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21, 23 and 25 McIntosh Street and 55 Werona Avenue, Gordon

Noise and Vibration Impact Assessment

SSD-83478456: Residential Flat Buildings with In-Fill Affordable Housing

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1 INTRODUCTION

This Noise and Vibration Impact Assessment accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction of the proposed residential flat buildings, reference SSD-83478456.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

SEARs Requirement
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.

The proposed development is residential flat buildings with in-fill affordable housing located at Lot A in DP 339345, Lot 5 in DP 651557, Lot 1 in DP 167505 and Lot 11 in DP 1078667, described in Section 4 of the report.

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 assessment addresses the impact on occupant amenity from the following nearby environmental noise sources:

- Railway Noise
- Traffic Noise
- And the impact of the proposed development on surrounding land uses.

Noise and vibration levels at the site have been measured using EPA recommended methodologies. The predicted likely impacts have been assessed using criteria established using the following policies and guidelines:

- State Environmental Planning Policy
- EPA Guidelines
- NSW Department of Planning
- Ku-Ring-Gai Council DCP (2024)

Where required, complying controls and mitigation have been determined to prevent adverse amenity impacts.

The subject site and local context are indicated in Figure 1.

2 REFERENCED DOCUMENTS

2.1 BACKGROUND INFORMATION USED

The assessment is based on the following drawings, reports and other information:

- Architectural Drawings prepared by PMDL as follows:

3303 DA00.00 Rev B 26/05/2025	3303 DA00.01 Rev C 27/05/2025
3303 DA00.02 Rev B 26/05/2025	3303 DA01.00 Rev B 26/05/2025
3303 DA01.01 Rev B 26/0/2025	3303 DA10.00 Rev B 26/05/2025
3303 DA10.01 Rev B 26/05/2025	3303 DA10.02 Rev B 26/05/2025
3303 DA10.03 Rev C 27/05/2025	3303 DA10.04 Rev C 27/05/2025
3303 DA10.05 Rev C 27/05/2025	3303 DA10.06 Rev C 27/05/2025
3303 DA10.07 Rev C 27/05/2025	3303 DA10.08 Rev C 27/05/2025
3303 DA10.09 Rev C 27/05/2025	3303 DA10.10 Rev C 27/05/2025
3303 DA20.01 Rev B 26/05/2025	3303 DA20.02 Rev B 26/05/2025
3303 DA20.03 Rev B 26/05/2025	3303 DA30.01 Rev B 26/05/2025

2.2 PLANNING GUIDELINES

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

- NSW EPA – 'Noise Policy for Industry' ("**NPfI**") October 2017
- NSW EPA – 'Noise Guide for Local Government' ("**NGLG**") Jan 2023
- NSW EPA – 'Road Noise Policy" ("**RNP**") March 2011
- State Environmental Planning Policy (Transport and Infrastructure) ("**TISEPP**") 2021
- NSW Department of Planning – 'Development Near Rail Corridors and Busy Roads – Interim Guideline' (2008) ("**DNRCBR**")
- Ku-Ring-Gai Council Development Control Plan (2024) (**DCP**)
- Ku-Ring-Gai Council Development Application Guide August 2023.

3 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
L_{90}	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)

4 SITE AND PROPOSAL DESCRIPTION

4.1 EXISTING SITE DESCRIPTION

The project site is located at 21-25 McIntosh Street and 55 Werona Avenue, Gordon, within the Ku-ring-gai local government area. The site is bound by McIntosh Street to the north, and residential buildings surrounding all other sides of the site (see the aerial site map in Figure 1 below).

The site consists of four individual lots, with a total area of approximately 7,776 sqm. All four properties are currently occupied with dwelling houses and associated development such as swimming pools, tennis courts and gardens. The site is rectangular in shape with the main frontage to McIntosh Street, a secondary access to the site is provided via an access handle to 55 Werona Avenue.

The site is defined as being both a Transport Oriented Development Area and 'accessible area', according to the Transport Orient Development Sites Map and schedule 10 of State Environmental Planning Policy (Housing) 2021 (Housing SEPP) respectively. The site is located on the northern side of the North Shore Railway Line and within walking distance (400m metres southeast) of the entrance to the Gordon Railway Station.

4.2 PROPOSED SCOPE OF WORKS

The project includes the construction of three residential buildings with a combined gross building area of 18,604.52 m^2, encompassing both residential units and affordable housing. The new development would consist of a eight-storey building, with additional basement level carparking, amenities and landscaping.

Figure 1 – Aerial site map, indicating the proposal area.

4.3 NEAREST SENSITIVE RECEVIERS

The following table lists the nearest sensitive receivers surrounding the site.

Table 1 – Sensitive Receivers

Noise Catchment Area	Receiver	Land Use	Address
NCA 1	R1	Residential	18 & 20 McIntosh Street, Gordon
	R2		22 McIntosh Street, Gordon
	R3		27 McIntosh Street, Gordon
NCA 2	R4		19 McIntosh Street, Gordon
	R5		51A Werona Avenue, Gordon
NCA 3	R6	Residential	49 Werona Avenue, Gordon 12, 16 & 18 Forsyth Street, Gordon
	R7		18A Forsyth Street, Gordon

Figure 2: Aerial site map indicating the nearest sensitive receivers to the site.

5 NOISE EMISSION ASSESSMENT

5.1 NOISE EMISSION CRITERIA

Operational noise emissions from the project site shall comply with the requirements of the following:

- NSW EPA '*Noise Policy for Industry (NPfI) 2017*'.
- NSW EPA '*Road Noise Policy 2011*'.
- Ku-ring-gai Council DCP

5.1.1 Summary of Noise Emission Criteria

The project noise trigger level (as outlined in section 2.1 of the policy) is the lower of the intrusiveness and project amenity noise levels. The project noise trigger levels are presented in the table below.

Table 2 – Project Noise Trigger Levels (NPfI)

Receiver(s)	Time Period	Project Trigger Noise Level dB(A) $L_{eq(15min)}$	Max Noise Event Criteria
NCA 1	Day	45	-
	Evening	41	-
	Night	35	40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}
NCA 2	Day	43	-
	Evening	40	-
	Night	35	40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}
NCA 3	Day	44	-
	Evening	42	-
	Night	37	40 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

5.1.2 Traffic Generation - NSW EPA Road Noise Policy 2011

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA *Road Noise Policy*. Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 3 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Sub-Arterial Roads (Werona Ave)	Day (7am to 10pm)	60 dB(A) $L_{eq(15hr)}$
	Night (10pm to 7am)	55 dB(A) $L_{eq(9hr)}$
Local Roads (McIntosh Street, Rosedale Road and Arthur Street)	Day (7am to 10pm)	55 dB(A) $L_{eq(1hr)}$
	Night (10pm to 7am)	50 dB(A) $L_{eq(1hr)}$

However, if existing noise levels exceed those in the table above, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts to be reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible.

5.2 OPERATIONAL NOISE EMISSION

Operational noise emissions are assessed in the following section. The following noise impacts have been included as part of this assessment:

- Mechanical plant noise.
- Traffic noise generation on surrounding roads.

5.2.1 Mechanical Plant Noise Emission

Mechanical plant noise emission will be generated by the condenser units located on the roof top plant deck. Final mechanical plant selections for the proposed development have not been made at the time of this report. The mechanical plant noise emission assessment has been conducted based on the following indicative selections and associated sound power levels.

Table 4: Mechanical Plant Sound Power Levels, dB

Item		Octave Band Centre Frequency, Hz							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Building A									
CU-1 (27 units)	Daikin RXYMQ5BVM	67	64	63	58	57	54	49	42
CU-2 (13 units)	Daikin RXYMQ6BVM	69	66	67	59	57	54	55	41
CU-3 (4 units)	Daikin RXYMQ9BVM	69	70	67	65	62	59	53	47
Building B									
CU-1 (28 units)	Daikin RXYMQ5BVM	67	64	63	58	57	54	49	42
CU-2 (14 units)	Daikin RXYMQ6BVM	69	66	67	59	57	54	55	41
CU-3 (4 units)	Daikin RXYMQ9BVM	69	70	67	65	62	59	53	47
Building C									
CU-1 (43 units)	Daikin RXYMQ5BVM	67	64	63	58	57	54	49	42
CU-2 (22 units)	Daikin RXYMQ6BVM	69	66	67	59	57	54	55	41
CU-3 (7 units)	Daikin RXYMQ9BVM	69	70	67	65	62	59	53	47

Note:

1. Noise data provide is for a single unit

Predicted noise emission from the plant outlined above to adjacent sensitive receivers comply with the established project trigger noise levels.

5.2.2 Traffic Noise Emission

The Traffix report *Traffic Impact Assessment – Proposed Residential Development 21-25 McIntosh Road and 55 Werona Avenue, Gordon* provides the following information with regards to existing traffic and predicted traffic generation from the proposed development:

Table 5 – Traffic Data provided by McLaren Traffic

Road	Volume, vehicles per hour				Increase in Road Traffic Noise Levels, dB	
	Existing AM Peak	Existing PM Peak	With Development, AM	With Development, PM	AM	PM
McIntosh Street (East of Werona Avenue)	329	275	349	289	0.3	0.2
McIntosh Street (West of Rosedale Road)	342	267	354	279	0.1	0.2
McIntosh Street (East of Rosedale Road)	298	212	302	216	0.1	0.1
McIntosh Street (West of Arthur Street)	268	191	273	212	0.1	0.5
McIntosh Street (East of Arthur Street)	63	54	63	54	0.0	0.0
Werona Avenue (North of McIntosh Street)	1074	784	1079	789	0.0	0.0
Werona Avenue (South of McIntosh Street)	1193	879	1208	888	0.1	0.0
Rosedale Road (North of McIntosh Street)	484	349	492	357	0.1	0.1
Arthur Street (South of McIntosh Street)	259	177	264	198	0.1	0.5

The predicted increase in traffic noise levels resulting from traffic generation by the proposed development is less than 2 dB. The increase in traffic noise levels from additional vehicle movements from the proposed development is predicted to comply with the relevant criteria presented in Section 5.1.2.

6 ROAD AND RAIL TRAFFIC NOISE INTRUSION ASSESSMENT

The noise sources assessed as potentially impacting the proposed development are traffic noise from Pacific Highway and the Sydney Trains Northern rail line.

6.1 GUIDELINES AND ASSESSMENT CRITERIA

6.1.1 AS/NZS 3671:1989

Australian Standard AS/NZS 3671:1989 – *'Acoustics – Road traffic noise intrusion – Building siting and construction'* notes the following in relation to traffic noise:

- Internal noise levels should be determined in accordance with AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors'.
- A suitable descriptor should be adopted relevant to the use of the development. As AS2107:2016 adopts the Leq descriptor, Acoustic Logic shall also use this descriptor.

- AS3671 does not specifically recommend a time interval. On this basis, Acoustic Logic have adopted the interval used by the EPA Road Noise Policy for main/arterial roads, that being:
    - Day – 7am to 10pm (15 hour); and
    - Night – 10pm to 7am (9 hour).
- Acoustic Logic have applied the daytime interval to the development as the proposed operation hours are entirely within the daytime interval.
- Internal noise levels have been selected in accordance with AS 2107:2016, as presented in the below section.

6.1.2 AS/NZS 2107:2016

AS2107-2016 recommends design criteria for internal spaces within various types of spaces/occupancies to ensure a healthy, comfortable and productive environment for the occupant.

Table 6– Recommended Design Sound Level

Occupancy/Activity Type	Recommended Design Sound Level
Sleeping areas (night time)	30-35 dB(A)L_{eq}
Living Areas	30-40 dB(A)L_{eq}

6.1.3 Summary of Noise Intrusion Criteria

The governing project criteria is presented in the table below based on requirements above.

Table 7 – Summary of Internal Noise Level Criteria

Space/Activity Type	Internal Traffic Noise Criteria dB(A)$L_{eq(period)}$
Bedroom	35dB(A)$L_{eq(9hour)}$
Living Room	40dB(A)$L_{eq(15hour)}$

6.2 AIRBORNE NOISE ASSESSMENT

An assessment of noise impact has been undertaken using the following methodology:

- Windows Closed Noise Levels

Windows closed noise levels were calculated to the centre of the room using the predicted octave band façade incident external noise levels and, for each façade element, correcting for the exposed area, octave band sound transmission loss and room sound power to pressure correction. The room noise level was calculated by accumulating all significant noise paths.

Envelope performance requirements to comply with the noise criteria are stipulated in section 6.1.

- Windows Open Noise Levels

"Windows open" noise levels have been calculated by subtracting 10 dB(A) from the façade incident noise level, as promulgated by the RNP (Table 7). The noise reduction assumes the open area of window is equivalent to 5% of the room floor area. Where openable windows to the room are located on different facades, the façade opening(s) with the lowest noise levels have been assessed first.

- No rooms exceeding the DNRCBR "windows open" noise level have been identified.

6.2.1 External Noise Levels

The measured noise levels have been used as a basis for predicting façade-incident noise levels around the development by:

- Correcting for different distances between the noise source compared to the monitoring location.
- Barrier effects, where applicable.
- Reflections off adjacent structures, where significant.

Table 8 – Traffic Noise Levels – Unattended Monitoring

Location	Noise Source	Descriptor / Time Period	Measured Noise Level, dB(A)
Front Garden 23 McIntosh Street	McIntosh Road	Day $L_{eq,15hr}$	53
		Night $L_{eq,9hr}$	45

6.3 COMPLYING MITIGATION

The assessment indicates that the building envelope is required to be upgraded beyond what is considered to be a "standard" form of construction to comply with the internal noise criteria. The following complying mitigation has been determined to comply with the required internal noise levels.

6.3.1 Building envelope

6.3.1.1 Glazed Windows and Doors

Acoustically rated external windows and doors are required. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria.

All external windows and doors listed are required to be fitted with Q-lon type (or equal) acoustic seals. **(Mohair Seals are unacceptable).** The suitability of alternative seal types should be determined by an appropriately qualified acoustic expert.

Table 9 provides the recommended glazing constructions for compliance with the required internal noise levels presented in Section 6.1.

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.

Table 9 – Recommended Glazing Thicknesses

Facade	Level	Space	Glazing Construction	Acoustic Seals
All Facades	All Levels	All Spaces	4mm Float	**Yes**

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.

In addition to complying with the minimum complying glazing construction, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening should not be lower than the values listed in the following table. This will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Table 10 – Minimum Rw of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
4mm toughened	27

6.3.2 External Walls

External walls constructed from concrete/masonry elements will not require any acoustic upgrading to achieve the acoustic requirements.

6.3.2.1 Non-Glazed Entry Doors

Doors to be minimum 44mm thick solid core timber (minimum 32 kg/m^2 surface density), fitted with full perimeter acoustic seals equal to Raven RP10 to the top and sides and Raven RP38 to the underside of a hinged door.

6.3.2.2 Penetrations in the External Envelope

Acoustically treat all penetrations in the external envelope, including any supplementary ventilation system, to prevent that the acoustic performance of the building envelope from being reduced.

6.3.2.3 Ventilation Requirements

All proposed rooms are expected to meet traffic noise intrusion requirements with the windows open. Supplementary ventilation is not required for the purposes of meeting acoustic requirements.

6.4 VIBRATION ASSESSMENT

A standard railway ground vibration assessment has not be applied to this project site as the distance from the rail corridor to the project site is outside the typically assessed parameters under the DNRCBR.

7 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

7.1 WORKS DESCRIPTION

The proposal is to demolish the existing residential occupancies and build residential flat buildings with in-fill affordable housing. The complex is to comprise 3 buildings: A, B and C. An indicative construction scope is summarised as following:

- **Demolition Stage**: Demolish existing residential homes on site.
- **Excavation Stage**: Excavation and amplification of services via Rosedale Road, excavation of basement car parks and ground floor transfer slab
- **Residential Towers**: Construct three residential towers (A, B and C)
- **External Works and Landscaping**

7.1.1 Source Noise Data

In this section, typical equipment/processes anticipated to be used during the construction of the project site are outlined in the table below with A-weighted sound power levels. The equipment list is prepared based on our experience with similar projects. Typically, the most significant sources of noise or vibration generated during a construction project will be demolition and excavation.

Table 11 - Sound Power Levels of Equipment

Equipment /Process	Typical Sound Power Level dB(A)	Total Sound Power Level dB(A)
Demolition		
Excavator with 10T hydraulic hammer	118[1]	118
10t Vibratory roller	109	
Truck	110	
Excavation		
Piling Rig	112	114
Excavator	100	
Truck	110	
Residential Towers		
Crane	113[2]	107
Concrete Pump	110	115
Concrete Truck	110	
Trucks	110	
Powered Hand Tools (Electric)	95[3]	
Diesel Generator	103	

Hoist	85	
External Works & Landscaping		
Jackhammer	113[1]	113
Powered Hand Tools (Electric)	95[3]	
Bobcat	105	

Notes:

1. *Equipment operating 75% of the time*
2. *Equipment operating 25% of the time*
3. *Equipment operating 50% of the time*

The noise levels presented in the above table are derived from the following sources, namely:

- On-site measurements.
- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary).

7.1.2 Proposed Hours of Work

The proposed hours of construction work are within the recommended standard hours of work of the ICNG.

The following hours are as follows:

Monday to Friday – 7:00am to 5:00pm

Saturdays – 7:00am to 3:00pm

Sundays and Public Holidays – No Construction Unless by Special Arrangement

Buildings A, B and C are planned to be developed under one collective phase, projected under a 20 Calendar month program.

It is envisaged that construction scope and staging would be further refined in subsequent stages of the development approval and documented (along with additional impacts or considerations) within a *Construction Environmental Management Plan*.

7.2 CONSTRUCTION NOISE ASSESSMENT

7.2.1 Construction Management Levels

Noise associated of construction activities on the site will be assessed in accordance with the NSW *DECC Interim Construction Noise Guideline* (**ICNG**) 2009.

The "quantitative" assessment procedure, as outlined in the ICNG will be used. The quantitative assessment method requires: Determination of noise generation goals (based on ambient noise monitoring); Prediction of operational noise levels at nearby development; and if necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

DECC guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- ***"Noise affected" level*** where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise affected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.

- **"*Highly noise affected level*"** where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of the above recommended noise levels from the ICNG is presented below.

Table 12 – Noise Management Levels at Residential Receiver

Receiver	"Noise Affected" Level dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level dB(A)$L_{eq(15min)}$
NCA 1	50 (RBL+10) externally at façade	75
NCA 2	48 (RBL+10) externally at façade	75
NCA 3	49 (RBL+10) externally at façade	75

Where noise from the construction works is above the "noise affected" level, the proponent should apply any feasible and reasonable work practices to minimise noise. The "noise affected" level is representative of a level where there may be some community reaction to noise.

If noise emissions are likely to exceed 75 dB(A)$L_{eq(15min)}$ "highly noise affected" at the boundary of surrounding affected residential receivers, the receiver is deemed to be "highly noise affected". The "highly noise affected" level is representative of a level where strong community reaction to noise is expected. Introduction of management controls such as scheduling of noisy periods, or respite periods is then recommended.

7.3 CONSTRUCTION NOISE EMISSION ASSESSMENT

7.3.1 Methodology

Noise from the loudest typical construction activities for all stages of works have been predicted to the nearest most affected sensitive receivers.

Predictions take into account:

- The distance between the noise source and the receiver.
- The screening effect provided by any building structure or building shell, if applicable. In particular, noise from works proposed during the fit-out stages when the building shell will screen these activities from the surrounding sensitive receivers.
- Recommended standard hours for construction work presented in Section 2.2 of the NSW DECC ICNG 2009 has been adopted for this project.

7.3.2 Predictions

Construction noise emissions to nearest development depend on the activities being undertaken at the time, and where on the site the activities occur.

Worst-case noise levels of equipment at the surrounding receivers have been predicted based on the following inputs.

- The plant sound power levels indicated in these have been corrected for estimated typical operation duty indicated in the table using 10 x log(% duty/100).
- Corrections for source to receiver distance attenuation.
- Barrier or directivity attenuation where present.
- Source heights – 1m above the ground/building level of the noise source location, unless noted otherwise.

7.3.3 Predicted Noise Impacts

The maximum predicted noise levels for each construction scenario for each noise catchment area are presented in Table 13 – Table 15.

Table 13 – Worse-Case Predicted Noise Impacts - Catchment 1

Scenario	Maximum Predicted Level dB(A) L_{eq}	NML/HANML dB(A) L_{eq}	Comment
1 – Demolition	105	50 75	Above HANML
2 – Excavation	80	50 75	Above HANML
3 – Residential Towers	81	50 75	Above HANML
4 – External Works & Landscaping	104	50 75	Above HANML

Table 14 – Worse-Case Predicted Noise Impacts – Catchment 2

Scenario	Maximum Predicted Level dB(A) L_{eq}	NML/HANML dB(A) L_{eq}	Comment
1 – Demolition	77	48 75	Above HANML
2 – Excavation	95	48 75	Above HANML
3 – Residential Towers	95	48 75	Above HANML
4 – External Works & Landscaping	105	48 75	Above HANML

Table 15 – Worse-Case Predicted Noise Impacts – Catchment 3

Scenario	Maximum Predicted Level dB(A) L_{eq}	NML/HANML dB(A) L_{eq}	Comment
1 – Demolition	104	49 75	Above HANML

2 – Excavation	94	49 75	Above HANML
3 – Residential Towers	95	49 75	Above HANML
4 – External Works & Landscaping	94	49 75	Above HANML

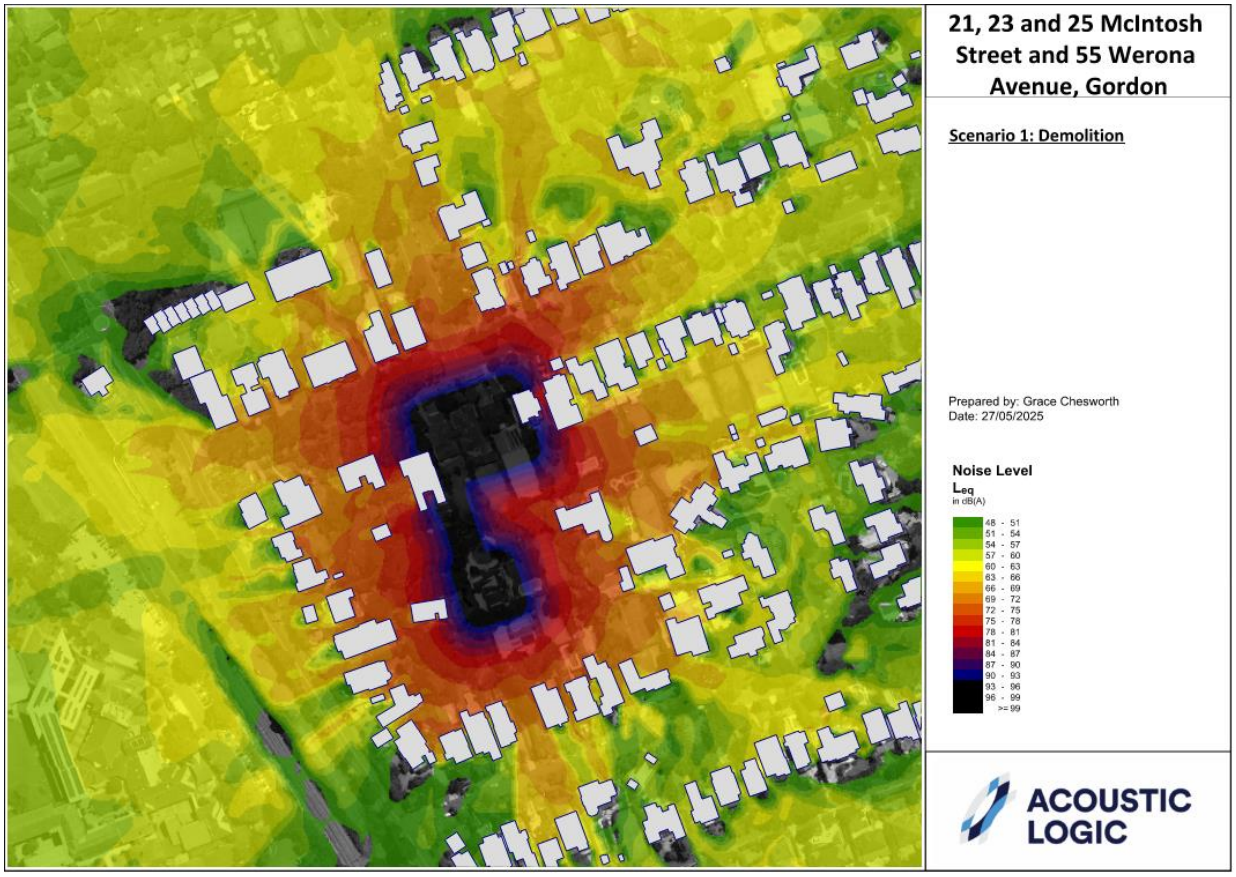


Figure 3: Construction Noise Emission – Demolition Phase

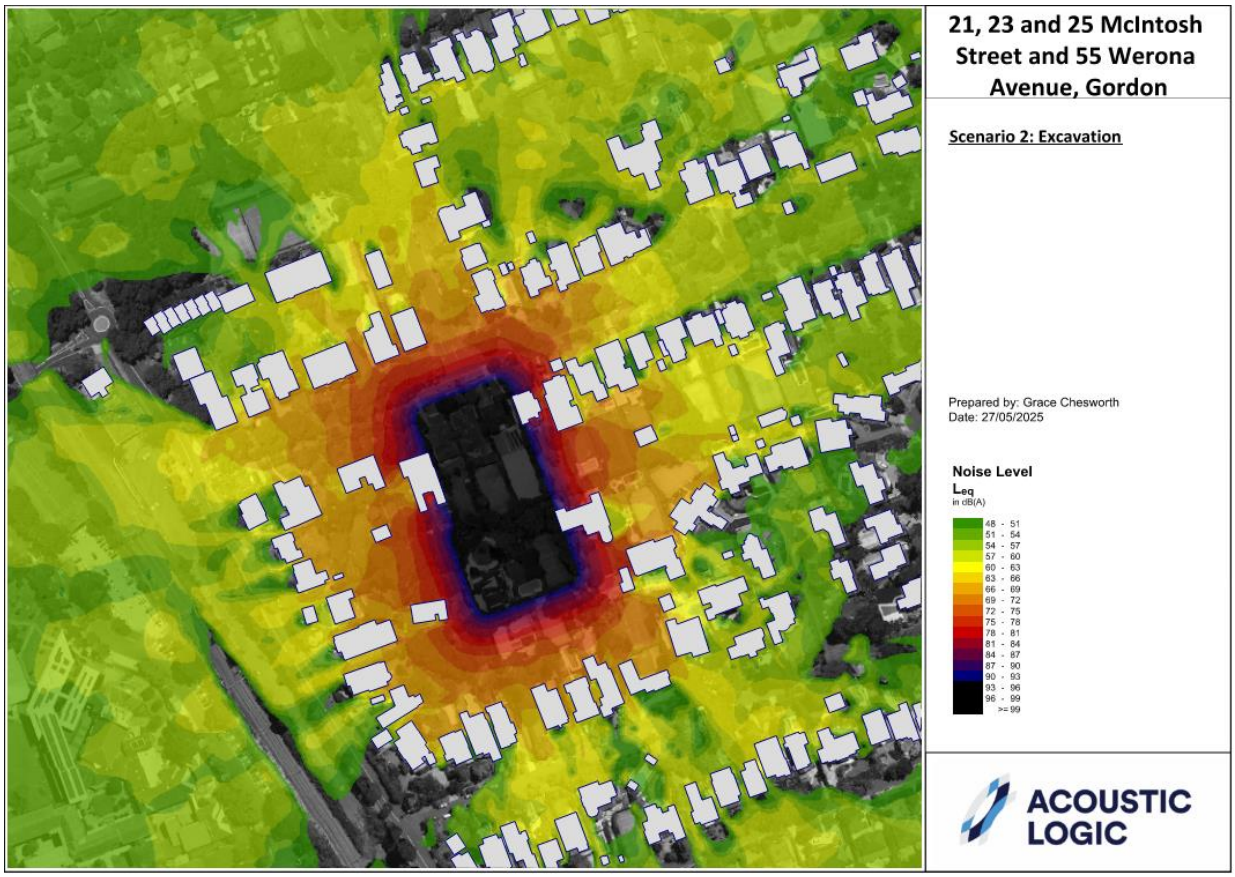


Figure 4: Construction Noise Emission – Excavation Phase

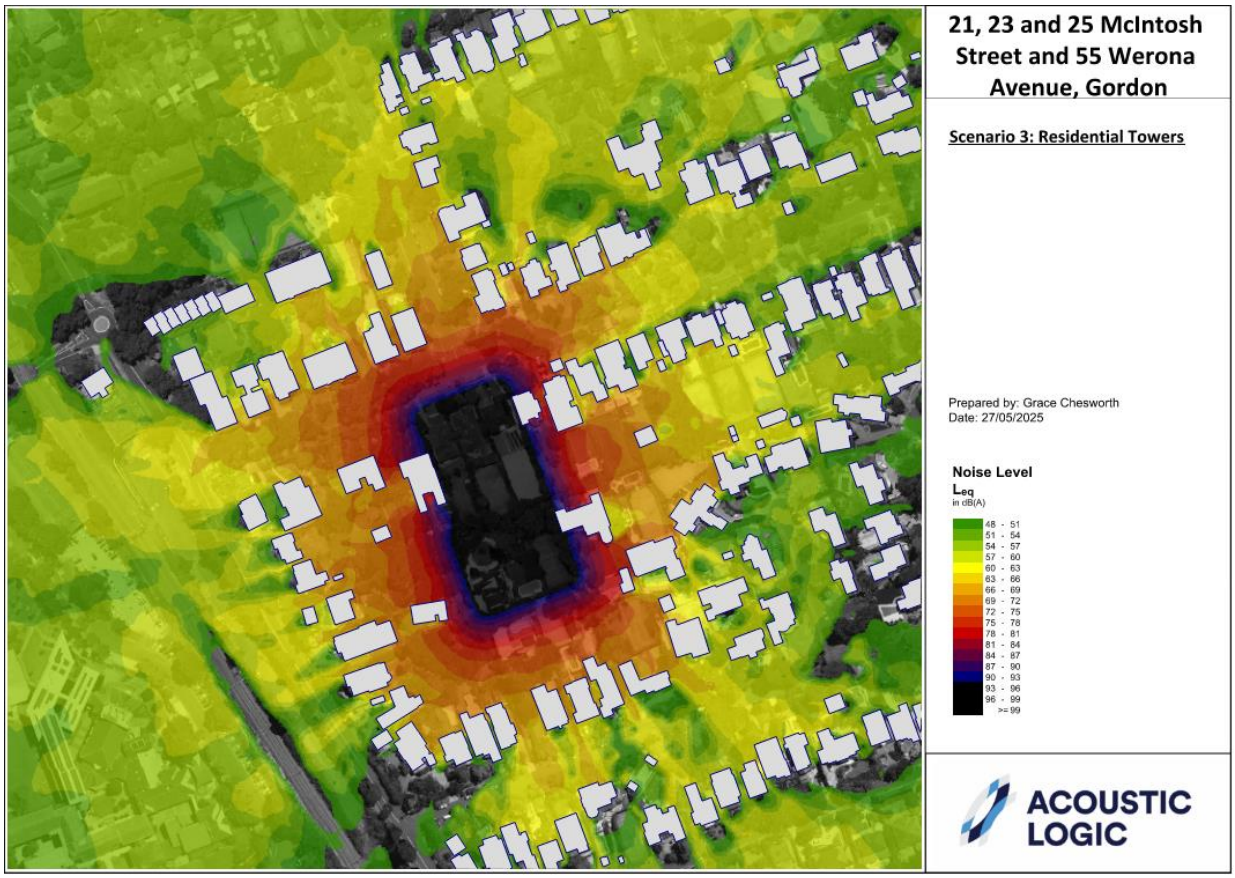


Figure 5: Construction Noise Emission – Residential Towers Phase

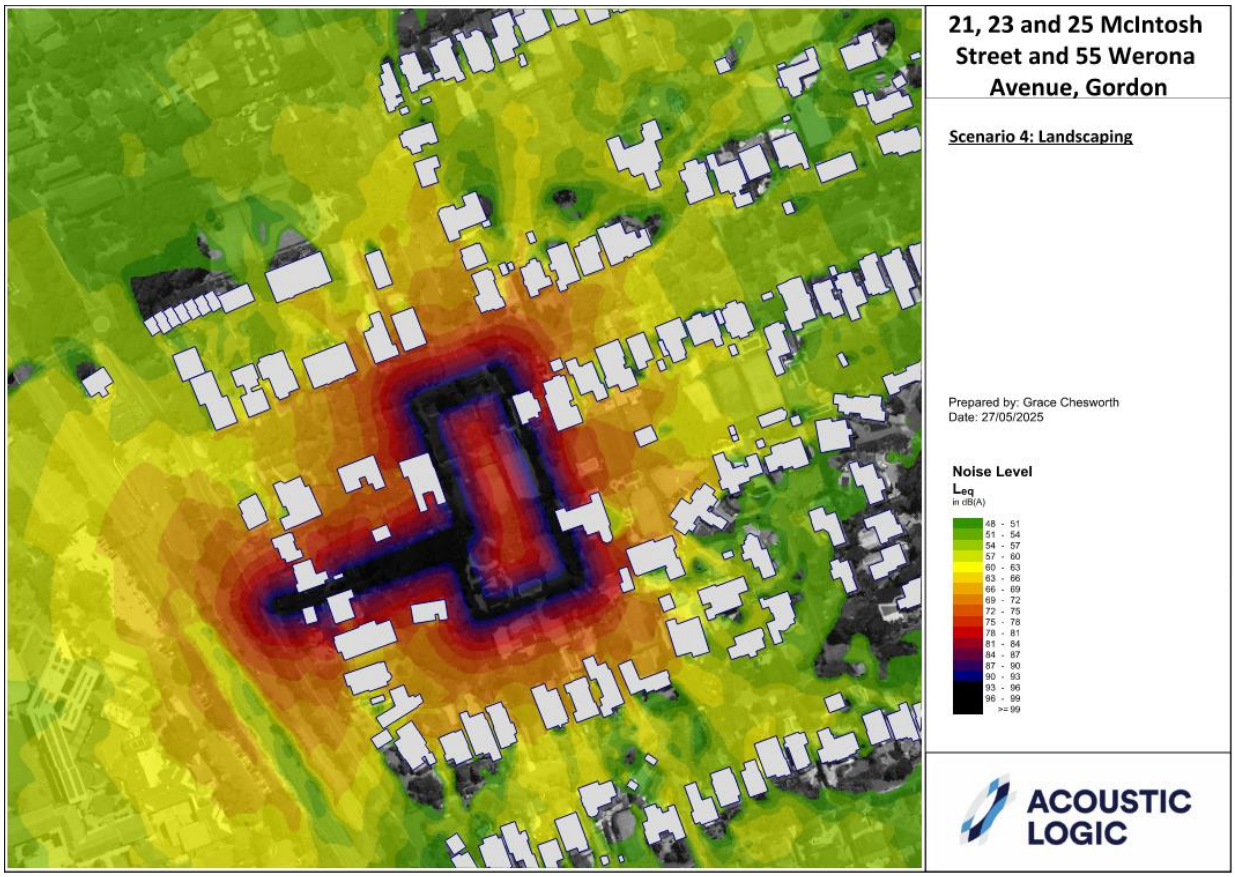


Figure 6: Construction Noise Emission – Landscaping Phase

7.3.4 Discussion of Predicted Results:

The analyses indicates that noise emissions are expected to exceed NMLs and HNAMLs during all construction stages.

Assessing mitigation for general construction activities is presented section 7.6 below.

7.4 CONSTRUCTION VIBRATION ASSESSMENT

7.4.1 Construction Vibration Objectives

7.4.1.1 Amenity Management

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline*. These levels (extracted from Tables 2.2 and 2.4 of the guideline) are presented in the following table for various types of vibration:

Table 16 -(Table 2.2 Assessing Vibration: A Technical Guideline) – Preferred and Maximum Weighted RMS Values for Continuous and Impulsive Vibration Acceleration (m/s2) 1-80Hz

Location	Assessment Period [1]	Preferred values		Maximum Values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous Vibration					
Residences	Daytime	0.010	0.0071	0.02	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive Vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate task require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS6472-1992.

Table 17 -(Table 2.4 Assessing Vibration: A technical guideline) – Acceptable Vibration Dose Values for Intermittent Vibration (m/s1.75)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum Value	Preferred value	Maximum Value
Residences	0.20	0.40	0.13	0.26

1 Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am.

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS6472-1992.

7.4.1.2 Structure Borne Vibration (Damage Criteria)

German Standard DIN 4150-3 (2016) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table following lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when 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.

It is noted that if measured vibration levels do not exceed the guidelines listed in the following table, damage that will reduce the serviceability of the building will not occur, and if damage to the building does occur, it is assumed that the damage is related to other causes. Furthermore, the DIN4150-3 guideline states the following regarding the limits presented in Table 1 of the standard:

"Exceeding the guideline values does not necessarily lead to damage. Should they be exceeded, however, further investigations may be necessary, such as determining and evaluating the stresses as detailed in 4.3 and 4.4.".

Table 18 – Table 1 – DIN 4150-3 (2016)) – Guideline Values for Vibration Velocity, $v_{i,max}$, for Evaluating the Effects of Short-Term Vibration on Structures

	TYPE OF STRUCTURE	Guideline values for $v_{i,max}$ in mm/s				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz [(a)]	All Frequencies	All Frequencies
L/C	1	2	3	4	5	6
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 under lines 1 and 2 **and** are of great intrinsic value (e.g. listed buildings) buildings that are under a preservation order)	3	3 to 8	8 to 10	8	20[(b)]

NOTE:

Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

a. At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.

b. b It may be necessary to lower the guideline value markedly to prevent minor damage

7.5 CONSTRUCTION VIBRATION ASSESSMENT

7.5.1 Vibration Sources

The following sources have been identified as potentially producing significant ground vibration:

- Vibratory rollers
- Impact Piling
- Hydraulic hammer (rock)

The remaining activities are not expected to produce significant ground vibration and/or are sufficiently separated from sensitive receivers. Vibration from these activities are expected to be significantly below amenity or damage risk management levels at all receivers.

7.5.2 Assessment of Vibration

A precise assessment of vibration emissions from the proposed works is not possible due to the large number of unknowns including the actual equipment employed, how it is operated, site conditions, etc.

In the absence of any specific equipment the generic minimum safe working distances presented in Table 19 should be used with caution for guidance. It is noted that the vibrating roller distances are based on asphalting road works and are not applicable to earthworks as the vibration frequencies are considerably lower leading to a greater safe-work distance requirement. Empirical formulae by Hiller and Crabb will be used in lieu.

Should the types and models of the plant and equipment be available then vibration levels may be predicted at the nearest and most affected receivers by using the published generic formulae, source levels or historical data as found in:

- BS 5228-2:2009+A1:2014
- ISO 4866:2010
- FTA Transit Noise and Vibration Impact Assessment Manual (2018)
- Caltrans Transportation and Construction Vibration Guidance Manual (2020)
- Construction Vibrations 2nd Edition (Dowding, 2000)

Regardless of the method used site vibration levels from machinery and processes should be verified on site as soil conditions may be different from the basis sources.

The assessment of building and soil settlement or the liquefaction of soils under induced vibration is outside the scope of typical vibration standards such as DIN 4150-3 and expert advice is to be sought from a Geotechnical Engineer

7.6 GENERAL DISCUSSION

7.6.1 Noise

Noise impacts on nearby development will be dependent on the activity and where on the site the activity is undertaken. Demolition works (e.g., use of hydraulic hammer) tend to be the loudest typical activity. Work close to the site boundaries will have the greatest impact on nearby receivers.

Noise impacts can be minimised using the following:

- Selection of equipment and process.
- Location of static plant.
- Use of screens or enclosures and erection of hoarding (typically only feasible for static plant).
- Scheduling of noisy activities and provision of respite periods.

Detailed construction noise planning is typically undertaken after engagement of a builder and a construction program is prepared (i.e., after DA stage) and therefore, detailed planning is not possible at this stage.

If the Construction noise levels are predicted is exceed the HNML 75dB(A) during any stages of the project, we recommend the following:

- During preparation of the construction program (CC stage), acoustic review of proposed construction activities and plant/methods should be undertaken to identify work items likely to exceed Noise Management Levels.

- For those activities likely to generate high noise levels, the analysis should identify where on the site are the areas likely to result in high noise levels. This will then assist in determining the likely time period for which high noise levels will occur.

- Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.

- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent excessive impact.

7.6.2 Vibration

The highest levels of vibration are likely to be produced during excavation activities are undertaken with the use of piling rig. This activity would only produce a moderate level of vibration close to the work site. Given the distance attenuation between existing residential receivers and the project site, the impact at the surrounding properties is moderate considering amenity and structure damage.

Where required, vibration monitors may be installed at critical locations to determine any impact. Ongoing review and assessment of vibration impact will be conducted throughout the construction process to determine appropriate vibration levels. The specific location and quantity of vibration monitors to monitor residential houses are to be determined in consultation with the builder and structural engineer.

7.7 NOISE AND VIBRATION MANAGEMENT AND CONTROLS FOR CONSTRUCTION

Notwithstanding that the assessment indicates noise and vibration emissions will generally comply with the noise and vibration management levels, emissions should be minimised as part of best practice endeavours, and contingency measures should be put into place to respond to complaints or if it is found the processes needed to complete the tasks vary from those envisaged in this assessment.

The recommended measures are provided below.

7.7.1 Noise And Vibration Monitoring, Reporting and Response Procedures

Given the relatively low level of impact predicted, monitoring would only be required in response to complaints, if the processes needed to complete the tasks vary from those envisaged in this assessment, or if works outside of standard hours are proposed.

Noise and vibration monitoring may either consist of manned and/or unmanned measurements. Active monitoring may be undertaken during the construction work phase of the project if required in the event complaints are received from neighbours.

In the event that complaints are received from neighbours the following process should be considered:

1. Assessing impacts and determining the offending plant/equipment/process.

2. Locating the plant/equipment/process further away from the affected receiver(s) if possible.

3. Implementing additional acoustic treatment in the form of localised barriers, silencers etc.

4. Selecting alternative equipment/processes.

Where monitoring is required and indicates exceedances of the predicted noise impacts immediate action should be taken to identify any further controls as required to reduce noise emissions so that the noise limits are complied with. Monitoring of the activities following the implementation of these additional controls will be undertaken to confirm compliance.

7.7.1.1 Reporting Requirements

The following is an example of reporting which may be kept on site:

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed below.

2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.

3. Any noise exceedances occurring including, the actions taken and results of follow up monitoring.

4. A report detailing complaints received and actions taken shall be presented.

5. All monitoring and reporting shall be conducted in conjunction with the conditions of consent.

7.7.1.2 Response Procedures

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the site manager and their contact telephone number.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form may list:

- The name and address of the complainant (if provided).
- The time and date the complaint was received.
- The nature of the complaint and the time and date the noise was heard.
- The name of the employee who received the complaint.
- Actions taken to investigate the complaint, and a summary of the results of the investigation.
- Indicate what operations were occurring on site at the time of the complaint.
- Required remedial action, if required
- Validation of the remedial action.
- Summary of feedback to the complainant.

The flow chart that follows illustrate the process followed to assess construction activities prior to the start of work on site and well as the ongoing investigation into noise during the construction period.

7.7.2 General Noise Control Methods

The determination of appropriate additional noise control measures will be dependent on the particular activities and the construction equipment and plant identified as requiring future acoustic treatments to those already identified in this report. This section provides an outline of available methods which have previously been used on similar construction sites and may be possible on this site.

7.7.2.1 Selection of Alternate Appliance or Process

Where a particular activity or plant and equipment is found to generate noise levels that exceed the management levels, it may be possible to select an alternative approach or plant and equipment. For example, the use of excavator mounted hydraulic hammers of the site may potentially generate high levels of noise. By carrying this activity by using concrete saws or smaller plant where practical, construction noise levels and/or length of exposure to construction noise levels may be reduced.

7.7.2.2 Acoustic Barriers

The placement of barriers at the source is generally only effective for static plant. Placing barriers at the source cannot effectively attenuate equipment which is on the move or working in rough or undulating terrain.

The degree of noise reduction provided by barriers is dependent on the amount by which the line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where the barrier does not obstruct line of sight, generally no noise reduction will occur.

Barriers are used to provide shielding and do not act as an enclosure. The material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier screening. In this case, the use of a material such as 15mm plywood (or equivalent material) would be acceptable for the barriers.

7.7.2.3 Silencing Devices

Where construction methodologies or plant and equipment permit, investigate the use of silencing devices. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts, for example.

7.7.2.4 Treatment of Specific Equipment

In certain cases, it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

7.7.2.5 Materials Handling/Vehicles

- Trucks and forklifts in general use on site are to use non-tonal reversing beacon where possible (subject to OH&S requirements) to minimise potential disturbance of surrounding receivers.
- Avoid careless dropping of construction materials in empty trucks.
- Trucks, trailers and delivery vehicles are to turn off engines when idling to reduce noise impacts (unless required for concrete pumping or similar).

7.7.2.6 Establishment of Site Practises

This involves the formulation of work practices to reduce noise generation. This includes, for example, investigating the possibility of locating fixed plant items as far as possible from residents, rotating plant and activities to provide respite to receivers, scheduling activities after the construction of buildings that will screen receivers, avoiding noise sensitive periods for receivers, identify “safe” working distances, etc.

7.7.2.7 Notification

Notification of affected receivers of the progress of works, particularly when short-term activities likely to create higher noise levels occur, can in many cases minimise community reaction.

7.7.2.8 Minimum Safe Work Distances for Vibration Intensive Activities

The following safe working distances apply for vibration intensive plant.

Table 19 – Recommended Base Minimum Working Distances for Vibration Intensive Plant From Sensitive Receivers

Plant item	Rating / Description	Minimum Working Distance			
		Cosmetic Damage			Human Response
		Light-Framed Structure (BS 7385)	Residential Structures (DIN 4150)	Heritage and Other Sensitive Structures (DIN 4150)	NSW EPA's Vibration Guideline
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	18.5	14 m	15m
	< 100 kN (Typically 2-4 tonnes)	6 m	17.8	16 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	43	33 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	51.5	41 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	-	54 m	100 m
	> 300 kN (> 18 tonnes)	25 m	-	68 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	-	5 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	-	19 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	-	60 m	73 m
Vibratory Pile Driver	Sheet piles	20 m	-	50 m	100 m

8 CONCLUSION

This report summarises the potential noise and vibration impact assessment undertaken for the proposed development. Construction and operational impacts have been assessed, as well as noise from traffic generated by the proposal.

- An assessment of operational noise emissions has been undertaken using Noise Policy for Industry guidelines. Site noise emissions from the development have been predicted and assessed against criteria adopted from the trigger levels determined using the Policy.
- It is concluded that no additional mitigation is required to control noise emission from roof top plant to comply with noise criteria established for the site.
- Additional road traffic noise generated by the proposed development has been assessed using the EPA "Road Noise Policy" guideline and found to be compliant.
- Noise and vibration emissions during construction should be assessed and managed in accordance with the EPA "Interim Construction Noise Guideline", as indicated in Section 0 of this report.

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

I Laura Keen, confirm this Noise and Vibration Impact Assessment addresses the requirement of SEAR No SDD-83478456 and relevant Sate and local legislation, policies, and guidelines as presented in Section 2.2. I further confirm that none of the information contained in this Noise and Vibration Impact Assessment is false or misleading.

Yours faithfully,

Acoustic Logic Pty Ltd
Laura Keen

APPENDIX A – NOISE MONITORING

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 L_{max} to represent a typical noise level from a number of high level, short term noise events.

A.2 UNATTENDED LONG TERM NOISE MONITORING

An unattended long-term environmental noise survey was carried out. Existing noise levels, used as a basis for this assessment are detailed in the following sections.

A.2.1 EQUIPMENT USED

Unattended noise monitoring was conducting using Rion NL-42 (Type 2) loggers. The loggers were programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

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.

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.

A.2.2 MEASUREMENT LOCATION

Three unattended environmental noise monitors were installed at 23 McIntosh Street and 55 Werona Avenue, Gordon. The first was installed next to the fence separating 23 McIntosh Street from 25 McIntosh Street. The second was installed on the south-western side of the tennis court of 23 McIntosh Street. The last logger was installed on the south-eastern side of the tennis court at 55 Werona Avenue.

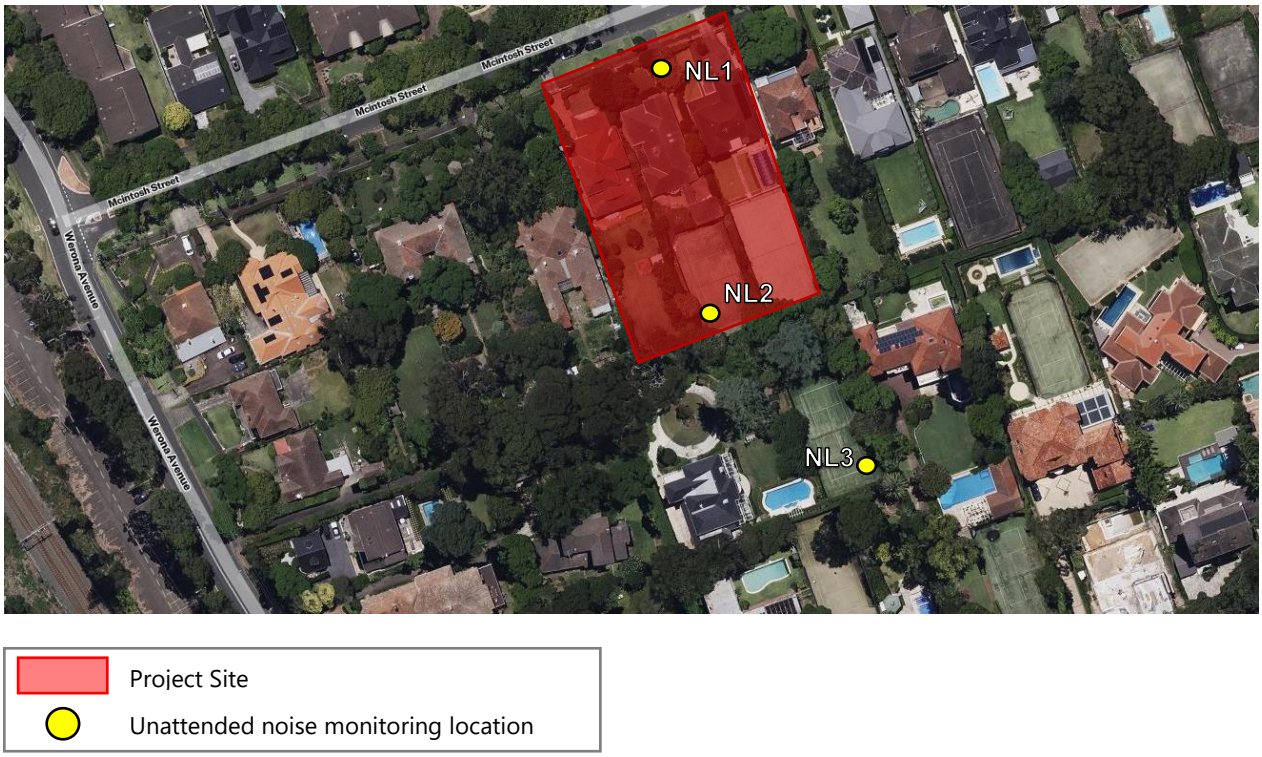


Figure 7: Unattended noise monitoring location

Figure 8: Photographs of installed noise loggers (left = NL1; middle = NL2; right = NL3).

A.2.3 WEATHER AFFECTED AND EXTRANEOUS/OUTLYING DATA

Periods affected by adverse weather conditions have been excluded from the assessment, as have any data identified as being unrepresentative/extraneous. Weather data was obtained from records provided by the Bureau of Meteorology for the Terrey Hills (Sydney) station.

A.3 RATING BACKGROUND NOISE LEVELS

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

Table 20 presents tabulated results and Appendix A.2 presents graphical results of the unattended noise monitoring.

Table 20 -Unattended Noise Monitoring Results

Date	ABL Day	ABL Evening	ABL Night
NL1 – Front Garden, 23 McIntosh Street			
Tuesday 13 May, 2025	-	35	27
Wednesday 14 May, 2025	39	34	28
Thursday 15 May, 2025	40	38	-
Friday 16 May, 2025	40	35	27
Saturday 17 May, 2025	40	-	-
Sunday 18 May, 2025	-	-	-
Monday 19 May, 2025	43	-	29
Tuesday 20 May, 2025	42	32	-
Wednesday 21 May, 2025	-	-	-
Thursday 22 May, 2025	-	-	-

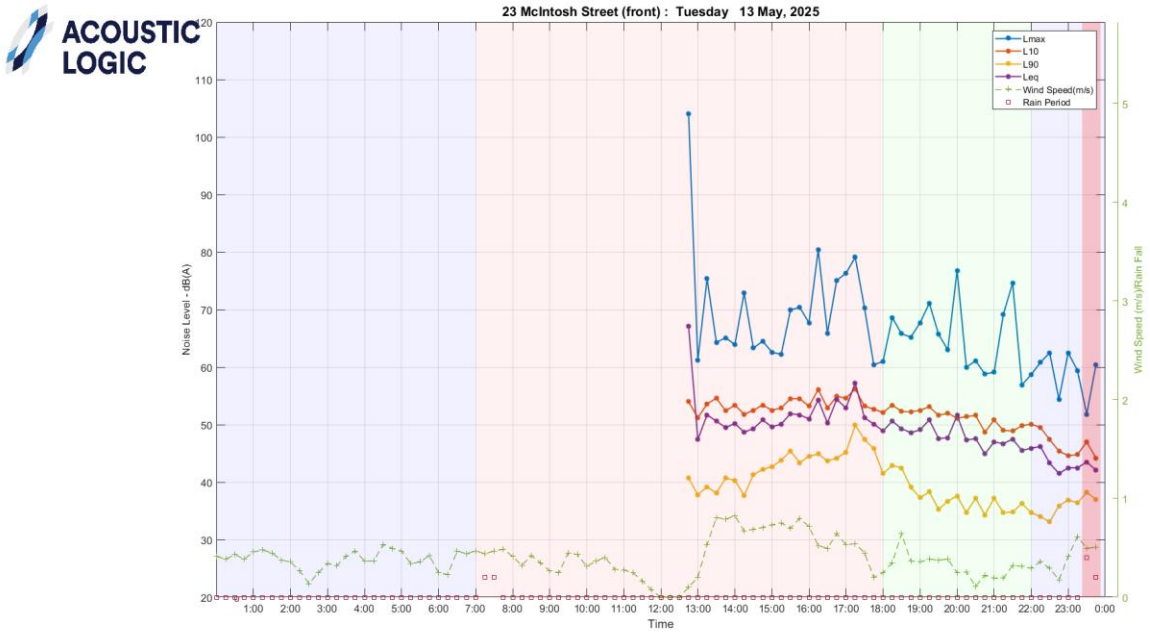
Friday 23 May, 2025	-	42	32
Saturday 24 May, 2025	42	38	29
Sunday 25 May, 2025	39	37	28
Monday 26 May, 2025	41	-	-
RBL	**40**	**36**	**30[3]**
NL2 – Rear Garden, 23 McIntosh Street			
Tuesday 13 May, 2025	-	35	27
Wednesday 14 May, 2025	34	33	29
Thursday 15 May, 2025	37	36	-
Friday 16 May, 2025	36	34	27
Saturday 17 May, 2025	35	-	-
Sunday 18 May, 2025	-	-	-
Monday 19 May, 2025	41	-	31
Tuesday 20 May, 2025	38	34	-
Wednesday 21 May, 2025	-	-	-
Thursday 22 May, 2025	-	-	-
Friday 23 May, 2025	-	39	32
Saturday 24 May, 2025	39	38	31
Sunday 25 May, 2025	38	37	28
Monday 26 May, 2025	40	-	-
RBL	**38**	**35**	**30[3]**
NL3 – Tennis Court, 55 Werona Avenue			
Tuesday 13 May, 2025	-	36	28
Wednesday 14 May, 2025	36	35	31
Thursday 15 May, 2025	39	37	-
Friday 16 May, 2025	37	38	28
Saturday 17 May, 2025	38	-	-
Sunday 18 May, 2025	-	-	-
Monday 19 May, 2025	43	-	34
Tuesday 20 May, 2025	40	36	-
Wednesday 21 May, 2025	-	-	-
Thursday 22 May, 2025	-	-	-
Friday 23 May, 2025	-	41	33
Saturday 24 May, 2025	41	41	32
Sunday 25 May, 2025	39	39	31
Monday 26 May, 2025	40	-	34
RBL	**39**	**37**	**32**

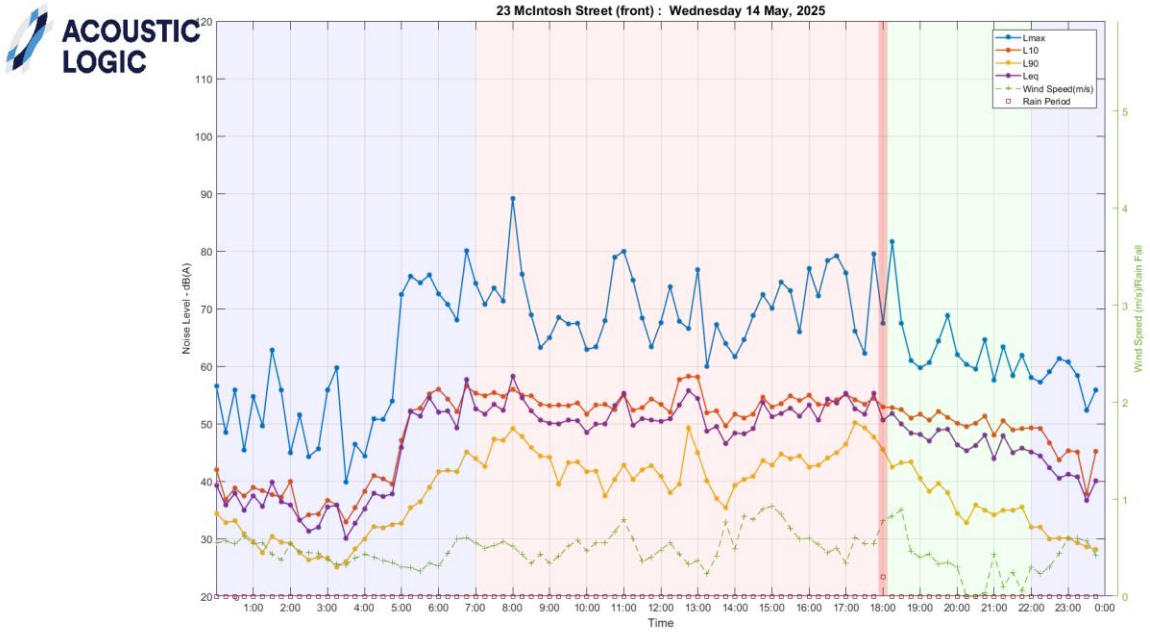
Note:

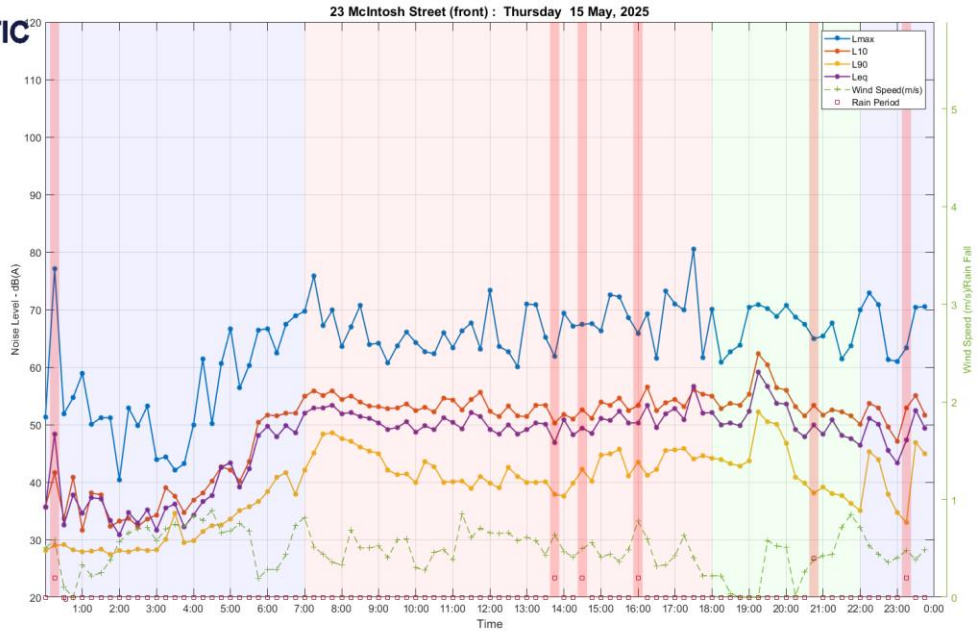
1. *Data excluded due to weather*
2. *Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.*
   Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays.
   Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.
3. *Since the calculated night background noise level was less than 30 dB(A), a "minimum" background noise level of 30 dB(A) has been adopted, as per the NPfI*

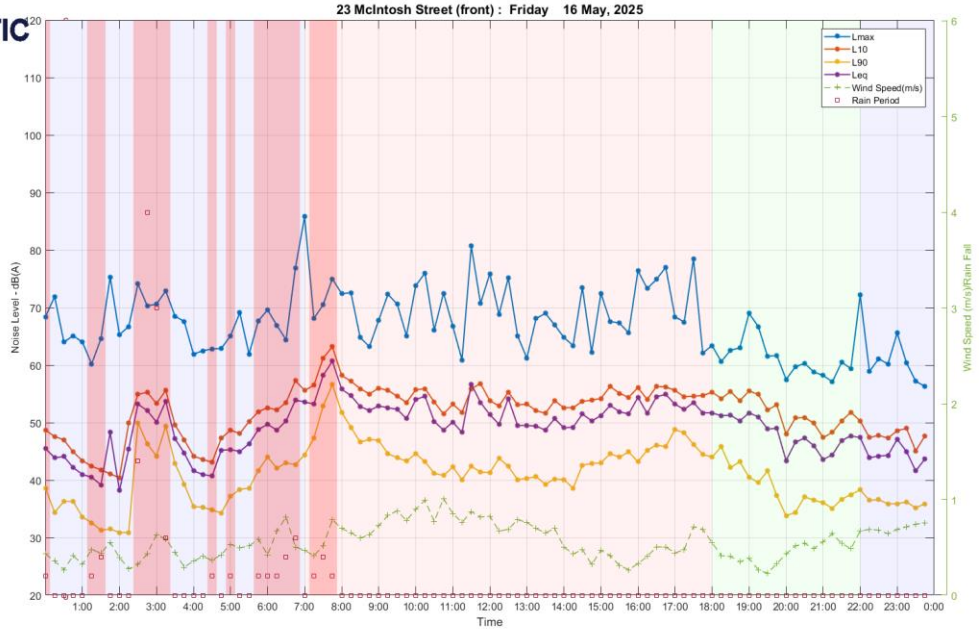
A.4 UNATTENDED NOISE MONITORING RESULTS

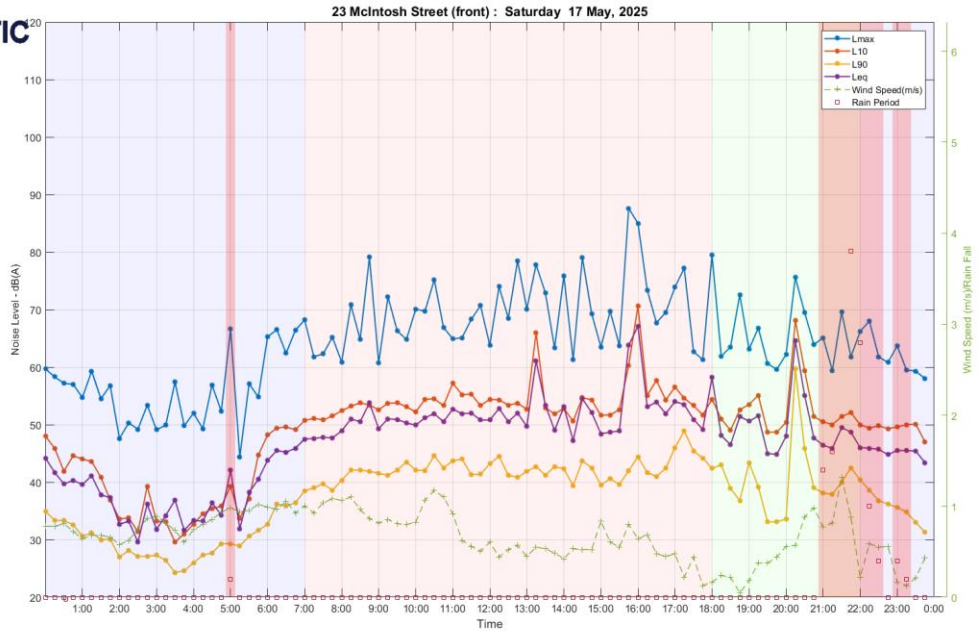
A.4.1 NL1 – FRONT GARDEN, 23 MCINTOSH STREET

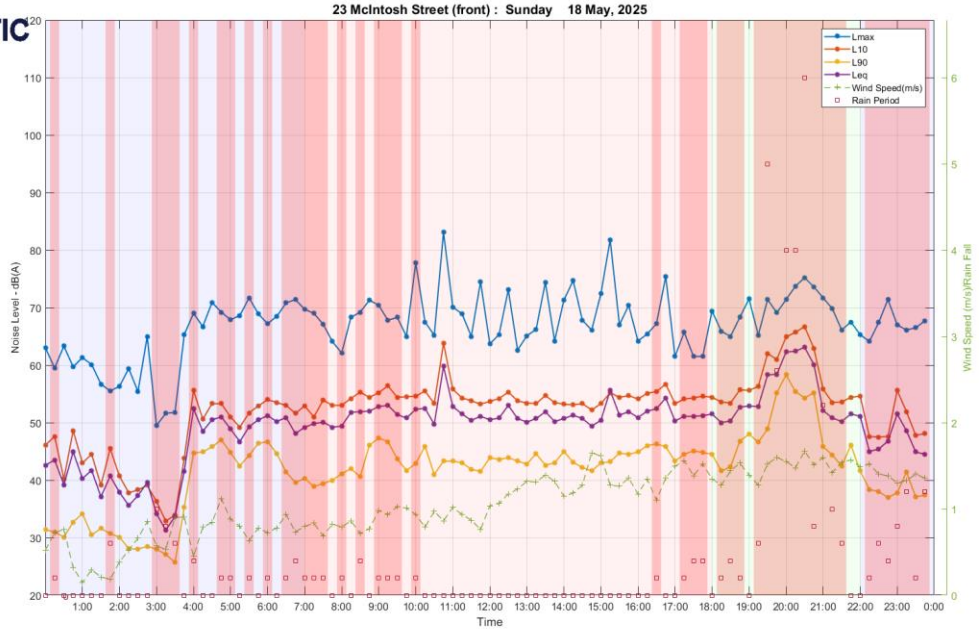


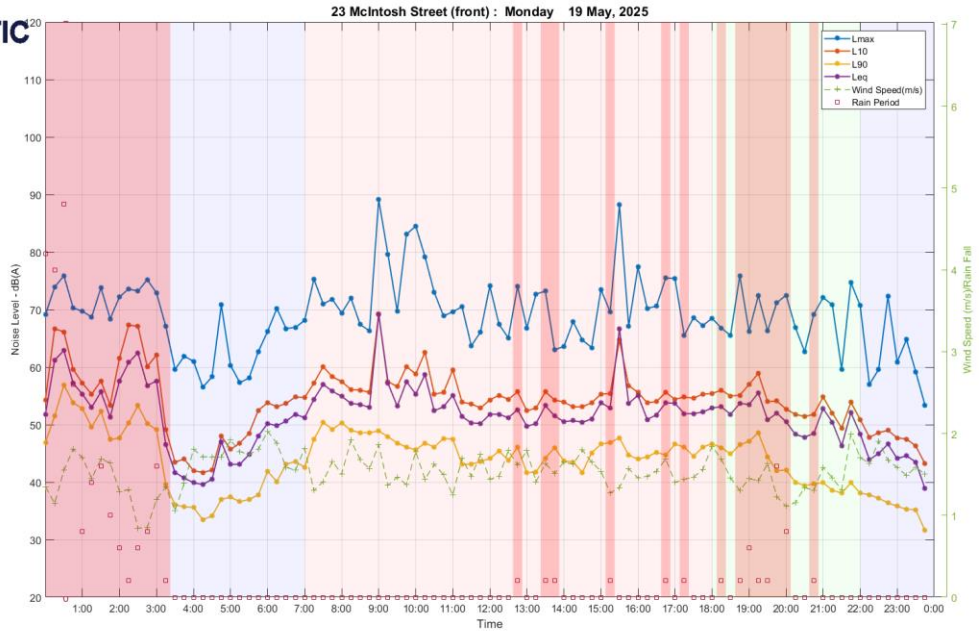


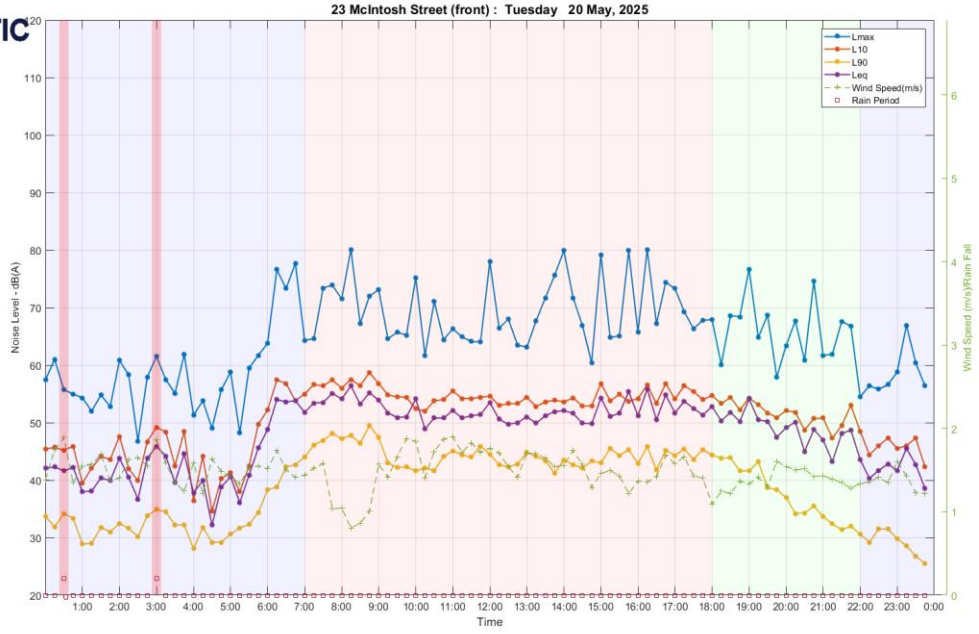

23 McIntosh Street (front) : Thursday 15 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time

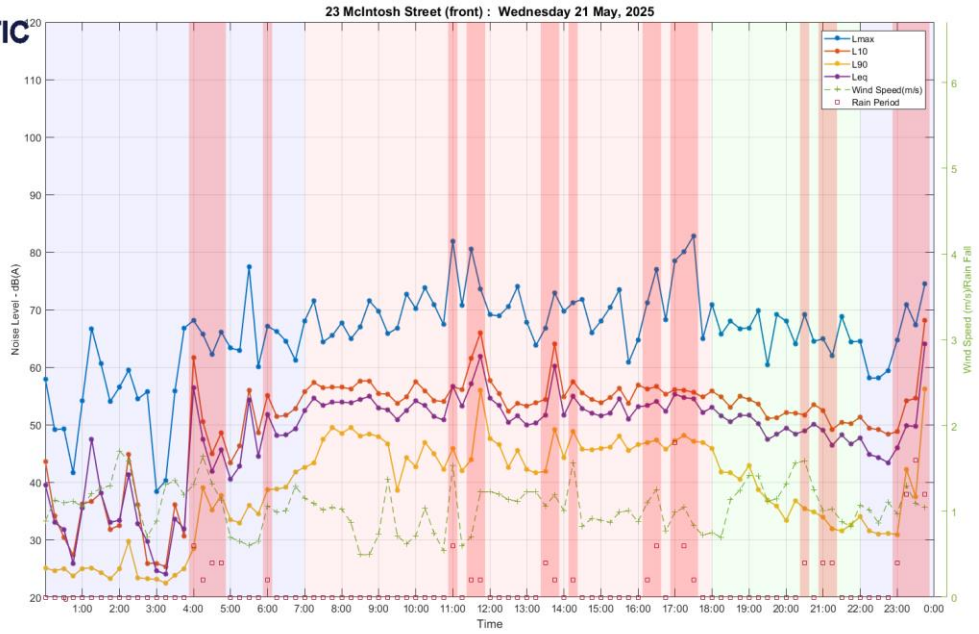

23 McIntosh Street (front) : Friday 16 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time

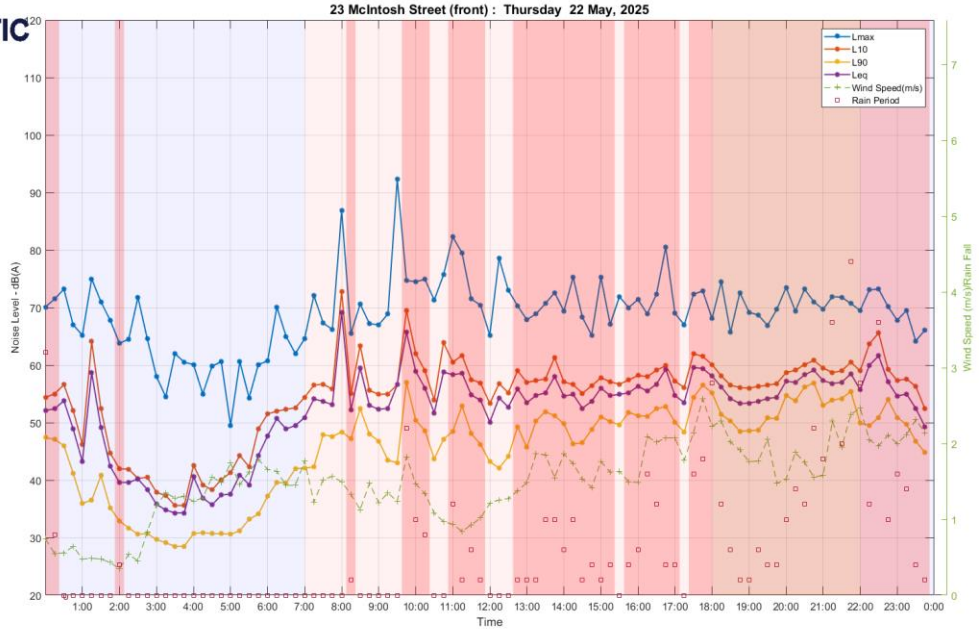

23 McIntosh Street (front) : Saturday 17 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time

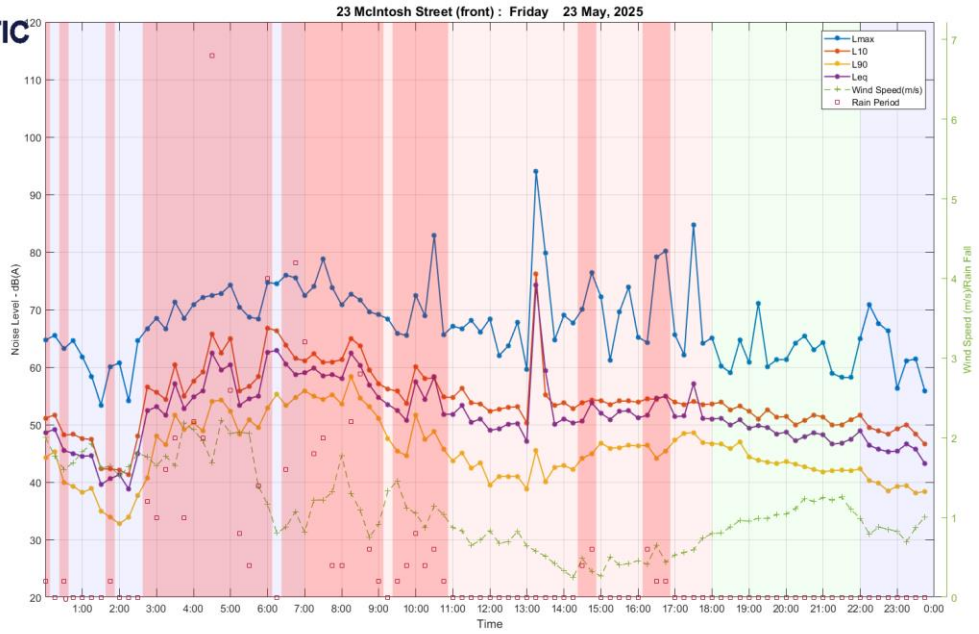

23 McIntosh Street (front) : Sunday 18 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (front) : Monday 19 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (front) : Tuesday 20 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (front) : Wednesday 21 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (front) : Thursday 22 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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Lmax
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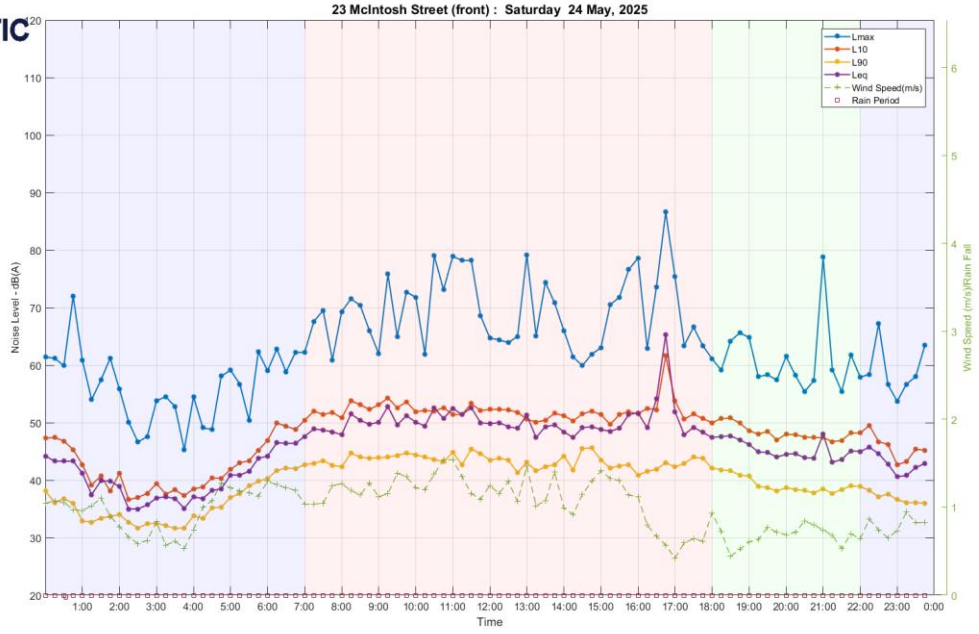
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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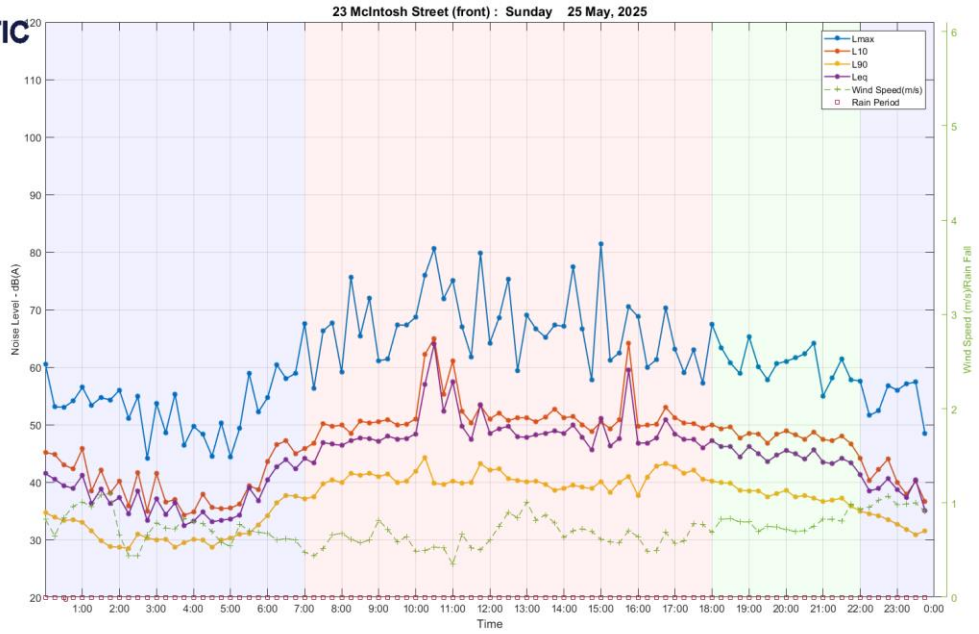
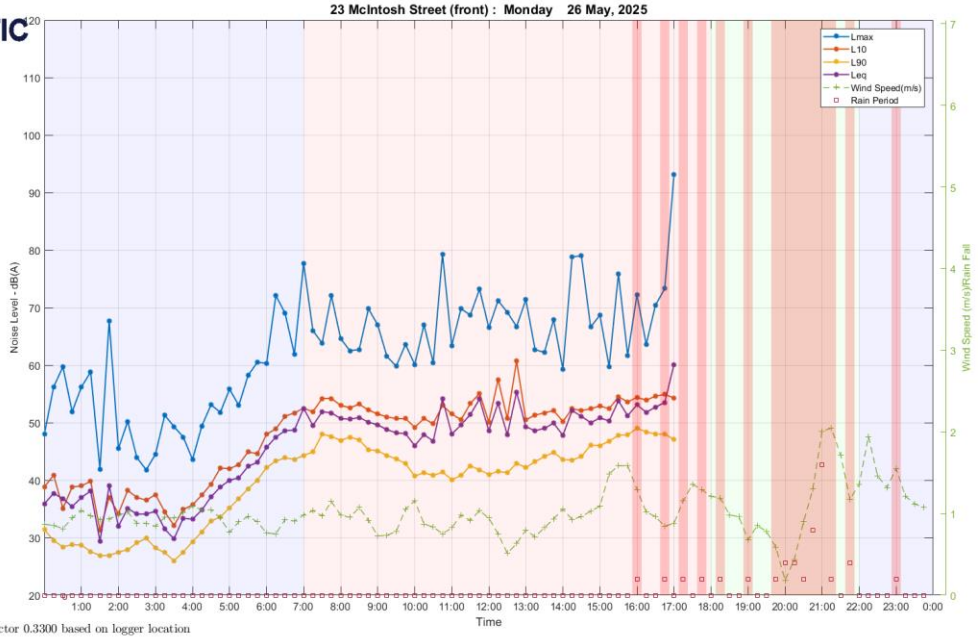
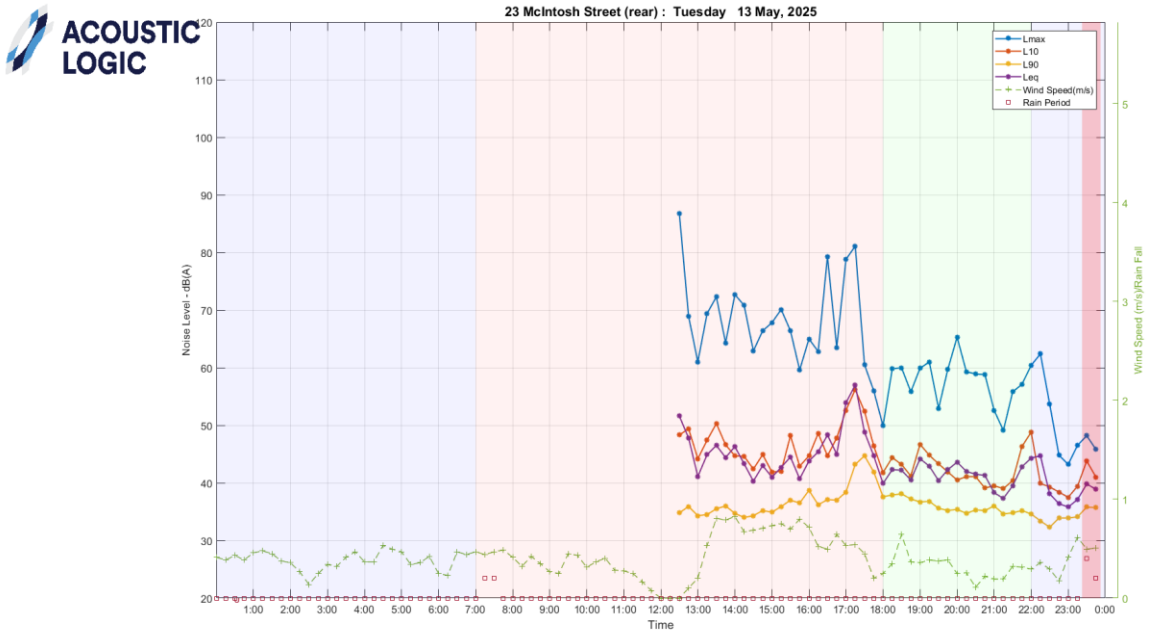
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time

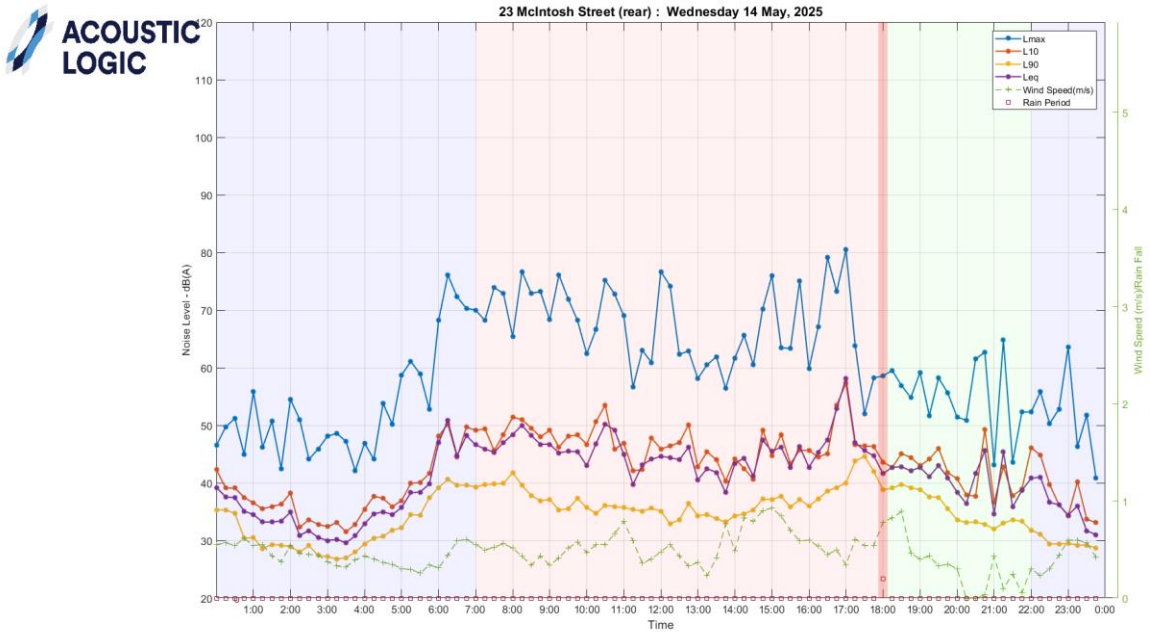


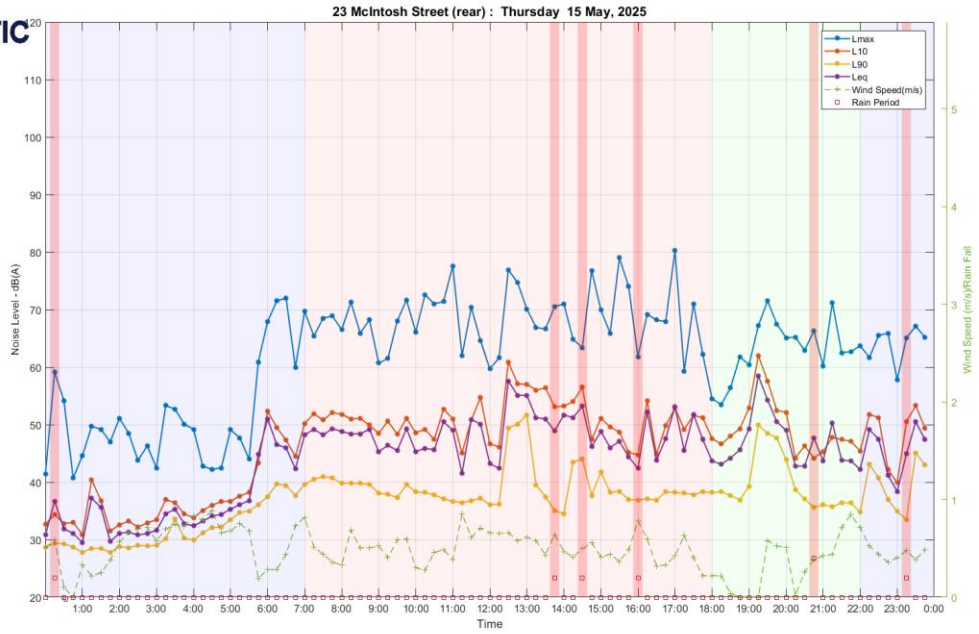


Wind Speed is corrected using factor 0.3300 based on logger location

A.4.2 NL2 – REAR GARDEN, 23 MCINTOSH STREET



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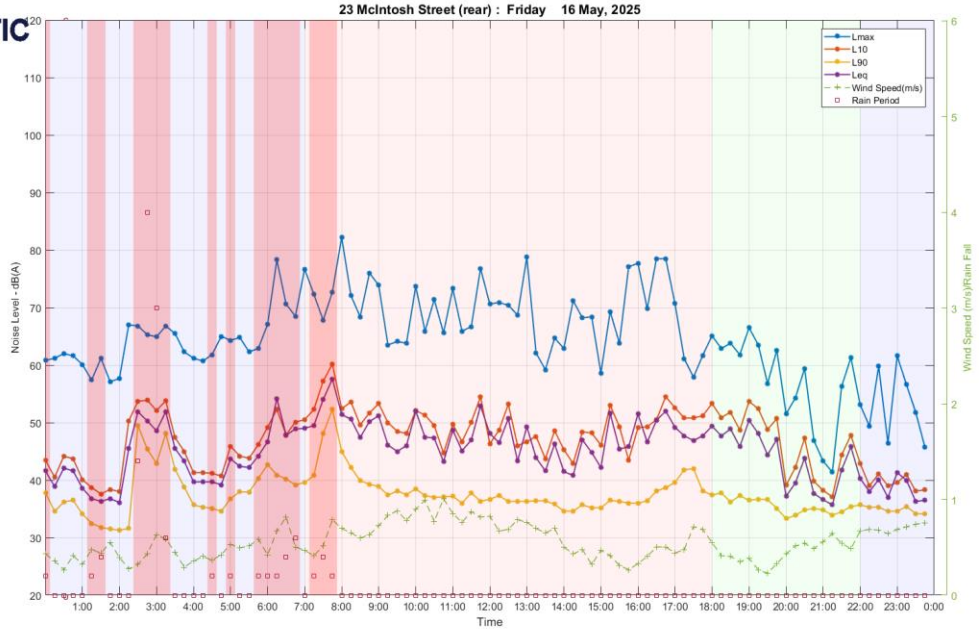
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Friday 16 May, 2025
Lmax
L10
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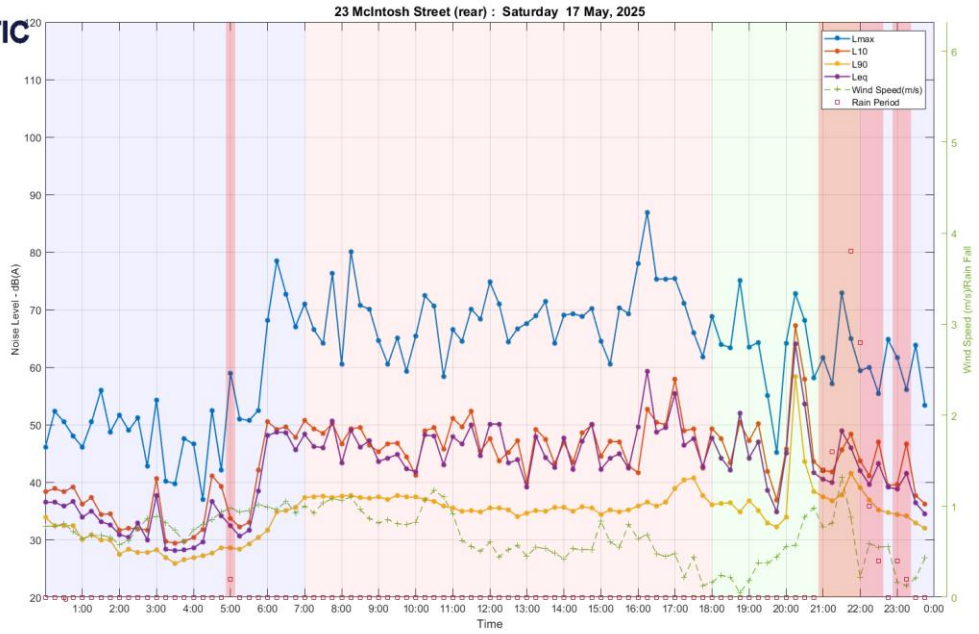
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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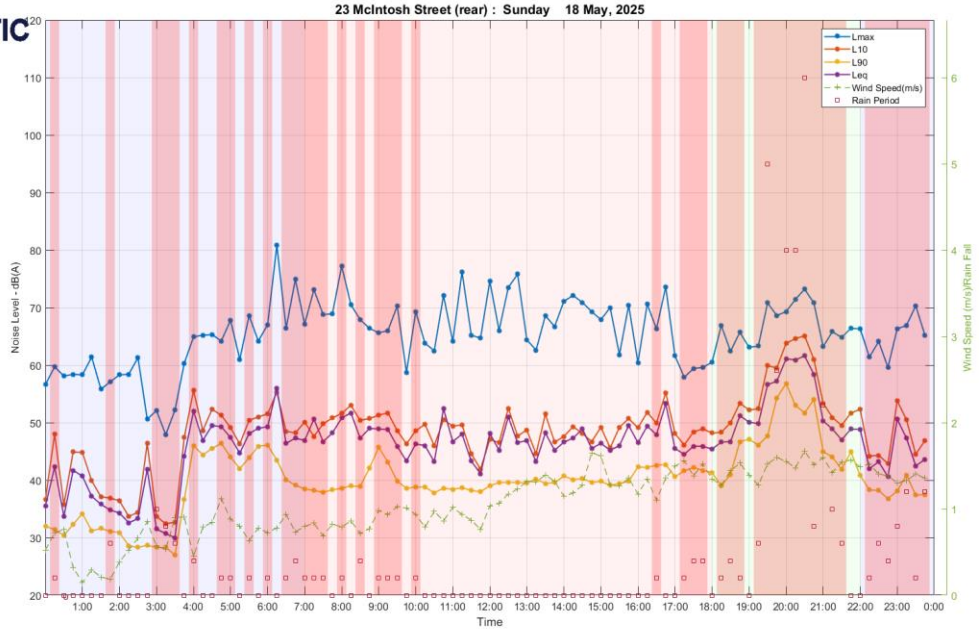
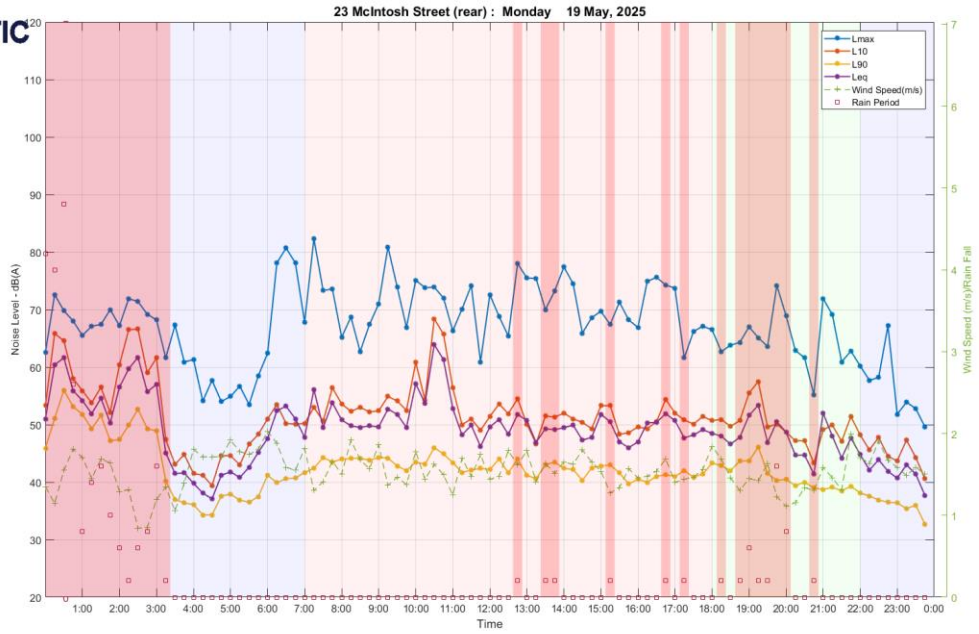
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Sunday 18 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Monday 19 May, 2025
Lmax
L10
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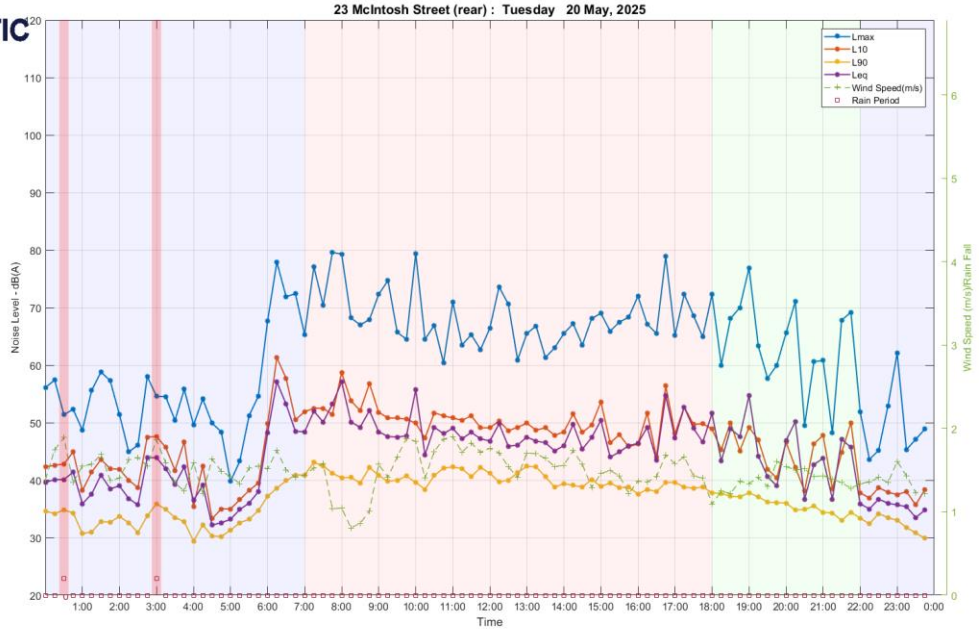
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Tuesday 20 May, 2025
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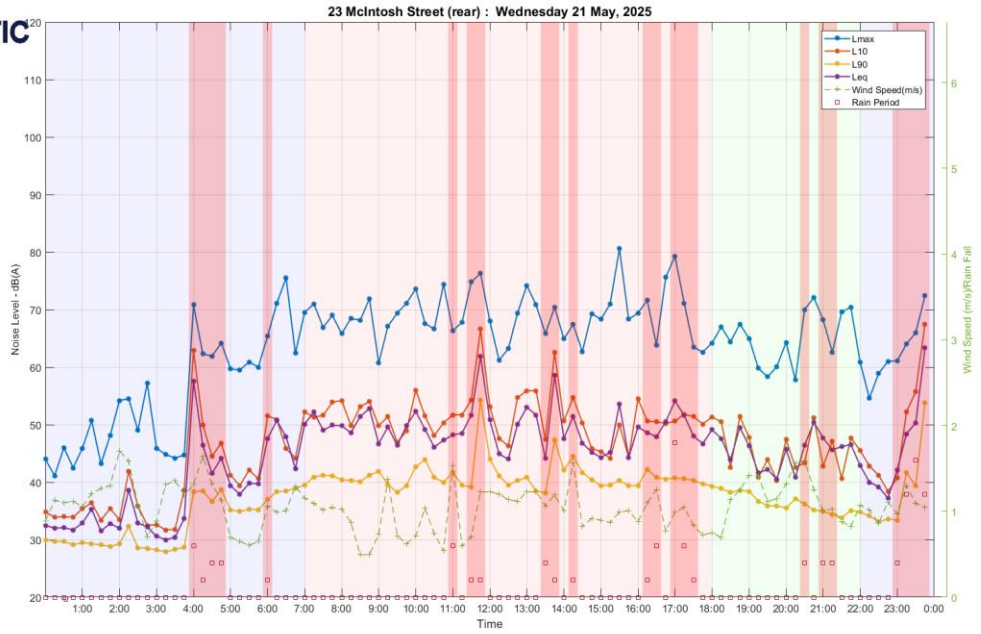
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Wednesday 21 May, 2025
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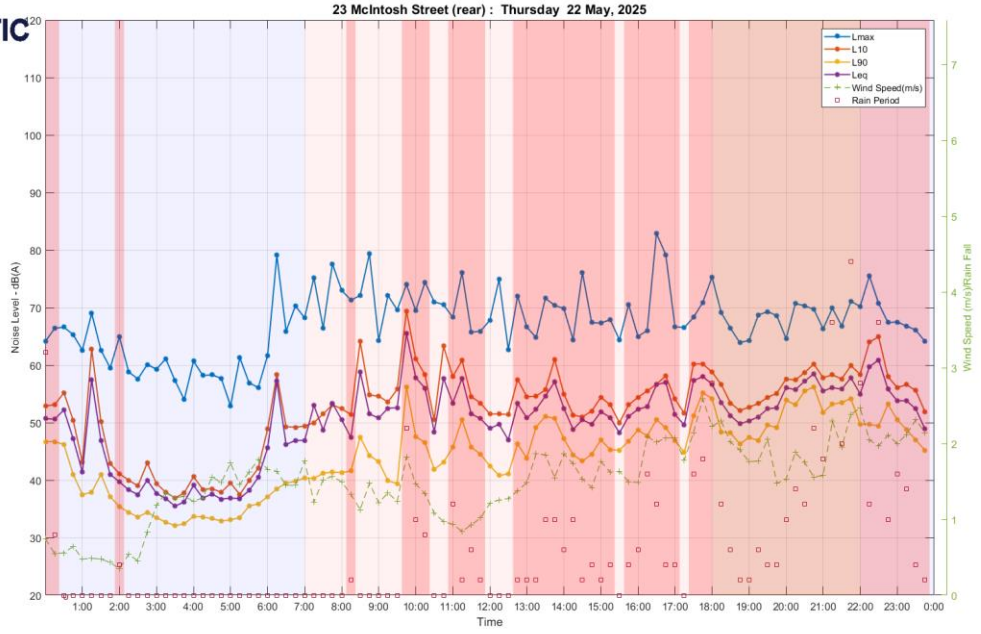
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Thursday 22 May, 2025
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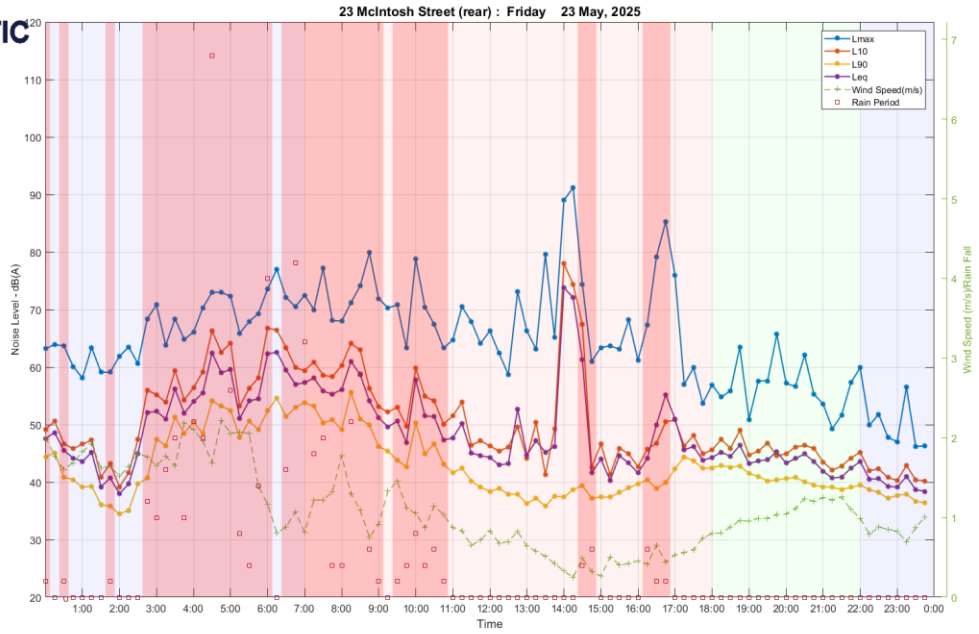
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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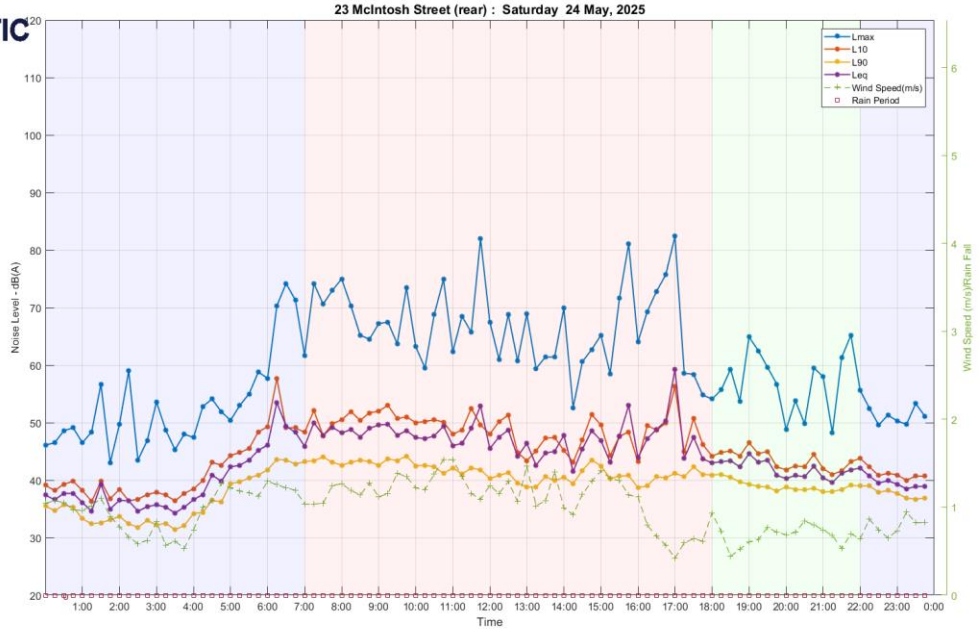
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


23 McIntosh Street (rear) : Saturday 24 May, 2025
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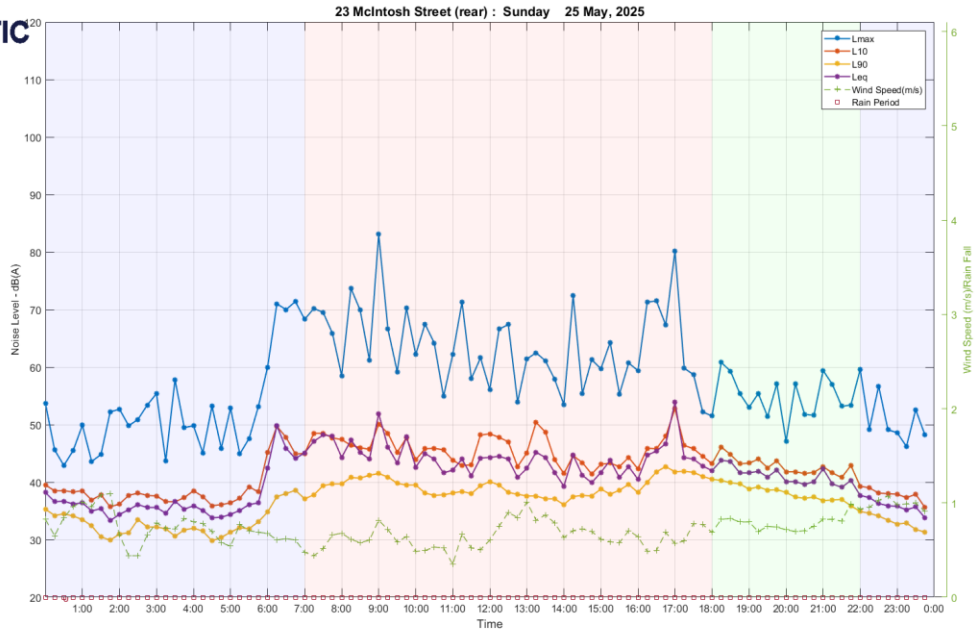
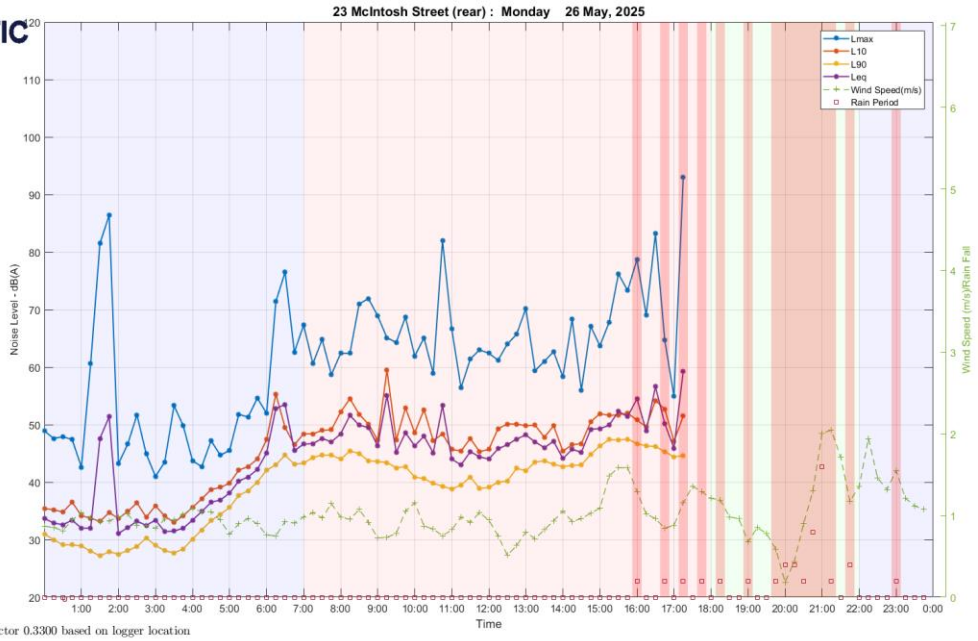
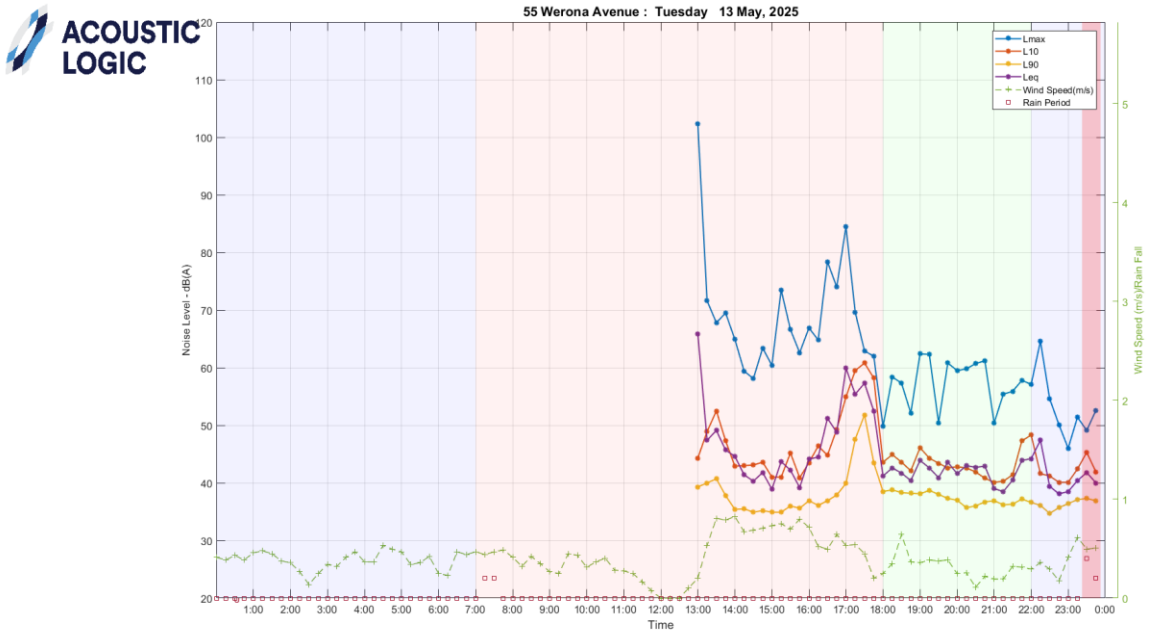
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time

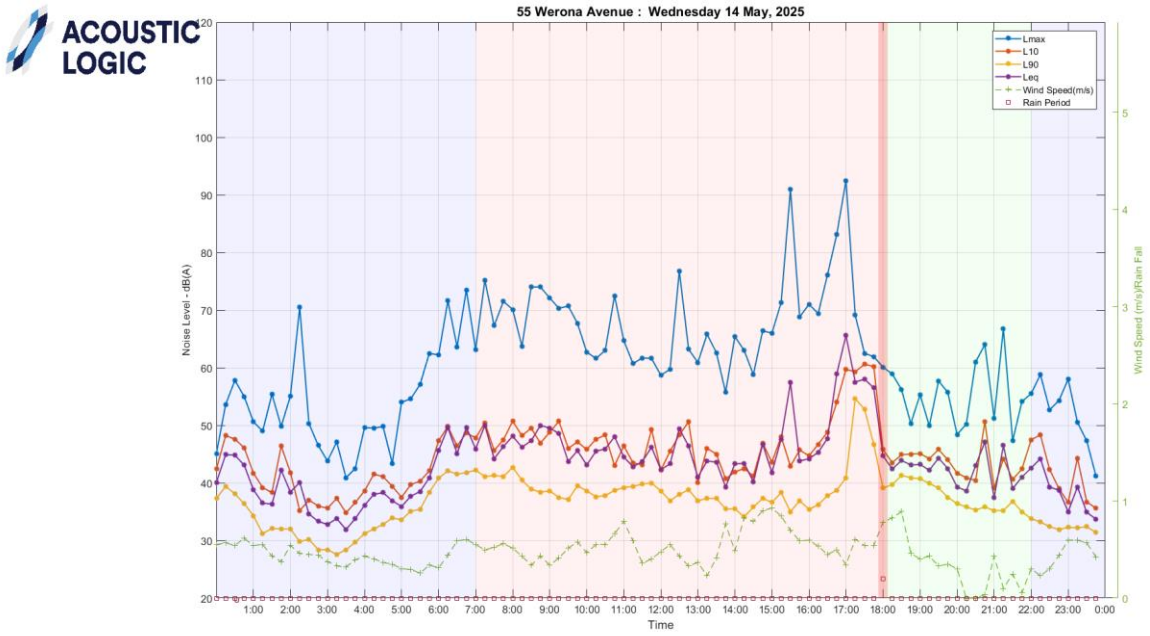


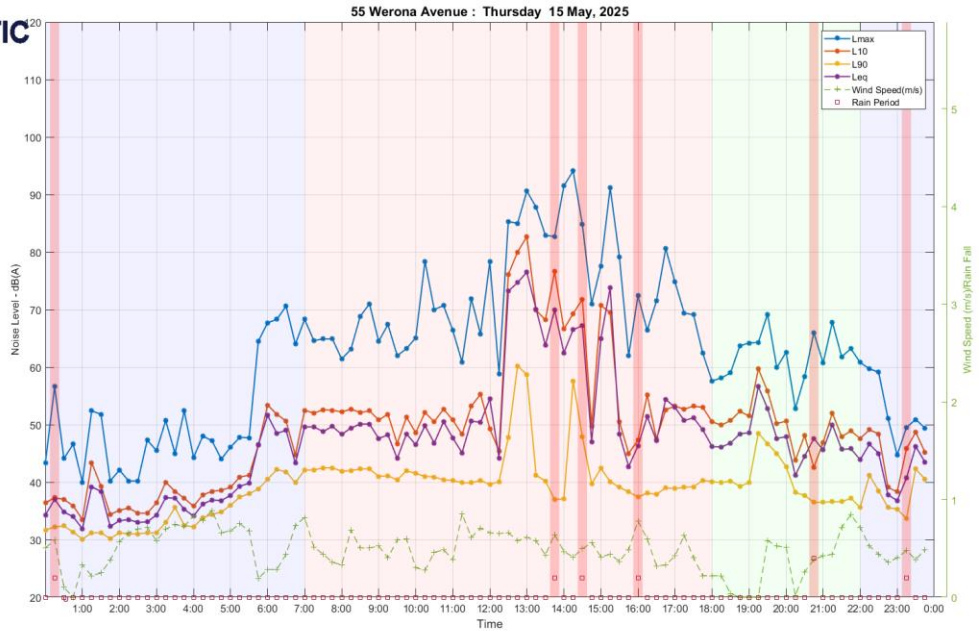


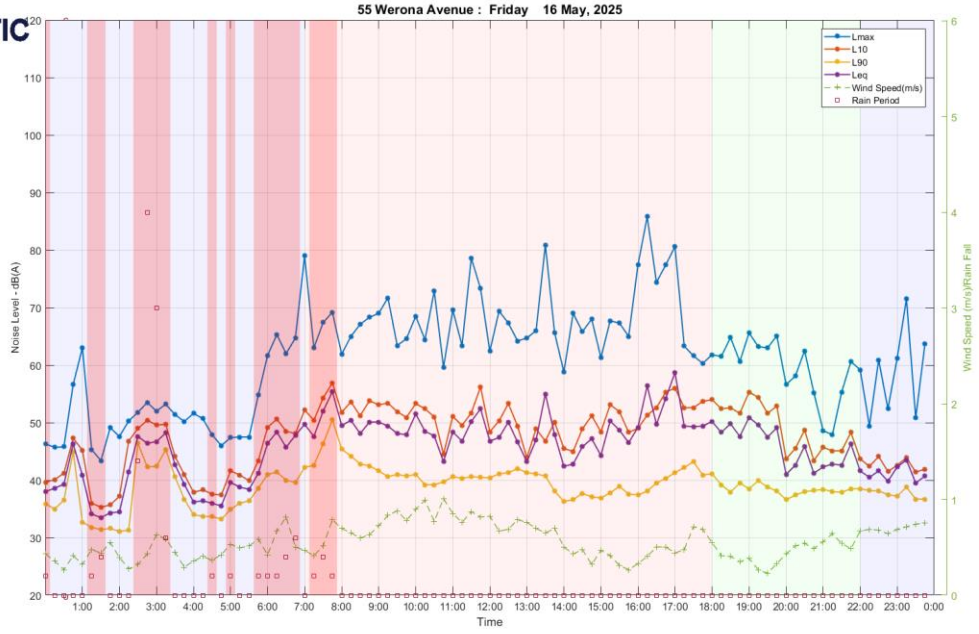
Wind Speed is corrected using factor 0.3300 based on logger location

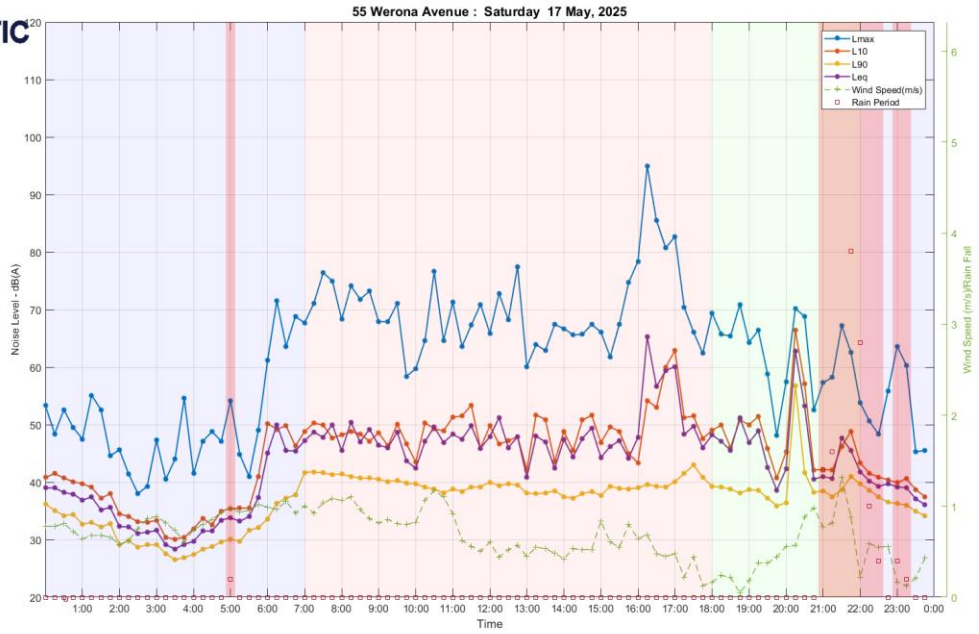
A.4.3 NL3 – TENNIS COURT, 55 WERONA AVENUE






55 Werona Avenue : Thursday 15 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Friday 16 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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Lmax
L10
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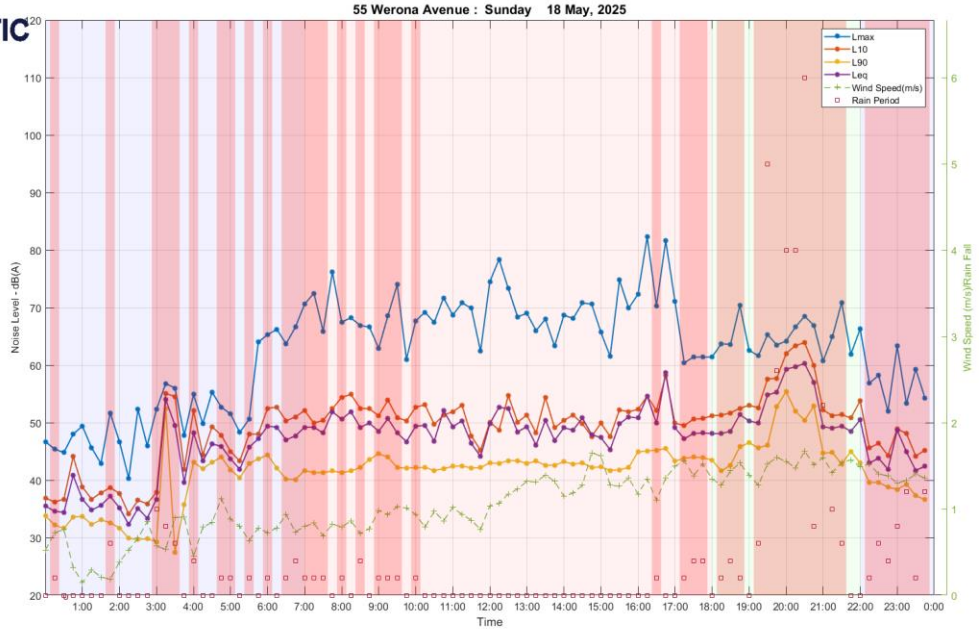
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Sunday 18 May, 2025
Lmax
L10
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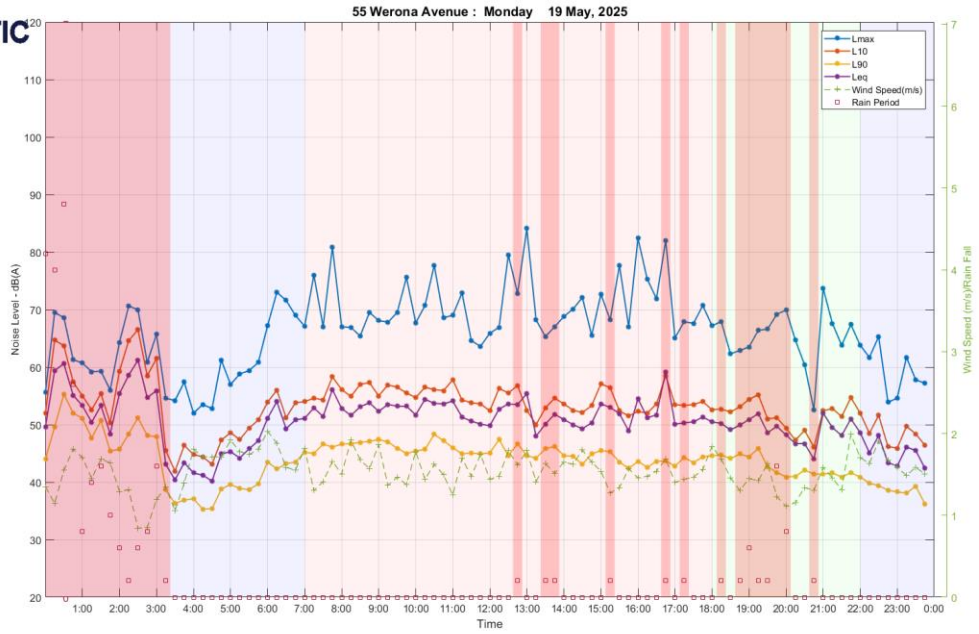
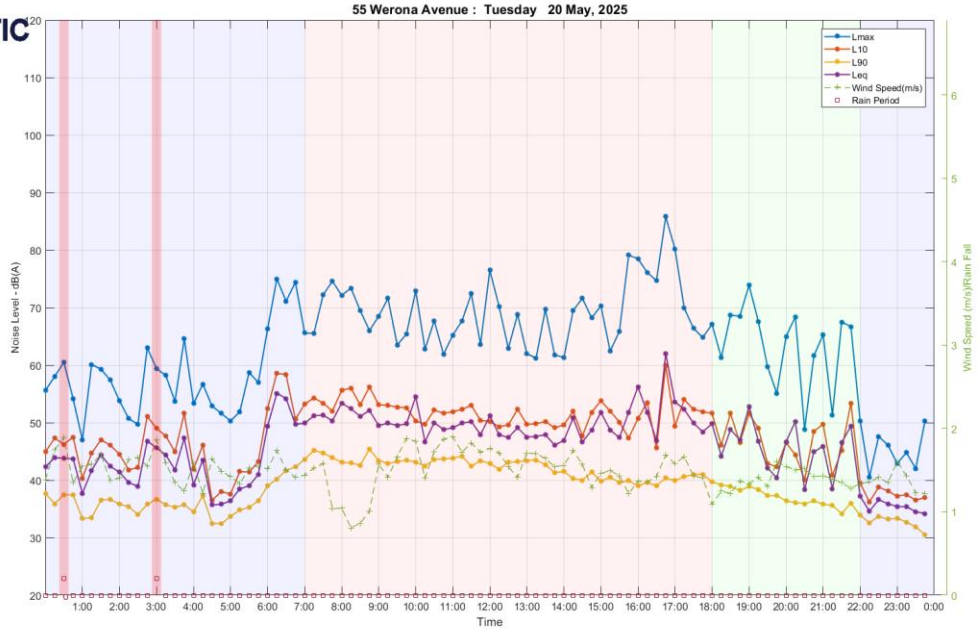
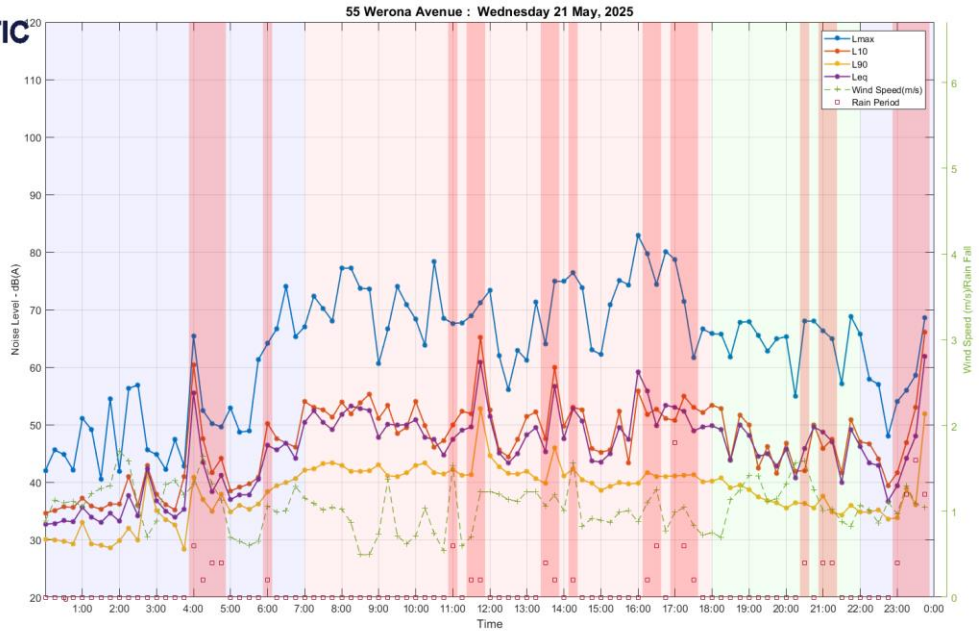
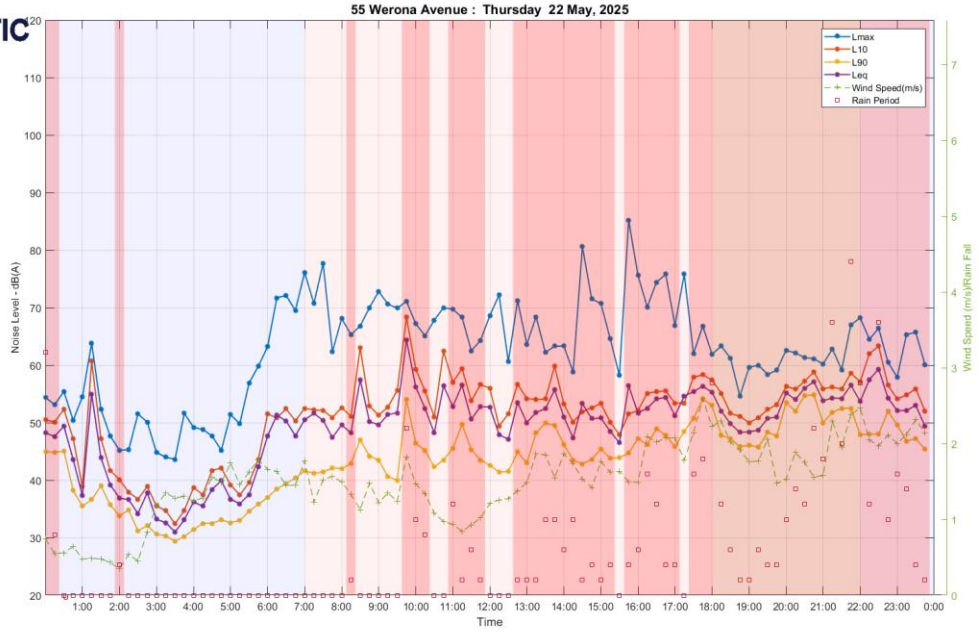
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Monday 19 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Tuesday 20 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Wednesday 21 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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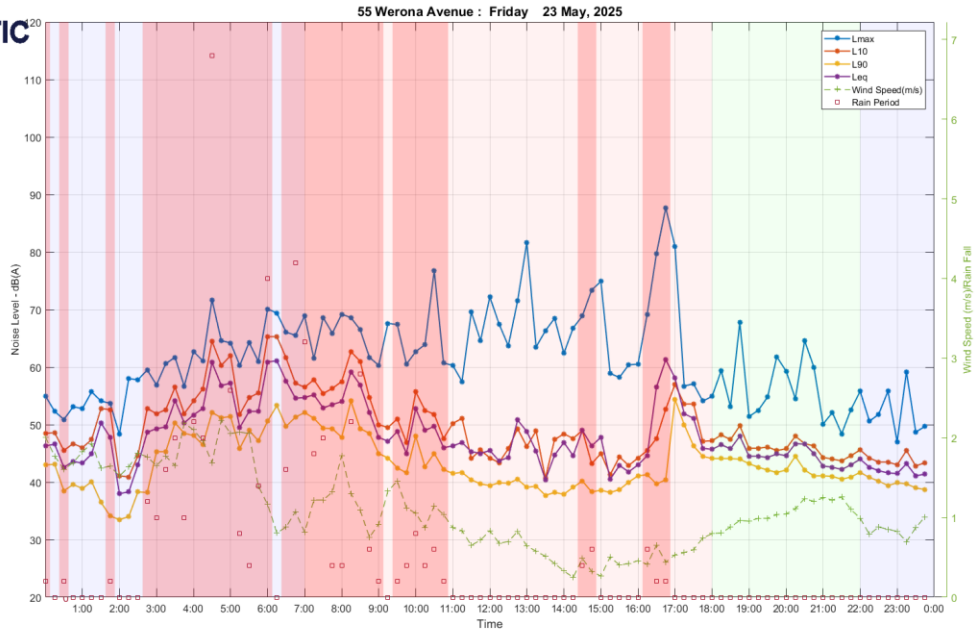
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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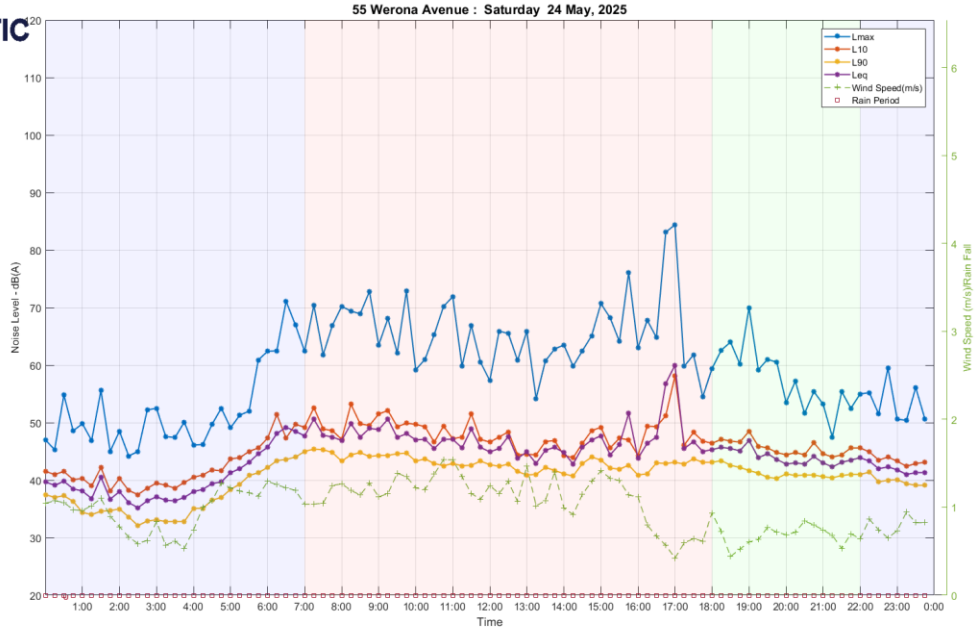
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time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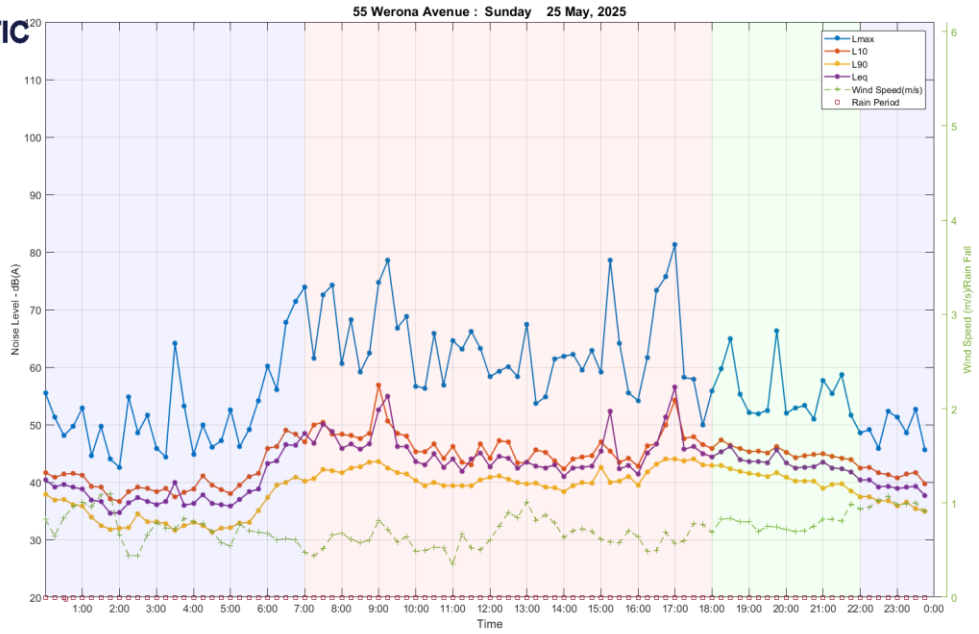
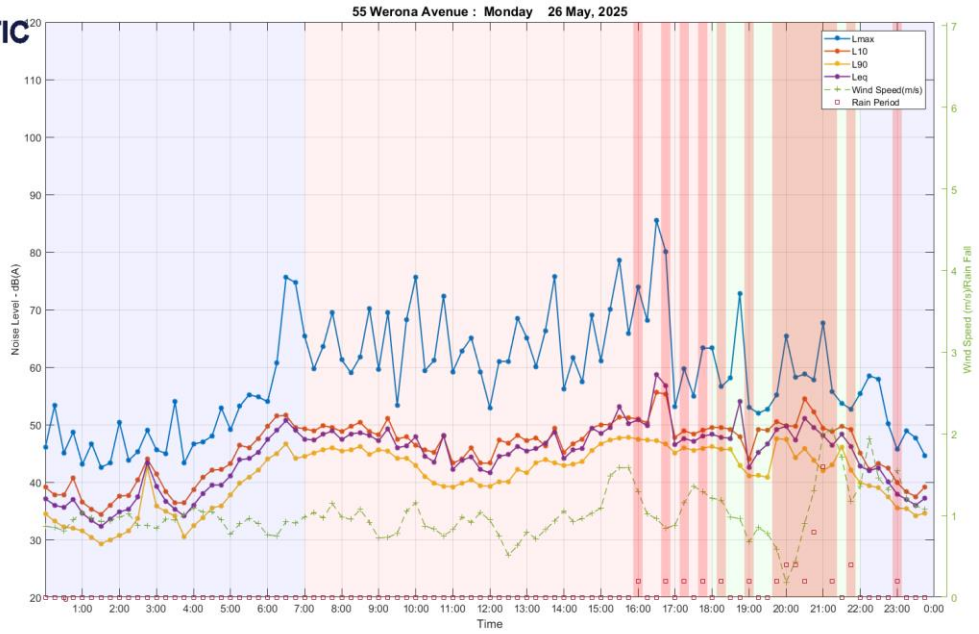
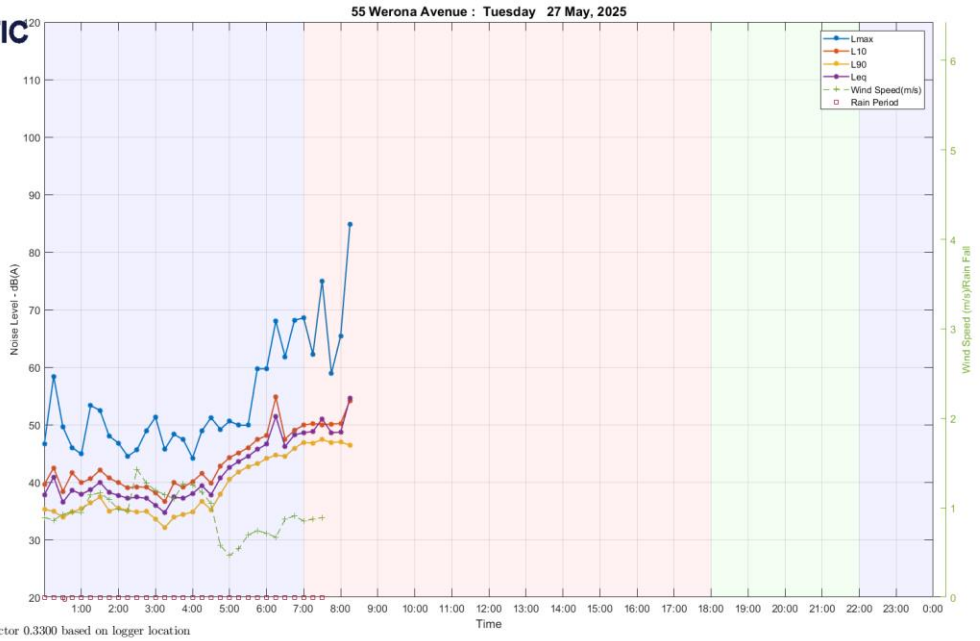
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Sunday 25 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time


55 Werona Avenue : Monday 26 May, 2025
Lmax
L10
L90
Leq
Wind Speed(m/s)
Rain Period
Noise Level - dB(A)
Wind Speed (m/s)/Rain Fall
Time



Wind Speed is corrected using factor 0.3300 based on logger location

APPENDIX B ENVIRONMENTAL NOISE EMISSION TARGETS

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

B.1 NPFI 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.2 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.

B.2.1 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:

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

Section 2.4 of the NPfI states:

Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

Given there are no other nearby "industrial" noise sources, and nor are any likely in the future, the applicable amenity $L_{Aeq,15min}$ trigger level can be calculated without the 5 dB(A) adjustment.

The NfPI permits the project specific amenity level to be increased in areas where ambient noise levels already significantly exceed the levels in Table 2.2 of the NPfI.

NPfI Table 2.2: Amenity Noise Levels			
Receiver	*Noise Amenity Area*	*Time of Day*	*Recommended Amenity Noise Level L_{Aeq}*
Residential	*Rural*	*Day*	*50*
		Evening	*45*
		Night	*40*
	Suburban	*Day*	*55*
		Evening	*45*
		Night	*40*
	Urban	*Day*	*60*
		Evening	*50*
		Night	*45*
Hotels motels caretakers' quarters holiday accommodation permanent resident caravan parks	*See column 4*	*See column 4*	*5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day*
School classroom – internal	*All*	*Noisiest 1-hour period when in use*	*35 (see notes for table)*
Hospital ward internal external	*All* *All*	*Noisiest 1-hour* *Noisiest 1-hour*	*35* *50*
Place of worship – internal	*All*	*When in use*	*40*
Area specifically reserved for passive recreation (e.g. national park)	*All*	*When in use*	*50*
Active recreation area (e.g. school playground golf course)	*All*	*When in use*	*55*
Commercial premises	*All*	*When in use*	*65*
Industrial premises	*All*	*When in use*	*70*
Industrial interface (applicable only to residential noise amenity areas)	*All*	*All*	*Add 5 dB(A) to recommended noise amenity area*

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

• industrial interface – an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies. This category may be used only for existing situations (further explanation on how this category applies is outlined in Section 2.7)

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

• industrial – an area defined as an industrial zone on a local environment plan; for isolated residences within an industrial zone the industrial amenity level would usually apply.

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.)

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.

B.2.2 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.2.3 Maximum Noise Level Assessment

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

Section 2.5 of NPfI 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 (L_{90}) plus 5 dB, whichever is the greater, and/or*
- *L_{max} 52 dB(A) or the prevailing RBL (L_{90}) 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.2.4 SUMMARY NPfI 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.

Table 21 – Project Noise Trigger Levels (NPfI)

Receiver(s)	Time Period	RBL dB(A) L_{90}	Trigger Noise Levels (dB(A) $L_{eq,\ 15min}$)		
			Intrusiveness	Amenity	Max Event
NCA 1	Day	40	45	53	n/a
	Evening	36	41	43	n/a
	Night	30	35	38	40 L_{eq} 52 L_{max}
NCA 2	Day	38	43	53	n/a
	Evening	35	40	43	n/a
	Night	30	35	38	40 L_{eq} 52 L_{max}
NCA 3	Day	39	44	53	n/a
	Evening	37	42	43	n/a
	Night	32	37	38	40 L_{eq} 52 L_{max}

Table Note:

1. The project noise intrusiveness noise level for the evening period shall not be higher than the day-time period.

B.3 KU-RING-GAI COUNCIL DCP

The Ku-ring-gai Council DCP states the following:

> *Noise levels associated with air conditioning, kitchen, bathroom, laundry ventilation, or other mechanical ventilation systems and plant either as an individual piece of equipment or in combination is not to be audible within any habitable room in any residential premises before 7am and after 10pm. Outside of these restricted hours noise levels associated with air conditioning, kitchen, bathroom, laundry ventilation, or other mechanical ventilation systems and plant either as an individual piece of equipment or in combination is not to emit a noise level greater than 5dB(A) above the background noise (LA90, 15 min) when measured at the boundary of the nearest potentially affected neighbouring properties. The background (LA90, 15 min) level is to be determined without the source noise present.*

Compliance with the established NPfI trigger levels will satisfy the DCP requirement outlined above.