RODNEY STEVENS ACOUSTICS
Acoustic Consultants
Member Australian Acoustical Society

Proposed Mixed Use Residential

297 Bringelly Road, Leppington NSW

Noise Impact Assessment

REPORT R170468R4

Revision 5

Prepared for:

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1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (RSA) has been engaged by Urban Link Pty Ltd to prepare a Noise Impact Assessment for the proposed mixed-use residential development at 297 Bringelly Road, Leppington NSW.

The primary purpose of the assessment is to determine the site's exposure to road traffic noise from Bringelly road and rail noise and vibration impacts from the T2 Inner West and Leppington line and where required provide in-principle design advice to achieve the requirements of acoustic amenity within future residential dwellings this also includes amenity from the proposed commercial spaces. A mechanical plant assessment for the site will also form part of this report.

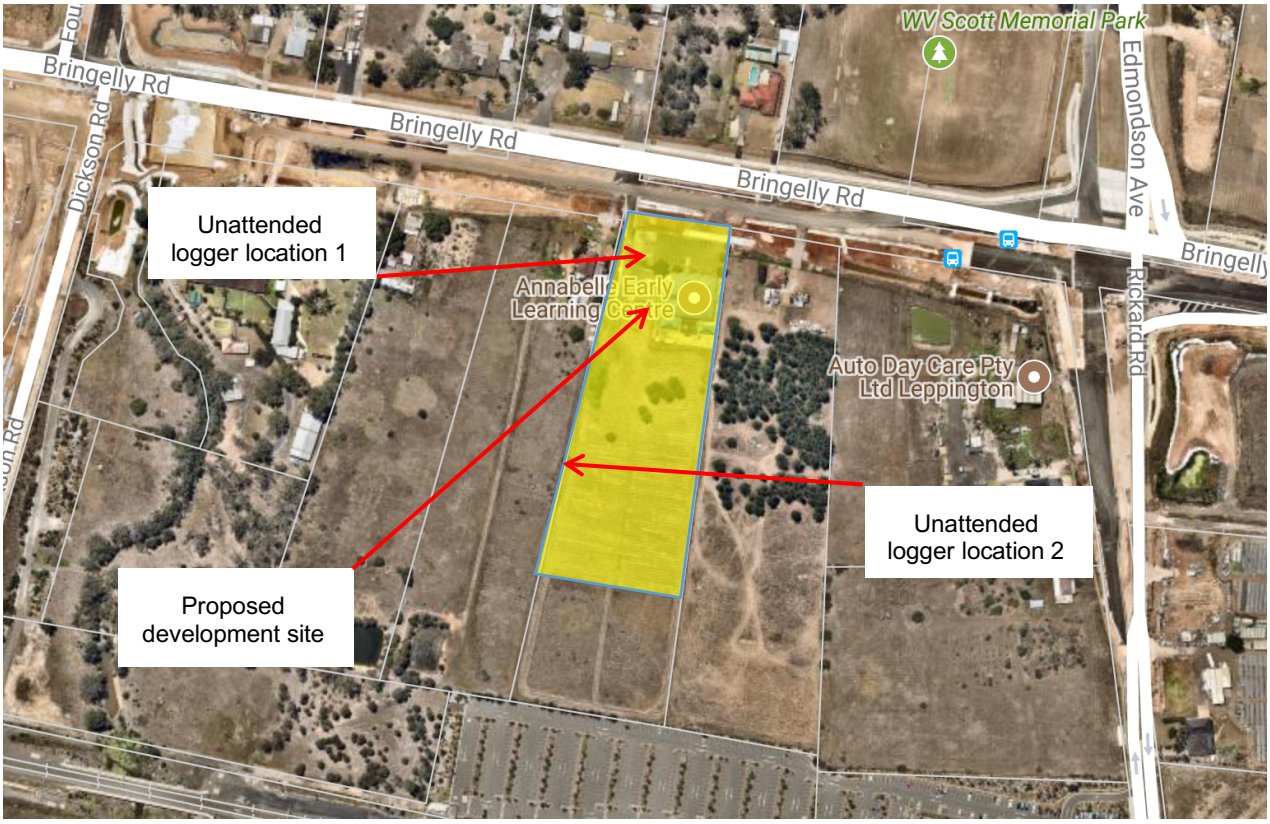
Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in Appendix C.

2 PROJECT OVERVIEW

2.1 Proposed Development

The proposed development is located at 297 Bringelly Road, Leppington. The project area and its surrounding environment are presented in Figure 2-1 below.

Figure 2-1 Project Area and Surrounding Environment



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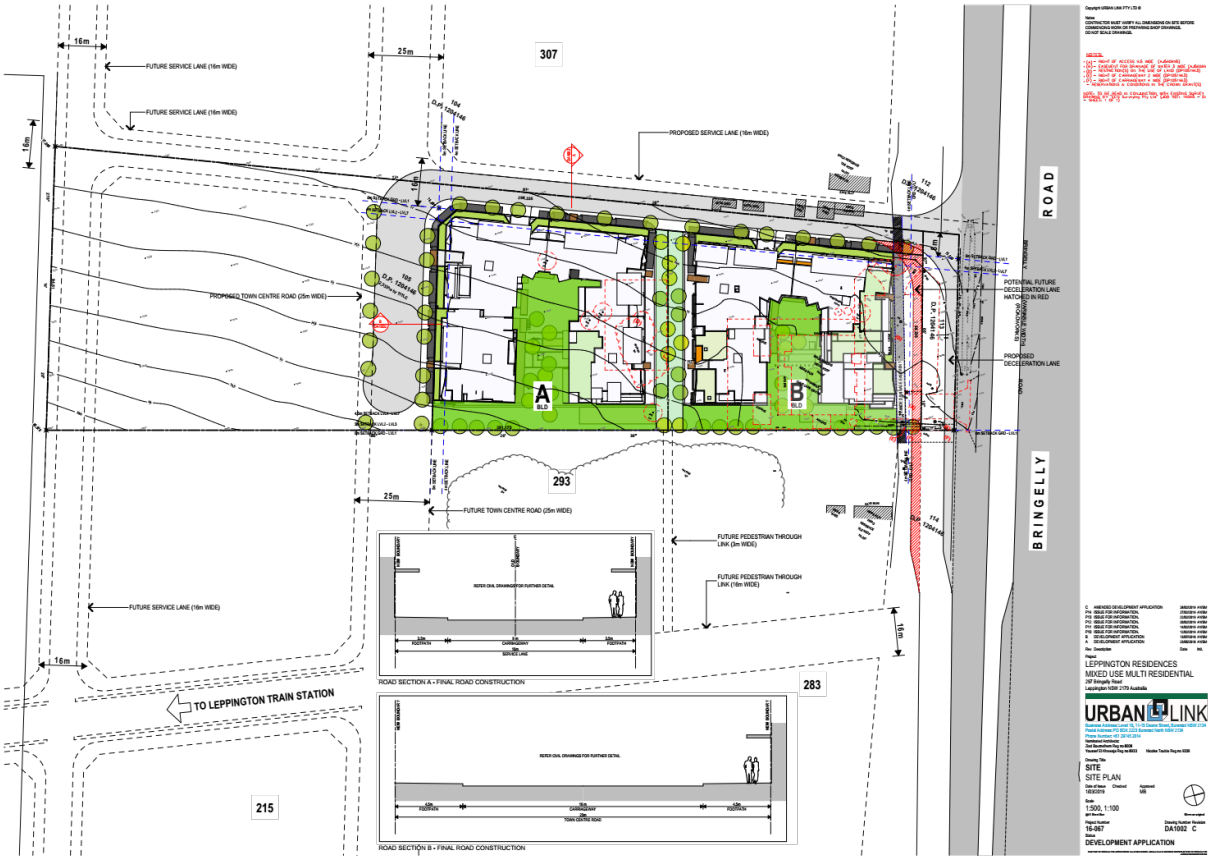
The proposed site layout and architectural drawings are presented in Figure 2-2 and Appendix D.

Figure 2-2 Proposed Site layout



3 EXISTING NOISE ENVIRONMENT

Unattended noise monitoring for the residential development was carried out between 4 April 2017 and 11 April 2017 at the locations shown in Figure 2-1.

The location was selected after a detailed inspection of the project area with consideration to other noise sources that may influence the readings, the proximity of noise-sensitive receivers and security issues for the noise monitoring device and gaining permission for access from the residents or landowners. The results of the ambient noise monitoring are shown in Table 3-1.

Instrumentation for the survey comprised of 2 RION NL-42 Environmental Noise Loggers (serial numbers 572559 and 184112) fitted with a microphone windshield. Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

From the measured noise levels, the results have been summarised and presented in Table 3-1. These results represent the external noise exposure to the proposed residential development site from the road traffic noise on Bringelly Road and the surrounding area. The monitored baseline noise levels are detailed in Table 3-1.

Table 3-1 Measured Existing Noise Levels Corresponding Assessment Time Periods

Location	Measurement Descriptor	Measured Noise Level – dBA re 20 µPa	
		Daytime 7.00 am – 10.00 pm	Night-time 10.00 pm – 7.00 am
Location 1	LAeq[1]	56	53
	RBL (Background)[2]	46	33
Location 2	LAeq[1]	48	47
	RBL (Background)[2]	40	35

Note 1: The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.
Note 2: The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

3.1 Road Traffic Noise Prediction

Calculation of the levels of road traffic noise likely to be experienced at the future residence constructed at the site have been carried out using the Calculation of Road Traffic Noise (CoRTN 1988) prediction method and the NSW Roads and Maritime Service's GHD Traffic & Transport Impact Assessment (21/24664) traffic volume figures for Bringelly Road.

Most recent RMS traffic volume count for Bringelly Road was conducted in 2015. Based on the GHD Road and Maritime Services Traffic Impact Assessment of the area, a 66% increase of background traffic on Bringelly Road has been assumed for a 10-year noise prediction. Based on extrapolation of the traffic volume data, we estimate that the AADT volume to be 10,726 vehicles for Year 2019 a 66% increase from 6,462 vehicles in 2015.

The predicted noise exposure levels to the proposed development from the road traffic from Bringelly Road is L_{Aeq} 67 dB(A) for day and L_{Aeq} 62 for night in 2029.

4 RAIL NOISE MEASUREMENTS

4.1 Attended Noise Measurements

Train noise measurements were carried to capture the typical noise levels from train pass bys. A set of 10 measurements were taken at approximately 80 metres from the railway line from the edge of the southern boundary line in line of sight with the rail corridor. Measurements were carried out on Wednesday 16 May 2018 between 6:30 pm and 8:30 pm

A NTI XL2-TA, serial (A2A-11435-E0) sound level meter was used to measure the train pass-by noise levels. The meter calibration setting was reference checked at the start and end of the monitoring period with a BSWA sound level calibrator. No significant drift was detected. Weather conditions were fine.

For each train pass by, the L_{Amax} and L_{AE} noise levels were recorded, as well as the frequency spectra of each of these parameters. "L_{AE}" refers to the sound exposure level (a measurement integrated over time, reflecting both the noise level and the duration of the event). L_{AE} values may be summed logarithmically and used to calculate the total daily noise exposure due to train noise emissions over the daytime (7.00 am to 10.00 pm) or night-time (10.00 pm to 7.00 am) periods. Train type and directions were noted during the measurements.

4.2 Measurement Conditions

Noise measurements were conducted at the approximate location of the southern boundary of the project area of the development. It has been determined that measurements performed at this location would be representative of rail noise entering the development.

4.3 Rail Noise Measurements

10 valid train noise measurements were conducted on Wednesday 16 May 2018. The train pass bys were 10 passenger trains. The results are summarised in Table 4-1 below.

Table 4-1 Measured Noise Levels

Time	Train Type	Direction	L_{AE} – dB(A)
6:45 pm	Passenger	East Bound	74
6:57 pm	Passenger	East Bound	72
7:08 pm	Passenger	East Bound	72
7:12 pm	Passenger	East Bound	68
7:23 pm	Passenger	East Bound	60
7:30 pm	Passenger	East Bound	72
7:38 pm	Passenger	East Bound	72
7:51 pm	Passenger	East Bound	76
7:54 pm	Passenger	East Bound	68
8:06 pm	Passenger	East Bound	69

5 ASSESMENT CRITERIA

5.1 Rail Noise and Vibration Criteria

The determination of an acceptable level of traffic noise impacting the internal residential spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities.

As sleep is the activity most affected by traffic noise, bedrooms are considered to be the most sensitive internal living areas. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to the television etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries etc. can be higher.

5.1.1 State Environmental Planning Policy (Infrastructure) 2007

Traffic and Rail Noise Criteria

The NSW Government's State Environmental Planning Policy (Infrastructure) 2007 (SEPP (Infrastructure) 2007) was introduced to facilitate the delivery of infrastructure across the State by improving regulatory certainty and efficiency. In accordance with the SEPP, Table 3.1 of the NSW Department of Planning and Infrastructure's "*Development near Rail Corridors and Busy Roads - Interim Guideline"* (the DP&I Guideline) of December 2008 provides noise criteria for residential and non-residential buildings. These criteria are summarised in Table 5-1 below:

Table 5-1 DP&I Interim Guideline Noise Criteria

Type of occupancy	Noise Level dB(A)	Applicable time period
Sleeping areas (bedroom)	35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)	40	At any time

Note 1: Airborne noise is calculated as $L_{Aeq(15hour)}$ daytime and $L_{Aeq(9hour)}$ night-time

The following guidance is also provided in the DP&I Guideline:

> *"These criteria apply to all forms of residential buildings as well as aged care and nursing home facilities. For some residential buildings, the applicants may wish to apply more stringent design goals in response to market demand for a higher quality living environment.*
>
> *The night-time "sleeping areas" criterion is 5 dB(A) more stringent than the "living areas" criteria to promote passive acoustic design principles. For example, designing the building such that sleeping areas are less exposed to road or rail noise than living areas may result in less onerous requirements for glazing, wall construction and acoustic seals. If internal noise levels with windows or doors open exceed the criteria by more than 10 dB(A), 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."*

Table 5-1 applies to a 'windows closed condition'. Standard window glazing of a building will typically attenuate noise ingress by 20 dB(A) with windows closed and 10 dB(A) with windows open (allowing for natural ventilation). Accordingly, the external noise threshold above which a dwelling will require mechanical ventilation is an $L_{Aeq(9hour)}$ of 55 dB(A) for bedrooms and $L_{Aeq(15hour)}$ of 60 dB(A) for other areas.

Where windows must be kept closed, the adopted ventilation systems must meet the requirements of the Building Code of Australia and Australian Standard 1668 – The use of ventilation and air conditioning in buildings.

Rail Vibration Criteria

Section 3.6.3 of the NSW Department of Planning and Infrastructure's "*Development near Rail Corridors and Busy Roads - Interim Guideline"* requires that intermittent vibration emitted by trains should comply with the criteria in the EPA's document Assessing Vibration: a technical guideline.

Table 2.4 of the "*Assessing Vibration guidelines"* sets out the following acceptable vibration dose values for residences affected by intermittent vibration:

Table 5-2 Acceptable vibration dose values for intermittent vibration in residences (m/s$^{\wedge 1.75}$)

Location	Period	Preferred VDV	Maximum VDV
Residences	Day (7am-10pm)	0.20	0.40
	Night (10pm-7am)	0.13	0.26

5.2 Camden Council Environmental Noise Policy

Part B, Section 5 of Camden Council's Environmental Noise Policy provides the criteria to assess noise intrusion from road traffic from local and major roads. The guideline provides a framework that "guides the consideration and management of traffic noise issues associated with new building developments near existing roads, and new upgraded road developments adjacent to new or planned building developments".

The main intention of this guideline is to allow:

• Council to develop and set their own controls and criteria for land uses that are affected by road traffic noise;

• Council to integrate land use and road transport planning;

• Inform road builders and their managers to select feasible and reasonable noise mitigation measures as required.

From the SEPP, "Part 3 - Division 17 Roads and Traffic, Clause 102 – Impact of road noise or vibration on non-road development", provides a number of sub-clauses that apply to development. This development involves buildings for residential use, a place of worship, a hospital, and educational establishments or child care centers that are proposed "on land in or adjacent to the road corridor that includes freeways, tollways or transit way or any other road with an annual average daily traffic volume of more than 40000 vehicles (RTA website) and that the consent authority considers is likely to be adversely affected by road noise or vibration".

The main intention of this SEPP with respect to noise is to ensure:

- that the Consent Authority considers any guidelines issued by the Director General prior to determining a development application; and

- that the proposed buildings for residential use comply with appropriate internal acoustic levels.

Council's Policy adopts the assessment criteria as contained within the ECRTN and the SEPP for assessing noise impact from road traffic noise on developments. However, consideration of the SEPP acoustic criteria

will only apply to developments impacted by roads that have an annual average daily traffic volume of more than 40,000 vehicles.

With reference to the SEPP, the consent authority must be satisfied that appropriate measures are taken to ensure that the following internal LAeq acoustic levels are not exceeded:

a) In any bedroom in the building - 35 dB(A) at any time between 10pm and 7am; and

b) Anywhere else in the building (other than the garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.

With reference to the Environmental Criteria for Road Traffic Noise (ECRTN) for road traffic noise intrusion into outdoor areas such as balconies, the following internal L_{Aeq} acoustic levels are not exceeded:

- New residential developments affected by traffic noise from local roads:
    - Between (Day) 7am – 10pm, $L_{Aeq(1hr)}$ 55 dB(A)
    - Between (Night) 10pm – 7am, $L_{Aeq(1hr)}$ 50 dB(A)

6 NOISE ASSESSMENT

6.1 Road Traffic Noise Intrusion – Internal Space

This assessment predicts future road traffic noise intrusion from Bringelly Rd, and the surrounding area to the proposed residential development.

Standard window glazing of a building will typically attenuate these noise levels by 20 dB(A) with windows closed and 10 dB(A) with windows open (allowing for natural ventilation). The predicted internal noise levels of the proposed residential units are presented in Table 6-1 for the windows open and windows closed scenarios. Standard window system (4 mm thick glass with aluminum frame) has been assumed for this prediction.

Table 6-1 Predicted Internal Noise Levels

Type of Occupancy	Descriptor	Internal Noise Level		Noise Criteria
		Windows Open	Windows Closed	
Residential Dwellings on the Northern Boundary				
Living Areas (Daytime)	$L_{Aeq,15hour}$	48 dB(A)	38 dB(A)	40 dB(A)
Living Areas (Night time)	$L_{Aeq,9hour}$	45 dB(A)	35 dB(A)	40 dB(A)
Sleeping Areas (Night time)	$L_{Aeq,9hour}$	45dB(A)	35 dB(A)	35 dB(A)

The predicted internal noise levels indicate that road traffic noise on the proposed residential dwellings will potentially exceed the noise criteria with windows opened for the residential dwellings. Further acoustic treatment is recommended for the development to comply with the SEPP criteria.

6.2 Road Traffic and Rail Noise Intrusion – Open spaces

Building B

Road traffic noise intrusion from Bringelly Road to the most sensitive residential private open spaces on the northern façade of Building B is predicted to be **58 dB(A)** $L_{Aeq(1hr)}$ **(Non-Compliant)** *. Noise intrusion the communal open areas on levels 5 & 6 north is predicted to be 52 dB(A) $L_{Aeq(1hr)}$ (Compliant) and negligible for open areas on level 5 & 6 south due to shielding. Noise intrusion to the larger central communal ground floor area is negligible due to shielding.

Note*: It must be noted that although the northern façade balconies do not comply to the 55dB(A) criteria set, these results are based on estimated 2029 future noise prediction levels and that a difference of 2dB(A) is manageable.

Building A

Due to both distance from Bringelly Road and the train line to the south and when considering the locations of all the open spaces of Building A and the shielding provided by Building B any noise intrusion to open spaces is considered negligible.

This assessment is based on similar designs including the provision of balcony balustrades and incidental barriers such as the landscape and the shielding caused by the development itself. **Buildings "A & B" are deemed to have enough distance from the train line so that any external rail noise into open spaces is negligible.**

6.3 Rail Noise

6.3.1 Rail Noise Intrusion Assessment

The sound exposure noise level (SEL) or L_{AE} measurements were used to calculate the $L_{eq(15hr)}$ and $L_{eq(9hr)}$ by extrapolating the measured results with the frequency of train pass-bys during the day time (07:00 to 22:00) and night time (22:00 to 07:00) periods, this was done by obtaining to number of train pass bys from the current CityRail timetable. We identified a number of 185 train pass bys for the daytime period and 45 trains for the nighttime period.

The final façade noise levels were predicted for each time period taking into account the distance attenuation from each respective source, virtual source, façade's orientation and any barrier effects.

The required noise reduction via the building façade for each respective room for each time period will be compared to determine the appropriate design criteria levels.

The internal noise levels were predicted accounting for the external noise levels, the area and sound attenuation properties of the façade elements and the dimensions and absorptive properties of the receiving room. The absorptive properties of the receiver rooms are typically governed by the furnishings. For this assessment all habitable rooms have been assumed to have timber flooring and all bathrooms and laundries are tiled.

It is typically accepted that an open window (fractionally open to meet ventilation requirements) results in an attenuation of external noise by 10 dB. This reduction has been used to predict the room noise level in the window open condition.

The calculated Rail $L_{eq(Period)}$ noise levels are presented in Table 6-2 below.

Table 6-2 Calculated L_{eq} Noise Levels For Day and Night Time periods

Location	Calculated Noise Level dB(A)	
	$L_{eq(15hour)}$ 7:00 to 22:00	$L_{eq(9hour)}$ 22:00 to 7:00
Southern Facade	20	16

7 RECOMMENDATIONS

Based on the above-predicted road traffic noise impact the following noise control measures are recommended for the residential units:

The following units will require alternative ventilation methods which meet the ventilation requirements of the BCA and Australian Standard AS 1668.2:2002 will be required and design input should be sought from an appropriately qualified mechanical services consultant.

- Residential units on the northern, eastern and western facades of the northern block of Building B (Levels 1-6). (With the exclusion of units with wintergardens providing a stream of natural ventilation throughout the unit) will require alternate ventilation. Facades in question are highlighted in RED in Appendix D. All remaining facades may have natural ventilation.

Based on the predicted internal noise levels, glazed windows and doors certain facades of residential development should have the following minimum Rw rating as indicated in Table 7-1 below.

Table 7-1 In-principle Glazing Recommendations

Location	Glazing Type	Minimum Glazing Rw Rating	Indicative Glazing System
(Building B) Residential Dwellings (Northern, Western and Eastern Facades) 1st Floor to 6th Floor			
Living Rooms	Sliding Door	Rw 30	6.38mm laminated glass in acoustically sealed frame*
	Sliding Window	Rw 30	6.38mm laminated glass in acoustically sealed frame*
Bedrooms	Sliding Door	Rw 32	6.38mm laminated glass in acoustically sealed frame*
	Sliding Window	Rw 32	6.38mm laminated glass in acoustically sealed frame*
(Building A) Residential Dwellings (Southern Façade/Communal Open Space) Ground Floor			
Living Rooms	Sliding Door	Rw 30	6.38mm laminated glass in acoustically sealed frame*

	Sliding Window	Rw 30	6.38mm laminated glass in acoustically sealed frame*
Bedrooms	Sliding Door	Rw 32	6.38mm laminated glass in acoustically sealed frame*
	Sliding Window	Rw 32	6.38mm laminated glass in acoustically sealed frame*
(Building A) Residential Dwellings Southern, Western and Eastern Facades (Including the inner communal area Northern facing façade) 1st Floor to 6th Floor			
Living Rooms	Sliding Door	Rw 30	6.38mm laminated glass in acoustically sealed frame*
	Sliding Window	Rw 30	6.38mm laminated glass in acoustically sealed frame*
Bedrooms	Sliding Door	Rw 32	6.38mm laminated glass in acoustically sealed frame*
	Sliding Window	Rw 32	6.38mm laminated glass in acoustically sealed frame*

Note *: glazing system are for reference only. Any glazing system to be installed for the development is to achieve the minimum Rw rating indicated above.

It must be noted that the above glazing recommendations take into consideration any noise generated by the proposed commercial and retail areas on the ground floor, glazing specification for Building A have thus been increased. Glazing recommendations for Building B are deemed to be sufficient. This is in direct response to council DA condition *Environmental Health 2. (External Noise).*

Standard glazing may be used for all other glazing throughout the development. This can be achieved with standard aluminium frames, seals and 4mm glass panes. Other glazing systems may be available but their Rw rating must be reviewed in accordance with Table 5-1. No further acoustic requirements are needed

Please note Rw ratings provided in Table 7-1 rely on the acoustic performance of the window glazing and frame. Rw ratings should be checked with glazing manufacturers and frames should be selected and installed as to not degrade the performance of the glazing. It is also recommended that glazing specifications are reviewed at the detailed design stage, most notably if changes to the glazing area are made throughout the design.

8 NOISE INTRUSION FROM RETAIL PREMISES

Urban Link has advised that wall and ceiling construction for adjoining residential and retail premises will consist of **Hebel walls, concrete slabs and dropped ceilings**. Due to possible internal noise intrusion from retail premises to adjoining dwellings these structural elements must have a **Rw+Ctr = 50**. If construction types are to change at a later stage, structural elements will need to uphold the specified recommended values.

9 VIBRATION ASSESSMENT

Due to the distance of the boundary line of the proposed development being greater than 25 meters to the T2 Inner West and Leppington line, a vibration assessment will not be required as part of this report. Furthermore, due to the distance to the site any train vibration is deemed negligible.

10 MECHANICAL PLANT AND OPERATIONS ASSESSMENT

10.1 Operational Noise Project Trigger Noise Levels

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the EPA. The EPA oversees the Noise Policy for Industry (NPfI) October 2017 which provides a framework and process for deriving project trigger noise level. The NPfI project noise levels for industrial noise sources have two (2) components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

10.1.1 Intrusiveness Noise Levels

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness noise level essentially means that the equivalent continuous noise level (LAeq) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15-minute period.

10.1.2 Amenity Noise Levels

The amenity noise level is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The noise levels relate only to other industrial-type noise sources and do not include road, rail or community noise. The existing noise level from industry is measured.

If it approaches the project trigger noise level value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the project trigger noise level.

10.1.3 Area Classification

The NPfI characterises the “Suburban” noise environment as an area with an acoustical environment 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

The area surrounding the proposed development falls under the “Suburban” area classification.

10.1.4 Project Specific Trigger Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific project trigger noise level. The intrusive and amenity project trigger noise level for nearby residential premises are presented in Table 10-1. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 10-1.

Table 10-1 Project Specific Trigger Noise Levels

Receiver	Time of Day	ANL [1] $L_{Aeq(15min)}$	Measured		Project specific Noise Levels	
			RBL [2] $L_{A90(15min)}$	L_{Aeq} Noise Level)	Intrusive $L_{Aeq(15min)}$	Amenity [3] $L_{Aeq(15min)}$
Residential	Day	55	40	53	**45**	55
	Evening	45	40	48	**45**	45
	Night	40	35	47	**40**	40

Note 1: ANL = "Acceptable Noise Level" for residences in Suburban Areas.
Note 2: RBL = "Rating Background Level".

11 OPERATIONAL NOISE ASSESSMENT

11.1 Mechanical Plant Noise Assessment

The proposed development is understood to be serviced by comfort ventilation of the individual living units using vented air conditioning. Mechanical plant design for the development includes the operation of multiple AC fan units, service fans, car park supply fans and car park exhaust fans. The noise data for the mechanical plants are presented in the table below:

Table 11-1 Sound Power Levels

Mechanical Plant	Resultant Noise Level per Octave Band (dB)						Overall (dBA)
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
CPEF 01 (Building A)	90	92	93	92	90	87	76
CPEF 02 (Building A)	97	93	93	90	89	86	75
CPSF 01 (Building A)	102	98	98	93	94	90	80
AC Condenser Units (Building A)	-	-	-	-	-	-	66
Carpark exhaust fan (Building B)	101	99	97	97	94	90	81
Carpark supply fan (Building B)	99	97	97	94	93	90	79
AC Condenser Units (Building B)	-	-	-	-	-	-	66

The noise impact to the surrounding residents from the operation of the mechanical plants have been calculated and presented in the table below. AC units and fans are partially shielded by proposed building façade and existing barriers and have factored into the calculations.

Table 11-2 Mechanical Plant Noise Assessment at Nearby Noise Sensitive Receiver

Residential Receiver	Noise Source	Resultant Noise Level at Sensitive Receiver	Criteria	Compliance (Y/N)
400 Bringelly Rd (north)	Mechanical Plant	22	Day: 45 dB(A) Evening: 45 dB(A) Night: 35 dB(A)	Y
293 Bringelly Rd (east)	Mechanical Plant	35		Y
307 Mitchell Ave (West)	Mechanical Plant	33		Y

* We note that an exceedance of 1 dB(A) is generally regarded as being acoustically insignificant

The operation of the mechanical plant shows compliance to all sensitive receivers.

The noise modelling has taken assumed the noise control measures presented in the mechanical plans and incorporated attenuation recommendations by Rodney Stevens Acoustics. The acoustic measures included below in section 11.2.

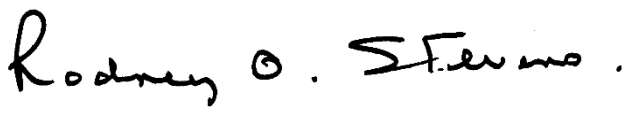
11.2 Mechanical Plant Noise Recommendations

- Both ducts for the CPSF and CPEF for both buildings A and B are lined with 50mm thick insulation for the first 3m from the fan to the duct (outlet).
- Building B's CPEF 01 should be relocated to the roof.
- All AC units are operating on Night Mode from 10pm - 7am

12 CONCLUSION

Rodney Stevens Acoustics has conducted a Road Traffic, Mechanical Plant and a Rail Noise and Vibration Assessment for the proposed residential development site at 297 Bringelly Road, Leppington NSW. The assessment has been conducted to satisfy State Environmental Planning Policy (Infrastructure) 2007 Clause 102, the EPA's NPfI and other regulatory criteria. With the recommendations set out in this report RSA

Approved: -



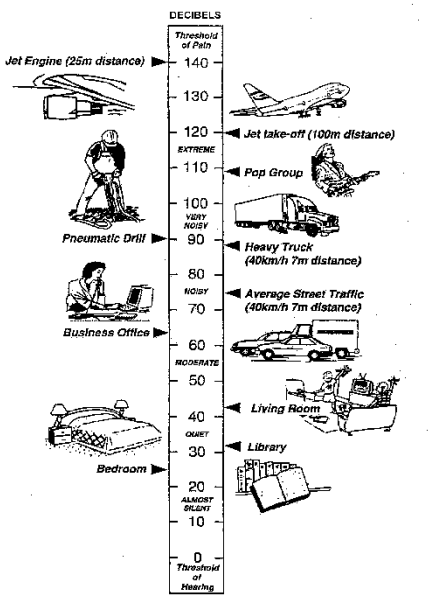
Rodney Stevens - MAAS

Appendix A – Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: ▪ character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) ▪ character of the environment (e.g. very quiet suburban, suburban, urban, near industry) ▪ miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) ▪ human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, considering the following factors: ▪ Noise mitigation benefits (amount of noise reduction provided, number of people protected). ▪ Cost of mitigation (cost of mitigation versus benefit provided). ▪ Community views (aesthetic impacts and community wishes).

- Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10^{th} percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound Power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

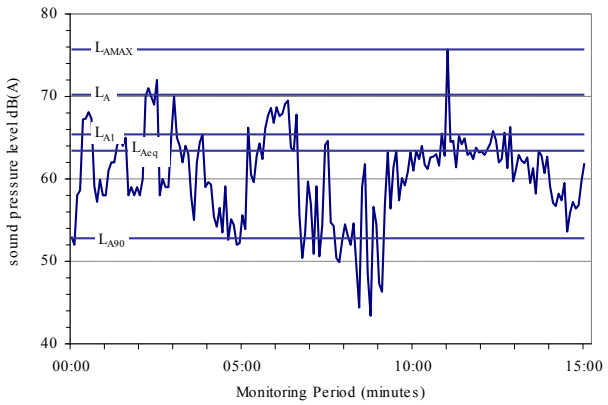
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistical noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15-minute measurement period is indicated in the following figure:



Key descriptor

- LAmax Maximum recorded noise level.

- L_{A1} The noise level exceeded for 1% of the 15 minute interval.
- L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.
- L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
- L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dBA penalty is typically applied to noise sources with tonal characteristics.

Appendix B – Calibration Certificates

Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013

Calibration Certificate

Calibration Number C17321

Client Details Rodney Stevens Acoustics Pty Ltd
1 Majura Close
St Ives Chase NSW 2075

Equipment Tested/ Model Number : Rion NL-42EX
Instrument Serial Number : 00572559
Microphone Serial Number : 170395
Pre-amplifier Serial Number : 72897

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.4°C	Ambient Temperature :	21.5°C
Relative Humidity :	42.9%	Relative Humidity :	42.3%
Barometric Pressure :	99.19kPa	Barometric Pressure :	99.15kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 04/07/2017
Secondary Check: Riley Cooper
Report Issue Date : 04/07/2017

Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic tests of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2013
Calibration Certificate

Calibration Number C18124

Client Details	Rodney Stevens Acoustics Pty Ltd 1 Majura Close St Ives Chase NSW 2075
Equipment Tested/ Model Number :	Rion NL-42EX
Instrument Serial Number :	00184112
Microphone Serial Number :	173008
Pre-amplifier Serial Number :	74638

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.8°C	**Ambient Temperature :**	22.3°C
Relative Humidity :	57.6%	**Relative Humidity :**	58.2%
Barometric Pressure :	99.35kPa	**Barometric Pressure :**	99.37kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 5 Mar 2018
Secondary Check: Riley Cooper
Report Issue Date : 5 Mar 2018

Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.15dB*	*Temperature*	*±0.07°C*
12.5kHz	*±0.21dB*	*Relative Humidity*	*±0.58%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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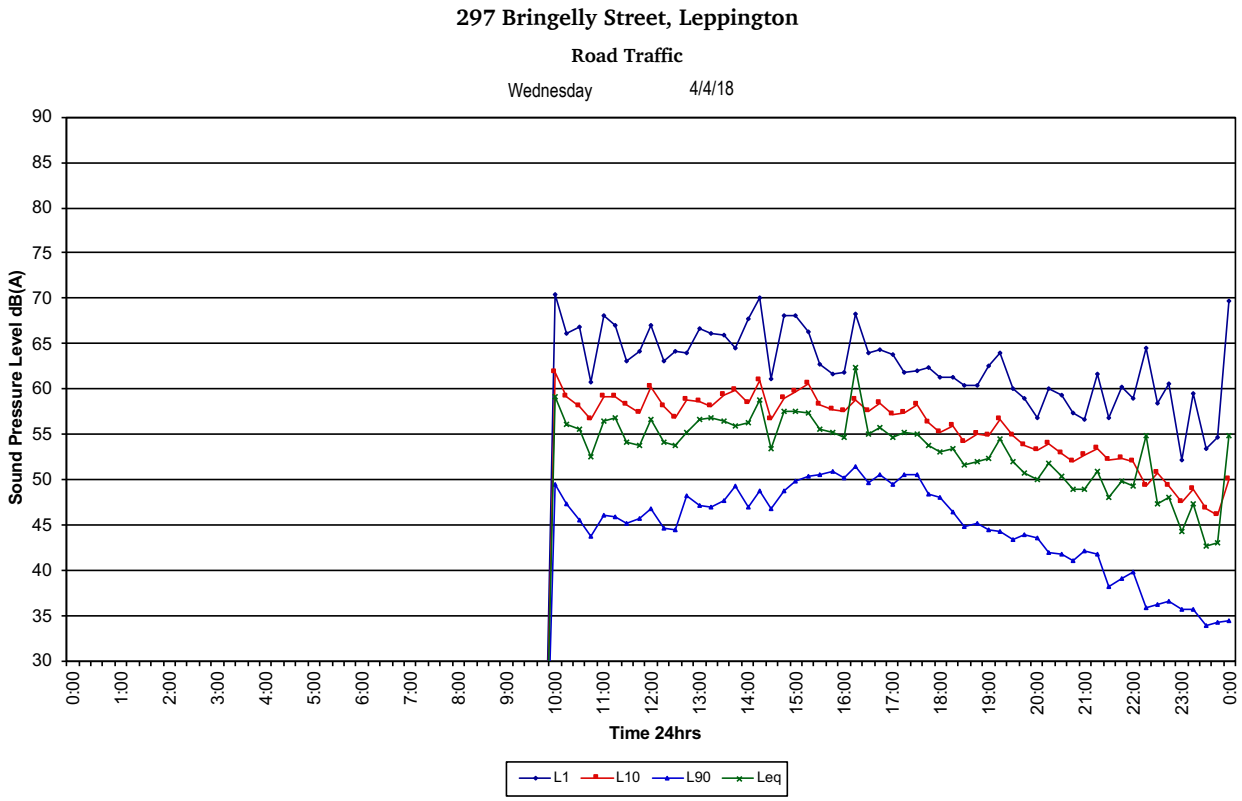
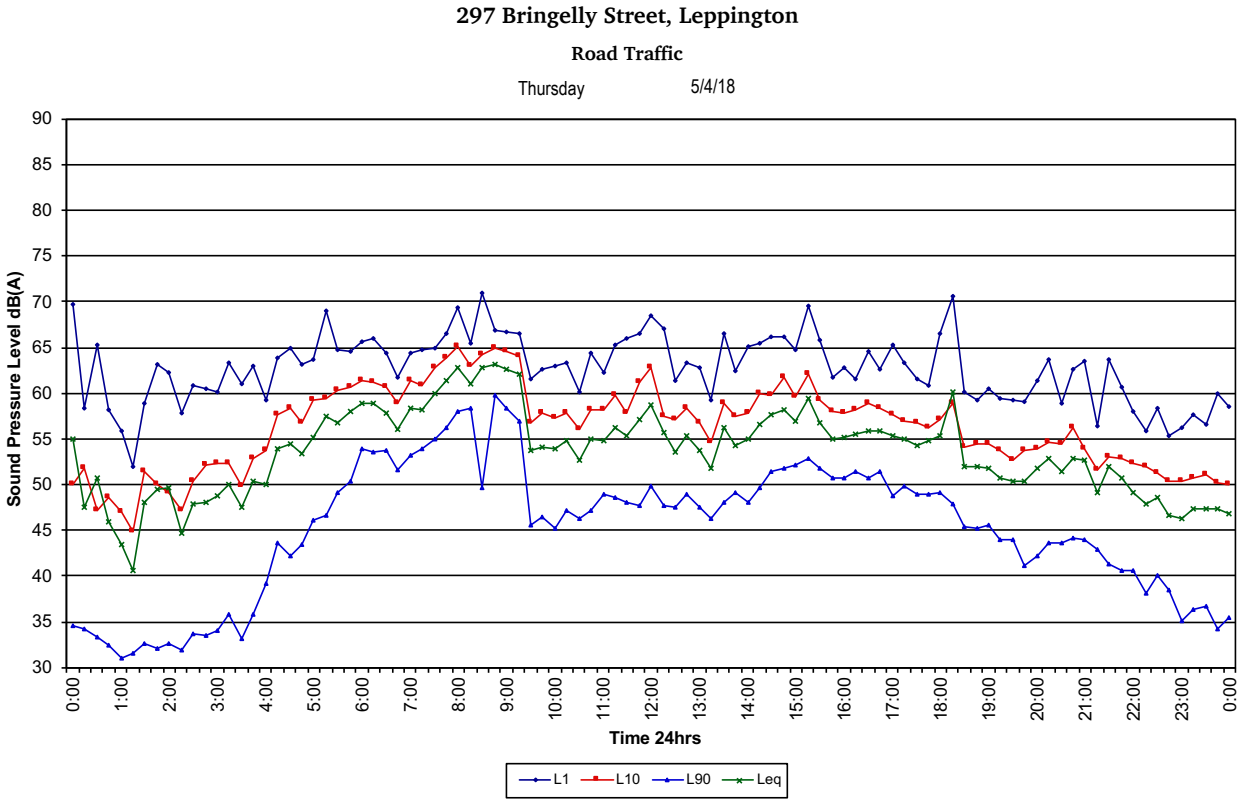
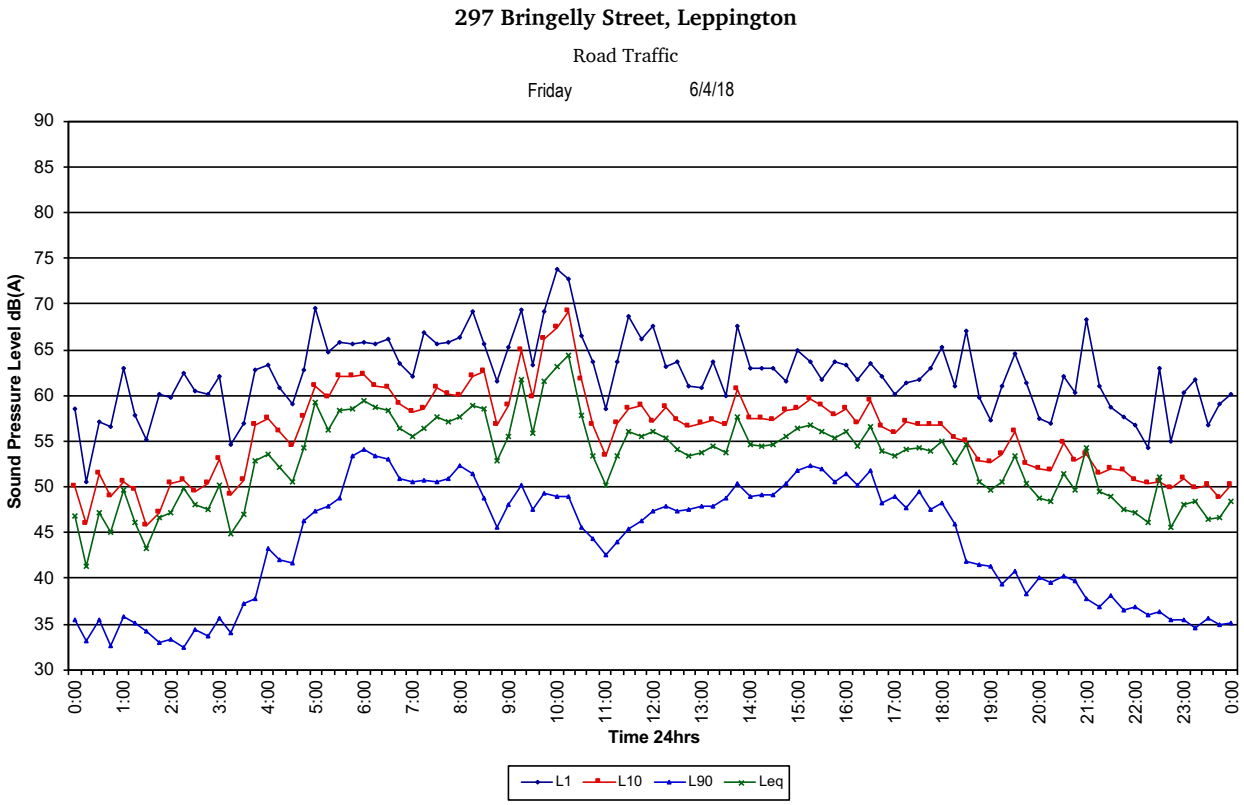
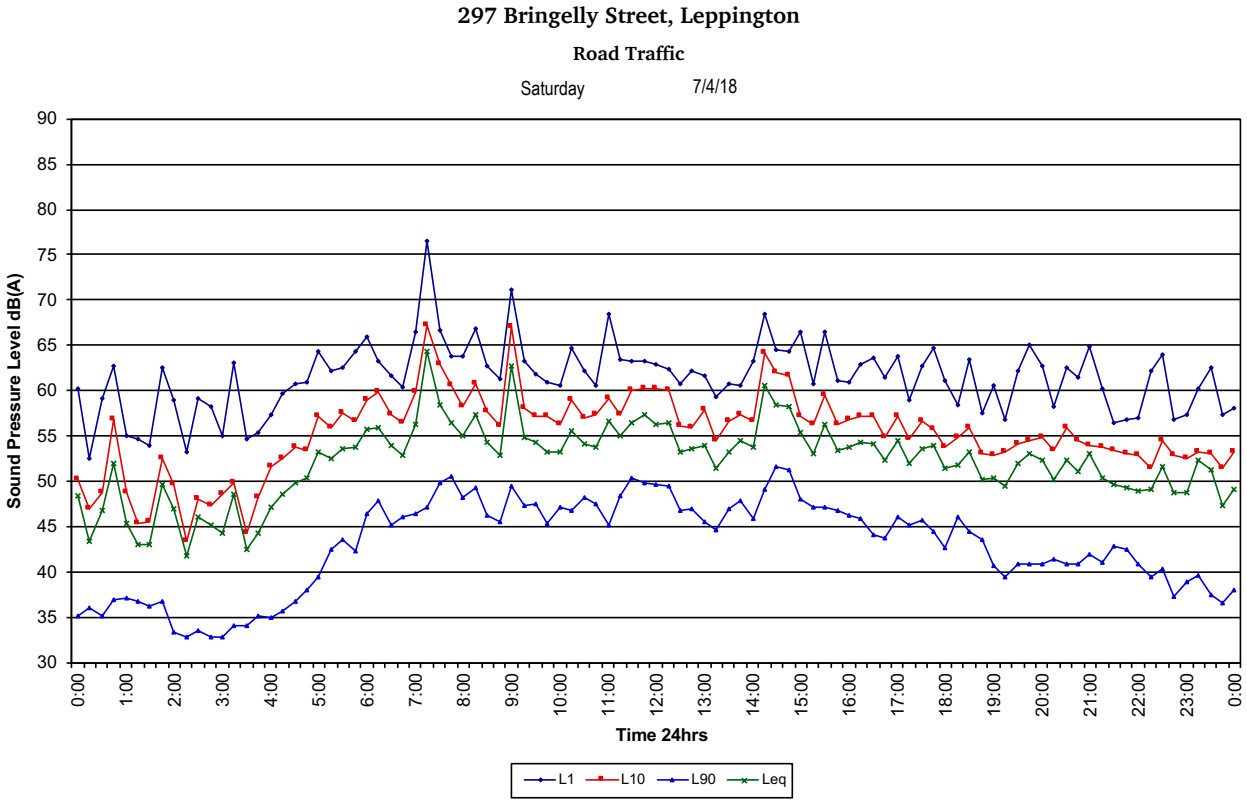
Appendix C – Unattended Noise Monitoring Results






297 Bringelly Street, Leppington
Road Traffic
Friday 6/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time 24hrs
L1
L10
L90
Leq


297 Bringelly Street, Leppington
Road Traffic
Saturday 7/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
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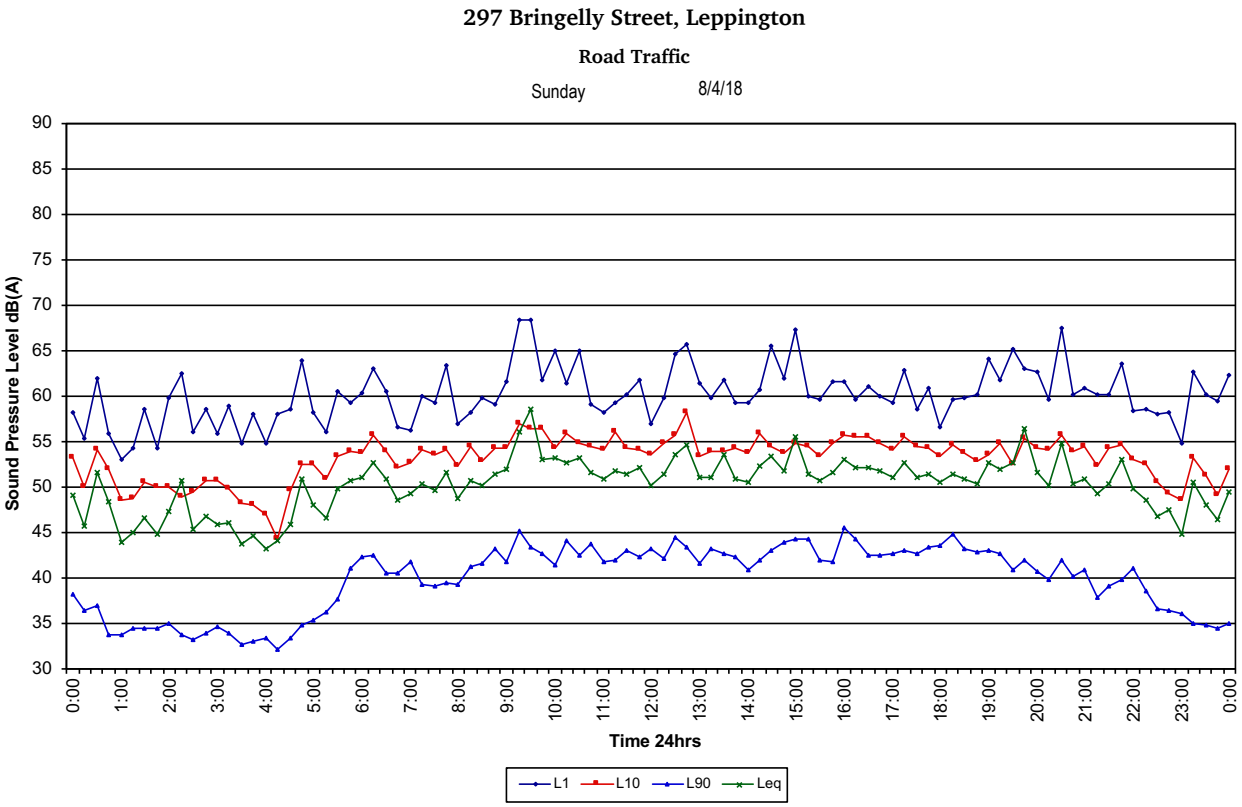
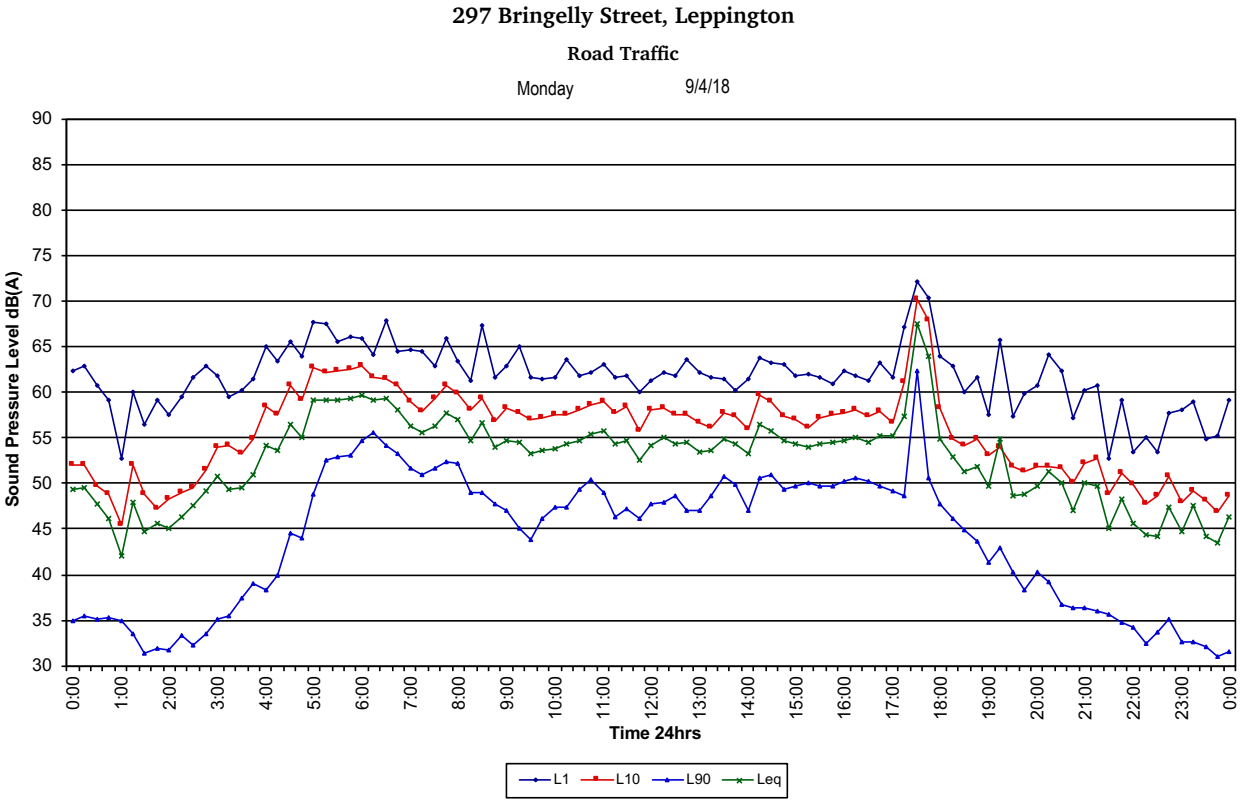
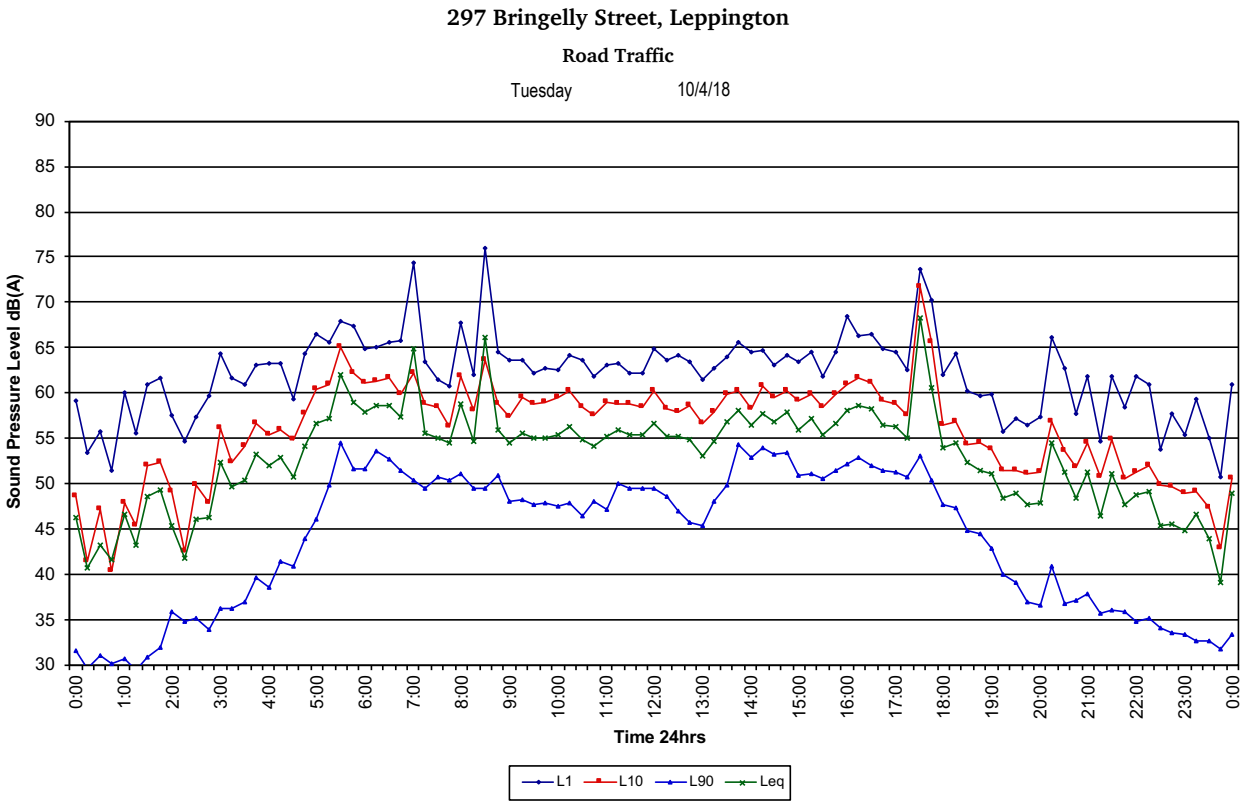
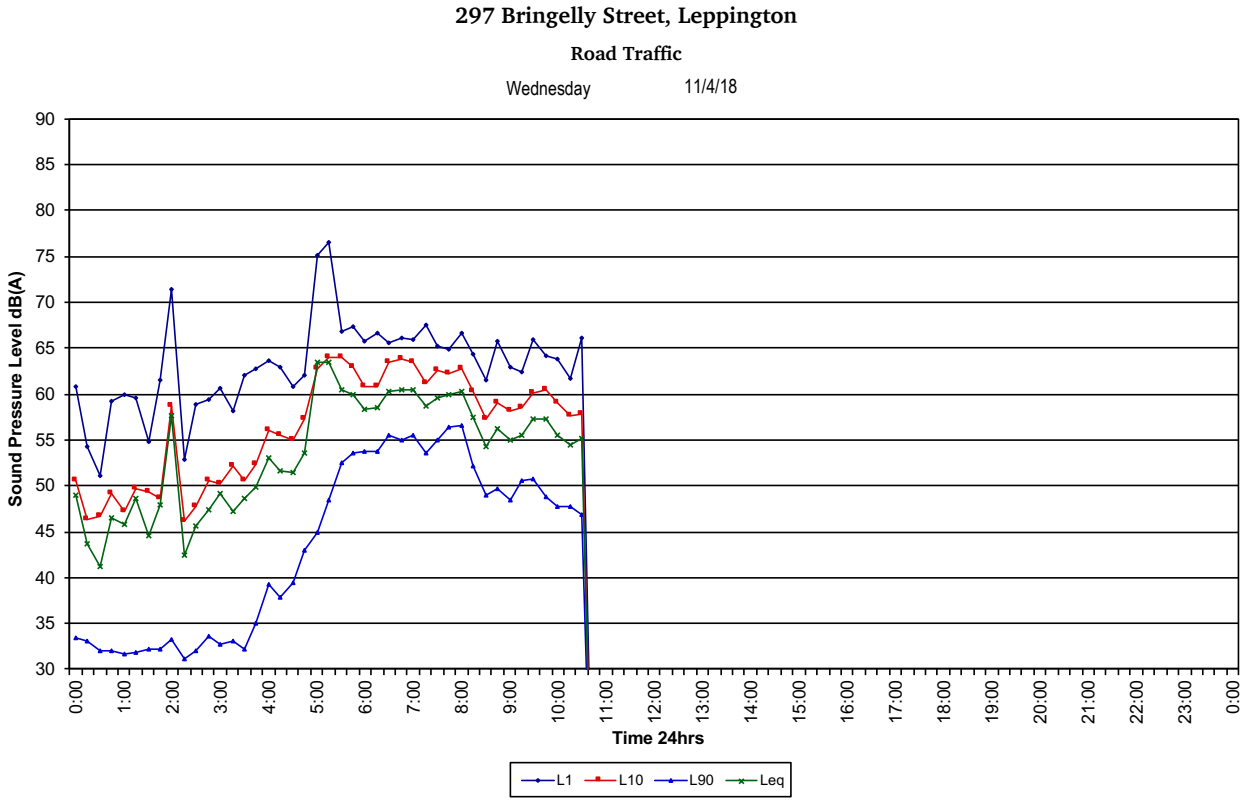
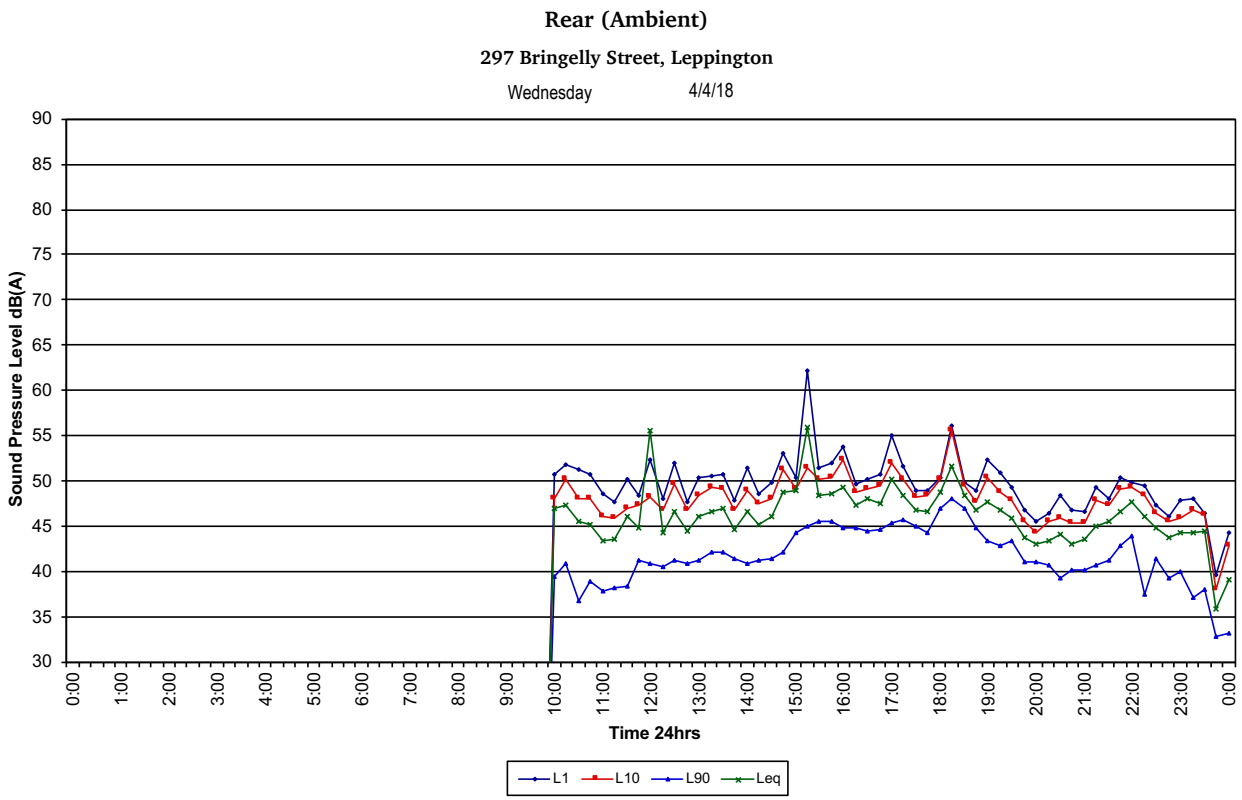
20:00
21:00
22:00
23:00
0:00
Time 24hrs
L1
L10
L90
Leq

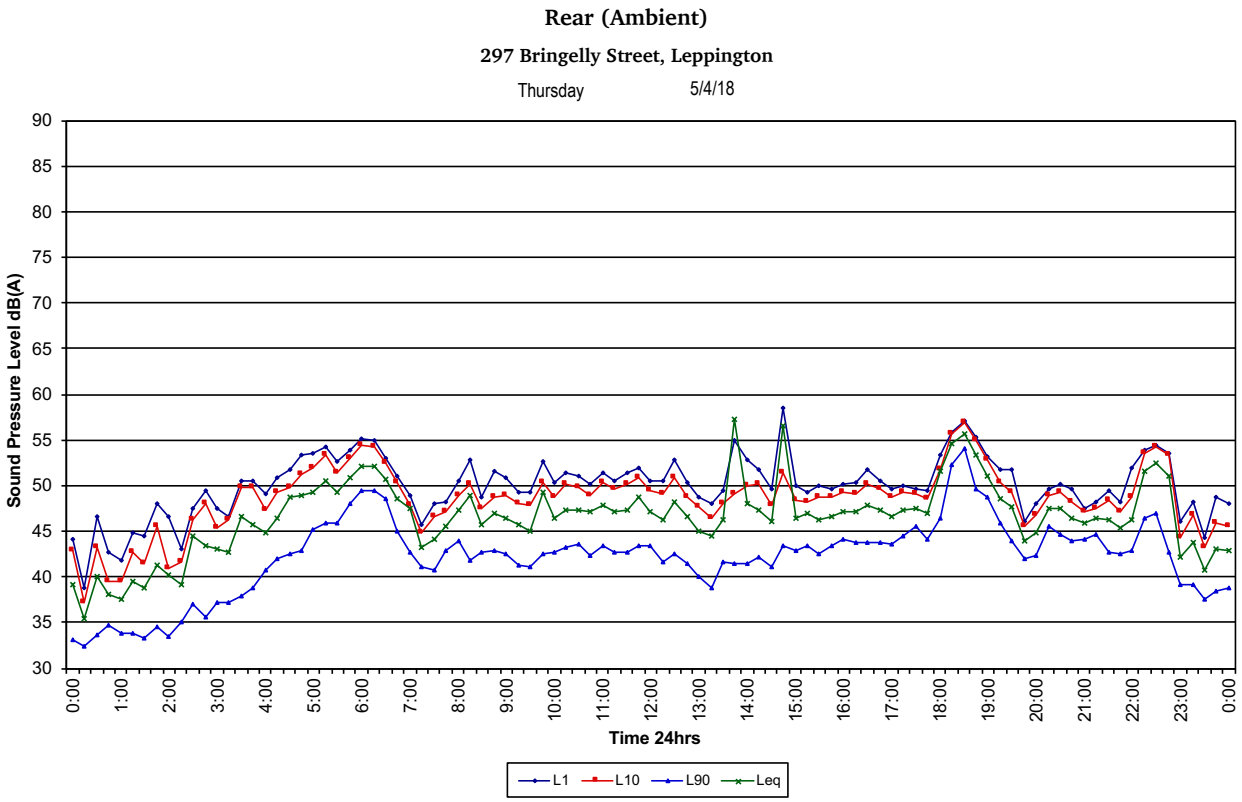

297 Bringelly Street, Leppington
Road Traffic
Sunday 8/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


297 Bringelly Street, Leppington
Road Traffic
Monday 9/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


297 Bringelly Street, Leppington
Road Traffic
Tuesday 10/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


297 Bringelly Street, Leppington
Road Traffic
Wednesday 11/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Rear (Ambient)
297 Bringelly Street, Leppington
Wednesday 4/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Rear (Ambient)
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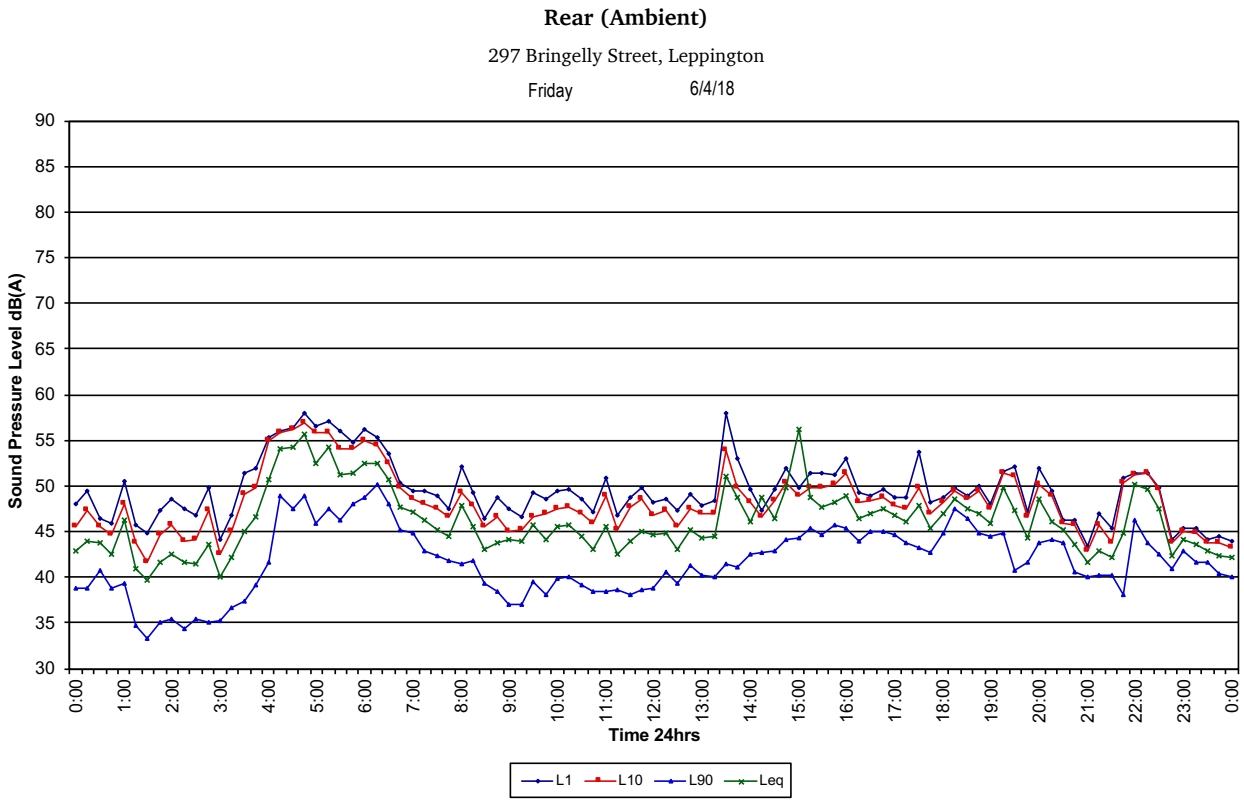
Thursday 5/4/18
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Rear (Ambient)
297 Bringelly Street, Leppington
Friday 6/4/18
Sound Pressure Level dB(A)
90
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50
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35
30
0:00
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3:00
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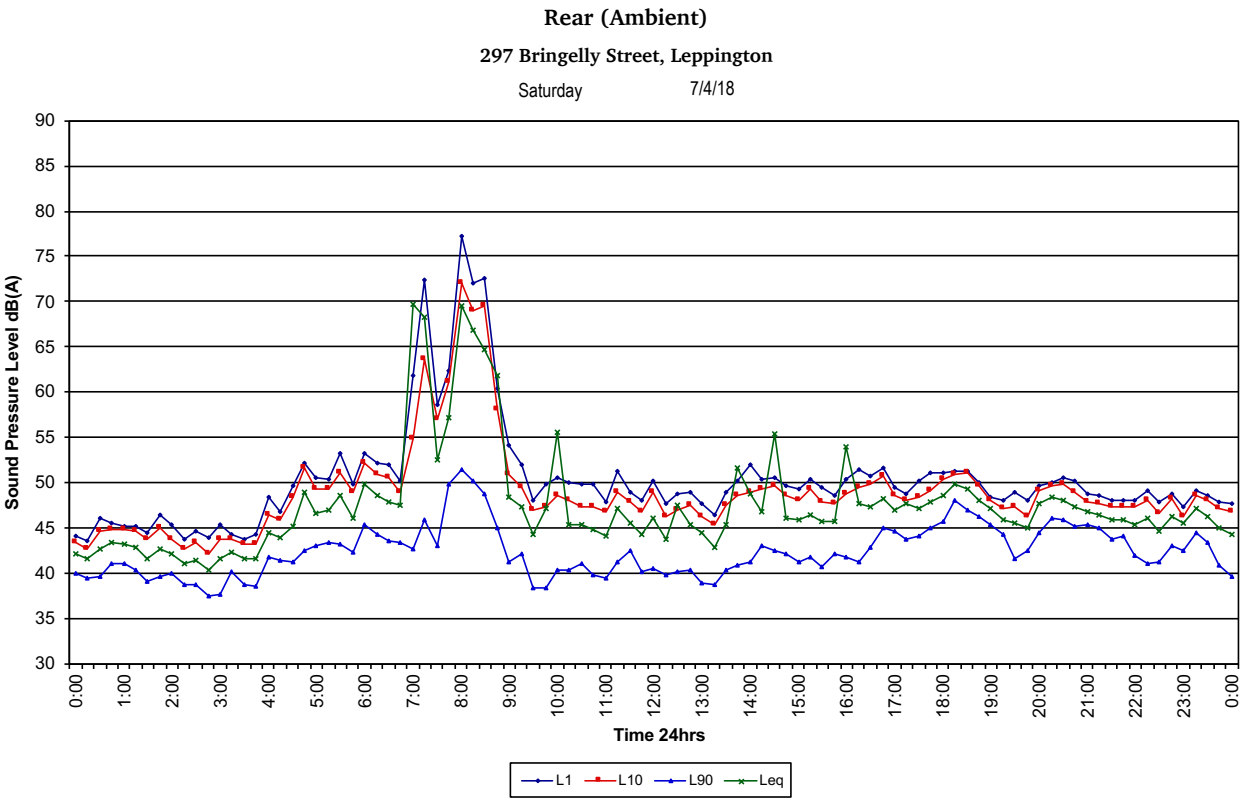
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time 24hrs
L1
L10
L90
Leq


Rear (Ambient)
297 Bringelly Street, Leppington
Saturday 7/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00
1:00
2:00
3:00
4:00
5:00
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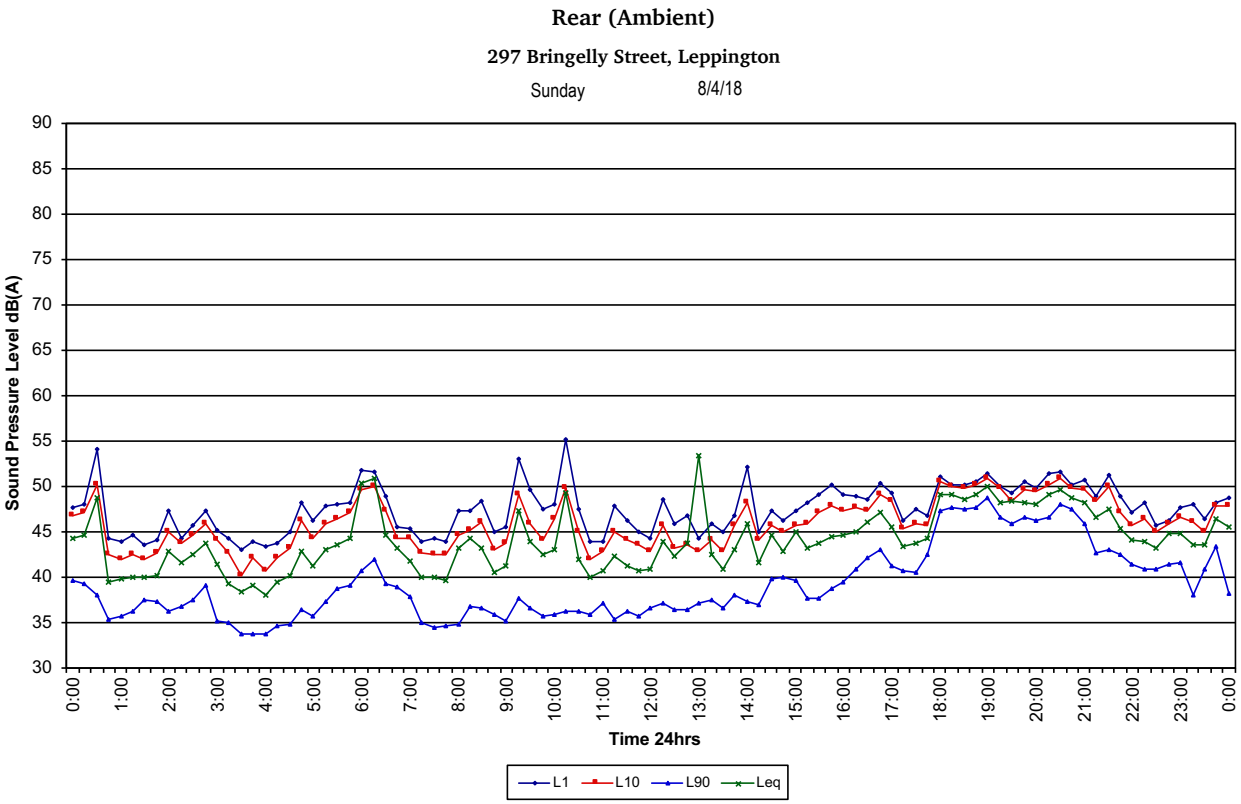
0:00
Time 24hrs
L1
L10
L90
Leq


Rear (Ambient)
297 Bringelly Street, Leppington
Sunday 8/4/18
Sound Pressure Level dB(A)
90
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75
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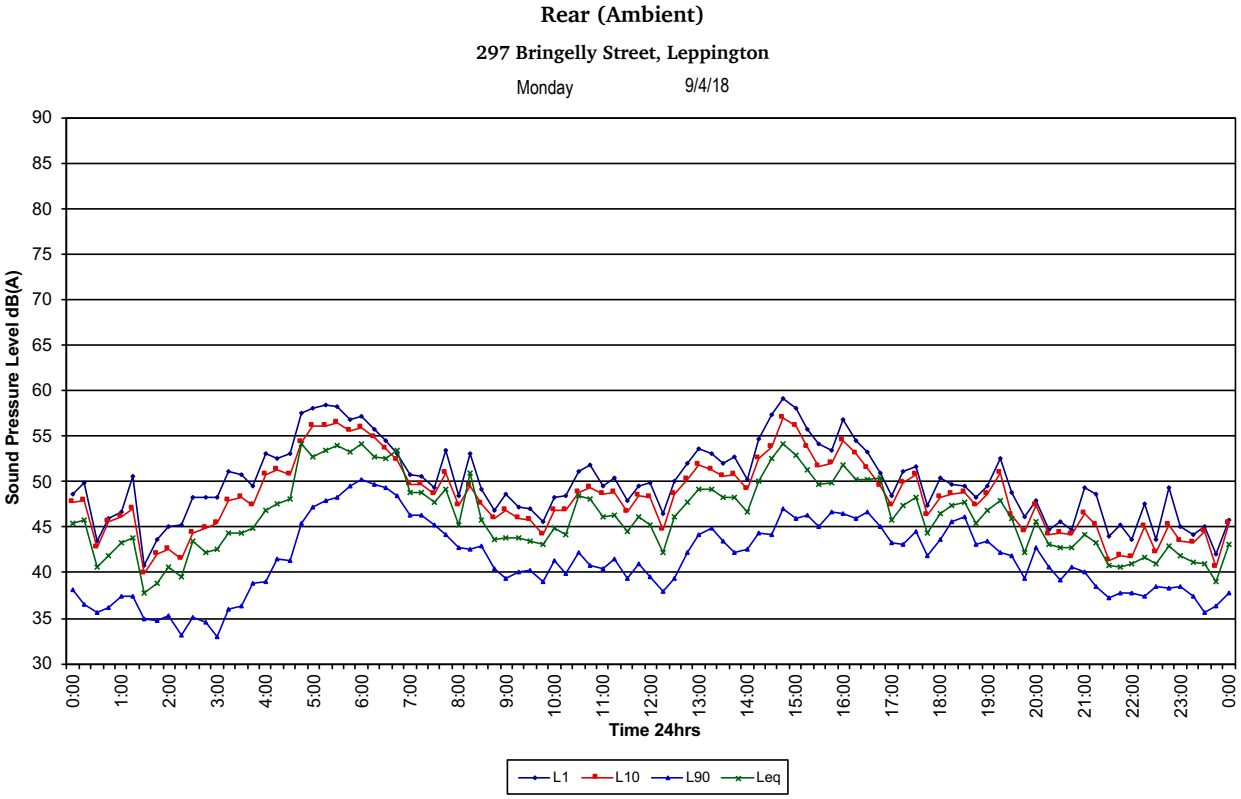
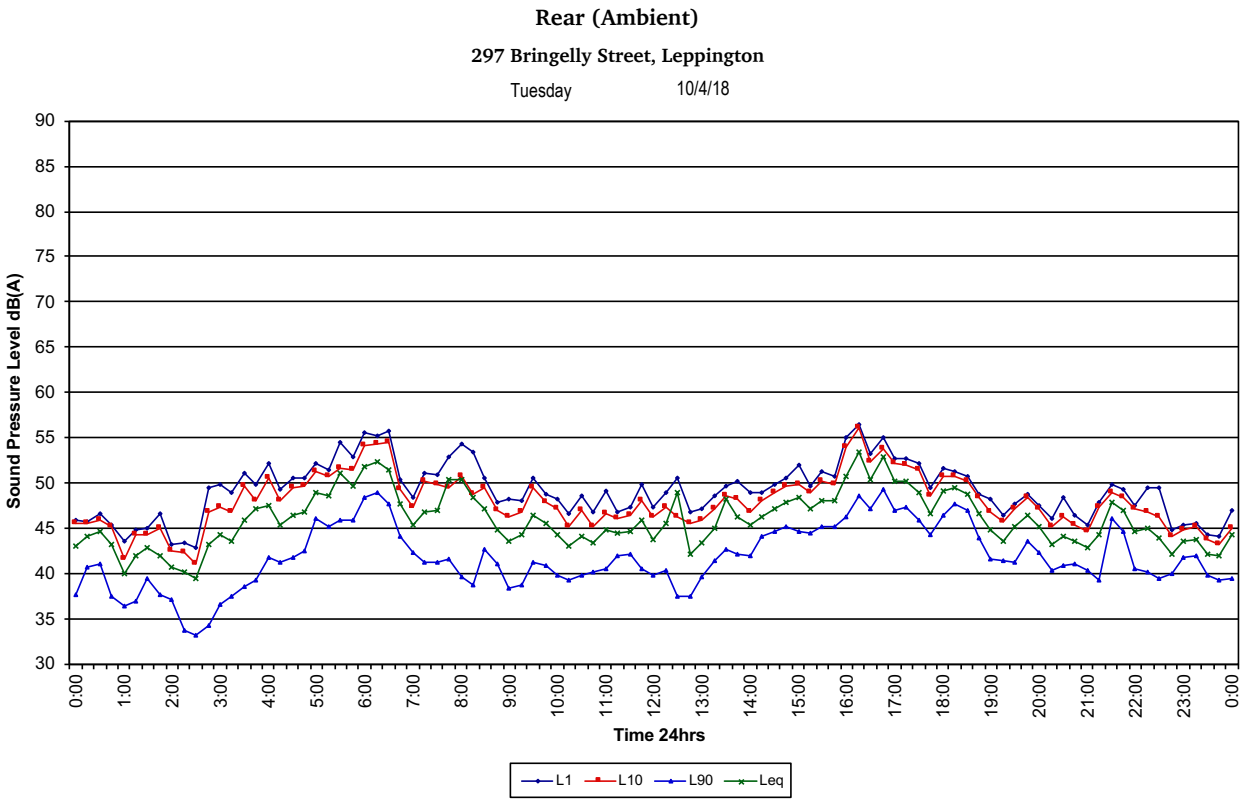
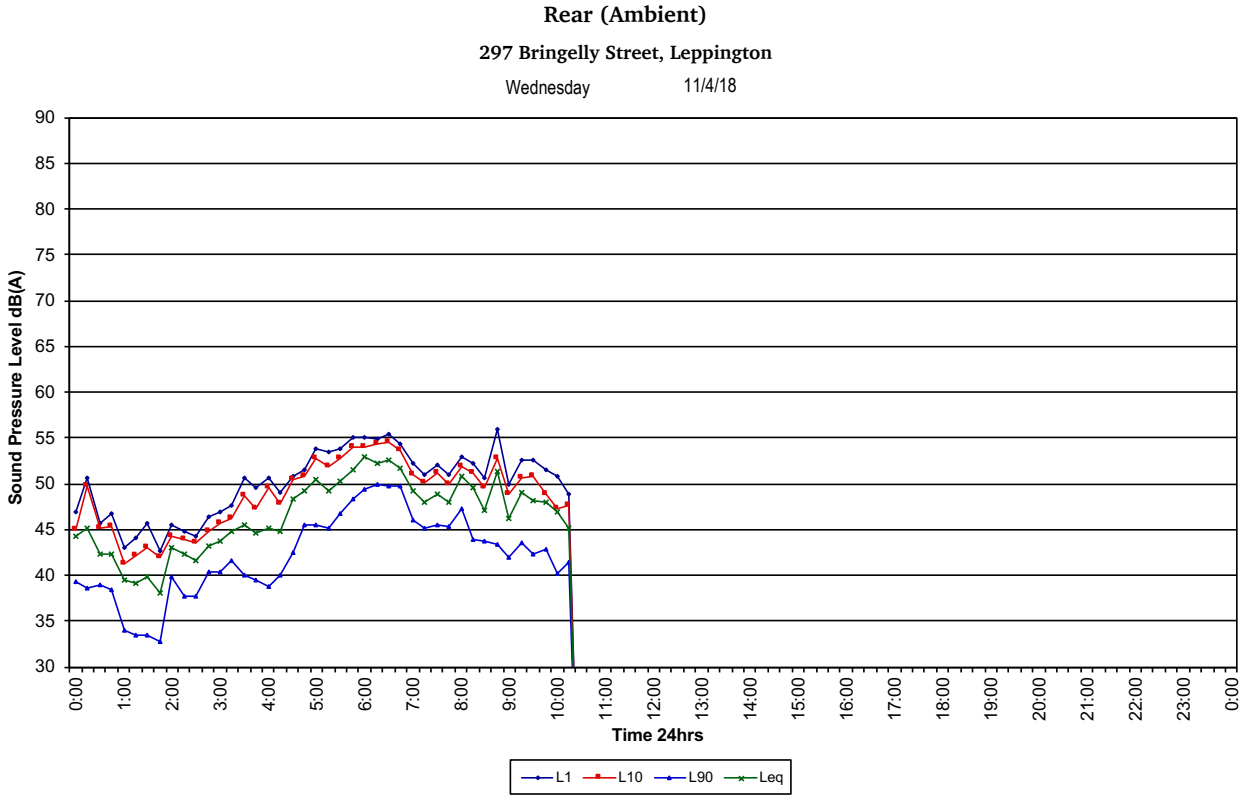
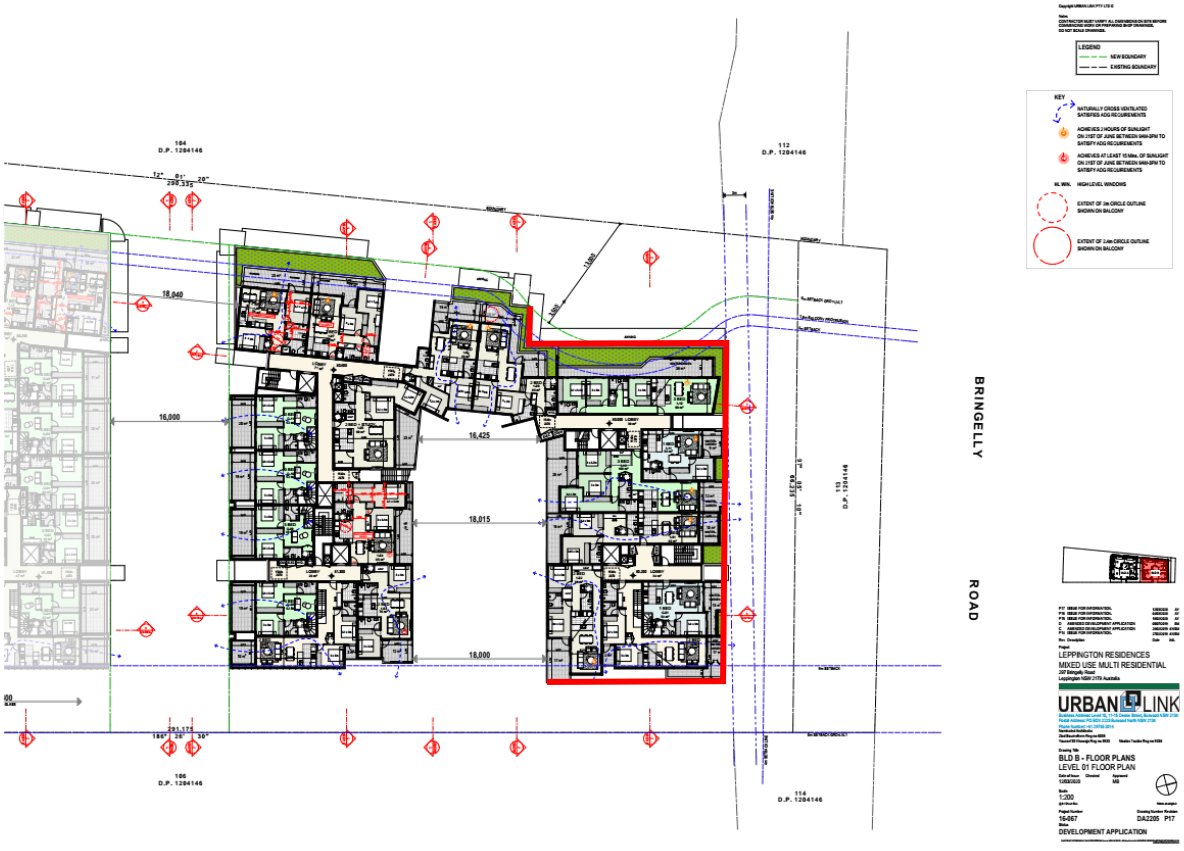
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

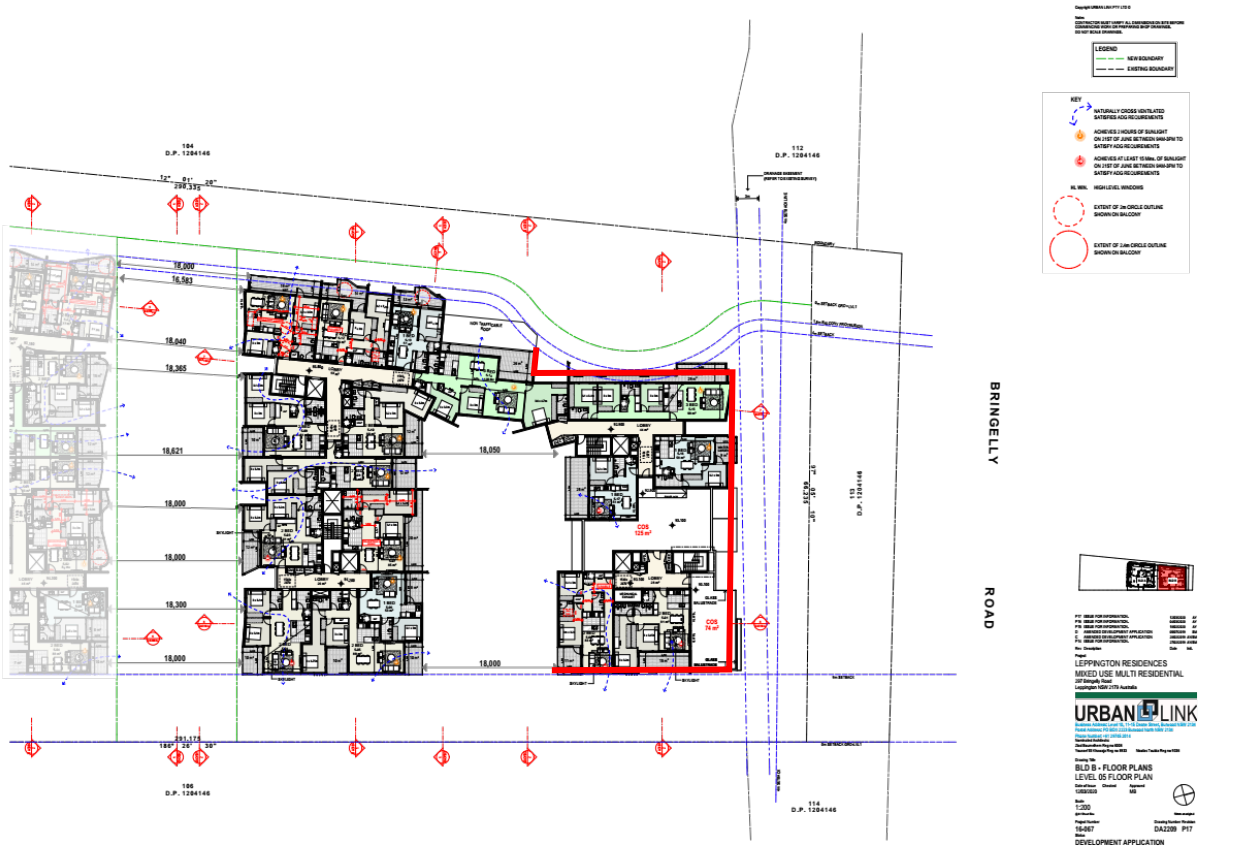

Rear (Ambient)
297 Bringelly Street, Leppington
Monday 9/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

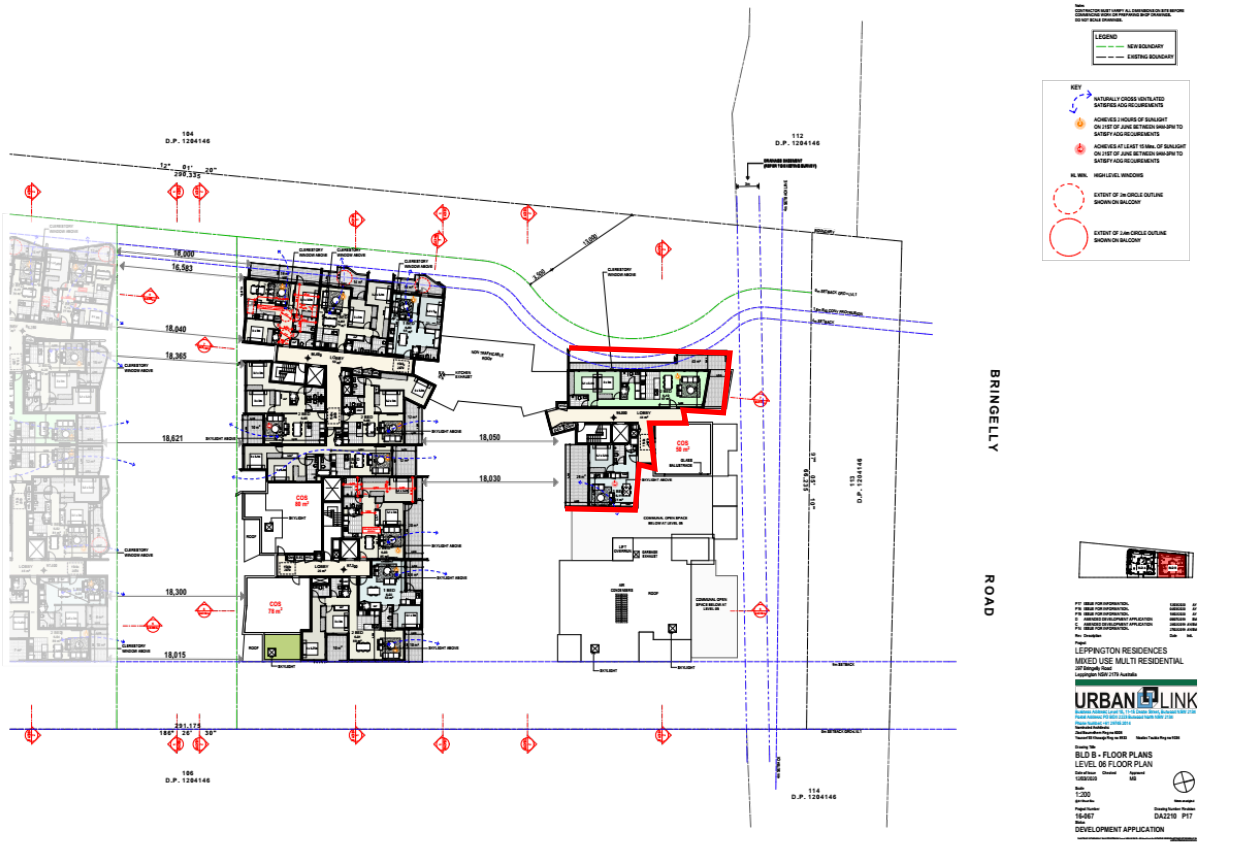

Rear (Ambient)
297 Bringelly Street, Leppington
Tuesday 10/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

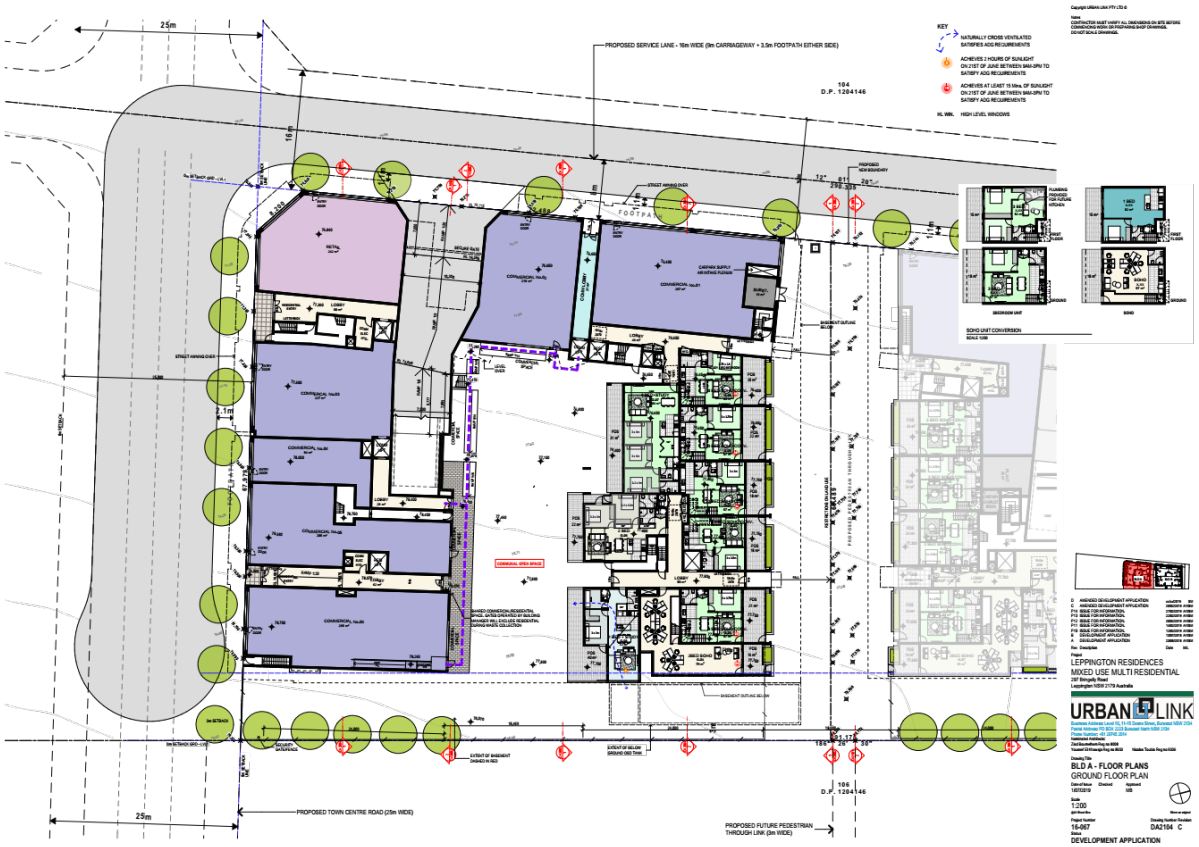

Rear (Ambient)
297 Bringelly Street, Leppington
Wednesday 11/4/18
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00
Time 24hrs
L1 L10 L90 Leq

Appendix D – Architectural Plans




BRINGELLY
ROAD
LEGEND
NEW BOUNDARY
EXISTING BOUNDARY
KEY
NATURALLY CROSS VENTILATED SATISFIES ADG REQUIREMENTS
ACHIEVES 2 HOURS OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
ACHIEVES AT LEAST 15 Mins. OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
HIGH LEVEL WINDOWS
EXTENT OF 2m CIRCLE OUTLINE SHOWN ON BALCONY
EXTENT OF 2.4m CIRCLE OUTLINE SHOWN ON BALCONY
LEPPINGTON RESIDENCES
MIXED USE MULTI RESIDENTIAL
URBAN LINK
BLD B - FLOOR PLANS
LEVEL 05 FLOOR PLAN
DEVELOPMENT APPLICATION


BRINGELLY
ROAD
LEGEND
NEW BOUNDARY
EXISTING BOUNDARY
KEY
NATURALLY CROSS VENTILATED SATISFIES ADG REQUIREMENTS
ACHIEVES 2 HOURS OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
ACHIEVES AT LEAST 15 Mins. OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
HIGH LEVEL WINDOWS
EXTENT OF 2m CIRCLE OUTLINE SHOWN ON BALCONY
EXTENT OF 2.4m CIRCLE OUTLINE SHOWN ON BALCONY
LEPPINGTON RESIDENCES
MIXED USE MULTI RESIDENTIAL
URBAN LINK
BLD B - FLOOR PLANS
LEVEL 06 FLOOR PLAN
DEVELOPMENT APPLICATION


PROPOSED SERVICE LANE - 16m WIDE (9m CARRIAGEWAY + 3.5m FOOTPATH EITHER SIDE)
PROPOSED TOWN CENTRE ROAD (25m WIDE)
PROPOSED FUTURE PEDESTRIAN THROUGH LINK (3m WIDE)
25m
LEPPINGTON RESIDENCES
MIXED USE MULTI RESIDENTIAL
297 Bringelly Road
Leppington NSW 2179 Australia
URBAN LINK
BLD A - FLOOR PLANS
GROUND FLOOR PLAN
DEVELOPMENT APPLICATION


20,453
17,251
17,560
LEPPINGTON RESIDENCES
MIXED USE MULTI RESIDENTIAL
297 Bringelly Road
Leppington NSW 2179 Australia
URBAN LINK
BLD A - FLOOR PLANS
LEVEL 01 FLOOR PLAN
DEVELOPMENT APPLICATION


KEY
NATURALLY CROSS VENTILATED SATISFIES ADG REQUIREMENTS
ACHIEVES 2 HOURS OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
ACHIEVES AT LEAST 15 Mins OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
HL WIN. HIGH LEVEL WINDOWS
LEPPINGTON RESIDENCES
MIXED USE MULTI RESIDENTIAL
297 Bringelly Road
Leppington NSW 2179 Australia
URBAN LINK
BLD A - FLOOR PLANS
LEVEL 05 FLOOR PLAN
1:200
16-067
DA2159 C
DEVELOPMENT APPLICATION


KEY
NATURALLY CROSS VENTILATED SATISFIES ADG REQUIREMENTS
ACHIEVES 2 HOURS OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
ACHIEVES AT LEAST 15 Mins OF SUNLIGHT ON 21ST OF JUNE BETWEEN 9AM-3PM TO SATISFY ADG REQUIREMENTS
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