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Noise and Vibration Impact Assessment

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This document is intended for the following recipients:

- *The Trustee for IPG Dev 2 Unit Trust*
- *GOP AFF 1 Unit Trust*
- *IPG AFF 1 Unit Trust*

1 INTRODUCTION

This report has been prepared to assess noise and vibration impacts associated with the proposed development located at 35-39 Darley St East, Mona Vale. The measures likely to be required to adequately mitigate any identified potential impacts have been determined.

The following have been indicated as requiring assessment:

- Traffic noise and vibration impact to the site from traffic on Barrenjoey Road.
- Mechanical plant noise emissions (in principle).

Noise and vibration impacts have been assessed using criteria established using the following policies and guidelines:

- State Environmental Planning Policy (Transport and Infrastructure) (2021) (**"TI-SEPP"**)
- Development Near Rail Corridors and Busy Roads – Interim Guideline (2008) (**"DNRCBR"**)
- NSW EPA – 'Interim Construction Noise Guideline' (July 2009) (**"ICNG"**)
- Australian Standard AS2436:2010 – 'Guide to Noise Control on Construction, Maintenance and Demolition Sites' (2010)
- German Standard DIN4150-3 – 'Vibration in Buildings' (2016-12)
- NSW EPA – 'Assessing Vibration: A Technical Guideline' (February 2026)

The report has been prepared for the sole purpose of a development application assessment and should not be used or relied on for any other purpose.

The subject site and local context are indicated in Figure 2.

2 REFERENCED DOCUMENTS

2.1 BACKGROUND DOCUMENTS

The following background documents have been used in the assessment:

- Architectural drawings prepared by Plus Architecture Pty Ltd (*reference: 20895*)

2.2 GUIDELINES

The following planning instruments and guidelines have been used in the assessment:

- Northern Beaches Council – Pittwater 21 Development Control Plan (2004) (**"DCP"**)
- Pittwater Local Environmental Plan (2014) (**"LEP"**)
- NSW Department of Planning – SSD-113872990 'Planning Secretary's Environmental Assessment Requirements' (April 2026)
- NSW EPA – 'Noise Policy for Industry' (October 2017) (**"NPfI"**)

3 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

This report has been prepared to respond to the Secretary's Environmental Assessment Requirements (SEARs) for the development at 35-39 Darley Street East, Mona Vale (SSD-113872990). Specifically, this report has been prepared to respond to those SEARs outlined in the table below.

Table 1 – Secretary's Environmental Assessment Requirements

SEARs (SSD-113872990)	Response/Location in Report
10. Noise and Vibration Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Noise and Vibration Impact Assessment

4 ABBREVIATIONS AND DEFINITIONS

The following abbreviations and definitions are used in this noise impact assessment.

dB	Decibels - unit for the measurement of sound
dB(A)	A-weighted decibels. Unit of measurement for broadband sound with the A-frequency weighting applied to approximate human loudness perception to sounds of different pitch.
L_{eq}	Energy, time averaged sound level
L_{max}	Maximum sound pressure level, fast response
L90	Sound level exceeded for 90% of the measurement period
R_w	Frequency weighted sound reduction index.
NRC	Average absorption co-efficient for the octave bands with centre frequencies of 250Hz to 2 kHz inclusive.
Day*	For noise emissions assessment - the period from 7 am to 6 pm (Monday to Saturday) and 8 am to 6 pm (Sundays and public holidays). For transportation noise - the period from 7 am to 10 pm
Evening*	Refers to the period from 6 pm to 10 pm.
Night*	The period from 10 pm to 7 am (Monday to Saturday), and 10 pm to 8 am (Sundays and public holidays). For transportation noise - the period from 10 pm to 7am
Project Trigger Level	Target receiver noise levels for a particular noise-generating facility.
Assessment Background Level (ABL)	A-weighted background noise level representative of a single period. (Calculated in accordance with NPfI unless noted otherwise)
Rating Background Level (RBL)	The overall, single-figure A-weighted background level representing each assessment period (day/evening/night) over the whole monitoring period. (Calculated in accordance with NPfI unless noted otherwise)

5 SITE DESCRIPTION AND THE PROPOSAL

The project site is located at 35-39 Darley St East, Mona Vale. The site is located south-east of the classified road (Barrenjoey Road), with the site kerb being approximately 200m from the nearest classified road kerb.

The proposal consists of the erection of a multi-storey residential building including the following:

- Three levels of basement,
- Ground: Communal spaces and five residential apartments,
- Level 1 through to Level 7: Residential apartments.

The RL of the finished development will be approximately 42.4 meters. Based on publicly available LiDAR measurements of the surrounding locality, as sourced from ELVIS provided by ICSM, Barrenjoey Road has an RL of approximately 7 metres. As such, it is expected that at least a part of the finished development will have line of sight to the classified road.

Figure 1 below shows the location of the site adjacent to Barrenjoey Road.

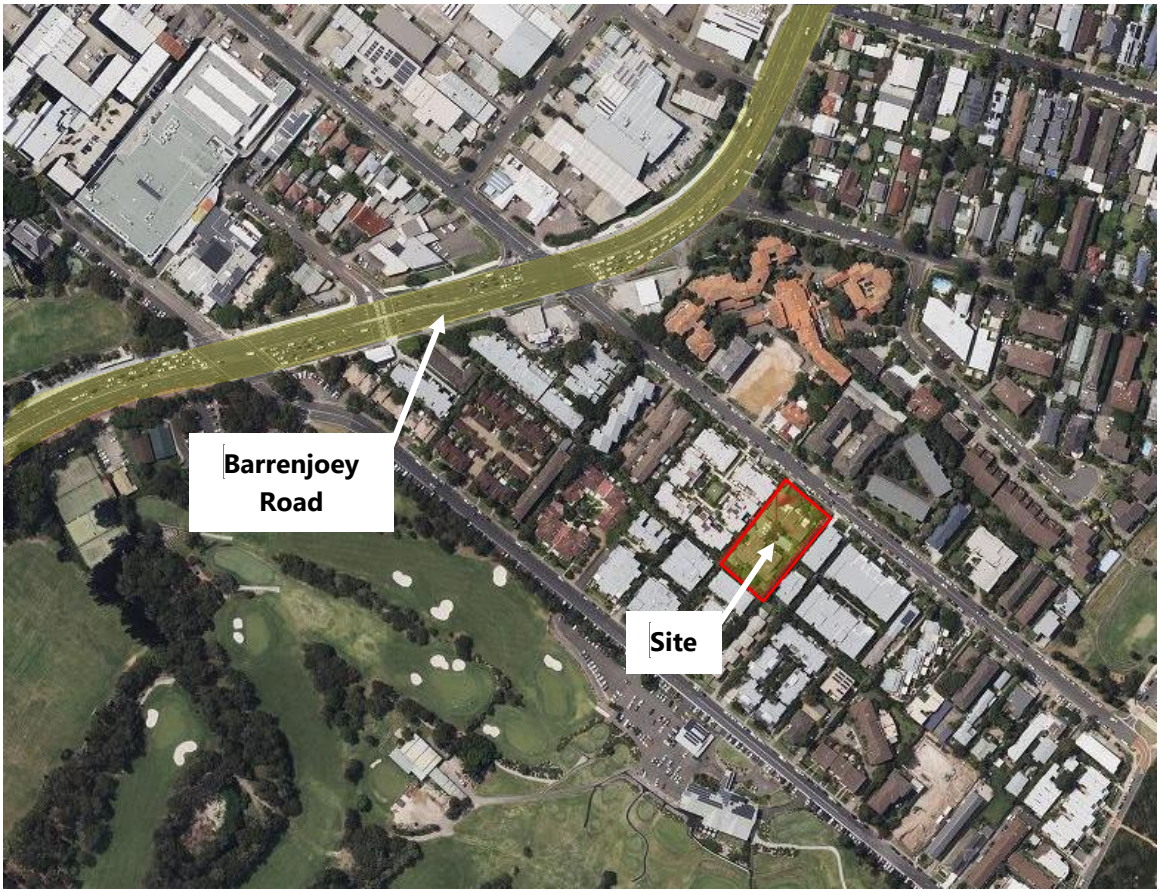


Figure 1 – Site Location

5.1 NOISE/VIBRATION SOURCES IDENTIFIED

Significant environmental noise sources that have been identified as potentially impacting the site include noise from traffic along Barrenjoey Road. Noise impacts will be assessed to comply with the requirements of the TI-SEPP.

5.2 SENSITIVE RECEIVERS

The following table lists the nearest/potentially most impacted sensitive receivers surrounding the site. An aerial photo of the site indicating nearby noise sensitive receivers is presented in Figure 2.

Table 2 – Sensitive Receivers

Receiver (Refer Figure 2)	Receiver Type	Comment
R1	Suburban Residential	Double storey standalone residential development, located adjacent to the north-western boundary of the project site, 41-49 Darley Street East, Mona Vale
R2		Single storey standalone residential development, located north of the project site, 22 Darley Street East, Mona Vale
R3		Multi storey standalone residential development, located adjacent to the north-eastern boundary of the project site, 20 Darley Street East, Mona Vale
R4		Multi storey standalone residential development, located adjacent to the north-eastern boundary of the project site, 18 Darley Street East, Mona Vale
R5		Multi storey standalone residential development, two buildings, located north-east of the project site, 16 Darley Street East, Mona Vale
R6		Double storey standalone residential development, located adjacent to the south-eastern boundary of the project site, 33 Darley Street East, Mona Vale
R7		Double storey standalone residential development, located south-east of the project site, 32 Golf Avenue, Mona Vale
R8		Double storey standalone residential development, three buildings, located adjacent to the south-western boundary of the project site, 28-30 Golf Avenue, Mona Vale
R9		Double storey standalone residential development, two buildings, located south-west of the project site, 24-26 Golf Avenue, Mona Vale
RE1	Public Recreation	Mona Vale Golf Club, multi storey, located south of the project site, 3 Golf Avenue, Mona Vale

Figure 2 – Site Map Showing Local Context

- Site
- Residential
- Recreational
- Unattended Monitoring Location

6 BACKGROUND NOISE SURVEY

The existing acoustic environment is categorised by low noise during the day and evening, and lower noise levels during the night consistent with a suburban environment.

Acoustic monitoring was conducted at the site to establish the background noise levels which will be used as a basis for this assessment. Detailed presentation of background noise monitoring results is presented within Appendix A of this document and summarised below.

6.1 SUMMARISED BACKGROUND NOISE LEVELS

The following table presents the summarised background noise levels for individual sensitive receivers maintained near the development site.

Table 3 – Summarised Background Noise Levels

Receiver	Time of Day	Rating Background Noise Level dB(A) $L_{A90(Period)}$
All Sensitive Receivers	Day (7am-6pm)	41
	Evening (6pm-10pm)	40
	Night (10pm-7am)	32

7 NOISE INTRUSION GUIDELINES AND ASSESSMENT CRITERIA

7.1 PITTWATER 21 2004 DCP

The following criteria is noted within the Pittwater 21 DCP (Northern Beaches Council):

"C1.6 Acoustic Privacy"

Noise-sensitive rooms, such as bedrooms, should be located away from noise sources, including main roads, parking areas, living areas and communal and private open space areas and the like.

Noise generating plants including pool/spa motors, air conditioning units and the like shall not produce noise levels that exceed 5dBA above the background noise when measured from the nearest property boundary.

7.2 STATE ENVIRONMENTAL PLANNING POLICY (TRANSPORT AND INFRASTRUCTURE) 2021

Certain development adjacent to major roadways must have regard to TI SEPP Clause 2.120, repeated below:

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

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

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

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

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

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

7.3 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS

This guideline provides general and specific advice for the planning and assessment of noise sensitive development impacted by roads and railways, and particularly those uses required to be addressed under the TI SEPP. The assessment criteria broadly mirror those in the TI SEPP.

7.3.1 Traffic Noise and Vibration Screening Test

DNRCBR provides screening tests that can be used to indicate whether the development site is likely to be adversely impacted by road noise. Standard building constructions will achieve compliance with the levels recommended in DNRCBR/TI SEPP if the screening tests indicate the site is not impacted by noise/vibration.

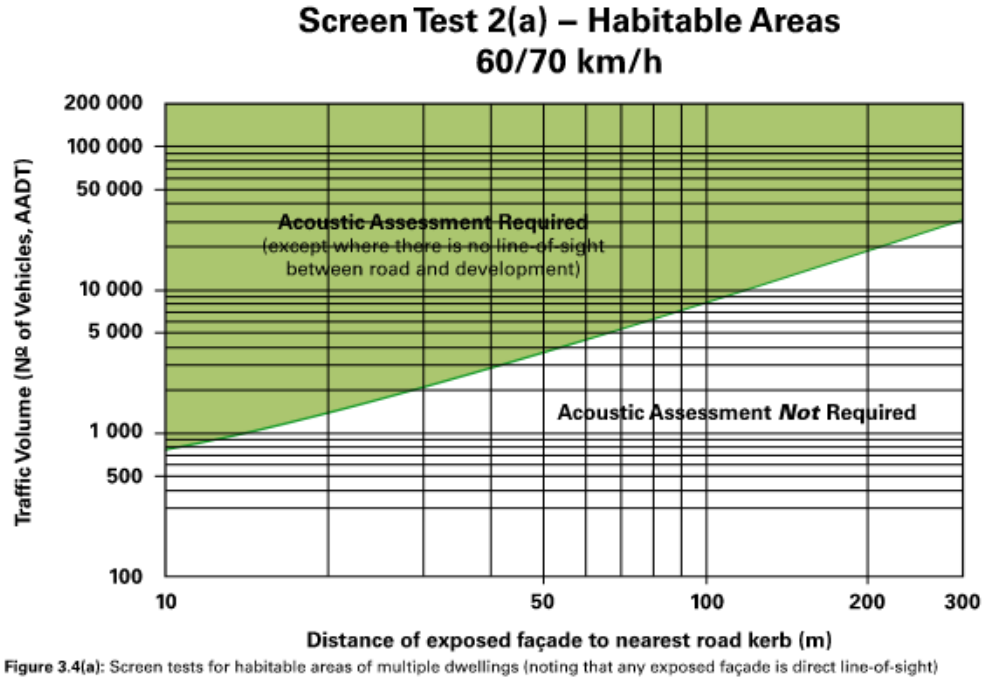


Figure 3 – DNRCBR's Apartments Screening Test Near Busy Roads

As the site boundary is approximately 180 metres from classified road, Barrenjoey Road, the screening test in Figure 3 indicates the proposed development falls within the "Acoustic Assessment Required" zone. Hence, an acoustic upgrade of the building envelope is required. This screening test was performed based on a traffic volume of 39,811 vehicles (sourced from TfNSW 2022 data) at a sign-posted speed of 60 km/hr.

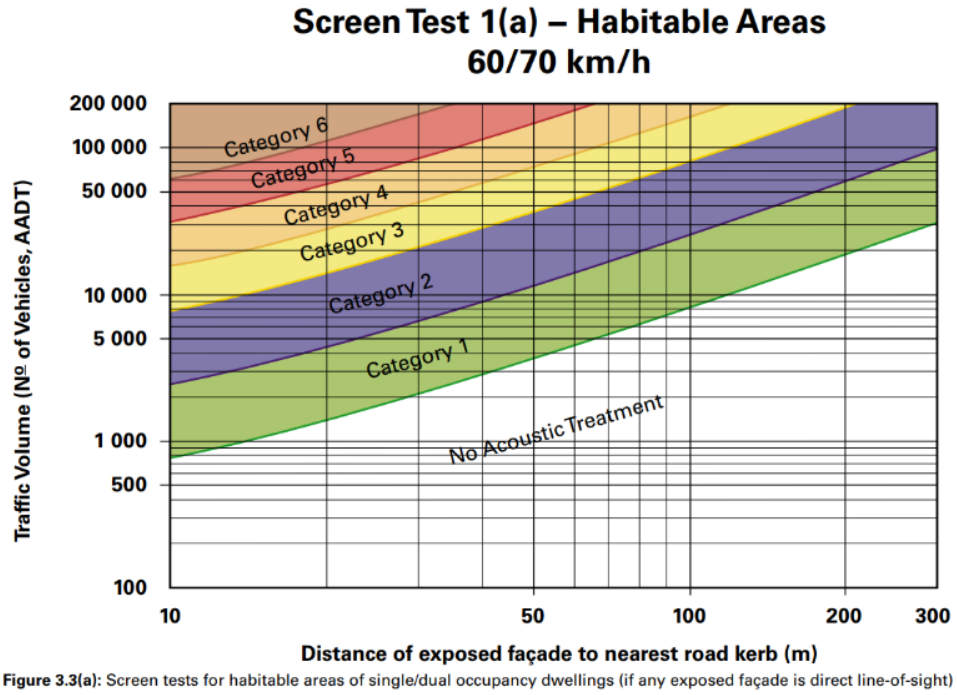


Figure 4 – DNRCBR's Screening Test for Road Traffic Noise

Figure 3.3(a) of DNRCBR proposes a category-based assessment of road traffic noise dependent on distance of the exposed façade to the nearest road kerb and the traffic volume of the road of interest. Category 1 areas are likely to have low road traffic noise, whereas Category 6 areas are likely to have the highest road traffic noise. Based on a daily traffic volume of approximately 40,000 at a sign-posed speed of 60 km/hr, some of the facades of the proposed development fall within the Category 1 Treatment.

Hence, an acoustic upgrade of the façade with direct line of site to Barrenjoey Road is required as detailed in Table 4 below. It is important to note that these acoustic upgrades are only required for the facades that are in direct line of sight and are exposed to Barrenjoey Road (that is, part of the facades across the north-western and north-eastern boundaries of the project site).

Table 4 – Traffic Noise Category 1 Typical Complying Construction

Element	Minimum R_w	Typical Complying Construction
Window/Sliding Doors	24	4 mm glazing with acoustic seals to all sashes
Front Façade Exposed to Noise	38	Brick veneer or 9 mm FC sheet/stud filled with glass-wool insulation/13 mm fire rated plasterboard internal lining
Roof	40	Metal deck or tile roof lined with 13 mm plasterboard ceiling and 75 mm glass-wool insulation in roof cavity
Entry Door	28	40 mm solid core timber door with acoustic seals top, sides and bottom
Floor	29	Any masonry, or 22 mm particleboard with enclosed perimeter except for minimal penetrations for ventilation

7.3.2 Internal Noise Requirements – Airborne Noise

Table 3.1 of the guideline summarises the internal traffic noise levels that should be achieved in noise sensitive developments, including residential buildings. The $L_{eq,9hr}$ descriptor is used to assess noise levels in sleeping areas (bedrooms) and the $L_{eq,15hr}$ descriptor is used to assess noise levels in other habitable rooms. Table 3.1 of DNRCBR is repeated below.

Table 5 – DNRCBR Airborne Noise Requirements

Building Use	Room	Internal Noise Level dB(A) L_{eq}
Residential	Sleeping areas (Bedroom)	35 (10pm to 7am)
	Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40 (anytime)

7.3.3 Ventilation

The DNRCBR recommends that when "windows open" noise levels are excessive, which is defined as when the "windows open" noise level exceeds the "windows closed" criterion by more than 10 dB(A), the occupants should be able to *"leave their windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia (BCA)."*

7.4 ADOPTED SPECIFIC REQUIREMENTS – AIRBORNE NOISE

The following table provides the requirements adopted for this assessment based on the applicable instruments and guidelines.

Table 6 – Internal Noise Level Objectives

Building Use	Room	Noise Level dB(A) $L_{eq(period)}$
Residential	Sleeping Area (Bedroom)	35 (10pm to 7am)
	Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40 (7am to10pm)

8 COMPLYING MITIGATION

As discussed previously in Section 7 of this report, the proposed development falls within the Category 1 zone of the DNRCBR screening tests for habitable areas with direct line-of-sight to the classified road, Barrenjoey Road. As such, the complying mitigation required are in line with the recommendations of the typical complying construction elements for Category 1 developments, as provided within the DNRCBR (see Table 4).

8.1 GLAZED WINDOWS AND DOORS

The DNRCBR Typical Complying Construction for Category 1 recommends 4mm glazing with acoustic seals to all sashes for any glazed window/sliding door construction.

Table 7 – Glazed Windows and Doors Complying Mitigation

Element	Minimum R_w	Typical Complying Construction
Window/Sliding Doors	24	4 mm glazing with acoustic seals

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

8.2 USE OF INSULATED GLASS UNITS (DOUBLE GLAZING)

Where single glazing has been recommended in Table 4, the following IGU's can be used in place of the tabled single glazing.

Table 8 – Equivalent IGU Systems

Single Glazing Assembly	Equivalent IGU	Minimum R_w/R_w+C_{tr} of Installed Window
4mm float or toughened	6/16/6	31/27

8.3 EXTERNAL WALLS/FLOORS

The DNRCBR Typical Complying Construction for Category 1 recommends Brick veneer or 9 mm FC sheet/stud filled with glass-wool insulation/13 mm fire rated plasterboard internal lining for any front façade exposed to noise.

Table 9 – External Walls/Floors Complying Mitigation

Element	Minimum R_w	Typical Complying Construction
Front Façade Exposed to Noise	38	Brick veneer or 9 mm FC sheet/stud filled with glass-wool insulation/13 mm fire rated plasterboard internal lining

8.4 NON-GLAZED ENTRY DOORS

The DNRCBR Typical Complying Construction for Category 1 recommends 40 mm solid core timber door with acoustic seals top, sides and bottom for any non-glazed entry door.

Table 10 – Non-Glazed Entry Doors Complying Mitigation

Element	Minimum R_w	Typical Complying Construction
Entry Door	28	40 mm solid core timber door with acoustic seals top, sides and bottom

8.5 VENTILATION ASSESSMENT

As referenced in Section 7.3.3, the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' specifies the following controls regarding natural ventilation:

> *With respect to natural ventilation of a dwelling the allowable internal noise goal is permitted to be 10 dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45 dB(A), and 50 dB(A) in living rooms). Where noise levels would exceed this, the NSW Planning guideline recommends that a ventilation system be provided to achieve the ventilation requirements of the BCA with windows closed.*

Based upon the predicted noise levels from the SEPP classified road, this document confirms that all habitable space within the development is capable of achieving the minimum open window area required for natural ventilation within Part F6 of the BCA, whilst also resulting in internal noise levels which are below the windows open emergence levels nominated within DNRCBR, and therefore supplementary ventilation is not required for any habitable space within the development.

9 SITE OPERATIONAL NOISE EMISSIONS ASSESSMENT

9.1 ENVIRONMENTAL NOISE AND VIBRATION SOURCES

The following significant sources have been identified as requiring assessment:

- Air conditioning, ventilation and mechanical plant generally.
- Construction Noise and Vibration.

9.2 NOISE ASSESSMENT REQUIREMENTS FOR ON-SITE NOISE SOURCES

Criteria to assess noise emissions from the operation of the proposed development have been developed using the NPfI. This policy was primarily developed to assess noise impacts from industrial development but can also be adapted to assess other types of development such as commercial buildings and air conditioning plant.

For each receiver type:

- Receivers have been grouped into "catchments". These are receivers that have been assessed as having similar characteristics (receiver type and ambient noise level). These are shown in Figure 2.
- For each catchment, representative noise assessment trigger levels have been determined based on NPfI guidelines. The trigger levels have been adopted in this assessment as criteria. These will be used to indicate whether additional mitigation is needed to manage noise emissions.
- For each catchment, noise emissions have been assessed to the most impacted receiver. This means that impacts at all other receivers within that catchment will be less. Compliance at the most impacted receiver will therefore also result in compliance at all other receivers within the catchment.

For residential receivers, three criteria are assessed:

- Intrusive assessment– that is, how audible loud is the emitted noise compared to ambient, background noise). Criteria are determined relative to the measured rating background noise level.
- Amenity assessment – that is, how loud is the absolute level of industrial noise, including cumulative noise from other industrial sources. The NPfI nominates appropriate amenity noise levels depending on the receiver type and prevailing noise environment/zoning.
- Maximum Noise assessment – will high-level, short-term noise events cause adversely impact sleep at night? Trigger levels are determined relative to the measured night rating background and assessed outside rooms where sleep is likely to occur.

For residential receivers, noise emissions are assessed against the trigger levels to determine the likely extent of impacts. The lower of the relevant intrusiveness and amenity trigger levels is adopted. Noise emissions lower than the trigger levels indicate there is no adverse impact. A maximum noise level assessment is separately undertaken if nighttime emissions occur. For other receiver types, only an "amenity" assessment is required.

Appendix A and Appendix B summarise the derivation of trigger levels for each of the receivers, and these are summarised in the following table.

Table 11 – Project Noise Trigger Levels

Location/Receiver Type	Time	RBL dB(A) L_{90}	Trigger Noise Level (dB(A) $L_{eq,15min}$)		
			Intrusiveness	Amenity	Max Event
Residential – R1 to R9	Day	41	**46**	53	
	Evening	40	45	**43**	
	Night	32	**37**	38	**40 L_{eq}** **52 L_{max}**
Mona Vale Golf Course – RE1	When in use	-	-	**53**	

Note: Project Noise Trigger Levels are presented within the above table in bold.

9.3 MECHANICAL PLANT

The design and selection of plant have not been undertaken but would generally consist of apartment air conditioning condensing units, bathroom ventilation fans (which would typically be small fans located internally), carpark ventilation fans, and other miscellaneous ventilation fans.

9.3.1 General Mitigation

The plant to service the development would be selected to meet the noise levels required by the noise limits indicated above and where required would be treated by enclosing the equipment, treating ducting, acoustic louvres, as required to meet limit noise emissions.

Designers should have regard for the fact that allowances should be made in respect of plant locations to minimise impacts on sensitive receivers and to provide sufficient space to incorporate treatment to plant areas to meet the above guidelines.

10 PRELIMINARY CONSTRUCTION NOISE AND VIBRATION

Noise and vibration during the demolition, excavation and construction phases of the project should be assessed prior to commencement of works on site using the quantitative method in accordance with the EPA Interim Construction Noise Guideline ("ICNG").

The assessment should:

- Establish the potentially impacted receivers for noise or vibration. In particular, the residential dwellings in the adjacent sites.
- Establish the noise and vibration management levels in accordance with the ICNG.
- Predict noise and vibration impacts.
- Where noise or vibration levels would exceed the management levels recommend reasonable and feasible mitigation.
- Where noise or vibration would exceed highly affected management levels apply additional mitigation such as respite periods. This would typically apply to hammering using excavator mounted hammers and similar highly intrusive activities.
- Recommend appropriate noise and vibration monitoring to be undertaken during the more intensive phases of the project.

Preliminary construction noise and vibration advice is provided over the following section. A detailed assessment is typically conducted once the proposed construction activities and equipment have been finalised. This assessment will present the relevant noise management levels and vibration criteria based on industry standards as follows:

- NSW EPA – 'Interim Construction Noise Guideline' (July 2009) ("ICNG")
- Australian Standard AS2436:2010 – 'Guide to Noise Control on Construction, Maintenance and Demolition Sites' (2010)
- German Standard DIN4150-3 – 'Vibration in Buildings' (2016-12)
- NSW EPA – 'Assessing Vibration: A Technical Guideline' (February 2026)

10.1 CONSTRUCTION NOISE REQUIREMENTS

10.1.1 NSW EPA – Interim Construction Noise Guideline

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise generation goals (based on ambient noise monitoring)
- Review of operational noise levels at nearby development
- If necessary, recommendation of noise control strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest receivers. As the surrounding receivers are residential, the following management levels in Table 12 apply.

Table 12 – ICNG Noise Management Levels

Receivers (refer to Figure 2)	Noise Management Level – dB(A)$L_{eq(15min)}$ (RBL + 10)	Highly Noise Affected Level – dB(A)$L_{eq(15min)}$
Residential Receivers – R1 through to R9	51	75

**Note – EPA minimum noise level for daytime period, plus 10dB(A)*

If noise levels exceeded the management levels identified in the table above, reasonable and feasible noise management techniques will be reviewed.

10.1.2 AS2436:2010 – Guide to Noise Control on Construction Maintenance and Demolition Site

Where compliance with EPA requirements cannot be achieved, noise emissions must be managed in accordance with the principles outlined in AS 2436:

- A reasonable suitable noise criterion is established.
- All practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

10.1.3 Summary of Applicable Guidelines

Based on these guidelines, the following procedure will be used to assess noise emissions:

- For residential receivers surrounding the subject site, a noise level of 10 dB(A) above background level at these receivers is allowed during recommended standard hours with a highly noise affected management level of 75dB(A)$L_{eq(15\text{-}min)}$.
- If noise levels exceed the project specific noise management level at sensitive receiver locations, investigate and implement all practical and cost-effective techniques to limit noise emissions.
- If the noise management levels are still exceeded after applying all practical engineering controls to limit noise emissions investigate management controls and other techniques to mitigate noise emissions.

10.1.4 Summarised Noise Management Levels

The summarised noise management levels for the construction activities associated with 35-39 Darley Street East, Mona Vale, are presented in the table below.

Table 13 – Summarised Noise Management Levels

Noise Receiver Location	Management Level dB(A)$L_{eq\ (15\ min)}$
Surrounding Residential Receivers	"Noise Affected" Level - 51 "Highly Noise Affected" Level – 75

10.1.5 Typical Construction Noise Levels

Typically, a detailed assessment of construction noise and vibration impacts is assessed prior to the beginning of construction as a construction programme is formed. As proposed construction methodologies / staging / equipment has not yet been selected, it is difficult to prepare a detailed assessment of construction activity for 35-39 Darley Street East, Mona Vale.

Notwithstanding, Appendix A of Australian Standard 2436-2010 provides an outline of the typical sound levels of construction plant and equipment. Based on the scope of works envisaged at 35-39 Darley Street East, Mona Vale, the use of the following construction plant and equipment is likely (but is not limited to):

Table 14 – Typical Sound Levels of Construction Plant and Equipment (Sourced from AS2436-2010)

Plant description	A-weighted sound power levels L_{wA} dB		A-weighted sound pressure levels L_{pA} (mid-point) dB at 10 m
	Typical or Range	Typical (mid-point)	
Excavator	97-117	107	79
Rock breaker	118	118	90
Loader (wheeled)	99-111	105	77
Truck (dump)	117	117	89
Truck (water cart)	106-108	107	79
Concrete saw	112-122	117	89
Bulldozer	102-114	108	80
Piling (bored)	111	111	83
Crane (mobile)	95-113	104	76
Crane (tower - diesel)	105	105	77
Concrete agitator truck	107-111	109	76
Concrete pump truck	103-113	108	80
Concrete pencil vibrator	101-105	103	75
Compressor (silenced)	93-110	101	73
Hand tools (electric)	95-110	102	74
Hand tools (pneumatic)	114-117	116	88
Asphalt paver	103-112	108	80
Roller (vibratory)	103-112	108	80

10.2 CONSTRUCTION VIBRATION CRITERIA

Vibration criteria for the nearest receivers will be based on the following documents:

- DIN 4150-3 (2016-12) – "*Vibration in Buildings – Part 3.*"
- NSW EPA – "*Assessing Vibration: A technical Guideline.*"

10.2.1 DIN 4150-3 (2016-12)

German Standard DIN 4150-3 (2016-12) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (2016-12) are presented in the table below.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 15 – DIN 4150-3 (2016-12) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

10.2.2 Assessing Amenity

Table 2.2 of EPA "Assessing Vibration: A technical guideline" specified the following vibration goal for human comfort:

Table 16 – Preferred and Maximum Weighted RMS Values for Vibration Acceleration (m/s^2)

Location	Assessment Period	Preferred Values Z-axis	Preferred Values X & Y-axis	Maximum Values Z-axis	Maximum Values X & Y-axis
Continuous Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residences	Day time	0.010	0.0071	0.020	0.014
Office	Day time	0.020	0.014	0.040	0.028
Impulsive Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residence	Day time	0.3	0.21	0.6	0.42
Office	Day time	0.64	0.46	1.28	0.92

Acceptable values for intermittent vibration shall comply with the requirements in Table 2.4 of EPA "Assessing Vibration: A technical guideline" detailed as below.

Table 17 – Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Day time preferred value	Day time maximum value
Critical Areas	0.10	0.20
Residences	0.20	0.40
Office	0.40	0.80

10.2.3 Summarised Recommended Vibration Limits

The summarised vibration criteria are presented in the table below.

Table 18 – Recommended Vibration Limits

Receivers (refer to Figure 2)	Peak Particle Velocity (mms^{-1})			
	At Foundation at a frequency of			Plane of Floor of Uppermost Storey
	<10 Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
Residential (R1 to R9)	5	5 to 15	15 to 20	15

10.3 CONSTRUCTION NOISE AND VIBRATION DISCUSSION

Typically, a detailed assessment of construction noise and vibration impacts is assessed prior to the beginning of construction as a construction programme is formed. As proposed construction methodologies / staging / equipment has not yet been selected, it is difficult to prepare a detailed assessment of construction activity for 35-39 Darley Street East, Mona Vale.

AL note that a detailed Construction Noise and Vibration Management Plan (CNVMP) shall be prepared for the construction works proposed once a contractor is engaged and construction methodology is determined. This CNVMP is to, at a minimum, adhere to the requirements stipulated within relevant NSW EPA documentation, as well as the requirements presented within Section 10 of this document.

When considering the nature of the site and the project, demolition and excavation activities are anticipated to be the most significant sources of noise for nearby receivers, particularly the surrounding receivers R1 through to R9. Consequently, airborne nose levels generated during construction are expected to exceed the limits set by the NSW EPA. Additionally, given the proximity of the works to the adjacent dwellings, it is expected that some scopes of work may also exceed the vibration limits applicable to the project. The management plan shall provide appropriate ameliorative measurements specific to the site to ensure that the risk of complaints is minimised and if complaints shall arise, are appropriately managed. It is expected that engaged contractor will adopt these mitigation methodologies so that construction noise and vibration from the construction of these lots can be managed appropriately.

11 CONCLUSION

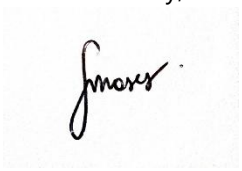
This report summarises the noise and vibration impact assessment undertaken for the proposed development. Environmental and operational impacts have been assessed.

- NSW planning instruments, guidelines and local authority planning guidelines have been used to develop project specific assessment criteria.
- Noise and vibration impacts have been predicted at the subject development based on site measurements and publicly available data of Barrenjoey Road. The predicted impacts have been assessed against the project specific criteria. The assessment indicates that additional mitigation of noise is required to comply with the assessment criteria.
- Noise emission criteria for the development have been established in accordance with Noise Policy for Industry guidelines. A detailed assessment of mechanical plant noise emissions is to be conducted at CC stage to ensure plant noise emissions comply with the trigger levels determined using the Policy.
- A preliminary construction noise and vibration assessment has been provided within Section 10 of the report.

The assessment has demonstrated that the proposed development is able to provide an adequate level of amenity with respect to the various noise and vibration impacts provided the mitigation indicated in this assessment is incorporated.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Pty Ltd
Samuel Moses

APPENDIX A – AMBIENT NOISE MONITORING

This appendix summarises the ambient noise data measured near the subject site, and the calculated noise level descriptors adopted to characterise the existing noise environment.

Monitoring has been undertaken by this office to provide the following ambient data:

- Background noise levels at the surrounding residential properties.
- Ambient noise levels at the surrounding residential properties.

A.1 NOISE DESCRIPTORS

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15-minute measurement interval is typically utilised. Noise levels are monitored on a continuous basis over this period, and statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters are:

L_{eq} – represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with how humans perceive the loudness of steady state and quasi-steady state noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the quieter periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft noise and ground vibration induced noise from railways.

L_1 is sometimes used in place of Lmax to represent a typical noise level from a number of high-level, short-term noise events.

A.2 UNATTENDED LONG TERM NOISE MONITORING

A.2.1 Equipment Used

Unattended noise monitoring was conducted by this office using the following equipment:

- Rion NL-42 (Type 2)
- Rion Sound Level Calibrator Type NC 74

Monitoring was continuous, with statistical noise levels recorded at 15-minute intervals throughout the monitoring period. Measurements were taken on "A" frequency weighting and fast time response, unless noted otherwise.

All monitoring equipment used retains current calibration - either manufacturers' calibration or NATA certified calibration. The monitors were field calibrated at the beginning and the end of the measurement with no significant drift in calibration noted.

A.2.2 Location Monitored

An unattended noise monitor was installed on the eastern boundary of the project site at 35-39 Darley Street East, Mona Vale. Monitoring was conducted between 1st December – 10th December 2025.

The location monitored is indicated in Figure A 1. Photographs of the noise monitor are provided in Figure A 2, Figure A 3, and Figure A 4.

Figure A 1 – Noise Monitoring Location

Unattended Monitoring Location

Figure A 2 – Noise Monitor (35-39 Darley Street East, Mona Vale)

Figure A 3 – Noise Monitor (35-39 Darley Street East, Mona Vale)

Figure A 4 – Noise Monitor (35-39 Darley Street East, Mona Vale)

A.2.3 Weather Affected and Extraneous/Outlying Data

Periods affected by adverse weather conditions (as defined by Fact Sheet B) are indicated on the following Acoustic Logic data graphs and have been excluded from the assessment. Weather data was obtained from records provided by the Bureau of Meteorology for the station located at Terrey Hills.

As the Bureau of Meteorology wind data is typically obtained at an exposed location at 10m above ground level, and the monitoring locations were at approximately 2.5m above ground in more sheltered locations a wind multiplying factor of 0.5 has been applied to the BOM data to estimate the wind speed at the microphone location.

For the Terrey Hills weather station during the monitoring period, no sets of data have been identified as likely to contain significant periods of non-representative data.

A.3 RATING BACKGROUND NOISE LEVELS

The following tables summarise the assessment background noise levels (ABL). Note that where no ABL is indicated, this is because that period was significantly affected by adverse weather or other extraneous noise.

In accordance with the NPfI, if the calculated:

- evening rating background noise level is higher than the day level, the day rating background noise level has been adopted for the evening period.
- night rating background noise level is higher than the evening level, the evening rating background noise level has been adopted for the night period.
- day rating background noise level was less than 35 dB(A), a "default" background of 35 dB(A) has been adopted.
- evening or night rating background noise level was less than 30 dB(A), a "default" background of 30 dB(A) has been adopted.

Table A 1 – Assessment Background Noise Levels

Location	Date	ABL		
		Day L90	Evening L90	Night L90
35-39 Darley Street East Eastern Boundary	01/12/2025	-	37	32
	02/12/2025	41	39	30
	03/12/2025	39	37	31
	04/12/2025	41	40	32
	05/12/2025	42	40	32
	06/12/2025	42	40	32
	07/12/2025	41	40	34
	08/12/2025	41	40	31
	09/12/2025	37	39	35
	10/12/2025	-	-	-
	RBL	41	40	32
	Adopted RBL	**41**	**40**	**32**

A.4 CALCULATION OF REPRESENTATIVE AMBIENT NOISE LEVELS

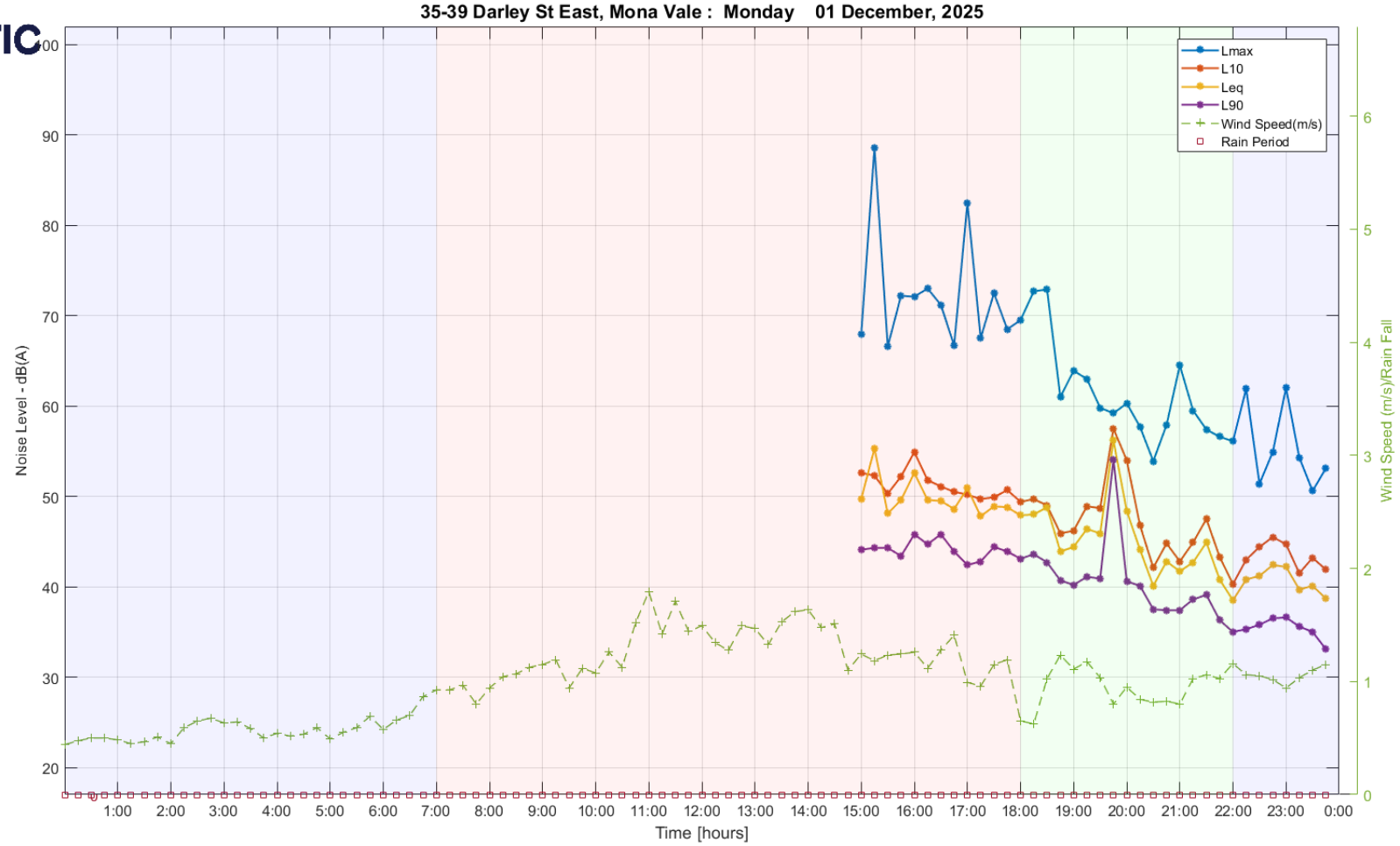
The ambient, assessment and rating background levels have been determined from the unattended, long-term noise monitoring data based on the methodology in the Noise Policy for Industry Fact Sheet B.

The $L_{eq,15hr}$ (day period, 7am to 10pm) and $L_{eq,9hr}$ (night period, 10pm to 7am) ambient noise level descriptors adopted in the EPA "Development Near Rail Corridors and Busy Roads" and NSW "Road Noise Policy" guidelines have been calculated from the monitoring data and are summarised in Table A 2 below.

Table A 2 – Calculated Ambient Noise Levels

Location	Ambient Noise Level (dB(A) $L_{eq,period}$)	
35-39 Darley Street East, Mona Vale	Day (7am to 10pm)	Night (10pm to 7am)
	53	44

A.5 UNATTENDED MONITORING GRAPHS


35-39 Darley St East, Mona Vale : Monday 01 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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19:00
20:00
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23:00
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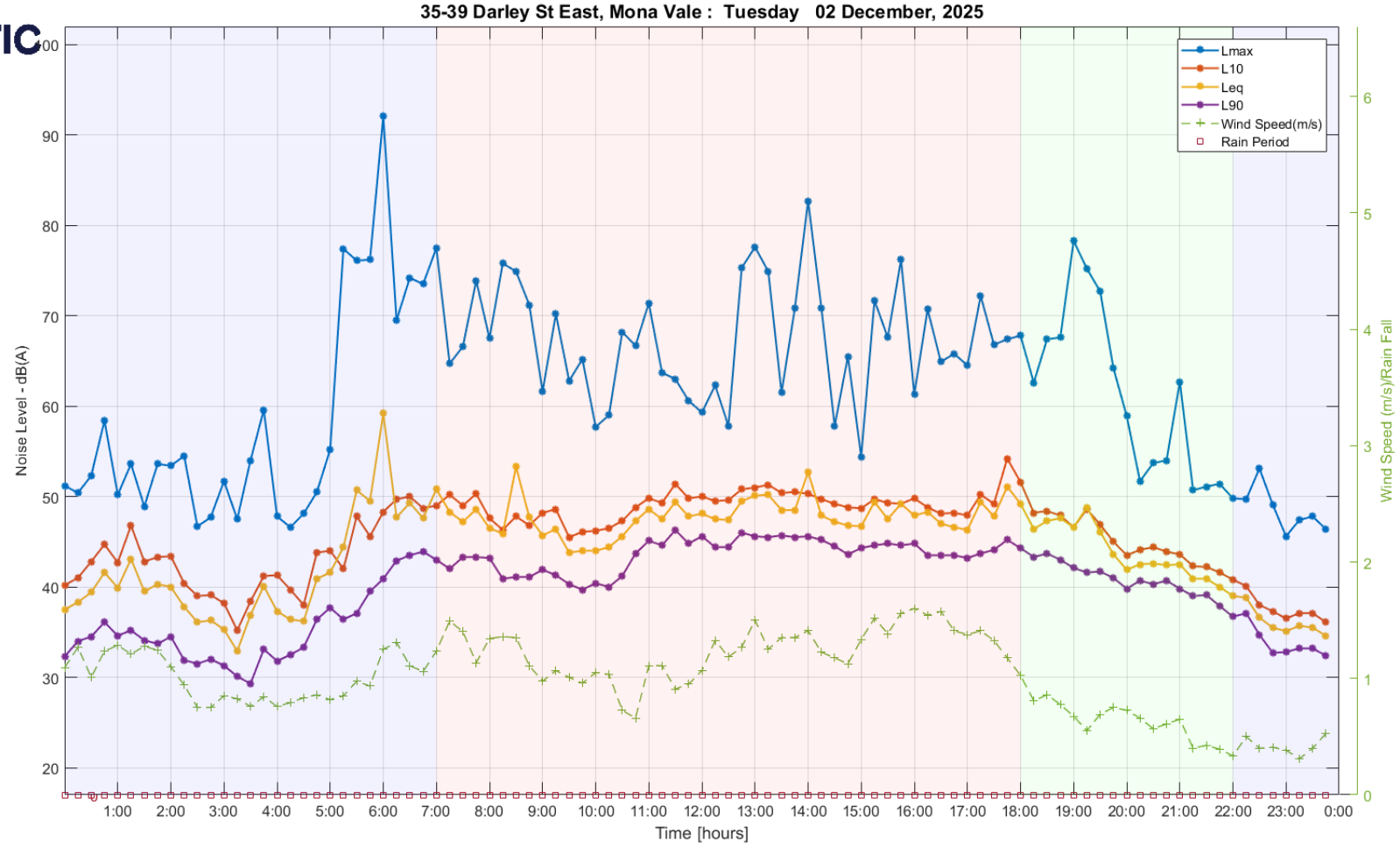
35-39 Darley St East, Mona Vale : Tuesday 02 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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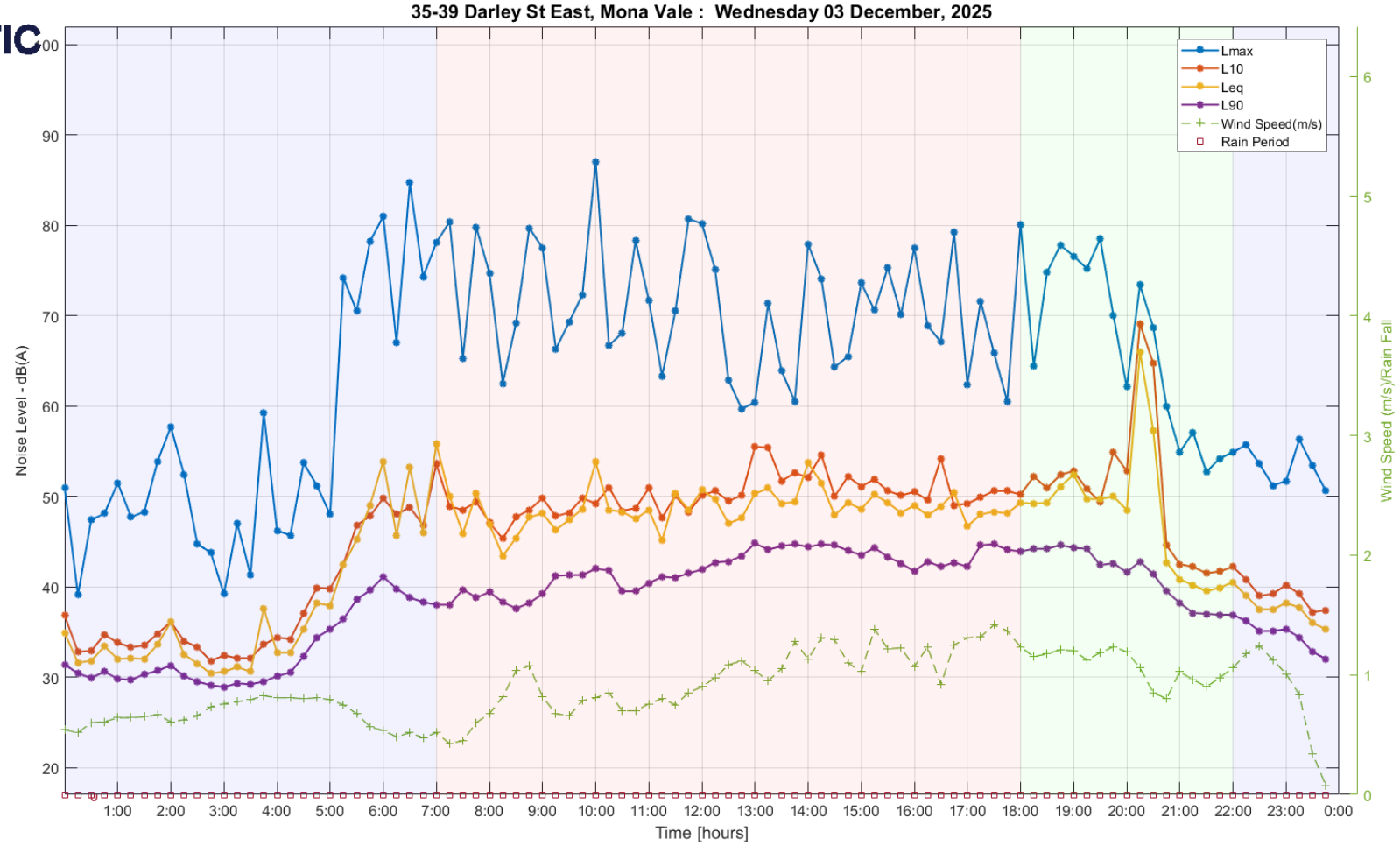
19:00
20:00
21:00
22:00
23:00
0:00


35-39 Darley St East, Mona Vale : Wednesday 03 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
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22:00
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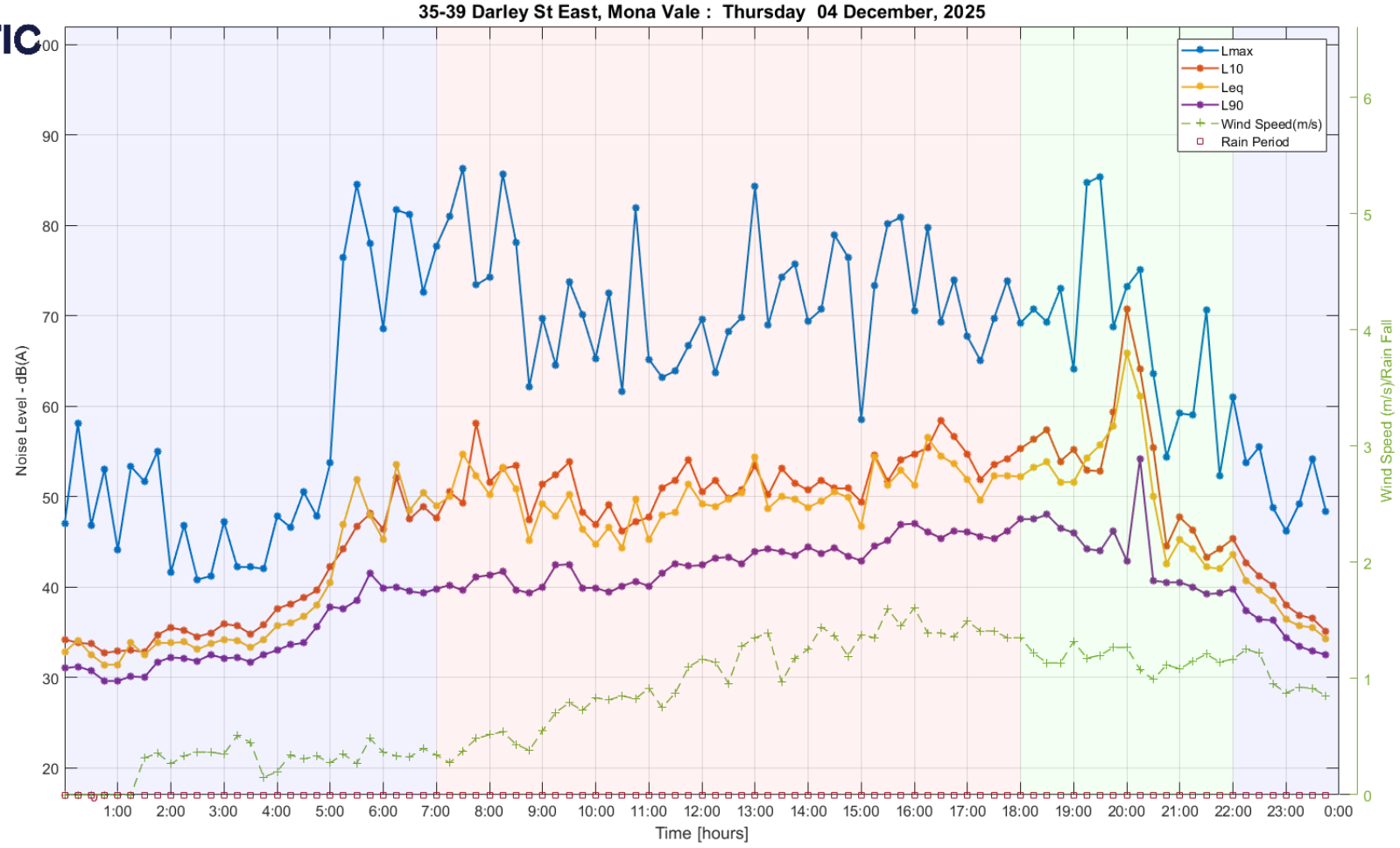
35-39 Darley St East, Mona Vale : Thursday 04 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
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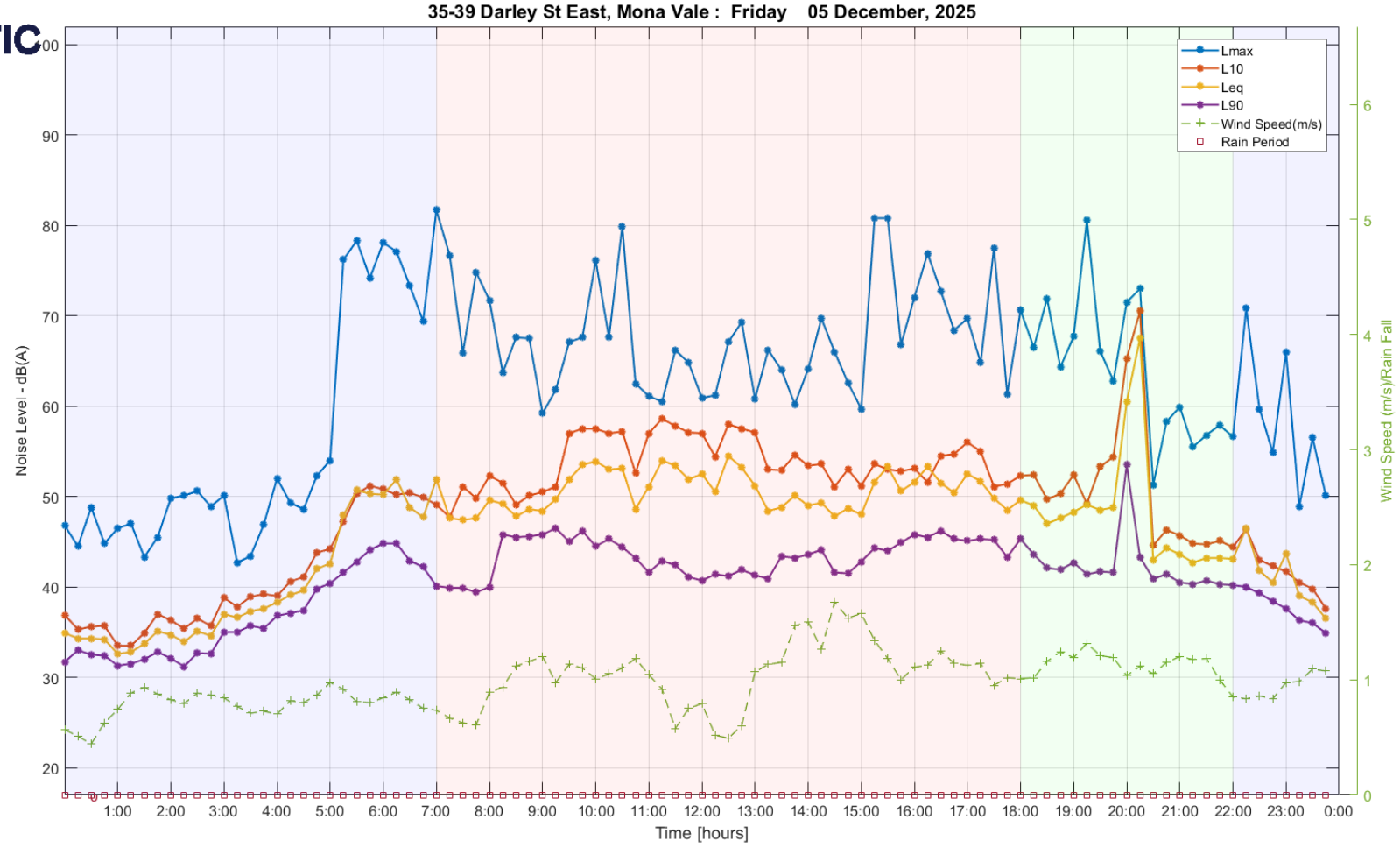
35-39 Darley St East, Mona Vale : Friday 05 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
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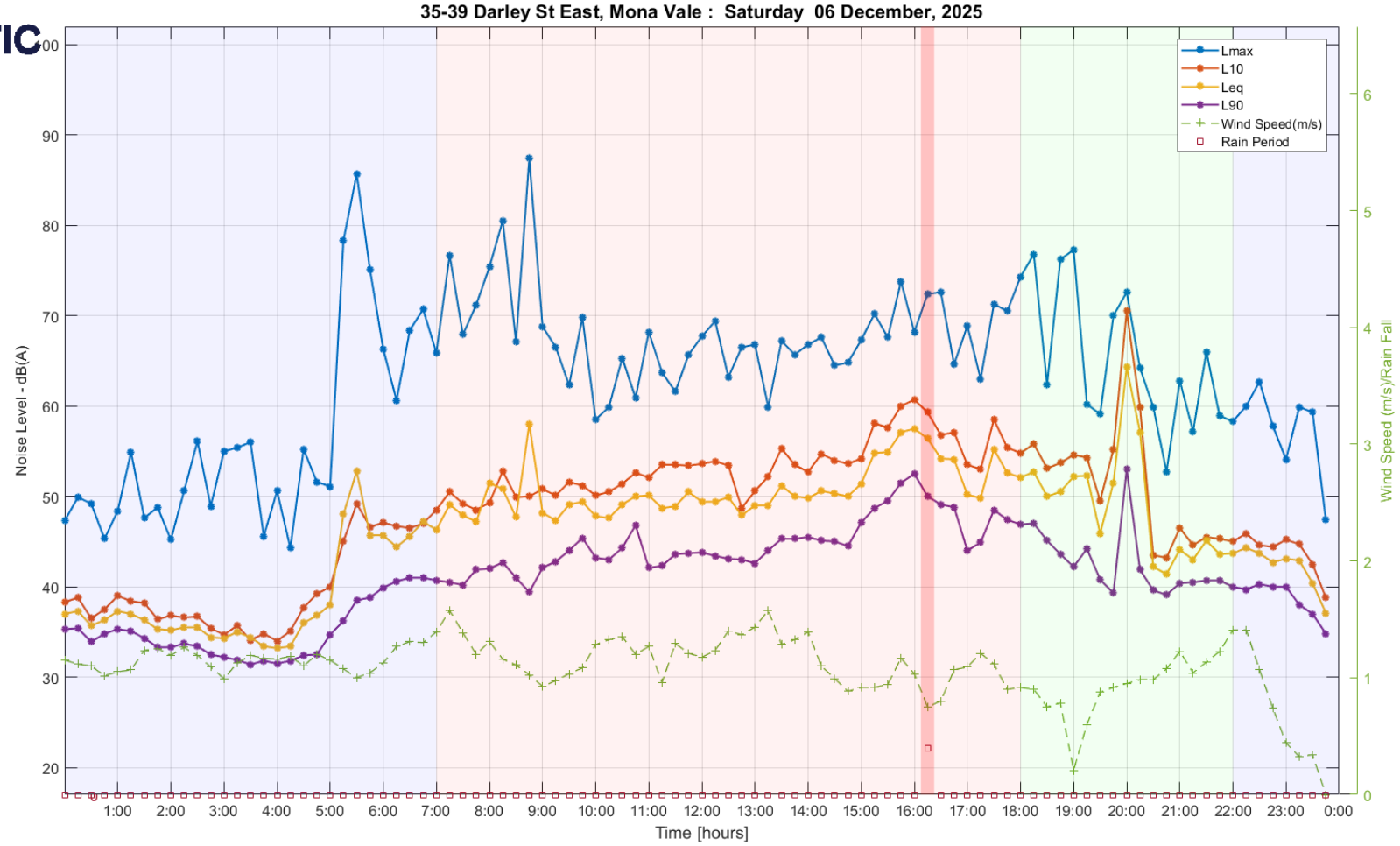
35-39 Darley St East, Mona Vale : Saturday 06 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
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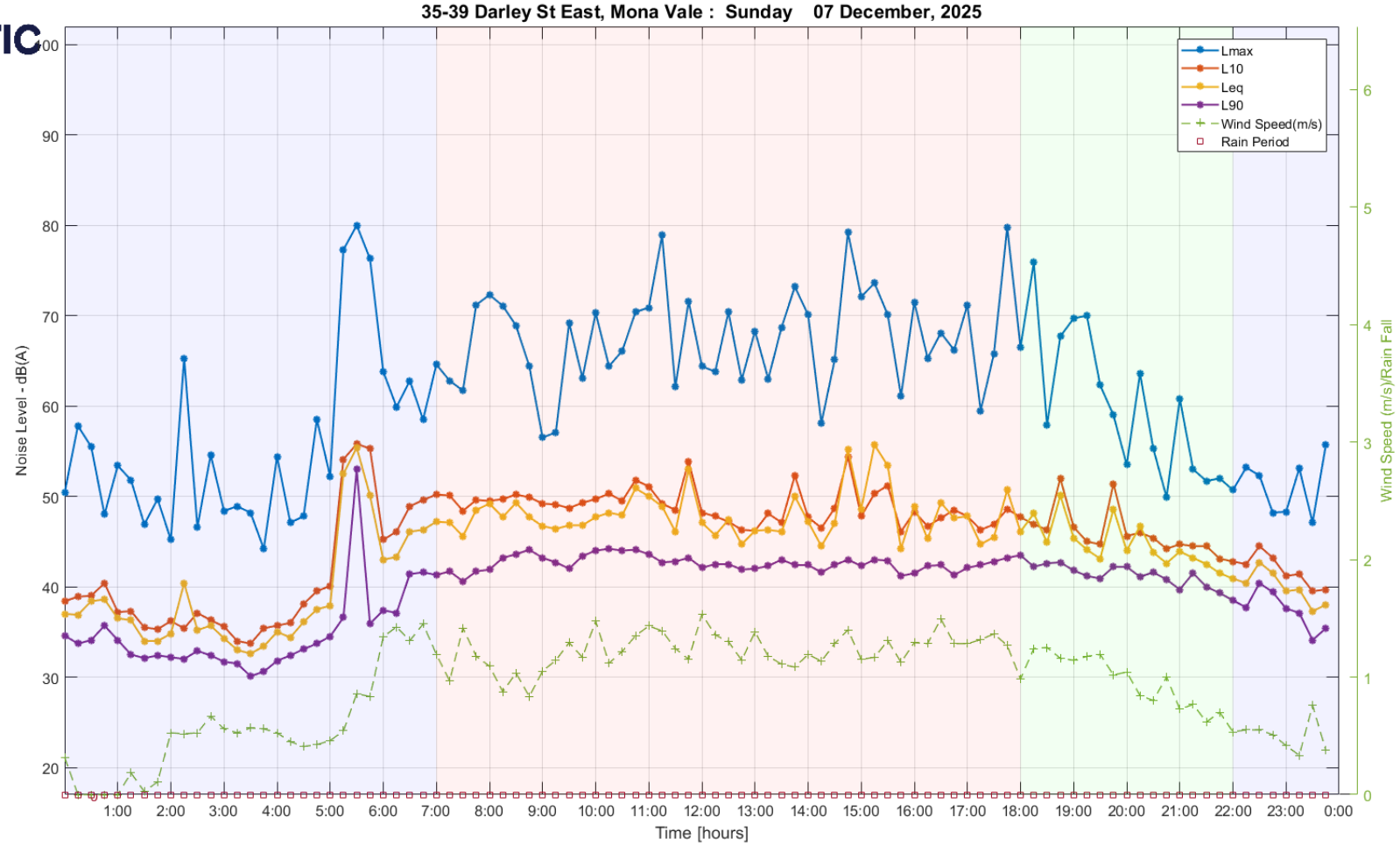
35-39 Darley St East, Mona Vale : Sunday 07 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
4:00
5:00
6:00
7:00
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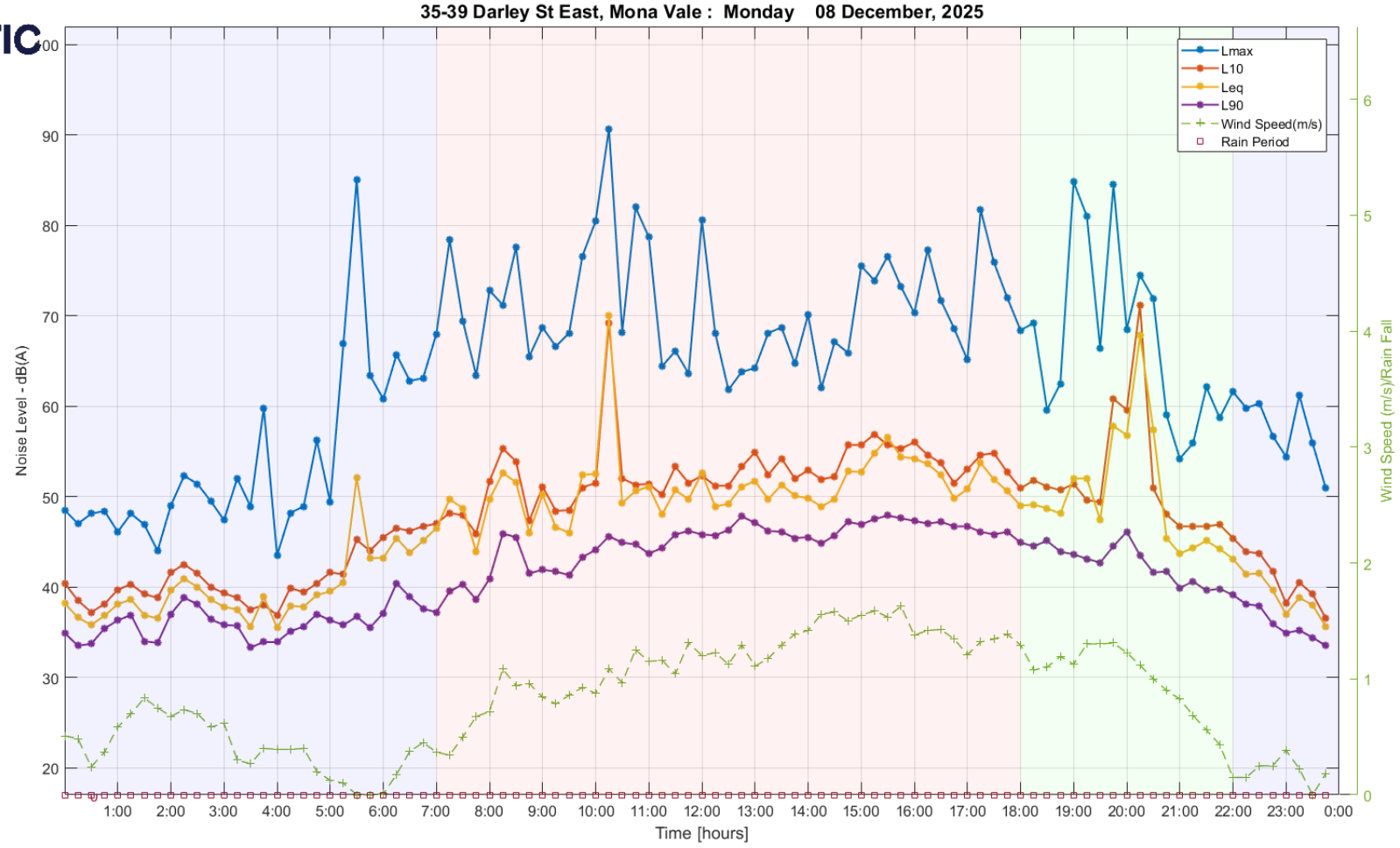
35-39 Darley St East, Mona Vale : Monday 08 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
1:00
2:00
3:00
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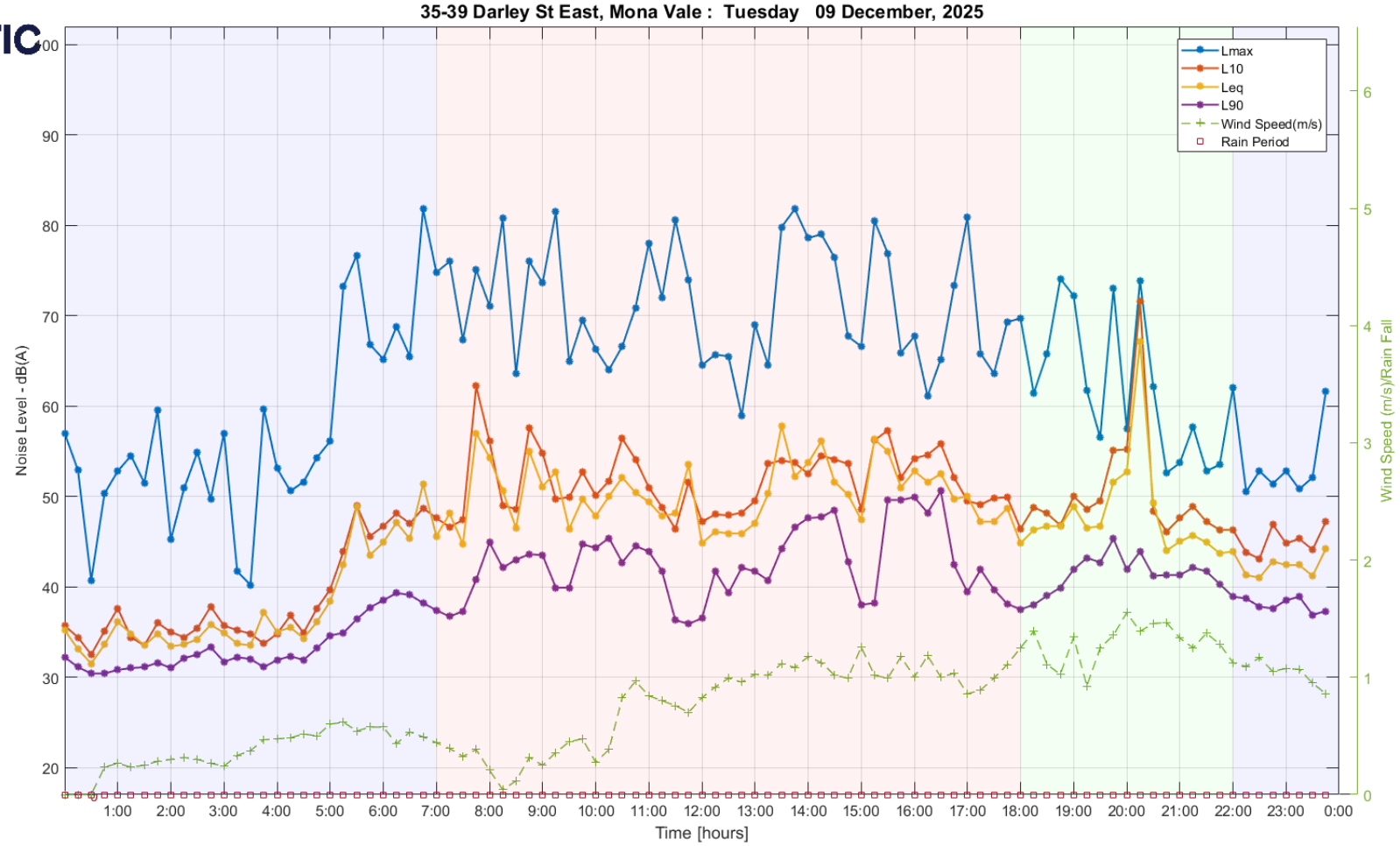
35-39 Darley St East, Mona Vale : Tuesday 09 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
100
90
80
70
60
50
40
30
20
6
5
4
3
2
1
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1:00
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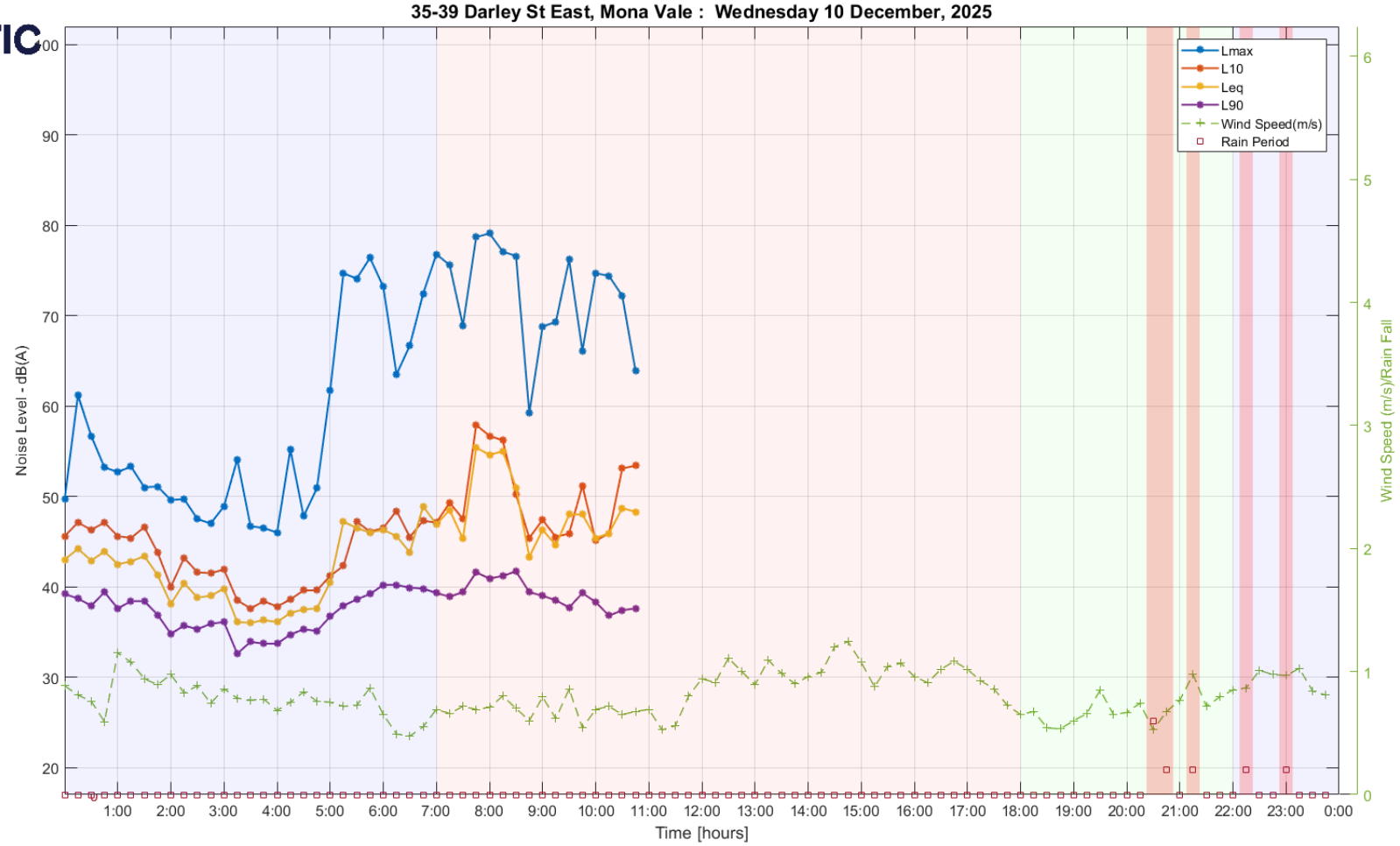
35-39 Darley St East, Mona Vale : Wednesday 10 December, 2025
Lmax
L10
Leq
L90
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time [hours]
100
90
80
70
60
50
40
30
20
6
5
4
3
2
1
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1:00
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APPENDIX B – EPA NOISE POLICY FOR INDUSTRY TRIGGER LEVELS

Project specific assessment trigger levels have been determined for each noise source applying at the identified potentially most impacted receivers.

B.1 NFPI TRIGGER LEVELS

The NPfI requires noise impacts at residential receivers to be assessed in 3 ways:

- Whether the emitted noise is unreasonably loud relative to ambient background noise. (which the EPA calls the "intrusiveness" trigger level).
- Whether the noise emitted is unreasonably loud in an absolute sense, and consistent with surrounding land use and environment. ("amenity" trigger level)
- For night noise emissions, whether discrete noise events are likely to adversely impact sleep ("maximum noise level" trigger levels).

For other receiver types only the amenity trigger level is relevant.

B.1.1 Intrusiveness

The $L_{eq,15min}$ descriptor is used for the intrusiveness trigger level, and is set at a level that is 5dB(A) above the rating background noise level for the relevant period.

B.1.2 Amenity

Table 2.2 of the NPfI (repeated below) sets out acceptable noise levels for various receiver types.

There are 3 categories of residential receivers - rural, suburban, urban. The nearest residential receivers to the subject site are categorised as "Suburban" receivers. Categories for non-residential uses are also indicated in the table.

The NPI typically requires project amenity noise levels to be calculated in the following manner:

$$L_{Aeq,15min} = \textit{Recommended Amenity Noise Level} - 5\ dB(A) + 3\ dB(A)$$

NPfI Table 2.2: Amenity Noise Levels			
Receiver	***Noise Amenity Area***	***Time of Day***	***Recommended Amenity Noise Level L_{Aeq}***
Residential	*Suburban*	*Day*	*55*
		Evening	*45*
		Night	*40*
Active recreation	*All*	*When in use*	*55*

Notes: The recommended amenity noise levels refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as follows:

• rural residential – see Table 2.3

• suburban residential – see Table 2.3

• urban residential – see Table 2.3

• commercial – commercial activities being undertaken in a planning zone that allows commercial land uses

Time of day is defined as follows:

• day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays

• evening – the period from 6 pm to 10 pm

• night – the remaining periods.

(These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

B.1.3 Noise Characteristic Modifying Factors

Where applicable, the emitted intrusive noise level should be modified (increased or decreased) to account for characteristics such as tonality, low frequency, duration, etc according to NPfI Fact Sheet C.

B.1.4 Maximum Noise Level Assessment

The purpose of this assessment is to identify whether discrete, nighttime noise events have the potential to produce adverse sleep impacts.

Section 2.5 of the NPfI, repeated below, recommends the following procedure to assess the potential for adverse sleep disturbance.

Where the subject development/ premises night -time noise levels at a residential location exceed:

- *$L_{eq(15min)}$ 40 dB(A) or the prevailing RBL (L90) plus 5 dB, whichever is the greater, and/or*
- *L_{max} 52 dB(A) or the prevailing RBL (L90) plus 15 dB, whichever is the greater,*

a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.

Other factors that may be important in assessing the extent of impacts on sleep include:

- *how often high noise events will occur*
- *the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development*
- *whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)*

- *current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.*

Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

B.2 PROJECT SPECIFIC NOISE TRIGGER LEVELS

The following table summarises the trigger levels applying at each of the identified "most impacted" receivers. These have been determined based on the NPfI methodology described above and the measured rating background noise levels.

The trigger levels in bold indicate the most stringent trigger level at each location

Table B 1 – Project Specific Noise Trigger Levels

Location/Receiver Type	**Time**	**RBL dB(A) L_{90}**	**Trigger Noise Level (dB(A) $L_{eq,15min}$)**		
			Intrusiveness	Amenity	Max Event
Residential – R1 to R9	Day	41	**46**	53	-
	Evening	40	45	**43**	-
	Night	32	**37**	38	40 L_{eq} 52 L_{max}
Mona Vale Golf Course – RE1	When in use	-	-	**53**	-