RODNEY STEVENS ACOUSTICS
Acoustic Consultants
Member Australian Acoustical Society

REPORT R190549R1

Revision 2

Noise Impact Assessment

Proposed Place of Worship

Lot 212 Forestwood Drive, Glenmore Park

PREPARED FOR:
Stimson & Baker Planning
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20 December 2019

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Noise Impact Assessment

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Lot 212 Forestwood Drive, Glenmore Park

PREPARED BY:

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
R190549R1	Revision 0	5 December 2019	Camilo Castillo	Rodney Stevens	Rodney Stevens
R190549R1	Revision 1	11 December 2019	Camilo Castillo	Rodney Stevens	Rodney Stevens
R190549R1	Revision 2	20 December 2019	Camilo Castillo	Rodney Stevens	Rodney Stevens

TABLE OF CONTENTS

1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (RSA) has been engaged by Stimson & Baker Planning to prepare a Noise Impact Assessment for the proposed Brethren meeting room located at Lot 212 Forestwood Drive, Glenmore Park. This assessment forms part of the supporting documentation for the Development Application stage of the project to Penrith City Council.

The purpose of this report is to determine possible noise impacts on nearby receivers and if necessary provide acoustic control recommendations so that the proposed meeting room may operate in an acoustically compliant manner in accordance with Penrith City Council's requirements.

This report presents RSA's methodology, assessment criteria and recommendations regarding noise breakout from the proposed building as well as the proposed carpark. Noise emission from mechanical plant does not form part of this assessment.

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

2 PROPOSED DEVELOPMENT

2.1 Site Description

The proposed development consists of a single storey dwelling to be used as a Brethren meeting room. The proposed layouts are presented in Figure 2-2.

The nearest residential dwellings most affected by the operation of proposed development are the future housing development in the surrounding empty lots. Figure 2-1 shows an aerial image of the location of the proposed building, the surrounding environment and the noise monitoring location.

2.2 Proposed Development

The proposal is to build a single storey building to serve as a Brethren meeting room. The proposed development will consist of a meeting room with amenities and parking spaces.

The proposed development will be used a number of times week by members of the congregation some of the proposed activities are presented in the table below

Table 2-1 Typical Weekly Events

Day/Time	Activity	Maximum Attendance
Monday 6:30 pm to 7:00 pm	Prayer Meeting	40
Friday 7:00 pm to 8:00 pm	Conversational Scripture Readings	90
Sunday 6:00 am to 7:00 am	Lords Supper	40
Sunday 3:00 pm to 4:00 pm	Gospel Preaching	50

Figure 2-1 Site Location

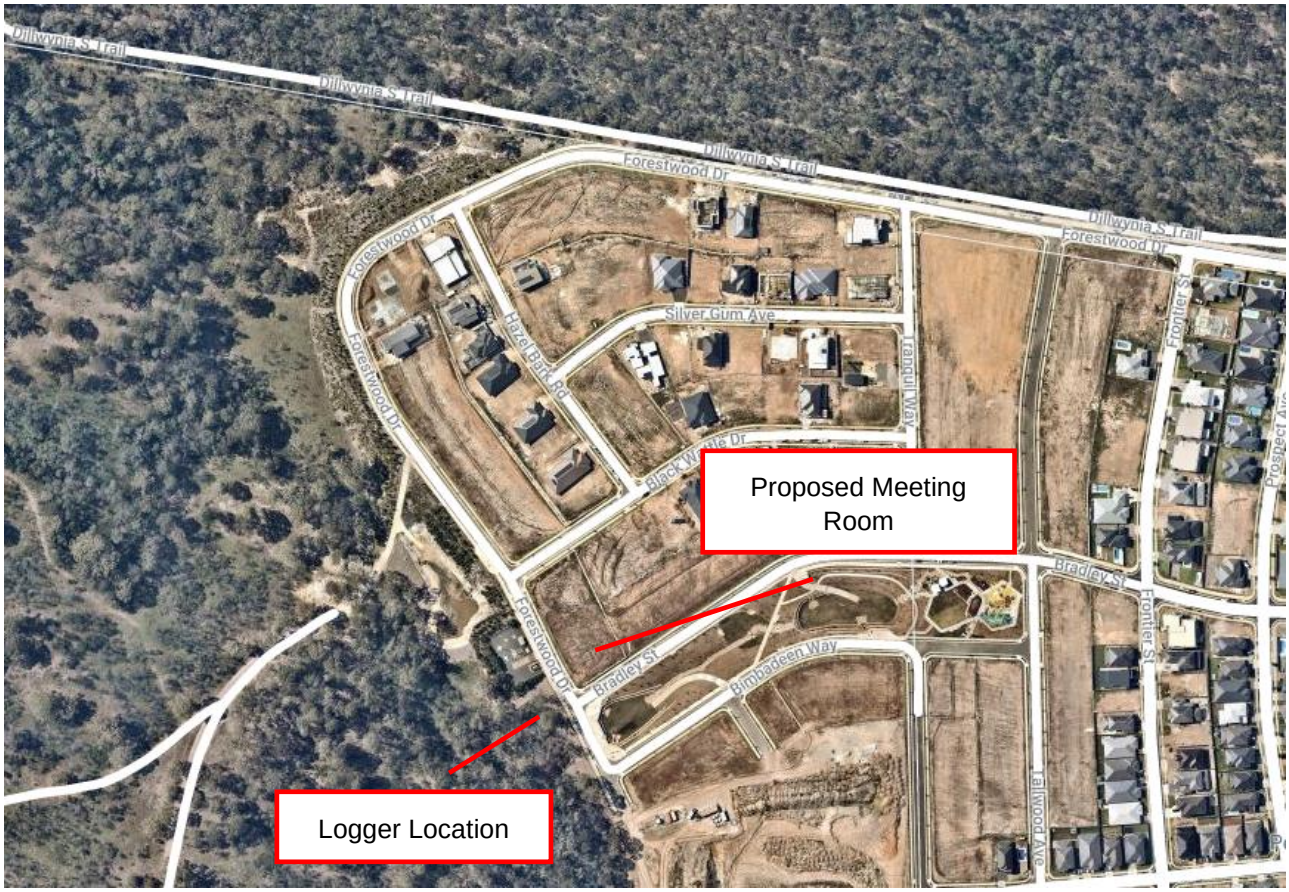
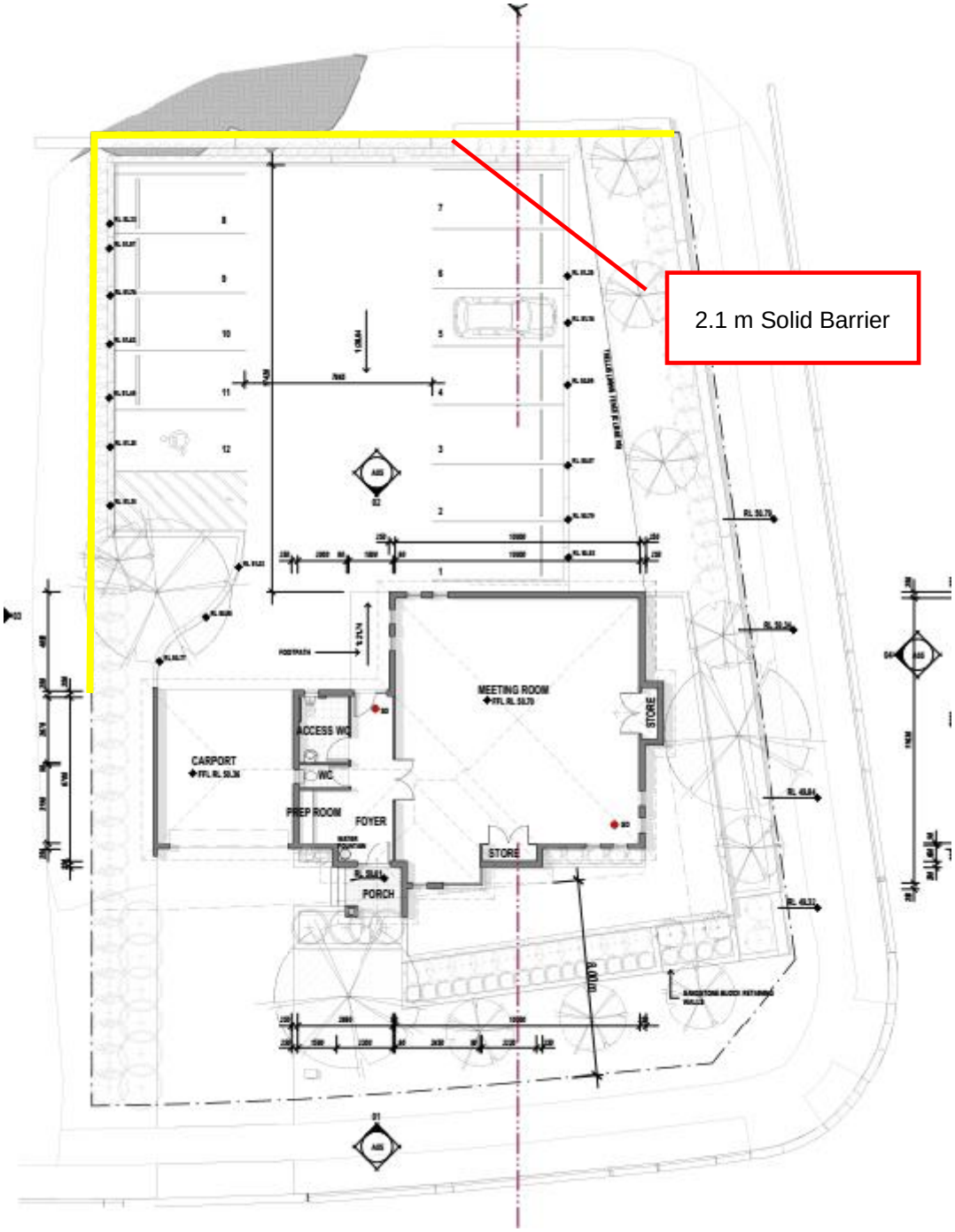


Image Courtesy of Near Maps © 2019.

Figure 2-2 Proposed Ground Floor Plan



3 BASELINE NOISE SURVEY

3.1 Unattended Noise Monitoring

In order to characterise the existing acoustical environment of the area unattended noise monitoring was conducted between Monday 25th November and Monday 2nd December 2019. The logger was located on the northern boundary of the site as shown in Figure 2.1

Logger location was selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

Instrumentation for the survey comprised of a Rion NL-42EX Environmental Noise Logger, (serial number 810779) fitted with microphone windshield. Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Measured data has been filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM).

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions in Appendix A).

Detailed results at the monitoring location are presented in graphical format in Appendix B. The graphs show measured values of L_{A1}, L_{A10}, L_{A90} and L_{Aeq} for each 15-minute monitoring period.

3.2 Data Processing

3.2.1 Noise Emission (*Noise Policy for Industry*)

In order to assess noise emission from the proposed meeting room, the data obtained from the noise logger has been processed in accordance with the procedures contained in the NSW Environmental Protection Authority's (EPA) *Noise Policy* for Industry (NPfI, 2017) to establish representative noise levels that can be expected in the residential vicinity of the site. The monitored baseline noise levels are detailed in Table 3-1.

Table 3-1 Measured Baseline Noise Levels Corresponding to Defined NPfI Periods

Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Daytime 7 am - 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
Logger Survey on Site	L_{Aeq}	49	46	46
	RBL (Background)	35	32	26

Notes: All values expressed as dB(A) and rounded to nearest 1 dB(A);

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 present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

4 NOISE CRITERIA

Penrith City Council DCP 2016 Council does not have specific noise criteria requirements for the assessment of noise breakout from the proposed meeting room, therefore we have adopted the NSW Environmental Protection Authority's (EPA) *Noise Policy* for Industry (NPfI, 2017)

4.1 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.

4.1.1 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.

4.1.2 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.

4.1.3 Area Classification

The NPfI characterises the "Rural" noise environment as an area with an acoustical environment that:

- is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.
- Settlement patterns would be typically sparse

The area surrounding the proposed development falls under the "Rural" area classification.

4.1.4 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 4-1. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

In this case, the ambient noise environment is not controlled by industrial noise sources and therefore the project amenity noise levels are assigned as per Table 2.2 of the NPfI (Recommended Amenity Noise Levels). For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive project trigger noise level are adopted. These are shown in bold text in Table 4-1.

Table 4-1 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL [1] $L_{Aeq(15min)}$	Measured		Project Trigger Noise Levels	
			RBL [2] $L_{A90(15min)}$	Existing $L_{Aeq(Period)}$	Intrusive $L_{Aeq(15min)}$	Amenity $L_{Aeq(15min)}$
Residential	Day	50	35	49	**40**	53
	Evening	45	32	46	**37**	48
	Night	40	30*	46	**35**	43

Note 1: ANL = "Amenity Noise Level" for residences in Rural Areas.

Note 2: RBL = "Rating Background Level".

* The RBL has set to 30 dB(A) as per NPfI Section A1.2

4.1.5 Shoulder Periods

The proposed development will operate from 6:00 am. It may be unreasonable to expect operations between 6:00 am and 7:00 am to be assessed against the night-time project noise trigger levels since the existing background noise levels are steadily rising in the early morning hours. For this situation the shoulder period assessment will be used to derive the relevant criteria in accordance to Fact Sheet A, Section A3 of the NPfI 2017. The resulting intrusiveness criteria is presented below.

Table 4-2 Shoulder Period Noise Criteria

Receiver	$L_{AF90(6\text{-}7am)}$ dB	Criteria
Residential	35	40

5 NOISE IMPACT ASSESSMENT

5.1 General Activity Noise Emissions

The following sections summarise the results of patron and carpark noise emissions and predicted levels at nearby residential receivers as a result of the operation of the proposed meeting room.

Calculations of the amount of noise transmitted to these receivers from the proposed meeting room have been based on voice levels as referenced in the Handbook of Acoustical Measurements and Noise Control by Cyril M. Harris. This handbook provides voice spectrums for males and females as well as different vocal efforts. The spectrum is given in Table 5-1.

The spectra have been scaled based upon the overall number of patrons expected to be in the different areas at any given time (Refer to Section 2.2)

Table 5-1 Speech Spectrums - Handbook of Acoustical Measurements and Noise Control.

Type	Noise Level (dB) at Octave Band Centre Frequency (Hz)							Overall dB(A)
	125	250	500	1 k	2 k	4 k	8 k	
Male (Loud)	56	65	72	71	66	60	50	74
Female (Loud)	34	58	64	65	64	57	49	69

5.1.1 Member Sound Power Levels

The main noise generating activities will occur in the meeting room, where chanting may occur. We have based the noise levels on a maximum number of 45 members.

5.2 Meeting Room Noise Emissions

Predictive resultant noise levels have been calculated for all proposed site activities. Noise emissions at the nearest residential receivers are presented in the table below. The predicted noise calculations take into account the following:

- No amplified music or PA system will be used
- Heights of receivers are assumed to be 1.5 m above their respective level.
- No activities will take place outside the building
- Most activities will not engage the members in noise generating activities

The following figure shows the proposed development in relation to the most affected receivers.

Figure 5-1 Receiver Locations

The resulting noise levels from the operation of the proposed meeting room into the adjoining residential premises are presented in the table below:

Table 5-2 Predicted Noise Impact Levels at Nearby Receivers.

Receiver	Time	Calculated Noise Level	Criteria	Compliance
R1	Day	30	40	Yes
	Evening	30	37	Yes
	Night	30	40	Yes
R2	Day	<20	40	Yes
	Evening	<20	37	Yes
	Night	<20	40	Yes

5.3 Carpark Noise Emissions

The proposal is to have a car park with capacity for 11 vehicles plus 1 disable space, calculations of noise from the carpark have been based on typical noise generating events within a carpark such as, door slams, engine starts and cars driving away. We have assumed the worst case where all vehicles enter or leaving the carpark.

The calculated noise levels from the activities carried out within the carpark are presented in the table below:

Table 5-3 Calculated Carpark Noise Levels

Receiver	Time	Calculated Noise Level	Criteria	Compliance
R1	Day	38	40	Yes
	Evening	38	37	Yes*
	Night	38	40	Yes
R2	Day	36	40	Yes
	Evening	36	37	Yes
	Night	36	40	Yes

* A 1 dB(A) exceedance is generally considered to be acoustically insignificant

6 NOISE CONTROL RECOMMENDATION

The noise emissions from the proposed meeting room has been assessed to comply with the project specific noise criteria, the following noise controls must be implemented to ensure compliance is maintained:

- All prayer related activities will be carried out within the meeting room
- All doors and windows must remain closed during the service
- No activities can occur outside the building.
- Signs must be in place advising devotees to not cause unnecessary noise
- A 2.1m high solid fence must be erected around the carpark (Refer to Figure 2-2)

7 CONCLUSION

A noise impact assessment has been conducted in relation to the operation of the proposed meeting room located at Lot 212 Forestwood Drive, Glenmore Park.

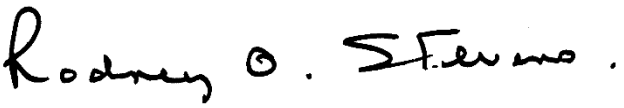
This assessment has been conducted and appropriate noise emission criteria have been established in accordance with the NSW EPA Noise Policy for Industry 2017 noise guidelines.

This report shows that under the most conservative operating scenarios and the implementation of the recommendations in this report, operational noise emission from the proposed meeting room will easily achieve the established noise criteria at neighbouring residences.

Criteria for noise emissions from mechanical plant have been established, a further acoustic survey by a qualified acoustic consultant may be required once mechanical plant schedules have been selected

It is therefore recommended that planning approval be granted for the proposed development on the basis of acoustics.

Approved:-



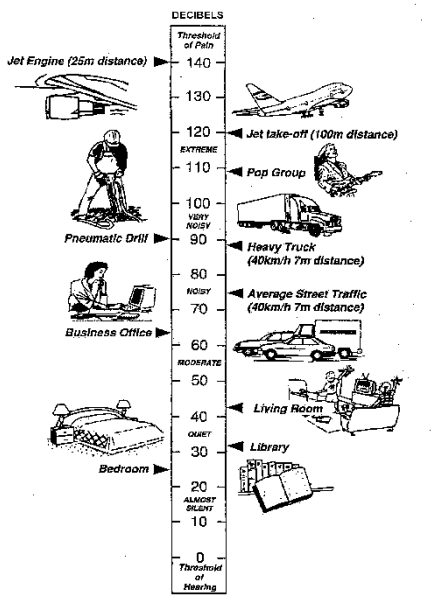
Rodney Stevens

Managing Director

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, taking into account 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)*.

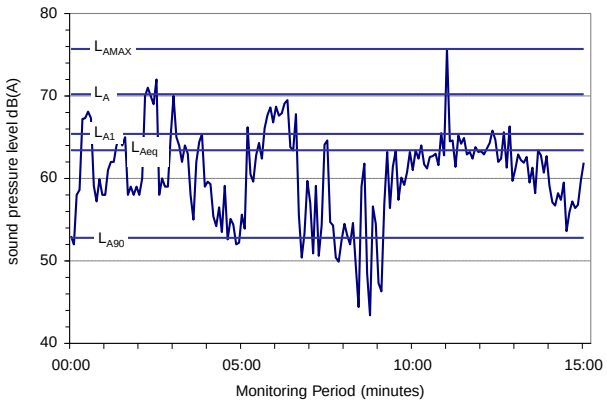
Sound Pressure Level (SPL)

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.

Statistic 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 descriptors:

L_{Amax} 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.

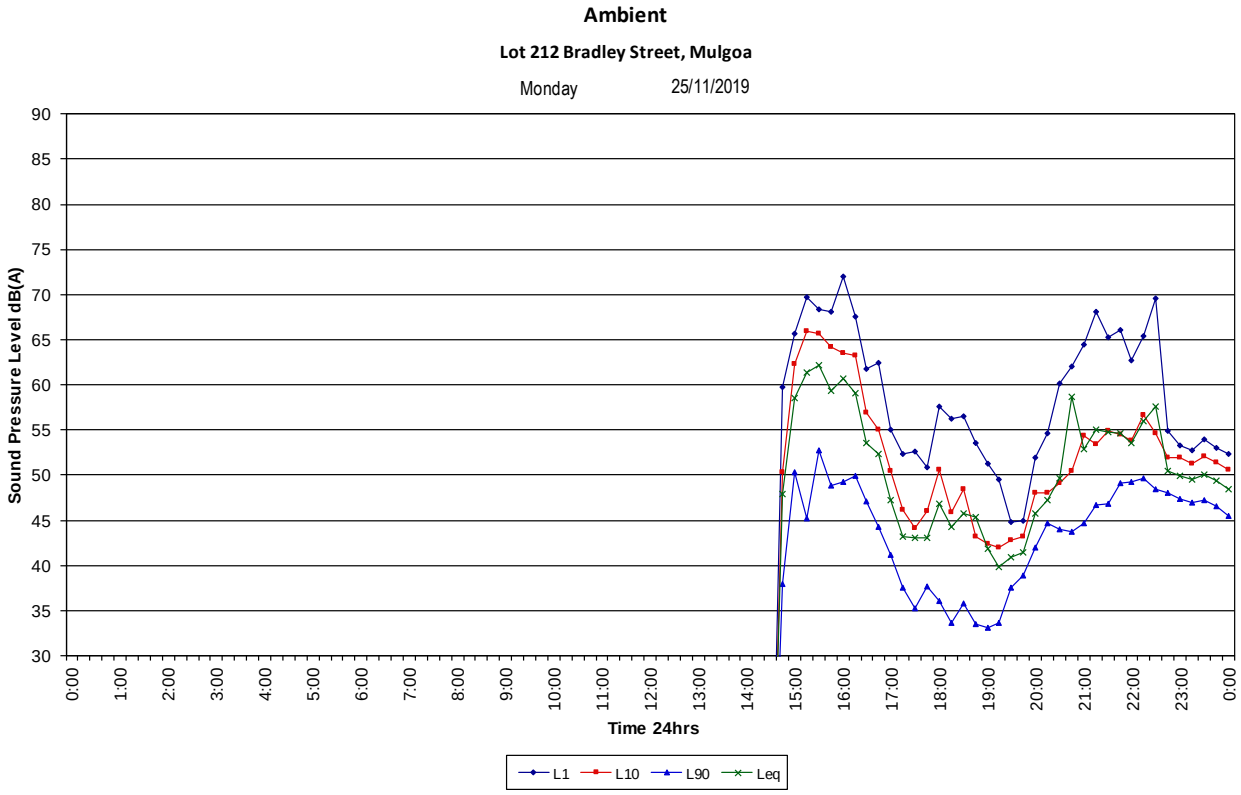
L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.

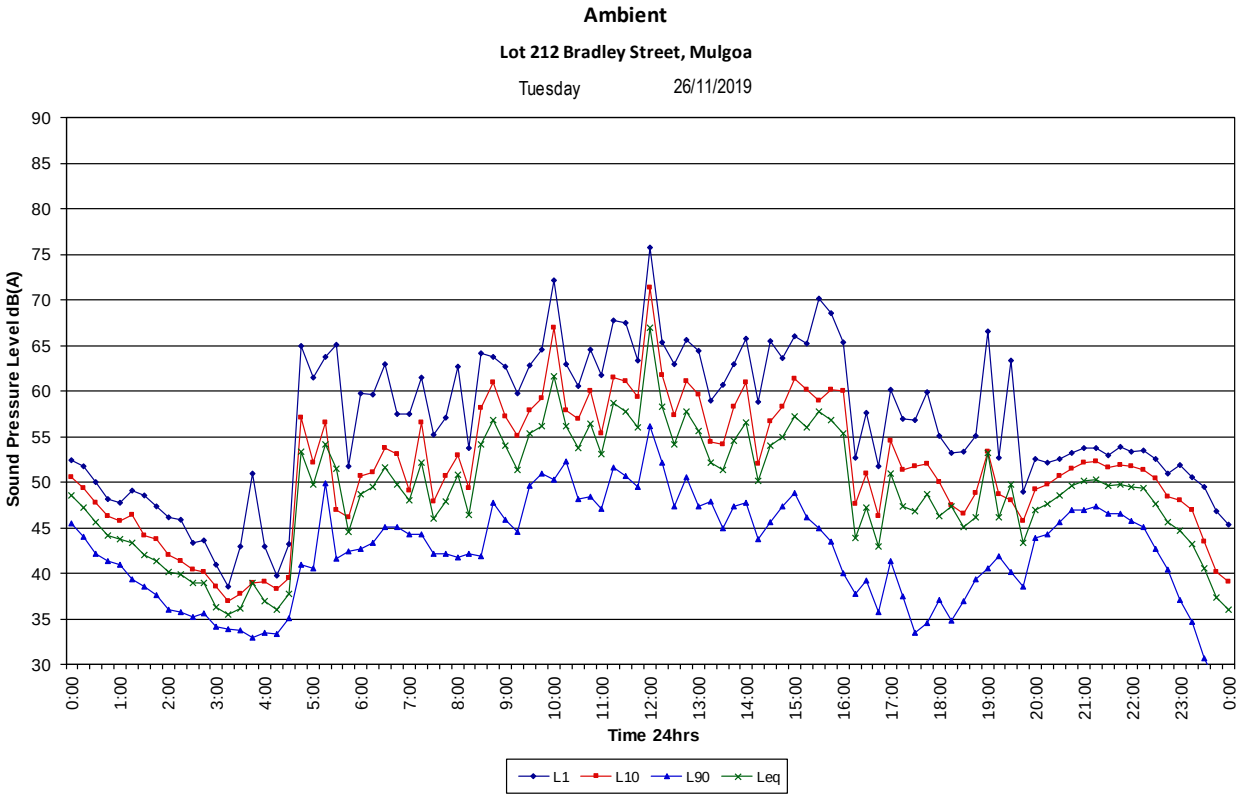
L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

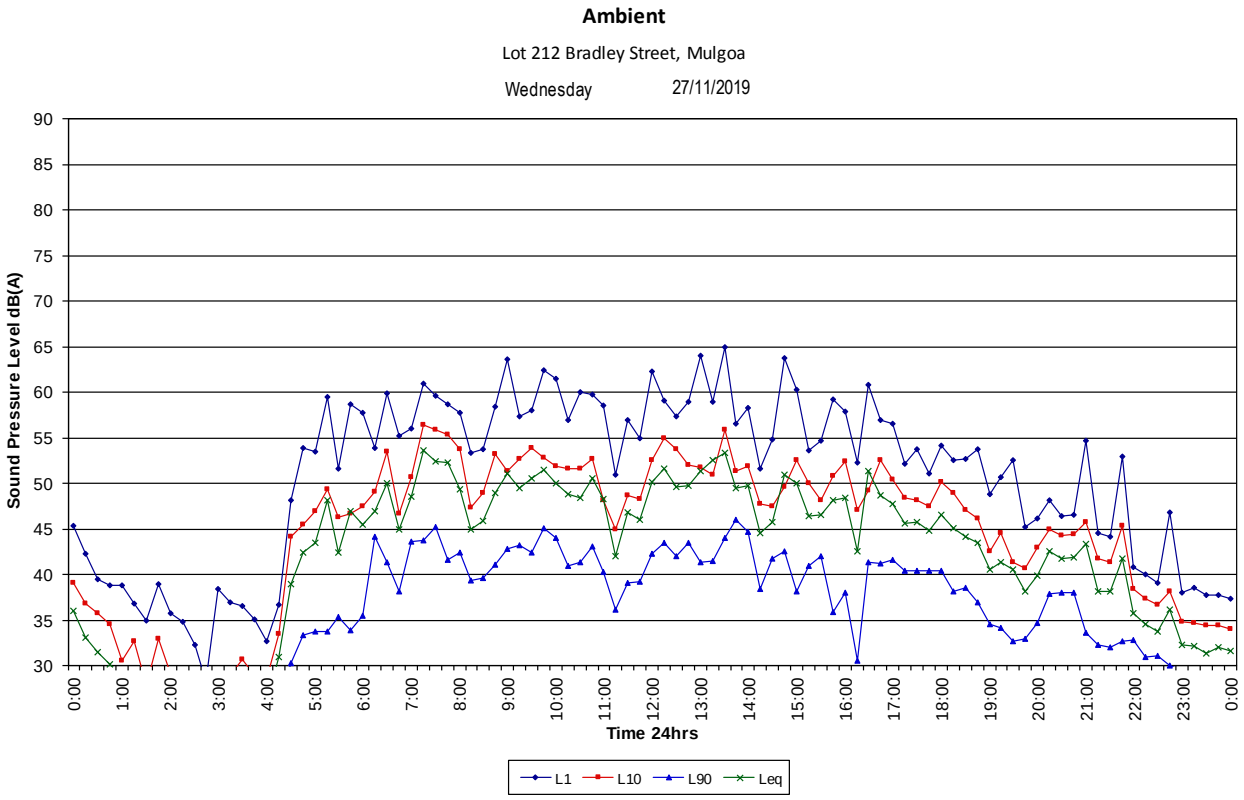
Threshold The lowest sound pressure level that produces a detectable response (in an instrument/person).

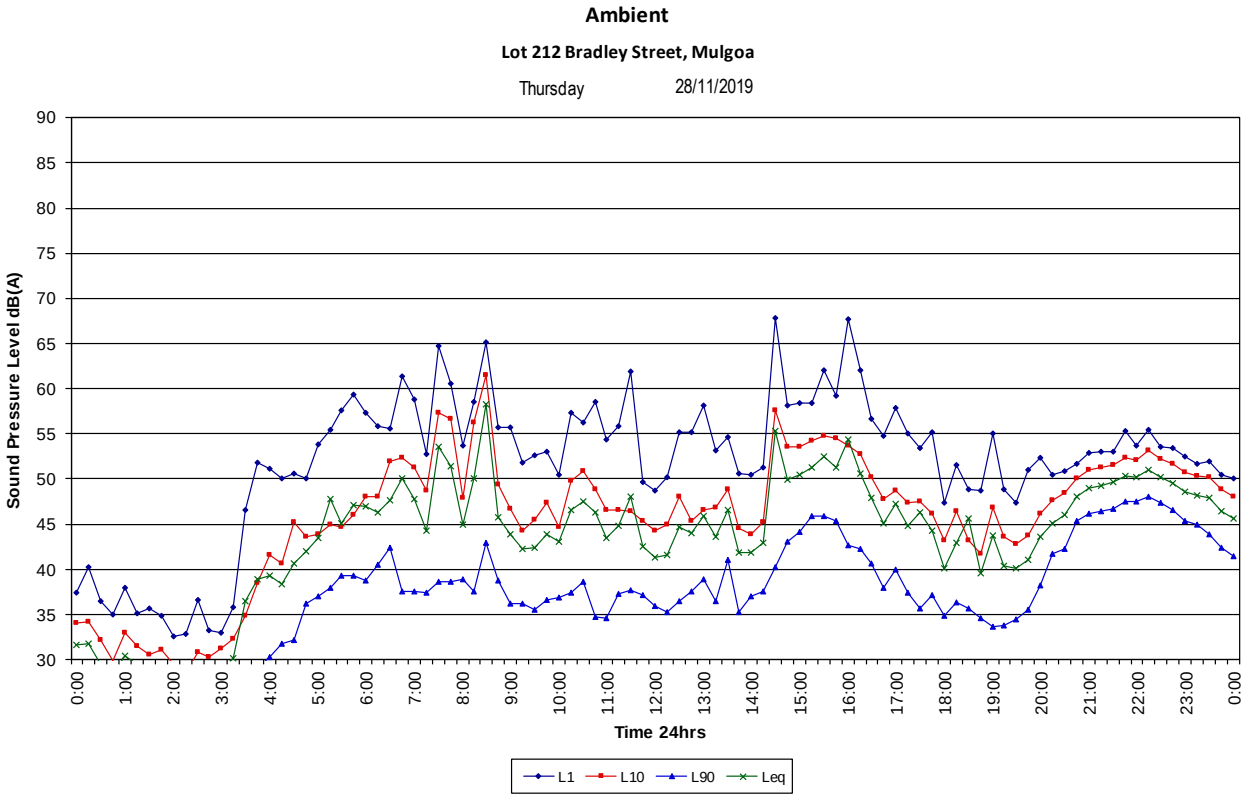
Tonality Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics

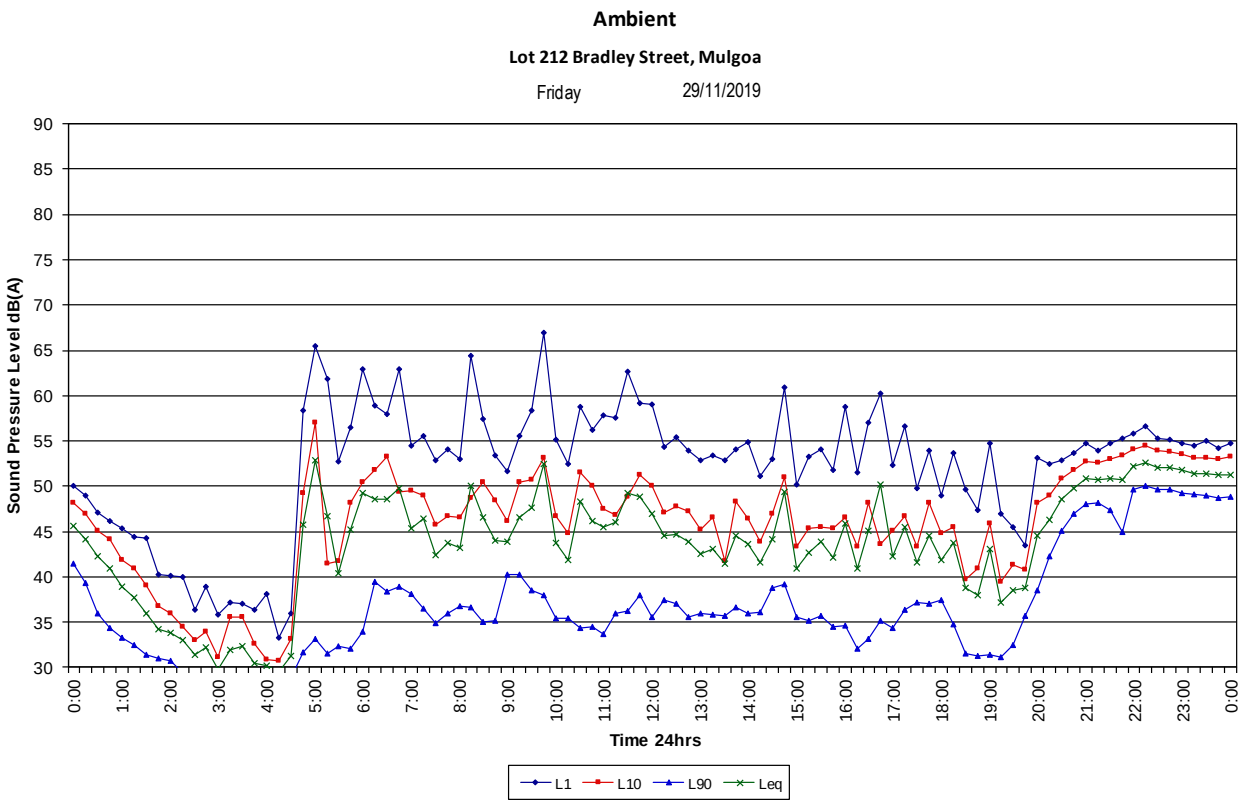
Appendix B – Baseline Noise Survey Graphs

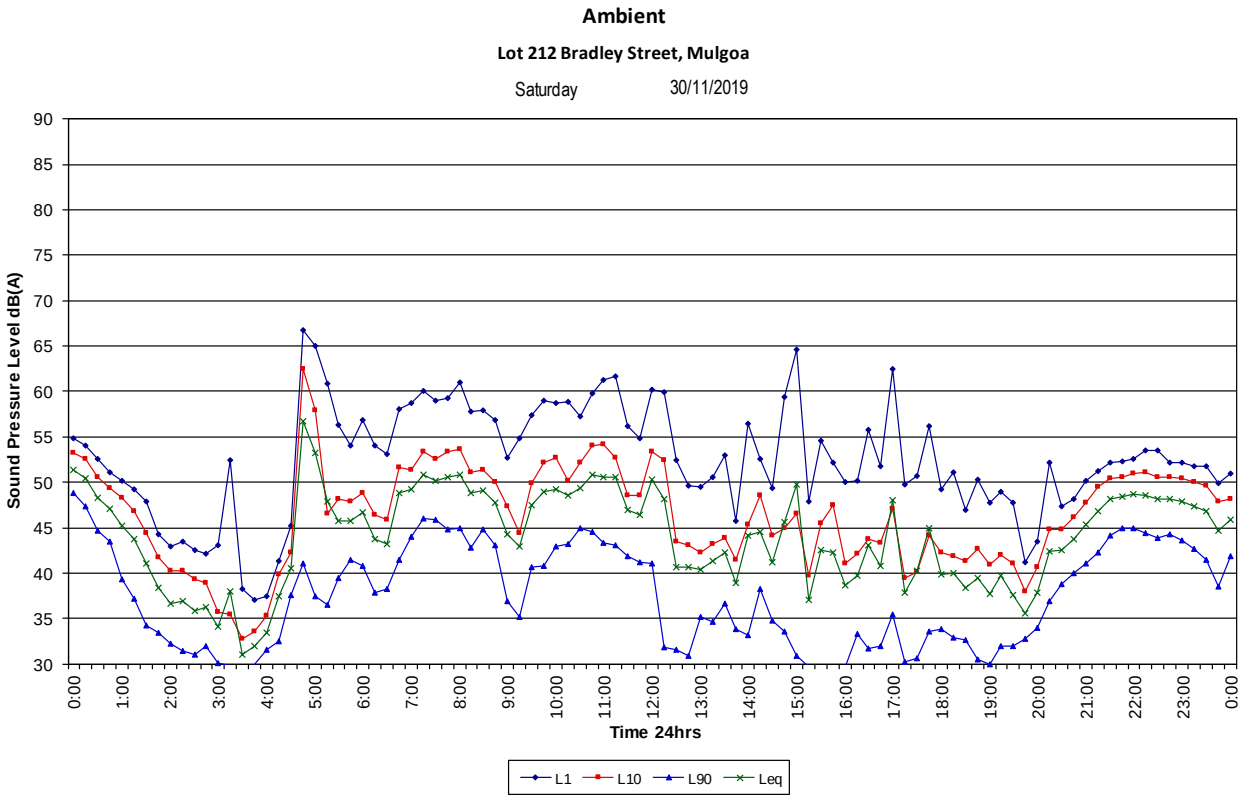


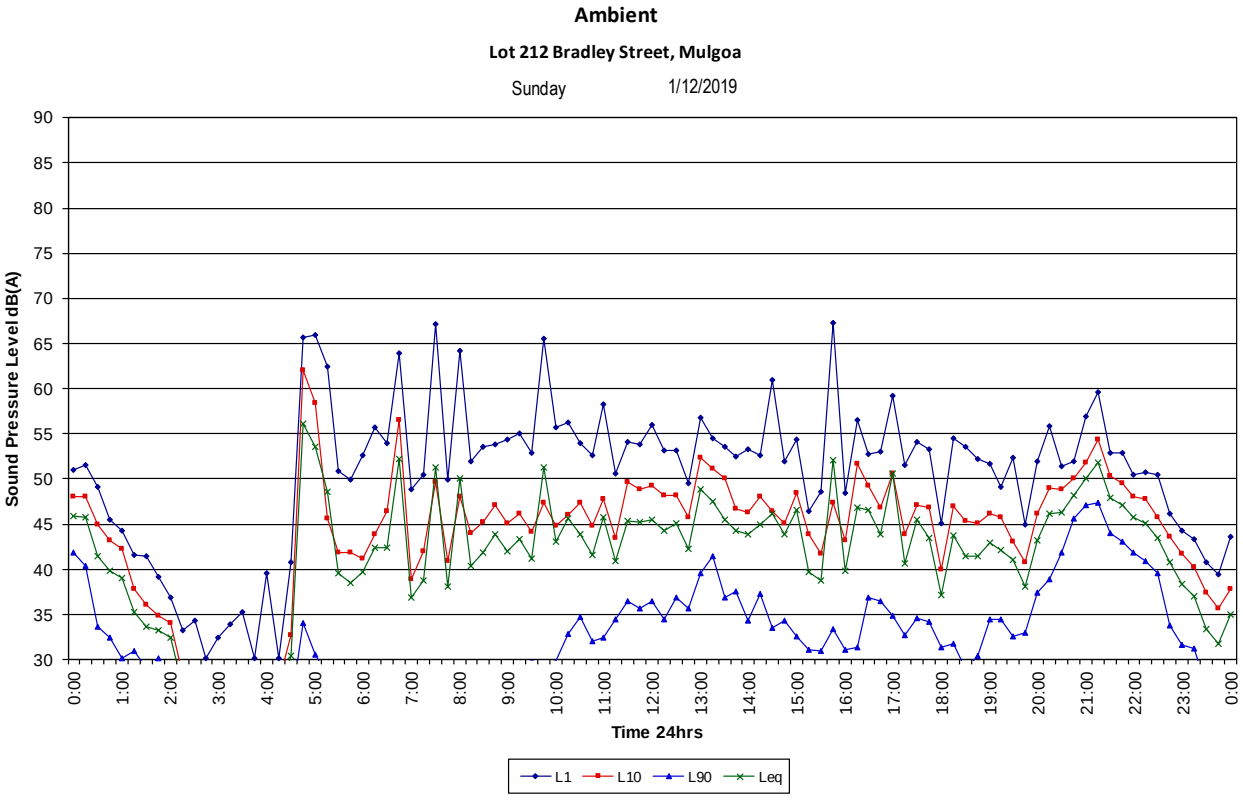


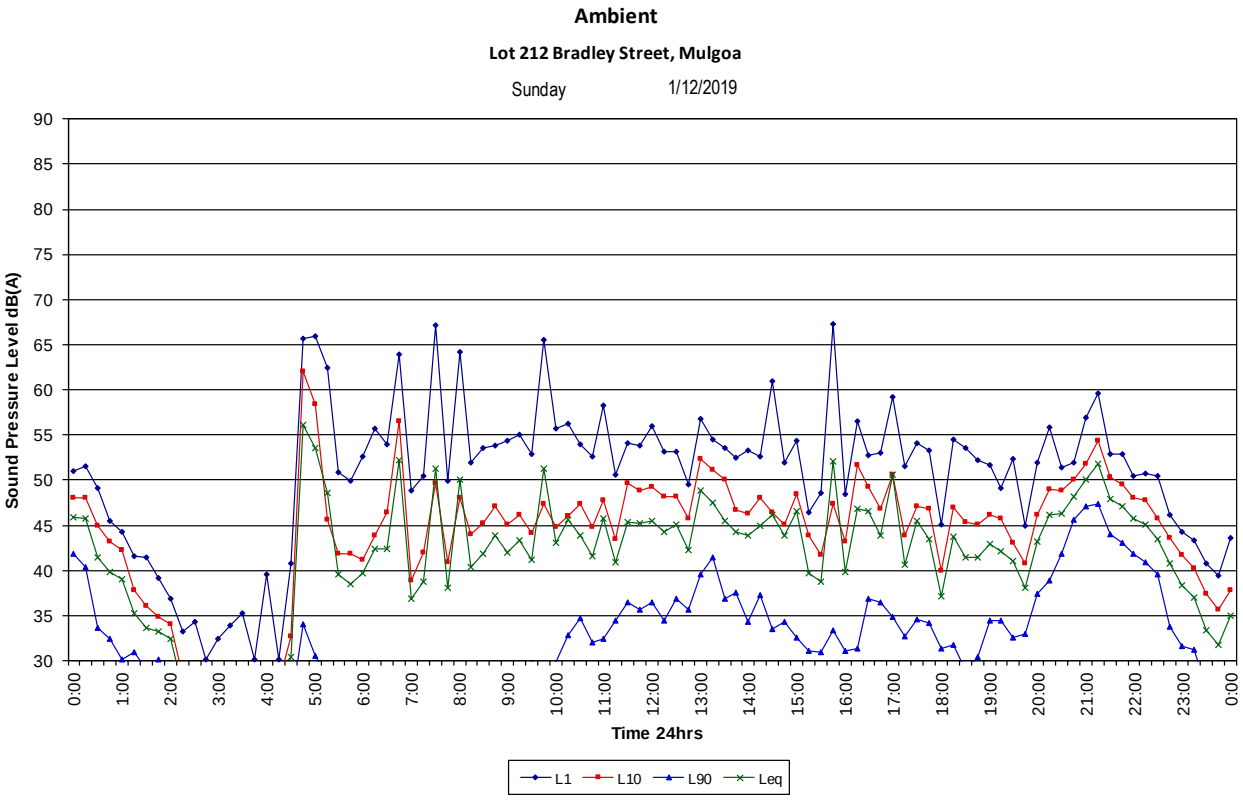












Appendix C – Instrument Calibration Certificate

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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 C19621

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 :	00810779
Microphone Serial Number :	148338
Pre-amplifier Serial Number :	22257

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.9°C	**Ambient Temperature :**	24.3°C
Relative Humidity :	33.4%	**Relative Humidity :**	32.7%
Barometric Pressure :	100.22kPa	**Barometric Pressure :**	100.21kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	James Jepsen
Calibration Date :	18 Oct 2019	**Report Issue Date :**	21 Oct 2019

Approved Signatory : Ken Williams

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	*±0.18dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.19dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.29dB*	*Barometric Pressure*	*±0.015kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.11dB*		

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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