulting Amenity Classification	Discussion
		Day	Eve	Night		
NCA01 to NCA05	R2 – Low Density Residential	38-46	38-43	30-35	Suburban	The residences around the site are zoned as R2 Low Density Residential and are typically standalone houses between one and three storeys. Existing noise levels are relatively low and are typically controlled by distant road traffic noise. Therefore, these residences have been classified as suburban.

3.3.1 Project Noise Trigger Levels

The trigger levels for industrial noise from the proposal are summarised in **Table 14**. They are based on the previously measured background noise levels, where appropriate. The Project Noise Trigger Levels (PNTL) are the most stringent of the intrusiveness and amenity trigger level for each period and are highlighted below.

The NPfI states that when converting the project amenity level from $L_{Aeq(period)}$ to $L_{Aeq(15minute)}$, the $L_{Aeq(15minute)}$ is equal to the $L_{Aeq(period)}$ plus 3 dB, unless robust evidence is provided for an alternative approach (refer to Section 2.2 of the NPfI). While the main source of operational noise from data centres is typically mechanical plant which would generally operate continuously, the dominant items of plant at the development (ie the cooling towers) have variable frequency drives and noise emissions are expected to vary depending on the number of units in use, their load, and the current ambient temperature. It is noted that the noise modelling of mechanical plant at the development assumes all mechanical plant items conservatively operate at representative worst-case loads at all times (see **Section 4.2.1** for further information). As such, it is considered appropriate to apply the standard NPfI assumption of $L_{Aeq(15minute)}$ equal to the $L_{Aeq(period)}$ plus 3 dB for this project.

Table 14 Project Noise Trigger Levels

Receiver Type	Period	Amenity Noise Level L_{Aeq} (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA)	
			RBL[1]	$L_{Aeq(period)}$	Intrusiveness	Amenity[2,3]
NCA01 – Residential	Day	55	43	58	**48**	53
	Evening	45	40	53	45	**43**
	Night	40	31	47	**36**	38
NCA02 – Residential	Day	55	43	55	**48**	53
	Evening	45	40	54	45	**43**
	Night	40	31	49	**36**	38

Receiver Type	Period	Amenity Noise Level L_{Aeq} (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels $L_{Aeq(15minute)}$ (dBA)	
			RBL[1]	$L_{Aeq(period)}$	Intrusiveness	Amenity[2,3]
NCA03 – Residential	Day	55	40	55	**45**	53
	Evening	45	38	53	**43**	**43**
	Night	40	30	47	**35**	38
NCA04 – Residential	Day	55	38	55	**43**	53
	Evening	45	38	55	**43**	**43**
	Night	40	33	46	**38**	**38**
NCA05 – Residential	Day	55	46	66	**51**	53[4]
	Evening	45	43	63	48	**43**[4]
	Night	40	35	54	40	**38**
Child care[5]	When in use	35 (internal) 55 (external)[6]	-	-	-	**53**
Educational	When in use	35 (internal) 45 (external)[7]	-	-	-	**43**
Place of worship	When in use	40 (internal) 50 (external)[7]	-	-	-	**48**
Active recreation	When in use	55	-	-	-	**53**
Industrial	When in use	70	-	-	-	**68**

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have been reduced by 5 dB, where appropriate, to give the project amenity noise levels due to other sources of industrial noise being present in the area, as outlined in the NPfI.

Note 3: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.

Note 4: The measured L_{Aeq} noise level was dominated by existing road traffic noise and exceeds the recommended amenity noise level by 10 dB or more, therefore, the 'high traffic project amenity noise level' is the existing LAeq(traffic) noise level minus 15 dB, as outlined in the NPfI.

Note 5: The NPfI does not include a recommended amenity noise level for child care centres so there are no defined criteria for industrial noise. The NPfI does include amenity noise level for school classroom (internal) which has been used for child care centres for similar SSDA's, and has been adopted in this assessment.

Note 6: The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been assumed that receivers in this area have fixed windows and external noise levels are therefore 20 dB higher than the corresponding internal level.

Note 7: The criterion is specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been assumed that receivers in this area have operable windows and external noise levels are therefore 10 dB higher than the corresponding internal level.

3.3.2 Cumulative Noise Impacts

The NSW Government *Cumulative Impact Assessment Guidelines for State Significant Projects* requires that the potential combined effect of cumulative impacts on all nearby industrial developments to be considered when assessing potential noise impacts from state significant projects. The guideline references the NPfI when determining the approach to assessing the cumulative industrial noise impacts.

The NPfI states that it aims to limit continuing increases in cumulative industrial noise through the application of amenity noise levels, which are applicable to all industrial noise sources in an area.

The NPfI requires that the amenity noise levels which are applied to an individual project be reduced by 5 dB to allow for the potential cumulative impact from multiple sources of industrial noise in an area (including existing and new).

By doing this, the policy accounts for potential cumulative impacts by lowering the criteria for each individual development to ensure that the ambient noise level within an area from all industrial noise sources combined remains below the recommended amenity noise levels, where feasible and reasonable. The NPfI states that *"where the project amenity noise level applies and it can be met, no additional consideration of cumulative industrial noise is required"*.

The potential cumulative impacts from the development and other sources of industrial noise in the area are therefore accounted for in the proposal-specific PNTLs (see **Table 14**).

3.3.3 Sleep Disturbance

The potential for sleep disturbance from maximum noise level events from the proposal during the night-time period is required to be considered. This is applicable only to residential receivers.

The NPfI defines the sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater.

The sleep disturbance screening levels for the proposal are shown in **Table 15**.

Table 15 Sleep Disturbance Screening Levels

Location	Noise Level (dBA)	
	Measured Prevailing Night-time Background Level	Sleep Disturbance Screening Level[1]
NCA01	31	52
NCA02	32	52
NCA03	30	52
NCA04	33	52
NCA05	35	52

Note 1: The sleep disturbance screening level as 52 dBA L_{AFmax} or the prevailing background level plus 15 dB, whichever is greater

A detailed maximum noise level event assessment should be completed where the sleep disturbance screening level is exceeded. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

The NPfI refers to the *Road Noise Policy* (RNP) for additional information regarding sleep disturbance. enHealth Council studies are referenced which indicate that for short-term or transient noise events, for good sleep over eight hours the indoor L_{AFmax} sound pressure level should ideally not exceed around 45 dBA more than 10 or 15 times per night.

The RNP goes on to conclude that from the research on sleep disturbance to date:

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

3.3.4 Corrections for Annoying Noise Characteristics

Sources of industrial noise can cause greater annoyance where they contain certain characteristics, such as tonality, intermittency or dominant low-frequency content. The NPfI specifies the following modifying factor corrections, shown in **Table 16**, which are to be applied where annoying characteristics are present. The corrections are to be added to the noise level at the receiver before comparison with the Project Noise Trigger Levels.

Table 16 NPfI Modifying Factor Corrections

Factor	Assessment/ Measurement	When to Apply	Correction[1]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by the levels defined in the NPfI.	5 dB[2]
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements	Measure/assess source contribution C and A weighted $L_{eq,t}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and the level to which the thresholds defined in the NPfI are exceeded.	2 or 5 dB[2]
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level	The source noise heard at the receiver varies by more than 5 dB and the intermittent nature of the noise is clearly audible. The NPfI further defines intermittent noise as noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB, for example, equipment cycling on and off. The EPA has confirmed[4] that the intermittent correction does not apply to short-term events that emerge above the general industrial noise level and is therefore not applicable to industrial or commercial sites that have vehicle or plant movements at night, including audible reversing alarms. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.	5 dB[3]

Factor	Assessment/ Measurement	When to Apply	Correction[1]
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated.	Maximum correction of 10 dB[2] (excluding duration correction)

Note 1: Corrections to be added to the measured or predicted levels.

Note 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.

Note 3: Adjustment to be applied to night-time only.

Note 4: *How to Apply the Noise Policy for Industry Intermittent Modifying Factor Corrections*, NSW Environment Protection Authority, Acoustics Australia Vol. 50, No. 3, September 2022.

Details of the modifying factor corrections applied in the assessment are provided in **Section 4.2.4**.

3.3.5 Residual Impacts

The NPfI defines residual noise impacts as exceedances of the Project Noise Trigger Levels which remain after all feasible and reasonable source and pathway mitigation measures have been considered.

The significance of residual noise impacts, as defined in the NPfI, is shown in **Table 17.** Examples of receiver-based treatments that can be used to mitigate residual impacts are shown in **Table 18**.

Table 17 NPfI Significance of Residual Noise Impacts

If the Predicted Noise Level minus the Project Noise Trigger Level is:	And the Total Cumulative Industrial Noise Levels is:	Then the Significance of the Residual Noise Level is:
≤ 2 dBA	Not applicable	Negligible
≥ 3 but ≤ 5 dBA	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1dB	Marginal
≥ 3 but ≤ 5 dBA	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate
> 5 dBA	≤ recommended amenity noise level	Moderate
	> recommended amenity noise level	Significant

Table 18 NPfI Examples of Receiver-based Treatments to Mitigate Residual Noise Impacts

Significance of Residual Noise Impact	Example of Potential Treatment
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
Moderate	As for 'marginal', but also upgraded facade elements, such as windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
Significant	May include suitable commercial agreements where considered feasible and reasonable.

3.3.6 Traffic on Surrounding Roads

The potential impacts from proposal-related traffic on the surrounding public roads are assessed using the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB. Where this is considered likely, further assessment is required using the RNP criteria shown in **Table 19**.

Table 19 RNP/NCG Criteria for Assessing Traffic on Public Roads

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am – 10 pm)	Night-time (10 pm – 7 am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)

4.0 Methodology

4.1 Construction Noise and Vibration Assessment

A noise model of the study area has been used to predict noise levels from the proposed construction work to all surrounding receivers. The model uses ISO 9613-2 algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

4.1.1 Construction Activities

Representative scenarios have been developed to assess the likely impacts from the various construction phases of the proposal. These scenarios are shown in **Table 20**.

The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

The sound power levels for the construction equipment used in each scenario are presented in **Appendix C.**

Table 20 Construction Equipment

Scenario	Works Activity	Equipment	Likely Duration
W.01	Vegetation clearing	Chainsaw, chipper, excavator, front end loader, dump truck, water truck	1 month
W.02	Demolition	Rockbreaker, dozer, front end loader, dump truck, water truck	6 months
W.03	Earthworks	Dozer, excavator, front end loader, vibratory roller, dump truck, water truck	3 months
W.04	Excavation of hard rock	Rockbreaker, dozer, excavator, front end loader, dump truck, water truck	1 month
W.05	Construction of pads and hardstands	Concrete pump, concrete truck/agitator, concrete vibrator	6 months
W.06	Construction of structures and equipment installation	Elevated working platform, flatbed truck, hand tools, mobile crane	12 months

4.1.2 Hours of Construction

Construction activities for the proposal would only be undertaken during the following hours:

- 7:00 am to 6:00 pm, Mondays to Fridays
- 8:00 am to 1:00 pm on Saturdays
- At no time on Sundays or Public Holidays.

4.2 Operational Noise Assessment

The potential operational noise levels from the proposal have been predicted to the surrounding receivers using the ISO 9613-2 algorithm in SoundPLAN V8.2, implemented in accordance with ISO 17534.

ISO 9613-2 is an industry standard algorithm that is considered suitable for use in the prediction of noise from industrial sources where intervening objects provide acoustic shielding, such as at the subject site and surrounding area.

The ISO 9613-2 algorithm predicts continuous A-weighted sound pressure levels under noise-enhancing meteorological conditions favourable to downwind propagation, or equivalently, propagation under a well-developed, moderate, ground-based temperature inversion, such as commonly occurs on clear calm nights.

Downwind propagation conditions include wind from source to receiver, with wind speeds of around 1 to 5 m/s, measured at a height of 3 to 11 m above the ground. These propagation conditions are considered consistent with the noise-enhancing weather conditions specified in *Fact Sheet D: Accounting for noise-enhancing weather conditions* of the NPfI.

ISO 9613-2 has been used extensively on industrial projects in Australia over several decades and has been accepted previously by NSW Department of Planning, Housing and Infrastructure (DPHI) in numerous environmental noise assessments.

The noise model includes ground topography, ground type (ground absorption modelled at 0.0 (hard ground) in the industrial area (NCA07 and project site), 0.5 (mixed ground) in suburban areas, and 0.75 (soft ground) in bushland areas), buildings and representative worst-case noise sources from the proposal.

The potential impacts have been determined by comparing the predicted worst-case noise levels to the NPfI PNTLs in a 15-minute assessment period.

Noise levels have been assessed at the identified sensitive receivers with reference to the requirements of ‘Section 2.6 – Assessment Locations’ of the NPfI. This includes assessment of impacts at all floors of the identified multi-storey buildings.

4.2.1 Operational Noise Sources

The proposal is a speculative development with no tenants committed. The facility has been designed to accommodate typical data centre users.

Several assumptions have been made regarding the future tenants and likely sources of noise. These assumptions have been used to develop representative worst-case noise modelling scenarios that reflect the expected highest noise emissions that the development would likely emit.

The development comprises a multi-storey data centre building with associated data halls, plant rooms, backup generators, ancillary office area, vehicle access, loading dock, carparking, security hut and fencing with secure access. Design plans of the development are shown in **Figure 3** to **Figure 8.**

Vehicle access would be from Mars Road. The site would be in use 24 hours a day. It is anticipated that deliveries and loading dock access would typically be via medium rigid trucks.

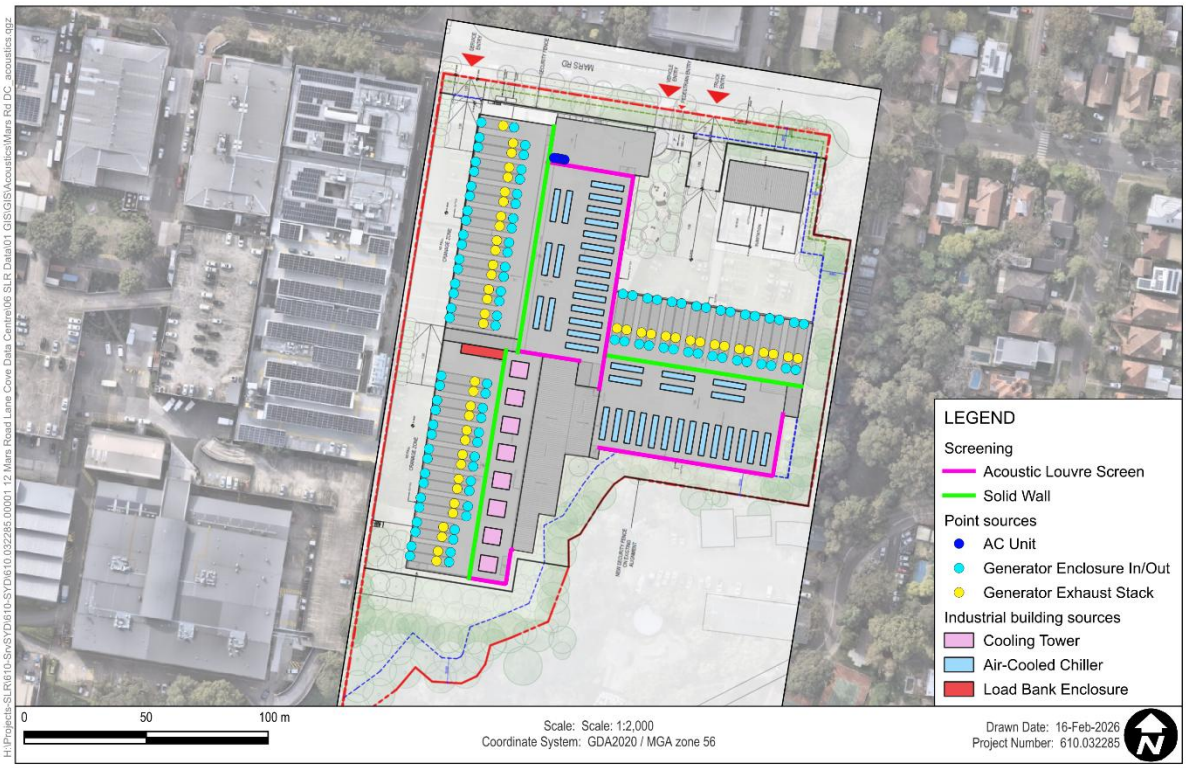
The main sources of operational noise at the development are expected to include:

- Rooftop cooling towers and other externally located items of mechanical plant
- Testing of backup generators (see **Section 4.2.2.1** for more details)
- Internally located mechanical plant, such as items within electrical plant rooms and other mechanical services areas
- On-site light and heavy vehicle movements
- Loading dock activities
- Off-site vehicle movements.

A summary of the expected noise sources and representative worst-case assessment scenarios associated with the operation of the development is provided below. The location of the modelled noise sources is shown in **Figure 10** and **Figure 11**.

Figure 10 Modelled Noise Sources – Ground Level Sources

Figure 11 Modelled Noise Sources – Rooftop Sources



4.2.1.1 Roof Layout

The proposed roof layout incorporates the following features:

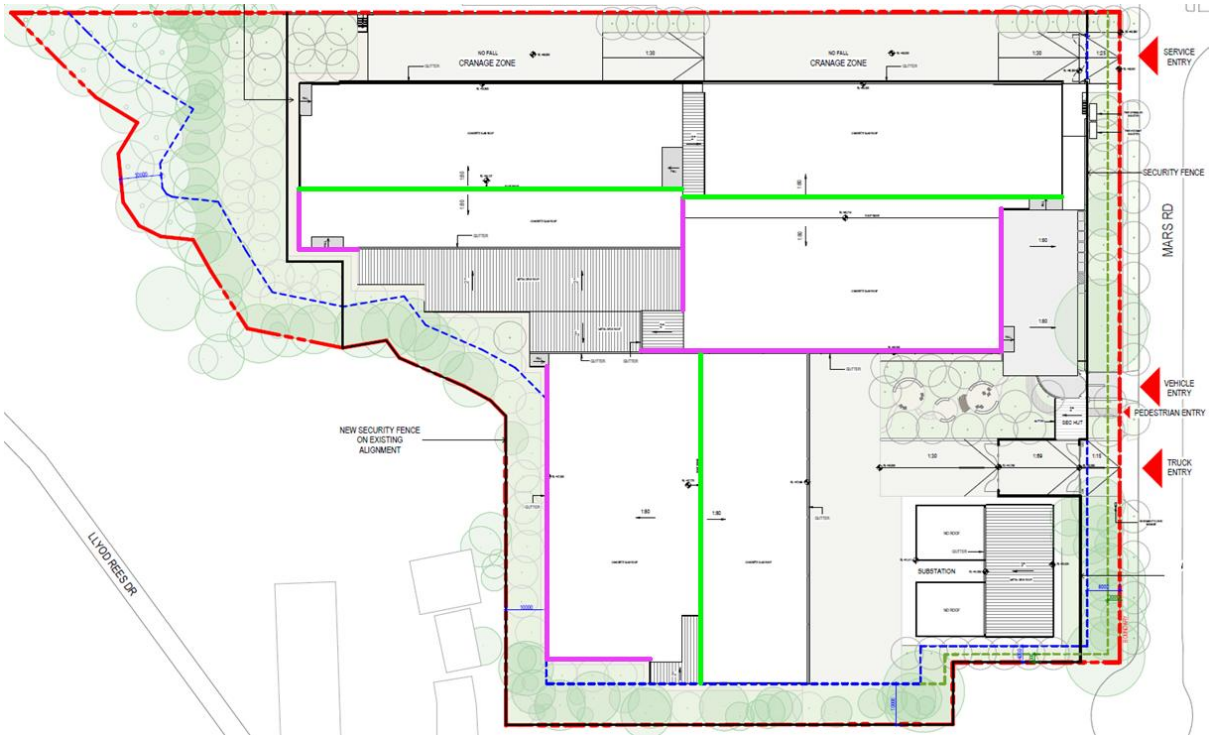
- Acoustic louvre screens to a height of 6.5 m above the respective roof level around each cooling tower area.
- Solid walls to a height of 6.5 m above the respective roof level between each generator area and the adjacent cooling tower area.

The indicative screens are shown in **Figure 12** to **Figure 13**. These screens have been included in the noise model. The design of the roof louvres, screens and parapets is indicative and will be reviewed during a later design stage of the project.

The acoustic louvre screen modelling methodology is described below:

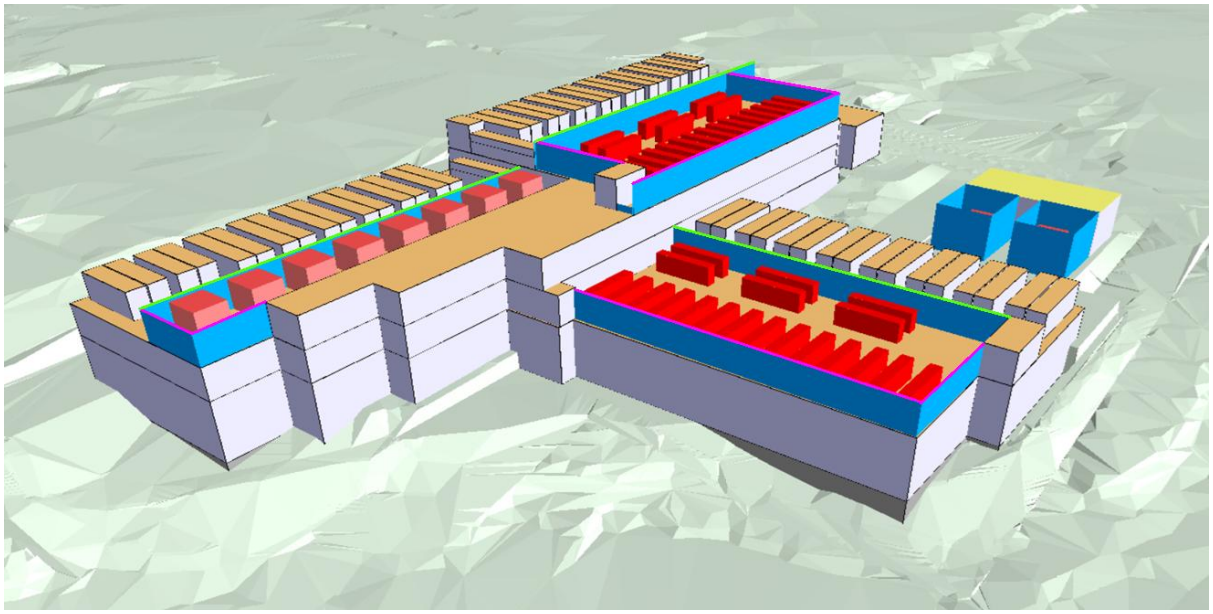
- The acoustic louvre screen is represented as a solid noise wall.
- The acoustic louvre wall is dissected into a high resolution grid of receiver points and incident noise levels from the rooftop plant are calculated for the inside face of the wall.
- A grid of area sources is applied to the outside face of the wall, emitting the incident noise levels minus the transmission loss of the example acoustic louvre.
- The acoustic louvre screen indicatively uses Architectural Product Solutions Model A12350 acoustic louvre transmission loss (acoustic rating STC 19 dB). Acoustic louvre data sheet is provided in **Appendix G**.

Figure 12 Indicative Screening on Rooftop – Top-Down View



Note 1: Pink is acoustic louvre screen to 6.5 m above the respective roof level. Green is solid wall to 6.5 m above the respective roof level.

Figure 13 Indicative Screening on Rooftop – 3D View



Note 1: Pink is acoustic louvre screen to 6.5 m above the respective roof level. Green is solid wall to 6.5 m above the respective roof level.

4.2.1.2 On-Site Traffic

On-site vehicles have been modelled using the data provided by the project's traffic consultant in **Table 21**. The volumes are representative of the expected worst-case 15-minute period for the daytime, evening and night-time. The volumes conservatively assume that light and heavy vehicles access the site concurrently during the worst-case 15-minute assessment period. In reality, vehicle access would be unlikely to occur concurrently, particularly during the night-time.

Heavy vehicle deliveries and loading dock access would typically be via medium rigid trucks.

Table 21 Vehicle Traffic Data – Worst-case 15-Minute Period

Vehicle Type	Location	Sound Power Level (dBA)	Vehicle Speed (km/h)	Number of Vehicles in Worst-case 15-Minute Period[1]		
				Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
Medium trucks	Vehicle entry and hardstand	95[2]	5	1	0	0
Light vehicles	Vehicle entry and carpark	90[2]	5	5	3	1

Note 1: Total vehicles, includes both inbound and outbound vehicles. Volumes are rounded up to whole numbers for display purposes.

Note 2: Sound power level based on SLR measurement data.

4.2.1.3 Loading Docks

Details of the loading dock noise sources are shown in **Table 22**. The various sources have been modelled in the loading dock area based on the corresponding number of heavy vehicle movements in the worst-case 15-minute periods (see **Table 21**). The loading docks are recessed and no forklifts would be operated externally.

Table 22 Typical Hardstand and Loading Dock Noise Sources

Noise Source	Sound Power Level (dBA)[1]	Typical Duration of Use in Worst-case 15-minute Period
Truck reversing alarm	107[2,3]	30 seconds
Air brakes	118	1 second
Roller door	94	15 seconds

Note 1: SWLs based on measurement data, where appropriate.

Note 2: SWL based on recommendation to use broadband reversing alarms, see **Section 7.2**.

Note 3: SWL includes a -3 dB reduction due to alarms being discrete events.

4.2.1.4 Mechanical Plant

The main sources of externally located mechanical plant noise at the development would be the rooftop cooling towers and air-cooled chillers, and maintenance testing of the backup generators.

The mechanical plant used in the assessment, together with corresponding sound power levels and number of units and locations, are detailed in **Table 23**. Mechanical plant specifications and data sheets are provided in **Appendix G**.

Table 23 Mechanical Plant

Noise Source	Example Unit	Sound Power Level (dBA)	Locations and Operations
Cooling towers	BAC S3E-1222-10P ENDURA/H	Day – 76 dBA[1] Evening – 75 dBA[1] Night – 73 dBA[1]	8 cooling towers on roof of Building B (see **Figure 11**). Assumed to operate 24 hours a day. Cooling towers are modelled as 'industrial building' objects in the noise model, which are equivalent to a 3D box with a noise source on each face. The noise sources were calibrated based on the manufacturers data to achieve the stated sound pressure levels at a distance of 15 m.
Air-cooled Chillers	Carrier 30XF-Z 1500 with AAL91033 acoustic package	Day – 70 dBA[1] Evening – 69 dBA[1] Night – 68.5 dBA[1]	20 air-cooled chillers on roof of Building A and 20 on roof of Building C (see **Figure 11**). Assumed to operate 24 hours a day. Air-cooled chillers are modelled as 'industrial building' objects in the noise model.
Office AC units	Mitsubishi PUZ-RP170	79 dBA	4 AC units on roof of office see **Figure 11**). Assumed to operate 24 hours a day. AC units are modelled as point sources in the noise model.
Backup generators	Rolls Royce MTU 12V4000G94F 2.8MW MTU 20V4000G24F 2.2MW MTU 16V2000G16F 600kW	Intake design SWL 83 dBA[2] Discharge design SWL 83 dBA[2] Exhaust stack design SWL 83 dBA[2]	16 2.8MW generators and 1 600kW generator on Building A, 12 2.8MW generators and 4 2.2MW generators on Building B, and 16 2.8MW generators on Building C. The backup generators would be tested during daytime hours (see **Section 4.2.2.1** for more details). Generators are modelled as individual enclosures. Enclosure air intake and discharge are modelled as point sources at the centroid of the those areas of the enclosure. Generator exhaust stacks rise up individually out of the top of the generator enclosure, modelled as point sources at the exhaust terminations.
Load bank	Sephco LS18V	107 dBA	2 load banks located in a precast concrete enclosure with acoustic louvres on roof of Building B (see **Figure 11**) will be used during testing of backup generators. Load bank enclosure is modelled as an 'industrial building' object in the noise model with source areas for the acoustic louvres indicatively using Architectural Product Solutions Model A12350 acoustic louvre transmission loss.

Note 1: Sound power level of cooling towers based on unit operating at typical peak speed for each period based on advice from the manufacturer.

Note 2: Generator enclosures are custom built with design sound power levels for the generator enclosure intakes and discharges, and generator exhaust gas stacks.

Various items of mechanical plant would also be located internally within the data centre. This includes items within the various data halls, electrical plant rooms and mechanical services areas. Details regarding these internal items of equipment are not currently available, however, breakout noise from these items is expected to be relatively minor compared to noise from externally located mechanical plant and testing of backup generators given the internal plant areas are generally separated from the external facades by service corridors (see **Figure 3** to **Figure 8**).

The exact requirements for all items of mechanical plant would be determined as the project progresses when specifics are known about tenant requirements. Further noise modelling of all items of mechanical plant would be completed during the production of later noise assessments when the selected mechanical plant is known.

4.2.1.5 Substation

A substation is proposed to be built in the northeastern area of the site (see **Figure 3** to **Figure 8**). This substation would be subject to a separate authority approval, and is proposed to be built during construction of the development.

Indicative noise emissions from the substation transformers have been included in the assessment to estimate cumulative impacts of the data centre and the substation operating concurrently.

Table 24 Indicative Substation Noise Sources

Noise Source	Reference	Sound Power Level (dBA)	Locations and Operations
Substation transformers	IEC60076-10 90 MVA (reduced limit)	80 dBA (attenuated sound power level)[1]	2 substation transformers indicatively modelled as ‘industrial building’ objects in the transformer bays. The walls of the transformer bay have been modelled with a height of 11.1 m and acoustic absorption on the inside face of the walls (see **Figure 10**). Assumed to operate 24 hours a day.

Note 1: Indicative sound power level supplied by the project team, based on attenuated noise levels provided by the proposed transformer manufacturer.

4.2.2 Operational Scenarios

4.2.2.1 Maintenance Testing of Backup Generators

The backup generators would require scheduled maintenance and would be tested during daytime business hours (7 am to 5 pm Monday to Friday). The maintenance testing schedule would include quarterly and annual testing, with a maximum of one generator being tested at a time, accompanied by two load banks.

The generators will operate as a standby power supply in the event of mains failure. The electricity feeders are fully rated supplies of the entire site load, with each feeder from a diverse bus section of the zone substation. Major power interruptions requiring the simultaneous operation of all standby generators would only occur infrequently and for a limited time.

Details regarding the backup generator testing are shown in **Table 25**.

Table 25 Proposed Generator Maintenance Testing Regime

Parameter	Value	
Test frequency per generator	Quarterly maintenance[1]	Annually operational run[1]
No of generators	49	49
No of tests each year per generator	3	1
Run time per test	30 minutes	60 minutes
Cooldown per test	10 minutes	10 minutes
No of generators per test	1	1
No of load banks per test	2	2
Cumulative hours	155.2 hours	
Testing schedule	7:00 am to 5:00 pm Monday to Friday	

Note 1: Quarterly maintenance occurs in three quarters of the year, with annual testing in the remaining quarter.

4.2.2.2 Emergency Power Failure

Operation of backup generators (outside of maintenance/testing) is only expected to occur during an emergency where mains power to the development is lost. It is not considered reasonable for the development to be required to meet the operational noise criteria during this infrequent emergency scenario. Predicted noise levels during a power outage with all backup generators operating are provided for information only and considered when determining feasible and reasonable noise mitigation and management measures.

4.2.2.3 Representative Operational Scenarios

Representative scenarios have been developed to assess the likely impacts from the operation of the proposal. These scenarios are shown in **Table 26**.

Table 26 Operational Assessment Scenarios

Scenario	Name	Description
OP.01	Normal Operations	• All equipment operating at typical peak capacity, except for backup generators and load banks. • Assessed during daytime, evening and night-time periods.
OP.02	Maintenance/Testing Operations	• All equipment operating at typical peak capacity, including concurrent maintenance / testing of one backup generator with two load banks. • All generator locations were modelled, with the worst-case generators for each receiver included in the predicted noise levels for that receiver. • Assessed during daytime only.
Power Outage	Emergency Power Failure	• All equipment operating at typical peak capacity, including all backup generators. • Load banks are not included in the power outage scenario as they are used only during testing of the backup generators.

4.2.3 Noise Source Inventory

A noise source inventory which includes the details of the various operational noise sources at the development is shown in **Table 27**.

Table 27 Noise Source Inventory

Category	Noise Source	Usage	Reference for Noise Data
On-site traffic	Light vehicles	Light vehicles would access the development and park in the car park. Modelled in the location shown in **Figure 10** using vehicle volumes in **Table 21**.	Sound power level taken from measurement data of various light vehicle types and models at speeds of up to around 40 km/h, including vehicle acceleration.
	Medium vehicle	Deliveries to the development would be via heavy vehicles. Heavy vehicle deliveries would typically be medium rigid trucks. Heavy vehicles would access the development via Mars Road and travel to the loading docks. Modelled on the heavy vehicle route shown in **Figure 10** using vehicle volumes in **Table 21**.	Sound power level taken from historical measurement data of various medium rigid truck types and models in approximate 5 to 15 tonne range.
Loading docks	Reversing alarms, air brakes, roller doors	Heavy vehicle deliveries would be unloaded via the recessed loading docks. No forklifts would be operated externally. Modelled in the loading docks shown in **Figure 10** using vehicle volumes in **Table 21**.	Sound power level taken from historical measurement data of typical loading dock activities at various warehousing and distribution facilities.
Internal activities	Typical data centre activities	Internal noise-generating activities would be associated with typical data centre activities, including mechanical plant in the various data halls, electrical plant rooms and mechanical services areas.	Details regarding these internal items of equipment are not currently available at this early stage in the development, however, breakout noise from these items is expected to be relatively minor (compared to noise from externally located mechanical plant and testing of backup generators) given the internal plant areas are generally separated from the external facades by service corridors.

Category	Noise Source	Usage	Reference for Noise Data
Mechanical plant	Cooling towers	Cooling towers would be used to expel heat from the data centre operations. Indicative cooling tower requirements are 8 units. These units would operate 24 hours a day and have been modelled on the Building B roof shown in **Figure 11** using the details in **Table 23**.	Sound power level and directivity taken from manufacturers specifications for the indicative units, supplied by the project team.
	Air-cooled chillers	Air-cooled chillers would be used as a heat exchange for various data centre operations. Indicative air-cooled chiller requirements are 40 units. These units would operate 24 hours a day and have been modelled on the Building A and Building C roof shown in **Figure 11** using the details in **Table 23**.	Sound power level taken from manufacturers specifications for the indicative units, supplied by the project team.
	Office AC units	AC units would be used for air conditioning in the office. AC unit requirements will be determined during a future design stage of the development. These units would operate 24 hours a day and indicatively 4 units have been modelled on the office roof shown in **Figure 11** using the details in **Table 23**.	Sound power level taken from manufacturers specifications for the indicative units, supplied by the project team.
	Backup generators	Backup generators would be used to provide power to the data centre in the event of loss of mains power. 49 backup generators have been modelled on the data centre roof shown in **Figure 11** using the details in **Table 23**. Backup generators would be operated as detailed in **Section 4.2.2**.	The generators would be housed in custom built containers with exhaust stacks that terminate above the generator enclosures. Design sound power levels were supplied by the project team based on manufacturers specifications and indicative attenuator and silencer designs to meet the design sound power levels.

Category	Noise Source	Usage	Reference for Noise Data
	Load banks	Two load banks will be used during testing of backup generators and have been modelled on the Building B roof shown in **Figure 11** using the details in **Table 23**. The load banks would be operated only during testing of backup generators as detailed in **Section 4.2.2**..	The load banks would be housed in a precast enclosure with acoustic louvres. Sound power level taken from manufacturers specifications for the indicative load bank unit and indicative acoustic louvres, supplied by the project team.
Substation	Transformers	A substation is proposed to be built in the northeastern area of the site (subject to separate authority approval). Two substation transformers have been modelled in the transformer bays with 11.1 m walls with acoustic absorption on the inside face of the walls shown in **Figure 10** using the details in **Table 24**. The substation has been included to estimate cumulative impacts with the data centre	Indicative sound power level supplied by the project team, based on attenuated noise levels provided by the proposed transformer manufacturer.

4.2.4 Corrections for Annoying Noise Characteristics

The potential annoying noise characteristics and modifying factor corrections relevant to the proposal are tonality, low-frequency noise and intermittent noise. The assessment of tonality and low-frequency noise is typically limited by the available data for the applicable noise sources, with manufacturer sound power level data for mechanical plant typically being supplied as either a single overall level, or limited octave band levels (typically 63 Hz to 8 kHz), rather than 1/3 octave levels required for NPfI assessment of tonality and low-frequency noise. Additionally, all mechanical plant is indicative and will be reviewed during detailed design once tenant requirements are confirmed.

Cooling towers/air-cooled chillers are the dominant items of equipment for normal operations. The proposed data centre at 1-5 Khartoum Road, Macquarie Park, proposes to uses similar model cooling towers as this assessment (refer to Arup report *"MPark Talavera Road Data Centre Noise and Vibration Impact Assessment"*, reference *304093-AC05 v5 SSDA NVIA*, dated December 2024) (1-5 Khartoum Rd NVIA). The SSD-63235720 1-5 Khartoum Rd NVIA was sourced from the NSW Major Projects Planning Portal.

As low frequency 1/3 octave spectrum noise levels for the cooling towers/air-cooled chillers are not provided on the manufacturer data sheets for the units, the 1/3 octave spectrum below 63 Hz for cooling towers has been conservatively estimated based on the data from the 1-5 Khartoum Rd NVIA, adjusted for the cooling tower/air-cooled chiller unit sound power levels in this assessment.

As an example, the adopted 1/3 octave spectrum for the cooling towers during the day period is shown in **Table 28**.

Table 28 Adopted 1/3 Octave Spectrum – Cooling Towers – Day Period

Source	Unweighted 1/3 Octave Frequency (Hz) Sound Power Level (dBZ)					Total A-Weighted Sound Power Level (dBA)
	10 12.5 16 20 25 31.5 40	50 63 80 100 125 160	200 250 315 400 500 630	800 1,000 1,250 1,600 2,000 2,500	3,150 4,000 5,000 6,300 8,000 10,000	
Cooling Towers	75 77 81 82 79 79 79	77 76 76 76 77 74	71 69 68 67 67 67	67 68 65 62 59 58	57 56 59 63 67 67	76

An example of the tonality and low-frequency assessment results is shown in **Table 29** based on the predicted operational noise levels at the most-affected residential receiver. The below assessment has been undertaken for all applicable receivers to determine the applicable corrections for annoying noise characteristics.

Table 29 Assessment of Annoying Noise Characteristics

Most-Affected Receiver	Predicted $L_{eq(15minute)}$ Noise Levels – OP.01 Night						Tonal Trigger	Low Frequency Trigger
	Unweighted 1/3 Octave Frequency (Hz) (dBZ)					Total Noise Level (dB)		
	10 12.5 16 20 25 31.5 40	50 63 80 100 125 160	200 250 315 400 500 630	800 1,000 1,250 1,600 2,000 2,500	3,150 4,000 5,000 6,300 8,000 10,000			
All NCA's	32 34 37 38 34 33 32	40 40 39 38 37 35	33 31 30 30 30 28	27 26 24 23 21 18	16 13 10 5 0 -6	36 dBA 49 dBZ 47 dBC	No	No

The above assessment has been undertaken for all applicable receivers to determine the applicable corrections for annoying noise characteristics, detailed as follows:

- **Tonality** – the only source identified with potential tonal characteristics is truck and forklift reversing alarms. However, when considering broadband reversing alarms have been recommended as a noise mitigation measure (see **Section 7.2**), it is unlikely that this noise source would result in tonal noise impacts at the receivers and no corrections have been applied.
- **Low frequency noise** – noise levels at residential receivers from development-related mechanical plant were analysed as per the requirements of the NPfI and are not expected to result in low frequency noise impacts. No corrections have been applied.
- **Intermittent noise** – the NPfI defines intermittent noise as noise heard at the receiver where the level suddenly drops or increases several times during the assessment period, with a noticeable change of at least 5 dB. The intermittent correction does not apply to short-term events that emerge above the general industrial noise level and is therefore not applicable to industrial or commercial sites that have vehicle or plant movements at night, including audible reversing alarms. While testing of the backup generators may be intermittent, the testing is only undertaken during the daytime when no correction is applicable. No other sources have been identified with potential intermittent characteristics.

The above corrections for annoying noise characteristics will be reviewed during the detailed design stage of the project when tenant requirements for specific mechanical plant are known.

4.2.5 Noise Sources with Potential for Sleep Disturbance

As the development is proposed to operate 24-hours a day, noise emissions during the night-time require assessment for potential sleep disturbance at the nearest residential receivers. The details of typical activities with the potential to cause sleep disturbance are shown in **Table 30**.

The various sources have been modelled in the car parking area and light vehicle access (see **Figure 10**). It is noted that truck movements and loading dock operations are not proposed during the night-time period.

Table 30 Sleep Disturbance Noise Events – L_{Amax} Sound Power Levels

Noise Source	Sound Power Level L_{Amax} (dBA)
Light vehicle movement and parking	100

4.2.6 Off-site Road Traffic

Access to/from the site would be via Mars Road, Sirius Road and Orion Road to Epping Road. There are no residential receivers between the site and Epping Road, however the residences at the west end of Banksia Close and close to the site entrance. Daytime and night-time vehicle movements from the proposed development are substantially lower than the existing warehouses on the site, and the proposed site entrances are a similar distance or further from the residences than the existing site entrances.

As such, the potential noise impacts from development related traffic would be lower than the existing development.

4.2.7 Weather Conditions

Fact Sheet D of the NPfI requires noise assessments to consider the potential effects of noise-enhancing weather conditions, such as wind from the source to the receiver and/or temperature inversions.

The nearest sensitive receivers are generally within 350 m of the proposal site and the effects of weather on noise levels are expected to be minimal. Notwithstanding, the noise prediction modelling uses ISO 9613-2 algorithms which include noise-enhancing weather conditions including downwind propagation, or equivalently, propagation under a well-developed moderate ground-based temperature inversion.

As such, the assessment has conservatively applied noise-enhancing weather conditions for all periods as per Option 1 of Fact Sheet D of the NPfI.

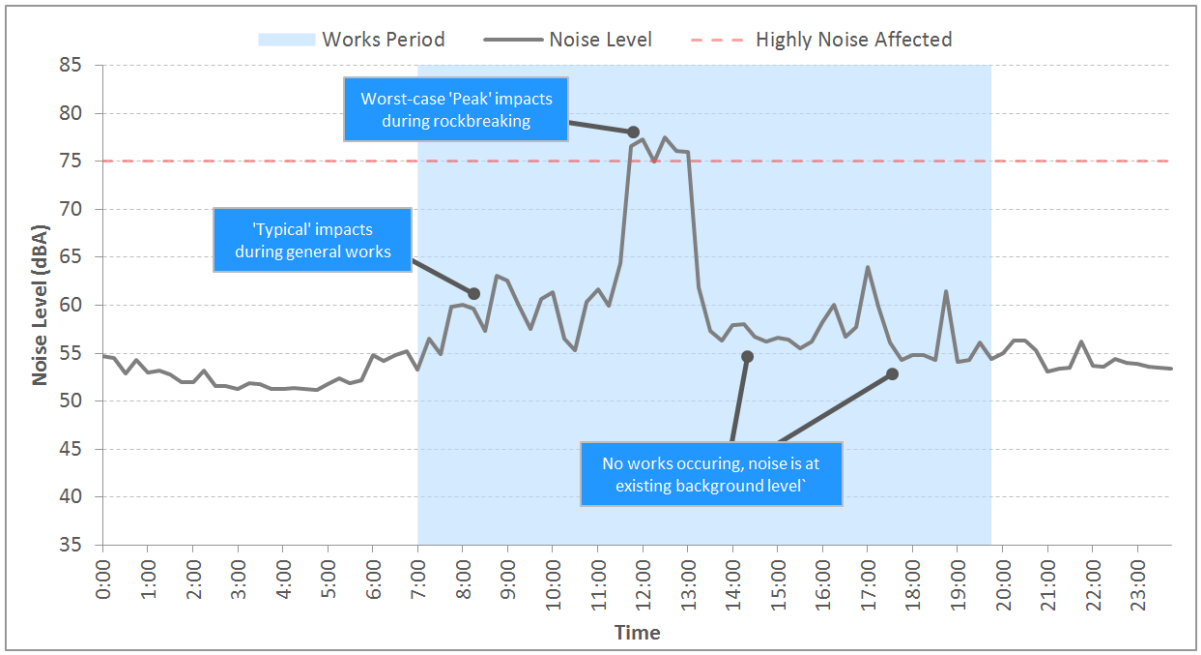
5.0 Assessment of Impacts

5.1 Construction Noise

5.1.1 Duration of Construction Noise Impacts

The following summary of construction noise impacts is based on the predicted noise levels at the most-affected receivers and is representative of the worst-case situation where construction equipment is at the closest point of the site to each receiver. For most works, construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only apparent for a relatively short period when noisy equipment is in use. This concept is illustrated in **Figure 14**, which shows noise levels measured next to major construction works during a period of 'peak impact' rock-breaking and shows how construction noise levels vary over the works period.

Figure 14 Example of Indicative Construction Noise Levels During Rock-Breaking



Note 1: The measurement location was around 40 metres away from the works.

In the above example, while the worst-case noise levels result in highly noise affected impacts, they only last for part of the works period and the noise levels during 'typical impacts' are much lower. There are also periods when no works are occurring, and noise levels are at the existing background level (eg road traffic and general urban hum).

5.1.2 Predicted Construction Noise Levels

The predicted noise levels at the most-affected sensitive receivers surrounding the site are shown in **Table 31** and exceedances of the NMLs are shown in **Table 32**.

A range of noise levels is shown which represent all the equipment for each scenario operating at the nearest location to most-affected receiver (near) and the furthest location away from the most-affected receiver (far). The predictions represent a realistic worst-case scenario where the equipment in each scenario is working concurrently in the same area of the site. It is expected that noise levels would frequently be lower than the worst-case levels

presented as equipment is moved around the site or not operated concurrently, as shown in **Figure 14**.

Construction of the facility will be during Standard Daytime Construction Hours. Construction outside standard hours will be managed in accordance with the out-of-hours works protocol in a Construction Noise and Vibration Management Plan (CNVMP) prepared prior to commencement of construction.

Table 31 Predicted Construction Noise Levels – Standard Daytime Construction Hours

Receiver Location	NML	Predicted Noise Level – $L_{Aeq(15minute)}$ (dBA)					
		W.01 Vegetation clearing	W0.2 Demolition	W.03 Earthworks	W.04 Excavation of hard rock	W.05 Construction of pads & hardstands	W.06 Construction of structures & equipment installation
NCA01 Residential	53	60-73	61-74	57-70	64-**77**	51-64	52-65
NCA02 Residential	54	62-**81**	63-**82**	59-**78**	66-**85**	53-72	54-73
NCA03 Residential	50	63-72	64-73	60-69	67-**76**	54-63	55-64
NCA04 Residential	48	59-68	60-69	56-65	63-72	50-59	51-60
NCA05 Residential	56	42-50	43-51	39-47	46-54	33-41	34-42
Child care centres	60	42-57	43-58	39-54	46-61	33-48	34-49
School classrooms	55	48-61	49-62	45-58	52-65	39-52	40-53
Places of worship	55	53-59	54-60	50-56	57-63	44-50	45-51
Active recreation (NCA02)	65	62-81	63-82	59-78	66-85	53-72	54-73
Active recreation (other)	65	59-70	60-71	56-67	63-74	50-61	51-62
Industrial	75	65-87	66-88	62-84	69-91	56-78	57-79

Note 1: **Bold red** indicates an exceedance of the Highly Noise Affected NML.

Table 32 Predicted Exceedance at Nearest Receivers – Standard Daytime Construction Hours

Address	NML	Predicted Exceedance – $L_{Aeq(15minute)}$ (dB)					
		W.01 Vegetation clearing	W0.2 Demolition	W.03 Earthworks	W.04 Excavation of hard rock	W.05 Construction of pads & hardstands	W.06a Construction of structures & equipment installation
NCA01 Residential	53	7-20	8-21	4-17	11-24	0-11	0-12
NCA02 Residential	54	8-27	9-28	5-24	12-31	0-18	0-19
NCA03 Residential	50	13-22	14-23	10-19	17-26	4-13	5-14
NCA04 Residential	48	11-20	12-21	8-17	15-24	2-11	3-12
NCA05 Residential	56	0	0	0	0	0	0
Child care centres	60	0	0	0	0-1	0	0
School classrooms	55	0-6	0-7	0-3	0-10	0	0
Places of worship	55	0-4	0-5	0-1	2-8	0	0
Active recreation (NCA02)	65	0-16	0-17	0-13	0-20	0-7	0-8
Active recreation (other)	65	0-5	0-6	0-2	0-9	0	0
Industrial	75	0-12	0-13	0-9	0-16	0-3	0-4
Legend (NML exceedances)		= Minor to marginal (1 to 10 dB)		= Moderate (11 to 20 dB)		= High (>20 dB)	

The above worst-case predictions show the following:

- **W.01 (vegetation clearing), W.02 (demolition), W.03 (earthworks) and W.04 (excavation of hard rock)**
  - Construction noise levels are predicted to result in moderate to high exceedances of the NMLs at the nearest residential receivers in NCA01 to NCA04 when works are closest to the receivers.
  - Exceedances would typically be minor to moderate when works are further across the site from the nearest residential receivers, and at residential receivers further back from the first row of buildings.
  - Noise levels at the nearest residential receivers in NCA01 to NCA03 are predicted to exceed the Highly Noise Affected NML when the noisiest equipment is working close to these receivers.

- No exceedances of the NMLs are predicted at NCA05 residential receivers or childcare centres, with the exception of a very minor exceedance at childcare during W.04 (excavation of hard rock).
- Noise levels at the Community Nursery in NCA02 are predicted to result in minor to moderate exceedances when works are closest to that receiver.
- Noise levels at the nearest school classrooms, place of worship and active recreation are predicted to result in minor exceedances when works are closest to those receivers.
- Noise levels at the nearest industrial receiver are predicted to result in minor to moderate exceedances when works are closest to the most-affected receivers.

- **W.05 (construction of pads and hardstands) and W.06 (construction of structures and equipment installation)**
  - Construction noise levels are predicted to result in low to moderate exceedances of the NMLs at the nearest residential receivers in NCA01 to NCA04 when works are closest to the receivers.
  - Exceedances would typically be minor or below the NMLs when works are further across the site from the nearest residential receivers, and at residential receivers further back from the first row of buildings.
  - Exceedances at the Community Nursery in NCA02 would typically be minor when works are closest to that receiver.
  - No exceedances of the NMLs are predicted at NCA05 residential receivers, childcare centres, school classrooms, place of worship and active recreation.
  - Noise levels at the nearest industrial receiver are predicted to result in minor exceedances when works are closest to the most-affected receivers.
- The highest impacts are predicted during ‘vegetation clearing’ when a chainsaw/chipper is in use, and during ‘demolition’ and ‘excavation of hard rock’ when a rockbreaker is in use.
- Works would only occur during Standard Daytime Construction Hours. There is no expectation that evening or night-time work would be required.

The presented impacts would only be expected to occur when noisy work is being completed close to the site boundaries, relative to each receiver. When work is further from the receiver, or when less noise-intensive equipment is being used, the noise levels and potential impacts would be lower.

Feasible and reasonable construction noise mitigation measures should be applied where exceedances of the NMLs are predicted. Construction noise mitigation and management measures are discussed in **Section 7.1**.

5.2 Construction Vibration

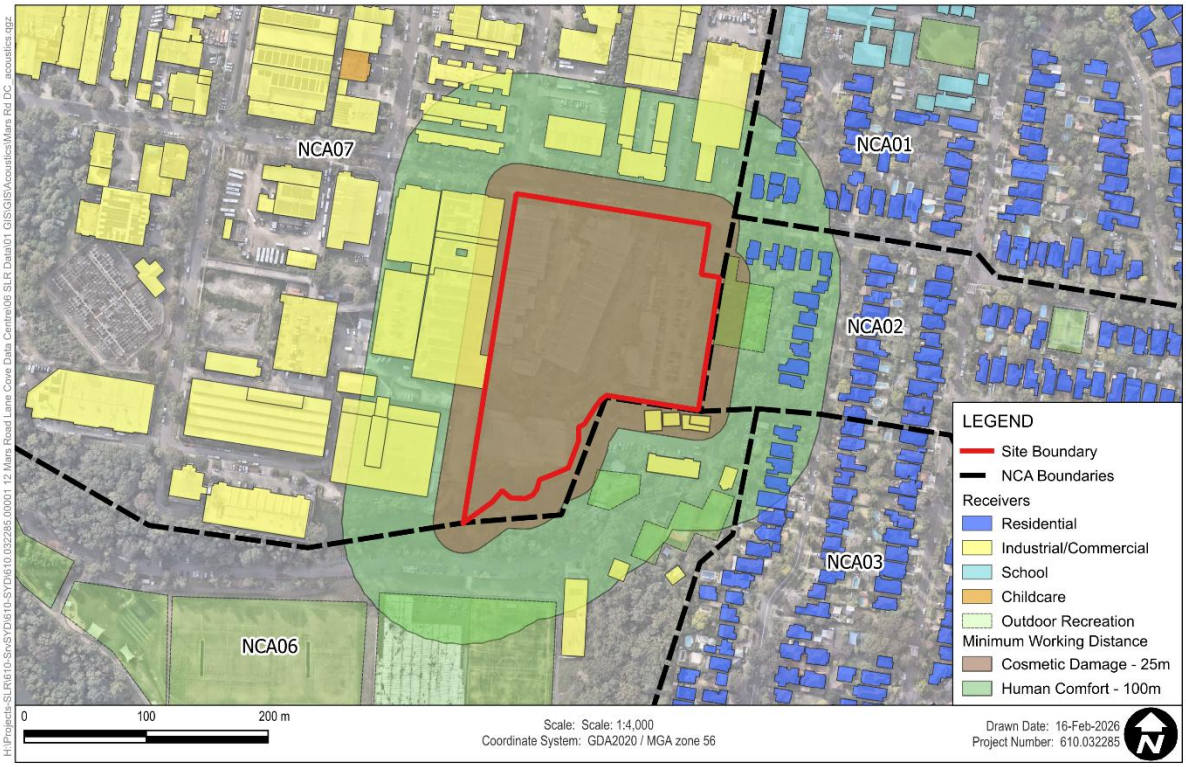
The major potential sources of vibration from the proposed construction activities would likely be during:

- ‘Earthworks’ when vibratory rollers are being used
- ‘Demolition’ and ‘excavation of hard rock’ when rockbreakers are being used.

Vibration offset distances have been determined from the CNVG minimum working distances for cosmetic damage and human comfort (see **Table 11**) and the assessment is

summarised in **Figure 15** for the potential worst-case scenario, which is during the use of a large vibratory roller. Buildings within the minimum working distances are highlighted in the figure.

Figure 15 Construction Vibration – Large Vibratory Roller



Cosmetic Damage Assessment

The above figure shows that the nearest industrial/commercial buildings to the west, the Council depot to the southeast and the Community Nursery to the east are likely within the minimum working distance when vibratory rollers are in use at the nearest boundaries of the construction site. The nearest residence to the east (10 Banksia Close) and the skatepark to the south are also close to being within the minimum working distance.

Feasible and reasonable construction vibration mitigation measures should be applied where vibration-intensive works are required within the minimum working distances. Construction mitigation and management measures are discussed further in **Section 7.1**.

Human Comfort Vibration Assessment

The above figure indicates that the nearest industrial/commercial, residential and outdoor recreation receivers surrounding the site are within the human comfort minimum working distance and occupants of these buildings/areas may be able to perceive vibration impacts at times when vibratory rollers or rockbreakers are in use nearby. Where impacts are perceptible, they would likely only be apparent for relatively short durations when vibration-intensive equipment is in use.

Feasible and reasonable construction vibration mitigation measures should be applied where vibration-intensive works are required within the minimum working distances. Construction mitigation and management measures are discussed further in **Section 7.1**.

5.3 Operational Noise

5.3.1 Predicted Noise Levels

A summary of the worst-case operational noise assessment at the receivers surrounding the proposal is shown in **Table 33**.

The predicted worst-case levels are compared to the Project Noise Trigger Levels to determine the potential impact from the proposal.

Table 33 Operational Noise Assessment

Receiver Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)[5]			Compliance OP.01 / OP.02
		Noise Criteria	OP.01[1]	OP.02[2]	
NCA01 Residential	Day	48	43	44	Yes / Yes
	Evening	43	39	-	Yes / -
	Night	36	36	-	Yes / -
NCA02 Residential	Day	48	48	47	Yes / Yes
	Evening	43	38	-	Yes / -
	Night	36	36	-	Yes / -
NCA03 Residential	Day	45	35	44	Yes / Yes
	Evening	43	34	-	Yes / -
	Night	35	33	-	Yes / -
NCA04 Residential	Day	43	28	40	Yes / Yes
	Evening	43	27	-	Yes / -
	Night	38	25	-	Yes / -
NCA05 Residential	Day	51	20	35	Yes / Yes
	Evening	43	19	-	Yes / -
	Night	38	18	-	Yes / -
Child care	When in use	53	28	38	Yes / Yes
Educational	When in use	43	30	35	Yes / Yes
Place of worship	When in use	48	29	38	Yes / Yes
Active recreation (NCA02)	When in use	53	52	53	Yes / Yes
Active recreation (other)	When in use	53	32	41	Yes / Yes
Industrial	When in use	68	54	68	Yes / Yes

Note 1: OP.01 – Normal Operations.

Note 2: OP.02 – Maintenance/Testing Operations.

The above assessment indicates that noise from the proposal is predicted to comply with the PNTLs at all receivers during both OP.01 (normal operations) and OP.02 (testing of backup generators) with the mitigation measures detailed in **Section 7.2**.

It is noted that the details of the mechanical plant used in this assessment are indicative, including the unit types, sound power levels, number of units and locations of equipment. All mechanical plant items should be reviewed during later acoustic assessments during the detailed design stage of the project to confirm compliance with the PNTLs. It is expected that compliance is achievable through a combination of appropriate mechanical plant selection, acoustic louvres where appropriate, etc.

A detailed investigation of all potential feasible and reasonable mitigation measures is provided in **Section 7.2**.

Noise contour maps of the predicted worst-case operational noise impacts are provided in **Appendix D**.

5.3.2 Emergency Power Failure

The emergency power failure scenario during a power outage includes all backup generators operating concurrently, along with all operational sources for the day, evening and night respectively. Load banks are not included in the power outage scenario as they are only used for testing of the backup generators.

It is noted that the power outage scenario is not required to meet the operational noise criteria as it is an infrequeny emergency scenario. However, noise impacts during the emergency scenario should be considered when determining feasible and reasonable mitigation and management measures.

The predicted noise levels during the emergency power failure scenario are shown in **Table 34**.

The predictions include noise-enhancing weather conditions as discussed in **Section 4.2.7**.

Table 34 Emergency Power Failure

Receiver Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)[5]
		Power Outage
NCA01 Residential	All	51
NCA02 Residential	All	55
NCA03 Residential	All	47
NCA04 Residential	All	40
NCA05 Residential	All	33
Child care	When in use	43
Educational	When in use	42
Place of worship	When in use	40
Active recreation (NCA02)	When in use	59
Active recreation (other)	When in use	42
Industrial	When in use	67

The above shows that predicted noise levels during the power failure scenario are up to 55 dB at the most-affected residential receivers, with lower levels predicted at receivers that are more distant or shielded from the generator areas.

As noted above, emergency power failure is an infrequent scenario. To understand the likelihood of exceedance under the worst-case scenario (ie, all backup generators operating continuously at 100% load), the reliability of the power network when evaluated against the latest information supplied in the 2024 Distribution Annual Planning Report (DAPR) from Endeavour Energy (Endeavour Energy, 2024).

Base on the DAPR and associated network reliability statisctics, the average unplanned outage duration per year per customer from financial-year 2013 to financial year 2023 equates to approximately 82.0 minutes, although exact duration of power outages requiring standby generators cannot be determined. Correspondingly, the likelihood of power interruptions occurring is approximately 0.016% of the time per year (82.0 / (8,760 x 60)) or have a probability of p=0.00016.

During an unplanned power outage event, the operation of the emergency power generators would result in acoustic impacts. However, the assessment quantifies the probability of this occurrence as very low, based upon the modelled likelihood of impacts, prevailing meteorological conditions and historical probability of power outage events.

Minimising noise impacts from the backup generators, including during the power outage scenario, has been achieved with the following measures:

- Site layout – Where possible, the site layout has been designed so that the buildings and acoustic walls screen the noisier areas of the development from the nearest receivers.
- Appropriate selection of mechanical plant – Generator specifications are typically controlled by the power generation requirements of the development. However, selection of generator models during detailed design will consider the noise emissions of the specific generator models to ensure compliance with the noise limits during testing and minimise impacts during power outages.
- Generator enclosure acoustic mitigation measures – The generator enclosures have been designed with large attenuators within the enclosure for the air intake and discharge through the enclosure. Additionally, silencers will be utilised within the generator exhaust gas flue. Specific models for the attenuators and silencers will be determined during detailed design once specific generator models are selected, and will consider the noise emissions of the specific generator models to ensure compliance with the noise limits during testing and minimise impacts during power outages.

5.3.3 Sleep Disturbance

The predicted night-time maximum noise levels at the nearest residential receivers are shown in **Table 35**. These include the mitigation measures specified in **Section 7.2**.

The predictions include noise-enhancing weather conditions as discussed in **Section 4.2.7**.

Table 35 Sleep Disturbance Assessment

Receiver Location	Source	Maximum Noise Level L_{Amax} (dBA)[1]			Below Screening Level
		Sleep Dist. Screening Level	Predicted	Exceedance	
NCA01 Residential	Light vehicle movements and parking	52	52	-	Yes
NCA02 Residential		52	50	-	Yes
NCA03 Residential		52	36	-	Yes
NCA04 Residential		52	31	-	Yes
NCA05 Residential		52	19	-	Yes

Note 1: Maximum noise level shown for the most-affected receiver in each NCA.

The above shows that maximum noise levels are predicted to comply with the sleep disturbance screening level at the nearest residential receivers. As such, maximum noise levels from the development are unlikely to result in sleep disturbance at these receivers and a detailed maximum noise level assessment is not required.

5.4 Off-site Traffic Assessment

As noted in **Section 4.2.6**, there are no residential receivers along the access route between the site on Mars Road and Epping Road, however the residences at the west end of Banksia Close and close to the site entrance.

Daytime and night-time vehicle movements from the proposed development are substantially lower than the existing warehouses on the site, and the proposed site entrances are a similar distance or further from the residences than the existing site entrances.

The potential impacts from development-related traffic on the surrounding roads, which would be lower than the existing development, are expected to be negligible and no consideration of mitigation is required.

6.0 Cumulative Impacts

The NSW Government *Cumulative Impact Assessment Guidelines for State Significant Projects* requires that the potential combined effect of cumulative impacts on all nearby industrial developments to be considered when assessing potential noise impacts from state significant projects.

Cumulative impacts can be caused by the compounding effects of multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

6.1 Construction Noise

Cumulative construction noise impacts can occur where multiple work activities are being completed near to a particular receiver at the same time.

The construction work associated with the proposal has the possibility of interacting with the construction activities of other nearby projects. Key projects are described in **Table 36**.

Table 36 Nearby Developments – Potential Cumulative Construction Impacts

Project	Development Description	Current Status	Comments Regarding Cumulative Impacts
Lane Cove West Data Centre 1 Sirius Road, Lane Cove West SSD-9741	Ongoing construction of data centre building alterations and additional space.	Most recent Modification approved 13 June 2024 – construction likely to continue for several years.	Located around 450 m to the northwest of the proposal, and 580 m from the receivers most-affected by construction of the proposal. Potential cumulative impacts not anticipated.
Apollo Place Data Centre 1 Sirius Road and 1 Apollo Place, Lane Cove West SSD-67407231	Demolition of existing warehouses and construction of data centre.	Approved 9 October 2025 – construction likely to commence in 2026.	Located around 380 m to the northwest of the proposal, and 540 m from the receivers most-affected by construction of the proposal. Potential cumulative impacts not anticipated.

The above indicates that the potential for cumulative construction noise impacts from the above projects are not anticipated due to their distance from the most-affected receivers adjacent to the proposal site.

Since construction scenarios and equipment for projects in the area would generally require similar items of equipment to the proposal, concurrent construction work could theoretically increase the worst-case noise levels in this report by around 3 dB (ie a logarithmic adding of two sources of noise at the same level). The likelihood of worst-case noise levels at any individual receiver being generated by works on different projects at the same time is, however, considered low.

Should other projects be approved in the area there is potential for cumulative construction impacts if they are constructed at the same time as the proposal, however this would be addressed in their respective Construction Noise and Vibration Management Plans.

As such, cumulative construction impacts are not likely to significantly alter the predictions in this report and no specific mitigation is expected to be required.

The potential cumulative impacts from the proposal and other projects would continue to be considered as the project progresses when detailed construction planning is developed.

6.2 Operational Noise

The *Noise Policy for Industry* states that it aims to limit continuing increases in cumulative industrial noise through the application of amenity noise levels, which are applicable to all industrial noise sources in an area.

The policy accounts for potential cumulative impacts by lowering the criteria for each individual development to ensure that the ambient noise level within an area from all industrial noise sources combined remains below the recommended amenity noise levels, where feasible and reasonable. As such (as discussed in **Section 3.3.2**), the potential cumulative impacts from the proposal and other potential sources of industrial noise in the area are accounted for in the proposal-specific PNTLs and, therefore, do not require further consideration.

7.0 Mitigation and Management Measures

7.1 Construction Impacts

The impacts during construction of the proposal are predicted to be consistent with major construction work near sensitive receivers. No works outside of Standard Construction Hours are currently proposed.

The use of standard mitigation measures to minimise the impacts is considered sufficient to control the majority of the impacts. Examples of measures that could be applied to the work are provided in the Transport for NSW *Construction Noise and Vibration Guideline* (see **Appendix E**).

Recommended universal work practices and standard mitigation measures for the proposal construction include:

- Regular toolbox notification and training of workers and contractors to be aware of nearby noise sensitive receivers and use equipment in ways to minimise noise.
- Use the minimum sized equipment necessary to complete the work and where possible, use alternative, low-impact construction techniques
- Long term stationary noise sources should be enclosed or shielded from nearby sensitive receivers where possible
- Where rockbreakers or other pneumatic equipment is required, select silenced and dampened equipment where possible
- Implement community consultation to provide surrounding receivers with information such as the total construction time, what works are expected to be noisy, their duration and mitigation measures that are being applied to minimise the noise
- Consultation should include nearby ‘other sensitive’ receivers such as educational institutions. Noise intensive work that is predicted to impact ‘other sensitive’ receivers will be scheduled outside of particularly sensitive periods, such as exams, where possible.

A Construction Noise and Vibration Management Plan (CNVMP) would be prepared before any work begins. The plan would:

- Identify nearby sensitive receivers
- Describe the activities, construction equipment and work that will be completed and quantify resulting impacts at sensitive receivers
- Include noise and vibration management criteria and relevant licence and approval conditions
- Include measures to manage noise and vibration and minimise the potential for impacts during construction, aligned with the results of community consultation and feedback during the approval process
- Set out requirements for noise and vibration verification monitoring
- Set out procedures for handling complaints.

AS 2436 provides further guidance on the control of construction noise and vibration and includes the nominal noise reduction possible from various mitigation strategies summarised in **Table 37**.

Table 37 Nominal Construction Noise Reductions

Control	Example	Nominal Noise Reduction (AS 2436)
Distance	Maximising the offset distance between noisy plant and adjacent sensitive receivers.	6 dB per doubling of distance
Screening	Use of structures (ie site shed, earth bund, temporary hoarding) to shield adjacent sensitive receivers from noisy plant and activities.	5-10 dB
Enclosure	Construct a solid enclosure around generators, compressors, pumps or similar long-term plant.	15-25 dB
Silencing	Fit muffler, silenced or dampened bit to relevant noise intensive equipment.	5-10 dB

Construction impacts are expected to remain during certain work activities at the nearest sensitive receivers even with the implementation of all feasible and reasonable mitigation measures. The CNVMP would review the predicted residual construction noise impacts when more detailed planning information is available and confirm the mitigation measures which would be implemented to minimise construction noise impacts as much as practicable.

7.2 Operational Noise Impacts

Where operational noise impacts from the development are predicted to exceed the relevant noise criteria, feasible and reasonable operational noise mitigation and management measures should be considered, with the aim of reducing noise emissions to the relevant criteria.

The typical hierarchy for mitigation and management of industrial noise sources is as follows:

- Reducing noise emissions at the source (ie noise source control)
- Reducing noise in transmission to the receiver (ie noise path control)
- Reducing noise at the receiver (ie at-receiver control).

A detailed assessment of potential feasible and reasonable mitigation measures that can be applied to the development to minimise the operational noise impacts has been completed and is summarised in **Table 38**.

The measures should be regarded as indicative and would be further refined during detailed design and in an Operational Noise Management Plan (ONMP) when the specific tenants operations are known.

Table 38 Operational Noise Mitigation Options

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
Source Control			
S1	Optimised site layout to minimise noise emissions from the site	Where possible, the site layout has been designed so that the buildings screen the noisier areas of the development from the nearest receivers.	Yes – applied during design of the concept
S2	Limit vehicle movements	A reduction in concurrent vehicle movements across the site by staggering delivery/pickup times and/or employee shift change times could reduce noise emissions. In practice, this would occur naturally due to operational requirements.	No – vehicle volumes used in this assessment are likely needed to meet tenant's requirements. Additionally, vehicle movements are not a dominant contributor to noise emissions from the site.
S3	Limit heavy vehicle movements during the evening and night-time	Preliminary noise modelling identified heavy vehicles and loading as a source of exceedance during the evening and night-time. Limiting heavy vehicles and loading to the daytime only removes exceedances of the noise criteria.	Yes – heavy vehicles will not be unloaded or access the site during the evening or night-time periods.
S4	Roller doors kept closed when loading/unloading is not occurring.	Reduce potential for noise breakout from internal activity.	Yes – roller doors should be kept closed when not in use for loading/unloading.
S5	Appropriate design of site layout to minimise the need for trucks to stop or brake outside of loading docks with line of sight to residential receivers.	Minimise noise emissions, particularly from truck airbrakes.	Yes – applied during design of the concept. The loading area was positioned as far as practicable from the receivers, with respect to site constraints, access points and equipment replacement requirements.
S6	Use broadband and/or ambient sensing alarms on heavy vehicles.	Reduce potential for annoying noise emissions.	Yes – encourage use of broadband and/or ambient sensing alarms on heavy vehicles.
S7	Scheduling of generator testing	Preliminary noise modelling identified generator testing concurrent with heavy vehicle access and loading as a source of exceedance. Limiting generator testing to the daytime and scheduling testing around deliveries removes exceedances of the noise criteria.	Yes – generator testing will be undertaken only during the daytime, and will be scheduled around deliveries so that heavy vehicles will not be unloaded or access the site during generator testing.

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
S8	Appropriate specification and location of mechanical plant during detailed design.	Reduce potential for noise impacts and annoying noise emissions, including from generator operation during power outages.	Yes – the specified example units of mechanical plant have been selected to meet the noise requirements of the project. The noise impacts from all items of mechanical plant would be reviewed during detailed design stage to confirm units selections and any mitigation requirements. This includes generator enclosures and exhaust silencers, load bank enclosures.
S9	Generator and load bank acoustic enclosure design during detailed design.	Reduce potential for noise impacts and annoying noise emissions from generators and load banks, including from generator operation during power outages.	Yes – the generator enclosures have been designed with large attenuators within the enclosure for the air intake and discharge through the enclosure. Additionally, silencers will be utilised within the generator exhaust gas flue. Load banks have been housed in a precast enclosure with acoustics louvres for the intake and discharge louvres. Specific models for the attenuators, silencers and acoustic louvres would be reviewed during detailed design stage to confirm units selections and mitigation requirements.
S10	Substation design during detailed design.	Reduce potential for noise impacts and annoying noise emissions from the substation.	Yes – the substation transformers have been modelled with an attenuated sound power levels based on data provided the proposed transformer manufacturer. Additionally, the two transformer bays are surrounded with 11.1m walls and propose to utilise acoustic absorption on the inside face of the walls. Specific models for the transformers, attenuation and absorption would be reviewed during detailed design stage to confirm units selections and mitigation requirements.
S11	Production of an Operational Noise Management Plan.	This would detail the measures that could be used by the various tenants to minimise general noise emissions from the site. Reference can be made to the Best Management Practice (BMP) measures listed in the NPfI (see **Appendix F**).	Yes – the ONMP would detail any operational requirements for the development.

Ref.	Mitigation Option	Noise Impact/Benefit	Feasible and Reasonable to Apply
Path Control			
P1	Acoustic Screening	Construction of acoustic screening has been incorporated into the design of the roof layout (see **Section 4.2.1**) to mitigate noise from the rooftop mechanical plant.	Yes – an indicative combination of solid screening and acoustic louvres on the rooftop has been incorporated in the building design. Additionally, screening around the indicative office AC units has been included in the noise model. Any louvred areas would indicatively use Architectural Product Solutions Model A12350 acoustic louvres or similar (manufacturer data sheet supplied by the project team). The design and requirements for acoustic screening would be confirmed during the detailed design stage of the project.
Receiver Control			
R1	Not considered required	n/a	n/a

The proposal does not have tenants committed and the exact operational procedures of the site are not known at the time of this assessment. Several assumptions have been made regarding the likely future uses and sources of noise. The noise predictions in this report represent the expected peak operational noise emissions based on currently available information for planning purposes and will be reviewed at a later stage when detailed information is available.

8.0 Conclusion

SLR has been engaged to assess the potential construction and operational noise emissions from the proposed Project Mars Data Centre, Lane Cove West. The proposal includes the operation of a multi-storey data centre, which would be in use 24/7.

The potential impacts from the proposal have been assessed against the noise and vibration specific Secretary's Environmental Assessment Requirements.

Moderate to high exceedances of the construction noise management levels are predicted at the nearest sensitive receivers during the noisier scenarios, particularly when noise-intensive items of equipment, such as rockbreakers, are in use. The nearest residences are predicted to be highly noise affected when noisy works are being undertaken near to the receiver. Exceedances are predicted to generally be low to moderate when works are not near the most-affected receivers, and at receivers further from the site. The use of vibration intensive equipment during construction may result in vibration impacts at receivers within the minimum working distances. Mitigation measures have been recommended to address the potential construction impacts including preparation of a Construction Noise and Vibration Management Plan.

The operational noise assessment includes feasible and reasonable mitigation measures to minimise potential impacts from the proposal. The measures include rooftop acoustic screening as per the building design, selection of appropriate mechanical plant during detailed design, and implementation of operational management measures. With the inclusion of the proposed mitigation, operational noise levels are expected to comply with the trigger levels at the nearest receivers.

The potential operational impacts and requirements for mitigation would be reviewed during further acoustic assessments completed during detailed design when tenant requirements are known.

Based on the predicted levels and indicative mitigation measures, the proposal is considered appropriate from an acoustic standpoint.

Appendix A Acoustic Terminology

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

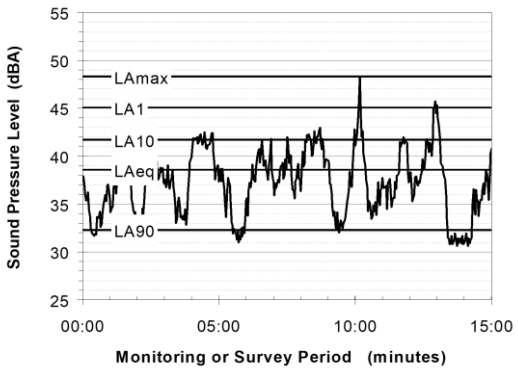
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

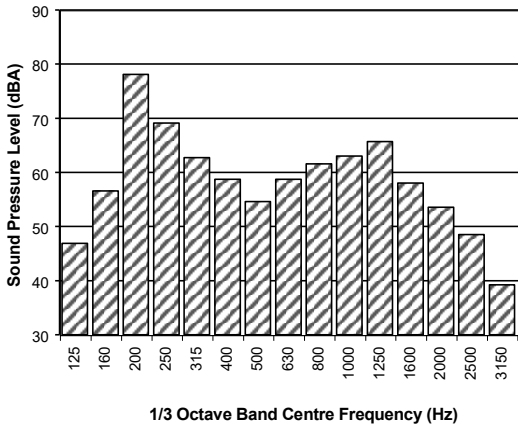
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

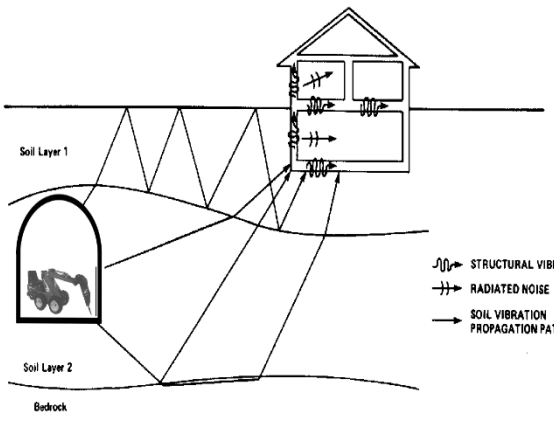
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B Noise Monitoring Data

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

Noise Monitoring Location	L01
Noise Monitoring Address	**17 Banksia Close, Lane Cove West**

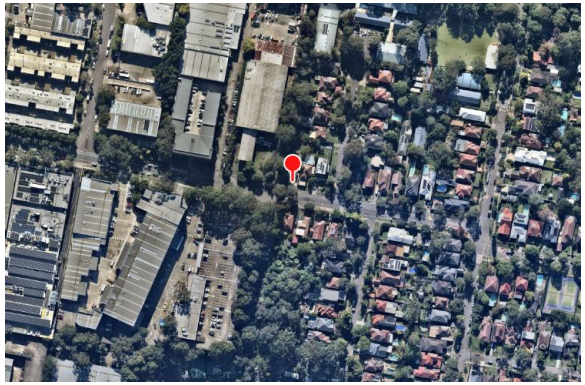
Logger Device Type: Svantek 957, Logger Serial No: 21423
Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3029485

Ambient noise logger deployed in the front yard of 17 Banksia Close, Lane Cove West. Noise logger location is adjacent to the ends of both Mars Road and Banskia Close, and looks towards the northeast corner of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by distant road traffic noise from Epping Road. Birds and local traffic on Mars Road and Banksia Close also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 44-48 dBA, Cars on Mars Road and Banksia Close: 51-57 dBA, Bus idling at Mars Road bus stop: 50-52 dBA, Motorbike on Mars Road: 66 dBA, Birds: up to 58 dBA.

Map of Noise Monitoring Location



Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	43	58	59	67
Evening	40	53	52	62
Night-time	31	47	40	45

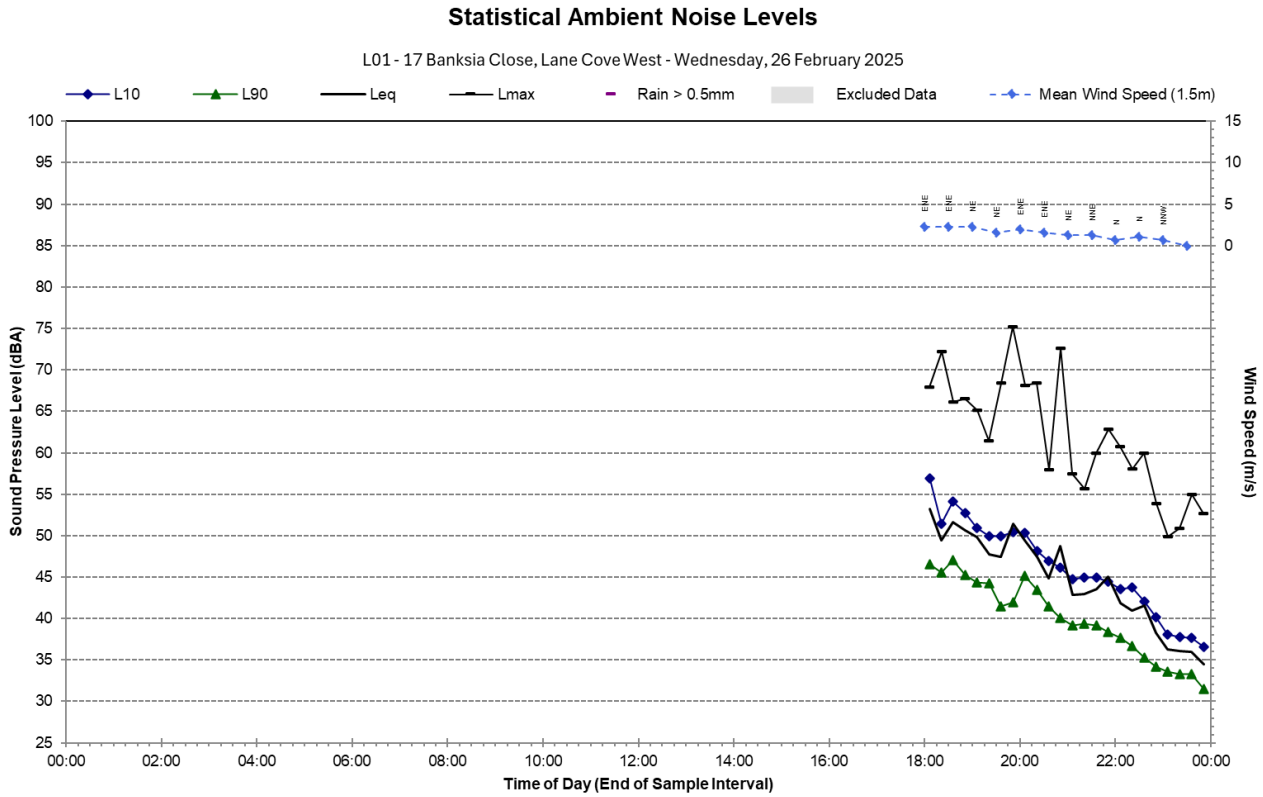
Ambient Noise Logging Results – RNP Defined Time Periods

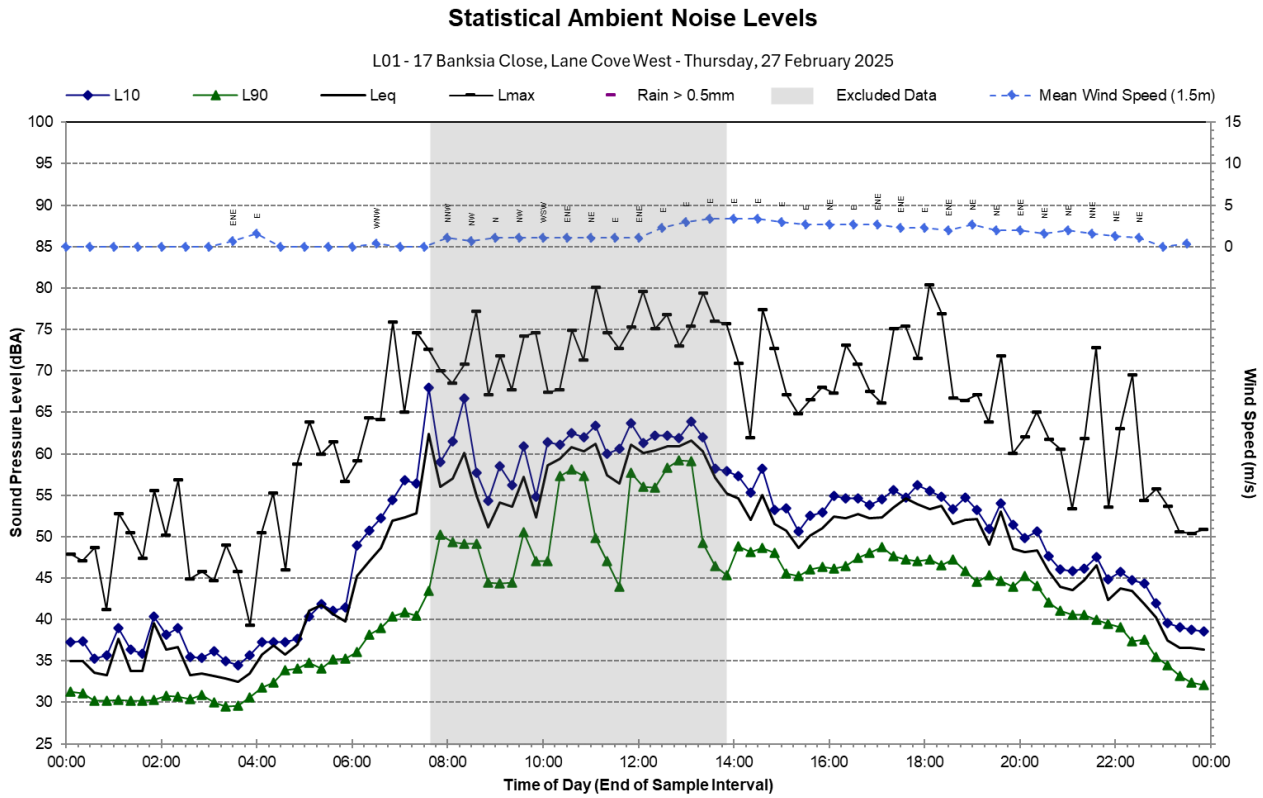
Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	57	58
Night-time (10pm-7am)	47	52

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
26/02/2025	17:22	47	51	66

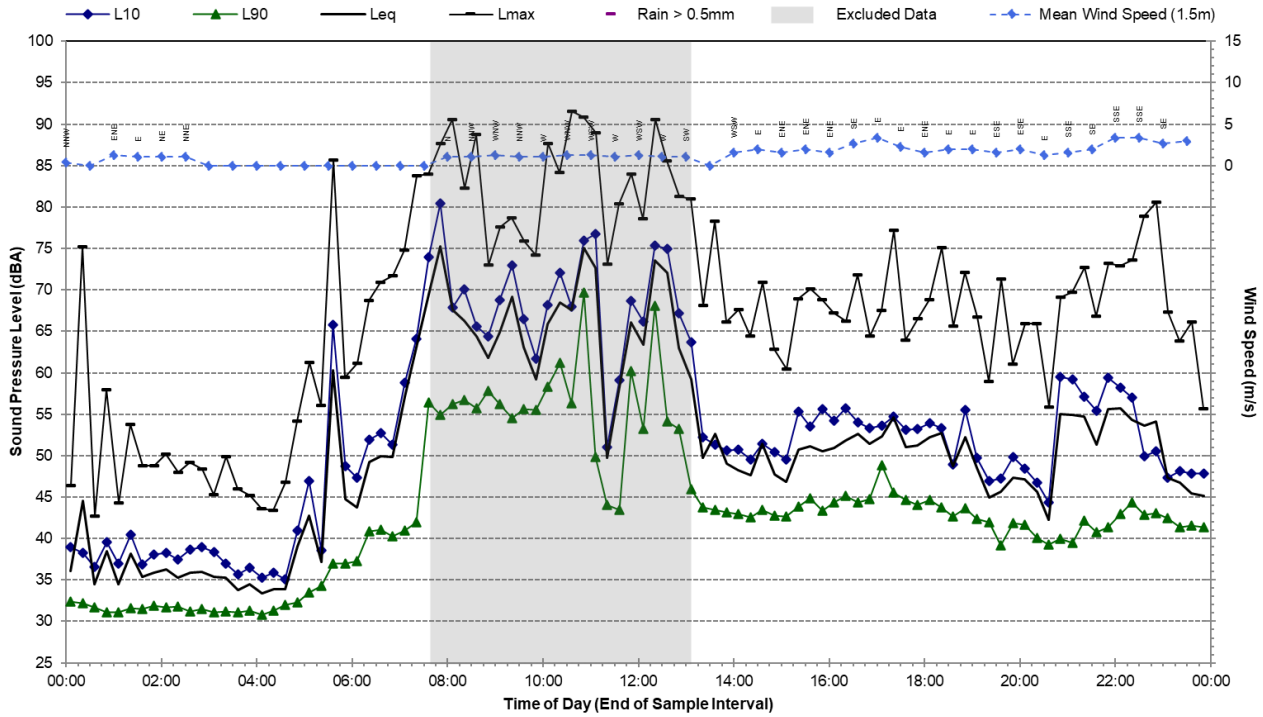
Photo of Noise Monitoring Location


Statistical Ambient Noise Levels
L01 - 17 Banksia Close, Lane Cove West - Wednesday, 26 February 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 17 Banksia Close, Lane Cove West - Thursday, 27 February 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

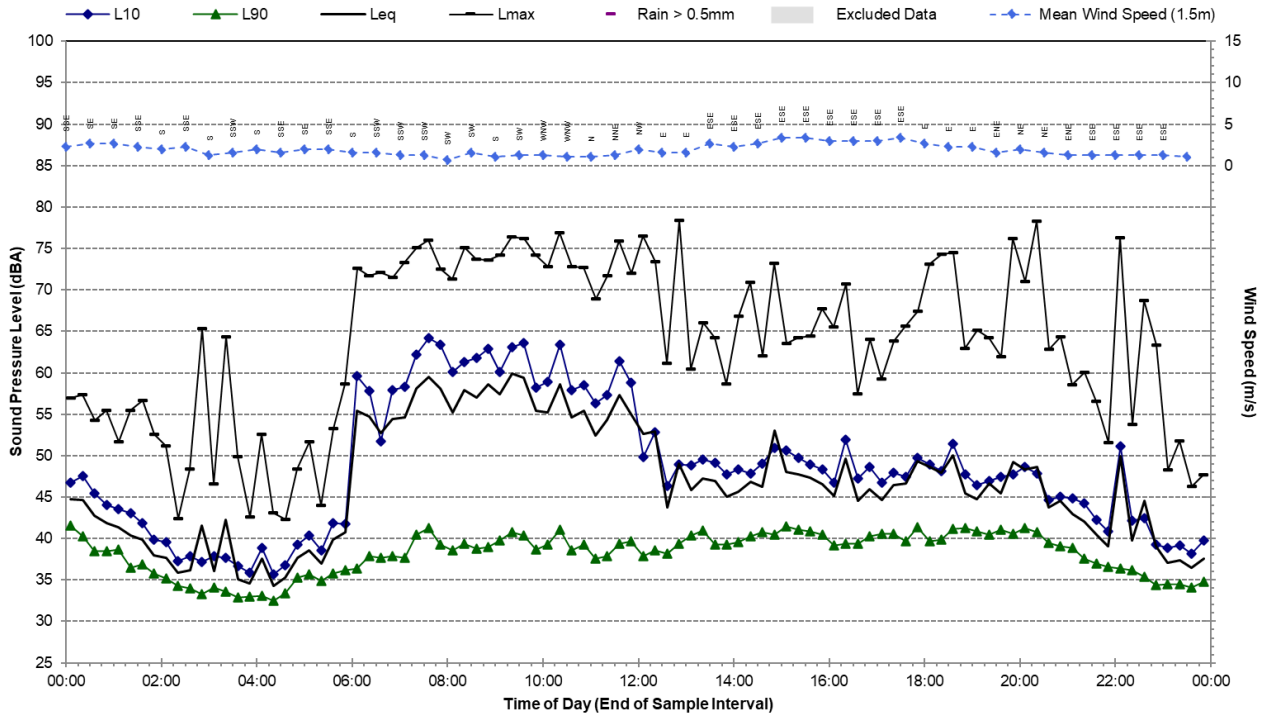
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Friday, 28 February 2025



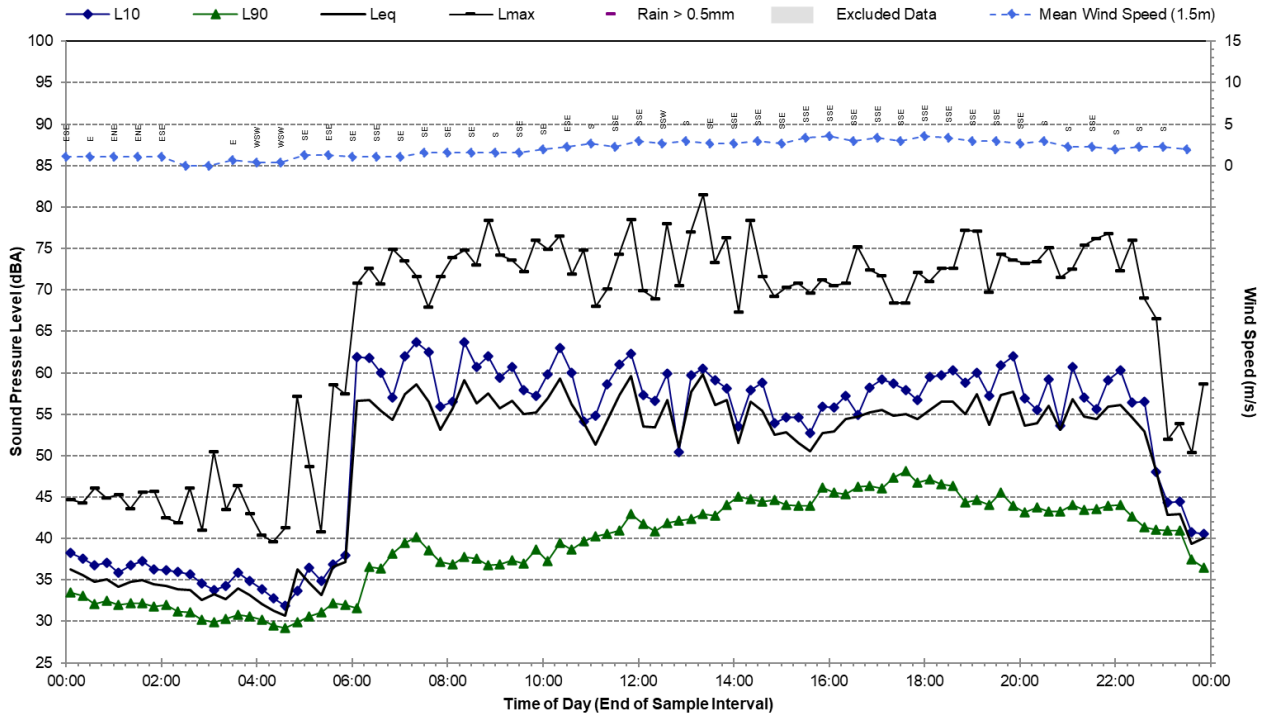
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Saturday, 1 March 2025



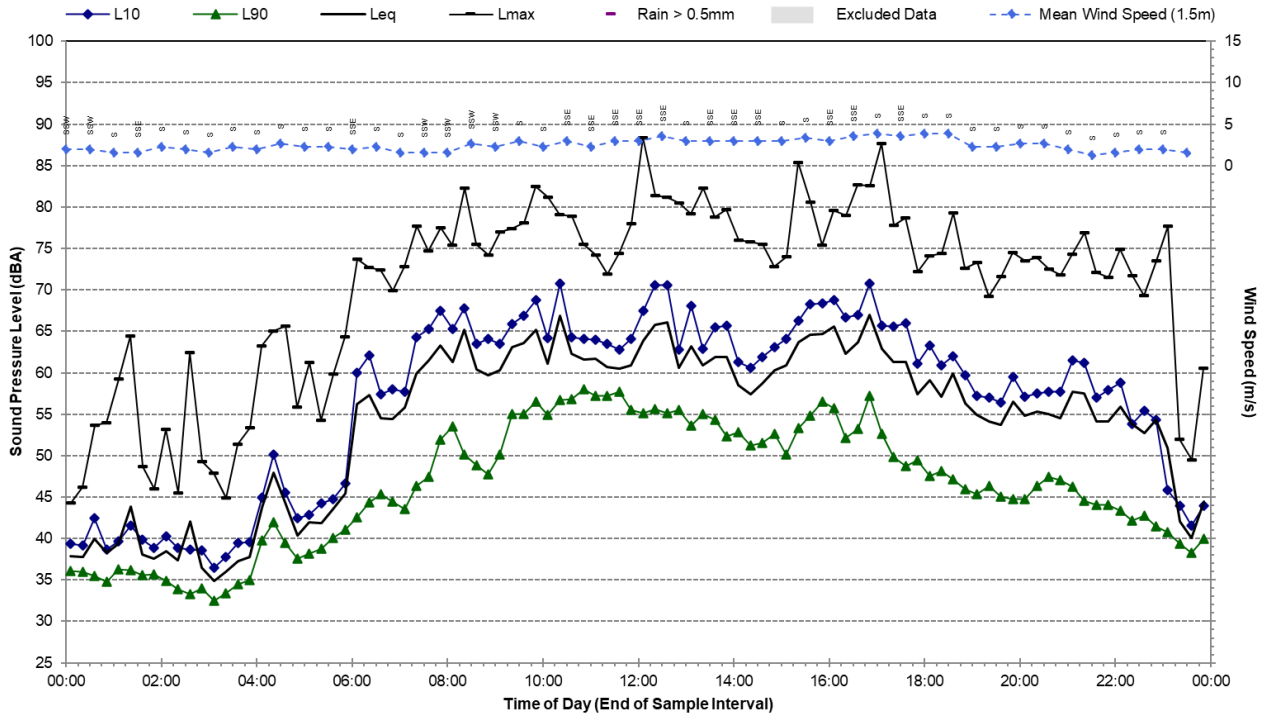
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Sunday, 2 March 2025



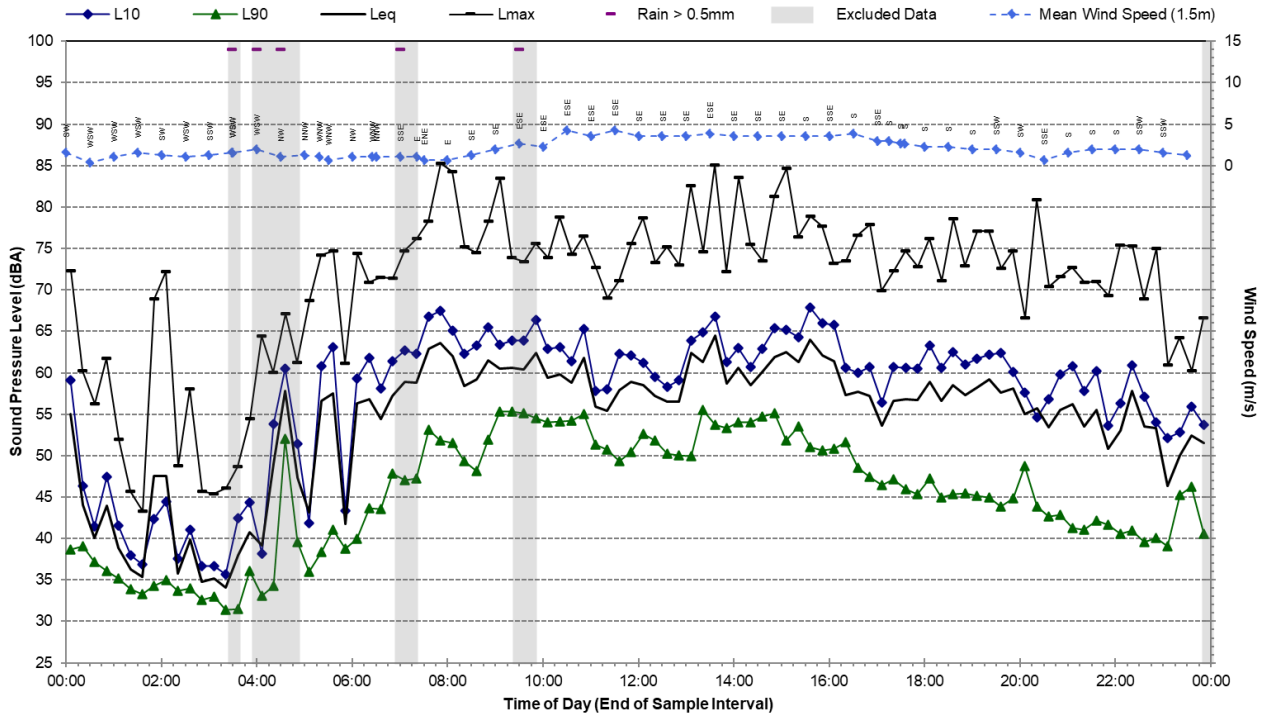
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Monday, 3 March 2025



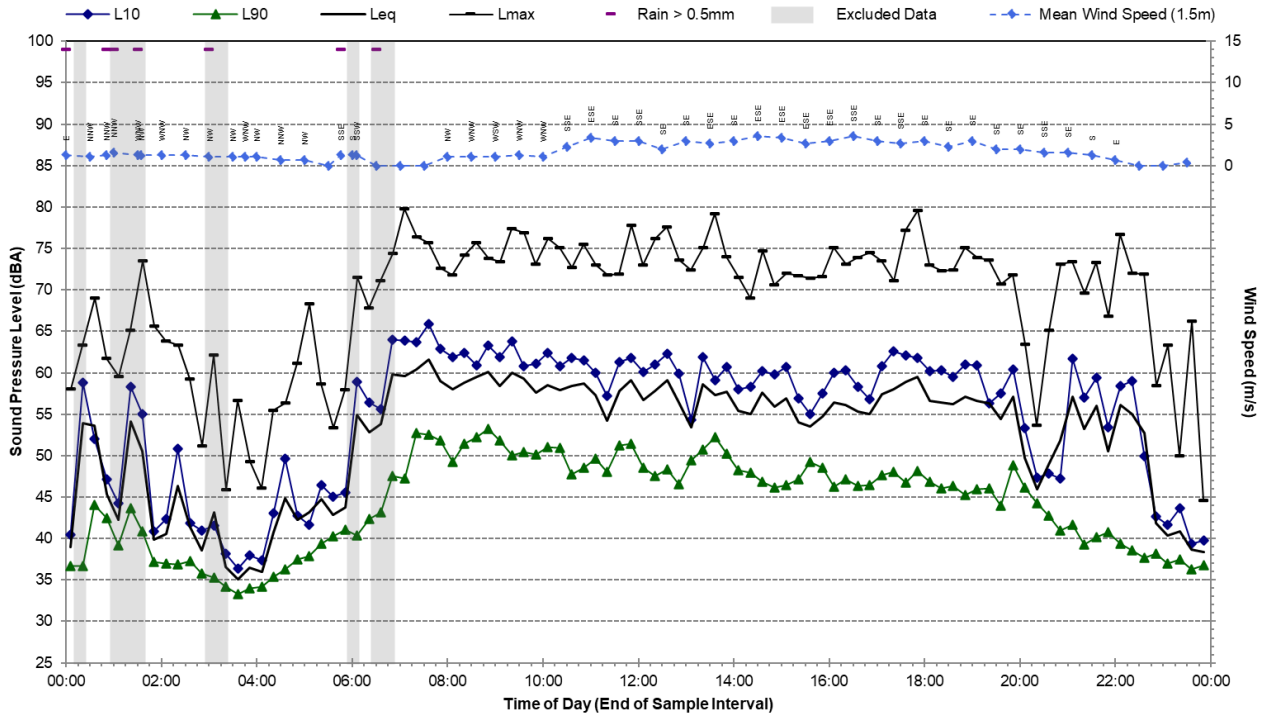
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Tuesday, 4 March 2025



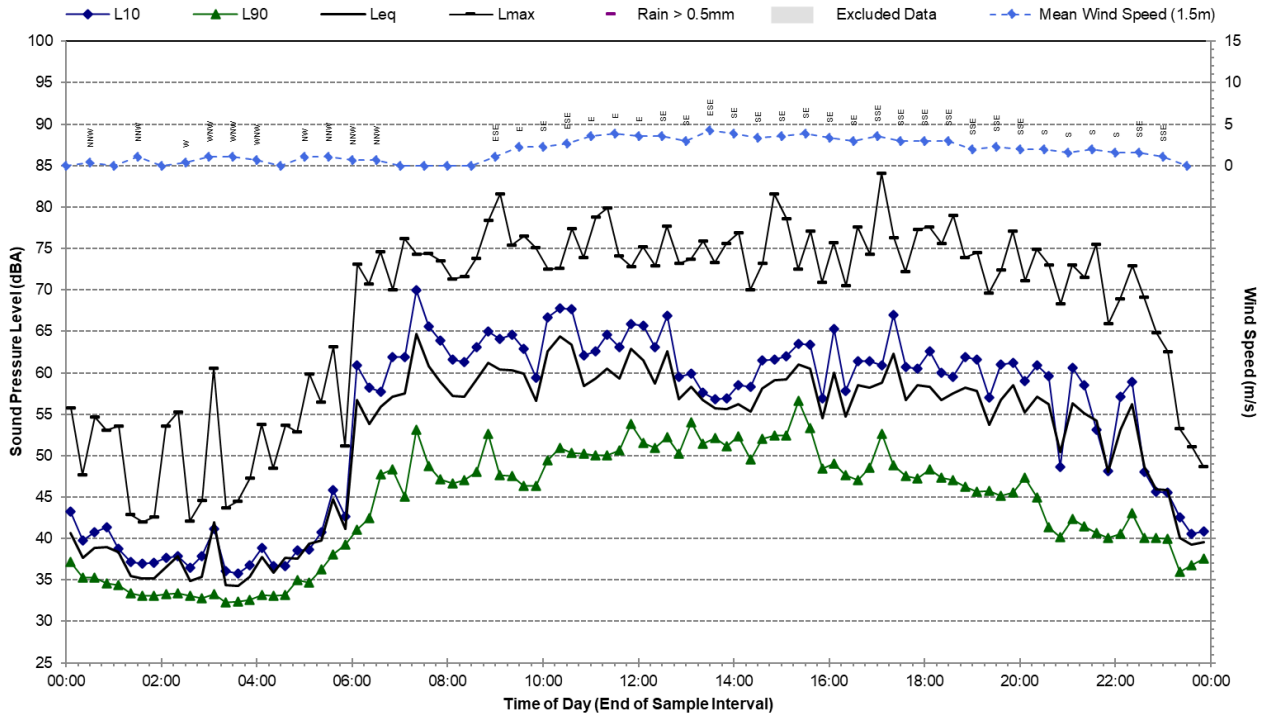
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Wednesday, 5 March 2025



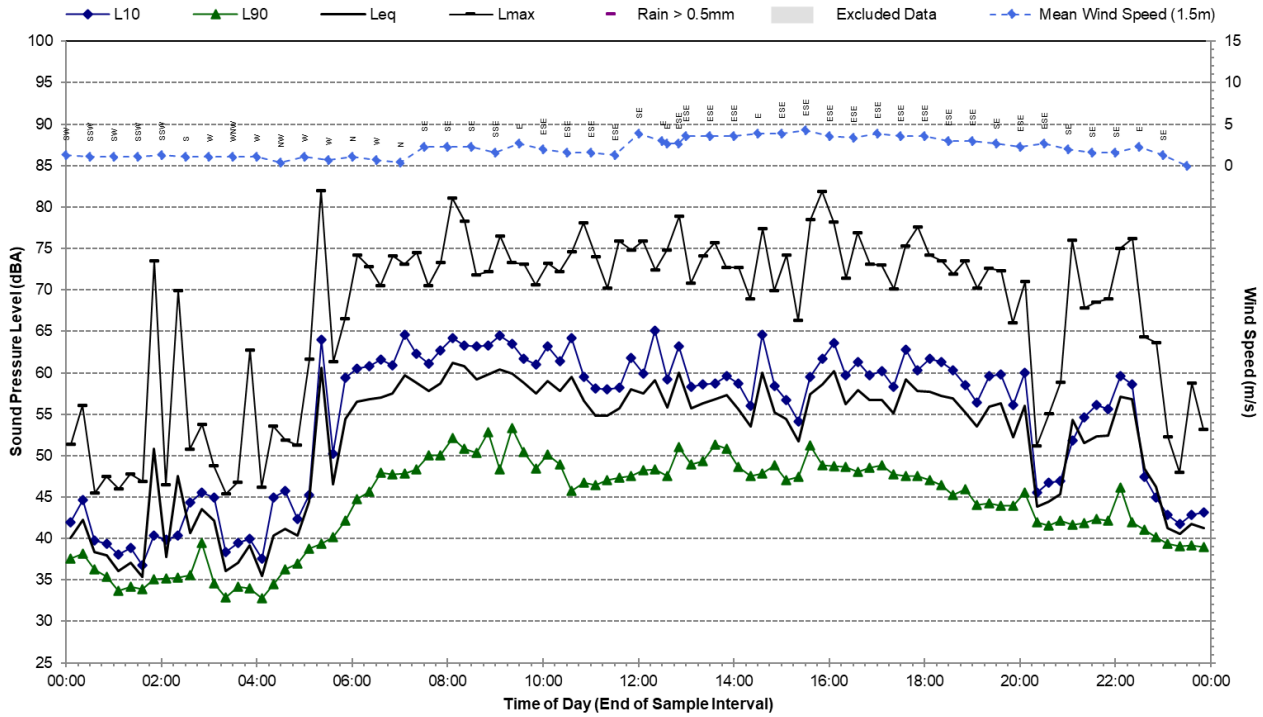
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Thursday, 6 March 2025



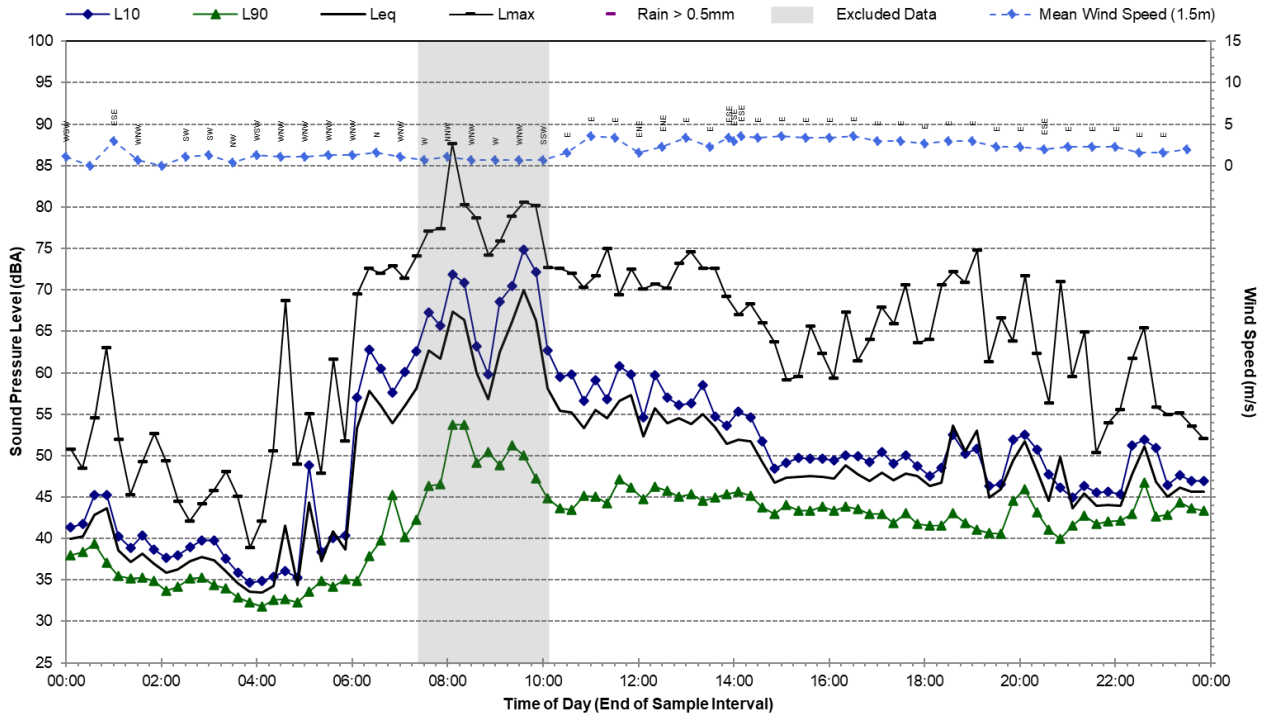
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Friday, 7 March 2025



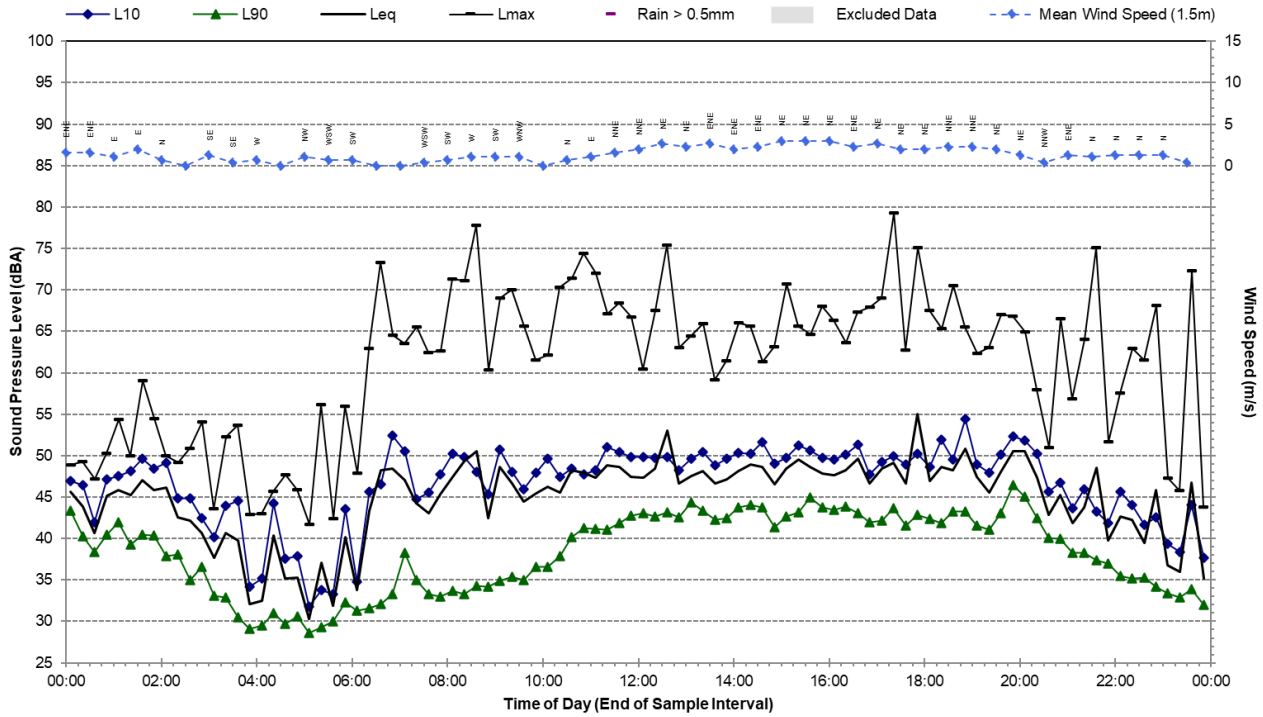
Statistical Ambient Noise Levels

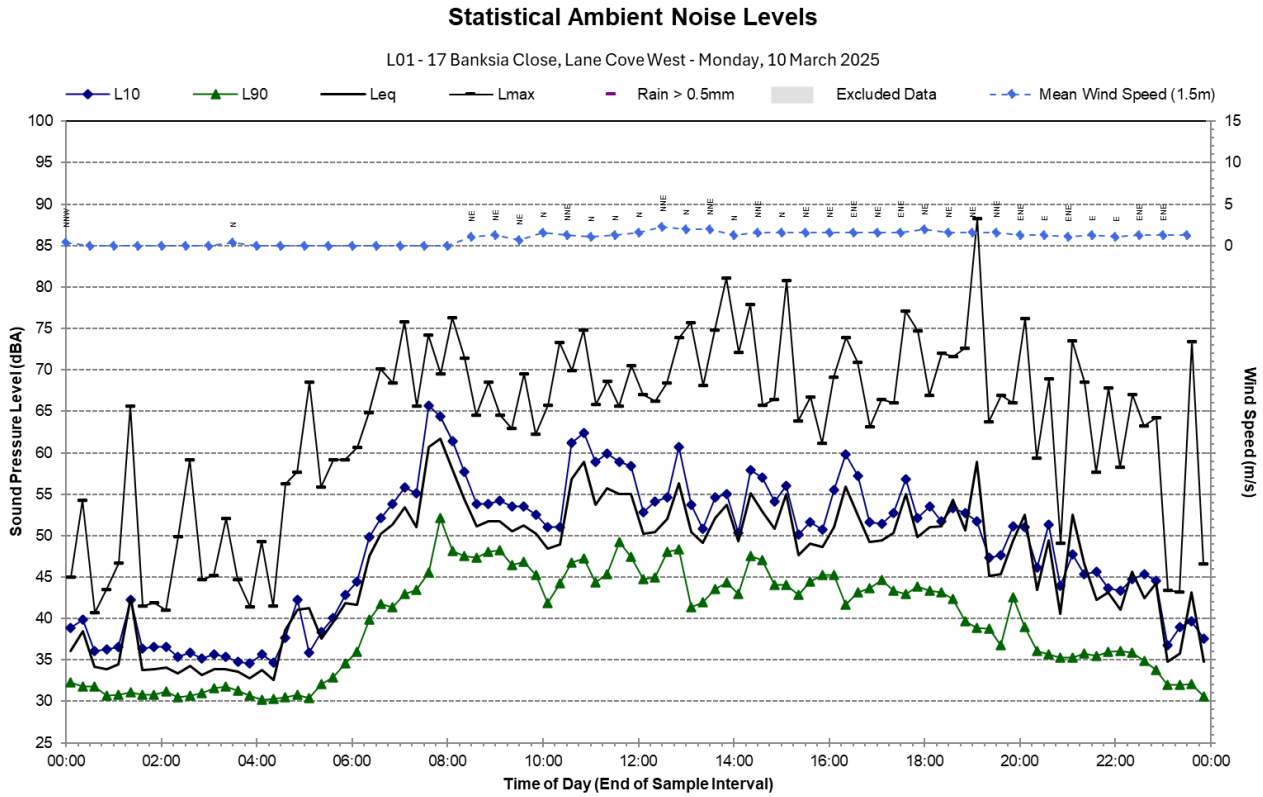
L01 - 17 Banksia Close, Lane Cove West - Saturday, 8 March 2025

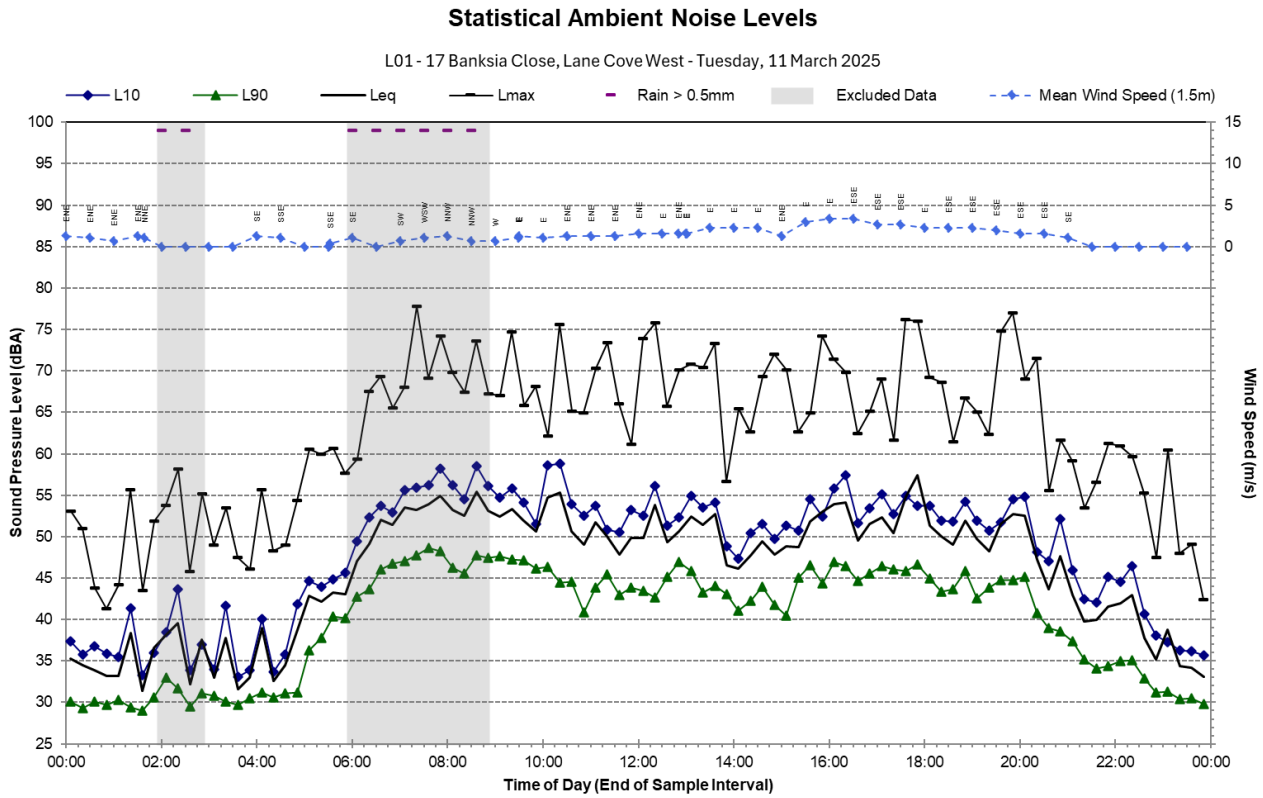


Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Sunday, 9 March 2025

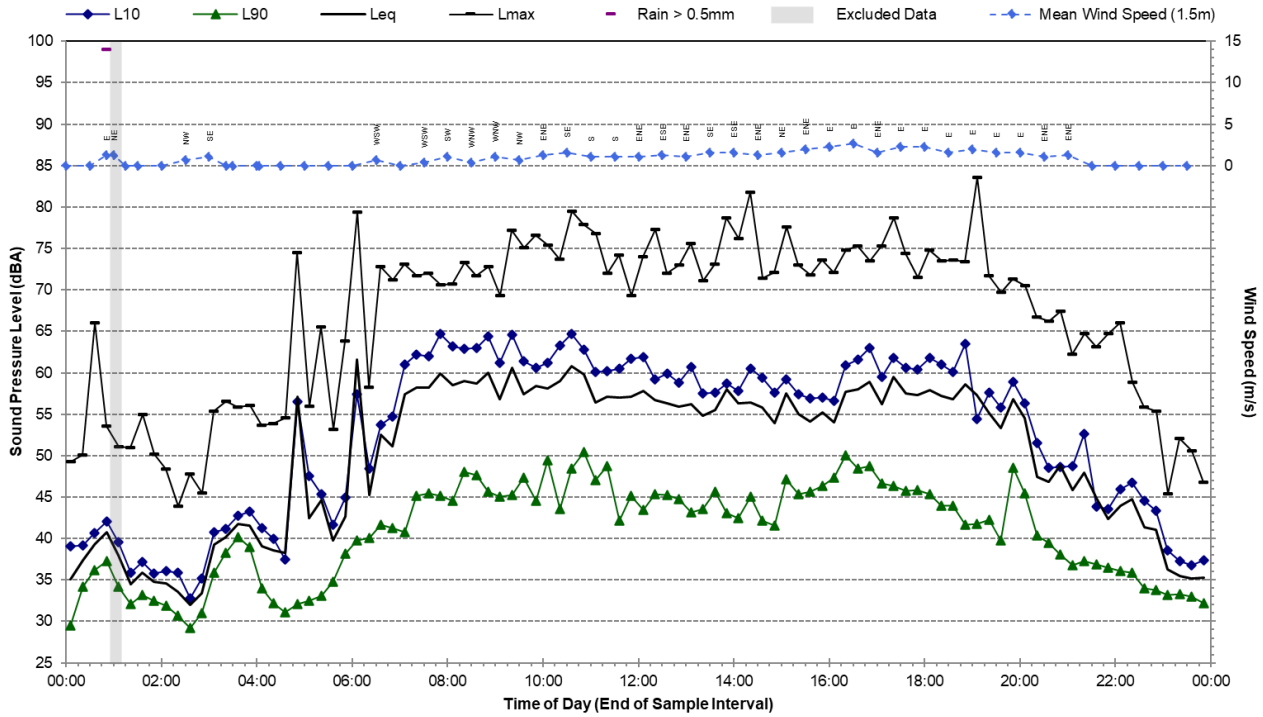



Statistical Ambient Noise Levels
L01 - 17 Banksia Close, Lane Cove West - Monday, 10 March 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 17 Banksia Close, Lane Cove West - Tuesday, 11 March 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

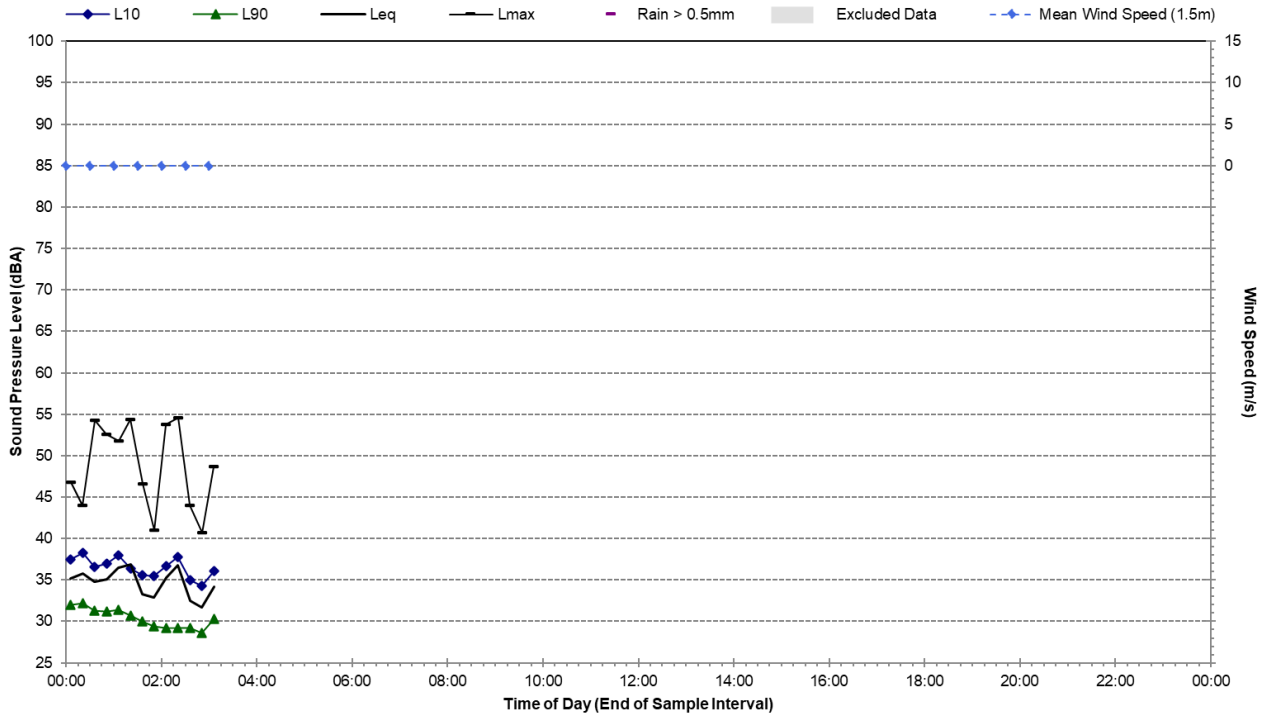
Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Wednesday, 12 March 2025



Statistical Ambient Noise Levels

L01 - 17 Banksia Close, Lane Cove West - Thursday, 13 March 2025



Noise Monitoring Location	L02
Noise Monitoring Address	**10 Banksia Close, Lane Cove West**

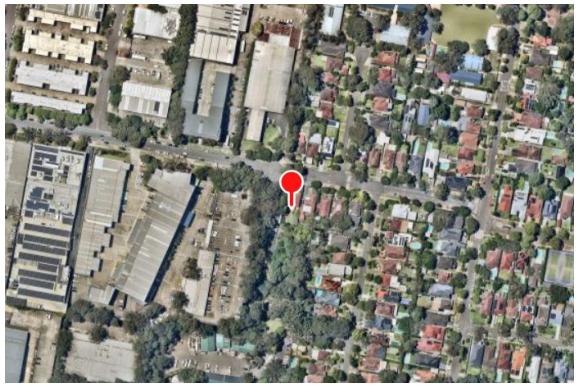
Logger Device Type: Svantek 977, Logger Serial No: 98465
Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3004636

Ambient noise logger deployed on the rear first floor balcony of 10 Banksia Close, Lane Cove West. Noise logger location is adjacent the Community Nursery, and looks towards the eastern boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise and distant road traffic noise from Epping Road, with some industrial noise. Birds, aircraft, and local traffic on Lloyd Rees Drive and Wood Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Insects: 44-50 dBA, Cicadas: up to 56 dBA (intermittent), Industrial fan noise: 44-45 dBA (intermittent), Distant traffic on Epping Road: audible, Cars on Lloyd Rees Drive and Wood Street: up to 50 dBA, Aircraft: 62-77 dBA, Birds: up to 73 dBA.

Map of Noise Monitoring Location



Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	43	55	52	58
Evening	40	54	54	61
Night-time	31	49	40	46

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	54	55
Night-time (10pm-7am)	48	52

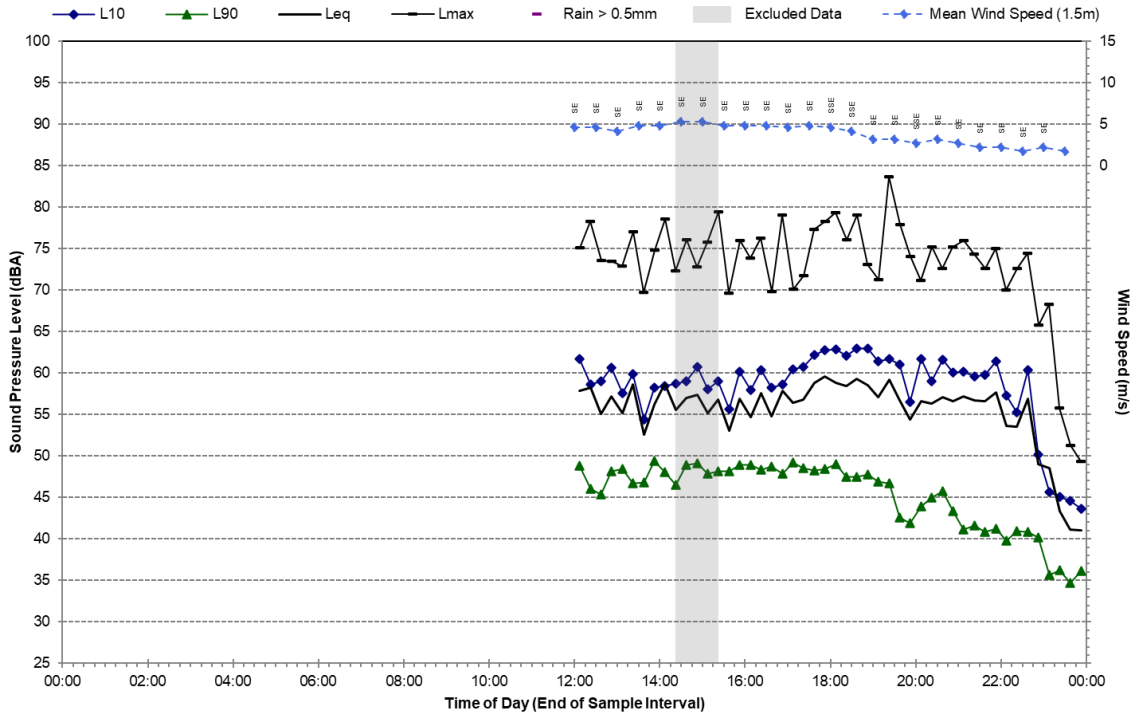
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
24/11/2025	11:56	47	58	77

Photo of Noise Monitoring Location

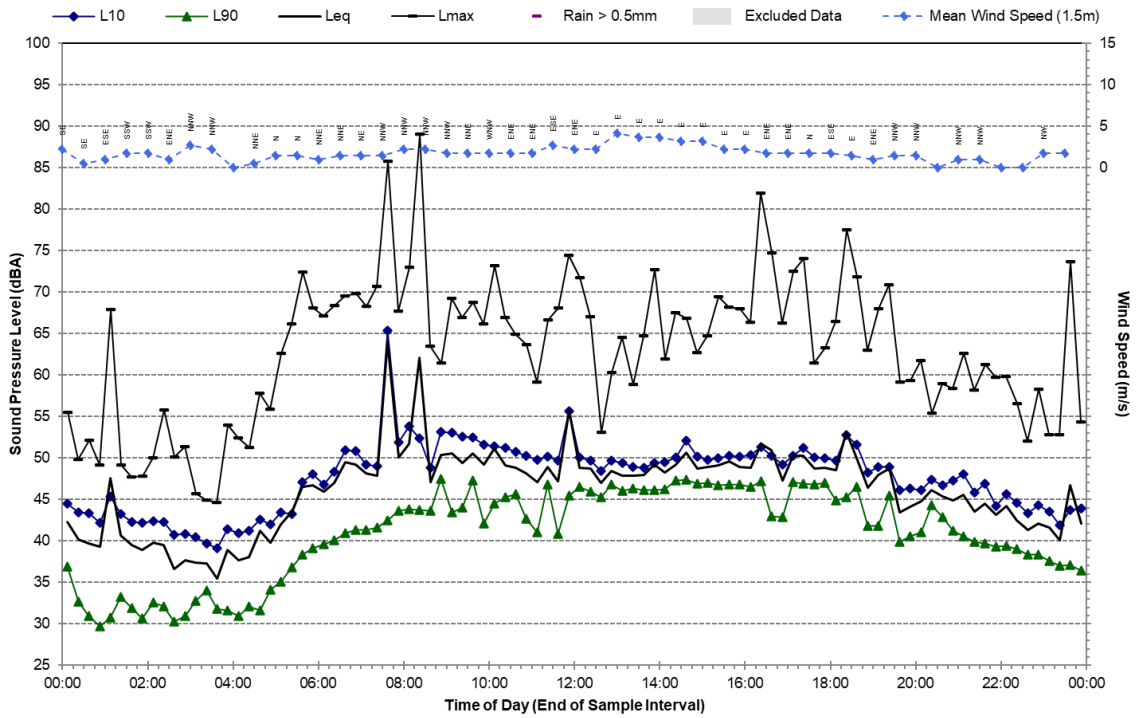
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Monday, 24 November 2025



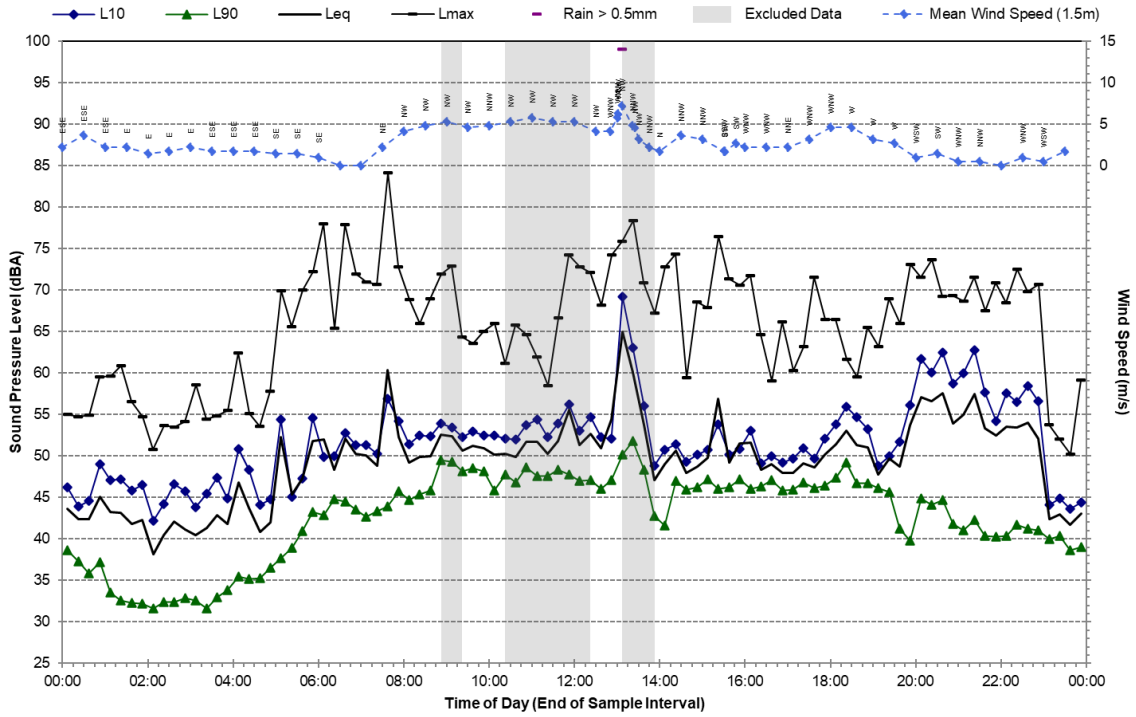
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Tuesday, 25 November 2025



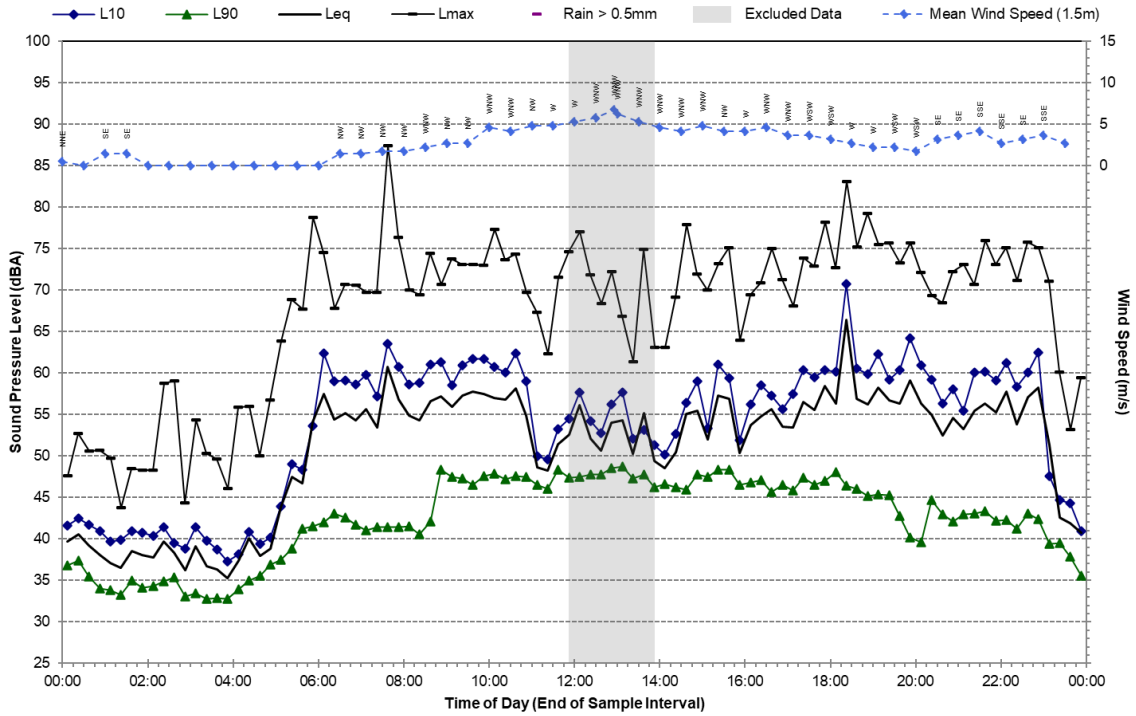
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Wednesday, 26 November 2025



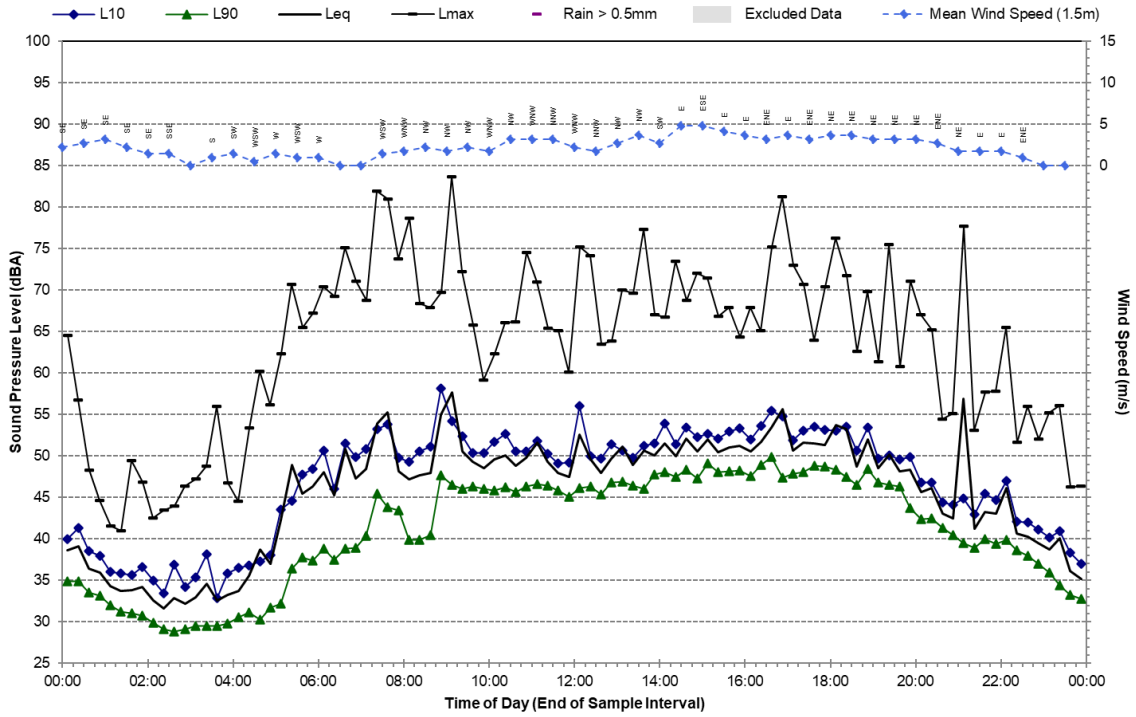
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Thursday, 27 November 2025



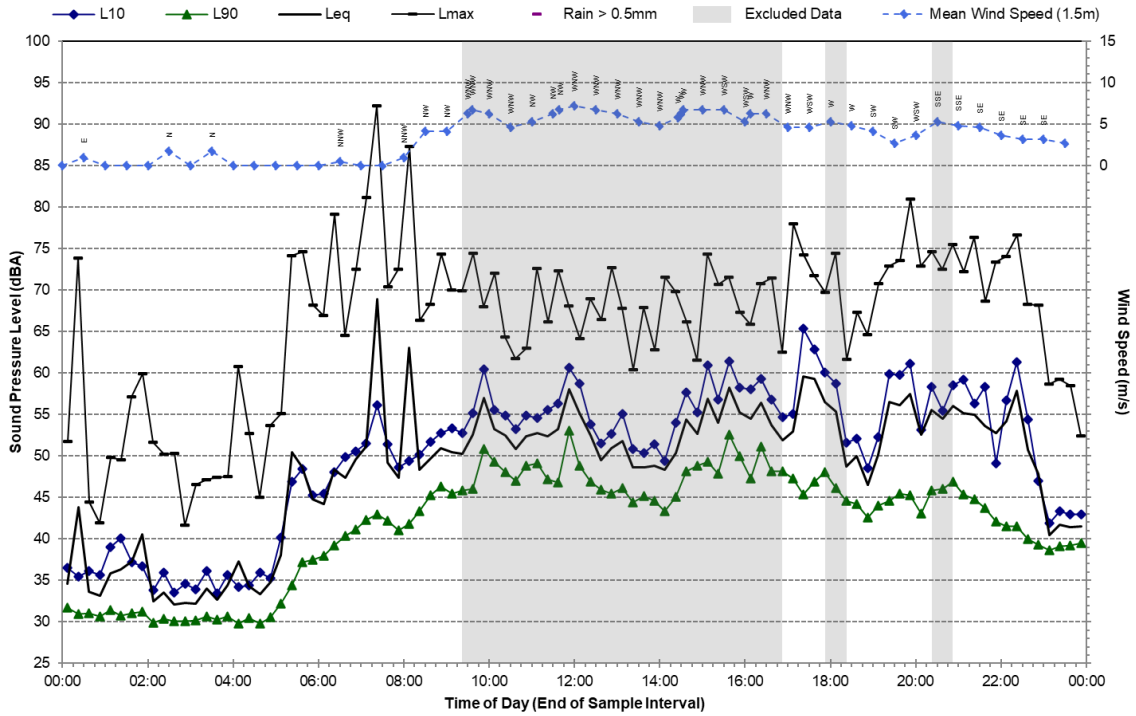
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Friday, 28 November 2025



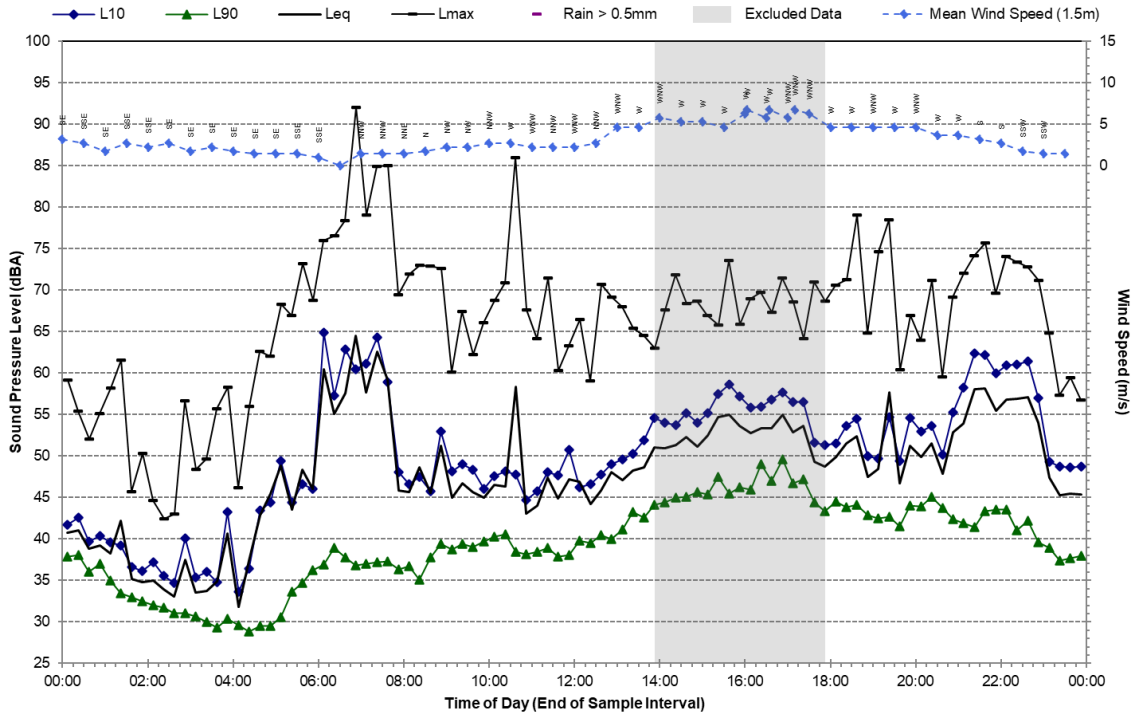
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Saturday, 29 November 2025



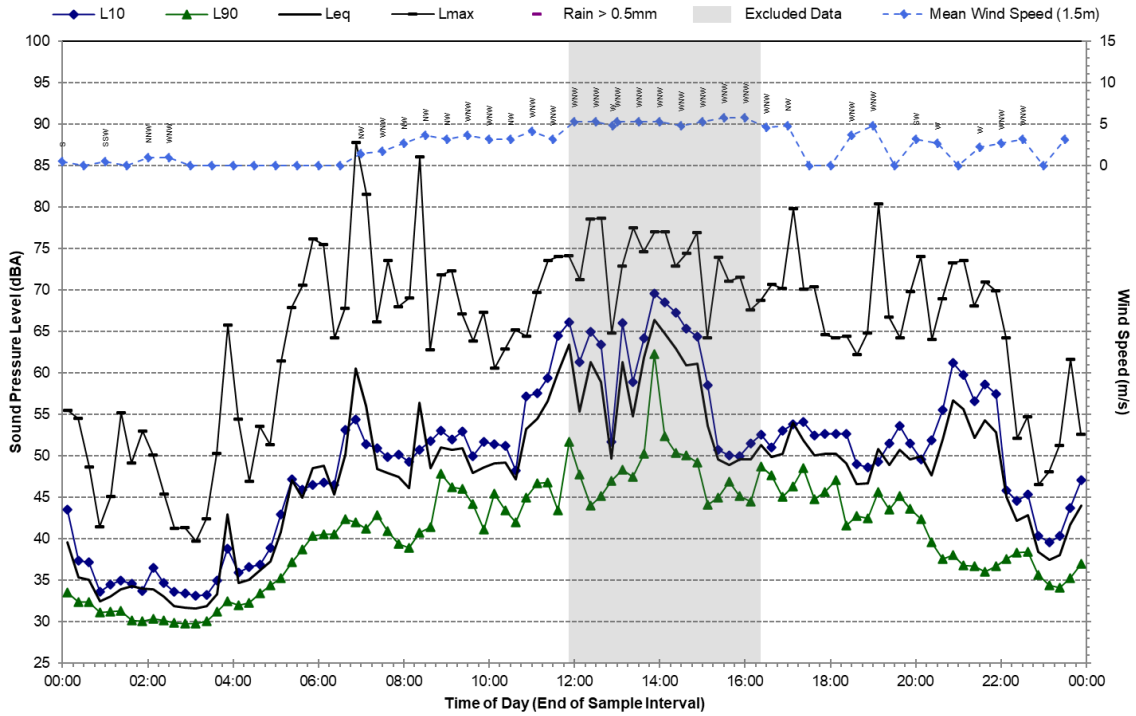
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Sunday, 30 November 2025



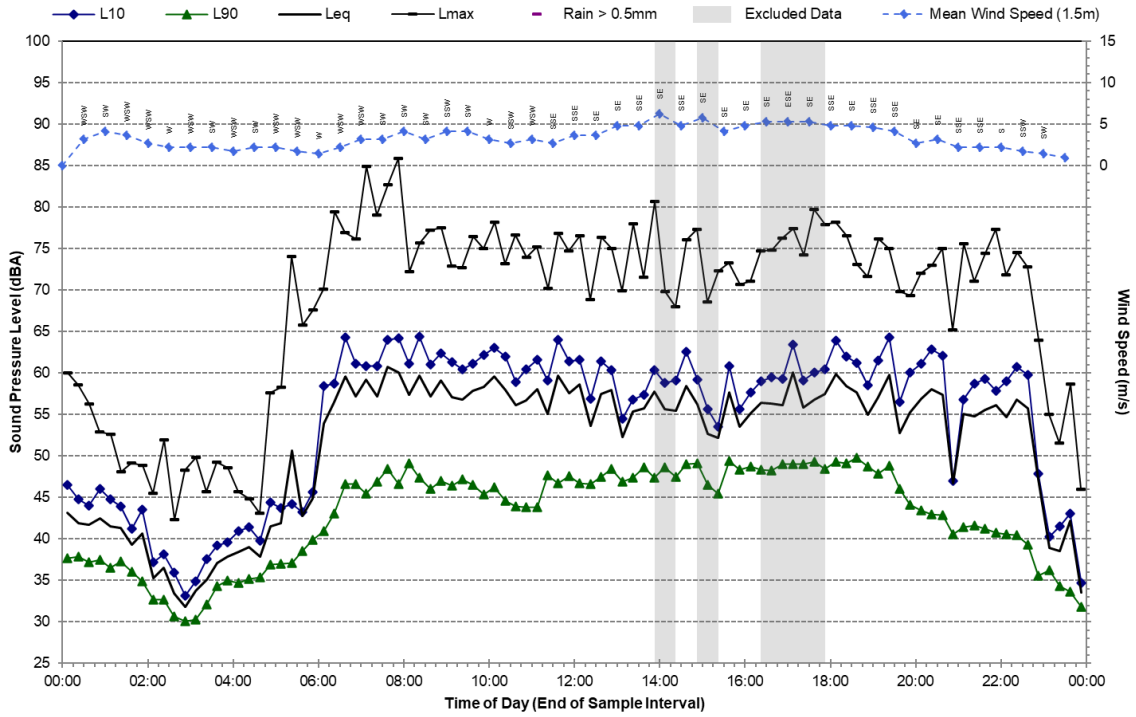
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Monday, 1 December 2025



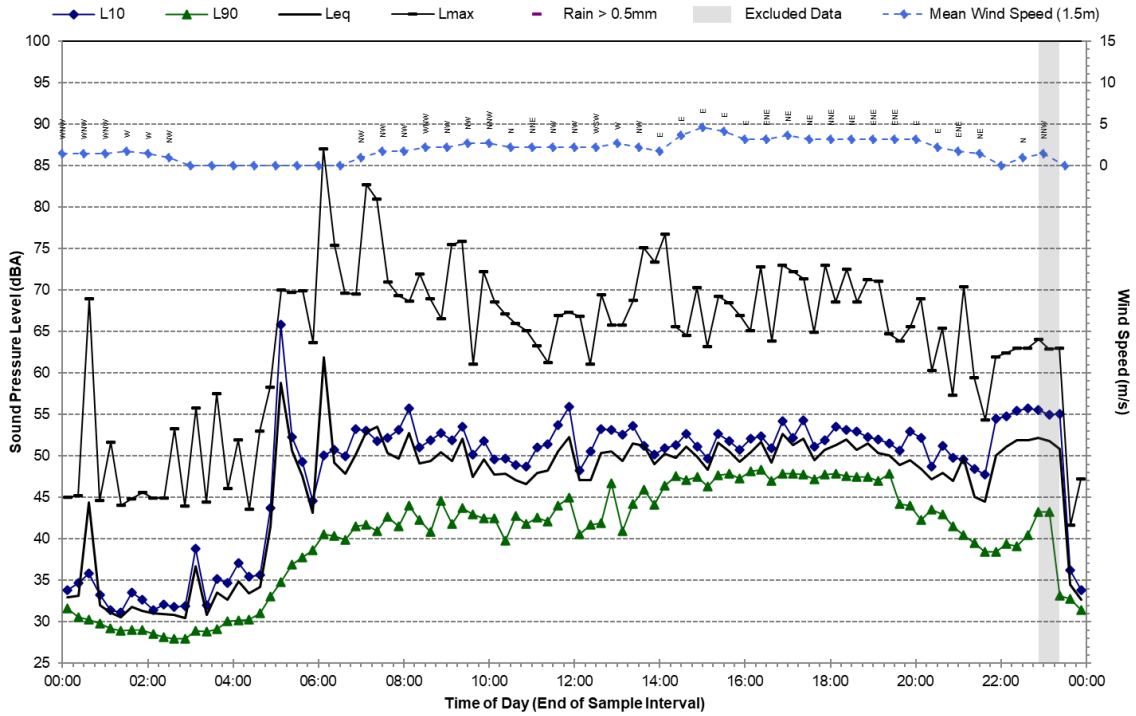
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Tuesday, 2 December 2025



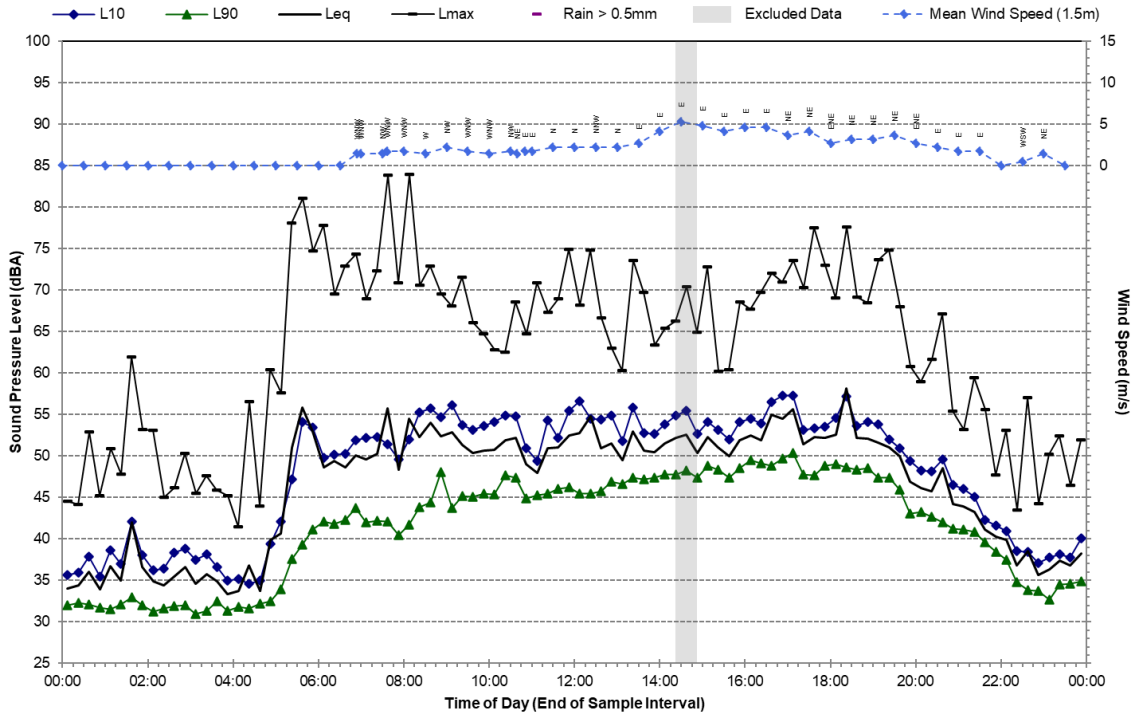
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Wednesday, 3 December 2025



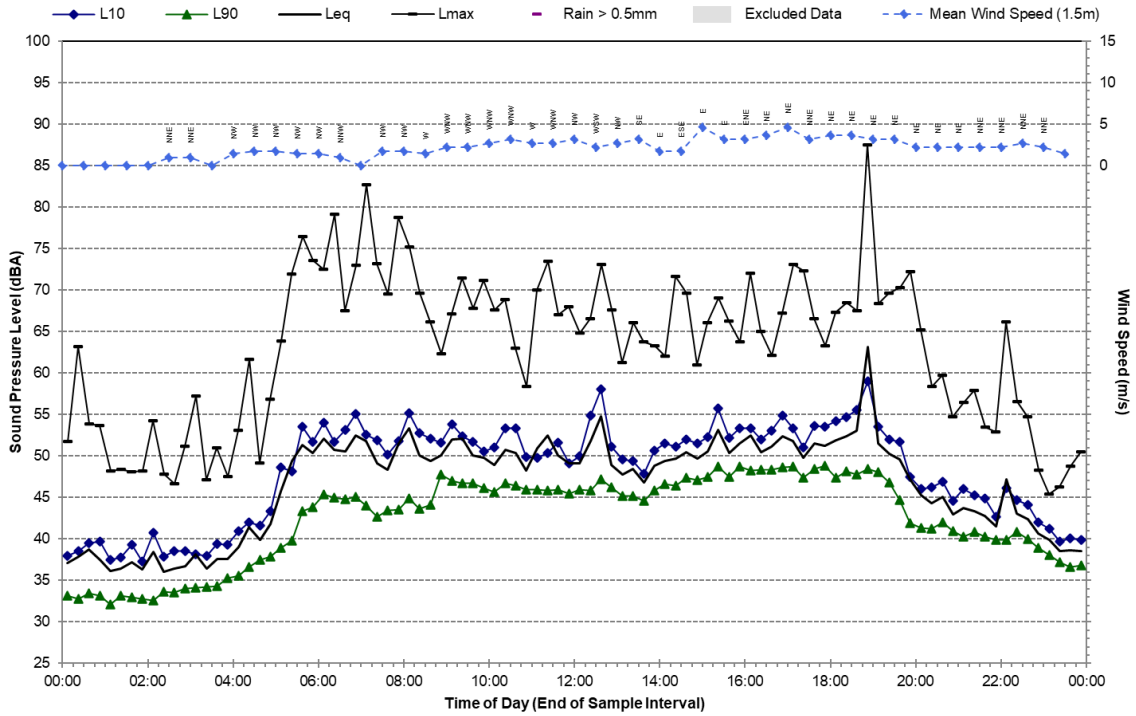
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Thursday, 4 December 2025



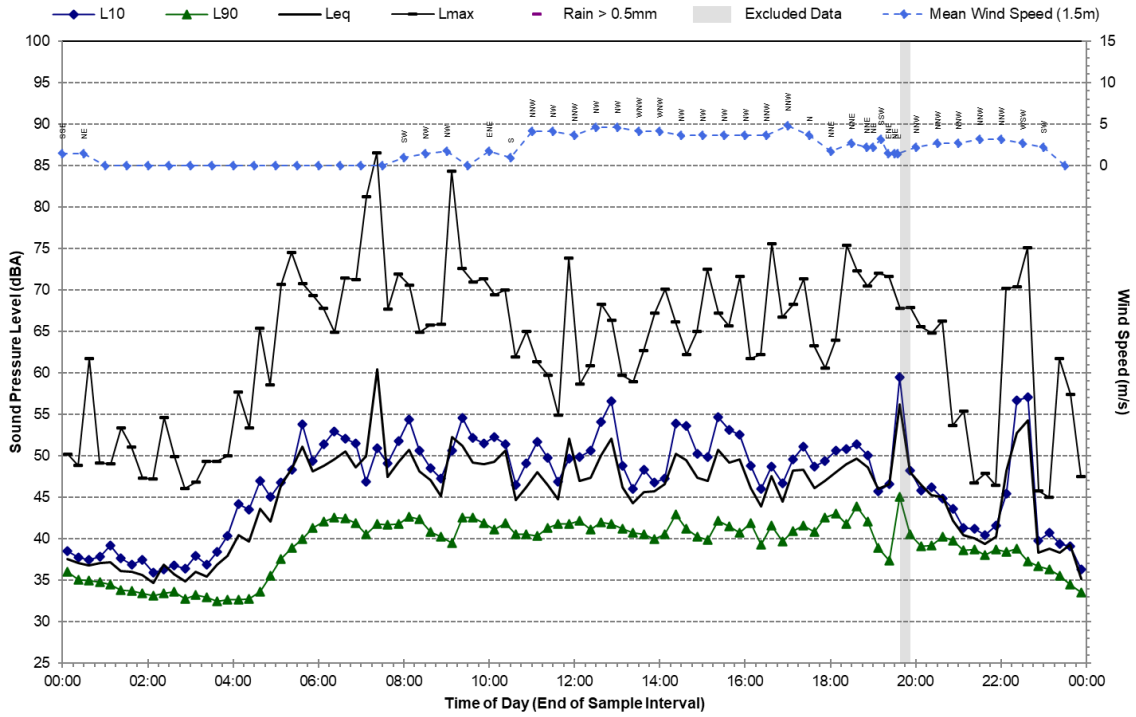
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Friday, 5 December 2025



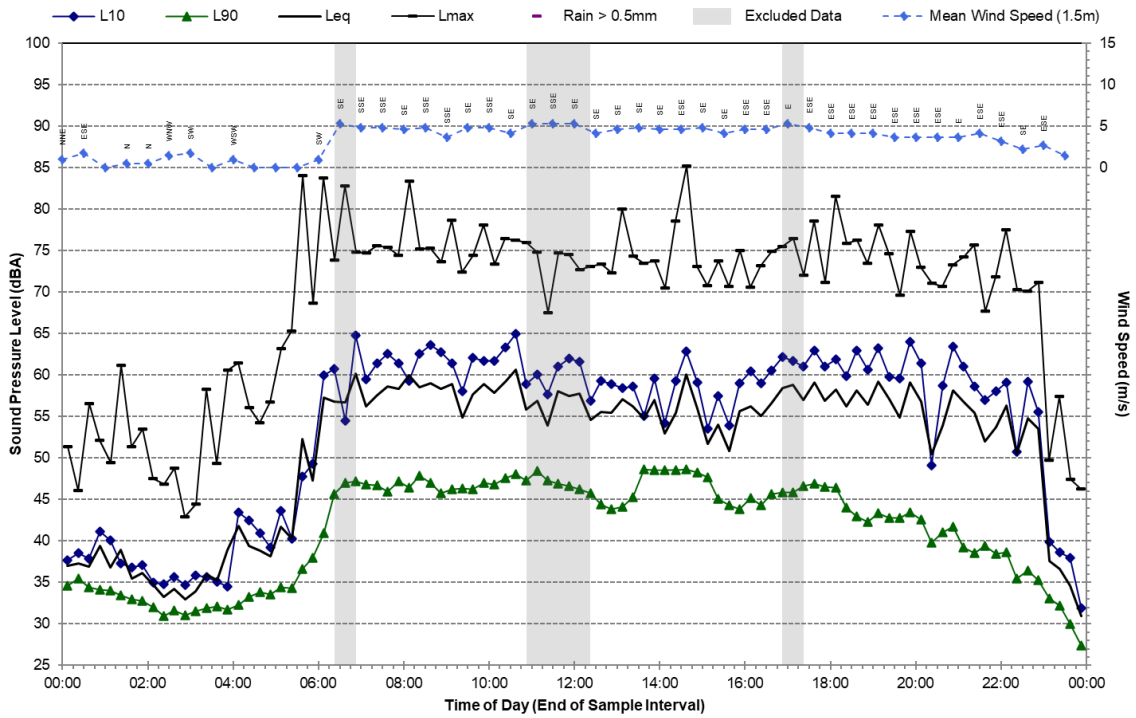
Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Saturday, 6 December 2025

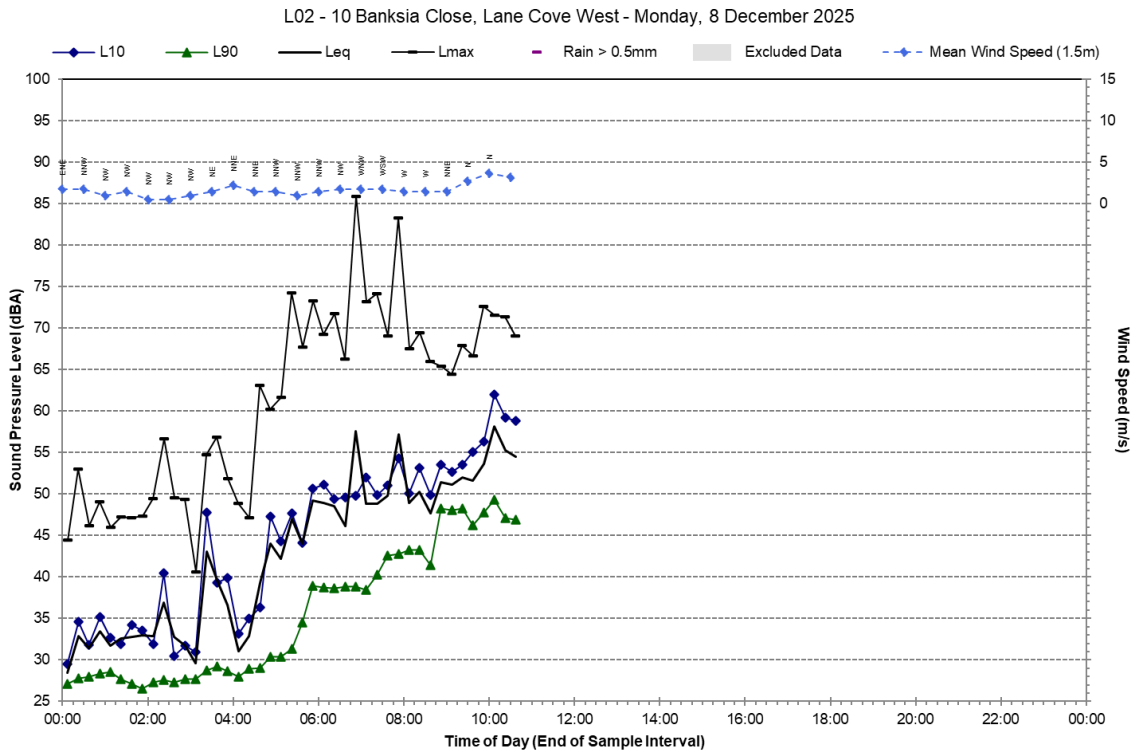


Statistical Ambient Noise Levels

L02 - 10 Banksia Close, Lane Cove West - Sunday, 7 December 2025



Statistical Ambient Noise Levels



Noise Monitoring Location	L03
Noise Monitoring Address	**50 Wood Street, Lane Cove West**

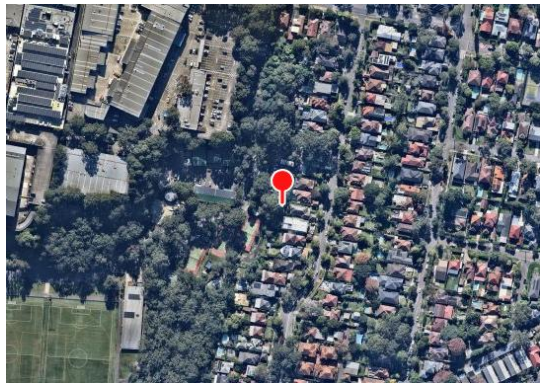
Logger Device Type: Svantek 957, Logger Serial No: 23241
Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3029485

Ambient noise logger deployed in the rear yard of 50 Wood Street, Lane Cove West. Noise logger location is adjacent to the Blackman Park tennis court carpark, and looks towards the Council depot and the southeastern boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by distant road traffic noise from Epping Road. Birds, activity in Blackman Park (tennis), and local traffic on Lloyd Rees Drive also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 42-46 dBA, Cars on Lloyd Rees Drive: up to 60 dBA, Activity in Blackman Park tennis): 46-52 dBA, Birds: up to 72 dBA.

Map of Noise Monitoring Location



Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	40	55	58	65
Evening	38	53	50	58
Night-time	30	47	36	44

Ambient Noise Logging Results – RNP Defined Time Periods

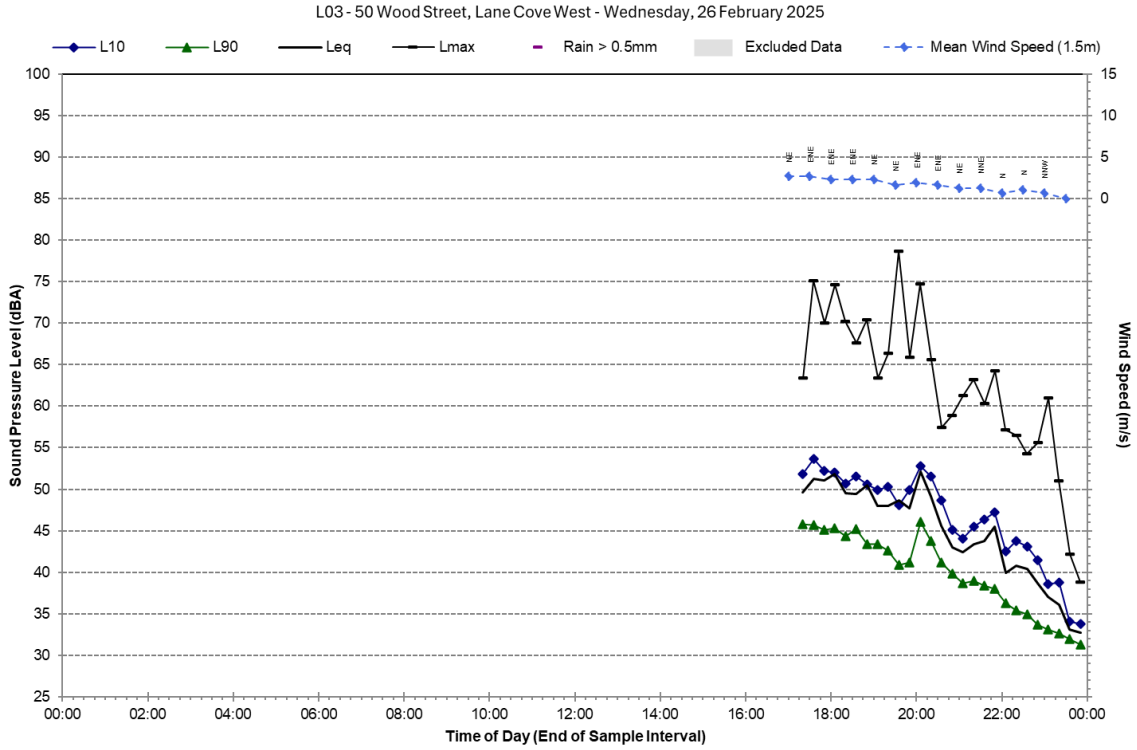
Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	54	57
Night-time (10pm-7am)	46	50

Attended Noise Measurement Results

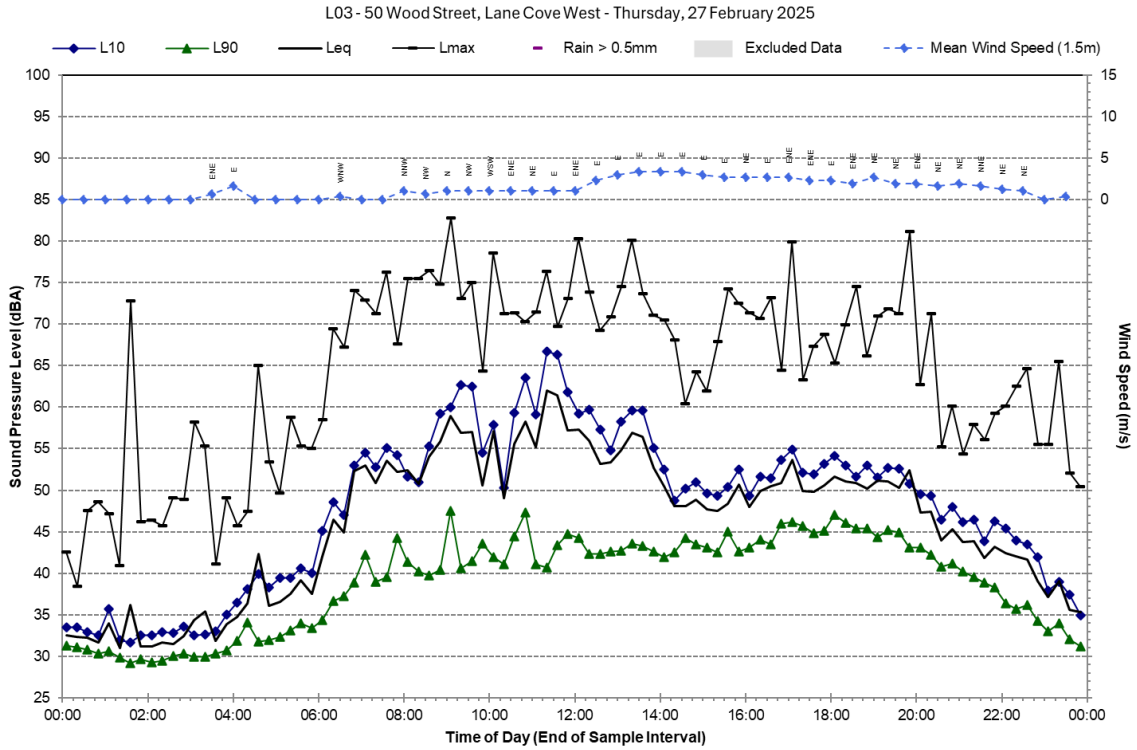
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
26/02/2025	16:38	45	51	72

Photo of Noise Monitoring Location

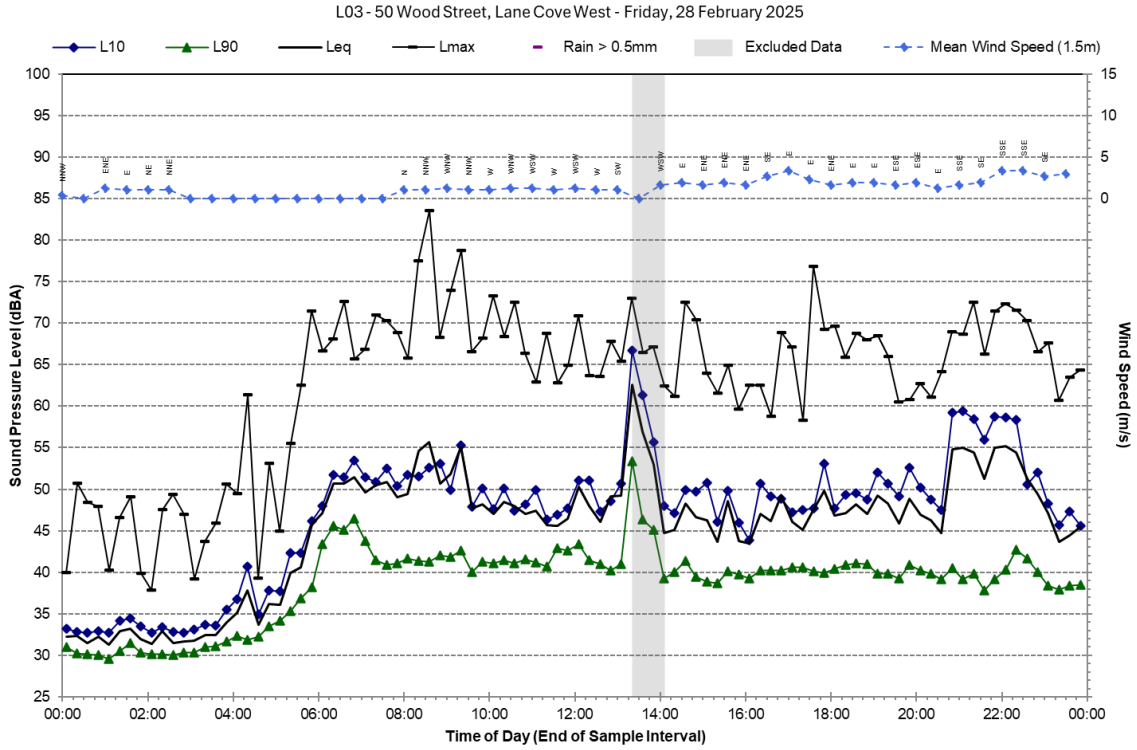
Statistical Ambient Noise Levels



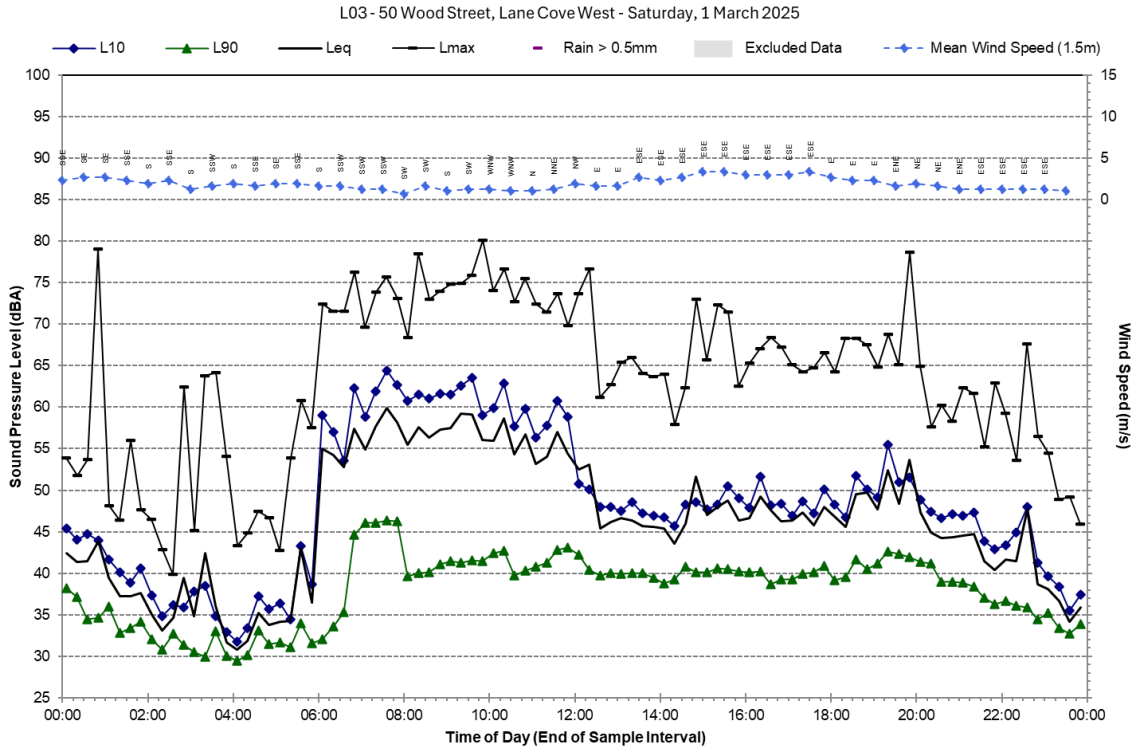
Statistical Ambient Noise Levels



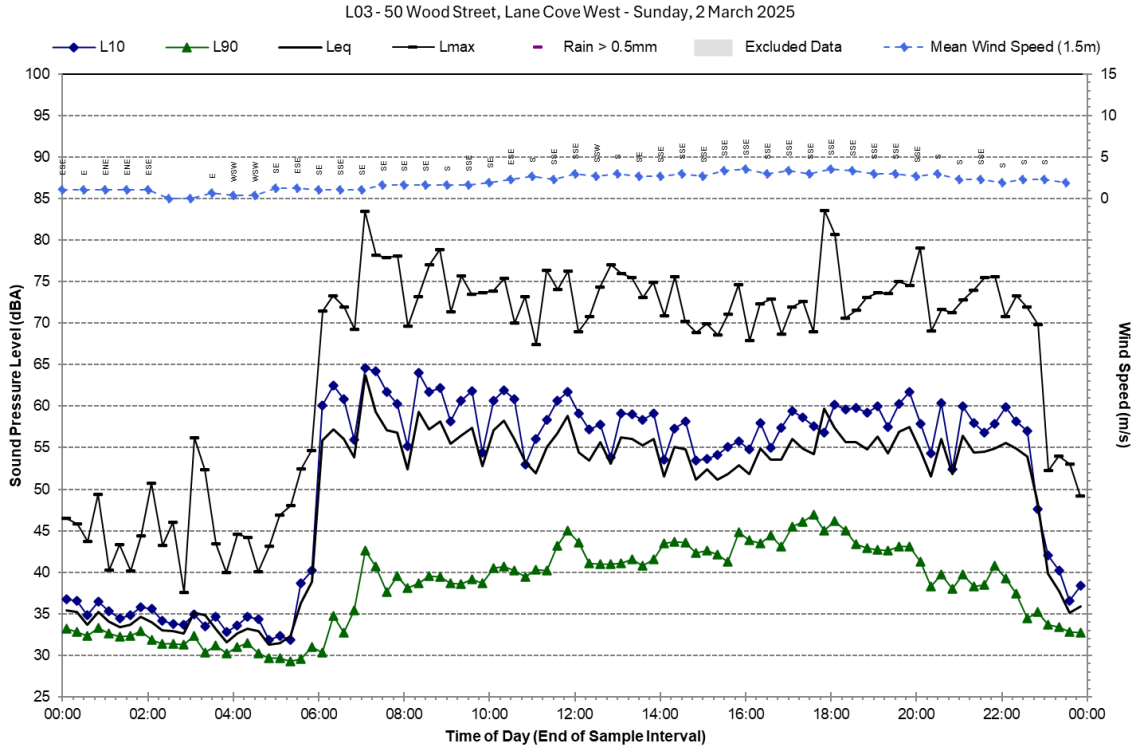
Statistical Ambient Noise Levels



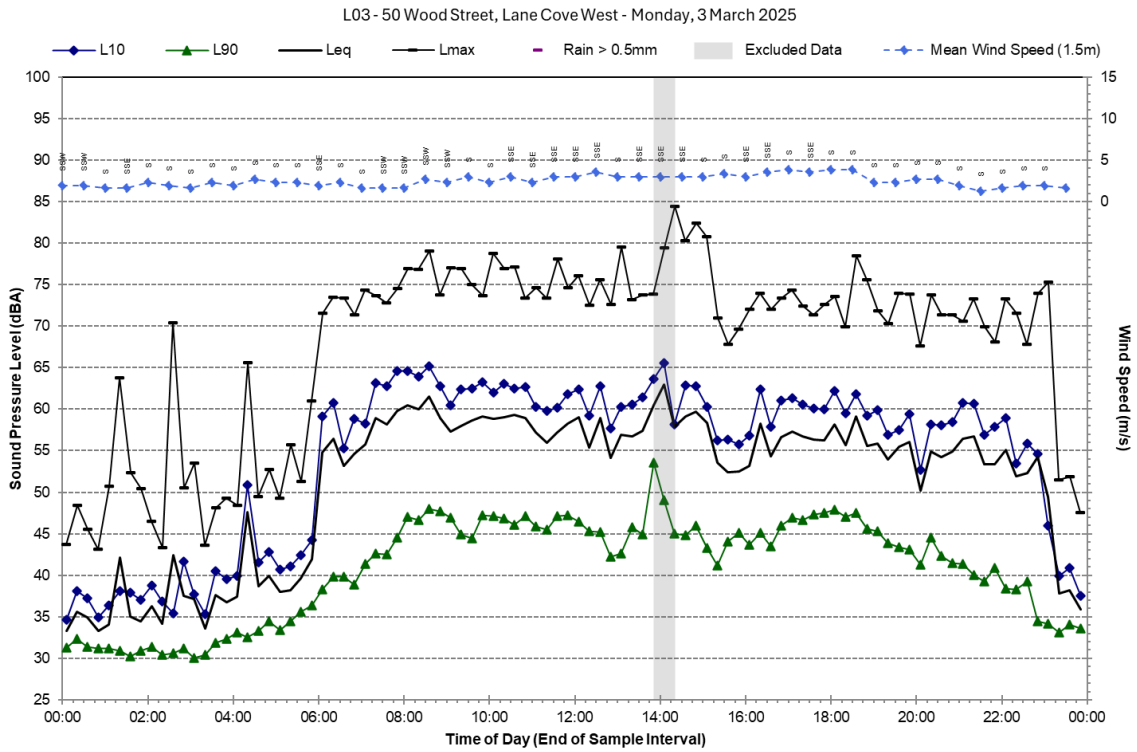
Statistical Ambient Noise Levels



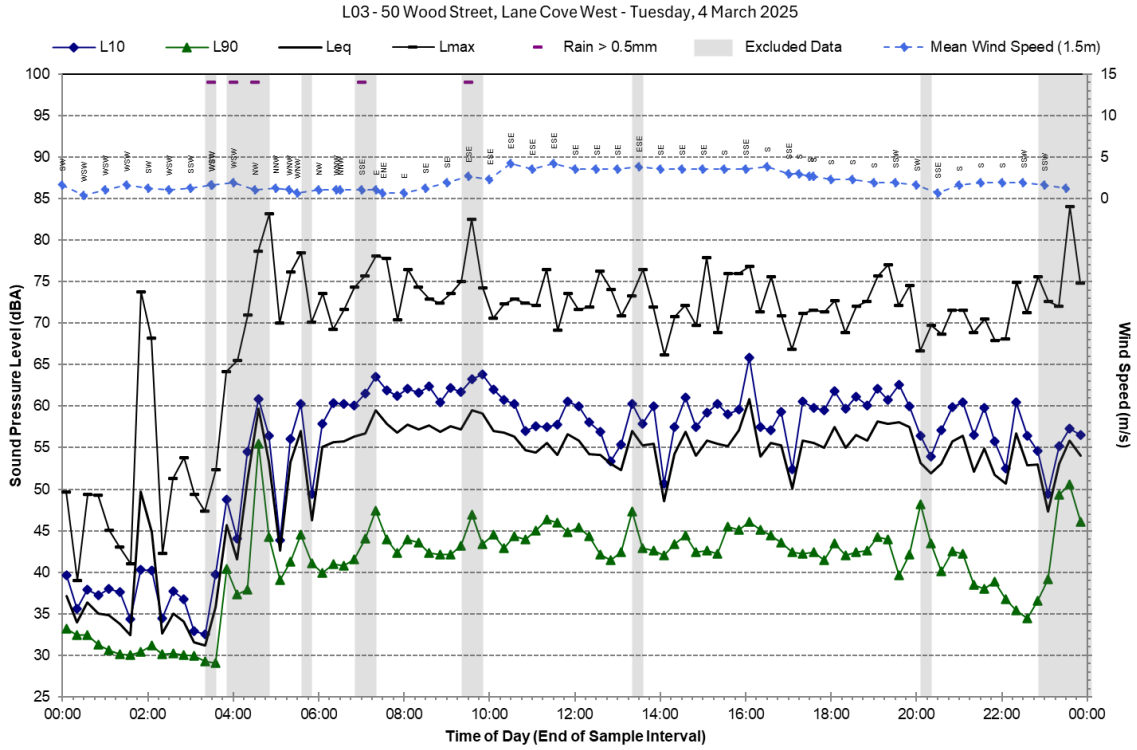
Statistical Ambient Noise Levels



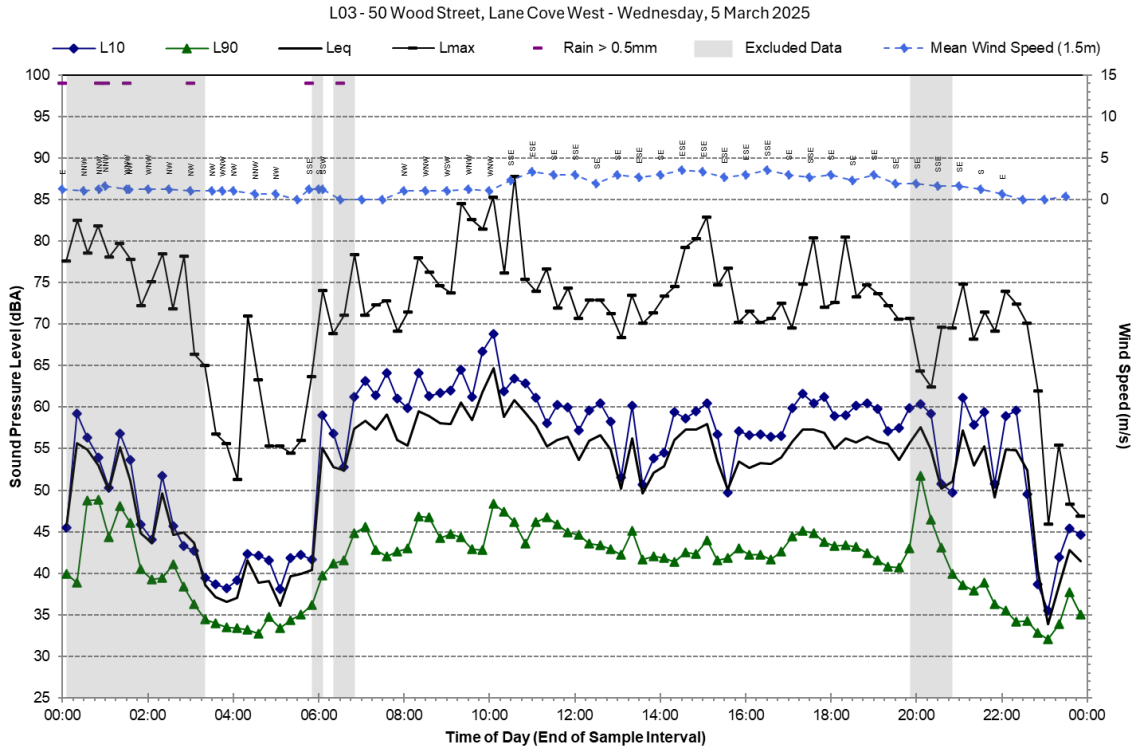
Statistical Ambient Noise Levels



Statistical Ambient Noise Levels

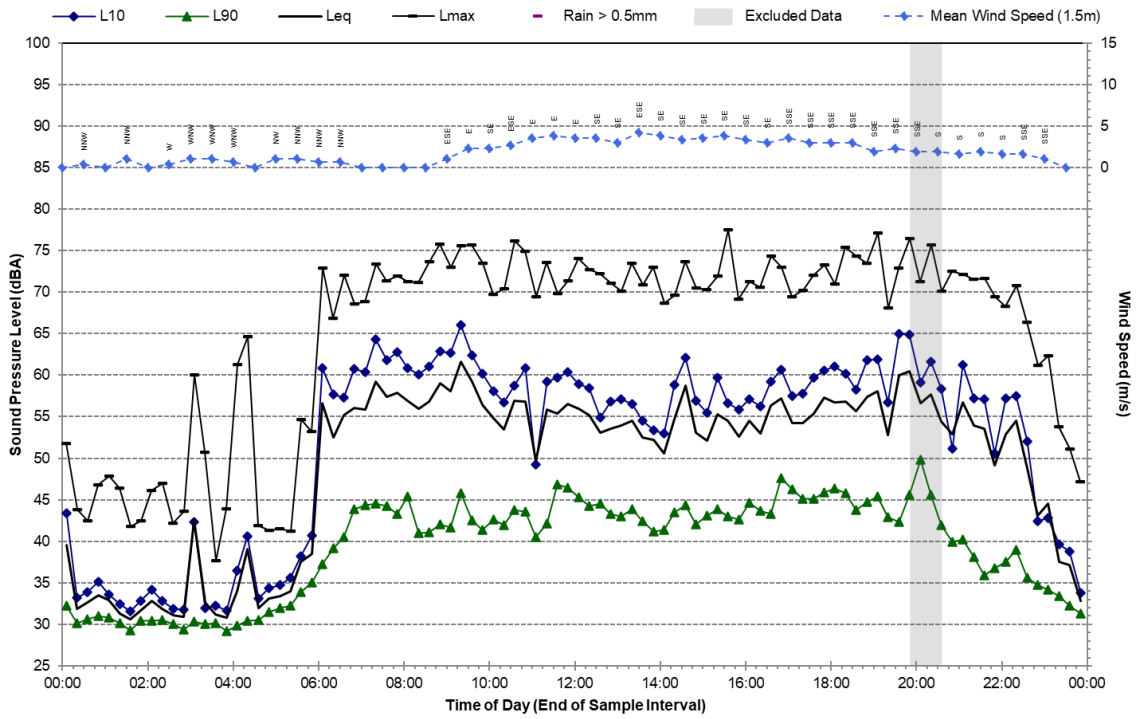


Statistical Ambient Noise Levels



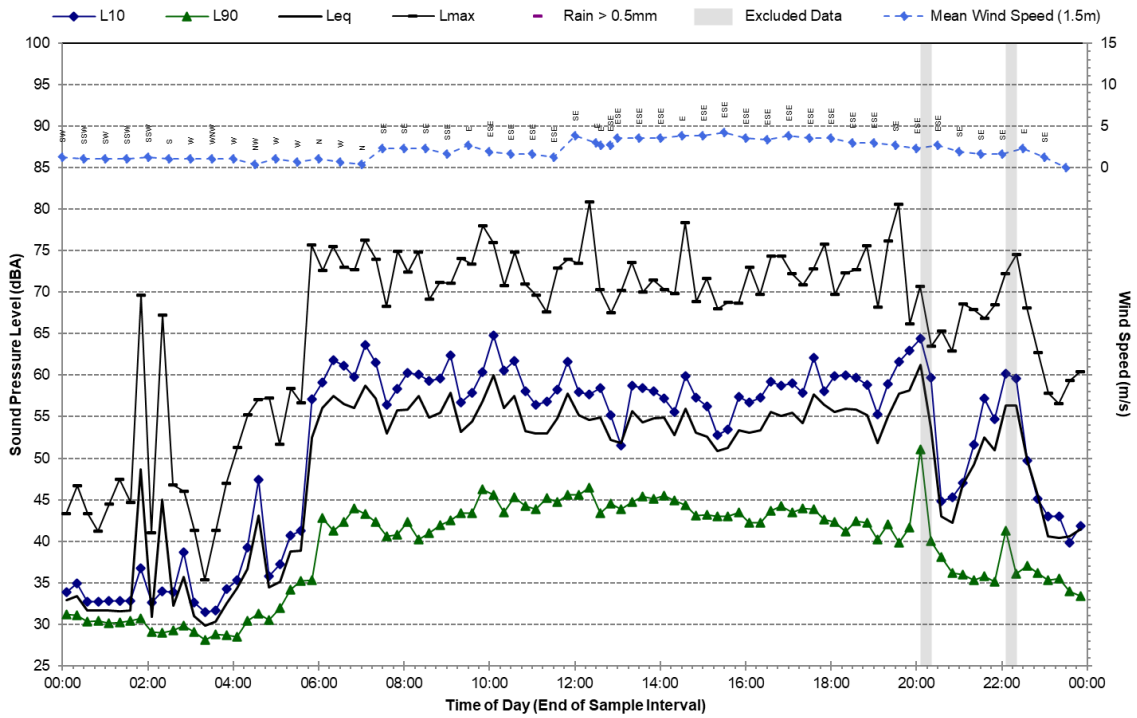
Statistical Ambient Noise Levels

L03 - 50 Wood Street, Lane Cove West - Thursday, 6 March 2025

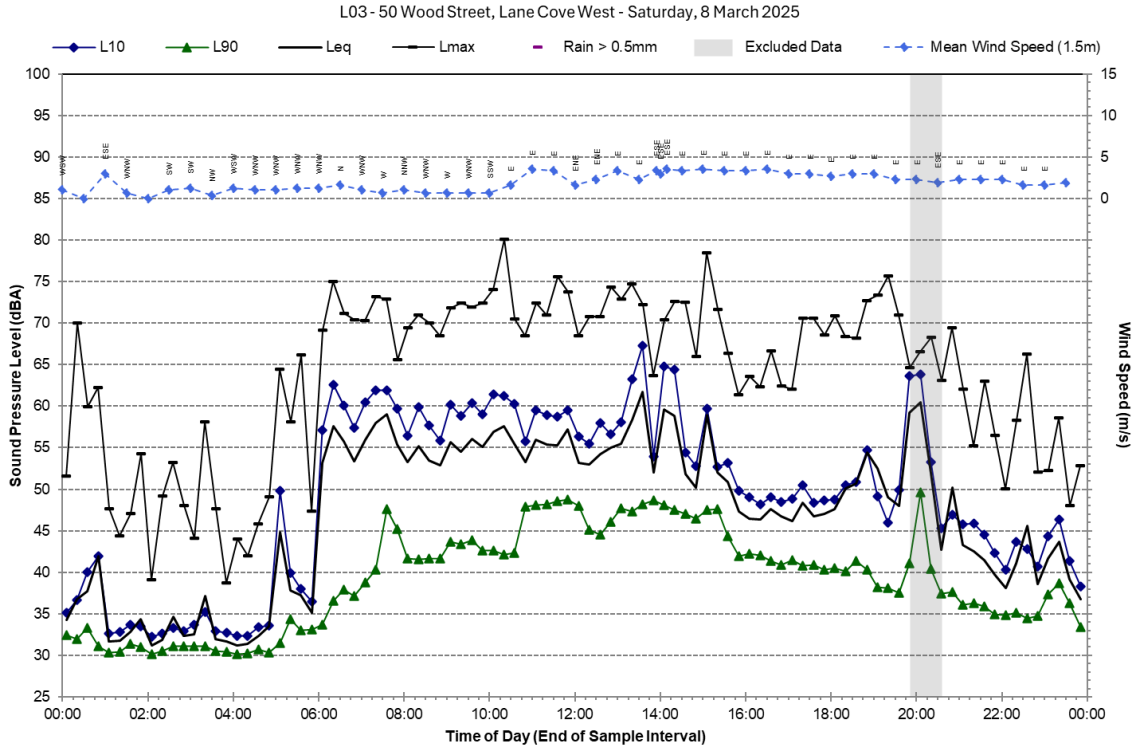


Statistical Ambient Noise Levels

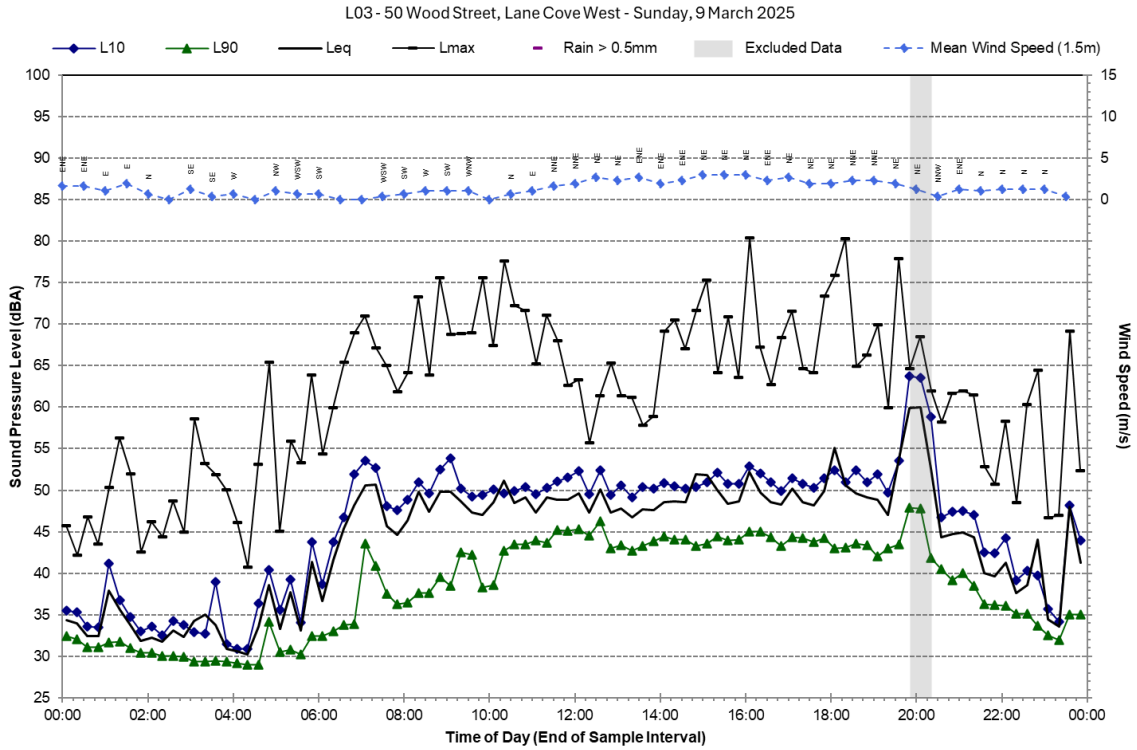
L03 - 50 Wood Street, Lane Cove West - Friday, 7 March 2025



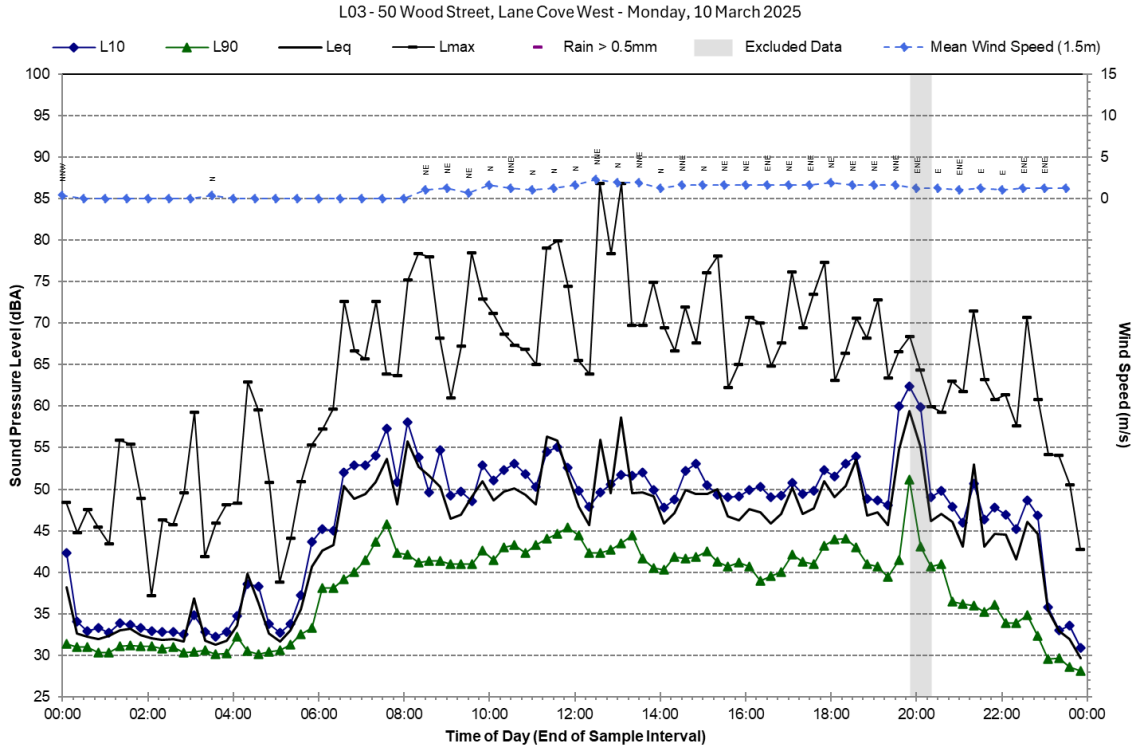
Statistical Ambient Noise Levels



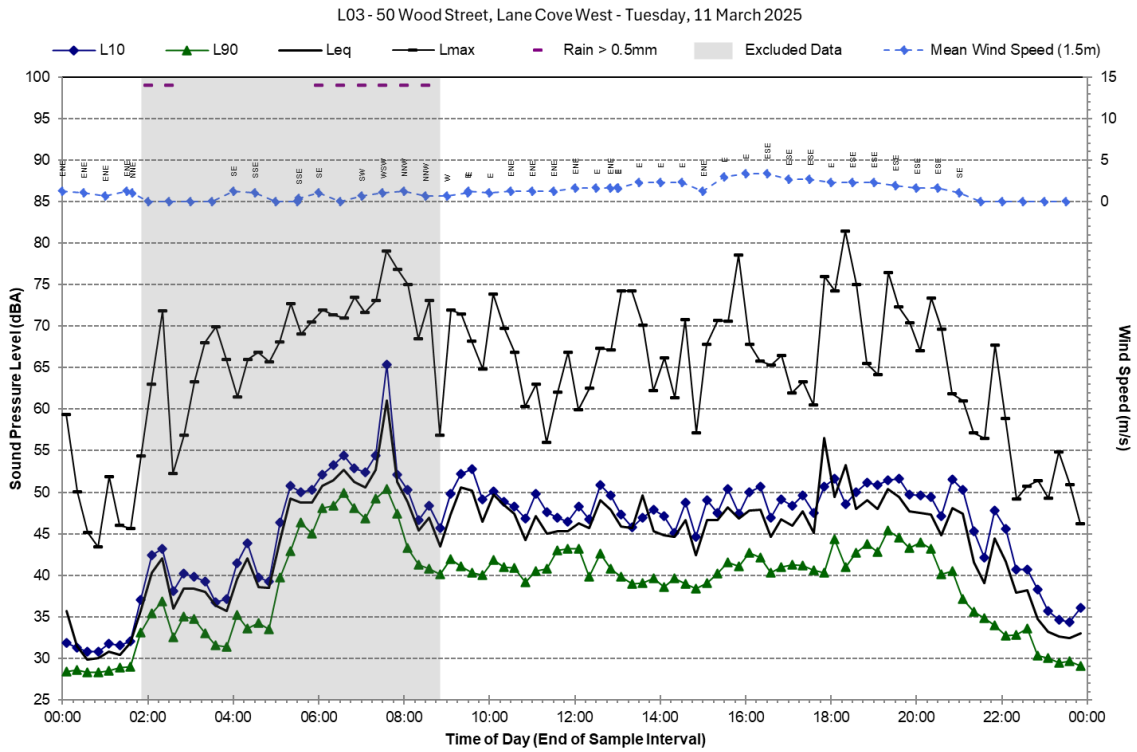
Statistical Ambient Noise Levels



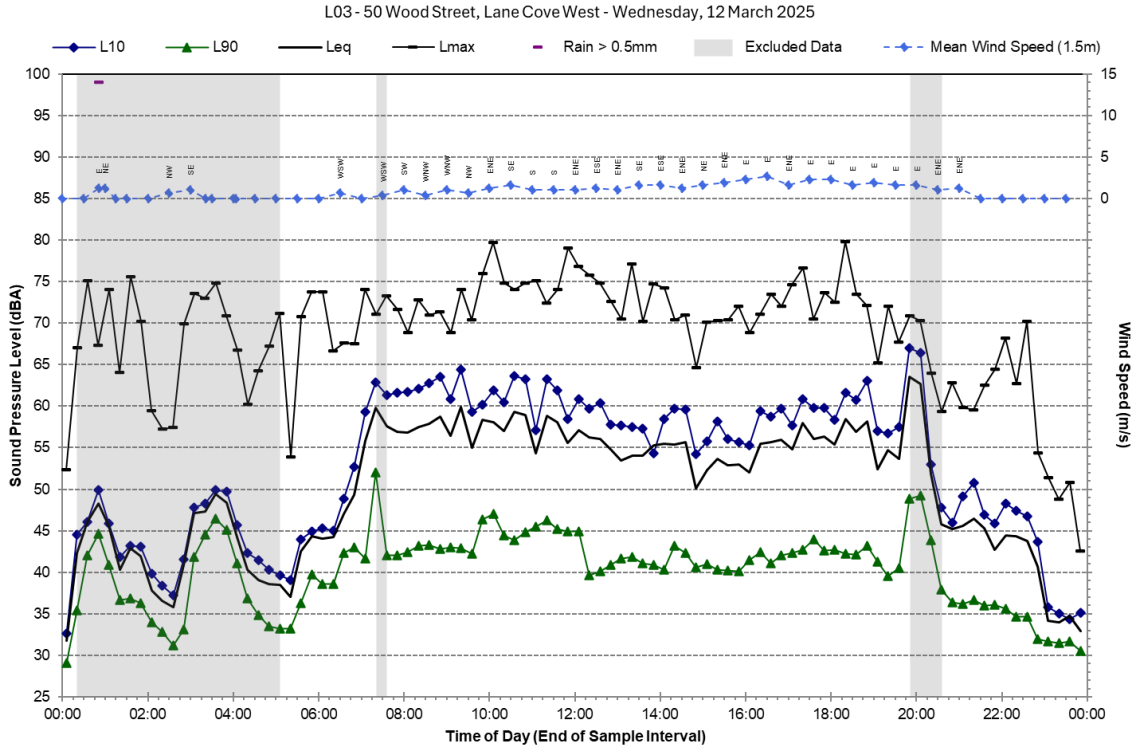
Statistical Ambient Noise Levels



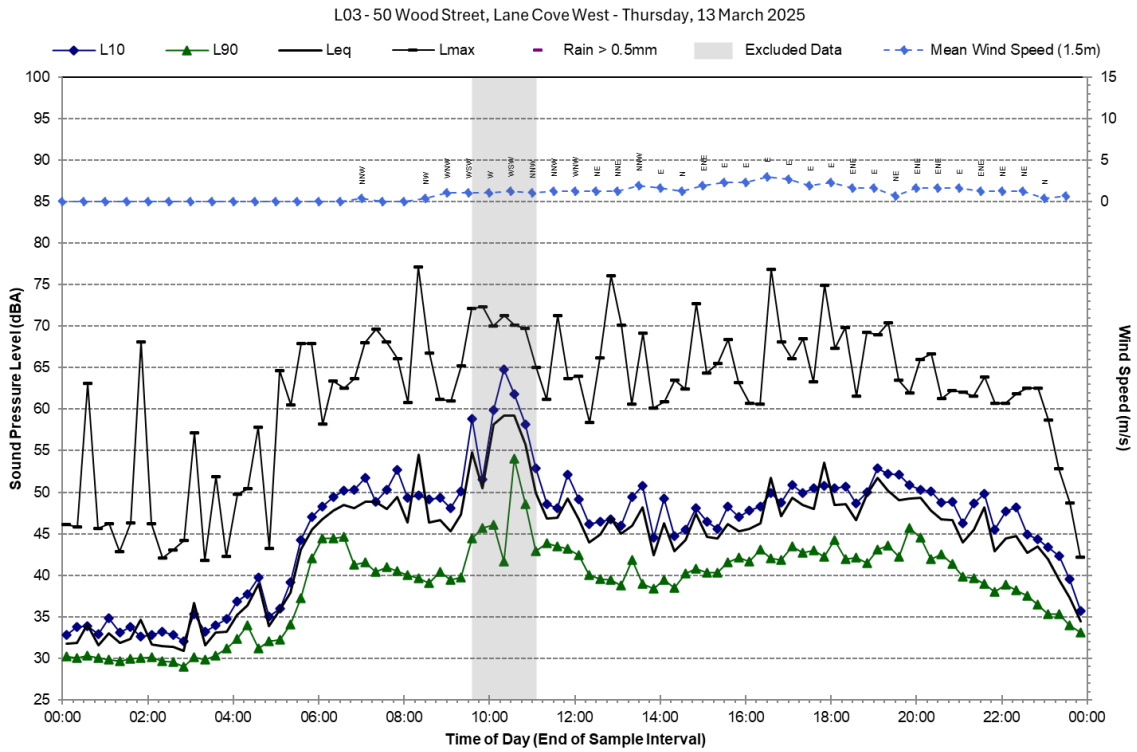
Statistical Ambient Noise Levels



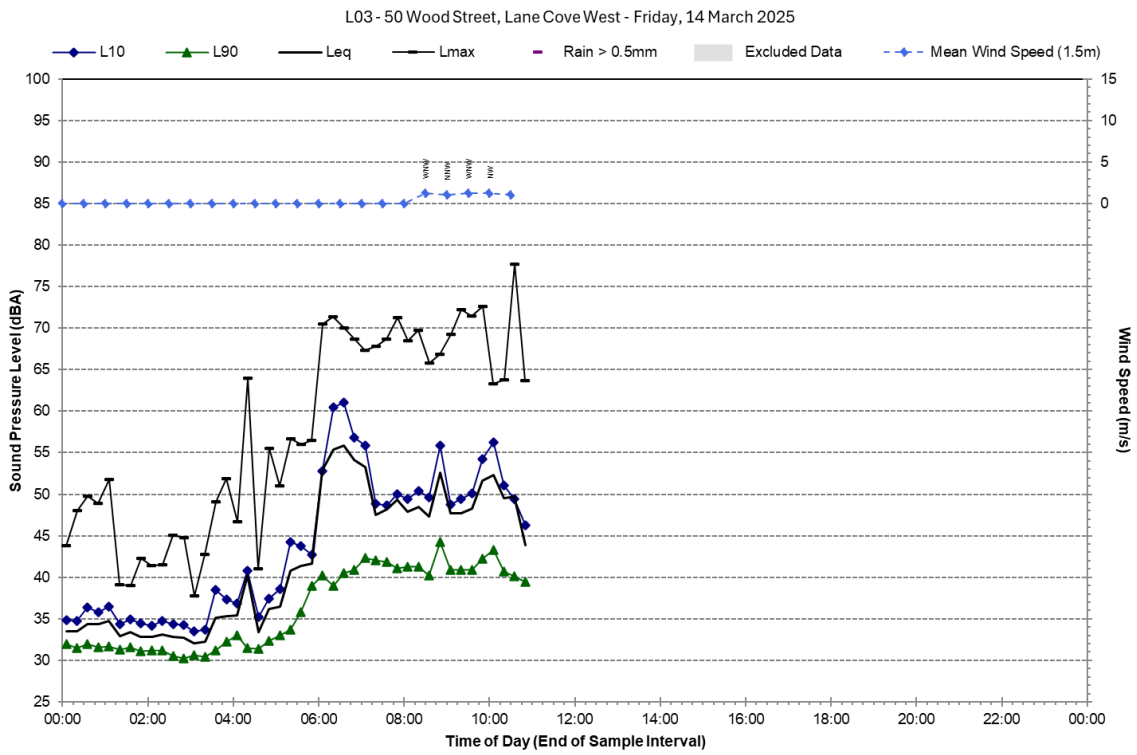
Statistical Ambient Noise Levels



Statistical Ambient Noise Levels



Statistical Ambient Noise Levels



Noise Monitoring Location	L04
Noise Monitoring Address	**86 Penrose Street, Lane Cove West**

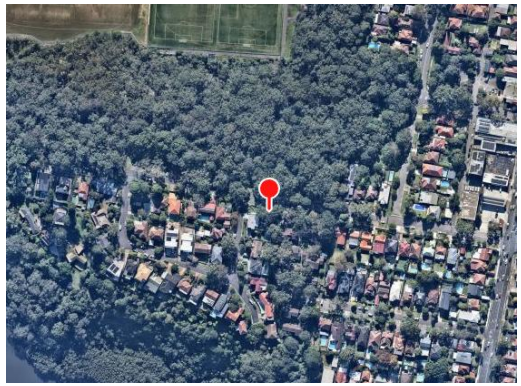
Logger Device Type: Svantek 957, Logger Serial No: 20666
Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3029485

Ambient noise logger deployed in the front yard of 86 Penrose Street, Lane Cove West. Noise logger location is adjacent to Penrose Street, and looks towards Blackman Park and the southern boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by distant road traffic noise from Epping Road and Burns Bay Road. Birds, aircraft flyovers, and local traffic on Penrose Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road and Burns Bay Road: 38-41 dBA, Cars on Penrose Street: up to 77 dBA, Aircraft flyovers: 54-69 dBA, Birds: up to 68 dBA.

Map of Noise Monitoring Location



Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	38	55	58	66
Evening	40	55	59	68
Night-time	33	46	40	44

Ambient Noise Logging Results – RNP Defined Time Periods

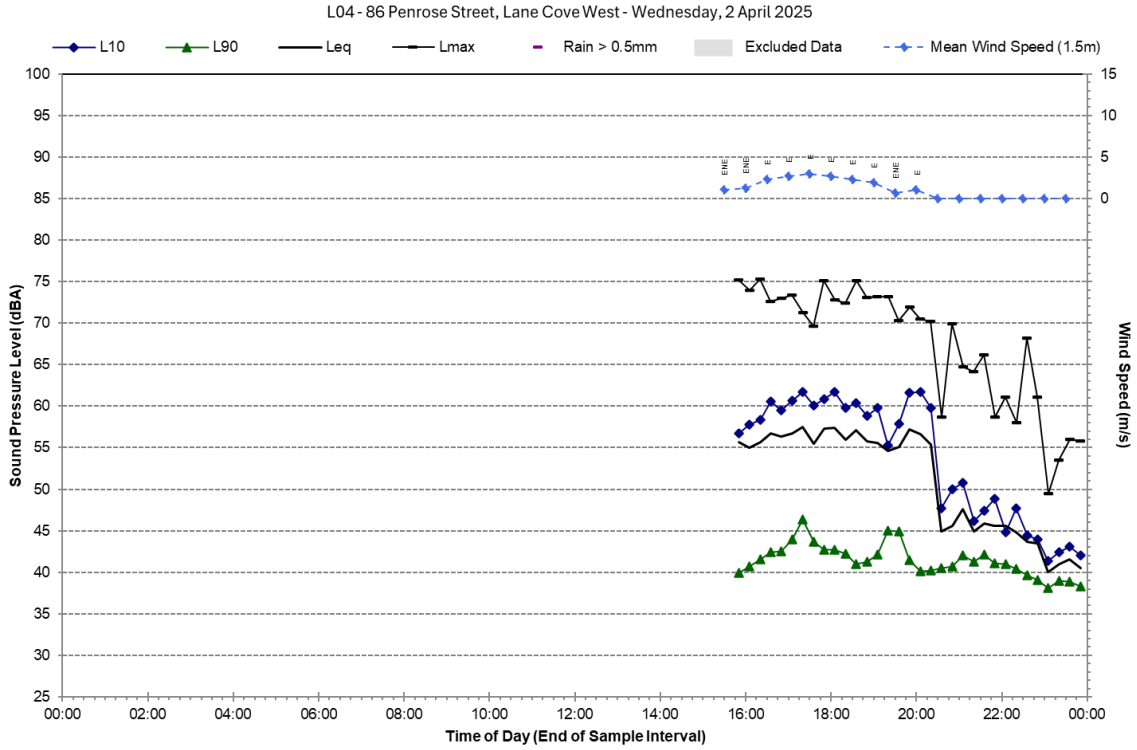
Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	55	58
Night-time (10pm-7am)	46	47

Attended Noise Measurement Results

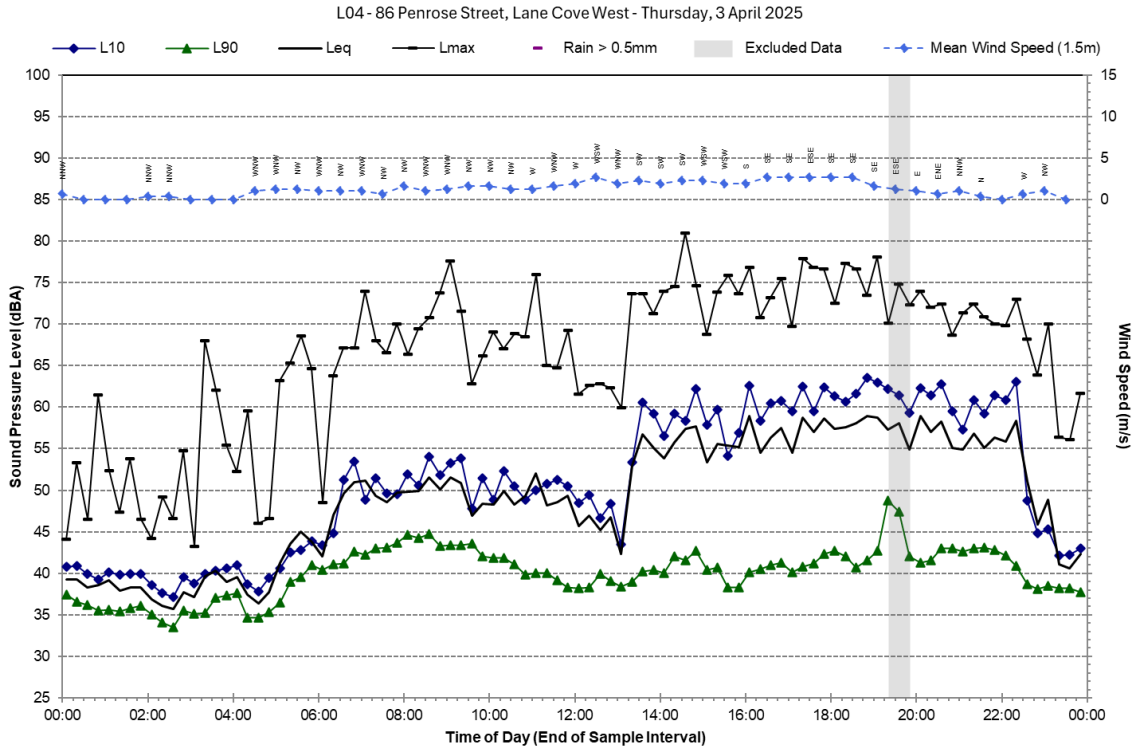
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
2/04/2025	15:24	40	57	77

Photo of Noise Monitoring Location

Statistical Ambient Noise Levels

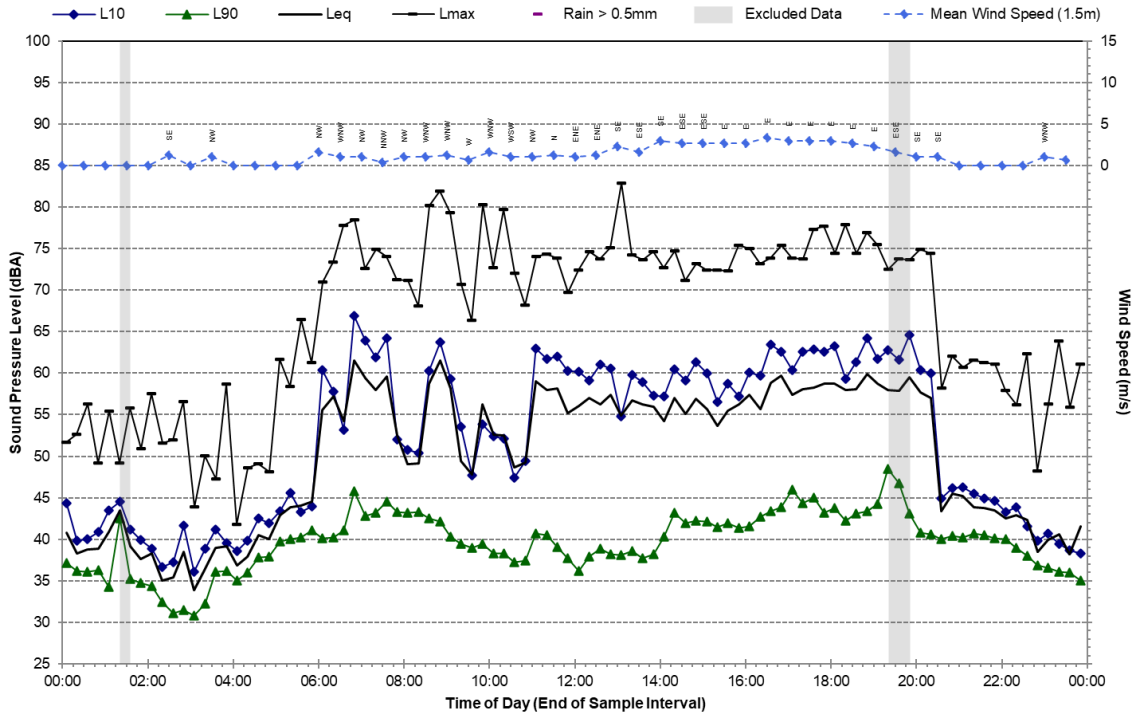


Statistical Ambient Noise Levels



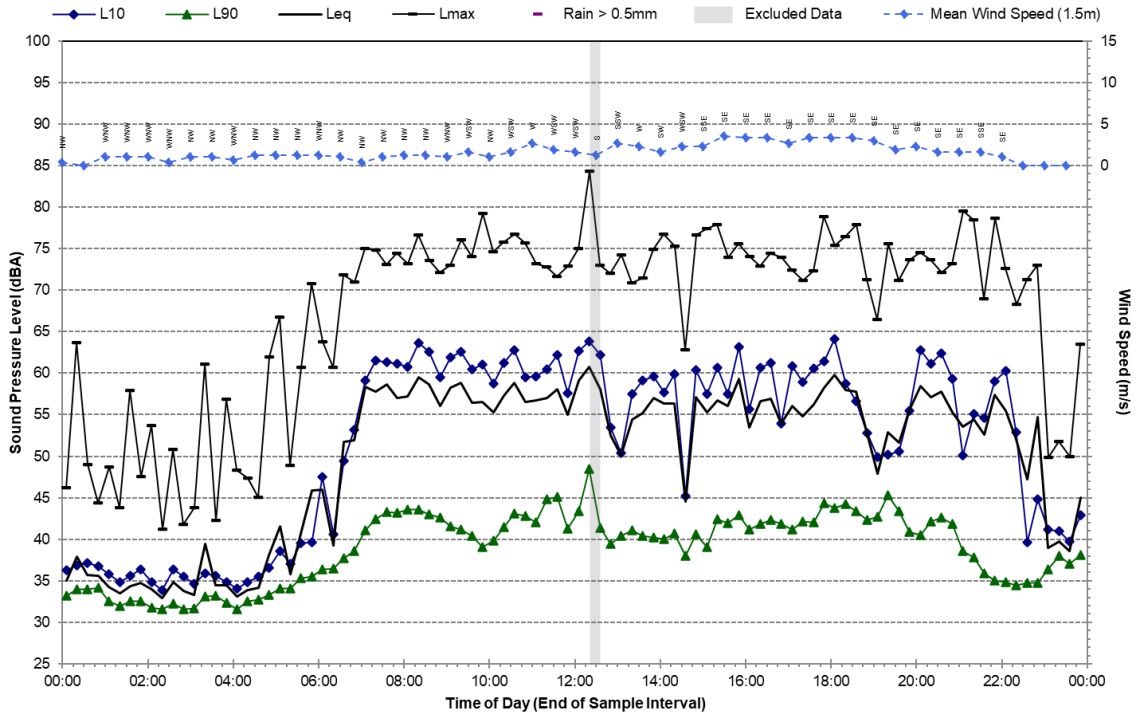
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Friday, 4 April 2025

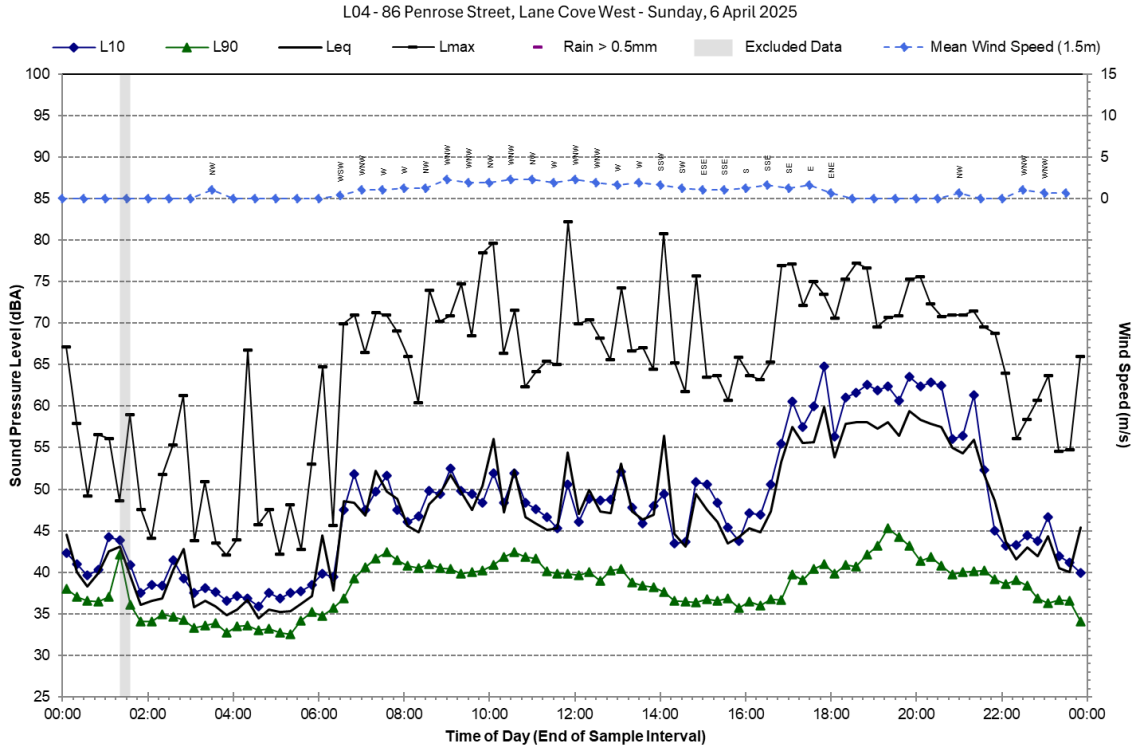


Statistical Ambient Noise Levels

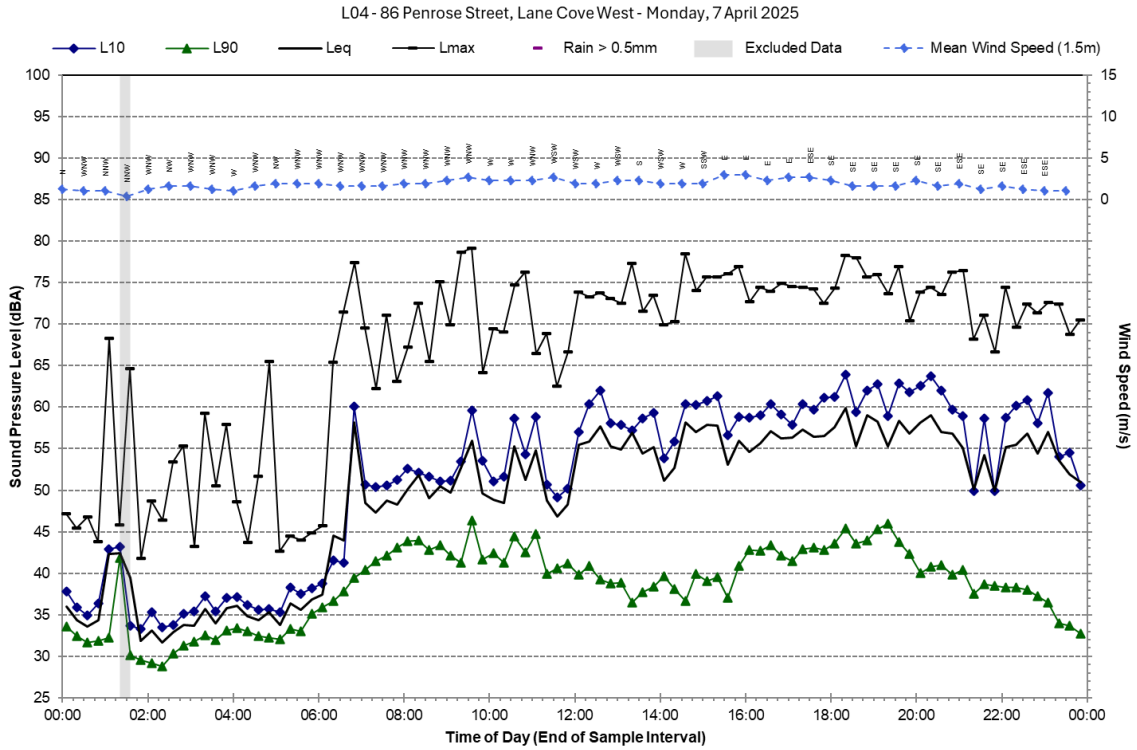
L04 - 86 Penrose Street, Lane Cove West - Saturday, 5 April 2025



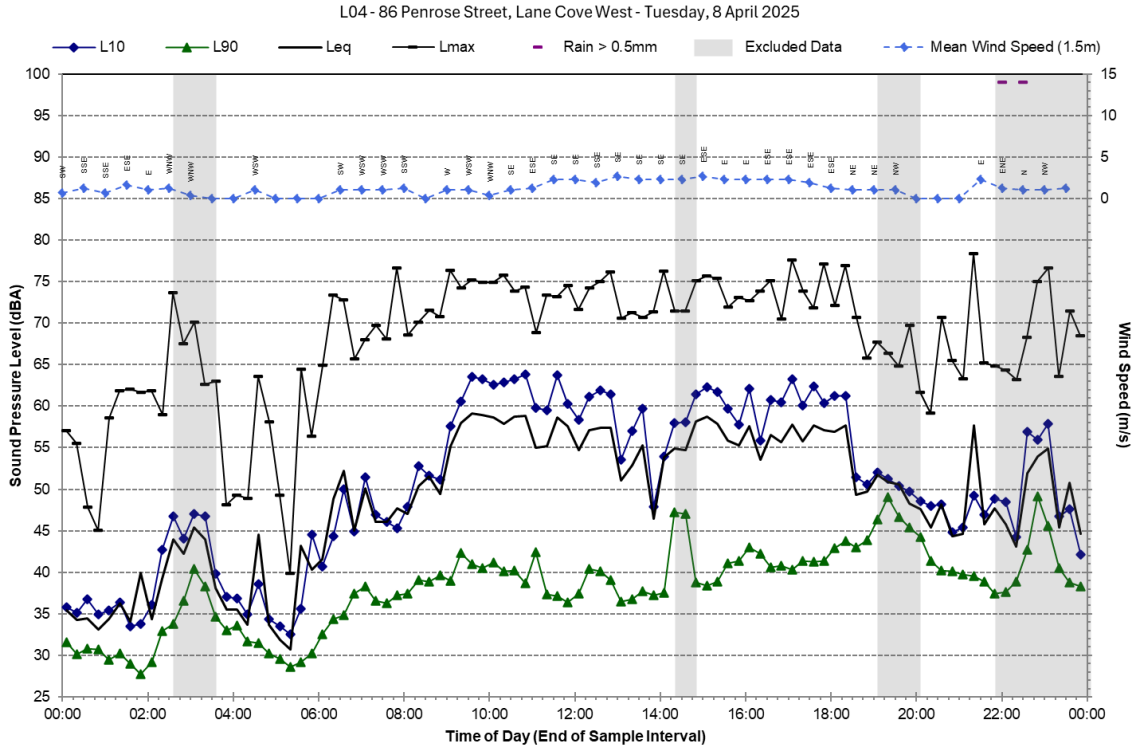
Statistical Ambient Noise Levels



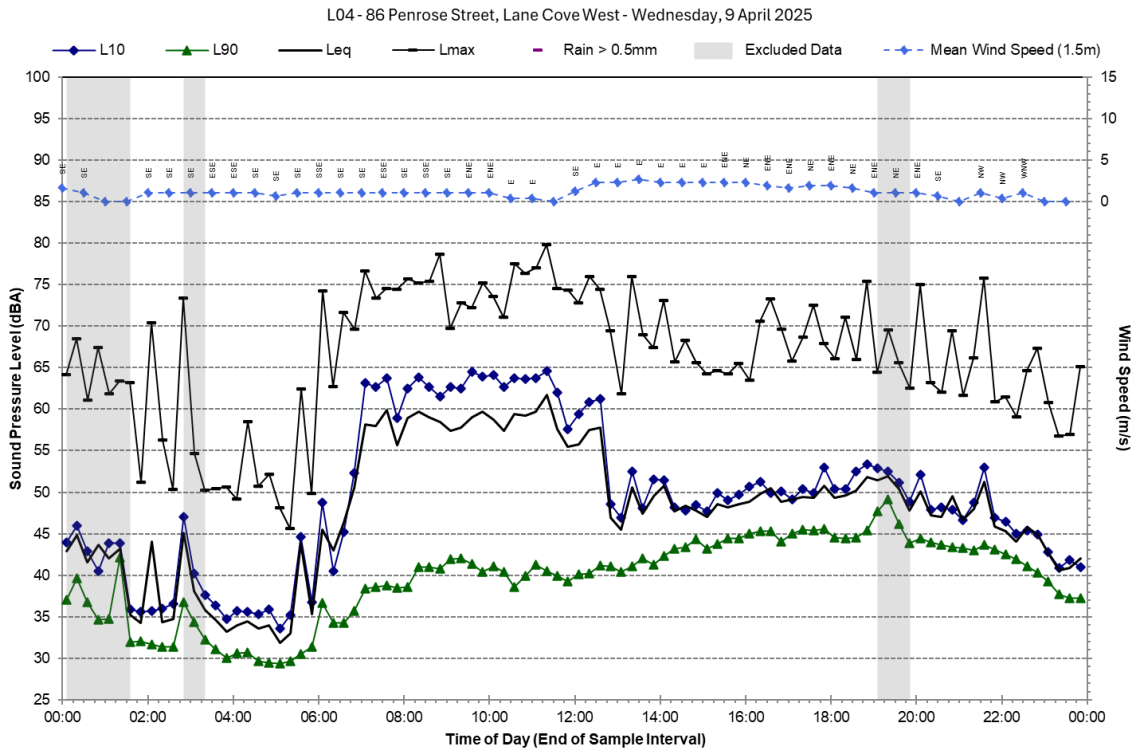
Statistical Ambient Noise Levels



Statistical Ambient Noise Levels

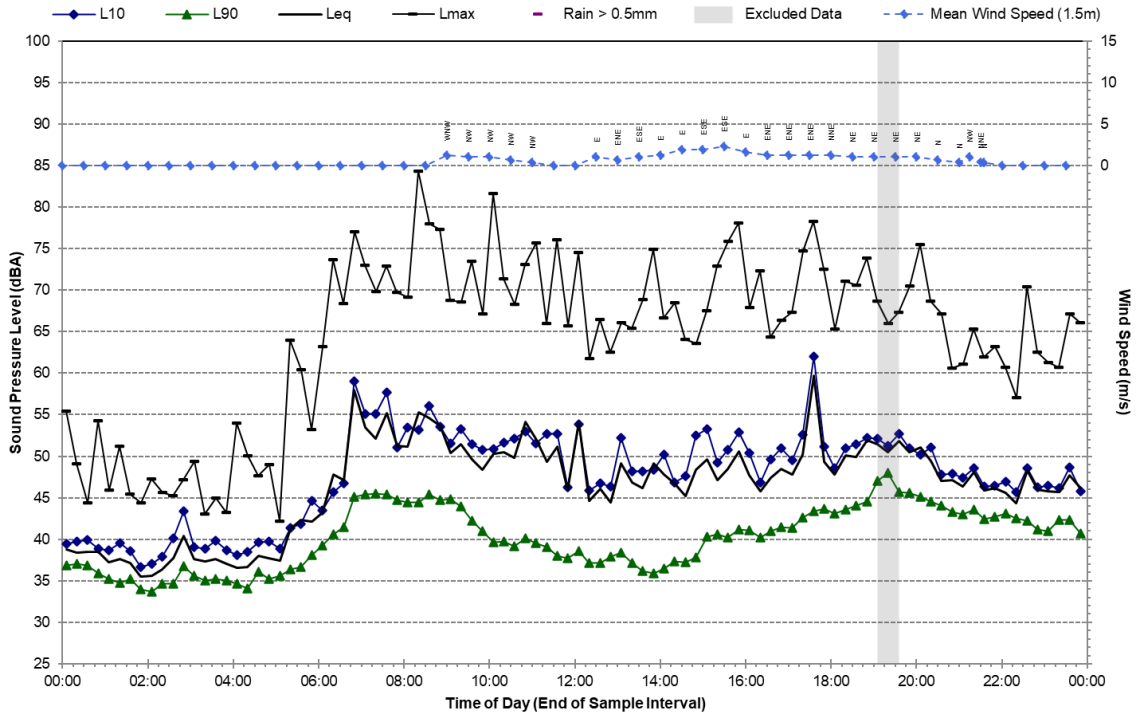


Statistical Ambient Noise Levels



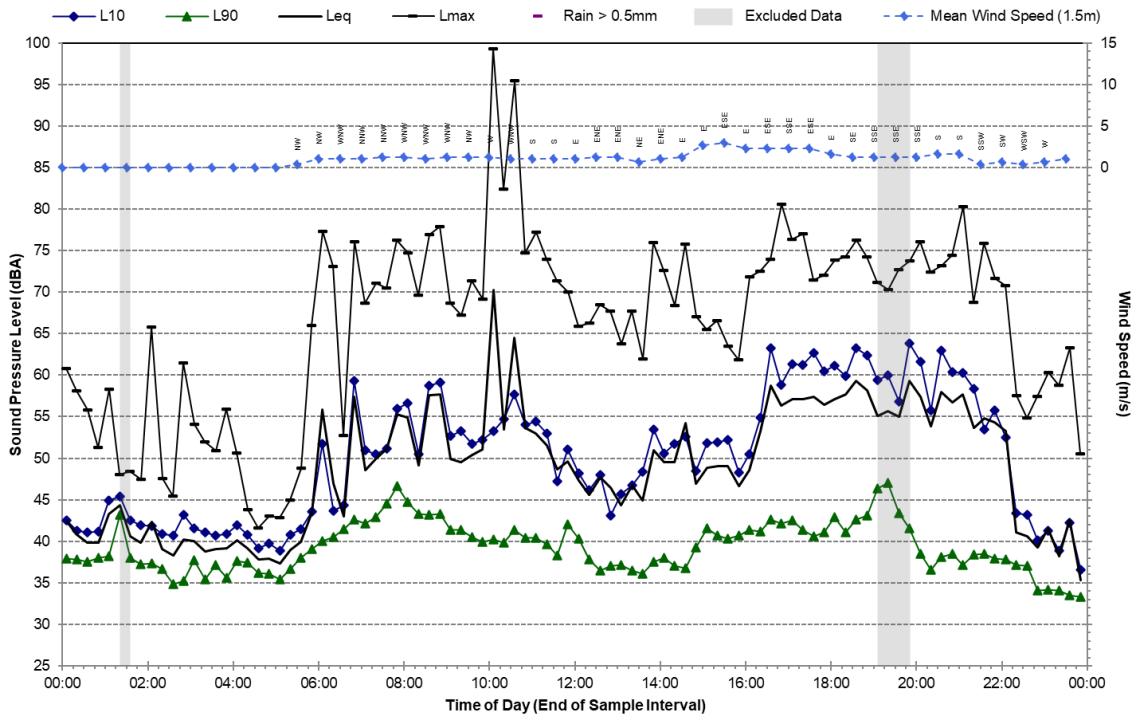
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Thursday, 10 April 2025



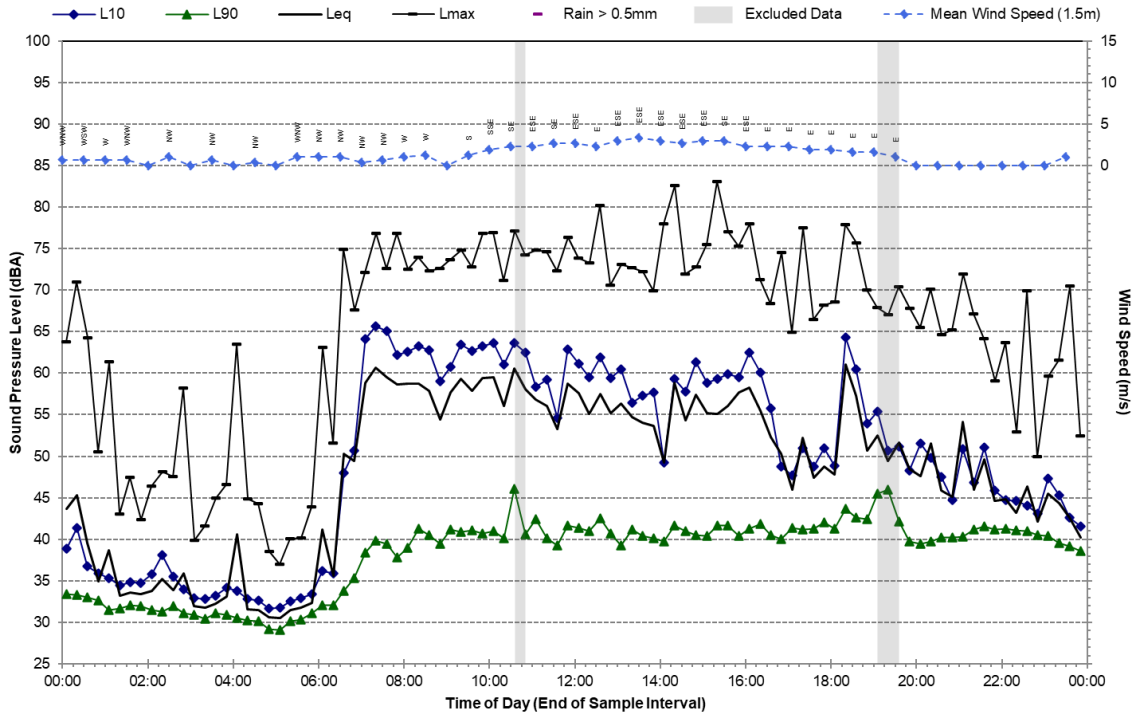
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Friday, 11 April 2025



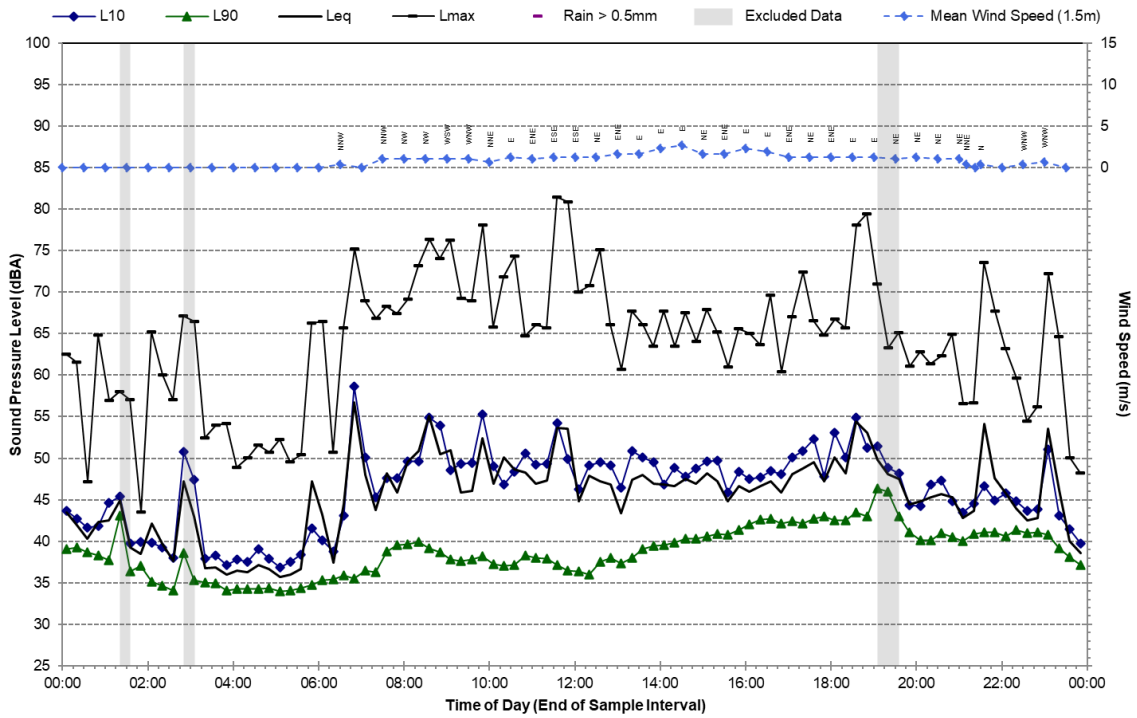
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Saturday, 12 April 2025



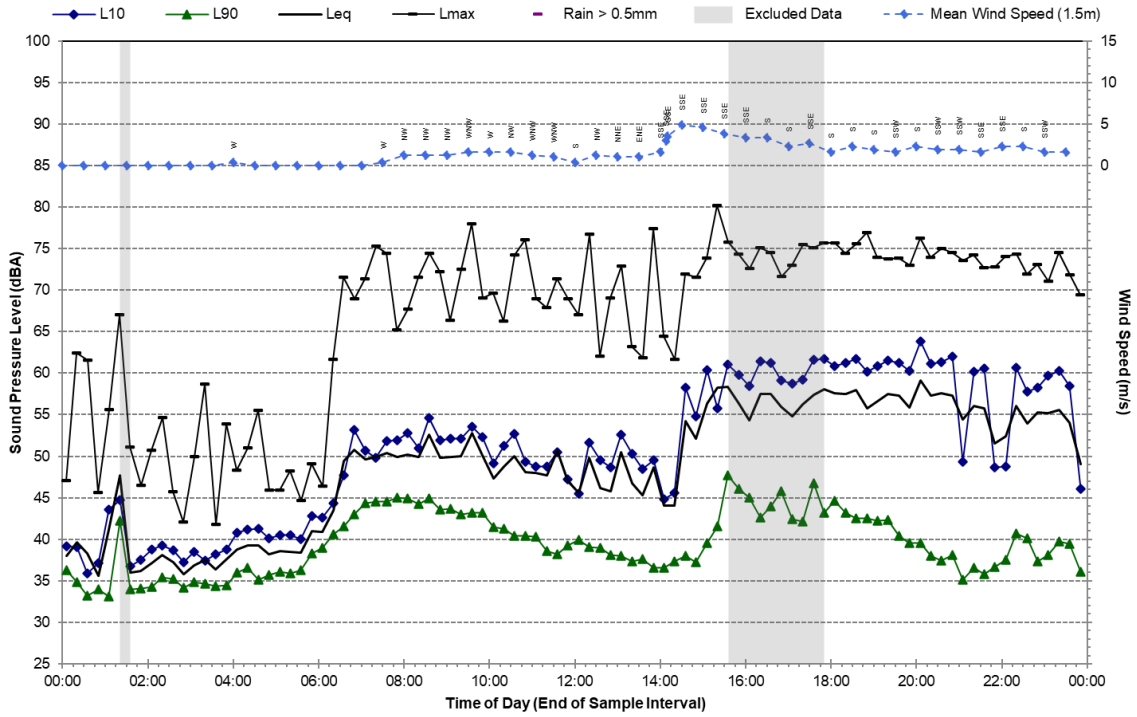
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Sunday, 13 April 2025



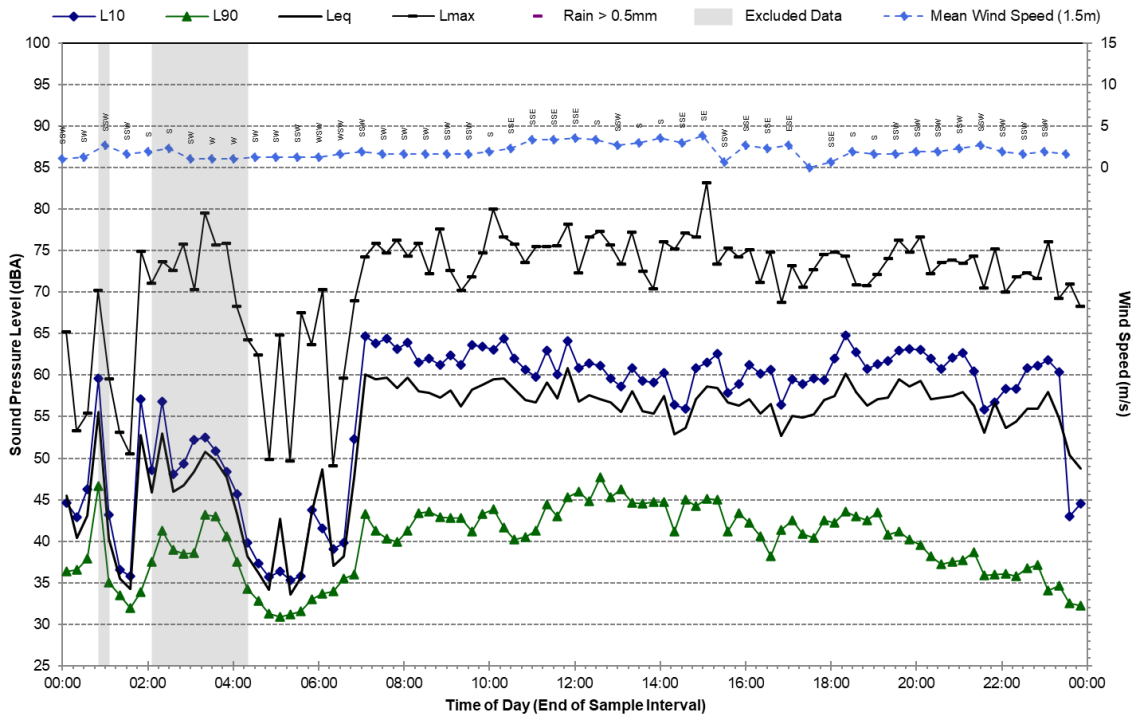
Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Monday, 14 April 2025

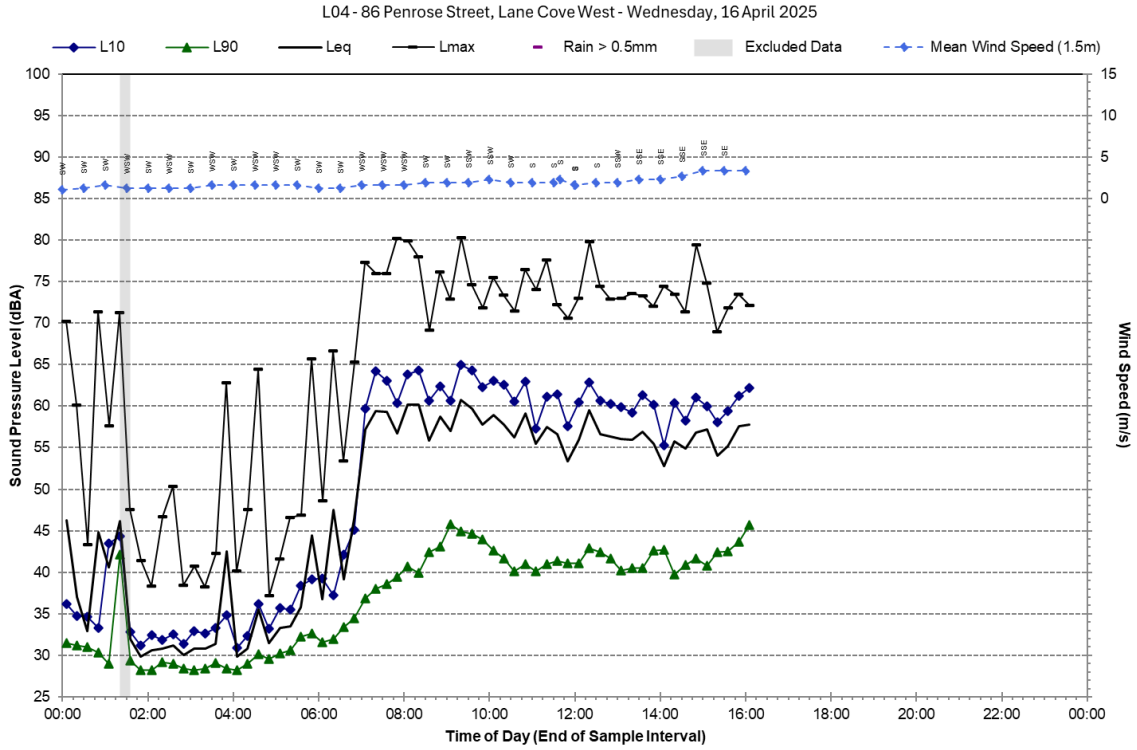


Statistical Ambient Noise Levels

L04 - 86 Penrose Street, Lane Cove West - Tuesday, 15 April 2025



Statistical Ambient Noise Levels



Noise Monitoring Location	L05
Noise Monitoring Address	**292 Pittwater Road, East Ryde**

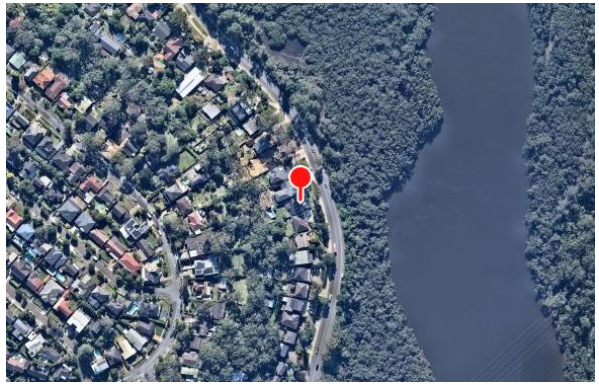
Logger Device Type: Svantek 957, Logger Serial No: 23241
Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3029485

Ambient noise logger deployed on the front balcony of 292 Pittwater Road, East Ryde. Noise logger location is adjacent to Pittwater Road, and looks towards the Lane Cove River, Lane Cove West Business Park, and the western boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by road traffic noise on Pittwater Road and distant road traffic noise from Epping Road. Aircraft flyovers also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 44-48 dBA, Traffic on Pittwater Road: up to 70 dBA, Trucks on Pittwater Road: up to 77 dBA, Aircraft flyovers: up to 72 dBA.

Map of Noise Monitoring Location



Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	49	66	69	72
Evening	46	64	67	71
Night-time	37	56	55	66

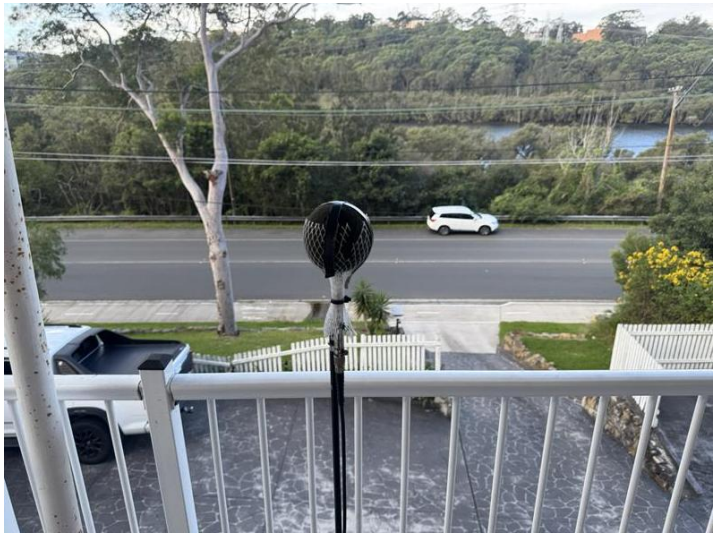
Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	65	67
Night-time (10pm-7am)	56	60

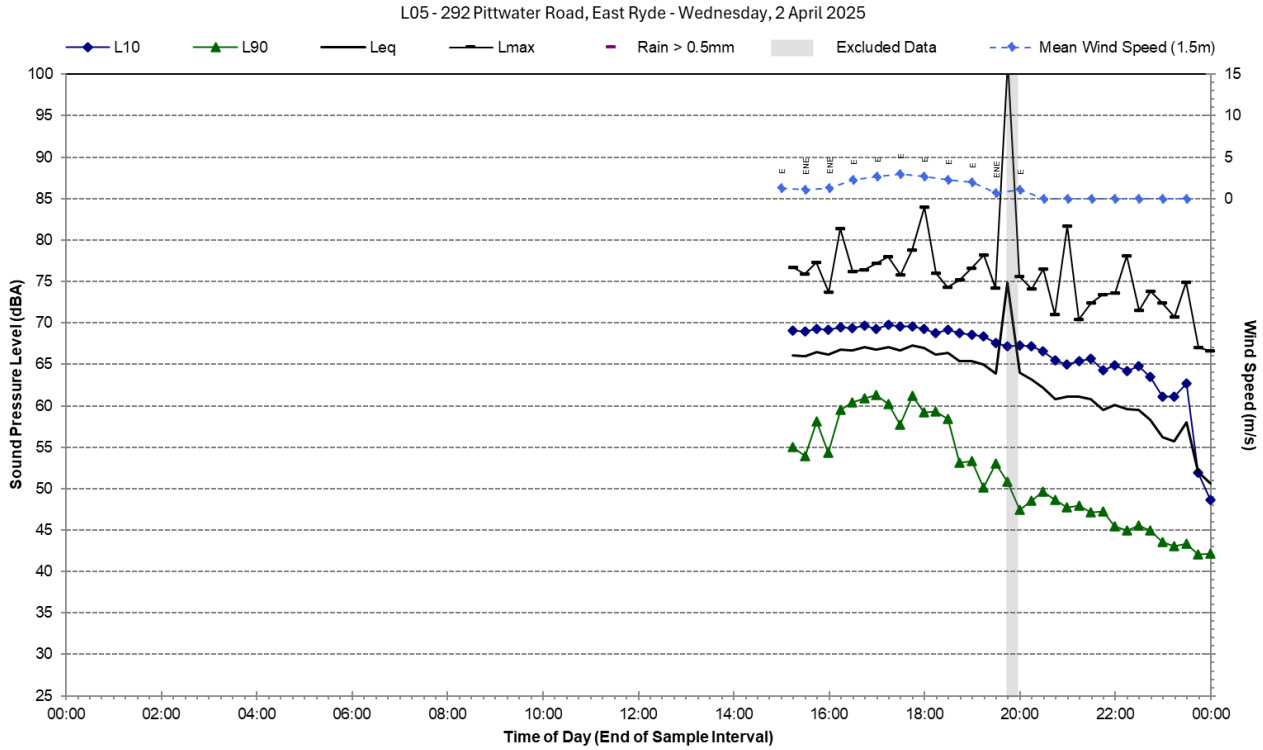
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
2/04/2025	14:27	51	65	77

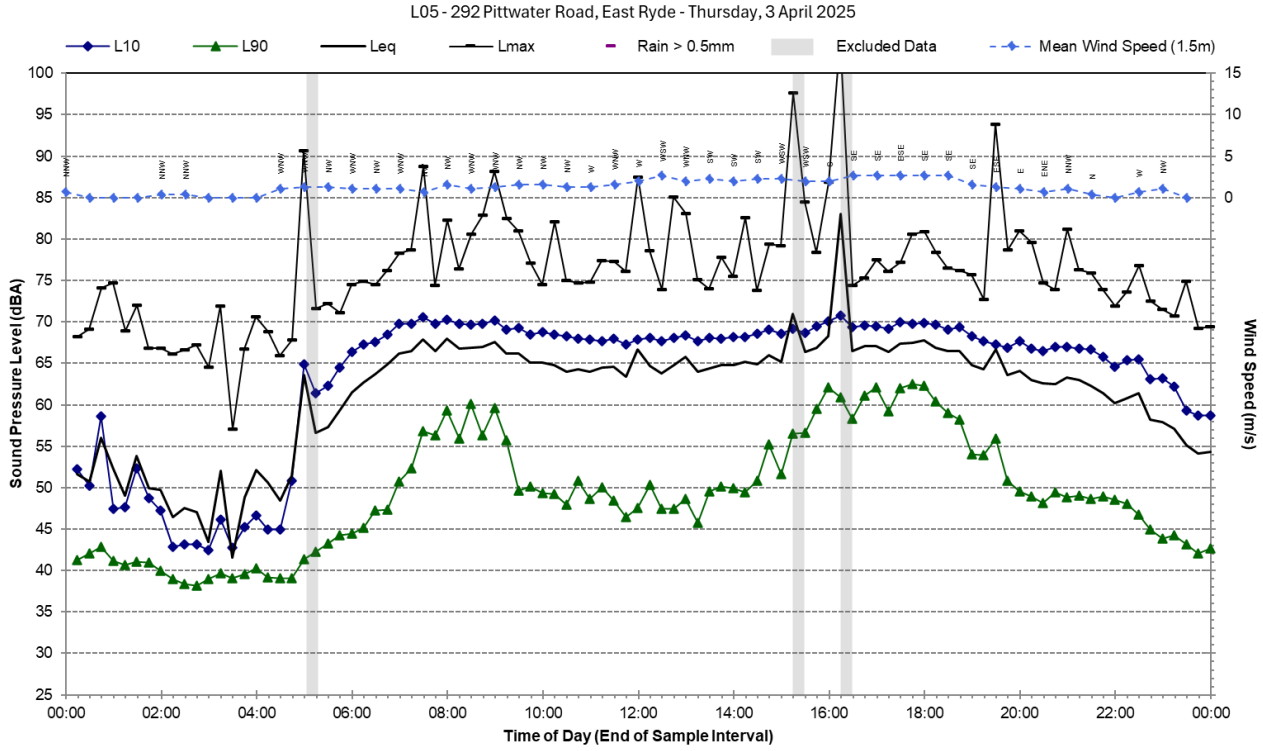
Photo of Noise Monitoring Location



Statistical Ambient Noise Levels

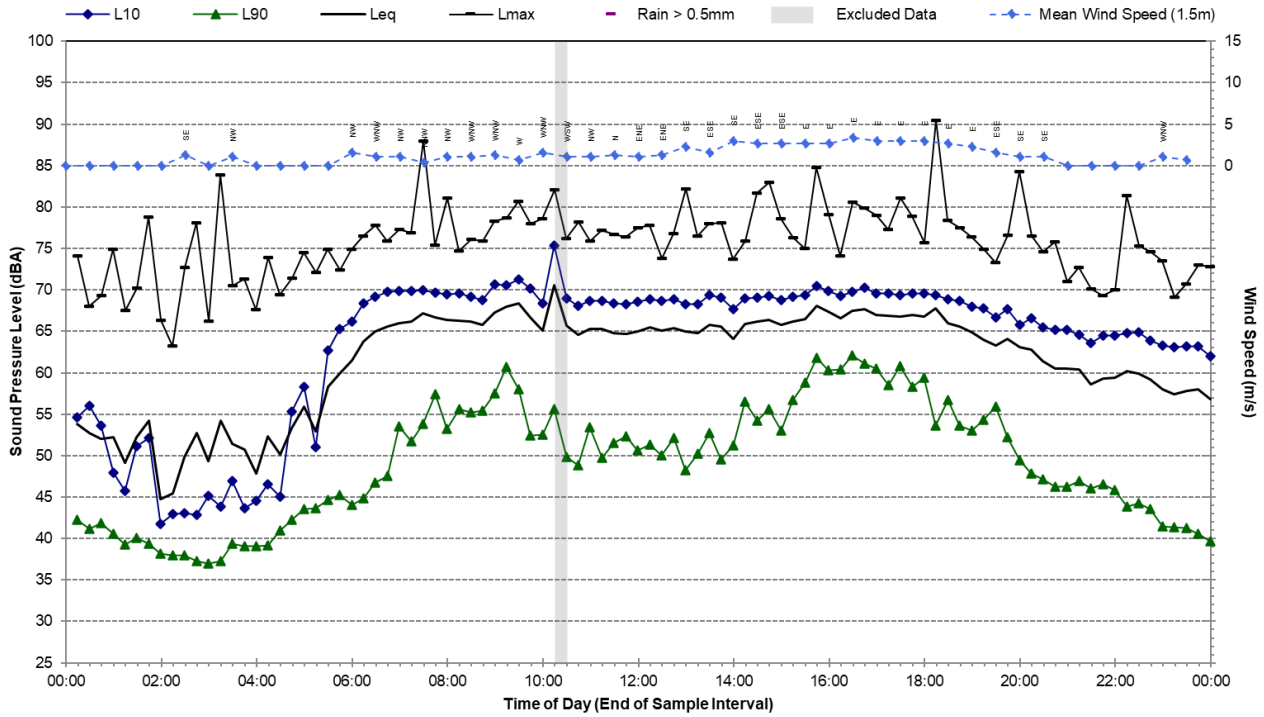


Statistical Ambient Noise Levels



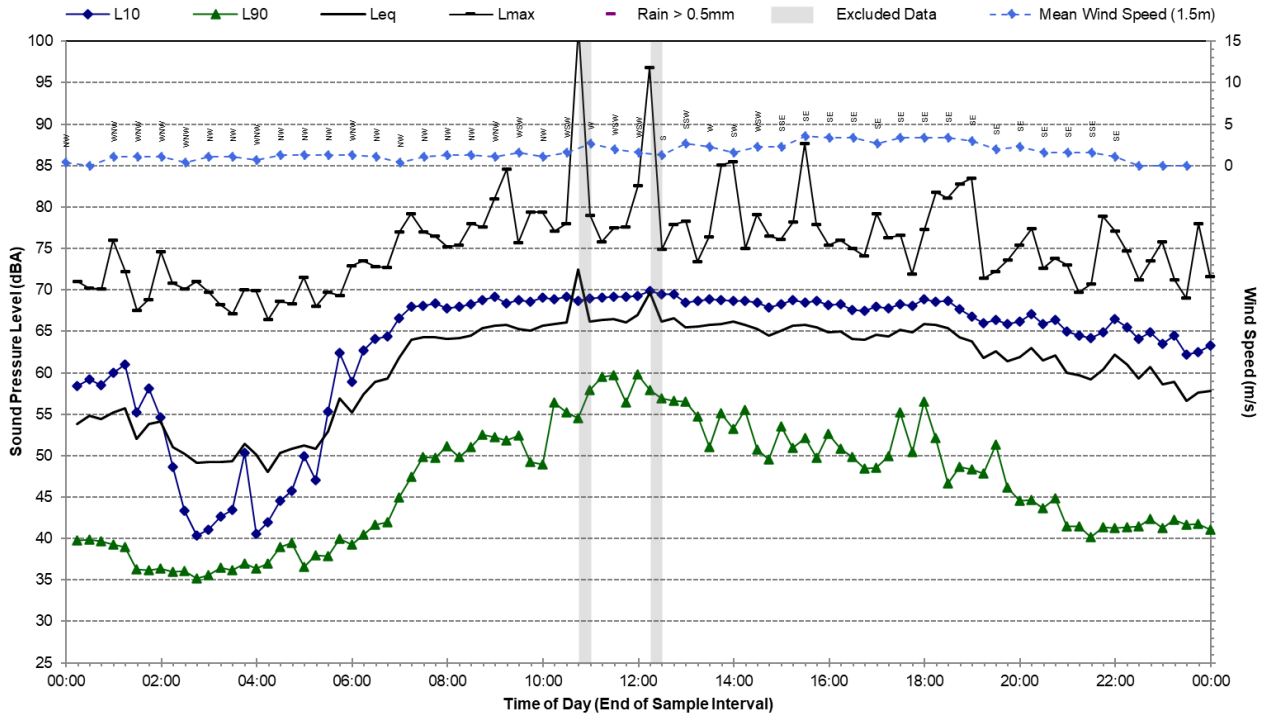
Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Friday, 4 April 2025



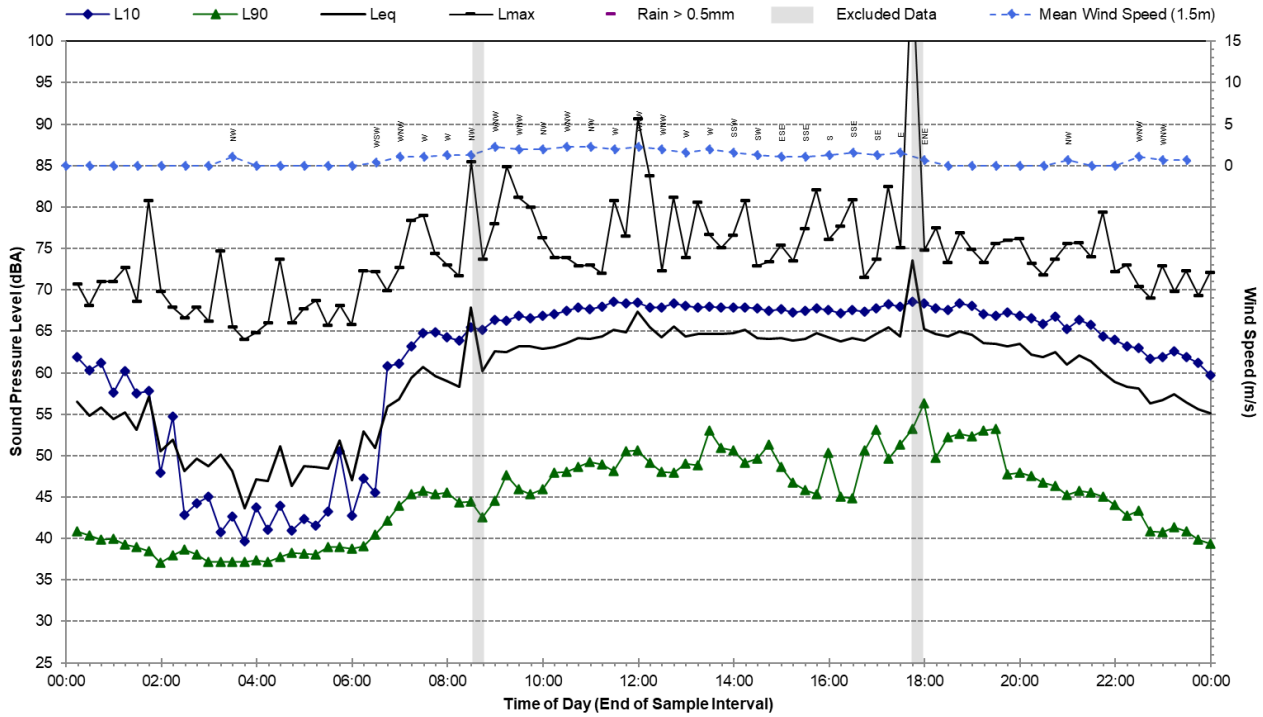
Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Saturday, 5 April 2025



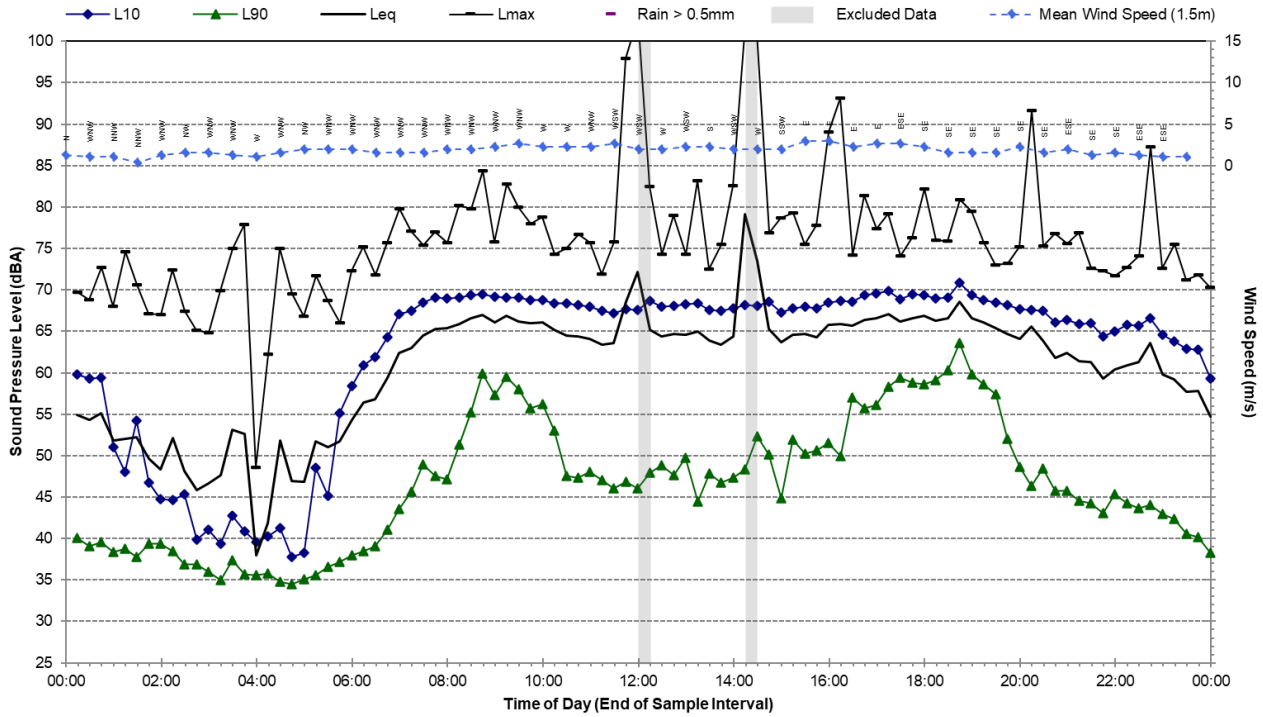
Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Sunday, 6 April 2025



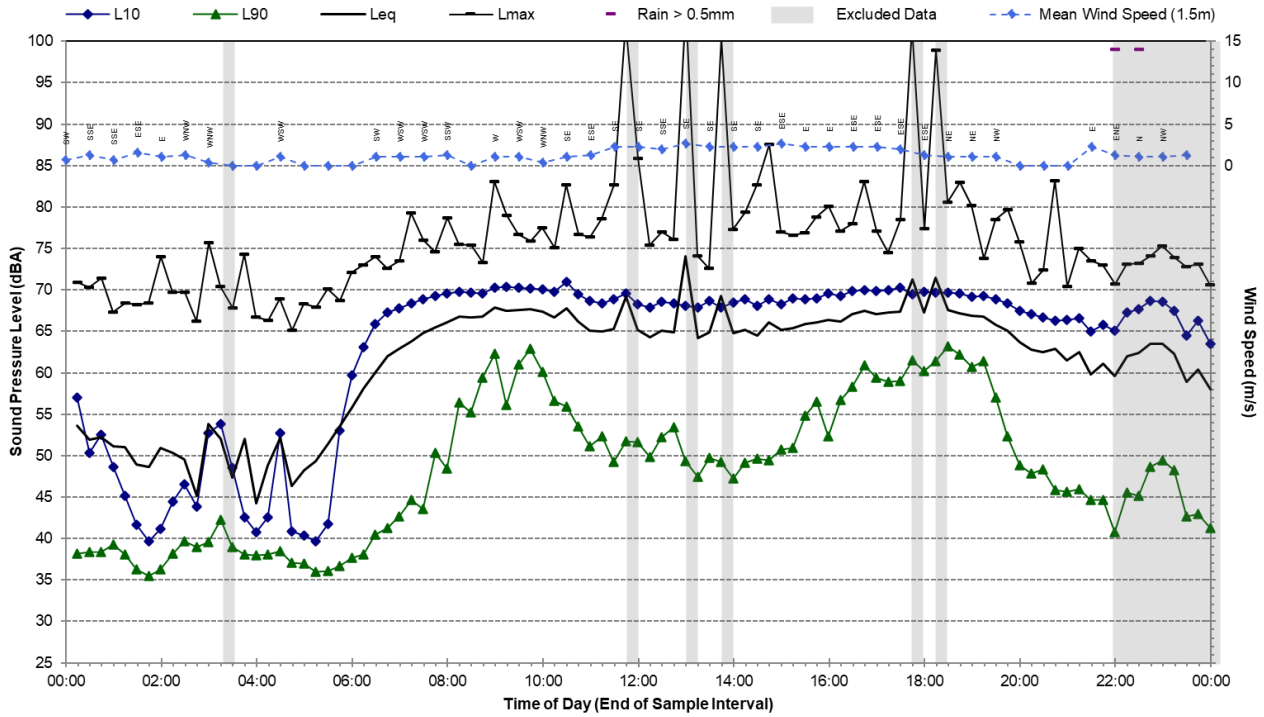
Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Monday, 7 April 2025



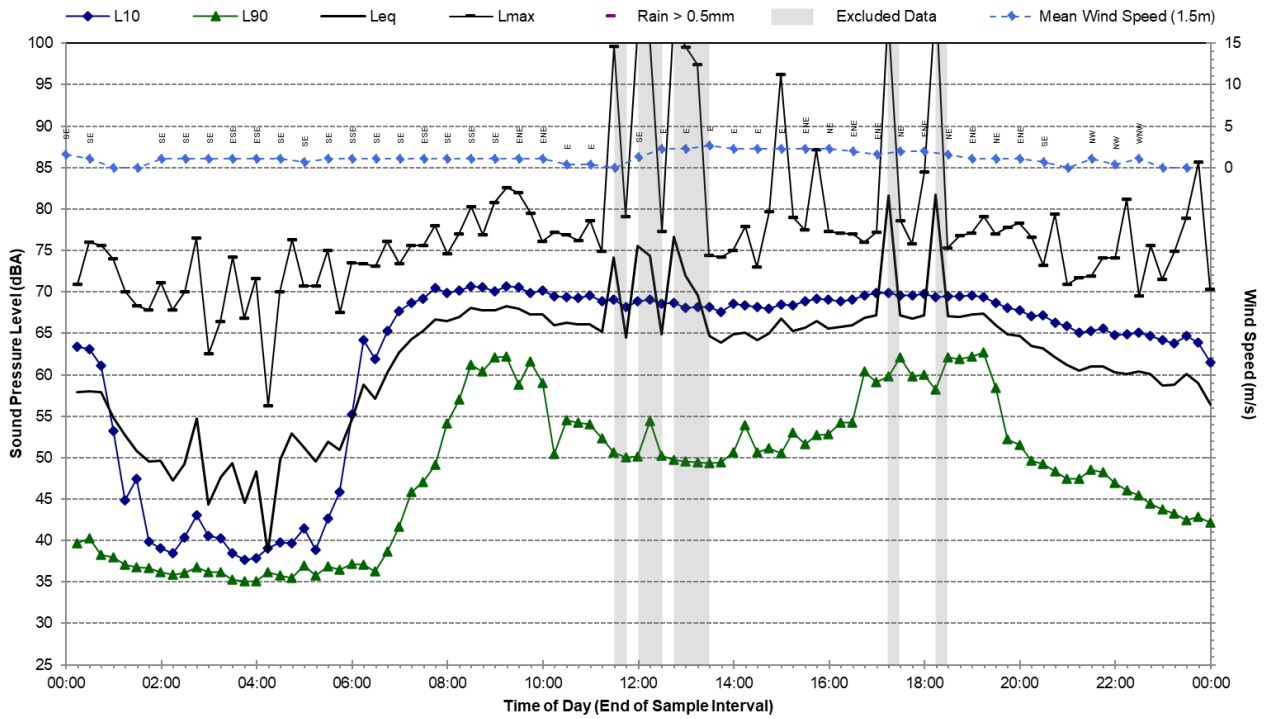
Statistical Ambient Noise Levels

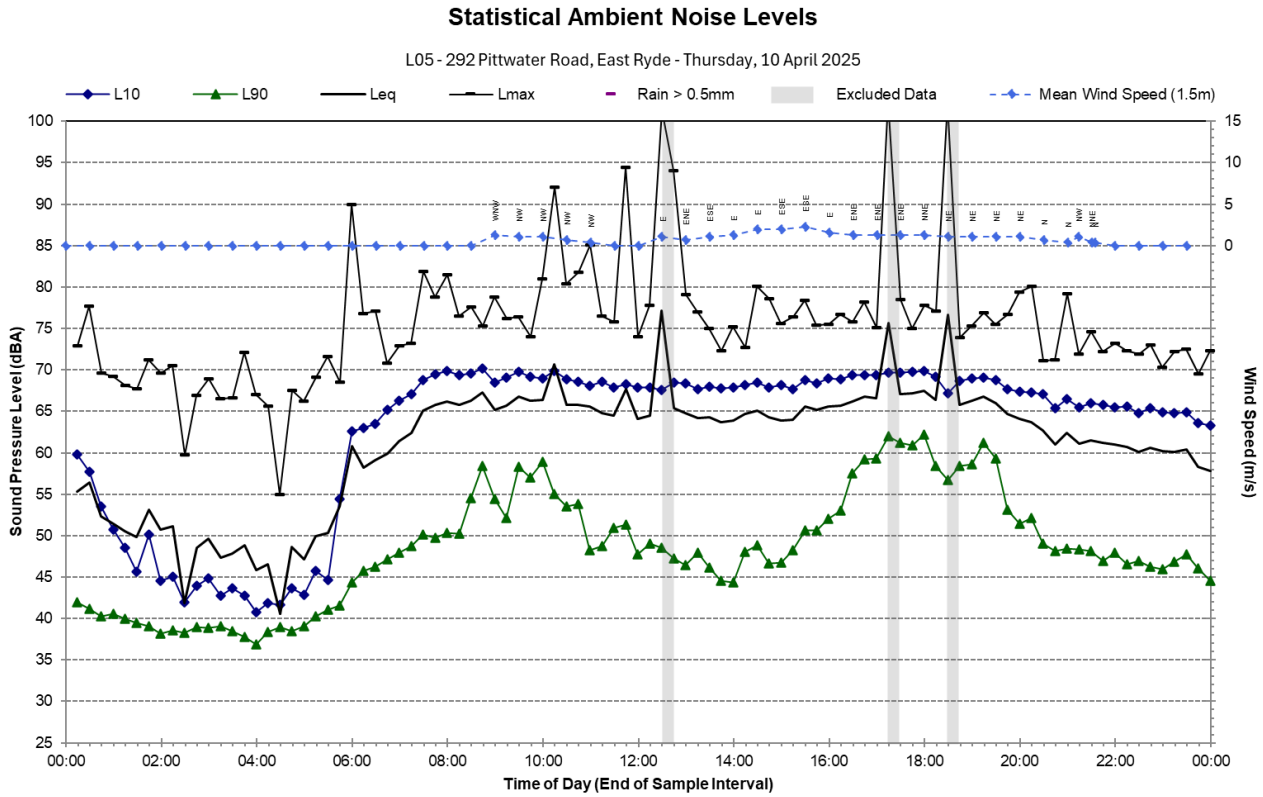
L05 - 292 Pittwater Road, East Ryde - Tuesday, 8 April 2025

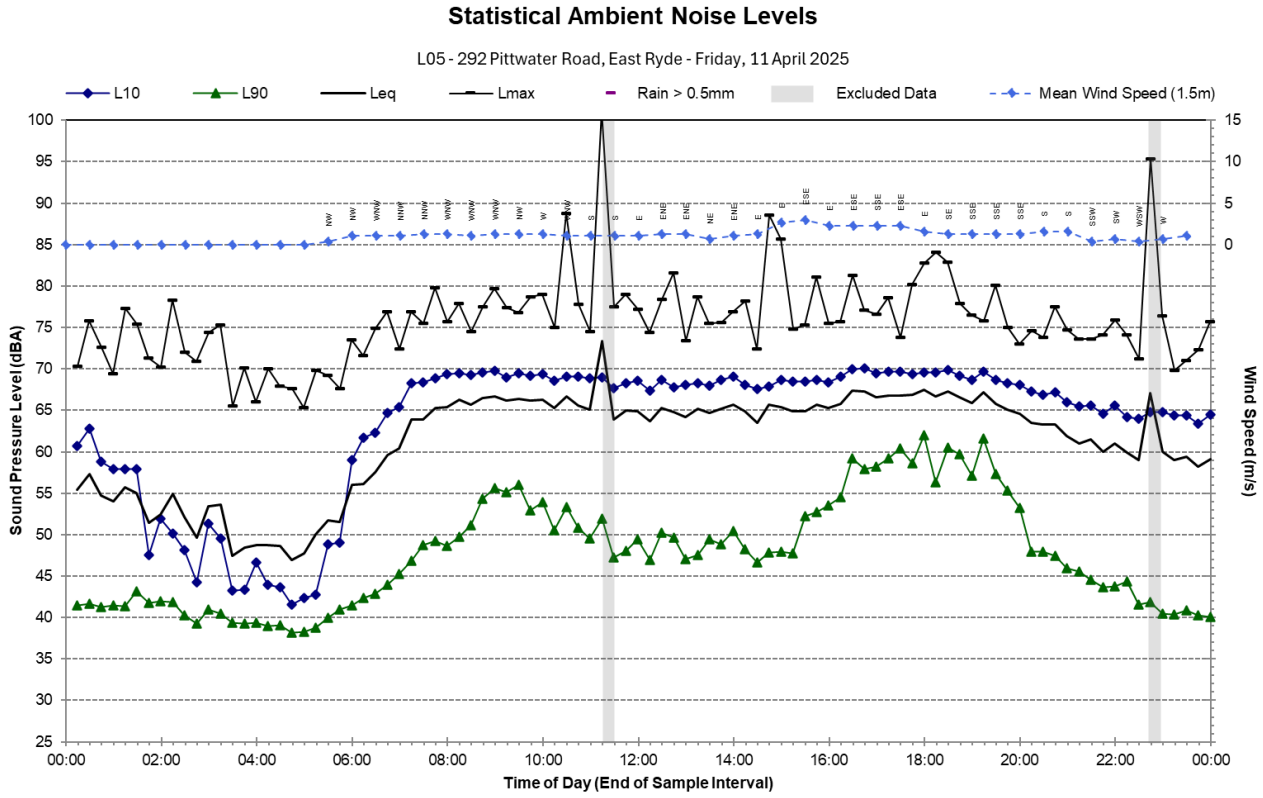


Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Wednesday, 9 April 2025

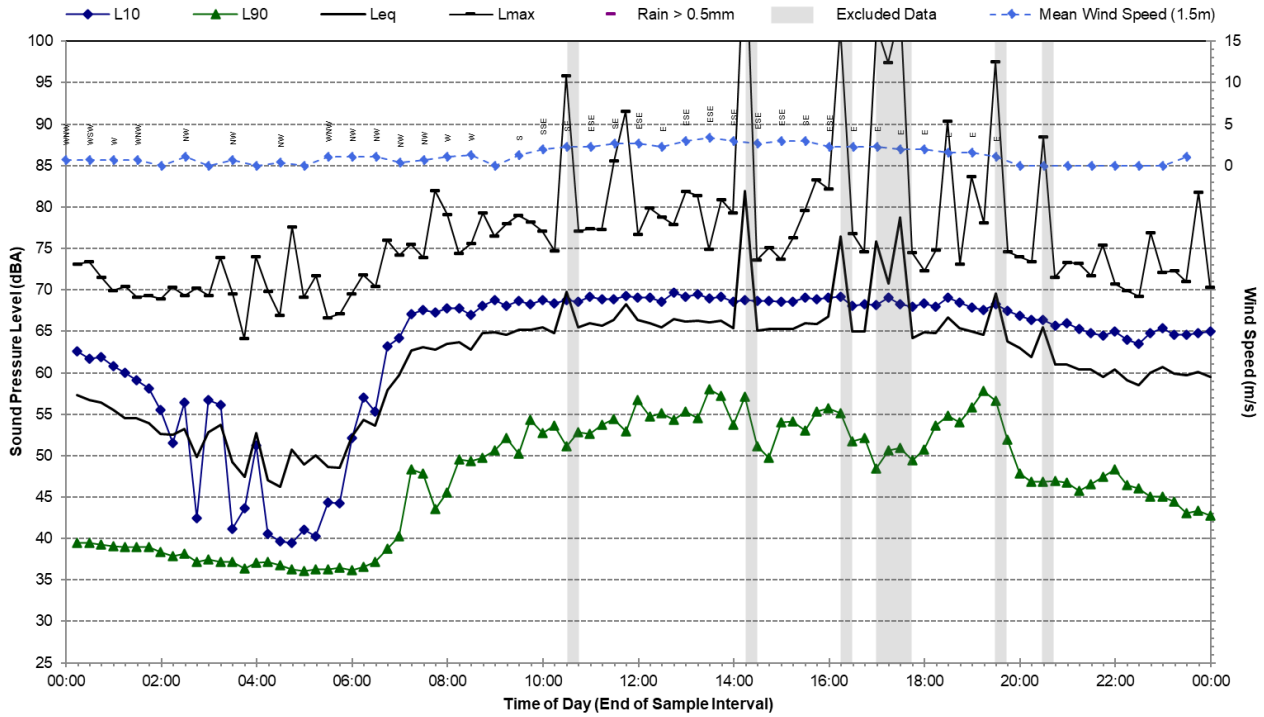



Statistical Ambient Noise Levels
L05 - 292 Pittwater Road, East Ryde - Thursday, 10 April 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 292 Pittwater Road, East Ryde - Friday, 11 April 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

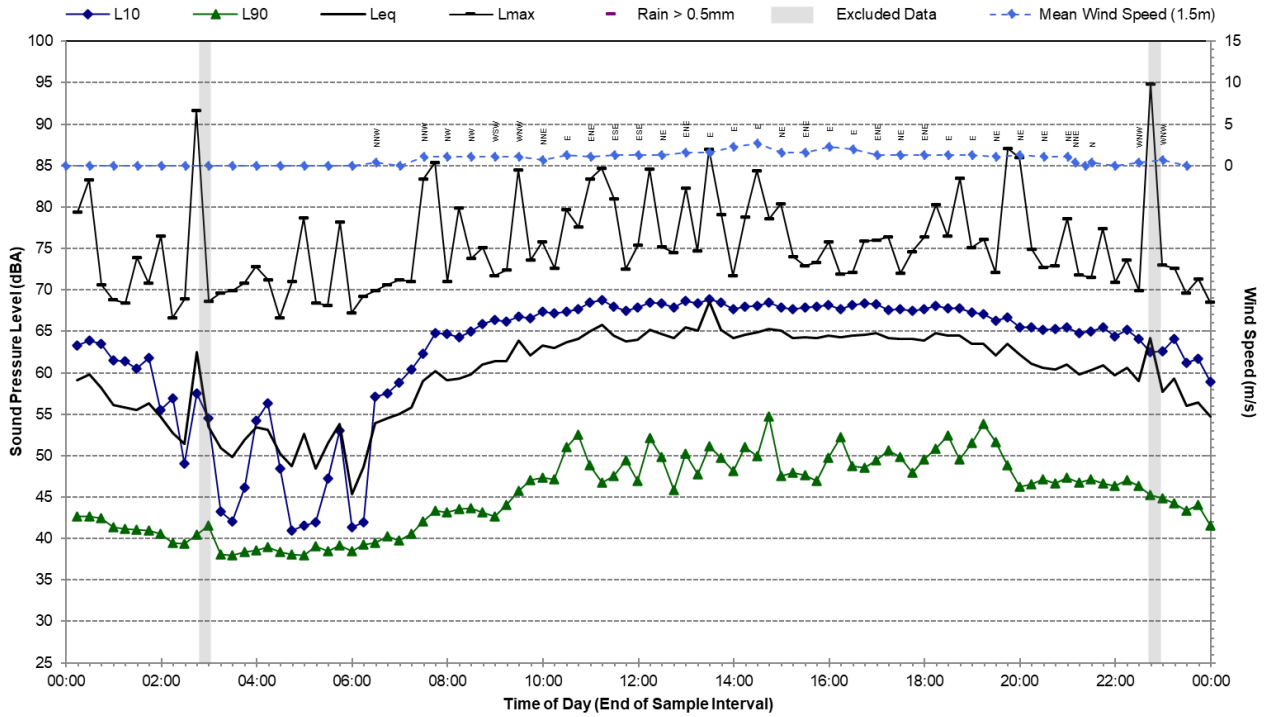
Statistical Ambient Noise Levels

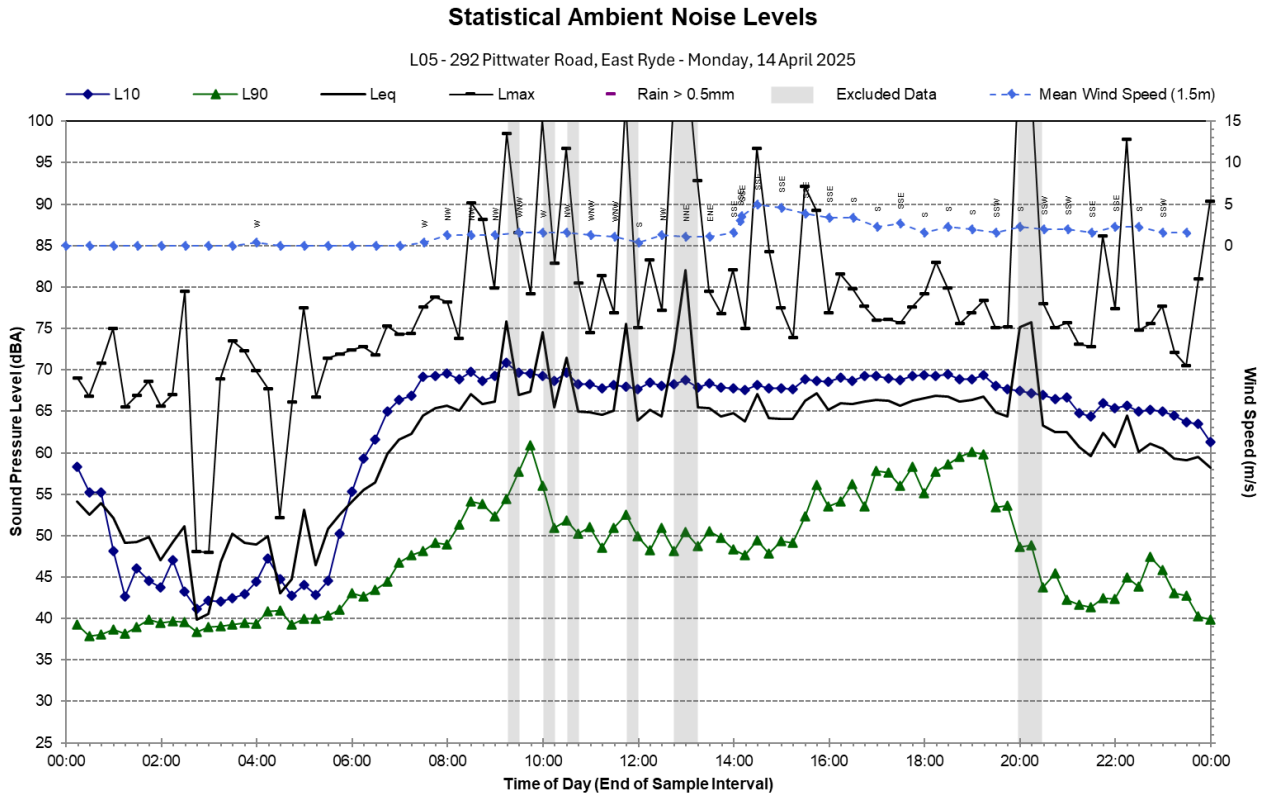
L05 - 292 Pittwater Road, East Ryde - Saturday, 12 April 2025

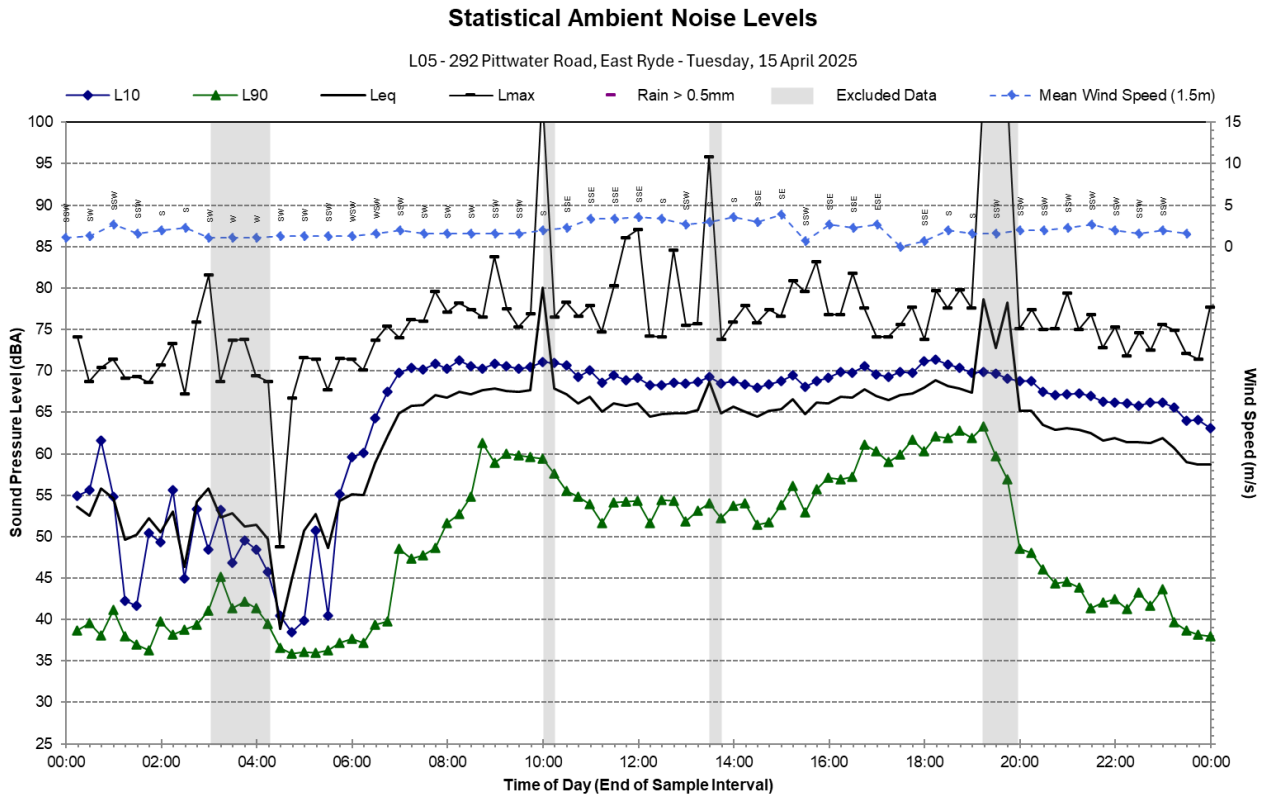


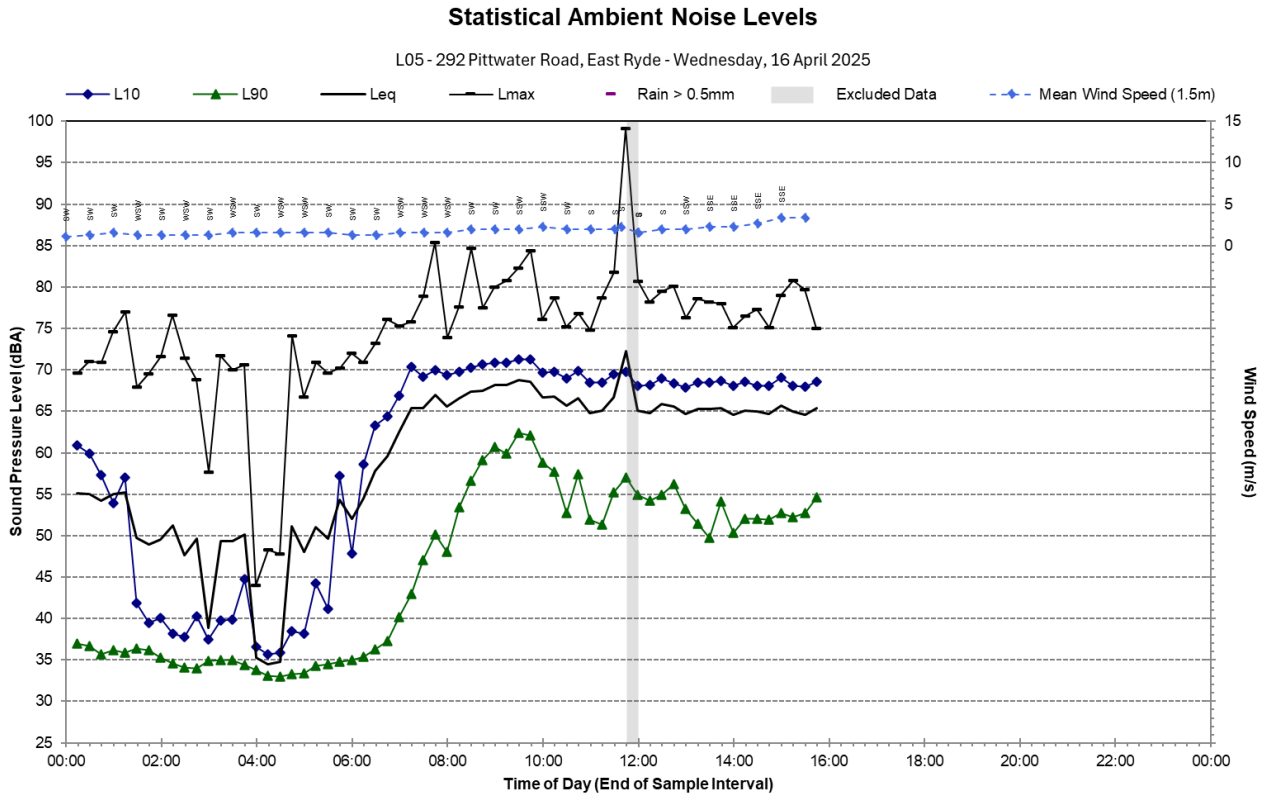
Statistical Ambient Noise Levels

L05 - 292 Pittwater Road, East Ryde - Sunday, 13 April 2025




Statistical Ambient Noise Levels
L05 - 292 Pittwater Road, East Ryde - Monday, 14 April 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 292 Pittwater Road, East Ryde - Tuesday, 15 April 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 292 Pittwater Road, East Ryde - Wednesday, 16 April 2025
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Noise Measurement Location	A01
Noise Measurement Address	**End of Mars Road / Banksia Close, Lane Cove West (NCA01/02 – near L01)**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3008204

Attended noise measurement location is adjacent to the end of Mars Road, near L01, and looks towards the northeast corner of the project site.

Attended noise measurements indicate the night-time ambient noise environment at this location is dominated by insects and distant road traffic noise from Epping Road and Centennial Avenue. Local traffic on Mars Road, aircraft flyovers and bats also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 39-55 dBA, Distant traffic on Centennial Avenue: audible, Insects: audible, Cars on Mars Road: 55-80 dBA, Motorbikes on Mars Road: 72-75 dBA, Car on Cullen Street: 43 dBA, Cyclist and pedestrians passing: 45-56 dBA, Aircraft flyover: 47 dBA, Bats: up to 45 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
3/09/2025	22:12	41	55	80

Map of Noise Measurement Location

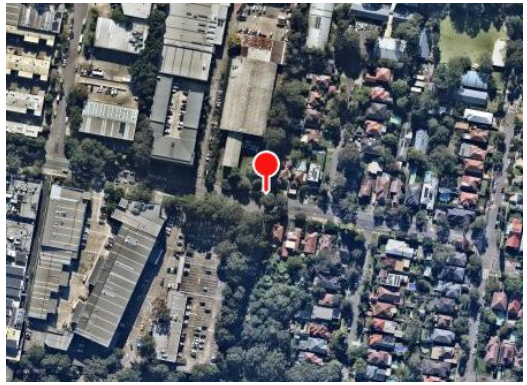


Photo of Noise Measurement Location

Noise Measurement Location	A02
Noise Measurement Address	**Behind Wood Street (near Blackman Park tennis courts), Lane Cove West (NCA03 – near L03)**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3008204

Attended noise measurement location is adjacent to the Blackman Park tennis court carpark, near L03, and looks towards the Council depot and the southeastern boundary of the project site.

Attended noise measurements indicate the night-time ambient noise environment at this location is dominated by distant road traffic noise from Epping Road. Industrial noise, local traffic on Lloyd Rees Drive and bats also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 37-50 dBA, Car on Lloyd Rees Drive: 56 dBA, Industrial fan noise to the west: audible, Impact noise from industrial site to the west: up to 50 dBA, Bats: up to 50 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
3/09/2025	23:26	38	40	56

Map of Noise Measurement Location

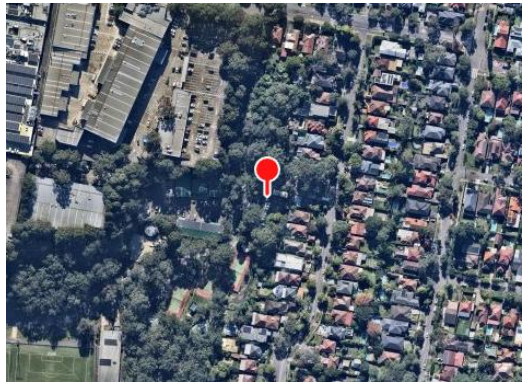
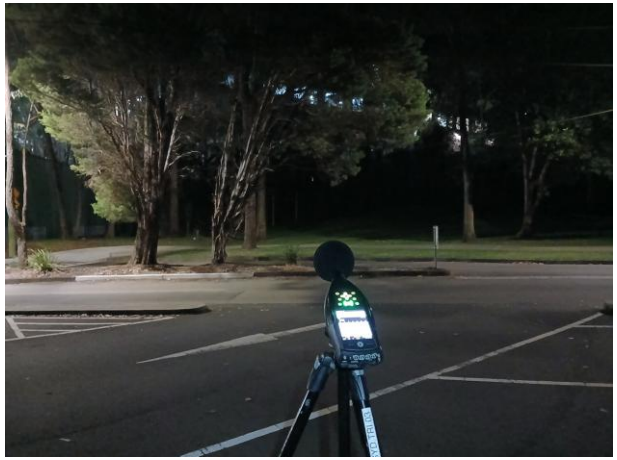


Photo of Noise Measurement Location



Noise Measurement Location	A03
Noise Measurement Address	**North side of Penrose Street, opposite Myee Crescent, Lane Cove West (NCA04 – near L04)**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3008204

Attended noise measurement location is adjacent to Penrose Street, near L04, and looks towards Blackman Park and the southern boundary of the project site.

Attended noise measurements indicate the night-time ambient noise environment at this location is dominated by distant road traffic noise from Epping Road and Burns Bay Road. Bats and local traffic on Penrose Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Distant traffic on Epping Road: 40-45 dBA, Distant traffic on Burns Bay Road: 40-45 dBA, Car on Penrose Street: 61 dBA, Loud cars on Pittwater Road to the west: audible, Bats: up to 52 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
3/09/2025	22:54	40	43	61

Map of Noise Measurement Location

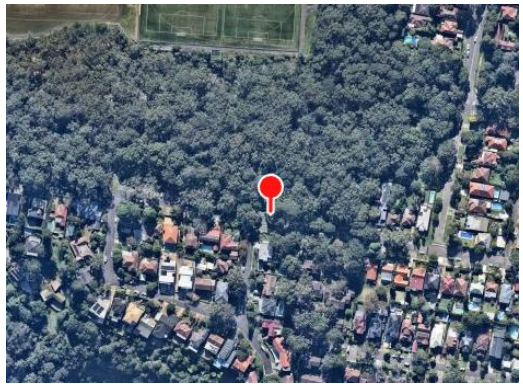


Photo of Noise Measurement Location

Noise Measurement Location	A04
Noise Measurement Address	**NCA02 – Behind 64 Wood Street (adjacent to southern entrance of Community Nursery), Lane Cove West**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3004636

Attended noise measurement location is behind 64 Wood Street in NCA02, adjacent to the southern entrance of the Community Nursery, and looks towards the eastern boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise and distant road traffic noise from Epping Road, with some industrial noise. Birds, aircraft, and local traffic on Lloyd Rees Drive and Wood Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Insects: 44-48 dBA, Industrial fan noise: audible (intermittent), Distant traffic on Epping Road: audible, Cars on Wood Street and Banksia Close: audible, Cars on Lloyd Rees Drive: up to 61 dBA, Aircraft: 63-74 dBA, Birds: up to 65 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
24/11/2025	12:32	47	56	74

Map of Noise Measurement Location

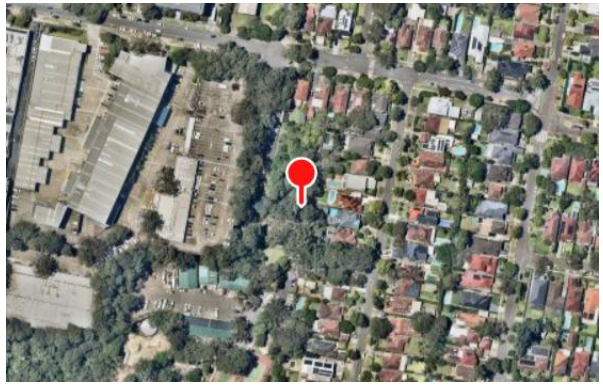


Photo of Noise Measurement Location

Noise Measurement Location	A05
Noise Measurement Address	**NCA02 – South of 62 Wood Street (adjacent to Lloyd Rees Drive), Lane Cove West**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3004636

Attended noise measurement location is to the south of 62 Wood Street in NCA02, adjacent to Lloyd Rees Drive, and looks towards the eastern boundary of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise and distant road traffic noise from Burns Bay Road. Birds, aircraft, and local traffic on Lloyd Rees Drive and Wood Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Insects: 44-47 dBA, Distant traffic on Burns Bay Road: audible, Cars on Wood Street: up to 55 dBA, Cars on Lloyd Rees Drive: 54-67 dBA, Aircraft: 62-68 dBA, Birds: up to 59 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
24/11/2025	12:54	46	53	68

Map of Noise Measurement Location

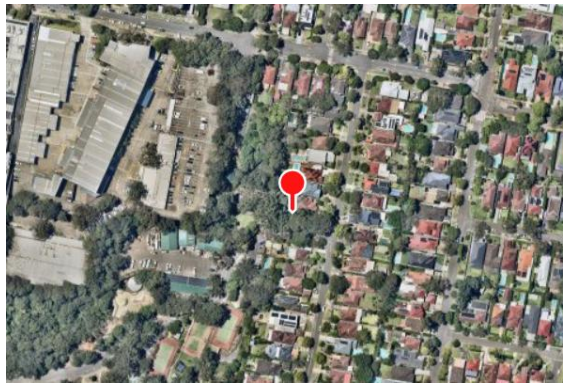


Photo of Noise Measurement Location

Noise Measurement Location	A06
Noise Measurement Address	**NCA02 – In front of 8 Banksia Close (adjacent to Banksia Close), Lane Cove West**

Sound Level Meter Device Type: Brüel & Kjær Type 2270, Sound Level Meter Serial No: 3004636

Attended noise measurement location is in front of 8 Banksia Close in NCA02, adjacent to Banksia, and looks towards the northeastern corner of the project site.

Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise and distant road traffic noise from Epping Road, with some industrial noise. Birds, aircraft, and local traffic on Banksia Close and Wood Street also contribute to the L_{Aeq} at this location.

Measured Typical L_{Amax}: Insects: 44-48 dBA, Cicadas: up to 55 dBA (intermittent), Industrial fan noise: 44-47 dBA (intermittent), Distant traffic on Epping Road: audible, Cars on Wood Street and Banksia Close: 54-71 dBA, Truck on Mars Road: 70 dBA, Aircraft: 69-78 dBA, Birds: up to 62 dBA.

Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
24/11/2025	13:40	47	59	78

Map of Noise Measurement Location

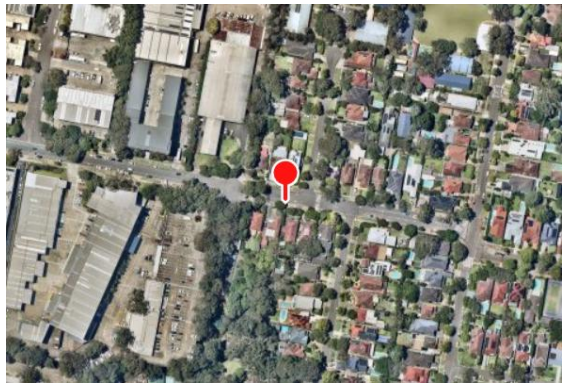


Photo of Noise Measurement Location

Appendix C Construction Noise Sources

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

Equipment	Total SWL	Chainsaw[1]	Chipper	Concrete Pump	Concrete Truck	Concrete Vibrator	Crane - Mobile (100t)	Dozer	Elevated Working Platform	Excavator (20t)	Excavator (30t) + Hydraulic Hammer[1]	Front End Loader	Hand Tools	Roller - Vibratory[1]	Truck - Dump	Truck - Flatbed	Water Truck
Sound Power Level[2]		119	120	109	109	113	113	116	97	105	127	112	104	114	110	103	107
Estimated on-time in any 15 minutes		5	15	10	15	5	15	10	15	10	5	10	15	15	10	10	10
Scenario																	
W.01 Vegetation clearing	122	X	X							X		X			X		X
W.02 Demolition	123							X			X	X			X		X
W.03 Earthworks	119							X		X		X		X	X		X
W.04 Excavation of hard rock	126							X		X	X	X			X		X
W.05 Construction of pads & hardstands	113			X	X	X											
W.06 Construction of structures & equipment install	114						X		X				X			X	

Note 1: Equipment classed as 'annoying' in the ICNG and requires a 5 dB correction.

Note 2: Sound power level data is taken from AS 2436, the DEFRA Noise Database and TfNSW *Construction and Vibration Guideline*.

Appendix D Operational Noise Contours

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

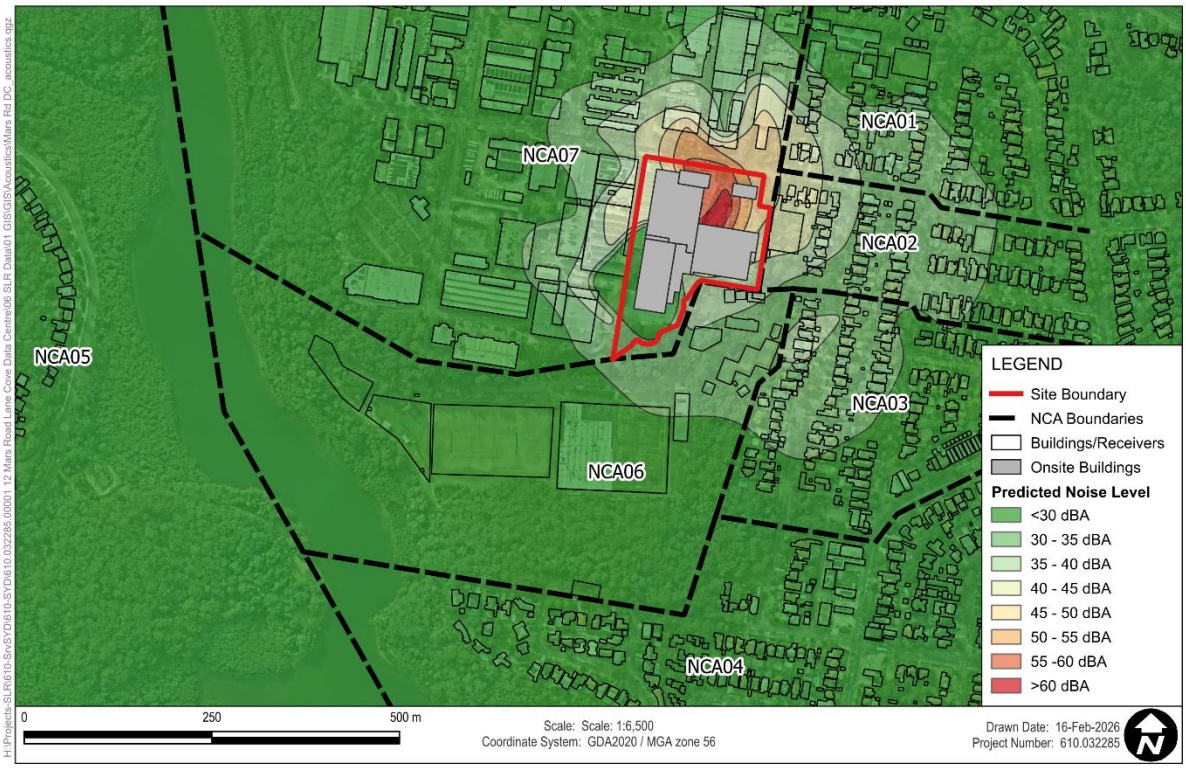
SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

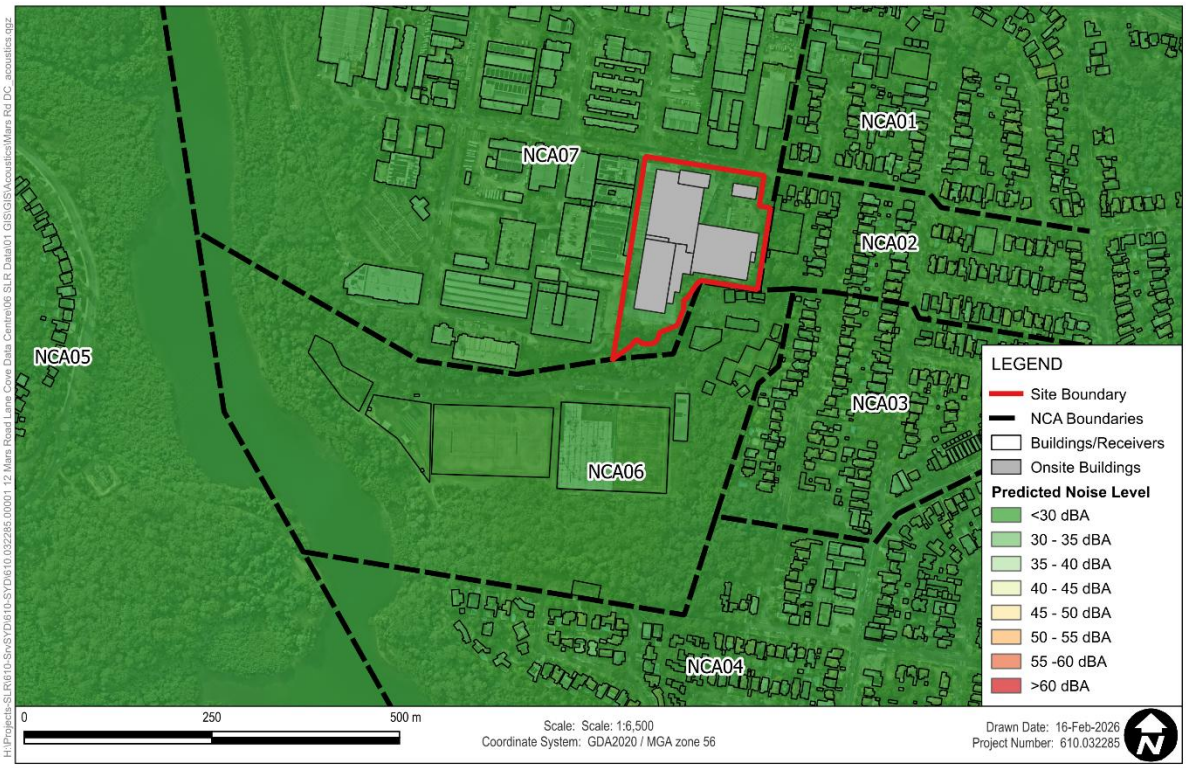
16 February 2026

Predicted Operational Noise Contours – OP.01: Day – 1.5m Height



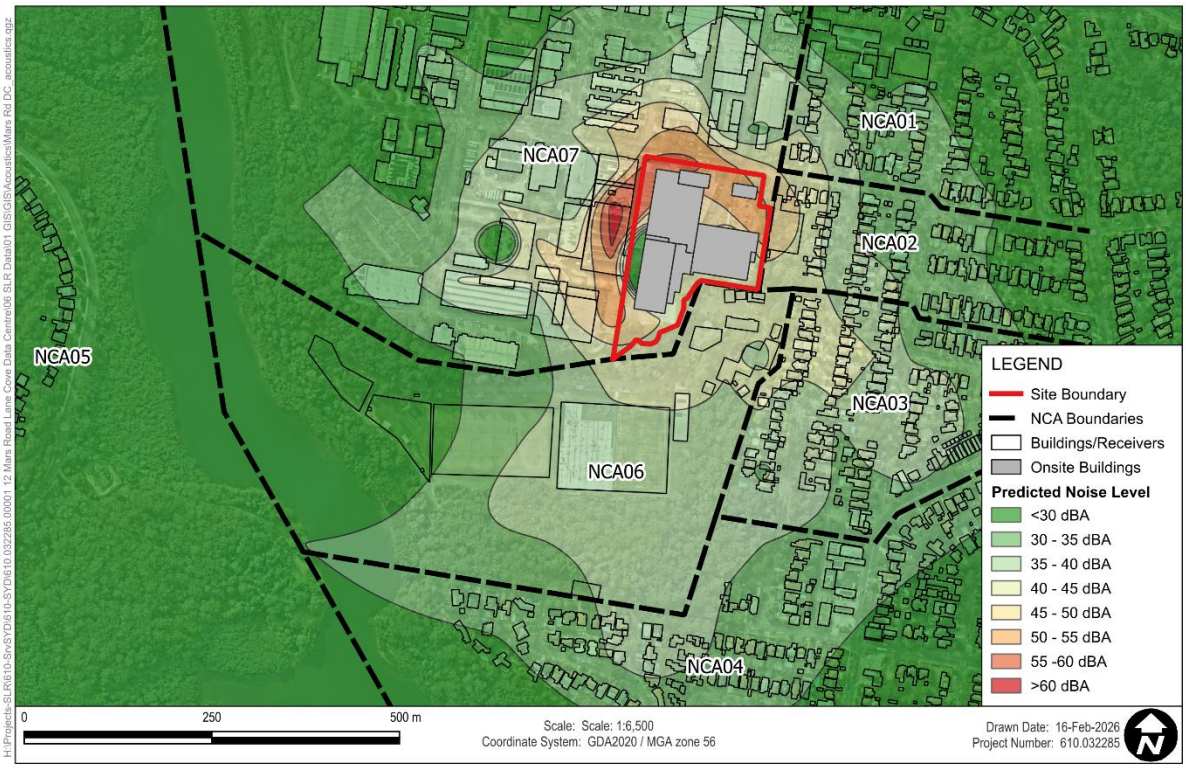
Note 1: Noise contours calculated at 1.5 m above ground level.

Predicted Operational Noise Contours – OP.01: Night – 1.5m Height



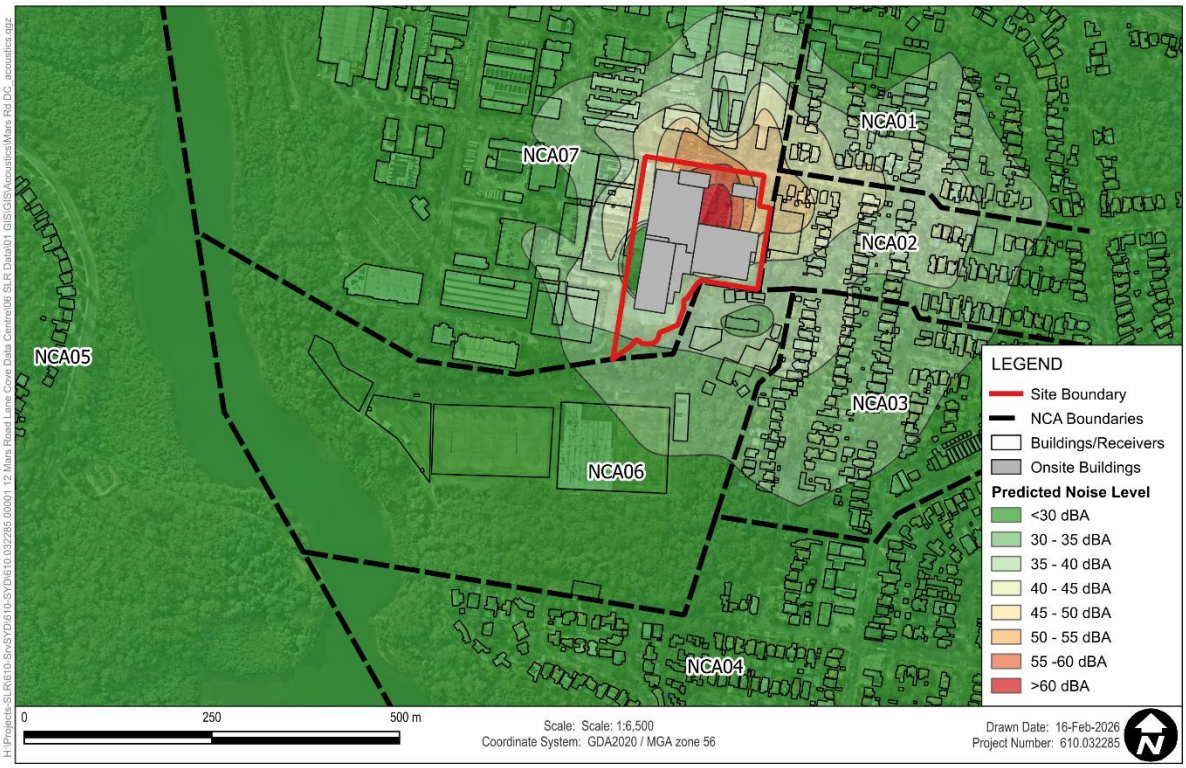
Note 1: Noise contours calculated at 1.5 m above ground level.

Predicted Operational Noise Contours – OP.02: Day + Generator Testing – 1.5m Height



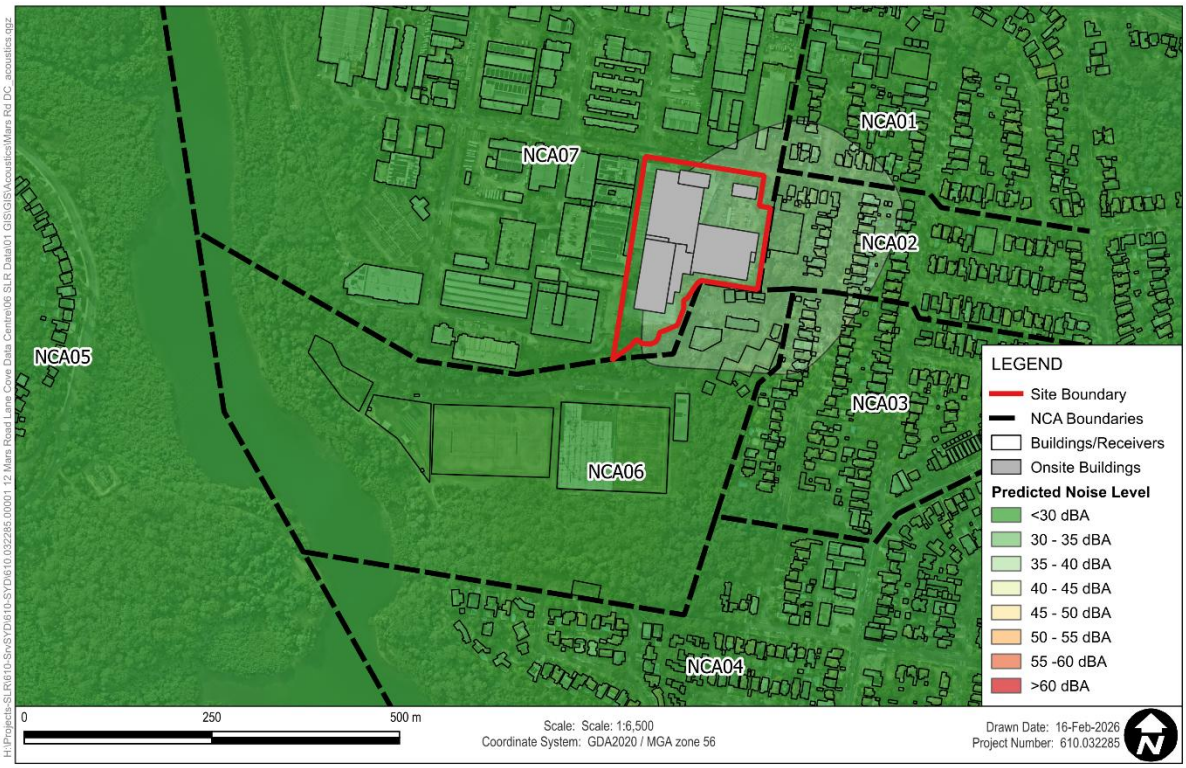
Note 1: Noise contours calculated at 1.5 m above ground level.

Predicted Operational Noise Contours – OP.01: Day – 4.5m Height



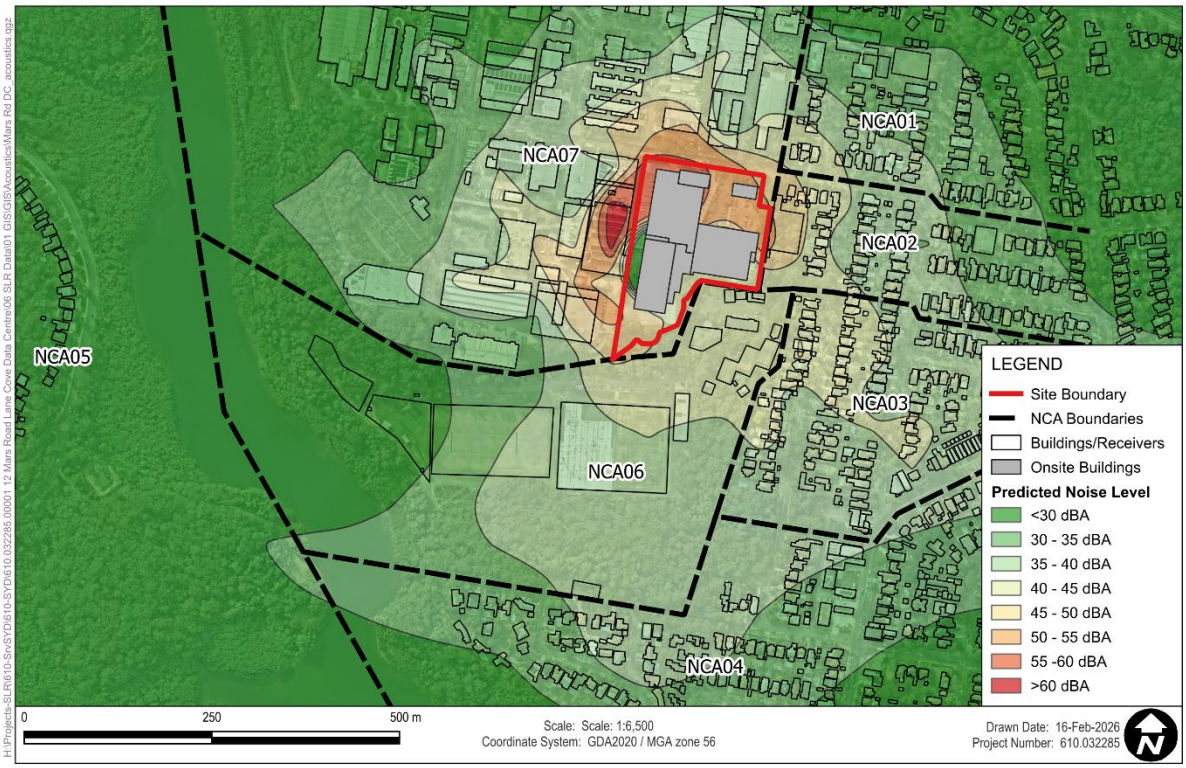
Note 1: Noise contours calculated at 4.5 m above ground level.

Predicted Operational Noise Contours – OP.01: Night – 4.5m Height



Note 1: Noise contours calculated at 4.5 m above ground level.

Predicted Operational Noise Contours – OP.02: Day + Generator Testing – 4.5m Height



Note 1: Noise contours calculated at 4.5 m above ground level.

Appendix E CNVG Mitigation Measures

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

CNVG Standard Mitigation and Management Measures

Action Required	Applies To	Details
Management measures		
Implementation of any project specific mitigation measures required.	Airborne noise	Implementation of any project specific mitigation measures required.
Implement community consultation or notification measures.	Airborne noise Ground-borne noise & vibration	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night-time period, any operational noise benefits from the works (where applicable) and contact telephone number. Notification should be a minimum of 7 calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required. Please contact Transport Communication and Stakeholder Engagement for guidance. Website (If required) Contact telephone number for community Email distribution list (if required) Community drop-in session (if required by approval conditions).
Site inductions	Airborne noise Ground-borne noise & vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
Verification	Airborne noise Ground-borne noise & vibration	Where specified under Appendix C of the CNVG a noise verification program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.

Action Required	Applies To	Details
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage
Source controls		
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period during normal hours and out-of-hours work	Ground-borne noise & vibration Airborne noise	See Appendix C of the CNVG for more details on the following respite measures: • Respite Offers (RO) • Respite Period 1 (R1) • Respite Period 2 (R2) • Duration Respite (DR)
Equipment selection.	Airborne noise Ground-borne noise & vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits. Ensure plant including the silencer is well maintained.
Plant noise levels.	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix H of the CNVG. Implement a noise monitoring audit program to ensure equipment remains within the more stringent of the manufacturers specifications or Appendix H of the CNVG.
Rental plant and equipment.	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 2 of the CNVG.
Use and siting of plant.	Airborne-noise	The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers. Only have necessary equipment on site.

Action Required	Applies To	Details
Plan worksites and activities to minimise noise and vibration.	Airborne noise Ground-borne vibration	Locate compounds away from sensitive receivers and discourage access from local roads. Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible. Very noise activities should be scheduled for normal working hours. If the work can not be undertaken during the day, it should be completed before 11:00pm. Where practicable, work should be scheduled to avoid major student examination periods when students are studying for examinations such as before or during Higher School Certificate and at the end of higher education semesters. If programmed night work is postponed the work should be re-programmed and the approaches in this guideline apply again.
Reduced equipment power	Airborne noise Ground-borne vibration	Use only the necessary size and power.
Non-tonal and ambient sensitive reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction sites.	Airborne noise	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise these out of hours movements where possible.
Engine compression brakes	Construction vehicles	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Path controls		
Shield stationary noise sources such as pumps, compressors, fans etc.	Airborne noise	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.

Action Required	Applies To	Details
Shield sensitive receivers from noisy activities.	Airborne noise	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Receptor control		
Structural surveys and vibration monitoring	Ground-borne vibration	Pre-construction surveys of the structural integrity of vibration sensitive buildings may be warranted. At locations where there are high-risk receptors, vibration monitoring should be conducted during the activities causing vibration.
See Appendix C of the CNVG for additional measures	Airborne noise Ground-borne vibration	In some instances, additional mitigation measures may be required.

Appendix F NPfI Mitigation Measures

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

Best Management Practice (BMP)

Best management practice (BMP) is the application of particular operational procedures that minimise noise while retaining productive efficiency.

Where applied, these measures and practices are often documented in a noise management plan so that operational practices and undertakings are clearly understood and applied at all levels of an industrial operation. Application of BMP can include the following types of practice:

- Using the quietest plant that can do the job
- Scheduling the use of noisy equipment at the least-sensitive time of day
- Not operating, or reducing operations at night
- Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently
- Keeping equipment well-maintained and operating it in a proper and efficient manner
- Using ‘quiet’ practices when operating equipment, for example, positioning idling trucks in appropriate areas
- Running staff-education programs and regular tool box talks on the effects of noise and the use of quiet work practices.

For many industries there are a wide range of factors that can restrict the feasibility and reasonableness of applying BMP measures on a particular site. Work health and safety considerations must also be taken into account as well as any other regulatory and process requirements.

Appendix G Mechanical Plant Data Sheets

Project Mars Data Centre – 12 Mars Road, Lane Cove West NSW

SSD-82052708 Noise and Vibration Impact Assessment

Goodman Property Services (Aust) Pty Ltd

SLR Project No.: 610.032285.00003

16 February 2026

30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

Performance Information(2)		Mixte Cooling	Free Cooling
Mode			
Cooling Capacity (1)	kW	1777	2356
Cooling Efficiency (EER)(COP^R)(1)	kW/kW	3.983	48.08
Unit Power Input (1)	kW	446.2	49.01
Sound power level (LwA) (1)	dB(A)	100.0	94.5
Sound Pressure Level at 0.0m (LpA) (1)	dB(A)	80.0	74.5
Minimum Capacity (3)	kW	202.2	-
Maximum Capacity	kW	1801	-

(1) All performances are compliant with AHRI Standard 551/591 (SI). Sound Power level according to ISO9614-1.
(2) Performances are calculated in parallel configuration.
(3) Due to the minimum flow rate allowable a lower inlet water temperature might have to be specified to achieve this performance.

Operating Conditions			Mixte Cooling	Free Cooling
System element				
Water heat exchanger				
Fluid	Fluid Type (5)		**Fresh Water**	**Fresh Water**
	Fouling Factor(4)	(sqm-K)/kW	0.0176	0.0176
	Leaving Temperature	°C	20.00	20.00
	Entering Temperature	°C	30.00	30.00
	Fluid Flow	l/s	42.70	56.62
	Total pressure drop	kPa	69.1	114
Air heat exchanger				
Air	Entering Air Temperature	°C	28.0	-5.0
Altitude		m	0	
Distance from coast			> 3km	

(4) The impact of fouling factor is calculated as per AHRI 550/590-551/591 method
(5) 305A option with Fresh Water selected : water could freeze in free cooling coils in low temperature environments and can generate corrosion. Please consider using an antifreeze solution and corrosion inhibitor compatible with aluminum.

Unit Configuration	
15	Low noise level
23A	Enclosure panels
92	Isolation valves set
149	Bacnet over IP
232	Capacity booster (Dedicated to Process Applications)
256	Insulation of the evap. in/out ref.lines
263AC	SuperEnviro-Shield on Total FreeCooling coils
263	Super Enviro-Shield anti-corrosion protection
284	230V electrical plug
295+	Ultra Fast Capacity Recovery
305A	Total hydraulic Free-Cooling
331	Plastic tarp
346C	Configurable AHF 450A

Non contractual picture

Seasonal Efficiency		
IPLV.SI	kW/kW	4.738
NPLV.SI	kW/kW	13.60

Unit Information				
Manufacturing Source			Montluel	
Refrigerant type			R1234ZE	
Refrigerant Weight		kg	211	
Tonnes CO2 Equivalent		Tonnes	0.29	
Number of Refrigerant Circuit			2	
Number of Compressor			2	
Number of Fan			20	
Fan Power Input		kW	38.03	
Total Fan Air Flow		m3/h	289378.9	
Operating	Weight	kg	13174	
	Length	mm	13393	
	Width	mm	2252	
	Height	mm	2325	
Shipping(6)	Module		1	2
	Weight	kg	6837	5215
	Length	mm	6785	6319
	Width	mm	2252	2252
	Height	mm	2325	2325

(6) Delivered separately in several units.

Electric Information		
Unit Voltage	V-Ph-Hz	400-3-50
Standby Power	W	613
Power Factor		0.92
Electrical Circuit		1
Maximum Current	A	863
Startup Current	A	<RLA
Current at AHRI Conditions	A	524

Documentation	
	PSD
	IOM
	Technical drawing
	Revit file

30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

Cooling Loadline											
Unit Performances											
Percent of required capacity	%	*Max*	*100.0*	*90.0*	*80.0*	*70.0*	*60.0*	*50.0*	*40.0*	*30.0*	*20.0*	*10.0*
Cooling Capacity	kW	*1801*	*1777*	*1599*	*1422*	*1244*	*1066*	*888.5*	*710.8*	*533.1*	*355.4*	*177.7*
Estimated Machine Load Percent	%	*100.0*	*100*	*89*	*72*	*58*	*47*	*37*	*28*	*21*	*14*	*7*
Unit Power Input	kW	*458.6*	*446.2*	*398.2*	*322.1*	*259.8*	*209.1*	*164.5*	*126.8*	*92.02*	*60.88*	*29.32*
Cooling Efficiency (EER)	kW/kW	*3.928*	*3.983*	*4.016*	*4.413*	*4.788*	*5.098*	*5.402*	*5.607*	*5.793*	*5.838*	*6.061*
Sound power level (LwA)	dB(A)	*101.0*	*100.0*	*99.0*	*99.0*	*101.5*	*98.0*	*96.5*	*94.5*	*90.0*	*88.0*	*87.0*
TDHI Option 346C	%	*5.0*	*5.0*	*5.0*	*5.0*	*5.0*	*5.0*	*5.0*	*5.7*	*7.8*	*9.9*	*N/A*
Evaporator Data											
Fluid Entering Temperature	°C	*30.00*	*30.00*	*29.00*	*27.99*	*26.99*	*25.99*	*24.99*	*23.99*	*22.99*	*22.08*	*21.26*
Fluid Leaving Temperature	°C	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*	*20.00*
Fluid Flow Rate	l/s	*43.28*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*	*42.70*
Total pressure drop	kPa	*70.7*	*69.1*	*38.5*	*38.6*	*38.8*	*38.9*	*39.1*	*39.2*	*39.4*	*39.5*	*80.1*
Condenser Data											
Entering dry bulb Air Temperature	°C	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*	*28.0*

Values given are interpolated and are not directly measurable under laboratory conditions
Bold values are performances for the maximum capacity.

30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

Acoustic information in cooling mode										
Octave Band Center Frequency	**Hz**	**63**	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**	**Total**
Full Load										
Sound Power at unit acoustic center	dB	92.0	94.5	95.0	99.0	96.5	91.0	92.0	87.5	103.5
A-Weighted Sound Power	dBA	66.0	78.0	86.5	96.0	96.5	92.5	93.0	86.5	101.0
Sound pressure at specified distance in a free field	dB	72.0	74.5	75.0	79.0	76.5	71.0	72.0	67.5	83.5
A-Weighted Sound Pressure Level	dBA	46.0	58.0	66.5	76.0	76.5	72.5	73.0	66.5	81.0
Target Load										
Sound Power at unit acoustic center	dB	89.5	92.5	94.0	99.0	94.0	91.0	90.0	86.0	102.5
A-Weighted Sound Power	dBA	63.5	76.5	85.0	96.0	94.0	92.0	91.0	85.0	100.0
Sound pressure at specified distance in a free field	dB	69.5	72.5	74.0	79.0	74.0	71.0	70.0	66.0	82.5
A-Weighted Sound Pressure Level	dBA	43.5	56.5	65.0	76.0	74.0	72.0	71.0	65.0	80.0
Percent of target load 90.0%										
Sound Power at unit acoustic center	dB	92.0	92.0	93.5	97.5	94.0	89.0	89.5	86.0	102.0
A-Weighted Sound Power	dBA	65.5	76.0	85.0	94.0	94.0	90.0	90.5	84.5	99.0
Sound pressure at specified distance in a free field	dB	72.0	72.0	73.5	77.5	74.0	69.0	69.5	66.0	82.0
A-Weighted Sound Pressure Level	dBA	45.5	56.0	65.0	74.0	74.0	70.0	70.5	64.5	79.0
Percent of target load 80.0%										
Sound Power at unit acoustic center	dB	91.0	92.5	93.5	98.0	94.0	89.0	87.0	87.0	102.0
A-Weighted Sound Power	dBA	64.5	76.5	85.0	95.0	94.0	90.5	88.0	85.5	99.0
Sound pressure at specified distance in a free field	dB	71.0	72.5	73.5	78.0	74.0	69.0	67.0	67.0	82.0
A-Weighted Sound Pressure Level	dBA	44.5	56.5	65.0	75.0	74.0	70.5	68.0	65.5	79.0
Percent of target load 70.0%										
Sound Power at unit acoustic center	dB	90.5	92.5	92.5	102.5	95.0	88.5	87.5	83.0	104.5
A-Weighted Sound Power	dBA	64.0	76.0	84.0	99.5	95.0	90.0	88.5	82.0	101.5
Sound pressure at specified distance in a free field	dB	70.5	72.5	72.5	82.5	75.0	68.5	67.5	63.0	84.5
A-Weighted Sound Pressure Level	dBA	44.0	56.0	64.0	79.5	75.0	70.0	68.5	62.0	81.5
Percent of target load 60.0%										
Sound Power at unit acoustic center	dB	89.5	91.5	91.5	93.0	95.0	88.5	87.0	83.5	100.0
A-Weighted Sound Power	dBA	63.0	75.5	83.0	89.5	95.0	89.5	88.0	82.0	98.0
Sound pressure at specified distance in a free field	dB	69.5	71.5	71.5	73.0	75.0	68.5	67.0	63.5	80.0
A-Weighted Sound Pressure Level	dBA	43.0	55.5	63.0	69.5	75.0	69.5	68.0	62.0	77.5
Percent of target load 50.0%										
Sound Power at unit acoustic center	dB	89.0	92.0	91.0	96.5	91.0	86.0	83.0	75.5	100.0
A-Weighted Sound Power	dBA	62.5	76.0	82.5	93.0	91.0	87.5	84.0	74.5	96.5
Sound pressure at specified distance in a free field	dB	69.0	72.0	71.0	76.5	71.0	66.0	63.0	55.5	80.0
A-Weighted Sound Pressure Level	dBA	42.5	56.0	62.5	73.0	71.0	67.5	64.0	54.5	76.5
Percent of target load 40.0%										
Sound Power at unit acoustic center	dB	88.0	90.0	91.0	92.5	91.0	84.0	80.5	80.0	98.0
A-Weighted Sound Power	dBA	62.0	74.0	82.5	89.0	91.0	85.5	81.5	79.0	94.5
Sound pressure at specified distance in a free field	dB	68.0	70.0	71.0	72.5	71.0	64.0	60.5	60.0	78.0
A-Weighted Sound Pressure Level	dBA	42.0	54.0	62.5	69.0	71.0	65.5	61.5	59.0	74.5
Percent of target load 30.0%										
Sound Power at unit acoustic center	dB	88.0	86.0	89.0	88.5	85.0	79.5	77.5	76.5	95.0
A-Weighted Sound Power	dBA	61.5	70.0	80.0	85.5	85.0	80.5	78.5	75.5	90.0
Sound pressure at specified distance in a free field	dB	68.0	66.0	69.0	68.5	65.0	59.5	57.5	56.5	75.0
A-Weighted Sound Pressure Level	dBA	41.5	50.0	60.0	65.5	65.0	60.5	58.5	55.5	70.0
Percent of target load 20.0%										
Sound Power at unit acoustic center	dB	83.5	85.0	87.0	85.5	84.0	76.0	76.0	76.0	92.5
A-Weighted Sound Power	dBA	57.0	69.0	78.5	82.5	84.0	77.5	77.0	75.0	88.0
Sound pressure at specified distance in a free field	dB	63.5	65.0	67.0	65.5	64.0	56.0	56.0	56.0	72.5
A-Weighted Sound Pressure Level	dBA	37.0	49.0	58.5	62.5	64.0	57.5	57.0	55.0	68.0
Percent of target load 10.0%										
Sound Power at unit acoustic center	dB	82.5	85.5	86.0	85.5	83.0	74.5	73.0	75.5	92.0
A-Weighted Sound Power	dBA	56.5	69.5	77.0	82.5	83.0	76.0	74.0	74.5	87.0
Sound pressure at specified distance in a free field	dB	62.5	65.5	66.0	65.5	63.0	54.5	53.0	55.5	72.0
A-Weighted Sound Pressure Level	dBA	36.5	49.5	57.0	62.5	63.0	56.0	54.0	54.5	67.0

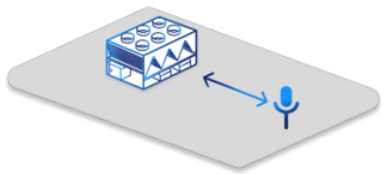
Tolerance on Global Level +/- 4dB(A)

30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

Acoustic Notes

d - Horizontal Distance From Chiller to Receiver = 0.0 m
Estimated Sound Power levels - dB re: 1 picowatt
Estimated Sound Pressure levels - dB re: 20 micropascal
Estimated sound levels given above are assumed to originate at the unit acoustic center.



Sound Power level Lw in accordance with ISO 9614. Sound levels are calculated at selection condition in cooling mode considering compressor, fan and pump stage or speed if present. The sound levels by octave band are guideline values only and not contractually binding.

Estimated average sound pressure Lp at a given distance on a reflective surface in a free field environment (directivity 2).

30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

DataCenter Table

			Circuit A	Circuit B
Power Consumption	Compressor Power	kW	282.7	116.8
	Fan Power Input	kW	18.59	19.43
Air Condenser	Fan Frequency	Hz	50	50
	Total air flow*	m3/s	43.3	43.1
	Outlet air temperature	°C	57.76	44.18

*Total air flow at unit outlet air temperature.

THDI Option Table

External Air Temperature	°C	28.00
Evap Leaving Temp	°C	20.00
Evap. Entering Temp	°C	30.00
Cooling Capacity	kW	1777
Anti Harmonic Filters - Option 346		
TDHI without filter*	%	39.4
TDHI Option 346A*	%	17.5
TDHI Option 346B*	%	5.0
TDHI Option 346C*	**%**	**5.0**

*THDI : Total Harmonic Distortion (current). Values are estimated and depend on local installation characteristics. 'N/A' value is returned when value can not be measured because of the very low input current.(RSCE:50.0)

	Dry Bulb Temp(°C)	Relative Humidity(%)	Anticipated IT Load (MW)
Evening Condition	33.2	29	40
Night Condition	29.3	34	40

Weather Station : Sydney Observatory

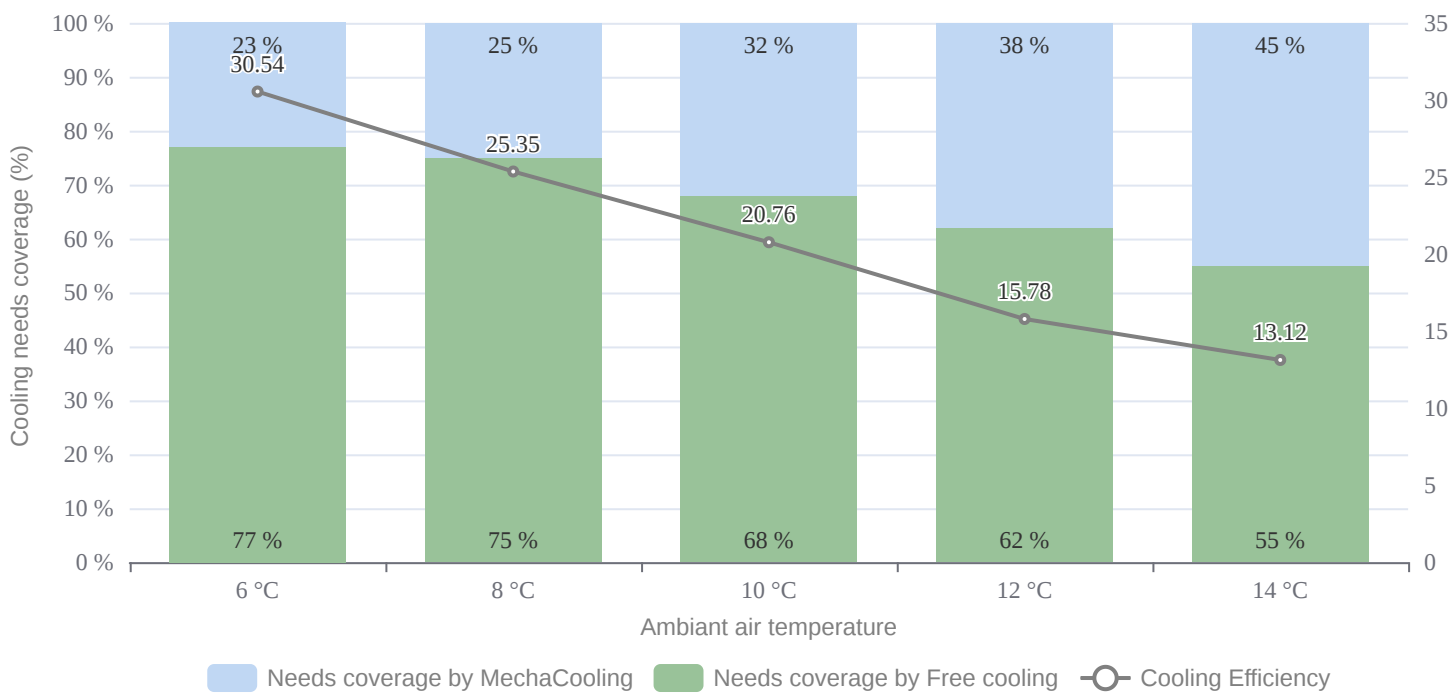
30XF-Z 1500

Variable Speed Air Cooled Chiller for Data Centers

Free Cooling Load Line						
Entering dry bulb Air Temperature	°C	6.00	8.00	10.00	12.00	14.00
Application cooling needs	kW	1777	1777	1777	1777	1777
Freecooling Performances						
FreeCooling Capacity	kW	1376.6	1325.0	1214.8	1099.4	981.5
Needs coverage	%	77	75	68	62	55
Fluid Entering Temperature	C	30.00	30.00	30.00	30.00	30.00
Fluid Leaving Coil Temperature	C	22.25	22.54	23.16	23.81	24.47
Mechacooling performances						
MechaCooling Capacity	kW	400.5	452.0	562.2	677.6	795.5
Fluid entering exchanger temperature	C	22.25	22.54	23.16	23.81	24.47
Fluid Leaving Temperature	C	20.00	20.00	20.00	20.00	20.00
Unit Performances						
Cooling Capacity	kW	1777	1777	1777	1777	1777
Unit Power Input	kW	58.18	70.10	85.62	112.6	135.4
Cooling Efficiency (EER)	kW/kW	30.54	25.35	20.76	15.78	13.12
Fluid Flow Rate	l/s	42.70	42.70	42.70	42.70	42.70
Total pressure drop	kPa	69.6	69.5	69.5	69.5	69.4

Values given are interpolated and are not directly measurable under laboratory conditions

Unit performance



Condition	Temperature, °C	Lp	Sound Power Unit	80% Loading	
				Without Treatment	With Treatment
Day Time	35.4	Lw Chiller Sound Power	dB	107	81.5
			dB (A)	104.5	70
		Lp Horizontal Distance	dB	84.5	58.5
			dB (A)	81.5	47
	20.9	Lw Chiller Sound Power	dB	101.5	81
			dB (A)	98.5	66
		Lp Horizontal Distance	dB	78.5	58
			dB (A)	75.5	43.5
Evening Time	33.2	Lw Chiller Sound Power	dB	107	81.5
			dB (A)	104.5	69
		Lp Horizontal Distance	dB	84	58.5
			dB (A)	81.5	46
	20	Lw Chiller Sound Power	dB	102	81
			dB (A)	99.5	66
		Lp Horizontal Distance	dB	79.5	58
			dB (A)	76.5	43
Night Time	29.3	Lw Chiller Sound Power	dB	107.5	81
			dB (A)	106.5	68.5
		Lp Horizontal Distance	dB	84.5	58
			dB (A)	83.5	45.5
	18.4	Lw Chiller Sound Power	dB	101	81
			dB (A)	98	66
		Lp Horizontal Distance	dB	78	58
			dB (A)	75.5	43

Acoustic Package: AAL91033

Baltimore Aircoil Company

Cooling Tower Selection Report

Version: 8.11.21 ANZ
Product data correct as of: May 12, 2025

Project Name: Project Mars
Selection Name: S3E-1222-10P ENDURA/H-2
Project State/Province: NSW
Project Country/Region: Australia
Date: July 13, 2025

Model Information

Product Line: Series 3000 (2021 WQF)
Model: S3E-1222-10P ENDURA/H
Number of Units: 2

Intake Option: None
Internal Option: None
Discharge Option: None

This model includes the ENDURADRIVE® Fan System.
Fan Type: Whisper Quiet Fan (2021)
Fan Motor: (1) 29.84 = 29.84 kW/Unit
Total Standard Fan Power: 38.2% of Full Speed, 1.66 BkW/Unit

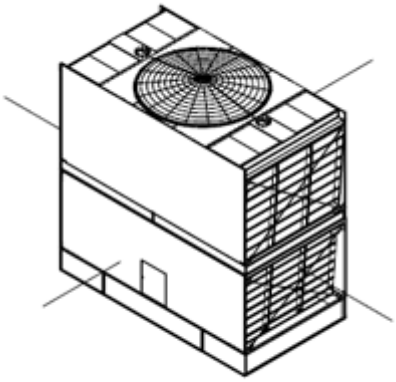
Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	56	45
2	55	47
3	50	41
4	47	36
5	46	37
6	43	40
7	39	31
8	33	20
A-wgtd	**51**	**44**

Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	56	47
2	57	45
3	49	40
4	47	33
5	48	39
6	39	34
7	36	26
8	47	31
A-wgtd	**52**	**42**



End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	47	48
2	49	40
3	41	32
4	39	25
5	38	27
6	34	24
7	32	20
8	27	12
A-wgtd	**43**	**32**

End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	47	48
2	49	40
3	41	32
4	39	25
5	38	27
6	34	24
7	32	20
8	27	12
A-wgtd	**43**	**32**

Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	56	47
2	57	45
3	49	40
4	47	33
5	48	39
6	39	34
7	36	26
8	47	31
A-wgtd	**52**	**42**

Total Sound Power (dB)

Octave Band	Center Frequency (Hertz)	Lw
1	63	79
2	125	79
3	250	73
4	500	68
5	1000	70
6	2000	71
7	4000	63
8	8000	57
A-wgtd		**76**

Note: The use of frequency inverters (variable frequency drives) can increase sound levels.
Extra Notes: Sound data provided by CTI ATC-128 sound test code revision 2019

Cooling Tower Evening Condition Report (Building B)

Baltimore Aircoil Company

Cooling Tower Selection Report

	Dry Bulb Temp(°C)	Relative Humidity(%)	Anticipated IT Load (MW)
Evening Condition	33.2	29	20

Weather Station : Sydney Observatory

Version: 8.11.21 ANZ
Product data correct as of: May 12, 2025

Project Name: Project Mars
Selection Name: S3E-1222-10P ENDURA/H-2
Project State/Province: NSW
Project Country/Region: Australia
Date: July 13, 2025

Model Information

Product Line: Series 3000 (2021 WQF)
Model: S3E-1222-10P ENDURA/H
Number of Units: 2

Intake Option: None
Internal Option: None
Discharge Option: None

This model includes the ENDURADRIVE® Fan System.
Fan Type: Whisper Quiet Fan (2021)
Fan Motor: (1) 29.84 = 29.84 kW/Unit
Total Standard Fan Power: 36.28% of Full Speed, 1.42 BkW/Unit

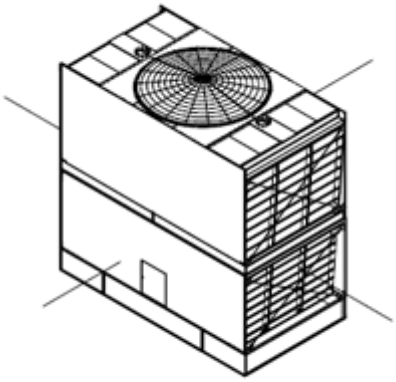
Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	55	43
2	54	46
3	49	40
4	46	35
5	45	36
6	42	39
7	38	30
8	32	19
A-wgtd	**50**	**43**

Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	54	46
2	56	43
3	48	39
4	46	32
5	48	38
6	39	33
7	36	25
8	47	31
A-wgtd	**52**	**41**



End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	46	47
2	48	39
3	40	31
4	38	24
5	37	26
6	33	23
7	31	20
8	26	12
A-wgtd	**42**	**31**

End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	46	47
2	48	39
3	40	31
4	38	24
5	37	26
6	33	23
7	31	20
8	26	12
A-wgtd	**42**	**31**

Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	54	46
2	56	43
3	48	39
4	46	32
5	48	38
6	39	33
7	36	25
8	47	31
A-wgtd	**52**	**41**

Total Sound Power (dB)

Octave Band	Center Frequency (Hertz)	Lw
1	63	77
2	125	78
3	250	72
4	500	67
5	1000	68
6	2000	70
7	4000	61
8	8000	57
A-wgtd		**75**

Note: The use of frequency inverters (variable frequency drives) can increase sound levels.
Extra Notes: Sound data provided by CTI ATC-128 sound test code revision 2019

Cooling Tower Night Condition Report (Building B)

Baltimore Aircoil Company

Cooling Tower Selection Report

	Dry Bulb Temp(°C)	Relative Humidity(%)	Anticipated IT Load (MW)
Night Condition	29.3	34	20

Weather Station : Sydney Observatory

Version: 8.11.21 ANZ
Product data correct as of: May 12, 2025

Project Name: Project Mars
Selection Name: S3E-1222-10P ENDURA/H-2
Project State/Province: NSW
Project Country/Region: Australia
Date: July 13, 2025

Model Information

Product Line: Series 3000 (2021 WQF)
Model: S3E-1222-10P ENDURA/H
Number of Units: 2

Intake Option: None
Internal Option: None
Discharge Option: None

This model includes the ENDURADRIVE® Fan System.
Fan Type: Whisper Quiet Fan (2021)
Fan Motor: (1) 29.84 = 29.84 kW/Unit
Total Standard Fan Power: 33.94% of Full Speed, 1.17 BkW/Unit

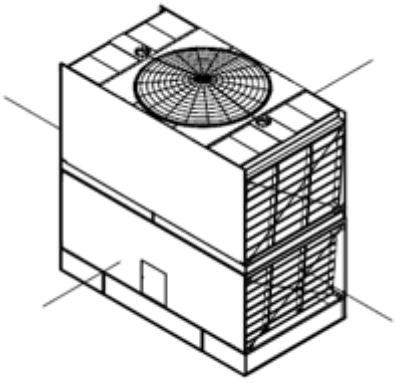
Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	53	42
2	52	44
3	47	38
4	44	33
5	43	34
6	40	38
7	36	28
8	30	17
A-wgtd	**48**	**41**

Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	52	44
2	54	42
3	46	38
4	44	30
5	46	37
6	38	32
7	36	25
8	47	30
A-wgtd	**51**	**40**



End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	44	46
2	46	37
3	38	29
4	36	22
5	36	24
6	32	21
7	30	19
8	25	11
A-wgtd	**41**	**30**

End
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	44	46
2	46	37
3	38	29
4	36	22
5	36	24
6	32	21
7	30	19
8	25	11
A-wgtd	**41**	**30**

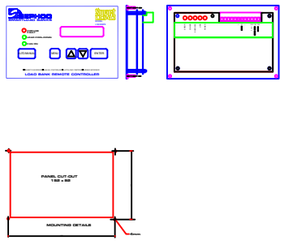
Air Inlet
Sound Pressure (dB)

Octave Band	Distance 1.5 m	Distance 15 m
1	52	44
2	54	42
3	46	38
4	44	30
5	46	37
6	38	32
7	36	25
8	47	30
A-wgtd	**51**	**40**

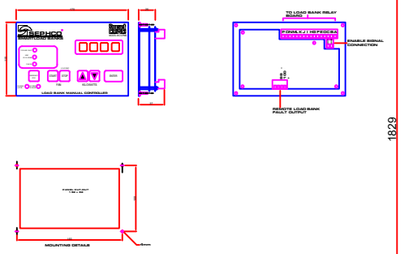
Total Sound Power (dB)

Octave Band	Center Frequency (Hertz)	Lw
1	63	76
2	125	76
3	250	70
4	500	65
5	1000	67
6	2000	69
7	4000	60
8	8000	56
A-wgtd		**73**

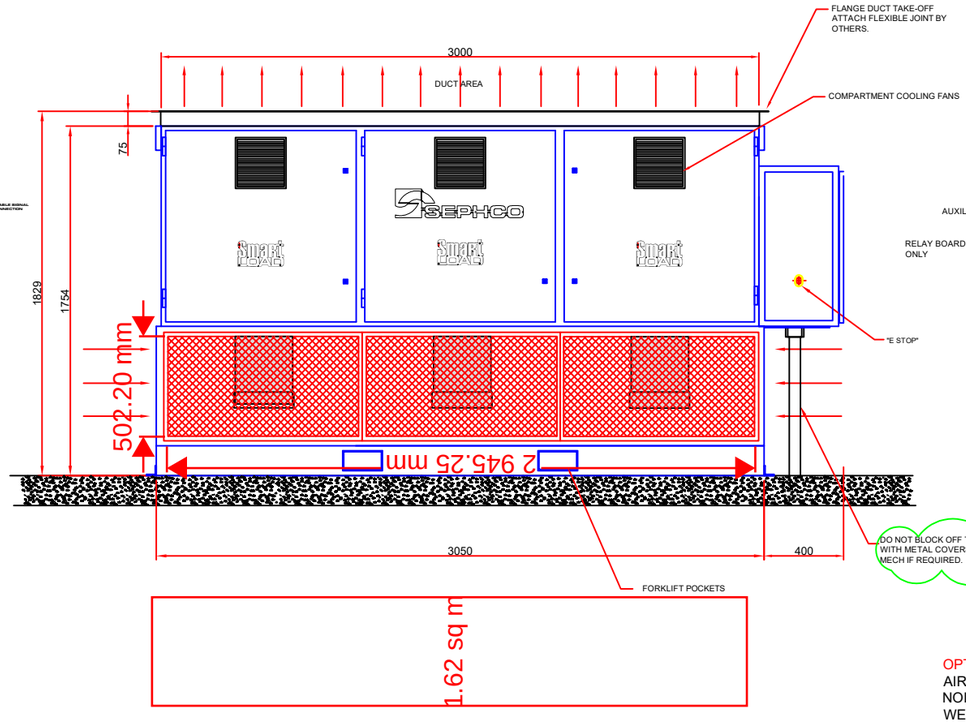
Note: The use of frequency inverters (variable frequency drives) can increase sound levels.
Extra Notes: Sound data provided by CTI ATC-128 sound test code revision 2019

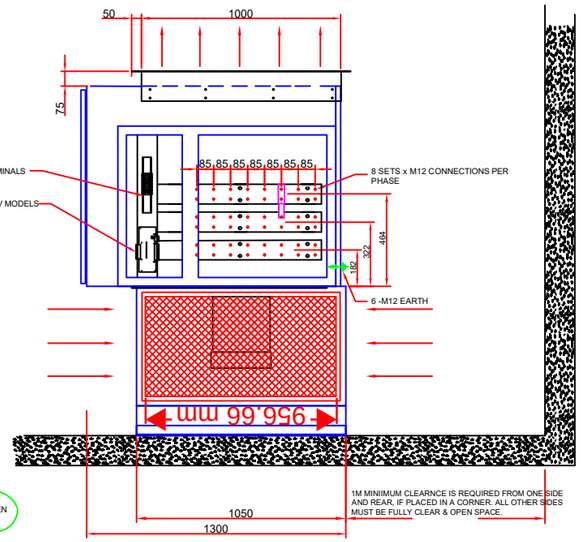


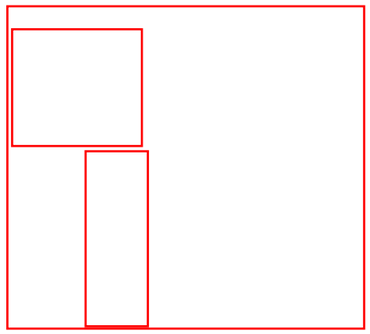
REMOTE MANUAL OVERRIDE CONTROL
PANEL TYPE LS800MPMB -
LS24V SERIES LOAD BANKS



REMOTE CONTROL PANEL TYPE MC12PMB







OPTION 1 STANDARD FREESTANDING OUTDOOR INSTALLATION :

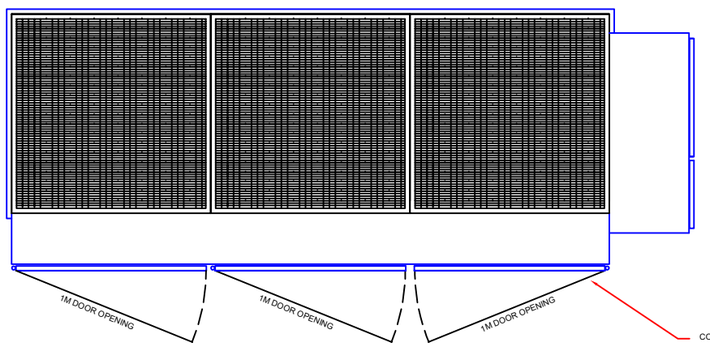
AIR DISCHARGE VOLUME		: 22.6 cuM/Sec (Nominal) @ 60Pa. 3 x 5.5kW 940RPM FAN MOTORS
NOISE LEVEL		: 93dBa @ 1M
WEIGHT	1500KW	: 1800KG
	1800KW	: 1900KG
	2000KW	: 1960KG

OPTION 2 CUSTOMISED WITH DUCT INSTALLATION :

AIR DISCHARGE VOLUME		: 28.9 cuM/Sec (Nominal) @ 150Pa. 3 x 7.5kW 1400RPM FAN MOTORS
NOISE LEVEL		: 99.2dBa @ 1M
WEIGHT	1500KW	: 1800KG
	1800KW	: 1900KG
	2000KW	: 1960KG

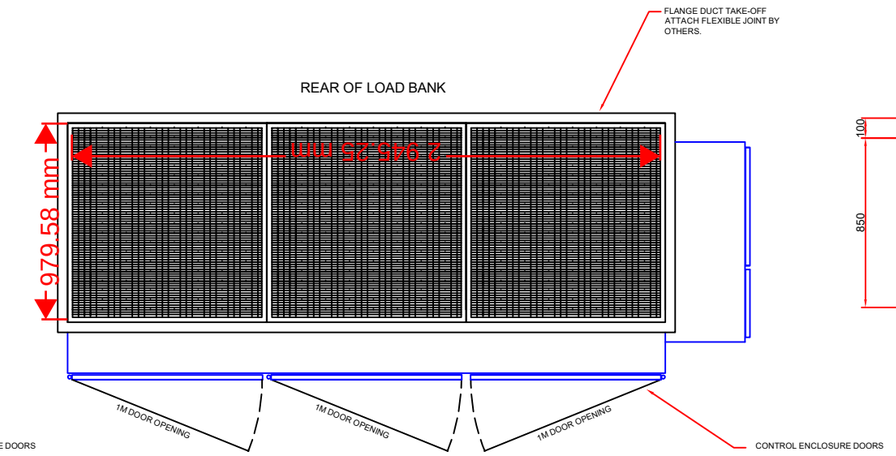
Use this data for noise modeling

REAR OF LOAD BANK

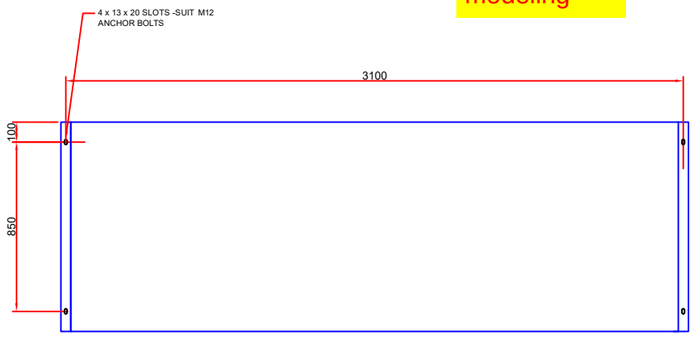


PLAN VIEW
FREE STANDING OUTDOORS TYPE

REAR OF LOAD BANK



PLAN VIEW
DUCT TAKE-OFF TYPE



BASE ANCHOR FOOTPRINT

PLAN VIEW

		DATE	REVISION	REV
CLIENT				
PROJECT				
JOB NO.				
REFERENCE				
DRAWINGS				

SEPHCO®
SEPHCO INDUSTRIES
sales@sephco.com www.sephco.com

INSTALLATION & GENERAL ARRANGEMENT SERIES BL18V & LS18V RESISTIVE LOAD BANKS

DRAWN	CHECKED	DRAWING NO.	REV
MW	LV	INS10337D	00
15.2.17			

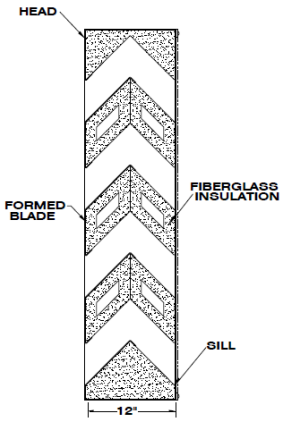
Model A12350
12" (304.8 mm) Sightproof Fixed Acoustical Louver

Material:

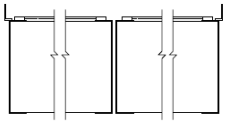
Material:	1100 Aluminum Alloy, Fiberglass Insulation protected by woven (self-extinguishing)100% Polyester sheeting
Nominal Thickness (heads, sills, jambs, & mullions):	0.081" (2.06 mm)
Nominal Blade Thickness:	0.081" (2.06 mm)
Furnished With:	Birdscreen: ½" (12.7mm) intercrimp aluminum mesh, 0.063" (1.60 mm) diameter wire removeable aluminum bird screen in an aluminum frame
Additional Options (at additional cost):	Insect screen (in lieu of bird screen), Continuous clip angles for attachment Sheet blank off, Insulated blank off Sill pans, Flange frames Integrated glazing frames

Test Summary:
For a 4 Foot by 4 Foot Unit.
Tested with mill finish and no screen

- Free area = 3.73 ft² (0.35 m²)
- Percent free area = 23.3%
- Free area velocity at the point of beginning water penetration (@ 0.01oz. / ft² of free area based on a 15 minute interval test) = 1096 FPM (5.57 m/s)
- Intake pressure drop at 1096 FPM free area velocity = 0.256 in H_2O (63.7 Pa)



SECTION VIEW



PLAN VIEW

Acoustical Data:

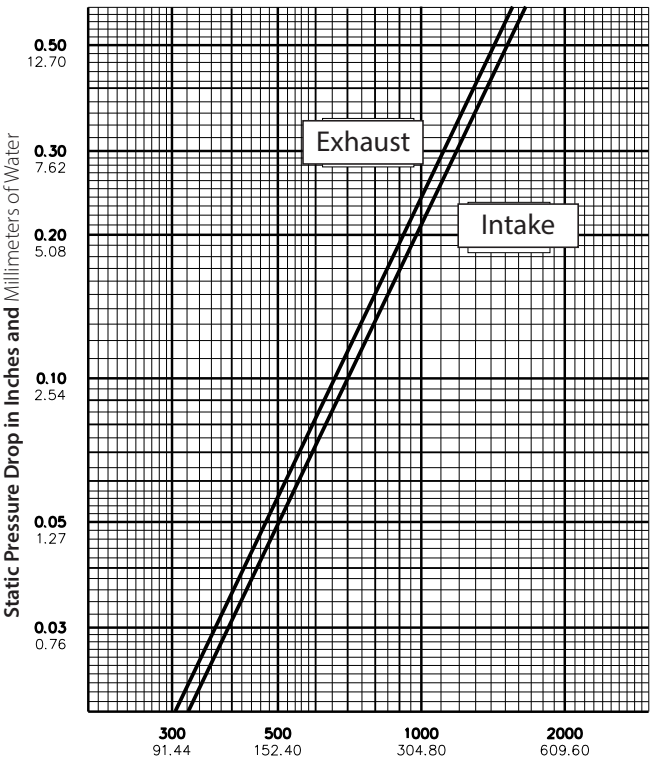
The louver manufacturer shall submit test data from an accredited acoustical laboratory in accordance with ASTM Standard E90-90. The minimum acceptable performance through all octave bands is as follows: STC = 19

Frequency (hz)	63	125	250	500	1000	2000	4000	8000
Transmission Loss	9	7	10	14	22	24	23	22
Noise Reduction	15	13	16	20	28	30	29	28

Model A12350
12" (304.8 mm) Sightproof Fixed Acoustical Louver

Water Penetration Statement

AMCA defines the point of beginning water penetration as the free area velocity at which the AMCA water test has yielded 0.01 or less ounces of water per square foot of louver free area during a 15-minute test period.



Air Velocity in Feet and Meters per Minute **Through Free Area**

Data corrected to standard air density.
48" x 48" (121.92cm x 121.92cm) louver tested to figure 5.5.

Free Area Table (Free area in **sq. feet** and sq. meters)

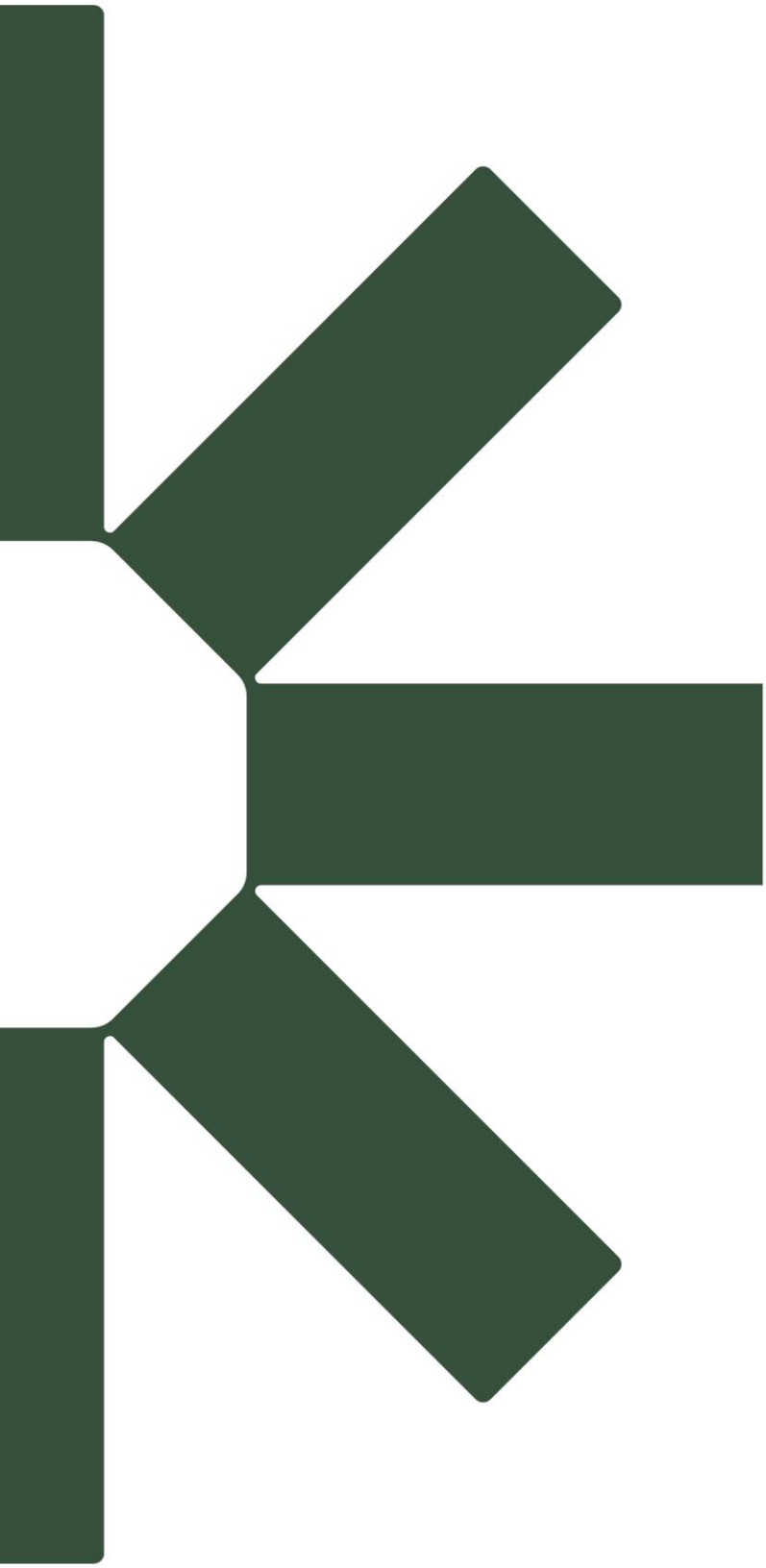
For additional sizes, please visit:
https://www.c-sgroup.com/architectural-louvers/louvers-airflow-tool

Width in Inches and Meters

Height in Inches and Meters

	12 0.30	18 0.46	24 0.61	30 0.76	36 0.91	42 1.07	48 1.22	54 1.37	60 1.52
18	**0.23**	**0.40**	**0.57**	**0.73**	**0.90**	**1.07**	**1.24**	**1.41**	**1.58**
0.46	0.02	0.04	0.05	0.07	0.08	0.10	0.12	0.13	0.15
24	**0.23**	**0.40**	**0.57**	**0.73**	**0.90**	**1.07**	**1.24**	**1.41**	**1.58**
0.61	0.02	0.04	0.05	0.07	0.08	0.10	0.12	0.13	0.15
30	**0.45**	**0.79**	**1.13**	**1.47**	**1.81**	**2.15**	**2.49**	**2.83**	**3.17**
0.76	0.04	0.07	0.10	0.14	0.17	0.20	0.23	0.26	0.29
36	**0.45**	**0.79**	**1.13**	**1.47**	**1.81**	**2.15**	**2.49**	**2.83**	**3.17**
0.91	0.04	0.07	0.10	0.14	0.17	0.20	0.23	0.26	0.29
42	**0.68**	**1.19**	**1.70**	**2.20**	**2.71**	**3.22**	**3.73**	**4.24**	**4.75**
1.07	0.06	0.11	0.16	0.20	0.25	0.30	0.35	0.39	0.44
48	**0.68**	**1.19**	**1.70**	**2.20**	**2.71**	**3.22**	**3.73**	**4.24**	**4.75**
1.22	0.06	0.11	0.16	0.20	0.25	0.30	0.35	0.39	0.44
54	**0.90**	**1.58**	**2.26**	**2.94**	**3.62**	**4.30**	**4.97**	**5.65**	**6.33**
1.37	0.08	0.15	0.21	0.27	0.34	0.40	0.46	0.52	0.59
60	**0.90**	**1.58**	**2.26**	**2.94**	**3.62**	**4.30**	**4.97**	**5.65**	**6.33**
1.52	0.08	0.15	0.21	0.27	0.34	0.40	0.46	0.52	0.59
66	**1.13**	**1.98**	**2.83**	**3.67**	**4.52**	**5.37**	**6.22**	**7.07**	**7.91**
1.68	0.10	0.18	0.26	0.34	0.42	0.50	0.58	0.66	0.73
72	**1.13**	**1.98**	**2.83**	**3.67**	**4.52**	**5.37**	**6.22**	**7.07**	**7.91**
1.83	0.10	0.18	0.26	0.34	0.42	0.50	0.58	0.66	0.73
78	**1.36**	**2.37**	**3.39**	**4.41**	**5.43**	**6.44**	**7.46**	**8.48**	**9.50**
1.98	0.13	0.22	0.31	0.41	0.50	0.60	0.69	0.79	0.88
84	**1.36**	**2.37**	**3.39**	**4.41**	**5.43**	**6.44**	**7.46**	**8.48**	**9.50**
2.13	0.13	0.22	0.31	0.41	0.50	0.60	0.69	0.79	0.88
90	**1.58**	**2.77**	**3.96**	**5.14**	**6.33**	**7.52**	**8.71**	**9.89**	**11.08**
2.29	0.15	0.26	0.37	0.48	0.59	0.70	0.81	0.92	1.03
96	**1.81**	**3.17**	**4.52**	**5.88**	**7.24**	**8.59**	**9.95**	**11.31**	**12.66**
2.44	0.17	0.29	0.42	0.55	0.67	0.80	0.92	1.05	1.18
102	**1.81**	**3.17**	**4.52**	**5.88**	**7.24**	**8.59**	**9.95**	**11.31**	**12.66**
2.59	0.17	0.29	0.42	0.55	0.67	0.80	0.92	1.05	1.18
108	**2.03**	**3.56**	**5.09**	**6.61**	**8.14**	**9.67**	**11.19**	**12.72**	**14.24**
2.74	0.19	0.33	0.47	0.61	0.76	0.90	1.04	1.18	1.32
114	**2.03**	**3.56**	**5.09**	**6.61**	**8.14**	**9.67**	**11.19**	**12.72**	**14.24**
2.90	0.19	0.33	0.47	0.61	0.76	0.90	1.04	1.18	1.32
120	**2.26**	**3.96**	**5.65**	**7.35**	**9.04**	**10.74**	**12.44**	**14.13**	**15.83**
3.05	0.21	0.37	0.52	0.68	0.84	1.00	1.16	1.31	1.47
126	**2.26**	**3.96**	**5.65**	**7.35**	**9.04**	**10.74**	**12.44**	**14.13**	**15.83**
3.20	0.21	0.37	0.52	0.68	0.84	1.00	1.16	1.31	1.47
132	**2.49**	**4.35**	**6.22**	**8.08**	**9.95**	**11.81**	**13.68**	**15.55**	**17.41**
3.35	0.23	0.40	0.58	0.75	0.92	1.10	1.27	1.44	1.62
138	**2.49**	**4.35**	**6.22**	**8.08**	**9.95**	**11.81**	**13.68**	**15.55**	**17.41**
3.51	0.23	0.40	0.58	0.75	0.92	1.10	1.27	1.44	1.62
144	**2.71**	**4.75**	**6.78**	**8.82**	**10.85**	**12.89**	**14.92**	**16.96**	**18.99**
3.66	0.25	0.44	0.63	0.82	1.01	1.20	1.39	1.58	1.76
150	**2.71**	**4.75**	**6.78**	**8.82**	**10.85**	**12.89**	**14.92**	**16.96**	**18.99**
3.81	0.25	0.44	0.63	0.82	1.01	1.20	1.39	1.58	1.76
156	**2.94**	**5.14**	**7.35**	**9.55**	**11.76**	**13.96**	**16.17**	**18.37**	**20.58**
3.96	0.27	0.48	0.68	0.89	1.09	1.30	1.50	1.71	1.91
162	**2.94**	**5.14**	**7.35**	**9.55**	**11.76**	**13.96**	**16.17**	**18.37**	**20.58**
4.11	0.27	0.48	0.68	0.89	1.09	1.30	1.50	1.71	1.91
168	**3.17**	**5.54**	**7.91**	**10.29**	**12.66**	**15.04**	**17.10**	**19.78**	**22.16**
4.27	0.29	0.51	0.73	0.96	1.18	1.40	1.59	1.84	2.06
174	**3.17**	**5.54**	**7.91**	**10.29**	**12.66**	**15.04**	**17.10**	**19.78**	**22.16**
4.42	0.29	0.51	0.73	0.96	1.18	1.40	1.59	1.84	2.06
180	**3.99**	**5.94**	**8.48**	**11.02**	**13.57**	**16.11**	**18.65**	**21.20**	**23.74**
4.57	0.37	0.55	0.79	1.02	1.26	1.50	1.73	1.97	2.21
186	**3.99**	**5.94**	**8.48**	**11.02**	**13.57**	**16.11**	**18.65**	**21.20**	**23.74**
4.72	0.37	0.55	0.79	1.02	1.26	1.50	1.73	1.97	2.21
192	**3.62**	**6.33**	**9.04**	**11.76**	**14.47**	**17.18**	**19.90**	**22.61**	**25.32**
4.88	0.34	0.59	0.84	1.09	1.34	1.60	1.85	2.10	2.35

Upper Numerals English Units/Lower Numerals Metric Units



Making Sustainability Happen