PLANNING PROPOSAL

Acoustic Assessment
Henry Lawson Centre
61-79 Henry St, Penrith

Prepared for:

Australian Foundation for Disability (AFFORD)
3-7 Marieanne Place
Minchinbury NSW 2770

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Australian Foundation for Disability (AFFORD) (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by AFFORD to prepare a preliminary acoustic assessment which will be submitted to Penrith City Council as part of the Planning Proposal for the proposed development at 61-79 Henry St, Penrith.

The Project is seeking approval under a Planning Proposal framework for the proposed development. As a result, this report predominantly addresses the requirements of both noise intrusion onto the development itself, and noise emission to the neighbouring facilities. Relevant acoustic requirements are outlined in this report. High level, qualitative commentary is provided in relation to the proposed buildings.

A glossary of acoustic terminology used throughout this report is included as **Appendix A**.

1.1 Purpose

The scope of this study is to:

- Identify existing noise source levels and identify nearby sensitive receivers surrounding the development footprint.
- Review of information provided by the client with regard to potential site layouts and other key features affecting noise impacts.
- Provide in-principle recommendations for potential treatment of any sensitive receivers identified.

2 Project Description

2.1 Site Overview and Layout

Henry Lawson Centre is located in the suburb of Penrith in Western Sydney. The site is located between Henry Street and North Street (Hume Highway) adjacent to the railway line. Penrith Station is located approximately 600m to the west. The site is bounded by Henry Street to the south, Lawson Street to the west, an area of green space between the site and North street to the north, with rail corridor on the other side of North Street, and a small commercial lot to the east (51 Henry Street, Penrith).

The site location is shown in **Figure 1.**

Figure 1 Site Overview

2.2 Proposed Works

The project involves the redevelopment of the area between Henry and Lawson streets, shown in **Figure 1**.

The development could comprise a scheme similar to that shown conceptually in **Figure 2**, which includes six 'zones' or separate buildings as follows:

- Building A: Three-storey pavilion (1400m^2 footprint) comprising both Retail and Hotel spaces, with the Hotel continuing to 35 storeys with a 700m^2 footprint.
- Building B: A 1700m^2 building footprint comprising of Retail on Levels 1 and 2, Commercial on Level 3, and Residential (with a reduced 1200m^2 footprint) from Levels 4 to 20.
- Building C: Level 1 Retail (875m^2 footprint), Level 2 Commercial (1050m^2 footprint), with Residential above from Levels 3 to 12 (1050m^2 footprint).
- Building D: Level 1 Retail (875m^2 footprint), Level 2 Commercial (1050m^2 footprint), with Residential above from Levels 3 to 12 (1050m^2 footprint).
- Building E: Levels 1 and 2 Community Services (950m^2), with Residential above from Levels 3 to 6 (950m^2).
- Building F: Levels 1 and 2 Community Services (1100m^2), with Residential above from Levels 3 to 6 (1100m^2).

The conceptual buildings and orientation are shown in **Figure 2** below. Further to the above building uses, the site may include:

- Basement Car Parking
- Drop-off zones
- Public Park
- Landscaped Plaza
- Footbridge across the train line
- Car park entry from a private road along North street

Figure 2 Conceptual Site Plan showing potential development zones

2.3 Potential Noise Impacts

The Henry Lawson Centre is proposed to be a mixed land use zone, comprising of Retail, Commercial, Residential and Public spaces.

The potential noise and vibration impacts which may arise as a result of the proposed development include:

- Operational noise emissions from onsite mechanical plant and equipment
- Potential noise and vibration emissions during the construction stage.

A screening assessment will need to be conducted to determine anticipated traffic increases on the surrounding road network due to the development. If traffic noise levels are expected to increase by more

than 2dB (approximately equal to a 60% increase in traffic levels), then a traffic noise increase assessment is to be conducted.

Potential external noise sources impacting the subject site include:

- Aircraft overflight noise and ground-based noise associated with the proposed Western Sydney Airport at Badgerys Creek.
- Road Traffic noise from Henry and Lawson Streets to the south and west respectively.
- Road Traffic noise from North Street (Hume Highway) to the north.
- Train noise from the rail corridor adjacent to the site to the north.

Noise emissions from the proposed development will be required to be appropriately controlled at any off-site noise sensitive uses. Identified off-site receivers include residential dwellings across the rail corridor to the north, and adjacent commercial premises to the south. Further to this, there is a future adjacent mixed-use development being planned at 51-57 Henry Street, Penrith (Dickson Rothschild development). We will conduct assessments to both existing residential properties across the railway to the north, and to the proposed future development adjacent the site to the east.

3 Ambient Noise Environment

3.1 Background Noise Survey

In order to characterise the existing acoustical environment at the nearest sensitive receivers, unattended noise monitoring was conducted between Wednesday 4 December and Wednesday 11 December 2019 at the locations shown in **Figure 1.**

Additionally, 15-minute attended noise measurements were conducted at the locations indicated in **Figure 1** to determine the character of the existing acoustic environment of the local area. Instrumentation for the noise survey included the following:

Table 1 Noise monitoring equipment list

Equipment	Location
Svantek 979 Noise Logger (Acoustic Research Labs)	Location 1 unattended
Svantek 971 Noise Logger (Acoustic Research Labs)	Location 2 unattended
Brüel & Kjær 2250 (S/N 3005904) Sound Level Meter	Attended measurements
Brüel & Kjær Calibrator (S/N 3008204)	-

Calibration of the logging devices was checked prior and after the measurements. There was no detectable drift in calibration. All equipment carried appropriate and current manufacturer calibration certificates.

The logging positions were selected to capture a representative sample of the ambient noise character of the site to establish the noise emission criteria.

The measured data has been filtered to remove data affected by adverse weather conditions following reference to the weather reports recorded at the Bureau of Meteorology (BOM) Penrith Lakes weather station.

Daily graphs representing the measured noise data are attached in **Appendix B**. The graphs represent each 24 hour period by incorporating the L_{A10}, L_{A90}, L_{Aeq} and L_{Amax} noise levels for the corresponding 15 minute periods.

3.1.1 Unattended Noise Monitoring

To assess the acoustical implications of the development on the levels of noise received at nearby potentially sensitive receivers, the measured data at the noise logging position was processed in accordance with the Environmental Protection Authority's (EPA) NSW *Noise Policy for Industry* (NPfI).

Table 2 details the Rating Background Level (RBL) and L_{Aeq} noise levels recorded during the daytime, evening and night-time periods. Data affected by adverse meteorological conditions and by spurious and uncharacteristic events has been excluded from the results and were also excluded from the data used to determine the noise emission criteria.

Table 2 Measured Ambient Noise Levels Corresponding to EPA NPfI Assessment Time Periods

Noise Monitoring Location	Period[1]	Measurement Parameter (dBA)	
		L_{A90} (RBL)[2]	L_{Aeq} [3]
Location 1 – North Street Rooftop	Daytime	54	63
	Evening	48	61
	Night-time	41	58
Location 2 – Lawson Street ground Level	Daytime	48	58
	Evening	45	57
	Night-time	35	55

Note 1: For Monday to Saturday, Daytime 7:00 am - 6:00 pm; Evening 6:00 pm - 10:00 pm; Night-time 10:00 pm - 7:00 am.

On Sundays and Public Holidays, Daytime 8:00 am - 6:00 pm; Evening 6:00 pm -10:00 pm; Night-time 10:00 pm - 8:00 am.

Note 2: The RBL noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: 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.

3.1.2 Attended Noise Monitoring

Operator attended noise monitoring measurements provide a context and noise level characteristics for the unattended noise measurements. A summary of the attended measurements is tabulated in **Table 3.**

Table 3 Operator Attended 15-minute Ambient Noise Survey

Location/ Description	Date/ Start time/ Weather	Primary Noise Descriptor (dB re 20 µPa)			Description of Noise Emission, Typical Maximum Levels L_{Amax} (dB)
		L_{AFmax}	L_{AFmin}	L_{Aeq}	
Location 1 – Lawson St nr Henry St	11/12/2019 12:45pm	78	53	65	Corner of Henry St and Lawson Streets. Traffic levels 65-70. Traffic lights 65 tonal.
Location 2 – Site boundary along 51 Henry St	11/12/2019 13:00pm	73	48	60	Outside 51 Henry Street. Traffic levels 60-65.

4 Noise Assessment Criteria

4.1 Aircraft Noise Intrusion

For land use planning around airports, Australia has adopted the Australian Noise Exposure Forecast (ANEF) system, which describes cumulative aircraft noise for an annual period. ANEF system is intended for use as a land use planning tool for controlling encroachment on airports by noise sensitive buildings and underpins Australian Standard 2021:2015 – Acoustics— Aircraft noise intrusion—Building siting and construction. Table 2.1 from AS2021 states the following regarding the acceptability of various building types within ANEF zones.

Table 4 Building site acceptability based on ANEF zones

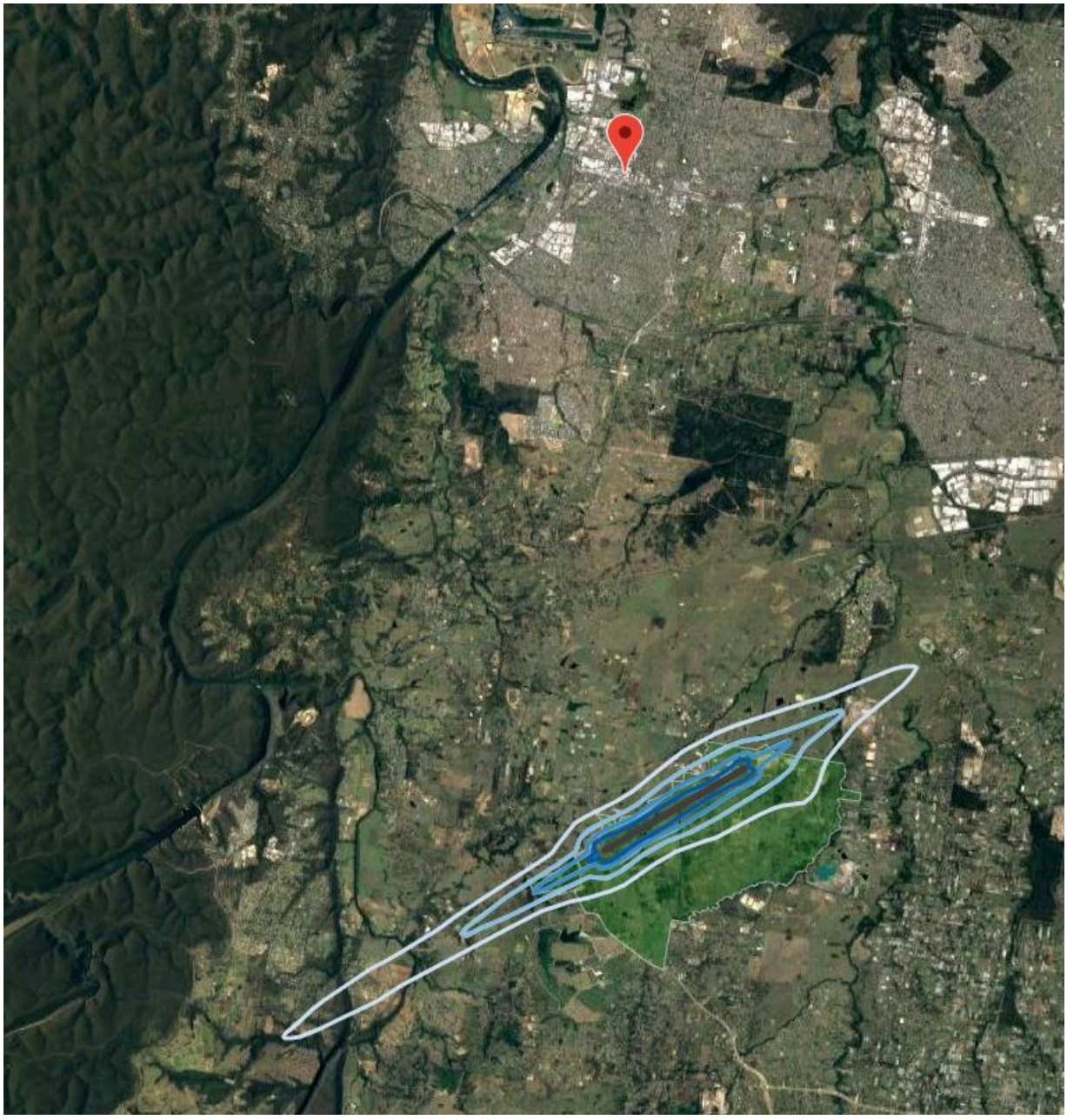
Building Type	ANEF Zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
Light Industrial	Less than 30ANEF	30 to 40	Greater than 40 ANEF
Commercial Building	Less than 25 ANEF	25 to 35	Greater than 35 ANEF
Hotel, motel, hostel Accommodation	Less than 25 ANEF	25 to 30	Greater than 30 ANEF
School, university, hospital, nursing home	Less than 20ANEF	20 to 25	Greater than 25 ANEF
Public Building	Less than 20ANEF	20 to 30	Greater than 30 ANEF

An "ANEF chart" is a set of land use planning contours for a specific airport which has been formally endorsed for technical accuracy by Airservices Australia, after a period of public consultation. The production of an ANEF chart for all major airports is a requirement of the Airports Act. For the Western Sydney Airport, flight paths and operating modes are yet to be finalised and approved and therefore an ANEF chart is not yet available. However several Australian Noise Exposure Concept (ANEC) charts have been produced. An ANEC is a noise exposure chart produced for a hypothetical future airport usage pattern, and is useful for considering the land use planning consequences of alternative operating strategies. ANEC charts for the subject site are contained in Appendix B. An ANEC map is essentially a draft ANEF, that has not yet been officially endorsed.

The ANEC / ANEF charts introduced above are used solely for the purpose of land use planning. Once it has been established that a site is potentially affected by aircraft noise, then this would a trigger an assessment of noise intrusion into the proposed building. The AS2021 document sets the noise criteria for internal sound levels (in terms of Maximum A-weighted Noise Levels, L_{Amax}) within buildings depending on the type/use of different rooms. As defined in AS2021, the design sound level is the maximum level (dBA) from aircraft flyovers which, when heard inside a building by the average listener while carrying out the specified activity, will be judged as not intrusive or annoying by that listener while carrying out the specified activity.

The development site is located 16km from Badgerys Creek Airport. It is also located outside the ANEC20 contours as shown in **Figure 3**, so an aircraft noise impact assessment is not required.

Figure 3 ANEC contours showing site location and anticipated noise contours



4.2 Internal Noise Levels as per AS/NZS2107:2016

Table 5 below lists internal design acoustic criteria for this project depending on the type/use of different rooms for steady state noise (such as noise from air-conditioning systems and road traffic). Recommendations for each space are in terms of an averaged A-weighted sound pressure level (L_{Aeq}) and Reverberation Time (RT60, s) are derived from guidelines from AS 2107-2016 Acoustics – Recommended design sound levels and reverberation times for building interiors.

Column 3 of the table sets out requirements for reverberation times within occupied spaces. The reverberation time defines the time taken for sound to decay within a space and thus affects the degree of speech intelligibility. Generally - the lower the reverberation time, the better for speech clarity.

Table 5 Internal design acoustic criteria from AS 2107

Occupancy	Design sound range L_{Aeq} dBA	Design Reverberation Time , RT60, s
Residential Buildings Houses and apartments in inner city areas or entertainment districts or near major roads		
Apartment common areas (e.g. foyer, lift lobby)	45 to 50	-
Living areas	35 to 45	-
Sleeping areas (night time)	35 to 40	-
Work areas	35 to 45	-
Hotels and motels		
Bars and lounges	<50	0.6 to 1.0
Conference areas		
Without sound reinforcement		
Up to 50 persons	35 to 40	Curve 1*
From 50 to 250 persons	30 to 35	Curve 1*
With sound reinforcement	35 to 45	Curve 1*
Dining rooms	40 to 45	Note 1
Enclosed carparks	<65	-
Foyers and recreation areas	45 to 50	Note 1
Kitchen, laundry and maintenance areas	<55	-
Sleeping areas (night time)	35 to 40	-
Washrooms and toilets	45 to 55	-
Office buildings		
Board and conference rooms	30 to 40	0.6 to 0.8
General office areas	40 to 45	0.4 to 0.6
Open plan office	40 to 45	0.4
Reception areas	40 to 50	0.6 to 0.8
Toilets	45 to 55	
Restaurants and Cafeterias		
Cafeterias	40 to 50	Note 1
Coffee Shops	40 to 50	Note 1
Shop Buildings		
Small retail stores (general)	<50	Note 1
Show rooms	<50	Note 1
Specialty shops (where detailed discussion is necessary in transactions)	<45	Note 1

Occupancy	Design sound range L_{Aeq} dBA	Design Reverberation Time , RT60, s
Supermarkets	<55	Note 1

Note 1: Reverberation time should be minimised for noise control.

Note 2: For spaces with many different room uses, the lowest L_{Aeq} value has been used in **Table 5**

Note 3: The levels for cinemas are shown above. This is the quietest space for recreational use. Other recreational building types require a sound range between 50 to 60 dBA.

Note 4: Hotel and motels in inner city areas or entertainment districts or near major roads

4.3 NSW Department of Planning 'Development near Rail Corridors and Busy Roads- Interim Guideline'

4.3.1 Road Noise

Major roads and rail operations generate noise and vibration, and people living and working near major transport corridors can be adversely affected. In addition, major roads can impact on air quality due to the volume of traffic they carry. The Guideline assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads.

In circumstances where a development is adjacent to a road that contains an annual average daily traffic (AADT) volume of between 20,000-40,000 vehicles (based on the traffic volume data published on the website of the RMS), the Guidelines provide best practice advice.

The AADT of the surrounding streets have been determined from the RTA 'Traffic volume maps for noise assessment for building on land adjacent to busy roads'. North Street has been identified as a road containing traffic levels between 20,000 – 40,000, which falls under the category 'Recommended' to undertake a noise assessment as per the requirements of the DoP 'Development near Rail Corridors and Busy Roads – Interim Guideline'.

As per the Guideline, it refers back to the State Environment Planning Policy (Infrastructure) 2007 (ISEPP) which identifies the following criteria to apply to this development:

For Clause 102 (Road):

If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- *In any bedroom in the building : 35 dB(A) at any time 10pm-7am.*
- *Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40 dB(A) at any time.*

It should be noted that the ISEPP criteria above is more stringent than the requirements of AS/NZS2107:2016 for the residential component of the development outlined in **Table 5**. Therefore, the internal noise level requirements of the Infrastructure ISEPP outlined in **Table 6** will be the relevant criteria for the residential component of the development (for the defined periods only).

Table 6 Project Specific Internal Noise Levels for Residential Premises as per ISEPP Guidelines

Location	Requirement, LA_{eq}
Sleeping Areas	35 dB(A) between 10pm – 7am
Other spaces	40 dB(A) at any time

4.3.2 Rail Noise

The rail corridor adjacent to the development contains Passenger Services travelling under 80km/h. As per Figure 3.1 in the DoP Interim Guideline, the distance from the rail corridor to the development mandating a full rail noise assessment is 10m.

For dwellings located between 10m and 60m from the rail corridor, standard mitigation measures consistent with road noise control are required, which will refer back to the typical assessment and requirements outlined in **Section 4.3.1**.

The subject development is located approximately 40m from the rail corridor. Thus, there is no requirement for a specific Rail Noise assessment to be conducted. The unattended noise monitoring will include train passbys and this will contribute to the overall ambient and traffic (from both road and rail) noise levels.

4.3.3 Rail Vibration

The vibration assessment zone for typical development sites adjacent to rail corridors or above rail tunnels is 25m for residential buildings on 'hard' ground. Note this distance is between the building façade and the nearest operational track. The subject site lies outside this threshold distance, therefore a rail vibration assessment is not required.

4.4 Operational Noise – Noise Policy for Industry

The *Noise Policy for Industry* (NPfI) was released in 2017 and sets out the NSW *Environment Protection Authority's* (EPA's) requirements for the assessment and management of noise from industry in NSW.

4.4.1 Trigger Levels

The NPfI describes 'trigger levels' which indicate the noise level at which feasible and reasonable noise management measures should be considered. Two forms of noise criteria are provided – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses.

- The **intrusiveness** of an industrial noise source is generally considered acceptable if the L_{Aeq} noise level of the source, measured over a period of 15 minutes, does not exceed the background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended **amenity** levels specified in the NPfI for that particular land use.

For this assessment, the area surrounding the proposal is considered to be 'urban' which we believe would be indicative of the future neighbourhood.

4.4.1.1 Project Noise Trigger Levels

The noise emission trigger levels for industrial noise generated by the proposal are provided in **Table 7**. The Project Noise Trigger Level is the lowest value of the intrusiveness or amenity noise level for each period and these are shown in the table in bold.

Table 7 Project Noise Trigger Levels for Surrounding Receivers

Receiver Type	Time of Day	Recommended Amenity Noise Level (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels L_{Aeq}(15minute) (dBA)	
			RBL[1]	**L_{Aeq}(period)**	**Intrusiveness**	**Amenity[2,3]**
Residential (toward North Street) – Logger 1	Day	60	54	63	**59**	58
	Evening	50	48	61	53	**48**
	Night	45	41	58	46	**43**
Commercial (toward Henry Street) – Logger 2	When in use	65	48	58	-	**63**

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have been used as the project amenity noise levels as there are no other industries present or likely to be introduced.

Note 3: The project amenity noise levels have been converted to a 15 minute level by adding 3 dB.

Two sets of project specific criteria (Residential and Commercial) were derived individually from relevant noise loggers L01 and L02 (shown in **Table 7**) to ensure that each affected residential receiver's existing ambient noise level was represented accurately.

4.5 Sleep Disturbance

The most recent guidance in relation to sleep disturbance is contained in the EPA's *Application Notes - NSW Industrial Noise Policy*. For this assessment, the following night-time sleep disturbance goal has been used:

- Night-time (10.00 pm to 7.00 am) RBL +15 dBA "screening criterion".

4.6 Construction Noise and Vibration Criteria

A separate Construction Noise and Vibration Management Plan (CNVMP) should be developed further into the design stage. Construction noise and vibration have not been assessed at this stage.

5 Noise Intrusion Assessment and Recommendations

5.1 Road and Rail Traffic Noise Intrusion

The site is bounded to the south by Henry Street, and to the north by North Street. Traffic noise levels are taken as 9 and 15-hour L_{Aeq} levels as per the Road Noise Policy.

Based upon the measured traffic noise levels, and considering the internal noise level targets as per **Table 5**, the minimum recommended façade acoustic ratings are as follows.

Table 8 Indicative building envelope performance ratings

Facade	Building Occupancy	External Traffic Noise LAeq, dB(A)	Traffic Noise Reduction required, dBA	Minimum recommended façade acoustic ratings, dB		
				Glazing/Doors	Walls	Roof
Facing North Street (to the north)	Commercial	60	20-25	Rw 28	Rw 36	-
	Residential (Sleeping Areas)	54	19	Rw 28	Rw 32	Rw 32
Facing Henry Street (to the south), adjacent development (to the east), and Lawson Street (to the west)	Commercial	54	14-19	Rw 25	Rw 32	-
	Residential (Sleeping Areas)	51	16	Rw 28	Rw 32	Rw 32

The minimum façade requirements are dictated by road traffic noise. The included Rw (weighted sound reduction index) performance ratings can be taken as preliminary and are subject to refinement during design development. An octave band assessment of the proposed constructions should be conducted to confirm adequate low frequency performance is achieved for noise control. General construction examples to achieve the above Rw ratings are discussed below.

Commercial and Retail building components:

- Glazing systems for commercial and retail spaces are expected to require 6mm fixed glazing towards North Street, and 4mm fixed glazing to all other facades.
- Wall elements would need to comprise dense outer cladding, acoustic insulation and dense internal sheeting. Alternatively, a concrete panel construction could be expected to achieve the ratings without any further upgrade.

Residential and Hotel accommodation building components:

- Glazing systems for residential and hotel accommodation areas are expected to comprise 6mm single glazed constructions to all facades.
- Roof construction shall be concrete or similar masonry construction. It is expected that plant equipment will be located on the roof. Equipment will need to be assessed later in the design phase to ensure noise intrusion into the apartments is not an issue.
- Wall elements would need to comprise dense outer cladding, acoustic insulation and dense internal sheeting. Alternatively, a concrete panel construction could be expected to achieve the ratings without any further upgrade.

5.2 Mechanical Plant/ Equipment

Environmental noise emissions from fixed plant will be required to be assessed during the later design stages to ensure compliance with the applicable NPfI levels specified in **Section 4.4**. The assessment will include typical day, evening and night-time operation and emergency operations. Acoustic mitigation measures will be applied to the design where necessary. These may include:

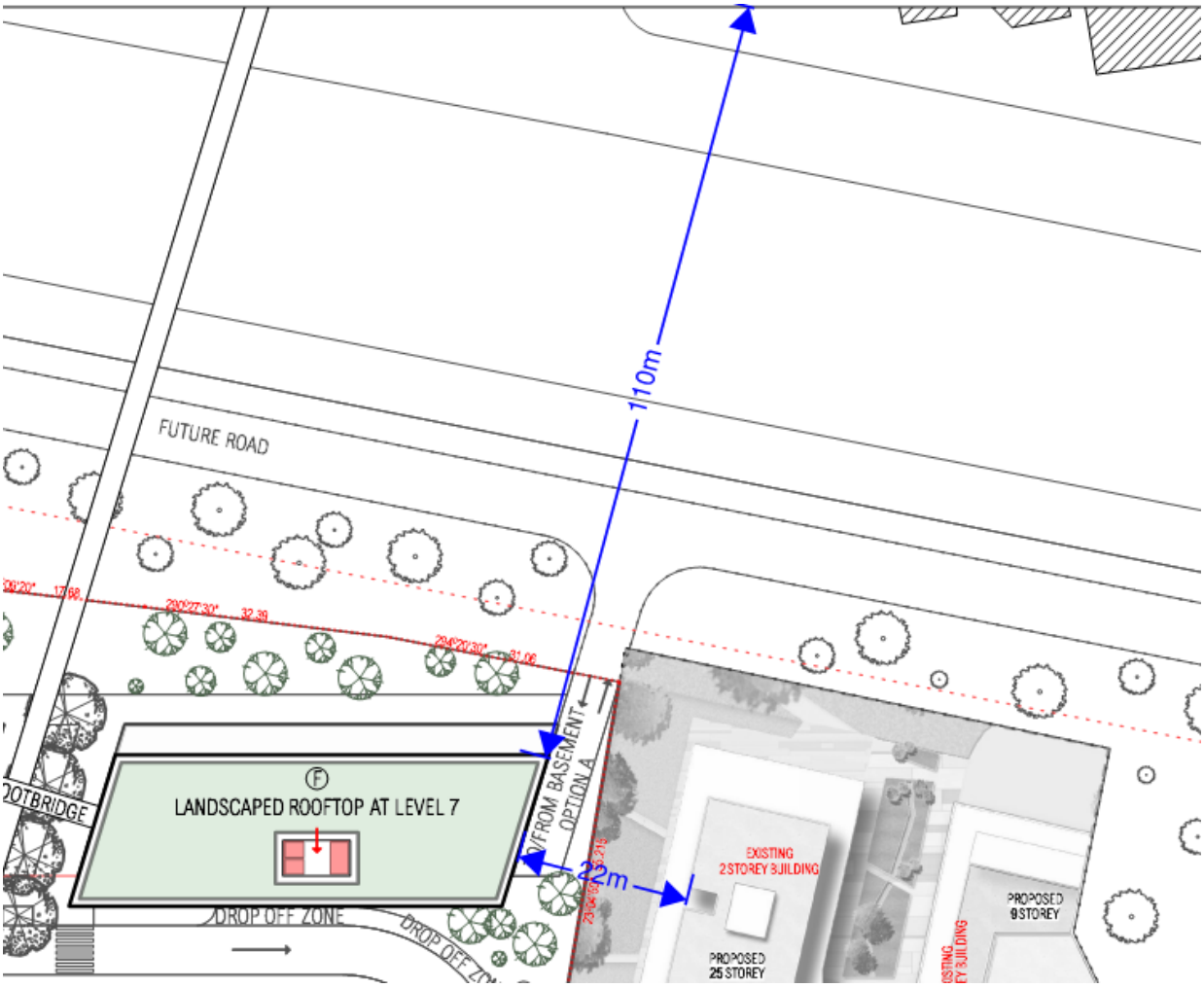
- Selection of quieter equipment
- Selection of equipment location
- Acoustic louvres
- Acoustic attenuators
- Acoustic barriers

Operational noise emissions from mechanical plant associated with the Project should be controlled to reduce noise impacts upon neighbouring residential receivers and occupants within the proposed development.

Detailed assessment and verification of mechanical noise emissions should be carried out during the detailed design stage of the project ensuring that the nominated criteria for mechanical plant emissions are met.

As we have not been provided any information on the approach for mechanical services, SLR can conduct a high-level assessment assuming typical equipment is to be located on the rooftop. Building F is in closest proximity to both the existing residential receivers 110m to the north, and the future development at 22m to the east, as shown in **Figure 4** below.

Figure 4 Distance to two nearest residential receivers



A preliminary assessment has been conducted to determine the allowable noise levels at the edge of the development rooftop to achieve compliance at the residential receivers.

Table 9 Allowable SPL at rooftop boundary due to mechanical equipment

Receiver Location	Criteria, dB(A)	Distance from rooftop edge	Allowable combined sound pressure level at Building F rooftop edge
Existing residential across the railway line to the north	43	110m to the north	53
Future residential component of adjacent development at 51-57 Henry Street	43	22m to the east	**48**

A typical spectrum has been put together representing a number of rooftop fans and condensers. This has been used with the results from **Table 9** above to provide an indicative maximum permissible combined sound level at the Building F rooftop edge.

Table 10 Indicative maximum permissible combined sound level at the Building F rooftop edge

	Maximum Allowable Sound Power Level of each unit, SWL							
Equipment	63	125	250	500	1k	2k	4k	8k
Combined level from all equipment	51	51	48	45	41	38	35	27

5.3 Increased road traffic

It is expected that potential noise emissions from the increased road traffic will be required to be assessed in any development approval stage noise assessment.

6 Conclusion

SLR Consulting Australia Pty Ltd has conducted a preliminary environmental noise impact assessment with regards to the planned development at Henry Lawson Centre.

Noise design objectives were set in accordance with the criteria set out in Australian Standard AS2107, the NSW Noise Policy for Industry, and the Department of Planning document 'Development near rail corridors and busy roads- Interim Guideline'.

Preliminary noise impacts onto the development were assessed based on available information regarding the future aircraft and existing road traffic movements. It is concluded that residential development on the site is capable of complying with all relevant controls, subject to design development and recommendations of a suitably qualified acoustic consultant.

As the development is in the early design stages, a detailed environmental noise emissions assessment has not been undertaken. The proposed development will need to be designed to achieve compliance with the applicable environmental noise limits as outlined in this report.

Overall, it is concluded that the proposed development will have limited acoustic impacts and the applicable environmental noise emission criteria will need to be complied with at the nearest sensitive receivers.

APPENDIX A

Acoustic Terminology

1 Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that in common usage 'noise' is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3 Sound Power Level

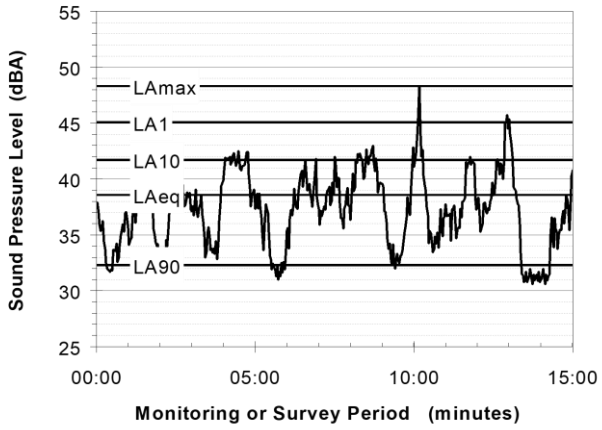
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or L_W, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

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

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the 'repeatable minimum' L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or 'average' levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than 'broad band' noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

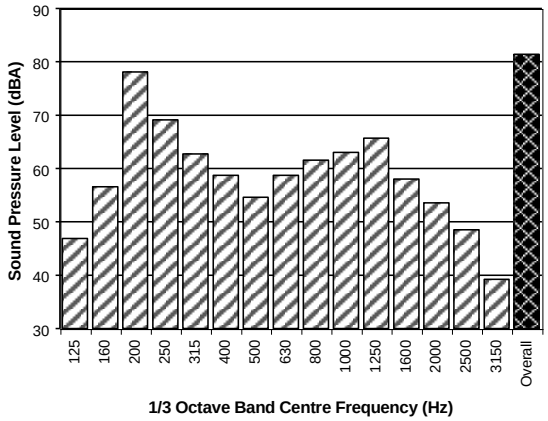
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organizations.

9 Human Perception of Vibration

People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

10 Over-Pressure

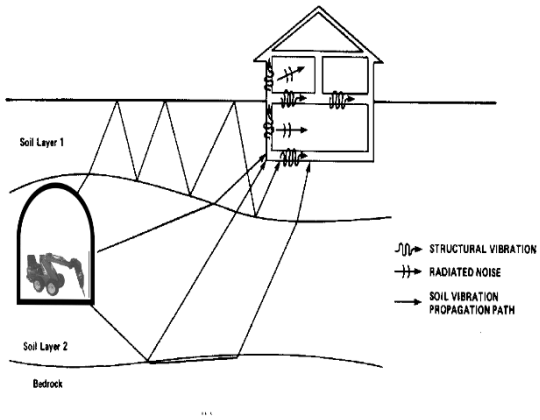
The term 'over-pressure' is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



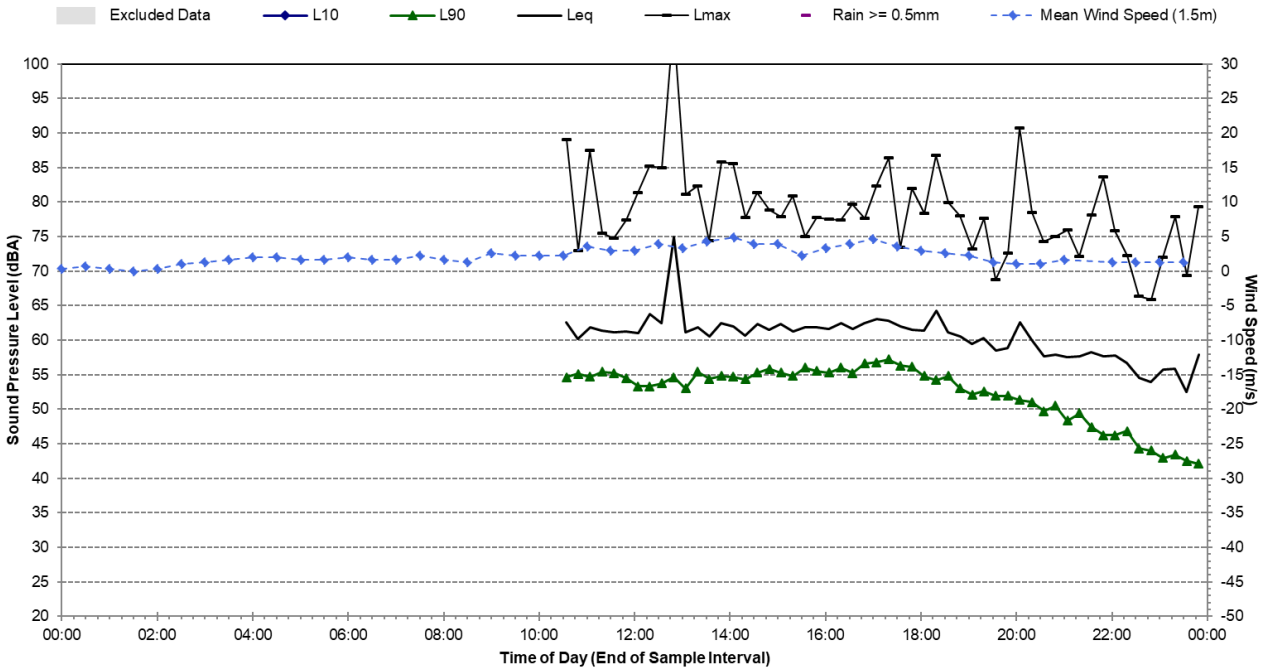
The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

APPENDIX B

Statistical Ambient Noise Data

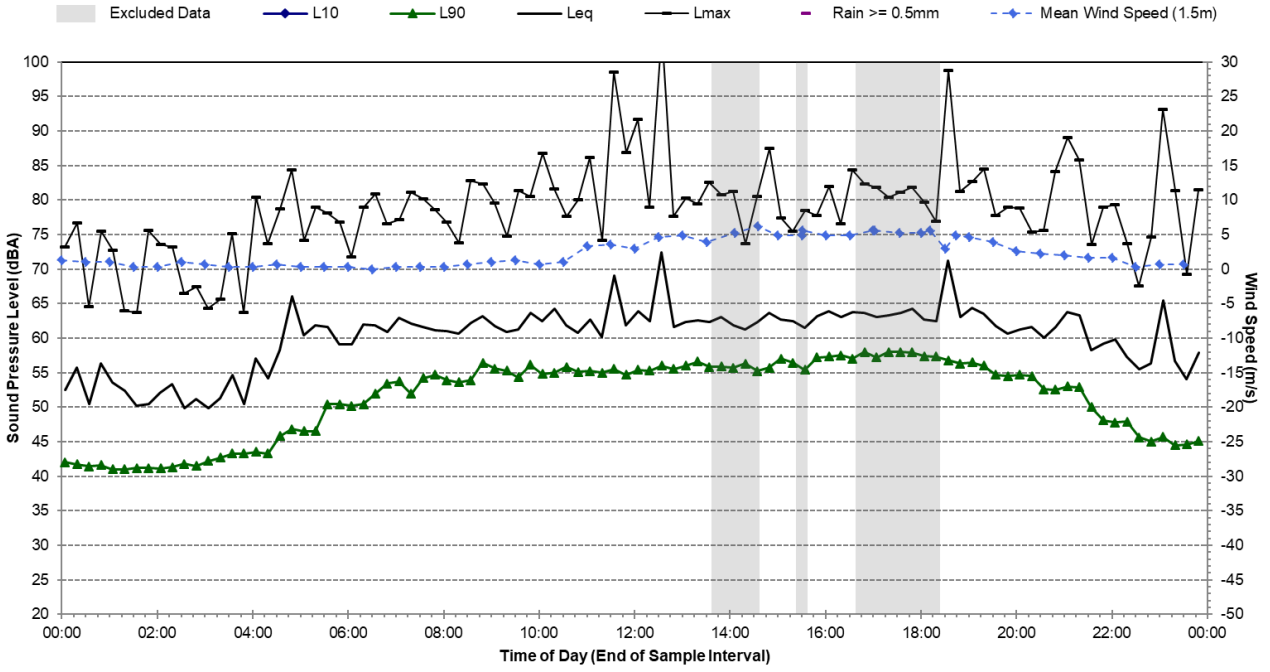
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Wednesday, 4 December 2019



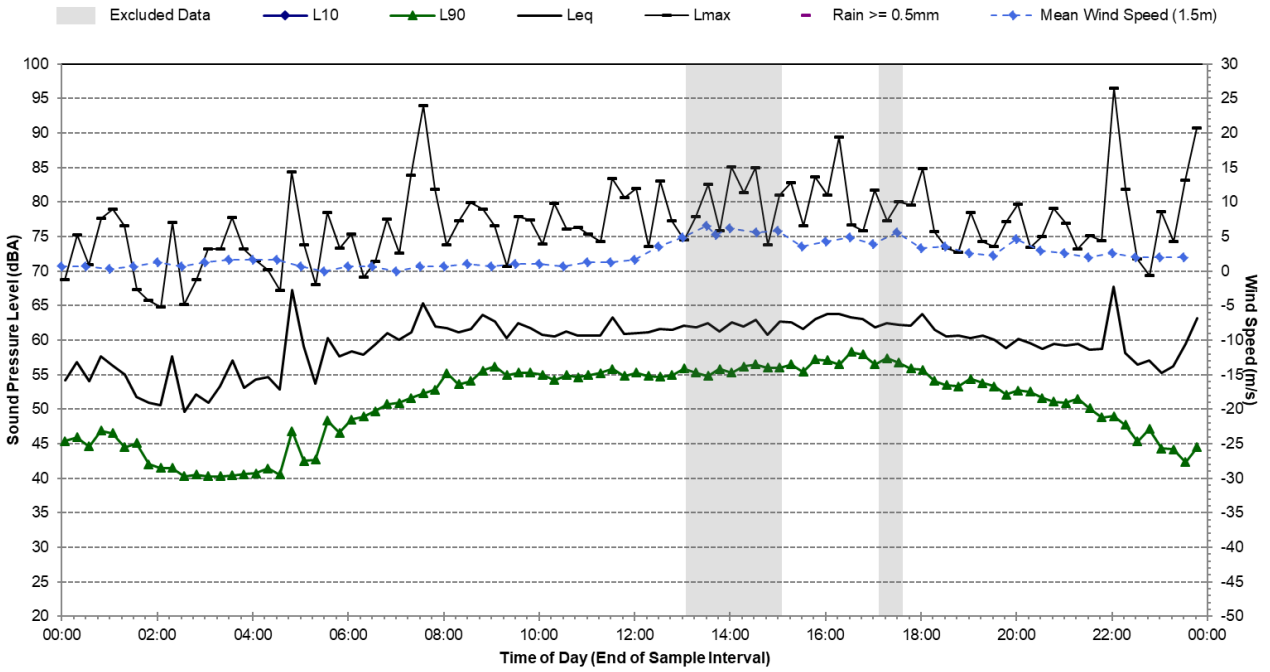
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Thursday, 5 December 2019



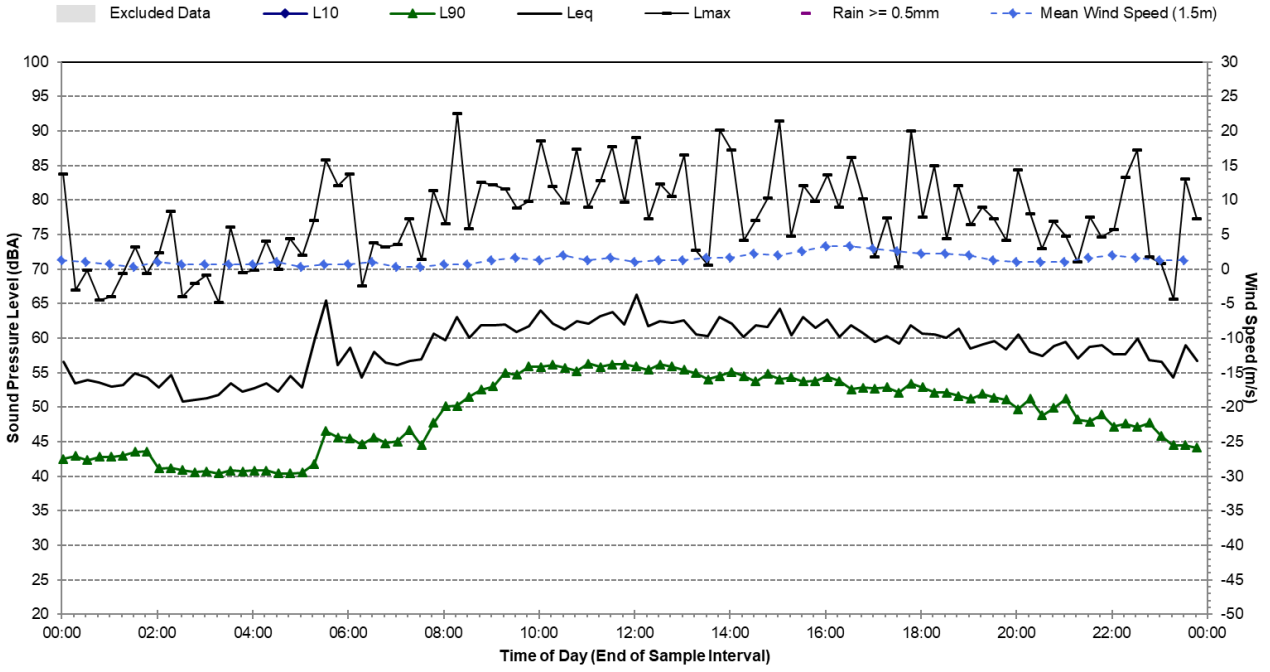
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Friday, 6 December 2019



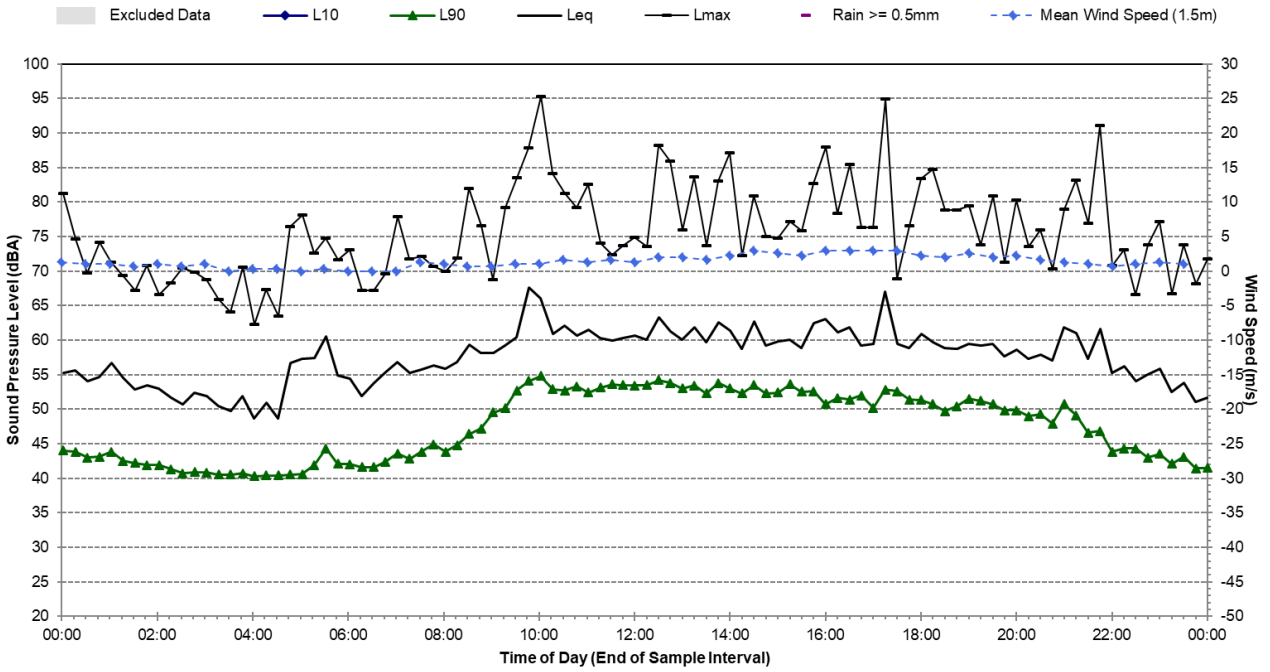
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Saturday, 7 December 2019



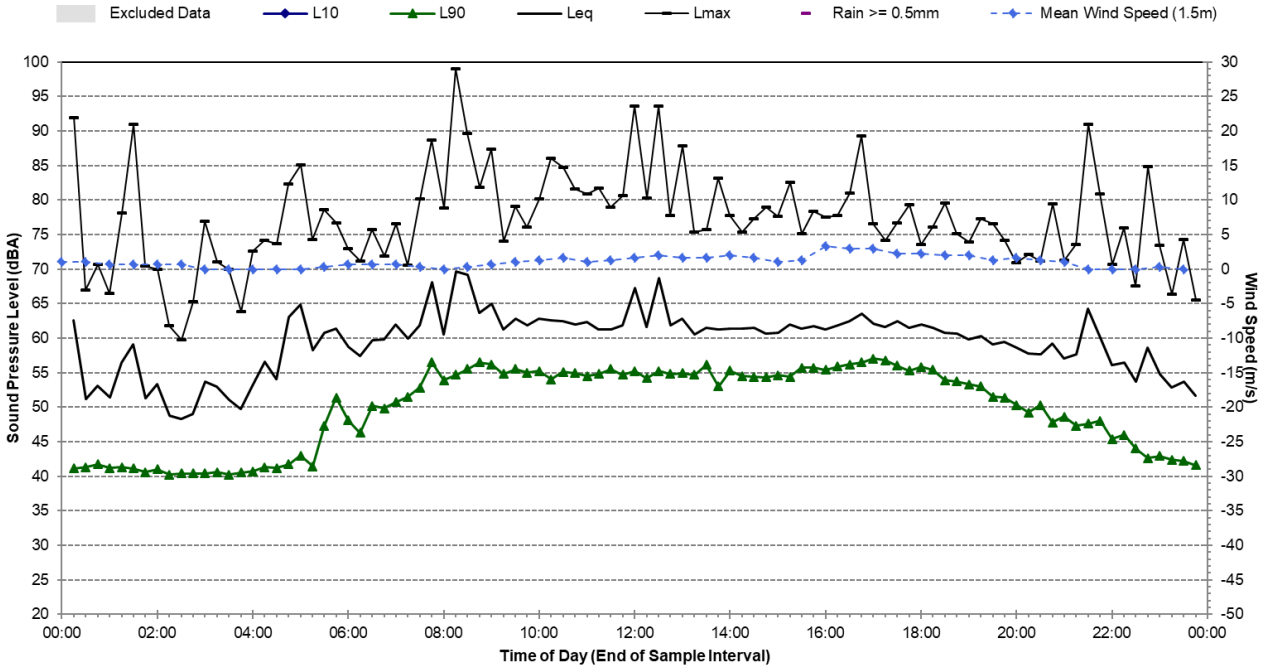
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Sunday, 8 December 2019



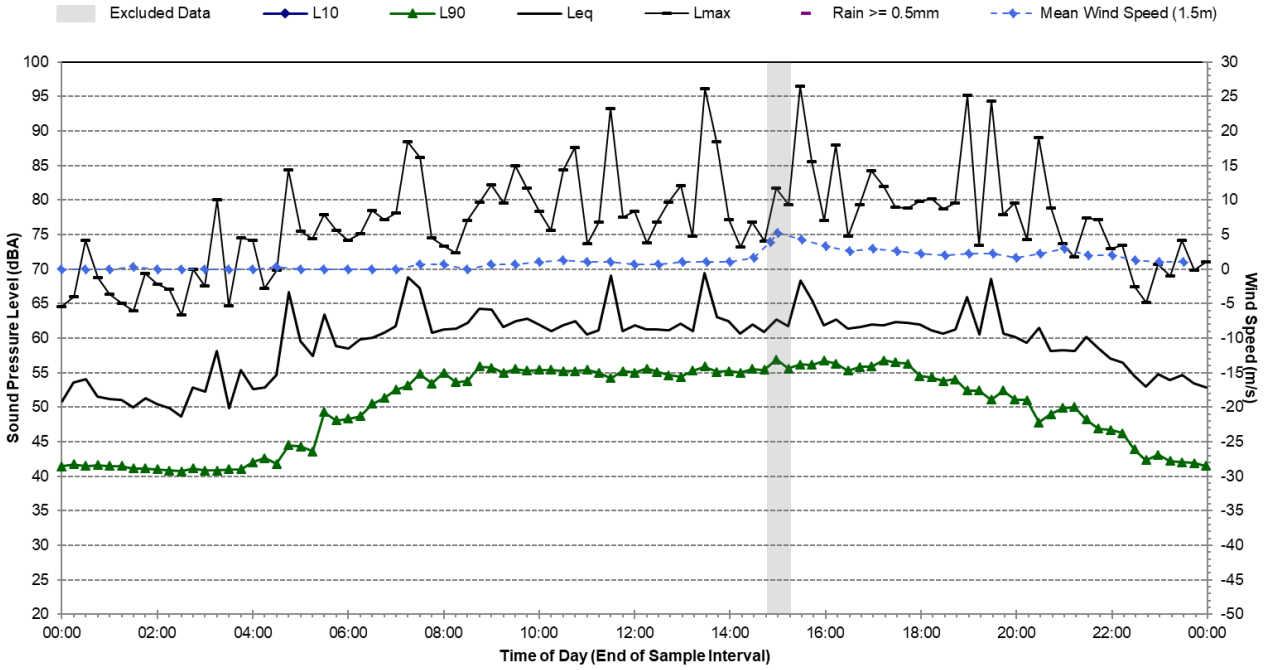
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Monday, 9 December 2019



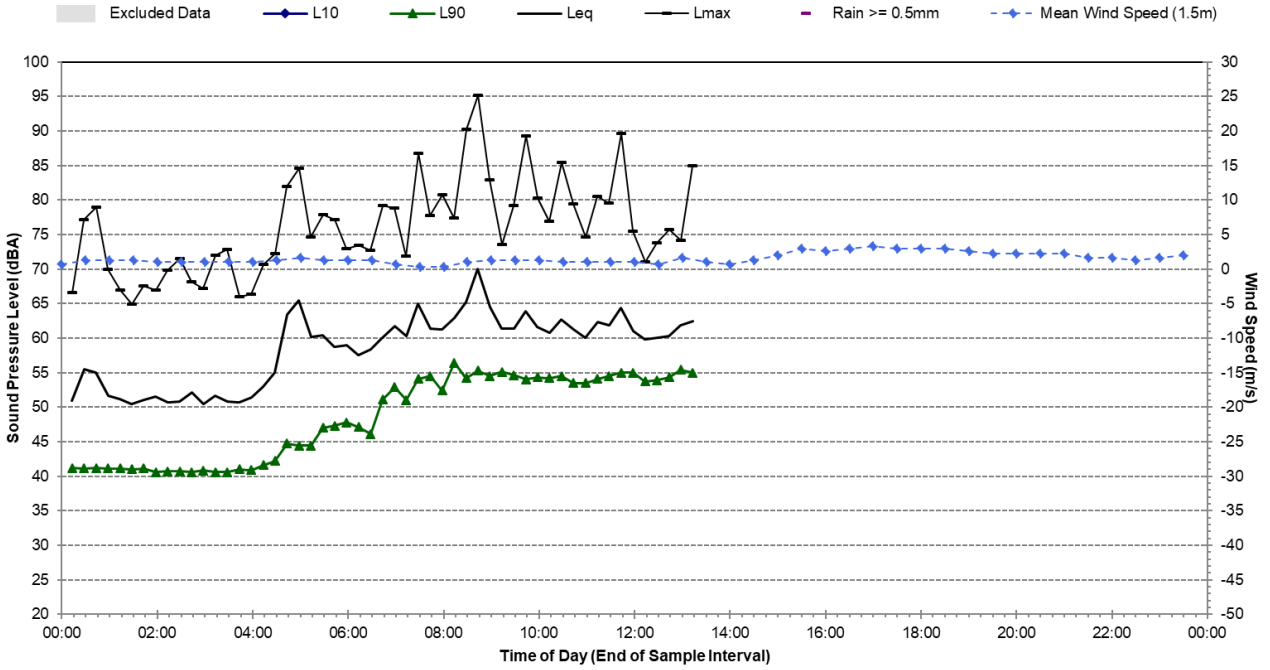
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Tuesday, 10 December 2019



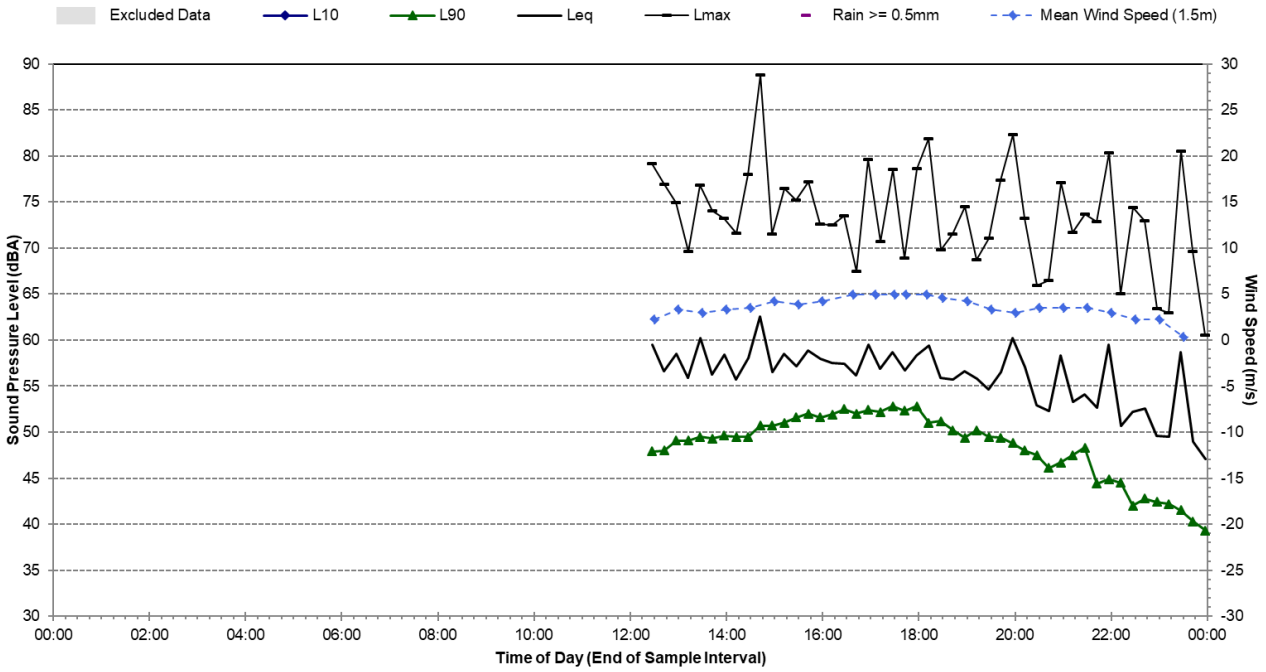
Statistical Ambient Noise Levels

Rooftop - North St, Penrith - Wednesday, 11 December 2019



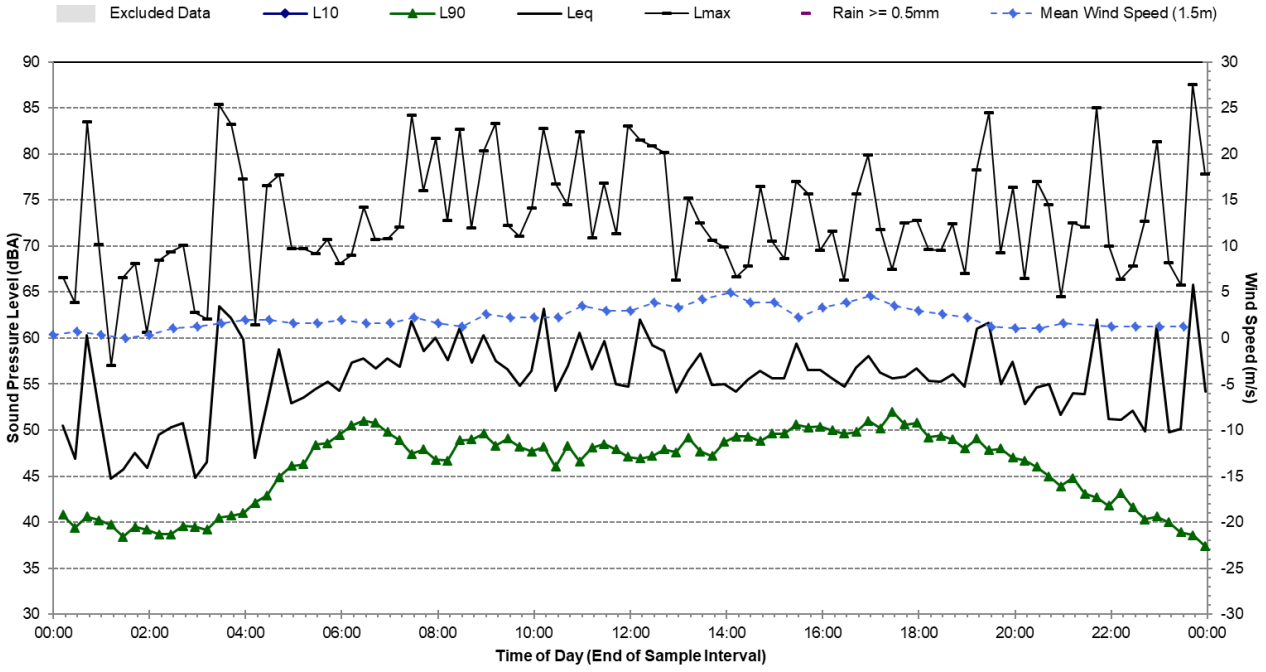
Statistical Ambient Noise Levels

Lawson St, Penrith - Tuesday, 3 December 2019



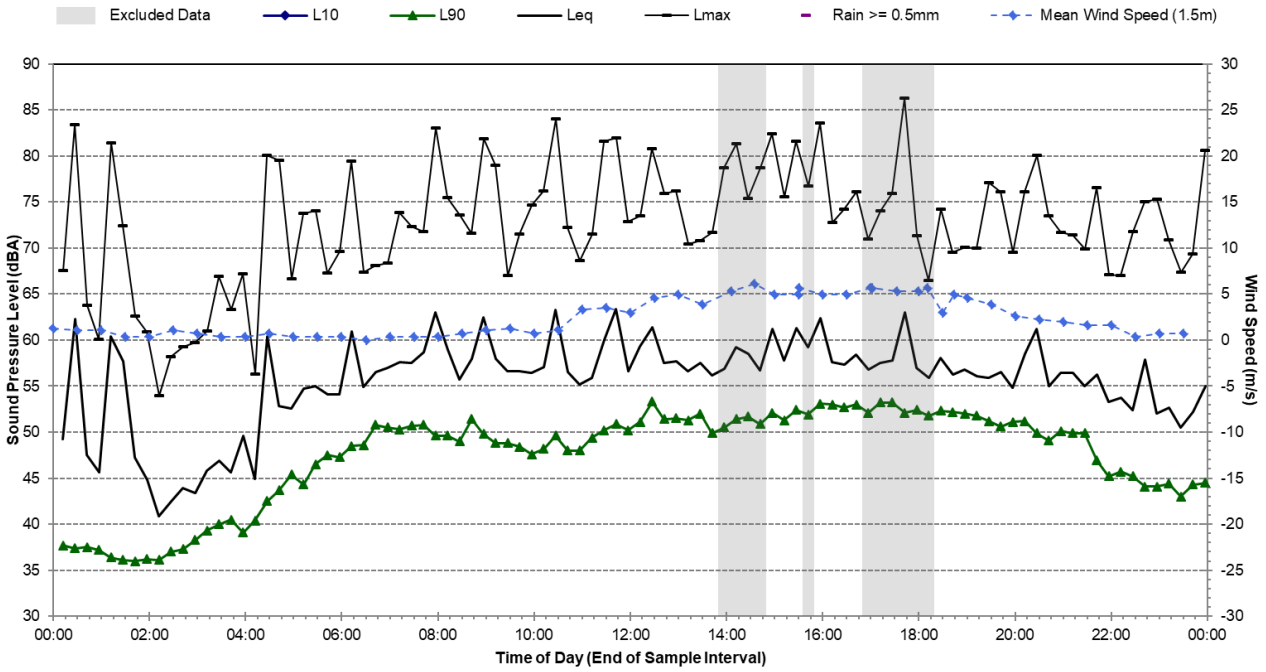
Statistical Ambient Noise Levels

Lawson St, Penrith - Wednesday, 4 December 2019



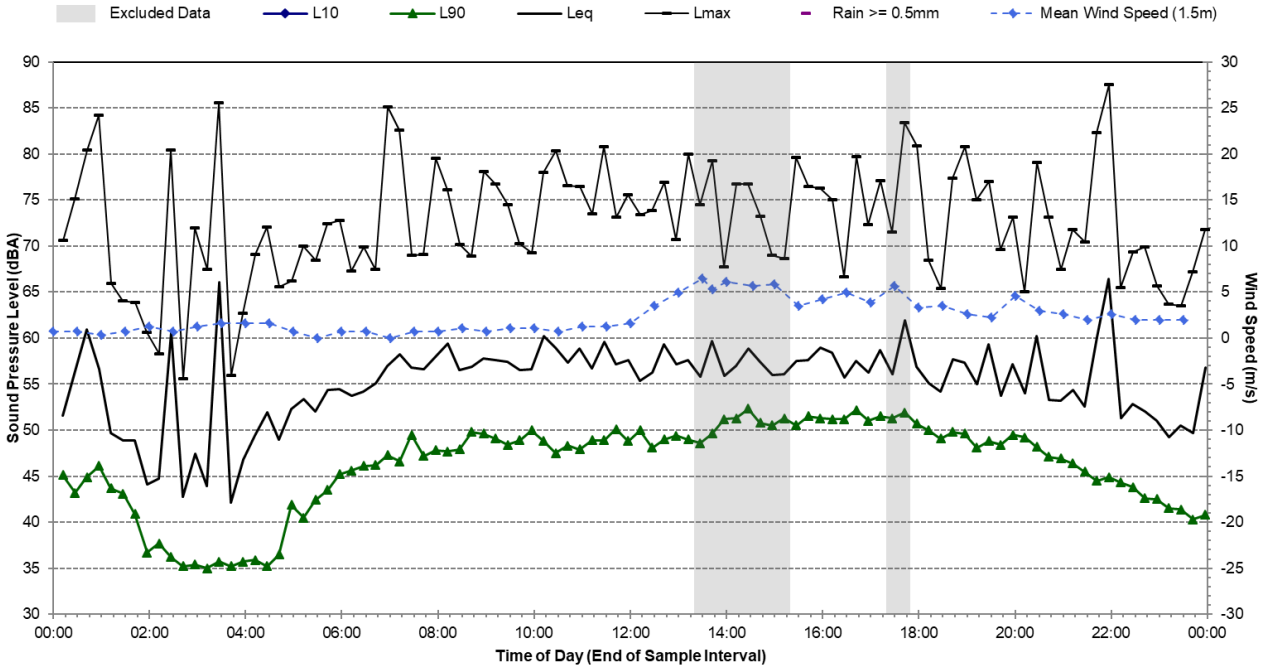
Statistical Ambient Noise Levels

Lawson St, Penrith - Thursday, 5 December 2019



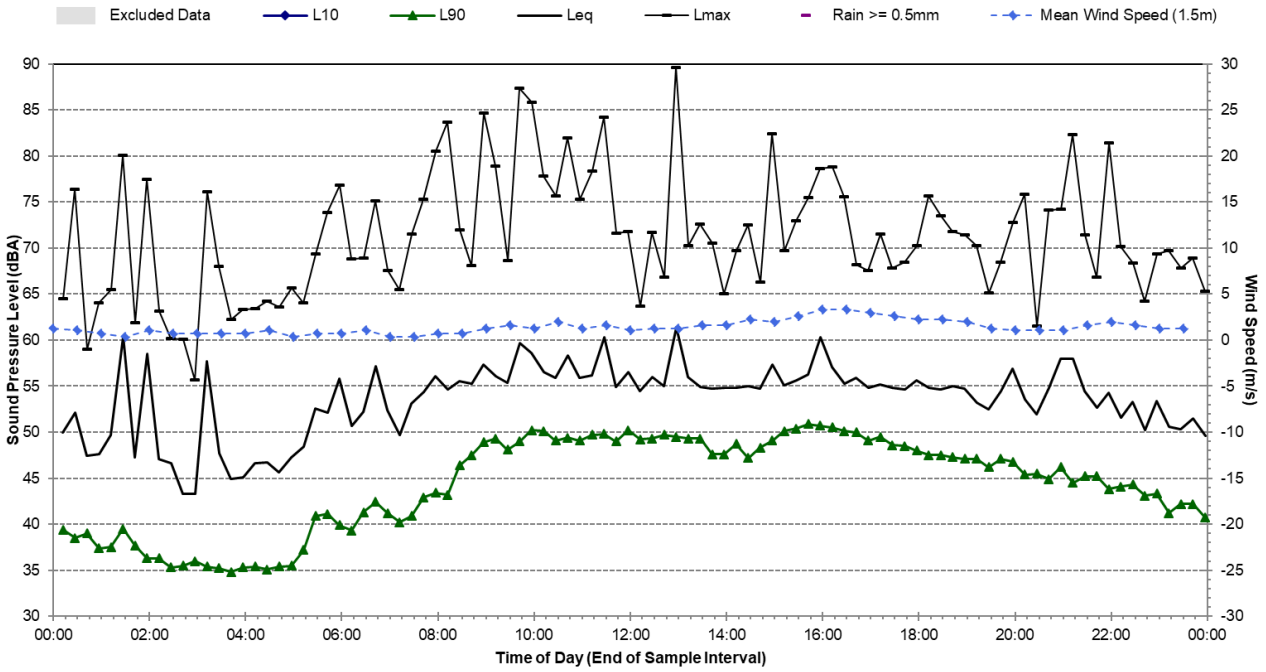
Statistical Ambient Noise Levels

Lawson St, Penrith - Friday, 6 December 2019



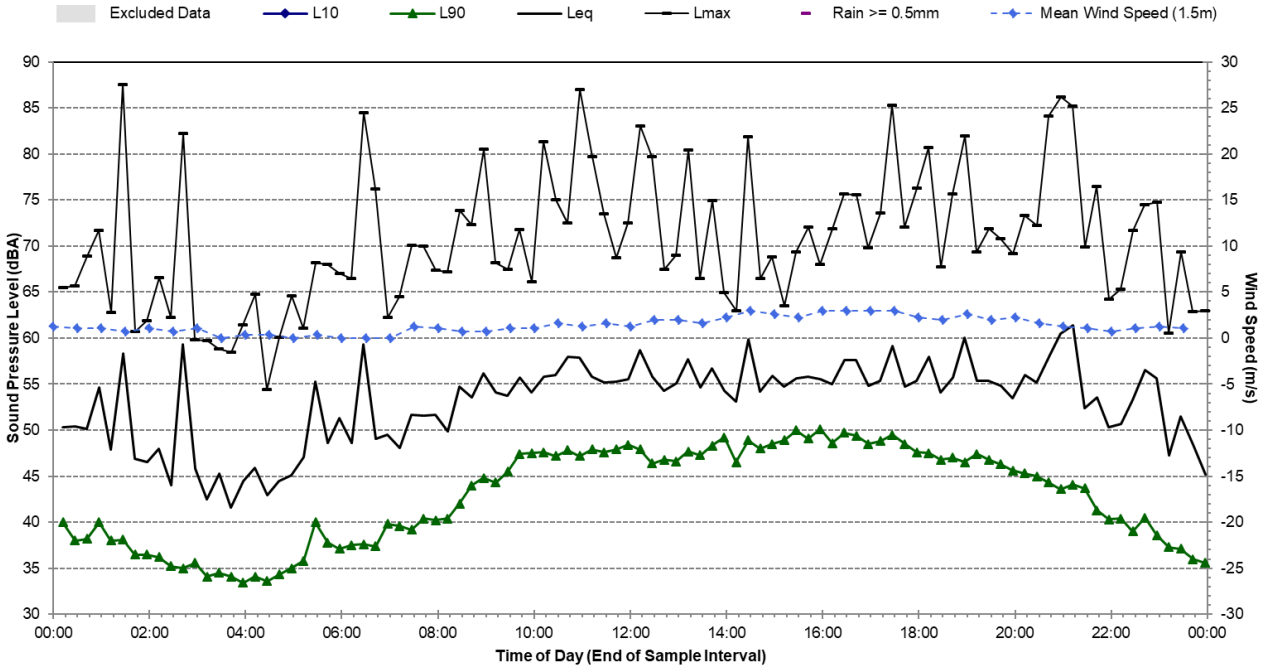
Statistical Ambient Noise Levels

Lawson St, Penrith - Saturday, 7 December 2019



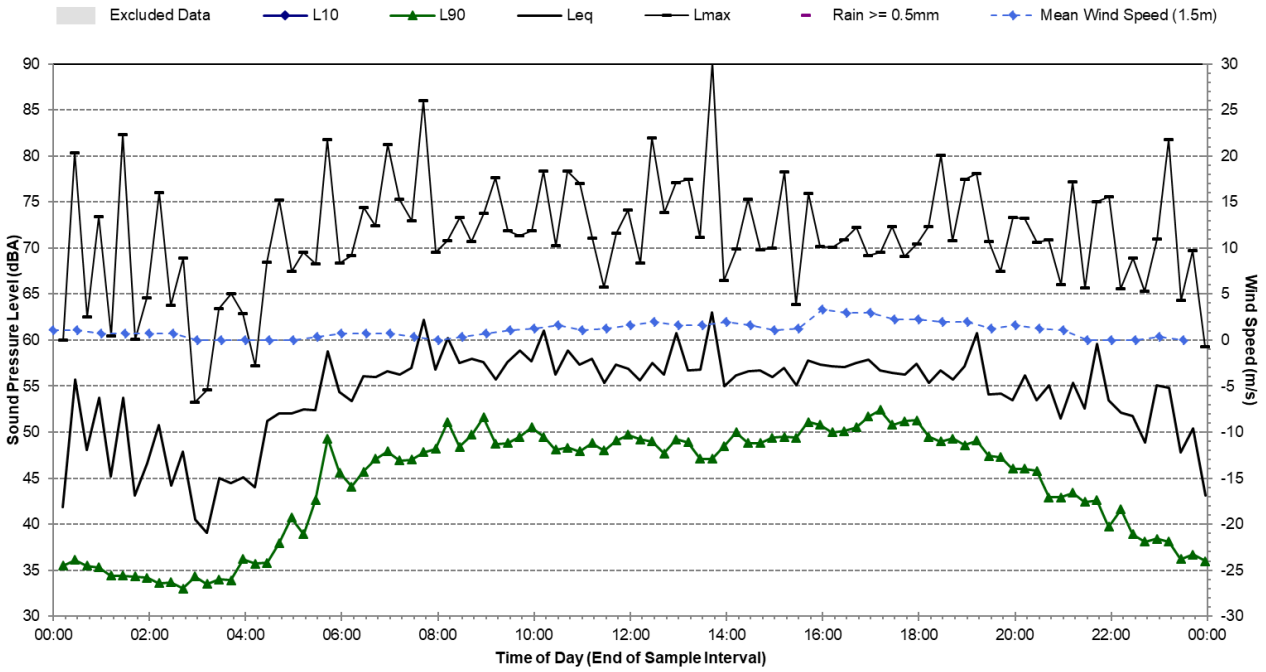
Statistical Ambient Noise Levels

Lawson St, Penrith - Sunday, 8 December 2019



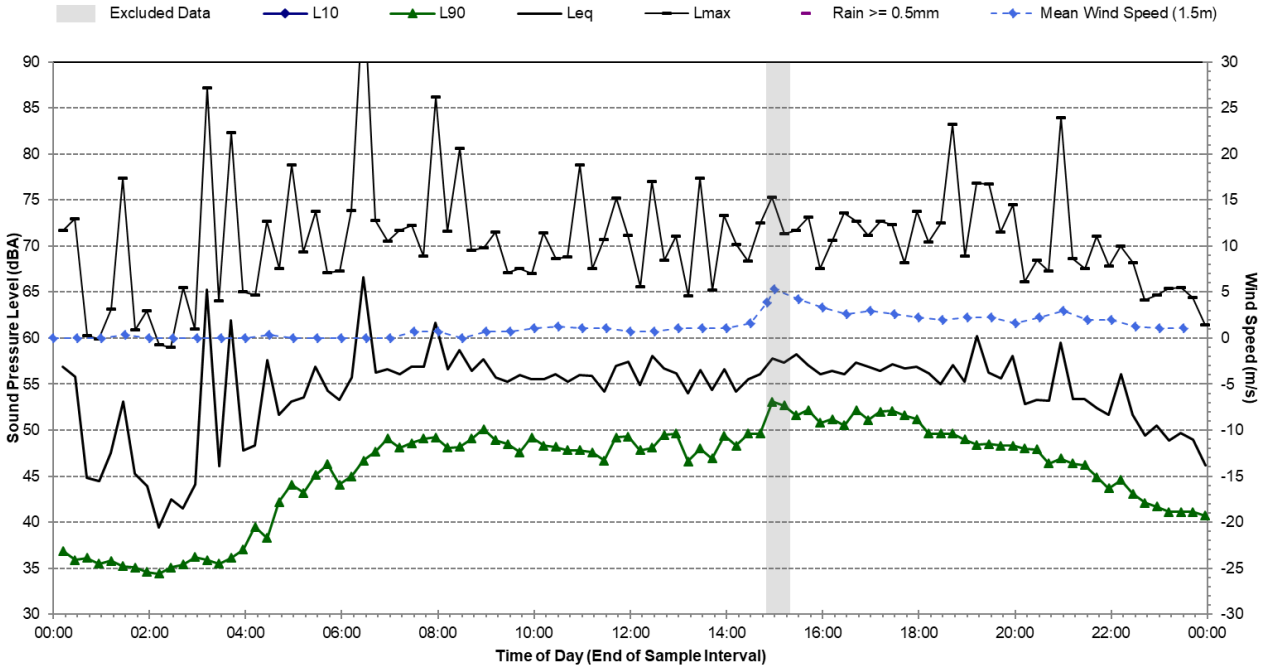
Statistical Ambient Noise Levels

Lawson St, Penrith - Monday, 9 December 2019



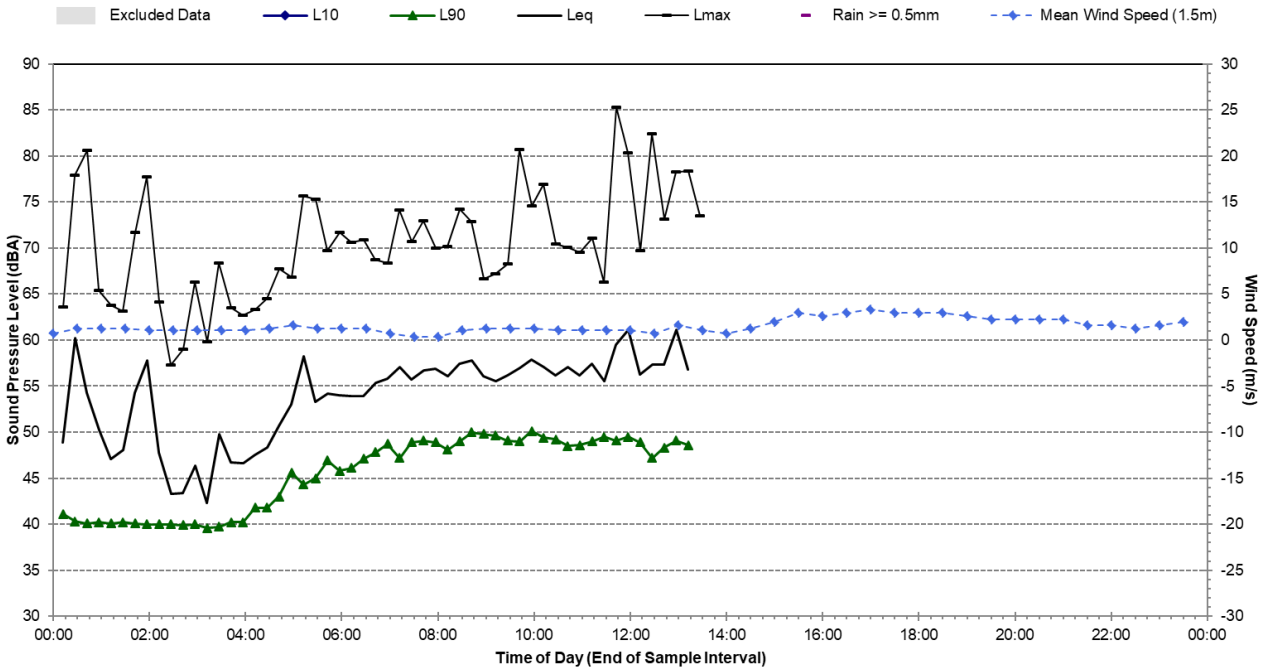
Statistical Ambient Noise Levels

Lawson St, Penrith - Tuesday, 10 December 2019



Statistical Ambient Noise Levels

Lawson St, Penrith - Wednesday, 11 December 2019



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15 May 2020

Document3

Australian Foundation for Disability (AFFORD)
3-7 Marieanne Place
Minchinbury NSW 2770

Attention: Matthew Bennett (BCM Property)

Dear Matthew,

Henry Lawson Centre
61-79 Henry St, Penrith
Statement to Council

The 'Acoustic Assessment' prepared by SLR titled '*610.19074-R01-v1.0*' dated 19 December 2019 considers the impact of road noise on development and outlines under Section 4.3.2 that no specific assessment is needed, as the standard provisions to address road traffic noise are sufficient.

The standard provisions referenced include mitigation measures contained in the Department of Planning's '*Development Near Rail Corridors and Busy Roads – Interim Guidelines*'. Section 5.3.1 of this guideline applies the mitigation measures for noise impacts to 'single dwelling residences'.

SLR confirms that the assessment and measures proposed to address noise will satisfactorily address the potential impacts associated with this development type. While the report specifically addressed BCA Class 1a buildings, it is still relevant to the Class 2 and mixed-use development proposed.

Yours sincerely,

ATTILA SZABO
Senior Project Consultant

Checked/
Authorised by: AZS