RODNEY STEVENS ACOUSTICS
Acoustic Consultants
Member Australian Acoustical Society

REPORT R190031R1

Revision 1

Acoustic Design Assessment
Proposed Rock-Climbing Facility
Shop 1, 1 Moore Road, Freshwater

PREPARED FOR:
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28 February 2019

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Acoustic Design Assessment

Proposed Rock-Climbing Facility

Shop 1, 1 Moore Road, Freshwater

PREPARED BY:

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
R190031R1	Revision 0	21 February 2019	Camilo Castillo	Rodney Stevens	Rodney Stevens
R190031R1	Revision 1	28 February 2019	Camilo Castillo	Rodney Stevens	Rodney Stevens

TABLE OF CONTENTS

1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (RSA) has been engaged by Andrew Martin Planning to prepare an acoustic assessment and design for the proposed rock-climbing facility at Shop 1, 1 Moore Road, Freshwater.

This report will address the possible noise breakout issues between the proposed rock-climbing facility, the adjacent suites and the residential receivers across Moore Road. The assessment has been carried out and prepared in accordance with *AS/NZ2107-2016 - Recommended Design Sound Levels and Reverberation Times for Building Interiors* and the *NSW EPA's Noise Policy for Industry (NPfI)*.

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

2 PROPOSED DEVELOPMENT

The proposal is to convert the existing commercial tenancy at Shop 1, 1 Moore Road, Freshwater, into a rock-climbing facility. The layout is presented in Figure 2-2

Figure 2-1 Shop Layout

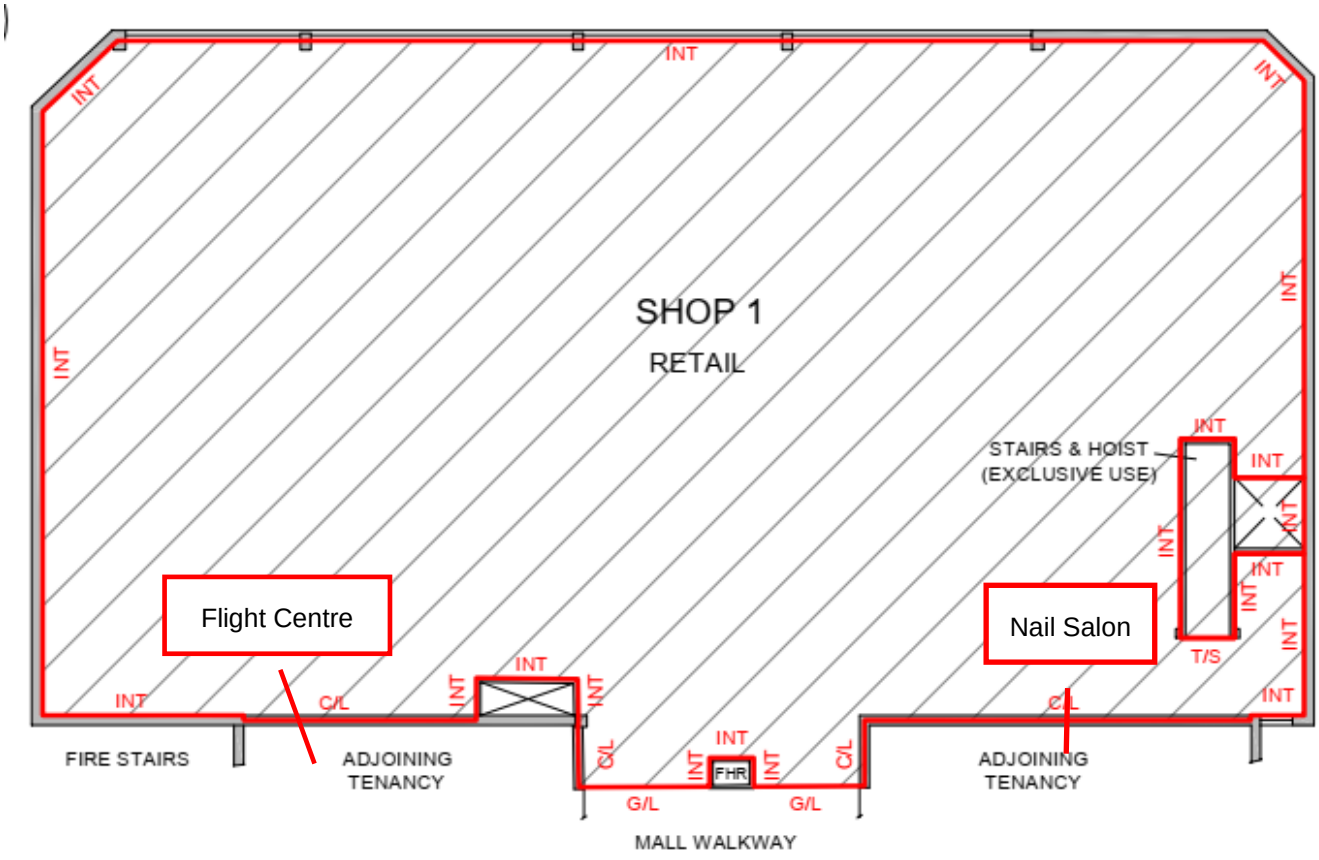


Figure 2-2 Proposed Facility Layout

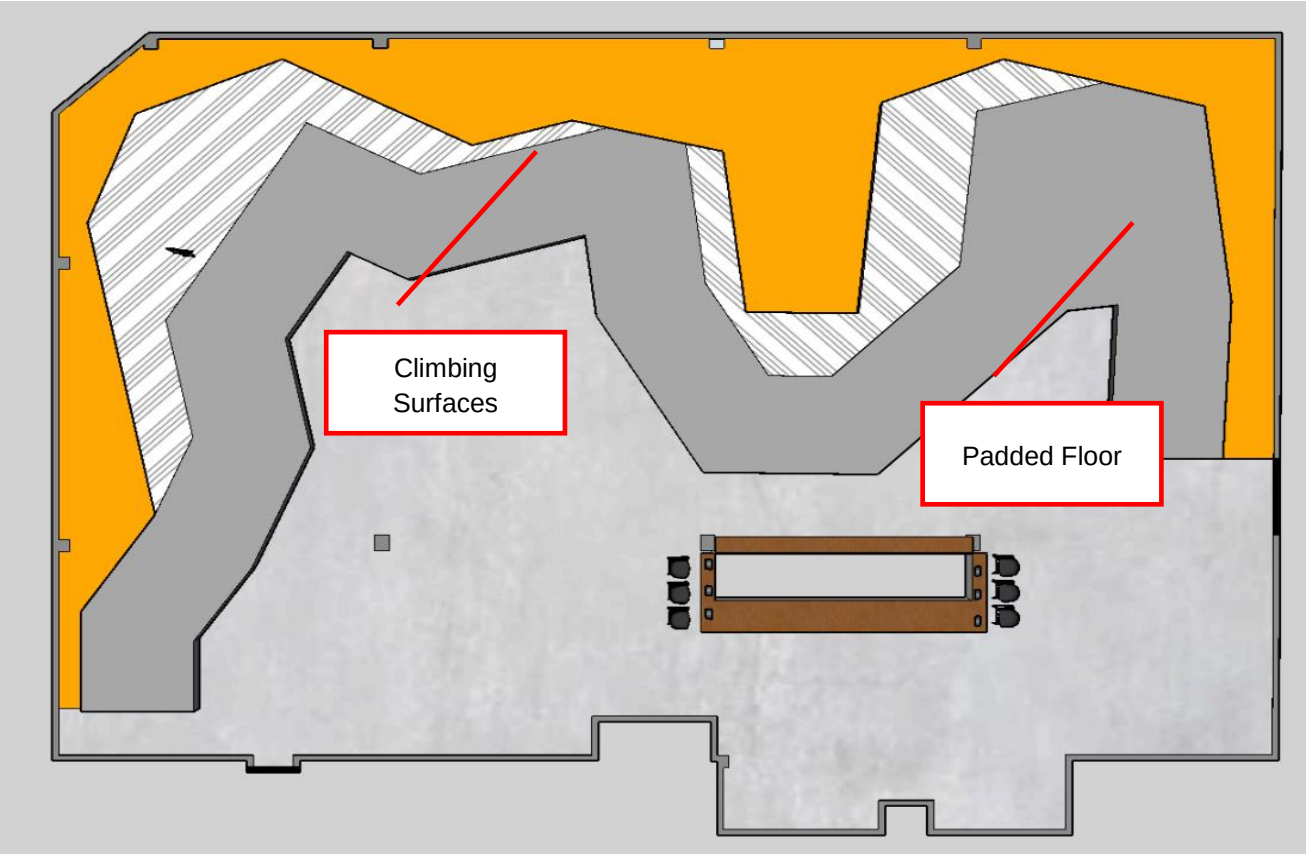


Figure 2-3 Site Location

Aerial image courtesy of Near Map © 2019

3 UNATTENDED NOISE MONITORING

In order to characterize the existing acoustical environment of the area unattended noise monitoring was conducted between Wednesday 13th February and Wednesday 20th February 2019. The logger was located at the front of 8 Moore Road, Freshwater.

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-42 environmental noise loggers (serial number 810779) fitted with microphone windshields. 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.

3.1 Data Processing

3.1.1 Ambient Noise Level Results

In order to assess the acoustical implications of the proposed development from the proposed development, the measured data was processed according to the *NSW Noise Policy for Industry (NPfI) - Ambient Noise Levels.*

Table 3-1 Ambient Noise Results

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
8 Moore Road	L_{Aeq}	59	57	52
	RBL (Background)	49	45	39

Note 1: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.

Note 2: 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.

4 ASSESSMENT CRITERIA

4.1 Australian Standard *AS/NZ 2107:2000*

The objectives set out in *AS/NZS 2107:2016 – Recommended Design Sound Levels and Reverberation Times for Building Interiors* provide good noise design goals for internal spaces with different uses. Table 4-1 presents an extract from the standard that pertains to recommended noise levels in office spaces including noise sensitive rooms.

Table 4-1 AS/NZS 2107:2000 – Recommended Internal Noise Levels

Type of Occupancy/Activity	Recommended Design Sound Level, L_{Aeq} dB(A)		
	Satisfactory	Maximum	Reverberation Time (s)
OFFICE BUILDINGS			
Corridors and Lobbies	45	50	0.4 – 0.6
Design Offices	40	45	0.4 – 0.6
General Offices	40	45	0.4 – 0.6
Private Offices	35	40	0.6 – 0.8
Shop Buildings			
Small Retail Stores (General)	<55		-

4.2 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.

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.3.4 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 4-2. These project trigger noise levels are nominated for the purpose of assessing potential noise impacts from the proposed development.

Table 4-2 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	60	49	59	**54**	58
	Evening	50	45	57	50	**48**
	Night	45	39	52	44	**43**

Note 1: ANL = “Amenity Noise Level” for residences in Urban Areas.

Note 2: RBL = “Rating Background Level”.

The noise criteria for commercial receivers is 65 dB(A) when in use.

5 ANALISYS AND DESIGN

5.1 Proposed Layout

The proposed rock-climbing facility will comprise of open space area with a U-shape wall with different climbing levels. The shop is adjacent to a Flight Centre and a nail salon to the south. The main acoustical issue is the noise breakout from music and patron noise into the adjacent suites and the residential receivers across Moore Road.

5.2 Mechanical Plant Noise Assessment

All mechanical ventilation will have to be installed in a way were all ducting is not connected to adjacent tenancy ducts. We have assumed that the proposed facility will connect to the base building ventilation system and no new mechanical plant will be installed.

5.3 Noise Emissions to Sensitive receivers

Calculations of the amount of noise transmitted to adjacent receivers from the proposed arcade 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 amount of patrons expected to be in the outdoor areas at any given time.

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 (Raised)	49	55	58	51	47	43	37	58
Female (Raised)	37	51	54	49	44	43	38	55

5.4 Patron Sound Power Levels

Based on a maximum number of 30 patrons, the following worst-case operational scenario has also been assumed for our assessment:

- A total of 30 patrons will be in the facility. Therefore, with 50 percent of the patrons talking (one person speaking and one person listening), the worst case scenario will be 15 patrons talking at any one time.

Table 5-2 Sound Power Levels of People talking with Raised Voice - L_w – dB(A)

Scenario	Resultant Sound Power Level per Octave Band (dB)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
30 Patrons with Raised Vocal Inside the Arcade	-	81	87	91	86	81	77	71

5.5 Music Sound Power Level

RSA has conducted measurements of background music noise levels at various venues, based on these measurements the sound power level spectrum of typical music is shown in Table 5-3 below:

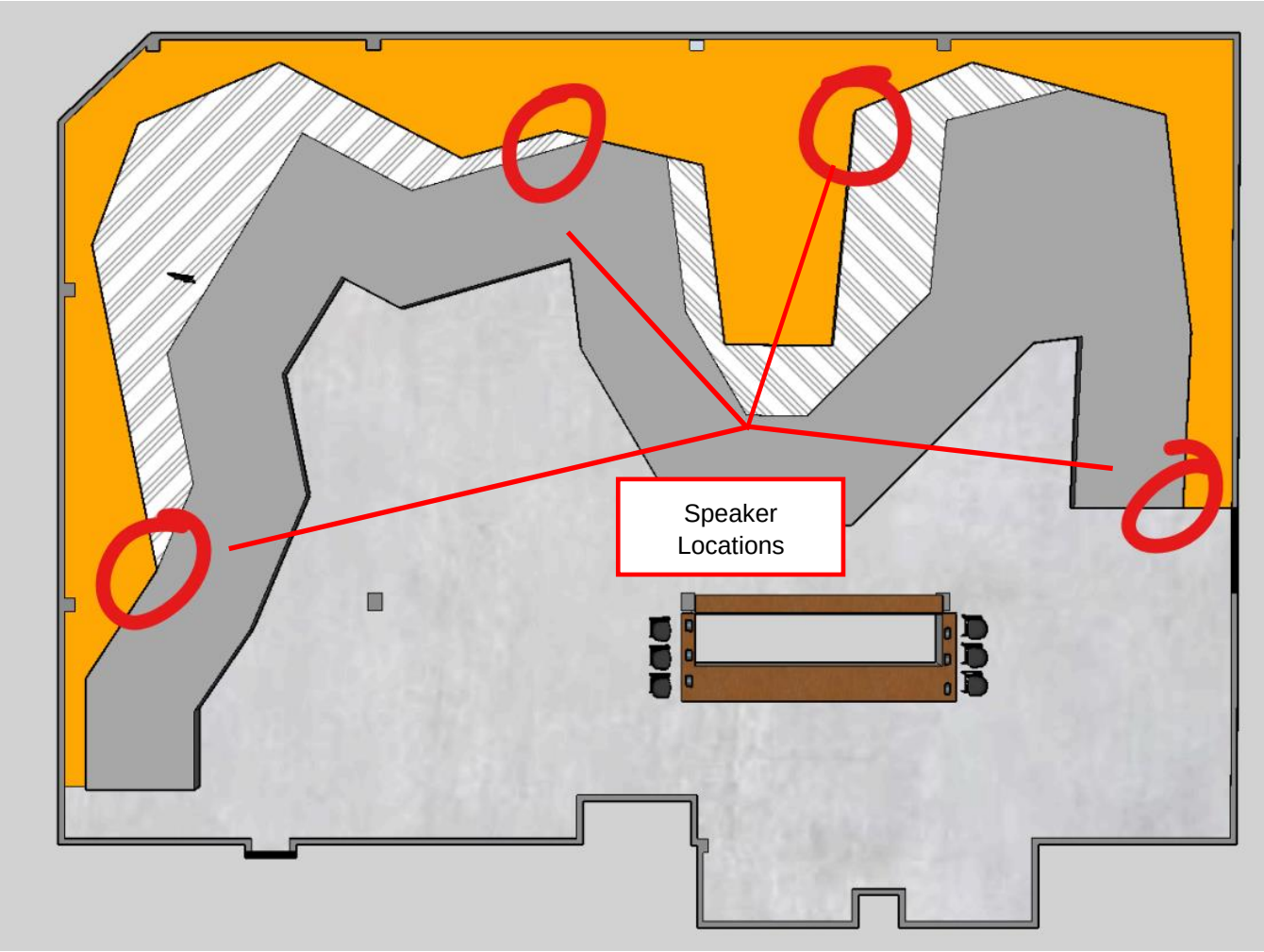
Table 5-3 Typical Sound Power Level of Typical Music - L_w – dB(A)

Scenario	Resultant Sound Power Level per Octave Band (dB)								
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Typical Background Music	70	79	87	84	79	82	80	78	71

The proposed facility will have a 4 speaker system, including a subwoofer, connected to an amplifier and music will be played through a tablet. We have been advised by management that patrons do not have access to the sound system controls and that music will be played at relatively low levels.

The speaker layout is presented in the following figure below:

Figure 5-1 Speaker Layout



5.6 Noise Emissions Calculation

Calculations of the noise levels from the arcade have been calculated using the data in Table 5-2 and Table 5-3. We have use the worst case scenario where all patrons are using the arcade and the music is playing at the same time. Calculations take into account factors such as distance, shielding from buildings and barriers.

The following figure presents the proposed development and all sensitive receivers.

Figure 5-2 Sensitive Receiver Location

The predicted noise calculations take into account the following:

- Heights of receivers are assumed to be 1.5 m above their respective floor level.
- All glazing on the northern façade consists of double glazing and will not be openable.
- Background music will be played throughout the site.
- The entry doors must be replaced with a door system having a minimum Rw 35 ratings and must be set to close automatically

Table 5-4 Predicted Noise Impact Levels at Nearby Receivers

Receiver	Time	Calculated Noise Level	Criteria	Compliance
R1	Day	24	54	Yes
	Evening	24	48	Yes
	Night	24	43	Yes
R2	Day	26	54	Yes
	Evening	26	48	Yes
	Night	26	43	Yes
R3	Day	29	54	Yes
	Evening	29	48	Yes
	Night	29	43	Yes
C1	When in Use	23	65	Yes
C2	When in Use	27	65	Yes
Flight Centre (Internal)	When in Use	27	55	Yes
Nail Salon (Internal)	When in Use	27	55	Yes

6 RECOMMENDATIONS

In order to maintain a high level of noise isolation between the proposed rock-climbing facility and the neighbouring suites a new set of doors must be implemented, the new glazed doors must have a minimum Rw 35 rating and must be able to close automatically after a patron enters or exits the facility.

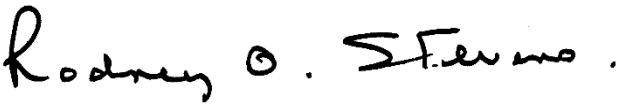
The windows on the northern façade must remain closed while music is being played within the facility

7 CONCLUSION

RSA has conducted a noise breakout assessment for the proposed rock-climbing facility at Shop 1, 1 Moore Road, Freshwater. The assessment has comprised the establishment building elements and acoustic treatment for the proposed rock-climbing facility to achieve compliance with Australian Standard *AS/NZS 2107:2016 – Recommended Design Sound Levels and Reverberation Times for Building Interiors* and the *EPA's Noise Policy for Industry 2017 (NPfI)*.

This report shows that under the most conservative operating scenario, operational noise emission from the proposed development will achieve the established noise criteria at neighbouring commercial and residential receivers. It is therefore recommended that planning approval be granted for the proposed development on the basis of acoustics

Approved:-

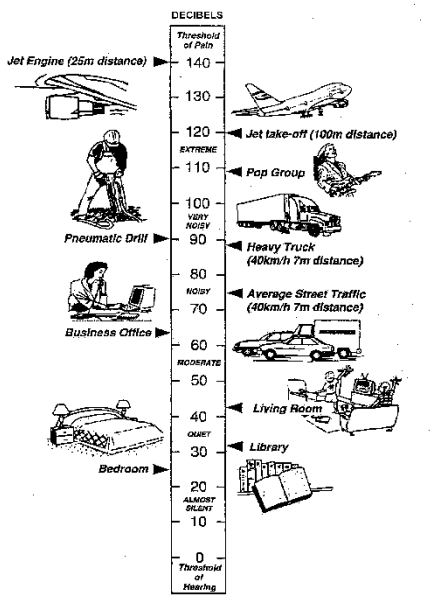


Rodney Stevens
Managing Director

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 10th 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)*.

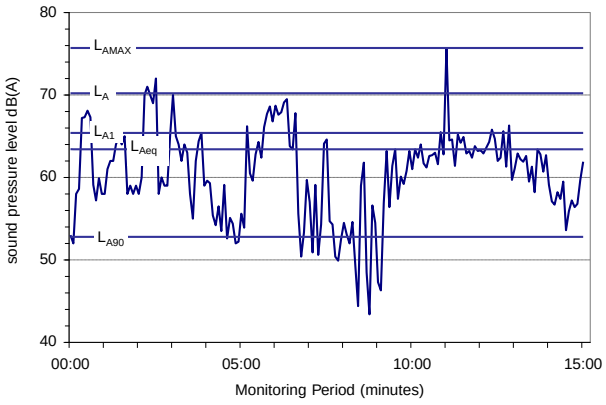
Sound Pressure Level (SPL)

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.

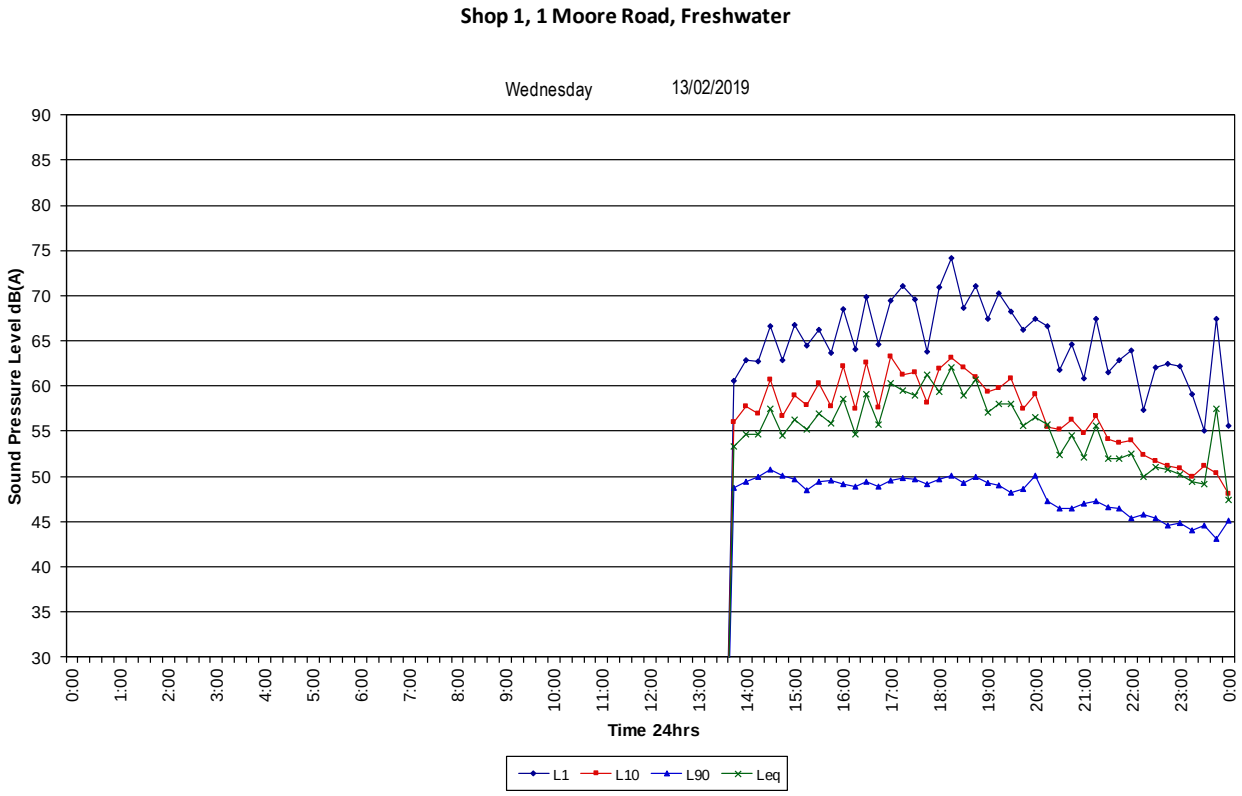
A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:

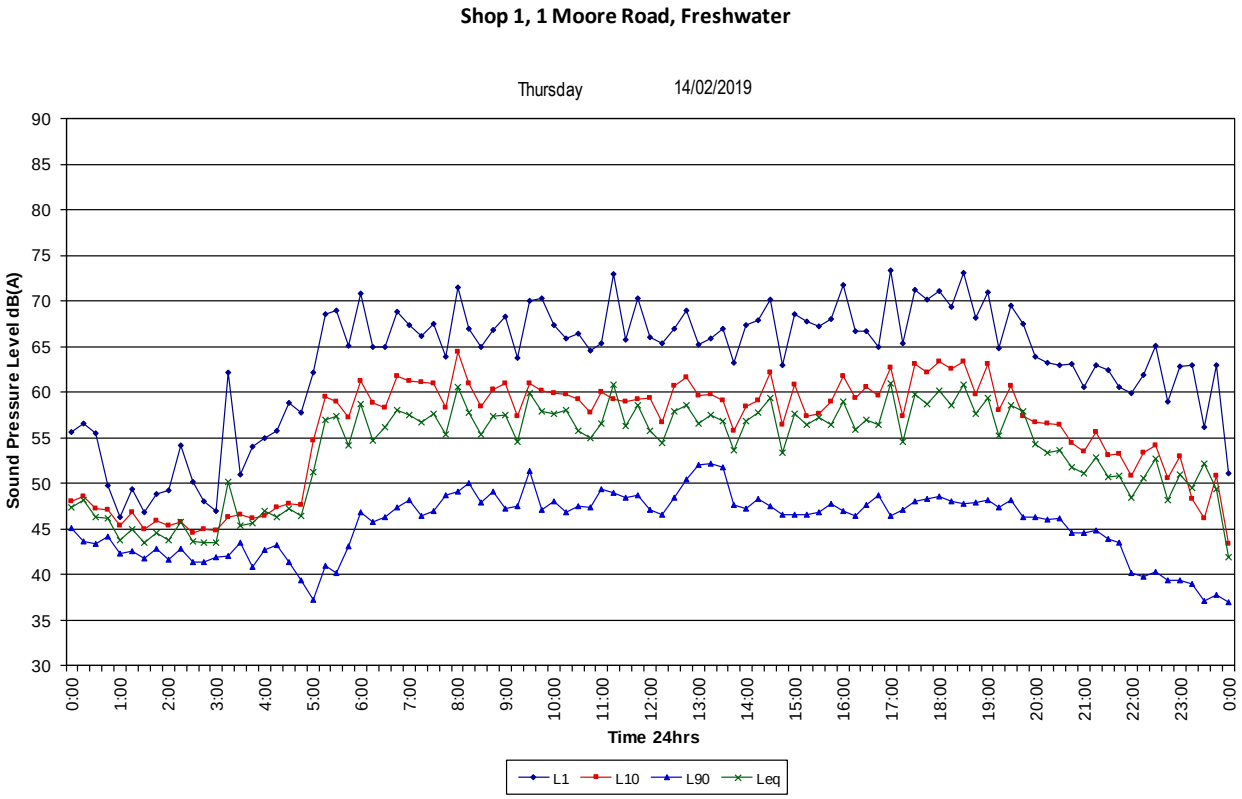


Key descriptors:

	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 – Logger Graphs





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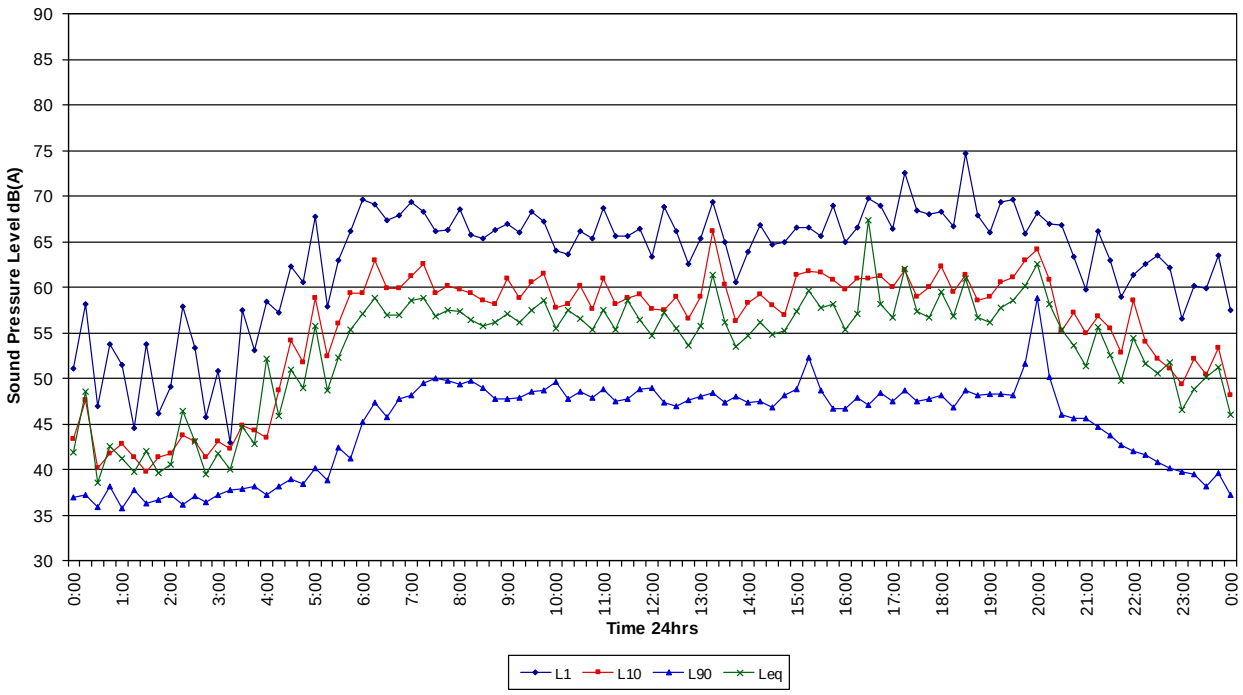
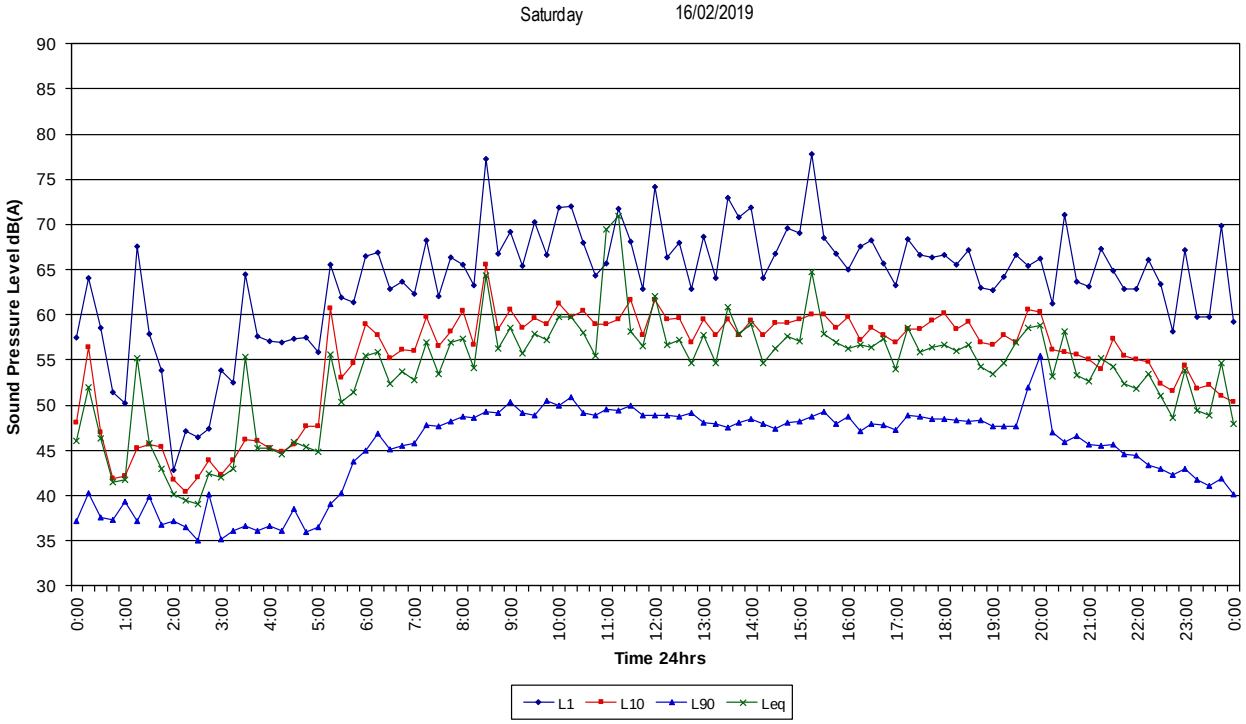
Friday 15/02/2019



Shop 1, 1 Moore Road, Freshwater

Saturday 16/02/2019



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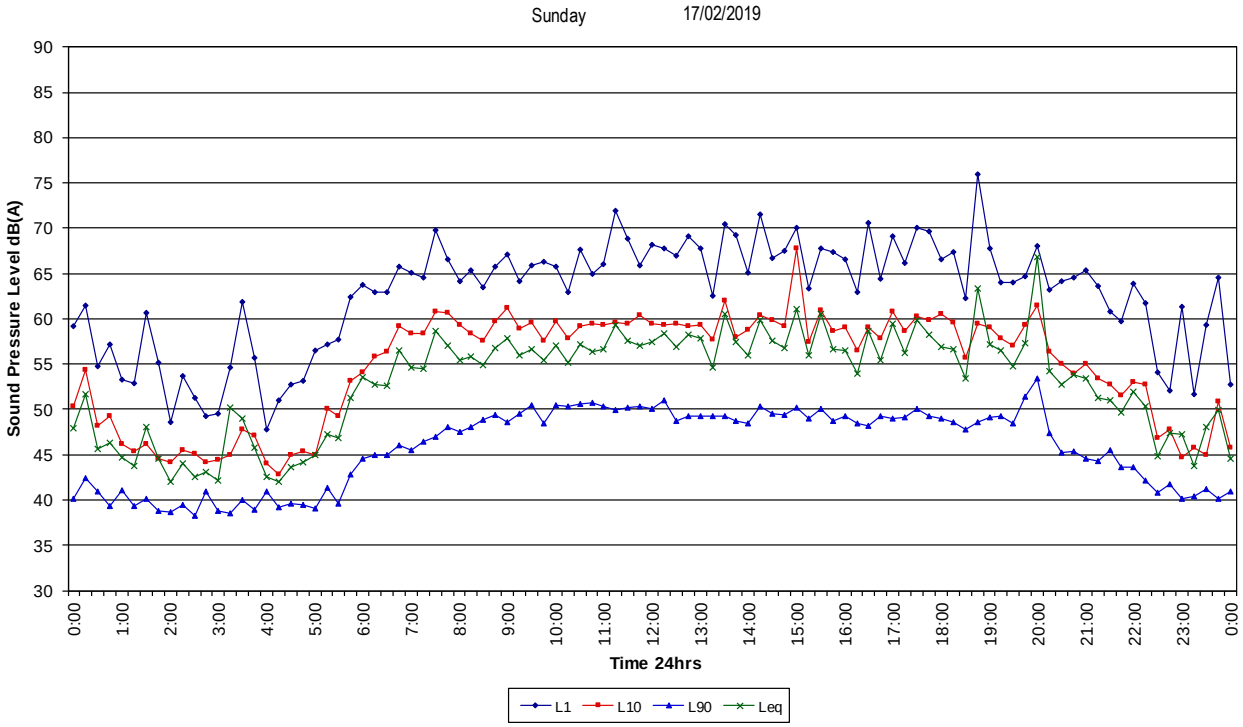

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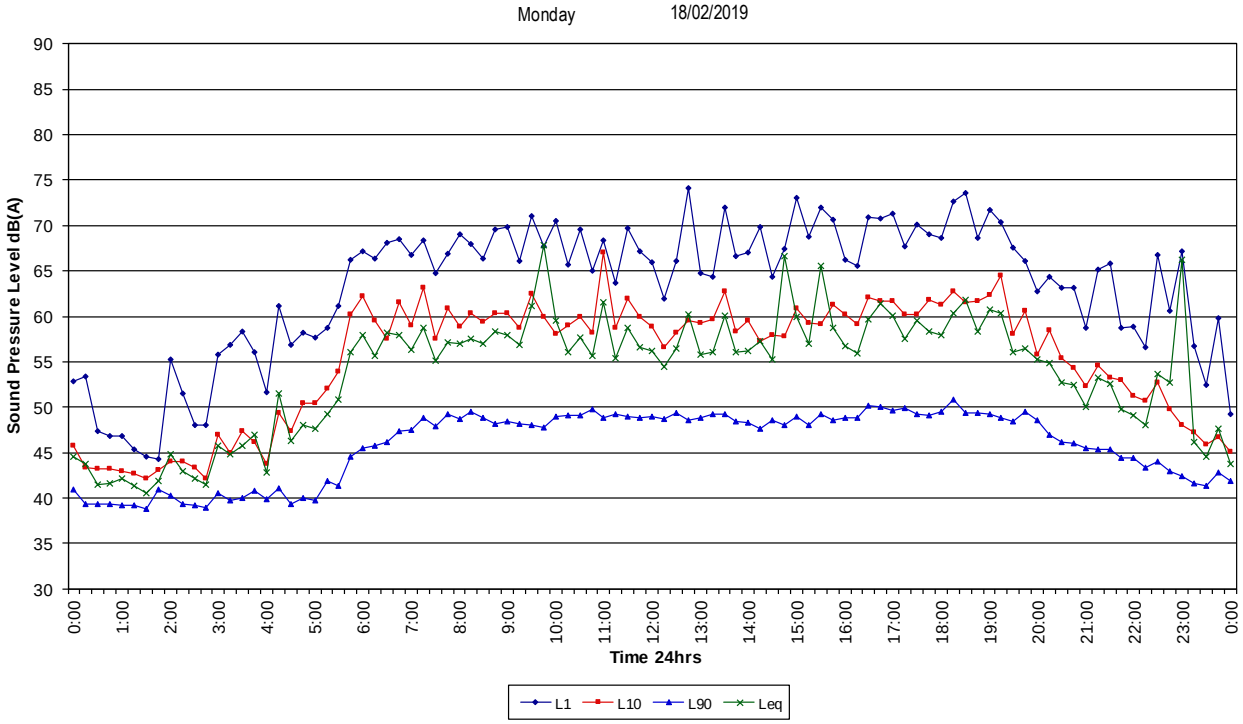

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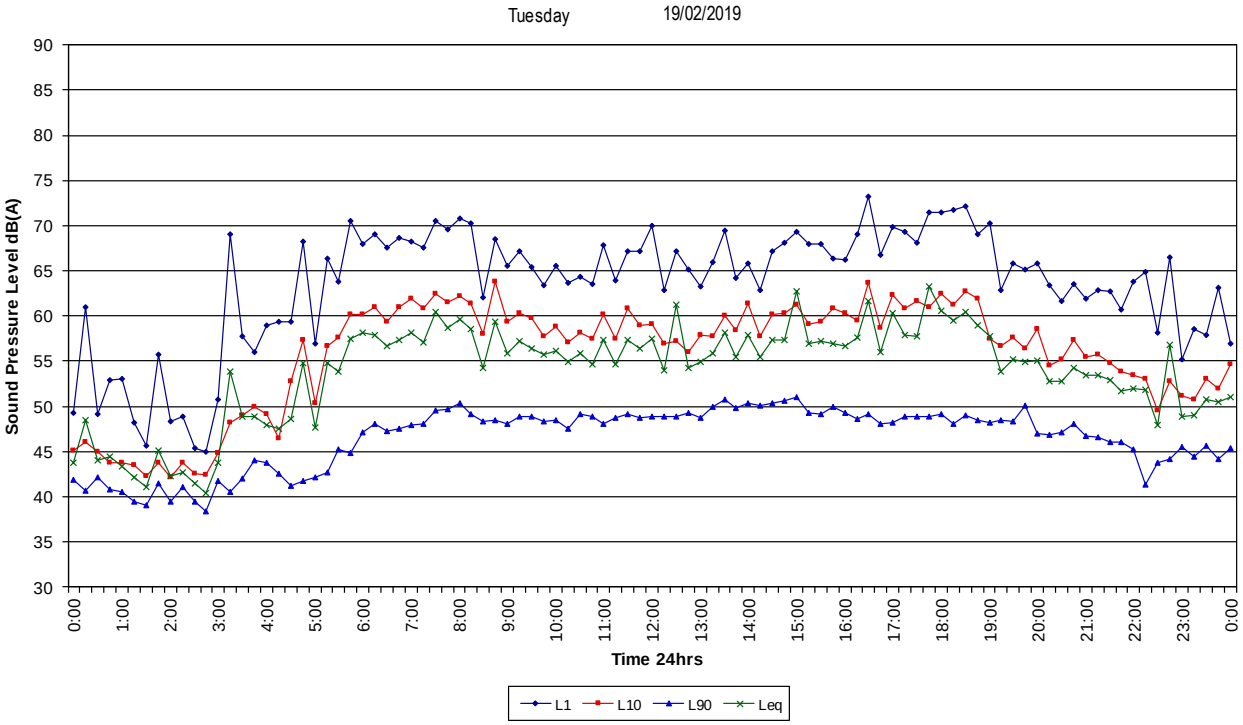
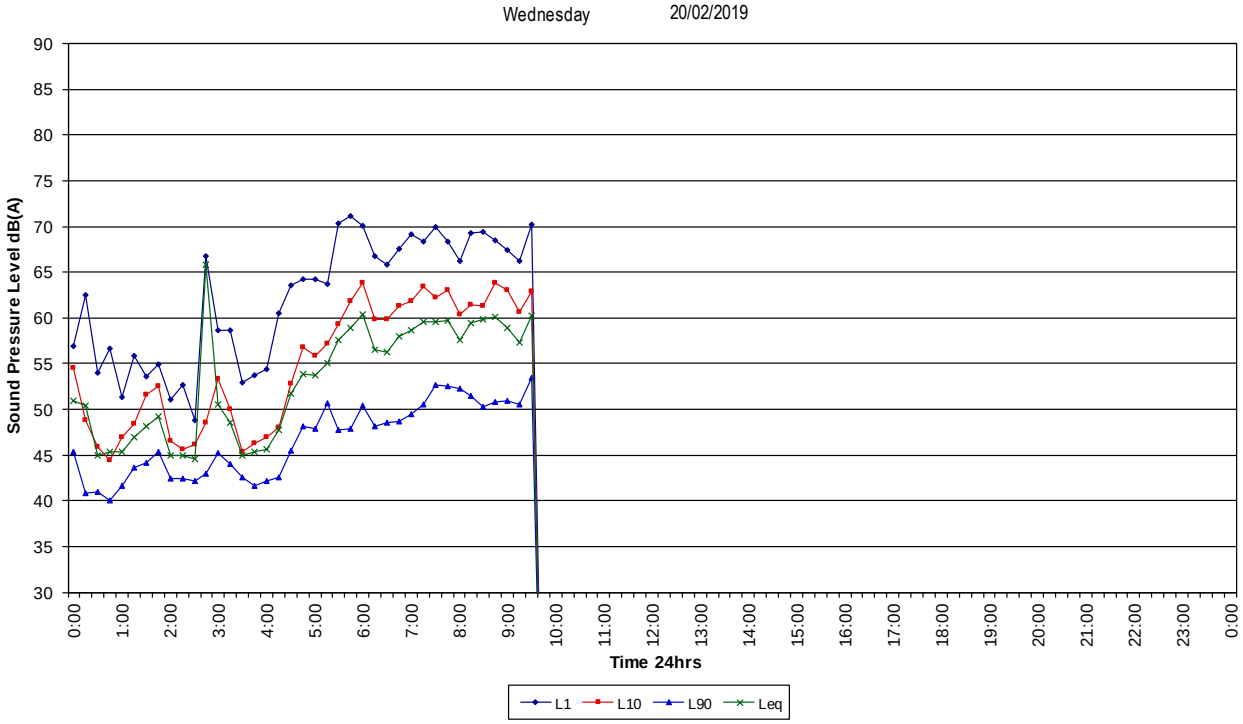


Shop 1, 1 Moore Road, Freshwater



Appendix C – Calibration Certificate

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 C17537

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

Equipment Tested/ Model Number : Rion NL-42
Instrument Serial Number : 00810779
Microphone Serial Number : 148338
Pre-amplifier Serial Number : 22257

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22°C	**Ambient Temperature :**	22.3°C
Relative Humidity :	45.5%	**Relative Humidity :**	47.1%
Barometric Pressure :	94.4kPa	**Barometric Pressure :**	99.35kPa

Calibration Technician : Jason Gomes
Calibration Date : 13/10/2017
Secondary Check: Riley Cooper
Report Issue Date : 17/10/2017

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 61672-3:2006, 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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