Blackwattle Bay

State Significant Precinct

Attachment 18:

Noise and Vibration Assessment

June 2021

NSW GOVERNMENT

BLACKWATTLE BAY STAGE 2

State Significant Precinct Study
Noise and Vibration Assessment

Prepared for:

Infrastructure NSW
Level 27, 201 Kent Street
Sydney NSW 2000

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Tenancy 202 Submarine School, Sub Base Platypus, 120 High Street
North Sydney NSW 2060 Australia

T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

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 Infrastructure NSW (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
610.17565-R03-v1.1	31 May 2021	Mark Irish	Alex Campbell	Mark Irish
610.17565-R03-v1.0	22 February 2021	Mark Irish	Alex Campbell	Mark Irish
610.17565-R01-v0.1	2 February 2021	Mark Irish	Alex Campbell	DRAFT

EXECUTIVE SUMMARY

This acoustic report has been prepared by SLR Consulting on behalf of Infrastructure NSW, to form part of the Blackwattle Bay State Significant Precinct Study (SSP Study). The SSP Study seeks a rezoning for new planning controls for Blackwattle Bay, located on the south-western side of Pyrmont.

The potential noise and vibration impacts to the State Significant Precinct (the Precinct) from existing sources have been predicted and mitigation measures recommended, where appropriate. The most significant existing noise sources were identified as:

- Road traffic noise, particularly from Western Distributor and Pyrmont Bridge Road
- Industrial noise associated with Hymix concrete batching plant located within the site, in the event that this land is not rezoned as part of the development

The assessment confirmed that for most residential areas of the Precinct, road traffic noise impacts would be greater than industrial noise.

Road Traffic Noise

Road traffic noise was found to have the greatest impact across the proposed residential areas of the site. Required façade attenuation would be greatest for bedrooms located on the Eastern façades overlooking the Western Distributor. To maximise the potential for natural ventilation, it would be recommended to locate other habitable spaces (such as living rooms) with attenuated or enclosed balconies on these façades.

Road traffic noise levels are broadly consistent across the same elevations of all buildings of the study area. Acoustically upgraded glazing and/or attenuated balconies and acoustically attenuating ventilation solutions or mechanical ventilation would be required for a number of proposed residential facades in proximity to the Western Distributor.

Industrial Noise

Should Hymix continue to operate as currently permitted, significant noise impacts to Buildings BLD 02 and PLO 02 are anticipated to the facades directly overlooking Hymix. In some locations bedrooms on these facades may require higher levels of façade attenuation than that required to mitigate road traffic noise.

Noise levels from the SSDA approved New Sydney Fish Market are not anticipated to result in any exceedances of the Project Noise Trigger Levels for industrial noise.

Summary

The study has shown that from an acoustic perspective, the site is suitable for the intended uses within the SSP proposal, subject to future design development on final proposals and the high-level mitigation measures summarised within this study.

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1 Introduction and Overview

1.1 Introduction

Blackwattle Bay offers an extraordinary opportunity to reconnect the harbour, its surrounding neighbourhoods and the city; to showcase Sydney's living culture and stories of Country; to build an inclusive and iconic waterfront destination that celebrates innovation, diversity and community.

This acoustic report has been prepared by SLR Consulting on behalf of Infrastructure NSW, to form part of the Blackwattle Bay State Significant Precinct Study (SSP Study). The SSP Study seeks a rezoning for new planning controls for Blackwattle Bay, located on the south-western side of Pyrmont.

Blackwattle Bay presents a significant opportunity for urban renewal across 10.4 hectares of predominantly government owned land located approximately 1km from the Sydney CBD. NSW Government is also investigating the delivery of a Metro Station in Pyrmont and has recognised the potential to transform the Pyrmont Peninsula with a new 20-year vision and planning framework through the Pyrmont Peninsula Place Strategy.

In 2015 the NSW Government recognised The Bays Precinct as one of the highest potential urban transformation sites in Australia with the release of The Bays Precinct, Sydney Transformation Plan. Following this, the Minister for Planning identified the renewal of Blackwattle Bay and the broader Bays Precinct as a matter of State planning significance and to be investigated for rezoning through the State Significant Precinct (SSP) process. Study Requirements for the Blackwattle Bay (formerly known as 'Bays Market District') investigation area were issued by the Minister on 28 April 2017.

A critical part of Blackwattle Bay's revitalisation and vision has been the NSW Government's decision to relocate the Sydney Fish Market (SFM) from its existing location on Bank Street to the head of Blackwattle Bay. This was sought through a State Significant Development Application (SSDA) process and approved in June 2020. The new SFM was designed alongside the baseline Blackwattle Bay studies to ensure that key aspects of the project are consistent with the vision and principles for Blackwattle Bay.

The outcome of the Blackwattle Bay State Significant Precinct process will be a new planning framework that will enable further development applications for the renewal of the Precinct, connected to the harbour and centred around a rejuvenated SFM. The framework will also provide for new public open spaces including a continuous waterfront promenade, community facilities, and other compatible uses.

This report provides a comprehensive investigation of noise and vibration to address a part of the Study Requirements and support the development of a new planning framework for Blackwattle Bay.

1.2 Blackwattle Bay State Significant Precinct

The Blackwattle Bay SSP Investigation Area ('Study Area') encompasses the land and water area, known as Blackwattle Bay, between Bank Street and the Glebe foreshore shown in **Figure 1.** The land is located within the City of Sydney local government area (LGA).

The land within the Study Area is approximately 10.4 hectares (ha) in size. It is largely government owned land containing the SFM (wholesale and retail), recreation and boating operations and facilities. There are three privately owned sites including a concrete batching plant operated by Hymix, seafood wholesaler Poulos Brothers and private developer Celestino which owns further wholesaling facilities.

The Blackwattle Bay land area wraps around the southern and eastern edges of Blackwattle Bay and is bounded by Bridge Road to the south and Bank Street to the east. The Western Distributor motorway / Anzac Bridge viaduct is located adjacent to the eastern boundary before traversing over the northern section of the site. The water area of Blackwattle Bay is approximately 21 hectares.

Figure 1 Blackwattle Bay SSP Study Area

Source: iNSW

1.3 The Proposal

The SSP Study is proposing to rezone Blackwattle Bay with a new planning framework and planning controls to enable its future urban renewal.

The rezoning proposal is based on the Blackwattle Bay Precinct Plan ('Precinct Plan') which provides a conceptual layout to guide the development of planning controls for the precinct and has informed this report. The Precinct Plan is shown in **Figure 2** below. The Precinct Plan provides overarching guidance about how the area should be developed based on community and stakeholder input, local character and place, current and future demographics, economic and social trends, cultural and environmental considerations, and urban renewal aspirations and needs regarding land use, community recreation, transportation, housing, and jobs.

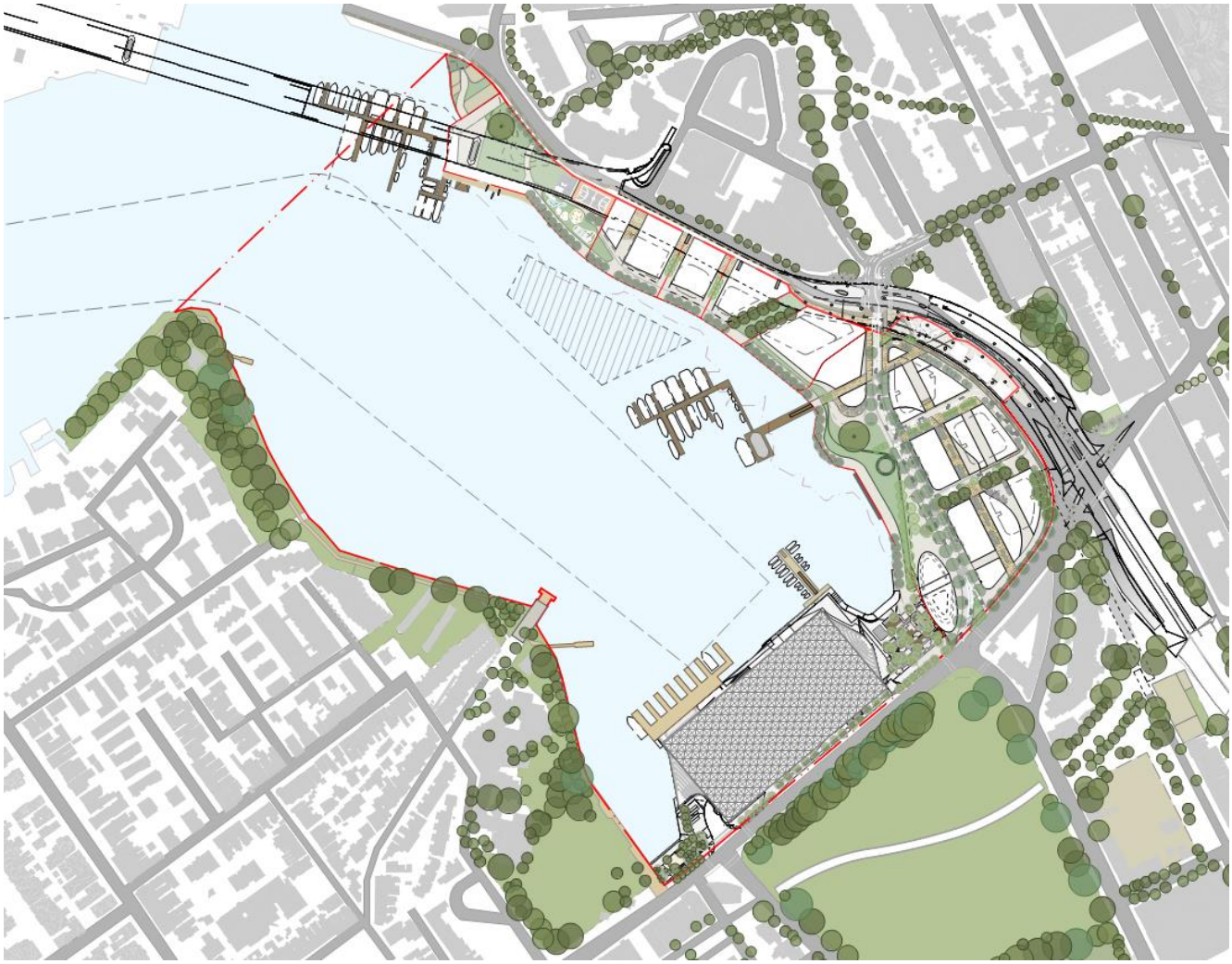
Key characteristics of the Precinct Plan include:

- New homes, jobs and services close to the CBD including:
  - 5,636 jobs / or approximately 5,600 jobs
  - 2,795 residents /or approximately 2,800 residents
  - 1546 dwellings
- A continuous waterfront promenade – the missing link in an otherwise 15km foreshore walk from Woolloomooloo to Rozelle
- New active transport connections to bring the neighbourhood closer to the harbour through new and improved pedestrian and cycling links
- Improved public transport options and minimised vehicle usage strategies including:
  - Minimising car parking spaces with limited on-street parking.
  - Ferry wharf
  - Opportunity for buses to service through site link
  - Connections to the existing light rail
  - Access to a future Sydney Metro West Station in Pyrmont
- New parks and green space with 30,000 m^2 of new open space
- An authentic, and world class new SFM at the heart of Blackwattle Bay
- An authentic place that builds on Indigenous and industrial stories and celebrating the local character.

Once the Study Area is rezoned and the new planning controls are in place, future development will need to seek development approval through the relevant approval pathway. This will include detailed development proposals and further associated environmental, social and economic assessments.

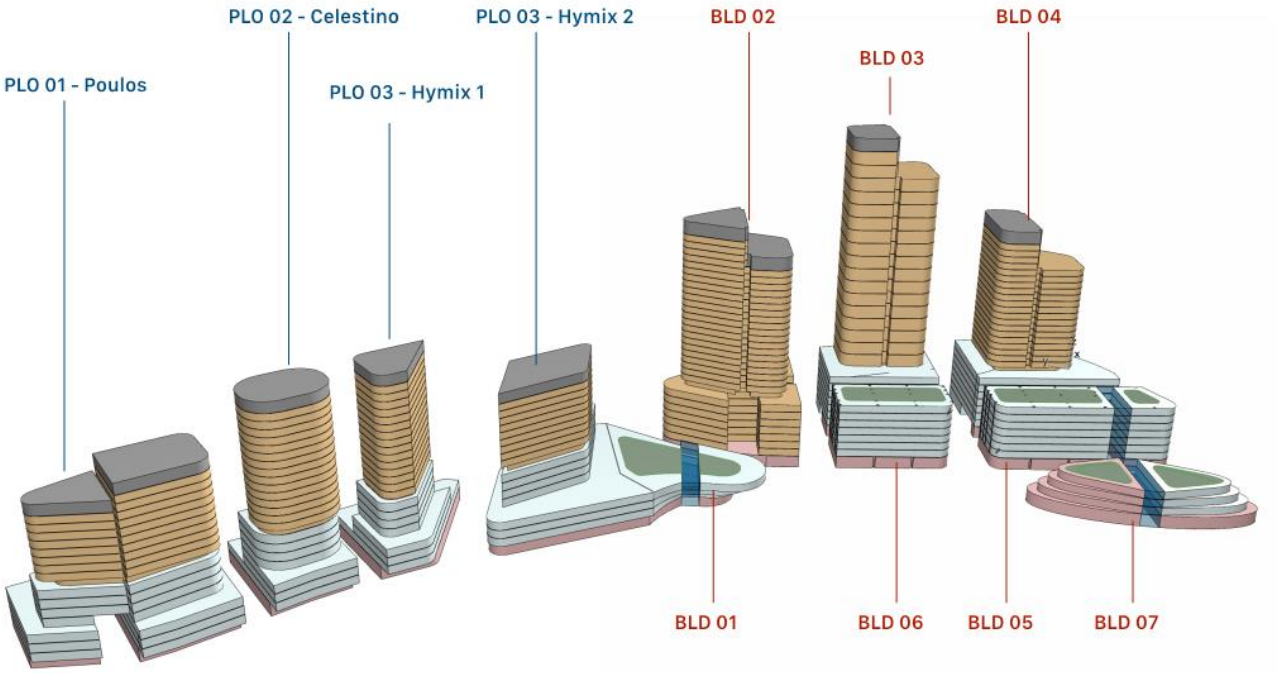
The rezoning proposal responds to the Study Requirements issued for Blackwattle Bay (formerly Bays Market District) by the Department of Planning and Environment in April 2017.

Figure 2 Blackwattle Bay Precinct Plan



The Reference Scheme used for this study is included in **Figure 3**.

Figure 3 Reference Scheme



Source: iNSW

1.4 Vision and Principles

Principles for a future Blackwattle Bay were formed through extensive community consultation in August 2017. These were further developed in 2019, together with a vision for the precinct. Both are provided below. These have guided the development of the Precinct Plan and will continue to guide future development proposals within the Study Area.

1.4.1 Vision

"Blackwattle Bay offers an extraordinary opportunity to reconnect the harbour, its surrounding neighbourhoods and the city; to showcase Sydney's living culture and stories of Country; to build an inclusive and iconic waterfront destination that celebrates innovation, diversity and community."

1.4.2 Principles

1. Improve access to Blackwattle Bay, the foreshore and water activities for all users
2. Minimise additional shadowing to Wentworth Park and Glebe Foreshore (in mid-winter) and create new places with comfortable conditions for people to enjoy.
3. Pursue leading edge sustainability outcomes including climate change resilience, improved water quality and restoration of natural ecosystems.
4. Prioritise movement by walking, cycling and public transport.
5. Balance diverse traffic movement and parking needs for all users.

6. Link the Blackwattle Bay precinct to the City, Glebe Island and White Bay and other surrounding communities and attractors.
7. Mandate Design Excellence in the public and private domain.
8. Integrate housing, employment and mixed uses to create a vibrant, walkable, mixed use precinct on the city's edge.
9. Maintain and enhance water uses and activities.
10. Allow for co-existence and evolution of land uses over time.
11. A place for everyone that is inviting, unique in character, socially inclusive.
12. Expand the range of recreational, community and cultural facilities.
13. Plan for the future community's education, health, social and cultural needs.
14. Deliver development that is economically, socially, culturally and environmentally viable.
15. Embed and interpret the morphology, heritage and culture of the site to create an authentic and site responsive place.
16. Foster social and cultural understanding and respect to heal and grow relationships.

1.5 Reference Documents

The following previous assessment reports are referenced in this study:

- Blackwattle Bay Stage 1 Noise & Vibration Study, SLR report 610.17565-R02-v2.0, dated 17/09/2019 (referenced herein as ***Stage 1 report*** and also included in **Appendix D**)
- New Sydney Fish Market SSDA Noise Impact Assessment, SLR report 610.17565-R01-v1.7, dated 1/04/2019 (referenced herein as ***NSFM report***)

1.6 Scope of Works and Study Requirements

This report details the existing sources of noise at the site, identifies sensitive receivers and references the findings of existing noise surveys completed within the study area.

The potential noise and vibration impacts to the State Significant Precinct (the Precinct) from existing sources have been predicted and mitigation measures recommended, where appropriate.

The study requirements relevant to noise are shown in **Table 1** and are reproduced from the Blackwattle Bay Final Study Requirements (28 April 2017).

Table 1 Study Requirements

Requirement	Section Reference
22.1 – Provide a noise impact assessment for the proposal. The assessment will address the relevant policies and guidelines in relation to noise including *State Environmental Planning Policy (Infrastructure)* 2007, *Development Near Rail Corridors and Busy Roads – Interim Guideline*.	This report
22.2 - Consider and assess potential noise pollution impacts from the proposed rezoning	**Section 5.2**
22.4 - Consider the approaches conceptually being applied in the Parramatta Road Corridor Urban Transformation Strategy (noting the difference in noise levels on a vertical plane).	**Section 7**
22.5 - Identify and map current and proposed future sensitive receptors (eg residential uses, schools, child care centres and public open spaces)	**Stage 1 Report, Section 3.3**
22.6 - Identify current and likely future noise, vibration and pollution affecting the precinct, including sources and nature and impact. Site monitoring will be required to determine current road noise levels for the Anzac Bridge approach, Western Distributor, Bank Street and Bridge Road at a minimum. Monitoring will also be required to determine current noise levels from the Sydney Fish Market (particularly from service vehicles) and maritime uses in the bay. 3D mapping to clearly communicate these impacts, including demonstrating for example how noise reduces with distance from the source, or with the use of barriers, is desirable.	**Stage 1 Report, Section 4.4**, **5.2**, **6.2**
22.7 - Assess the impact of potential noise generated from the relocated fish market on Sydney Secondary College and Blackwattle Bay Campus (particularly during exam times)	**NSFM Report (Section 5.3.4)**
22.8 - Model the likely future noise, vibration and pollution scenario based on 3D block envelope diagrams prepared by the consultant appointed urban designer. This is to include noise generated by road rail and maritime uses and noise from the Sydney Fish Market, particularly from service vehicles.	**Section 4.4**, **5.2**, **6.2**
22.9 - Recommend appropriate noise and vibration mitigation measures. The consultant is expected to work with the consultant appointed urban designer, and suggested measures are to cover new buildings (ie careful siting and layout of buildings maintaining natural ventilation through open windows as required by the Apartment Design Guide).	**Section 4.4**, **5.2**, **6.2** and **7.3**
22.10 - Outline the recommended measures relating to noise, vibration to minimise the nuisance and harm to people or property within / adjoining the precinct.	**Section 7**

1.7 Terminology

Specific acoustic terminology is used within this assessment. An explanation of common acoustic terms is included in **Appendix A**.

2 Noise Sources Potentially Impacting the Precinct

Existing noise sources that have the potential to impact the Precinct include:

- Road traffic noise, particularly from Western Distributor and Pyrmont Bridge Road
- Rail noise from the Light Rail Line L1 which runs along a viaduct through Wentworth Park to the South
- Maritime uses in Blackwattle Bay
- Industrial noise associated with Hymix concrete batching plant located within the site, in the event that this land is not rezoned as part of the development

Future noise sources that have the potential to impact the Precinct include:

- Commercial noise associated with the New Sydney Fish Market to the West
- Noise from new non-residential areas within the Precinct, such as commercial tenancies, public recreation areas, community facilities, etc, affecting future receivers within the Precinct.

2.1 Road Traffic Noise

2.1.1 Road Traffic Noise on the Precinct

The existing noise environment throughout the project area is generally controlled by road traffic noise. The major arterial road near the project is the Western Distributor/Anzac Bridge, which passes adjacent to the north of the project in an elevated location. This road becomes congested during peak hours, which can create increased noise at certain times from the acceleration and deceleration of vehicles. The surface appears to be a worn dense-graded asphalt (DGA) pavement and is likely to perform consistent with the standard DGA pavement road surface correction for the purposes of road noise modelling.

Other major roads near the site include Pyrmont Bridge Road, Bridge Road and Wattle Street to the south east of the site. Vehicle speeds on these roads are typically slower than the Western Distributor which results in lower noise generation per vehicle. Congestion during peak hours also affects these routes, especially around intersections.

Road traffic typically generates very low vibration levels which are well below the applicable criteria. Where large discontinuities such as potholes, road plates or joins in the pavement occur, vibration levels can be perceived in close proximity to the road when heavy vehicles travel over them. Those vibration generating circumstances are a maintenance issue, rather than a design issue and are not assessed.

2.1.2 Road Traffic Noise Increase due to the Precinct

There is potential for increased noise levels due to additional traffic generated by the Precinct from the introduction of new medium to high density residential units. Increased road traffic noise levels have the potential to affect existing receivers surrounding the Precinct.

The NSW *Road Noise Policy* (RNP) requires consideration of noise mitigation where new land use developments increase road traffic noise by more than 2 dB.

2.2 Rail Traffic Noise and Vibration

The Dulwich Hill Light Rail line passes around the north east and south east of the site, with the Fish Market and Wentworth Park stops being located approximately 50 m and 100 m respectively away from the proposal site. The track alignment to the north east is located in a cutting whereas the track to the south east is on embankment and viaduct through Wentworth Park.

Whilst the light rail noise may be audible at times in the vicinity of the elevated line at Wentworth Park, it is considered highly unlikely to be a controlling noise source within the study area due to the busy surrounding road network.

The potential for noise, vibration and ground-borne noise impacts within the Precinct from the existing operation of the light rail line is considered minimal and has therefore not been separately considered in this assessment.

2.3 Maritime Uses

There are existing maritime uses in Blackwattle Bay including moorings and facilities for recreational vessels which are proposed to remain unchanged. Recreational maritime uses are understood to occur primarily during the daytime period, when noise levels due to the surrounding road network are considered dominant above all other transportation noise.

The potential for noise impacts within the Precinct from the existing maritime use is considered minimal and has therefore not been separately considered in this assessment.

Wharf unloading operations associated with the new Sydney Fish Market are considered to be potentially significant and are discussed in **Section 2.4**.

2.4 Commercial Noise

Existing and approved commercial developments impacting the Precinct are as follows:

- Hymix concrete batching plant, in the event that this land is not rezoned as part of the development.
- New Sydney Fish Market (SSDA approved)

At this stage the future non-residential uses of the Precinct are unknown. It is anticipated that the lower levels of the proposed buildings would likely accommodate small scale commercial developments such as retail, restaurants/cafes, community facilities, etc. Significant external noise sources associated with these uses would potentially include:

- Mechanical plant
- Loading docks or service access routes
- Outdoor seating areas for food and beverage
- Public outdoor recreation areas

2.5 Existing Environment Noise Study

Details of the existing noise environment and noise surveys are included in the ***Stage 1 Report*** included in **Appendix D**.

3 Noise and Vibration Criteria

3.1 Internal Noise Criteria – Residential

3.1.1 State Environment Planning Policy

The *State Environment Planning Policy* (Infrastructure) 2007 (Infrastructure SEPP) provides guidelines for new residential development near existing road and railway infrastructure. The key objectives are to:

- Protect the safety and integrity of key transport infrastructure from adjacent development
- Ensure that the development achieves appropriate acoustic amenity by meeting internal noise criteria.

The key clauses of the Infrastructure SEPP (also in the NSW *Development near Rail Corridors and Busy Roads – Interim Guideline*) that relate to noise and vibration requirements for the project are:

Rail Corridors

Clause 87 Development for any of the following purposes that is on land that is in or immediately adjacent to a rail corridor and the consent authority considers development is likely to be adversely affected by rail noise or vibration:

- Building for residential use
- A place of worship
- A hospital
- An educational establishment or childcare centre.

Road Corridors

Clause 102 Development for any of the following purposes that is on land in or adjacent to a road corridor for a freeway, a tollway, or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles and that the consent authority considers is likely to be adversely affected by road noise or vibration:

- Building for residential use
- A place of worship
- A hospital
- An educational establishment or childcare centre.

3.1.2 Internal Noise Criteria

For Clauses 87 (Rail) and 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 L_{Aeq} noise levels are not exceeded:

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

As the study requirements refer to natural ventilation being maintained, the following internal criteria for open windows are recommended (taken from the *City of Sydney Development Control Plan*):

- In any bedroom in the building: 45 dBA at any time (10pm – 7am)
- Anywhere else in the building (other than a garage, kitchen, bathroom, or hallway): 55 dBA at any time.

3.1.3 City of Sydney Development Control Plan 2012

The City of Sydney Development Control Plan provides noise criteria for the development of new residential houses and units. Provided below is a summary of the requirements relevant to external noise.

- The repeatable maximum LAeq(1 hour) for residential buildings and serviced apartments must not exceed the following levels:
  a. for closed windows and doors:
     - 35 dB for bedrooms (10pm-7am); and
     - 45 dB for main living areas (24 hours).

  b. for open windows and doors:
     - 45 dB for bedrooms (10pm-7am); and
     - 55 dB for main living areas (24 hours)
- Where natural ventilation of a room cannot be achieved, the repeatable maximum $L_{Aeq\ (1hour)}$ level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:
  - 38dB for bedrooms (10pm-7am); and
  - 48dB for main living areas (24 hours)
- These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally.

3.1.4 Apartment Design Guideline and City of Sydney Consultation

It is understood that the project should be designed to meet the requirements of DPIE's *Apartment Design Guide* (ADG) Objective 4B-1 for natural ventilation where possible. As a result, residential areas should comply with the "windows open" (item b) noise criteria of the CoS DCP as repeated in **Section 3.1.3**.

3.1.5 Entertainment / Licenced Premises Noise

It is considered likely that future development on the site will contain a mix of commercial and residential development, with potential Food and Beverage offerings. In order to maintain the amenity to residential receptors both on and off the site, noise from any potential future entertainment or Food and Beverage / Licenced Premises should be controlled.

The proposed criteria below are based on standard conditions originally developed by Liquor and Gaming NSW, but have since been withdrawn. Nonetheless, it is common and appropriate to apply the criteria to noise emissions from licensed premises in NSW, and these same are commonly adopted by the City of Sydney in Conditions of Approval for licenced premises.

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.*

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.

* For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises.

3.1.6 Ground-borne Noise

Ground-borne noise impacts may be present where buildings are constructed over or adjacent to land over tunnels and the corresponding airborne noise level is not dominant. The NSW *Development near Rail Corridors and Busy Roads – Interim Guideline* specifies a night-time residential criteria of 35 dBA $L_{Amax,slow}$ which is required to be complied with by 95% of train passbys.

3.1.7 Vibration Criteria

There are no specific vibration requirements in the Infrastructure SEPP. Vibration transmission into the buildings would need to be controlled to meet the ground-borne noise criteria. Where ground-borne noise levels are met then vibration would also typically be sufficiently controlled.

3.2 Internal Noise Criteria – Non-residential uses

All internal non-residential areas should be designed to mitigate external noise intrusion to the recommended internal noise criteria based upon their use in AS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

3.3 Operational Noise Criteria

The future non-residential uses of the Precinct may include small scale commercial developments such as retail, restaurants/cafes, community facilities, etc. Industrial noise from mechanical plant at these developments has the potential to impact the surrounding noise sensitive receivers and future residential sections of the Precinct.

The NSW *Noise Policy for Industry* (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

3.3.1 Industrial Noise Trigger Levels

The NPfI defines how to determine 'trigger levels' for noise emissions from industrial developments. Where a development is likely to exceed the trigger levels at existing noise sensitive receivers, feasible and reasonable noise management measures are required to be considered to reduce the impacts.

There are two types of trigger levels – 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 representative 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 study area is considered to be 'urban' as per the NPfI definitions.

The trigger levels for industrial noise from the Precinct were derived in New Sydney Fish Market Report included in the New Sydney Fish Market State Significant Development Application (***NSFM Report***) and are summarised in **Table 2**. Noise Catchment Areas (NCAs) have been updated to reflect the inclusion of future residential receivers within the study area as indicated in **Figure 4**.

The Project Noise Trigger Levels (PNTL) are the most stringent of the intrusiveness and amenity trigger level for each period and are highlighted below.

Table 2 Project Noise Trigger Levels

NCA	Nearest Receiver Location	Representative Noise Logger Location	Period	Recommended Amenity Noise Level LAeq (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels LAeq(15minute) (dBA)	
					RBL[1]	LAeq(period)	Intrusiveness	Amenity[2,3]
NCA1	Bank St, Pyrmont (Commercial)	L01	When in use	65	66	71	n/a	**68**
	Bank St, Pyrmont (Residential)	L01	Day	60	66	71	71	**59**
			Evening	50	64	68	69	**56**[4]
			Night	45	60	67	65	**55**[4]
NCA2	Wattle Crescent, Pyrmont	L04	Day	60	62	71	67	**59**
			Evening	50	57	68	62	**56**[4]
			Night	45	50	64	55	**52**[4]
NCA3	Corner of Wentworth Park and Bridge Road, Glebe	L04[5]	Day	60	62	71	67	**59**
			Evening	50	57	68	62	**56**[4]
			Night	45	50	64	55	**52**[4]
NCA4	1A Burton Street, Glebe	L07[6]	Day	60	54	67	**59**	63
			Evening	50	50	64	55	**52**
			Night	45	42	58	**47**	46
	Sydney Secondary College, Glebe	L05	When in use	55[7]	55	58	n/a	**58**
NCA5	13 Griffin Place, Glebe	L06	Day	60	50	54	**55**	63
			Evening	50	51	54	55[8]	**53**
			Night	45	46	50	51	**48**
NCA6	Southern study area (adjacent to Pyrmont Bridge Rd)	L04	Day	60	62	71	67	**59**
			Evening	50	57	68	62	**56**[4]
			Night	45	50	64	55	**52**[4]
NCA7	Northern study area (ground level, below Western Distributor)	L01	Day	60	66	71	71	**59**
			Evening	50	64	68	69	**56**[4]
			Night	45	60	67	65	**55**[4]

Note 1: RBL = Rating Background Level.

Note 2: The recommended amenity noise levels have **not** been reduced by 5 dB to give the project amenity noise levels, as outlined in the NPfI, due to no other sources of industrial noise being present in the area.

Note 3: The project amenity noise levels have been converted to a 15 minute level by adding 3 dB, as outlined in the NPfI.

Note 4: The measured L_{Aeq} noise level was dominated by road traffic noise and exceeds the recommended amenity noise level by 10 dB or more, therefore the 'high traffic project amenity noise level' is the existing $L_{Aeq(traffic)}$ noise level minus 15 dB.

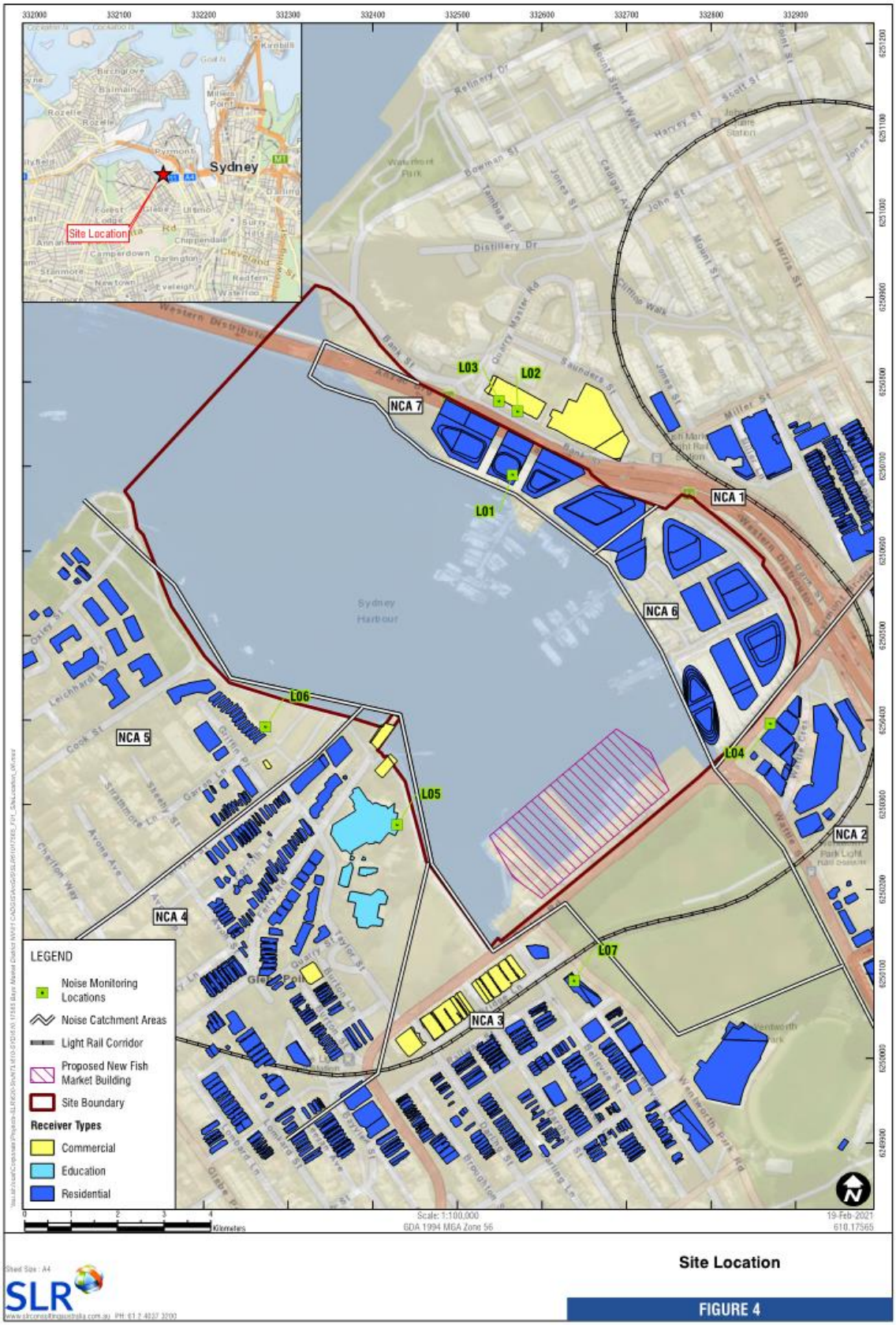
Note 5: Due to the nearest receivers' proximity to Bridge Road, L04 has been used as the representative noise logger location.

Note 6: Based on site observations of the similarities of the surrounding road network for the nearest receiver, L07 has been used as the representative noise logger location.

Note 7: An external criterion of 55 dBA has been set for Sydney Secondary College. The NPfI sets an internal level of 35 dBA and 20 dB external to internal transmission loss is assumed.

Note 8: These values have been lowered to be no greater than the applicable daytime project intrusiveness noise level, as outlined in the NPfI.

Figure 4 NCAs, Noise Logging Locations and Sensitive Receivers



While the noise criteria apply to all sensitive receivers potentially affected by the development, the above locations have been chosen as they are representative of the most affected receiver in each noise catchment area.

3.3.2 Sleep Disturbance

Guidance for assessing the potential for sleep disturbance impacts on nearby residences is provided in Section 2.5 of the NPfI, which states:

Where the subject development/premises night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken

Note that the $L_{Aeq(15minute)}$ criteria would be equal to or higher than the Project Noise Trigger Levels outlined in **Table 2**. As such, the assessment against Project Noise Trigger Levels is considered to address this part.

The night-time sleep disturbance L_{Amax} screening noise levels for the residential areas in the vicinity of the development are presented in **Table 3**.

Table 3 Night-time Sleep Disturbance Screening Noise Levels

Residential Receiver NCA	Noise Level (dBA)	
	Measured Night-time RBL	Sleep Disturbance Screening Noise Level (L_{Amax})
NCA6	50	65
NCA7	60	75

Where the sleep disturbance screening noise level is predicted to be exceeded then a detailed maximum noise level event assessment should be undertaken.

The detailed assessment should discuss the predicted level of the events, the exceedance of the screening level, existing maximum noise levels, and consider guidance from current literature regarding sleep disturbance, such as the *Road Noise Policy*.

3.3.3 Patron Areas and Licenced Premises

The criteria are applicable for all noise emissions from licenced premises, ie patron noise and music (where applicable), at all nearby noise sensitive receivers.

The above criteria are only applicable to residential receivers. In order to protect the amenity of existing commercial receivers surrounding the site, it is recommended that a similar criteria for commercial receivers is applied, with a reduction of 5 dB due to the reduced sensitivity of commercial spaces compared to residential.

Based on the above criteria and the existing measured ambient noise levels detailed in **Appendix D - *Stage 1 Report***, the project specific noise limits for the patron area have been established for the 7:00am - midnight period as shown in **Table 4**.

Table 4 Project Specific Noise Limits – Patron Areas

NCA	Location	Noise Emission Criteria, dB L_{A10} Octave Band Centre Frequency (Hz)								
		31.5	63	125	250	500	1k	2k	4k	8k
NCA1	Commercial Receivers East of Development	42	54	61	65	70	73	68	60	48
	132 Bank St, Pyrmont	37	49	54	60	65	68	63	55	43
NCA2	217/1 Wattle Crescent, Pyrmont	32	45	51	55	60	64	59	50	38
NCA3	Corner of Wentworth Park and Bridge Road, Glebe	32	45	51	55	60	64	59	50	38
NCA4	Southern study area (adjacent Pyrmont Bridge Rd)	32	45	51	55	60	64	59	50	38
NCA5	Northern study area	37	49	54	60	65	68	63	55	43

Note: A criterion has been set for the 7:00am - midnight period only as it is anticipated that this will capture all the likely operating hours of the new Sydney Fish Market and future commercial premises within the development area.

For the purposes of an initial screening assessment, a conservative external façade noise level criteria of L_{Aeq} 60 dB has been used to assess potential noise impact on the proposed residential receivers within the study area.

4 Road Traffic Noise Assessment

4.1 Noise Model

A noise model of the study area has been used to predict the potential impacts to the surrounding receivers. Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the Precinct and surrounding areas.

SoundPLAN is a software package which allows noise predictions to be made in a 3D environment and includes a digitised ground map (containing ground contours and significant structures, where appropriate), the location and acoustic power levels of significant noise sources, and the location of noise-sensitive receivers.

Indicative heights of buildings in the Precinct were taken from the architectural drawings provided.

The potential road traffic noise levels in the Precinct have been predicted using *Calculation of Road Traffic Noise* (CoRTN) (UK Department of Transport, 1988) algorithms in SoundPLAN software.

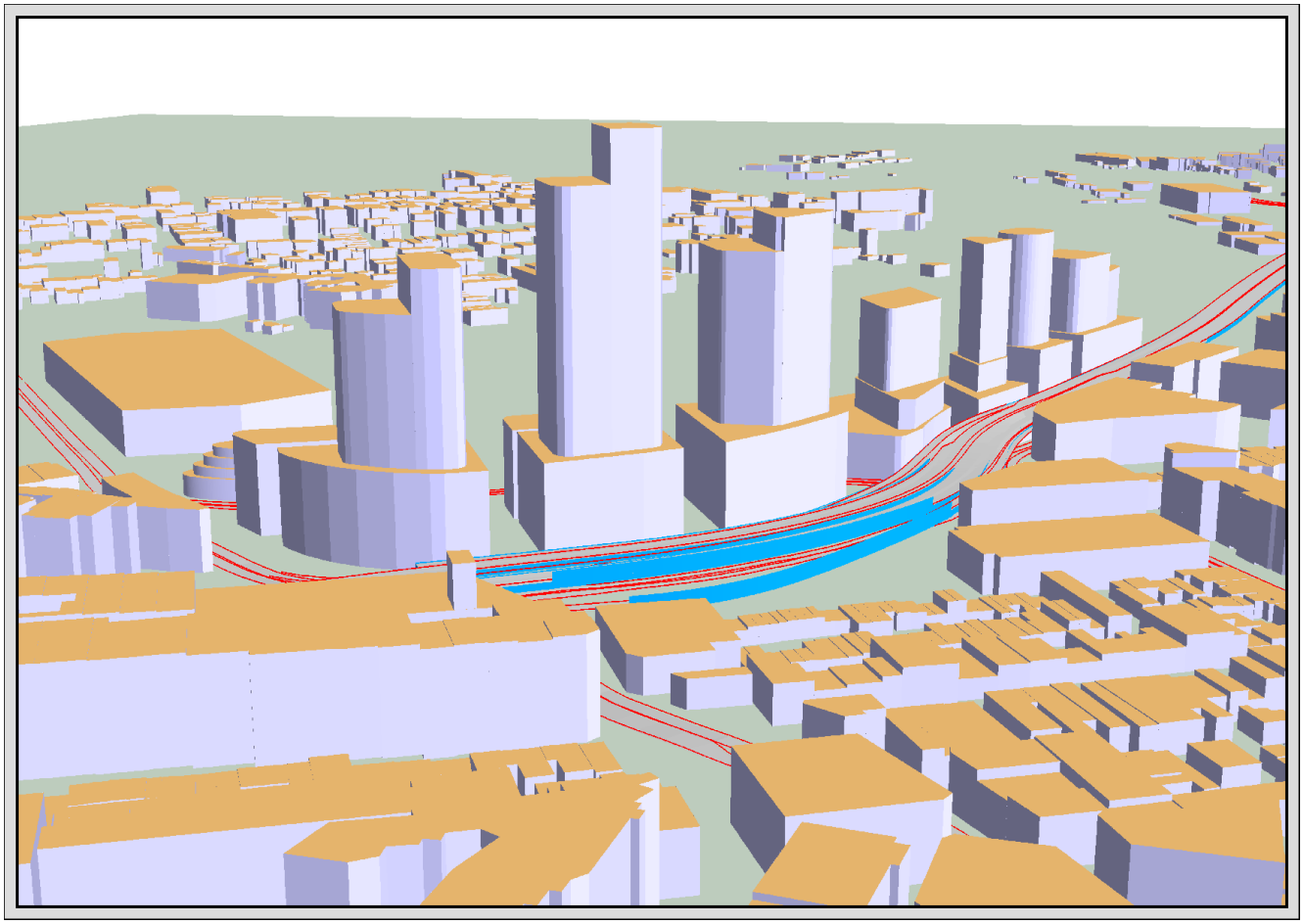
The computer model generates noise emission levels accounting for factors such as road traffic volume flows, attenuation due to distance, ground and air absorption and shielding attenuation, as well as meteorological conditions.

Daytime 15 hour (7am to 10pm) and night-time 9 hour (10pm to 7am) two-way traffic volumes were assigned to the road traffic sources and are presented in Error! Reference source not found..

For each of the proposed Project buildings, single point receivers were positioned at selected facades (refer to **Figure 5**). The receivers were located at each discrete floor height to predict the potential impact of road traffic noise levels at different facade heights.

A 2.5 dB correction was added to the predicted receiver levels to account for increased levels due to facade and balcony reflections.

Figure 5 Blackwattle Bay Precinct SoundPLAN 3D Model



Note 1: Road traffic sources are shown in red.

Note 2: Single point receivers were located at every floor of each of the proposed building facades.

4.2 Road Traffic Scenarios

The impact assessment has been undertaken by using the following assessment process:

- Base (2019) – an 'existing' or 'validation' scenario to validate the noise model against the existing noise monitoring (see **Section 2.5**).
- Future (2033) – to assess road traffic noise impacts on the Precinct. Whilst the Infrastructure SEPP does not require an assessment of a future traffic growth scenario, the project traffic flows used in the noise modelling reflect the anticipated design for the year 2033.

4.3 Road Traffic Noise Model Inputs

4.3.1 Existing Traffic – Validation

The existing traffic volumes in the study area were validated in the noise model developed for the ***Stage 1 Report*** included in **Appendix D**. The traffic noise sources from validated Stage 1 model have been added to the current Stage 2 noise model with adjustments made to future traffic volumes as indicated below.

4.3.2 Future Traffic

Future traffic volumes in the study area were based on the following information provided by the project team:

- Blackwattle Bay Transport Improvements: Noise & Vibration Technical Paper, SLR report 610.18957-R01-v0.3, dated 6/11/2020
- Revised 2033 AM Link Volumes supplied by Aecom, dated 3/2/21

The traffic flows for each road traffic source used in the modelling are detailed in **Appendix B**.

4.3.3 Pavement Surface

The existing roadway pavement surfaces are typically variable in age and condition and are understood to be Dense Graded Asphaltic Concrete (DGA). The future pavement surfaces have been assumed to also be DGA.

4.3.4 Vehicle Types

No consideration of future changes to the mix of vehicles (eg electric vehicles) using the surrounding road network has been included in this study. It should be noted that at the posted road speeds for the Western Distributor, the primary noise impacts would be dominated by tyre noise rather than engine noise so no significant noise reductions are considered likely for the same traffic volume.

4.4 Road Traffic Noise Impacts

Noise levels have been predicted across the Precinct during the daytime and night-time periods in 2033. The daytime noise predictions represent the period from 7 am to 10 pm and the night-time period is 10 pm to 7 am.

The results are provided in **Figures C1** to **C8** in **Appendix C** as facade noise maps for each building, including the Eastern and Western elevations.

To give an indication of the required facade construction, the indicative facade reduction performance for each building is shown in **Table 5** (eastern/north-eastern façade) and **Table 6** (western/south-western façade).

Residential towers are further subdivided into the following floor level ranges (numbering starting from base of tower level):

- Tower – Low: Levels 1 to 10
- Tower – Mid: Levels 11 to 20
- Tower – High: Levels 21 and above

Table 5 Range of Noise Impacts by Building – Eastern/North-eastern facade

Building	Levels	Use	Predicted Facade Noise Level (dBA)		Indicative Facade Noise Reduction (dB)[1]
			Daytime LAeq(15hour)	Night-time LAeq(9hour)	
PLO 01 – Poulos	Podium	Commercial [2]	> 78	63 to 78	
	Tower - Low	Residential	66 to 78	57 to 75	26 to 40
	Tower - Mid	Residential	72 to 78	66 to 72	31 to 38
PLO 02 – Celestino	Podium	Commercial [2]	> 78	66 to 78	
	Tower - Low	Residential	66 to 75	57 to 72	26 to 37
	Tower - Mid	Residential	66 to 75	63 to 72	28 to 37
PLO 03 – Hymix 1	Podium	Commercial [2]	> 75	66 to 78	
	Tower - Low	Residential	72 to 78	66 to 75	31 to 40
	Tower - Mid	Residential	69 to 75	66 to 72	29 to 37
PLO 03 – Hymix 2	Podium	Commercial [2]	> 75	63 to 78	
	Tower - Low	Residential	57 to 75	54 to 72	17 to 37
	Tower - Mid	Residential	72 to 75	66 to 72	31 to 37
BLD 01	Podium	Commercial [2]	> 72	66 to 78	
BLD 02	Podium	Residential	66 to 78	66 to 75	29 to 37
	Tower - Low	Residential	57 to 75	54 to 72	17 to 37
	Tower - Mid	Residential	66 to 75	66 to 72	26 to 37
	Tower - High	Residential	66 to 72	63 to 72	26 to 37
BLD 03	Podium	Commercial [2]	> 75	66 to 75	
	Tower - Low	Residential	63 to 75	66 to 72	29 to 37
	Tower - Mid	Residential	66 to 75	66 to 72	26 to 37
	Tower - High	Residential	66 to 72	63 to 69	26 to 34
BLD 04	Podium	Commercial [2]	66 to 78	66 to 72	
	Tower - Low	Residential	66 to 75	60 to 72	25 to 37
	Tower - Mid	Residential	66 to 75	66 to 72	26 to 37
	Tower - High	Residential	66 to 72	66 to 69	26 to 34

Note 1: In general, daytime noise levels are predicted to be approximately 3 dB above night-time noise levels and hence the required reduction to bedrooms will be around 2 dB higher than living spaces.

Note 2: For commercial tenants the required façade noise reduction will depend on the type of use proposed.

Table 6 Range of Noise Impacts by Building – Western/South-western façade

Building	Levels	Use	Predicted Facade Noise Level (dBA)		Indicative Closed-Facade Noise Reduction (dB)[1]
			Daytime LAeq(15hour)	Night-time LAeq(9hour)	
PLO 01 – Poulos	Podium	Commercial [2]	51 to 72	48 to 69	
	Tower - Low	Residential	57 to 72	48 to 66	17 to 32
	Tower - Mid	Residential	57 to 72	57 to 66	17 to 32
PLO 02 – Celestino	Podium	Commercial [2]	48 to 75	45 to 72	
	Tower - Low	Residential	51 to 72	51 to 69	11 to 34
	Tower - Mid	Residential	54 to 72	54 to 66	14 to 32
PLO 03 – Hymix 1	Podium	Commercial [2]	51 to 72	51 to 66	
	Tower - Low	Residential	51 to 72	51 to 69	11 to 34
	Tower - Mid	Residential	57 to 72	54 to 66	17 to 32
PLO 03 – Hymix 2	Podium	Commercial [2]	48 to 60	48 to 60	
	Tower - Low	Residential	51 to 72	51 to 69	11 to 34
	Tower - Mid	Residential	57 to 69	54 to 66	17 to 31
BLD 01	Podium	Commercial [2]	45 to 69	45 to 66	
BLD 02	Podium	Residential	60 to 72	54 to 69	19 to 34
	Tower - Low	Residential	51 to 72	51 to 66	11 to 32
	Tower - Mid	Residential	57 to 72	57 to 69	17 to 34
	Tower - High	Residential	51 to 72	48 to 69	11 to 34
BLD 03	Podium	Commercial [2]	45 to 72	45 to 69	
	Tower - Low	Residential	48 to 72	48 to 66	8 to 32
	Tower - Mid	Residential	57 to 72	57 to 69	17 to 34
	Tower - High	Residential	51 to 72	48 to 69	11 to 34
BLD 04	Podium	Commercial [2]	54 to 75	54 to 72	
	Tower - Low	Residential	54 to 72	54 to 66	14 to 32
	Tower - Mid	Residential	60 to 72	60 to 69	20 to 34
	Tower - High	Residential	54 to 72	54 to 66	14 to 32

Note 1: In general, daytime noise levels are predicted to be approximately 3 dB above night-time noise levels and hence the required reduction to bedrooms will be around 2 dB higher than living spaces.

Note 2: For commercial tenants the required façade noise reduction will depend on the type of use proposed.

The colour coding in the facade noise maps in **Appendix B** can be correlated to the required façade noise reduction, façade mitigation and indicative glazing shown in Error! Reference source not found. and Error! Reference source not found..

Table 7 Indicative habitable room façade noise reduction – daytime

Colour code	Predicted Facade Noise Levels (dBA) Daytime LAeq(15hour)	Required Facade Noise Reduction (natural ventilation) (dB)	Facade mitigation to permit natural ventilation [1]	Required Facade Noise Reduction (closed windows) (dB)	Indicative Facade Glazing
Green Yellow Orange	< 66	< 11	Louvres/screens, balcony absorption	< 21	Standard single or double glazing
Red	66 to 72	11 to 17	Enclosed balcony	21 to 27	Upgraded glazing
Violet	72 to 75	17 to 20	Enclosed balcony with attenuated ventilation path	27 to 30	Upgraded glazing
Purple	75 to 78	20 to 23	Natural Ventilation not advised	30 to 33	Upgraded glazing

Note 1. Refer to **Section 7.3** for further information on potential façade noise mitigation options.

Table 8 Indicative bedroom façade noise reduction – night-time

Colour code	Predicted Facade Noise Levels (dBA) Night-time LAeq(9hour)	Required Facade Noise Reduction (natural ventilation) (dB)	Facade mitigation to permit natural ventilation [1]	Required Facade Noise Reduction (closed windows) (dB)	Indicative Facade Glazing
Green	< 57	< 12	Louvres/screens, balcony absorption	< 22	Standard single or double glazing
Yellow	57 to 60	12 to 15	Enclosed balcony	22 to 25	Upgraded glazing
Orange	60 to 66	15 to 21	Enclosed balcony with attenuated ventilation path	25 to 31	Upgraded glazing
Red	66 to 72	21 to 27	Natural Ventilation not advised	31 to 37	Upgraded glazing
Violet	72 to 75	27 to 30	Natural Ventilation not advised	37 to 40	Upgraded glazing

Note 1. Refer to **Section 7.3** for further information on potential façade noise mitigation options.

4.5 Road Traffic Noise Impact Summary

The above assessment shows:

- The worst-case noise levels impacting the Eastern facades in the Precinct are predicted to be in the region of 70 to 78 dBA during the daytime period, with night-time levels typically being around 3 dB lower.

- Required façade attenuation would be greatest for bedrooms located on the Eastern façade overlooking the Western Distributor. To maximise the potential for natural ventilation, it would be recommended to locate other habitable spaces (such as living rooms) with attenuated or enclosed balconies on this façade.
- It would also be beneficial to locate other rooms including bathrooms, kitchens and laundries on the highly noise affected Eastern facades.
- The highest impacts are seen at Building PLO 01 Poulos, which is closest to the Western Distributor at the northern end of the site.
- Noise levels are broadly consistent across the same elevations of all buildings of the study area.
- Standard window glazing typically attenuates external noise levels by around 20 dB with windows closed and 10 dB with windows open (allowing for natural ventilation). Where attenuation of more than 20 dB is required (see **Table 7** and **Table 8**), then upgraded glazing would likely be required along with alternative means of ventilation to allow residents to keep windows closed. It is noted that one of the study requirements is for natural ventilation to be provided to the future buildings where practicable (see **Table 1**) and this is discussed in more detailed in **Section 7.3**.
- The predicted noise levels indicate that acoustically upgraded glazing and/or attenuated balconies would be required for all Eastern and North-eastern facades of residential buildings.
- Significant areas of the Western and South-western facades would also likely require acoustically upgraded glazing and/or attenuated balconies in order to achieve the internal noise levels.

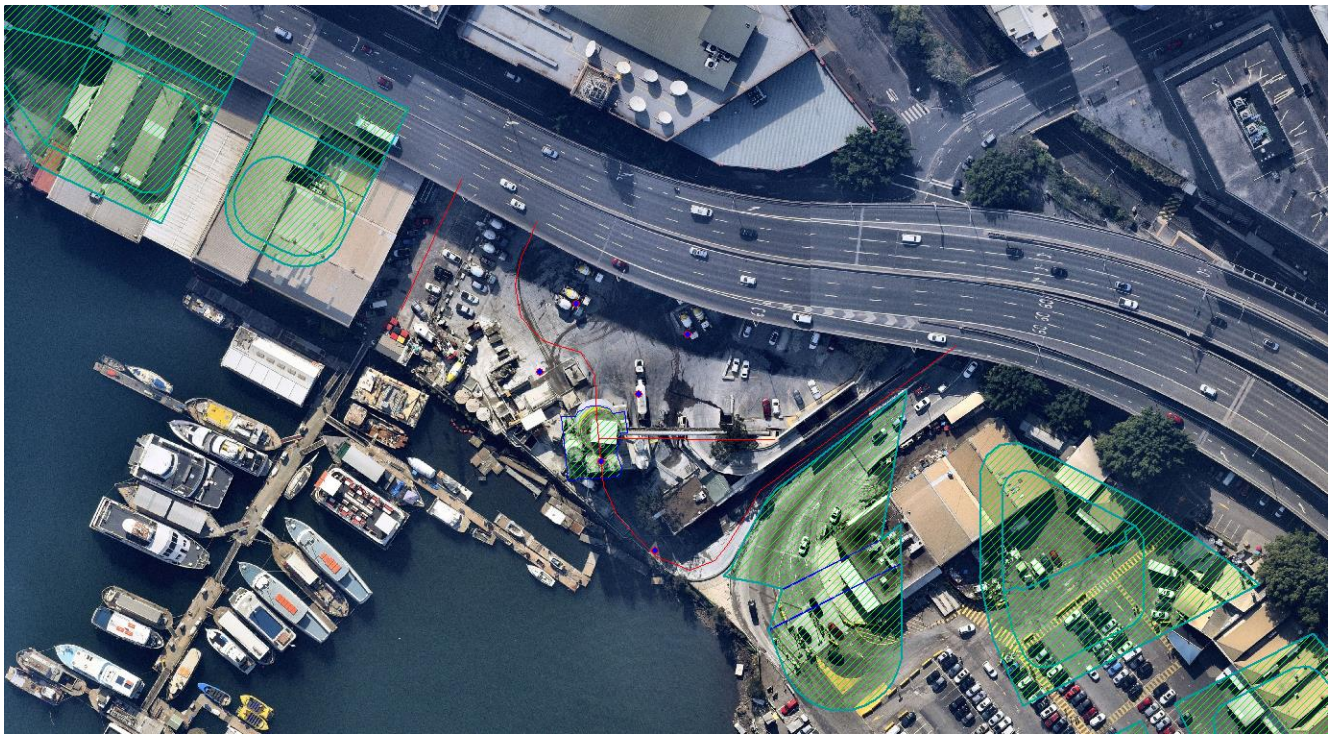
5 Industrial Noise Assessment

Details of significant noise sources associated with future commercial tenant types within the Precinct (e.g. mechanical plant, loading docks) are not known at this stage. As such, it has been necessary to make certain assumptions as to the type and location of equipment together with details regarding operational measures. These assumptions are defined in the following sections.

SoundPLAN has been used for modelling the noise emissions from the operation of the Precinct using the CONCAWE industrial noise prediction algorithms.

The existing Hymix industrial facility has been modelled as part of this study, on the basis that it may continue to operate while surrounding parts of the study area are redeveloped and occupied. The location of the facility relative to the adjacent proposed buildings is indicated in **Figure 6**.

Figure 6 Hymix Noise Sources and Nearest Proposed Buildings



5.1 Noise Model Inputs

5.1.1 Hymix Vehicle Movements

In order to assess the operational noise impacts from the Hymix site, worst-case peak light and heavy vehicle movements have been modelled. Light vehicles have been modelled from the access road to the car parking area, and heavy vehicles entering and exiting via the the access roads and idling in the hardstand areas.

Vehicle volumes were taken from site observations conducted in September 2018 and are understood to be considered representative of typical operations.

The following assumptions have been adopted based the information provided:

- Heavy vehicles Peak 15 minute – 13 two-way vehicle movements, 5 idling vehicles on site
- Light vehicles Peak 15 minute – 15 two-way vehicle movements

5.1.2 New Sydney Fish Market

Industrial noise sources associated with the New Sydney Fish Market have been taken from the ***NSFM Report*** for the SSDA approved scheme including the following:

- Heavy vehicles
- Light vehicles
- Forklifts – wharf and loading bays
- Loading activities – wharf and loading bays
- Mechanical plant

5.1.3 Industrial Noise Source Sound Power Levels

Sound power levels (SWLs) and speed assumptions for the modelled vehicle movements are outlined in **Table 9**.

Table 9 Sound Power Levels for Onsite Vehicle Movements

Noise Source	Sound Power Level (SWL), per vehicle	Average Speed
Heavy Vehicles access roads	103 dBA[1]	10 km/h
Light Vehicles access roads	95 dBA	10 km/h
Concrete Mixer and Cement Trucks	112 dBA	Idling
Front End Loader	107 dBA	n/a
Conveyor	92 dBA	n/a
Gas-powered Forklifts[2]	93 dBA	n/a
Wharf Forklifts	99 dBA	n/a
People Manually Unloading Stock	95 dBA	n/a

Note 1: Based on SLR's noise measurement database, this sound power level is typical of trucks travelling at low speeds, such as within industrial estates.

Note 2: If electric forklifts are proposed, noise emissions from forklifts would be considerably lower than gas-powered forklifts.

5.1.4 Noise Sources for Potential for Sleep Disturbance

As the industrial areas operate during the night-time, noise emissions during the night-time require assessment for potential sleep disturbance at the nearest residential receivers. The details of typical activities with the potential to cause sleep disturbance are shown in **Table 10**.

Table 10 Sleep Disturbance Noise Events – L_{Amax} Sound Powe Levels

Noise Source	Sound Power Level L_{Amax} (dBA)	Source Height
Heavy Vehicles	108	1m

Noise Source	Sound Power Level L_{Amax} (dBA)	Source Height
Airbrake	120	1m
Reversing Alarm	110	1m

5.1.5 Mechanical Plant

At this stage only mechanical plant associated with the Hymix and New Sydney Fish Market site has been modelled. Given the high ambient noise levels impacting the study area, it is envisaged that standard engineering controls for proposed rooftop plant would be suitable to ensure internal noise goals for residential dwellings will be achieved.

5.2 Predicted Industrial Noise Levels

Noise levels have been predicted across the Precinct during the night-time period. This is considered the controlling time period for industrial noise impact on residential areas as both industrial sites are permitted to operate at night-time.

The following scenarios have been modelled:

- Hymix and New Sydney Fish Market – night-time peak 15 minute scenario
- New Sydney Fish Market only – night-time peak 15 minute scenario

The results are provided in **Figures C9** to **C12** in **Appendix C** as facade noise maps for each building during the night-time period.

The colour coding in the facade noise maps in **Appendix C** can be correlated to the required noise reduction and indicative façade glazing shown in **Table 11** and **Table 12.**

Table 11 Habitable room façade noise reduction – daytime and night-time (Hymix and New Sydney Fish Market)

Colour code	Predicted Facade Noise Levels (dBA) Night-time $L_{Aeq(15min)}$	Indicative Internal Noise Level (open windows) (dB)	Facade mitigation to permit natural ventilation [1]	Minimum Facade Noise Reduction (closed windows) (dB) [2]	Indicative Facade Glazing (Habitable room)
Green [3]	< 57	< 47	None required	< 20	Standard single or double glazing
Yellow	57 to 60	< 50	None required	< 20	Standard single or double glazing
Orange	60 to 66	50 to 56	Louvres/screens, balcony absorption	< 20	Standard single or double glazing
Red	66 to 72	56 to 62	Louvres/screens, enclosed balcony	21 to 27	Upgraded glazing

Note 1. Refer to **Section 7.3** for further information on potential façade noise mitigation options.
Note 2. Glazing attenuation required to achieve internal noise levels commensurate with Green façade areas, assuming no balcony or other façade attenuation measures are used.
Note 3. Green façade areas would be compliant with the Project Noise Trigger Levels for the night-time period.

Table 12 Bedroom façade noise reduction – night-time (Hymix and New Sydney Fish Market)

Colour code	Predicted Facade Noise Levels (dBA) Night-time $L_{Aeq(15min)}$	Indicative Internal Noise Level (open windows) (dB)	Facade mitigation to permit natural ventilation [1]	Minimum Facade Noise Reduction (closed windows) (dB)[2]	Indicative Facade Glazing (Bedroom)
Green [3]	< 57	< 47	Louvres/screens, balcony absorption	< 22	Standard single or double glazing
Yellow	57 to 60	< 50	Enclosed balcony	22 to 25	Upgraded glazing
Orange	60 to 66	50 to 56	Enclosed balcony with attenuated ventilation path	25 to 31	Upgraded glazing
Red	66 to 72	56 to 62	Natural Ventilation not advised	31 to 37	Upgraded glazing

Note 1. Refer to **Section 7.3** for further information on potential façade noise mitigation options.

Note 2. Glazing attenuation required to achieve internal noise levels commensurate with Green façade areas, assuming no balcony or other façade attenuation measures are used.

Note 3. Green façade areas would be compliant with the Project Noise Trigger Levels for the night-time period.

Table 13 Habitable room/Bedroom façade noise reduction – night-time (New Sydney Fish Market only)

Colour code	Predicted Facade Noise Levels (dBA) Night-time $L_{Aeq(15min)}$	Indicative Internal Noise Level (open windows) (dB)	Facade mitigation to permit natural ventilation	Minimum Facade Noise Reduction (closed windows) (dB)	Indicative Facade Glazing (Bedroom)
All	< 48	< 38	None required	< 20	Standard single or double glazing

The above assessment shows:

- The worst-case industrial noise levels impacting the Precinct are predicted to be in the region of 65 to 71 dBA during the night-time period for Buildings BLD 02 and PLO 02, assuming Hymix industrial site continues to operate.
- Required façade attenuation would be greatest for bedrooms located on the façades overlooking the Hymix site. To maximise the potential for natural ventilation, it would be recommended to locate other habitable spaces (such as living rooms) with attenuated or enclosed balconies on these façades for Buildings BLD 02 and PLO 02.
- For all other residential buildings in the Precinct, noise impacts from road traffic will be greater than the industrial noise sources. Achieving the façade attenuation requirements for road traffic noise would ensure that the industrial noise impacts are also suitably controlled.
- Noise levels from the SSDA approved New Sydney Fish Market are not anticipated to result in any exceedances of the Project Noise Trigger Levels.

Standard window glazing typically attenuates external noise levels by around 20 dB with windows closed and 10 dB with windows open (allowing for natural ventilation). Where attenuation of more than 20 dB is required (see **Table 11**), then upgraded glazing would likely be required along with alternative means of ventilation to allow residents to keep windows closed. This is discussed in more detailed in **Section 7.3**.

Feasible and reasonable operational noise mitigation and management measures should also be considered to minimise noise impacts at the receivers where the L_{Aeq} criteria is predicted to be exceeded. Potential operational noise mitigation and management measures are discussed further in **Section 5.3.**

5.2.1 Sleep Disturbance Screening Assessment

An initial screening assessment of maximum noise events due to existing Hymix operations has been conducted. The results indicate that noise levels up to L_{Amax} 76 dB would be expected at the most exposed residential facades of Buildings BLD 02 and PLO 02 overlooking the site.

In accordance with the sleep disturbance screening criteria in **Table 3**, where exceedances are predicted a more detailed assessment should be carried out when more detailed information becomes available.

It is anticipated that the required façade attenuation of L_{Aeq} industrial noise levels will also serve to mitigate exceedances of the sleep disturbance screening criterion at the relevant receiver locations.

5.3 Operational Noise Mitigation and Management Measures

Where noise impacts from the development are predicted to exceed the relevant noise criteria, feasible and reasonable operational noise mitigation and management measures should be considered, with the aim of reducing noise emissions to the relevant criteria.

The typical hierarchy for mitigation and management of industrial noise sources is as follows:

- Reducing noise emissions at the source (ie noise source control)
- Reducing noise in transmission to the receiver (ie noise path control)
- Reducing noise at the receiver (ie at-receiver control)

The NPfI recognises that residual noise impacts may exist after the implementation of feasible and reasonable noise mitigation and management measures.

The NPfI generally considers the significance of residual impacts as summarised in **Table 14**.

Table 14 Significance of Residual Impacts

Exceedance of the Criteria	Significance of Residual Noise Impacts	Example of Potential Treatment
0 to 2 dBA	Negligible	The exceedances would generally not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
3 to 5 dBA with minimal increase to cumulative industrial noise	Marginal	Provision of mechanical ventilation to enable windows to be closed without compromising internal air quality/amenity.

Exceedance of the Criteria	Significance of Residual Noise Impacts	Example of Potential Treatment
3 to 5 dBA with significant increase to cumulative industrial noise	Moderate	Provision of mechanical ventilation along with upgrade facade elements, such as windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
>5 dBA but less than recommended amenity noise level		
>5 dBA and greater than recommended amenity noise level	Significant	May include suitable commercial agreements where considered feasible and reasonable.

The significance of any potential residual noise impacts should be taken into account when considering the reasonableness and feasibleness of operational noise mitigation and management measures.

The below sections discuss potential options for mitigating and managing operational noise emissions from the development. These measures should be investigated further during detailed design of the development, including an assessment of whether the option is feasible and reasonable for the benefit that it provides.

5.3.1 Noise Source Control

It should be noted that the predicted operational noise impacts assume peak 15-minute operations would occur concurrently across all industrial sites within and around the development. Some of the noise source control measures outlined below may occur naturally as the different sources would potentially have different shift times or typical peak operating hours.

Potential options for mitigating and managing sources of operational noise may include the combination of several measures, such as:

- Locating heavy vehicle access routes away from the site boundary, or otherwise taking advantage of any screening afforded by commercial building envelopes.
- Reducing peak 15-minute heavy vehicle movements by staggering delivery/pickup times.
- Reducing peak 15-minute light vehicle movements across the development by staggering shift change times for employees.
- Minimising the concurrent use of forklifts and other mobile plant outside the building envelopes (ie in the hardstand areas) and/or limiting their use to the less sensitive daytime and evening periods.
- The use of quieter mobile plant options, such as electric forklifts instead of gas-powered forklifts.
- Locating fixed mechanical plant away from the most-affected sensitive receivers, such as ground-level locations instead of rooftop locations, and/or shielded behind the commercial building structures.
- The use of quieter fixed mechanical plant options.
- Acoustic screening, no less than 500 mm higher than the top of the plant, located as close as practicable to the plant.

- Best management practice – such as switching vehicles and plant off when not in use, no yelling/swearing/loud music onsite, education of staff and drivers regarding noise impacts, regular maintenance of plant and equipment to minimise noise emissions, use of silent or non-tonal reverse alarms instead of tonal alarms, minimising use of reverse alarms by providing forward manoeuvring where practicable.

5.3.2 Noise Path Control

Noise path control is typically in the form of noise barriers and/or noise mounds. Barriers and mounds work best when located close to the noise source or close to the receiver.

In the case of elevated receivers overlooking the noise sources, such barriers would likely take the form of screening close to and above the noise source, or alternatively localised screening near the receiver in the form of balcony louvres, enclosed balconies.

5.3.3 Receiver Controls

At-receiver controls typically involve upgraded façade attenuation and provision of alternative means of ventilation, to enable appropriate internal acoustic amenity to be achieved.

Due to the high level of noise from road traffic on the study area, façade attenuation measures are likely to be required for many of the receivers also affected by industrial noise.

Therefore, receiver controls in the form of façade attenuation and alternative ventilation are considered likely to be cost effective and reasonable to be applied to the majority of industrial noise affected locations.

5.4 Industrial Noise Impact Summary

An industrial noise assessment of the existing Hymix facility and SSDA approved New Sydney Fish Market has been conducted. The assessment confirmed that for most residential areas of the Precinct, road traffic noise impacts would be greater than industrial noise.

Should Hymix continue to operate, significant noise impacts to Buildings BLD 02 and PLO 02 are anticipated, particularly to the facades overlooking Hymix. In some locations bedrooms on these facades may require higher levels of façade attenuation than that required to mitigate road traffic noise.

Noise levels from the SSDA approved New Sydney Fish Market are not anticipated to result in any exceedances of the Project Noise Trigger Levels.

Further information on façade mitigation measures is included in **Section 7.3**.

6 Patron Noise Assessment

This section assesses potential patron noise from the New Sydney Fish Market impacting on the residual Blackwattle Bay precinct. A summary of the locations and occupancies of the primary source of patron noise associated with the New Sydney Fish Market is presented below in **Table 15**.

Table 15 Summary of Primary Patron Areas

Name	Location	Level	Occupancy[1]
Shared Dining	New Fish Market - Northern Façade	Upper Ground 01	600
Shared Dining	New Fish Market - Eastern Façade	Upper Ground 01	300
Shared Dining	New Fish Market - Western Façade	Upper Ground 01	300
Skybar	New Fish Market - South Eastern Corner	Upper Level 02	70
Seafood School Terrace	New Fish Market - North Eastern Corner	Upper Level 02	150
North of BLD 06	North of BLD 06	Ground	220
Between BLD 06 and BLD 03	Between BLD 06 and BLD 03	Ground	200
Between BLD 05 and BLD 04	Between BLD 05 and BLD 04	Ground	140

Note 1: Occupancy is assumed to be based upon an approximate capacity of 1 person per square metre.

6.1 Patron Activity Noise Sources

Noise associated with patron activity (such as dining) was calculated using the following source data shown in **Table 16**.

Table 16 Patron Source Noise Levels - 100% Occupancy

Noise Source – 100% Occupancy	Sound Power Level, dB (L_{eq} per source) at 1/1 Octave Band									
	dBA	31.5	63	125	250	500	1k	2k	4k	8k
North-West terrace (facing wharves)	102	81	86	92	98	102	98	92	87	79
East and West terraces	99	78	83	89	95	99	95	89	84	76
Skybar	96	74	79	85	91	95	91	85	80	72
Seafood School Terrace	93	71	76	82	88	92	88	82	77	69
North of BLD 06	101	79	84	90	96	100	96	90	85	77
Between BLD 06 and BLD 03	101	79	84	90	96	100	96	90	85	77
Between BLD 05 and BLD 04	99	77	82	88	94	98	94	88	83	75

Note: Source levels calculated assuming that 50% of patrons in each space will be speaking at any given time, using the "raised voice" spectrum in ANSI S3.5-1997 (R2017) "*Methods for Calculation of the Speech Intelligibility Index*".

6.2 Patron Activity Noise Impact

Noise levels have been predicted across the Precinct during the 07:00 am and 12:00 midnight period with the noise sources included in **Table 15**.

The L_{Aeq} screening assessment results are provided in **Figures C13** and **C14** in **Appendix C** as facade noise maps for each building.

The colour coding in the facade noise maps in **Appendix C** can be correlated to the screening assessment shown in **Table 17**.

Table 17 Indicative patron noise screening assessment

Colour code	Predicted Facade Noise Levels (dBA) Night-time $L_{Aeq(15min)}$	Indicative Internal Noise Level (open windows) (dB)	Facade mitigation to permit natural ventilation	Minimum Facade Noise Reduction (closed windows) (dB)[1]	Indicative Facade Glazing (Bedroom)
Green [2]	< 57	< 47	None required	< 20	Standard single or double glazing
Yellow	57 to 60	47 to 50	None required	< 20	Standard single or double glazing
Orange	60 to 63	50 to 53	Louvres/screens, balcony absorption	< 20	Standard single or double glazing

Note 1. Glazing attenuation required to achieve internal noise levels commensurate with Green façade areas, assuming no balcony or other façade attenuation measures are used.

Note 2. Green façade areas would be compliant with the patron noise screening assessment criterion (refer **Section 3.3.3**).

6.3 Patron Noise Impact Summary

An indicative patron noise assessment has been conducted, considering the SSDA approved New Sydney Fish Market and proposed outdoor areas near Buildings BLD 03, 04, 05 and 06.

The assessment indicated the following:

- The worst-case patron noise levels impacting the Precinct are predicted to be in the region of 60 to 63 dBA during the night-time period for Buildings BLD 02, BLD 03 and BLD 04 which overlook the outdoor patron areas.
- Upgraded façade glazing is unlikely be required for a closed window compliance scenario.
- To maximise the potential for natural ventilation, consideration of balcony absorption and localised screening should be considered for areas exceeding the screening criterion on these façades.
- Sleep disturbance effects during the night-time period have not been considered in this screening assessment.
- Further information on façade mitigation measures is included in **Section 7.3**.

7 Recommendations

7.1 Noise Impacts on the Development

Sensitive receivers in the Precinct which have line of sight to major roads will likely be affected by noise impacts and noise mitigation measures would need to be incorporated into the design of the site. The preferred mitigation strategy would be determined at a later stage in the project and would likely use a combination of the measures discussed below.

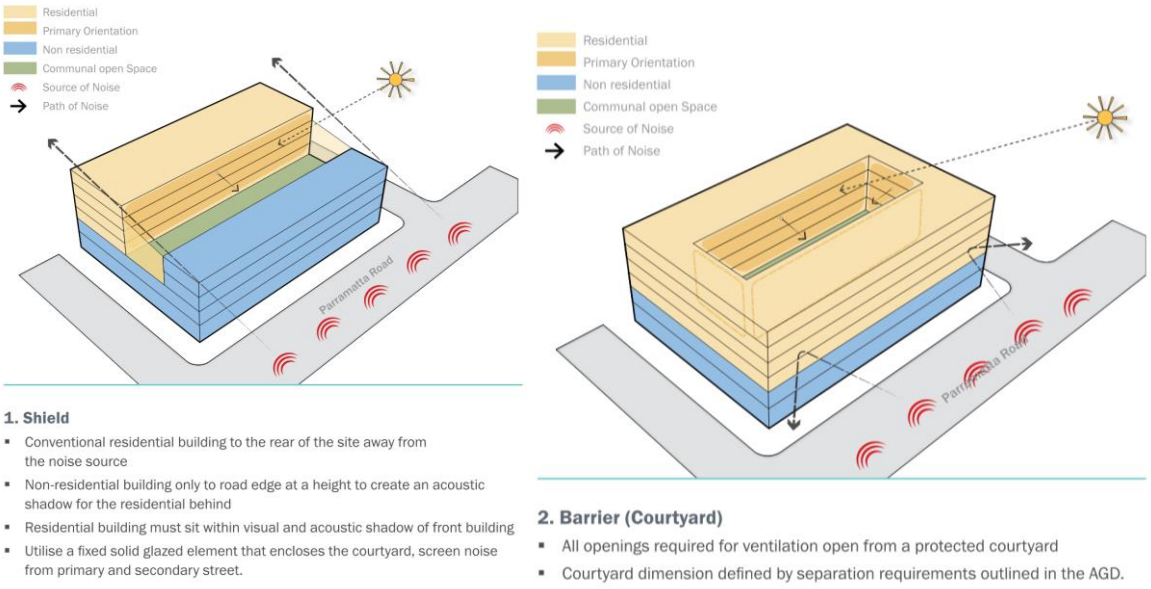
For the Blackwattle Bay Study Area, the Western Distributor, Pyrmont Bridge Road and Bridge Road are the most significant sources of noise, with these roads carrying a significant amount of traffic each day. The removal of buildings currently located on the boundary of these roads and the existing Fish Market would result in an increase in noise levels to internal parts of the site.

The built environment of the Investigation Area should be designed to ensure that line-of-sight is eliminated from Pyrmont Bridge Road and Bridge Road to the residential elements of the Blackwattle Bay as much as practicable. There are however limitations to amount of noise attenuation that this approach can provide, given the elevated nature of the Western Distributor to the immediate north of the site, which is also a significant contributor to noise levels across the precinct.

In particular, the draft precinct plan for Blackwattle Bay seeks to vertically distance residential uses from the Western Distributor where possible. During the detailed design phase, residential buildings adjacent to the Western Distributor will require careful consideration with regard to internal layout and configuration in order to ensure that the noise requirements of the City of Sydney DCP (and the Apartment Design Guide) can be achieved.

Additionally, the built form should be carefully considered in future developments in order to place non-residential uses in closest proximity to the noise source, as well as providing more sheltered areas and access to ventilation from shielded facades. Examples of this approach can be found in the Urban Growth document “Parramatta Road Corridor Urban Transformation - Planning and Design Guidelines” (Nov 2016, herein referred as the ‘Parramatta Road Study’).

Figure 7 Built form options providing acoustic shielding (taken from the Parramatta Road Study)



7.2 Noise Barriers

Noise barriers can be an effective way to reduce road noise impacts. While noise barriers can provide significant noise benefit they can also introduce a number of negative aspects, including access to property, aesthetic impacts, daylight access, overshadowing, drainage, graffiti, restriction of line-of-sight, maintenance access and safety concerns.

Noise barriers are, however, unlikely to be considered a feasible approach for mitigating the impacts for the following reasons:

- Noise barriers would need to be built immediately adjacent to the elevated Western Distributor, which would have significant aesthetic and daylight access impacts.
- Noise barriers are less common on arterial roads such as Bridge Road or on roads where access is required to be maintained.
- Noise barriers are generally only effective for horizontally adjacent receivers, and typically provide no benefit to upper floors of multi-storey apartment blocks which overlook the road.

7.3 Increased Facade Specifications and Natural Ventilation

The assessment in **Section 4.4** concluded that many facades are likely to require increased glazing specifications to mitigate high external noise levels and to provide a suitable internal noise environment.

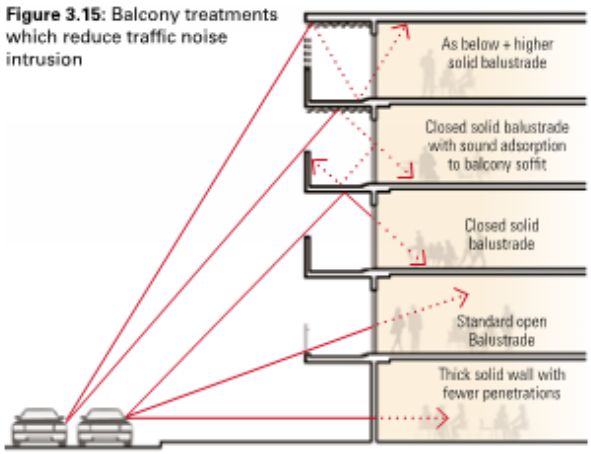
The requirements should be verified during detailed design when details of the proposed buildings, their uses, internal layout and room dimensions are known. It is noted that increased glazing specifications are relatively cheap to include in the design of buildings but can be prohibitively expensive to retrofit.

7.3.1 Natural Ventilation

One of the study requirements is for natural ventilation to be provided to the future buildings. While this would be relatively straightforward to provide in cases where ventilation can be taken from a non-noise impacted facade, such as from the rear of buildings, the provision of natural ventilation to habitable spaces which face the Western Distributor, Bridge Road and Hymix industrial site would likely require one of the approaches outlined below due to high external noise levels.

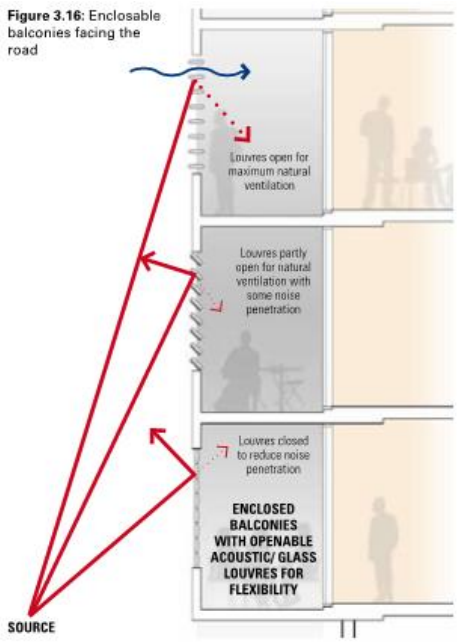
Some examples of increased façade noise mitigation that continue to allow for natural ventilation in the form of louvres, balcony soffit absorption, enclosed balconies are shown in **Figure 8** and **Figure 9**.

Figure 8 Concept of Open Balcony Treatments (section view)



Note: Taken from DP&I *Development near Rail Corridors and Busy Roads – Interim Guideline*.

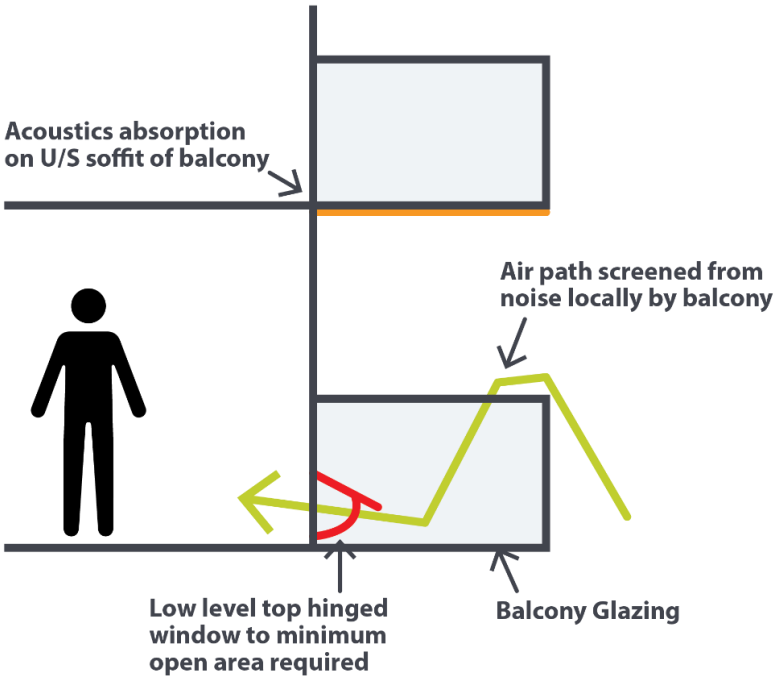
Figure 9 Concept of Enclosed Balconies (section view)



Note: Taken from DP&I *Development near Rail Corridors and Busy Roads – Interim Guideline*.

Engineering solutions can be designed which use localised balcony screening, low-level openable windows and acoustic absorption on balcony surfaces to control noise ingress. A conceptual design of this system is shown in **Figure 10**.

Figure 10 Concept of Attenuated Balcony Openings (section view)



The above systems are expected to achieve a noise reduction of up to 15 dB, which may be sufficient to attenuate external noise levels to meet the natural ventilation internal noise criteria discussed in **Section 3.1.2** at many locations in the Precinct.

For locations exposed to high traffic or industrial noise levels requiring more than 15 dB attenuation the above systems are unlikely to be sufficient. These residential façade locations are identified on the façade noise maps included in **Appendix C** with the following colour coding:

- Habitable rooms (other than bedrooms): Red, Violet, Purple
- Bedrooms: Orange, Red, Violet, Purple

For these locations consideration would need to be given to the following façade mitigation measures:

- Enclosed balconies with attenuated ventilation openings (may require to be mechanically assisted)
- Closed windows and mechanical ventilation

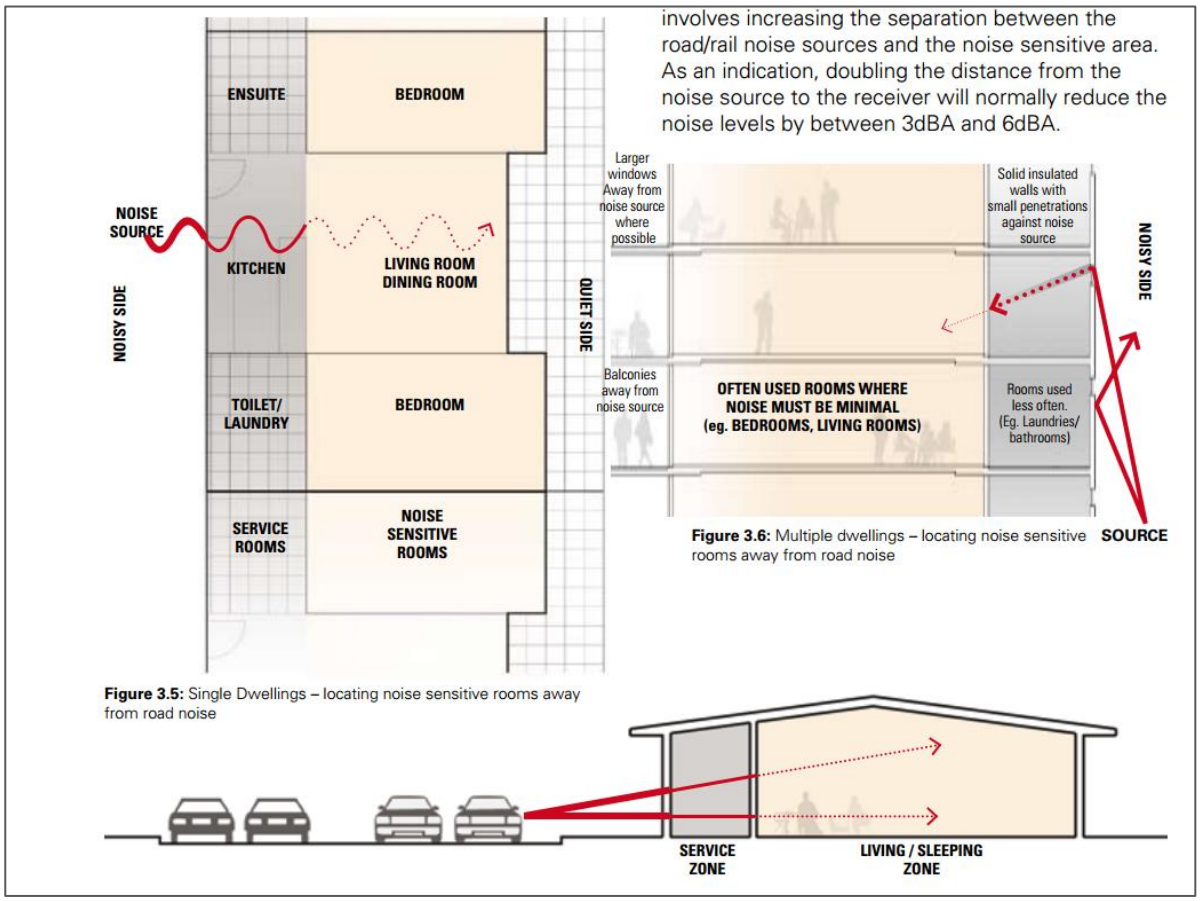
The requirements for facade design and natural ventilation should be reviewed as the project progresses. Where natural ventilation is deemed as being required, the design solution will require careful consideration of the high road traffic and industrial noise levels in the area.

7.4 Internal Layout of Buildings

Where residential buildings are located close to sources of road noise, the layout of the buildings can be optimised to minimise road traffic noise intrusion into sensitive areas. Buildings can be constructed so that noise insensitive areas such as kitchens, storage areas and laundries are located closer to the noise source, with habitable spaces being positioned away from the most noise affected facades. Noise levels in habitable spaces protected by less noise sensitive uses would be expected to comply with the appropriate internal noise criteria in most cases.

An example of how residential buildings can be designed to shield sensitive sleeping and living areas is shown in **Figure 11**.

Figure 11 Examples of Design Orientation and Room Layout



Note: Taken from DP&I *Development near Rail Corridors and Busy Roads – Interim Guideline*.

Where structures are used to provide shielding to internal areas, the use of multi-storey buildings of at least two storeys would provide the most benefit to non-elevated roads.

The effect of this principle is shown below in **Figure 12** and **Figure 13**. The first image illustrates how uninterrupted noise levels can propagate across a site, whereas the second image illustrates the effect of intervening structures. The comparison shows that significantly lower noise levels can be achieved if acoustic considerations are appropriately applied to the site layout early on in a project.

Figure 12 Cross Sectional Noise Map – With Intervening Structures

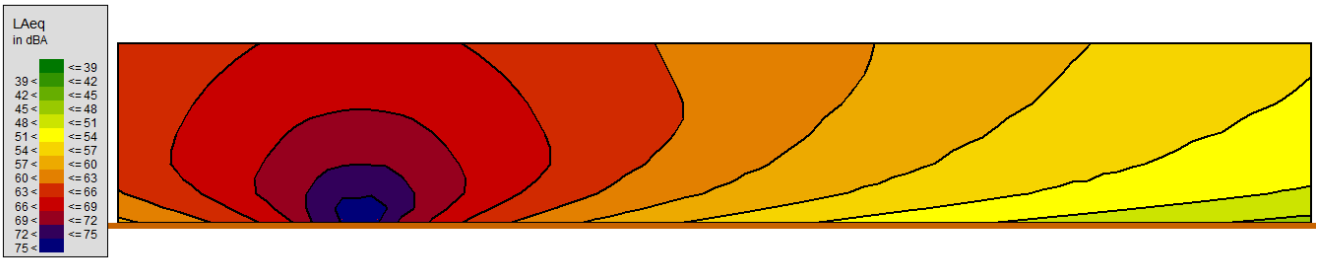
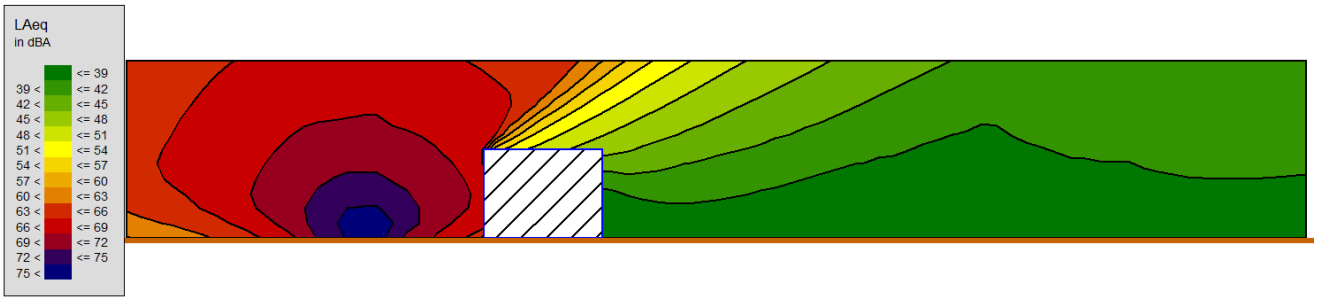


Figure 13 Cross Sectional Noise Map –Without Intervening Structures



Where possible absorptive and diffusive surfaces should also be prioritised in close proximity to road traffic noise sources, or down paths through which noise could potentially propagate.

The provision of quiet spaces for both passive and active recreation has many positive health benefits. To achieve this, green space should be provided within the proposal site which are situated in locations as shielded from roads traffic noise impacts (and other noise sources) as possible. The built environment should be designed with consideration of providing quiet areas shielded from road traffic noise, where possible, however the limitations of being in an area with very high levels of road traffic noise are noted.

While these strategies can help minimise noise propagating into the Blackwattle Bay Investigation Area, for residential developments higher than five to ten storeys (dependant on their location) few at-source mitigation options will be available. These higher properties would be impacted by noise from the surrounding road network to a greater extent than properties closer to the ground. Mitigation options will be limited to the properties themselves, such as specification of increased facade or glazing elements.

7.5 Noise Impacts within the Development

Local or internal roads should include traffic calming measures. Speed humps should be avoided as the impacts create additional noise sources. Opportunities such as shared zones, curb extensions, pedestrian refuges, and speed limits should be considered. Measures which reduce the need for vehicles to accelerate throughout the area should be prioritised.

It is considered likely that future development on the site will contain a mix of commercial and residential development, with potential Food and Beverage offerings. In order to maintain the amenity to residential receptors both on and off the site, noise from any potential future entertainment or Food and Beverage / Licenced Premises should be adequately controlled. The preferred method of controlling noise from such sources is to:

- Locate high noise generating uses (such as licenced premises) together and away from areas of residential receptors. Use non-residential zones as buffers to shield residential areas
- Develop precinct plans which appropriately limit operational hours of noisy developments, as well as management plans for reducing noise impacts, as far as practical. Such plans may include the need to close windows / doors of high-noise generating venues at certain times, as well requiring venues to be designed and constructed to control noise egress should predicted internal noise levels within venues exceed a certain limit (to be defined by the design of the building).
- Use appropriate mitigation measures within the design of future residential developments, which may include appropriately upgraded facades and ventilation systems in proximity to high noise-generating uses.

7.6 Industrial Noise Recommendations

Noise emissions from mechanical plant at future non-residential uses in the Precinct would be required to be assessed against the noise goals in **Table 2**, noting that the criteria relate to the total noise from the cumulative impact of all industrial sources in the area, including existing and approved sources of industrial noise including Hymix and the New Sydney Fish Market.

At this stage the non-residential tenant types within the Precinct are unknown but would likely consist of small scale retail, restaurants/cafes and community facilities. Noise impacts may be apparent at receivers situated nearby where these facilities have mechanical plant.

It is recommended that a detailed acoustic assessment of the potential industrial noise impacts is completed once the various non-residential tenant types are finalised. The following strategies are recommended where exceedances are predicted:

- Spatial separation between noisy activities and noise sensitive areas through locating less noise sensitive uses in high noise areas.
- Taking advantage of any site features that can be used to screen noise impacts when planning land use in an area.
- Using intervening structures such as less noise sensitive multi-storey buildings to act as barriers. Buildings used as barriers should incorporate noise mitigation principles into their building design to ensure appropriate internal noise conditions.
- Locating mechanical plant inside plant rooms or in enclosures with appropriate acoustic treatment.

Noise impacts from new industrial/commercial noise sources within the Precinct would be assessed individually in the DA stage of the project.

8 Conclusion

SLR Consulting Australia Pty Ltd (SLR) was engaged by Infrastructure NSW to prepare a noise and vibration study forming part of the Blackwattle Bay State Significant Precinct Study (SSP Study). The SSP Study seeks a rezoning for new planning controls for Blackwattle Bay, located on the south-western side of Pyrmont.

The impact of the future road traffic noise on the study area varies across the site and various building facades. The most exposed facades which face Western Distributor or Bridge Road are predicted to be subject to relatively high road traffic noise levels and mitigation strategies have been recommended, including upgrading facade elements and designing building layouts to place less noise sensitive usages near to source of road traffic noise.

The potential impacts from the continued operation of Hymix industrial facility and the approved New Sydney Fish Market have also been assessed. The most exposed facades which face Hymix are predicted to be subject to relatively high night-time industrial noise levels and mitigation strategies have been recommended, including upgrading facade elements and designing building layouts to place less noise sensitive usages near to source of industrial noise.

No significant noise impacts from the approved operation of New Sydney Fish Market have been predicted within the study area.

The required noise mitigation for each building would be further assessed during the next stages of the project. The study has shown that from an acoustic perspective, the site is site is suitable for the intended uses within the SSP proposal subject to the future design development on final proposals of high-level mitigation measures summarised within this study.

APPENDIX A
ACOUSTIC TERMINOLOGY

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being 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 LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 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 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB 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

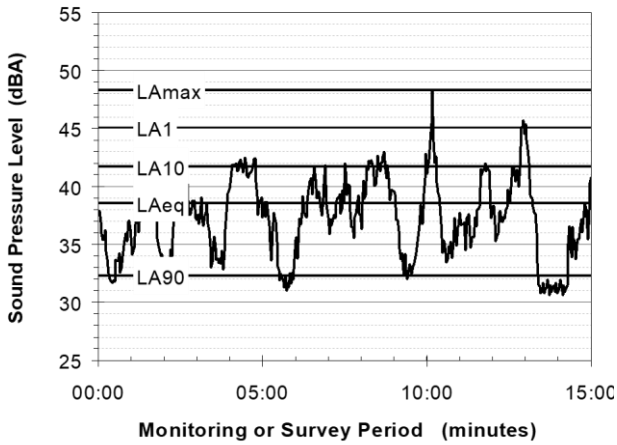
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of 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 LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 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:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 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.

LAeq 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.

5. Frequency Analysis

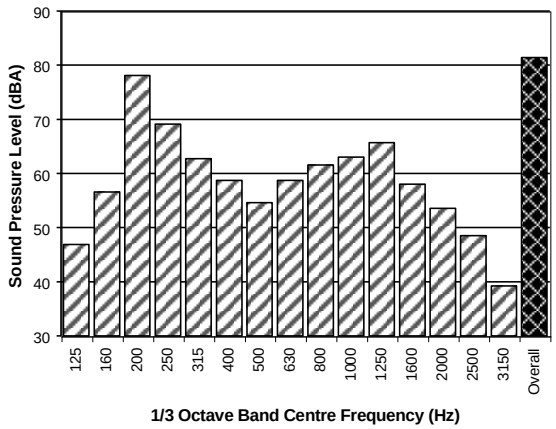
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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 (three 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.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. 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 (ie vertical, longitudinal 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/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

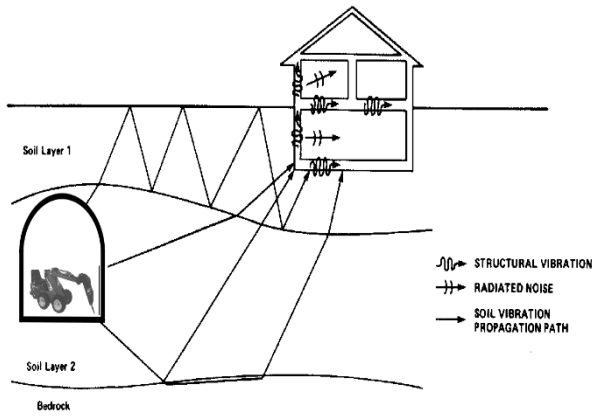
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience 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.

9. 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 an example of 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
PROJECT TRAFFIC FLOWS

Road Section	2033 Full Development Traffic Data			
	Daytime (15 hour)		Night-time (9 hour)	
	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Anzac Bridge - Eastbound				
Between Victoria Rd and Off Ramp to Pyrmont Bridge Rd	73,491	2,931	17,120	787
Western Distributor - Eastbound				
Between Off Ramp to Pyrmont Bridge Rd and Off Ramp to Allen St	65,581	2,669	15,277	717
Between Off Ramp to Allen St and On Ramp from Pyrmont Bridge Rd	51,036	1,863	11,889	500
Western Distributor - Westbound				
Between On Ramp from Druitt St and Off Ramp to Pyrmont Bridge Rd	63,033	2,183	13,325	461
Between Off Ramp to Pyrmont Bridge Rd and On Ramp from Pyrmont Bridge Rd	51,268	2,114	10,838	447
Anzac Bridge - Westbound				
Btw On Ramp from Pyrmont Bridge Rd and Victoria Rd	71,785	3,023	15,175	639
Ramps				
Eastbound On Ramp from Pyrmont Bridge Rd	6,169	265	1,276	55
Westbound On Ramp from Pyrmont Bridge Rd	22,788	726	4,817	153
Eastbound Off Ramp to Pyrmont Bridge Rd	9,762	374	2,019	77
Westbound Off Ramp to Pyrmont Bridge Rd	20,098	370	4,249	78
Surface Roads				
Bridge Road Eastbound between Wentworth Park Road and Wattle Street	12,821	408	3,504	112
Bridge Road Westbound between Wentworth Park Road and Wattle Street	14,574	408	3,984	112
Pyrmont Bridge Road Eastbound between Wattle Street and Bank Street	17,825	620	4,872	169
Pyrmont Bridge Road Westbound between Wattle Street and Bank Street	13,123	393	3,587	107
Pyrmont Bridge Road Eastbound between Bank Street and Harris Street	23,313	726	6,372	198
Pyrmont Bridge Road Westbound between Bank Street and Harris Street	9,888	423	2,703	116
Bank Street Northbound between Pyrmont Bridge Road and Miller Street	8,875	272	2,426	74

Road Section	2033 Full Development Traffic Data			
	Daytime (15 hour)		Night-time (9 hour)	
	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Bank Street Southbound between Pyrmont Bridge Road and Miller Street	8,315	816	2,273	223
Bank Street Northbound north of miller street	8,875	272	2,426	74
Bank Street Southbound north of miller street	4,294	166	1,174	45
Through Site Link Northbound	4,838	181	1,322	50
Through Site Link Southbound	1,436	76	393	21

Note: Individual HGV percentages have been applied to each road with an average of 3.5% for the daytime and 5.7% for the night-time.

APPENDIX C
FAÇADE NOISE MAPS

Figure C1 Eastern/North-eastern Facade Road Traffic Façade Noise Map – Daytime (Hymix site redeveloped)

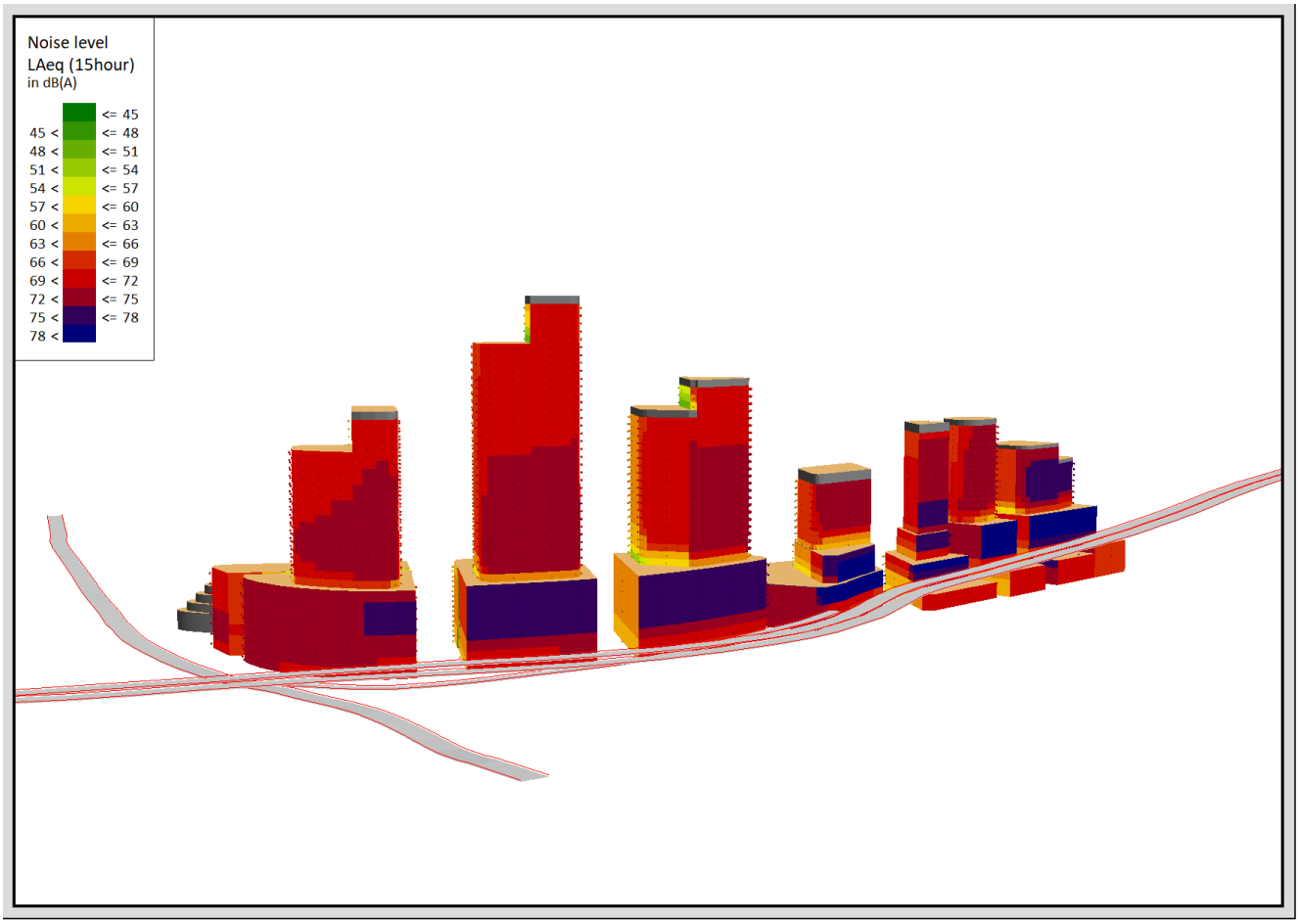


Figure C2 Eastern/North-eastern Facade Road Traffic Façade Noise Map – Daytime (Hymix site operational)

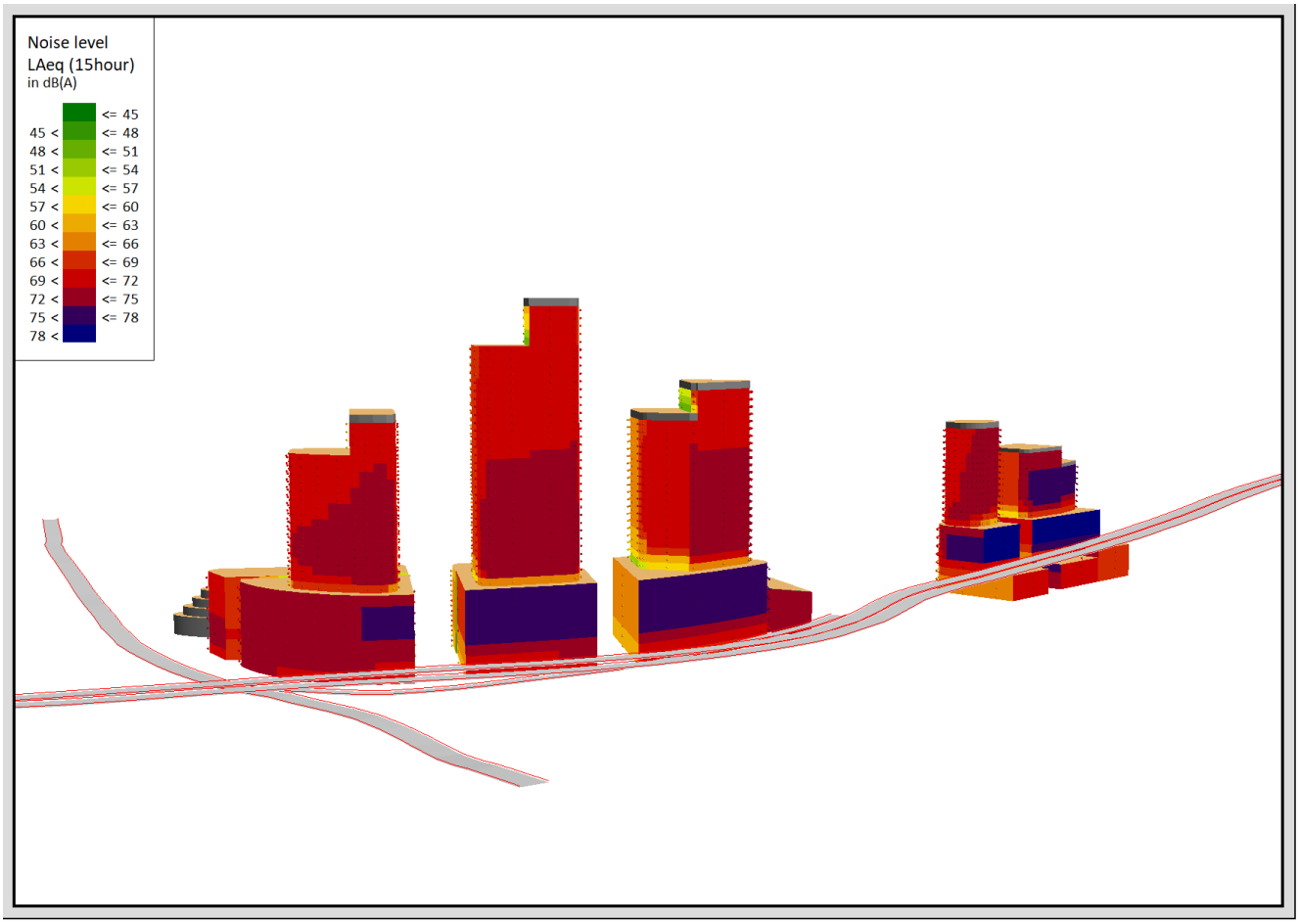


Figure C3 Eastern/North-eastern Facade Road Traffic Façade Noise Map – Night-time (Hymix site redeveloped)

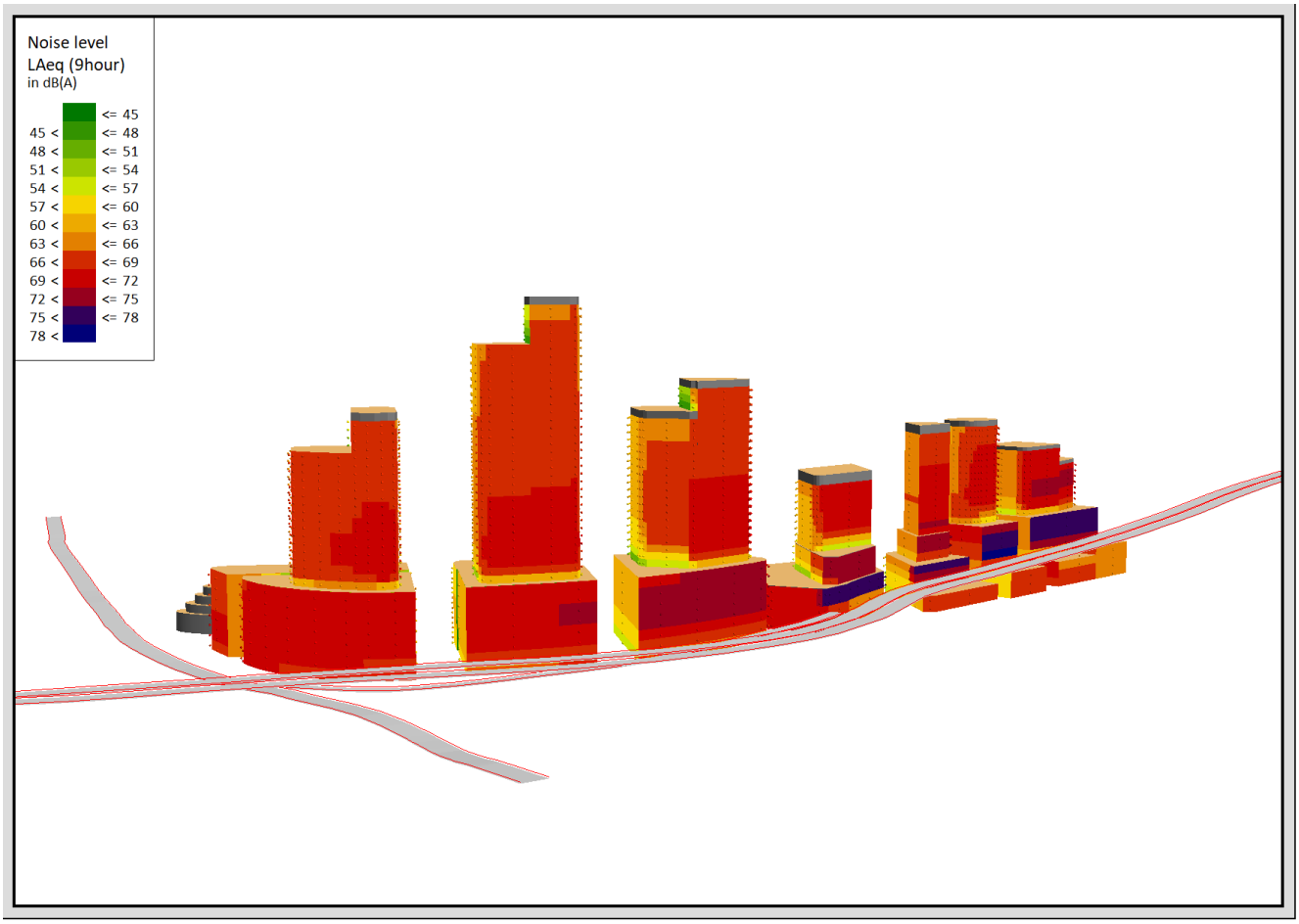


Figure C4 Eastern/North-eastern Facade Road Traffic Façade Noise Map – Night-time (Hymix site operational)

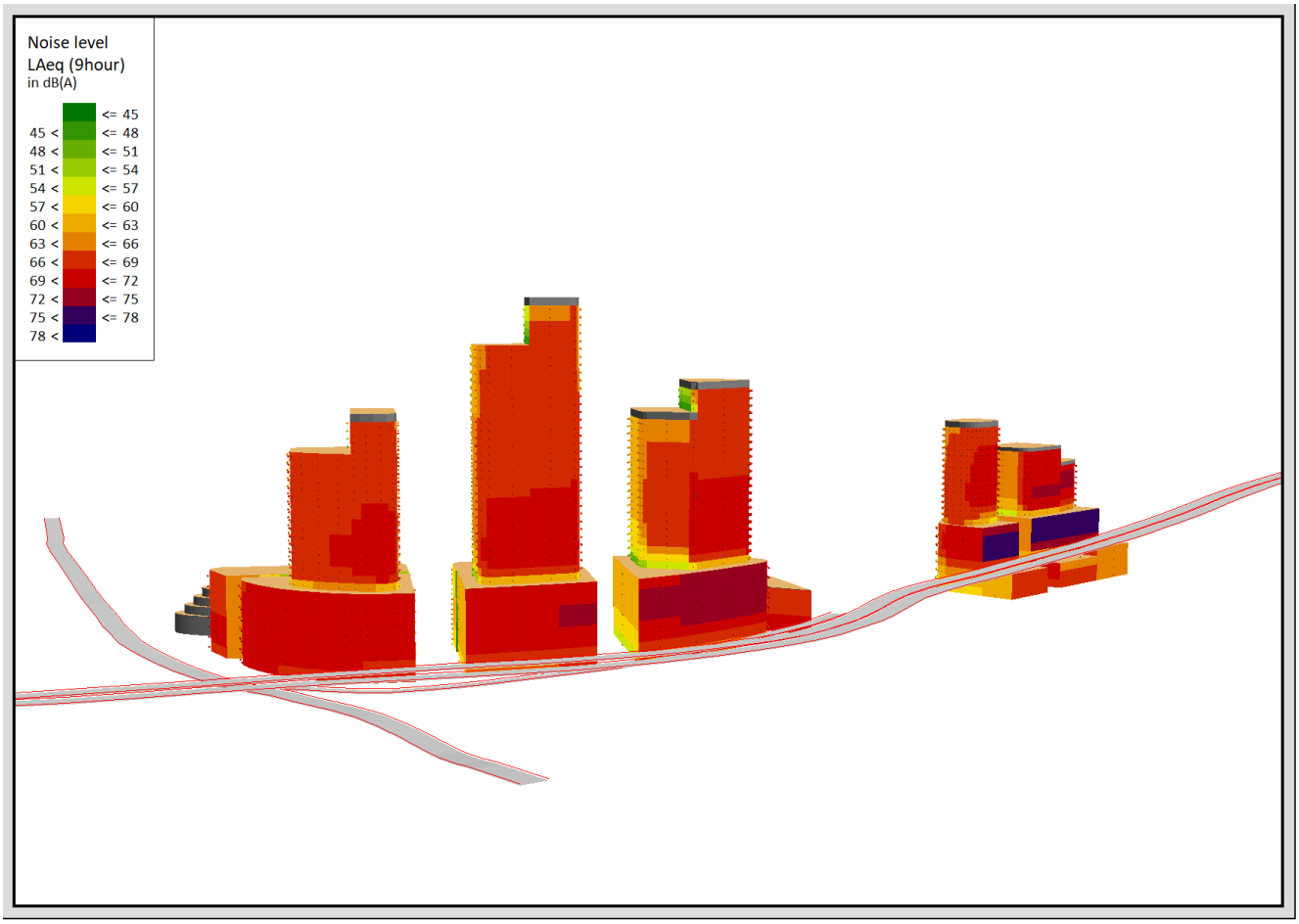


Figure C5 Western/South-western Facade Road Traffic Façade Noise Map – Daytime (Hymix site redeveloped)

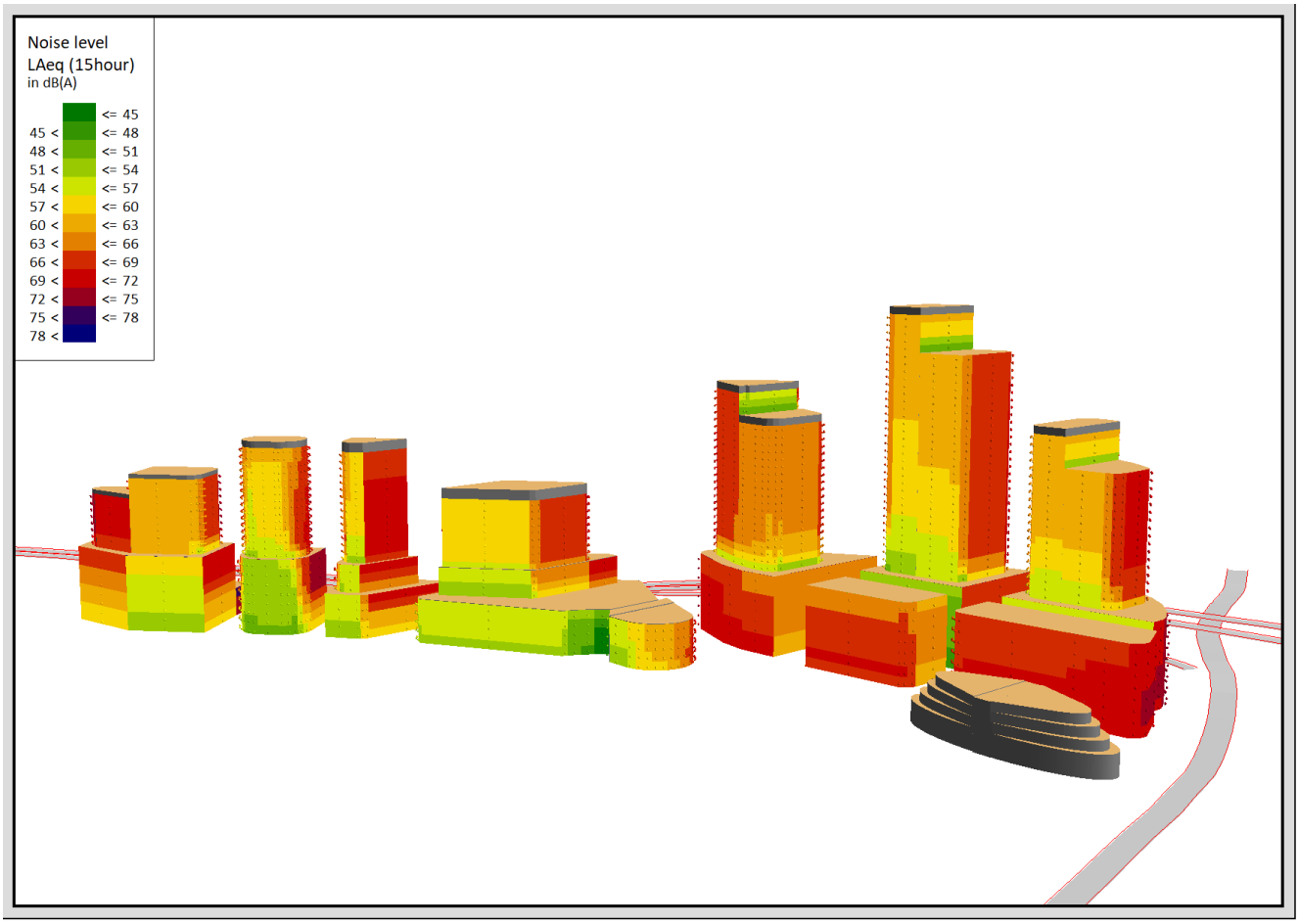


Figure C6 Western/South-western Facade Road Traffic Façade Noise Map – Daytime (Hymix site operational)

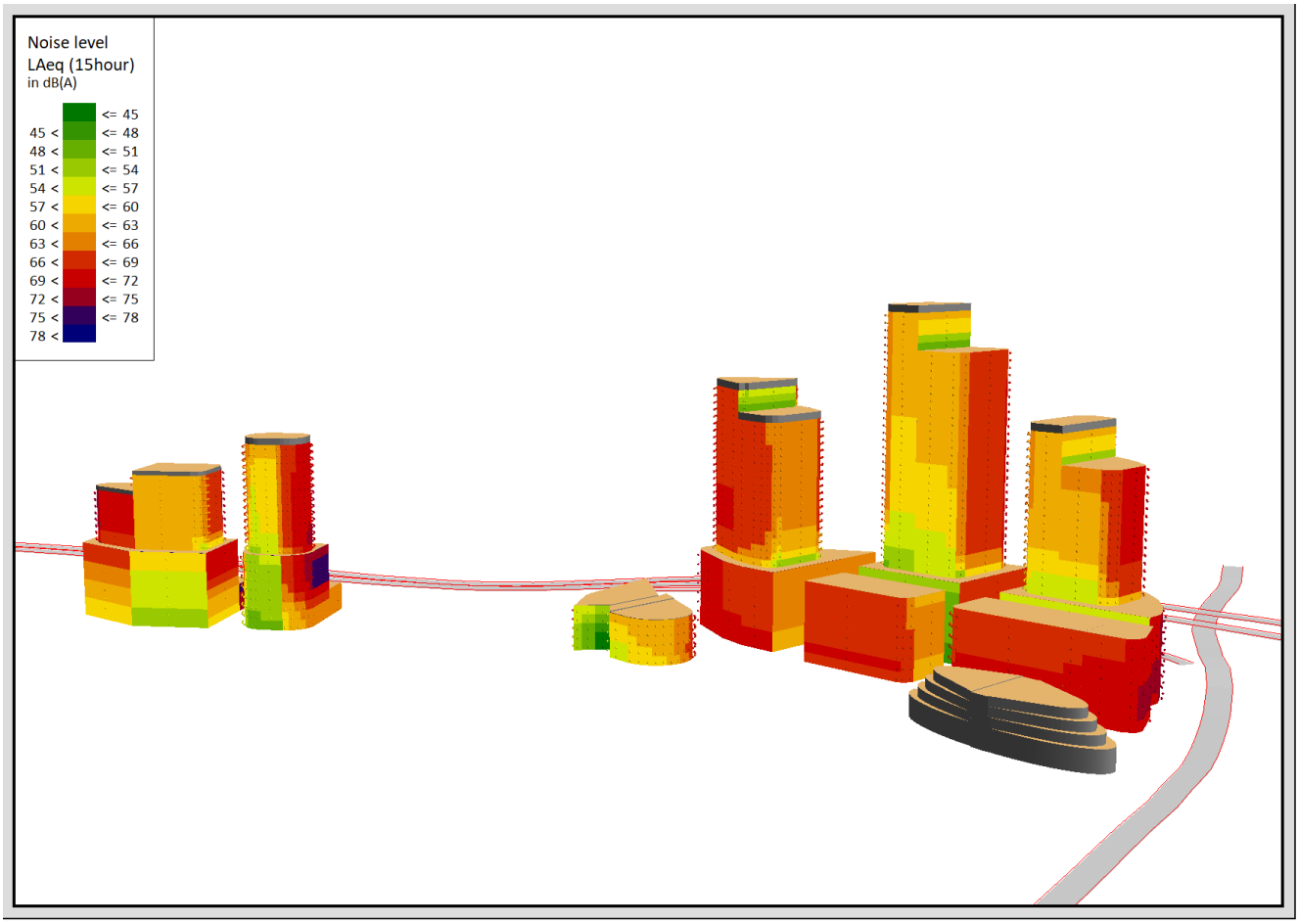


Figure C7 Western/South-western Facade Road Traffic Façade Noise Map – Night-time (Hymix site redeveloped)

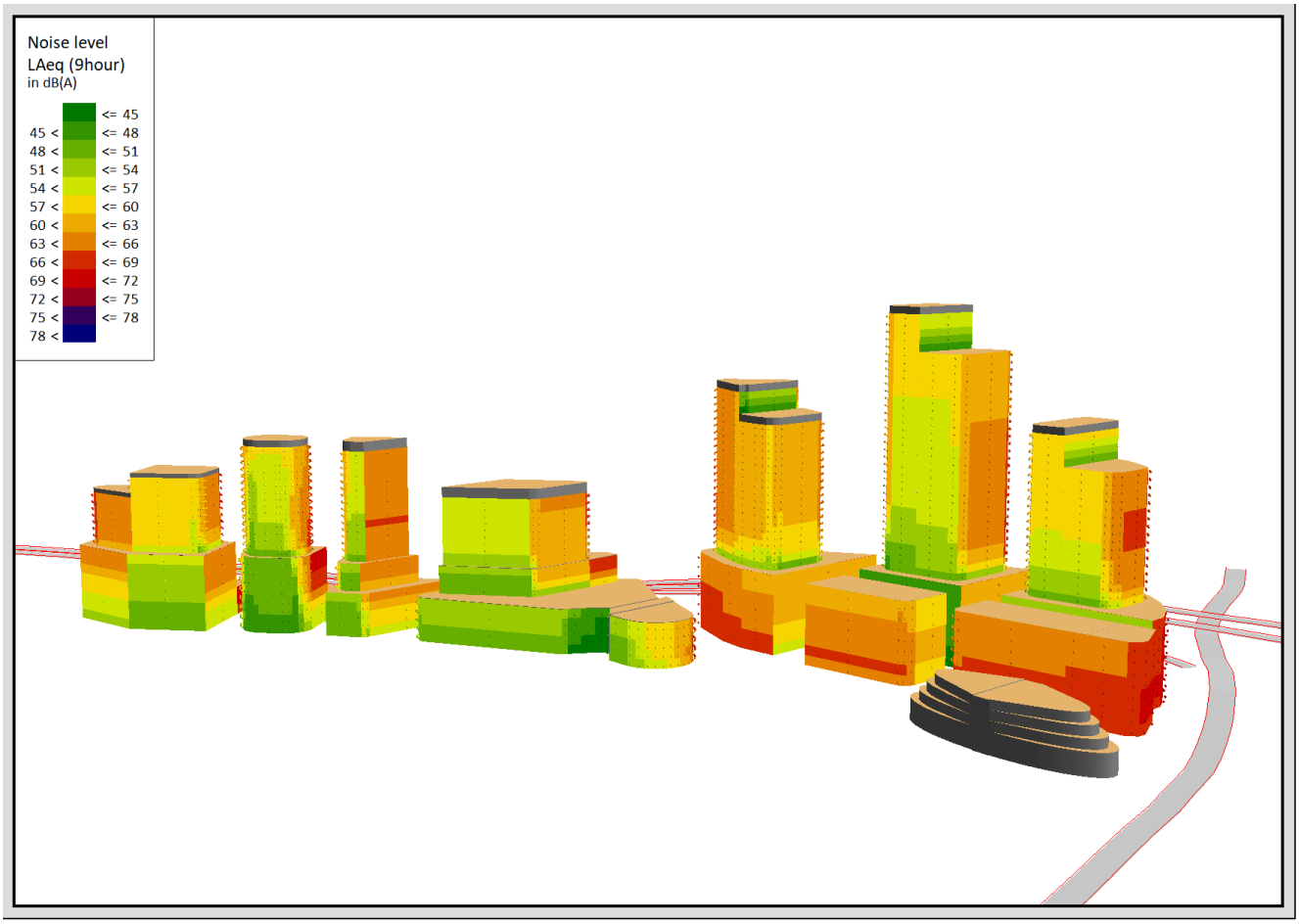


Figure C8 Western/South-western Facade Road Traffic Façade Noise Map – Night-time (Hymix site operational)

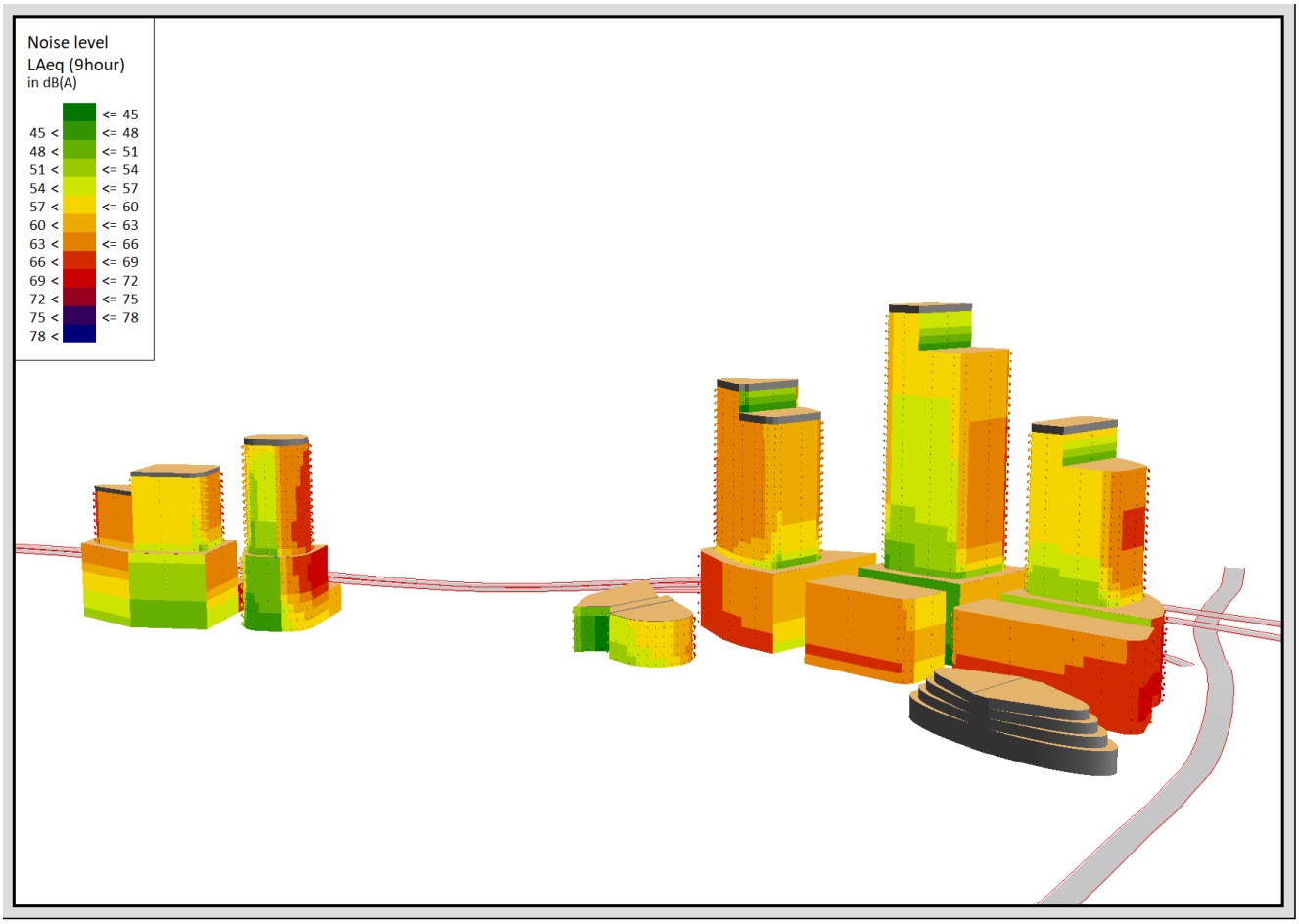


Figure C9 Eastern/North-eastern Facade Industrial Façade Noise Map – Night-time (Hymix & New Sydney Fish Market)

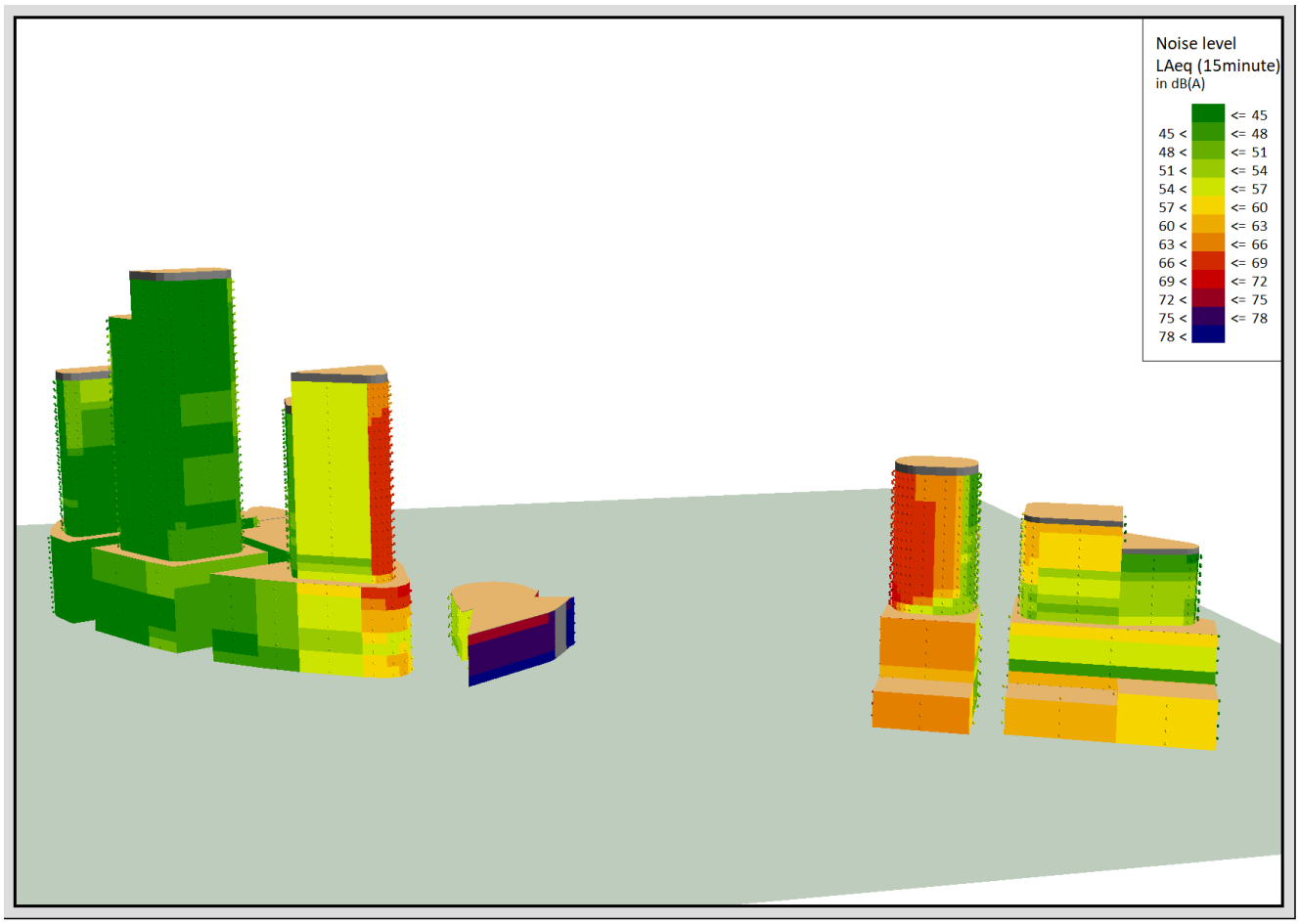


Figure C10 Western/South-western Facade Industrial Façade Noise Map – Night-time (Hymix & New Sydney Fish Market)

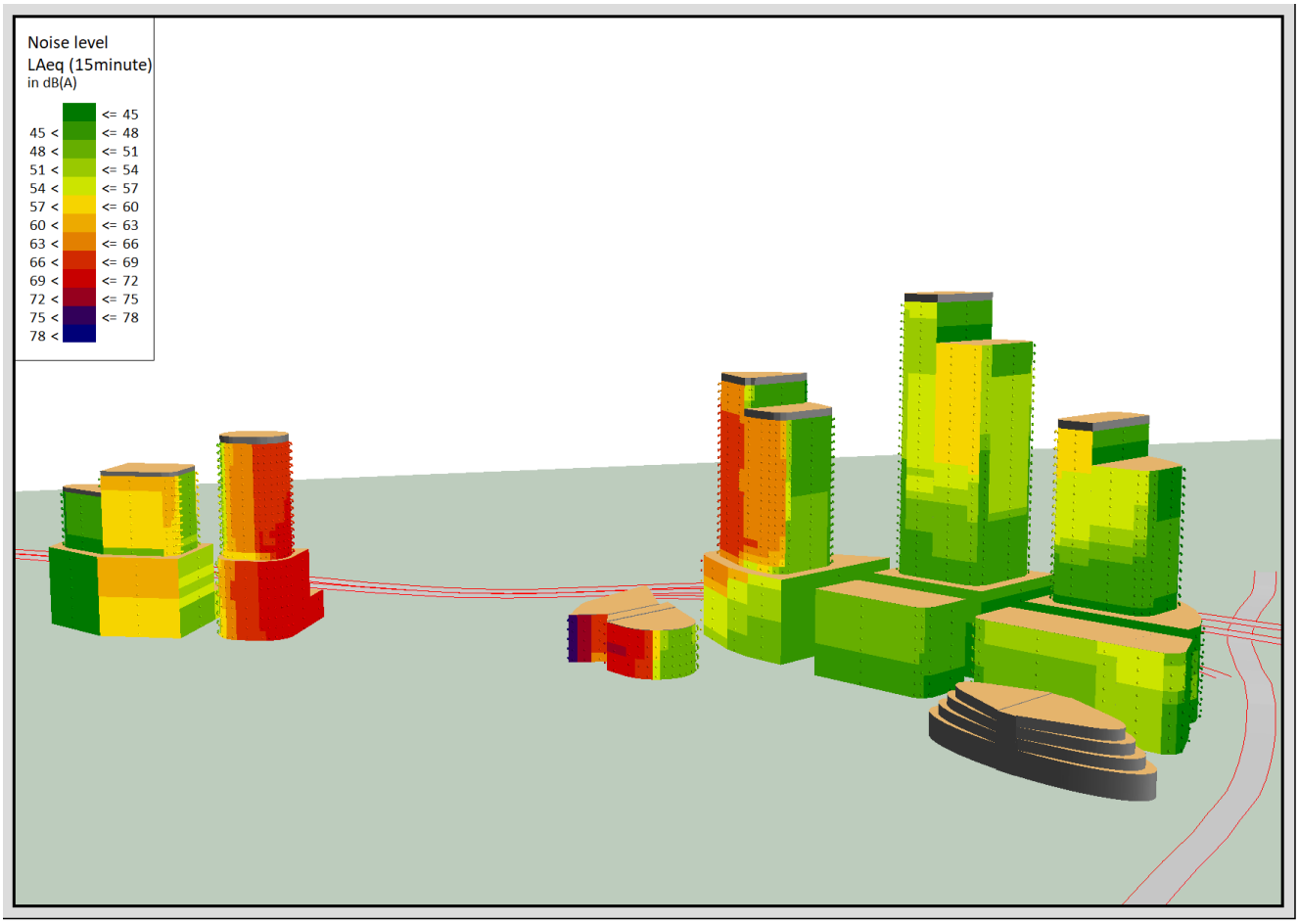


Figure C11 Eastern/North-eastern Facade Industrial Façade Noise Map – Night-time (New Sydney Fish Market only)

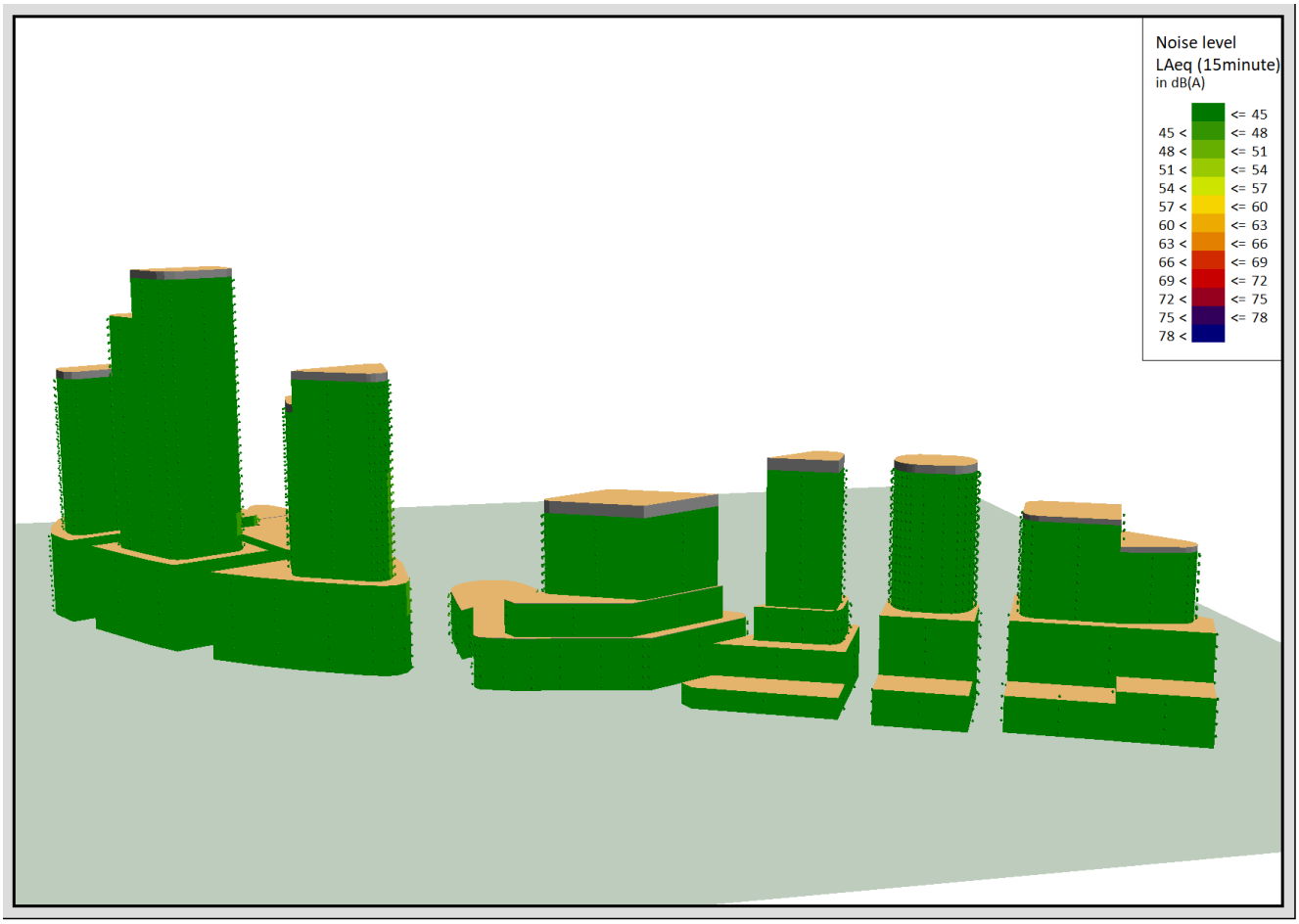


Figure C12 Western/South-western Facade Industrial Façade Noise Map – Night-time (New Sydney Fish Market only)

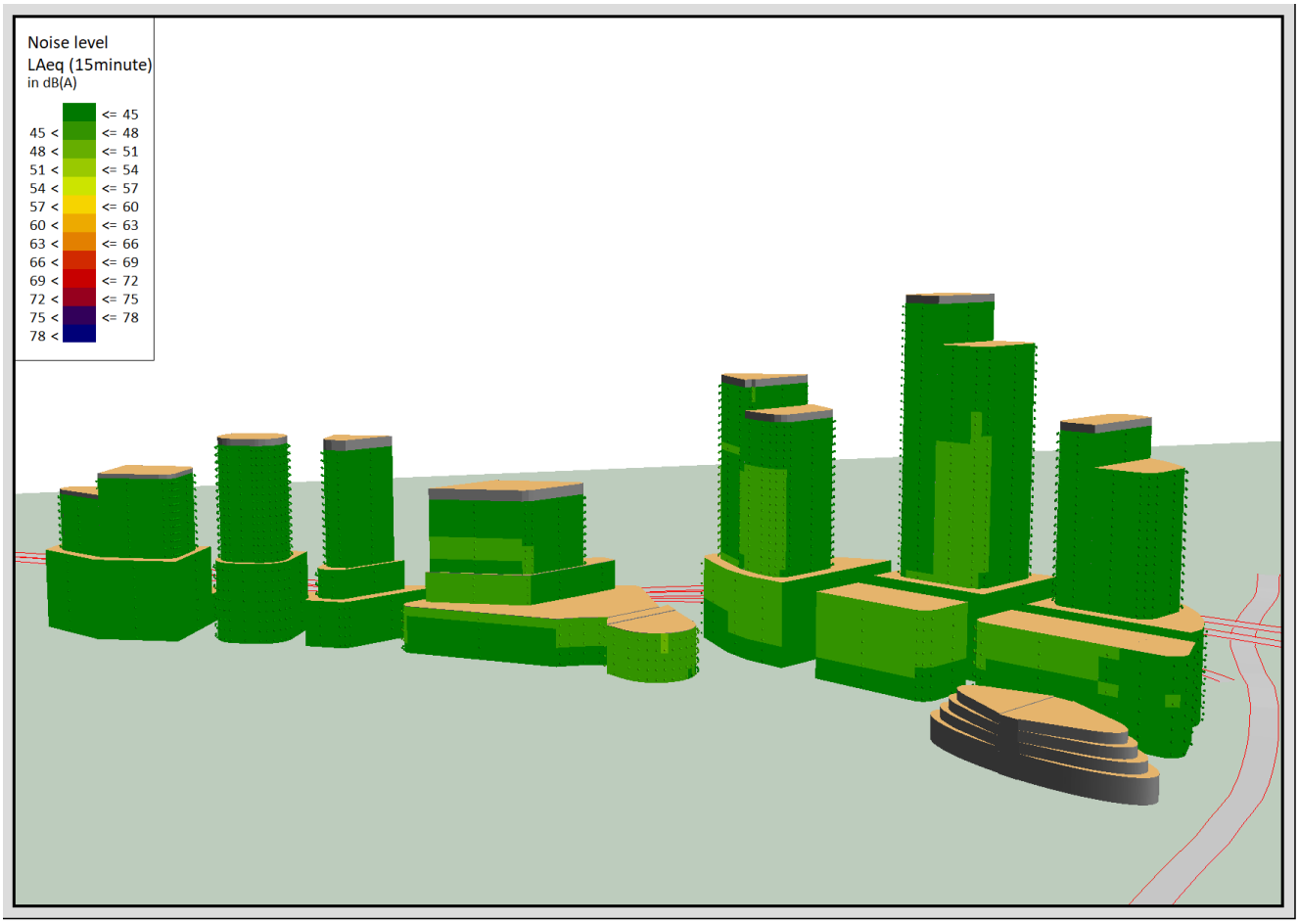


Figure C13 Eastern/North-eastern Facade Outdoor Patron Façade Noise Map

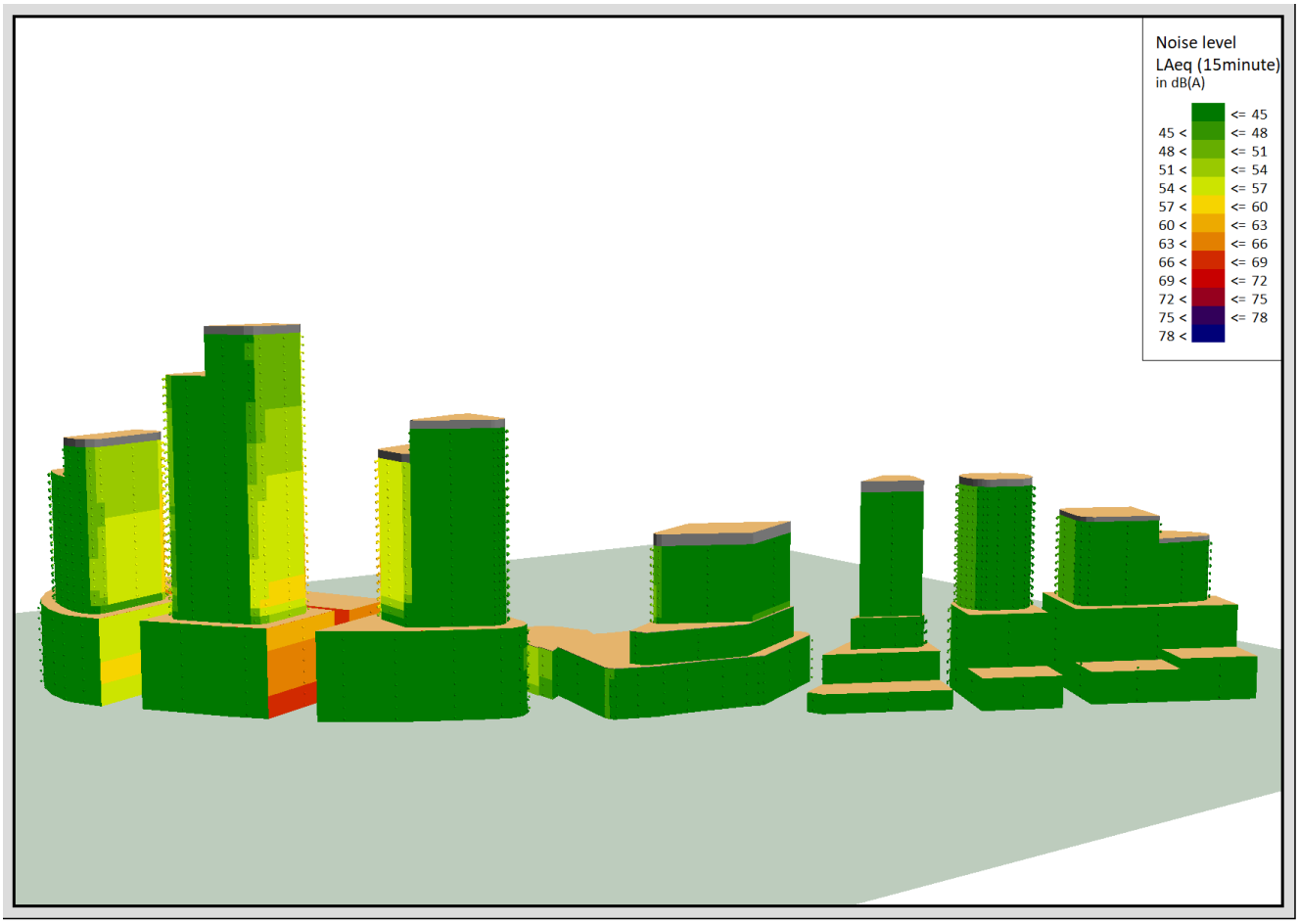
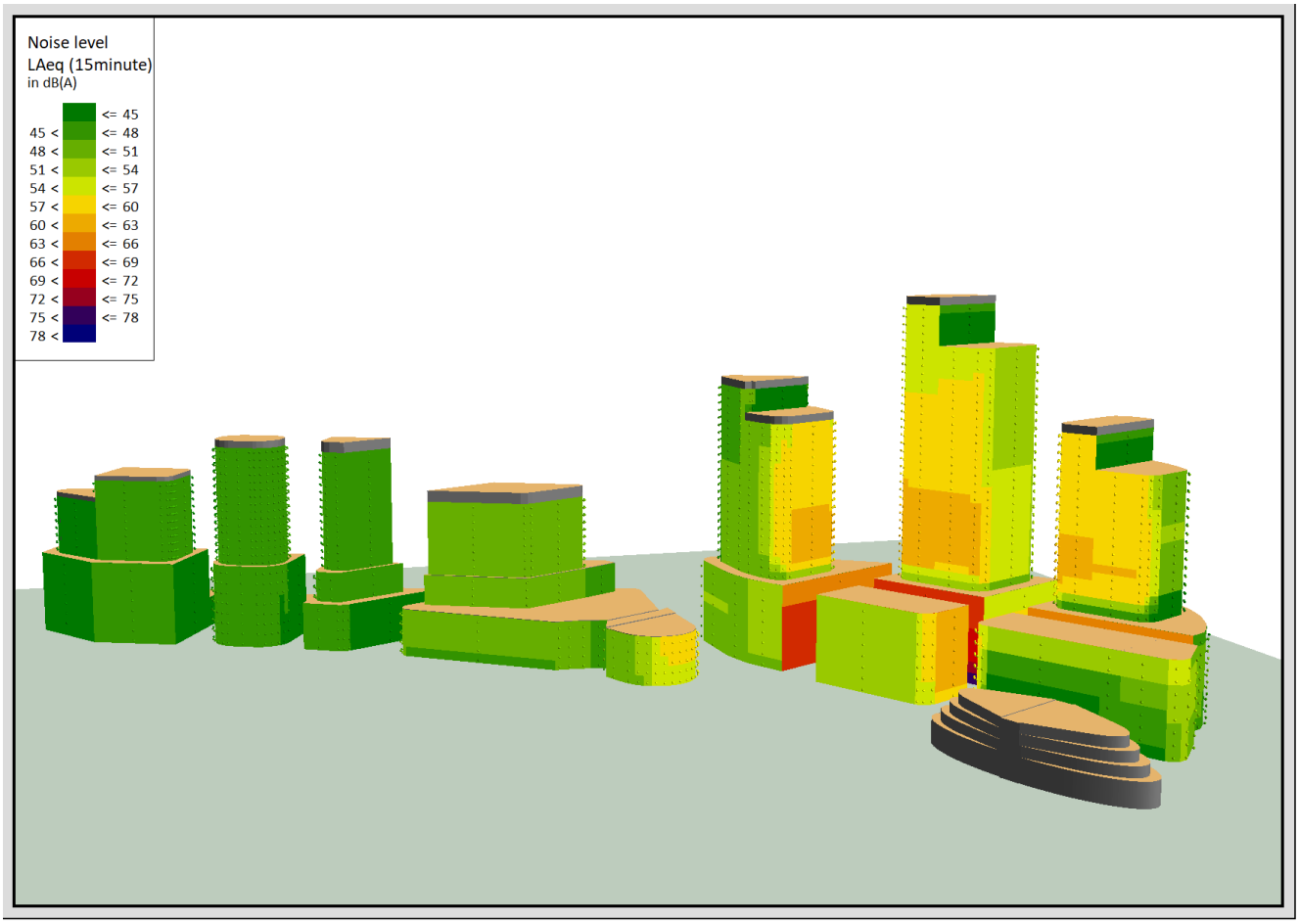


Figure C14 Western/South-western Facade Outdoor Patron Façade Noise Map



APPENDIX D

BLACKWATTLE BAY STAGE 1 NOISE & VIBRATION STUDY

we are insw Infrastructure New South Wales

Noise and Vibration Study

Existing Environment Report

A report to support the Bays Market District State Significant Precinct Proposal

DATE

Issue date:
September 2019
Version:
Issued and authorised by:
SLR Consulting Pty Ltd

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Executive Summary

Objectives

The purpose of this report is to address the Study Requirements relevant to Noise and Vibration. This report provides a comprehensive baseline investigation to address part of the Study Requirements to assist in determining the Precinct Proposal and the new planning framework for 'Blackwattle Bay'. Future work will include detailed assessment of the potential impacts from the project.

Methodology

The following activities have been completed as part of this study:

- Comprehensive baseline noise monitoring at the site and surrounds
- Modelling the noise impacts on potential future development on the site
- High level summary of potential key issues and recommendations made regarding mitigation / management options to be considered in the next stages of the project.

Findings

- The site has no significant vibration impacts.
- The existing noise environment throughout the project area is generally controlled by road traffic noise. The major arterial road near the project is the Western Distributor/Anzac Bridge, which passes adjacent to the north of the project in an elevated location.
- Careful consideration of the design in terms of massing and building orientation are required near to major roads in order to achieve internal noise levels with natural or crossflow ventilation, in particular adjacent to the Western Distributor/Anzac Bridge.

Conclusions

Provided sufficient and considered detailed design development is undertaken in line with the framework established within this report, there are no existing noise conditions which would preclude future residential development on the site from achieving compliance with the established policy and guideline requirement noise levels.

1. Introduction

The Minister for Planning has determined that the Bays Precinct is of State planning significance which should be investigated for rezoning through the State Significant Precinct process. Study Requirements for 'Blackwattle Bay' (formerly the Bays Market District) investigations were issued by the Minister on 28 April 2017.

Relocating the existing Sydney Fish Market is the catalyst that will facilitate the rezoning and subsequent regeneration of Blackwattle Bay. The NSW Government has lodged a State Significant Development Application (SSDA) for relocation of the Sydney Fish Markets to the head of Blackwattle Bay. The design of the new Sydney Fish Market has ensured that key aspects of the project are consistent with the vision for Blackwattle Bay. This was achieved through concurrent baseline analysis and investigations of the broader area, to inform both the SSDA and State Significant Precinct process.

The outcome of the State Significant Precinct process will be a new planning framework that will enable further development applications for the renewal of the Precinct, connected to the harbour and centred around a rejuvenated Sydney Fish Market. The framework will also provide for new public open spaces including a continuous waterfront promenade, community facilities, and other compatible uses.

This report provides a comprehensive baseline investigation to address part of the Study Requirements to assist in determining the Precinct Proposal and the new planning framework for 'Blackwattle Bay'. The Precinct Proposal will be finalised, exhibited and coordinated with the determination of the SSDA for the relocation of the Sydney Fish Markets.

1.1. Purpose

The purpose of this report is to address Study Requirements for Noise.

1.2. ‘Blackwattle Bay’ State Significant Precinct

The ‘Blackwattle Bay’ State Significant Precinct (SSP) investigation area is located less than 2km west of Sydney’s CBD (refer **Figure 1**). The land area is located partially within the City of Sydney local government area (LGA). The water area is within the Sydney Harbour Catchment.

Figure 1 Location and site plan of the Precinct Source: FJMT

The ‘Blackwattle Bay’ land area is approximately 9.2 hectares (ha) of primarily government owned land containing the Sydney Fish Market (wholesale and retail), cruise and boating operations and facilities, and 3 privately owned sites. ‘Blackwattle Bay’ land area wraps around the southern and eastern edges of Blackwattle Bay and is bounded by Bridge Road to the south and Bank Street to the east. The Western Distributor road / Anzac Bridge is located adjacent to the eastern boundary before traversing over the northern section of the site. The water area of ‘Blackwattle Bay’ is approximately 24 hectares.

The location of the existing and proposed Sydney Fish Market site within the ‘Blackwattle Bay’ investigation area is shown at **Figure 2**.

Figure 2 Blackwattle Bay Source: Infrastructure NSW

1.3. Principles and Vision for 'Blackwattle Bay'

The Principles for 'Blackwattle Bay' were formed through extensive community consultation in August 2017. Through stakeholder meetings, community workshops and an online survey, 13 principles for the regeneration of 'Blackwattle Bay' were established. These include:

landscape + environment

1. Improve access to Blackwattle Bay, the foreshore, and water activities for all users
2. Minimise additional shadowing to Wentworth Park and the Glebe Foreshore in mid-winter
3. Pursue leading edge sustainability, climate change resilience and improved water quality outcomes

access + movement

4. Prioritise movement by walking, cycling and public transport
5. Balance diverse traffic movement and parking needs for all users
6. Link the Bays Market District to the City, Glebe, Pyrmont, Ultimo, Glebe Island and White Bay

land uses + built form

7. Mandate Design Excellence in public domain, landscape and built form design

8. Integrate housing, employment and mixed uses suitable to living on the city's edge and the site's characteristics
9. Maintain and enhance water-based uses and activities
10. Allow for co-existence of evolving land uses over time

social, economic + community

11. A place for everyone that is inviting, unique in character, and socially inclusive
12. Expand the range of active, recreational and community facilities, such as the Waterfront Promenade
13. Plan for the community's education, health, social and cultural needs

The Vision for 'Blackwattle Bay', which builds on the Principles, is:

> *A welcoming new harbour side place for all of Sydney. Connected to its past and its surrounding communities, and providing a vibrant and amenable environment for all who visit.*
>
> *A complement to the new Fish Market, 'Blackwattle Bay' will be a forward looking place to live, work and play. A place to gather, to innovate and to celebrate.*
>
> *The 'Blackwattle Bay 'vision is for a new public place for Sydney, formed in the natural and man built environment of Blackwattle Bay and embracing indigenous and European heritage, working harbour past and looking forward to a new connected, vibrant and innovative future.*

1.4. Study Requirements

On 28 April 2017 the Minister issued Study Requirements for the Precinct. Of relevance to this study are the following requirements:

> ***22. Noise and Pollution***
>
> *22.1. Provide a noise impact assessment for the proposal. The assessment will address the relevant policies and guidelines in relation to noise including State Environmental Planning Policy (Infrastructure) 2007 and the Development Near Rail Corridors and Busy Roads – Interim Guideline.*
>
> *22.2. Consider and assess potential pollution impacts from the proposed rezoning including, but not limited to, water, air, noise and light pollution..*
>
> *22.3. Provide an air quality assessment for the proposal. The assessment will address the relevant policies and guidelines in relation to air quality including State Environmental Planning Policy (Infrastructure) 2007 and the Development Near Rail Corridors and Busy Roads – Interim Guideline. These assessments should also consider other current and future local air and noise issues in the Bays area, including potential cumulative impacts from the current Sydney Fish Market and from maritime uses in the Bay*
>
> *22.4. Consider the approaches conceptually being applied in the Parramatta Road Corridor Urban Transformation Strategy (noting the difference in noise levels on a vertical plane). A copy of these measures can be obtained at http://www.urbangrowth.nsw.gov.au/assets/Projects/Parramatta-Road/Publications-161109/Strategy-Documents/6.-Implementation-Tool-Kit-Planning-and-Design-Guidelines-November-2016.pdf.*
>
> *22.5. Identify and map current and proposed future sensitive receptors (eg residential uses, schools, child care centres and public open spaces).*

22.6. Identify current and likely future noise, vibration and pollution affecting the precinct, including sources and nature and impact. Site monitoring will be required to determine current road noise levels for the Anzac Bridge approach, Western Distributor, Bank Street and Bridge Road at a minimum Monitoring will also be required to determine current noise levels from the Sydney Fish Market (particularly from service vehicles) and maritime uses in the bay. 3D mapping to clearly communicate these impacts, including demonstrating for example how noise reduces with distance from the source, or with the use of barriers, is desirable.

22.7. Assess the impact of potential noise generated from the relocated fish market on Sydney Secondary College and Blackwattle Bay Campus (particularly during exam times).

22.8. Model the likely future noise, vibration and pollution scenario based on 3D block envelope diagrams prepared by the consultant appointed urban designer. This is to include noise generated by road rail and maritime uses and noise from the Sydney Fish Market, particularly from service vehicles

22.9 Recommend appropriate noise and vibration mitigation measures. The consultant is expected to work with the consultant appointed urban designer, and suggested measures are to cover new buildings (ie careful siting and layout of buildings maintaining natural ventilation through open windows as required by the Apartment Design Guide)

22.10 Outline the recommended measures relating to noise, vibration and pollution to minimise the nuisance and harm to people or property within / adjoining the precinct.

This report will address the above noise related requirements (conditions 22.1-22.6), excluding any assessment of the Sydney Fish Market which is subject to a separate assessment completed for that project. The remaining requirements in relation to noise will be addressed as part of the finalisation of the Precinct Study.

2. Existing Noise Environment

AT A GLANCE:
This section summarises the existing noise environment surrounding the site and relevant noise criteria to be used when developing masterplanning options.

2.1. Existing Noise Sources

1.1.1 Road Traffic Noise

The existing noise environment throughout the project area is generally controlled by road traffic noise. The major arterial road near the project is the Western Distributor/Anzac Bridge, which passes adjacent to the north of the project in an elevated location. This road becomes congested during peak hours, which can create increased noise at certain times from the acceleration and deceleration of vehicles. The surface appears to be a worn dense-graded asphalt (DGA) pavement and is likely to perform consistent with the standard DGA pavement road surface correction for the purposes of road noise modelling.

Other major roads near the site include Pyrmont Bridge Road, Bridge Road and Wattle Street to the south east of the site. Vehicle speeds on these roads are typically slower than the Western Distributor which results in lower noise generation per vehicle. Congestion during peak hours also affects these routes, especially around intersections.

1.1.2 Railway Noise

The Dulwich Hill Light Rail line passes around the north east and south east of the site, with the Fish Market and Wentworth Park stops being located approximately 50 m and 100 m respectively away from the proposal site. The track alignment to the north east is located in a cutting whereas the track to the south east is on embankment and viaduct through Wentworth Park.

Noise from light rail vehicles was audible around Wentworth Park during the site surveys, however it was not audible in any other areas surrounding the project due to high existing road traffic noise levels. While the rail noise may be audible at times in the vicinity of the elevated rail at Wentworth Park, it is unlikely to be a controlling noise source due to the busy surrounding road network.

1.1.3 Industrial Land Use Noise Sources

Existing industrial premises are located within the northern section of the proposal site, on Bank Street. Noise levels measured in the vicinity of these premises are currently influenced by industrial noise, especially where line-of-sight to the Western Distributor is shielded by intervening structures.

2.2. Ambient Noise Surveys and Monitoring Locations

To quantify and characterise the existing ambient noise environment across the proposal area, a baseline noise monitoring survey was undertaken in February 2018. The measured noise levels have been used to establish existing ambient noise levels throughout the project area and to develop a detailed understanding of the existing noise environment.

Noise monitoring equipment was deployed with consideration of other noise sources that may influence the measurements, accessibility and security, and with the consent of relevant land owners. The noise monitoring locations are shown in **Figure 3** and outlined in **Table 1**.

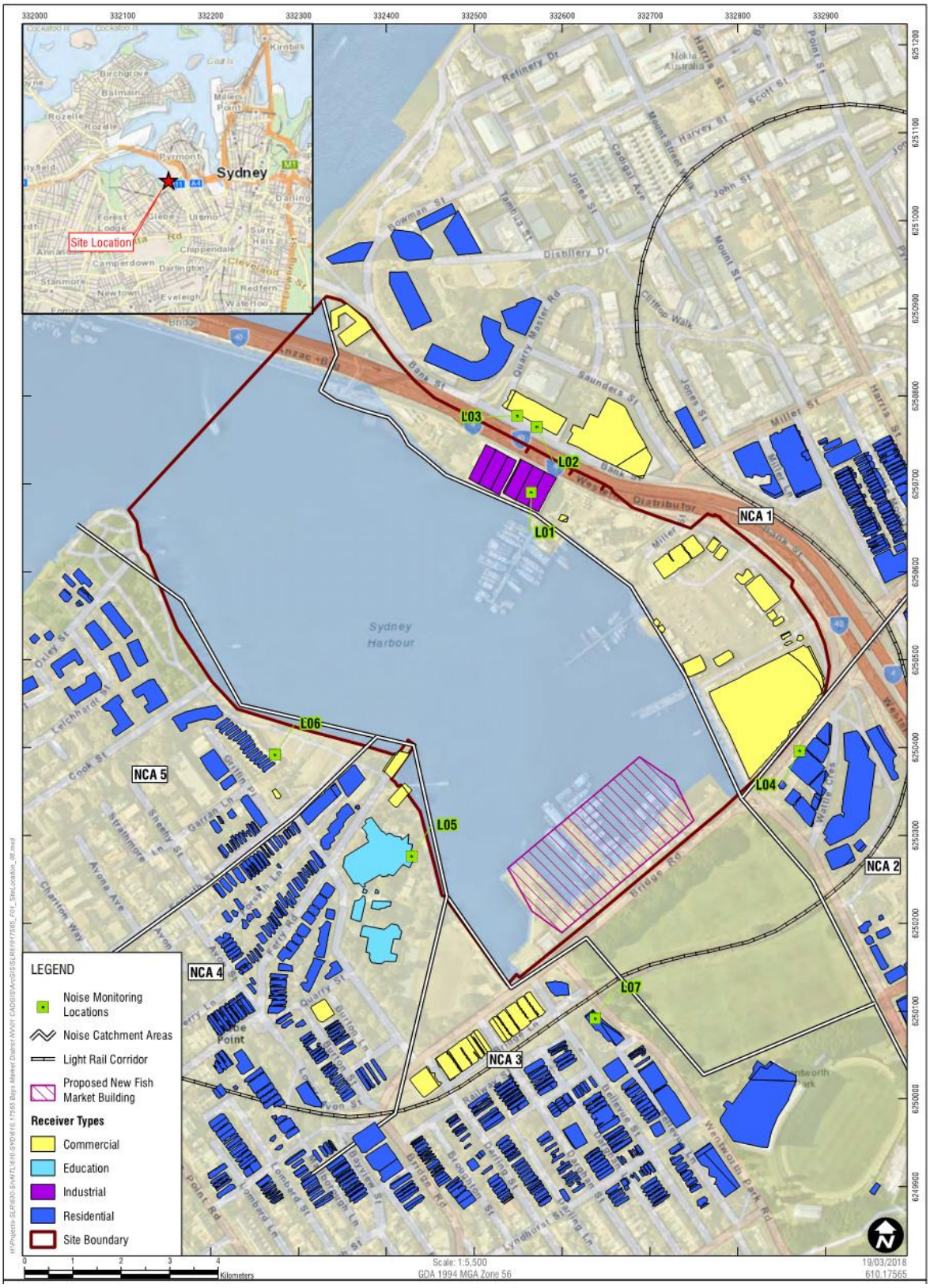


Figure 3 Site Plan – NCAs, Noise Logging Locations and Sensitive Receivers

Table 1 Ambient Noise Logger Overview

ID	Location	Monitoring Period	Model	Serial Number
L01	31-35 Bank Street, Pyrmont	08/02/2018 - 15/02/2018	ARL EL-316	16-004-038
L02	Goodman Building, Rooftop, 123 Bank Street, Pyrmont	08/02/2018 - 16/02/2018	B&K 2250L	3005908
L03	Goodman Building, at the level of the Western Distributor, 123 Bank Street, Pyrmont	08/02/2018 - 16/02/2018	B&K 2250L	3005904
L04	Unit 217, 1 Wattle Crescent, Pyrmont	12/02/2018 - 16/02/2018	SVAN956	20668
L05	Sydney Secondary College, Taylor St, Glebe	08/02/2018 - 15/02/2018	ARL EL-316	16-306-044
L06	13 Griffin Place, Glebe	08/02/2018 - 15/02/2018	ARL EL-316	16-207-021
L07	6/82 Wentworth Park Road, Glebe	08/02/2018 - 15/02/2018	ARL EL-316	16-203-505

Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in **Appendix B**. The charts present each 24 hour period by incorporating the L_{Amax}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods.

The measured data has been filtered to remove periods affected during adverse weather conditions following review of weather data recorded at the Bureau of Meteorology (BOM) Observatory Hill weather station. The filtered data is shown in **Appendix B**.

The data obtained from the ambient noise monitoring was processed in accordance with the procedures contained in the NSW *'Noise Policy for Industry'* (NPfI) to establish Rating Background Level (RBL, background noise level) at the nearest sensitive receivers. The results of this analysis are presented in **Table 2**.

Table 2 Measured Ambient Noise Levels

ID	Location	Measured Noise Level – (dBA)				
		NPfl Periods (RBL1)			RNP Periods (LAeq)	
		Daytime2	Evening2	Night-time2	Daytime (15 hour)	Night-time (9 hour)
L01	31-35 Bank St, Pyrmont	66	64	60	70	67
L02	132 Bank St, Pyrmont (rooftop)	70	70	61	74	72
L03	132 Bank St, Pyrmont (WD Level)	71	71	60	75	71
L04	Unit 217 1 Wattle Crescent, Pyrmont	62	57	50	71	65
L05	Sydney Secondary College	55	54	48	57	53
L06	13 Griffin Place, Glebe	50	51	46	54	50
L07	682 Wentworth Park Road, Glebe	54	50	42	66	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: 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.

2.3. Attended Airborne Noise Measurements

In order to identify noise sources contributing to the ambient noise environment at the nearest sensitive receivers, operator attended spot measurements were conducted at each of the unattended logger locations.

A Brüel and Kjær 2260 sound level meter (serial number 2487418) fitted with a microphone windshield was used for the measurements. Calibration of the sound level meter was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Measurements were conducted in accordance with AS 1055.1-1997: *"Acoustics - Description and measurement of environmental noise – General procedures".*

The results of the operator attended noise measurements are summarised in detail in **Appendix B**.

2.4. Noise Criteria

State Environment Planning Policy

The State Environment Planning Policy (Infrastructure) 2007 (herein referred to as the "Infrastructure SEPP") provides guidelines to ensure that the development of new residential buildings protects the occupants adequately from noise associated with existing road and railway infrastructure. The key objectives of the provisions are to:

- Protect the safety and integrity of key transport infrastructure from adjacent development; and
- Ensure that adjacent development achieves an appropriate acoustic amenity by meeting the internal noise criteria specified in the Infrastructure SEPP.

The key clauses of the Infrastructure SEPP are:

Clause 87 Impact of rail noise or vibration on non-rail development

This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre

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

(a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,

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

Clause 102 Impact of road noise or vibration on non-road development

This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

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

(a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,

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

City of Sydney Development Control Plan

The City of Sydney Development Control Plan provides noise criteria for the development of new residential houses and units. Provided below is a summary of the requirements relevant to external noise.

1 The repeatable maximum LAeq(1 hour) for residential buildings and serviced apartments must not exceed the following levels:

a. for closed windows and doors:

- 35 dB for bedrooms (10pm-7am); and
- 45 dB for main living areas (24 hours).

b. for open windows and doors:

- 45 dB for bedrooms (10pm-7am); and
- 55 dB for main living areas (24 hours)

2 Where natural ventilation of a room cannot be achieved, the repeatable maximum $L_{Aeq\ (1hour)}$ level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:

- 38dB for bedrooms (10pm-7am); and
- 48dB for main living areas (24 hours)

3 These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally.

Entertainment / Licenced Premises Noise

It is considered likely that future development on the site will contain a mix of commercial and residential development, with potential Food and Beverage offerings. In order to maintain the amenity to residential receptors both on and off the site, noise from any potential future entertainment or Food and Beverage / Licenced Premises should be controlled.

The proposed criteria below are based on standard conditions originally developed by Liquor and Gaming NSW, but have since been withdrawn. Nonetheless, it is common and appropriate to apply the criteria to noise emissions from licensed premises in NSW, and these same are commonly adopted by the City of Sydney in Conditions of Approval for licenced premises.

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.*

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.

** For the purposes of this condition, the LA10 can be taken as the average maximum deflection of the noise emission from the licensed premises.*

2.5. Existing Traffic Noise Model

A noise model has been developed to visualise the existing noise environment throughout the Investigation Area. The local road noise sources have been modelled using Sound PLAN and the Calculation of Road Traffic Noise (CoRTN) algorithm. Only road traffic noise has been modelled as it is the dominant noise source in the area.

Ground elevation contours have been used in the noise modelling, incorporating a resolution of 2 m. Buildings have been digitised from aerial photography, LiDAR and a visual survey confirming heights.

The road traffic noise model of existing conditions at the proposal site has been calibrated to the L_{Aeq} noise levels measured during the ambient noise survey, as shown in **Table 2**.

1.1.4 Noise Mapping Results

Existing Conditions

Noise levels have been predicted across the Investigation Area representing the existing exposure to road traffic noise during the daytime and night-time periods. The results of the predictions are provided below in Figure 4 and **Figure 5** as grid noise maps that represent the predicted noise level at 1.5 m above existing ground level.

The daytime noise predictions represent the period from 7 am to 10 pm and the night-time period is 10 pm to 7 am.

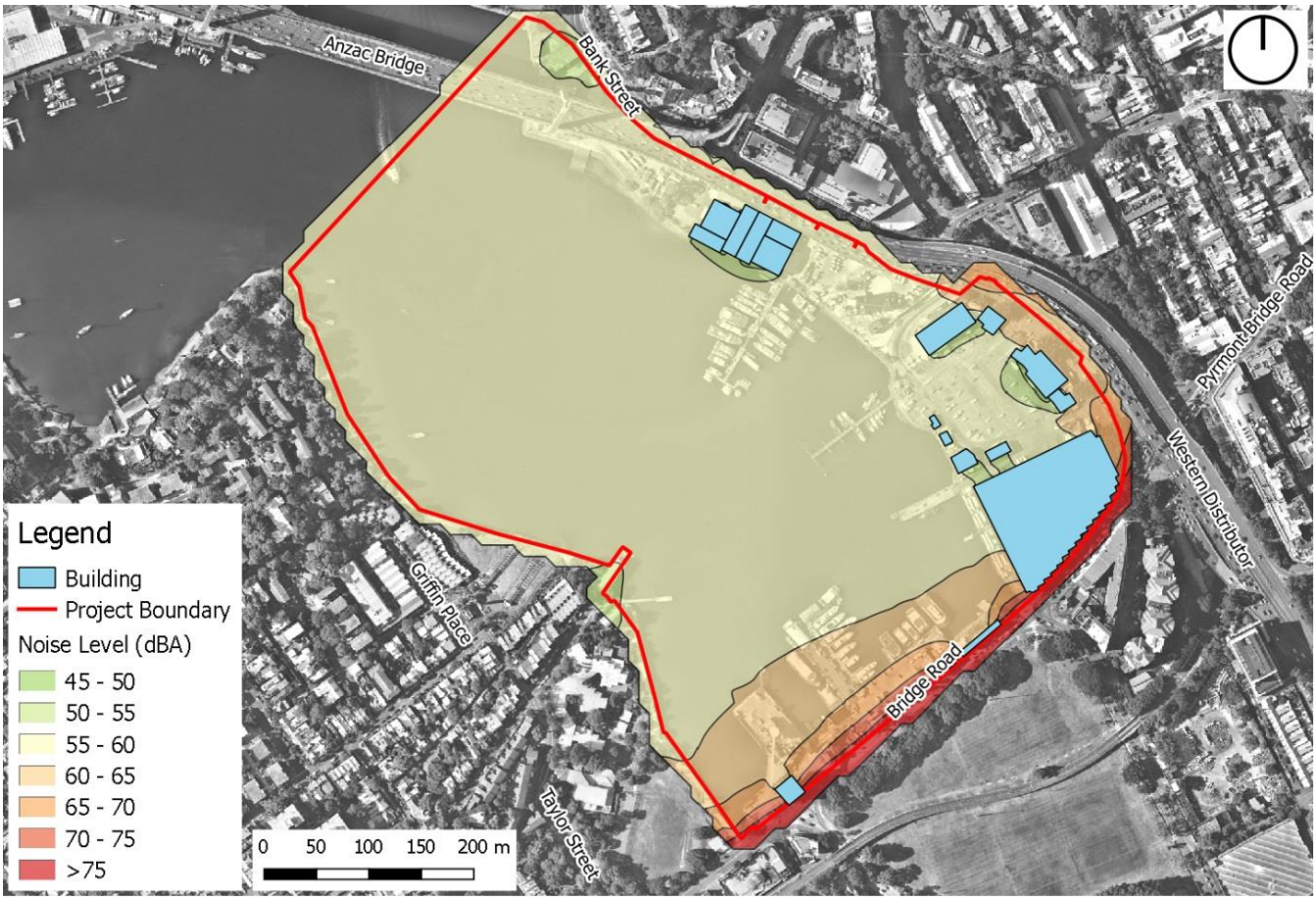


Figure 4 Existing Daytime Noise Levels (LAeq(15hour))

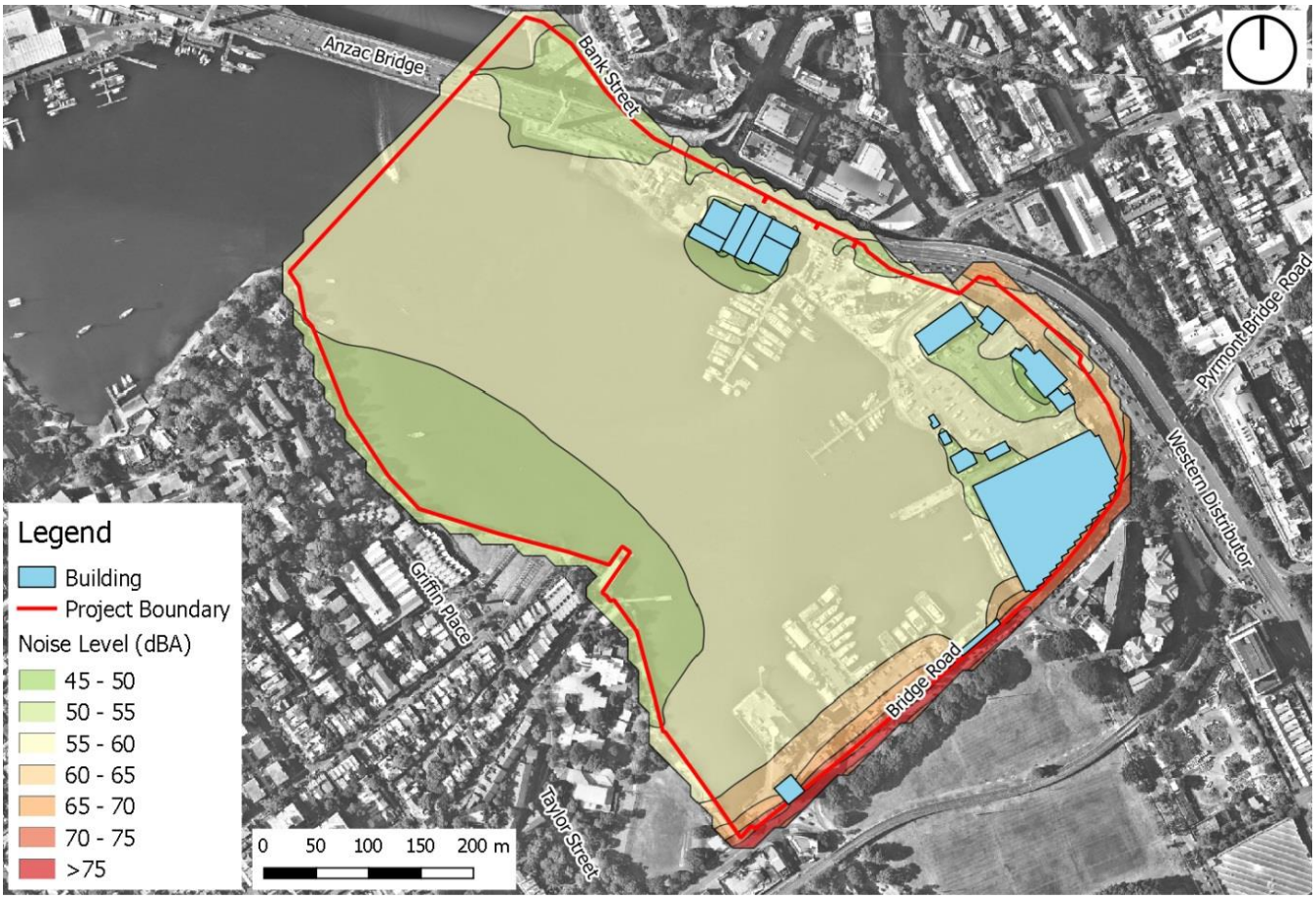


Figure 5 Existing Daytime Noise Levels (LAeq(15hour))

These results show that noise levels within the Investigation Area are controlled by traffic on the surrounding roads, including the Western Distributor and Bridge Road. Noise levels are highest in locations of the Investigation Area that are immediately adjacent to Bridge Road due to the lack of any screening between this area and the road.

High noise levels are also apparent in the north eastern section of the site, which is adjacent to the Western Distributor and the intersection of Pyrmont Bridge Road. Noise levels are however slightly lower here than next to Bridge Road due to the elevated position of the Western Distributor, which shields the noise from this source to some degree.

Quieter areas are located to the western side of the site, especially on the shore opposite the existing fish markets, which is due to the increased separation distance from the major roads in the area.

The results in Figure 4 and Figure 5 are presented at a level 1.5m above ground. It should be noted that along the north eastern boundary of the site, noise levels will significantly increase with height as the grid noise maps reach (or are above) the height of the Western Distributor. Grid noise maps at Western Distributor level are provided in the following section.

2.6. Existing Conditions – All Blackwattle Bay Buildings Removed

Calculations of the potential noise impacts across the site with the removal of existing buildings within the Blackwattle Bay Investigation Area are shown below in Figure 6 and **Figure 7**. Noise levels have again been predicted for the daytime and night-time periods at a height of 1.5 m above local ground.

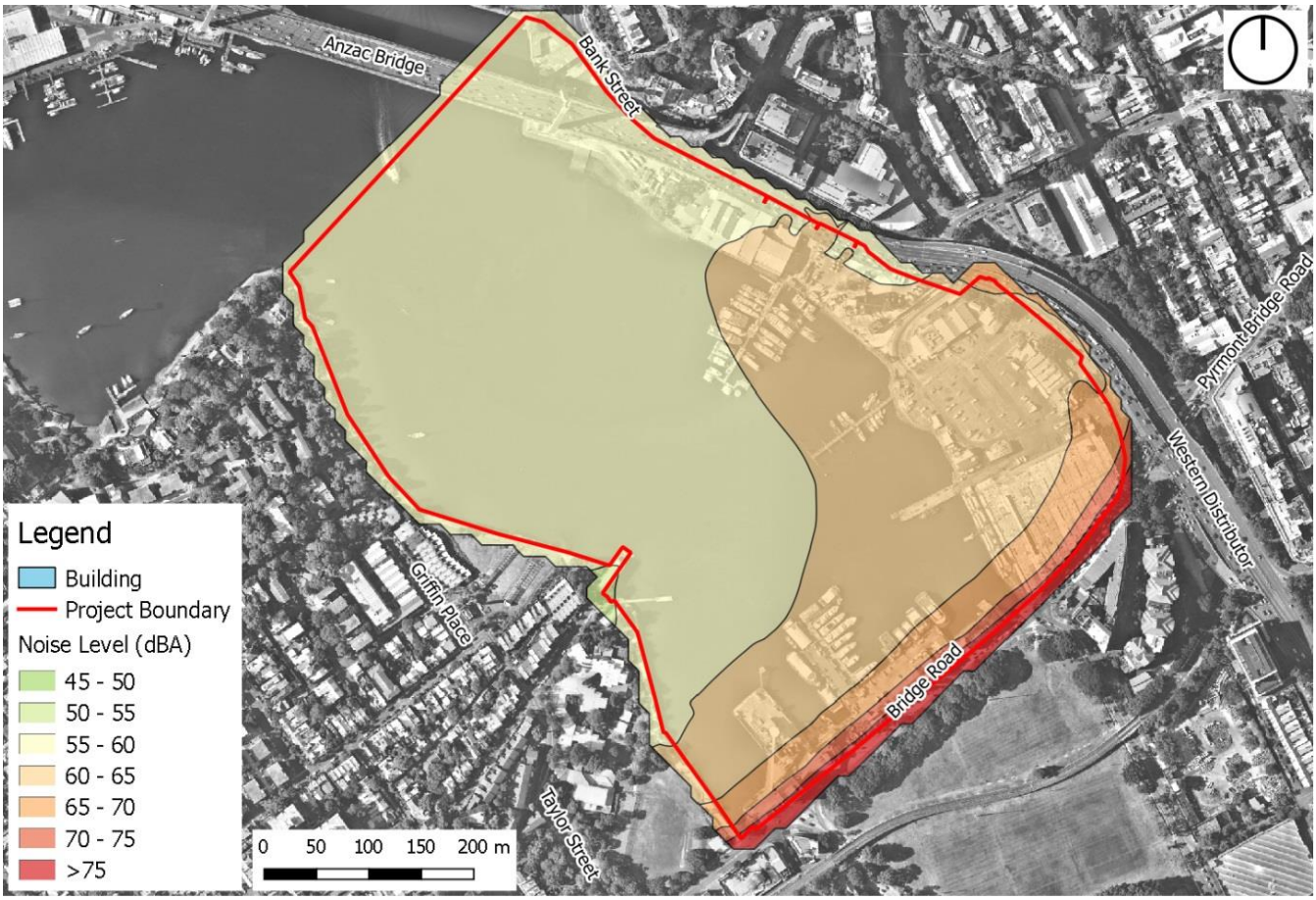


Figure 6 Existing Daytime Noise Levels (LAeq(15hour)) – No Buildings

Figure 7 Existing Night-time Noise Levels (LAeq(9hour)) – No Buildings

The results indicate that without the existing buildings shielding the surrounding roads, noise levels from road traffic are likely to extend further into the Investigation Area, particularly around the north eastern section near the location of the existing Sydney Fish Market site.

This increase shows the noise benefit that can potentially be achieved by locating buildings (or structures) towards the boundary of the Investigation Area, adjacent to major roads, to provide shielding to the internal areas.

As the Western Distributor is located in an elevated position with respect to the Investigation Area, an additional calculation scenario has been modelled at 25 m above ground height. This represents a location generally slightly above the Western Distributor and reflects the upper floors of future buildings that would have line-of-sight to the elevated carriageways of the Western Distributor. The results of this for the daytime and night-time are presented in Figure 8 and **Figure 9**.

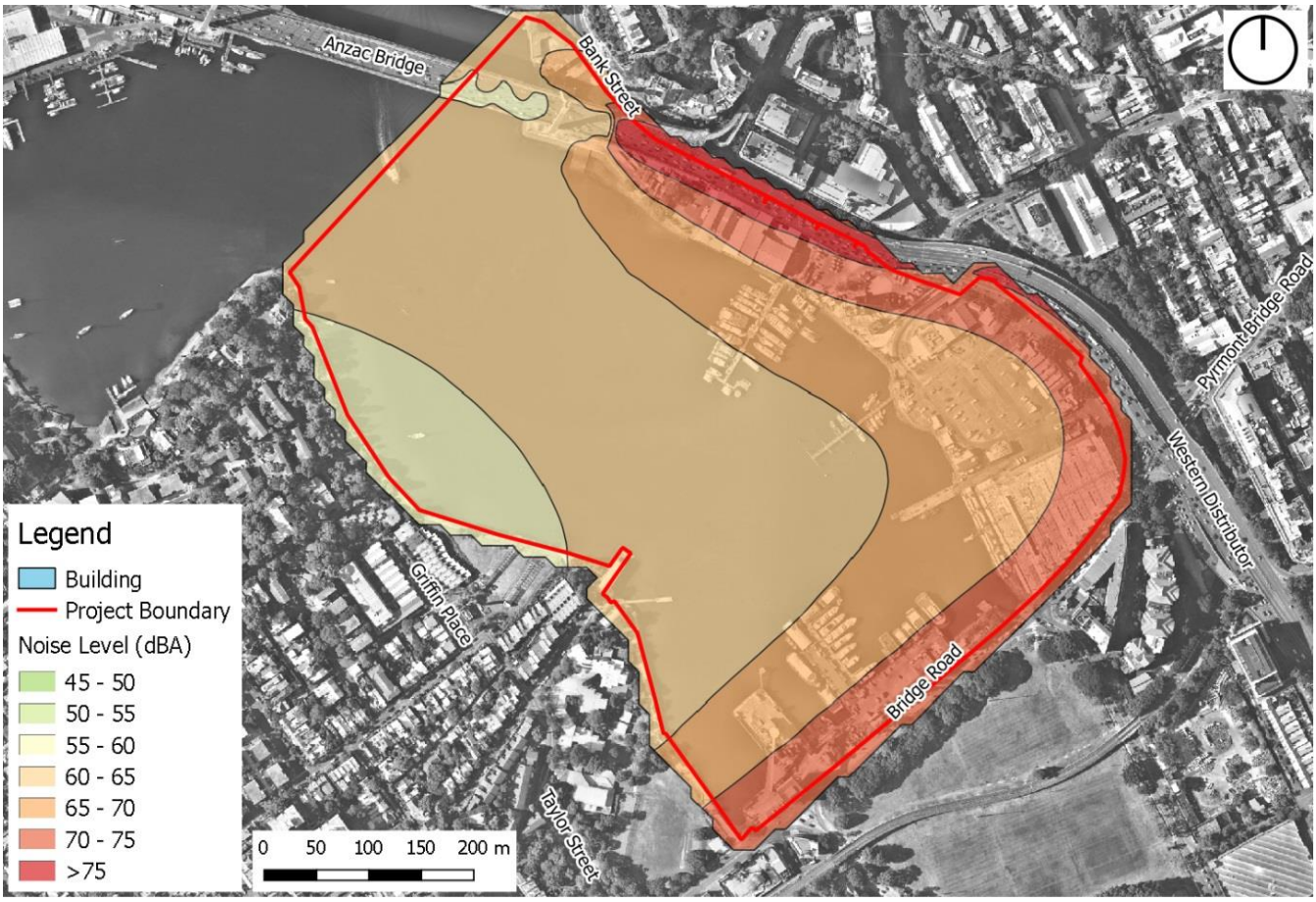


Figure 8 Existing Daytime Noise Levels (LAeq(15hour)) – No Buildings, 25m Height above Ground

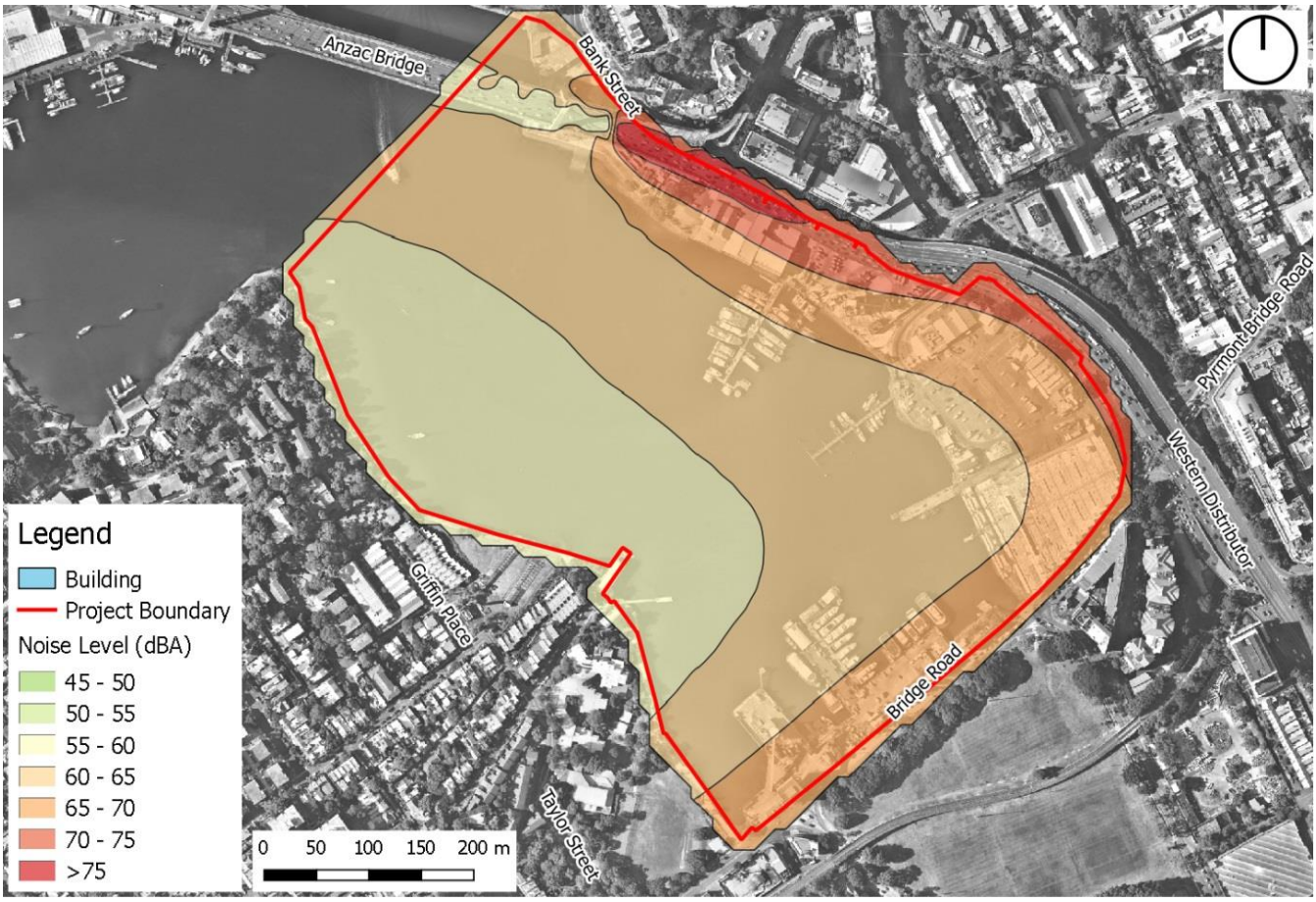


Figure 9 Existing Night-time Noise Levels (LAeq(9hour)) – No Buildings, 25m Height above Ground

The above shows substantially increased noise levels across the site at a height of 25 m above ground level due to line-of-sight to the Western Distributor at this level. Noise increases of between 5 and 15 dB are predicted when compared to ground level, with the largest increases being at the northern and north eastern boundaries.

Future buildings with floors at or above this height would need to be appropriately constructed to take into consideration the high level of road traffic noise in this area. Mitigation would likely include upgraded facade and/or glazing requirements for facades with line-of-sight to the surrounding roads, and optimisation of the internal layout of buildings to locate less sensitive usages on facades exposed to high levels of road traffic noise.

3. Existing Vibration Environment

3.1. Existing Vibration Environment

There are currently no major vibration sources located in or near to the Investigation Area. Road traffic typically generates relatively low levels of vibration which are generally well below the applicable criteria.

Where significant discontinuities in the pavement occur, such as potholes or poorly maintained plates of bridge joints, vibration levels are sometimes able to be perceived in close proximity to the road when heavy vehicles pass by. Such vibration generating circumstances are however typically considered a maintenance issue rather than a design issue, and are therefore not assessed.

3.2. Vibration Criteria

Although vibration requirements are not specified in the Infrastructure SEPP, impacts from vibration associated with transport infrastructure are commonly translated into ground-borne noise. Where vibration is apparent, transmission into nearby buildings will need to be controlled to ensure that ground-borne noise levels comply with the internal airborne noise criteria for residential buildings discussed in Section 2.4.

3.3. Future Vibration Environment

The future vibration environment is not anticipated to significantly change from that of the existing situation.

4. Recommendations

4.1. Noise

Noise Impacts on the Development

For the Blackwattle Bay Investigation Area, the Western Distributor, Pyrmont Bridge Road and Bridge Road are the most significant sources of noise, with these roads carrying a significant amount of traffic each day. The removal of buildings currently located on the boundary of these roads and the existing Fish Market would result in an increase in noise levels to internal parts of the site.

The built environment of the Investigation Area should be designed to ensure that line-of-sight is eliminated from Pyrmont Bridge Road and Bridge Road to the residential elements of the Blackwattle Bay as much as practicable. There are however limitations to amount of noise attenuation that this approach can provide, given the elevated nature of the Western Distributor to the immediate north of the site, which is also a significant contributor to noise levels across the precinct.

In particular, current massing options for the design of the Blackwattle Bay places multi-story residential towers in close proximity to the Western Distributor. Such towers will require careful design and internal layout configuration in order to ensure that the noise requirements of the City of Sydney DCP (and the Apartment Design Guideline) can be achieved.

Additionally, the built form should be carefully considered in future developments in order to place non-residential uses in closest proximity to the noise source, as well as providing more sheltered areas and access to ventilation from shielded facades. Examples of this approach can be found in the Urban Growth document "Parramatta Road Corridor Urban Transformation - Planning and Design Guidelines" (Nov 2016, herein referred as the 'Parramatta Road Study'). See Figure 10.

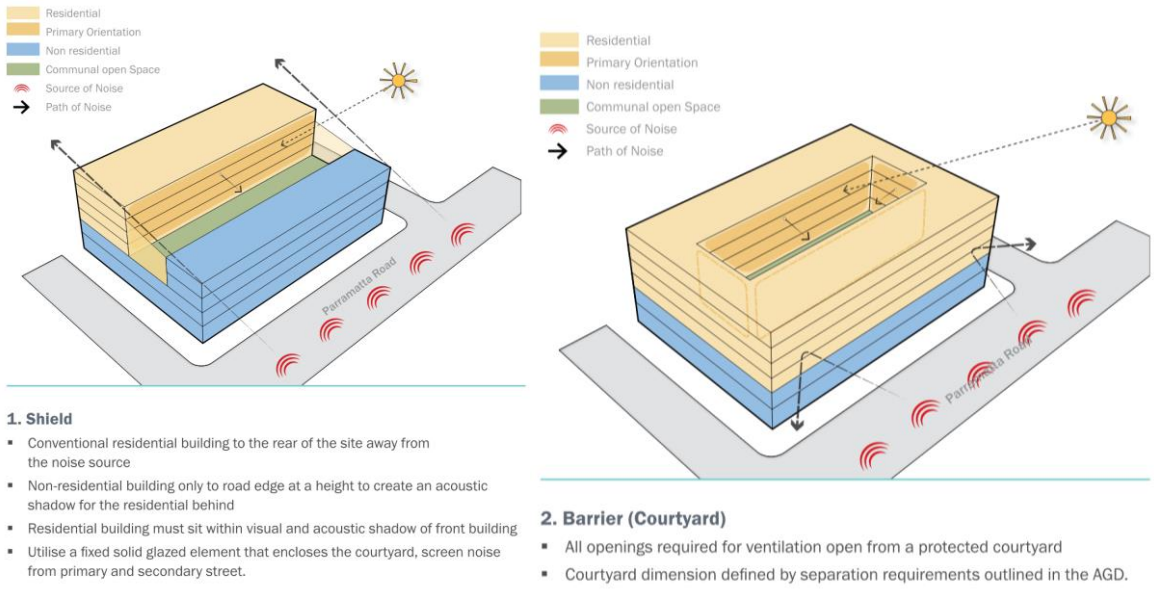


Figure 10 Built form options providing acoustic shielding (taken from the Parramatta Road Study)

SLR understands that the City of Sydney's opinion is the noise requirements of the City of Sydney DCP (and the Apartment Design Guideline) must be achieved within all residential dwellings and the dwellings must also be naturally ventilated. As a result, it is recommended that non-habitable spaces and circulation routes are planned for spaces overlooking the Western Distributor or Bridge Road within any residential towers that are proposed on the northern boundary of the site.

An example of how residential buildings can be designed to shield sensitive sleeping and living areas from road traffic noise is shown in **Figure 11**.

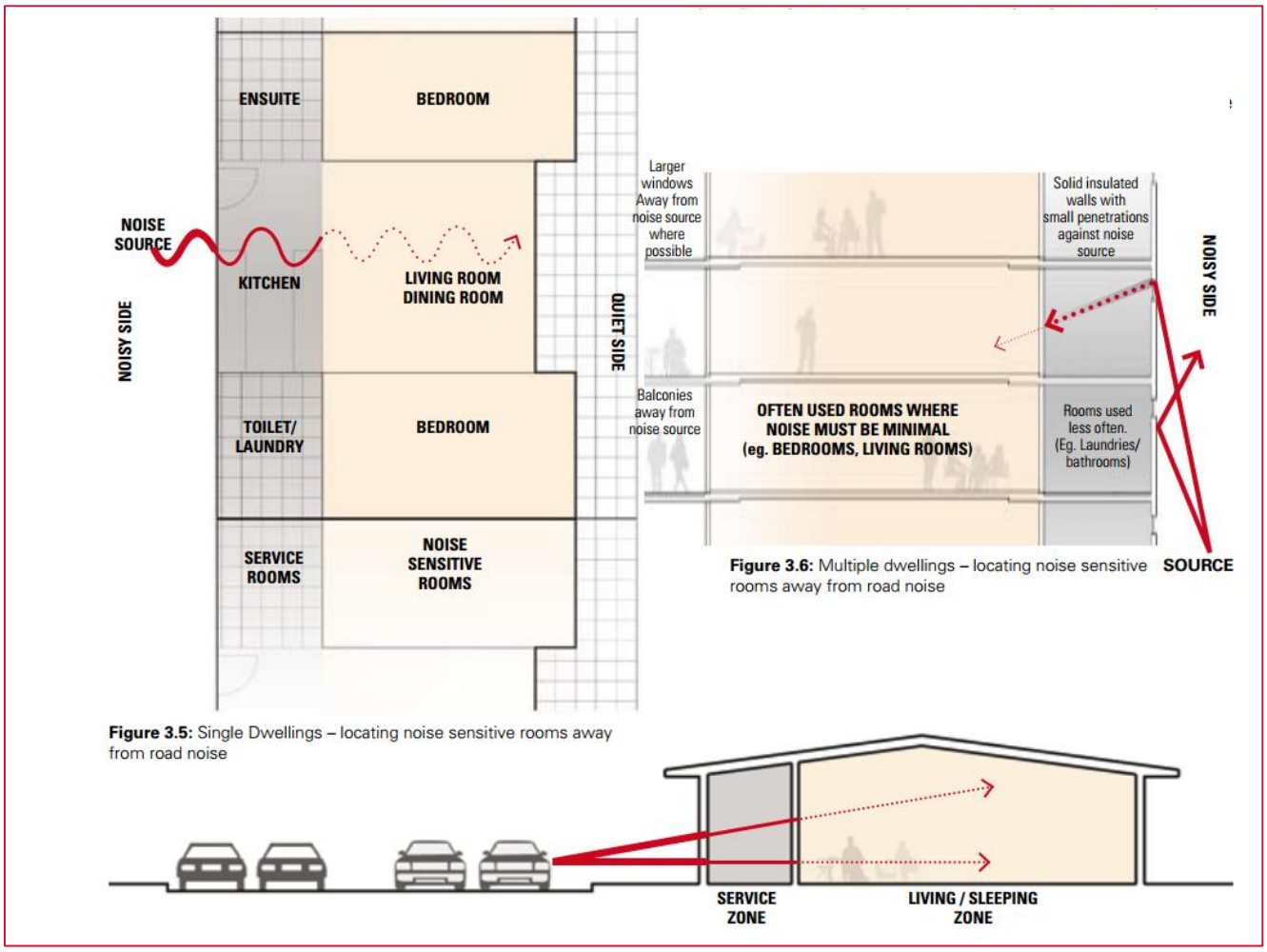


Figure 3.5: Single Dwellings – locating noise sensitive rooms away from road noise

Figure 3.6: Multiple dwellings – locating noise sensitive rooms away from road noise

Note: Taken from DP&I Development near Rail Corridors and Busy Roads – Interim Guideline.

Figure 11 Examples of Design Orientation and Room Layout

Where structures are used to provide shielding to internal areas, the use of multi-storey buildings of at least two storeys would provide the most benefit to non-elevated roads.

The effect of this principle is shown below in **Figure 13** and **Figure 12**. The first image illustrates how uninterrupted noise levels can propagate across a site, whereas the second image illustrates the effect of intervening structures. The comparison shows that significantly lower noise levels can be achieved if acoustic considerations are appropriately applied to the site layout early on in a project.

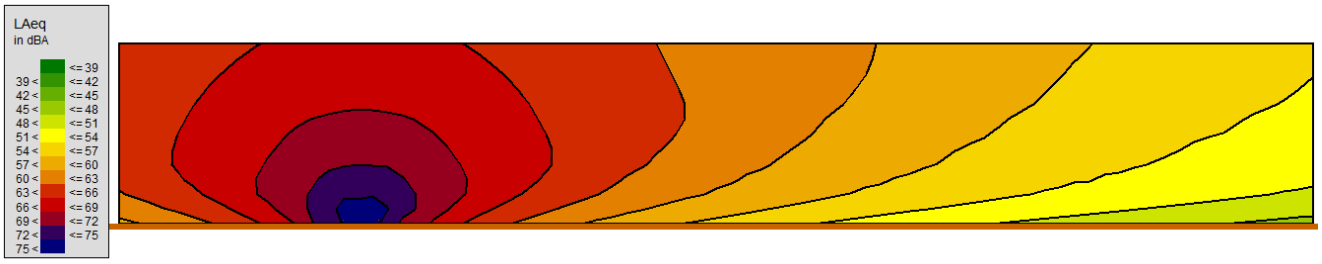


Figure 12 Cross Sectional Noise Map – With Intervening Structures

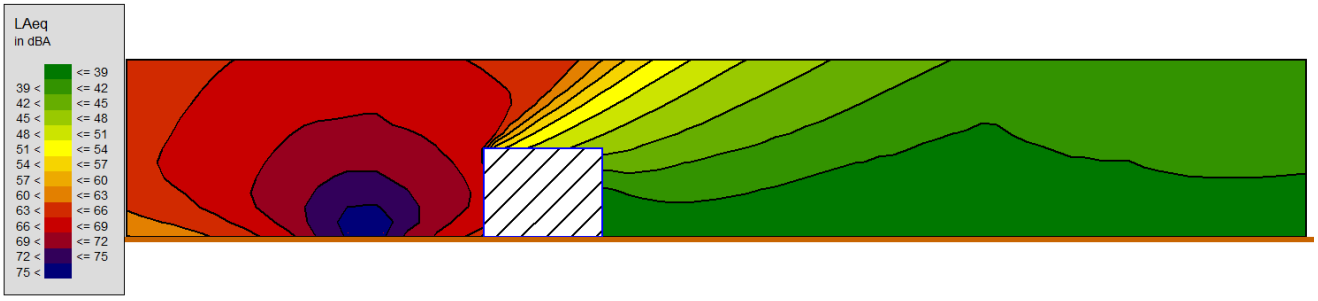


Figure 13 Cross Sectional Noise Map –Without Intervening Structures

Where possible absorptive and diffusive surfaces should also be prioritised in close proximity to road traffic noise sources, or down paths through which noise could potentially propagate.

The provision of quiet spaces for both passive and active recreation has many positive health benefits. To achieve this, green space should be provided within the proposal site which are situated in locations as shielded from roads traffic noise impacts (and other noise sources) as possible. The built environment should be designed with consideration of providing quiet areas shielded from road traffic noise, where possible, however the limitations of being in an area with very high levels of road traffic noise are noted.

While these strategies can help minimise noise propagating into the Blackwattle Bay Investigation Area, for residential developments higher than five to ten storeys (dependant on their location) few at-source mitigation options will be available. These higher properties would be impacted by noise from the surrounding road network to a greater extent than properties closer to the ground. Mitigation options will be limited to the properties themselves, such as specification of increased facade or glazing elements.

Noise Impacts within the Development

Local or internal roads should include traffic calming measures. Speed humps should be avoided as the impacts create additional noise sources. Opportunities such as shared zones, curb extensions, pedestrian refuges, and speed limits should be considered. Measures which reduce the need for vehicles to accelerate throughout the area should be prioritised.

It is considered likely that future development on the site will contain a mix of commercial and residential development, with potential Food and Beverage offerings. In order to maintain the amenity to residential receptors both on and off the site, noise from any potential future entertainment or Food and Beverage / Licenced Premises should be adequately controlled. The preferred method of controlling noise from such sources is to:

- Locate high noise generating uses (such as licenced premises) together and away from areas of residential receptors. Use non-residential zones as buffers to shield residential areas
- Develop precinct plans which appropriately limit operational hours of noisy developments, as well as management plans for reducing noise impacts, as far as practical. Such plans may include the need to close windows / doors of high-noise generating venues at certain times, as well requiring venues to be designed and constructed to control noise egress should predicted internal noise levels within venues exceed a certain limit (to be defined by the design of the building).
- Use appropriate mitigation measures within the design of future residential developments, which may include appropriately upgraded facades and ventilation systems in proximity to high noise-generating uses.

4.2. Vibration

As there are no existing sources of significant vibration in the Investigation Area, there are not anticipated to be any impacts from vibration for the future uses of the site.

5. Conclusion

This report has provided a detailed analysis of the existing noise and vibration environment in the Blackwattle Bay Investigation Area.

Noise

Ambient noise measurements were undertaken over a period of one week at seven locations. The existing noise environment throughout the precinct is typically dominated by road traffic noise.

A detailed noise model was developed to predict road traffic noise levels and illustrate the noise impact across the Investigation Area.

Recommendations have been made with the aim of minimising the potential impacts from the project to the Investigation Area. The recommendations include:

- Provide structures next to busy roads to reduce noise impacts, where possible.
- Develop the layout and configuration of residential towers in proximity to the Western Distributor to achieve the required internal noise levels whilst permitting natural ventilation.
- Provide quiet spaces within the precinct by using the built environment to shield areas from nearby road traffic noise.
- Traffic calming measures to reduce noise from internal traffic routes.
- Noise control within the development area from mixed-uses

Provided sufficient and considered detailed design development is undertaken in line with the framework established within this report, there are no existing noise conditions which would preclude future residential development on the site from achieving compliance with the established policy and guideline requirement noise levels.

Vibration

The area does not currently have any significant sources of vibration and the risk of potential vibration impacts on the future uses of the proposal is considered to be low.

Appendix 1 – 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 LP are commonly used to represent Sound Pressure Level. The symbol LA 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

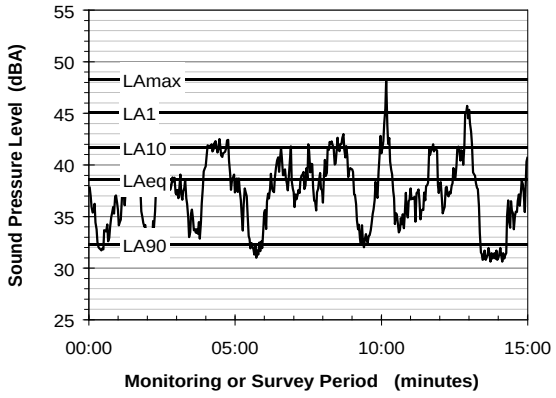
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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 LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 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:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 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.

LAeq 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' LA90 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 (LAeq, LA10, 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

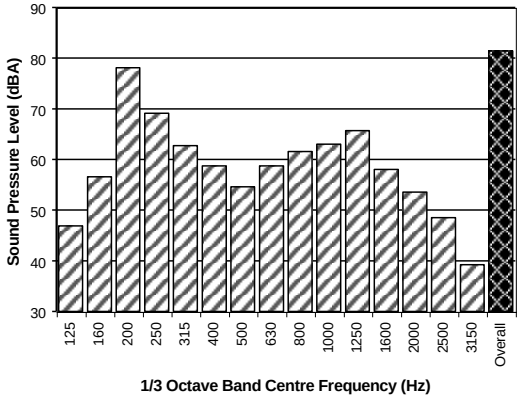
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

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/Vo), where Vo 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

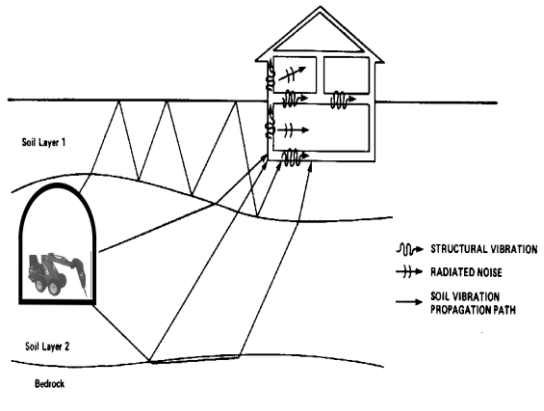
The term 'over-pressure' is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

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 2 – AMBIENT NOISE DATA

Noise Monitoring Location:	**L.01**
Noise Monitoring Address:	**31-35 Bank Street**

Logger Device Type: ARL-EL 316, Logger Serial No: 16-004-038

Sound Level Meter Device Type: Brüel and Kjær 2260, Sound Level Meter Serial No: 2487418

Ambient noise logger deployed at commercial address 31-35 Bank Street, Pyrmont. Logger located directly beneath Western Distributor with in direct line of sight to Bank Street.

Attended noise measurements indicate the ambient noise environment at this location is dominated by road traffic noise from Western Distributor and continuous operational noise emissions from nearby industrial premises. Frequent light and heavy vehicle passbys on Bank Street and intermittent transient operational noise from surrounding commercial properties also contributed to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

08/02/2018: Light-vehicle traffic (Bank Street): 70-77 dBA, Heavy-vehicle traffic (Bank Street): 70-75 dBA, Car park alarm: 72 dBA, Heavy-vehicle traffic (Western Distributor): 72 – 78 dBA, Operational noise: 79 dBA

Map of Noise Monitoring Location

Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	66	71	73	78
Evening	64	68	70	74
Night-time	60	67	67	73

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(Period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	70	71
Night-time (10pm-7am)	67	72

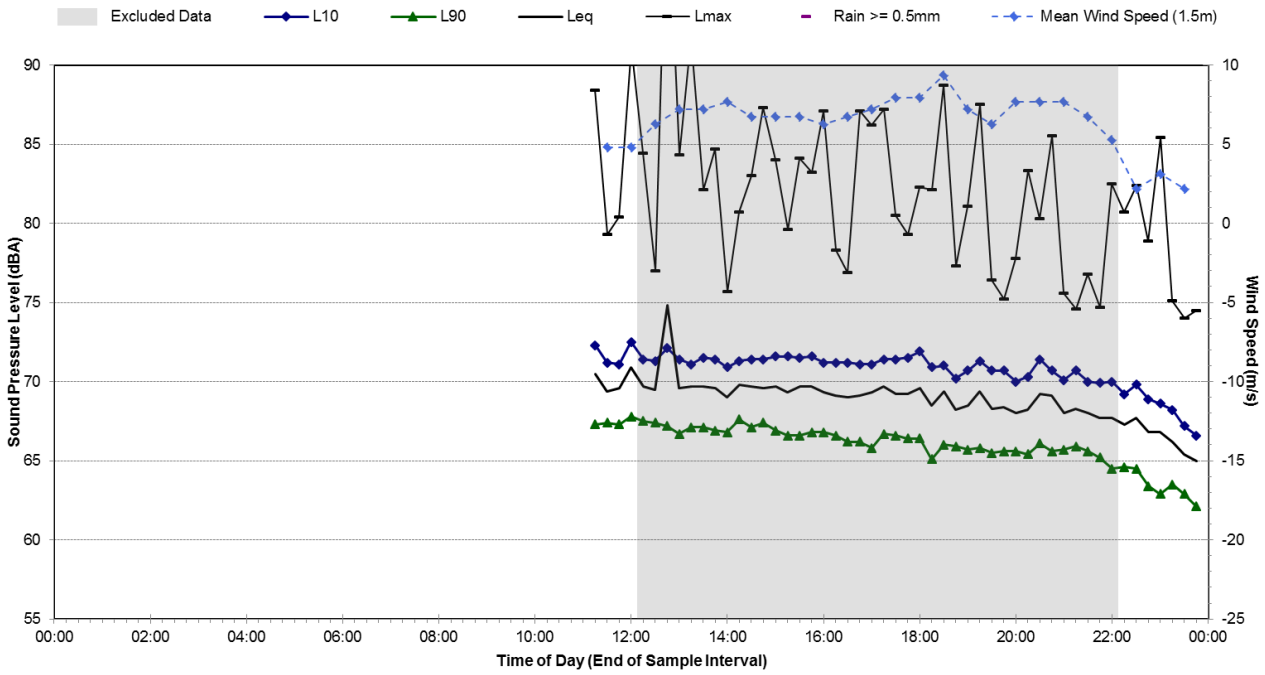
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
08/02/2018	9:39am	67	69	79

Photo of Noise Monitoring Location

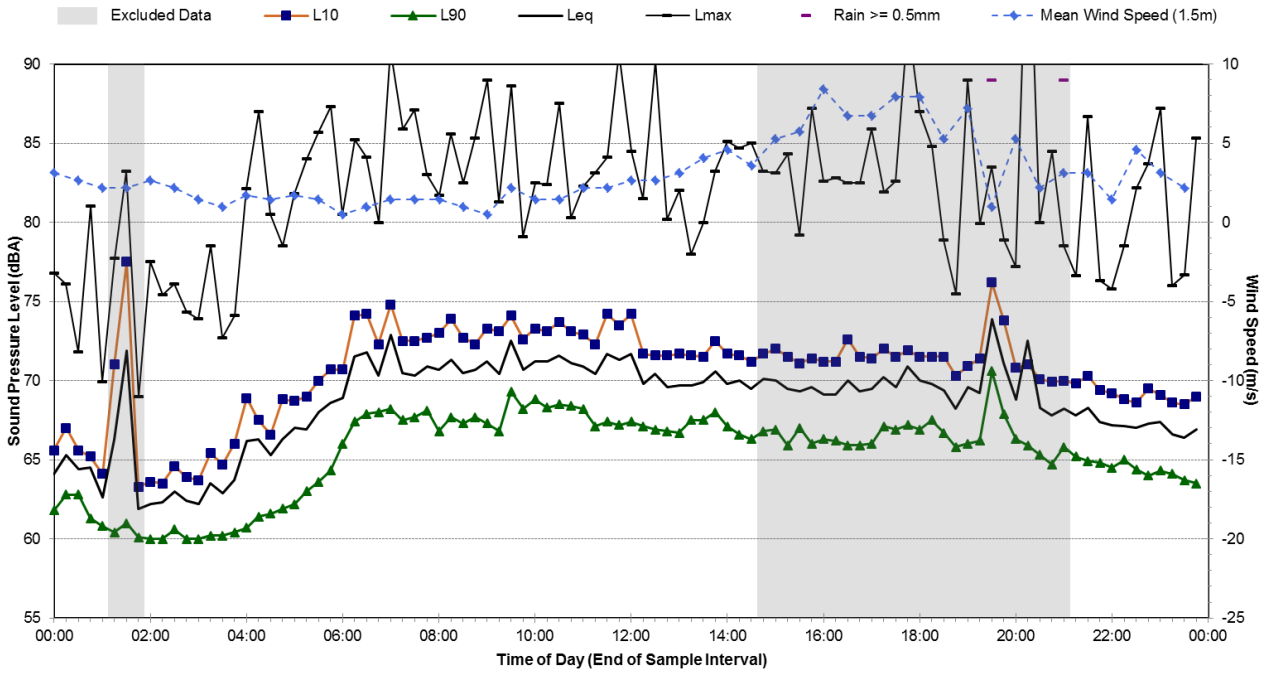
Statistical Ambient Noise Levels

L01 31-35 Bank St - Thursday, 8 February 2018



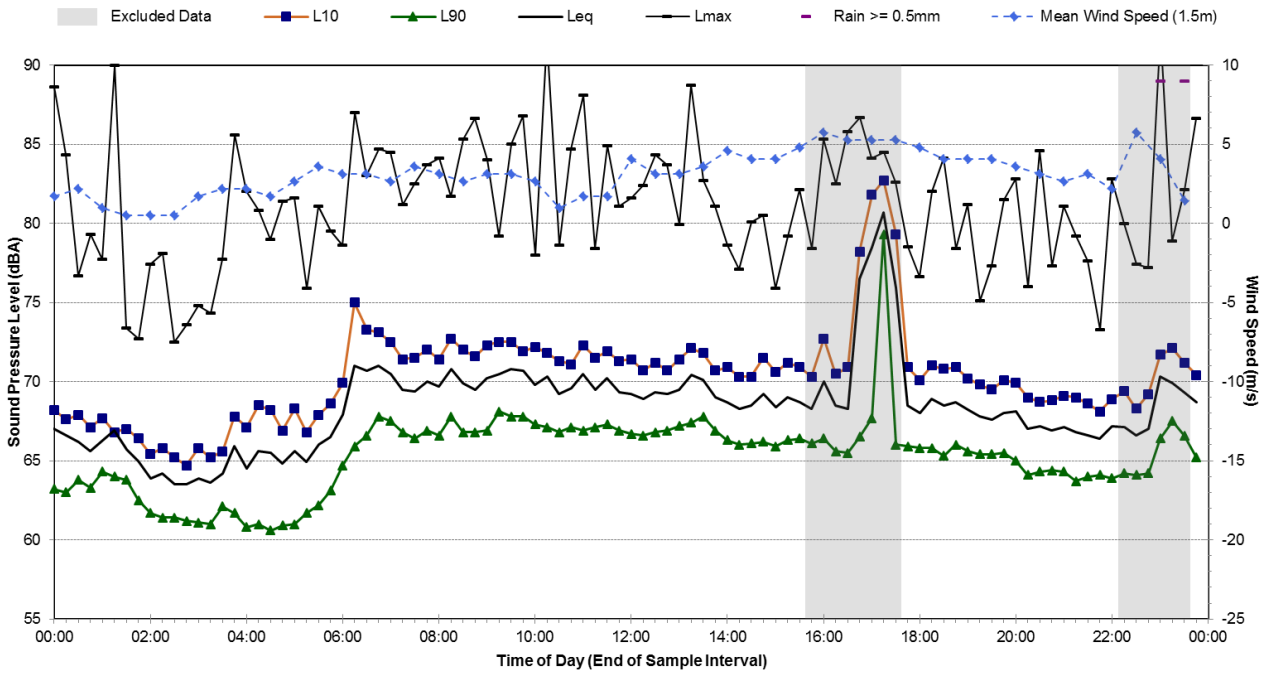
Statistical Ambient Noise Levels

L01 31-35 Bank St - Friday, 9 February 2018



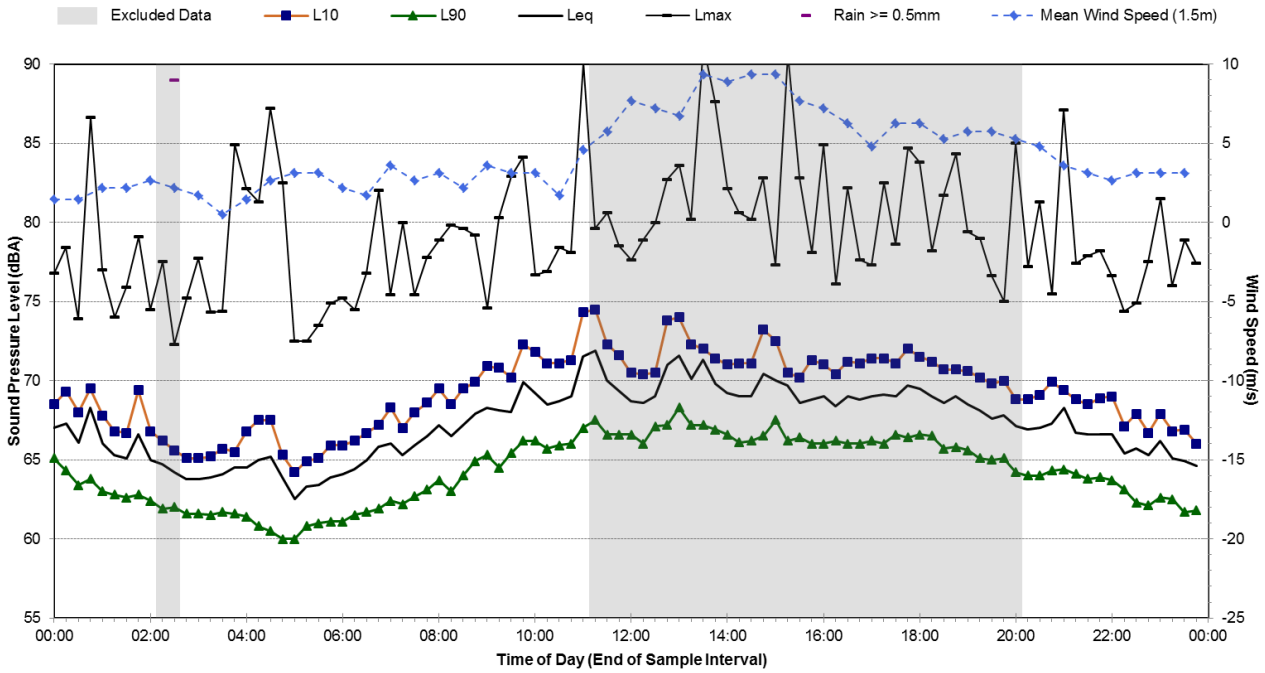
Statistical Ambient Noise Levels

L01 31-35 Bank St - Saturday, 10 February 2018



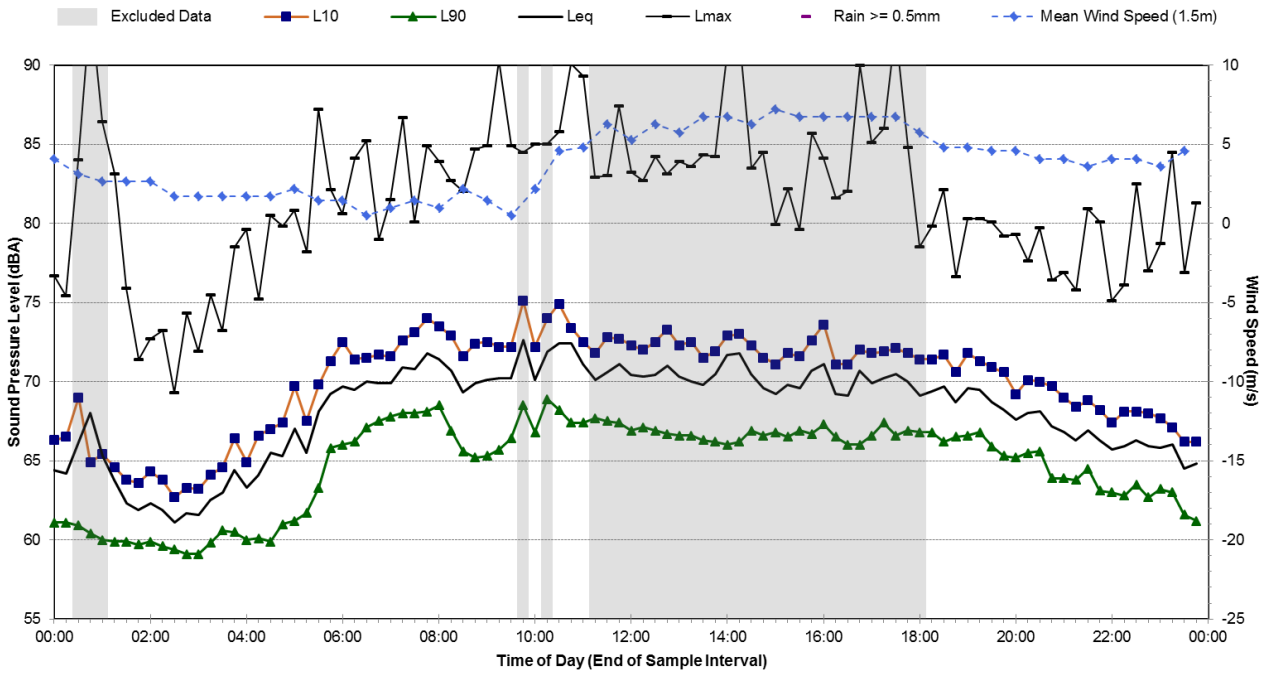
Statistical Ambient Noise Levels

L01 31-35 Bank St - Sunday, 11 February 2018



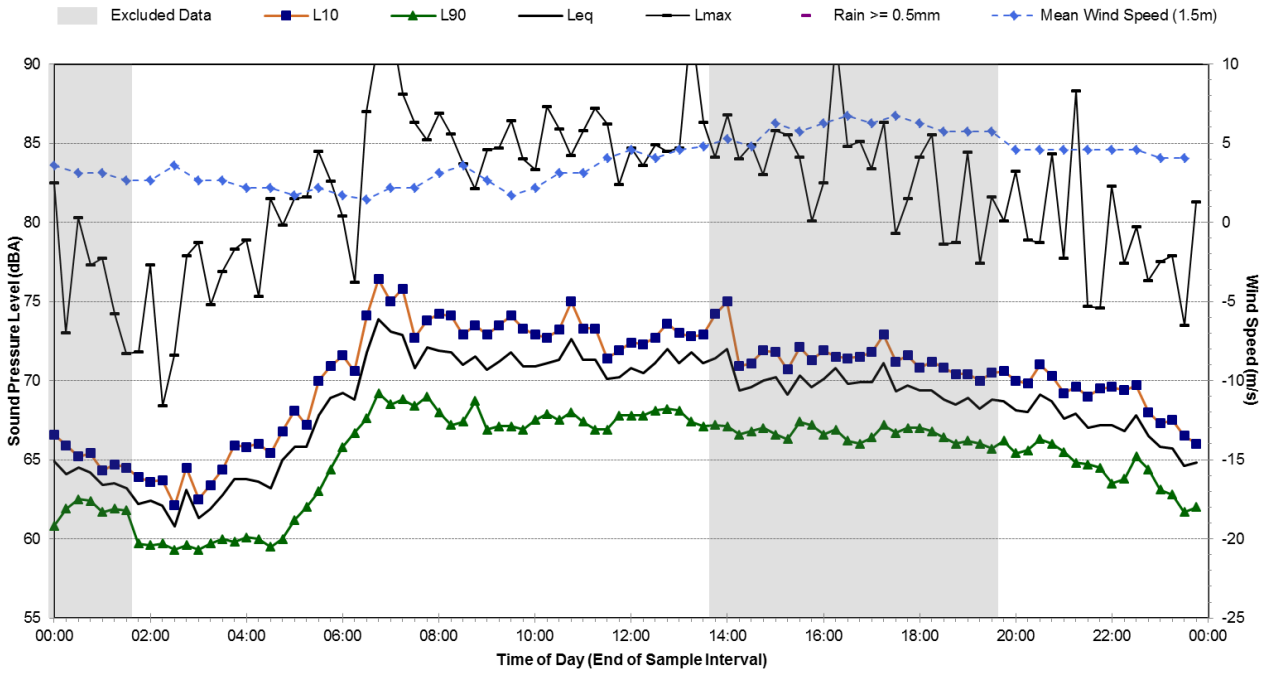
Statistical Ambient Noise Levels

L01 31-35 Bank St - Monday, 12 February 2018



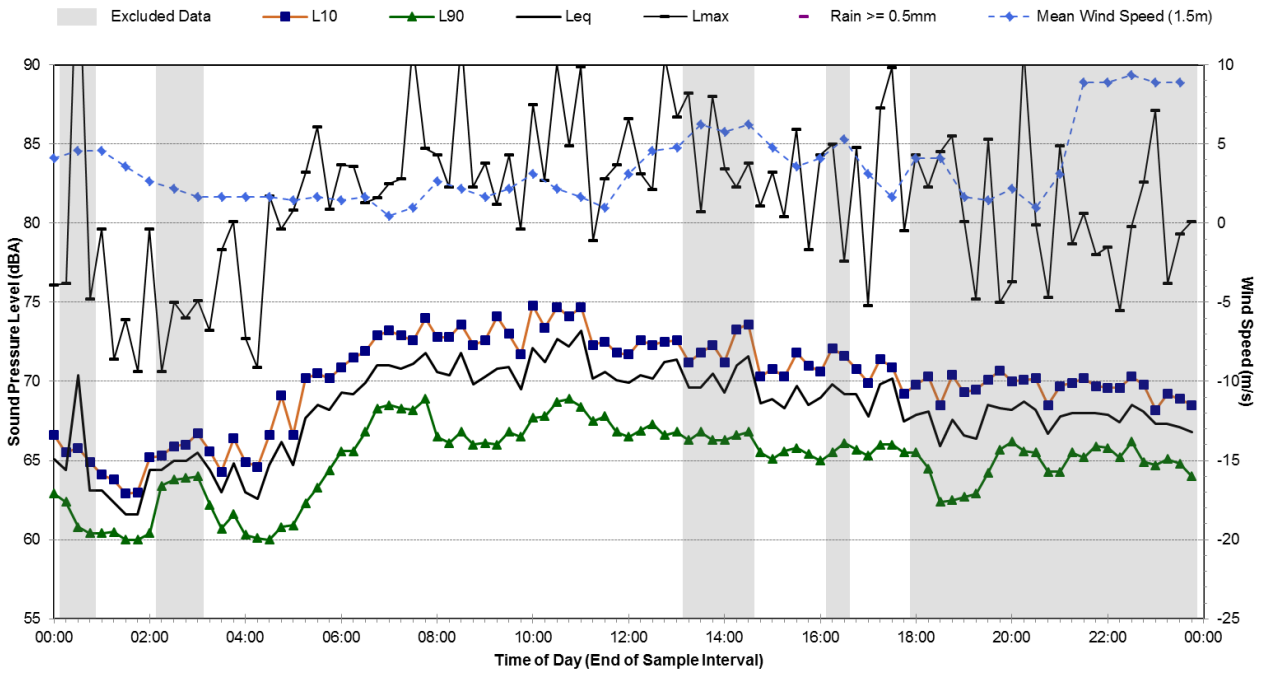
Statistical Ambient Noise Levels

L01 31-35 Bank St - Tuesday, 13 February 2018



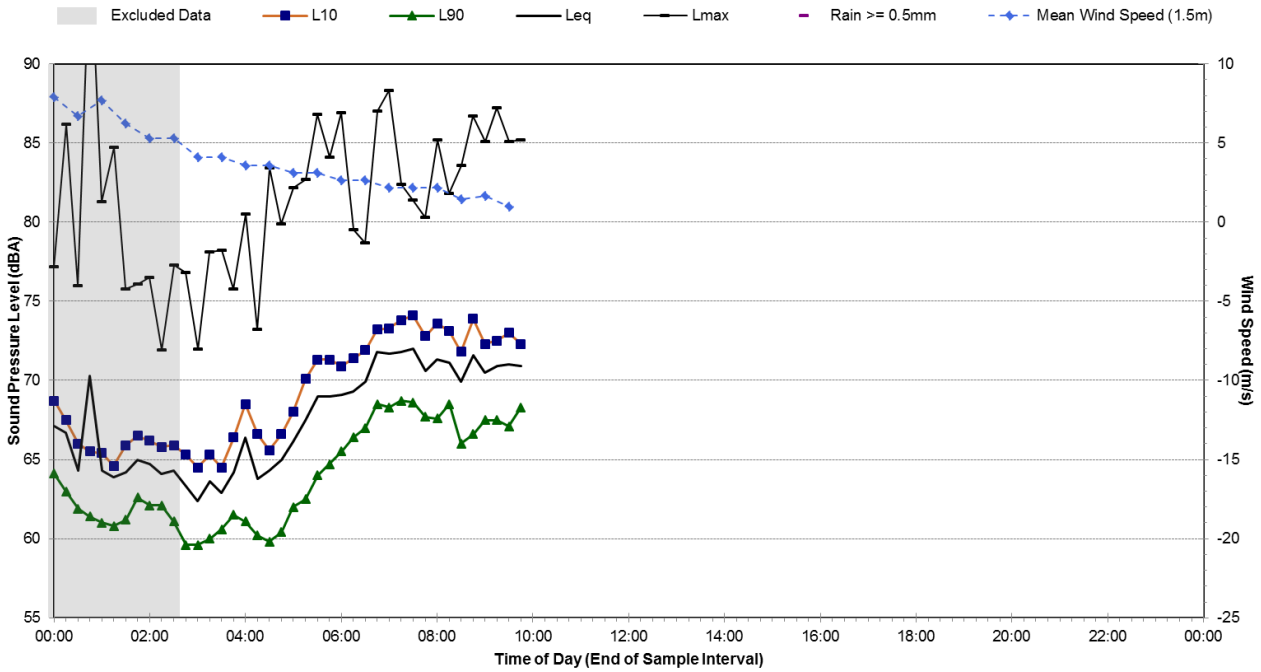
Statistical Ambient Noise Levels

L01 31-35 Bank St - Wednesday, 14 February 2018



Statistical Ambient Noise Levels

L01 31-35 Bank St - Thursday, 15 February 2018



Noise Monitoring Location:	**L.02**
Noise Monitoring Address:	**132 Bank Street**

Logger Device Type: Brüel and Kjær 2250, Logger Serial No: 3005908

Sound Level Meter Device Type: Brüel and Kjær 2250, Sound Level Meter Serial No: 2487418

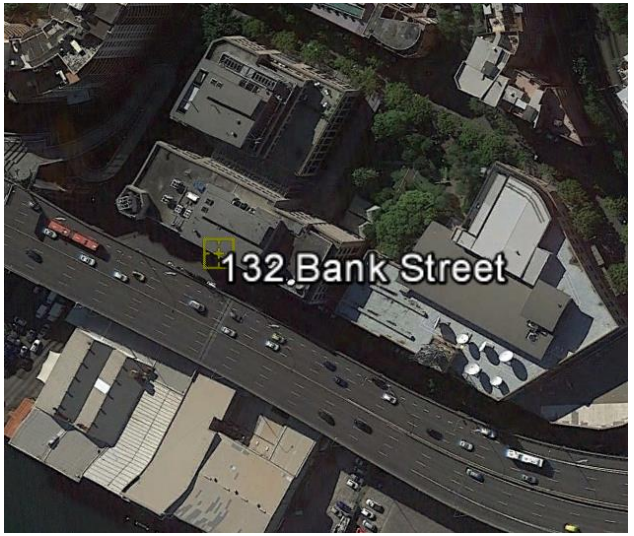
Ambient noise logger deployed at commercial address 132 Bank Street, Pyrmont. Logger located at Goodman, Level 2, in line with the height of the Western Distributor.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Western Distributor with intermittent operational noise emissions from nearby industrial premises at ground level also contributed to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

15/02/18: Light-vehicle traffic (Bank Street): 72 - 73 dBA, Heavy-vehicle traffic (Bank Street): 78 dBA, Light-vehicle traffic (Western Distributor): 75 – 82 dBA, Heavy-vehicle traffic (Western Distributor): 81 – 82 dBA, Operational noise: 75 76 dBA

Map of Noise Monitoring Location



Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	70	75	76	79
Evening	70	74	75	78
Night-time	61	72	72	76

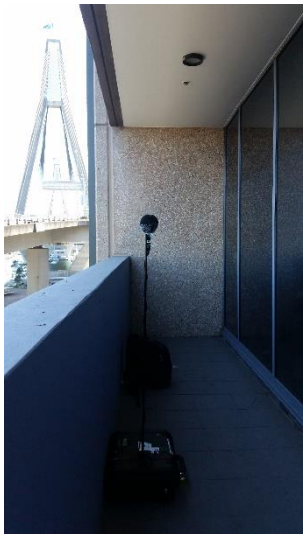
Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(Period)	LAeq(1hour)
Daytime (7am-10pm)	74	76
Night-time (10pm-7am)	72	76

Attended Noise Measurement Results

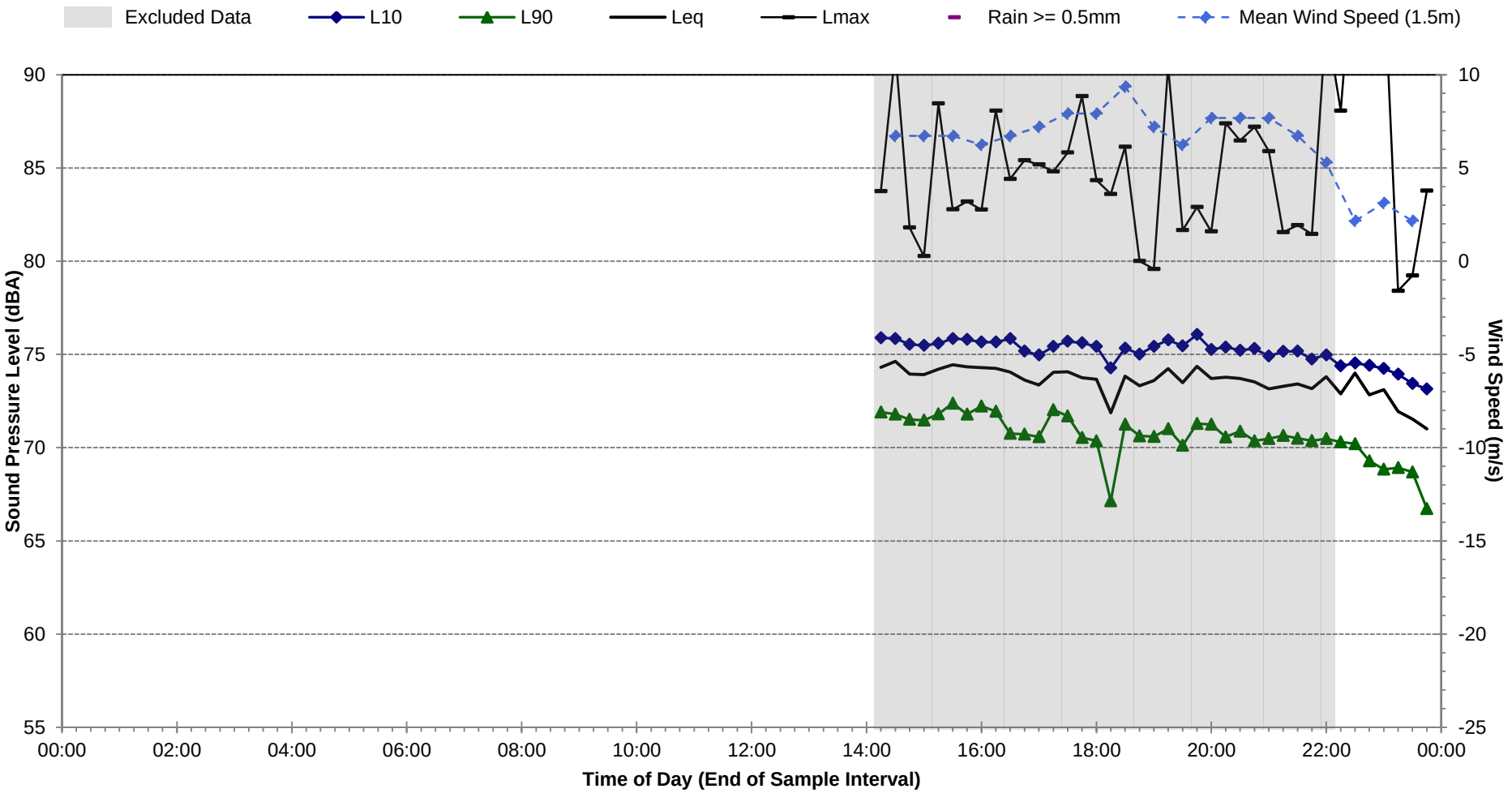
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
15/02/2018	7:40am	67	71	82

Photo of Noise Monitoring Location



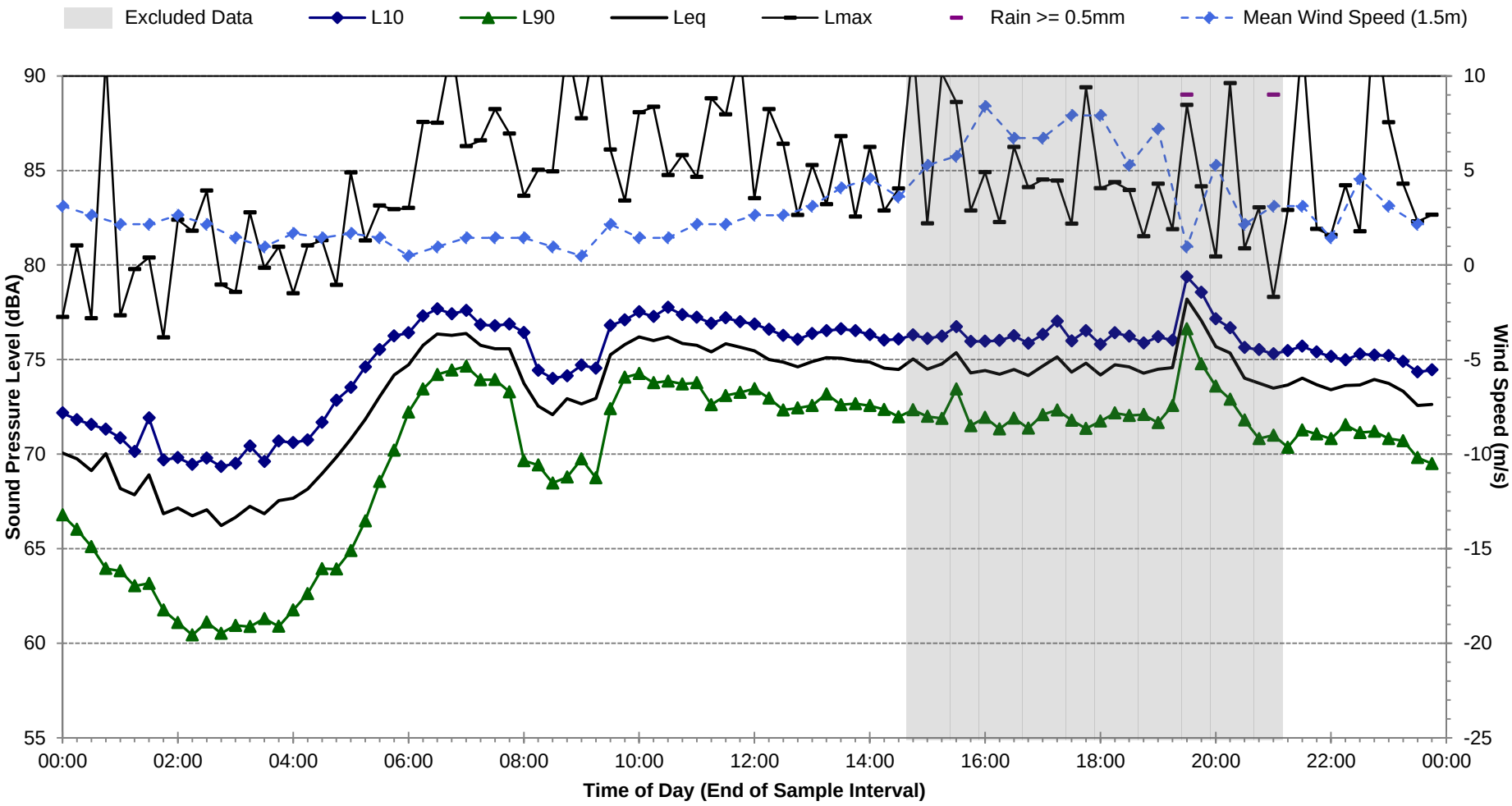
Statistical Ambient Noise Levels

132 Bank Street - Thursday, 8 February 2018



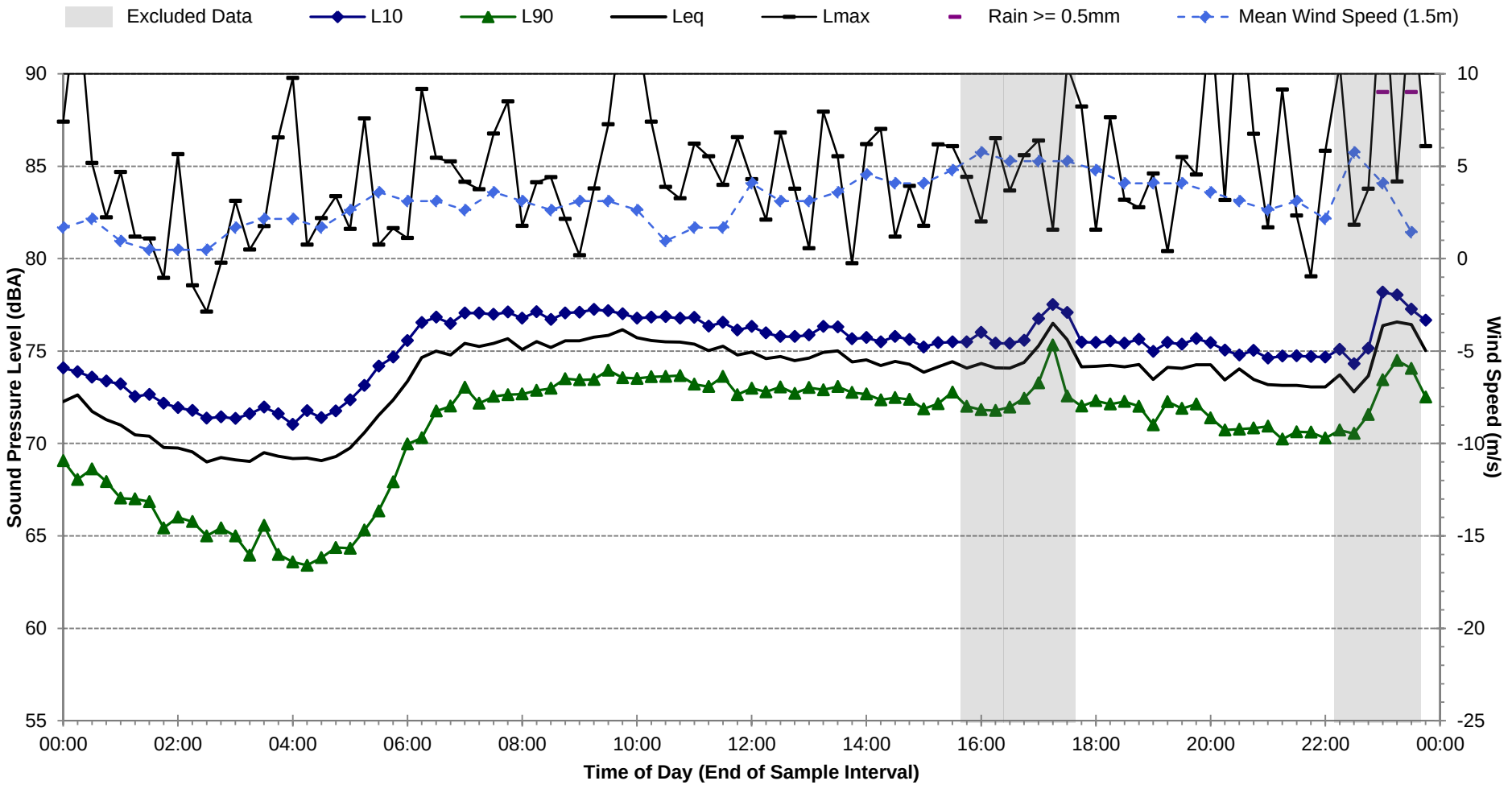
Statistical Ambient Noise Levels

132 Bank Street - Friday, 9 February 2018



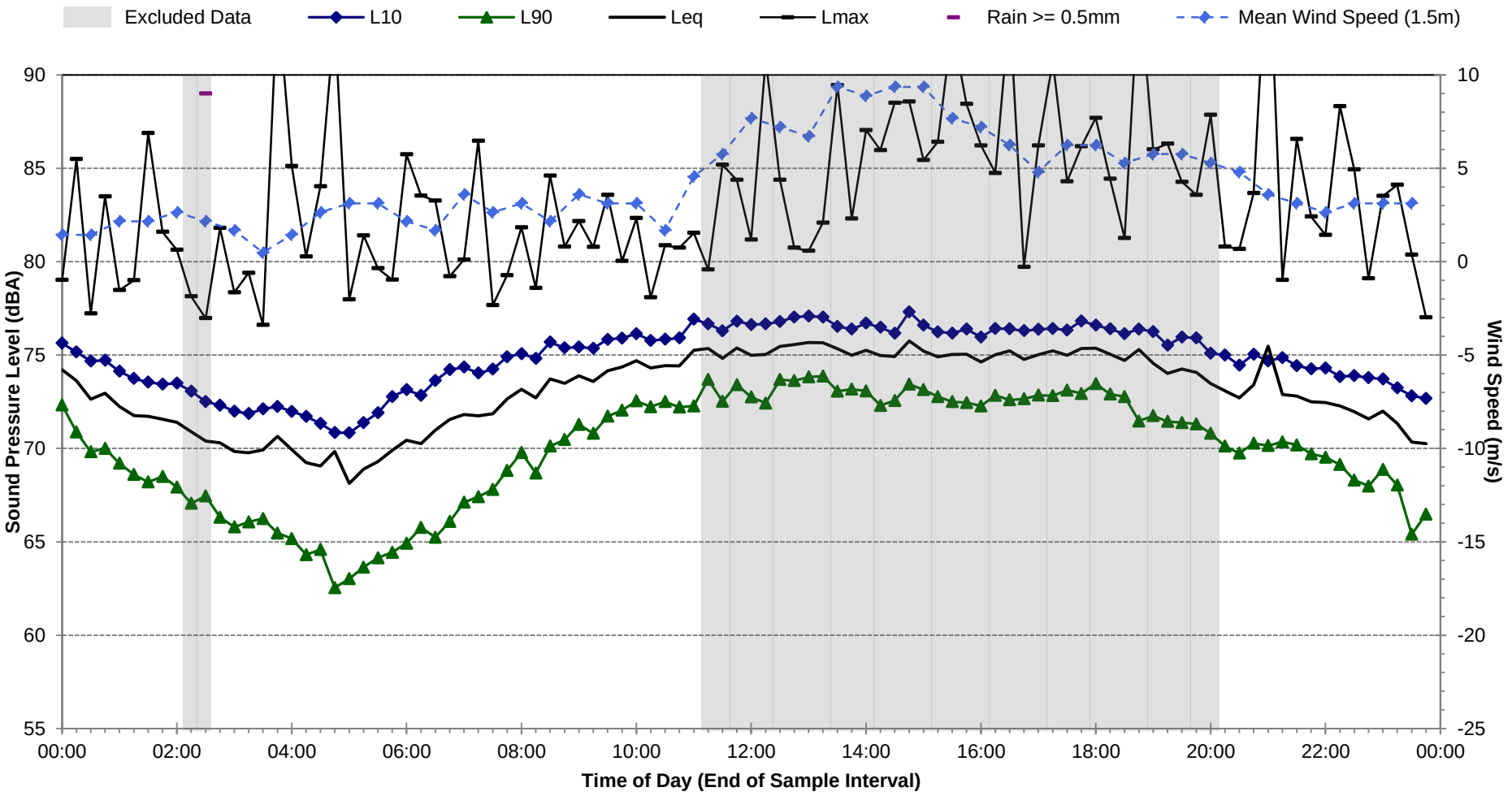
Statistical Ambient Noise Levels

132 Bank Street - Saturday, 10 February 2018



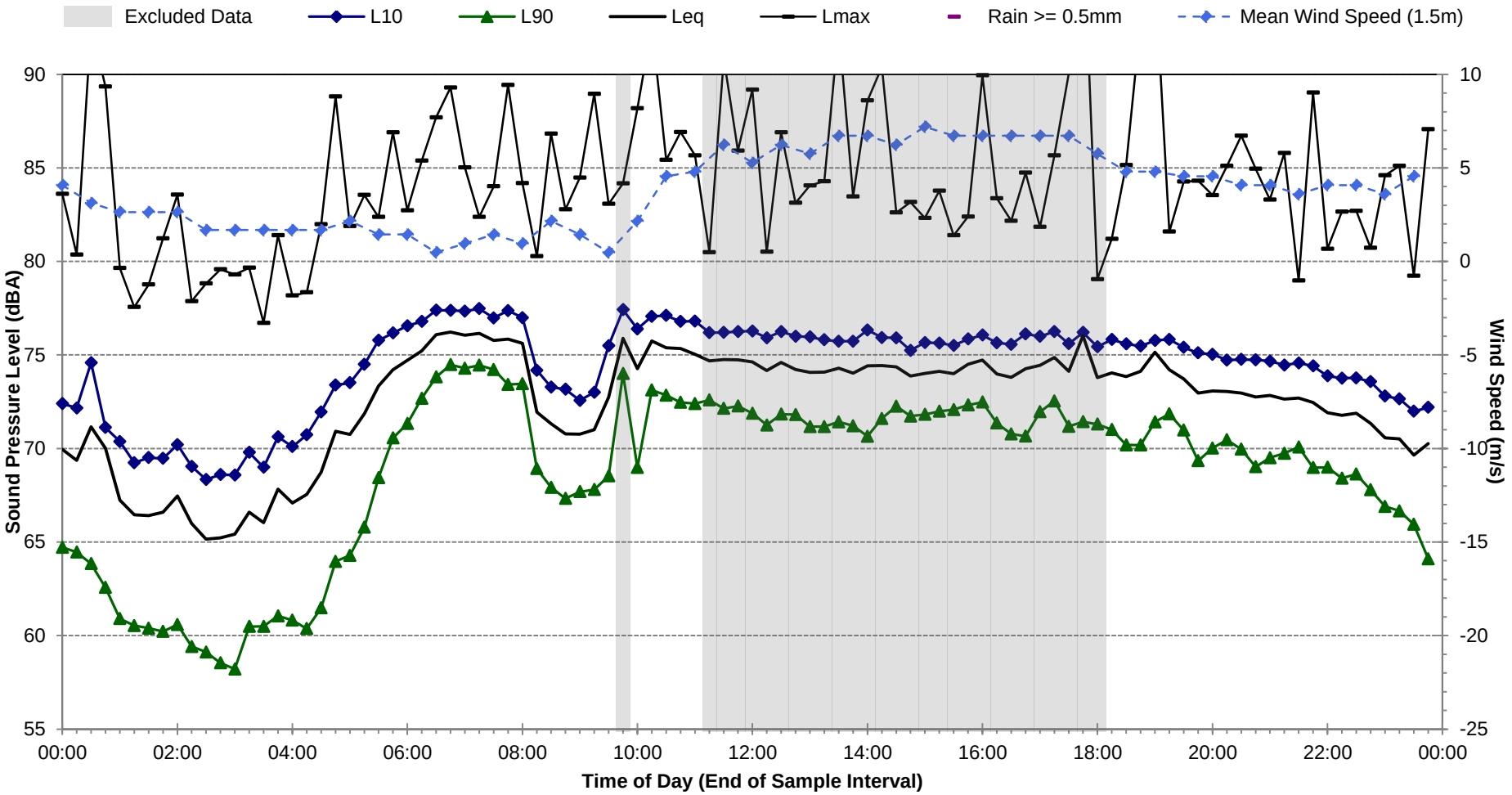
Statistical Ambient Noise Levels

132 Bank Street - Sunday, 11 February 2018



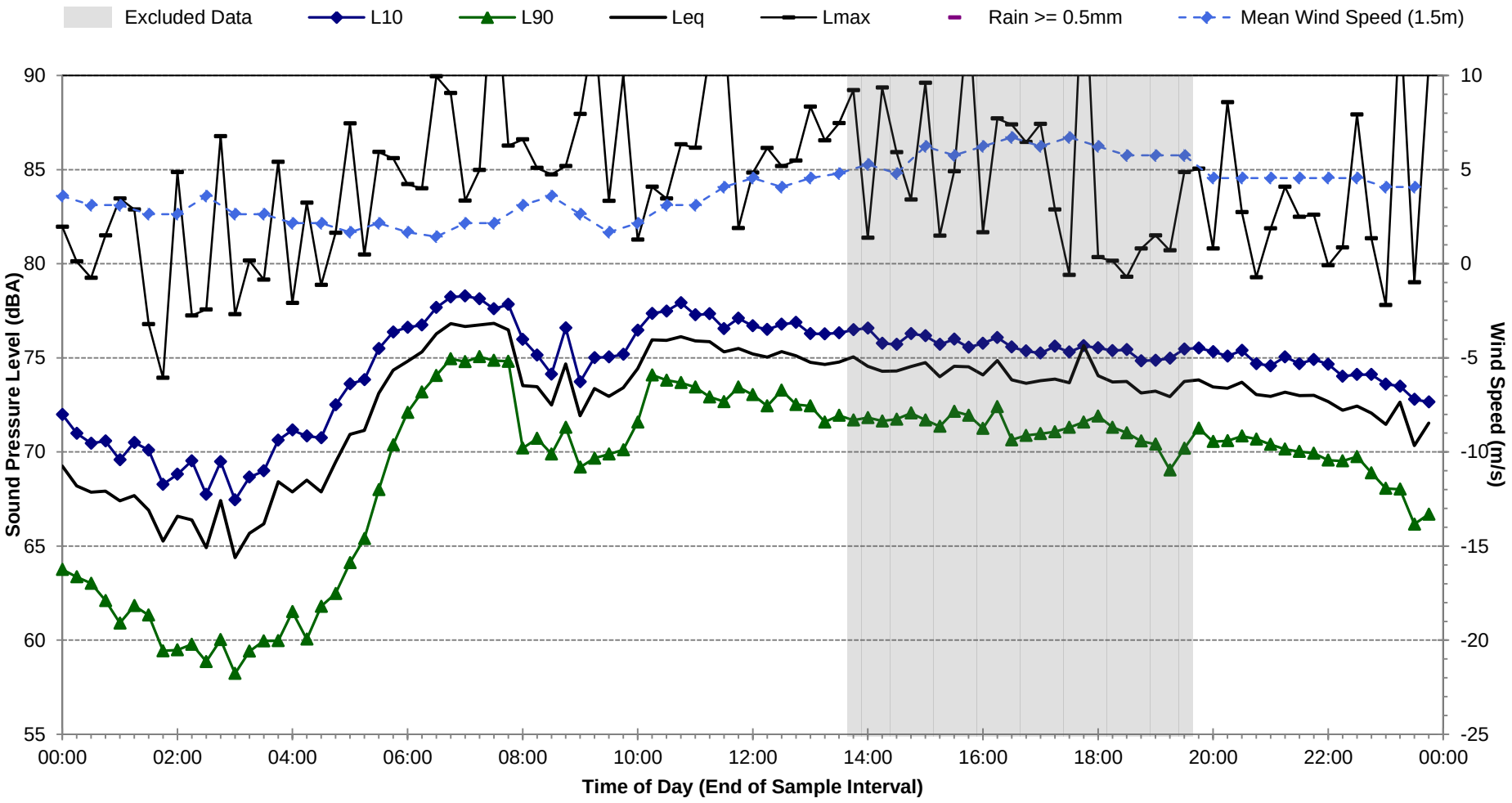
Statistical Ambient Noise Levels

132 Bank Street - Monday, 12 February 2018

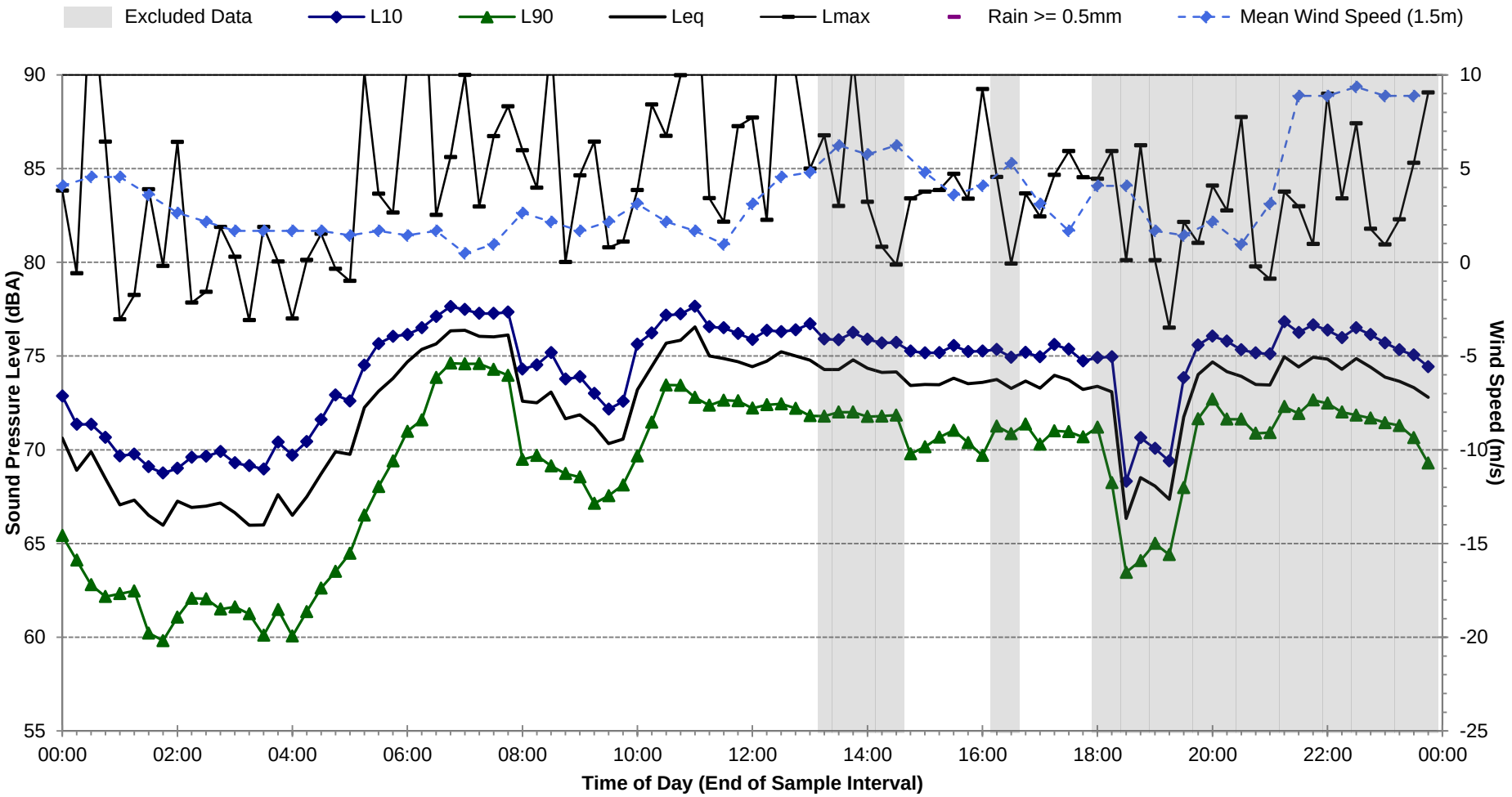


Statistical Ambient Noise Levels

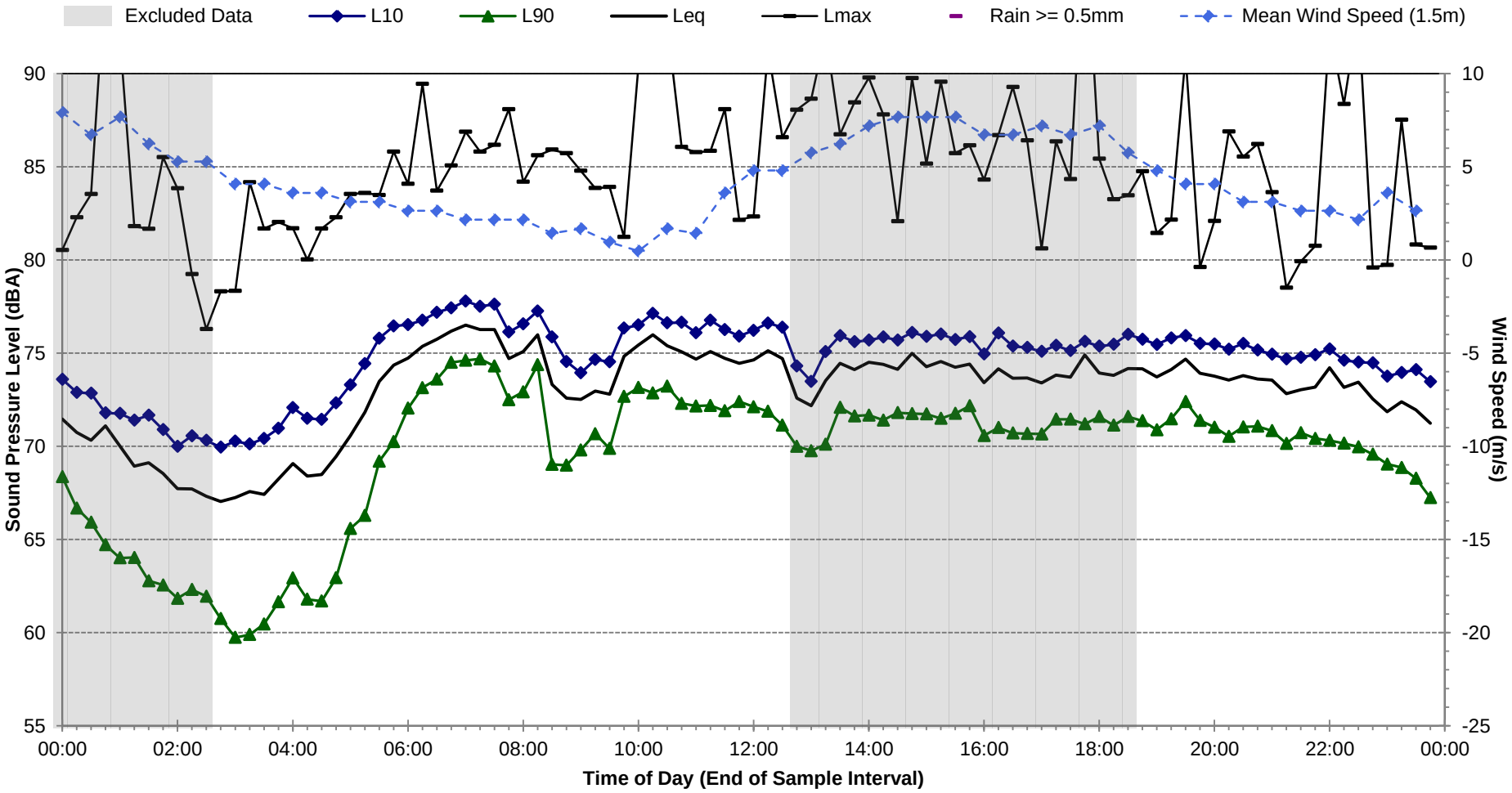
132 Bank Street - Tuesday, 13 February 2018



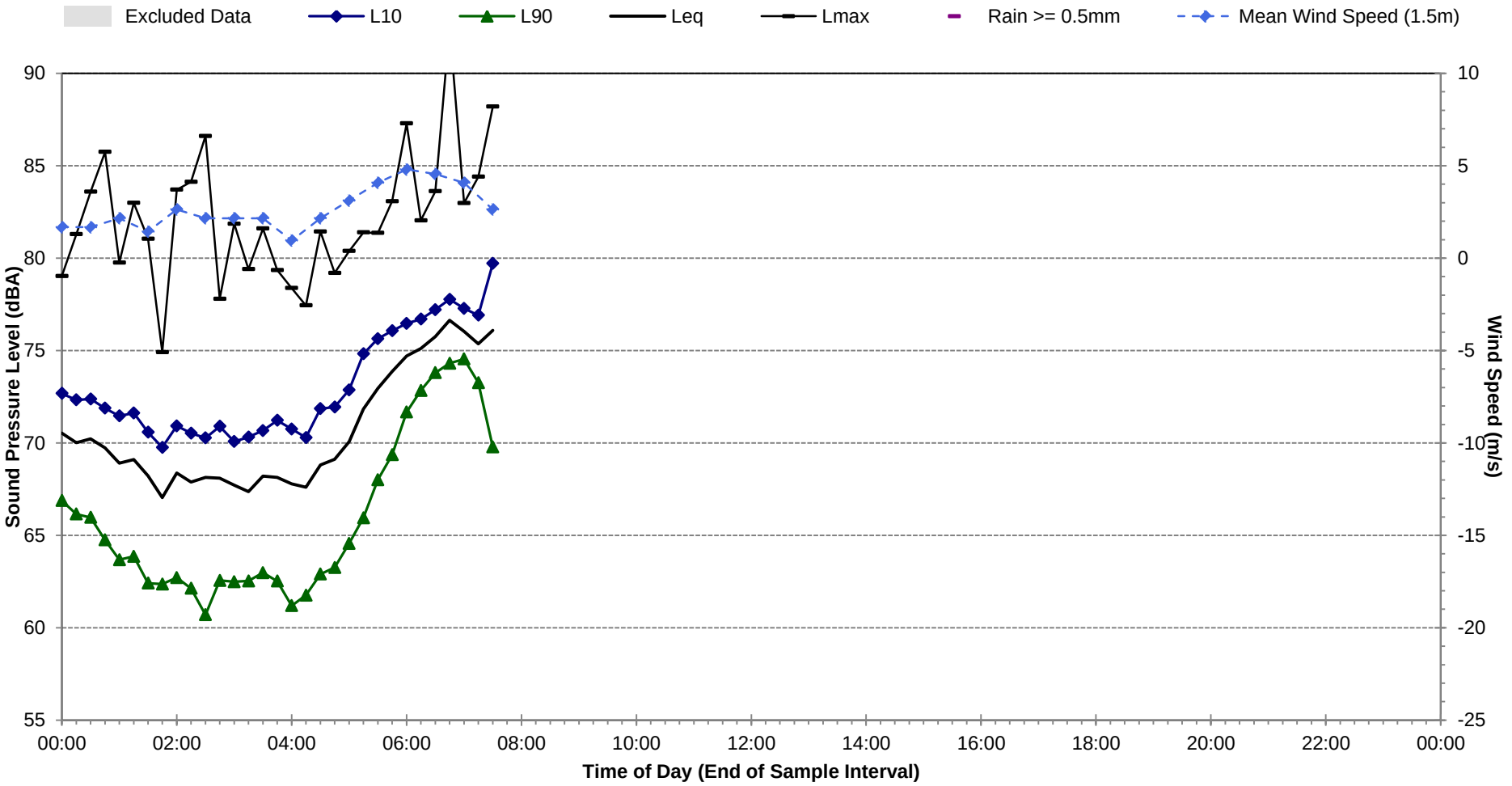
Statistical Ambient Noise Levels
132 Bank Street - Wednesday, 14 February 2018



Statistical Ambient Noise Levels
132 Bank Street - Thursday, 15 February 2018



Statistical Ambient Noise Levels
132 Bank Street - Friday, 16 February 2018



Noise Monitoring Location:	**L.03**
Noise Monitoring Address:	**132 Bank Street**

Logger Device Type: Brüel and Kjær 2250, Logger Serial No: 3005904

Sound Level Meter Device Type: Brüel and Kjær 2260, Sound Level Meter Serial No: 2487418

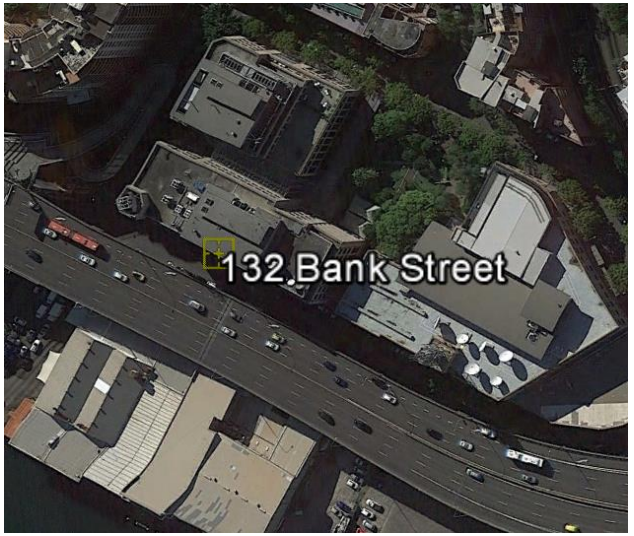
Ambient noise logger deployed at commercial address 132 Bank Street, Pyrmont. Logger located at Goodman, Rooftop, above the Western Distributor, with direct line of sight.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Western Distributor, inbound to the city.

Recorded Noise Levels: (LAmax):

15/02/18: Light-vehicle traffic (Western Distributor): 73 – 81 dBA, Heavy-vehicle traffic (Western Distributor): 75 – 87 dBA, MC traffic (Western Distributor): 74 – 81 dBA, Car horn: 74 dBA

Map of Noise Monitoring Location



Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	71	75	76	78
Evening	71	74	75	77
Night-time	60	71	72	75

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(Period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	75	76
Night-time (10pm-7am)	71	75

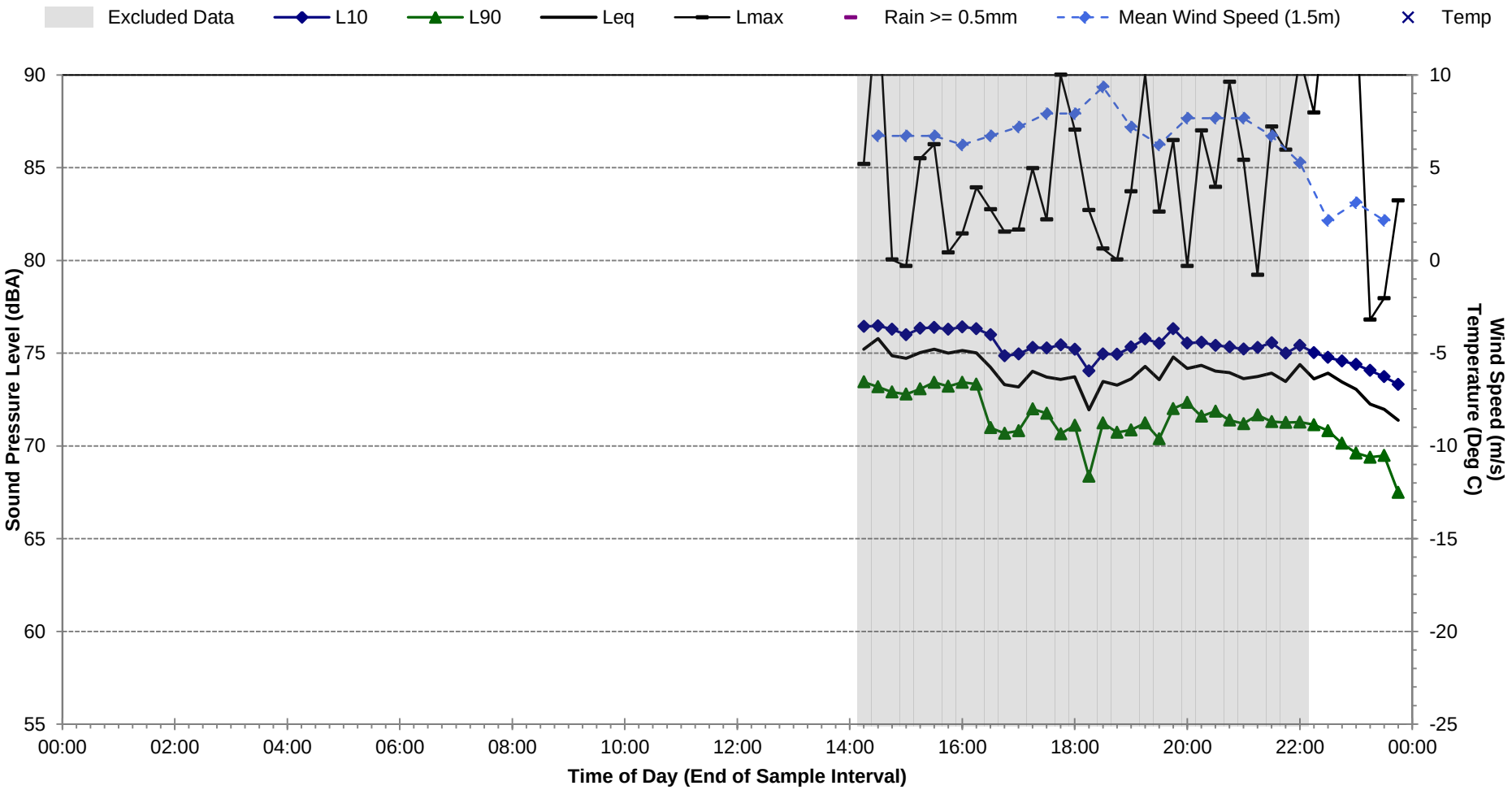
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
15/02/2018	7:40am	70	73	87

Photo of Noise Monitoring Location

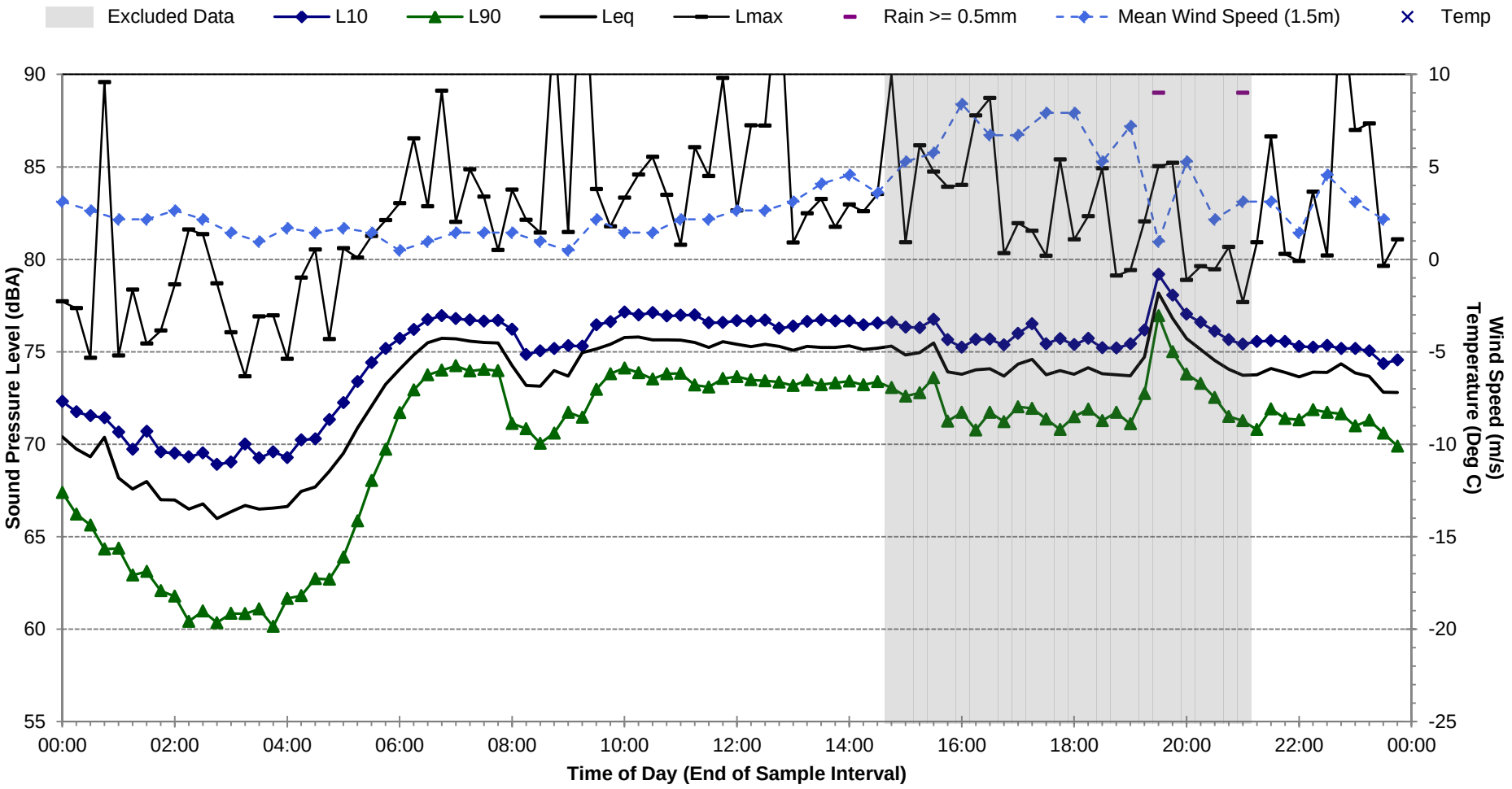
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Thursday, 8 February 2018



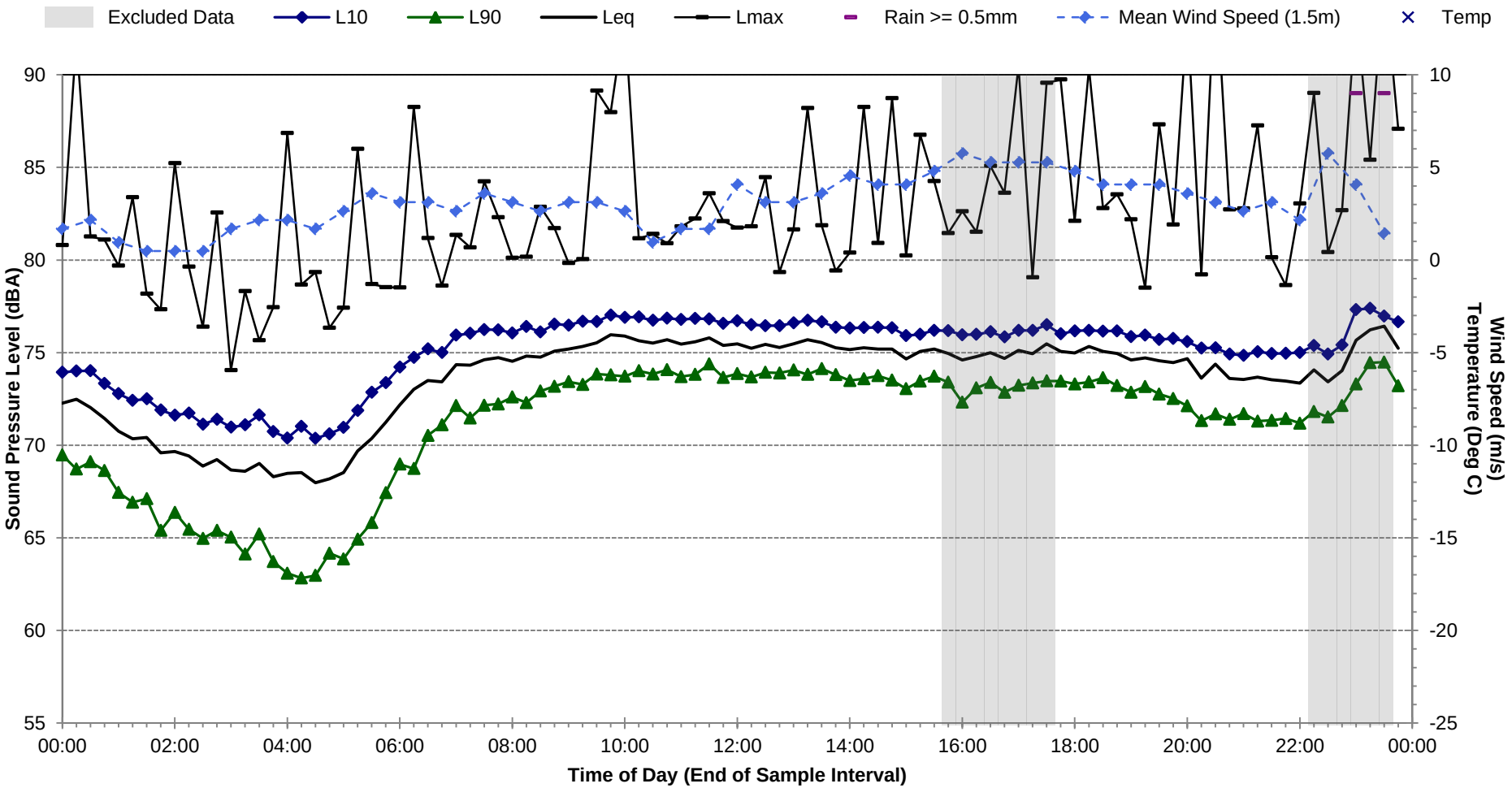
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Friday, 9 February 2018



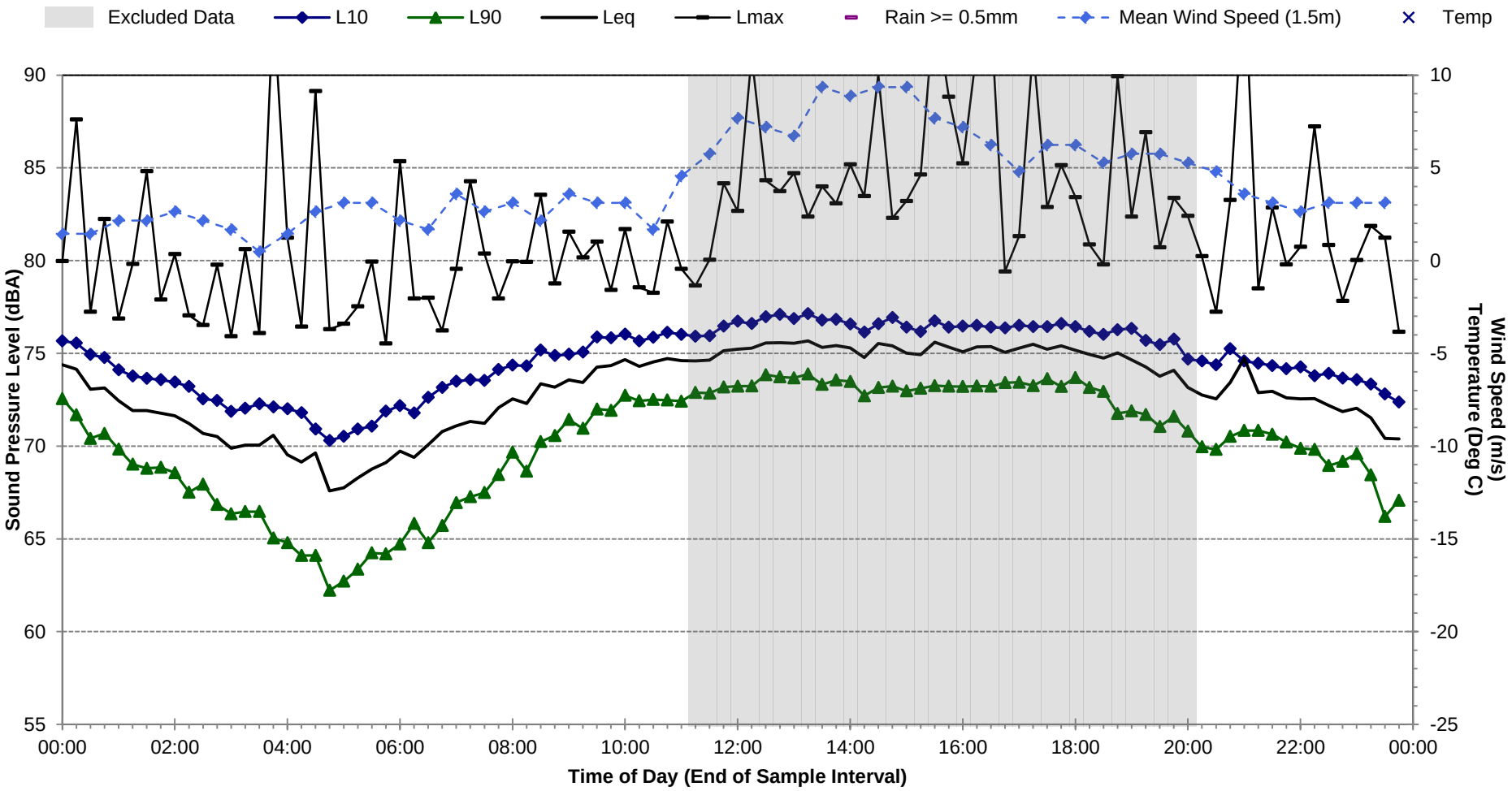
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Saturday, 10 February 2018



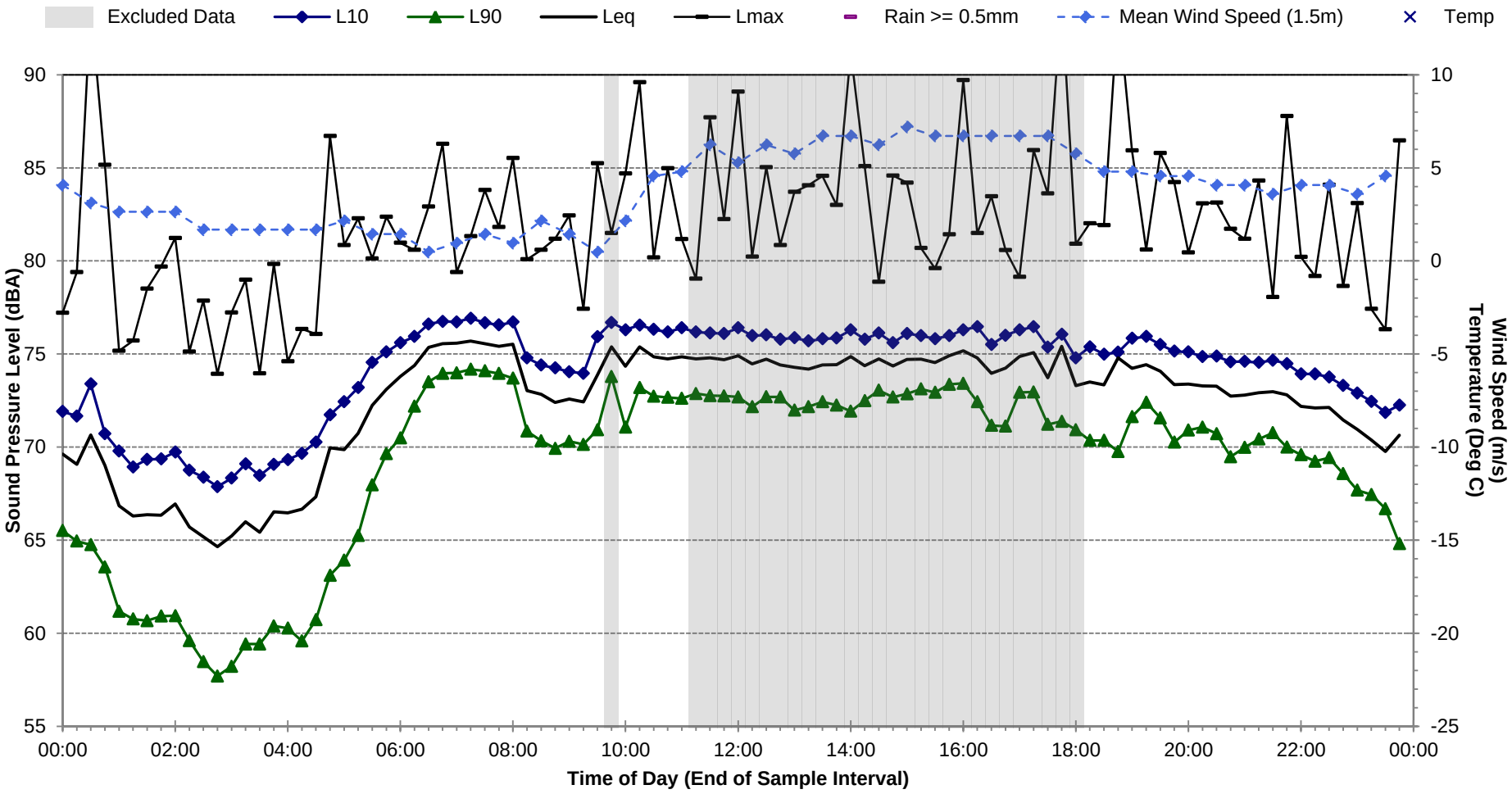
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Sunday, 11 February 2018



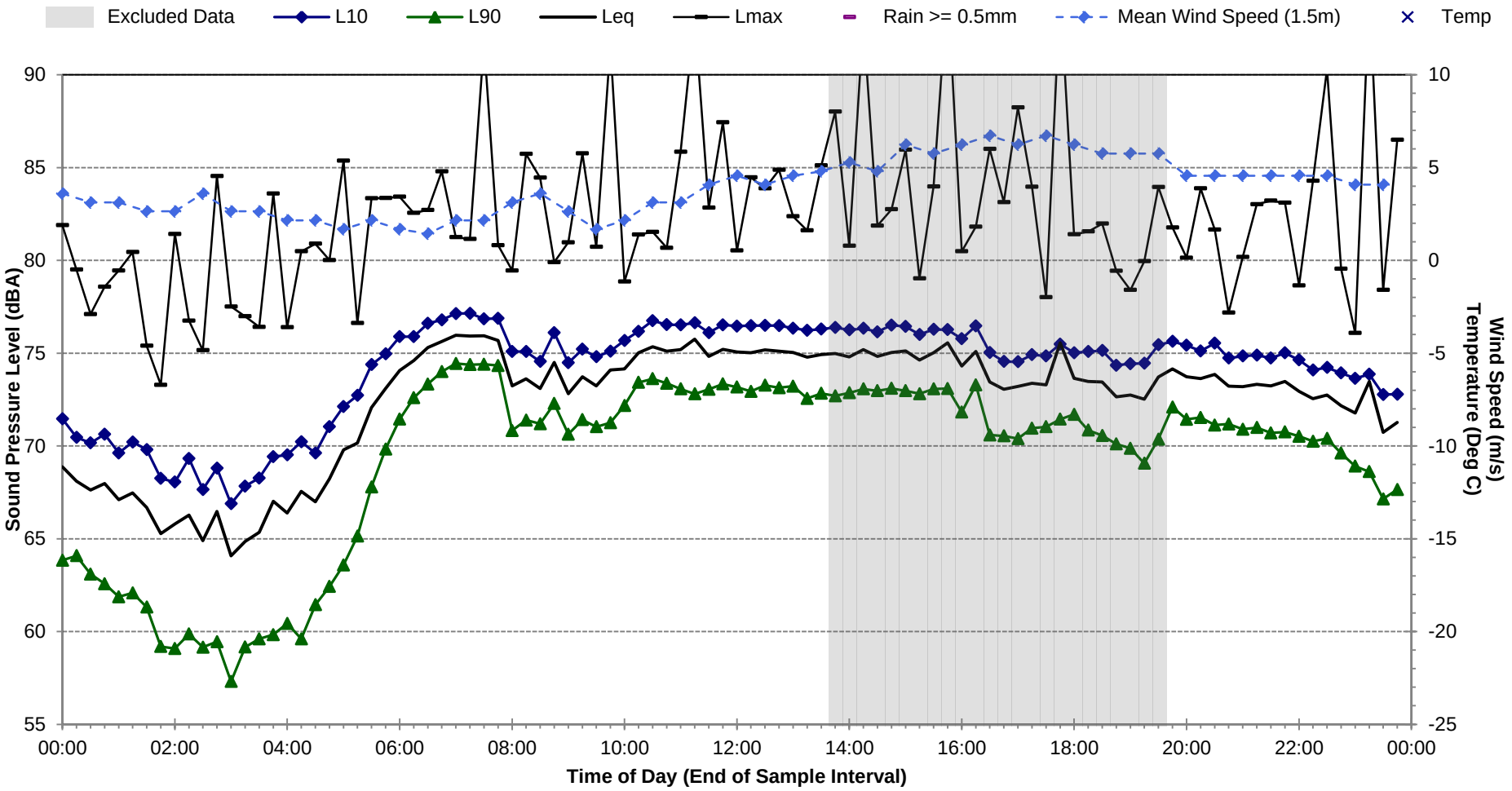
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Monday, 12 February 2018



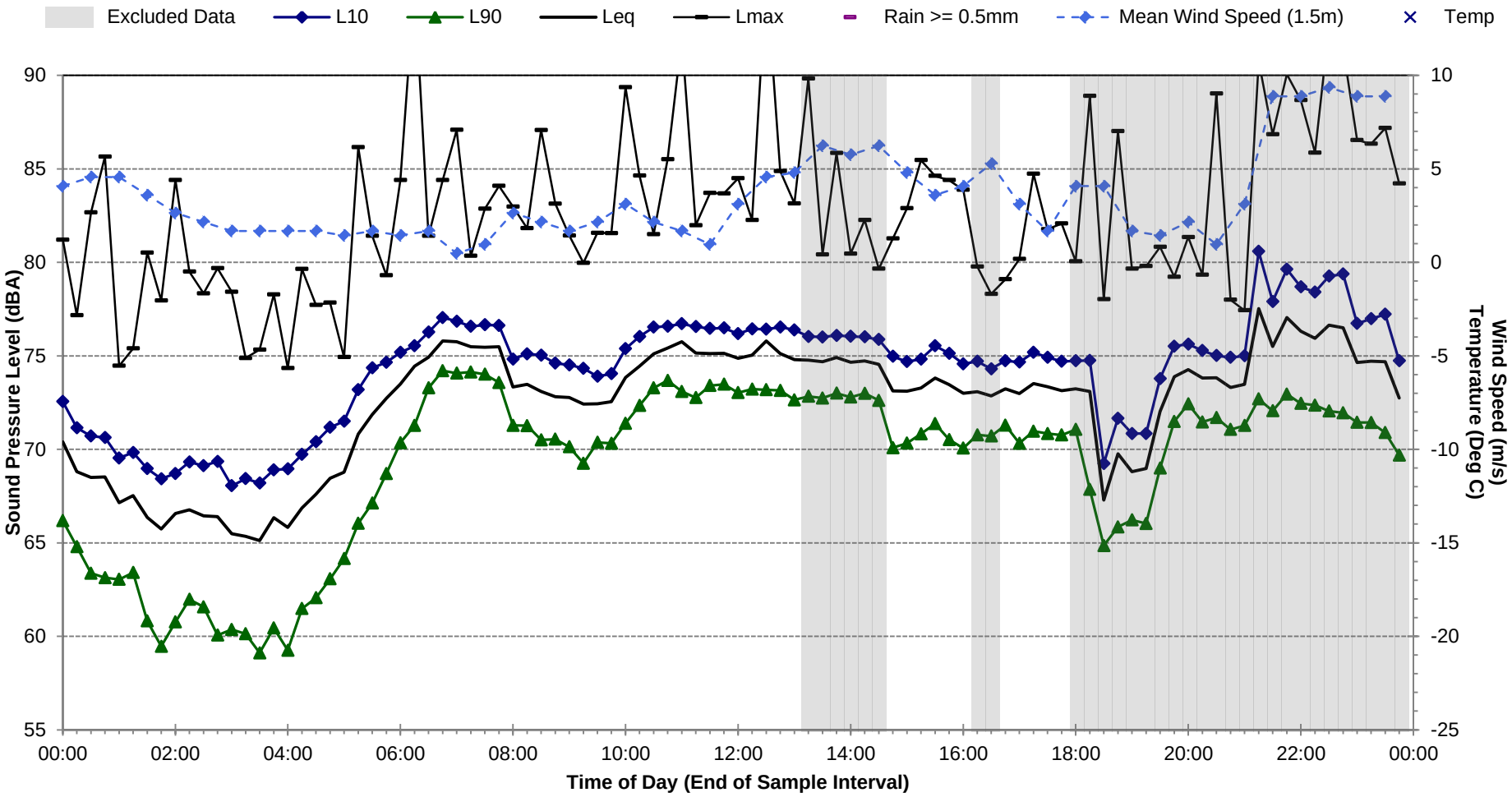
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Tuesday, 13 February 2018



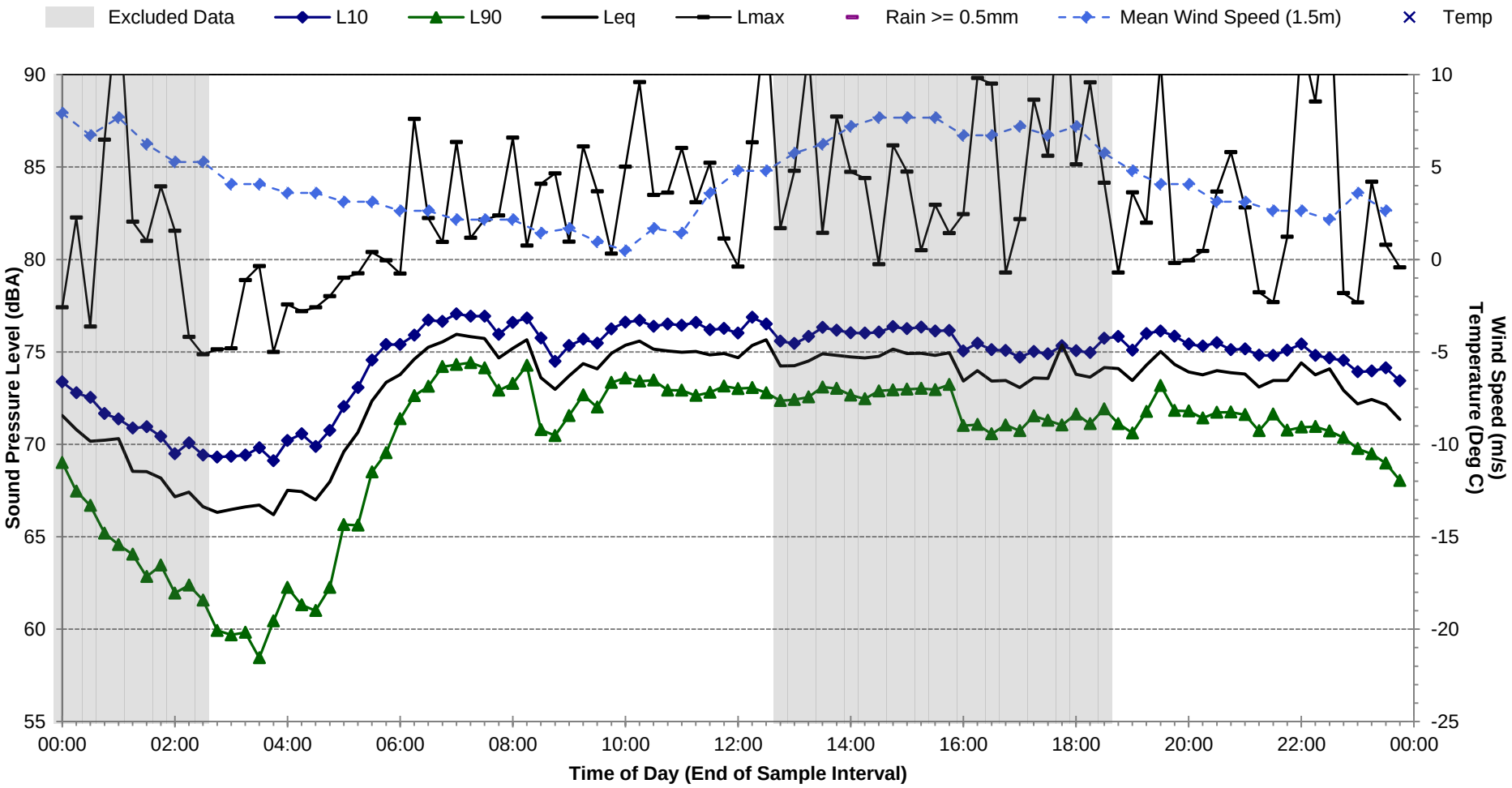
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Wednesday, 14 February 2018



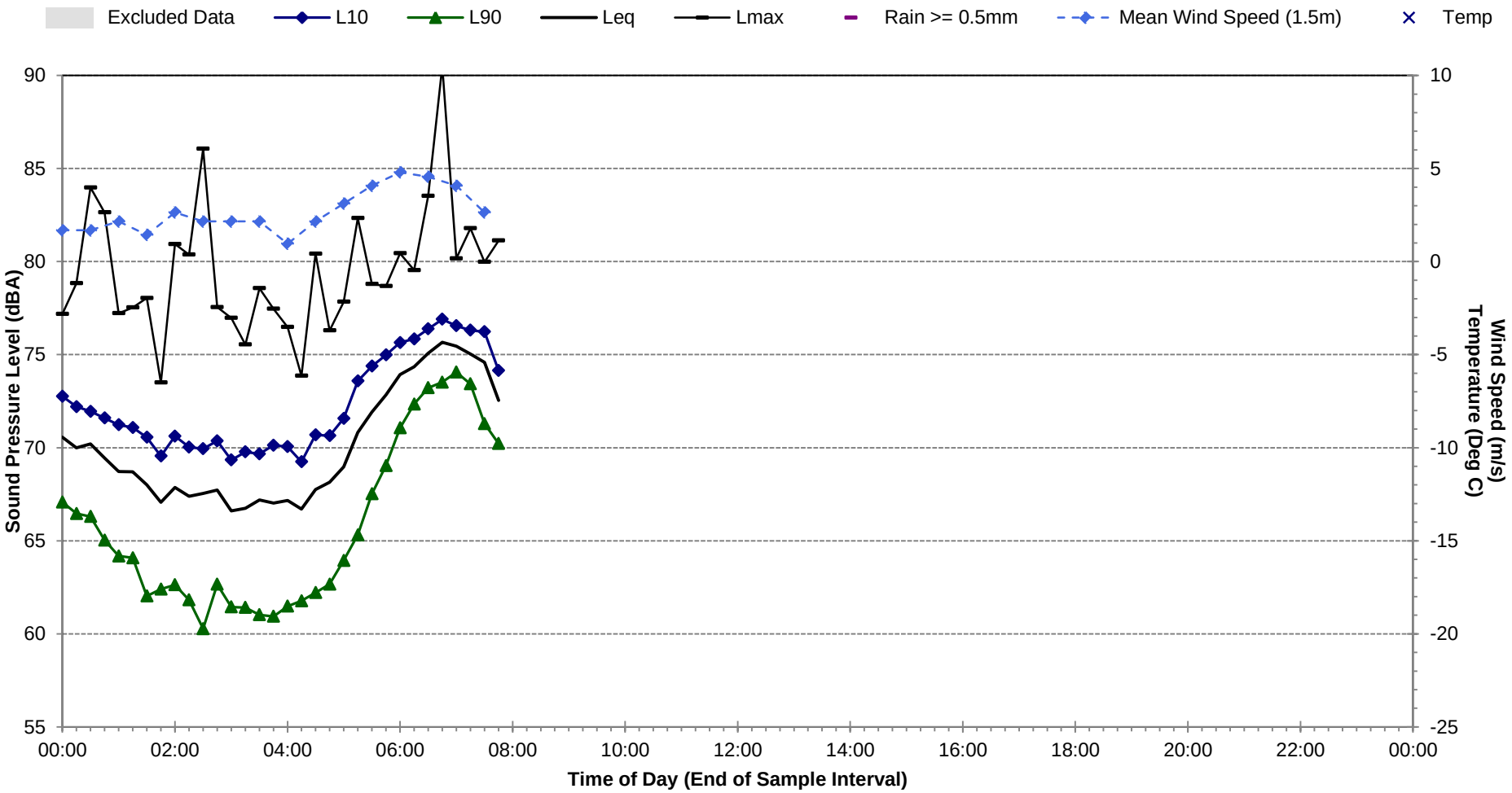
Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Thursday, 15 February 2018



Statistical Ambient Noise Levels

132 Bank Street, Rooftop - Friday, 16 February 2018



Noise Monitoring Location:	**L.04**
Noise Monitoring Address:	**Unit 217, 1 Wattle Crescent**

Logger Device Type: Brüel and Kjær 2250, Logger Serial No: 20668

Sound Level Meter Device Type: Brüel and Kjær 2250, Sound Level Meter Serial No: 2414608

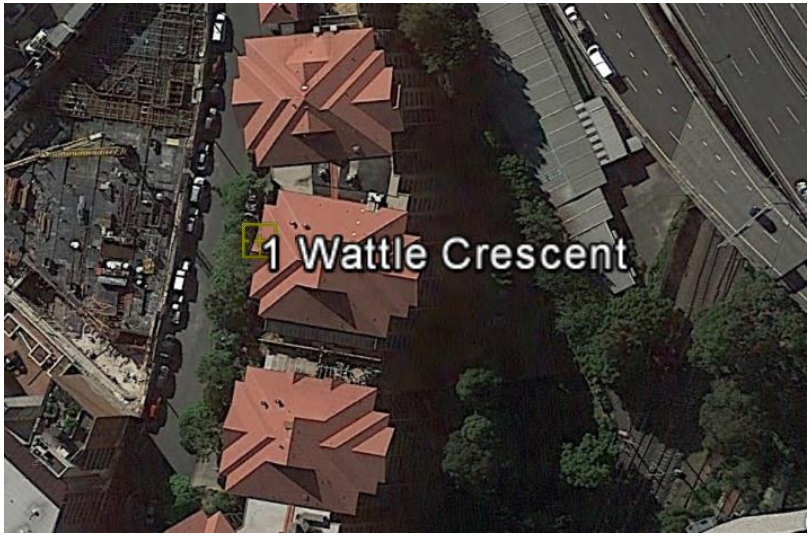
Ambient noise logger deployed at residential address Unit 217, 1 Wattle Crescent, Pyrmont. Logger located Unit 217, 1 Wattle Crescent, Pyrmont with obstructed view of the Western Distributor from a temporary noise wall, and direct line of sight to Pyrmont Bridge Road below.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Pyrmont Bridge Road, including frequent heavy vehicle passbys travelling east, with infrequent bird calls and pedestrian noise also contributing to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

15/02/18: Light-vehicle traffic (Pyrmont Bridge Road): 68 – 81 dBA, Heavy-vehicle traffic (Pyrmont Bridge Road): 65 - 89 dBA, Brake squeal: 91 dBA, Motorcycle traffic (Pyrmont Bridge Road): 83 – 84 dBA, Padestrian noise: 66 dBA

Map of Noise Monitoring Location



Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	62	71	73	80
Evening	57	68	70	76
Night-time	50	65	65	74

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(Period)	LAeq(1hour)
Daytime (7am-10pm)	71	72
Night-time (10pm-7am)	65	70

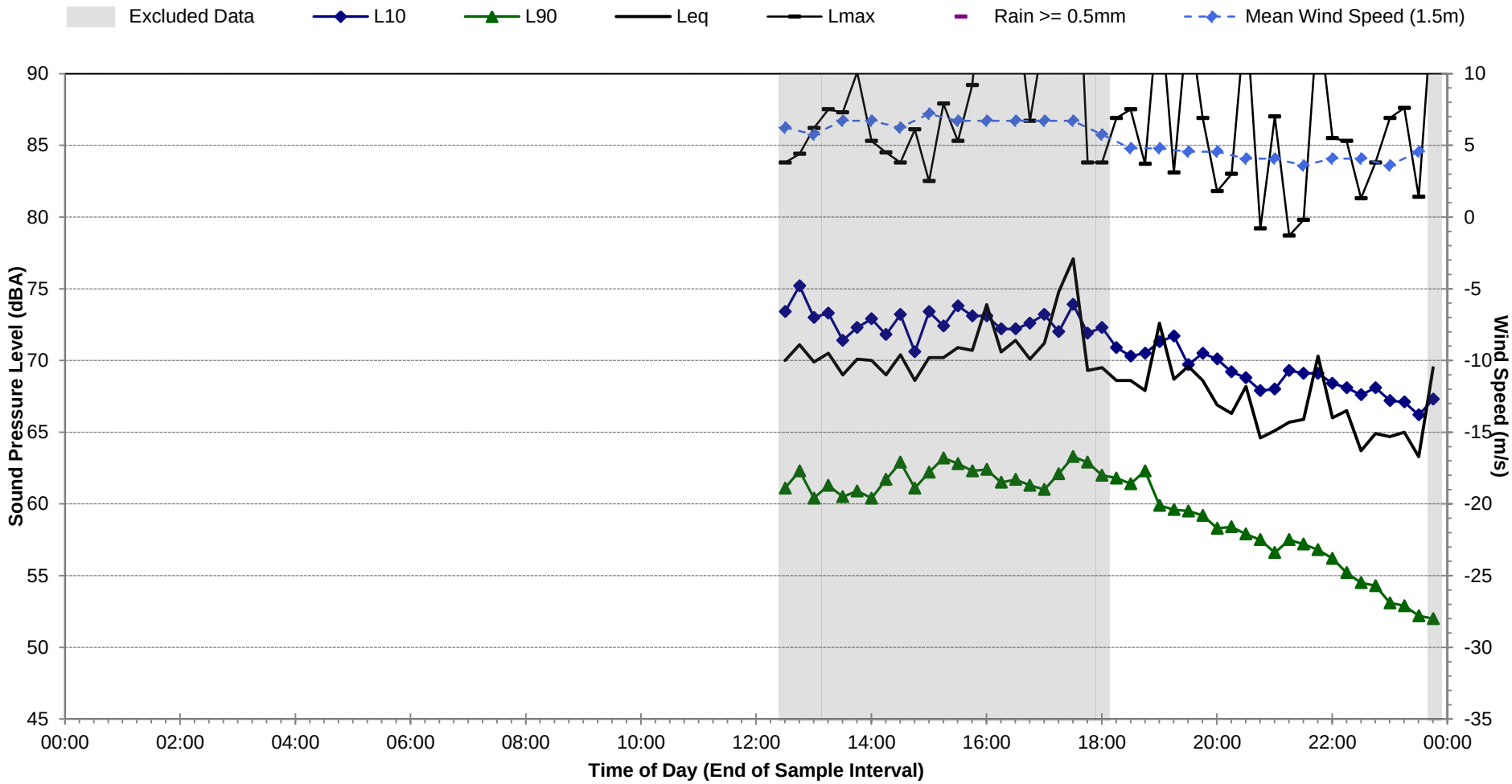
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
15/02/2018	7:40am	61	71	91

Photo of Noise Monitoring Location

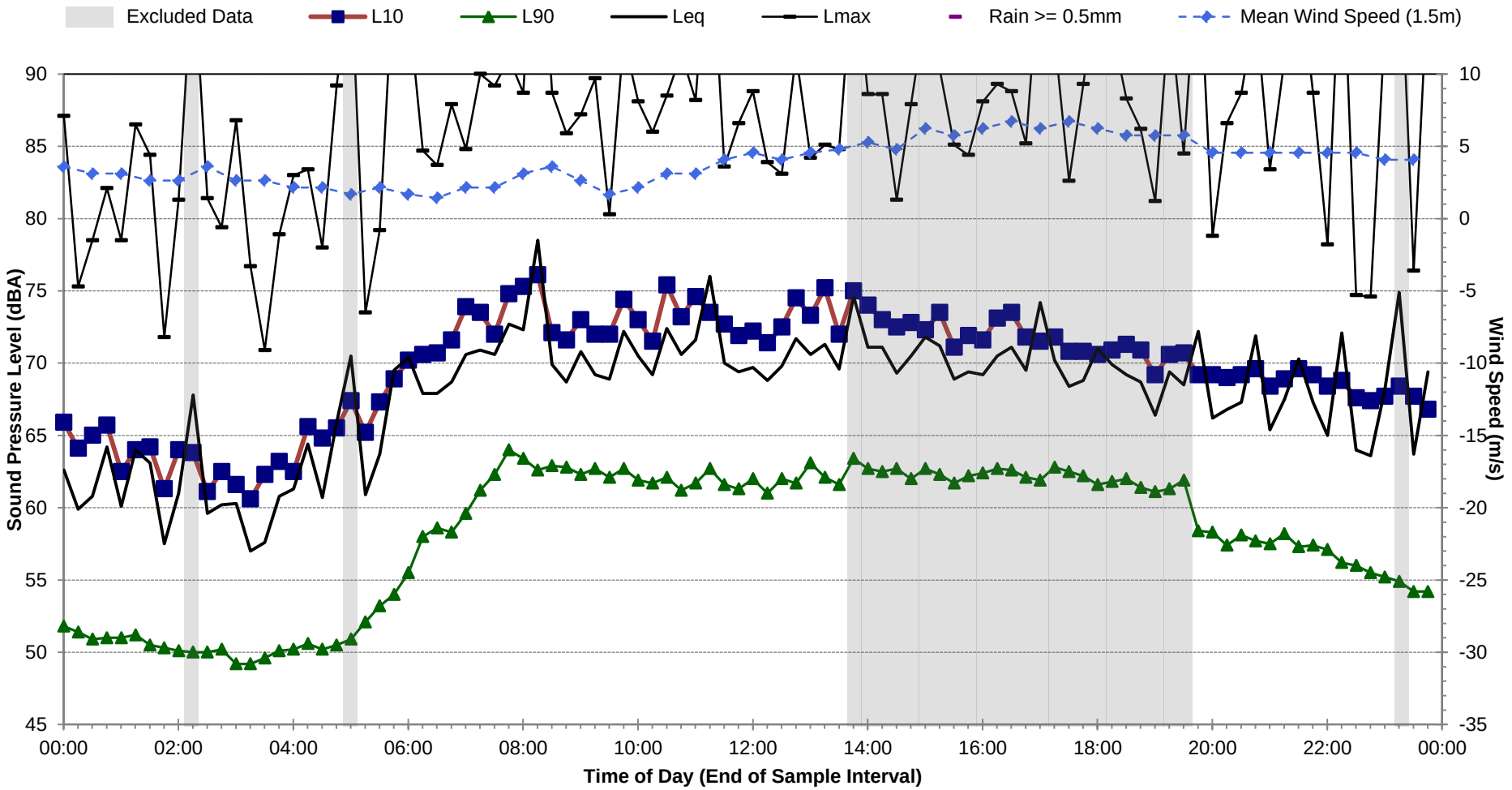
Statistical Ambient Noise Levels

Unit 217, 1 Wattle Crescent - Monday, 12 February 2018



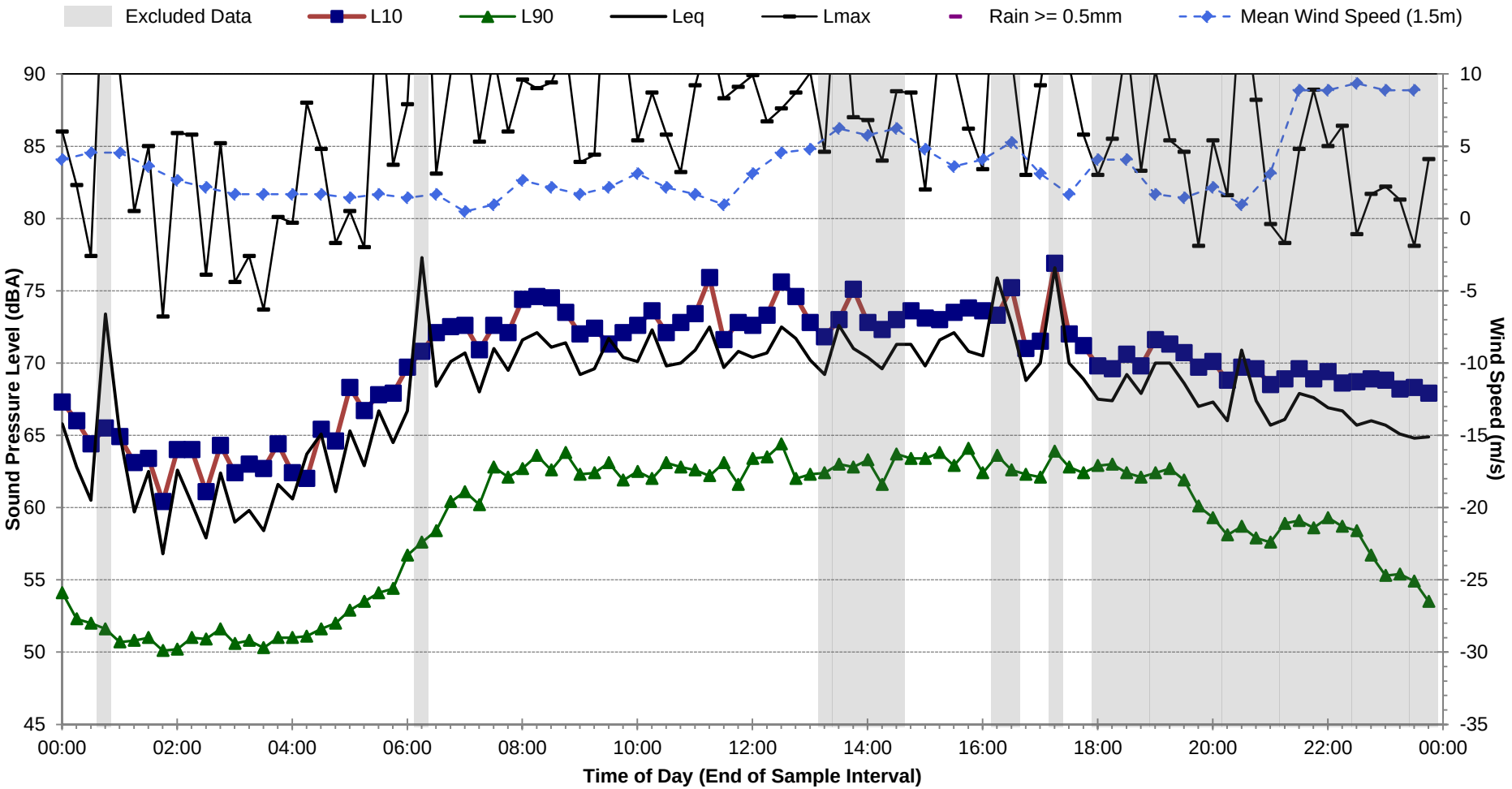
Statistical Ambient Noise Levels

Unit 217, 1 Wattle Crescent - Tuesday, 13 February 2018



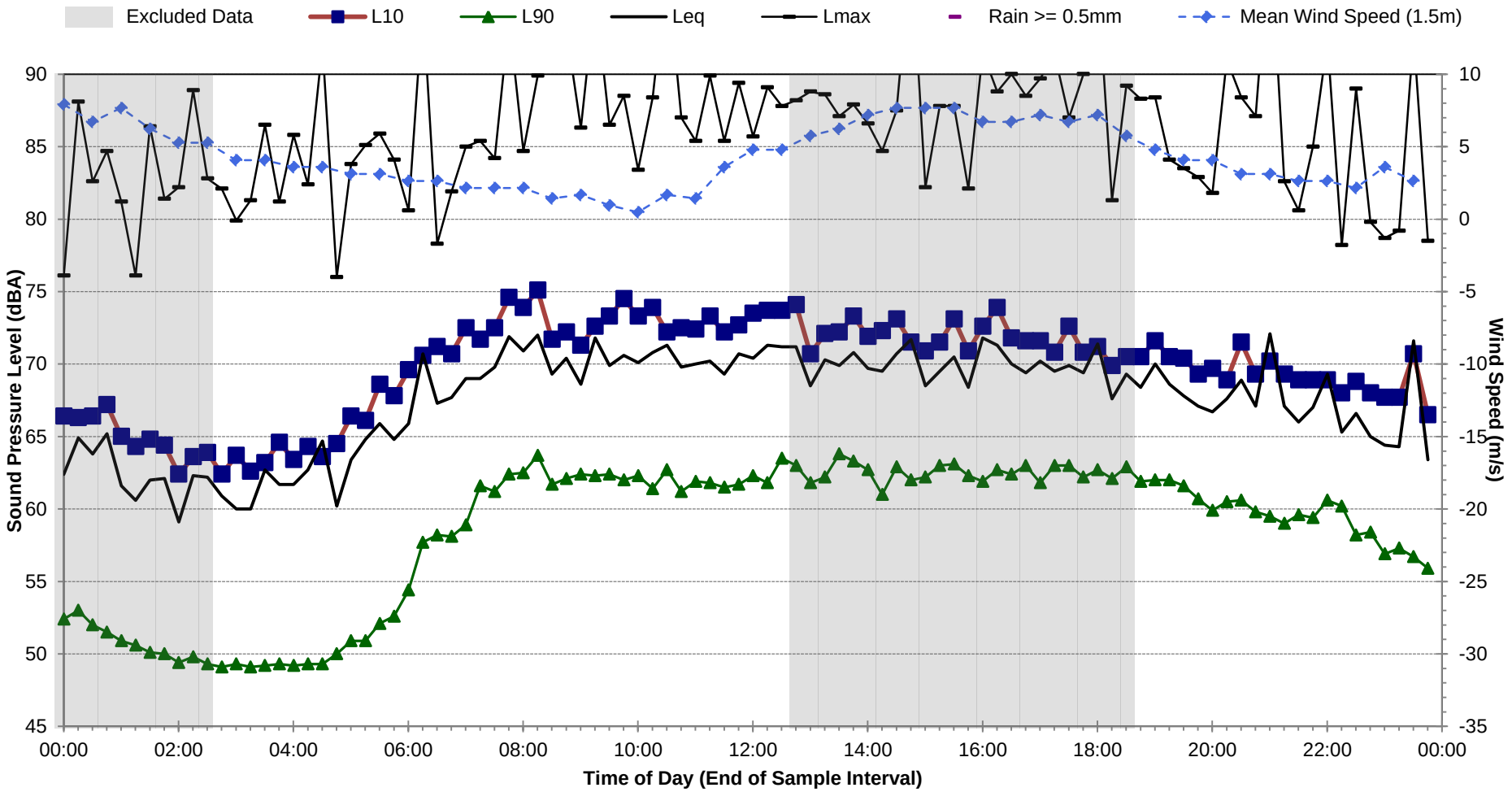
Statistical Ambient Noise Levels

Unit 217, 1 Wattle Crescent - Wednesday, 14 February 2018



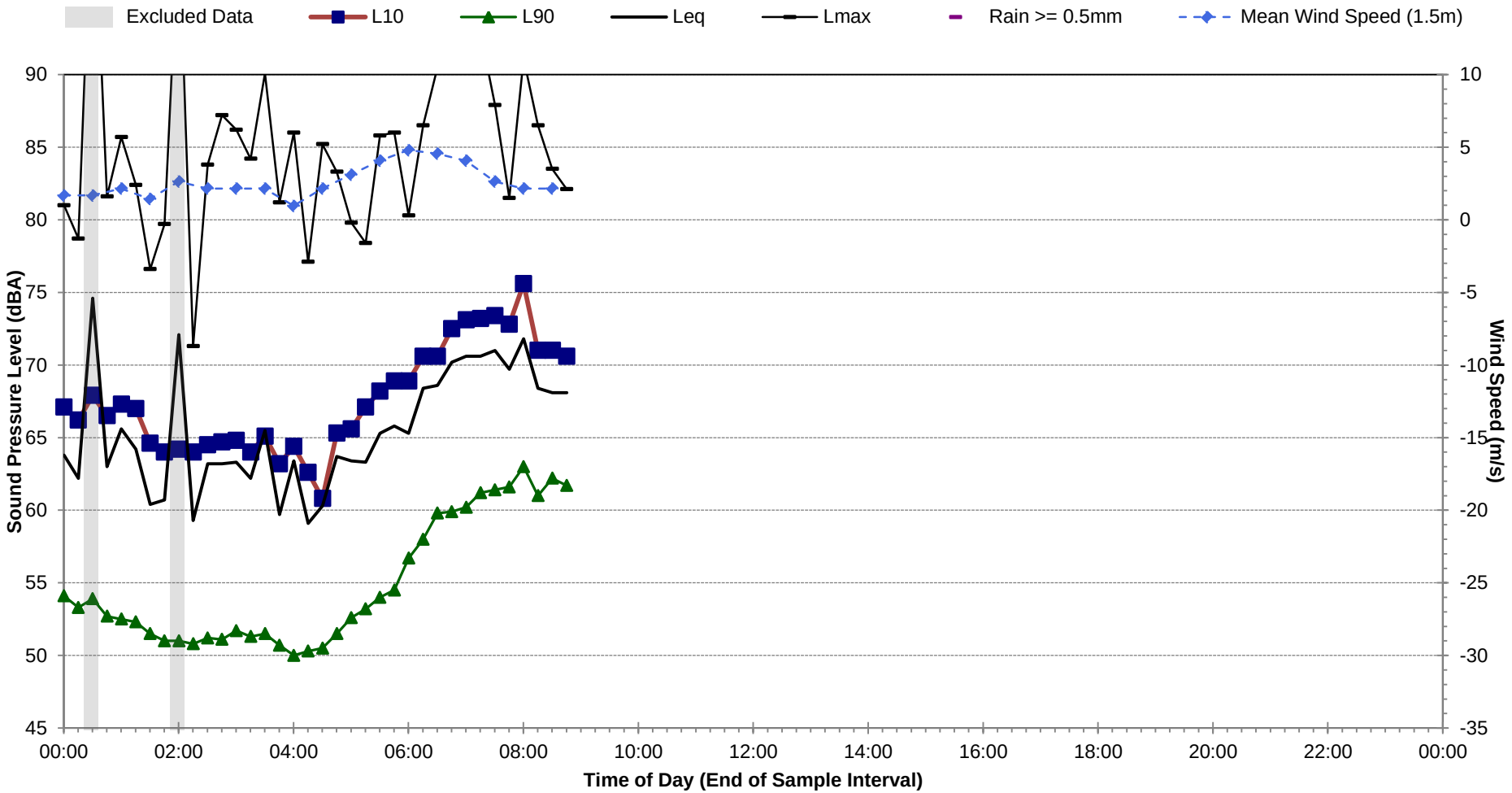
Statistical Ambient Noise Levels

Unit 217, 1 Wattle Crescent - Thursday, 15 February 2018



Statistical Ambient Noise Levels

Unit 217, 1 Wattle Crescent - Friday, 16 February 2018



Noise Monitoring Location:	**L.05**
Noise Monitoring Address:	**Blackwattle Bay Campus, Taylor Street, Glebe**

Logger Device Type: ARL-EL 316, Logger Serial No: 16 – 306 - 044

Sound Level Meter Device Type: Brüel and Kjær 2250, Sound Level Meter Serial No: 2487418

Ambient noise logger deployed at commercial address Blackwattle Bay Campus, Taylor Street, Glebe. Logger located along pedestrian walkway, facing Blackwattle Bay.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Western Distributor with continuous operational noise emissions from nearby industrial premises at ground level also contributing to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

08/02/18: Heavy & Light-vehicle traffic (Western Distributor): 58 - 60 dBA, Distributor): 75 – 82 dBA, School Bell: 62 dBA, Aeroplane: 69 dBA, Wind gusts: 60 dBA, Operational noise: 62 – 71 dBA, Pedestrian Noise: 61 – 64 dBA

Map of Noise Monitoring Location

Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	55	58	59	61
Evening	54	56	57	62
Night-time	48	53	52	55

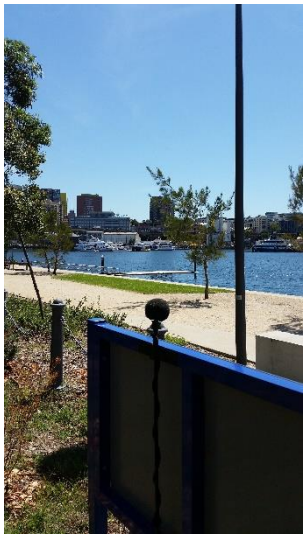
Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	LAeq(Period)	LAeq(1hour)
Daytime (7am-10pm)	57	58
Night-time (10pm-7am)	53	56

Attended Noise Measurement Results

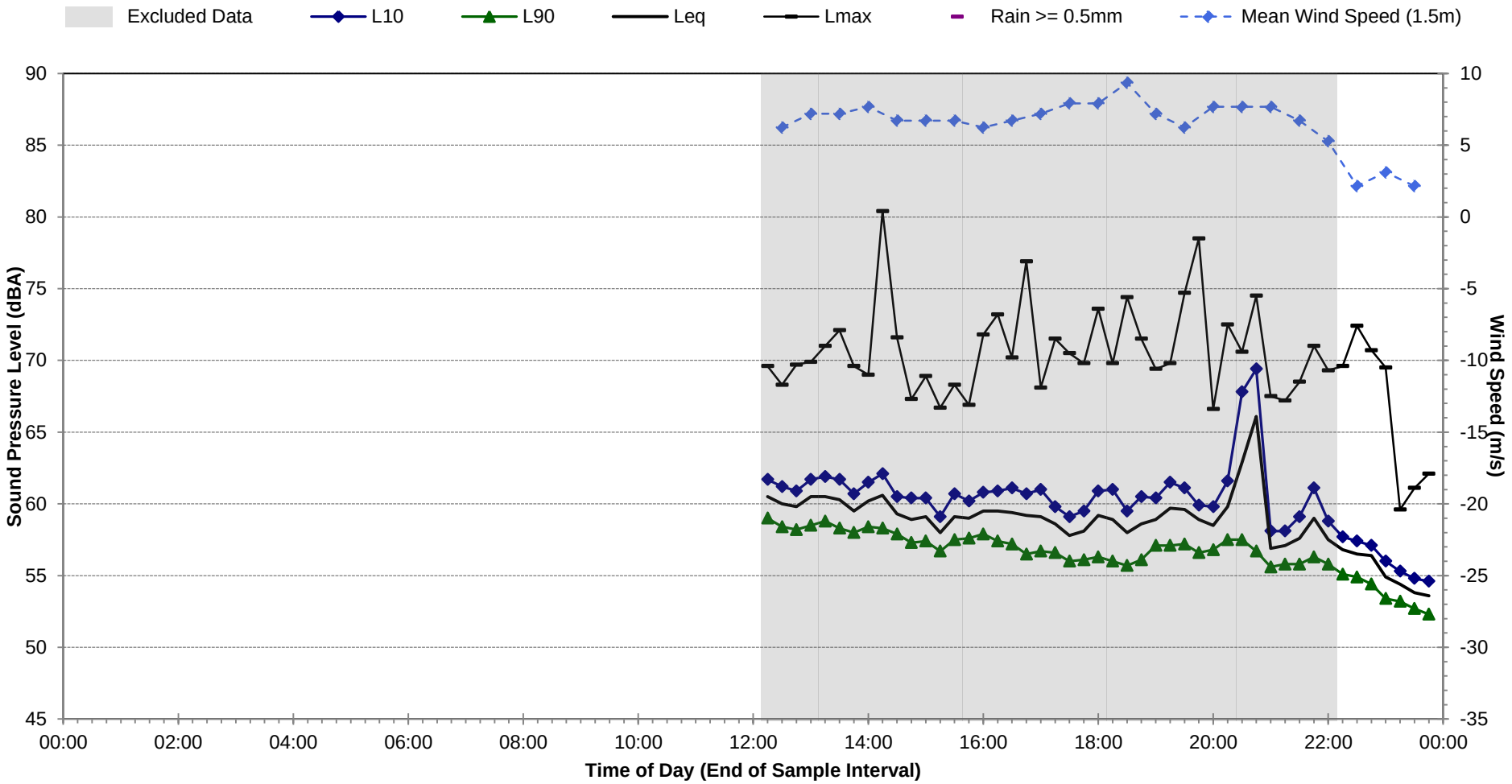
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
08/02/2018	11:38am	57	59	71

Photo of Noise Monitoring Location



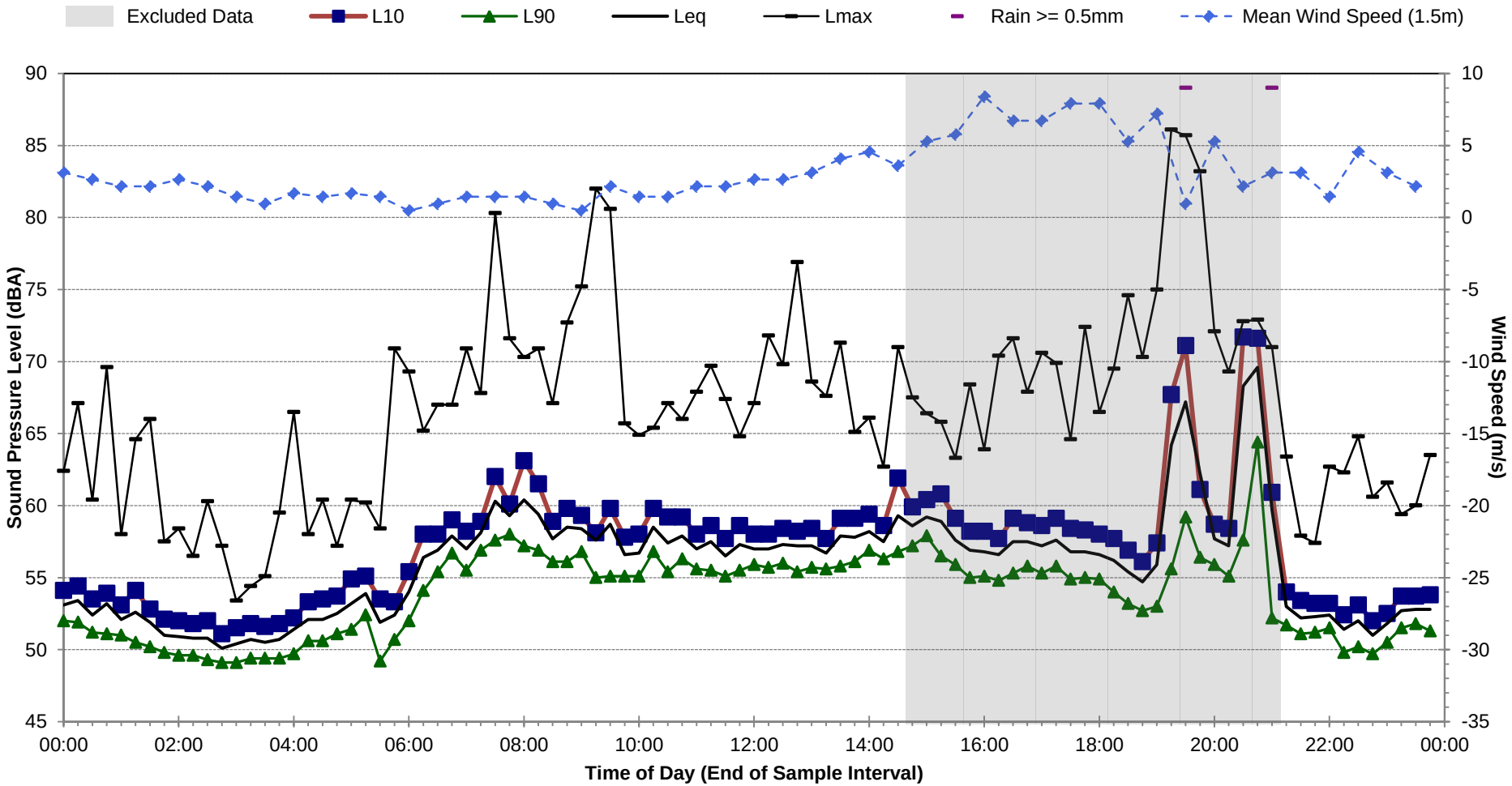
Statistical Ambient Noise Levels

Sydney Secondary College - Thursday, 8 February 2018



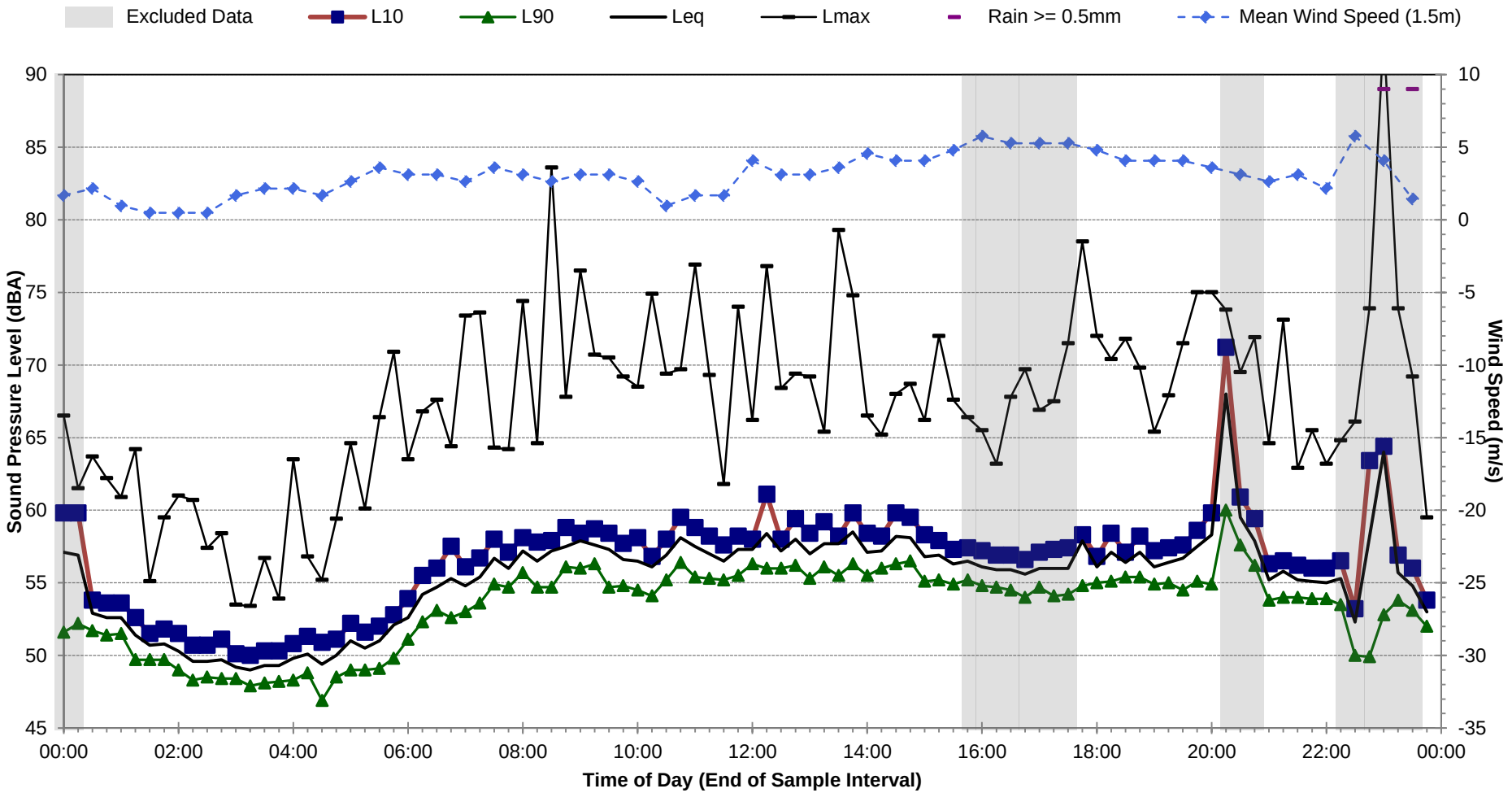
Statistical Ambient Noise Levels

Sydney Secondary College - Friday, 9 February 2018



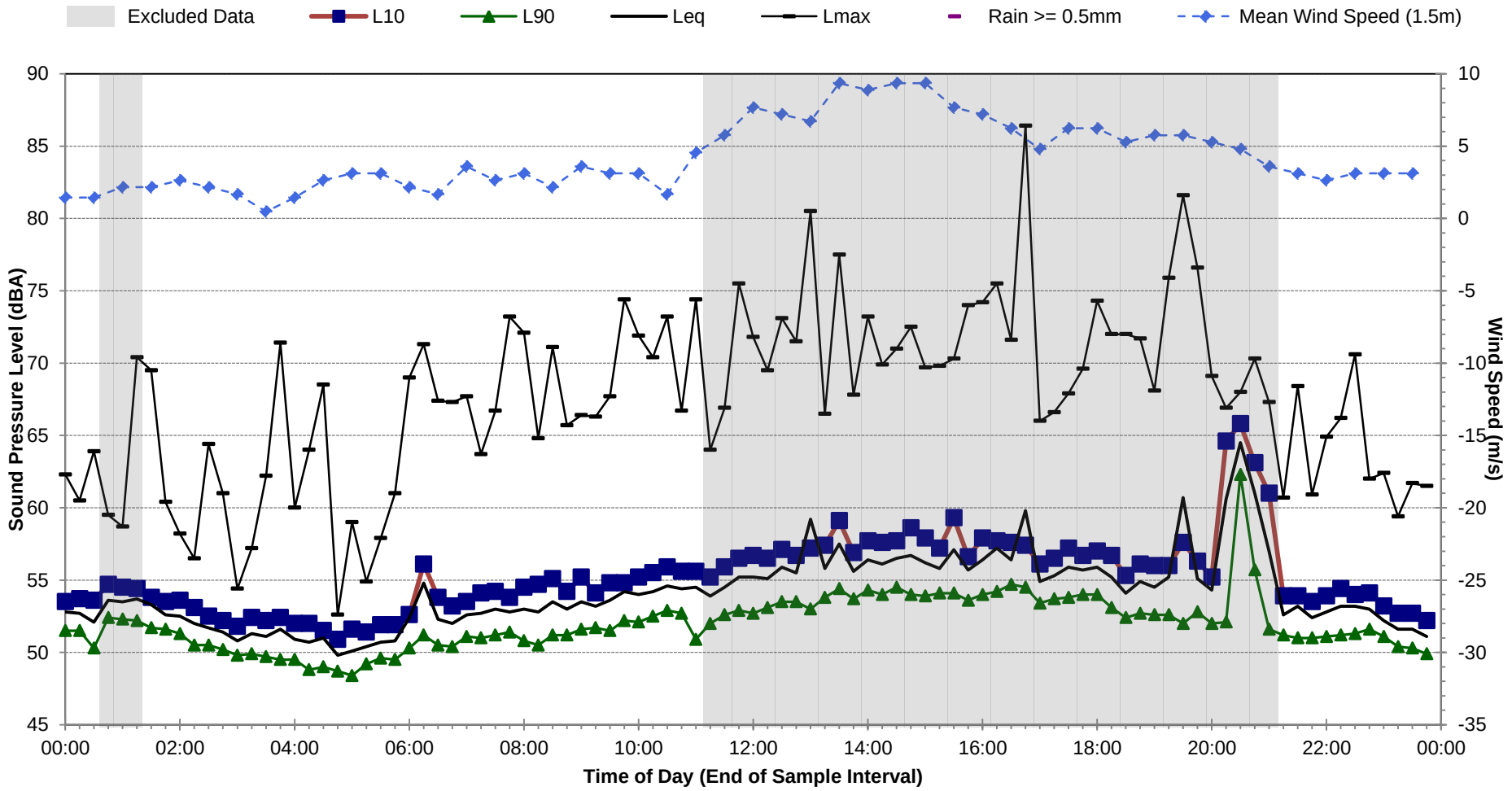
Statistical Ambient Noise Levels

Sydney Secondary College - Saturday, 10 February 2018



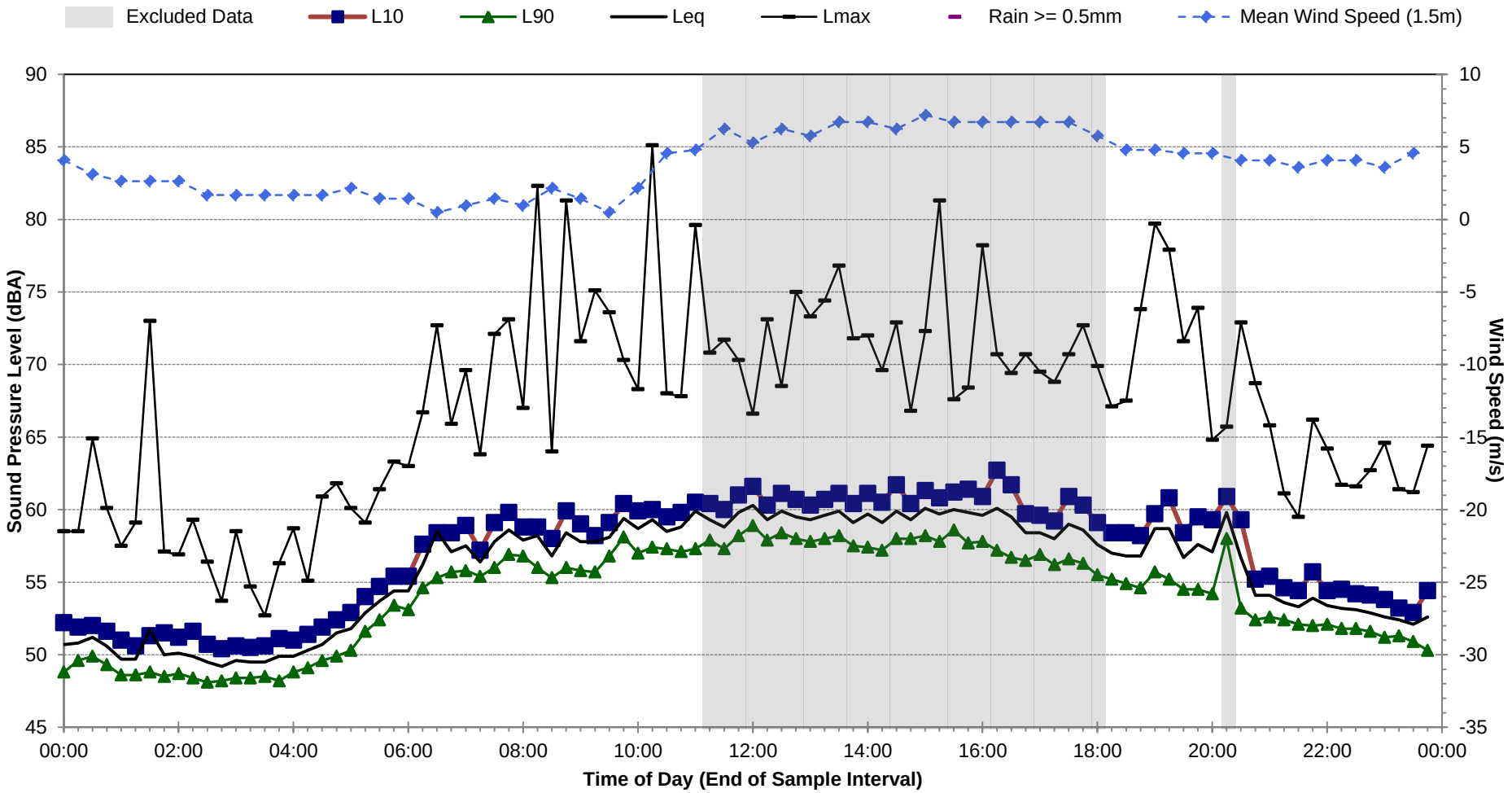
Statistical Ambient Noise Levels

Sydney Secondary College - Sunday, 11 February 2018



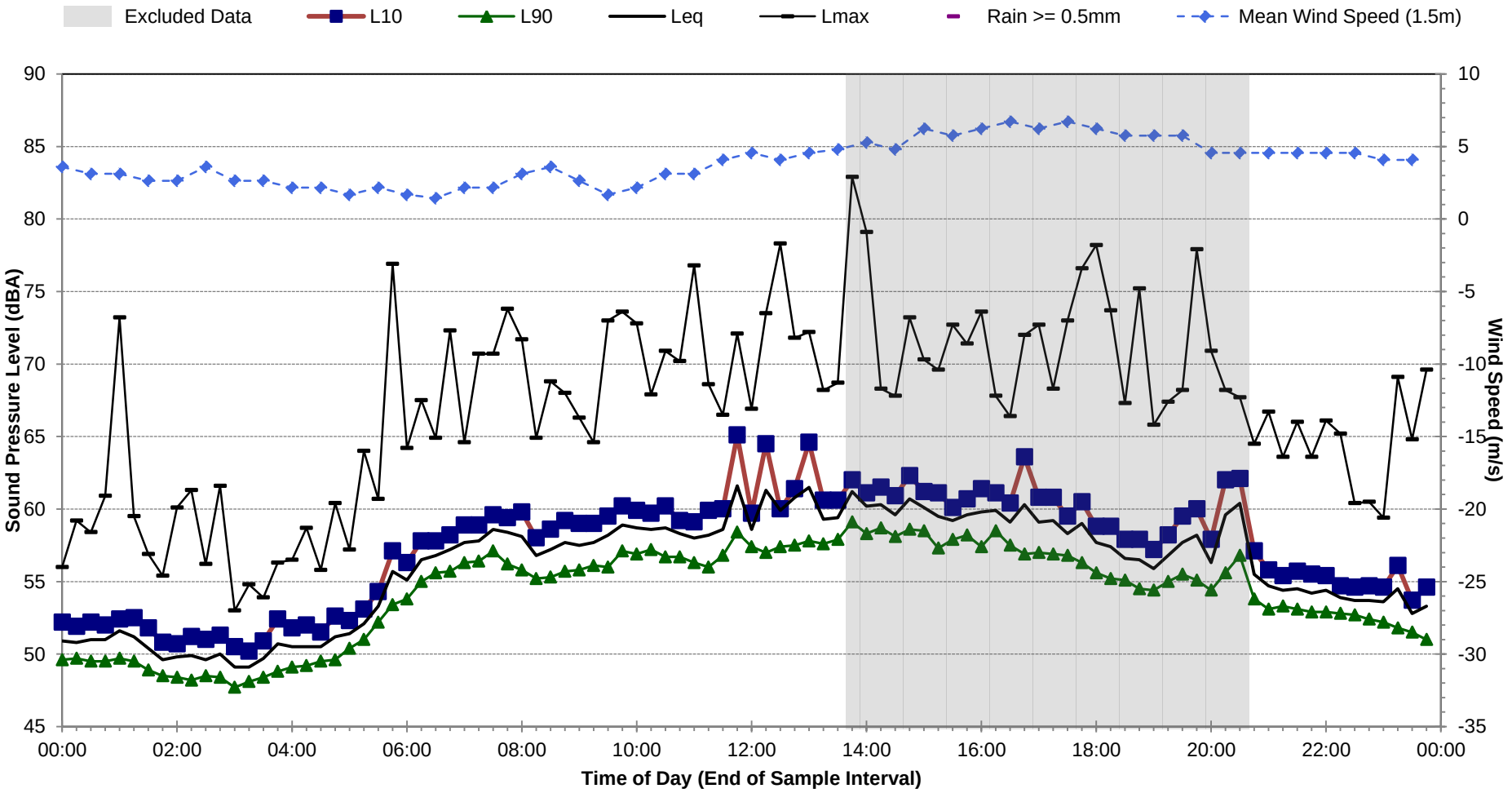
Statistical Ambient Noise Levels

Sydney Secondary College - Monday, 12 February 2018



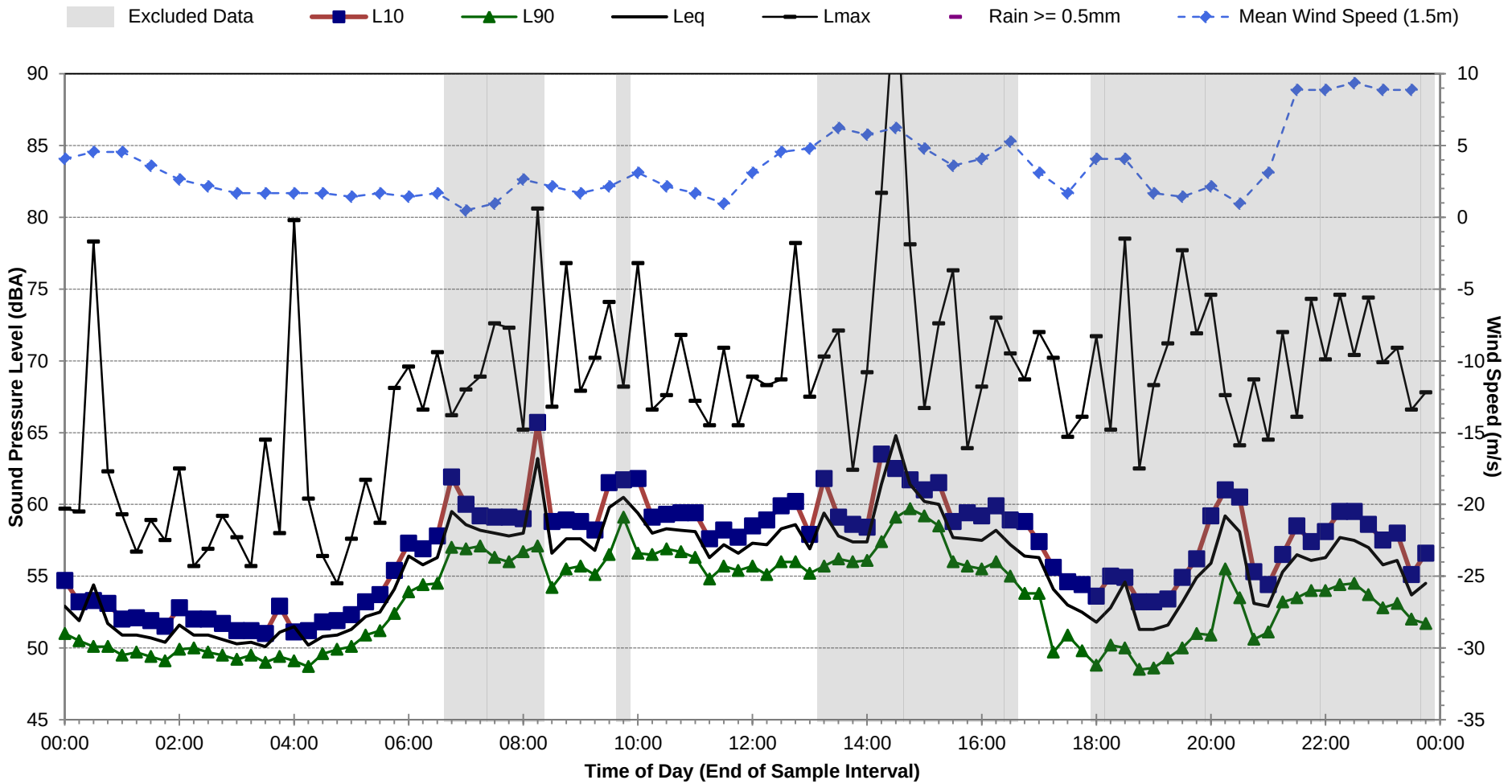
Statistical Ambient Noise Levels

Sydney Secondary College - Tuesday, 13 February 2018



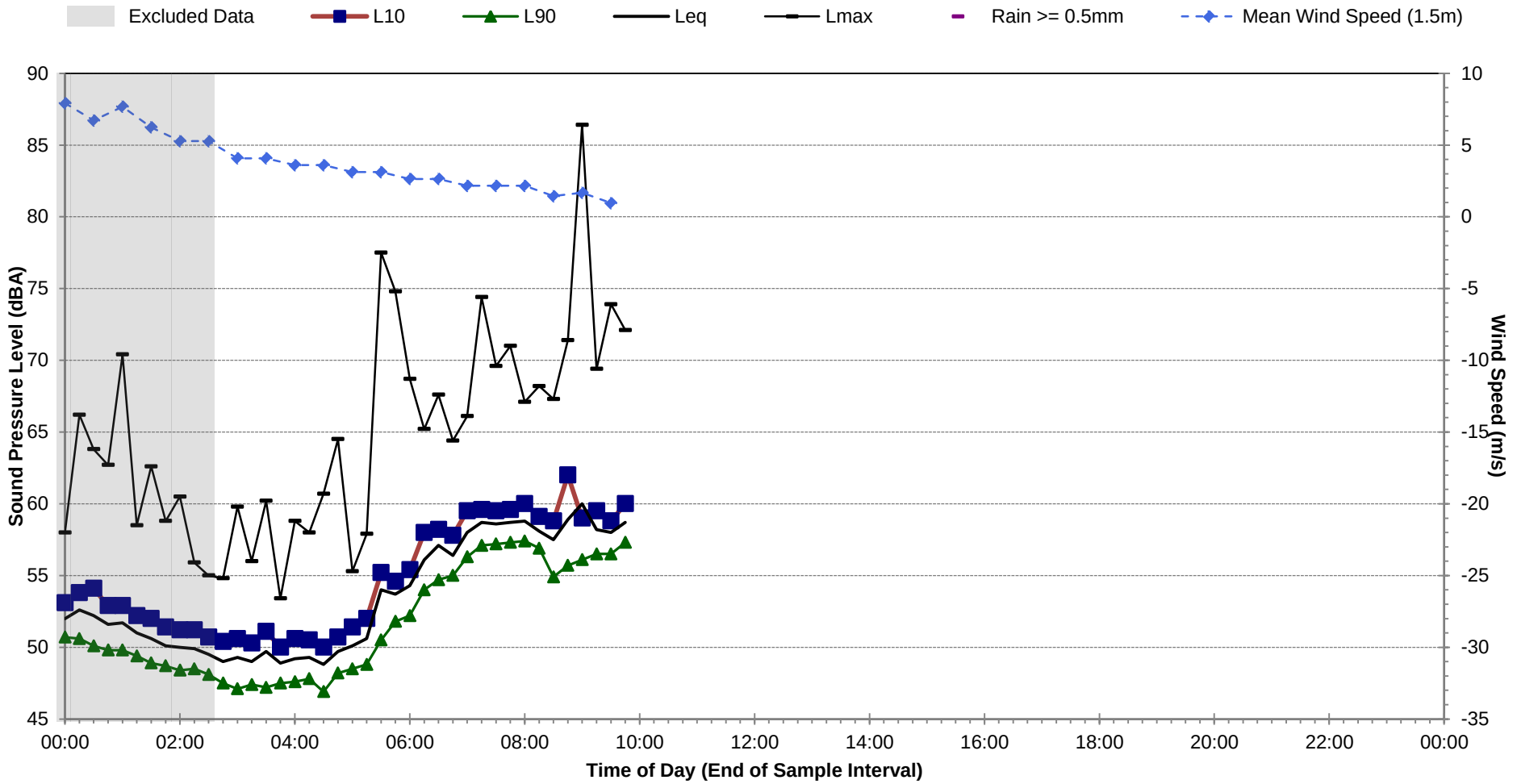
Statistical Ambient Noise Levels

Sydney Secondary College - Wednesday, 14 February 2018



Statistical Ambient Noise Levels

Sydney Secondary College - Thursday, 15 February 2018



Noise Monitoring Location:	**L.06**
Noise Monitoring Address:	**13 Griffin Place, Glebe**

Logger Device Type: ARL-EL 316, Logger Serial No: 16 – 203 - 528

Sound Level Meter Device Type: Brüel and Kjær 2250, Sound Level Meter Serial No: 2487418

Ambient noise logger deployed at residential address 13 Griffin Place, Glebe. Logger located in grassed area, with direct line of sight to Blackwattle Bay.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Western Distributor with transient operational noise emissions from nearby industrial premises and intermittent bird calls also contributing to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

15/02/18: Heavy & Light-vehicle traffic (Western Distributor): 60 – 63 dBA, Ambient noise: 54 dBA, Bird calls: 62 – 66 dBA, Aeroplane: 58 - 59 dBA, Operational noise: 58 dBA, Pedestrian Noise: 64 dBA

Map of Noise Monitoring Location

Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	50	54	55	57
Evening	51	54	55	57
Night-time	46	50	51	53

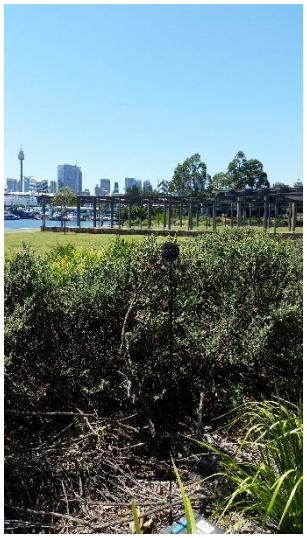
Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(Period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	54	55
Night-time (10pm-7am)	50	54

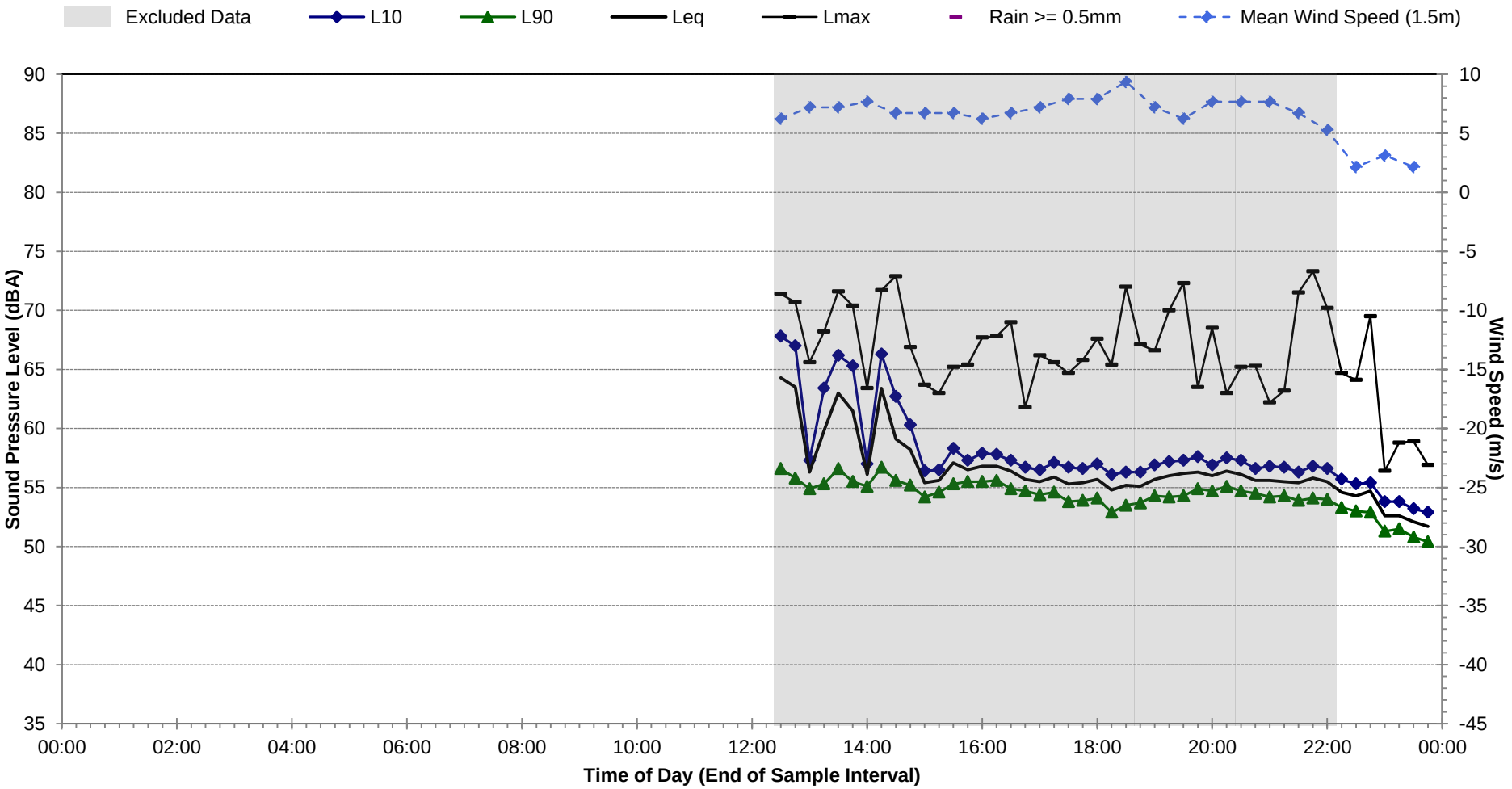
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
15/02/2018	9:59am	54	56	66

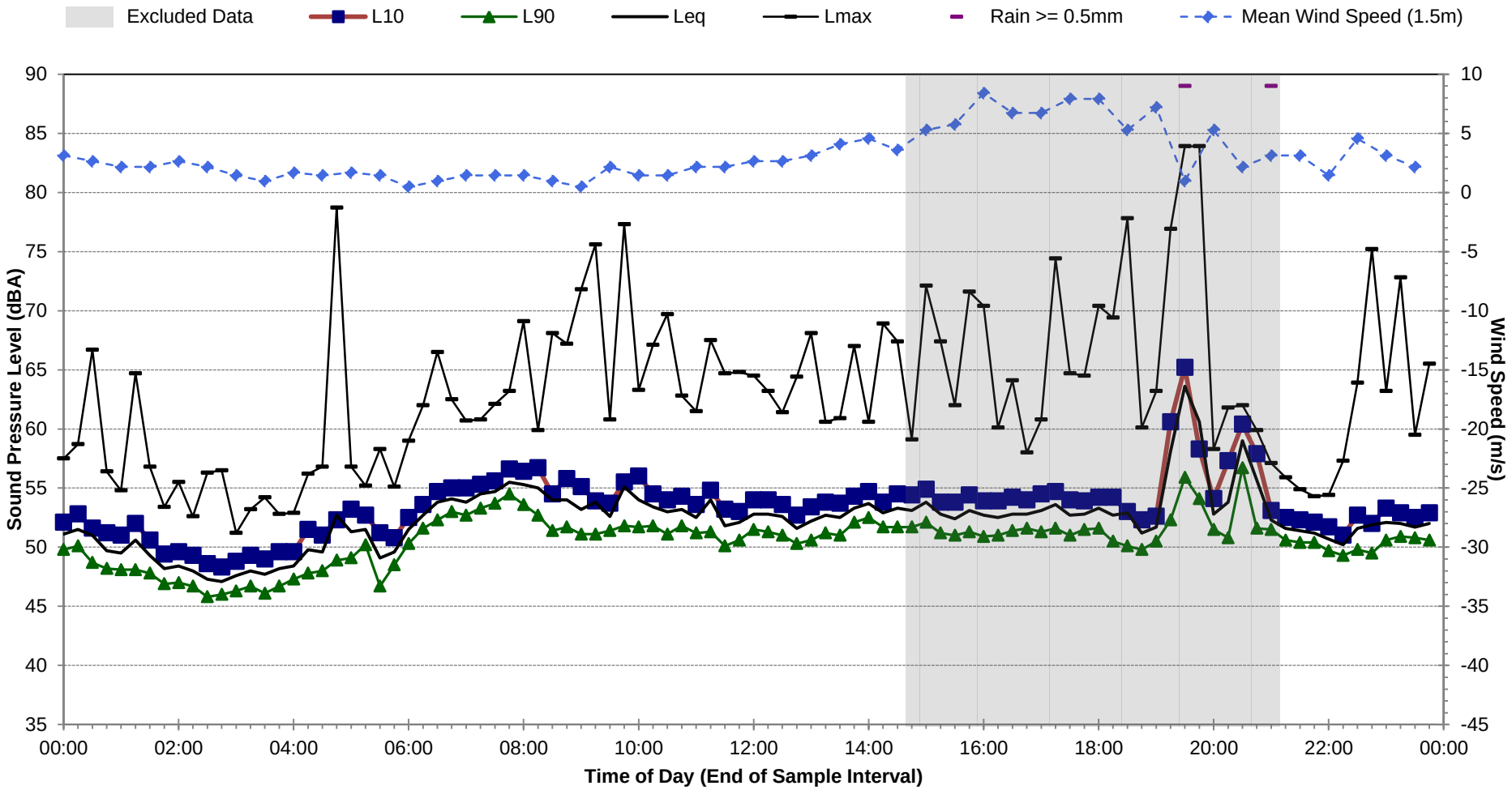
Photo of Noise Monitoring Location



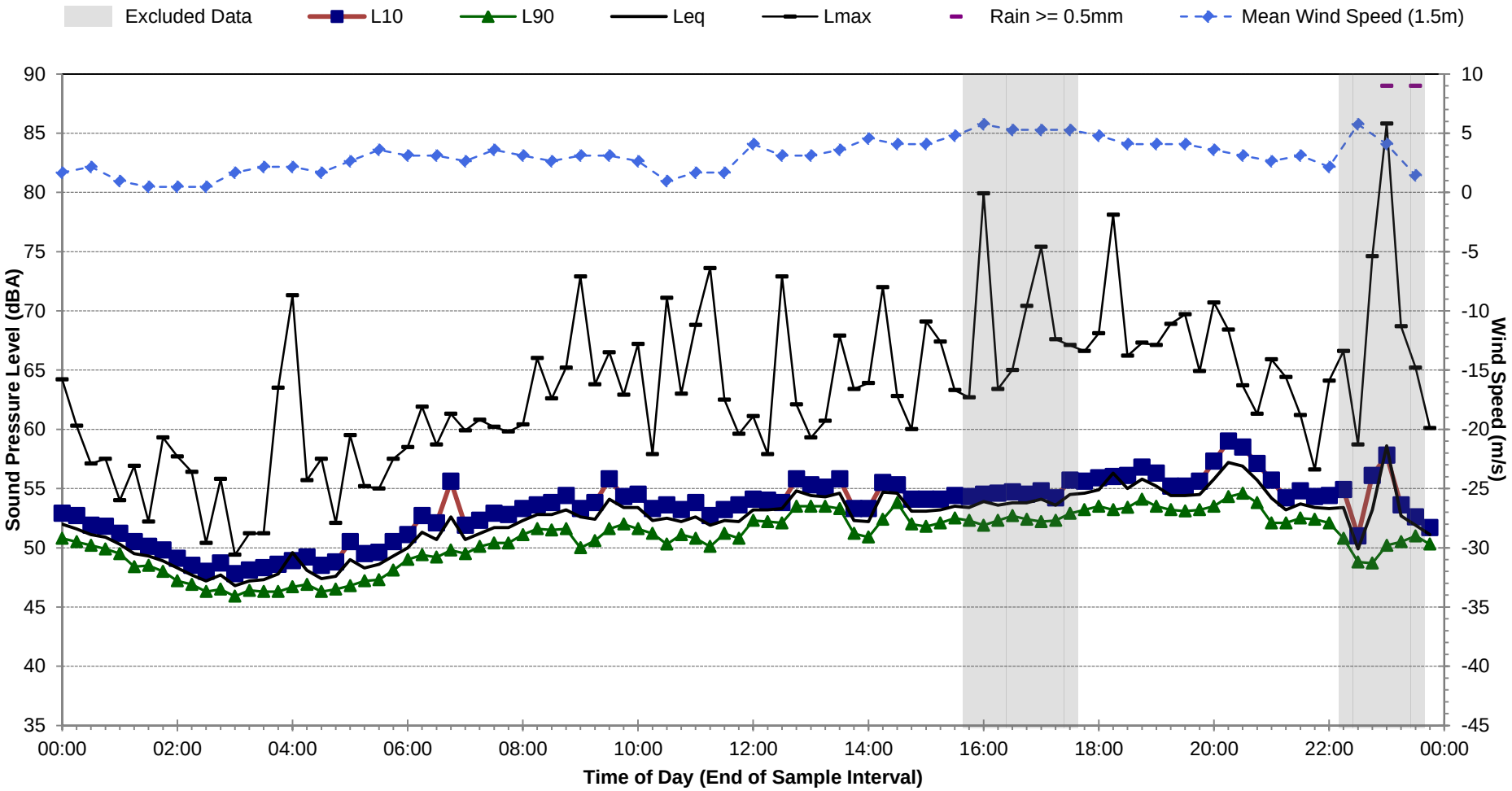
Statistical Ambient Noise Levels
13 Griffin Place - Thursday, 8 February 2018



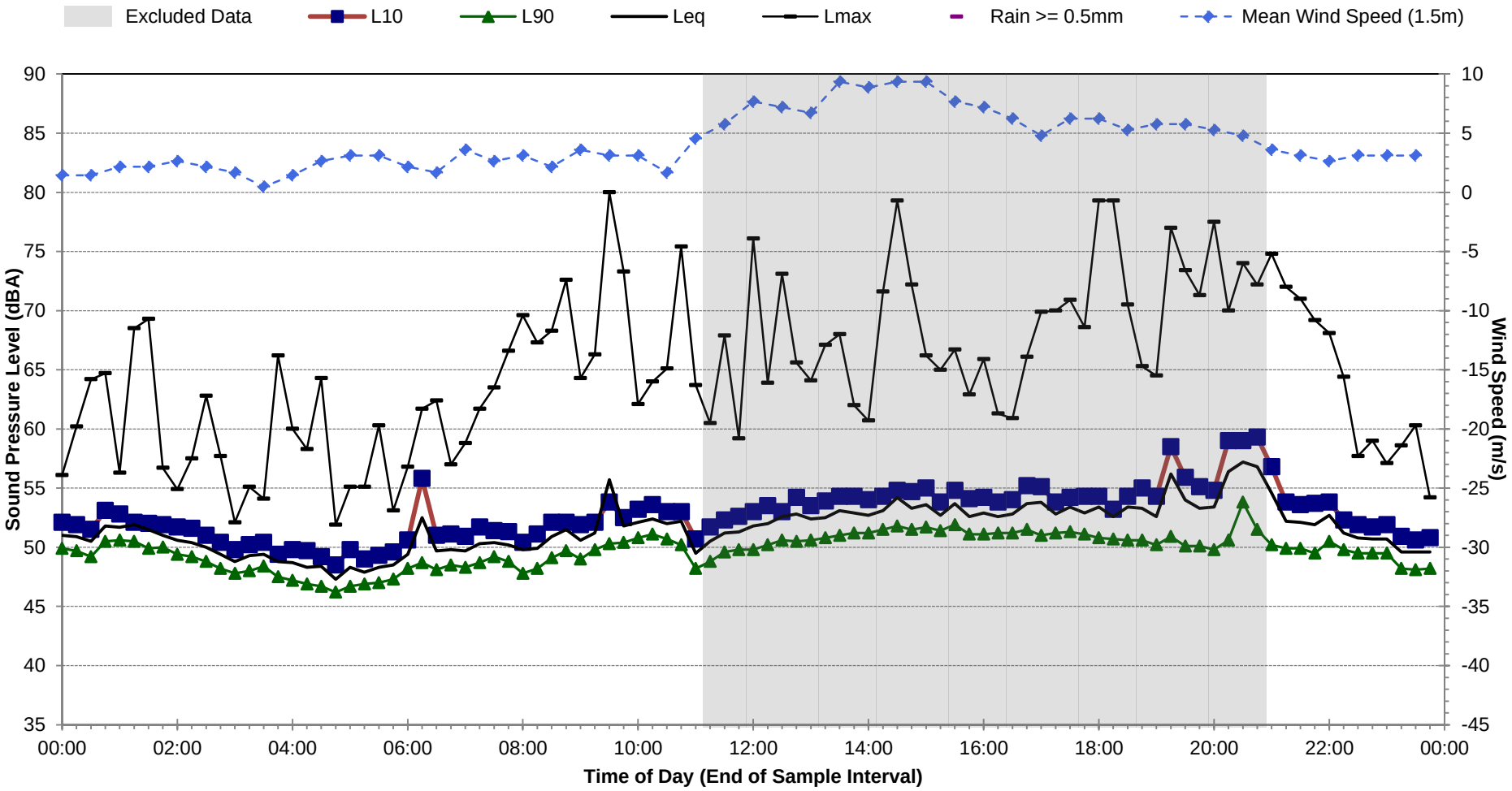
Statistical Ambient Noise Levels
13 Griffin Place - Friday, 9 February 2018



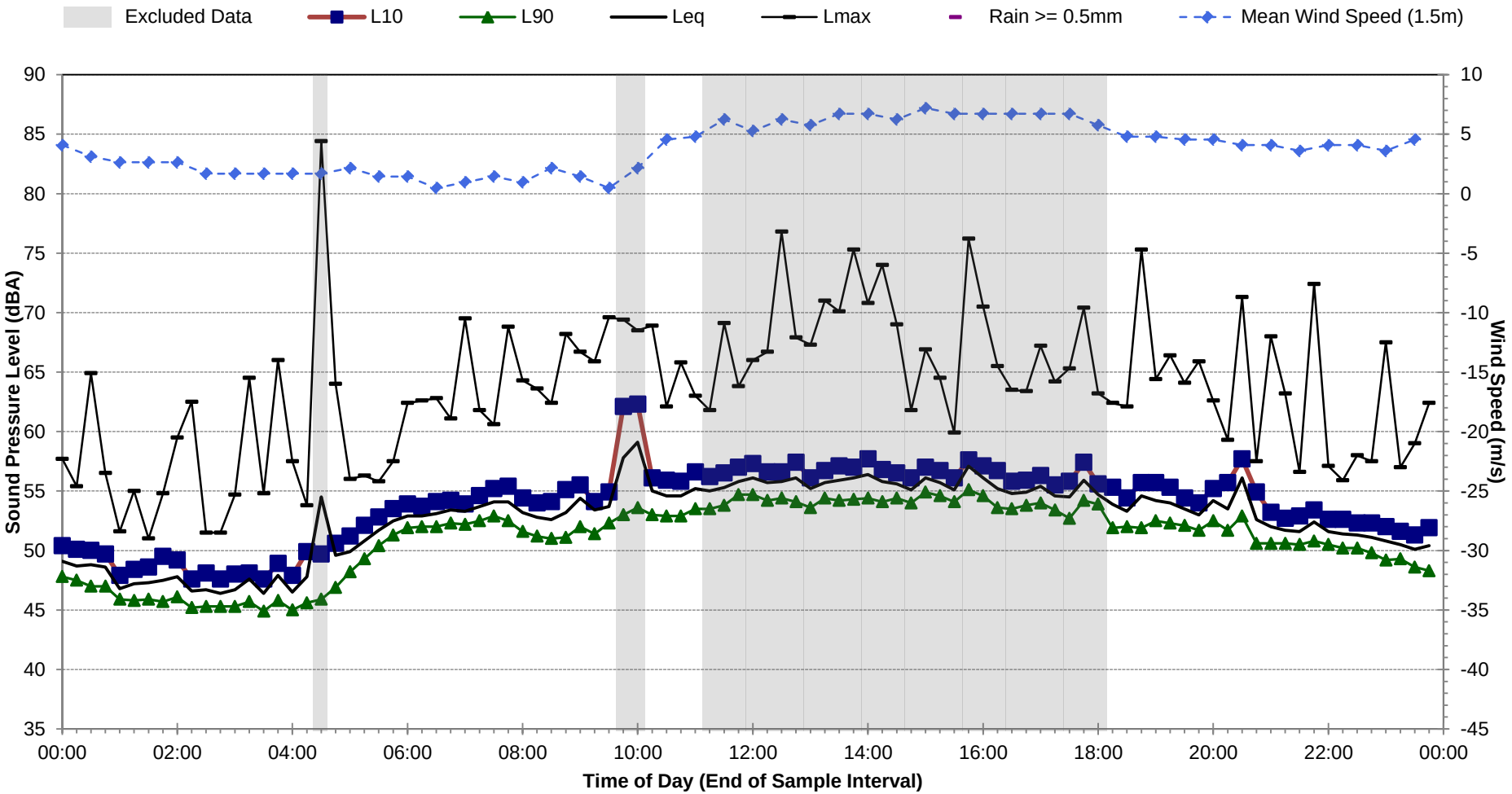
Statistical Ambient Noise Levels
13 Griffin Place - Saturday, 10 February 2018



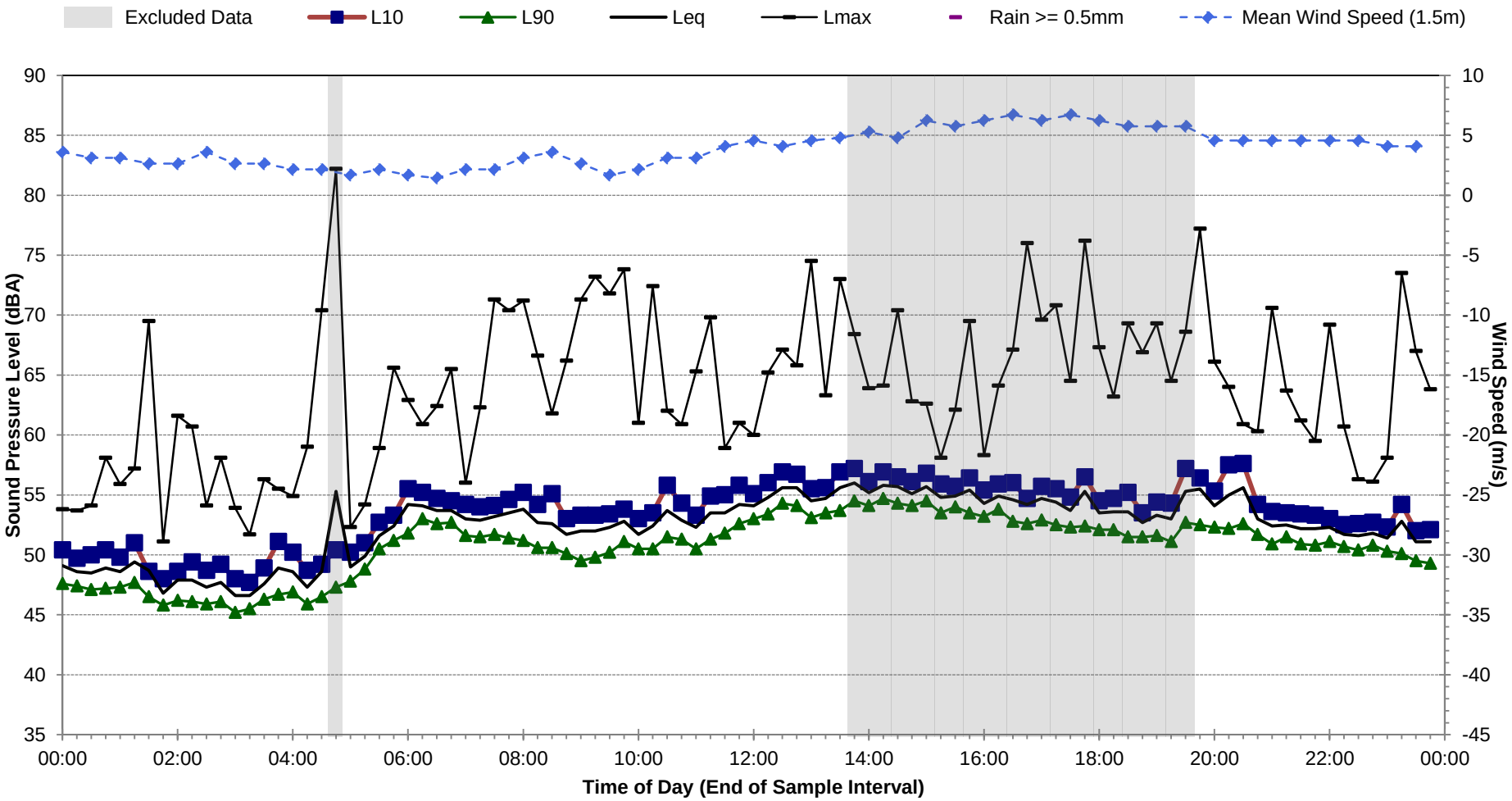
Statistical Ambient Noise Levels
13 Griffin Place - Sunday, 11 February 2018



Statistical Ambient Noise Levels
13 Griffin Place - Monday, 12 February 2018

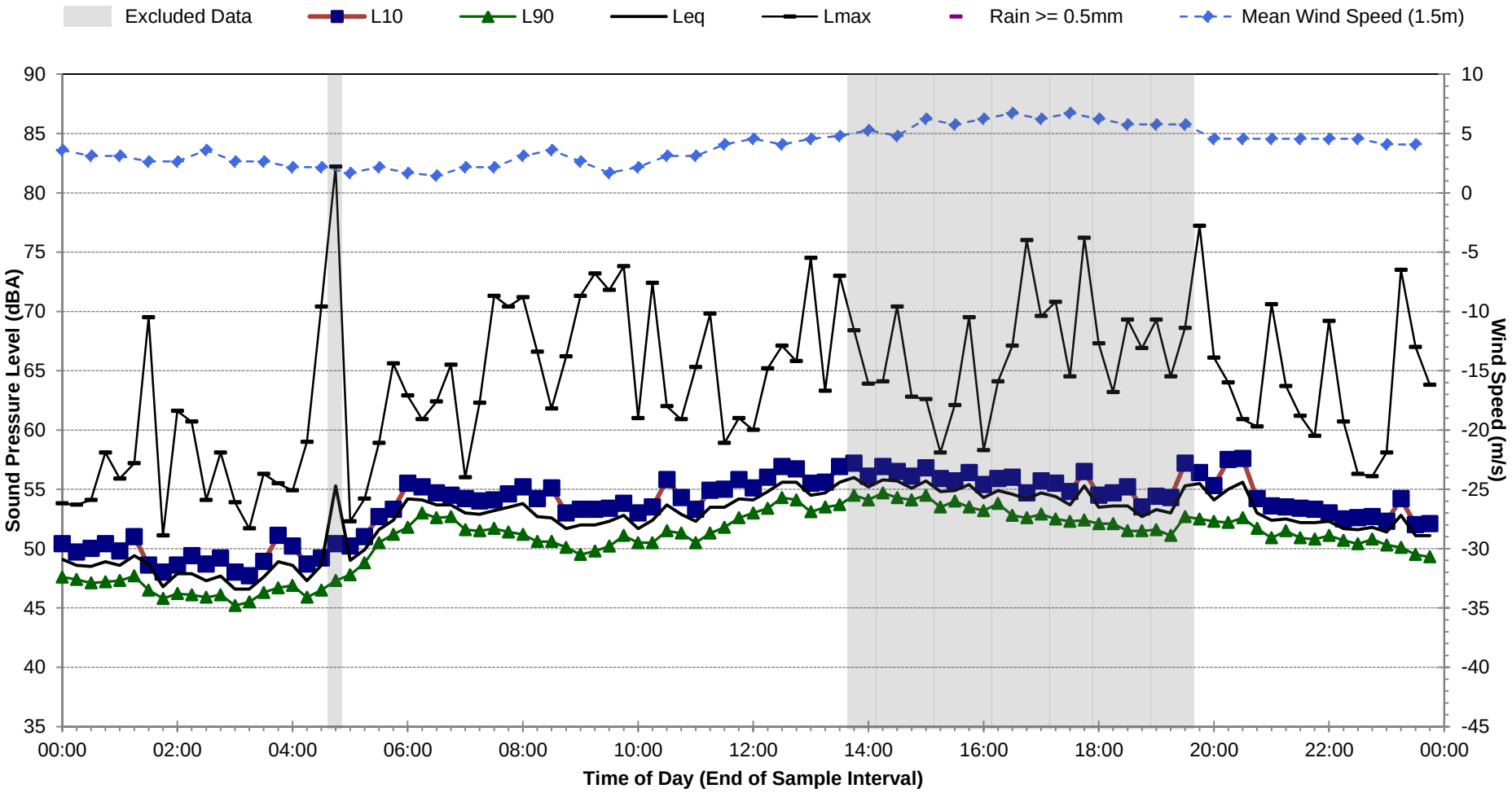


Statistical Ambient Noise Levels
13 Griffin Place - Tuesday, 13 February 2018



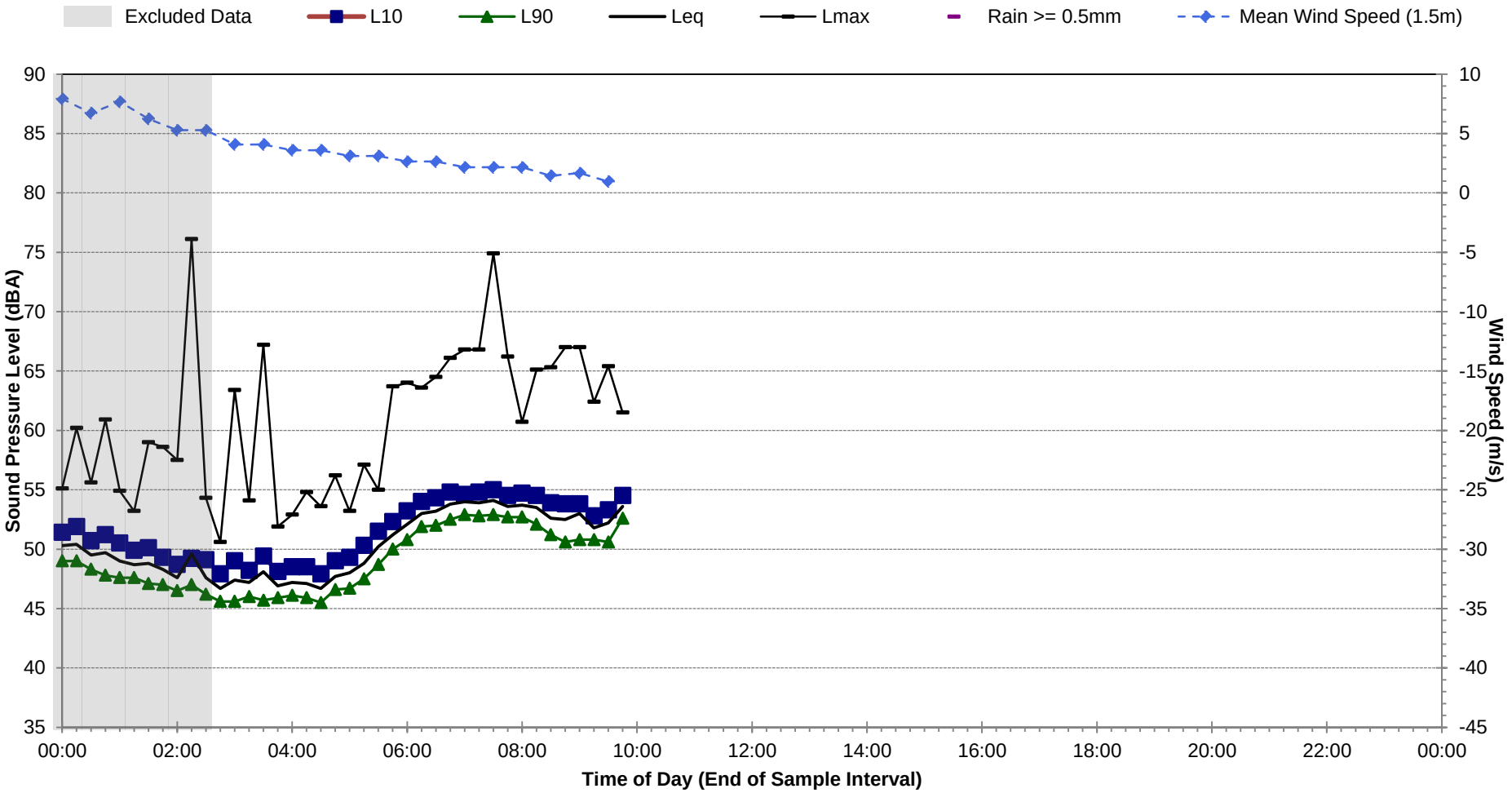
Statistical Ambient Noise Levels

13 Griffin Place - Tuesday, 13 February 2018



Statistical Ambient Noise Levels

13 Griffin Place - Thursday, 15 February 2018



Noise Monitoring Location:	**L.07**
Noise Monitoring Address:	**6/82 Wentworth Park Road**

Logger Device Type: ARL-EL 316, Logger Serial No: 16 – 203 - 505

Sound Level Meter Device Type: Brüel and Kjær 2250, Sound Level Meter Serial No: 2487418

Ambient noise logger deployed at residential address 6/82 Wentworth Park Road, Glebe. Logger located at footpath boundary directly facing Wentworth Park Road.

Attended noise measurements indicate the ambient noise environment at this location is dominated by continuous road traffic noise from Wentworth Park Road with transient operational noise emissions from nearby industrial premises and intermittent bird calls also contributing to the LAeq at this monitoring position.

Recorded Noise Levels: (LAmax):

08/02/18: Heavy-vehicle traffic (Wentworth Park Road): 72 - 82 dBA, Light-vehicle traffic (Wentworth Park Road): 66 – 77 dBA, Ambient noise: 56 - 57 dBA, Motorcycle traffic: 68 – 82 dBA, Light rail: 62 dBA, Operational noise: 55 - 57 dBA

Map of Noise Monitoring Location

Ambient Noise Logging Results – NPfl Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	54	67	70	76
Evening	50	64	67	73
Night-time	42	59	58	70

Ambient Noise Logging Results – RNP Defined Time Periods

Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(Period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	66	68
Night-time (10pm-7am)	59	66

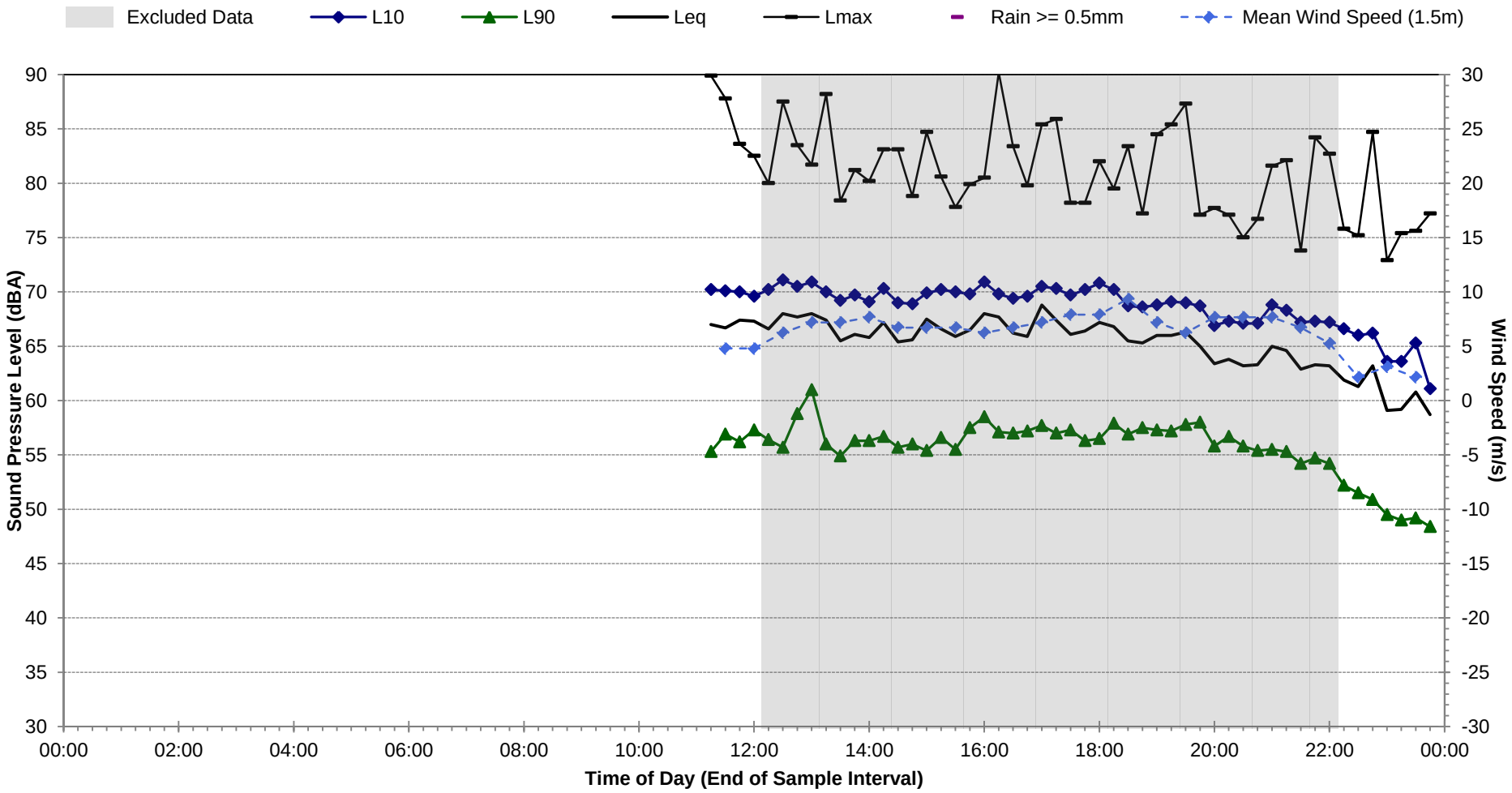
Attended Noise Measurement Results

Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
08/02/2018	10:49am	56	66	82

Photo of Noise Monitoring Location

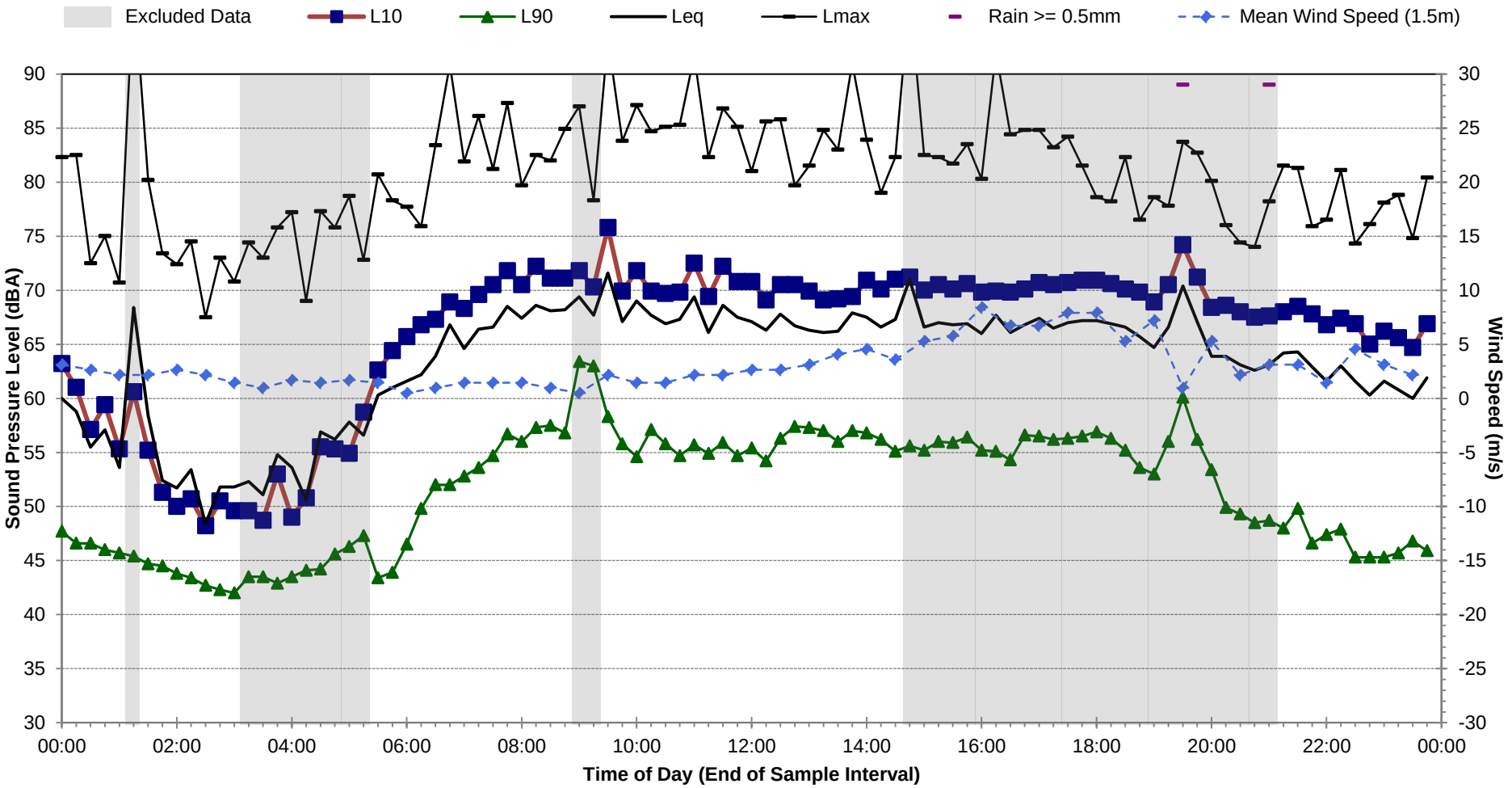
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Thursday, 8 February 2018



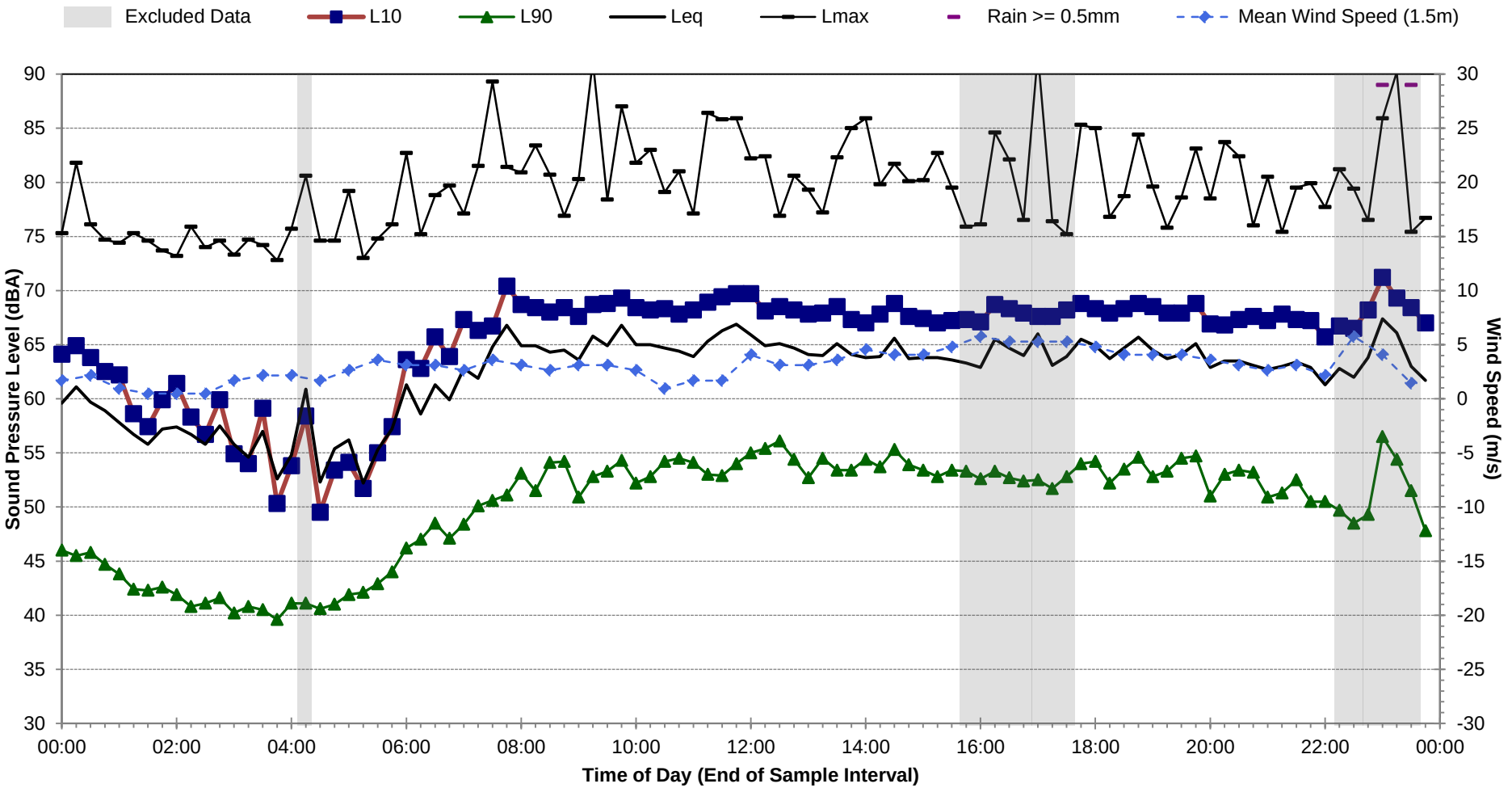
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Friday, 9 February 2018



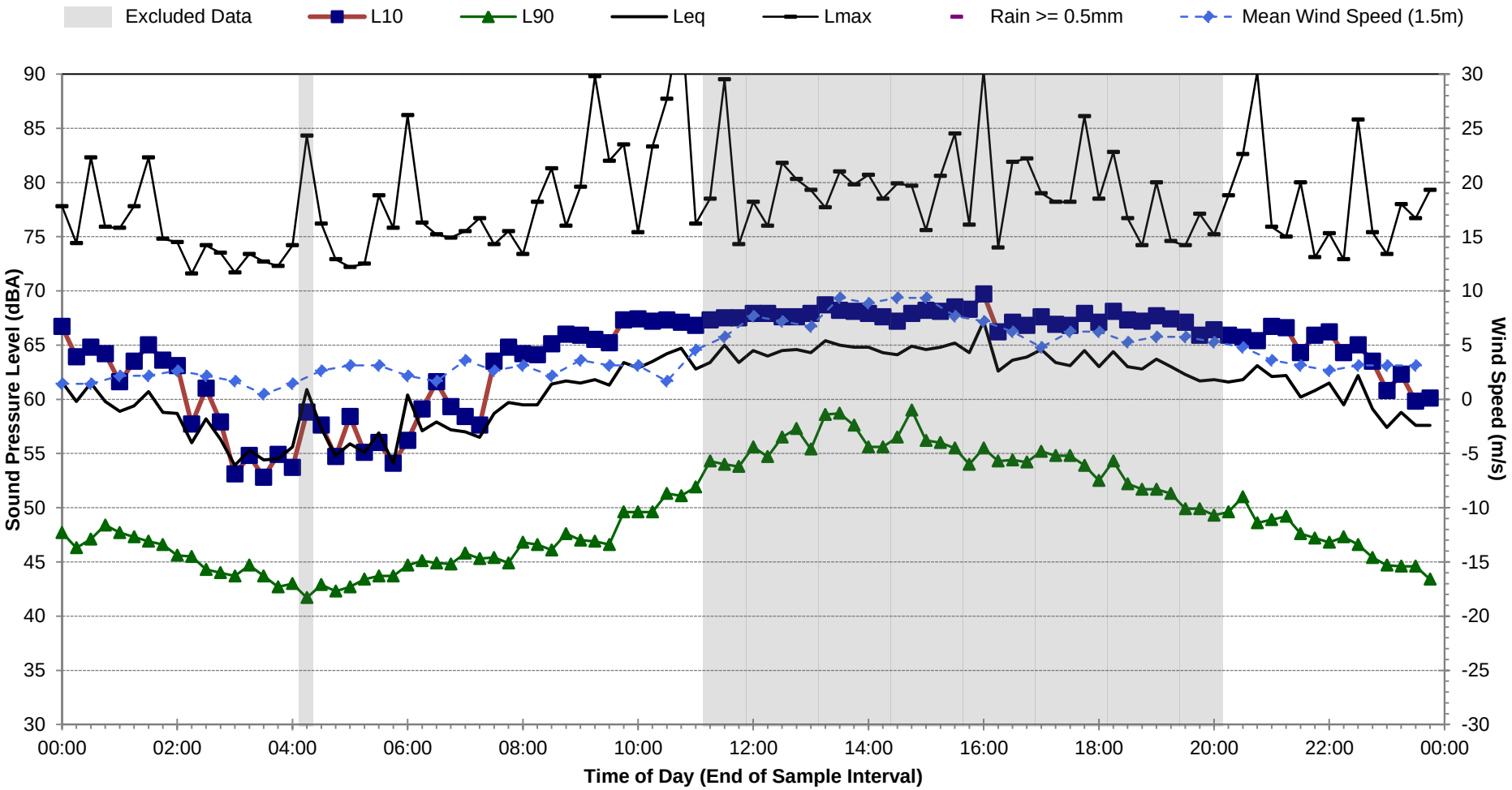
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Saturday, 10 February 2018



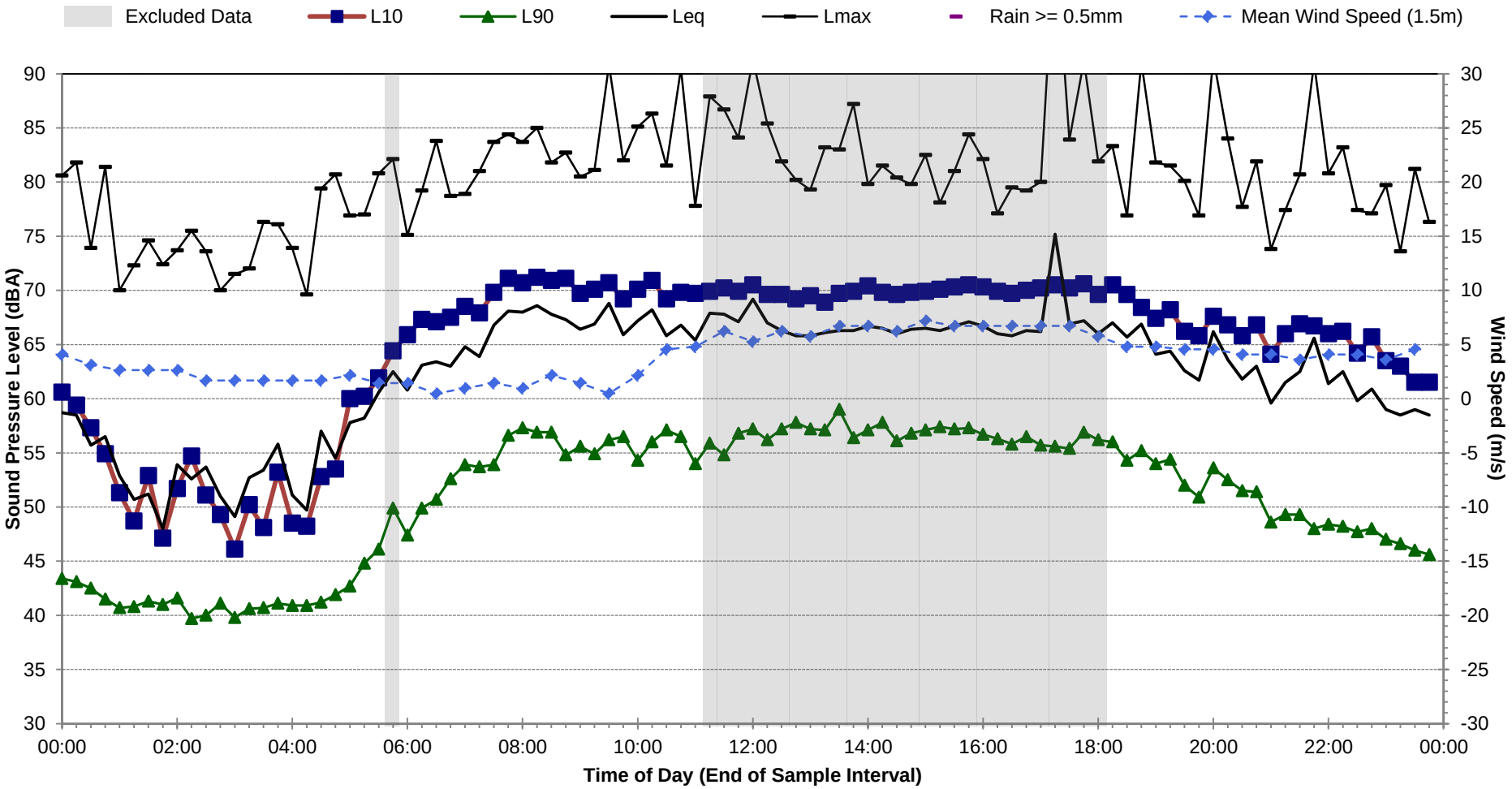
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Sunday, 11 February 2018



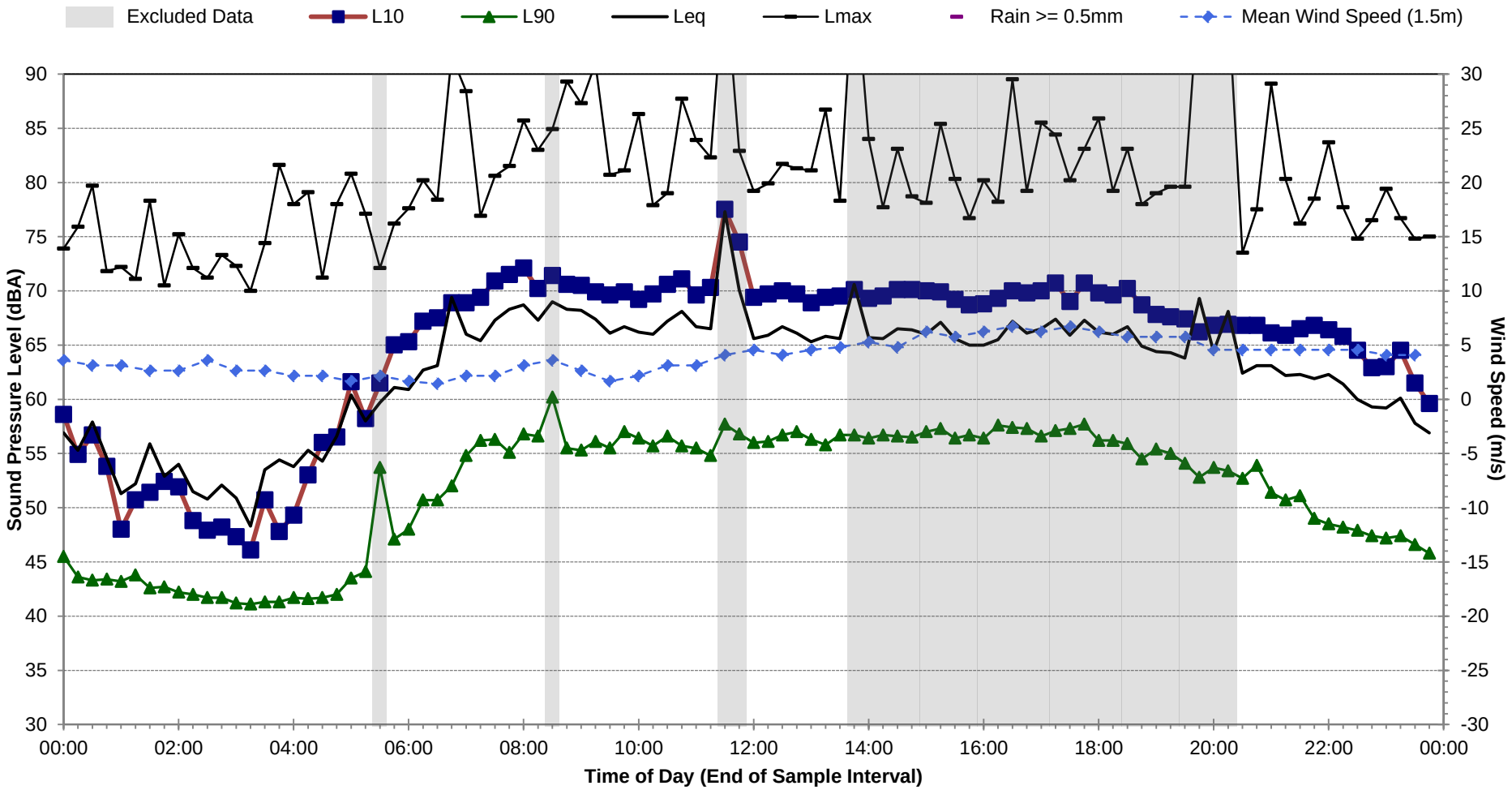
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Monday, 12 February 2018



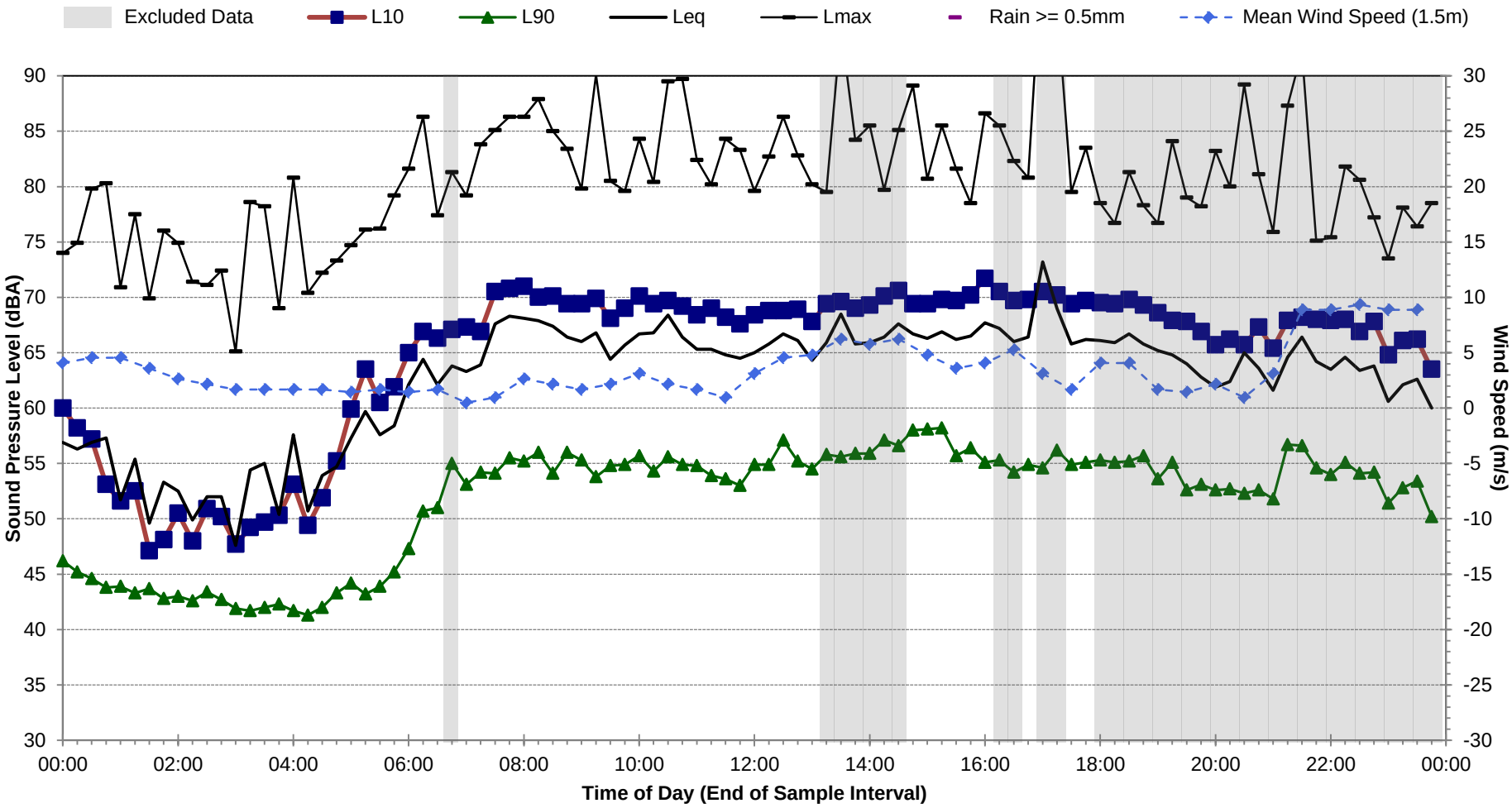
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Tuesday, 13 February 2018



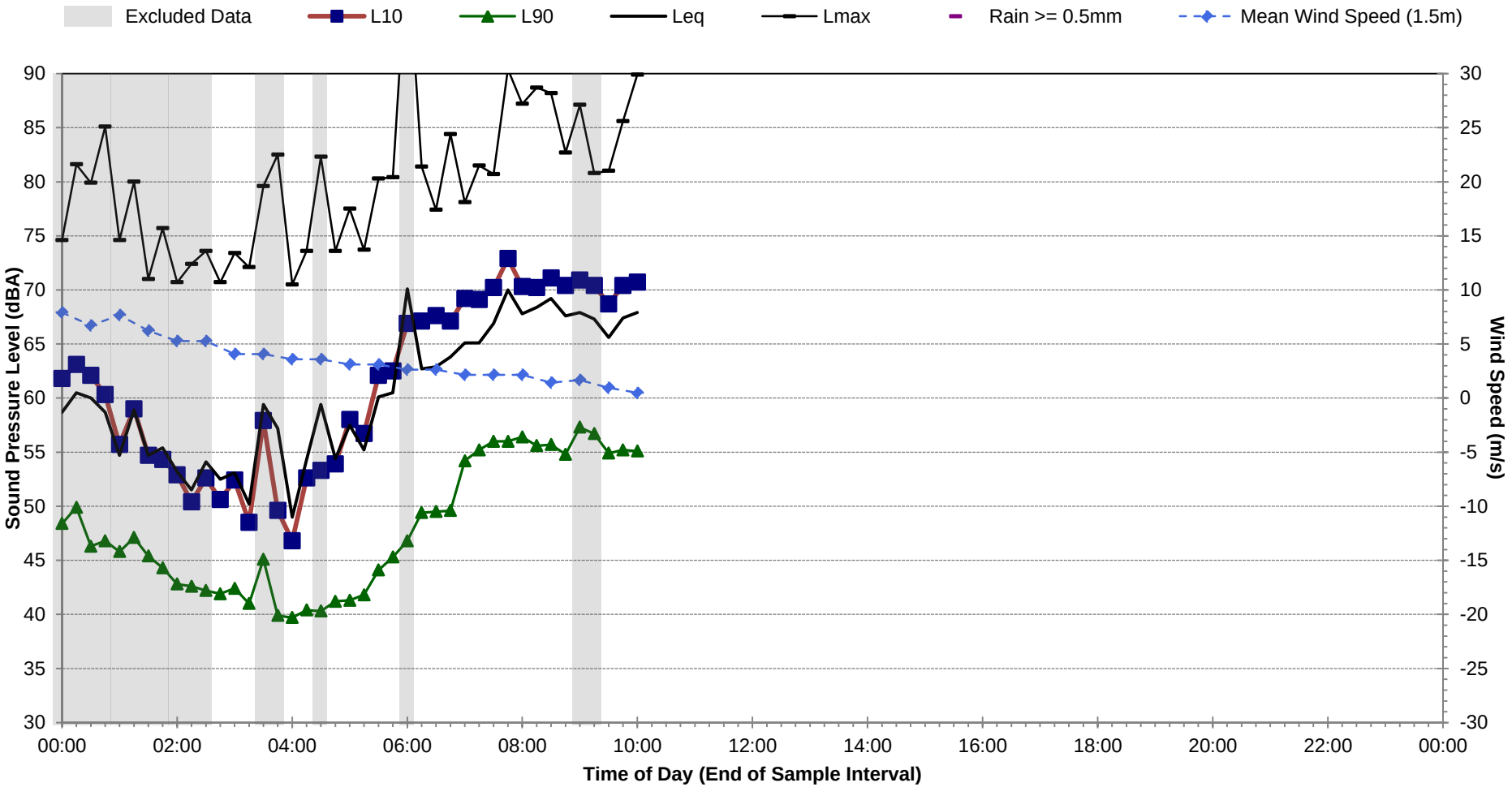
Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Wednesday, 14 February 2018



Statistical Ambient Noise Levels

L07 6/82 Wentworth Park Road - Thursday, 15 February 2018



ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 404 939 922

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: 0800 757 695

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628