RODNEY STEVENS ACOUSTICS
Acoustic Consultants
Member Australian Acoustical Society

REPORT 170016R1

Revision 4

# Acoustic Impact Assessment
# Proposed Mixed Use Development
# 21 - 25 Woodriff Street, Penrith

PREPARED FOR:
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18 December 2020

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# Acoustic Impact Assessment

# Proposed Mixed Use Development

# 21 - 25 Woodriff Street, Penrith

PREPARED BY:

Rodney Stevens Acoustics Pty Ltd

[redacted]

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DOCUMENT CONTROL

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# 1 INTRODUCTION

Rodney Stevens Acoustics Pty Ltd (here forth referred to as RSA), has been engaged by Morson Group to conduct an acoustic impact assessment for Development Application (DA) lodgment of the proposed mixed-use development at 21 - 25 Woodriff Street, Penrith.

This report will address:

- Road traffic noise impact from Woodriff Street and the surrounding commercial areas on the amenity of the proposed multi-residential development
- Construction and vibration management plan
- Statements concerning the proposed gym/swimming pool and the potential effects of any traffic caused by the site.
- Operation of the bar and kitchen
- Use of the conference centre

This assessment is to form part of the supporting documentation for the DA submission to Penrith City Council.

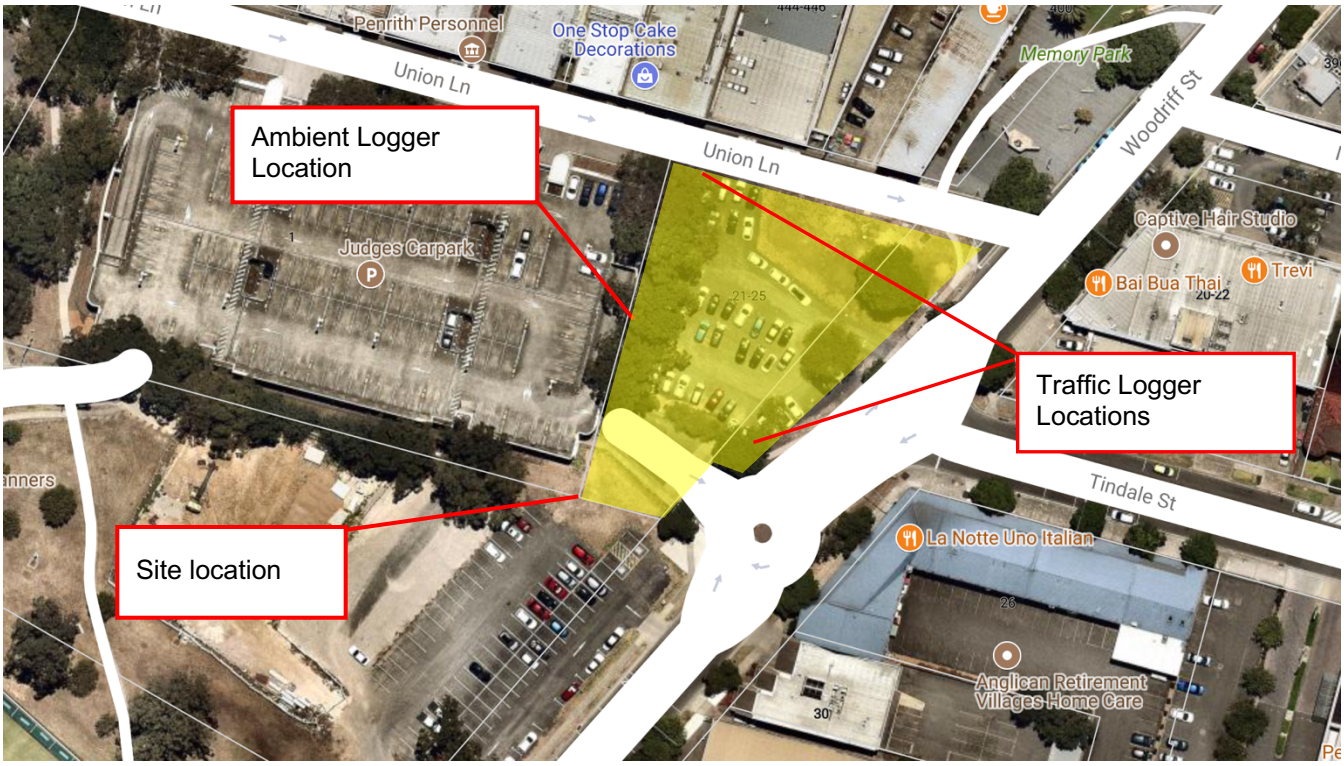
Specific acoustic terminology is present throughout this report. An explanation of these acoustic terms is provided in Appendix A

# 2 PROPOSED DEVELOPMENT

## 2.1 Site Location

The proposed residential development site is located at 21 - 25 Woodriff Street, Penrith. It is bounded by commercial premises to the north, east and south, with Judges Carpark to the west. The location of the proposed site and surrounding area is presented in Figure 2-1.

Figure 2-1 Site Location




Aerial image courtesy of Near Map © 2018

## 2.2 Proposed Development

The proposal is the construction of a seven-storey mixed use residential building comprising of residential apartments, commercial tenancies, a conference hall and a bar with swimming pool on the roof. The architectural plans of the proposed residential development are presented in Appendix D.

# 3 EXISTING ACOUSTIC ENVIRONMENT

## 3.1 Unattended Noise Monitoring

In order to characterize the existing acoustical environment of the area, RSA carried out unattended noise monitoring between Monday 27 February and Monday 6 March 2017 at the logging location shown in Figure 2-1. The noise monitoring at this location is representative of the acoustic ambient environment at the project site.

RSA also carried out unattended noise monitoring between Monday 27 February and Monday 6 March 2017 at the secondary logging locations shown in Figure 2-1. The noise monitoring at this location is representative of the traffic noise intrusion at the project site.

In order to establish the spectral background noise levels, additional noise monitoring was conducted between Friday 11th September and Thursday 17th September 2020 at the nearest residential receiver being 164 Lethbridge Street. Noise logging for the period of 9am to 2pm on 17th September have been removed due to weather.

RSA selects logger location with consideration to; other noise sources, which may influence readings, equipment security issues and gaining permission for access from other landowners.

Instrumentation for the survey comprised of three RION NL-42 environmental noise loggers (serial numbers 810713, 546394, 572558) and RION NL-42EX (serial number 546395) 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.

## 3.2 Ambient Noise Level Results

In order to assess the acoustical implications of the proposed development on the levels of noise received at the neighboring residential and commercial premises, the measured data was processed according to the NSW Environment Protection Authority (EPA) and Noise Policy for Industry (NPfI) assessment time periods. Table 3-1 details the RBL (background) and $L_{Aeq}$ noise levels recorded during the daytime, evening and nighttime periods.

Table 3-1 Measured Ambient Noise Levels

| Noise Level – dB(A) re 20 µPa | | | | | |
|---|---|---|---|---|---|
| Day | | Evening | | Night | |
| RBL [1] | $L_{Aeq}$ [2] | RBL [1] | $L_{Aeq}$ [2] | RBL [1] | $L_{Aeq}$ [2] |
| 50 | 61 | 42 | 55 | 40 | 59 |

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 $L_{Aeq}$ 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 NOISE CRITERIA

## 4.1 Road Noise and Vibration Criteria

The determination of an acceptable level of road noise that will impact 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.

### 4.1.1 Penrith City Council Requirements

Penrith City Council has specific requirements for traffic noise intrusion into residential spaces. These requirements are detailed in the Penrith City Council's DCP and pertain to the SEPP (Infrastructure) 2007 they are as follows:

> ***State Environmental Planning Policy (Infrastructure) 2007***
>
> *Appropriate measures must be taken to ensure that the following LAeq levels are not exceeded:*
>
> *In any bedroom in the building – 35 dB(A) at any time between 10 pm and 7 am*
>
> *Anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time*
>
> ***Environmental Health***
>
> *An acoustic report is to be prepared by an appropriately qualified acoustic consultant having the technical eligibility criteria required for membership of the Association of Australian Acoustical Consultants (AAAC) and/or grade membership of the Australian Acoustical Society (MAAS). The report shall consider noise intrusion from the road and measures to ensure compliance with SEPP (Infrastructure) 2007. The report should also consider noise emissions from the development including but not limited to proposed mechanical plant (air conditioners, lift shift, automatic roller doors, and ventilation plant for the underground car park) and*

*construction/vibration impacts. The report should be prepared in accordance with the NSW Environment Protection Authority Industrial Noise Policy, EPA's Interim Construction Noise Guidelines & NSW DP&I's Development near Rail Corridors and Busy Roads – Interim Guideline*

### 4.1.2 State Environmental Planning Policy (Infrastructure) 2007

**Road 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 summarized in Table 4-1.

Table 4-1 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 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."*

The noise criteria presented in Section 4.1.2 and in Table 4-1 apply 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.

## 4.2 Mechanical Services Noise Criteria –*Noise Policy for Industry*

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 noise criteria. The NPfI criteria 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.

### *4.2.1* Intrusiveness Criterion

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion 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.

### *4.2.2* Amenity Criterion

The amenity criterion 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 criteria 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 criterion 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 criterion.

### *4.2.3* Area Classification

The NPfI characterises the Urban – an area with an acoustical environment that:

- is dominated by 'urban hum' or
- industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources
- has through-traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above.

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

### *4.2.4* Project Specific Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific noise criteria. The intrusive and amenity criteria for nearby residential premises are presented in Table 4-2. These criteria 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 criteria are adopted.

These are shown in bold text in Table 4-2.

Table 4-2 Operational Project Trigger Noise Levels

| Receiver | Time of Day | ANL [1] $L_{Aeq(15min)}$ | Measured | | Project Trigger Noise Levels | |
|---|---|---|---|---|---|---|
| | | | RBL [2] $L_{A90(15min)}$ | $L_{Aeq}$ Noise Level) | Intrusive $L_{Aeq(15min)}$ | Amenity $L_{Aeq(15min)}$ |
| Residential | Day | 60 | 50 | 61 | **55** | 60 |
| | Evening | 50 | 42 | 55 | **47** | 50 |
| | Night | 45 | 46 | 59 | 51 | **45** |
| Commercial | When in use | 65 | - | - | - | **65** |

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

Note 2: RBL = "Rating Background Level".

## 4.3 Liquor and Gaming

Liquor and Gaming NSW provides a guideline to access noise from licensed venues, the noise criteria is required to be in one octave band frequency. The noise logger used for the unattended measurements has the capability of recording noise data in one octave band frequency allowing us to establish spectral information of typical background noise levels experienced by the nearby residential receivers.

LG guidelines for the assessment of noise from licensed premises is as follows:

*a) The $L_{A10}$ noise level emitted from the use must not exceed the background noise level ($L_{90}$) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) by more than 5 dB between the hour of 7.00 am and 12.00 midnight when assessed at the boundary of any affected residence.*

*b) The $L_{A10}$ noise level emitted from the use must not exceed the background noise level ($L_{90}$) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) between the hour of 12.00 midnight and 7.00 am when assessed at the boundary of any affected residence.*

*c) Notwithstanding compliance with a) and b) above, the noise from the use must not be audible within any habitable room in any residential property between the hours of 12.00 midnight and 7.00 am.*

## 4.4 Project Specific Noise Criteria

Based on the spectral data from the noise logger (serial 546395) the project specific noise criteria for the operation of the proposed bar have been established in accordance with LG noise guidelines. The project specific noise criteria for the proposed bar is presented in tables below.

Table 4-3 External Criteria for Operational Noise

| Description | Ambient Noise Level per Octave Band -dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1k Hz | 2k Hz | 4k Hz | 8k Hz |
| Measured Daytime $L_{90}$ Background Noise Level | 49 | 49 | 45 | 40 | 39 | 36 | 28 | 26 | 18 |

| Description | Ambient Noise Level per Octave Band -dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1k Hz | 2k Hz | 4k Hz | 8k Hz |
| **$L_{10}$ Daytime Criterion (Between 7 am and 12 midnight): At Surrounding Residences** | **54** | **54** | **50** | **45** | **44** | **41** | **33** | **31** | **23** |
| | | | | | | | | | |
| Measured Night-time $L_{90}$ Background Noise Level | 43 | 43 | 40 | 38 | 38 | 33 | 24 | 22 | 15 |
| **$L_{10}$ Night-time Criterion (Between 12 midnight and 7 am): At Surrounding Residences** | 43 | 43 | 40 | 38 | 38 | 33 | 24 | 22 | 15 |

# 5 NOISE IMPACT ASSESSMENT

## 5.1 Road Traffic Noise

### 5.1.1 Road Traffic Noise Intrusion Assessment

In order to ascertain the existing noise levels from the surrounding area, the measured noise logger data was processed in accordance to the NSW Road Noise Policy assessment time periods. Table 5-1 details the traffic noise levels.

Table 5-1 Measured Traffic Noise Levels

| Logger Location | Noise Level – dB(A) re 20 µPa | |
|---|---|---|
| | $L_{Aeq\ (15hour)}$ 07:00 – 22:00 | $L_{Aeq\ (9hour)}$ 22:00 to 07:00 |
| Woodriff Street | 62 | 55 |
| Union Street | 60 | 52 |

Traffic noise levels recorded by the noise logger have been corrected to account for the distance from the road to the proposed façade. These are representative of the noise levels the proposed façade will encounter.

## 5.2 Mechanical Plant Noise Assessment

Mechanical plant selection for the development hasn't been finalised at this stage. It is envisaged that with standard mechanical plant selection and installation the project specific noise goals can be achieved. The plant would need to be selected on the basis of quiet operation. Potential mechanical plants and equipment that could have an adverse acoustic impact includes commercial kitchen exhaust, outdoor air-conditioning units, pool pumps, automatic roller shutter doors, deliveries and garbage collection.

It is recommended that any outdoor air-conditioning plants be located on the roof or basement of the proposed building to provide maximum attenuation to neighbouring residential receivers. It is envisaged that any mechanical noise emissions will be controllable by selection of low-noise equipment and judicious location of plant, as well as installation of an acoustic enclosure (where required).

Automatic roller doors noise emissions can be controlled through installing a slow closing motor to avoid the roller door generating noise at closing.

Kitchen exhaust is proposed to be installed on the roof of the building. At this stage, there is no selected fans for the intake and the exhaust of the commercial kitchen. It is likely that the criteria set out in this report will be met through the use of conventional noise control methods (e.g. selection of equipment on the basis of quiet operation and, where necessary, providing localised barriers, silencers and lined ductwork).

An appropriately qualified acoustic consultant should review the mechanical plant associated with the development at the detailed design stage when final plant selections have been made.

# 6 RECOMMENDED NOISE CONTROL TREATMENT

The calculation procedure establishes the required noise insulation performance of each surface component such that the internal noise level is achieved whilst an equal contribution of traffic noise energy is distributed across each component. Building envelope components with a greater surface area must therefore offer increased noise insulation performance.

The recommended acoustic treatments are based on the following floor finishes:

- Bedrooms: Carpet and underlay
- Living Room Hard Flooring
- Kitchen/Wet Areas: Tiles

The acoustic requirements shown in this report will further increase where bedroom floor finishes are tiled or timbered.

All recommendations must be checked against others to ensure compliance with other non-acoustic requirements that Council or other authorities may impose (e.g. Thermal requirements for BASIX compliance).

## 6.1 Glazing

The $R_w$ rating required for each window will vary from room to room. Recommendations for windows also apply to any other item of glazing located on the external facade of the building in a habitable room unless otherwise stated.

Note that the $R_w$ rating is required for the complete glazing and frame assembly. The minimum glazing thicknesses will not necessarily meet the required $R_w$ rating without an appropriate frame system. It will be therefore necessary to provide a window glass and frame system having a laboratory tested acoustic performance meeting the requirements acoustic requirements.

The window systems must be tested in accordance with both of the following:

- Australian Window Association Industry Code of Practice Window and Door – Method of Acoustic Testing; and
- AS 1191 Acoustics – Method for laboratory measurement of airborne sound insulation of building elements.

It is necessary to submit such Laboratory certification for the proposed glazing systems (i.e. windows and framing systems) (e.g. NAL or CSIRO) for approval by RSA Acoustics prior to ordering or commitment.

The entire frame associated with the glazing must be sealed into the structural opening using acoustic mastics and backer rods. Normal weather proofing details do not necessarily provide the full acoustic insulation potential of the window system. The manufacturers' installation instructions for the correct acoustic sealing of the frame must be followed.

It is possible that structural demands for wind loading or fire rating or the like may require more substantial glass and framing assemblies than nominated above. Where this is the case the acoustic requirements must clearly be superseded by the structural or fire rating demands.

## 6.2 Rw Requirements for Glazing

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

- Glazed windows and doors on all facades of levels 1-3 facing union lane and levels 1-3 facing Judges carpark of the residential development will need to be closed to meet internal noise levels. Therefore, 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.

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 6-1 below.

Table 6-1 In-principle Glazing Recommendations

| Location | Glazing Type | Minimum Glazing Rw Rating | Indicative Glazing System |
|---|---|---|---|
| **Residential Apartments on Level 1 - 2 (Eastern Façade) Facing Woodriff Street** | | | |
| Living Rooms | Sliding Door | Rw 32 | 6.38mm laminated glass in acoustically sealed frame* |
| | Sliding Window | Rw 32 | 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* |
| **Residential Apartments on Level 3 - 6 (Eastern Façade) Facing Woodriff Street** | | | |
| Living Rooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| Bedrooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| **Residential Apartments on Level 1 - 2 (Northern/Western Facades) Facing Union Lane & Judges Carpark** | | | |

| | | | |
|---|---|---|---|
| Living Rooms | Sliding Door | Rw 32 | 6.38mm laminated glass in acoustically sealed frame* |
| | Window | Rw 32 | 6.38mm laminated glass in acoustically sealed frame** |
| Bedrooms | Sliding Door | Rw 34 | 10.38mm laminated glass in acoustically sealed frame* |
| | Window | Rw 34 | 10.38mm laminated glass in acoustically sealed frame* |
| **Residential Apartments on Level 3- 6 (Northern/Western Facades) Facing Union Lane & Judges Carpark** | | | |
| Living Rooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| Bedrooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| **Residential Apartments on Level 1 - 2 (Southern Façade)** | | | |
| Living Rooms | Sliding Door | Rw 26 | 6mm clear glass in acoustically sealed frame* |
| | Window | Rw 26 | 6mm clear glass in acoustically sealed frame* |
| Bedrooms | Sliding Door | Rw 30 | 6.38mm laminated glass in acoustically sealed frame* |
| | Window | Rw 30 | 6.38mm laminated glass in acoustically sealed frame* |
| **Residential Apartments on Level 3 - 6 (Southern Façade)** | | | |
| Living Rooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| Bedrooms | Sliding Door | Rw 38 | 6.38mm lam/50mm/6mm float in acoustically sealed frame* |
| | Window | Rw 38 | 6.38mm lam/50mm/6mm float 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.

Please note Rw ratings provided in Table 6-1 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.

# 7 BAR & CONFERENCE NOISE IMPACT ASSESSMENT

## 7.1 Typical Patron Vocal Levels

The following sections summarise the results of patron noise assessment and predicted levels at nearby residential receivers as a result of the operation of the proposed bar and conference room.

Calculations of the amount of noise transmitted to these receivers from bar and the conference 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 7-1.

The spectra have been scaled based upon the overall number of patrons expected to be in the respective areas at any given time

Table 7-1 Speech Spectrums - Handbook of Acoustical Measurements and Noise Control.

| Type | Noise Level (dB) at Octave Band Centre Frequency (Hz) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1 k | 2 k | 4 k | 8 k |
| Male (Raised) | 53 | 59 | 64 | 58 | 54 | 49 | 43 |
| Female (Raised) | 35 | 55 | 60 | 58 | 54 | 49 | 43 |

## 7.2 Patron Sound Power Levels

Based on the maximum number of patrons 200 patrons per area the following worst-case operational scenarios have been assumed for our assessment:

- Only 50% of all patrons per room will be talking at any given time, this is assuming that 1 person will be talking and 1 person will be listening.

Table 7-2 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 |
| 100 Patrons with Raised Vocal in the outdoor bar | 83 | 89 | 94 | 88 | 84 | 79 | 73 | 83 |
| 100 Patrons with Raised Vocal the conference room | 83 | 89 | 94 | 88 | 84 | 79 | 73 | 83 |

It is generally agreed that the human voice is not capable of producing noise at 32 Hz and 63Hz octave bands at significant amplitudes. It is also very likely that even if noise emission in this low frequency octave bands exceeds the noise criterion; it will be very close to, if not below, the human threshold of hearing at the receivers.

Appropriate sound power levels conversations have been made for the varying distribution number of patrons.

## 7.3 Music Sound Power Level

RSA has conducted measurements of background music noise levels at various licensed venues, based on these measurements the sound power level spectrum of typical music is shown in Table 7-3 below:

Table 7-3 Typical Sound Power Level of Typical Music - Lw – 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 |
| Typical Live Music | 79 | 89 | 93 | 89 | 87 | 89 | 81 | 73 | 66 |

## 7.4 Predicted Noise Impacts

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

- Heights of receivers are assumed to be 1.5 m above their respective floor level.
- The number of patrons is as presented in Section 7.2
- Background music and live music in the bar area
- Background music and live music in the Conference/function centre
- The bar will operate until 12:00am
- Conference/function room will operate until 12:00am
- 1.6m solid balustrade around the outdoor bar/lower rooftop deck
- Resulting noise levels have been calculated to the most affected point on the boundary of the affected receivers

The site is surrounded by commercial tenancies and residential premises to the south on Lethbridge Street.

The resulting noise levels from the operation of the proposed conference room and outdoor bar are presented in the table below, we have assumed the worst-case scenario were the conference room and the outdoor bar are operating simultaneously and at full capacity.

The following table shows the predicted noise level results for the residential receivers.

Table 7-4 Predicted External Noise Impact Levels - Residential Receivers Daytime

| Receivers | Resultant Sound Pressure Level per Octave Band - dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| **Daytime Assessment (7:00am to 12:00am)** | | | | | | | | | |
| | **Combined Noise Level** | | | | | | | | |
| 164 Lethbridge Road | 22 | 31 | 38 | 41 | 35 | 33 | 29 | 25 | 21 |

| Receivers | Resultant Sound Pressure Level per Octave Band - dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 Hz | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
| 109 Station Street | 22 | 24 | 31 | 34 | 28 | 26 | 22 | 18 | 21 |
| Daytime Criteria | **54** | **54** | **50** | **45** | **44** | **41** | **33** | **31** | **23** |
| *Exceedance R1* | - | - | - | - | - | - | - | - | - |
| *Exceedance R2* | - | - | - | - | - | - | - | - | - |

The predicted noise levels at the nearest residential receivers show compliance to the established noise criteria.

### 7.5 Noise Control Measures

The above noise impact show compliance to the established noise criteria. In order to preserve acoustic amenity at nearby residential receivers, the following noise control measures are recommended:

- A noise limiter is to be installed to ensure live music in all areas does not exceed 80 dB(A) at 1 metre from the speakers. 32Hz and 63Hz to be limited to no more than 65 dB(A) at 1 metre from the speakers.
- All speakers are to face the centre of the bar area
- The glazing of the function/conference room be required to achieve a rating of $R_w$ 38. These Rw ratings are generally achieved with 6.38mm lam/50mm/6mm float double glazed system with aluminium frames and acoustic seals.

## 8 GYMNASIUM RECOMMENDATIONS

### 8.1 Noise and Vibration Criteria

#### 8.1.1 Australian Standard *AS/NZ 2107:2000*

There is the potential of the use of the gym to impact on the amenity of the adjoining residential tenancies located next below the gym. As Penrith Council DCP 2011 has no acoustic criteria for the preservation of the amenity of residential tenancies specific to this type of assessment, we have adopted noise objectives as set out in *AS/NZS 2107:2016 – Recommended Design Sound Levels and Reverberation Times for Building Interiors*. Table 8-1 is an extract from the standard that pertains to recommended noise levels in residential apartments near major road.

Table 8-1 AS/NZS 2107:2016 – Recommended Internal Noise Levels

| Type of Occupancy/Activity | Recommended Design Sound Level, $L_{Aeq}$ dB(A) | |
|---|---|---|
| | Satisfactory | Maximum |
| **Residential Building** (Houses and apartments in inner city areas or entertainment districts or near major roads) | | |
| Apartment common areas | 45 | 50 |
| Living areas | 35 | 45 |
| Sleeping areas (night time) | 35 | 40 |
| Work areas | 35 | 45 |

## 8.2 EPA Vibration Guideline

In February 2006, the NSW Environment Protection Authority (EPA) introduced its "*Assessing vibration: a technical guideline*". This document is based on guidelines contained in British Standard (BS) 6472–1992, "*Evaluation of human exposure to vibration in buildings (1–80 Hz)*".

The EPA document contains guidelines for "continuous and impulsive vibration" and also for "intermittent vibration" and was to be considered interim until the revision of BS 6472-1992. The document does not contain criteria per se, but rather, ranges of levels of "preferred values" of vibration, below which "a low probability of adverse comment" can be expected.

BS 6472 was subsequently revised in 2008. BS 6472-1:2008: "*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*" focuses on Vibration Dose Values (VDVs) which allow assessment of impulsive and intermittent vibration.

Whilst the previous (1992) version of BS6472 contained the same criteria for human exposure to continuous vibration as AS2670, the revised version focuses on the use of VDVs which allow an assessment of the severity of impulsive and intermittent vibration to be carried out.

It is recommended that an assessment in terms of intermittent vibration (VDVs) is appropriate as each Physio Gym's training/workout session, which occurs for a period of approximately 45 minutes to an hour, may potentially have more than three vibration events.

BS 6472-1:2008 nominates criteria for various categories of disturbance, the most stringent of which are the levels of building vibration associated with a "low probability of adverse comment" from occupants. The "low probability of adverse comment" level for residential buildings is:

- **0.2 to 0.4 m/s$^{1.75}$** (Vibration Dose Value)

BS 6472-1:2008 goes on to state:

> *These values represent the best judgement currently available and may be used for both vertical and horizontal vibration, provided that they are correctly weighted. It is inevitable that the criteria have to be presented as ranges rather than discrete values. This stems largely from the widely differing susceptibility to vibration evident among members of the population, but also from their differing expectations of the vibration environment. Parallel effects can also exert some influence. Because there is a range of values for each category, it is clear that the judgement can never be precise*.

### 8.2.1 Gym Assessment and Recommendations

There is potential for airborne noise and structure borne transmission from the use of the gymnasium to the residents on the levels directly below. Noise from the gym can be caused from various activities including the use of treadmills and weights being dropped on the floor.

Structure borne noise from weights being dropped on the floor and high impact activities at the proposed gym have the potential to cause disturbances to the residents, the following noise controls must be implemented to ensure the amenity of the residents of the development is protected:

- A specific area for weight training or high impact floor exercises i.e. jump squats, kettle bells must be selected. The entire floor must be covered with a 15mm thick A1 Rubber flooring system with and additional layer of 45mm high density EVA foam as a minimum.
- Treadmills should be installed on vibration isolation system suitable for high impact treadmills. This can include a composite material design compromising of Pyrotek Subdue on Sylomer Pads. Similar design can be incorporate however it is recommended RSA to be consulted.
- The gym must not be used between the hours of 10 pm and 7 am.
- Patrons must have duty of care when handling weights and using equipment in order to avoid unnecessary noise. Signs should be posted in the gym restricting any weights being dropped on the floor.
- All free weights and plates should be rubber coated.
- A Plan of Management should also be incorporated with the operation of the gym. The following should be included in the POM:
- Patrons are not to drop any weights on the gym floor
- Signs to be posted on the gym advising patrons not to generate any unwanted noise
- External doors to have a self-closing mechanism to ensure door is always closed

With the provision of the above recommendations, the noise and vibration criteria can be met for the worst-case resident directly below the gym. The impact of the gym on the development must be revaluated at a later stage when plans are finalised and more details are made available. This should be done prior to the issue of a construction certificate.

## 9 SWIMMING POOL RECOMMENDATIONS

Noise and vibration generated by the use of the swimming pool can cause an adverse acoustic impact to the residents directly below the pool. People jumping and swimming in the pool will cause structure borne vibration and noise which will flank to the residential living spaces below.

Further acoustic treatment to the swimming pool is recommended to be incorporated within the design of the swimming pool. The following measures are recommended:

- Embleton Type TDRP 26 spring mounted vibration isolation mounts are designed specifically to isolate swimming pools from the main building structure. By isolating the swimming pool, vibration and structure borne noise will be attenuated

## 10 ROAD NOISE POLICY

With added vehicles on the local roads from the future residents, there is a potential for increase in local traffic volume. Any increase in local traffic volume has the potential to increase the noise levels of the roads. NSW Road Noise Policy (RNP) governs the increase in noise levels from either a redevelopment of roads, adding additional roads or any residential and commercial developments. Table 6 of the RNP has the following criteria:

*Existing residences affected by additional traffic on existing local roads generated by land use developments. With a day (7am – 10pm) criteria of $L_{Aeq(1hour)}$ 55 dB external and a night (10pm – 7am) criteria of $L_{Aeq(1hour)}$ 55 dB external.*

The current noise levels on the site was measured to be 60dB for daytime and 58dB for night time. Looking at the current volume of location traffic and the additional traffic volume from the proposed development, it is in the opinion of Rodney Stevens Acoustics that the RNP criteria will be met.

# 11 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

## 11.1 Project Area and Sensitive Receivers

Construction will wholly take place within the boundaries of at 21 - 25 Woodriff Street, Penrith. Potentially affected sensitive receivers are displayed below in red in correlation to the site in yellow in Figure 11-1.

Figure 11-1 Sensitive Receivers


## 11.2 Proposed Construction Works

All construction works required to complete the proposed development will be undertaken during standard daytime construction hours of 7 am – 6 pm Monday to Friday and 8 am – 1 pm Saturday only. Works outside of the standard daytime construction hours will only be undertaken with prior assessment and required approvals.

The construction program is to include the following key work stages and potential noise and ground vibration generating activity:

- Demolition of the parts of the existing building located at the project site;
- Excavation of some of the bedrock adjacent to the residence;

- Construction of the new parts of the residential building including foundation works, concreting and infrastructure installation of framework, walls, roof and electrical fit out;

The construction phases will include some limited site clearance, foundation preparation and infrastructure installation. It is our understanding that the construction program is proposed to be more than 3 weeks in duration.

## 11.3 Construction Noise and Vibration Criteria

### 11.3.1 Construction Noise

Noise criteria for construction works are established in accordance with the EPA *Interim Construction Noise Guidelines* (ICNG).

All construction works are to be undertaken during daytime core hours of 7 am–6 pm Monday to Friday and 8 am-1 pm Saturdays. No construction works are anticipated to be required outside of the standard daytime standard construction hours unless otherwise approved.

The ICNG provides recommended construction (airborne) noise management levels for residential receivers as detailed in Table 11-1.

Site specific noise management levels (NML) have been established adopting the background noise levels ($L_{A90}$) measured within the project site.

The noise management levels are design as a trigger for the project to investigate feasible and reasonable noise management and mitigation measures to reduce noise impacts at nearest noise affected receivers.

Table 11-1 Recommended Residential Construction Noise Criteria

| Time of construction | Noise Management level $L_{Aeq,\ 15min}$ | Adopted noise NML $L_{Aeq,\ 15min}$ at neighbouring residences |
|---|---|---|
| Standard construction hours<br>Monday to Friday 7 am – 6 pm<br>Saturday 8 am-1 pm<br>No work on Sundays or public holidays | Noise affected receivers RBL + 10 dB(A) | 60 dB(A) |

Note: RBL rating background level, the measured $L_{A90}$ noise level.

As construction works for the proposed development will only be carried out during the daytime period a standard daytime construction noise management level for the neighbouring residential receivers of 60 dB(A) $L_{Aeq,\ 15min}$ has been adopted in accordance with the ICNG. NMLs for the evening and night periods are not applicable to this assessment.

There are no noise sensitive receivers such as schools, hospitals or places of worship that have been identified within the study area.

A 75 dB(A) $L_{Aeq,15min}$ highly noise affected construction noise management level will be applied as a trigger for the application of additional construction noise controls such as respite periods or restriction of construction hours of operation. This trigger would apply to noise impacts on residential receivers only.

The recommended noise management levels are planning goals only. Factors such as the social benefits of the activity, economic constraints, and the nature and duration of the proposed construction program need to be considered when assessing potential noise impacts from construction works.

### 11.3.2 Construction Vibration

Vibration during construction works is considered an intermittent source associated with two main types of impact; disturbance at receivers and potential architectural/structural damage to buildings. Generally, if disturbance issues are controlled, there is limited potential for structural damage to buildings.

Detailed in Table 11-2, the ICNG guidance adopts the *Environmental Noise Management Assessing Vibration: a technical guideline* (2006) for the assessment of human annoyance due to construction vibration. German Standard DIN 4150: Part 3-1999, provides guidelines for evaluating the effects of vibration on structures.

Dependent upon the dominant frequency of vibration, assessed in Hertz (Hz), structural vibration limits are established at the foundation of nearest buildings.

Table 11-2 Adopted Vibration Constriction Criteria

| Receiver | Annoyance VDV criteria, $m/s^{1.75}$ | | Structural PPV criteria, mm/s |
|---|---|---|---|
| | Preferred | Maximum | |
| Residential | 0.2 | 0.4 | 5 - 20 |

Notes: structural vibration goals established for < 10 – 100 Hz dominant frequency of vibration.

VDV = vibration dose value; PPV = peak particle velocity

# 12 CONSTRUCTION NOISE ASSESSMENT

The most sensitive receivers are the residential dwellings to the south and west. Figure 11-1 below shows the site location in reference to the surrounding receivers

## 12.1 Sleep Disturbance

The proposed construction activities will only occur during the day time hours (7:00 to 18:00 Monday to Friday and 8:00 to 18:00 on Saturday) and no works will be carried out during the Sunday and/or public holidays, therefore a sleep disturbance assessment is not required.

## 12.2 Construction Noise Calculations

Noise level predictions from construction activities at the site have been predicted by utilising NSW EPA recognised and approved computer noise model SoundPlan 8 software. SoundPlan is a fully integrating software suite that specialises in computer simulations of noise situations incorporating over 50 calculation standards. The model calculates overall noise levels at receiver locations considering distance, atmospheric absorption, barriers effects of intervening ground types, weather conditions, source levels, source and receiver locations and topography.

### 12.2.1 Typical Equipment Noise Levels

A detailed construction equipment schedule has not been provided at this stage. We have used equipment noise levels for demolition and excavation activities in accordance to Australian Standard AS2436-2010. The following table presents the sound power levels (SWL) from the related equipment.

Table 12-1 Typical Sound Levels of Construction Equipment

| Plant Description | A-weighted Sound power Levels $L_{WA}$ dB ref: $10^{-12}$W | | A-weighted Sound Pressure Levels $L_{PA}$ (mid point) dB at 10m |
|---|---|---|---|
| | Typical Range | Typical (mid point) | |
| Excavator | 97-117 | 107 | 79 |
| Backhoe | 100-108 | 104 | 76 |
| Concrete Pump Truck | 103-113 | 108 | 80 |
| Crane | 95-113 | 104 | 76 |
| Truck (>20tonne) | 107 | 107 | 79 |
| Backhoe with Auger | 100-11 | 106 | 78 |
| Vehicle (light commercial e.g. 4WD) | 100-111 | 106 | 78 |
| Front End Loader | 110-115 | 113 | 85 |
| Generator | 84-113 | 99 | 71 |
| Hand Tools | 114-117 | 116 | 88 |

### 12.2.2 Construction Stages

The proposed construction works will comprise excavation, concrete slab pouring and construction of the building.

A SoundPlan noise model has been used in order to assess the impacts of the proposed activities, we have assumed the worst-case scenarios were all machinery will be operating at once.

### 12.2.3 Project Construction Hours

The hours of operation will be in accordance with the NSW Environment Protection Authority's (EPA) *Interim Construction Noise Guideline* (ICNG, 2009) and are as follows:

**Standard hours (SH)**

- Monday to Friday 7 am to 5 pm
- Saturday 8 am to 5 pm
- No work on Sundays or public holidays

We note that no out of hours construction has been proposed at this stage.

### 12.2.4 Modelling Results

Calculations of the expected noise levels at the nearest sensitive receivers are presented in the tables below. We note that all noise levels are external $L_{Aeq(15min)}$.

Table 12-2 Calculated Noise Level Results

| Receiver | Calculated Noise Level $L_{Aeq(15min)}$ | Criteria | | Complies |
|---|---|---|---|---|
| | | Standard Hours RBL + 10 dB | Highly Noise Affected | |
| C1 | 81 | 70 | 75 | No |
| C2 | 82 | 70 | 75 | No |
| C3 | 75 | 70 | 75 | No |

We note that no out of hours works have been proposed at this stage. If out of hours works are required in the future, a new noise assessment must be carried out by a suitable consultant.

The results presented in the tables above are based on noise levels for construction equipment derived from Australian Standard AS2436-2010. These noise levels are likely to change if different construction equipment is used.

# 13 MONITORING OF CONSTRUCTION NOISE & VIBRATION

## 13.1 Noise Monitoring

Noise monitoring will be performed in the event of a complaint received by the construction contractor, by an Acoustical Consultant engaged directly by the client.

Noise monitoring would be undertaken using statistical noise loggers supplemented by attended monitoring (where necessary) in order to differentiate between construction noise sources and other sources (such as road traffic and aircraft noise) and also in order to observe and identify any abnormally noisy construction equipment or operations.

During attended monitoring, typical maximum noise levels associated with particular operations and/or plant items will be noted. Where possible, extraneous noise events such as road and air traffic noise will be excluded from the results or highlighted in accompanying notes.

Noise monitoring will, if required, be undertaken by the Acoustical Consultant and reported weekly. Equipment and methods will comply with AS 1055.1-1989. The statistical parameters to be measured will be the $L_{Amin}$, $L_{A90}$, $L_{A10}$, $L_{A1}$, $L_{Amax}$ and $L_{Aeq}$ evaluated over consecutive 15-minute periods.

## 13.2 Vibration Monitoring

Vibration monitoring, will be performed in the event of a complaint received by the construction contractor, by an Acoustical Consultant engaged directly by the client. Vibration monitoring would be carried out continuously on the closest, potentially most affected structures during any works considered to potentially generate significant levels of vibration.

A single geophone mounting plate would be installed on the adjacent buildings/structures. The monitoring locations would be on a stiff part of the structures (at the foundations) on the side of the structures adjacent to the subject excavation works, in accordance with BS 7385:1993 Part 2.

The vibration monitoring system will be configured to record the peak vibration levels and to trigger an audible/visual alarm when predetermined vibration thresholds are exceeded. The thresholds correspond to an "Operator Warning Level" and an "Operator Halt Level", where the Warning Level is 75% of the Halt Level

The vibration threshold will be set to an "Operator Warning Level" of 6 mm/s (ppv) and an "Operator Halt Level" of 8 mm/s (ppv), the exceedance of which will be indicated by the audible/visual alarm in the construction site.

Based on the foregoing information, the nominated site control vibration criteria are presented in Table 13-1 and correspond to the minimal risk of cosmetic damage criterion from BS 7385.

Table 13-1 Nominated Site Control Vibration Criteria (ie Operator Warning and Halt Levels)

| Structure | Site Control Criteria | |
|---|---|---|
| | Operator Warning Level | Operator Halt Level |
| Nearest Potentially Affected | 6 mm/s | 8 mm/s |

Exceedance of the "Operator Warning Level" does not require excavation activity to cease but rather alerts the construction contractor to proceed with caution at reduced force or load. An exceedance of the "Operator Halt Level" requires the construction contractor to implement an alternative excavation technique. The vibration monitoring equipment would be downloaded on a weekly basis by the Acoustical Consultant.

Weekly reports of the measured vibration levels and their likely impacts would be prepared by the Acoustical Consultant and distributed by the Project Manager.

Attended vibration monitoring will, if considered necessary, be conducted by the Acoustical Consultant. Attended vibration monitoring (structural damage and/or human comfort) will also be carried out in response to complaints or to structural damage criterion exceedances. This monitoring will provide direct feedback to the operators in order to allow appropriate modification of excavation techniques.

## 13.3 Noise Mitigation Measures

The following noise mitigation measures will be implemented by the construction contractor.

The construction contractor will, where reasonable and feasible, apply best practice noise mitigation measures including:

- Maximising the offset distance between noisy plant items and nearby noise sensitive receivers.
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers.

- Minimising consecutive works in the same locality.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

Further, in order to minimise noise impacts during the works, the construction contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers. Silenced air compressors fitted with noise labels indicating a maximum ($L_{Amax}$) sound pressure level of not more than 75 dB(A) at 7 m will be used on site. The sound pressure level of noise emitted from a compressor used will comply with noise label requirements.

## 13.4 Vibration Mitigation Measures

The following vibration mitigation measures will be implemented by the construction contractor:

- Relocate any vibration generating plant and equipment to areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of excavation plant and equipment e.g. smaller capacity rock breaker hammers.
- Minimise consecutive works in the same locality (if applicable).
- Schedule a minimum respite period of at least 0.5 hour before activities commence which are to be undertaken for a continuous 4-hour period.
- Use only dampened rock breakers and/or “city” rock breakers to minimise the impacts associated with rock breaking works.

## 13.5 Summary of Mitigation Measures

The noise and vibration mitigation measures to be implemented by the construction contractor are summarised in Table 13-2.

Table 13-2 Noise and Vibration Mitigation Measures

| Item | Description |
|---|---|
| Construction Hours | Works will be carried out within the approved construction hours. |
| Deliveries | Deliveries will be carried out within the approved construction hours. |
| Site Layout | Where possible, plant and equipment will be located and orientated to direct noise away from sensitive receivers. |
| Quietest Suitable Equipment | Plant and equipment will be selected to minimise noise emission, where possible, whilst maintaining efficiency of function. Residential grade silencers will be fitted and all noise control equipment will be maintained in good order. |
| Reversing Alarms | Mobile plant and trucks operating on site for a significant portion of the project will have reversing alarm noise emissions minimised, where possible, recognising the need to maintain occupational safety standards. |
| PA System | No public address system will be used at this site. |

| Item | Description |
|---|---|
| Vibration Monitoring | Vibration monitoring will be carried out where any vibration intensive activities are required to be carried out where there is considered to be a risk that vibration levels may exceed the relevant structural damage criteria. |
| Truck Noise (off site) | All trucks regularly used for the project are to have mufflers and all noise control equipment will be maintained in good working order. Trucking routes will use main roads, where feasible. |
| Community Liaison | A programme of community liaison and complaint response will be implemented. |
| Training | Site induction training will include a noise awareness component. |

## 13.6 Identifying and Managing Future Noise And Vibration Issues

If additional activities or plant are found to be necessary that will emit noise and/or vibration emissions significantly exceeding those assumed for this assessment, these will be assessed by the Acoustical Consultant on a case-by-case basis and appropriate mitigation measures will be implemented.

Progressive impact assessments will be conducted as the works proceed in the event that works significantly deviate from those originally planned.

## 13.7 Non-Compliance and Corrective Action

Where the noise and/or vibration monitoring identifies non-compliance with the relevant criteria, the construction contractor will plan and carry out corrective action. The corrective action may involve supplementary monitoring in order to identify the source of the non-conformance and/or may involve modification of the construction techniques or programme to avoid any recurrence or minimise its adverse effects.

## 13.8 Complaint Handling

The construction contractor will adopt the following protocol for handling complaints. This protocol is intended to ensure that the issues are addressed and that appropriate corrective action is identified and implemented as necessary:

- The construction contractor will record all verbal and telephone complaints in writing and will forward all complaints to the Project Manager together with details of the circumstance leading to the complaint and all subsequent actions.
- Complaints received by the Project Manager will, as an initial step, be referred to the construction contractor. The construction contractor will respond as described above.
- The Project Manager will investigate the complaint in order to determine whether a criterion exceedance has occurred or whether noise and/or vibration have occurred unnecessary.
- If excessive or unnecessary noise and/or vibration have been caused, corrective action will be planned and implemented by the construction contractor.
- Complainants will be informed by the Project Manager that their complaints are being addressed, and (if appropriate) that corrective action is being taken.
- Follow up monitoring or other investigations will be carried out by the Project Manager and the construction contractor to confirm the effectiveness of the corrective action.
- Complainants will be informed of the implementation of the corrective action that has been taken to mitigate the adverse effects.

### 13.9 Community Consultation and Liaison

Community consultation will be undertaken via the construction contractor and will include:

- Advising the community of work to be undertaken.
- Recording and managing any complaints.

These and other elements of the community consultation will be addressed under the relevant procedures for the subject works.

## 14 CONCLUSION

Rodney Stevens Acoustics has conducted an acoustic impact assessment of the proposed mixed-use development located at 21 - 25 Woodriff Street, Penrith NSW. The review has assessed the noise intrusion of the site and compared it with the noise criteria required by in Penrith City Council and other relevant standards.

Rodney Stevens Acoustics has developed a construction noise and vibration management plan for the proposed residential development located at 21 - 25 Woodriff Street, Penrith NSW.

A noise survey has been carried out and the processed data has been used to determine traffic noise from the surrounding area to the project site. Based on the noise impact study conducted, the proposed development is deemed to comply with the SEPP (Infrastructure) 2007-noise criteria with recommendations from this report. It is therefore recommended that planning approval be granted for the proposed development based on acoustics.

Approved: -

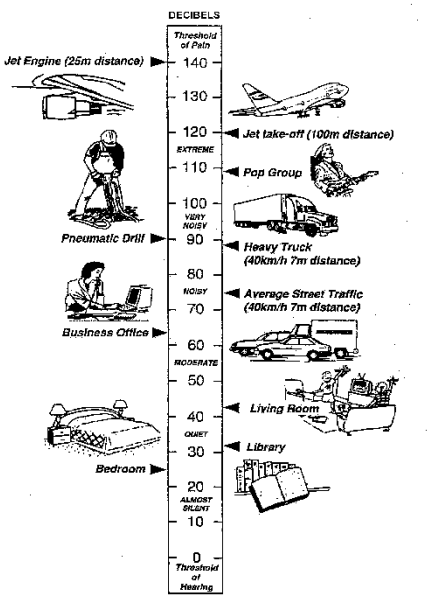
Rodney Stevens

Manager/Principal

## 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:<br>▪ character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content)<br>▪ character of the environment (e.g. very quiet suburban, suburban, urban, near industry)<br>▪ miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations)<br>▪ 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:<br>▪ Noise mitigation benefits (amount of noise reduction provided, number of people protected).<br>▪ Cost of mitigation (cost of mitigation versus benefit provided).<br>▪ Community views (aesthetic impacts and community wishes).<br>▪ 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.<br><br>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)*.

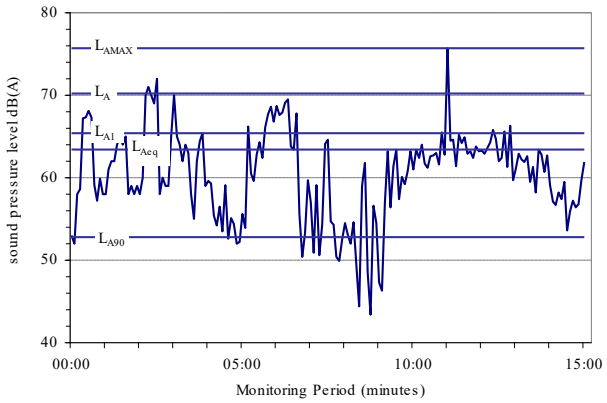
Sound Pressure Level (SPL)

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:



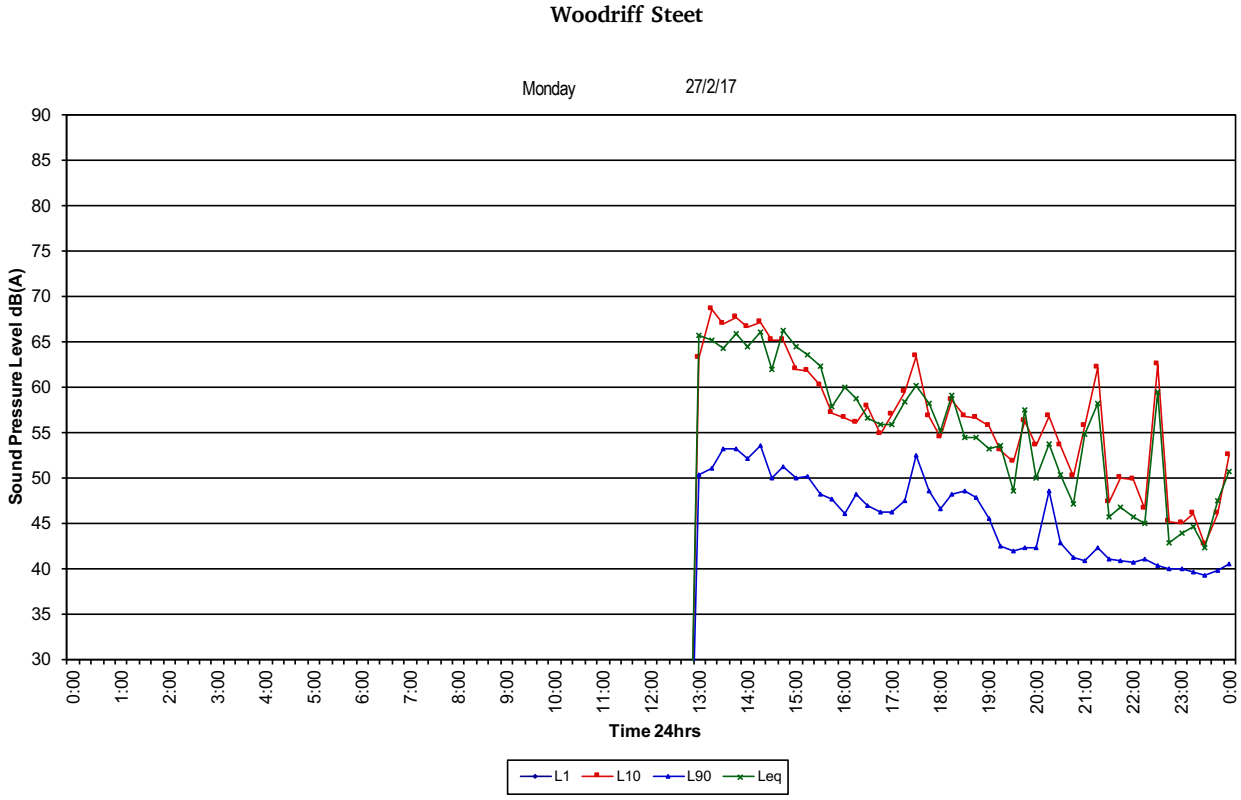

Key descriptors:

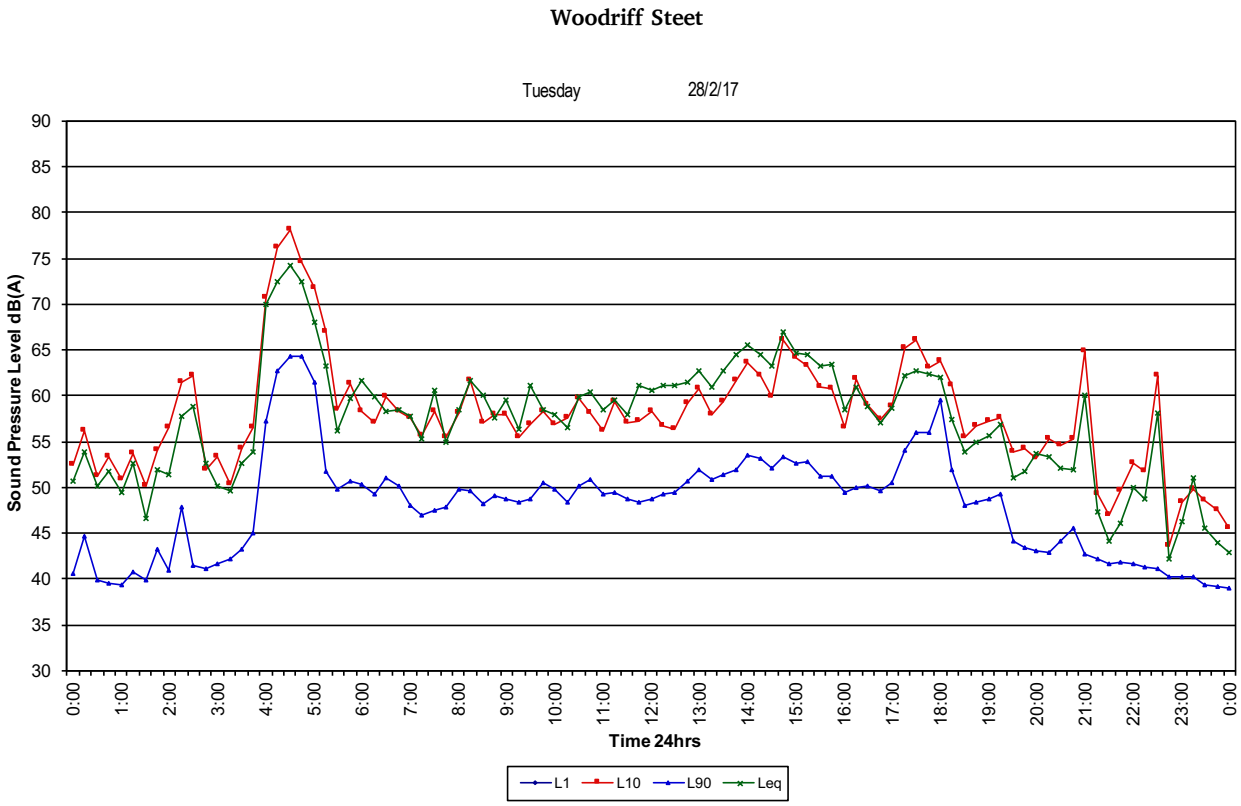
$L_{Amax}$ Maximum recorded noise level.

$L_{A1}$ The noise level exceeded for 1% of the 15 minute interval.

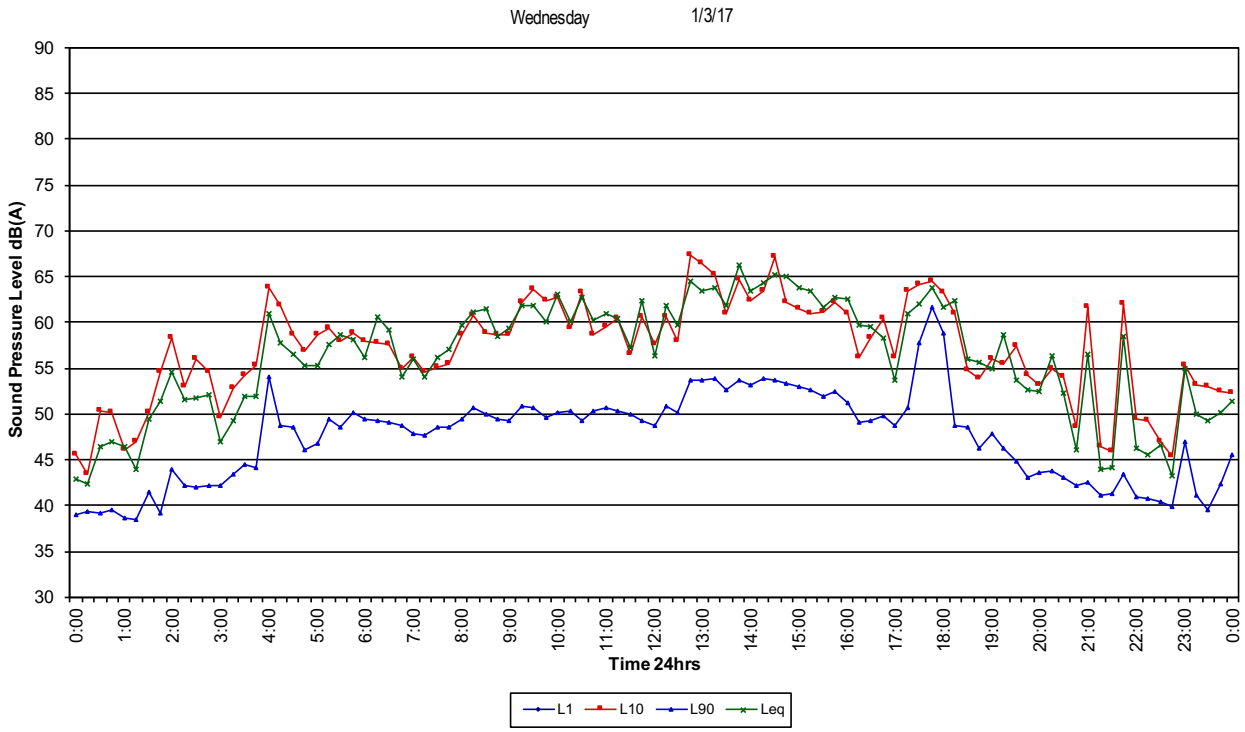
| | |
|---|---|
| | $L_{A10}$ Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.<br><br>$L_{Aeq}$ Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.<br><br>$L_{A90}$ 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

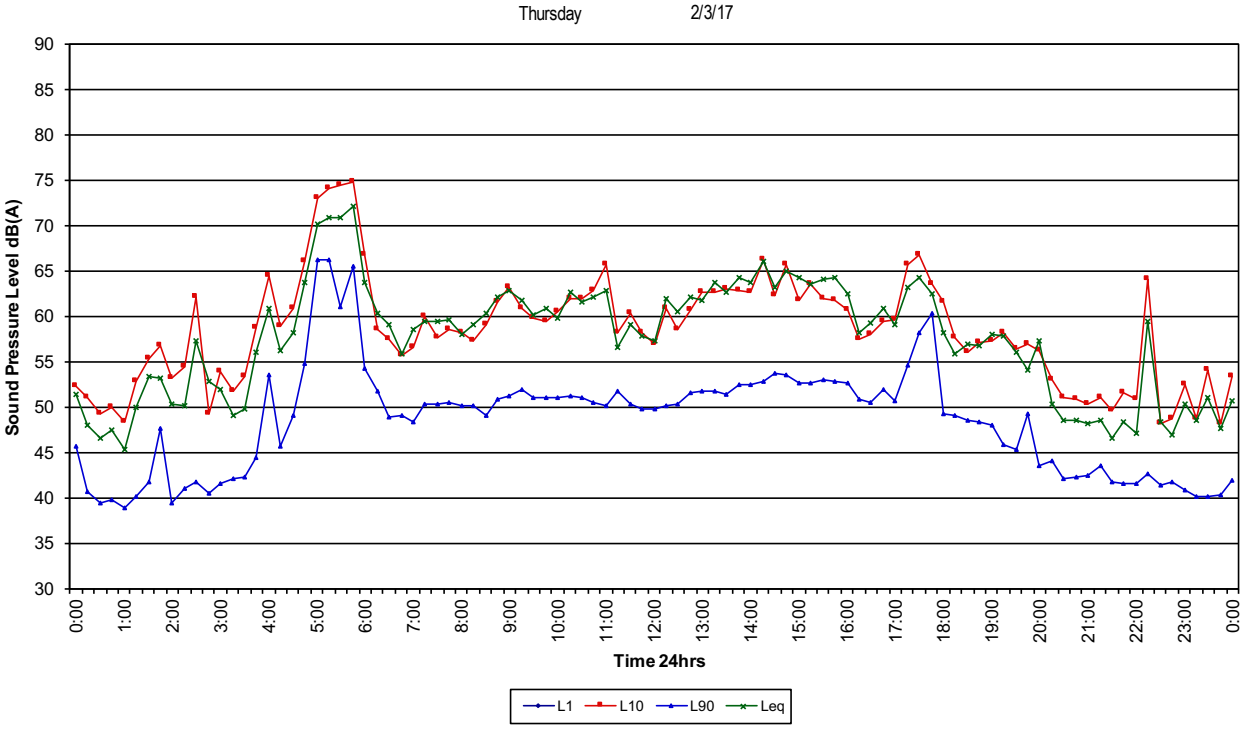


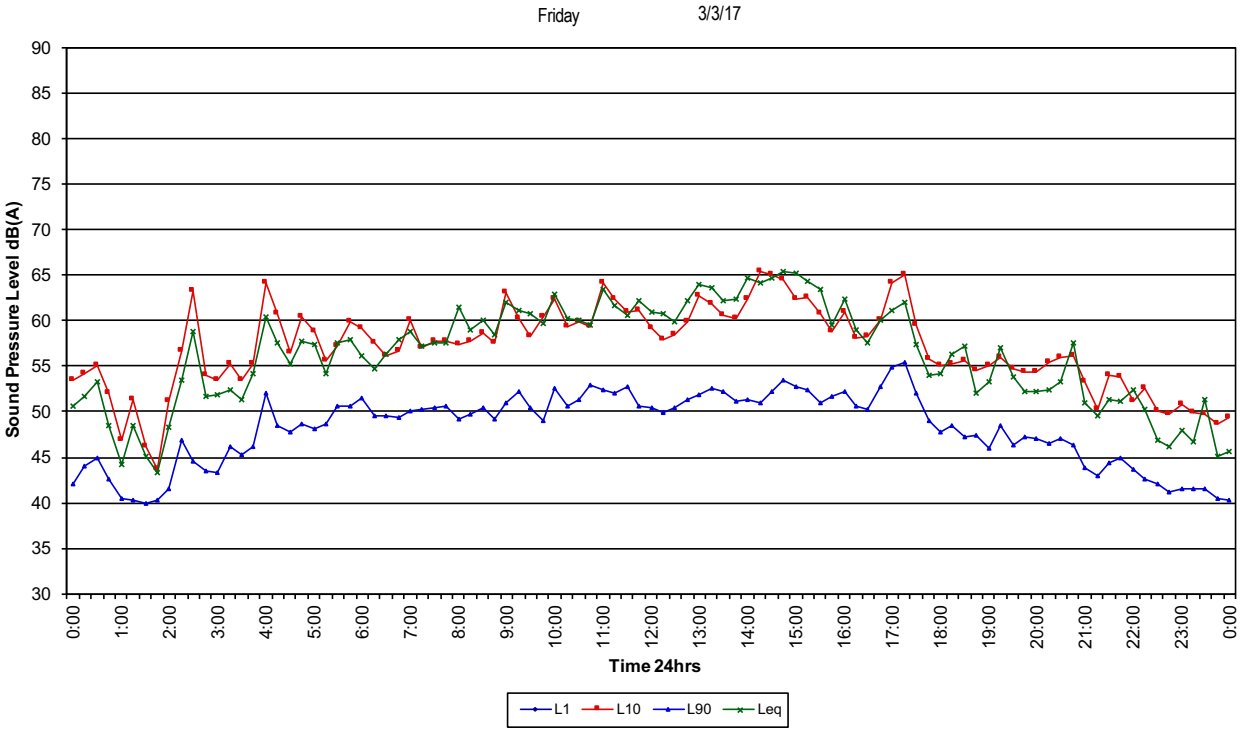
## Woodriff Steet




## Woodriff Steet



## Woodriff Steet

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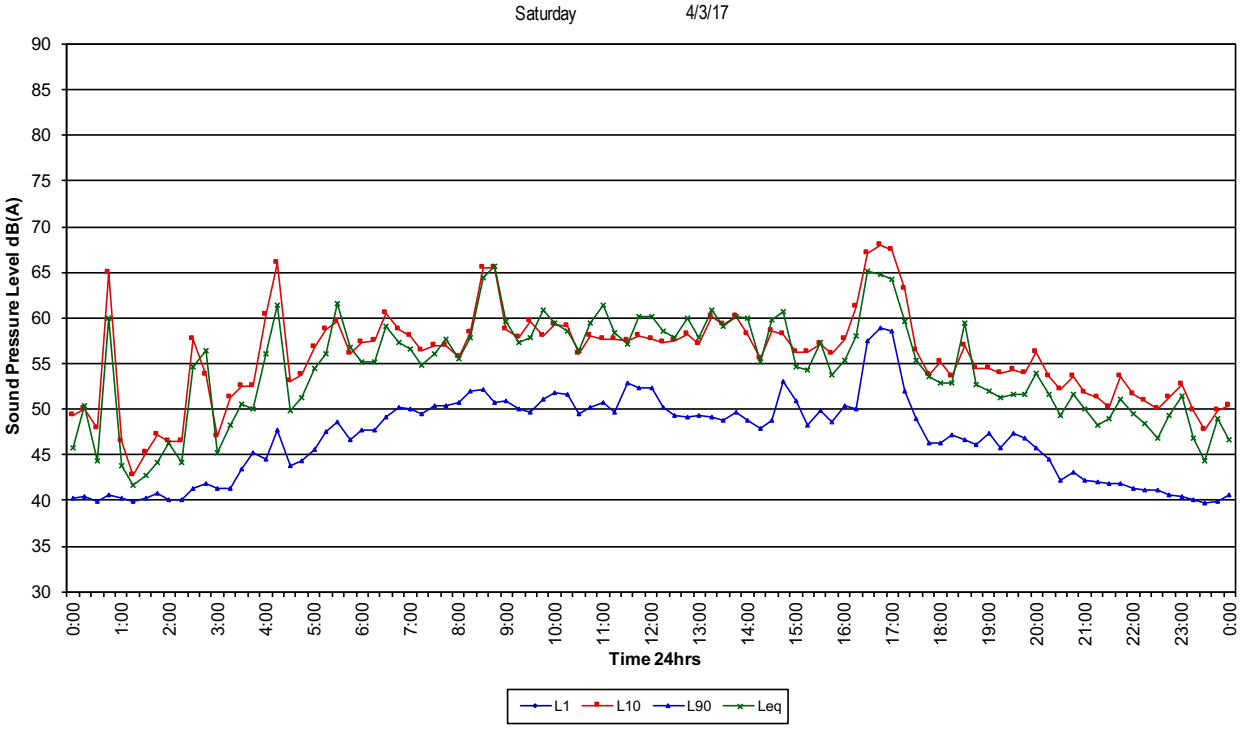

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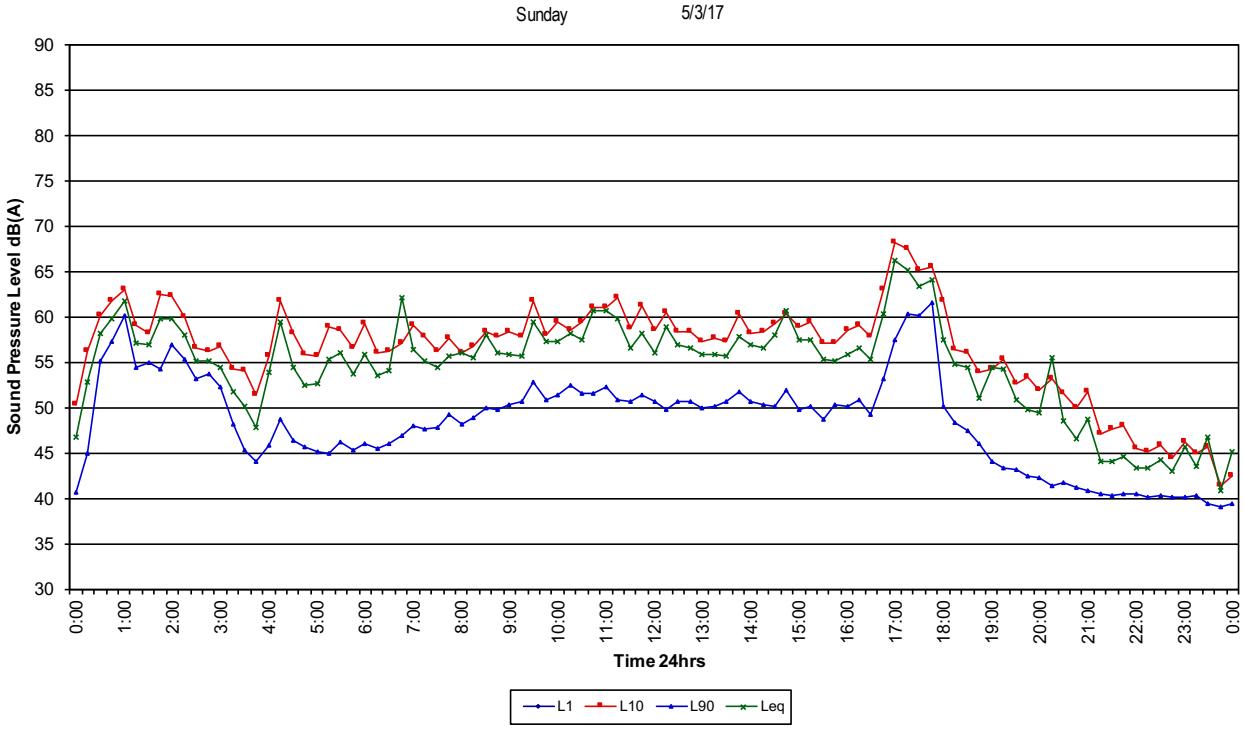
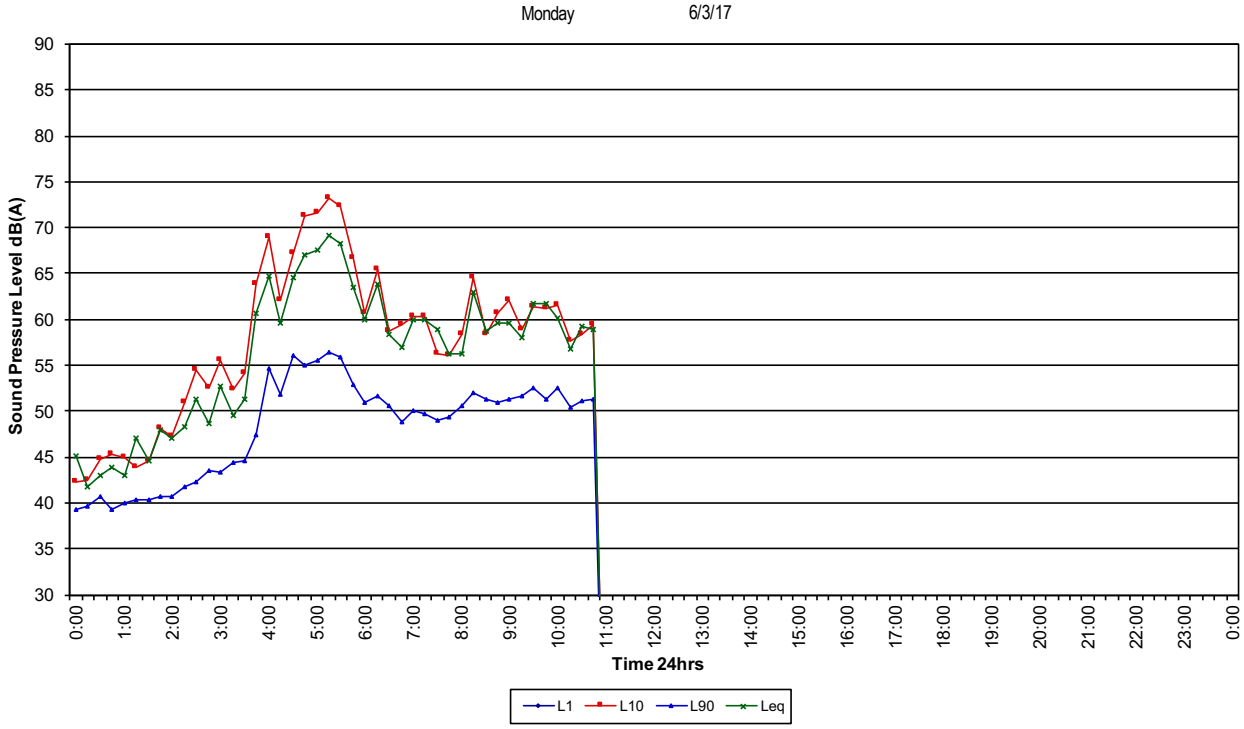
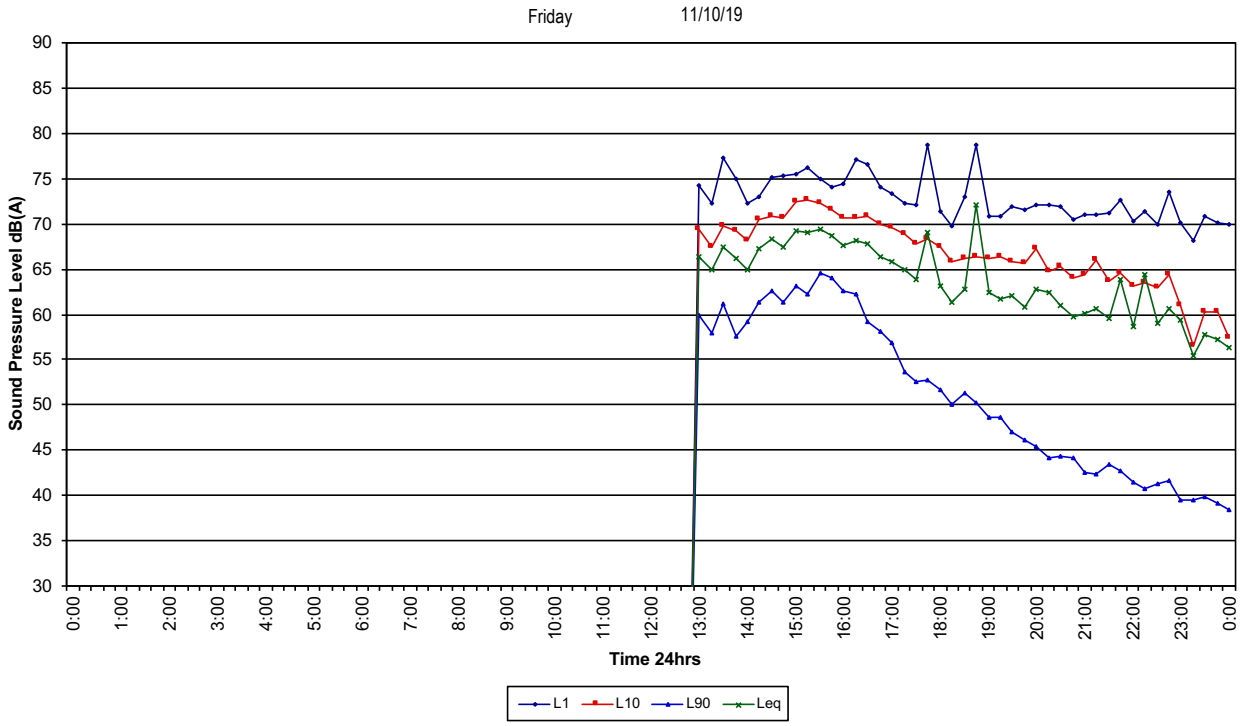


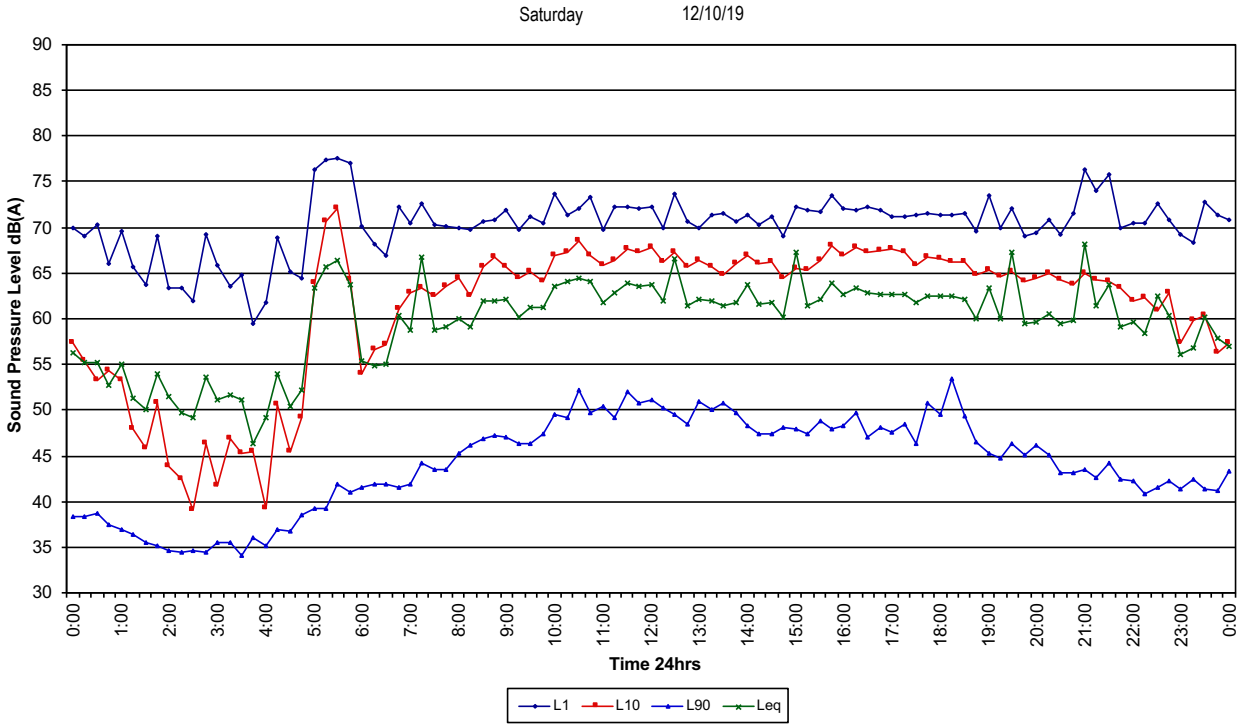

## Woodriff Steet



**Woodriff Street Penrith**




**Woodriff Street Penrith**



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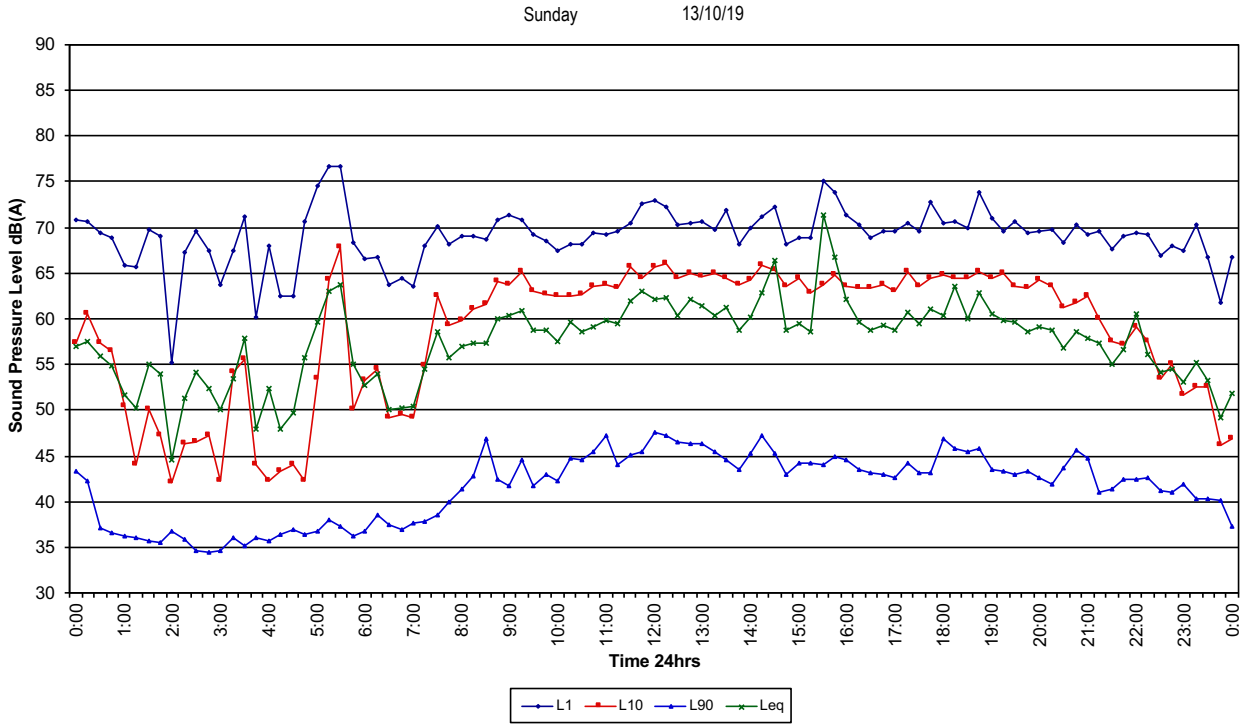


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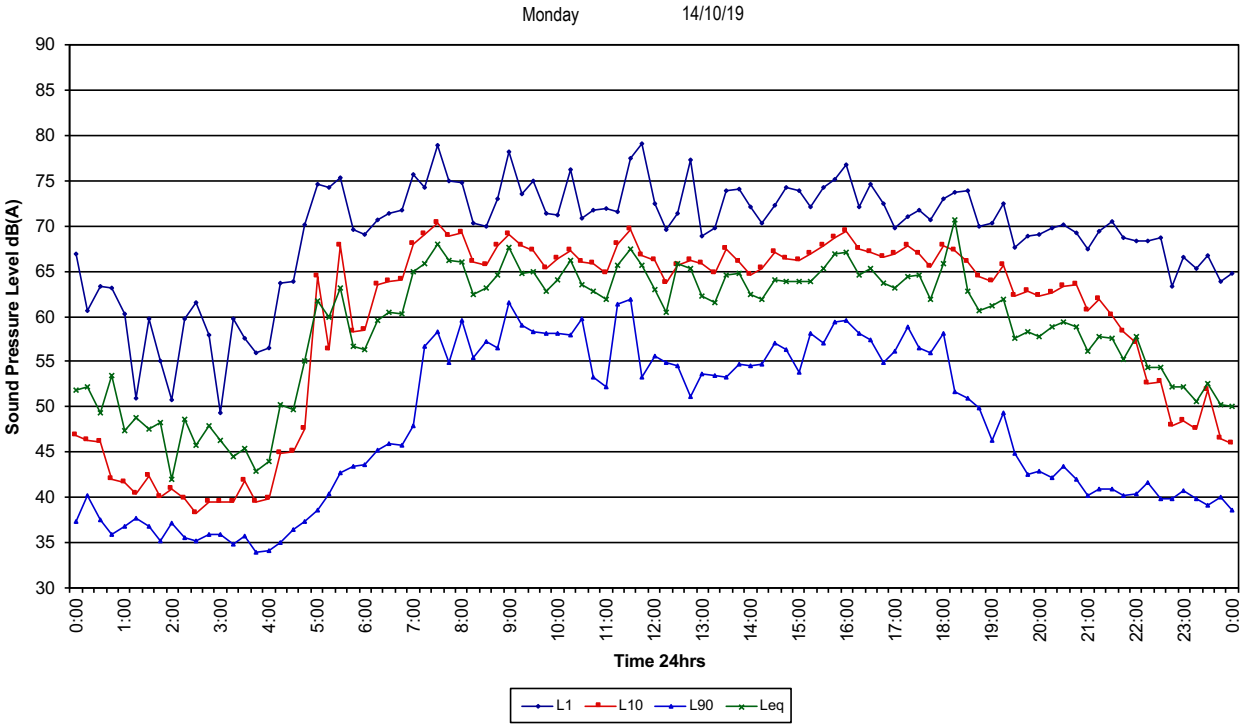

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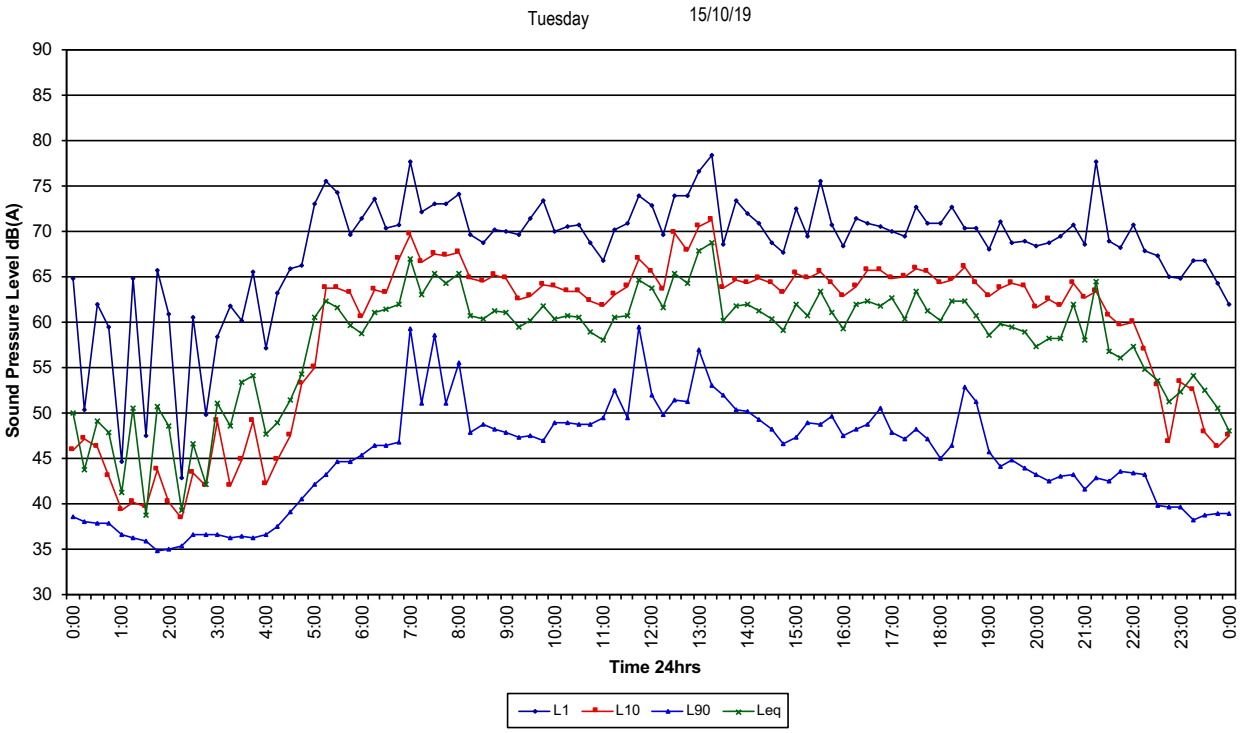
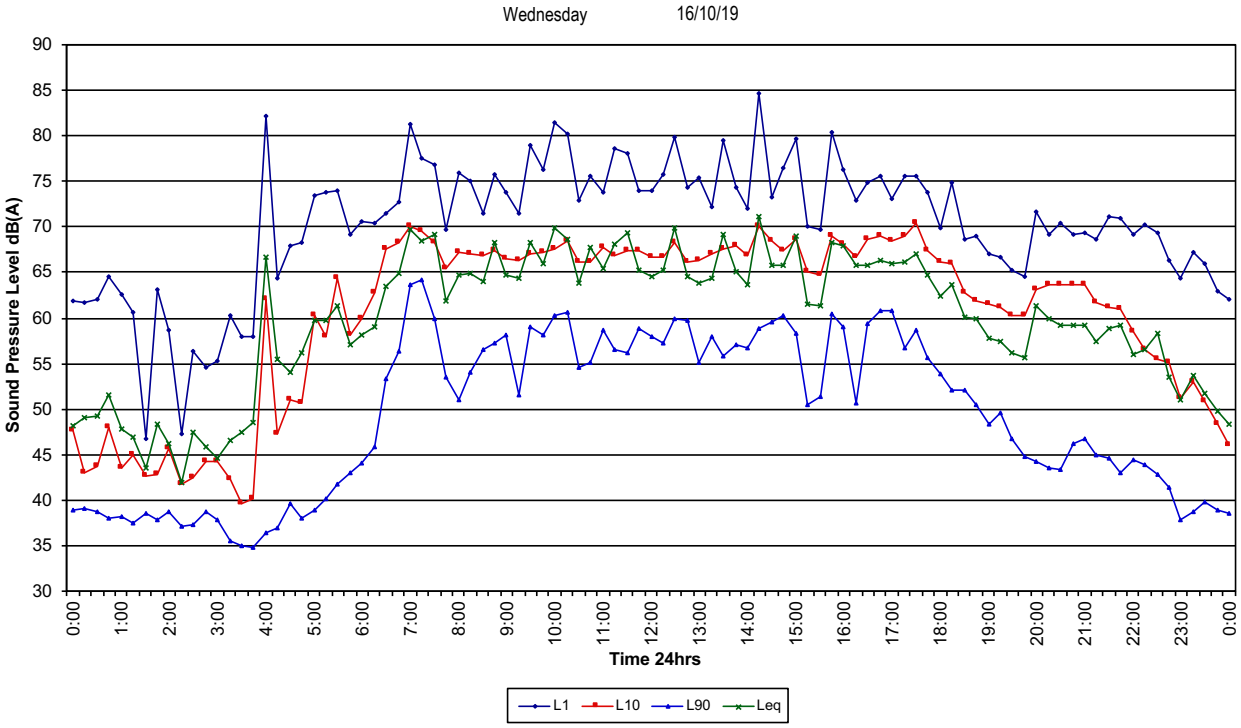
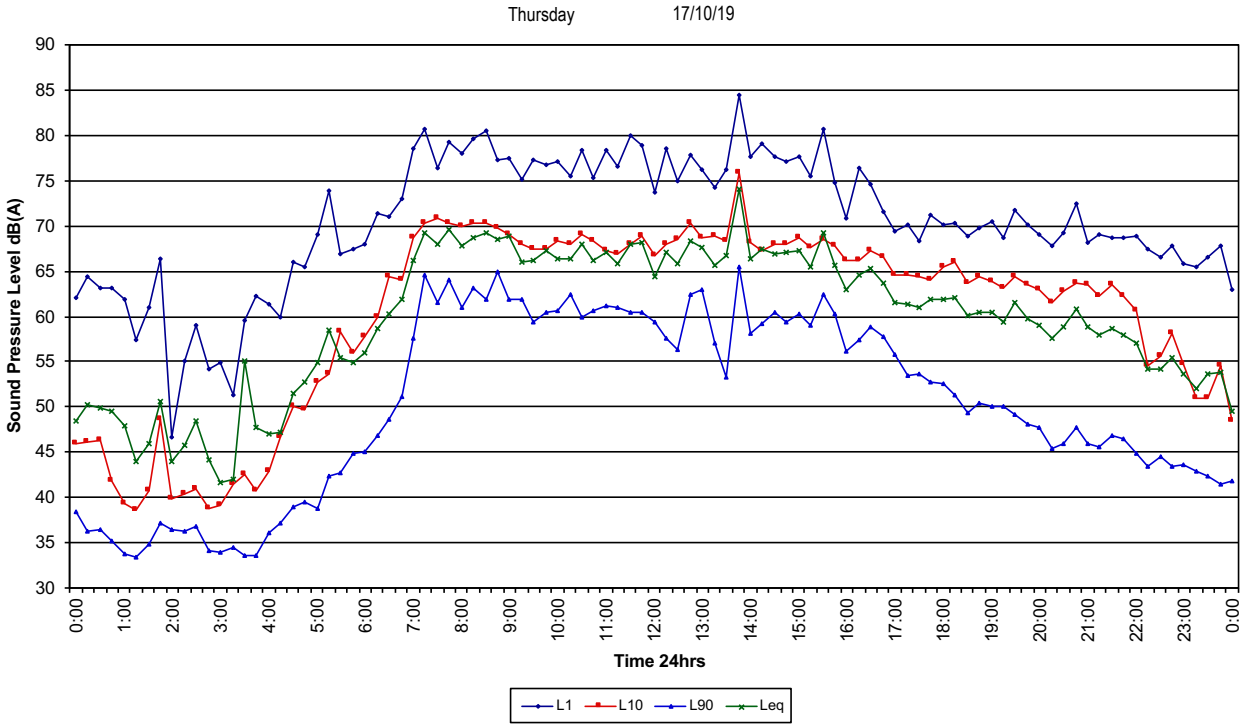


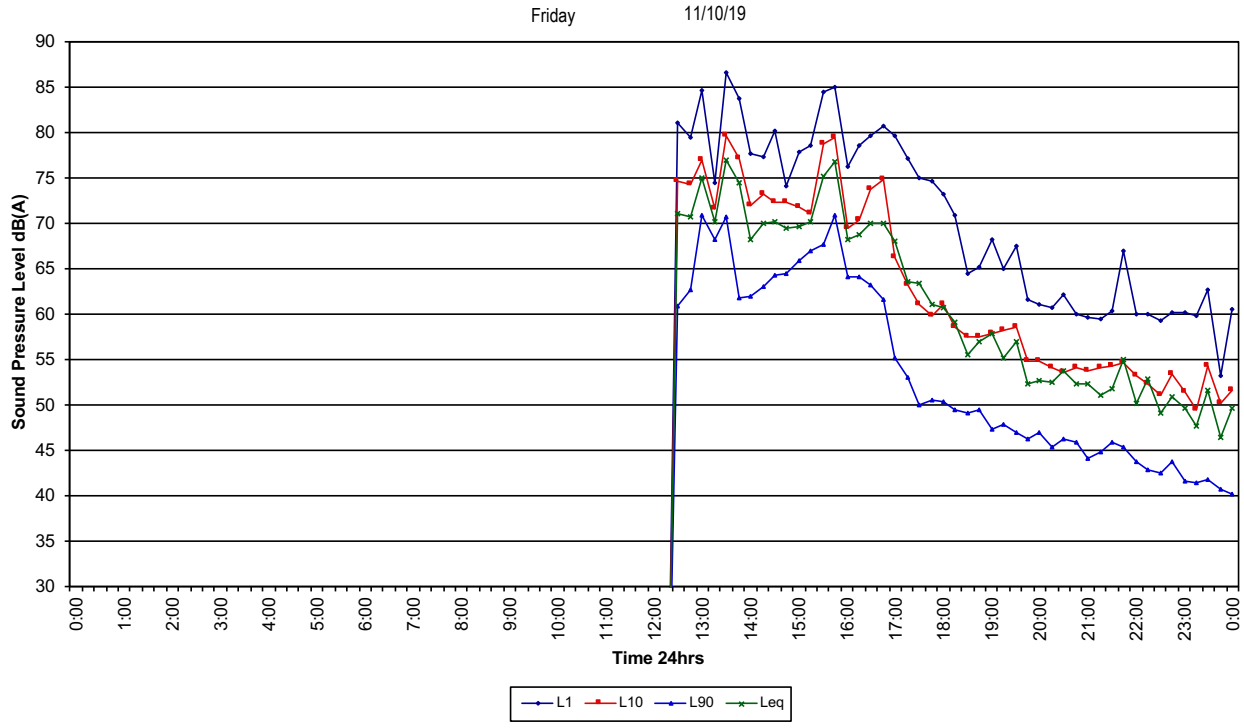

**Woodriff Street Penrith**



## Woodriff Street Penrith




## Union Lane Penrith



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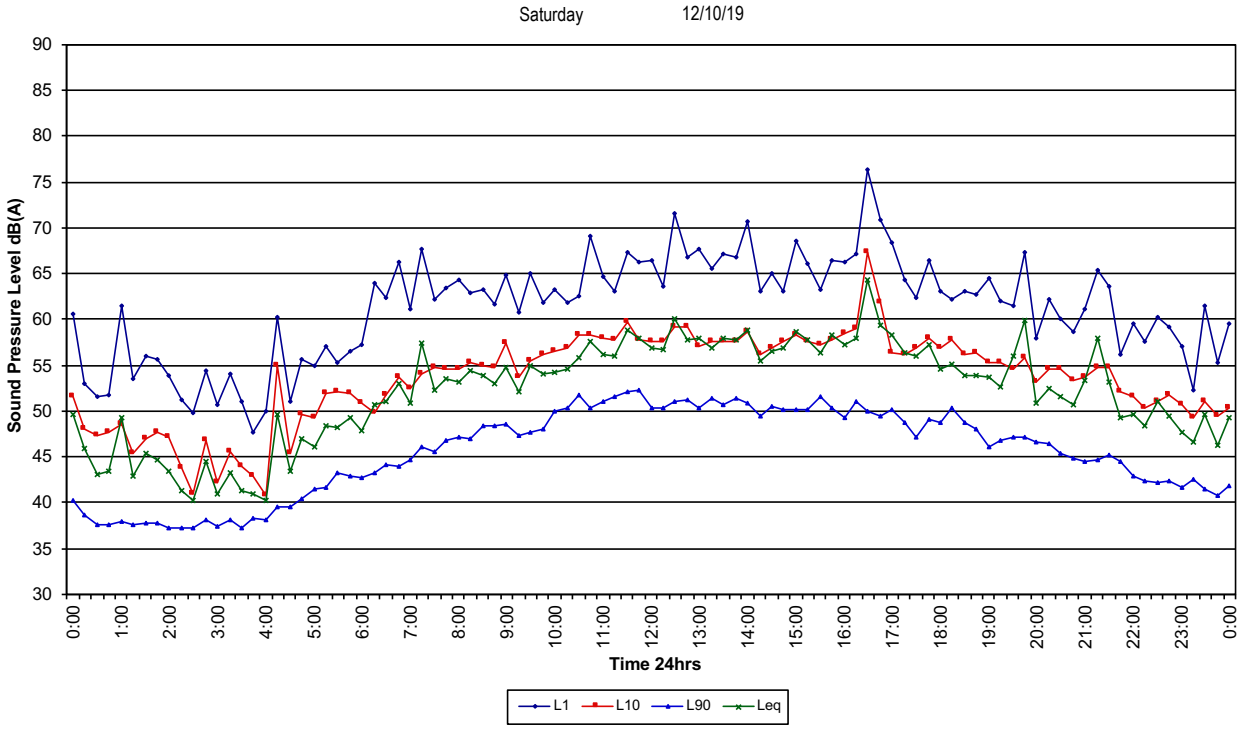
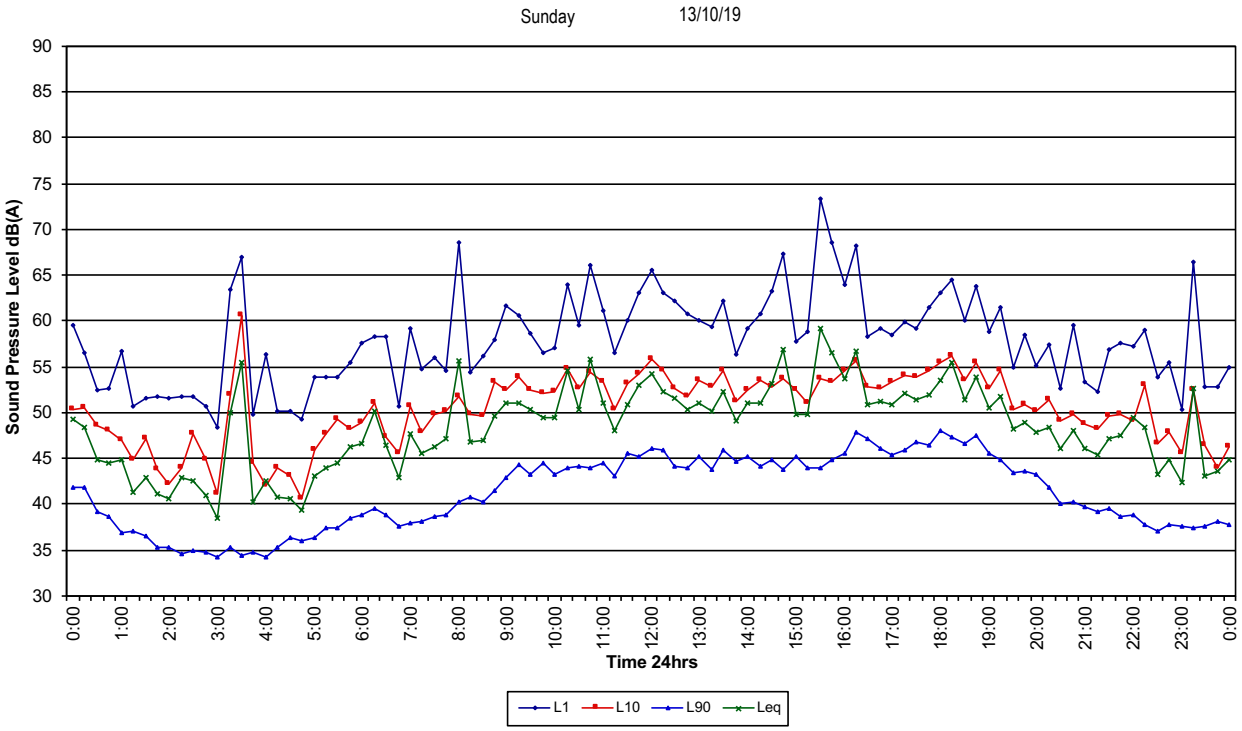
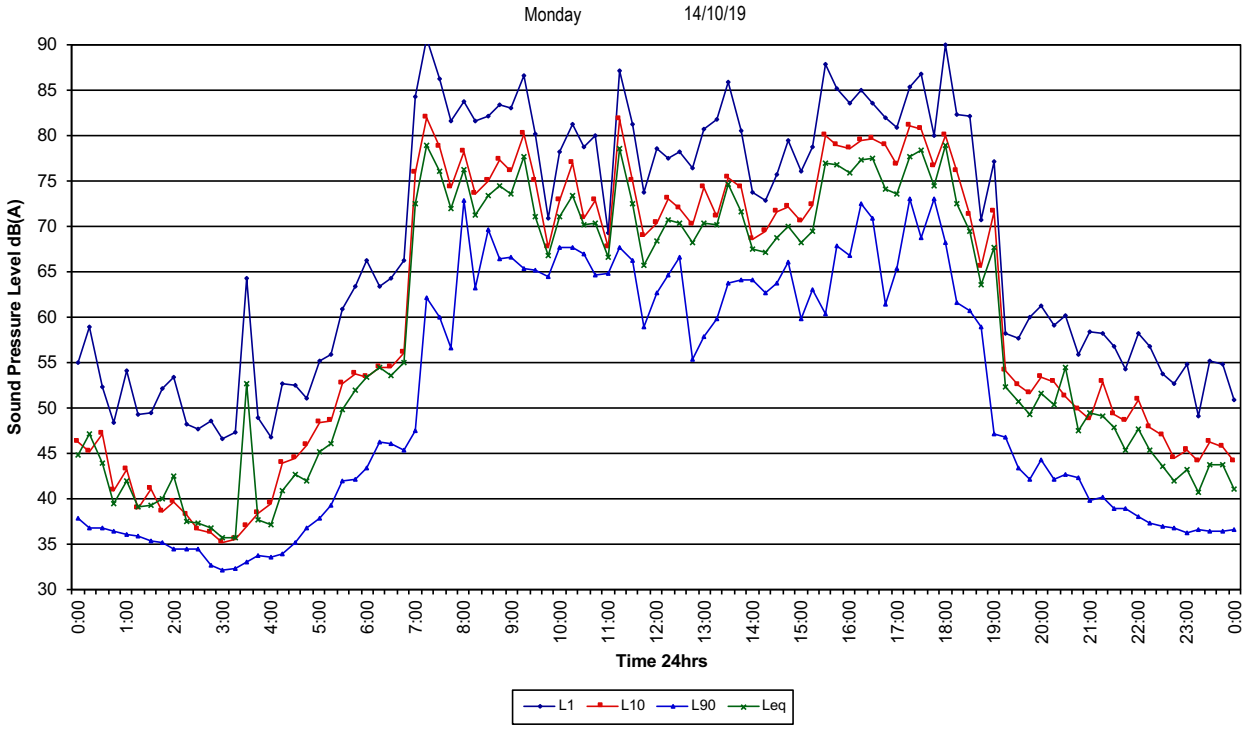



**Union Lane Penrith**



**Union Lane Penrith**

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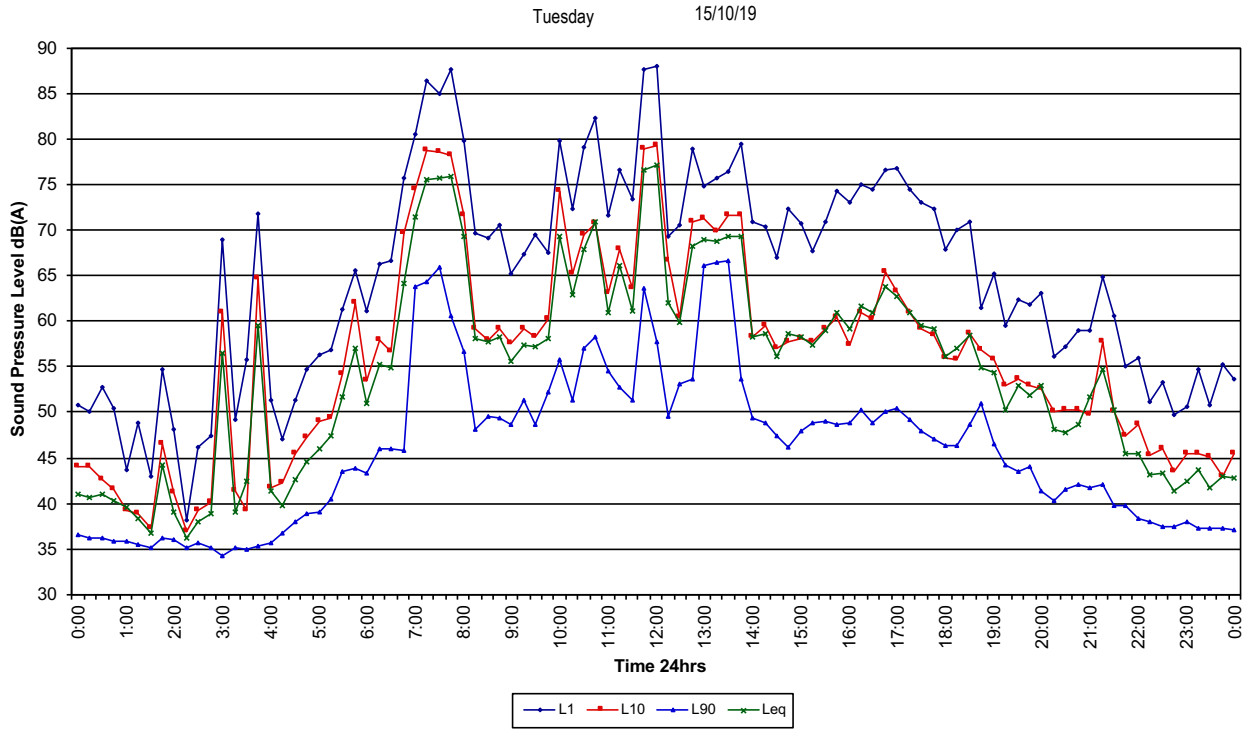

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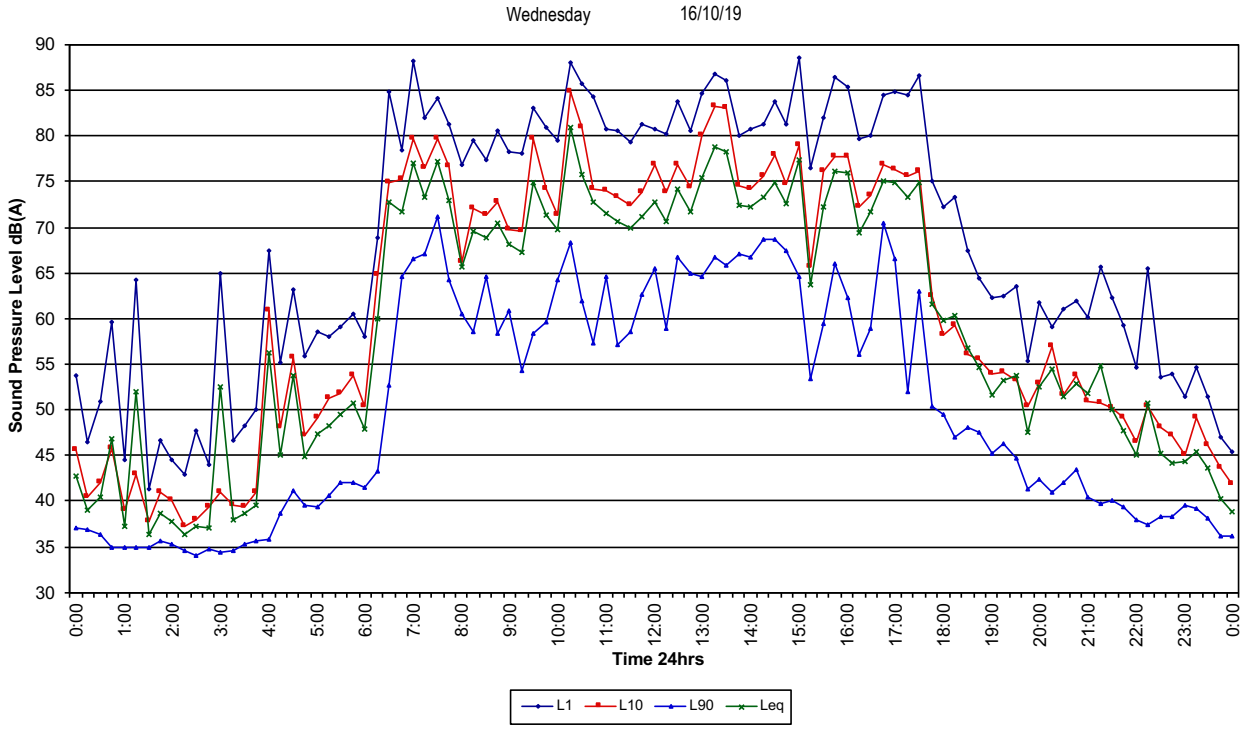


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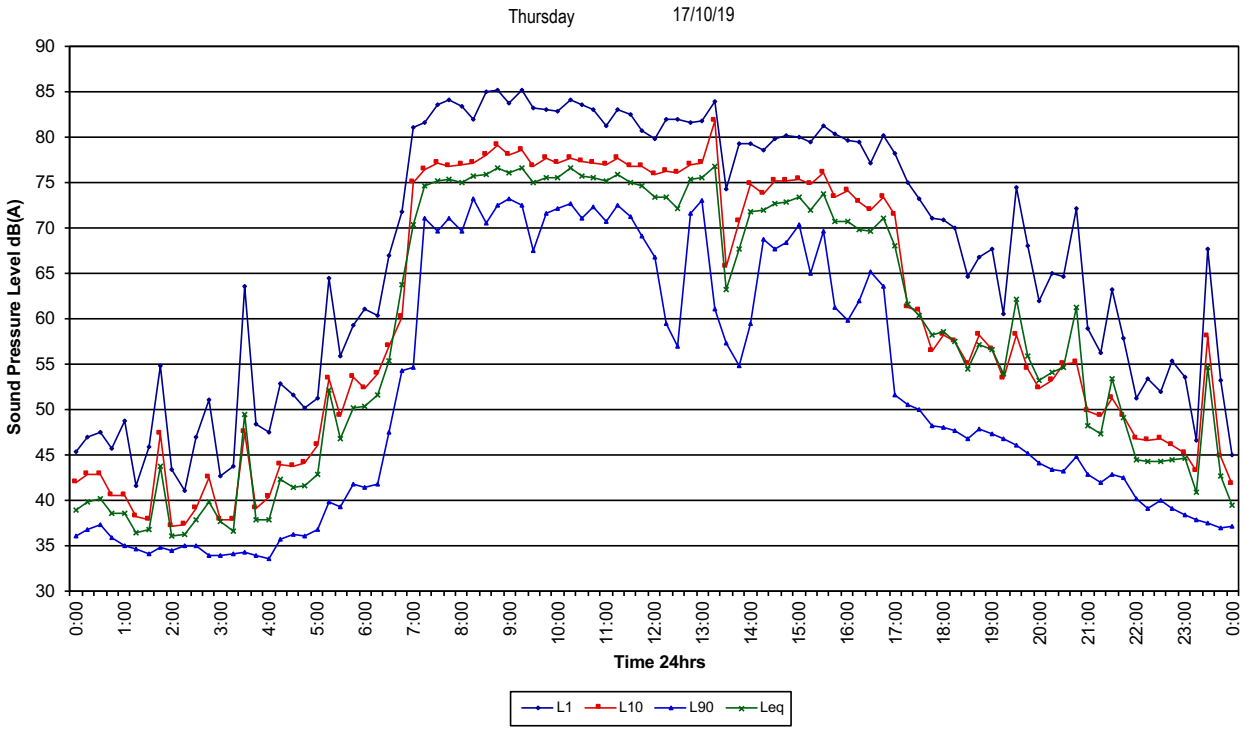
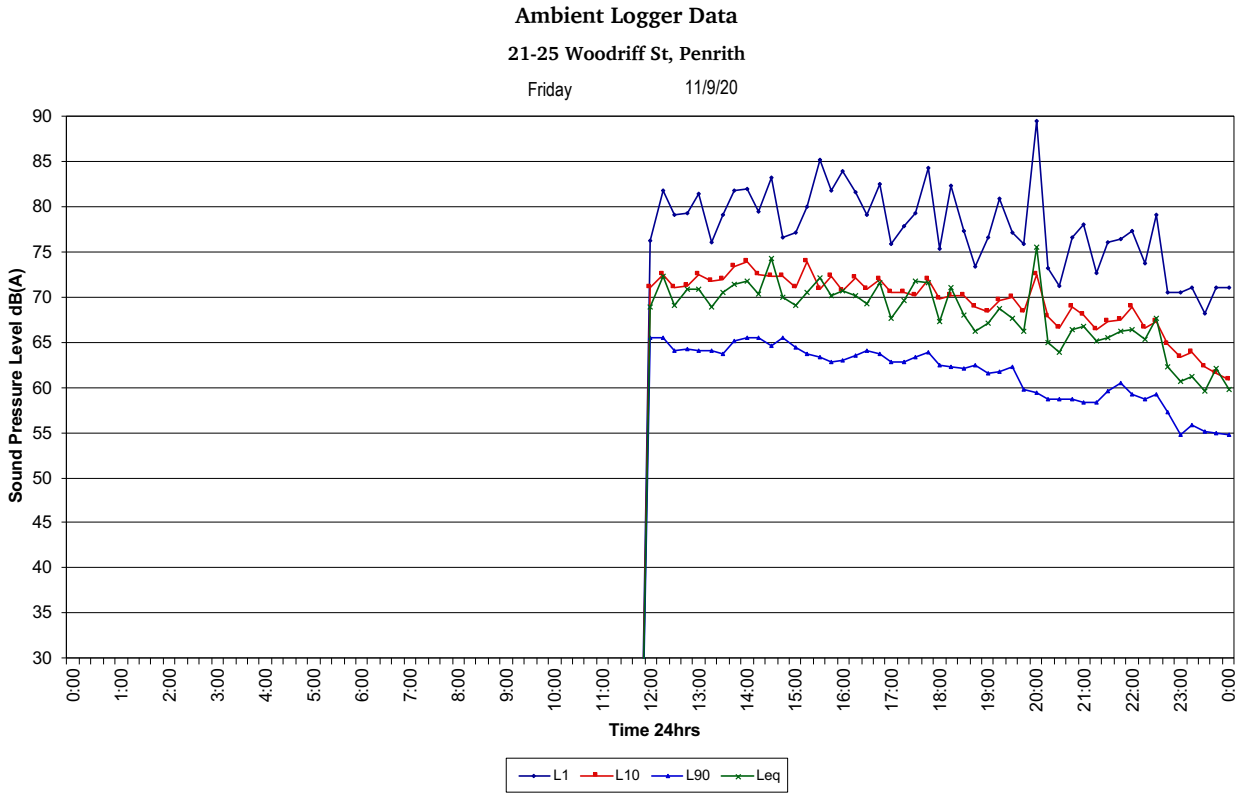
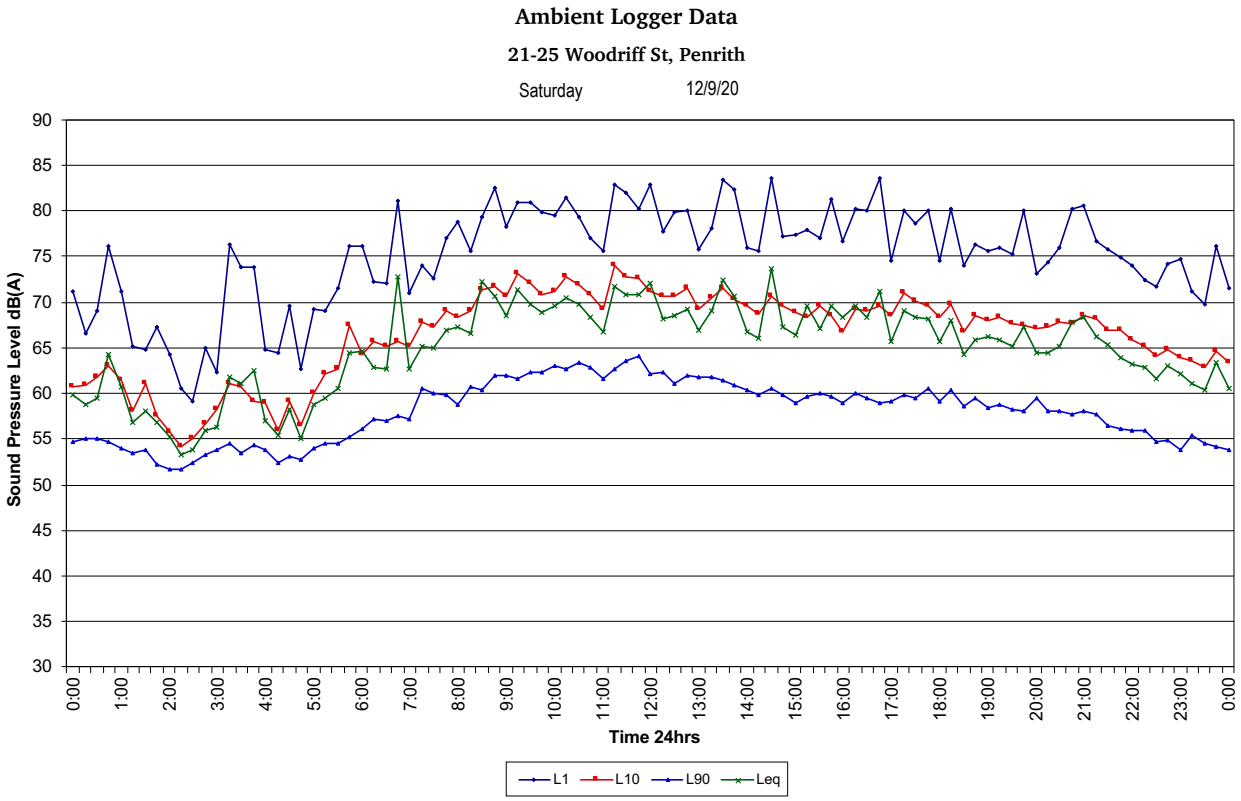


Spectral Noise Survey – September 2020

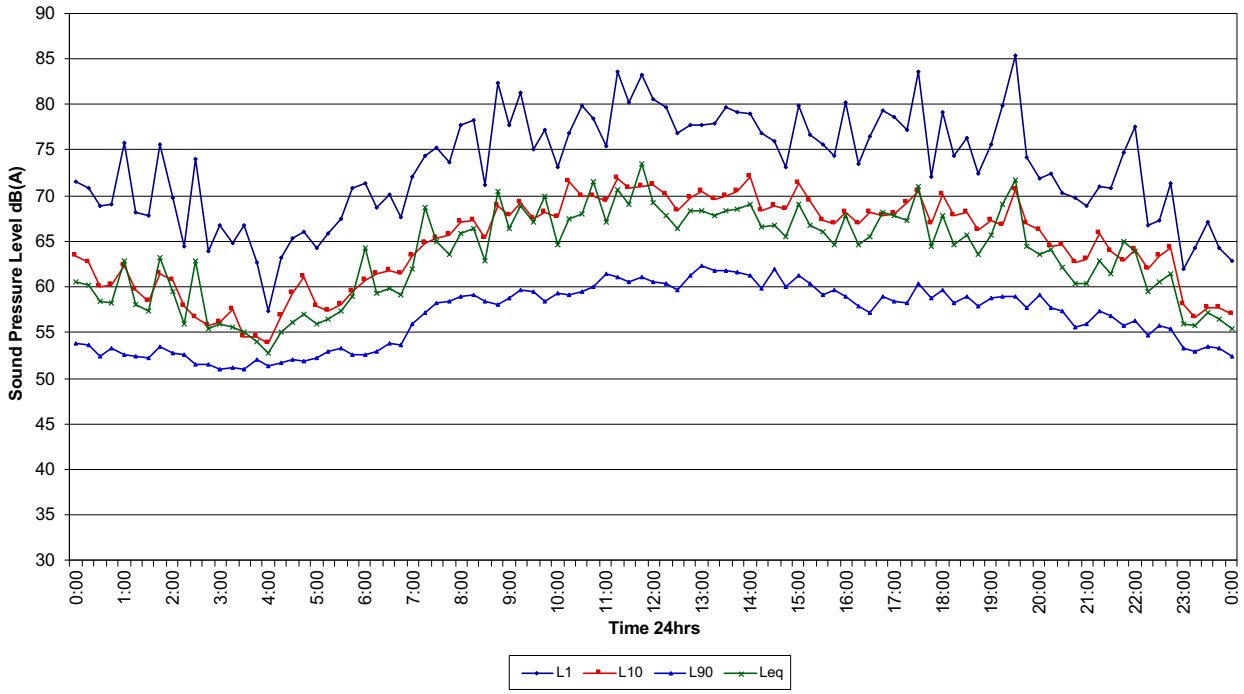


**Ambient Logger Data**

21-25 Woodriff St, Penrith

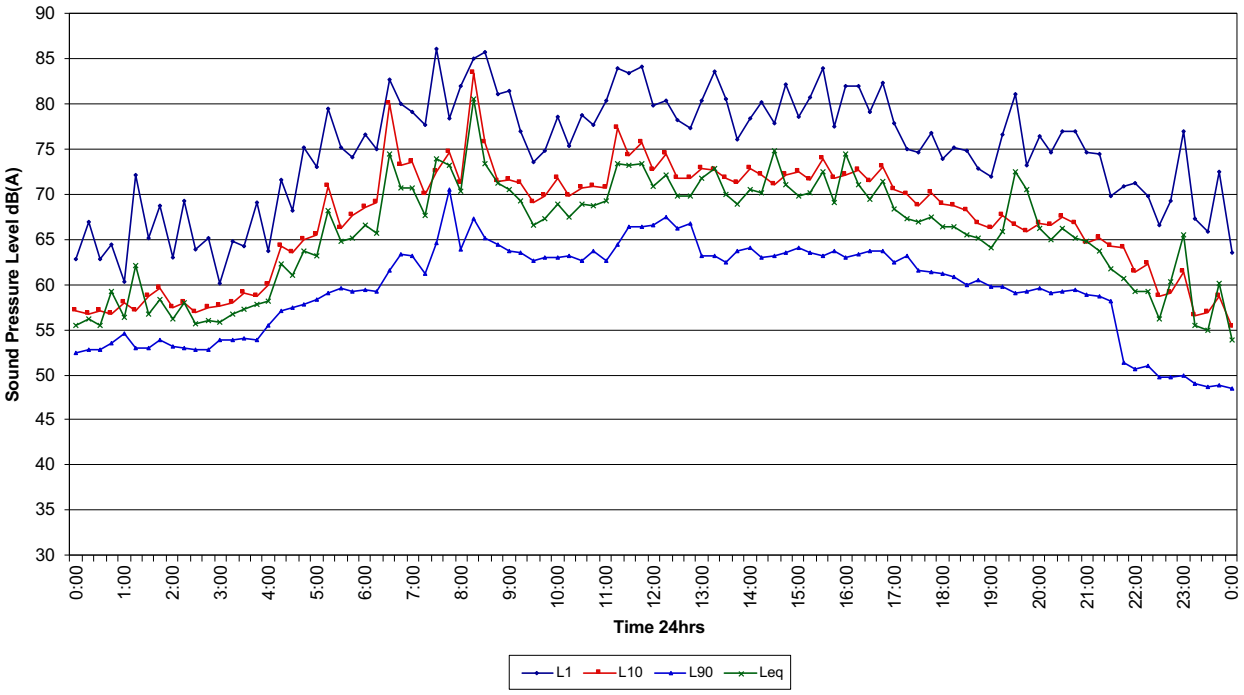
Sunday 13/9/20




**Ambient Logger Data**

**21-25 Woodriff St, Penrith**

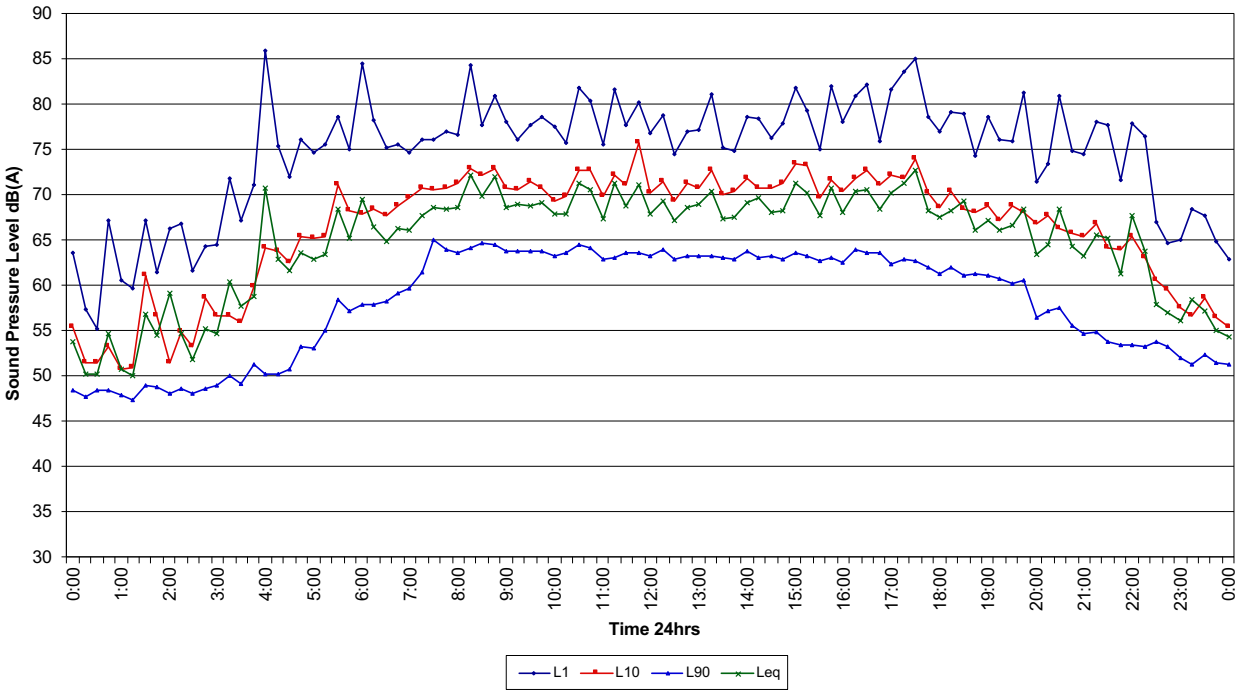
Monday 14/9/20



**Ambient Logger Data**

**21-25 Woodriff St, Penrith**

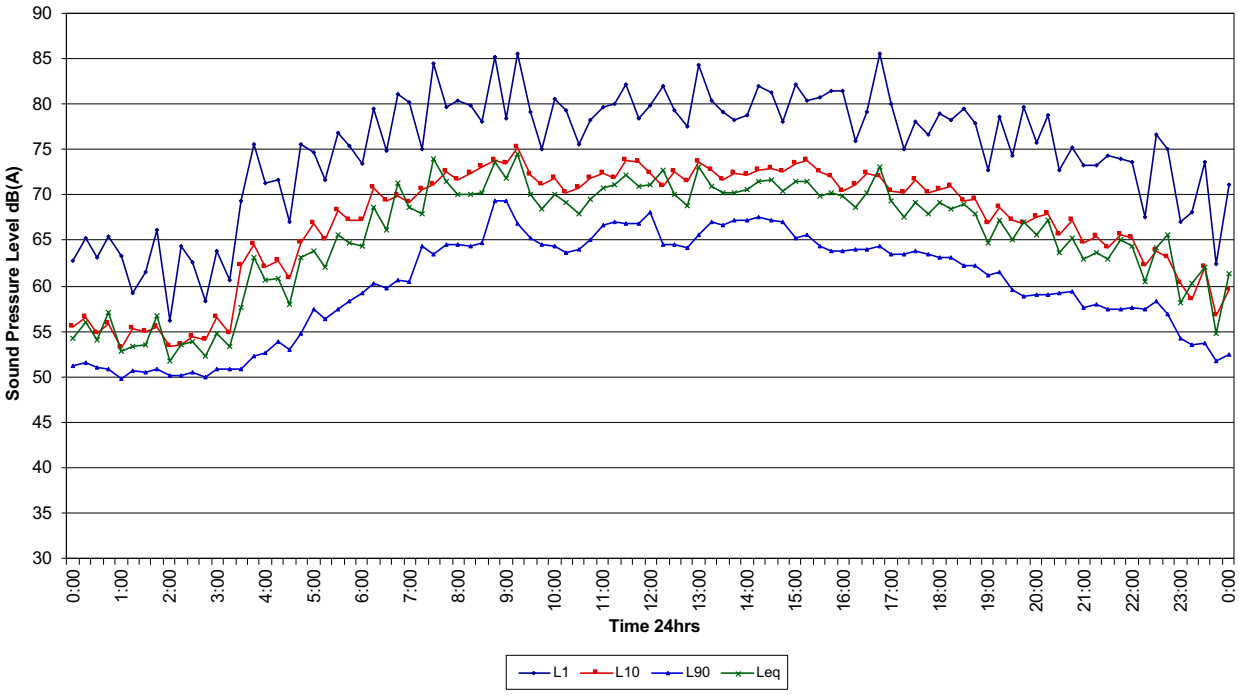
Tuesday 15/9/20




**Ambient Logger Data**

**21-25 Woodriff St, Penrith**

Wednesday 16/9/20



## Ambient Logger Data

**21-25 Woodriff St, Penrith**

Thursday 17/9/20

## Appendix C Calibration Certificate

Acoustic Research Labs Pty Ltd [redacted]

# Calibration Certificate

Number : C13697

| | |
|---|---|
| **Client Details :** | ARL Hire |
| | [redacted] |
| **Equipment Tested/ Model Number :** | **Rion NL-42EX** |
| **Instrument Serial Number :** | 00810713 |
| **Microphone Serial Number :** | 137169 |
| **Preamplifier Serial Number :** | 10714 |
| **Ambient Temperature :** | 23°C |
| **Relative Humidity :** | 50% |
| **Barometric Pressure :** | 102.2 kPa |
| **Calibration Technician :** | Adrian Walker |
| **Calibration Date :** | 18-December-2013 |
| **Secondary Check by :** | Luke Hudson |
| **Report Issue Date :** | 18-December-2013 |
| **Approved Signatory :** | [redacted] |
| **Tested To :** | IEC61672-3:2006 |

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|---|---|---|---|
| 9: Indication at the calibration check frequency | Pass | 14: Level linearity on the reference level range | Pass |
| 10: Self-generated noise | Pass | 15: Level linearity incl. the level range control | Pass |
| 11: Acoustical tests of a frequency weighting | Pass | 16: Toneburst response | Pass |
| 12: Electrical tests of frequency weightings | Pass | 17: Peak C sound level | Pass |
| 13: Frequency and time weightings at 1 kHz | Pass | 18: Overload indication | 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.

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Accredited for compliance with ISO/IEC 17025.
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Acoustic Research Labs Pty Ltd [redacted]

# Sound Level Meter
## IEC 61672-3.2013
# Calibration Certificate

**Calibration Number** C16717

**Client Details** Rodney Stevens Acoustics Pty Ltd [redacted]

**Equipment Tested/ Model Number :** Rion NL-42EX
**Instrument Serial Number :** 00546394
**Microphone Serial Number :** 152908
**Pre-amplifier Serial Number :** 46606

| Pre-Test Atmospheric Conditions | | Post-Test Atmospheric Conditions | |
|---|---|---|---|
| **Ambient Temperature :** | 23.7°C | **Ambient Temperature :** | 24.2°C |
| **Relative Humidity :** | 50.3% | **Relative Humidity :** | 45.3% |
| **Barometric Pressure :** | 98.8kPa | **Barometric Pressure :** | 98.75kPa |

**Calibration Technician :** Vicky Jaiswal
**Calibration Date :** 09/01/2017
**Secondary Check:** Riley Cooper
**Report Issue Date :** 10/01/2017

**Approved Signatory :** [redacted] 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* | *±0.12dB* | *Temperature* | *±0.05°C* |
| *12.5kHz* | *±0.18dB* | *Relative Humidity* | *±0.46%* |
| *16kHz* | *±0.31dB* | *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.*

NATA WORLD RECOGNISED ACCREDITATION

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

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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.

PAGE 1 OF 1

Acoustic Research Labs Pty Ltd [redacted]

# Sound Level Meter
## IEC 61672-3.2013
# Calibration Certificate

**Calibration Number** C19415

**Client Details** Rodney Stevens Acoustics Pty Ltd
[redacted]

**Equipment Tested/ Model Number :** Rion NL-42EX
**Instrument Serial Number :** 00572558
**Microphone Serial Number :** 170393
**Pre-amplifier Serial Number :** 72896

| Pre-Test Atmospheric Conditions | | Post-Test Atmospheric Conditions | |
|---|---|---|---|
| **Ambient Temperature :** | 22.1°C | **Ambient Temperature :** | 23.2°C |
| **Relative Humidity :** | 36.7% | **Relative Humidity :** | 34.5% |
| **Barometric Pressure :** | 100.84kPa | **Barometric Pressure :** | 100.8kPa |

**Calibration Technician :** Lucky Jaiswal
**Calibration Date :** 16 Jul 2019
**Secondary Check:** Eloise Burrows
**Report Issue Date :** 16 Jul 2019
**Approved Signatory :** [redacted] 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* | *±0.15dB* | *Temperature* | *±0.2°C* |
| *12.5kHz* | *±0.2dB* | *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.
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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

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NATA WORLD RECOGNISED ACCREDITATION

## Appendix D Architectural plans