NORTHROP

ACOUSTICS REPORT

Broomfield St, Cabramatta

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PREPARED FOR
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Acoustics Report

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Executive Summary

Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Moon Investments Pty Ltd to provide an acoustic report for the proposed mixed-use development to be located at Broomfield Street, Cabramatta (the Site). The Site will comprise of three residential buildings, three levels of basement carparks, and commercial spaces such as a childcare centre, restaurants and a Tavern.

The report has assessed the noise and vibration impacts associated with the Site. As part of the assessment, long term unattended noise monitoring was undertaken to determine the existing ambient noise levels at the site.

The noise and vibration concerns associated with the Site have been addressed and summarised below.

Noise Impacting the Project

The internal noise criteria for different occupancies within the proposed development were determined in accordance with *State Environmental Planning Policy (Transport and Infrastructure)*, 2021 (Infrastructure SEPP) and Australian New Zealand Standard AS/NZS 2107:2016.

Based on the site noise measurements, the existing road and rail noise levels were quantified. The measured external noise levels were used to determine the required construction of the façade to reduce the external noise to comply with internal noise criteria.

The recommended acoustic performance of the façade is detailed Section 4.3.

Operational Noise Emission Assessment

The measured background noise levels were used to determine the noise emission criteria in accordance with the Environmental Protection Agency's (EPA) NSW *Noise Policy for Industry* (2017) (NPfI).

The number of on site vehicle movements (including waste collection) were based on the Traffic Report provided by Arc Traffic + Transport (ref: *Cabramatta East Transport Assessment* dated May 2023). The on site vehicle movements were modelled in a 3D noise modelling software to predict the noise at the nearest sensitive receivers. The predicted noise levels were below the noise emission criteria and therefore no further mitigation measures were required.

Details of the commercial tenancies and mechanical plant servicing the Site is not known at this stage and therefore a quantitative assessment cannot be undertaken. During the detailed design stage, a quantitative assessment should be undertaken for commercial tenancies and mechanical plant to ensure compliance with the NPfI noise emission criteria.

Noise emissions from the childcare and licensed premises are assessed under separate criteria as detailed below.

Childcare Noise Assessment

The childcare noise assessment has two components:

- Noise emission assessment: noise from the childcare affecting the surrounding receivers
- Noise intrusion assessment: noise from road/ rail impacting the childcare centre

The noise emissions from the proposed childcare centre were assessed in accordance with the AAAC *Guideline for Child Centre Acoustic Assessment* V.30 (AAAC Childcare Guideline). The noise level from the outdoor play area were calculated using the sound data provided in the AAAC Childcare Guideline. It was assumed that the noise from the childcare was equally distributed along the outdoor play area. From the predicted noise levels, the recommendations provided in Section 6.4 were required to reduce the noise to comply with AAAC Childcare Guideline noise emission criteria.

Noise intrusion into the childcare centre was based on Fairfield Council's DCP and the AAAC Childcare Guideline. From the assessment undertaken in Section 6.5.2, no additional noise mitigation measures were required to reduce noise to comply with the internal noise criteria provided by Fairfield Council's DCP and the AAAC Childcare Guideline.

Licensed Premise Noise Emission Assessment

Licensed premises were assessed in accordance with the requirements stipulated by NSW Liquor and Gaming. The noise from the licensed premise (ie. the Tavern) were calculated using the sound data provided in the AAAC Licensed Premise Guideline. The noise emissions were predicted at the nearest affected receiver to determine the required mitigation measures to achieve compliance. The recommended noise mitigation measures for the licensed premise are provided in Section 7.5.

Road Traffic Noise Generated by the Site

The noise associated with the traffic generated by the Site travelling on public roads was assessed under the EPA's *Road Noise Policy* (2011) (RNP). For the surrounding public roads, the existing traffic noise levels were compared with the predicted future traffic noise levels.

The noise predictions indicated that increase in noise level from the generated traffic will be less than 2dB, which is considered acceptable under the RNP and therefore no further mitigation measures were proposed.

Rail Vibration Impacts

Rail vibration impacts were assessed in accordance with the Department of Planning *Development near Rail Corridors and Busy Roads Interim Guideline*, 2008 and the Department of Environment and Conservation's document *Assessing Vibration: A Technical Guideline* (2006) (AVaTG).

On site vibration testing was undertaken to determine the existing vibration impacts associated with the rail corridor located to the west of the site. Using the measured vibration levels, the vibration exposure for the day and night periods were predicted. The predicted vibration exposure for the day and night periods complied with the vibration criteria stipulated in the AVaTG and therefore vibration mitigation measures are not required.

Acoustic Separation

The residential parts of this mixed-use development are classified as Class 2 under the Building Code of Australia (BCA). The BCA acoustic requirements for the residential dwellings have been summarised in Table 27 and should be adopted during the detailed design.

Conclusion

Provided the recommendations are implemented, the Site is expected to comply with the acoustic requirements of Fairfield City Council and other relevant Australian standards and guidelines.

Table of Contents

1. Introduction

Northrop Consulting Engineers Pty Ltd (Northrop) Acoustics have been engaged by Moon Investments Pty Ltd to provide an acoustic report for the proposed mixed-use development to be located at Broomfield Street, Cabramatta (the Site). The Site will comprise of three residential buildings, three levels of basement carparks, and commercial spaces such as a Childcare Centre, restaurants and a Tavern.

Long term unattended noise monitoring was undertaken to determine the existing ambient noise levels at the Site. Vibration monitoring was carried out to quantify the existing vibration impacts associated with the rail line located to the west.

This report assesses the noise and vibration impacts associated with the nearby rail line and roads. It provides recommendations to reduce the external noise to levels specified in relevant standards and guidelines.

The external noise emission criteria for the site were determined in accordance with the Environmental Protection Agency's (EPA) *Noise Policy for Industry*. The noise impacts associated with the childcare centre, the Tavern and traffic generated by the Site have also been assessed. Where exceedances occurred, recommendations were provided to achieve compliance.

Provided our recommendations are implemented, the proposed development is expected to comply with the acoustic requirements of Fairfield City Council and other relevant Australian standards and guidelines.

1.1 Referenced Documents

This assessment has been prepared considering the following documentation:

1.1.1 Project Documents:

- Architectural drawings issued by Plus Architecture – see Appendix A
- Traffic Report issued by Arc Traffic + Transport titled *Cabramatta East Transport Assessment* dated May 2023

1.1.2 Consent Authority, Design Guidelines and Standards:

- Fairfield Citywide Council *Development Control Plan*, 2013 and Cabramatta Town Centre DCP No. 5 / 2000 amendment 4 (DCP)
- NSW EPA *Noise Policy for Industry*, 2017 (NPfI)
- State Environmental Planning Policy (Transport and Infrastructure), 2021 (Infrastructure SEPP)
- Department of Planning *Development near Rail Corridors and Busy Roads Interim Guideline*, 2008 (DoP Guideline)
- NSW Government Department of Environment, Climate Change and Water *Road Noise Policy,* 2011 (RNP)
- Department of Environment and Conservation *Assessing Vibration: A Technical Guideline*, 2006
- National Construction Code Building Code of Australia, 2022 (NCC)
- Australian New Zealand Standard 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS/NZS 2107)
- AAAC Guideline for Child Centre Acoustic Assessment V.30
- AAAC Licensed Premises Guideline V.20

1.2 Acoustic Consideration

The following acoustic concerns were considered in this assessment:

- Noise intrusion – Road and rail noise impacting the future development
- Noise emission – Noise emission from industrial noise, including noise from on site vehicle movements, commercial tenancies and mechanical plant and equipment
- Childcare noise – Noise emissions from the childcare to the nearest sensitive receivers and noise intrusion into the childcare centre
- License premises – Noise emissions from the Tavern to the nearest sensitive receivers
- Road noise – Increase in traffic noise levels on public roads due to the development
- Rail vibration impacts – Vibration from the adjacent rail corridor impacting future residences
- Acoustic separation – The acoustic performance of intertenancy walls to minimise noise transfer within the development

The following table details the guidelines and methodology used to address the above items and notes where they have been addressed in this report.

Table 1: Project overview

Acoustic consideration	Adopted guidelines/ methodology	Report section
Noise intrusion	Infrastructure SEPP/ DoP Guideline/ AS/NZS 2107	Section 4
Noise emission (industrial noise)	Noise Policy for Industry	Section 5
Childcare noise	AAAC Childcare Guideline	Section 6
Licensed premises	NSW Liquor and Gaming	Section 7
Road noise	Road Noise Policy	Section 8
Rail vibration impacts	DoP Guideline/ AVaTG	Section 9
Acoustic separation	NCC (BCA)	Section 10

2. Project Description

2.1 Site Description

The proposed development is located along Broomfield Street, Cabramatta NSW (the Site). The site boundary is outlined in Figure 1. The Site is part of a broader parcel that was recently rezoned and bounded by Broomfield Street to the west, Fisher Street to the north and Cabramatta Road East to the south. The development is zoned as B4 (mixed-use) and is surrounded by B4 and R4 (High Density Residential) zoned land.

Residential receivers are located to the north, south and east of the site. Commercial receivers are located to the south and west of the site. The elevations of the nearest receivers are shown in Appendix D.

The development will consist of three mixed-use buildings, as shown in Figure 2. The Site elevations are shown in Figure 3 to Figure 6.

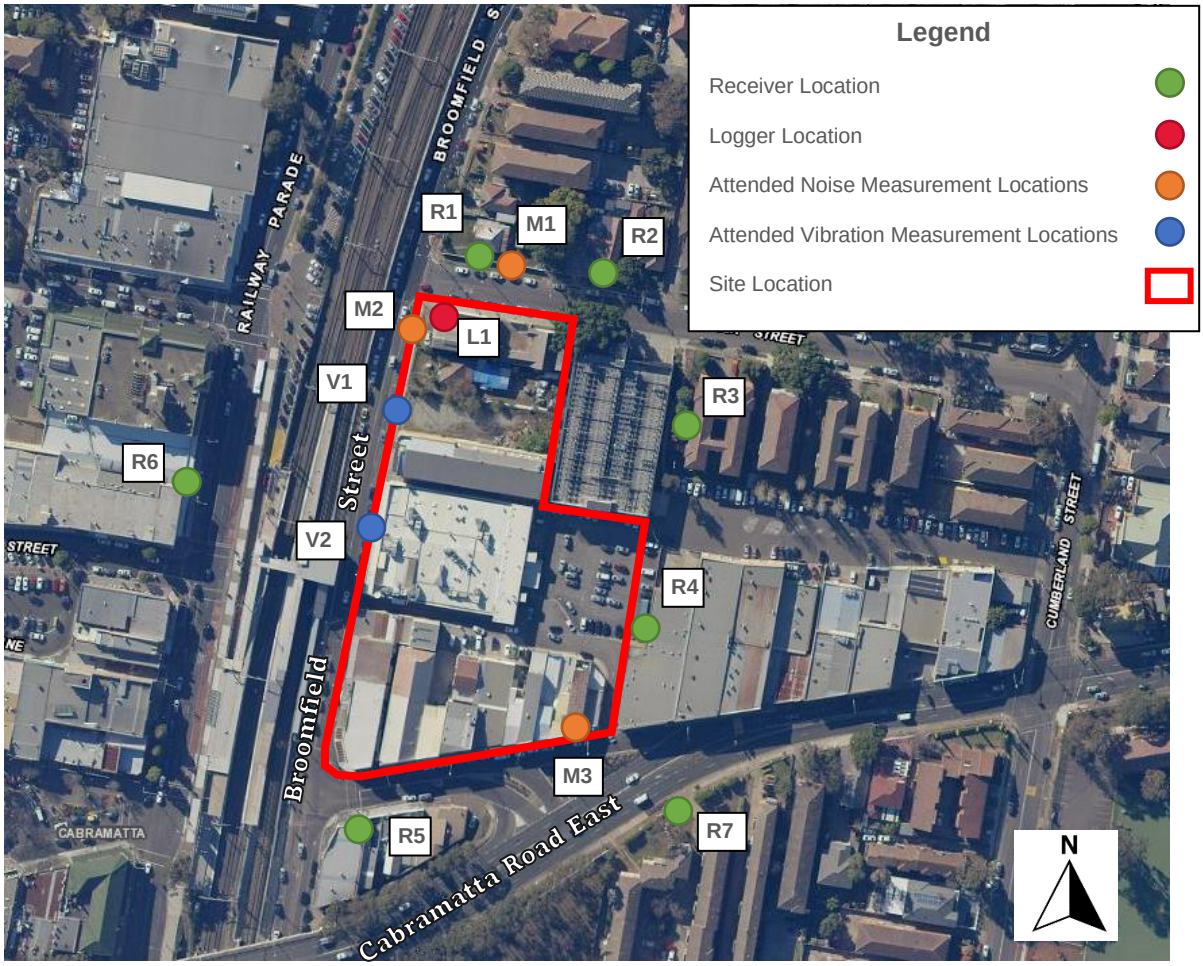


Figure 1: Site, surrounds, monitoring and measurement locations

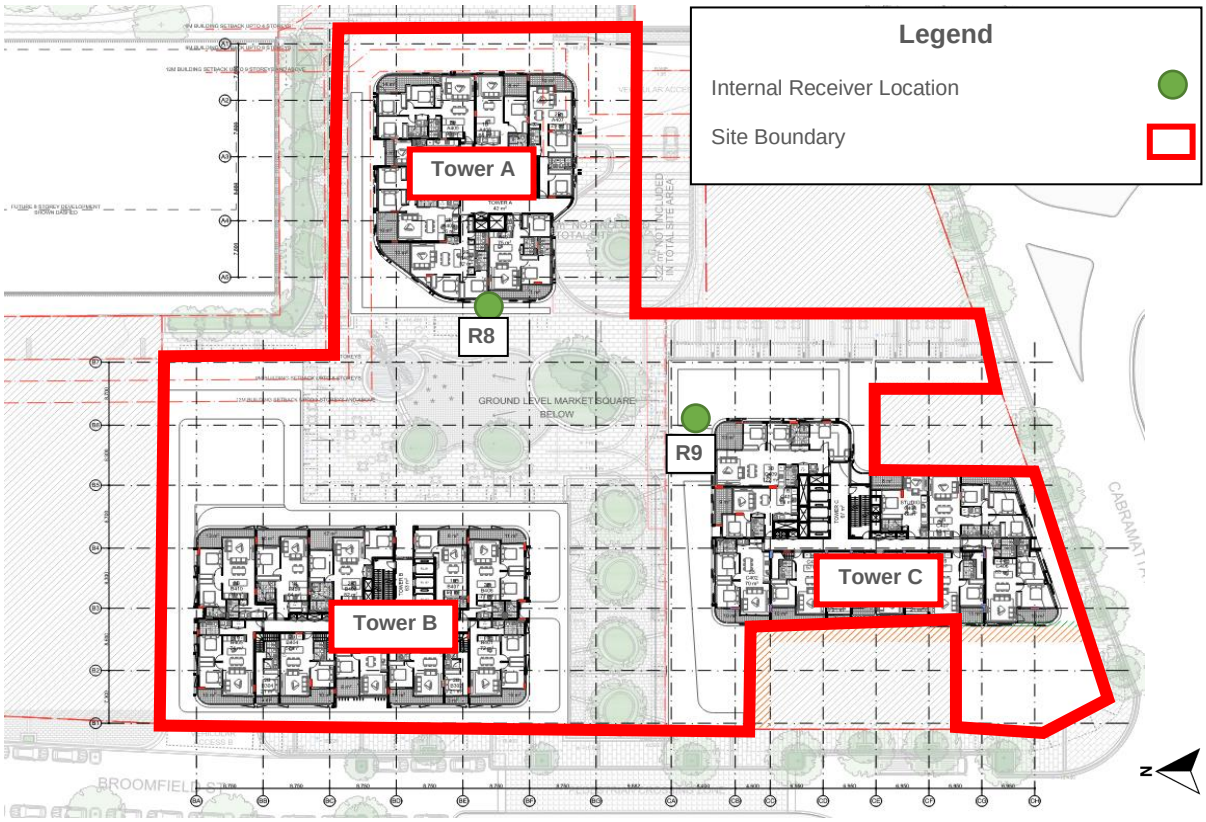


Figure 2: Typical floor level

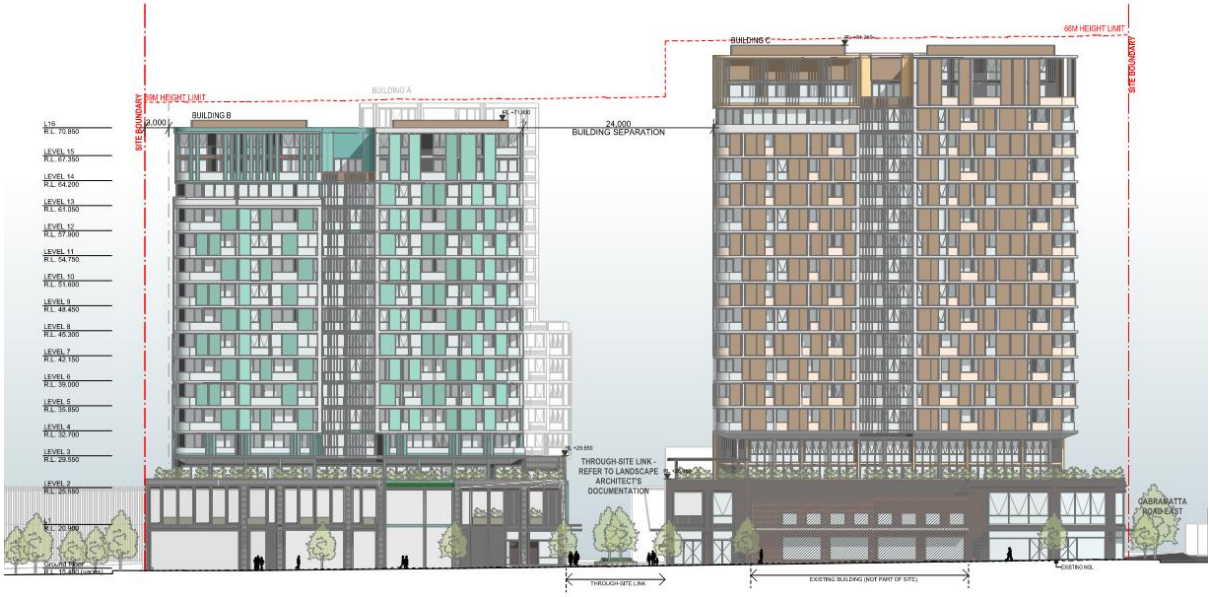


Figure 3: Building B and C - west elevation

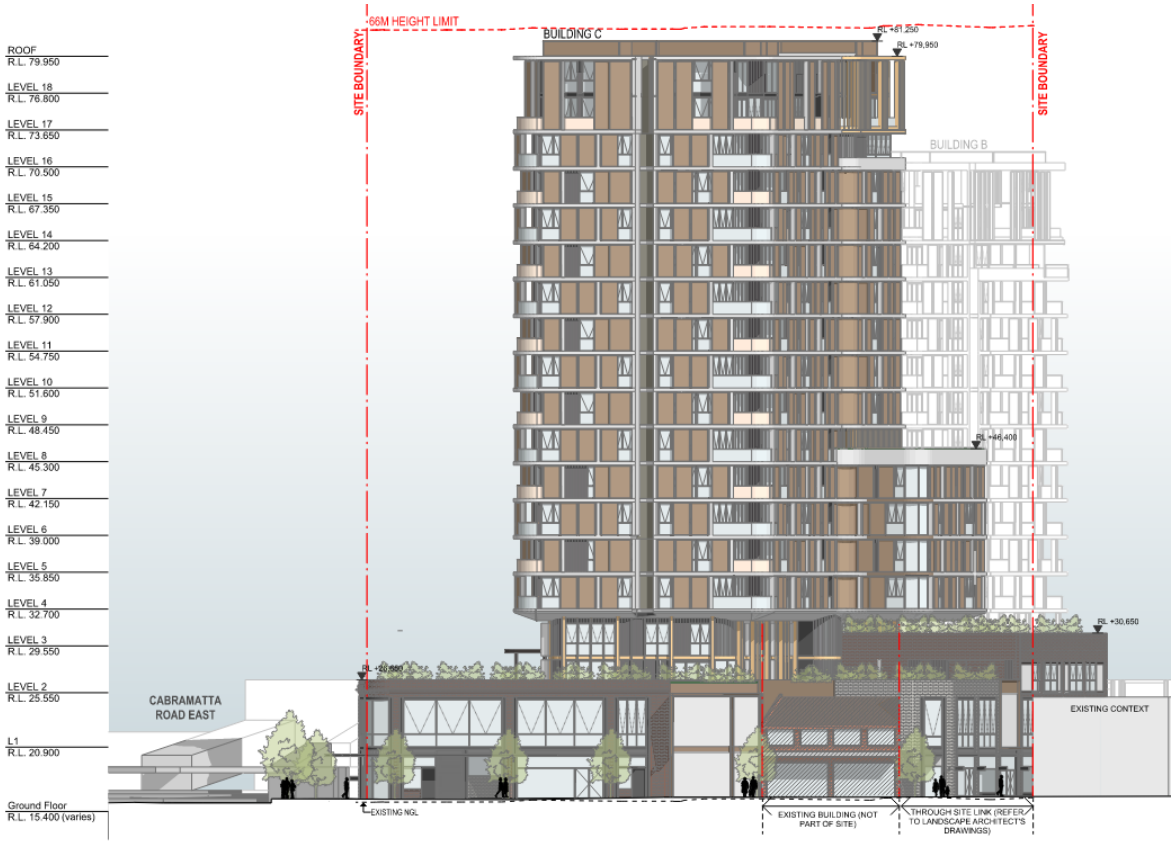


Figure 4: Building C - south elevation

Figure 5: Building A and B - south elevation

Figure 6: Building B and C - east elevation

2.2 Sensitive Receivers

Sensitive receivers which have the potential of being impacted by noise and vibration are located outside and within the Site.

Sensitive receivers that do not form part of the Site are referred to as “external receivers”, while sensitive receivers within the Project are defined as “internal receivers”.

The most affected external and internal receivers have been identified in Table 2. Additionally, external receivers have been marked in Figure 1 and most affected internal receivers have been marked in Figure 2.

Table 2: Noise sensitive receivers

Receiver ID	Address	Land use	Approximate location
R1	68 Broomfield Street, Cabramatta	Residential	23m north of site
R2	15 Fisher Street, Cabramatta	Residential	23m north of site
R3	8A Fisher Street, Cabramatta	Residential	50m east of site
R4	123 Cabramatta Road East, Cabramatta	Commercial	10m east of site
R5	156 Cabramatta Road East, Cabramatta	Commercial	20m south of site
R6	193 Railway Parade, Cabramatta	Commercial	70m west of site
R7	120-124 Cabramatta Road East, Cabramatta	Residential	55m south-east of site, 97m from the proposed Tavern
R8	Unit A108 – Building A (facing childcare centre)	Residential	1st floor level within Building A

R9	Unit C212 – Building C (facing childcare centre)	Residential	2nd floor level within Building C

3. Existing Environment

A site survey was previously undertaken as part of a development application for the Site (ref: *SY183030-AUR01-[A] Acoustic Report for Development Application - Broomfield Street Cabramatta* dated 30/04/2019). During the survey, the existing noise and vibration levels were determined. The survey included long term unattended noise monitoring and operator attended noise and vibration measurements.

In addition to the 2019 survey, additional long term noise monitoring was undertaken to confirm the background noise levels measured previously in 2019.

The results of the site surveys are summarised in the following Sections.

3.1 Long Term Noise Monitoring

Long term unattended noise monitoring was conducted between Wednesday 17 April 2019 and Tuesday 30 April 2019. Additional noise monitoring was undertaken between Tuesday 30 January 2024 and Wednesday 7 February 2024.

Both noise surveys used a Rion NL-52 Type 1 noise logger that was installed on site at the location shown in Figure 1. The logger was installed in the free field at a height of 1.5 metres above the first floor level. The noise environment at the logger location consisted of intermittent rail and road noise.

The noise logger continuously recorded noise parameters over fifteen minute periods. These noise parameters included the L_{eq}, L_{max}, L_{min}, L_{90} and the L_{10}. In accordance with the NPfI, the rating background noise level (RBL) was determined for the different time periods.

The measured ambient (L_{eq}) and RBLs (L_{90}) are presented in Table 3. Detailed results of the logger measurements are shown in Appendix C.

Table 3 Long-term noise logging results

Monitoring period	Rating Background Noise Level (RBL) L_{90} dBA			Ambient noise levels L_{eq} dBA		
	Day	Evening	Night	Day	Evening	Night
17th April to 30th April 2019	48	46	40	58	55	52
30th January to 7th February 2024	48	46	39	59	59	57

1. Time periods defined as: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am

Based on the results presented in Table 3, the 2019 background noise levels are consistent with the measured 2024 background noise levels. Therefore, the 2019 noise and vibration data is still considered relevant.

It is noted that the 2024 night time RBL is 1 dB lower than the 2019 night time RBL, and therefore has been adopted herein for a conservative assessment.

3.2 Operator Attended Noise Measurements

Fifteen minute attended measurements were conducted to verify unattended background noise levels and to characterise the acoustic environment around the Site. Operator attended noise measurement survey was conducted with an NTI XL2 sound level meter (Class 1).

The operator attended noise measurements were performed on 17 and 26 April 2019 at locations M1-M3, shown in Figure 1. Results are presented in Table 4 below.

Table 4 Operator attended noise measurement results

Location	Measurement date and time	$L_{eq,15min}$ dBA	$L_{10,15min}$ dBA	$L_{90,15min}$ dBA	Notes
M1	17/04/2019 7:46am – 8:01am	65	67	51	At corner of Fisher and Broomfield Streets
M2	17/04/2019 8:06am – 8:21am	64	66	48	At nearest affected residents
M3	26/04/2019 12:36am – 12:51am	64	67	56	Road traffic noise from Cabramatta Road East

The attended measurement at M2 is consistent with the day time RBL measured by the long term noise monitor.

3.3 Operator Attended Vibration Measurements

Operator attended vibration measurements were taken at the Site to quantify the vibration impact upon the site from freight and passenger trains on the adjacent railway corridor. Measurements were performed on a Rion VM-56 Tri-axial Vibration Meter on Tuesday 23 and Friday 26 April 2019. Measurement locations V1 and V2 are shown in Figure 1. Vibration measurement results are shown in Table 5 below.

Table 5 Operator attended train vibration measurements and passby noise levels results

Time	Measurement Location	Train Type	Weighted rms values for vibration acceleration (m/s^2) 1–80 Hz			Train Pass-by Noise
			Z-Axis	X-Axis	Y-Axis	L_{eq} dBA
23/04/2019 9:54 am	V1	Freight	0.00098	0.00164	0.00138	70
23/04/2019 10:15 am	V1	Freight	0.00119	0.00224	0.00150	74
23/04/2019 10:27 am	V1	Freight	0.00172	0.00255	0.00192	74
23/04/2019 10:33 am	V1	Passenger	0.00032	0.00171	0.00085	63
23/04/2019 10:35 am	V1	Passenger	0.00029	0.00155	0.00062	59
23/04/2019 10:38 am	V1	Passenger	0.00034	0.00143	0.00056	65

23/04/2019 11:10 am	V1	Passenger	0.00035	0.00133	0.00069	60
23/04/2019 11:22 am	V1	Freight	0.00134	0.00210	0.00154	77
23/04/2019 12:12 pm	V1	Freight	0.00098	0.00189	0.00166	76
23/04/2019 12:57 pm	V1	Freight	0.00118	0.00222	0.00275	71
23/04/2019 1:11 pm	V1	Freight	0.00133	0.00232	0.00258	74
26/04/2019 5:55 am	V2	Passenger	0.00041	0.00161	0.00153	63
26/04/2019 6:07 am	V2	Freight	0.00153	0.00346	0.00285	78
26/04/2019 6:46 am	V2	Passenger	0.00033	0.00163	0.00152	63
26/04/2019 8:02 am	V2	Passenger	0.00028	0.00160	0.00141	64
26/04/2019 8:15 am	V2	Freight	0.00136	0.00564	0.00423	78
26/04/2019 8:21 am	V2	Passenger	0.00029	0.00171	0.00139	67
26/04/2019 9:06 am	V2	Passenger	0.00040	0.00164	0.00133	66
26/04/2019 9:07 am	V2	Passenger	0.00031	0.00188	0.00101	64
26/04/2019 9:17 am	V2	Passenger	0.00029	0.00227	0.00153	63
26/04/2019 9:22 am	V2	Passenger	0.00024	0.00238	0.00137	61
26/04/2019 9:37 am	V2	Passenger	0.00047	0.00315	0.00182	71
26/04/2019 10:17 am	V2	Passenger	0.00019	0.00199	0.00106	61
26/04/2019 10:47 am	V2	Passenger	0.00072	0.00348	0.00155	65
26/04/2019 11:26 am	V2	Freight	0.00116	0.00681	0.00614	76
26/04/2019 11:35 am	V2	Passenger	0.00026	0.00284	0.00151	62
26/04/2019 11:47 am	V2	Passenger	0.00022	0.00265	0.00086	62

26/04/2019 11:55 am	V2	Passenger	0.00023	0.00284	0.00097	62
26/04/2019 12:03 pm	V2	Passenger	0.00174	0.00441	0.00214	77
26/04/2019 12:13 pm	V2	Passenger	0.00036	0.00267	0.00166	64
26/04/2019 12:15 pm	V2	Passenger	0.00018	0.00180	0.00044	64
26/04/2019 12:26 pm	V2	Passenger	0.00024	0.00350	0.00104	65

4. Noise Intrusion Assessment

The noise intrusion assessment identifies the required noise mitigation required to reduce the external noise (such as traffic and rail) to acceptable internal noise levels.

4.1 Noise Intrusion Criteria

4.1.1 Fairfield Citywide Development Control Plan 2013

The following is an excerpts from Fairfield Citywide Development Control Plan 2013 (DCP) Chapter 7 – Residential Flat Buildings and Shop Top Housing relate to noise intrusion.

*c) **Noise attenuation** measures must be incorporated in all new developments along Classified State and Regional Roads and Unclassified Regional Roads and properties in proximity to the railway line. Developments adjacent to rail corridors, shall take into consideration the provisions within SEPP (Infrastructure) 2007 relating to impact of rail noise or vibration on non-rail development.*

*e) **Land use conflicts between existing and new development** – Noise attenuation measures must be incorporated into all new residential development proposed near an existing retail/commercial property that generates noise at times or levels not compatible with residential living. An acoustic assessment and proposed acoustic attenuation measures are to be detailed in an Acoustic Report prepared by an Acoustic Engineer or suitably qualified individual.*

The Cabramatta Town Centre DCP generally replicates these requirements.

In accordance with the Fairfield DCP, the provisions provided within the State Environmental Planning Policy (Infrastructure) (Infrastructure SEPP) is considered for this assessment.

4.1.2 State Environmental Planning Policy (Transport and Infrastructure) 2021 / Development Near Rail Corridors and Busy Roads

The Transport and Infrastructure SEPP (2021) provides internal noise goals for residential buildings located near rail corridors and busy roads. The Development Near Rail Corridors and Busy Roads Interim Guideline (DoP Guideline) aims to provide further guidance for developments to achieve the outcomes of the Infrastructure SEPP. This includes providing further clarification and more detailed noise criteria.

Table 3.1 of the DoP Guideline presents noise criteria for residential and non residential buildings. The DoP Guideline further states that:

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

The DoP Guideline noise criteria for windows open and windows closed scenarios are presented in Table 6.

Table 6: Internal noise criteria (SEPP Infrastructure/ DoP Guideline)

Condition	Occupancy	Design noise level dBA	Applicable time period
Windows closed	Sleeping areas (bedroom)	35 $L_{eq,9hr}$	10pm to 7am
	Other habitable rooms (excluding garages,	40 $L_{eq,15hr}$	At any time

	kitchens, bathrooms & hallways)		
Windows open	Sleeping areas (bedroom)	45 $L_{eq,9hr}$	10pm to 7am
	Other habitable rooms (excluding garages, kitchens, bathrooms & hallways)	50 $L_{eq,15hr}$	At any time

4.1.3 Australian New Zealand Standard AS/NZS 2107:2016

For spaces that are not covered by the DoP Guideline, guidance has been taken from AS/NZS 2107.

AS/NZS 2107 provides recommended noise level and reverberation times for different areas of occupancy in buildings. The recommended noise levels are given in terms of an equivalent continuous A-weighted noise level (L_{Aeq}). The AS/NZS recommended values for the internal background noise levels and reverberation times are shown in Table 7.

Table 7: Internal design sound levels

Type of occupancy	Recommended design sound level range – L_{eq} dBA
Small retail stores (general)	< 50
Restaurants	40 – 50
Weight training/fitness rooms	< 50
Enclosed car parks	65
Consulting rooms (medical)	40 to 45
Waiting rooms, reception areas (medical)	40 to 50

4.2 Calculated Internal Noise Levels

The noise levels from the train pass-bys measured in Table 5 were averaged to estimate the train noise level along the western façade (67 L_{eq} dBA). A 3 dB reduction has been applied to the northern and southern facade to account for a reduced line of sight to the noise source. A 10 dB reduction has been applied to the eastern facades with no line of sight to the rail line.

Using the external noise levels above, spreadsheet based calculations were used to predict the internal noise levels within the development.

4.3 Recommendations

4.3.1 Glazing

The glazing was designed to reduce the external noise levels (calculated in Section 4.2) to the levels shown in Table 6 and Table 7. Additionally, glazing has been design to reduce noise break-out from commercial spaces.

The minimum performance requirements for façade glazing have been provided in Table 8.

Table 8: Glazing schedule

Level	Space	Façade	Recommendations	
			R_w glass + frame	Glazing type
1-18	Bedroom	West	40	12.5mm VLam Hush
		North and south	32	10.38mm laminated
		East	28	6mm monolithic
1-18	Living area	West	36	10.38mm laminated
		North & south	32	6.38mm laminated
		East	28	6mm monolithic
Ground	Lobby	All	27	4mm laminated
Ground-1	Restaurants/ cafes	All	36	10.38mm laminated[1]
1	Medical	All	27	4mm laminated
Ground-1	Commercial	All	27	4mm laminated[1]
Ground	Tavern	All	40	12.5mm VLam Hush[2]

1. Provisional glazing to minimise noise break-out from commercial spaces as discussed in Section 5.2.2
2. Glazing recommendation based on the licensed premise assessment in Section 7

The above glazing thicknesses are the minimum required for acoustics insulation. Glazing thicknesses can be increased to comply with Section J requirements or as required.

Glazing is generally the weakest component of the facade, and if not designed or installed properly would be a major transmission path.

Sometimes different glass configurations have the same R_w rating but they have different sound transmission loss characteristics at each frequency band. Our recommendations for glazing have been based on glass performance across frequency spectrum. Alternative glazing selections should be approved by an Acoustic Consultant.

All windows / doors should be well sealed when closed with quality seals such as Q-LON acoustic seals along the top and bottom sliders. Special attention should be given to balcony or slider doors to have quality acoustic seals all around them. Any airgap will significantly reduce the acoustic performance or the ability to reduce noise. Mohair seals are not considered to be acoustic seals.

For service rooms such as toilets, kitchen or laundries where the glazing is not specified in the glazing schedule, a 4 mm standard glass and frame with R_w 25 is considered sufficient.

4.3.2 External Walls

The podium levels will consist of brick construction while a lightweight system is proposed for the levels above podium. The lightweight structure proposed consists of the following construction:

- External 9mm fibre cement sheet, steel stud with 150mm gap with 75mm thick insulation, and 13mm internal plasterboard

The noise intrusion through the external walls was included in the glazing design calculations. No further upgrades to the external walls are required.

4.3.3 Natural Ventilation

Based on the internal noise predictions undertaken in Section 4.3, the windows of the residential apartments are to be closed to comply with the internal noise criteria. In accordance with the Infrastructure SEPP and accompanying guidelines, the spaces must also meet the ventilation requirements of the Building Code of Australia when the windows are closed. Alternatively, natural ventilation can be provided through balcony designs, winter gardens or sound attenuating ventilation solutions. A detailed review of the ventilation strategy should be undertaken at the detailed design stage.

5. Noise Emission Assessment

This section assesses the noise from the development impacting the surrounding receivers.

5.1 Criteria

5.1.1 Fairfield Citywide Development Control Plan 2013

The following is an excerpts from Fairfield Citywide Development Control Plan 2013 (DCP) Chapter 7 – Residential Flat Buildings and Shop Top Housing relate to noise emission.

*b) **Noise impact** assessments may be required. An assessment of the existing and expected future noise levels together with a mitigation strategy must be provided in the noise impact assessment.*

*d) **Land uses/activities noise conflicts minimised** – In mixed-use developments, the design must minimise the transfer of noise between business and commercial activities and residential development by using measures that will address noise associated with:*

a. Goods and service deliveries as well as waste and garbage disposal and collections, particularly if this is occurring early in the morning or late at night;

b. Restaurants and cafes particularly those operating at night or those with outdoor seating; and

c. Extraction fans and air conditioning units.

*f) **Air conditioning units** proposed are to be detailed in the acoustic assessment.*

Fairfield Council's DCP does not provide quantitative noise criteria to assess noise emissions from a development therefore guidance has been taken from the EPA's Noise Policy for Industry (NPfI).

5.1.2 NSW EPA Noise Policy for Industry (2017)

The NPfI sets out noise criteria to control the noise emission from industrial noise sources. Operational noise from the development will be assessed in accordance with the NPfI.

The NPfI assessment procedure has two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

The project noise trigger level is the lower (that is, the more stringent) value of the project intrusiveness noise level and project amenity noise level determined in Section and Section 5.1.2.2. The project noise trigger level provides a benchmark for assessing the noise emissions from a development.

5.1.2.1 Project Intrusiveness Noise Level

The intrusiveness noise level aims to limit the change in the existing environment due to the introduction of a new noise source. The intrusiveness noise level is defined as:

$$L_{Aeq,15min} = RBL + 5\ dB$$

Where the RBL is determined through the background noise monitoring undertaken in Section 3.1.

From the attended noise monitoring in Table 4, it is evident that the background noise levels surrounding the Site is the lowest at the logger location. For a conservative assessment, the background noise levels measured at the logger location has been adopted for all the surrounding residential receivers.

The project intrusiveness noise levels are presented in Table 9 below.

Table 9: Project instrusiveness noise level (residential receivers only)

Receiver	Time period[1]	Measured RBL – $L_{90,15min}$ dBA	Project intrusiveness noise level – $L_{eq,15min}$ dBA
Residential (R1 – R3)	Day	48	53
	Evening	46	51
	Night	39	44

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday

5.1.2.2 Project Amenity Noise Level

For the purpose of limiting continual increase in noise levels, recommended noise levels are defined to maintain amenity acoustic amenity for different types of land uses. The recommended amenity noise levels are described in Table 2.2 of the NPfI.

Based on the RBLs presented in Table 3 and Table 2.3 of the NPfI, the residential receivers can be considered as urban. The recommended amenity noise levels applicable to the proposed development are detailed in Table 10.

Table 10: Amenity noise levels

Receiver	Noise amenity area	Time period[1]	Recommended amenity noise level – $L_{Aeq,\ period}$ dBA	Project amenity noise level – $L_{Aeq,\ period}$ dBA[2]	Project amenity noise level – $L_{Aeq,15min}$ dBA[3]
Residential	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Commercial premises	All	When in use	65	60	63

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday
2. Recommended amenity noise level minus 5 dB
3. In accordance with the NPfI, a 3dBA correction has been applied to convert from a period level to a 15 minute level

5.1.2.3 Project Trigger Levels

The project noise trigger level is the more stringent of the project intrusiveness noise level and project amenity noise level. The site specific project trigger levels have been determined for the nearby sensitive receivers and have been detailed in Table 11.

Table 11: Project Noise Trigger Levels

Receiver ID	Land use	Time period[1]	Project intrusiveness noise level – $L_{eq,15min}$ dBA	Project amenity noise level – $L_{eq,15min}$ dBA	Project trigger levels – $L_{eq,15min}$ dBA
R1 – R3 & R7 – R9	Residential	Day	53	58	53
		Evening	51	48	48
		Night	44	43	43
R4 – R6	Commercial	When in use	-	63	63

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday

5.1.2.4 Maximum Noise Level Event Assessment

The potential for sleep disturbance from maximum noise level events from the licensed premise during the night should be considered.

In accordance with the NPfI, where the subject development/premises night-time noise levels at a residential location exceed the following, a detailed maximum noise level event assessment should be undertaken.

- $L_{eq,15min}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater.

The maximum noise trigger levels are detailed in Table 12.

Table 12: Maximum noise level criteria

Receiver type	Assessment level – $L_{eq,15min}$	Assessment level – L_{Fmax}
Residential	39 + 5 = 44 dBA	39 + 15 = 54 dBA

5.2 Noise Emission Assessment

The noise emission from the Site should comply with the external noise emission criteria detailed in Table 11. It is anticipated that the noise from the Site will emanate from the following noise sources.

- Vehicle movements within the development (including waste collection)
- Operational noise breakout from commercial tenancies (including restaurants that are not considered licensed premises)
- Mechanical plant and equipment

The cumulative noise from the above noise sources should comply with the criteria presented in Table 11. The noise from the childcare centre and the Tavern are not included in this assessment and are assessed separately in Section 6 and 7.

5.2.1 On Site Vehicle Movements/ Waste Collection

The development has two vehicular access points to the basement carparks. Vehicular access is located along the south side on Cabramatta Road East and another access point is located on the west side on Broomfield Street. As there are no sensitive or residential receivers on the west side, the Broomfield Street access is not likely to cause a noise impact upon the neighboring buildings. For a conservative assessment, it is assumed that all vehicles enter and exit the driveway located along Cabramatta Road East. In reality the vehicles will utilise both access points and therefore the actual predicted noise levels will be lower than the levels predicted in Table 14.

It is also noted that vehicles/ loading dock activities within the basement parking will be significantly shielded from the nearby sensitive receivers, it is expected that the noise impacts would be minimal. Therefore, only the vehicle movements from the public road into the car park basement has been considered.

Vehicle movements generated by the development will typically be associated with the following uses of the development:

- Residents of the development
- Commercial and retail uses including childcare centre, Tavern, retail and restaurants

The Traffic Report (*Cabramatta East Transport Assessment* dated May 2023) details the peak number of track movements associated with the different types of uses and has been presented in Table 13.

Table 13: Predicted traffic volumes

Site component	AM peak hour	PM peak hour
Residential	43	34
Retail	22	65
Childcare	51	37
Medical centre	22	23
Commercial	12	12
Tavern	3	10
Total	**153**	**181**

Based on the above inputs, the following traffic movements have been assumed for the day, evening and night time period)

- Day time: 181 vehicle movements and 2 heavy vehicle movements occurring in a one hour period
- Evening time: As a worst case scenario, the evening time traffic volumes are assumed to be the same as the day time volumes (ie. 181 vehicle movements and 2 heavy vehicle movements in a one hour period)
- Night time: It was advised that the residential night time traffic movements can be estimated by taking 10% of the AM peak. For the traffic assessment it is also assumed that the Tavern will be operational during the night time. Therefore, 28 night time traffic movements have been assumed.

Noise emissions were predicted by using Cadna-A (version 2023) noise modelling program. A sound power of 81 dBA was used for light vehicles and 103 dBA was used for heavy vehicles. The noise model assumed that all vehicles travelled at 10km/h while on site.

Additionally, noise model takes the following into account:

- Distance from source to receiver
- Ground type between the source and the receiver
- Shielding from buildings

The noise levels were predicted at the nearest affected receivers and are presented in Table 14.

Table 14: Predicted noise emission from on site vehicle movements

Receiver Location	Noise Criteria – $L_{eq,15\ min}$ dBA			Predicted Noise Level – $L_{eq,15\ min}$ dBA			Complies (Y/N)?
	Day	Evening	Night	Day	Evening	Night	
R1	53	48	43	< 20	< 20	< 20	Yes
R2	53	48	43	< 20	< 20	< 20	Yes
R3	53	48	43	31	31	< 20	Yes
R4	63[1]	63[1]	63[1]	58	58	41	Yes
R5	63[1]	63[1]	63[1]	27	27	< 20	Yes
R6	63[1]	63[1]	63[1]	< 20	< 20	< 20	Yes
R7	53	48	43	41	41	25	Yes
R8	53	48	43	30	30	< 20	Yes
R9	53	48	43	39	39	24	Yes

1. When in use

Based on Table 14, the predicted noise levels associated with on site vehicle movements is predicted to comply and therefore no additional noise mitigation measures are required.

5.2.2 Noise Emissions from Commercial Tenancies

At this stage the specific uses of the commercial tenancies (including the restaurants) are not known, therefore the noise impacts associated with the noise breakout from commercial tenancies cannot be quantified. However, the building envelope can be upgraded/ management measures can be implemented to minimise the breakout noise from commercial tenancies.

It is anticipated that in principle noise engineering measures can be utilised to meet the environmental noise criteria. This may include any of the following:

- Closing windows and doors to minimise noise breakout
- Upgrading the glazing of the commercial tenancies
- Limiting the number of patrons in the outdoor dinning areas
- Design of solid balustrades to act as acoustic noise barriers
- Line internal spaces with acoustic absorption

It is proposed that a more detailed assessment should be undertaken at the detailed design stage of the project to confirm the required acoustic treatment.

5.2.3 Mechanical Plant

The mechanical plant has yet to be selected at this stage and therefore a noise assessment of the mechanical plant servicing the Site cannot be undertaken.

It is anticipated that in principle noise engineering measures can be utilised to meet the environmental noise criteria. This can include the following:

- Selection of quieter equipment
- Locate equipment away from sensitive receivers
- Incorporate acoustic louvres or attenuators
- Incorporate duct lining
- Design acoustic barriers/ enclosures

6. Childcare Centre Noise Assessment

6.1 Childcare Layout and Description

The childcare centre is located on Level 1 of Building B and will accommodate up to 80 children. The childcare centre will consist of the following spaces:

- A covered outdoor play area
- activity rooms and indoor play areas
- offices and staff room
- cot room
- reception
- kitchen

The extent of the Childcare Centre is outlined in Figure 7.

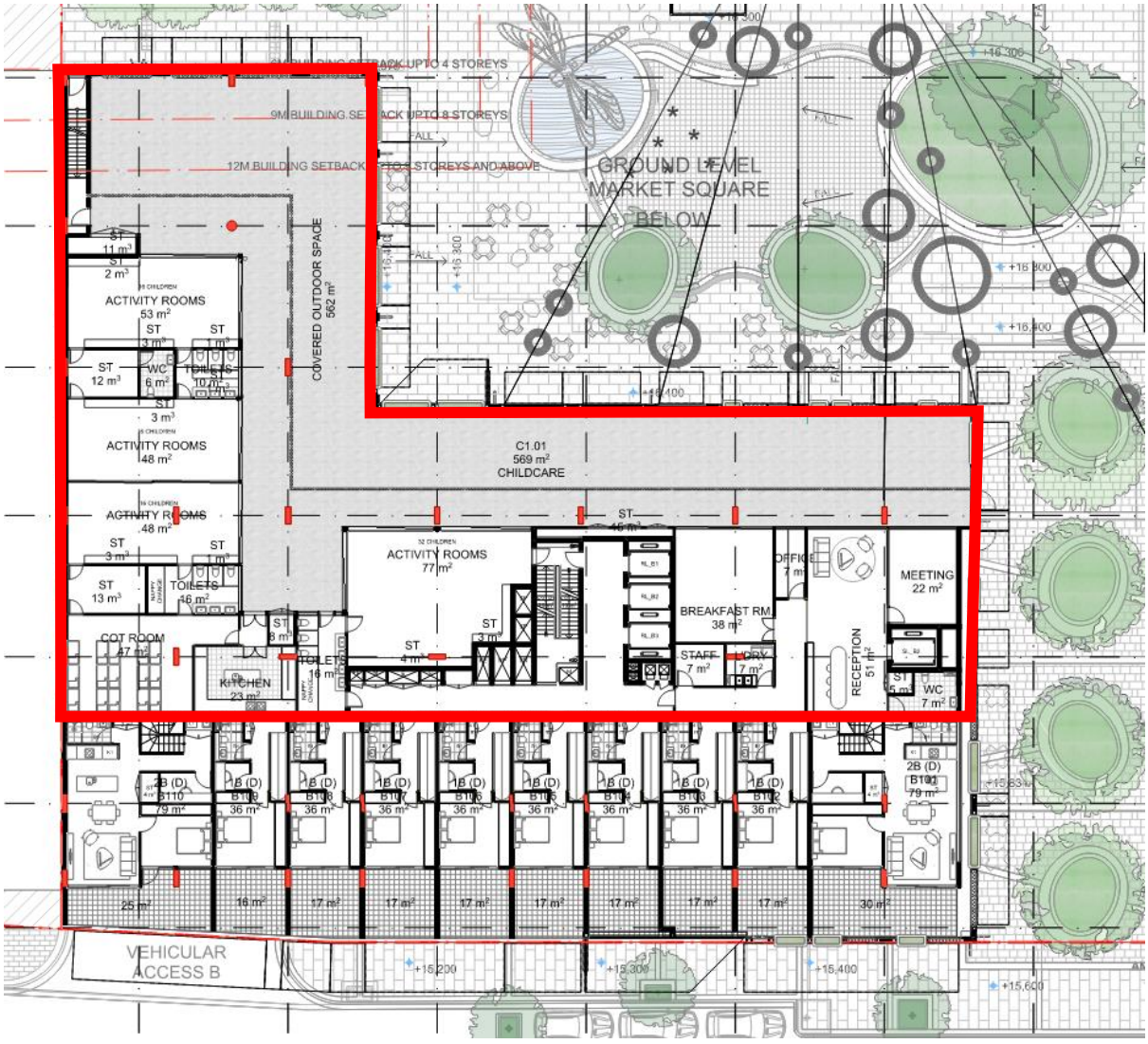


Figure 7: Childcare centre layout (Level 1 – Building B)

6.1.1 Hours of Operation

The childcare centre proposed hours of operation are as follows:

- 7 am - 6 pm Monday to Friday

6.2 Noise Sources

The sound power levels recommended in the AAAC Guideline have been used in the noise calculations for the outdoor play area.

For a conservative assessment it is assumed that all the children are aged between 3 to 5 years. For modelling purposes, it is assumed that up to 20 children are playing outside at the same time.

It is proposed that the windows of the childcare will remain closed during operation. It is anticipated that the contribution from the noise breakout from indoor play areas would be insignificant in comparison to the noise from the outdoor play area. For the purpose of this assessment, only the outdoor play area has been modelled.

The sound power levels used for this assessment are presented in Table 15.

Table 15: Children playing Sound Power Levels

Number and Age of Children	Overall Sound Power Level dBA	Sound Power Levels at Octave Band Centre Frequencies (Hz) (dB)							
		63	125	250	500	1k	2k	4k	8k
10 Children - 3 to 5 years	87	64	70	75	81	83	80	76	72
20 Children - 3 to 5 years	90	67	73	78	84	86	83	79	75

6.3 Childcare Centre Noise Emission Assessment

6.3.1 Noise Emission Criteria

Fairfield Council's DCP does not provide quantitative noise criteria to assess noise emissions from the childcare centre, as such the noise criteria stipulated in the Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment (version 3.0) have been adopted for this assessment.

The AAAC Childcare Guideline provides the following criteria for assessing noise emissions from outdoor play areas to residential receivers.

- Outdoor play limited to four hours per day: $L_{eq,15min} \leq$ RBL + 10
- Outdoor play areas used more than four hours per day: $L_{eq,15min} \leq$ RBL + 5

For commercial receivers the following criteria is proposed by the AAAC guideline.

The cumulative $L_{eq,15min}$ noise level emitted from the use and operation of the Childcare Centre shall not exceed 65 dBA, from all activities (including outdoor play), when assessed at the most affected point on or within any commercial property boundary.

The noise emission criteria for the childcare centre are summarised in Table 16.

Table 16: Noise Emission Criteria for the Childcare Centre

Receiver	Land Use	Time period	Noise Criteria – $L_{eq,15min}$ dBA
R1	Residential	Day	53
R2	Residential	Day	53
R3	Residential	Day	53
R4	Commercial	When in use	65
R5	Commercial	When in use	65
R6	Commercial	When in use	65
R7	Residential	Day	53
R8	Residential	Day	53
R9	Residential	Day	53

6.3.2 Predicted Noise Levels

Noise emissions were predicted by using Cadna-A (version 2023) noise modelling program. The noise model assumed that the noise from the children playing was evenly distributed along the outdoor play area.

The noise model takes the following into account:

- Distance from source to receiver
- Ground type between the source and the receiver
- Shielding from buildings and barriers (including a 1m high balustrade surrounding the outdoor play area)

The predicted noise levels from the childcare are presented in Table 17.

Table 17: Predict Childcare Noise Emissions

Receiver Location	Time of Day	Noise Criteria	Predicted Noise Level $L_{eq,15\ min}$ dBA	Complies (Y/N)?
R1	Day	53	22	Yes
R2	Day	53	26	Yes
R3	Day	53	29	Yes
R4	When in use	65	20	Yes
R5	When in use	65	< 20	Yes
R6	When in use	65	< 20	Yes
R7	Day	53	< 20	Yes
R8	Day	53	53	Yes
R9	Day	53	49	Yes

The noise levels are predicted to comply with the noise criteria provided that the mitigation measures listed in Section 6.4 are implemented.

6.4 Childcare Centre Recommendations

The predicted noise levels comply with the relevant noise criteria provided that the following mitigation measures are implemented:

- The number of children playing in the outdoor area at one time should be limited to 20 children
- The roof directly above the outdoor play area should be solid with no gaps.
- A one metre high barrier shall be installed above the finished floor level of the outdoor play area. There shall be no gaps in the fence or between the fence and the playground floor. The extent of the barrier is shown in Figure 8.
- Acoustic barriers and the roof directly above the outdoor play area shall be constructed using a material that has a minimum mass of 8kg/m^2. This can include: treated timber (lapped and capped), glass, precast concrete panels, lightweight aerated concrete, transparent acrylic panels, metal sheet cladding or fibre cement sheeting.

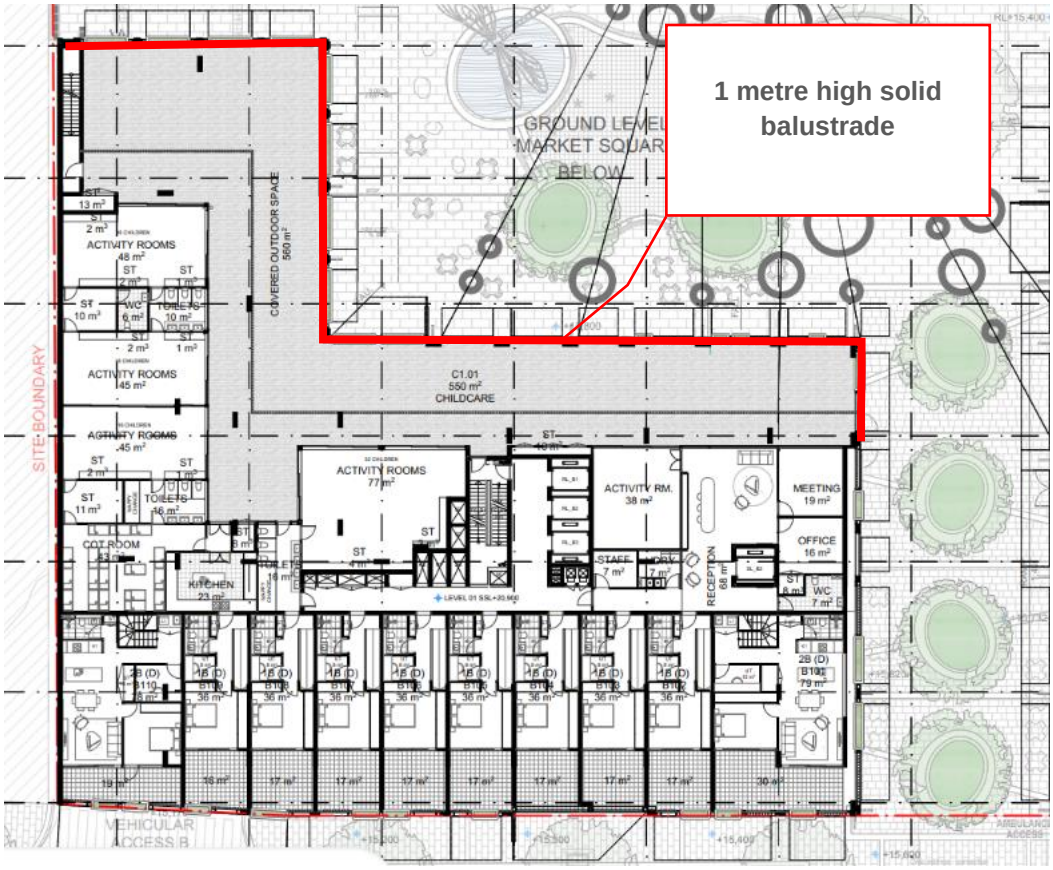


Figure 8: Childcare Centre Acoustic Barrier

6.5 Childcare Centre Noise Intrusion Assessment

6.5.1 Noise Intrusion Criteria

With respect to the noise impacting a Childcare Centre, Section 13.1.8 of the Fairfield DCP states that:

a) Child care centres must achieve an ambient noise level within the centre not exceeding 40dB(A) within learning areas. Designated sleeping areas are to achieve a level not exceeding 35dB(A) within

the room. Designs should aim to locate sleep rooms and play areas away from the principal noise sources. Where necessary the impact of noise must be reduced by solid fencing and double glazing.

The AAAC Guideline provides more detailed noise intrusion criteria that is consistent with the Fairfield DCP criteria. Therefore, the AAAC Guideline's noise intrusion criteria, detailed below, have been adopted for this assessment.

- *The LAeq,1hr noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).*
- *The LAeq,1hr noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (ie with doors and / or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas.*

6.5.2 Noise Intrusion Assessment

The ambient noise measured around the site at points M1, M2 and M3 had levels of L_{eq} 65, 64 and 64 dBA respectively. These values were measured around the Site at locations close to traffic or rail noise. Those values will be significantly attenuated by the intervening structures when perceived at the location of the outdoor play area. It is anticipated that the ambient noise level at the outdoor play area will be below the 55 dBA recommended limit.

The sensitive internal spaces of the childcare centre will be the office and the cot room. Assuming that the outer glazing of the childcare centre will be 4-5 mm standard glass, the internal noise levels inside the office will be below 40 dBA, and those of the cot room will be below 35 dBA. Therefore, it is anticipated to comply with the criteria detailed in Section 6.5.1 with no additional acoustic treatment.

7. Licensed Premise Noise Assessment

Given that the Tavern is a licensed premise, the noise emissions should be assessed in accordance with the requirements stipulated by NSW Liquor and Gaming.

7.1 Licensed Premise Layout and Description

The Tavern is located on the ground level towards the south-west corner of the site.

The Tavern will be operating 24/7 with a maximum capacity of 300 patrons. It is proposed that the Tavern may occasionally have amplified music. It is noted that the premises will not have an outdoor area.

The Tavern has entrance doors on Cabramatta Road East and the northern façade. The Tavern position is highlighted in Figure 9.

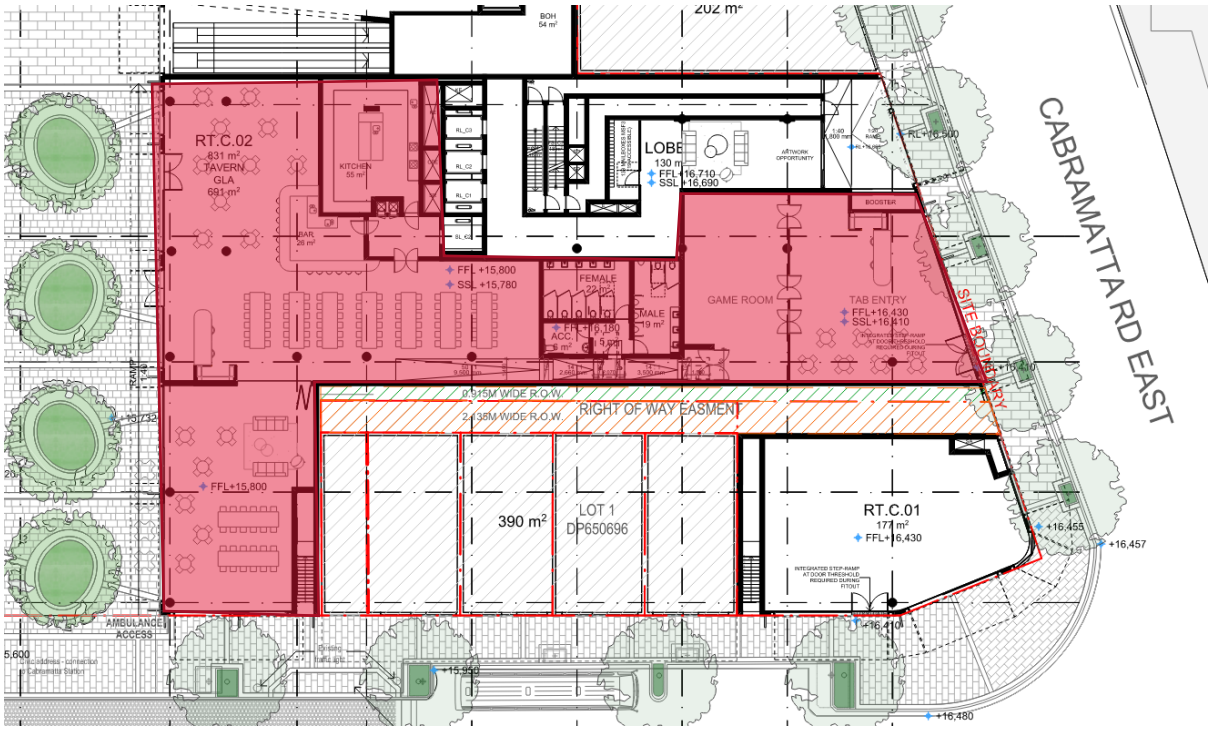


Figure 9: Position of the Tavern

7.2 Licensed Premise Criteria

NSW Liquor and Gaming are the consent authorities for licensed premises. NSW Liquor and Gaming have the following noise limits for licensed premises impacting nearby residences.

- The L_{A10}* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) by more than 5dB between 7:00 am and 12:00 midnight at the boundary of any affected residence.
- The L_{A10}* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) between 12:00 midnight and 7:00 am at the boundary of any affected residence.
- Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00 am.

Based on the noise monitoring detailed in Section 3.1, the licensed premise noise criteria were determined and presented in Table 18.

Table 18: Licensed premise noise emission criteria

	Overall dBA	Octave Band Centre Frequencies (Hz)								
		31.5	63	125	250	500	1k	2k	4k	8k
Measured night time RBL – L_{90}, dBA	39	44	44	44	38	35	35	30	23	23
Criteria (7am to 12am), dBA	44	49	49	49	43	40	40	35	28	30
Criteria (12am to 7am)[1], dBA	29	34	34	34	28	25	25	20	13	13

1. For a conservative assessment, inaudibility criteria have been set as 10dB below the background noise level

7.3 Noise Sources

The noise from amplified music is typically louder than the noise from patrons. Therefore, for a conservative assessment the noise from amplified music has been assessed to the nearest affected external receiver.

The noise level for amplified music was based on noise levels provided in the AAAC Licensed Premise Guideline v2. The assumed internal levels used for the licensed premise assessment is detailed in Table 19.

Table 19: Internal music noise levels, L_{10}

Noise Source	Overall dBA	L_{10} Sound Power Levels at Octave Band Centre Frequencies (Hz) (dB)								
		31.5	63	125	250	500	1k	2k	4k	8k
Amplified music	98	124	116	105	96	87	92	88	85	83
Amplified music with noise limiter	97	100	100	105	96	87	92	88	85	83

7.4 Predicted Noise Levels

Noise levels were predicted at the worst affected external receiver (receiver R7). The noise model assumes that all windows and doors are closed. The construction for the windows and doors were assumed to be 12.5mm laminated glass (R_w 40).

The predicted noise levels at R7 are presented in Table 20.

Table 20: Predicted licensed premise noise at Receiver R7, L_{10}

	Overall dBA	Octave Band Centre Frequencies (Hz)								
		31.5	63	125	250	500	1k	2k	4k	8k
Criteria (7am to 12am), dBA	44	49	49	49	43	40	40	35	28	30

Criteria (12am to 7am)[1], dBA	29	34	34	34	28	25	25	20	13	13
Predicted noise (amplified music), dBA	21	48	45	30	18	< 10	< 10	< 10	< 10	< 10
Predicted noise (amplified music with noise limiter), dBA	17	34	34	30	18	< 10	< 10	< 10	< 10	< 10

1. Shaded cells indicate compliance with the inaudibility criteria

Based on Table 20, the amplified music complies with the noise criteria up until 12am; after 12am a noise limiter is required at the low frequencies to comply with the inaudibility criteria.

7.5 Licensed Premise Mitigation Measures

The noise from the licensed premise is predicted to comply with the noise criteria provided that the mitigation measures are implemented.

- Windows of the Tavern must remain closed at all times
- Glazing (windows and doors) must have a minimum R_w of 40 (12.5mm glazing)
- A noise limiter must be used for amplified music from 12am-7am. Noise limits are detailed in the bottom row of Table 19
- When amplified music is played or during large events, it is recommended that patrons use the entry doors located along the northern facade to minimise noise impacts to surrounding receivers.

7.6 Maximum Noise Level Assessment

The potential for sleep disturbance is assessed using the NPfI maximum noise level event assessment. It is anticipated that the maximum noise level from the development would likely be from a patron shouting while leaving the development.

Based on measurements previously undertaken, a person shouting can produce a sound power of 94 L_{Fmax} dBA. The Cadna-A noise model was used to predict the noise level at the worst affected external receiver (Receiver R7). The noise model predicted a sound pressure level of 41 dBA at R7, which complies with the maximum noise level screening level presented in Table 12. Therefore, the development is not predicted to impact the sleep of nearby residential receivers.

8. Road Traffic Noise

The following sections assesses the noise impact by generated traffic from the development travelling on public roads.

8.1 Road Traffic Noise Criteria

The noise from traffic associated with the development travelling on public roads are assessed under the RNP. For a conservative assessment, it is assumed that the surrounding roads are considered as local roads from a noise perspective. The road traffic noise criteria for the nearby sensitive receivers are summarised in Table 21.

Table 21: Road traffic noise criteria for residential receivers affected by additional traffic from land use developments

Receiver	Road traffic noise criteria	
	Day time[1]	Night time[1]
Residential	55 $L_{eq,1hr}$ dBA	50 $L_{eq,1hr}$ dBA

1. Day time defined as 7am to 10pm and night time is 10pm to 7am.

Additionally, the RNP further states:

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

Therefore, if the road traffic noise associated with additional traffic from the development exceeds the road traffic noise criteria in Table 21 and the relative increase is more than 2 dBA, then mitigation measures should be considered for the affected receivers.

8.2 Existing Traffic Volumes

Traffic counting was undertaken by Traffic Information Specialist along Broomfield Street and Cabramatta Road East on Tuesday 28 February 2023. The traffic survey findings are summarised in Table 22 and Table 23.

Table 22: Existing traffic volumes along Broomfield Street

Road	Peak	Time	Northbound Movements		Southbound Movements	
			Heavy Vehicle	Light Vehicle	Heavy Vehicle	Light Vehicle
Broomfield Street	AM Peak	8am - 9am	6	155	3	102
	PM Peak	4:45pm – 5:45pm	0	127	0	155

Table 23: Existing traffic volumes along Cabramatta Road East

Road	Peak	Time	Westbound Movements		Eastbound Movements	
			Heavy Vehicle	Light Vehicle	Heavy Vehicle	Light Vehicle
Cabramatta Road East	AM Peak	8am - 9am	6	145	3	64
	PM Peak	4:45pm – 5:45pm	0	127	0	82

8.3 Road Traffic Noise Predictions

Using the generated traffic volumes predicted in Section 5.2.1, the road traffic noise was predicted at the residential receivers located along Broomfield Street and Cabramatta Road East.

For a conservative assessment, the road traffic noise levels for the AM peak have been assessed herein. The results are presented in Table 24.

Table 24: Predicted road traffic noise (AM Peak)

Receiver location	Distance from receiver[1]	Time Period[2]	Criteria $L_{eq,1hr}$ dBA	Existing[3] $L_{eq,1hr}$ dBA	Predicted[3] $L_{eq,1hr}$ dBA	Relative Increase, dB	Compliance
Residences along Broomfield Street	10 m	Day	55	62.2	63.8	1.7	Yes
Residences along Cabramatta Road East	10 m	Day	55	61.6	63.2	1.6	Yes

1. Typical distance from residential receiver to the closest carriageway
2. Time periods as defined in the RNP
3. Predicted noise level includes façade reflection (i.e. at façade noise level)

From Table 24, the noise levels are predicted to comply with the RNP noise criteria. Hence no further mitigation measures are required.

9. Vibration Assessment

9.1 Vibration Criteria

Vibration associated with rail operations can result in impacts on human comfort or the damage of the physical structures such as dwellings.

With respect to human comfort, the DoP Guideline references the following standards:

- Assessing Vibration: a technical guideline (AVaTG)
- British Standard BS 7385 Part 2 1993
- Australian Standard AS 2670.2 1990

For the purpose of assessing the risk of vibration damage to structures the following standards are referenced in the DoP Guideline.

- German Standard DIN 4150 Part 3 1999
- British Standard BS 7385 Part 2 1993

It is noted that the human comfort criteria are more stringent than the structural damage criteria. Therefore, for a conservative assessment, the human comfort criteria have been adopted for the Site.

The AVaTG human comfort vibration criteria are presented in Table 25 below.

Table 25: Preferred VDVs for intermittent vibration ($m/s^{1.75}$)

Location	Day time	Night time
Residences	0.2	0.13

9.2 Predicted Vibration Exposure

The eVDV is calculated based on the expected exposure to vibration for the day and night time period. The number of train pass-bys from passenger trains were obtained from the train timetables provided by Transport for New South Wales. It was identified that there are 265 train pass-bys during the day time and 74 train pass-bys at night. It is noted that freight time tables are not publicly available and therefore it was assumed that the number of freight pass-bys observed during the site visit was typical for a day. For a conservative assessment, it is assumed that the number of freight train pass-bys during the day and night were the same.

In summary the following train pass-bys were used for the purpose of calculating the eVDV.

- Passenger trains (day time): 265 pass-bys
- Passenger trains (night time): 74 pass-bys
- Freight (day time): 7
- Freight (night time): 7

Table 26 presents the calculated eVDV for each pass-by in each direction.

Table 26: Train passby eVDV

Train Type	Weighted rms values for vibration acceleration (m/s^2) 1–80 Hz			Calculated eVDV						Criteria (preferred) (m/s1.75)		Exceedance
				Day			Night					
	Z-Axis	X-Axis	Y-Axis	Z	X	Y	Z	X	Y	Day	Night	
Freight	0.00098	0.00164	0.00138	0.007	0.012	0.010	0.007	0.012	0.010	0.2	0.13	No
Freight	0.00119	0.00224	0.0015	0.009	0.017	0.011	0.009	0.017	0.011	0.2	0.13	No
Freight	0.00172	0.00255	0.00192	0.013	0.019	0.014	0.013	0.019	0.014	0.2	0.13	No
Passenger	0.00032	0.00171	0.00085	0.005	0.027	0.013	0.004	0.020	0.010	0.2	0.13	No
Passenger	0.00029	0.00155	0.00062	0.005	0.024	0.010	0.003	0.018	0.007	0.2	0.13	No
Passenger	0.00034	0.00143	0.00056	0.005	0.022	0.009	0.004	0.016	0.006	0.2	0.13	No
Passenger	0.00035	0.00133	0.00069	0.006	0.021	0.011	0.004	0.015	0.008	0.2	0.13	No
Freight	0.00134	0.0021	0.00154	0.010	0.016	0.012	0.010	0.016	0.012	0.2	0.13	No
Freight	0.00098	0.00189	0.00166	0.007	0.014	0.013	0.007	0.014	0.013	0.2	0.13	No
Freight	0.00118	0.00222	0.00275	0.009	0.017	0.021	0.009	0.017	0.021	0.2	0.13	No
Freight	0.00133	0.00232	0.00258	0.010	0.017	0.019	0.010	0.017	0.019	0.2	0.13	No
Passenger	0.00041	0.00161	0.00153	0.006	0.025	0.024	0.005	0.018	0.017	0.2	0.13	No
Freight	0.00153	0.00346	0.00285	0.012	0.026	0.021	0.012	0.026	0.021	0.2	0.13	No
Passenger	0.00033	0.00163	0.00152	0.005	0.026	0.024	0.004	0.019	0.017	0.2	0.13	No
Passenger	0.00028	0.0016	0.00141	0.004	0.025	0.022	0.003	0.018	0.016	0.2	0.13	No
Freight	0.00136	0.00564	0.00423	0.010	0.043	0.032	0.010	0.043	0.032	0.2	0.13	No
Passenger	0.00029	0.00171	0.00139	0.005	0.027	0.022	0.003	0.020	0.016	0.2	0.13	No
Passenger	0.0004	0.00164	0.00133	0.006	0.026	0.021	0.005	0.019	0.015	0.2	0.13	No

Passenger	0.00031	0.00188	0.00101	0.005	0.030	0.016	0.004	0.021	0.012	0.2	0.13	No
Passenger	0.00029	0.00227	0.00153	0.005	0.036	0.024	0.003	0.026	0.017	0.2	0.13	No
Passenger	0.00024	0.00238	0.00137	0.004	0.037	0.022	0.003	0.027	0.016	0.2	0.13	No
Passenger	0.00047	0.00315	0.00182	0.007	0.050	0.029	0.005	0.036	0.021	0.2	0.13	No
Passenger	0.00019	0.00199	0.00106	0.003	0.031	0.017	0.002	0.023	0.012	0.2	0.13	No
Passenger	0.00072	0.00348	0.00155	0.011	0.055	0.024	0.008	0.040	0.018	0.2	0.13	No
Freight	0.00116	0.00681	0.00614	0.009	0.051	0.046	0.009	0.051	0.046	0.2	0.13	No
Passenger	0.00026	0.00284	0.00151	0.004	0.045	0.024	0.003	0.032	0.017	0.2	0.13	No
Passenger	0.00022	0.00265	0.00086	0.003	0.042	0.014	0.003	0.030	0.010	0.2	0.13	No
Passenger	0.00023	0.00284	0.00097	0.004	0.045	0.015	0.003	0.032	0.011	0.2	0.13	No
Passenger	0.00174	0.00441	0.00214	0.027	0.069	0.034	0.020	0.050	0.024	0.2	0.13	No
Passenger	0.00036	0.00267	0.00166	0.006	0.042	0.026	0.004	0.031	0.019	0.2	0.13	No
Passenger	0.00018	0.0018	0.00044	0.003	0.028	0.007	0.002	0.021	0.005	0.2	0.13	No
Passenger	0.00024	0.0035	0.00104	0.004	0.055	0.016	0.003	0.040	0.012	0.2	0.13	No

From Table 26, the calculated eVDV is below the preferred VDV limits detailed in Table 25.

Therefore, no vibration mitigation measures are required.

10. Acoustic Separation (NCC 2022)

The residential parts of this mixed-use development are classified as Class 2 under the Building Code of Australia (BCA):

> *"A building containing 2 or more sole-occupancy units each being a separate dwelling."*

As such, Part F7 of the BCA (summarised in Table 27 below) applies to building elements for acoustic insulation. Recommended constructions to achieve these ratings will be provided at the detailed design stage.

Table 27: BCA required acoustic insulation performance

Building element separating:			Required acoustic performance
Floors	Sole-occupancy unit (including ensuite)	Sole-occupancy unit (SOU), plant room, lift shaft, stairway, public corridor, public lobby or the like; parts of a different classification.	Min. $R_w + C_{tr}$ 50 Max. $L_{n,w} + C_I$ 62
Walls	Sole-occupancy unit	Sole-occupancy unit	Min. $R_w + C_{tr}$ 50
		Stairway, public corridor, public lobby or the like; parts of a different classification.	Min. R_w 50, with min. R_w 30 door
		Plant room, lift shaft	Min. R_w 50 Discontinuous construction
	Habitable room (other than a kitchen)	Bathroom, sanitary compartment, laundry or kitchen in an adjoining unit	Min. $R_w + C_{tr}$ 50 Discontinuous construction
Services	Habitable room in a sole-occupancy unit	Duct, soil pipe, waste pipe, water supply pipe, storm water pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one SOU	Min. $R_w + C_{tr}$ 40
	Non-habitable room or kitchen in a sole-occupancy unit		Min. $R_w + C_{tr}$ 25

11. Conclusion

Northrop have undertaken a noise and vibration impact assessment of the proposed development along Broomfield Street, Cabramatta. The noise and vibration impact assessment forms part of the development application for the Site.

A noise and vibration survey were conducted on site for the assessment. Long term unattended noise monitoring was undertaken to determine the existing ambient noise levels. Vibration monitoring was carried out to quantify the existing vibration impacts associated with the rail line located to the west.

This report assessed the noise and vibration impacts associated with nearby rail line and roads. Section 4.3 provides glazing recommendations to comply with the internal noise criteria.

On site vehicle movements were assessed in accordance with the NPfI and was found to comply with noise emission criteria. Mechanical plant and commercial tenancies should be assessed at the detailed design stage to ensure the cumulative noise from the Site complies with the external noise criteria.

A noise emission assessment was undertaken for the childcare centre and the licensed premise (the Tavern). Recommendations have been provided in Sections 6.4 and 7.5.

Given that the measured vibration levels were below the human comfort vibration criteria, no treatment for vibration impacts was required.

Traffic noise associated with generated traffic travelling on public roads was predicted to comply with the relevant road noise criteria.

Based on the noise and vibration impact assessment, the Site can comply with the relevant noise and vibration criteria provided that all the recommended mitigation measures are implemented. A summary of the proposed recommendations for each acoustic assessment is provided in Table 28.

Table 28: Summary of recommendations

Assessment type	Report section	Recommendations
Noise intrusion	Section 4	• Glazing should be upgraded as detailed in Table 7 • Ventilation strategy should be undertaken during the detailed design
Noise emission (industrial noise)	Section 5	• Noise emissions from commercial tenancies and mechanical plant should be reviewed during the detailed design stage and should comply with the NPfI noise emission criteria • Noise associated with on site vehicle movements and waste collection is predicted to comply at all sensitive receivers and therefore no additional recommendations are required
Childcare noise	Section 6	• The number of children playing in the outdoor area at one time should be limited to 20 children • The roof directly above the outdoor play area should be solid with no gaps • A one metre high barrier shall be installed above the finished floor level of the outdoor play area. There

		shall be no gaps in the fence or between the fence and the playground floor. The extent of the barrier is shown in Figure 8 • Acoustic barriers and the roof directly above the outdoor play area shall be constructed using a material that has a minimum mass of 8kg/m^2. This can include: treated timber (lapped and capped), glass, precast concrete panels, lightweight aerated concrete, transparent acrylic panels, metal sheet cladding or fibre cement sheeting
Licensed premises	Section 7	• Windows and doors of the Tavern must remain closed at all times • Glazing (windows and doors) must have a minimum R_w of 40 (12.5mm glazing) • A noise limiter must be used for amplified music from 12am-7am. Noise limits are detailed in the bottom row of Table 19 • When amplified music is played or during large events, it is recommended that patrons use the entry doors located along the northern facade
Road noise	Section 8	• Road noise is predicted to comply with the RNP criteria therefore no mitigation measures are required
Rail vibration impacts	Section 9	• Vibration levels are predicted to comply with the AVaTG human comfort criteria and therefore no mitigation measures are required
Acoustic separation	Section 10	• It is recommended that the walls and floor of the proposed development are reviewed at the detailed design stage to ensure compliance with the acoustic separation requirements detailed in Table 27

Appendix A: Drawings

The following drawings were produced by Plus Architects were used in the preparation of this report.

Drawing No.	Revision	Title	Date Issued
DA0099	05	Ground floor plan	10/05/2023
DA0100	03	Mezzanine	2/05/2023
DA0101 – DA0118	03	Level 1 to Level 18	2/05/2023

Appendix B: Glossary of Acoustic Terminology

Decibel – dB – Unit of Acoustic measurements for power, pressure and intensity. Expressed in dB relative to standard levels.

A-weighted decibel – dB(A) – Unit of acoustic measurement weighted approximately to human hearing to sound.

SPL – Sound Pressure Level – 20 times the logarithm to the base 10 of the ratio of r.m.s. sound pressure to the reference pressure of 20 micro Pascals, sound pressure level is measured using a microphone and a sound level meter and varies with distance from the source.

SWL – Sound Power Level – 10 times the logarithm to base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone and a sound level meter, and it does not change with distance. The sound power of a machine will vary depending on the operation conditions or load.

R_w – Weighted Sound Reduction Index – Measured sound reduction of a building element in a laboratory, corrected for room volume and reverberation time, the higher values correspond to better sound insulation. It describes the sound-proofing effectiveness of a partition or glazing depending on its material and construction. Each increasing increment in R_w is equivalent to 1 dB of noise reduction. R_w however, is a rating determined in a laboratory - a highly controlled environment - and should only be used as an indicative value for design purposes. Spectrum adaptation terms C and C_{tr} are often added to the measured R_w result to account for low frequency noise.

L_{nw} – Weighted Normalised Impact Sound Pressure Level – the design value of the achievable impact noise attenuation of a building element. L_{nw} measures the perceived impact noise in the receiver room, so maximum values are usually quoted, with lower values corresponding to lower levels of theoretical perceived impact noise. Each increasing increment in L_{nw} is equivalent to 1 dB of impact noise increase. Spectrum adaptation term CI is often added to the L_{nw} result to account for low frequency noise.

L_{Amax} – The Maximum Noise Level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A10} – The noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A10}^* – For the purpose of licensed premise assessments, the L_{A10}* can be taken as the average maximum deflection of the noise emission from the licensed premises.

L_{Aeq} – The Equivalent Continuous Sound Level is the energy average of the varying noise over the sample period (often given in the subscript) and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise. L_{Aeq} is measured in dB(A).

L_{A90} – The noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level or RBL.

L_{Amin} – The Minimum Noise Level over a sample period is the minimum level, measured on fast response, during the sample period.

Appendix C: Long Term Noise Monitoring Results

The details are of the noise logging measurements are shown below. The measurements are in general accordance with the NPfI. The logger set up is shown in Figure 1.

To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes.

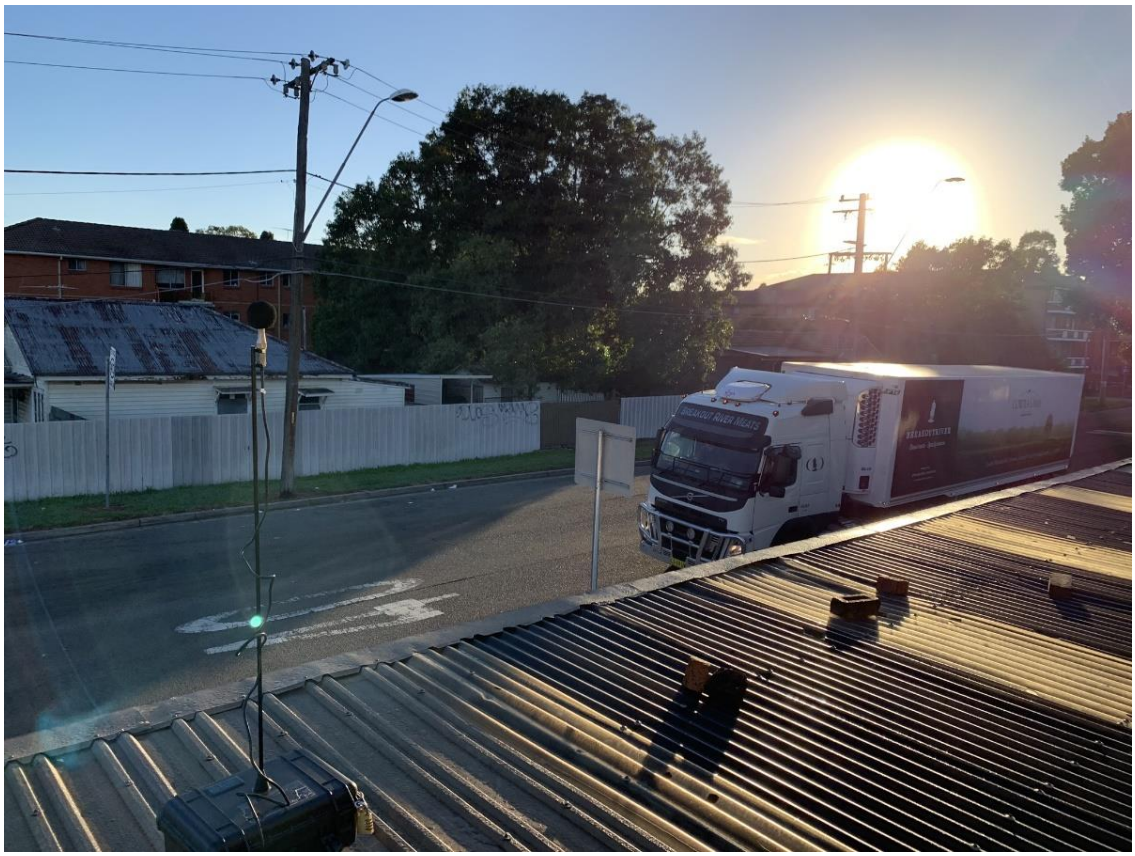
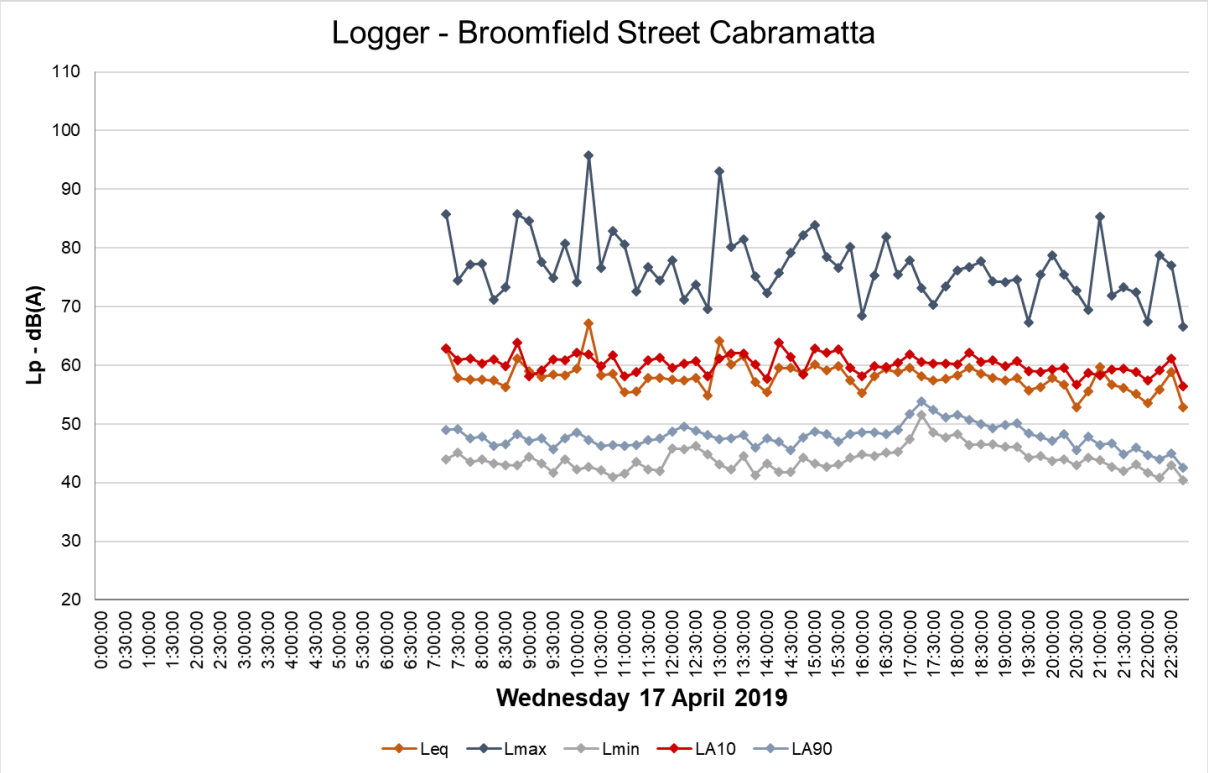
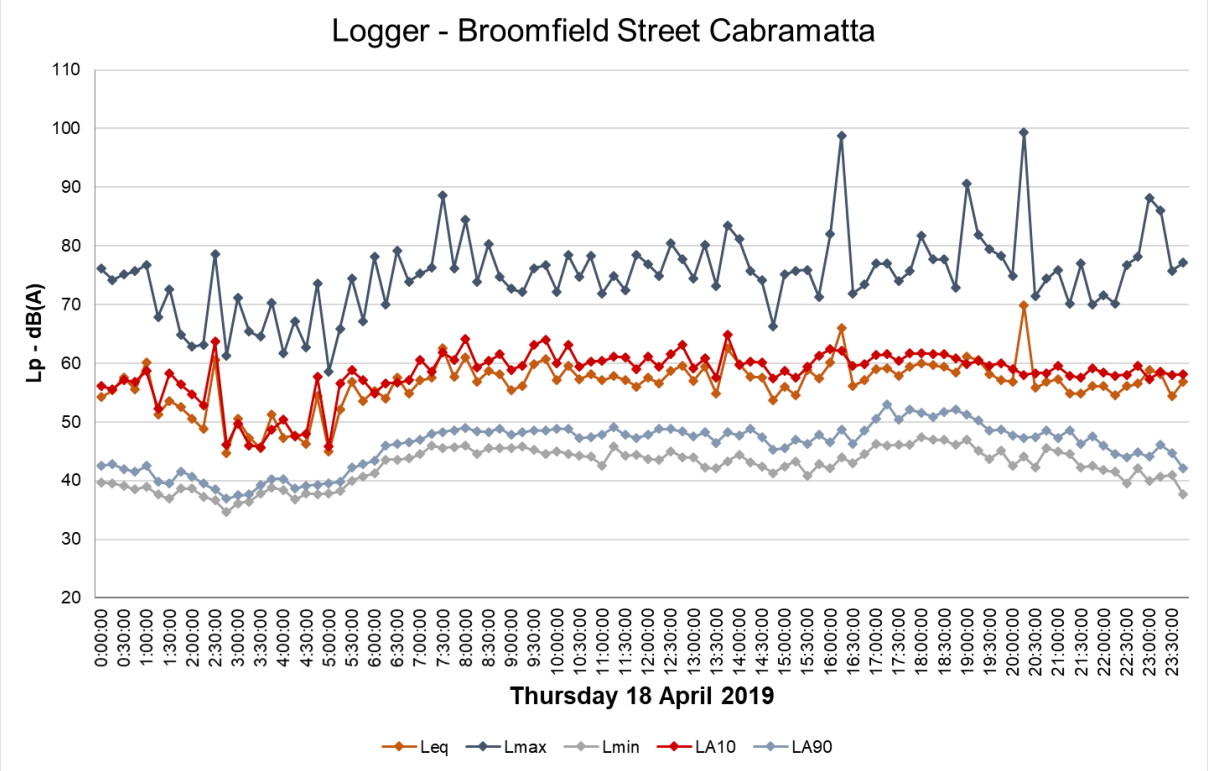
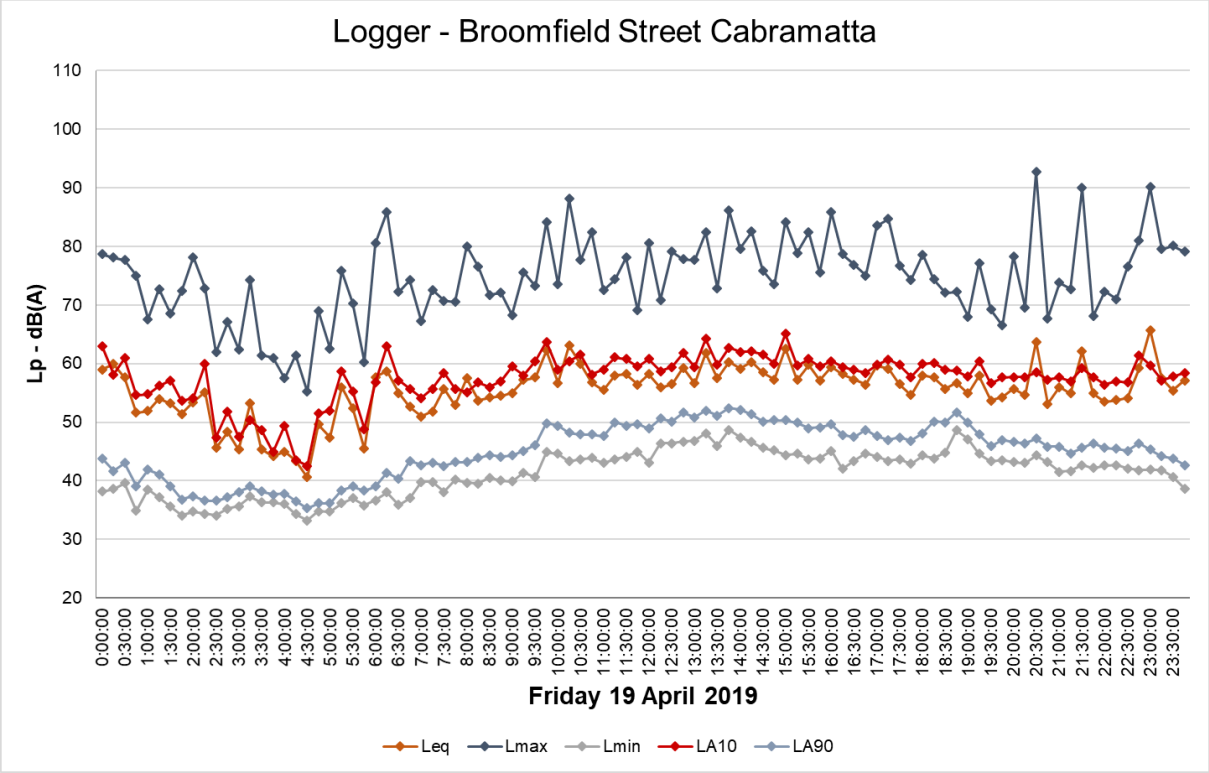


Figure 10 Noise Logger location

2019 Noise Monitoring Graphs



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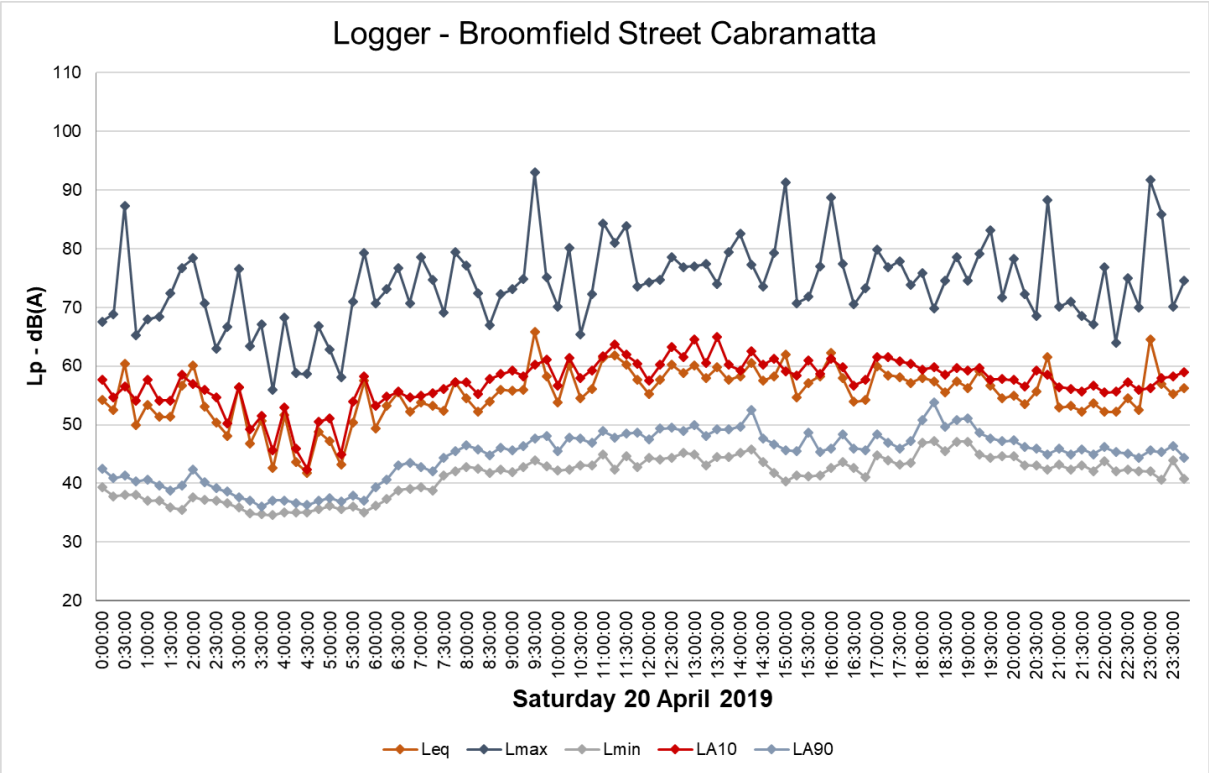
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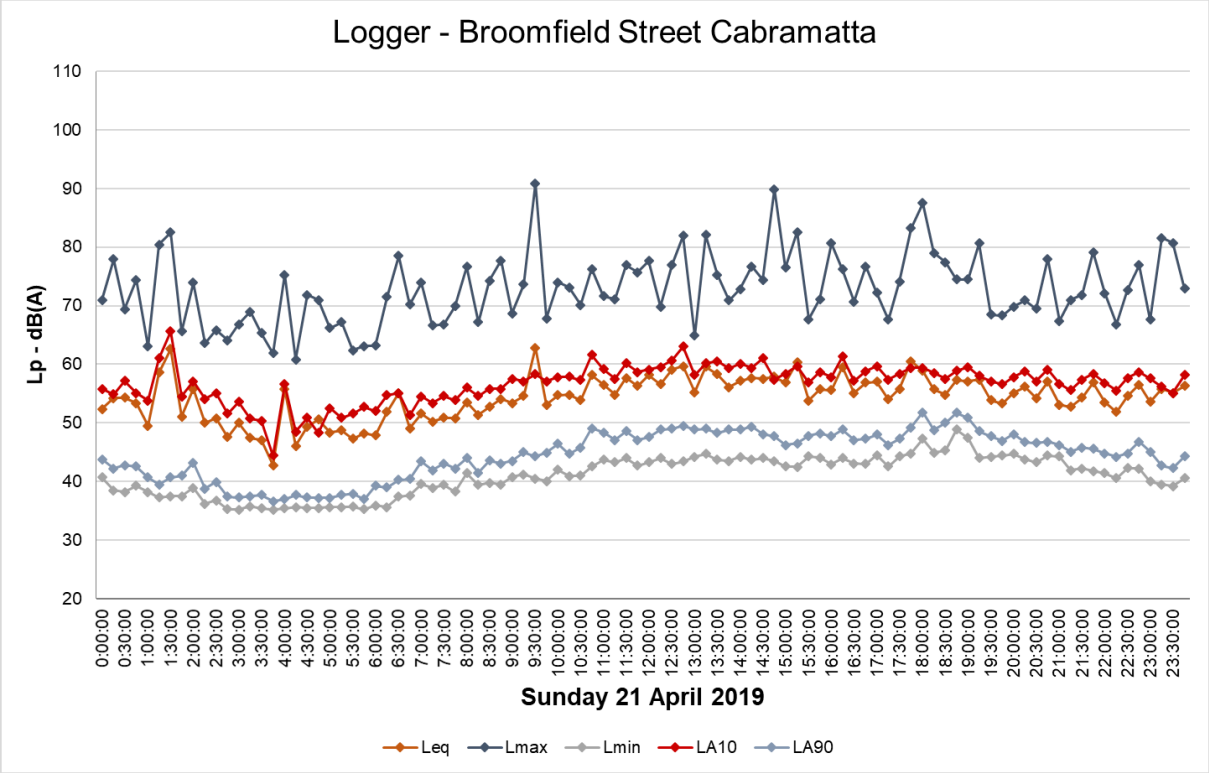
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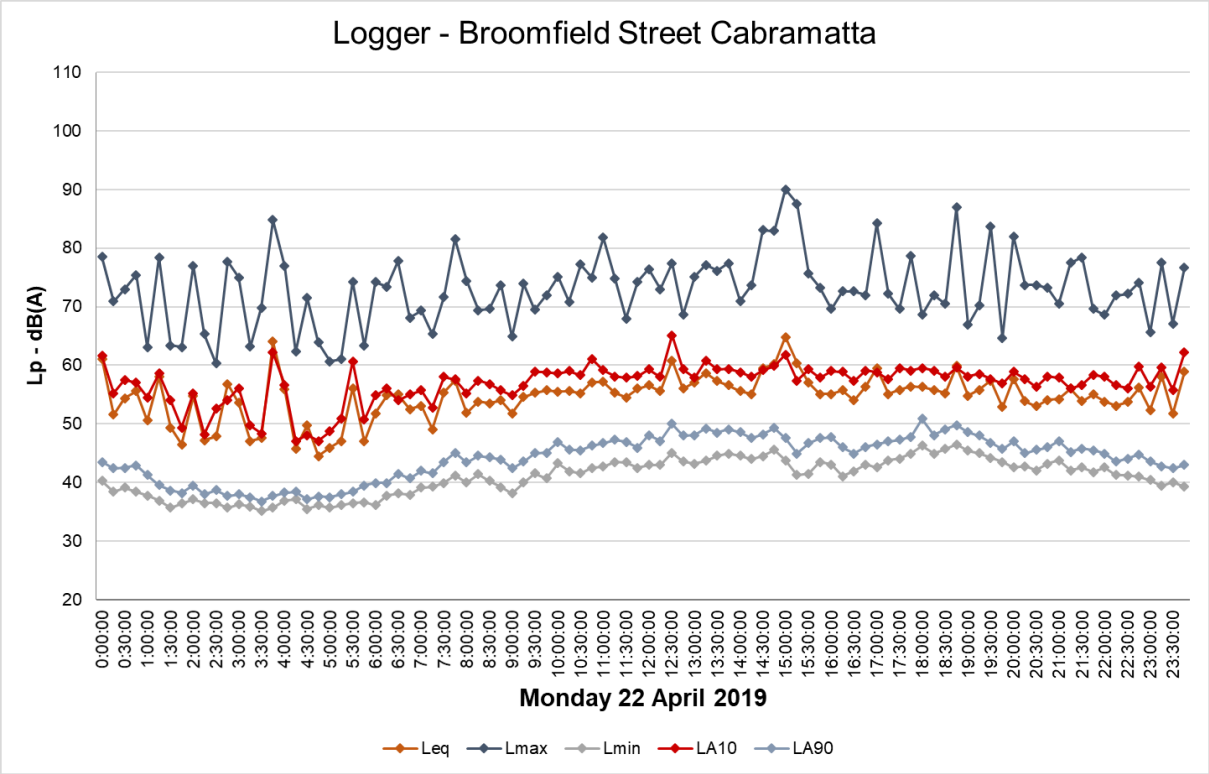
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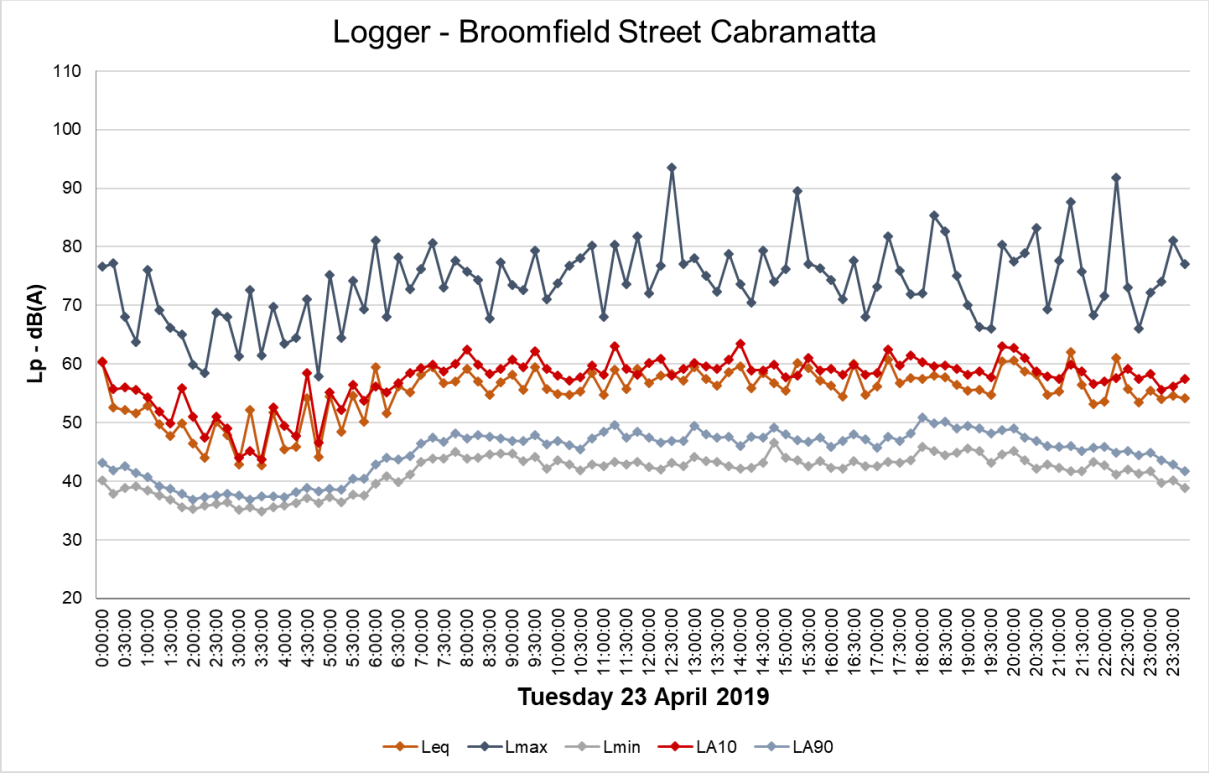
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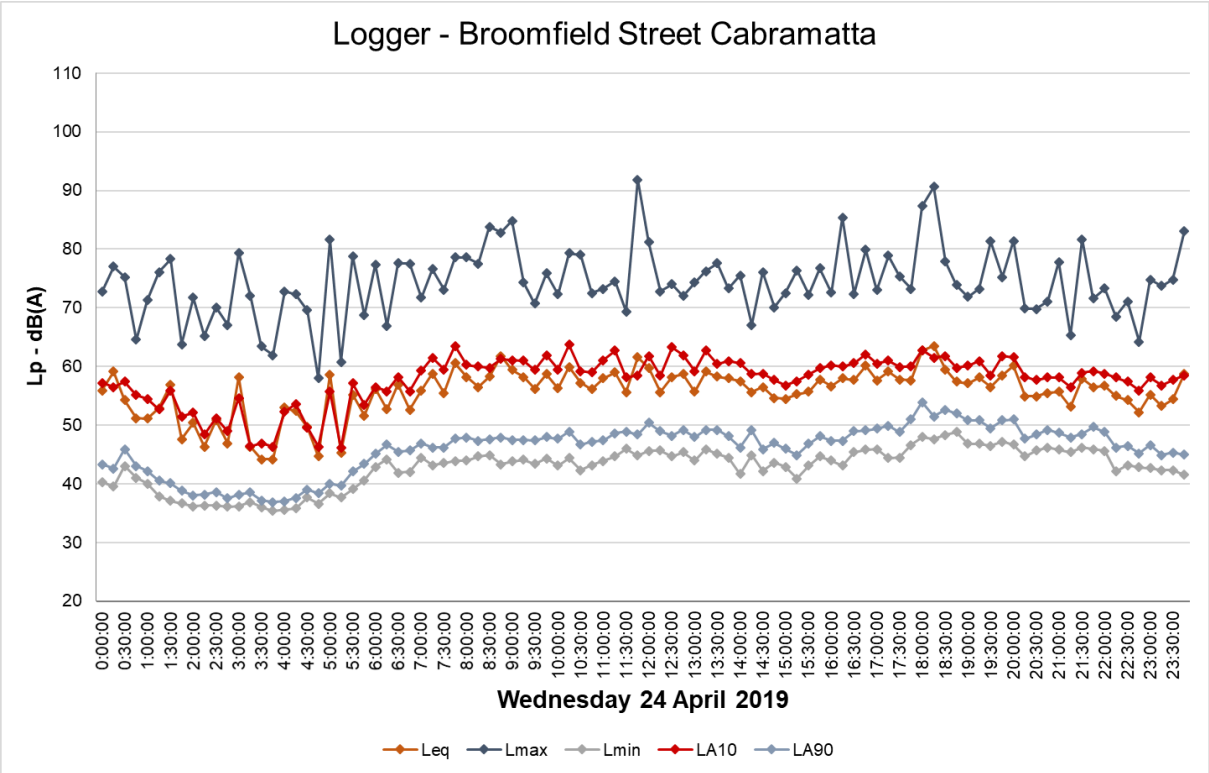
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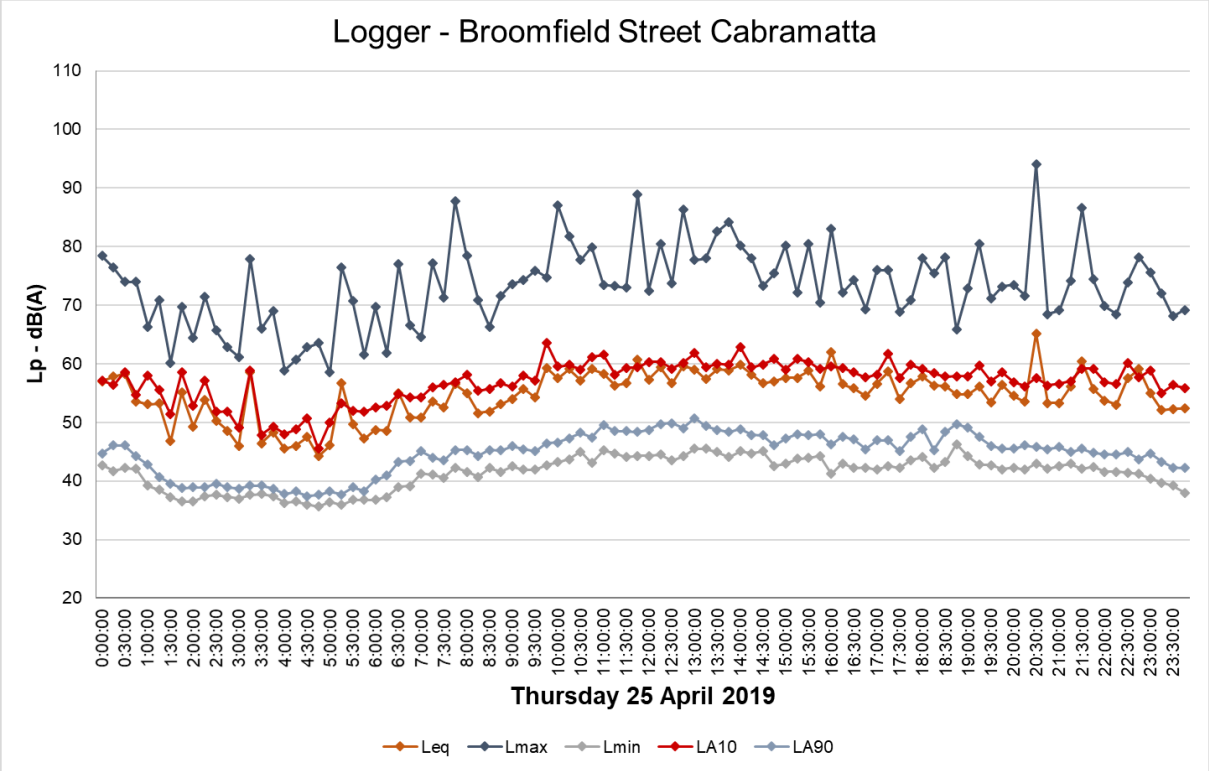
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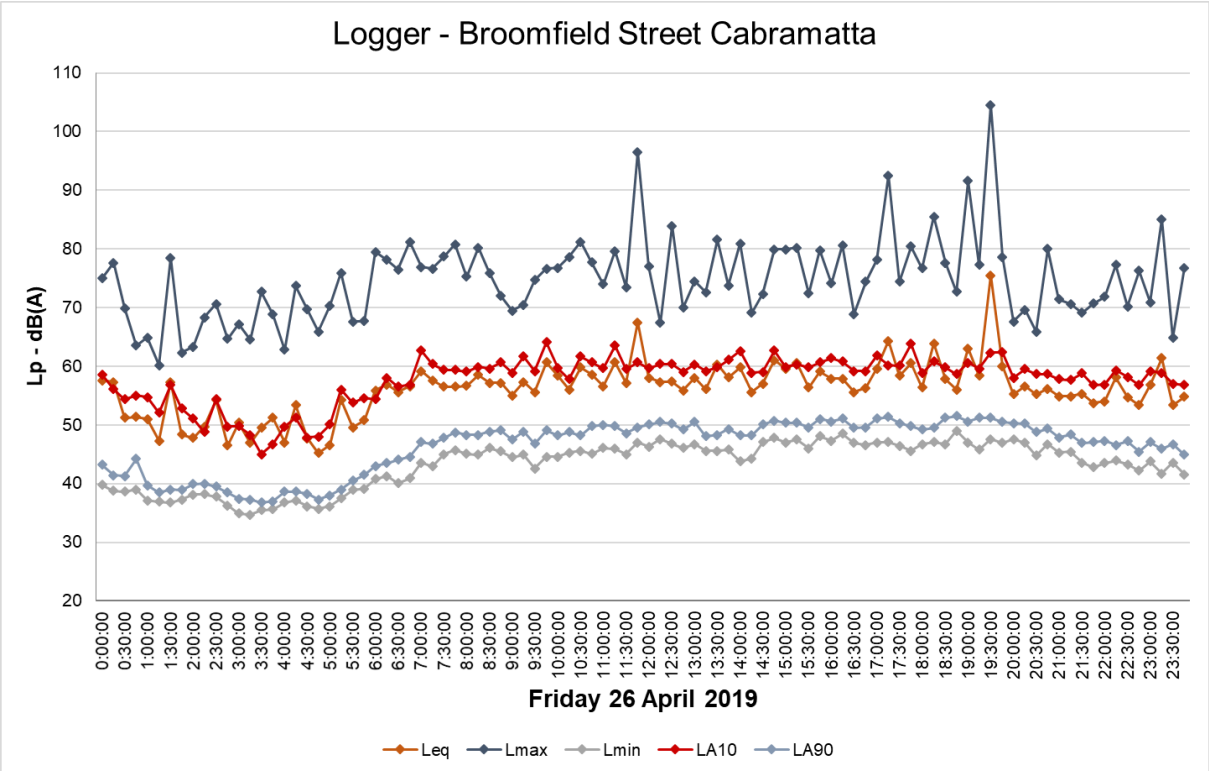
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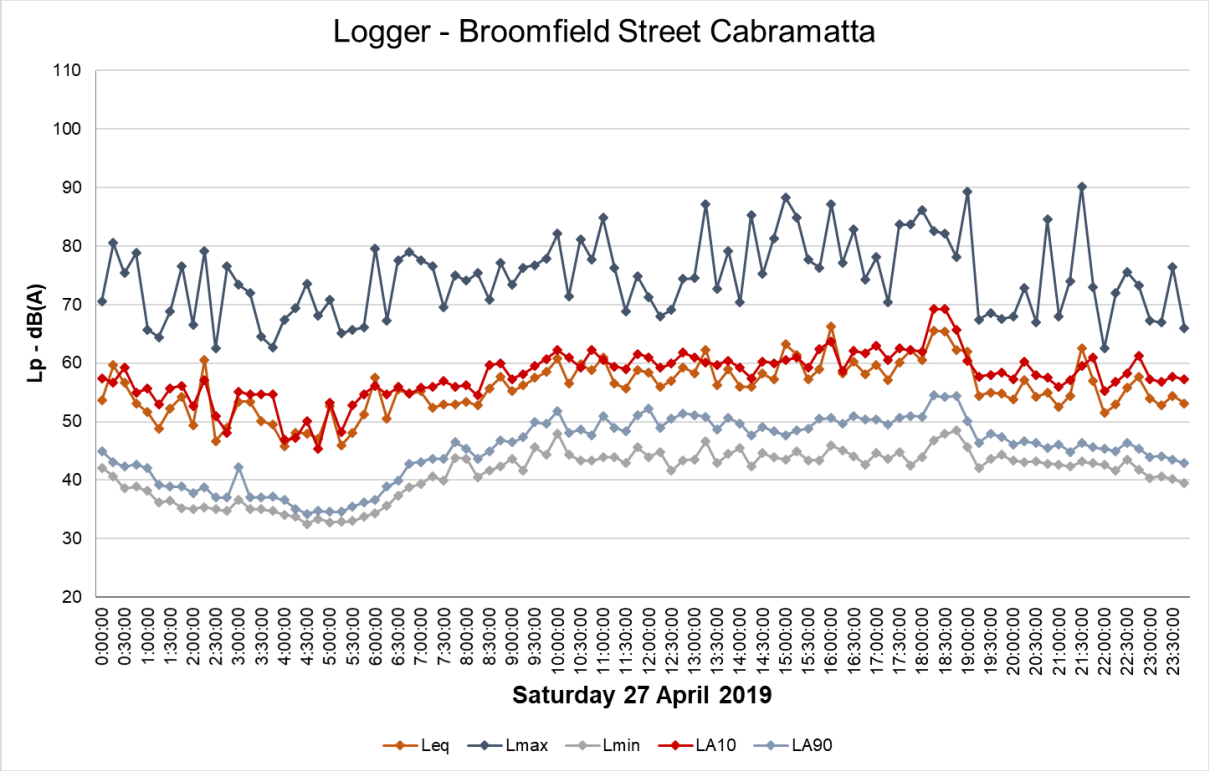
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40
30
20
0:00:00
0:30:00
1:00:00
1:30:00
2:00:00
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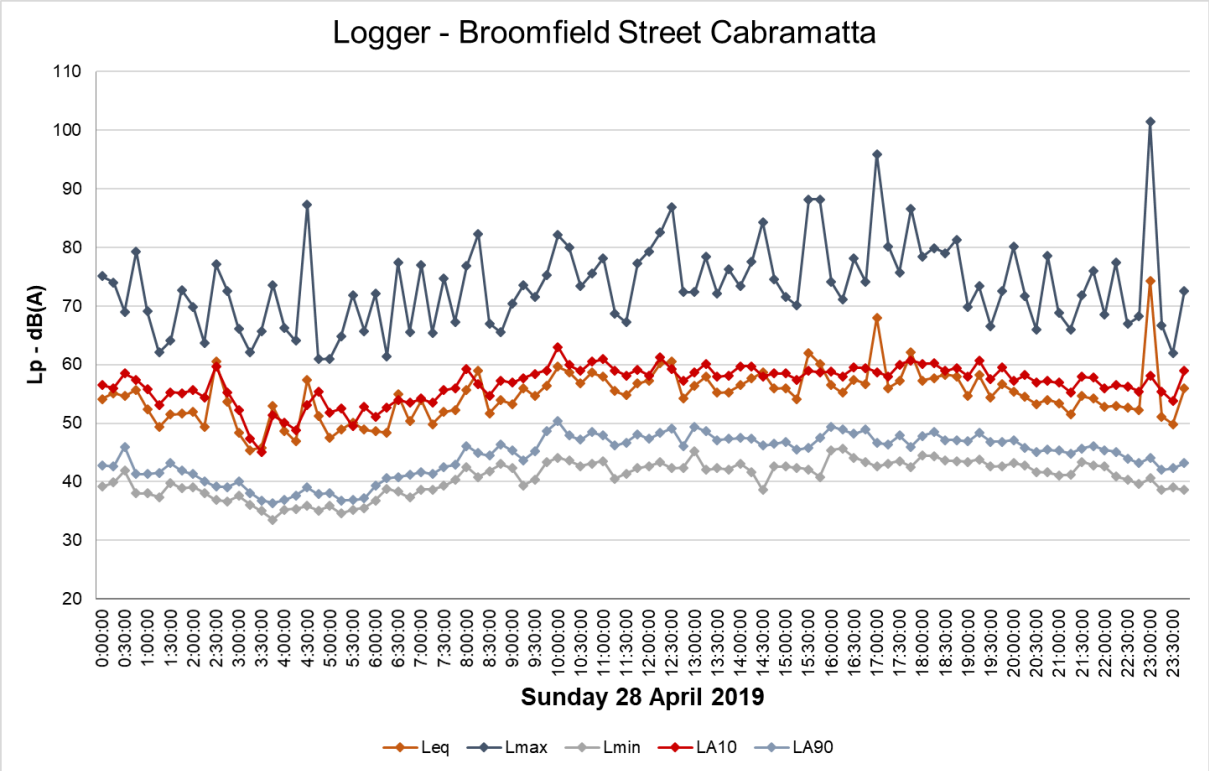
20:00:00
20:30:00
21:00:00
21:30:00
22:00:00
22:30:00
23:00:00
23:30:00
Saturday 27 April 2019
Leq
Lmax
Lmin
LA10
LA90


Logger - Broomfield Street Cabramatta
Lp - dB(A)
110
100
90
80
70
60
50
40
30
20
0:00:00
0:30:00
1:00:00
1:30:00
2:00:00
2:30:00
3:00:00
3:30:00
4:00:00
4:30:00
5:00:00
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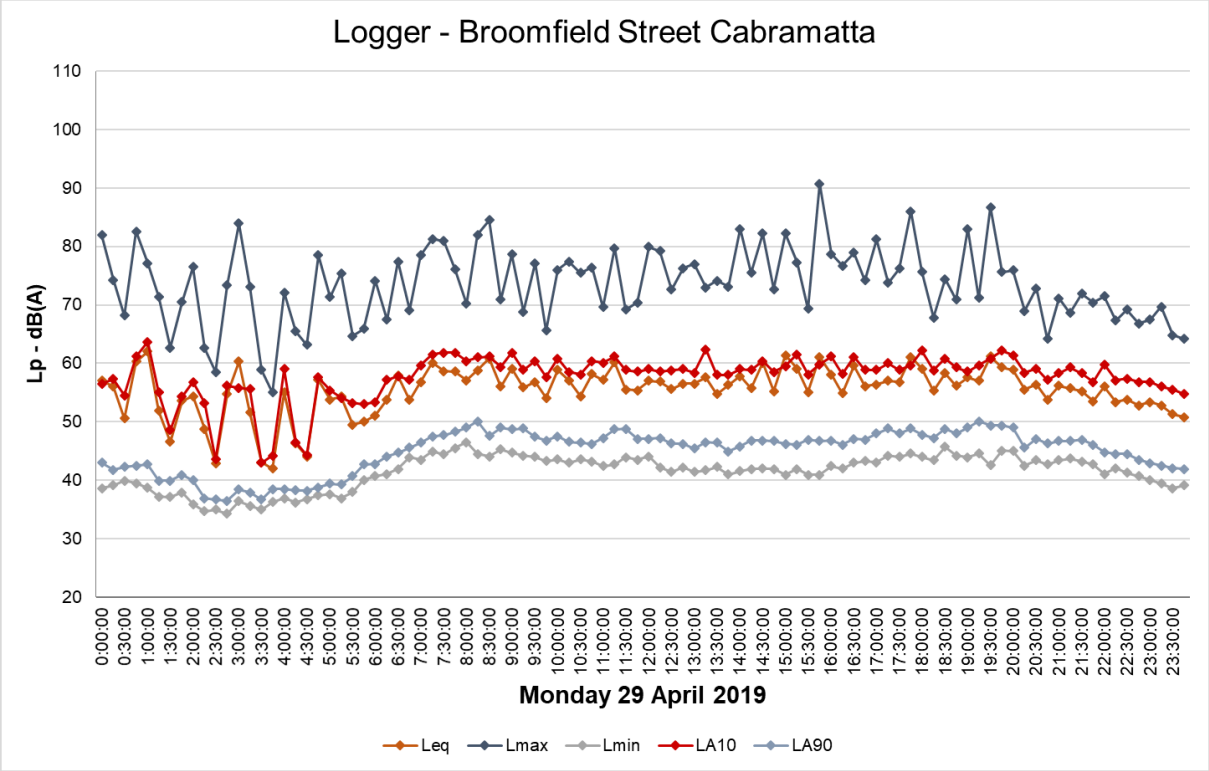
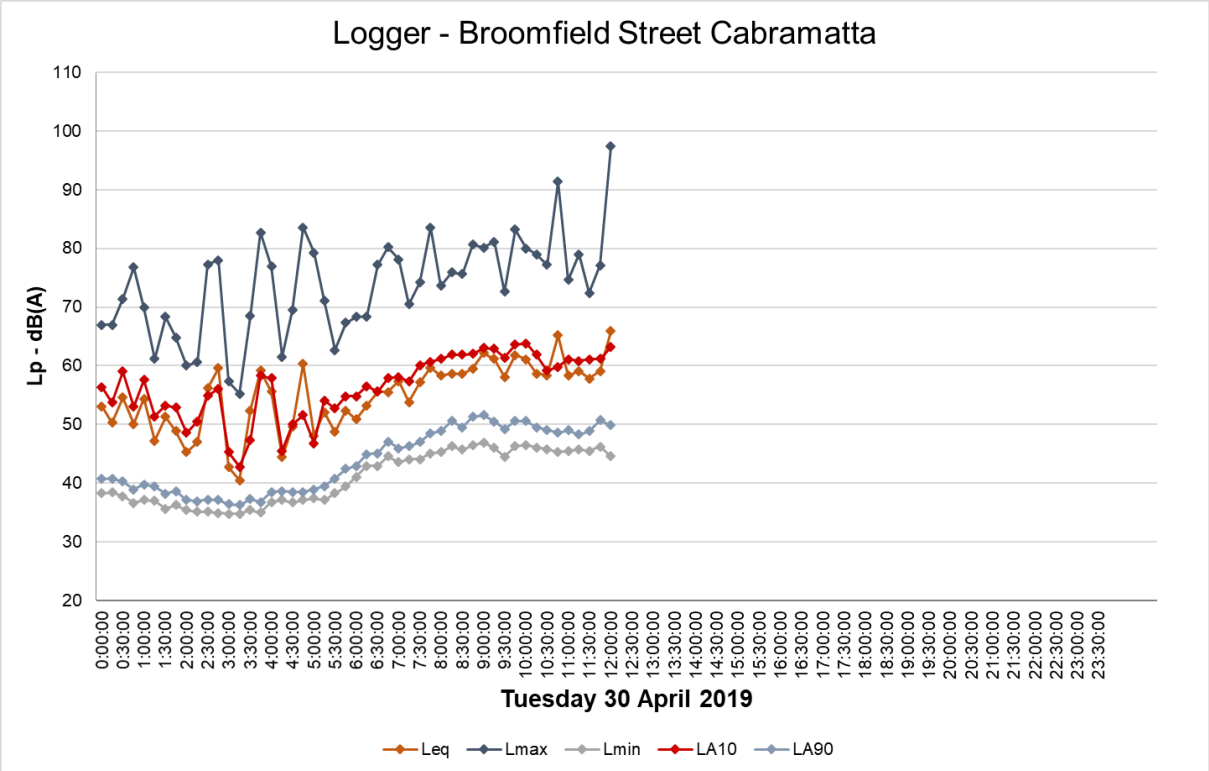
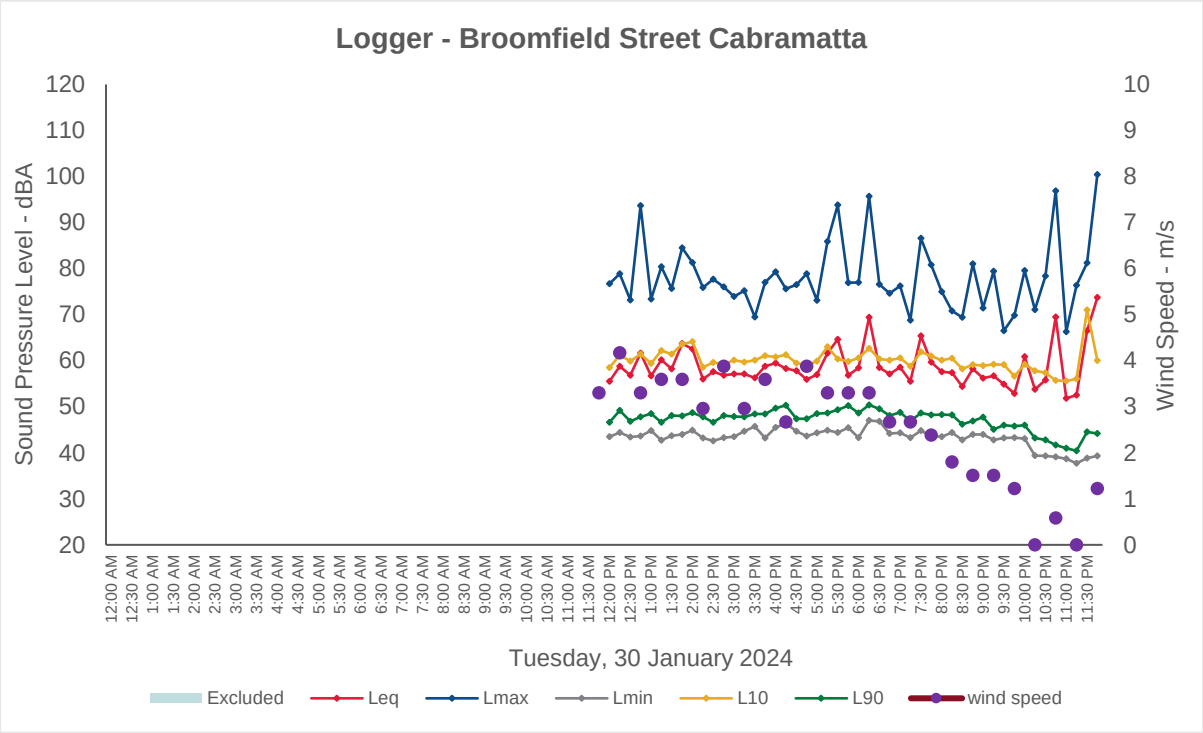
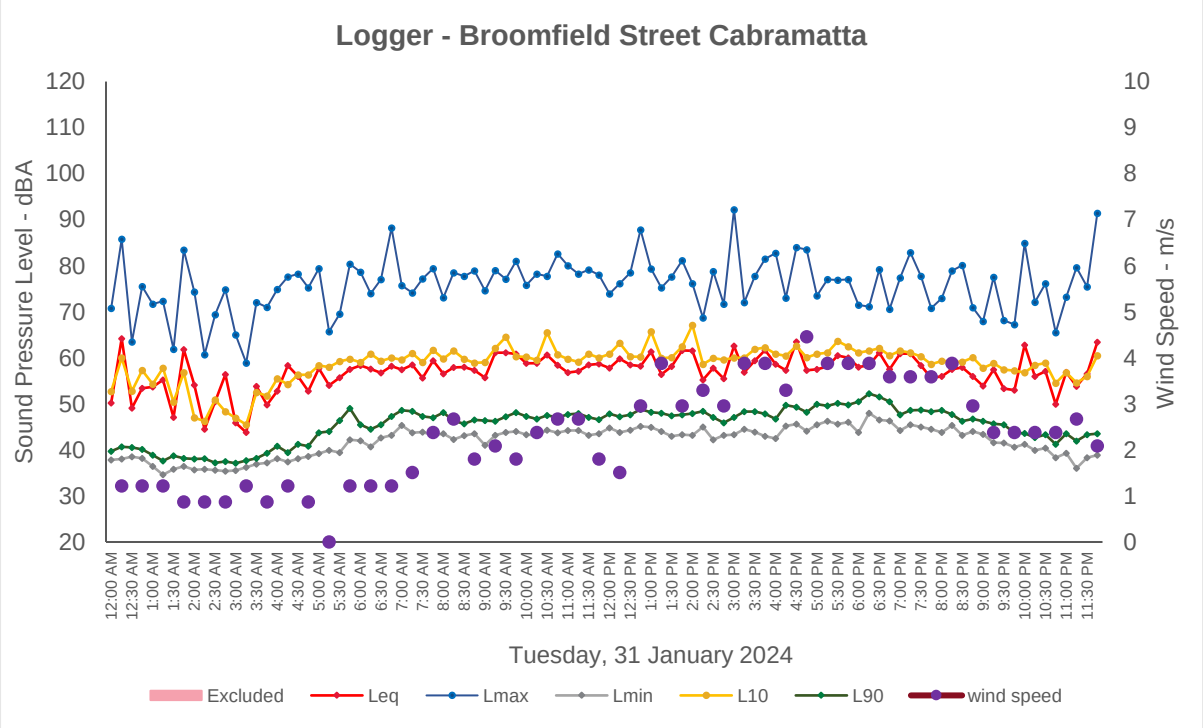
21:30:00
22:00:00
22:30:00
23:00:00
23:30:00
Sunday 28 April 2019
Leq
Lmax
Lmin
LA10
LA90

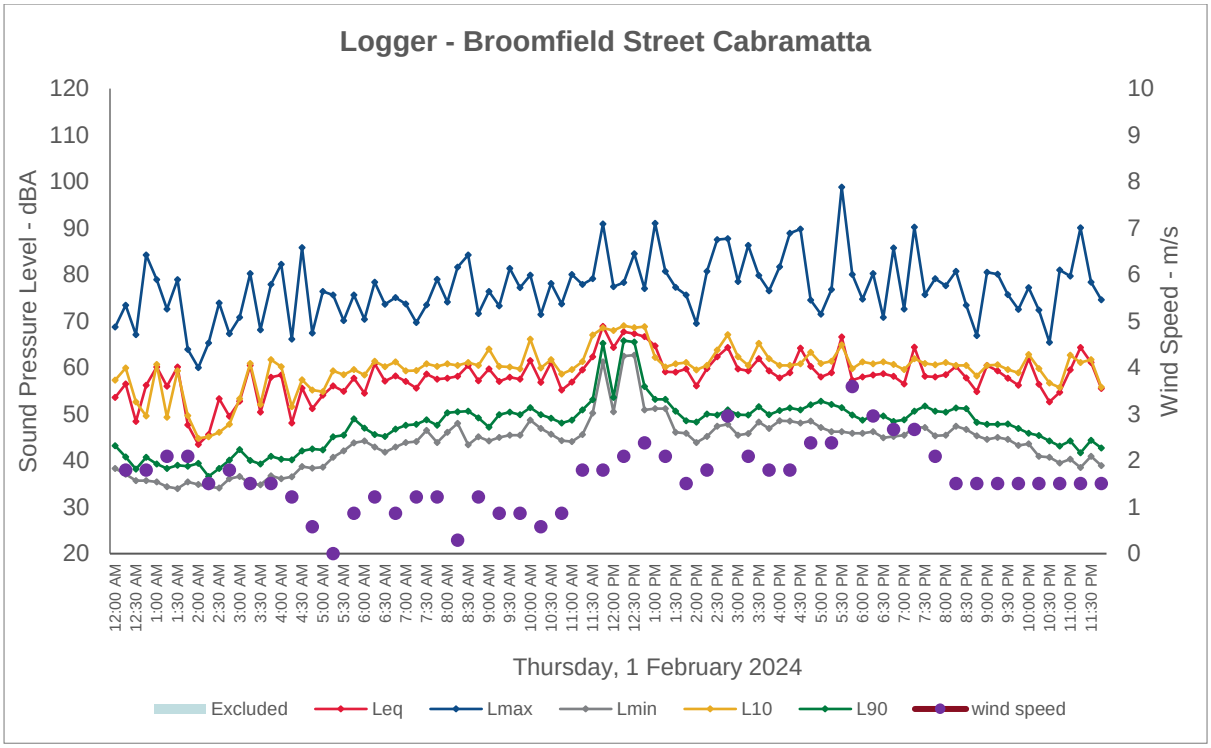

Logger - Broomfield Street Cabramatta
Lp - dB(A)
Monday 29 April 2019
Leq
Lmax
Lmin
LA10
LA90

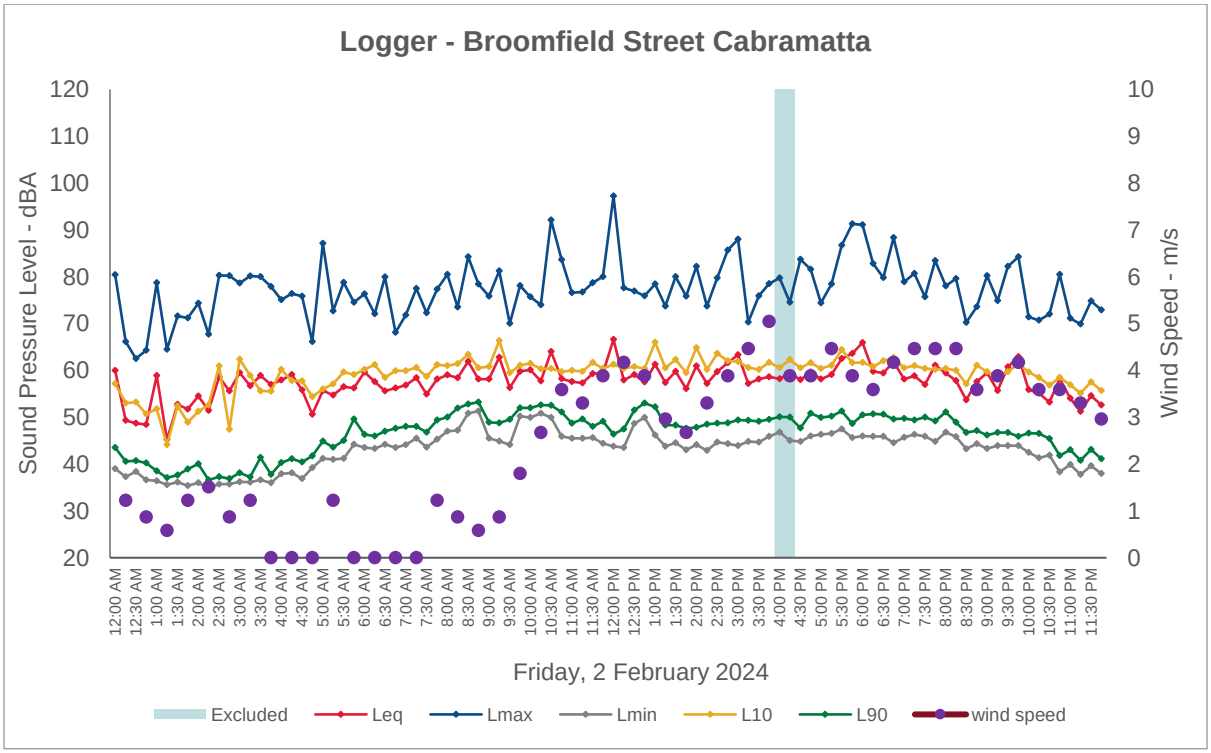

Logger - Broomfield Street Cabramatta
Lp - dB(A)
Tuesday 30 April 2019
Leq
Lmax
Lmin
LA10
LA90

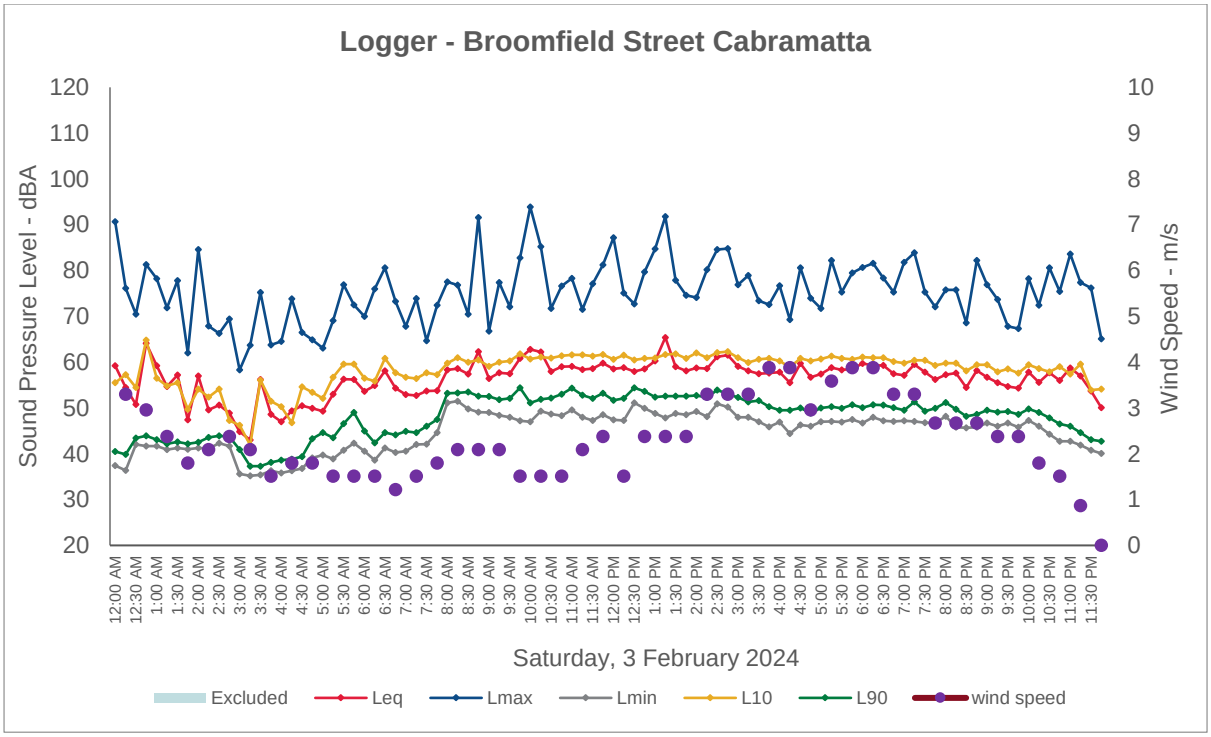
2024 Noise Monitoring Graphs

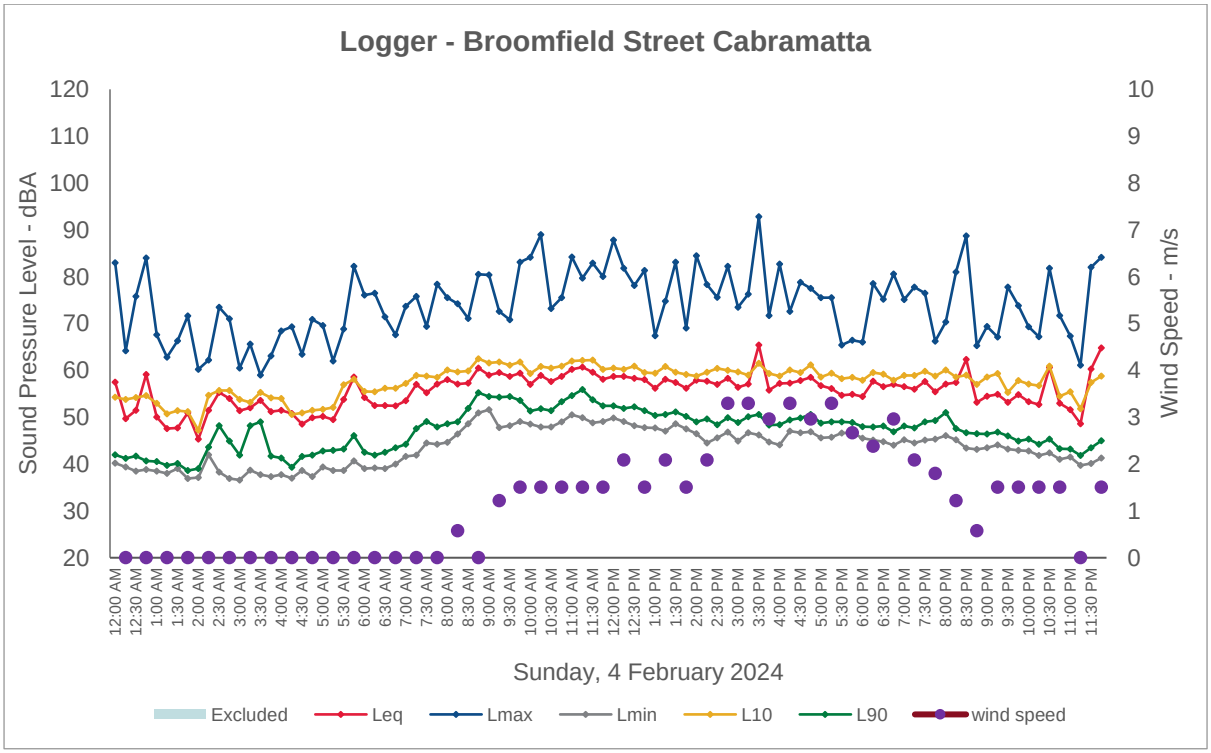


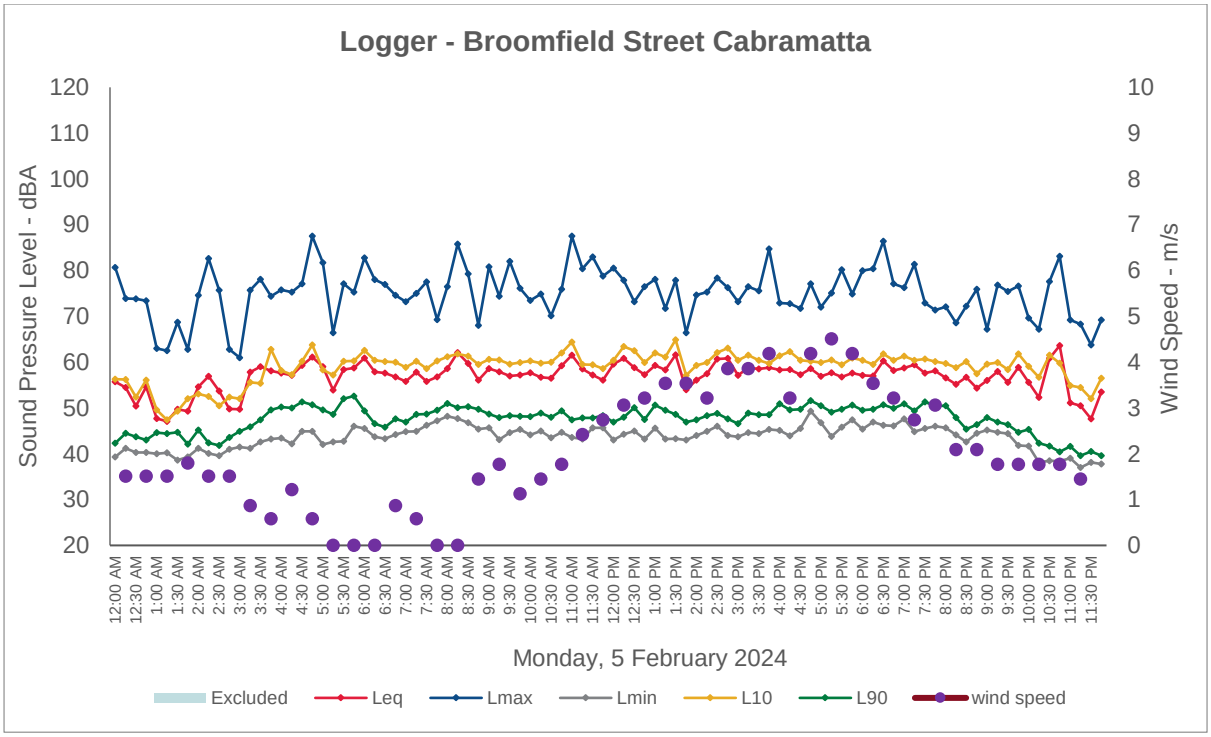


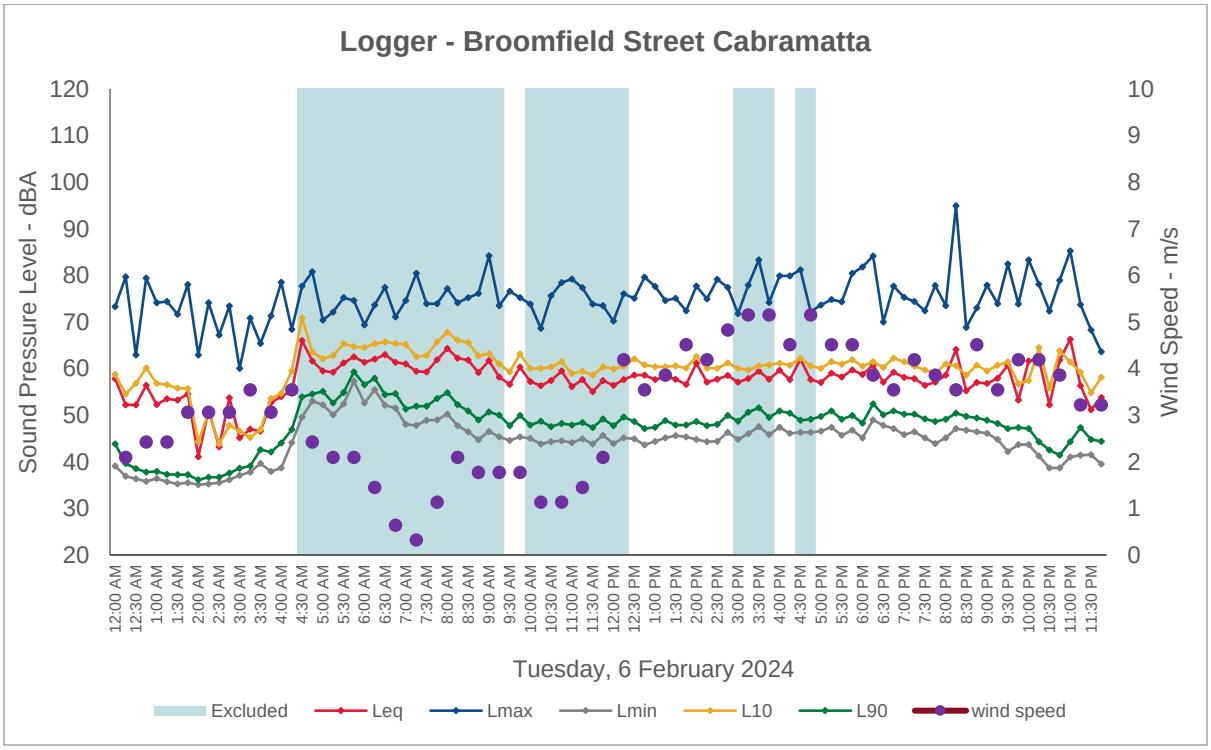

Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Thursday, 1 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed

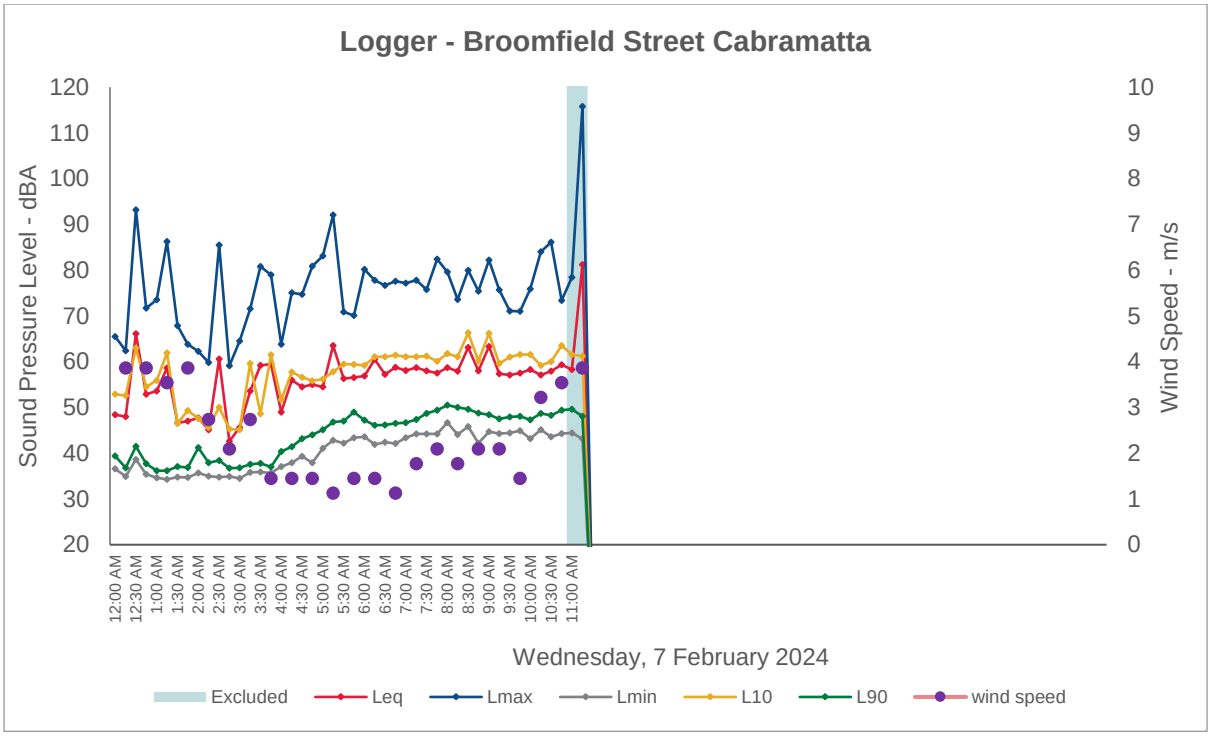

Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Friday, 2 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed


Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Saturday, 3 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed


Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Sunday, 4 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed


Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Monday, 5 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed


Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
Tuesday, 6 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed


Logger - Broomfield Street Cabramatta
Sound Pressure Level - dBA
Wind Speed - m/s
120
110
100
90
80
70
60
50
40
30
20
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9
8
7
6
5
4
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2
1
0
12:00 AM
12:30 AM
1:00 AM
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2:30 AM
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8:00 AM
8:30 AM
9:00 AM
9:30 AM
10:00 AM
10:30 AM
11:00 AM
Wednesday, 7 February 2024
Excluded
Leq
Lmax
Lmin
L10
L90
wind speed

Appendix D: Elevations of Nearest Affected Receivers

All photos below were obtained from Google Street view

68 Broomfield Street, Cabramatta

15 Fisher Street, Cabramatta

8A Fisher Street, Cabramatta

123 Cabramatta Road East, Cabramatta

156 Cabramatta Road East, Cabramatta

193 Railway Parade, Cabramatta

120-124 Cabramatta Road East, Cabramatta