Austral North
495 Fourth Avenue Austral
Proposed Shopping Centre

Client:
Fabcot Pty Ltd

12 June 2024

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Notice

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GLOSSARY

NOISE

Noise is produced through rapid variations in air pressure at audible frequencies (20 Hz – 20 kHz). Most noise sources vary with time. The measurement of a variable noise source requires the ability to describe the sound over a particular duration of time. A series of industry standard statistical descriptors have been developed to describe variable noise, as outlined in **Section 2** below.

NOISE DESCRIPTORS

L_{eq} – The sound pressure level averaged over the measurement period. It can be considered as the equivalent continuous steady-state sound pressure level, which would have the same total acoustic energy as the real fluctuating noise over the same time period.

$L_{Aeq(15\ Min)}$ – The A-weighted average equivalent sound level over a 15 minute period.

L_{A1} – The A-weighted noise level exceeded for 1% of the sample time.

L_{Amax} – The maximum A-weighted noise level.

L_{A90} – The A-weighted noise level that has been exceeded for 90% of the measurement duration. This descriptor is used to describe the background noise level.

RBL – Rating Background Level. The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24hr period used for assessment background level) This is the level used for assessment purposes.

dB – Decibels. The fundamental unit of sound, a Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell. Probably the most common usage of the Decibel in reference to sound loudness is dB sound pressure level (SPL), referenced to the nominal threshold of human hearing. For sound in air and other gases, dB(SPL) is relative to 20 micropascals (μPa) = 2×10^{-5} Pa, the quietest sound a human can hear.

A-WEIGHTING

"A-weighting" refers to a prescribed amplitude versus frequency curve used to "weight" noise measurements in order to represent the frequency response of the human ear. Simply, the human ear is less sensitive to noise at some frequencies and more sensitive to noise at other frequencies. The A-weighting is a method to present a measurement or calculation result with a number representing how humans subjectively hear different frequencies at different levels.

1 INTRODUCTION

1.1 SUMMARY

Acoustic Dynamics is engaged by **Fabcot Pty Ltd** to conduct an assessment of noise impacts associated with the proposed shopping centre located at 495 Fourth Avenue, Austral NSW.

This document provides a review of the proposed development and advice for best practice design, to ensure potential noise impacts are considered and addressed at the planning stage to ensure compliance with the relevant acoustic criteria and objectives.

It has been prepared in accordance with the requirements of Liverpool City Council, relevant Australian Standards, the NSW Environmental Protection Authority (EPA) and the NSW Department of Planning.

1.2 LOCATION AND DESCRIPTION OF DEVELOPMENT

The subject shopping centre is located on the corner at 495 Fourth Avenue, Austral, on the corner of Fourth Avenue and Gurner Avenue and is situated within a Neighbourhood Centre (B1) land zone.

The proposal includes the construction of a full line supermarket (Woolworths), drive up Direct-to-Boot, BWS, specialty and commercial shops and a combination of on-grade and basement parking

In addition there will be various items of fixed mechanical plant installed to service the various tenancies (see location in **Appendix A**).

It is understood the development will operate during the following hours:

- Shop hours: 6:00am to midnight; and
- Loading dock: 6:00am to 10:00pm.

Acoustic Dynamics advises that for the purpose of the acoustical assessment, the nearest noise sensitive receivers are:

1. **[R1]** Residential receiver at 145 Gurner Avenue (approx. 95m to the north west);
2. **[R2]** Residential receiver at 135 Gurner Avenue (approx. 55m to the north west);
3. **[R3]** Residential receiver at 121 Gurner Avenue (approx. 35m to the north east);
4. **[R4]** Residential receiver at 90 Gurner Avenue (approx. 30m to the east);
5. **[R5]** Residential receiver at 485 Fourth Avenue (approx. 50m to the south);
6. **[R6]** Residential receiver at 500 Fourth Avenue (approx. 70m to the south west);
7. **[R7]** Residential receiver at 510 Fourth Avenue (approx. 150m to the west); and
8. **[S1]** School receiver at 115 Gurner Avenue (approx. 45m to the north).

The assessment of noise emission from the site to the nearest receivers is considered to be the worst-case scenario. Compliance at the assessed locations will ensure compliance at **all**

other receivers located at distances further away. The overall site, surrounding area and receiver locations are shown in the Location Map, Aerial Image and Drawings presented within **Appendix A**.

1.3 SCOPE

Acoustic Dynamics is engaged to provide an acoustic assessment suitable for the progression of the concept design. The scope of the assessment includes the following:

- Review of relevant legislation and criteria;
- Conduct background noise monitoring on site to establish operational noise limits;
- Prediction of noise emission associated with the use of the proposal; and
- Provision of design recommendations and noise controls required for planning.

2 RELEVANT ACOUSTIC CRITERIA AND STANDARDS

Acoustic Dynamics has conducted a review of the local council, state government and federal legislation that is applicable to the assessment of potential noise impacts associated with the proposal. The relevant sections of the legislation are presented below. The most stringent criteria which have been used in the assessment of noise impacts is summarised below.

2.1 LIVERPOOL CITY COUNCIL REQUIREMENTS

2.1.1 LOCAL ENVIRONMENTAL PLAN

Acoustic Dynamics has conducted a review of Liverpool Local Environmental Plan (2008) with no relevant acoustic information contained within.

2.1.2 DEVELOPMENT CONTROL PLAN

Acoustic Dynamics has conducted a review of the Liverpool Growth Centre Precincts Development Control Plan (2021) with references to acoustic requirements and relevant noise criteria presented below.

"***2.0 Precinct Planning Outcomes***

2.3.9 Noise

Objectives

a. *To minimise the impacts of noise from major transport infrastructure, industrial and employment areas on residential amenity.*

b. *To achieve an acceptable residential noise environment whilst maintaining well designed and attractive residential streetscapes.*

Controls

1. *Figure 2-2 provides guidance to applicants on measures to mitigate the impacts of rail and traffic noise within the Precinct.*
2. *Development Applications must be accompanied by an acoustic report where the development is in a location, shown on the Potential noise attenuation measures figure in the relevant Precinct Schedule, such as:*

3. *adjacent to a railway line, arterial road, sub-arterial road, transit boulevard or other road with traffic volumes predicted to exceed (or currently exceeding) 6,000 vehicles per day;*

4. *potentially impacted upon by a nearby industrial / employment area; or*

5. *potentially impacting upon sensitive receivers such as residences within the precinct and outside the precinct.*

6. *The acoustic report shall demonstrate that the noise criteria in Development Near Rail Corridors and Busy Roads- Interim Guideline (Department of Planning 2008) have been considered.*

7. *Subdivision design on land adjacent to significant noise sources is to consider and implement measures to attenuate noise within dwellings and in external areas that are classified as Principle Private Open Space (refer to clause 4.2.7)*

8. *Physical noise barriers (ie. Noise walls or solid fencing) are not generally supported, and measures to attenuate noise through subdivision layout, such as setbacks, building orientation, and building design and materials selection should be implemented to achieve appropriate internal noise standards.*

2.2 NSW EPA'S ENVIRONMENTAL NOISE CRITERIA

The EPA, in its Noise Policy for Industry (NPfI) document published in October 2017, outlines and establishes noise criteria for industrial or other noise sources in various zoning areas.

The following criteria have been applied for the assessment of the noise emission associated with the proposed use of the site.

Project Noise Trigger Level

The *project noise trigger level* provides a benchmark or objective for assessing a proposal or site. It takes into account (amongst other factors):

- The receiver's background noise environment;
- The time of day of the activity;
- The character of the noise; and
- The type of receiver and nature of the area.

Put simply, the *project noise trigger level* is the lower (that is, more stringent) value of the *project intrusiveness noise level* and the *project amenity noise level* which are described in detail below.

Project Intrusiveness Noise Level

The intrusiveness noise level is determined as follows:

$L_{Aeq,\ 15min}$ = rating background noise level + 5 dB	
where:	
$L_{Aeq,\ 15min}$	represents the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes.
and	
Rating background noise level	represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B.

Project Amenity Noise Level

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level** represents the objective for a noise from a **single** industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

Furthermore, the NPfI provides exceptions to the above methodology when deriving the project amenity noise level:

> *"The following exceptions to the above method to derive the project amenity noise level apply:*
>
> *1. In areas with high traffic noise levels (see Section 2.4.1).*
>
> *2. In proposed developments in major industrial clusters (see Section 2.4.2).*
>
> *3. Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.*

4. 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."

Acoustic Dynamics undertook site inspections on Tuesday 24 October 2023 and Tuesday 31 October 2023, and conducted background noise monitoring between those days, to establish noise criteria for the proposal, in accordance with the requirements of the EPA. At the site and neighbouring sensitive receiver locations, the noise environment is dominated by intermittent road traffic flow, suburban activity and intermittent construction noise associated with projects to the east.

Based on the residential receiver categories of the NPfI, the site is classes as Suburban residential) which is an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.

2.2.1 SITE NOISE SURVEY

To establish the acoustic environment at the subject site in accordance with the guidelines of the NSW EPA's NPfI, unattended noise logging was conducted at the central eastern aspect of the site between Tuesday 24 October and Tuesday 31 October 2024. Acoustic Dynamics advises the noise logging location is conservatively representative of the existing noise environment of the nearest sensitive receivers. Any periods of adverse weather or construction noise have been excluded from the data.

The long-term noise monitoring locations are shown within **Appendix A**. Following the general procedures outlined in the EPA's NPfI, a summary of the established noise environment, is presented in **Table 2.1**.

Table 2.1 Measured Noise Levels and Project Noise Objectives

Location	Time of Day	Measured RBL (L_{A90}) [dB]	Measured L_{Aeq} Noise Level [dB]	Project Intrusive Noise Level $L_{Aeq,15min}$ [dB]	Project Amenity Noise Level $L_{Aeq,15min}$ [dB]	Project Noise Trigger Level L_{Aeq} [dB]
Nearest residential receivers	Day (7am[1] to 6pm)	38	48	43	53	**43**
	Evening (6pm to 10pm)	34	44	39	43	**39**
	Night Shoulder (10pm to 12am)	32	34	37	-	**37**
	Night (12am to 5:30am)	29	35	34	38	**35**[3]
	Early Morning (5:30am to 7am)	39	46	44	-	**43**[4]
School receivers	When in use	-	-	-	45 (external)	**45** (external)
Commercial receivers	When in use	-	-	-	65	**65**

Note: 1) 8:00am to 6:00pm on Sundays and public holidays.

2) Amenity adjustment based on "Suburban" receiver type. The noise emission objective has been modified in accordance with the recommendations detailed within the NPfI Section 2.2, for time period standardising of the intrusiveness and amenity noise levels ($L_{Aeq,15min}$ will be taken to be equal to the $L_{Aeq, period}$ + 3 decibels (dB)).
3) Minimum project intrusiveness noise levels have been adopted in accordance with Table 2.1 of the NPfI.
4) Daytime project trigger noise level has been adopted as the more conservative design target.

NB. Project noise trigger level is the lowest value of project intrusiveness or project amenity noise level after conversion to L_{Aeq} equivalent value. The EPA's NPfI specifies additional noise emission level corrections that should be applied when a noise source is determined to include "modifying factors" that can vary the perceived intrusiveness of a noise source. Such modifying factors include tonal, low frequency, or intermittent noise.

2.3 SLEEP DISTURBANCE

The NSW EPA has in the past investigated overseas and Australian research on sleep disturbance. The method of assessing noise for sleep disturbance relies on the application of a screening that indicates the potential for this to occur. The EPA's *Noise Guide for Local Government*, provides the following guidance for such a screening test:

> *"Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship. Where likely disturbance to sleep is being assessed, a screening test can be applied that indicates the potential for this to occur. For example, this could be where the subject noise exceeds the background noise level by more than 15 dB(A). The most appropriate descriptors for a source relating to sleep disturbance would be $L_{A1(1\ minute)}$ (the level exceeded for 1% of the specified time period of 1 minute) or L_{Amax} (the maximum level during the specified time period) with measurement outside the bedroom window."*

Additionally, the guidelines of the NSW EPA's NPfI provide the following additional information:

> *"Where the subject development/premises night-time noise levels at a residential location exceed:*
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater".*

Further to the above information, the following summarizes the sleep disturbance screening criterion:

$$L_{Amax} \text{ or } L_{A1(1\ minute)} < L_{A90} + 15\ dB(A)$$

In addition to the above, the EPA has previously published the following additional information relating to findings of significant research carried out for sleep disturbance:

> *"Maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions… One or more noise events per night, with maximum internal noise levels of 65-70 dBA, are not likely to affect health and wellbeing significantly."*

In accordance with the NPfI guidelines detailed above, the following sleep disturbance screening criteria has been applied for this project:

Sleep Disturbance Criteria:
10pm to 6am = 52 dB(A)
6am to 7am = 54 dB(A)

2.4 ROAD TRAFFIC NOISE CRITERIA

The EPA's Road Noise Policy (RNP) 2011 provides road traffic noise target levels for land use developments with potential to create additional traffic on existing local roads. **Table 2.2** shows the assessment criteria relevant to the assessment of the offsite road traffic noise impacts.

Table 2.2 RNP Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project / Land Use	Assessment Criteria [dB]	
		Day (7am-10 pm)	Night (10 pm-7am)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	55 $L_{Aeq,1hour}$ (external)	50 $L_{Aeq,1hour}$ (external)

Accepted application of Section 2.4 of the RNP is that where road traffic noise levels already exceed the assessment criteria, an increase of less than 2 dB represents a minor impact that is barely perceptible to the average person.

2.5 PROTECTION OF THE ENVIRONMENT OPERATIONS (POEO) ACT 1997

Noise emission from the any items of mechanical plant (i.e. condenser units, fans and exhausts) must also comply with the requirements of the relevant legislation, being the *Protection of the Environment Operations* (POEO) *Act 1997*. The POEO Act 1997 requires that the subject mechanical equipment must not generate "offensive noise".

Offensive noise is defined as follows:

> *"**"offensive noise"** means noise:*
>
> *(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*
> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
> *(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations."*

3 NOISE EMISSION ASSESSMENT

The following section provides an assessment of the maximum cumulative noise impacts from noise sources associated with the proposal at nearby sensitive receivers. The assessment location is defined as the most affected point on or within any sensitive receiver property boundary. Examples of this location may be:

i. 1.5m above ground level;
ii. On a balcony at 1.5m above floor level; and
iii. Outside a window on the ground or higher floors, at a height of 300mm below the head of the window.

Note. To ensure noise impacts are adequately assessed, this report is based on an assessment of noise associated with **maximum capacity operations** during each assessment period.

Although maximum capacity operations are unlikely to occur all the time, the assessment is conducted in this conservative manner to ensure that even during a worst-case noise emission scenario, the amenity of neighbouring residents is protected.

The noise emission has been assessed based on the **maximum** capacity operations during each assessment period and the modelling assumptions as presented in **Section 3.1.2** and **Section 3.1.3**.

3.1 NOISE MODEL ASSUMPTIONS AND SCENARIO

3.1.1 MODEL CONFIGURATION

Acoustic modelling was undertaken using computer modelling software (CadnaA Version 2023) to predict operational noise levels generated by the development. CadnaA calculates environmental noise propagation according to the applicable ISO standards, including the ISO 9613 algorithm.

Ground absorption, reflection and relevant shielding objects are taken into account in the calculations. Topographical contour information was imported into the model as 2m contours.

3.1.2 NOISE MODEL ASSUMPTIONS

The following assumptions were made with regard to the configuration of the noise model:

i. All source sound power levels are taken from manufacturer data, site measurements or our extensive library of noise source data;
ii. All vehicles driving on site are modelled at an average speed of 15 km per hour;
iii. All delivery trucks will access the site via the loading dock entrance on Fourth Avenue;
iv. All indicative mechanical plant modelled at indicative locations (as shown in **Appendix A**); and
v. Maximum capacity use of the docks during a 15 minute assessment period.

Note. It is highly unlikely that all mechanical plant or noise generating activities would be occurring at maximum capacity simultaneously and certain types of equipment would be used on site for only brief periods during certain activities. Therefore, the noise modelling predictions are considered conservative.

3.1.3 MODELLING SCENARIOS

Acoustic Dynamics has conducted modelling of worst-case **15-minute** noise emission scenarios during each of the assessment periods as follows:

Early Morning / Day / Evening (6:00am to 10:00pm)

- All indicative mechanical noise sources (including rotary auger compactor) operating simultaneously and continuously;
- 2 x articulated (or 2 x small rigid) delivery truck accessing the loading dock (6am to 6pm);
- 1 x articulated (or 2 x small rigid) delivery trucks accessing the loading dock (6pm to 10pm);
- 2 x small rigid delivery trucks accessing the loading dock (6am to 10pm);
- 150 vehicles per hour accessing the carpark;

Night Shoulder (10:00pm to midnight)

- All indicative mechanical noise sources (including rotary auger compactor) operating simultaneously and continuously;
- 150 vehicles per hour accessing the carpark; and

Night (midnight to 6:00am)

- All indicative mechanical noise sources (including rotary auger compactor) operating simultaneously and continuously.

NB: All listed noise sources and activities assumed to be operating simultaneously and continuously, over any 15-minute period during the assessment period. It is highly unlikely that all equipment would be operating at their maximum sound power levels at any one time and certain types of equipment would be used on site for only brief periods during certain activities. Therefore, the noise modelling predictions are considered conservative.

3.1.4 SOURCE SOUND POWER LEVELS

Sound power levels of external noise sources associated with the proposal are presented in **Table 3.1**. At this stage of the proposal, the specifics regarding mechanical plant are yet to be finalised. Acoustic Dynamics has conducted the assessment based on the provided planning information and our experience with assessing similar types of developments. Typical equipment noise levels have been obtained from manufacturer data, conditioned driving tests and our library of noise emission data.

Table 3.1 Equipment Details and Sound Power Levels

Source	Typical Noise Levels[1]
All delivery vehicles fitted with smart reverse alarms	SWL = 77
Passenger vehicle entering/exiting the site (15 km/hr)	SWL = 81 dB(A) per vehicle
Articulated vehicle accessing loading dock (5 km/hr)	Wheel SWL = 97 dB(A)
	Engine SWL = 104 dB(A)
	Exhaust SWL = 99 dB(A)
Articulated vehicle idling in loading dock	SWL = 95 dB(A)
Small rigid truck accessing the loading dock	SWL = 97 dB(A)
Small rigid truck idling in loading dock	SWL = 85 dB(A)
Air cooled heat pump	SWL = 95 dB(A)
Package unit	SWL = 94 dB(A)
WW smoke exhaust	SWL = 85 dB(A)
WW kitchen exhaust	SWL = 85 dB(A)
General exhaust fans	SWL = 80 B(A)
Carpark exhaust fan	SWL = 90 dB(A)
Carpark supply fan	SWL = 90 dB(A)
Retail & commercial condenser deck (x 4 condensers)	SWL = 80 dB(A)
BWS condenser deck (x 2 condensers + compressor)	SWL = 80 dB(A)
Fire pump room supply fan	SWL = 80 dB(A)
Fire pump room exhaust fan	SWL = 80 dB(A)
Fire control centre supply fan	SWL = 80 dB(A)
MSB room intake fan	SWL = 80 dB(A)
7.5kW Stationary Auger Compactor	SWL = 88 dB(A)

Note: 1) Octave band levels have not been displayed however have been used in the modelling predictions.

3.2 OPERATIONAL NOISE ASSESSMENT PREDICTIONS

The calculated maximum external noise emission levels at the nearest receiver locations are presented in **Table 3.2** below, assessed against the relevant noise emission criteria. It is advised that by achieving compliance with the nearest receiver locations, compliance will also be achieved at those further away. The predicted noise emission levels presented below in **Table 3.2** include allowances for relevant distance, direction and shielding losses.

Table 3.2 External Predicted Noise Emission Levels & Relevant Criteria – Nearest Receivers

Residential Receiver Location[1]	Assessment Period	Activity / Noise Source	Calculated Maximum L_{Aeq} Noise Level [dB]	EPA NPfI $L_{Aeq(15minute)}$ Noise Emission Objective [dB]	Complies?
Early Morning / Day					
R1 145 Gurner Ave	6am to 6pm	Loading dock[3]	37	**43**	**Yes**
		Mechanical plant	30		
		Carpark	25		
		Total	**38**		
R2 135 Gurner Ave	6am to 6pm	Loading dock[3]	40	**43**	**Yes**
		Mechanical plant	33		
		Carpark	25		
		Total	**41**		
R3 121 Gurner Ave	6am to 6pm	Loading dock[3]	22	**43**	**Yes**
		Mechanical plant	32		
		Carpark	16		
		Total	**33**		
R4 90 Gurner Ave	6am to 6pm	Loading dock[3]	22	**43**	**Yes**
		Mechanical plant	33		
		Carpark	29		
		Total	**35**		
R5 485 Fourth Ave	6am to 6pm	Loading dock[3]	33	**43**	**Yes**
		Mechanical plant	35		
		Carpark	33		
		Total	**39**		
R6 500 Fourth Ave	6am to 6pm	Loading dock[3]	38	**43**	**Yes**
		Mechanical plant	35		
		Carpark	33		
		Total	**41**		
R7 510 Fourth Avenue	6am to 6pm	Loading dock[3]	34	**43**	**Yes**
		Mechanical plant	31		
		Carpark	25		
		Total	**36**		
S1 510 Fourth Avenue	When in use	Loading dock[3]	24	**45**	**Yes**
		Mechanical plant	33		
		Carpark	12		
		Total	**34**		
Evening					
R1 145 Gurner Ave	6pm to 10pm	Loading dock[3]	34	**39**	**Yes**
		Mechanical plant	30		
		Carpark	25		
		Total	**36**		
R2 135 Gurner Ave	6pm to 10pm	Loading dock[3]	38	**39**	**Yes**
		Mechanical plant	33		
		Carpark	25		
		Total	**39**		

Residential Receiver Location[1]	Assessment Period	Activity / Noise Source	Calculated Maximum L_{Aeq} Noise Level [dB]	EPA NPfI $L_{Aeq(15minute)}$ Noise Emission Objective [dB]	Complies?
R3 121 Gurner Ave	6pm to 10pm	Loading dock[3]	20	**39**	**Yes**
		Mechanical plant	32		
		Carpark	16		
		Total	**32**		
R4 90 Gurner Ave	6pm to 10pm	Loading dock[3]	21	**39**	**Yes**
		Mechanical plant	33		
		Carpark	29		
		Total	**35**		
R5 485 Fourth Ave	6pm to 10pm	Loading dock[3]	31	**39**	**Yes**
		Mechanical plant	35		
		Carpark	33		
		Total	**38**		
R6 500 Fourth Ave	6pm to 10pm	Loading dock[3]	36	**39**	**Yes[4]**
		Mechanical plant	35		
		Carpark	33		
		Total	**40**		
R7 510 Fourth Avenue	6pm to 10pm	Loading dock[3]	32	**39**	**Yes**
		Mechanical plant	31		
		Carpark	25		
		Total	**35**		
S1 510 Fourth Avenue	6pm to 10pm	Loading dock[3]	22	**45**	**Yes**
		Mechanical plant	33		
		Carpark	12		
		Total	**33**		
Night Shoulder					
R1 145 Gurner Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	30		
		Carpark	25		
		Total	**31**		
R2 135 Gurner Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	33		
		Carpark	25		
		Total	**34**		
R3 121 Gurner Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	32		
		Carpark	16		
		Total	**32**		
R4 90 Gurner Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	33		
		Carpark	29		
		Total	**34**		

Residential Receiver Location[1]	Assessment Period	Activity / Noise Source	Calculated Maximum L_{Aeq} Noise Level [dB]	EPA NPfI $L_{Aeq(15minute)}$ Noise Emission Objective [dB]	Complies?
R5 485 Fourth Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	35		
		Carpark	33		
		Total	**37**		
R6 500 Fourth Ave	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	35		
		Carpark	33		
		Total	**37**		
R7 510 Fourth Avenue	10pm to midnight	Loading dock[3]	0[1]	**37**	**Yes**
		Mechanical plant	31		
		Carpark	25		
		Total	**32**		
Night					
R1 145 Gurner Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	30		
		Carpark	0[2]		
		Total	**30**		
R2 135 Gurner Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	33		
		Carpark	0[2]		
		Total	**33**		
R3 121 Gurner Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	32		
		Carpark	0[2]		
		Total	**32**		
R4 90 Gurner Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	33		
		Carpark	0[2]		
		Total	**33**		
R5 485 Fourth Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	35		
		Carpark	0[2]		
		Total	**35**		
R6 500 Fourth Ave	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	35		
		Carpark	0[2]		
		Total	**35**		
R7 510 Fourth Avenue	Midnight to 6am	Loading dock[3]	0[2]	**35**	**Yes**
		Mechanical plant	31		
		Carpark	0[2]		
		Total	**31**		

Note. 1) Loading dock not in use during this period.
2) Loading dock and carpark not in use during this period.
3) Includes noise associated with heavy vehicles accessing the site.
4) An exceedance of 1 dB is considered to be negligible.

3.2.1 SLEEP DISTURBANCE ASSESSMENT

To assess any potential for sleep disturbance, maximum noise levels due to instantaneous noise events (such as vehicle door slams (L_{AMax} 95 dB), and heavy vehicles accessing the site (L_{AMax} 105 dB)) were calculated to the nearest sensitive receiver locations.

The predictions indicate that during the night time assessment period 10:00pm to 6:00am, the calculated L_{AMax} 52 dB achieves compliance with the night time sleep disturbance objective (**L_{AMax} 52 dB**) at the closest sensitive receivers.

The predictions indicate that during the early morning assessment period 6:00am to 7:00am, the calculated L_{AMax} 54 dB achieves compliance with the early morning sleep disturbance objective (**L_{AMax} 54 dB**) at the closest sensitive receivers.

Acoustic Dynamics advises that although there may be instantaneous noise events (i.e. a vehicle door slamming, a vehicle accelerating or other instantaneous noise events) that exceed the external sleep disturbance criterion at the nearest residential receivers, the maximum instantaneous internal noise levels are predicted to comply with the internal noise guideline (**L_{AMax} ≤ 45 dB(A)**) and is unlikely to cause awakening reactions.

Design considerations have been made to ensure that any noise impacts associated with the proposal are reduced. This would include the implementation of an operational noise management plan to ensure that all workers and drivers are aware of their noise obligations.

3.2.2 ROAD TRAFFIC NOISE ASSESSMENT

The calculated maximum noise emission levels at sensitive residential receivers, due to the vehicles utilizing surrounding local roads, are presented in **Table 3.3** below. It is advised that by achieving compliance with the nearest residential locations, compliance will also be achieved at all other residential receiver locations further away.

Table 3.3 Modelled Sensitive Receiver Daytime $L_{eq,1hr}$ Sound Pressure Level

Most Affected Receiver	Relevant $L_{Aeq,1hr}$ Objective [dB][1]	Predicted $L_{eq,1hr}$ Sound Pressure Level [dB][2]	Complies? (Yes/No)
Receivers Located on Surrounding Roads	$L_{Aeq,\ (1\ hour)}$ 55 (external) **Day (7am – 10pm)**	51	**Yes**
Receivers Located on Surrounding Roads	$L_{Aeq,\ (1\ hour)}$ 50 (external) **Night (10pm – 7am)**	50	**Yes**

Note: 1) Night criterion applies for the time period 7:00am to 10:00pm.
2) Predicted L_{Aeq} noise level is the maximum noise level within a 1_{hr} period.

Based on the above, Acoustic Dynamics advises that the noise emission due additional traffic as a result of the proposed development will achieve compliance with the NSW EPA's Road Noise Policy.

4 DISCUSSION

Noise emission has been assessed as worst-case scenario (being maximum capacity operations) occurring during the assessment periods. The predicted maximum noise emission results associated with the proposal (inclusive of the acoustic planning recommendations outlined in **Section 5**) indicate the following:

1. The results of the noise modelling and predictions indicate that noise emission associated with the worst-case noise scenario is likely to **comply** with the relevant noise emission criteria at the assessed neighbouring receiver locations;

2. Noise emission has been assessed as a worst-case scenario (i.e. maximum number of vehicle movements per hour) however Acoustic Dynamics understands that vehicle numbers are likely to be lower than those used in the assessment of noise emission;

3. Noise associated with the proposed operations is not considered to be atypical for the area (i.e. existing use of the loading docks). The proposal includes significant design considerations to ensure noise impacts are reduced;

4. Noise emission associated with vehicles utilizing the surrounding local roads is predicted to comply with the EPA's *Road Noise Policy (RNP) 2011* at all nearby residential receivers; and

5. To ensure the assessment is conducted in a conservative manner, noise emission has been assessed as a **worst-case** scenario (i.e. all noise generating activities and noise sources occurring simultaneously and at maximum capacity). Generally, the noise emission associated with the proposed use and operation of the site would be lower than the predicted results presented in **Table 3.2** above.

5 RECOMMENDATIONS

The predicted noise emission results indicate that noise emission resulting from the proposal, at all nearby sensitive receivers, can be reduced, provided suitable design recommendations are implemented.

5.1.1 MECHANICAL PLANT

Acoustic Dynamics advise that at this stage of the proposal, the selection and location of mechanical plant has not been finalised. Indicative mechanical plant locations and assumptions have been included within this assessment.

The indicative mechanical noise calculations and operational assumptions should not be considered prescriptive. They are modelling assumptions that have been used to

demonstrate typical mechanical noise sources associated with the development **can be designed to achieve compliance** with the relevant criteria.

To ensure the use of the mechanical plant complies with the *Protection of the Environment Operations* (POEO) *Act 1997*, the requirements of Council and the EPA, it is advised the following mechanical plant recommendations may be required to be implemented in to the design (pending review of the mechanical plant documentation):

1. Mechanical noise from items of plant can be mitigated via the construction of acoustic screening or through judicious locating to block line of site to adjacent receivers;

2. If required, acoustic screens must be constructed to a minimum height of 500mm to 1000mm above the height of the top of mechanical plant. This is to be reviewed prior to the selection and installation of any mechanical plant;

3. The mechanical plant room facade and roof is to be constructed from material with a minimum surface density of 15 kg/m^2, and contain no gaps along the surface. Fresh air can be provided via acoustic louvres in the facade;

   NB. Where mechanical plant is installed outside the plant room, acoustic barriers will be required around the perimeter of the plant and constructed to a minimum height of 500mm to 1000mm above the height of the top of mechanical plant. This is to be reviewed prior to the selection and installation of any mechanical plant;

4. As a guide, acoustic louvres (such as Fantech SBL2, or equivalent) should be selected on the following minimum sound transmission loss:

Table 5.1 Mechanical Plant Room Facade Louvre Required Sound Transmission Loss

63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
5 dB	10 dB	14 dB	22 dB	27 dB	25 dB	21 dB	17 dB

5. Where mechanical items are not located in the indicative plant areas, the proposed installation location must be reviewed by an acoustic consultant prior to installation to ensure appropriate attenuation will be achieved;

6. Mechanical plant should be selected on the basis of low noise emissions. In general, the following sound power levels (SWLs) should be used as a guide when selecting plant:
   - Package unit SWL ≤ 94 dB(A);
   - Heat pump SWL ≤ 95 dB(A);
   - Smoke exhaust SWL ≤ 85 dB(A);
   - Kitchen exhaust SWL ≤ 85 dB(A);
   - General exhaust fan SWL ≤ 80 dB(A);
   - Carpark exhaust fan SWL ≤ 75 dB(A);

- Carpark supply fan SWL ≤ 75 dB(A);
- Condenser SWL ≤ 80 dB(A);
- Compressor SWL ≤ 80 dB(A);
- Fire pump room supply SWL ≤ 80 dB(A);
- Fire pump room exhaust SWL ≤ 80 dB(A);
- Fire control centre supply SWL ≤ 80 dB(A);
- MSB intake fan SWL 80 ≤ dB(A);
- 7.5kW Stationary Auger Compactor SWL ≤ 88 dB(A);

7. Installation of in-duct silencers and attenuators can be used to control noise levels at end of duct;

8. Ensuring all exposed duct work is lined with a suitably dense acoustic material or wrap;

9. All items of mechanical plant should be isolated from the building structure through the use of resilient mounts, resilient sleeves and or spring hangers;

10. Reduce mechanical plant vibration through inspection and where necessary maintenance and repair of any fans, motors or ductwork. Inspection and maintenance should include motors, shafts, bearings, belts and tightening of any loose parts or connections; and

11. Once a detailed mechanical schedule and layout has been determined, an acoustic consultant should be engaged to provide a review and recommendations to ensure mechanical noise emission is adequately controlled.

5.1.2 BACKUP GENERATOR

Depending on the selected model, noise associated with a backup generator may exceed the night time criterion when measured at the closest affected receivers. However, given that the generator will operate during emergency situations only, it is unlikely to cause unreasonable disturbance.

In addition, mitigation measures can be implemented to ensure noise impacts are reduced include:

1. The backup generator is to be housed within the rooftop plant room enclosure;

2. The facade walls of the plant room enclosure can be fitted with acoustic louvres; and

3. The backup generator can be fitted with a muffler/silencer to reduce the noise emitted.

5.1.3 LOADING DOCK SCHEDULE

Acoustic Dynamics advises that the following loading dock schedule is to be implemented to ensure compliance with the requirements of Council.

1. 6:00am to 6:00pm:
    i. A maximum of 2 articulated (or 2 x small rigid) delivery trucks to access the loading dock per 15 minutes;
    ii. A maximum of 2 small rigid delivery trucks to access the loading dock per 15 minutes (this is in addition to the 2 articulated or 2 small rigid delivery trucks);
    iii. The roller door is to be kept closed except to allow for ingress and egress;
    iv. Rotary auger compactor can be used;

2. 6:00pm to 10:00pm:
    i. A maximum of 1 articulated (or 2 x small rigid) delivery truck to access the loading dock per 15 minutes;
    ii. A maximum of 2 small rigid delivery trucks to access the loading dock per 15 minutes (this is in addition to the 1 articulated or 2 small rigid delivery trucks);
    iii. The roller door is to be kept closed except to allow for ingress and egress;
    iv. Rotary auger compactor can be used;

3. 10:00pm to 6:00am:
    i. No delivery trucks are to access the loading dock;
    ii. The roller door is to be kept closed; and
    iii. Rotary auger compactor can be used.

Note: Our noise modelling includes noise associated with additional reversing manoeuvres and operation of broadband reversing alarms (or equivalent).

5.1.4 LOADING DOCKS

Acoustic Dynamics advises that the following measures are required to be implemented to ensure compliance with the requirements of Council.

To ensure the use of the loading docks and waste collection areas does not cause unreasonable disturbance, the following practicable operational noise management measures should be implemented by the site operator. Suitable controls would include:

1. Signage at the entrance of the site advising drivers switch off engines during deliveries/collections;

2. Signage at the entrance of the site advising delivery drivers switch off refrigeration units whilst at the loading dock;

3. Roller door to the loading dock is to be kept closed except to allow for vehicle ingress and egress;

4. Signage at the entrance of the site advising drivers restrict the use of compression brakes when in close proximity to residential properties;

5. Drivers trained and instructed to adhere to a conditioned driving procedure including:
   i. Adhering speed limits whist on site;
   ii. No unnecessary revving of engines;
   iii. No unnecessary honking of horns;
   iv. No waiting and idling adjacent to residential properties;

6. Training and induction of all staff in appropriate behaviour and use of the loading dock and waste collection areas; and

7. Doors to loading dock area should be kept closed following the completion of vehicle access.

5.1.5 REVERSING ALARMS

The use of tonal reversing alarms has the potential to cause disturbance to neighbouring residential properties.

To ensure impacts are minimised, broadband (smart) reversing alarms should be incorporated on all vehicles used on site. The broadband (smart) reversing alarm will reduce the tonal aspects of the traditional beeping alarm and will maintain the safety of the workers on site.

Further to the above, noise impact associated with alarms can be addressed via the following measures:

1. “Smart” broadband alarms (Vhedia Reverse Squawker Alarm – Smart Version, BBS-TEK White Sound alarms, or equivalent), should be installed to all site vehicles and should be programmed to operate at a maximum of 77 dB; and

2. Staff are to be provided with appropriate instruction and training to ensure safe and appropriate manoeuvring procedures.

5.1.6 ACOUSTIC ENCLOSURE & BARRIERS

The calculated noise emission results include the benefit of an acoustic enclosure to the rooftop plant room, localised acoustic barriers around the rooftop mechanical plant, acoustic barrier walls to the loading dock, and a parapet wall along the perimeter of the rooftop.

Note. As the mechanical plant design is unknown at this stage, the modelling assumptions are indicative only and any mitigation will be determined subject to a review of the detailed mechanical design following development approval. As such, the following guidance is provided in relation to the acoustic enclosures and barriers should they be required.

Acoustic enclosures and barriers should be constructed to the following specification:

1. The rooftop plant room enclosure and barriers must contain no gaps along the surface area, and be close fitting (i.e., within 20mm) to the ground (to prevent the transmission of noise below the façade/barrier);

2. The rooftop plant room enclosure and barriers must provide a minimum surface density of 15 kg/m^2, and contain no gaps along the surface. All gaps are to be adequately sealed using a flexible mastic sealant. Acoustic Dynamics advises that the acoustic enclosure and barriers could be constructed to be:

    a) Proprietary wall system (i.e. Acoustic+ noise wall, 15kg/m^2);
    b) A minimum 9mm thick compressed fibros-cement sheeting on a timber or steel stud;
    c) A double layer Colorbond Custom Blue Orb^{TM} (or equivalent) barrier; or
    d) Masonry blockwork; or
    e) Other suitable material (minimum surface density of **15 kg/m^2**) (i.e. Flexshield V50 or equivalent); and

3. All building materials specified must be tested and certified by a locally recognised and accepted testing agency in respect of their intended use. Where appropriate, materials and noise mitigation measures specified by Acoustic Dynamics must be certified by a locally recognised (qualified) and accepted professional for suitability (structural, wind loading, or other) for the intended use.

Acoustic Dynamics advises the above acoustic screens/barriers will sufficiently reduce noise emission to the adjacent receivers achieves compliance with the various relevant acoustic criteria and objectives. The location of the acoustic barriers/screens is detailed within the mark-up provided in **Appendix A**.

5.1.7 LOADING DOCK CONSTRUCTION

The following recommendations are to be incorporated into the design and construction of the loading dock, to ensure noise is adequately controlled.

1. The facade walls of the loading dock should be constructed to achieve an acoustic rating **R_w 50**;

2. Suitable facade wall construction materials would be:
    i. Stud frame lined each side with 2 layers of fibre cement sheeting and infilled with high density insulation; or
    ii. Masonry blockwork; or
    iii. Tilt-up concrete panel; or
    iv. Construction material of equivalent acoustic performance;

3. The roof of the loading dock should be constructed to achieve an acoustic rating **R_w 40**;

4. Suitable roof construction materials would be:
    i. Suspended concrete slab (150mm thick); or
    ii. Sheet metal roof to joists lined with fibre cement sheeting; or
    iii. Construction material of equivalent acoustic performance;

5. The eastern and western internal facade walls of loading dock should be lined with durable 50mm polyester acoustic insulation NRC 0.75 (Martini MSB or equivalent) from floor level to a minimum of 4.5 metres high (to be confirmed following development approval);

6. The mechanical roller door motor selected for installation should have a maximum sound power rating **SWL ≤ 70 dBA** or **L_{Amax} 62 dBA** at 1 metre;

7. The roller doors to the outbound dock should be constructed using interlocked solid panels (e.g. galvanised steel panels) with no mesh or grille infills;

8. All roller door components such as the motor, roller tracks and guides or other mountings should be decoupled from the building structure through the use of resilient pads, mounts and fittings;

9. Guide rails should be Teflon coated/sprayed to ensure smooth transitions during opening and closing;

10. Any drainage channels or grates located on the driveway should be securely fixed to ensure that no noise is emitted when a vehicle drives over the channel; and

11. Following development approval, and prior to construction certification, an acoustic consultant should be engaged to review the proposed construction and provide appropriate design advice as required.

6 CONCLUSION

Acoustic Dynamics has conducted an assessment of the noise impacts associated with the proposed development located at 495 Fourth Avenue, Austral NSW.

A review of applicable noise standards and local authority noise criteria was conducted. Noise levels were assessed in accordance with the requirements of:

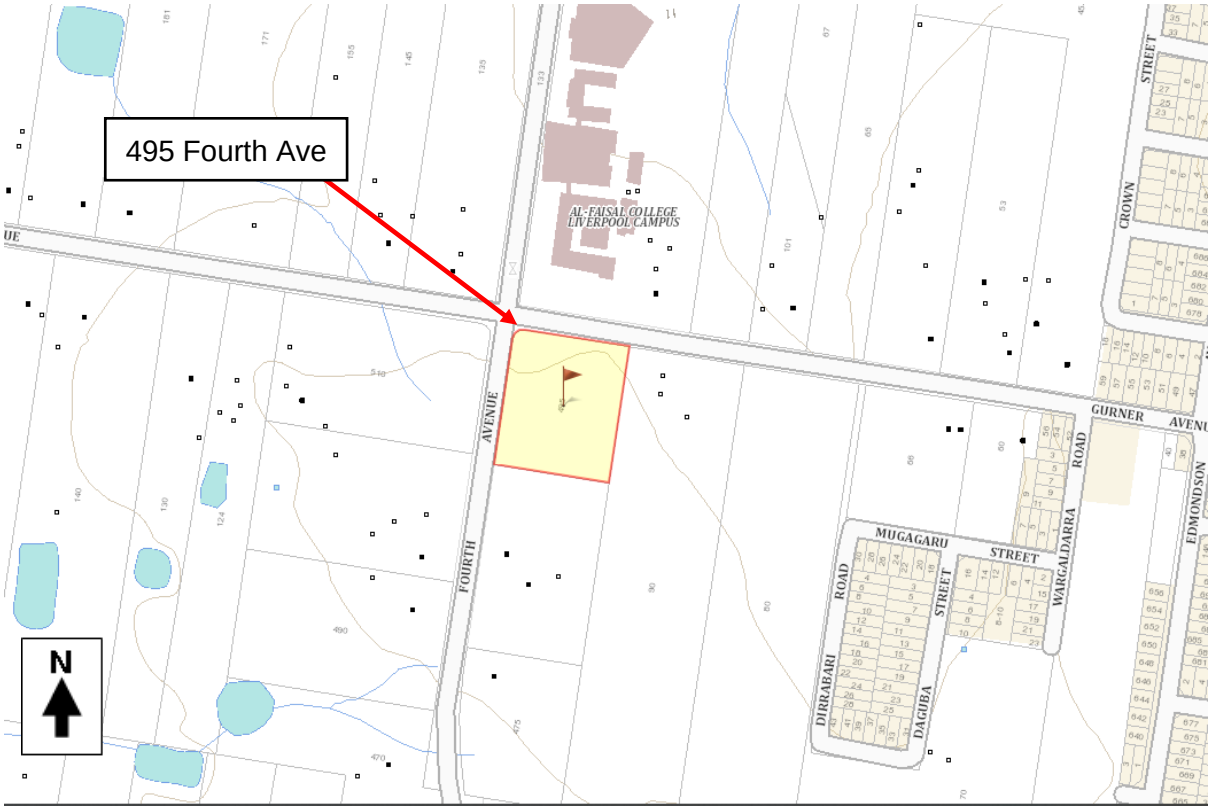
(a) Liverpool Council;
(b) The NSW EPA;
(c) The NSW Department of Planning; and
(d) Australian Standards.

Acoustic Opinion
Noise emission associated with the proposal can be designed to comply with relevant noise emission criteria of Council and the NSW EPA, subsequent to the incorporation of and strict adherence to the recommendations outlined within Section 5.

We trust that the above information meets with your requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

APPENDIX A – LOCATION MAP, AERIAL IMAGE AND DRAWINGS

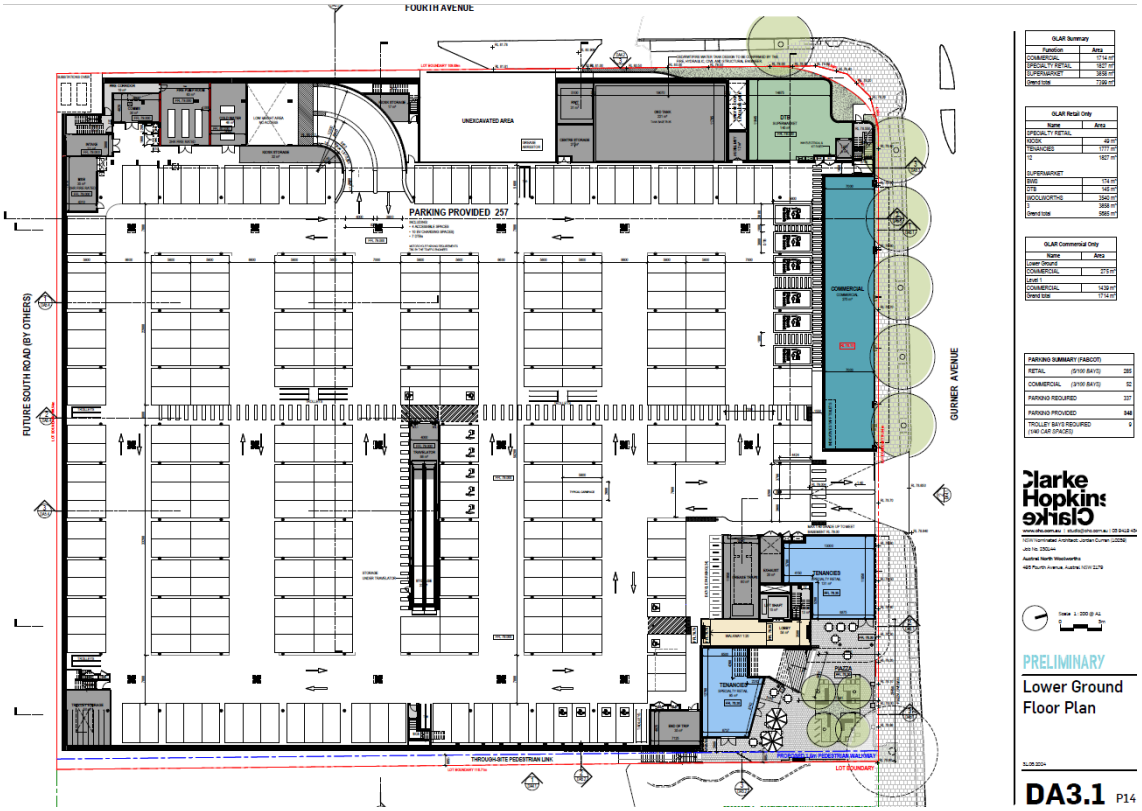
A.1 LOCATION MAP



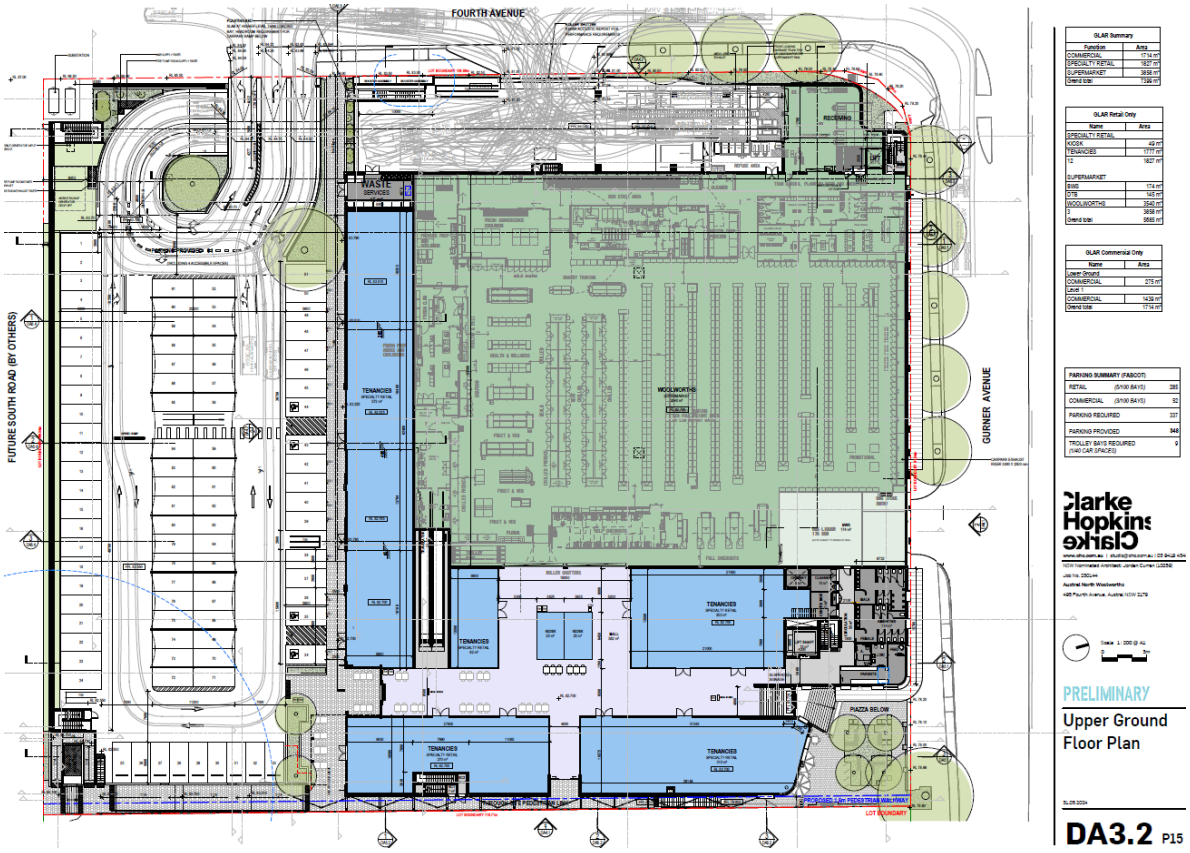
A.2 AERIAL IMAGE (COURTESY OF SIX MAPS)

A.3 DRAWINGS

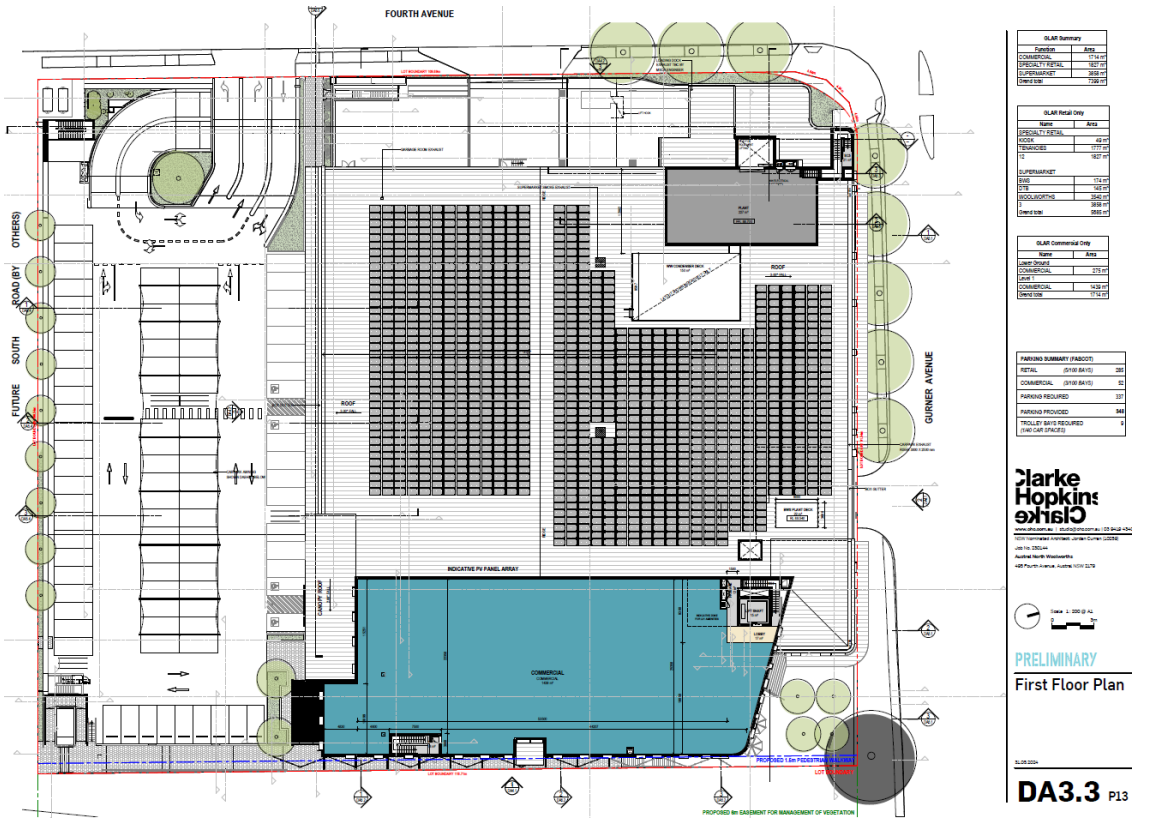
A.3.1 LOWER GROUND FLOOR PLAN



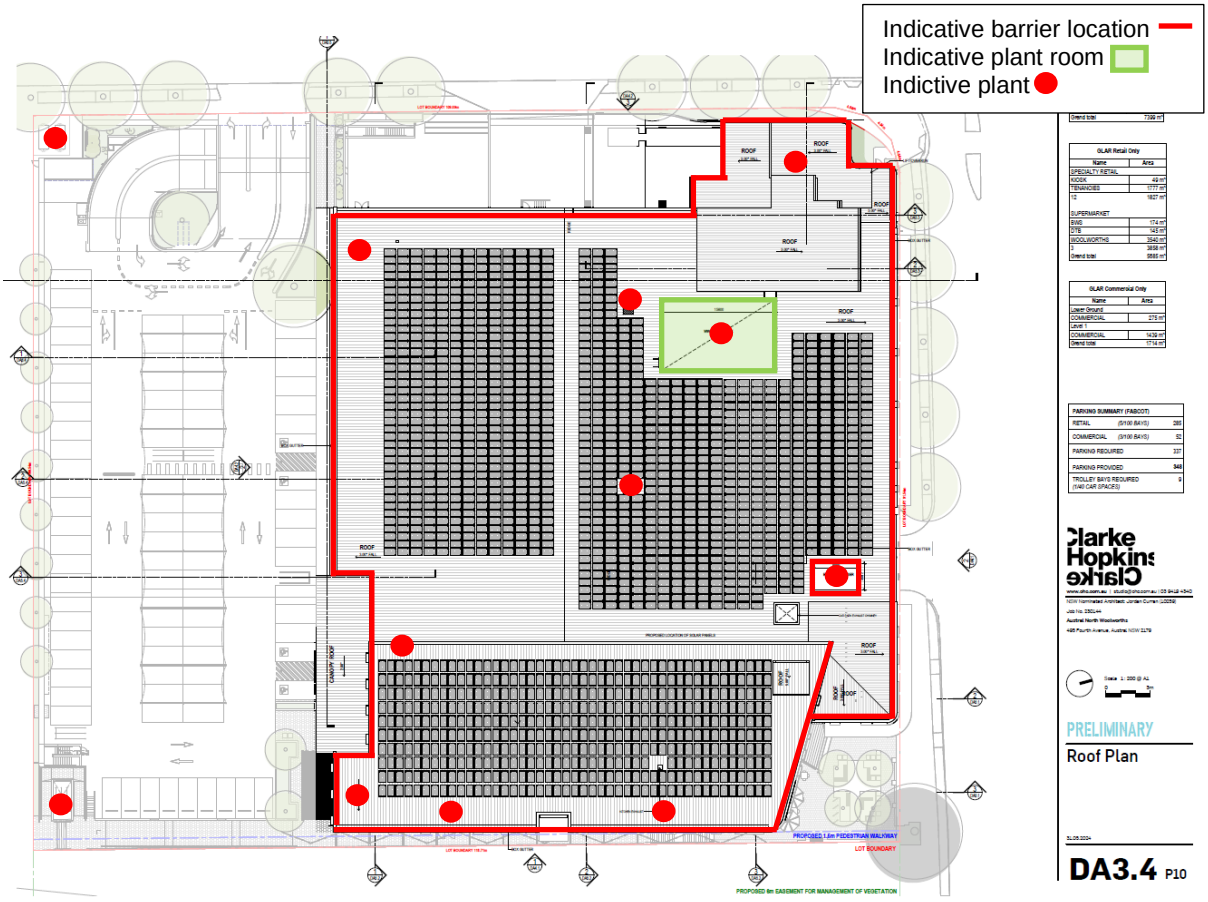
A.3.2 UPPER GROUND FLOOR PLAN



A.3.3 FIRST FLOOR PLAN

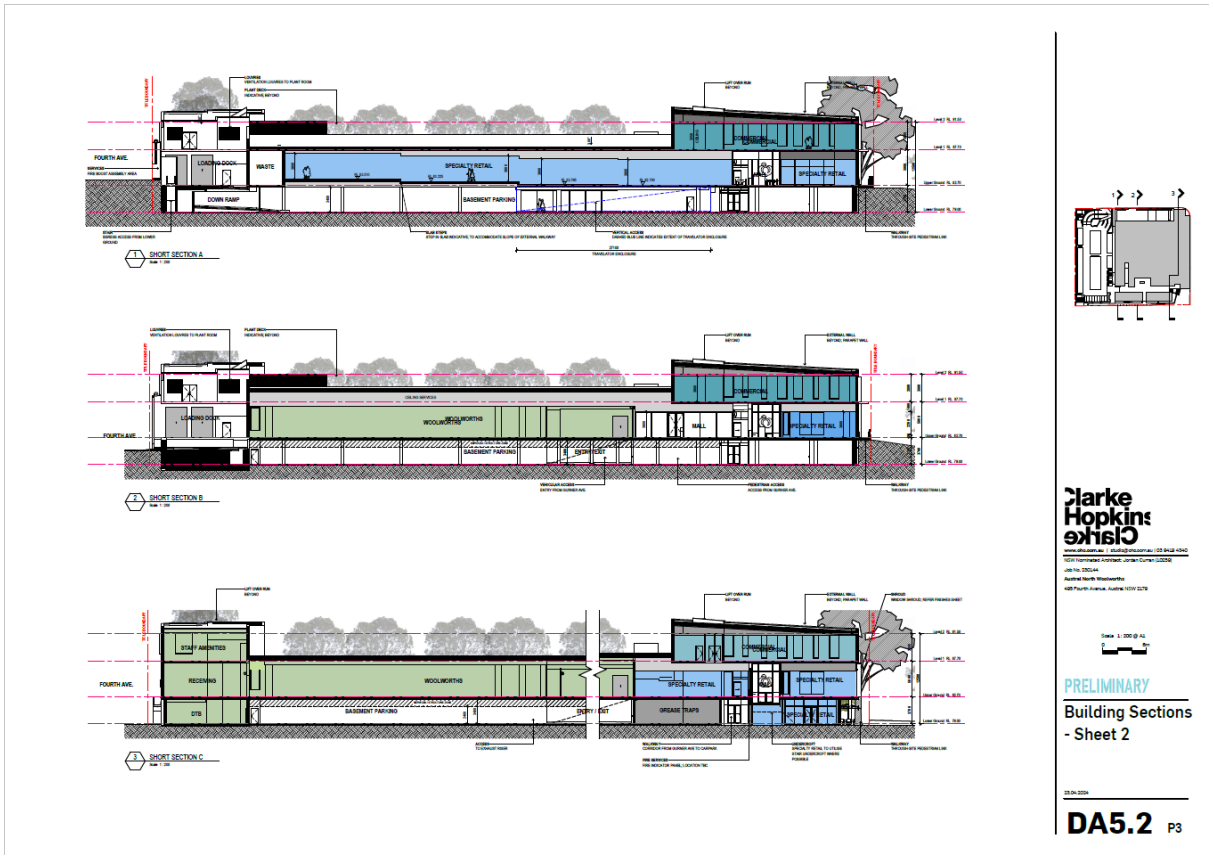


A.3.4 ROOF PLAN



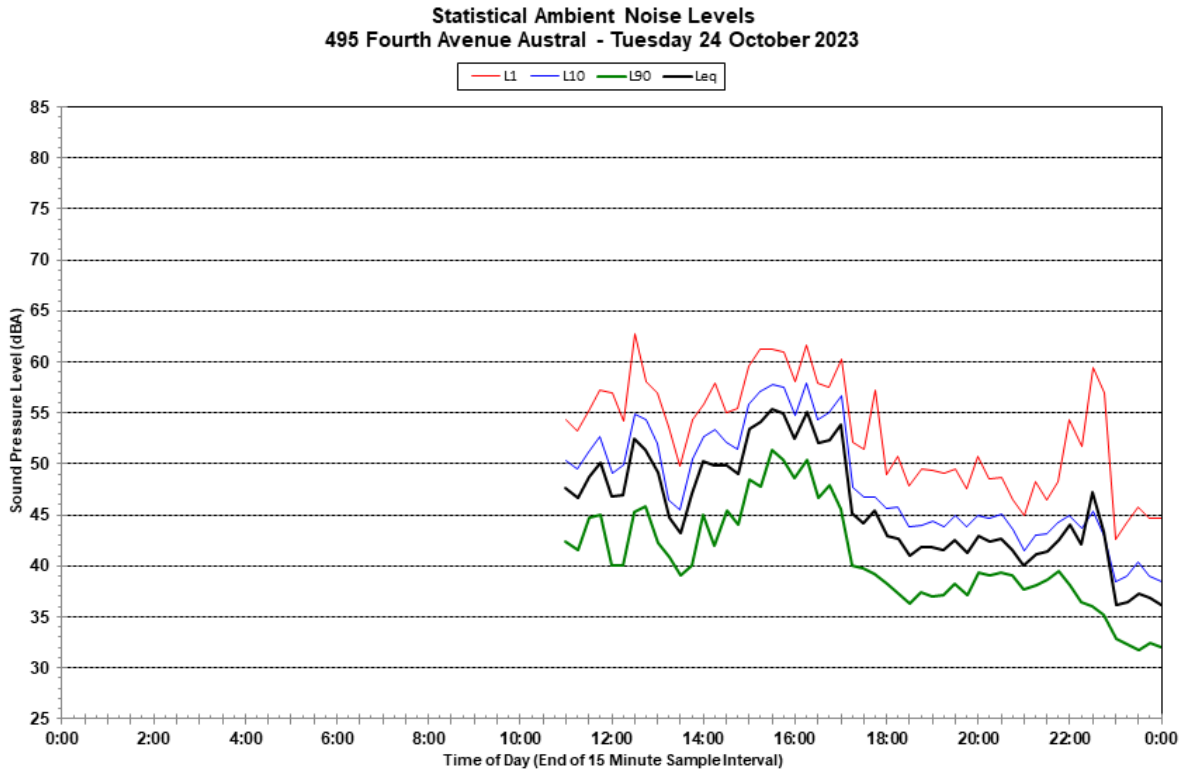
A.3.5 BUILING SECTIONS 01

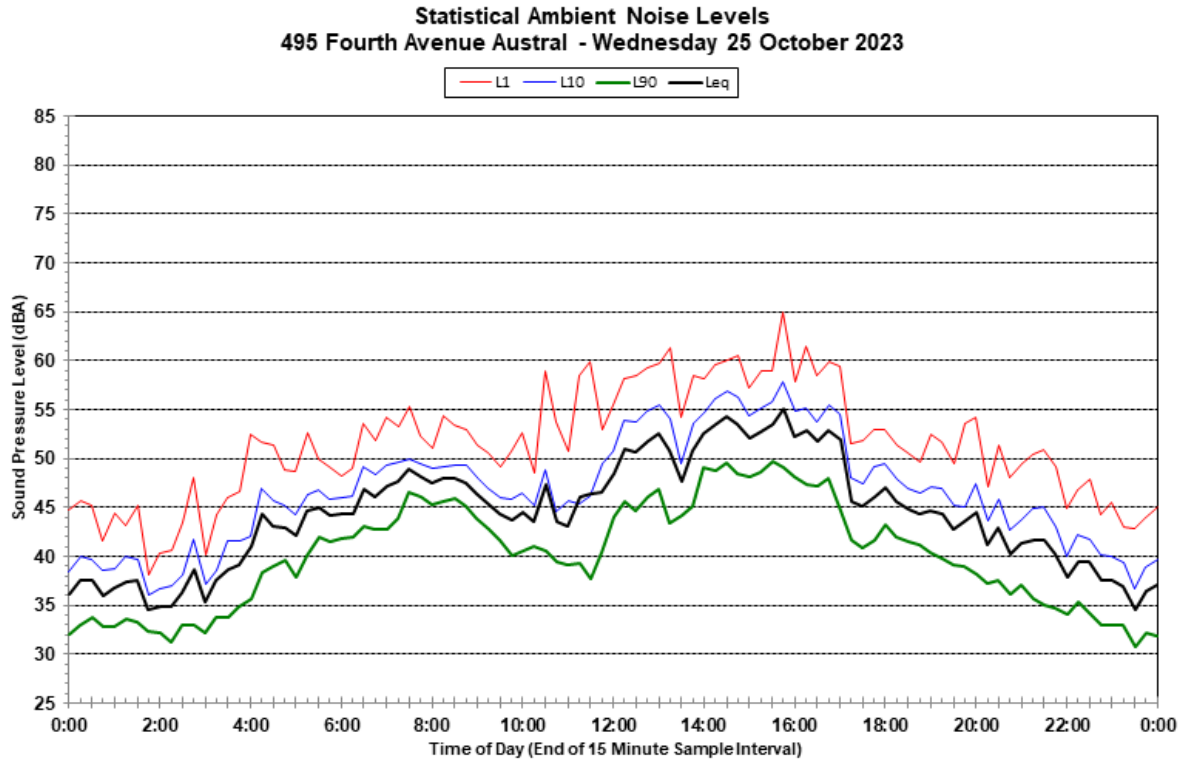
A.3.6 BUILDING SECTIONS 02

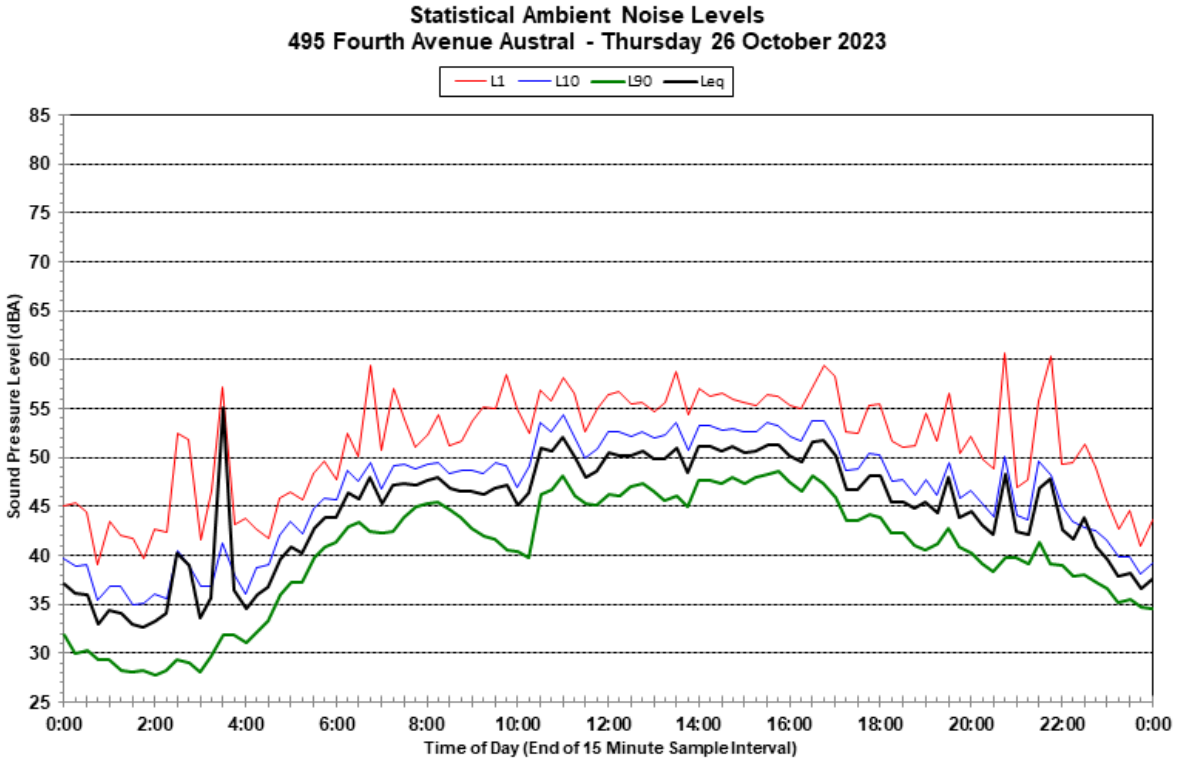


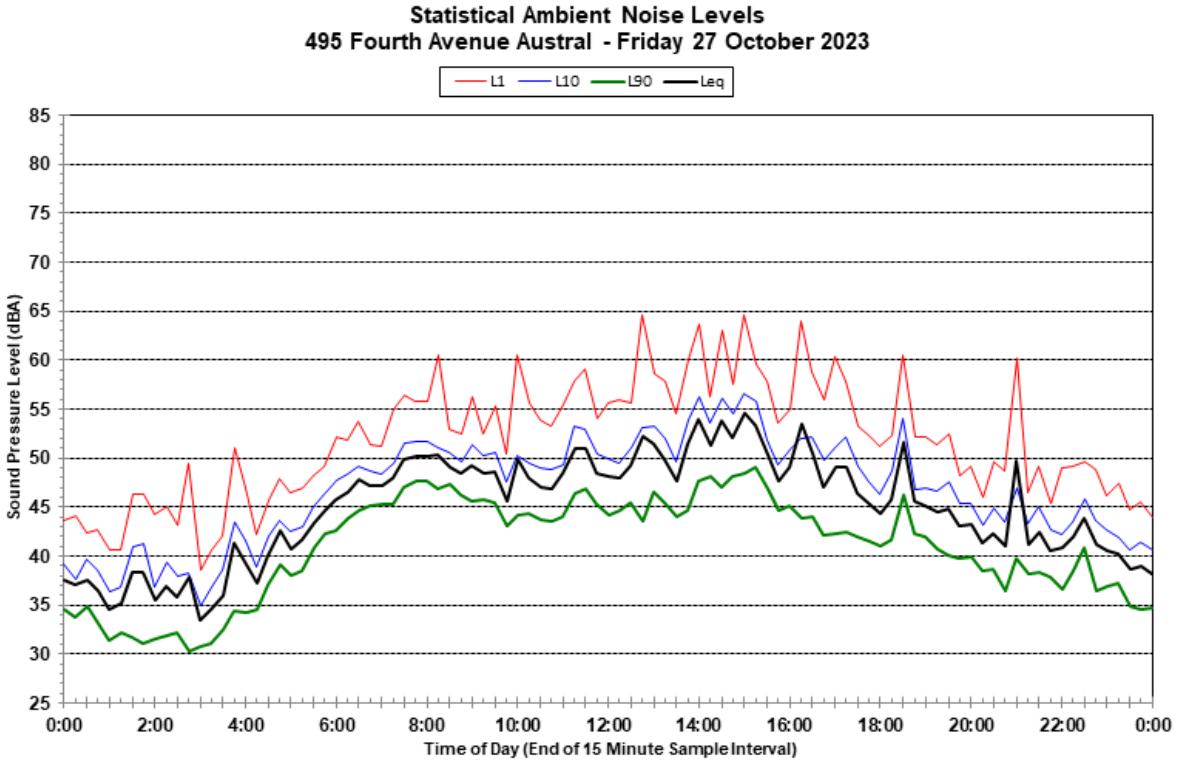
APPENDIX B – LOGGER DATA

B.1 UNATTENDED LOGGER DATA






Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Thursday 26 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Friday 27 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
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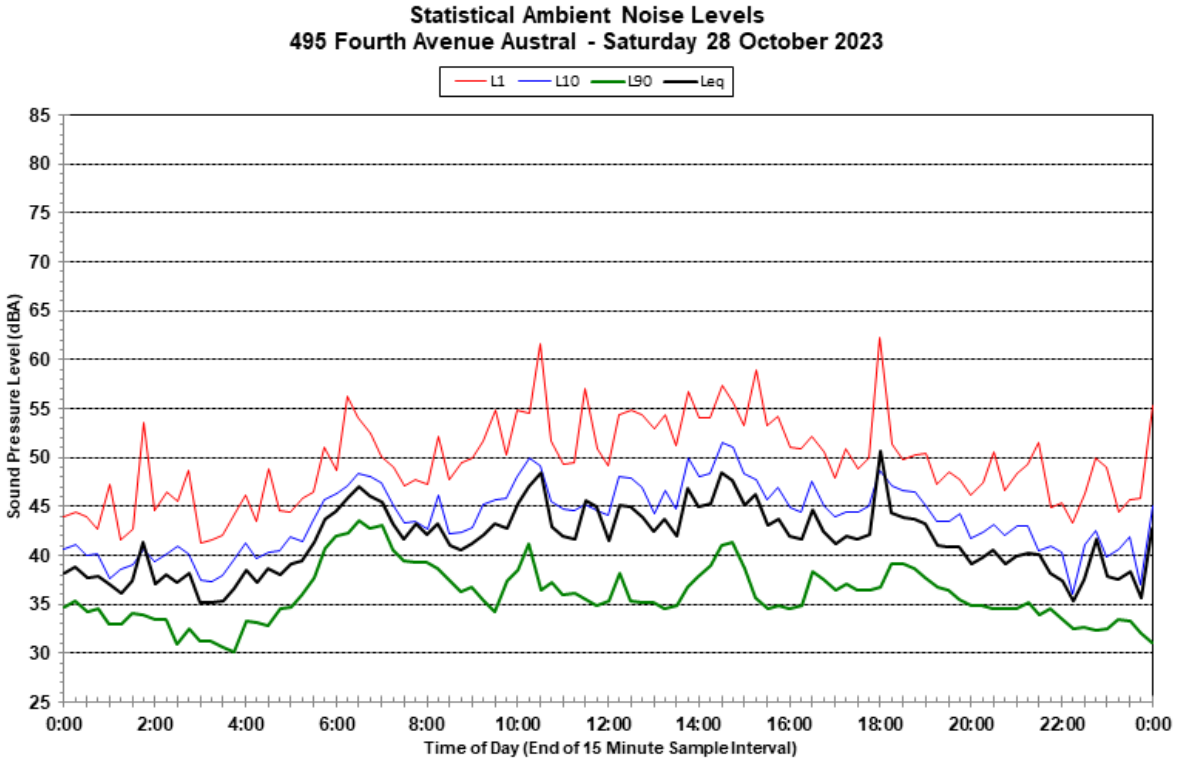
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Saturday 28 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
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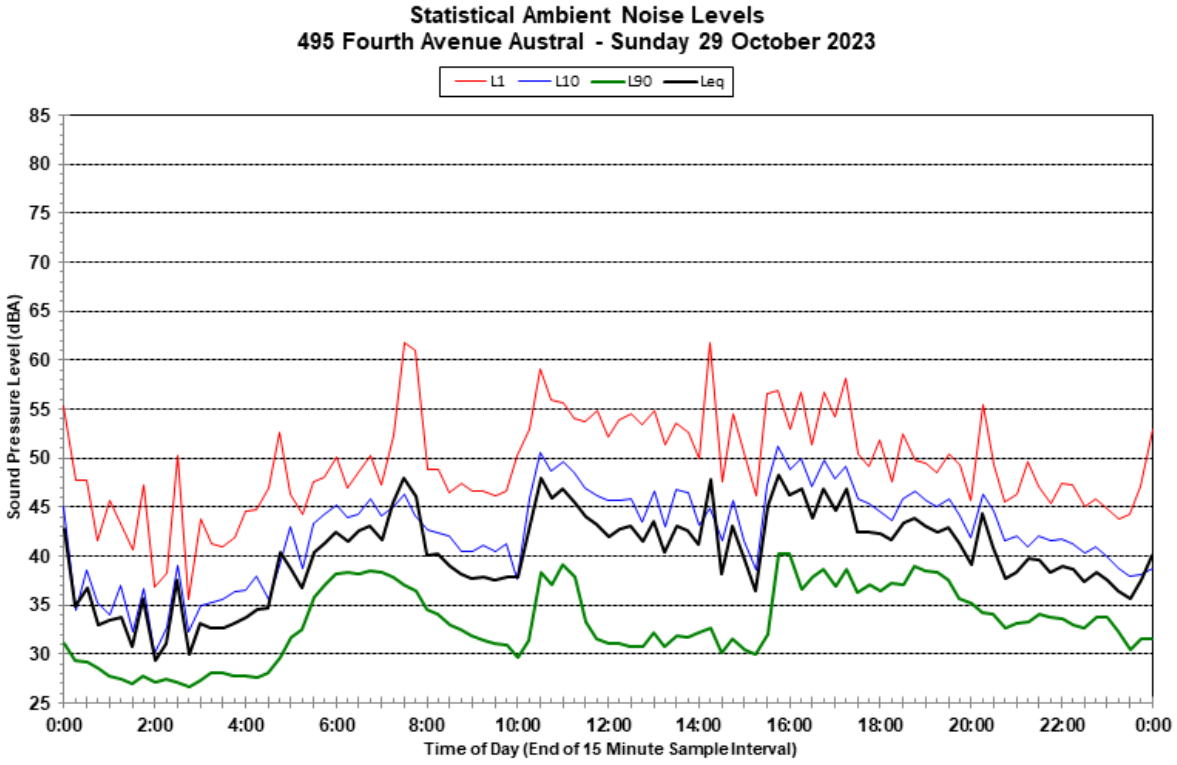
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Sunday 29 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
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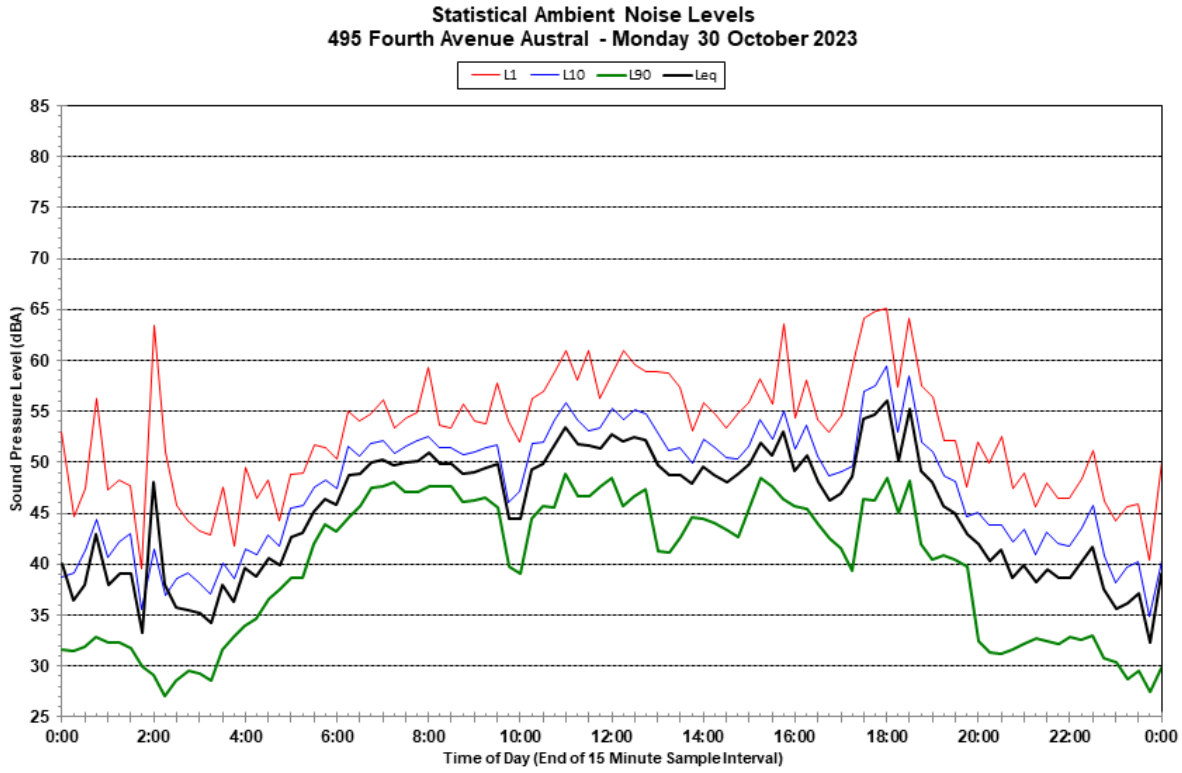
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Monday 30 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
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10:00
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20:00
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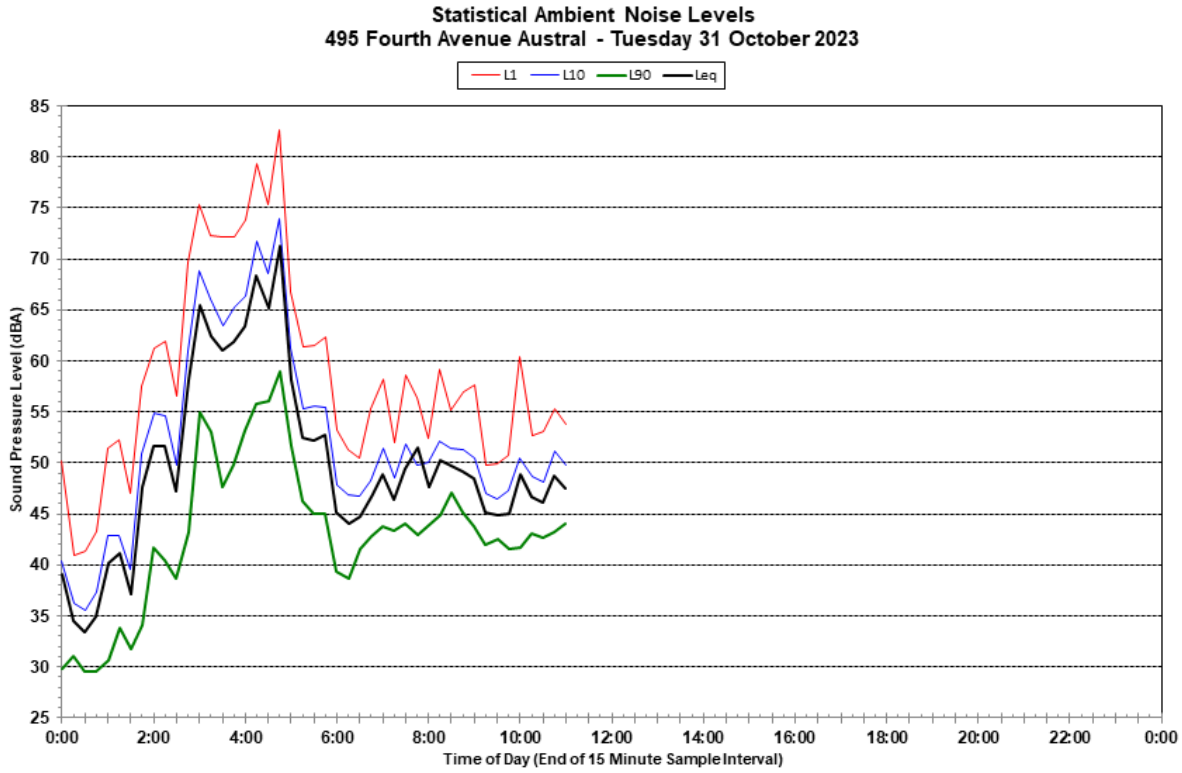
0:00
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
495 Fourth Avenue Austral - Tuesday 31 October 2023
L1
L10
L90
Leq
Sound Pressure Level (dBA)
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time of Day (End of 15 Minute Sample Interval)