MATTHEW PALAVIDIS
VICTOR FATTORETTO
MATTHEW SHIELDS

104-116 Regent Street, Redfern

Noise & Vibration Impact Assessment

SYDNEY
9 Sarah St
MASCOT NSW 2020
(02) 8339 8000

ABN 98 145 324 714
www.acousticlogic.com.au

Project ID	20210248.1
Document Title	Noise & Vibration Impact Assessment
Attention To	The Trust Company (Australia) Limited ATF WH

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	22/04/2021	20210248.1/2204A/R0/AR	AR		GW
1	5/11/2021	20210248.1/0511A/R1/AR	AW		AW
2	15/12/2021	20210248.1/1512A/R2/AR	AW		AW

TABLE OF CONTENTS

1 INTRODUCTION

Acoustic Logic have been engaged to conduct an acoustic assessment of potential noise and vibration impacts associated with the proposed mixed-use development to be constructed at 104-116 Regent Street, Redfern as part of the State Significant Development Application for SSD 12618001.

In this report we will:

- Conduct an external noise intrusion assessment and propose indicative acoustic treatments that will ensure a reasonable level of amenity is achieved for future occupants.
- Assess train vibration impacts from the existing T4 (Eastern Suburbs & Illawarra Line) railway tunnel to residential elements of the site, to determine if vibration isolation treatment is required for the proposed development.
- Provide an indicative assessment of noise and vibration impacts from the future operation of the Sydney Metro line currently under construction. This will include a review of the *Environmental Impact Statement* prepared by SLR Consulting Australia.
- Identify potential noise sources generated by the site and determine noise emission goals for the development to meet relevant acoustic requirements, ensuring that nearby developments are not adversely impacted by the subject development.
- Conduct a preliminary review of construction noise and vibration impacts to nearby noise sensitive receivers and identify potential treatment and/or controls where feasible and reasonable.

Acoustic Logic have utilised the following documents and regulations in the assessment of noise intruding into and noise emanating from the development:

- NSW Department of Planning *State Environmental Planning Policy SEPP (Infrastructure)* 2007.
- NSW Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline*.
- NSW Environmental Protection Authority (EPA) document *Noise Policy for Industry (NPfI)* 2017.
- EPA Interim Construction Noise Guideline (ICNG).

This assessment has been conducted using the Antoniades Architects architectural drawings, dated 25th November 2021.

2 RESPONSE TO SEARS

The environmental noise and vibration assessment is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 12618001. The table below identifies the SEARS that have been issued to the development located at 104-116 Regent Street, Redfern as part of the State Significant Development Application. The relevant reference within this report has also been provided.

Table 1 -SEARs and Relevant Reference

SEARs Item	Report Reference
18. Noise and Vibration The EIS must include a noise and vibration assessment in accordance with the relevant EPA guidelines. This assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and outline the proposed management and mitigation measures that would be implemented.	Section 4-8
23. Aviation If the site is near an airport, airfield or helicopter landing site (HLS), or a HLS is proposed, the EIS must include a report prepared by a suitably qualified aviation expert: - Identifying whether the proposed development is located within any of the applicable Australian Noise Exposure Forecast contours. - Providing details of any flight paths that may be impacted by the proposed development. - Assessing any potential impacts of the proposed development on the aviation operations of any nearby airports and affected flight paths of any existing HLS.	Section 5

3 PROPOSAL & SITE DESCRIPTION

The proposal comprises the redevelopment of the site as summarised below:

- Construction of an 18-storey building comprising a total of 9,562m² gross floor area with a mix of land use activities including:
    - Level 1: 72 m² of retail floorspace, 490m² of communal area for the student accommodation, 102 bicycle parking spaces, loading and waste management facilities and ancillary services and facilities.
    - Upper levels: student accommodation providing a total of 411 beds, including ensuite rooms, studios and two-bedroom configurations, with indoor and outdoor communal spaces on Levels 2, 4 and 16 and additional indoor communal areas on Levels 2 and 4.
- Hard and soft landscaping within the outdoor communal terraces on the roof-top of the podium level and Levels 4 and 16.
- Public domain improvements including provision of a landscaped through-site link connecting William Lane to Margaret Street and associated improvements to the Regent Street and Margaret Street frontages, including awnings and footpath upgrades.

The site is bounded as follows:

- To the east by Regent Street, which is identified on RTA maps as carrying an annual average daily traffic volume (AADT) greater than 40,000 vehicles per day.
- To the south by Margaret Street. Further south is St Luke's Presbyterian Church which we note is locally heritage listed pursuant to the Sydney Local Environment Plan 2012.
- To the west by future student accommodation approved under SSD 9194. We note that this site is currently under construction.
- To the north by existing retail/shop top housing which has been approved under SSD 10382 as an 18 storey building comprising of student accommodation.

Nearby noise sensitive receivers have been summarised in the table below.

Table 2 – Summary of Nearby Sensitive Receivers

Receiver Number	Receiver Type	Description
R1	Residential & Commercial	Future mixed-use building with residential apartments at 11 Gibbons Street, Redfern (SSD 7749).
R2	Residential	Future 18-storey residential building (student accommodation) at 90-102 Regent Street, Redfern (SSD 10382).
R3	Residential	Future 18-storey residential building (student accommodation) at 13-23 Gibbons Street, Redfern (SSD 9194).
R4	Residential & Commercial	Existing mixed-use building with residential apartments across Regent Street.
R5	Commercial	Existing commercial tenancy within the former St Luke's Presbyterian Church at 118 Regent Street, Redfern. Building is listed on the NSW State Heritage Inventory.
-	Rail Tunnel	Sydney Metro tunnel, which runs generally below Regent Street and the R2 to the north.

A site map highlighting key aspects of the surrounding noise environment, including environmental noise sources, noise sensitive receivers and measurement locations is presented in Figure 1. We note, the location of and predicted impacts from the future City & Southwest Metro line is discussed in Section 6.4.

Figure 1 – Site Map, Receivers and Measurement Locations

Sourced from SIX Maps NSW

Unattended Noise Monitor

Attend Vibration Measurement

Residential Receiver

Mixed-Use Receiver

Commercial/Heritage Structure

Project Site

4 SURVEY OF AMBIENT NOISE

Acoustic monitoring was conducted establish the background noise levels of the existing acoustic environment which will be used as basis for this assessment.

4.1 ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15-minute period. L_{eq} is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

The L_{max} parameter is the loudest sound pressure level during a measurement period.

4.2 BACKGROUND NOISE LEVELS

Background noise levels which will be used as a basis for this assessment are detailed in the following sections.

4.2.1 Measurement Equipment

Unattended noise monitoring was conducting using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

4.2.2 Measurement Location

An unattended noise monitor was installed at the rear of the project site adjacent to Margaret Street. Refer to Figure 1 above for a detailed location.

4.2.3 Measurement Period

Unattended noise monitoring was conducted from Thursday 1st April 2021 to Wednesday 14th April 2021.

4.2.4 Measured Background Noise Levels

The background noise levels established from the unattended noise monitoring are detailed in the table below.

NSW EPA's RBL assessment procedure requires determination of background noise level for each day (the ABL) then the median of the individual days as set out for the entire monitoring period.

Appendix A provides detailed graphed results of the unattended noise monitoring for background noise levels. Weather data has been obtained from the Observatory Hill weather station. Weather affected data (rainfall and wind speeds above 5m/s) has been excluded from the assessment in accordance with Factsheets A & B of NPfI.

The processed Rating Background Noise Levels (lowest 10th percentile noise levels during operation time period) are presented in the tables below.

Table 3 – Unattended Noise Monitor – Rating Background Noise Level

Date	Measured Assessment Background Noise Level dB(A)$L_{90(Period)}$		
	Day (7:00am-6:00pm)	**Evening (6:00pm-10:00pm)**	**Night (10:00pm-7:00am Next Day)**
Thursday 1st April 2021	-	50	42
Friday 2nd April 2021	47	47	41
Saturday 3rd April 2021	48	48	41
Sunday 4th April 2021	45	47	41
Monday 5th April 2021	46	46	41
Tuesday 6th April 2021	51	47	41
Wednesday 7th April 2021	55	51	40
Thursday 8th April 2021	56	48	42
Friday 9th April 2021	55	50	41
Saturday 10th April 2021	54	51	43
Sunday 11th April 2021	49	49	41
Monday 12th April 2021	55	49	42
Tuesday 13th April 2021	55	49	41
Wednesday 14th April 2021	55	-	-
Median	**54**	**49**	**41**

4.2.5 Discussion of Unattended Noise Monitoring Results

We note that the noise monitor detailed above was affected by construction noise impacts during the daytime (7am-6pm) typically due to on-going works adjacent to the site at 11 & 23 Gibbons Street, 88 Regent Street, and 11 Gibbons Street. In light of the above, we note:

- Development at 90-102 Regent Street, Redfern has been approved as future student accommodation under SSD 10382.
- Noise monitoring has been conducted as part of the SSD acoustic assessment on the boundary of Regent Street, as detailed in the Northrop *Acoustic Report for State Significant Development Application* (ref: 191235-AUR01, dated 21st October 2020).
- A monitor to measure ambient noise levels (referred to as Monitor 1) was placed at the rear on William Lane.
- The measured rating background noise levels (RBL's) from the approved report are detailed below:

Table 4 – Northrop Measured Background Noise Levels for SSD 10382

Time of Day	Rating Background Noise Level dB(A)$L_{eq(period)}$
Day (7am-6pm)	53
Evening (6pm-10pm)	49
Night (10pm-7am)	45

Based on the above noise levels, we note:

- The construction noise affected background noise level measured by the monitor detailed in Section 4.2.4 is only marginally higher (1dB) during the daytime than the Northrop approved noise monitoring for SSD 10382.
- Background noise levels have been measured to be equivalent during the evening period, and moderately lower during the night-time.
- On this basis, the lower value from each set of monitoring data will be adopted in establishing noise emission goals in order to provide a conservative assessment.

4.2.6 Summarised Background Noise Levels

The background noise levels to be adopted for the purposes of establishing noise emission goals have been summarised in the table below.

Table 5 – Summarised Background Noise Levels

Time of Day	Rating Background Noise Level dB(A)$L_{eq(period)}$
Day (7am-6pm)	53
Evening (6pm-10pm)	49
Night (10pm-7am)	41

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigations indicate that the major external noise sources around the project site is traffic noise from Regent Street situated along the eastern boundary of the project site, and Gibbons Street beyond the apartment building to the west. Noise intrusion from these sources will be assessed in accordance with the nominated criteria below.

With regards to airborne noise for the nearby on grade rail lines, given the distance separation between the tracks and the proposed development, as well as the traffic noise level from Gibbons Street, façade noise levels from rail movements will be significantly below the relevant traffic noise levels. Recommended constructions to address traffic noise levels will inherently meet the airborne noise requirements from rail noise.

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment has been conducted to address the requirements of the following noise criteria/standards:

- Secretary's Environmental Assessment Requirements (SEARs) for SSD 12618001 – Item 23
- NSW Planning State Environmental Planning Policy (SEPP) Infrastructure 2007.
- NSW Department of Planning document – '*Development near Rail Corridors and Busy Roads – Interim Guideline*'.

5.1.1 Secretary's Environmental Assessment Requirements (SEARs) for SSD 12618001 – Item 23

Item 23 of the SEARs states the following:

23. Aviation

If the site is near an airport, airfield or helicopter landing site (HLS), or a HLS is proposed, the EIS must include a report prepared by a suitably qualified aviation expert:

- *Identifying whether the proposed development is located within any of the applicable Australian Noise Exposure Forecast contours.*
- *Providing details of any flight paths that may be impacted by the proposed development.*

Assessing any potential impacts of the proposed development on the aviation operations of any nearby airports and affected flight paths of any existing HLS.

Upon review of the Sydney Airport *Australian Noise Exposure Forecast (ANEF)* 2039, we note that the project site at 104-116 is outside of the ANEF 20 contour. On this basis, no further assessment of aircraft noise impacts on the proposed development is required.

5.1.2 NSW Department of Planning – *State Environmental Planning Policy (SEPP) (Infrastructure) 2007*

Map 16 of the traffic volume maps for the Infrastructure SEPP on the RTA website, classifies Regent and Gibbons Streets as roads with > 40,000 AADT. As such, an assessment of the development will be undertaken as per clause 102 of the State Environmental Planning Policy (SEPP Infrastructure) 2007.

Clause 102 of the NSW SEPP for road traffic noise stipulates,

"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 transit way or any other road with an annual average daily traffic volume of more than 20,000 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,

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 L_{Aeq} levels are not exceeded:

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

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

5.1.3 NSW Department of Planning – *Development near Rail Corridors or Busy Roads – Interim Guideline*

The NSW Department of Planning's policy, *Development Near Rail Corridors And Busy Roads – Interim Guideline*, sets out internal noise level criteria adapted from the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') for developments with the potential to be impacted by traffic or rail noise and vibration.

Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
  - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*
  - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

Section 3.6 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline) specifies the following noise descriptors for the assessment of traffic noise:

- Day - $L_{eq\ (15\ hour)}$
- Night - $L_{eq\ (9\ hour)}$

The guideline also provides guidance on the assessment of natural ventilation. The allowable internal noise goal is permitted to be 10 dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45 dB(A), and 50 dB(A) in living rooms). Where noise levels would exceed this, the NSW Planning guideline recommends that a ventilation system be provided to achieve the ventilation requirements of the BCA with windows closed. We note that where the 'open window/door' scenario cannot be achieved, this does not necessarily mean than there cannot be operable elements on these façades, only that internal noise level requirements will only be met when they are closed.

5.1.4 Summarised Internal Noise Criteria for Proposed Site

The summarised criteria for all spaces of the development is summarised in Table 6.

Table 6 – Summarised Criteria for Internal Noise Levels

Space / Occupancy	Time of Day	Criteria	
		SEPP (Infrastructure) 2007	
Residential (Living Areas)	Day (7am – 10pm)	Doors/ Windows Closed -40 dB(A) $L_{eq(15hr)}$	Doors/ Windows Closed -50 dB(A) $L_{eq(15hr)}$-
Residential (Bedrooms)	Night (10pm – 7am)	Doors/ Windows Closed -35 dB(A) $L_{eq(9\ hr)}$	Doors/ Windows Open-45 dB(A) $L_{eq(9\ hr)}$

5.2 TRAFFIC NOISE MEASUREMENTS

Noise measurements have been conducted at the site to establish traffic noise levels impacting the development. The results of these measurements are presented below.

5.2.1 Measurement Equipment.

Unattended noise monitoring was conducting using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of each measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weight fast response mode.

Attended short term measurements of traffic noise were undertaken by this office. Measurements were conducted using a Norsonic 140 Sound Analyser. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic Sound Calibrator type 1251. No significant drift was noted.

5.2.2 Measurement Location

An unattended noise monitor was installed at the rear of the project site adjacent to Margaret Street. Refer to Figure 1 above for a detailed location.

5.2.3 Measurement Period

Unattended noise monitoring was conducted from Thursday 1st April 2021 to Wednesday 14th April 2021.

5.2.4 Measured Traffic Noise Levels

Results of the unattended noise monitoring conducted around the site has been summarised in the table below. Further detailed results can be found in Appendix A of this report.

Table 7 – Unattended Noise Monitor –Traffic Noise Levels

Date	Measured Traffic Noise Level dB(A)$L_{eq(Period)}$	
	Day (7:00am-10:00pm)	**Night (10:00pm-7:00am)**
Thursday 1st April 2021	-	60
Friday 2nd April 2021	60	58
Saturday 3rd April 2021	61	58
Sunday 4th April 2021	60	58
Monday 5th April 2021	60	58
Tuesday 6th April 2021	62	58
Wednesday 7th April 2021	64	59
Thursday 8th April 2021	65	60
Friday 9th April 2021	66	59
Saturday 10th April 2021	62	59
Sunday 11th April 2021	60	59
Monday 12th April 2021	66	58
Tuesday 13th April 2021	65	59
Wednesday 14th April 2021	-	-
Logarithmic Average	**63**	**59**

5.2.5 Discussion of Measured Traffic Noise Levels

We note that the noise monitor detailed above was affected by construction noise impacts during the daytime (7am-6pm) typically due to on-going works adjacent to the site at 11 & 23 Gibbons Street, and 88 Regent Street. In light of the above, we note:

- Development at 90-102 Regent Street, Redfern has been approved as future student accommodation under SSD 10382.
- Noise monitoring has been conducted as part of the SSD acoustic assessment on the boundary of Regent Street, as detailed in the Northrop *Acoustic Report for State Significant Development Application* (ref: 191235-AUR01, dated 21st October 2020).
- A monitor to measure traffic noise impacts from Regent Street (referred to as Monitor 2) was installed outside the window of the existing vacant building on Level 1, with the microphone installed on a long pole extended 1.2m out of the window.
- The results of noise monitoring from this report have been summarised in the table below:

Table 8 – Northrop Noise Monitoring Results for SSD 10382 Acoustic Assessment

Period	Measured Noise Levels		
	dB(A)$L_{eq(period)}$	**dB(A)$L_{eq(1hr)}$**	**dB(A)L_{90}**
Day (7am-10pm)	67	68	56
Night (10pm-7am)	63	65	45

In addition to the above, long-term unattended road traffic noise measurements along Gibbons Street have been detailed in the Renzo Tonin & Associates *Acoustic Assessment for Development Application* (Revision 6, dated February 2nd 2019) for the approved mixed use development under SSD 7749 at 11 Gibbons Street Redfern. We note:

- Noise monitoring has been conducted as part of the SSD 7749 acoustic assessment at a distance of 1.2m from the site boundary (approximately 5m from the roadside kerb).
- The results of noise monitoring from this report have been summarised in the table below:

Table 9 – Renzo Tonin & Associates Monitoring Results for SSD 7749 Acoustic Assessment

Monitor Location	Period	Measured Noise Levels dB(A)$L_{eq(period)}$
Gibbons Street 1.2m from Site Boundary	Day (7am-10pm)	71
	Night (10pm-7am)	69

5.3 COMPLYING FAÇADE CONSTRUCTIONS

Indicative treatments to meet the criteria detailed in Section 5.1.4 are presented in Table 10. A full assessment of all treatments recommended within this report is to be conducted during detailed design to ensure that the criteria determined within this report is met.

5.3.1 Glazed Windows and Doors

The following constructions are recommended to comply with the project noise objectives. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria. All external windows and doors listed are required to be fitted with Q-Lon type acoustic seals. (**Mohair/ Mohair + Fin Seals not considered acoustic seals**).

Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

Table 10 – Recommended Glazing Construction

Facade	Level	Space/Room Type	Glazing Thickness	Acoustic Seals
East	Levels 2-9	Student Accommodation Sleeping Areas	12.38mm Laminated	Yes
	Level 10 and Above		10.38mm Laminated	Yes
South/North	Level 2-9		10.38mm Laminated	Yes
	Level 10 and Above		6.38mm Laminated	Yes
West	All		6mm Float	Yes

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

In addition to complying with the minimum scheduled glazing thickness, the R_w rating of the glazing fitted into open-able frames and fixed into the building opening should not be lower than the values listed in Table 7 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of open-able frames and the frame will need to be sealed into the building opening using a flexible sealant.

Note: The final glazing thicknesses are to be reviewed when plans are finalised.

Table 11 – Minimum Glazing R_w

Glazing Assembly	Minimum R_w of Installed Window
6mm Float	29
6.38mm Laminated	31
10.38mm Laminated	35
12.38mm Laminated	37

5.3.2 External Wall Construction

External walls constructed from concrete/masonry systems will not require further acoustic treatment. In the event external walls are to be constructed from a lightweight façade system, a review is to be conducted at CC stage to ensure internal noise levels are per the criteria in Section 5.1 are achieved.

If any penetrations are required through any of the external linings in the systems above for other building services, all gaps should be filled with acoustic sealant.

5.3.3 Roof/Ceiling Construction

The roof for the proposed development is to be constructed from concrete systems and will not require further acoustic treatment.

If any penetrations are required through any of the external linings of the roof/ceiling system for other building services, all gaps should be filled with acoustic sealant.

5.3.4 Ventilation and Air Conditioning

As referenced in Section 5.1.3, the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' specifies the following controls regarding natural ventilation:

- With respect to natural ventilation of a dwelling the allowable internal noise goal is permitted to be 10 dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45 dB(A), and 50 dB(A) in living rooms). Where noise levels would exceed this, the NSW Planning guideline recommends that a ventilation system be provided to achieve the ventilation requirements of the BCA with windows closed. We note the following:
    - All habitable rooms on the eastern facade (facing Regent Street), northern and southern facades are required to be closed in order to achieve required noise levels.
    - All habitable rooms on the western façade (facing 13-23 Gibbons Street) will be able to achieve required internal noise levels with windows/doors open.

Where the recommended internal noise levels cannot be achieved with windows open within the development, confirmation on the ventilation requirements for student accommodation rooms will be required.

Any supplementary ventilation system or façade opening proposed to be installed to provide ventilation to apartments should be acoustically designed to ensure that the internal noise level requirements are achieved. In the event mechanically assisted ventilation is utilised, it should be acoustically designed so that internal noise levels within apartments are appropriate, and any external noise emissions to surrounding noise sensitive receivers is within the requirements detailed in Section 7.1 of this report.

6 RAIL INDUCED VIBRATION

6.1 PROJECT CRITERIA

An assessment of vibration impacts from the operation of the existing T4 rail tunnel adjacent to the project site has been conducted based on the requirements of the following acoustic noise criteria/standards:

- British Standard BS 7385:1990 Part 2 *'Evaluation and measurement for vibration in buildings – part 2'*;
- Australian Standard AS2670:1990 *'Vibration and Shock – Guide to the evaluation of human exposure to whole body vibration'*.
- NSW Department of Environment and Conservation's document *'Assessing Vibration: A Technical Guideline'*.
- NSW Department of Planning's – '*Developments near Rail Corridors or Busy Roads – Interim Guideline'*.

A review of noise and vibration impacts from the operation of the future City & Southwest Metro line is presented in this section.

6.2 ASSESSMENT CRITERIA

This section presents the applicable assessment criteria for ground borne noise and tactile vibration.

6.2.1 Ground Borne Noise

Development located adjacent to railway lines must be assessed in accordance with Clause 87 of the SEPP (Infrastructure) 2007. It is noted that the requirements of this standard are achieved when assessed in accordance with the NSW Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline (2008)*. The section relevant to ground borne noise is as follows:

Where buildings are constructed over or adjacent to land over tunnels, ground borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground borne LAmax noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter.

Table 12 - Internal Railway Noise Level Criteria for Ground Borne Noise

Location	Time of Day	Internal Ground Borne Noise Criteria $dB(A)L_{max\ (SLOW)}$
Living and sleeping areas	Day (7am-10pm)	40
	Night (10pm-7am)	35

6.2.2 Tactile Vibration

Human comfort is normally assessed with reference to the British Standard BS 7385 Part 2 1993 or Australian Standard AS 2670.2 1990.

The Interim Guideline references the DECCW *Assessing Vibration- A technical guideline* which recommends that habitable rooms should comply with the criteria therein which is in line with the requirements of British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)".

British Standard BS 6472:1992 "Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)" is recommended by the RIC's and SRA's Interim Guidelines for Councils "Consideration of rail noise and vibration in the planning process" as this standard includes guidance for the assessment of human response to building vibration including intermittent vibrations such as that caused by trains.

Human response to vibration has been shown to be biased at particular frequencies, which are related to the orientation of the person. This standard provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard 2670 "Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)" which represent the worst case of the X, Y and Z axes. Filtered measurements are made in all three co-ordinate axes and the highest value axis used.

This standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am). The overall value is then compared to the levels in Table 9. For this project the aim will be for a low probability of adverse comment.

Table 13 - Vibration Dose Values (m/s1.75) above which various degrees of adverse comment may be expected in residential buildings

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hr day (Daytime)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night (Night time)	0.13	0.26	0.51

6.3 VIBRATION MEASUREMENTS

Rail vibration measurements were conducted externally within William Lane at the rear of the proposed site, as well as within the adjacent development at 13-23 Gibbons Street (being closed to the existing T4 tunnel than the proposed site).

Attended train vibration measurements were conducted on 5th July 2020 between 10am and 12pm. A Svan 958 AE Vibration Analyser was used for the vibration measurements. The analyser was fitted with a Dytran triaxial accelerometer.

6.3.1 Tactile Vibration

The measured vibration levels, duration of train pass-by and the number of rail movements per hour were used to determine the overall vibration dose (VDV) at the proposed development for both daytime and night-time periods. The results are presented the table below.

Table 14 - Vibration Dose Values

Time Period	Calculated VDV $m/s^{1.75}$	Criteria VDV $m/s^{1.75}$	Complies
Day (7am – 10pm)	< 0.05	0.2 to 0.4	Yes
Night (10pm -7am)	< 0.05	0.13	Yes

The Vibration Dose Values were found to be less than the "low probability of adverse comment" criteria (the most stringent criteria) for the subject site.

6.3.2 Structure Borne Noise Measurements

Internal noise levels within student accommodation rooms as a result of structure borne noise have been calculated for a number of train pass-bys. Noise levels have been determined based on-site measurements of rail induced vibration. Refer to Figure 1 for measurement locations.

Table 15 – Predicted Structure Borne Vibration Levels

Location	Time of Day	Predicted Internal Ground Borne Noise $dB(A)L_{max(Slow)}$	Criteria $dB(A)L_{max(Slow)}$	Complies
Level 1 Residential Apartments	Day (7am-10pm)	< 30	40	Yes
	Night (10pm-7am)	< 30	35	Yes

The results above indicate that vibration isolation treatment is not required to comply with structure borne noise criteria.

6.4 CITY & SOUTH WEST METRO NOISE AND VIBRATION IMPACTS

Operational noise and vibration levels expected to be generated by the City & Southwest line are detailed in the SLR document Sydney Metro Chatswood to Sydenham Technical Paper 2: Noise & Vibration (Report Number 610.14718R1, dated 28 April 2016, Version Final). The report details the expected acoustic impacts on existing properties along the proposed rail line, including properties at 104-116 Regent Street, Redfern. Both tactile vibration and structure borne noise are considered as part of the technical paper.

104-116 Regent Street is located approximately 1km south of Central Station relative to the track chainage –Figure 2 indicates the location of the project site relative to the Metro rail tunnels and Central Station, whilst Figure 3 & Figure 4 indicate the predicted ground borne vibration and noise respectively, both of which meet the project requirements.

We also note that the predictions detailed in the SLR report assume the noise/vibration level on the ground floor of each residence, however in this case the nearest level containing student accommodation will occur on Level 2. As vibration travels up the building, there will be additional attenuation, further reducing the impact of future occupants.

Figure 2 – Location of Project Site Relative to Chain Linkage from Central Station, Including Predicted Ground Borne Noise Levels (reproduced Appendix H1 from SLR Technical Paper)

Figure 34 Predicted Ground-borne Vibration Levels (Proposed Track Form)

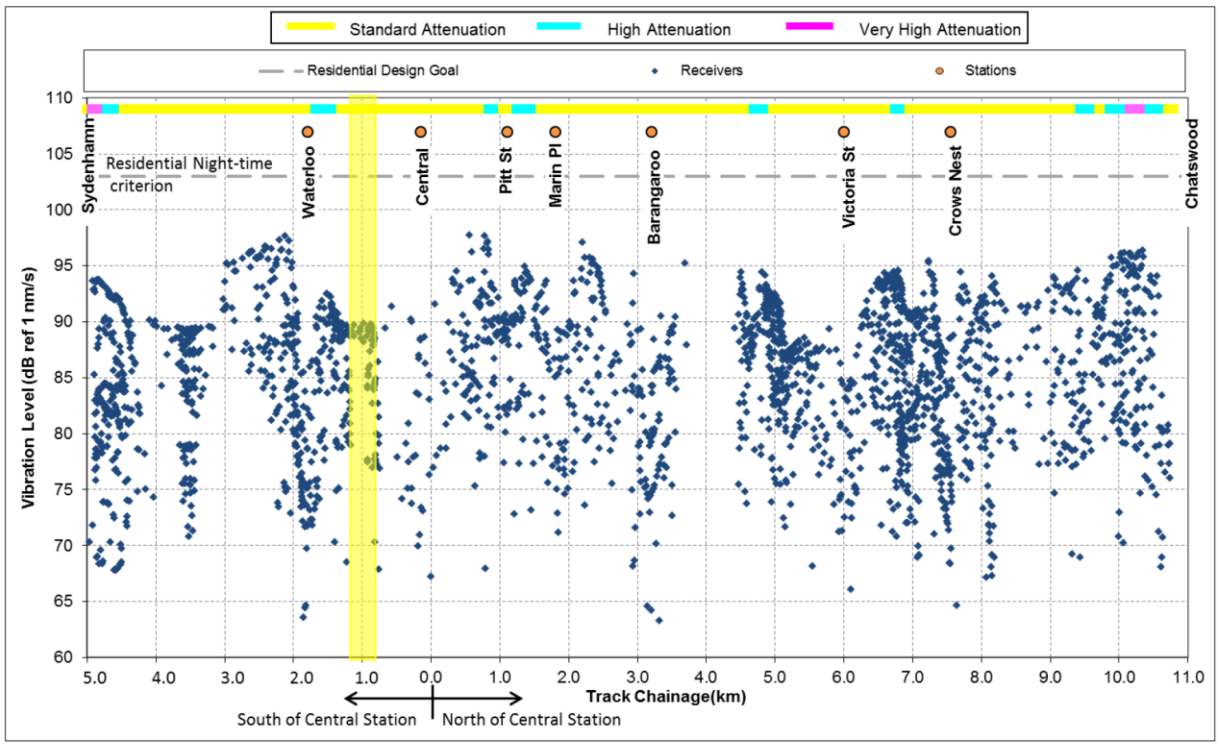


Figure 3 – Predicted Tactile Vibration Levels (Approximate Site Location Indicated in Yellow)

Figure 40 Predicted Ground-borne Noise Levels - Residential Receivers

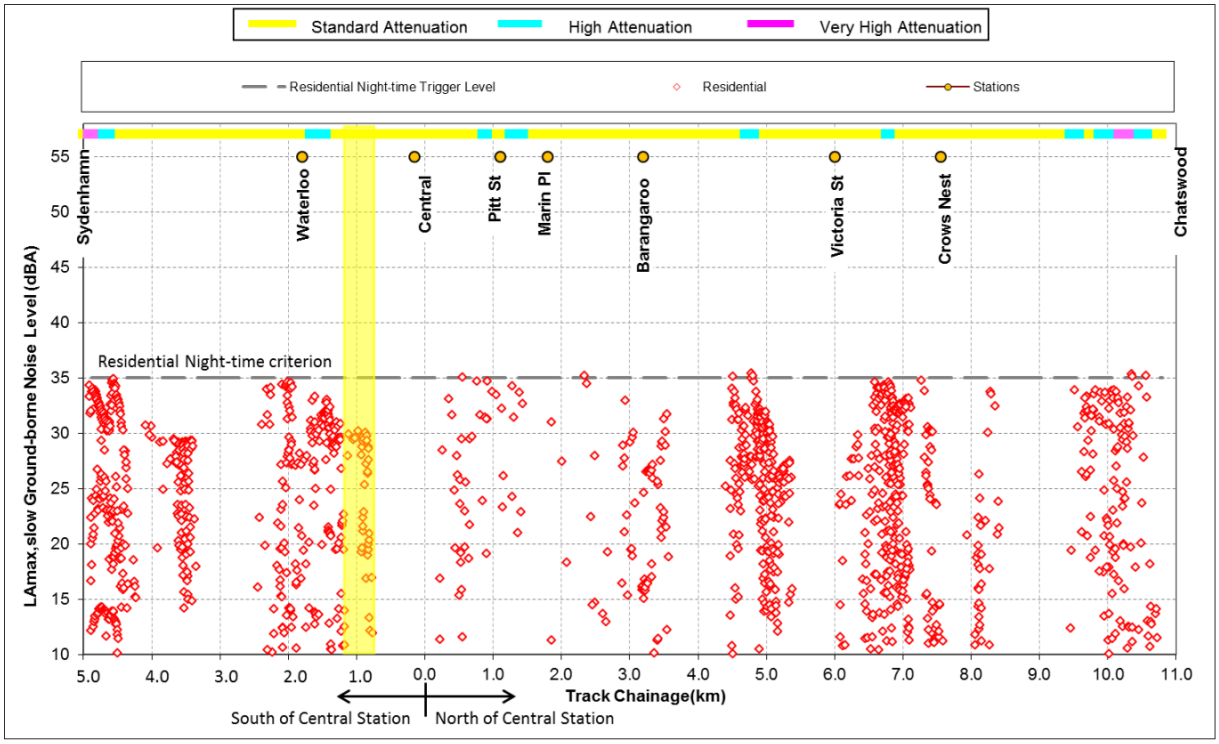


Figure 4 – Predicted Ground Borne Noise Levels (Approximate Site Location Indicated in Yellow)

7 NOISE EMISSION ASSESSMENT

Noise emissions from the site should be assessed to ensure that the amenity of nearby land users is not adversely affected. The primary noise sources from the project site will be mechanical plant and from use of commercial/retail areas. Nearby noise sensitive receivers have been summarised in Table 2.

7.1 NOISE EMISSION CRITERIA

Noise emissions from the development are to be assessed against the NSW Environmental Protection Authority (EPA) *Noise Policy for Industry (NPfI)* 2017 (for mechanical plant).

The NPfI provides guidelines for assessing noise impacts from developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements which must both be complied with, namely an amenity criterion and an intrusiveness criterion.

7.1.1.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A).

Table 16 – NPfI Intrusiveness Criteria

Receiver	Time of day	Background Noise Level dB(A)$L_{90(Period)}$	Intrusiveness Criteria (Background + 5dB(A)$L_{eq(15minute)}$
Residential	Day (7:00am-6:00pm)	53	58
	Evening (6:00pm-10:00pm)	49	54
	Night (10:00pm-7:00am)	41	46

7.1.1.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The Noise Policy for Industry sets out acceptable noise levels for various land uses. Table 2.2 on page 11 of the policy has four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. Acoustic Logic will assess noise emissions in accordance with the 'Urban' category.

The NPfI requires project amenity noise levels to be calculated in the following manner:

$$L_{Aeq(15\text{min})} = Recommended\ Amenity\ Noise\ Level - 5dB(A) + 3dB(A)$$

The amenity levels appropriated for the receivers surrounding the project site are presented in the table below.

Table 17 – NPfI Project Amenity Criteria

Type of Receiver	Time of day	Recommended Project Acceptable Noise Level dB(A)$L_{eq(15\text{-}minutes)}$
Residential (Urban)	Day (7:00am-6:00pm)	58
	Evening (6:00pm-10:00pm)	48
	Night (10:00pm-7:00am)	43
Commercial	When in Use	63

7.1.1.3 Sleep Arousal Criteria

The NPfI also recommends the following noise limits to mitigate sleeping disturbances:

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 even assessment should be undertaken.

Table 18 - Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Adjacent Residential Receivers Night (10pm – 7am)	41	46 dB(A)$L_{eq,\ 15min}$; 56 dB(A)L_{AFmax}

In addition to the above, we note that the NSW EPA Road Noise Policy states:

- *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
- *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

7.1.2 Summarised Noise Policy for Industry Criteria

A summary of noise emission criteria based on the requirements of the NSW EPA NPfI is provided in the table below.

Table 19 – Summary of NPfI Noise Emission Criteria

Receiver	Time of day	Background Noise Level dB(A)$L_{90(Period)}$	Intrusiveness Criteria (Background + 5dB(A)$L_{eq(15\text{-}minute)}$	Project Amenity Criteria dB(A)$L_{eq(15\text{-}minute)}$	NPfI Criteria for Sleep Disturbance
Residential Receivers (Urban)	Day (7:00am-6:00pm)	53	58	**58**	N/A
	Evening (6:00pm-10:00pm)	49	54	**48**	N/A
	Night (10:00pm-7:00am)	41	46	**43**	46 dB(A)$L_{eq,\ 15min}$; 56 dB(A)L_{AFmax}
Commercial	When in Use	N/A	N/A	63	N/A

Note – Bolded values represent the project noise trigger level, being the lower of the amenity and intrusive level.

7.2 MECHANICAL PLANT NOISE

Detailed plant selection has not been undertaken at this stage, as plant selections have not been determined. Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels. Satisfactory levels will be achievable through appropriate plant selection and location and, if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services plant to the closest residential receiver should comply with the noise emission criteria in Section 7.1.

7.3 NOISE FROM GROUND FLOOR COMMERCIAL/RETAIL

Noise from the use of this space cannot be assessed without knowing the intended use, however we expect appropriate controls (management and building construction) will be sufficient to achieve noise emission goals above. It is expected that each commercial/retail tenancy would be subject to an individual assessment if required.

In the event that the space were to incorporate liquor licensing or an outdoor dining area, this would likely be subject to a separate approval, at which time the proposal would need to demonstrate compliance with the relevant noise emission criteria. With respect to noise transmission through the floor slab (internal/internal noise transmission), the construction of an appropriate ceiling may be required, depending on the level of noise expected to be generated by the ultimately proposed use.

Additionally, the Building Code of Australia (BCA) requires that a floor separating a sole occupancy unit (SOU) from an area of different classification (i.e. retail) achieve a weighted noise reduction index (R_w) of no less than 50. This will be achieved by a typical 150mm thick concrete slab.

8 CONSTRUCTION NOISE AND VIBRATION

An assessment of likely construction noise impacts has been undertaken. The assessment includes:

- Identification of the noise and vibration guidelines which will be applicable to this project.
- Identification of potentially impacted nearby sensitive receivers.
- Identify likely sources of noise and vibration generation and predicted noise levels at nearby development.
- Formulation of a strategy to address the guidelines identified and mitigation treatments.

8.1 NOISE MANAGEMENT LEVELS

Noise and vibration emissions from construction activities at the project site will be assessed against the following guidelines:

- Noise
    - EPA Interim Construction Noise Guideline (ICNG)
- Vibration
    - German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*
    - British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)*

8.1.1 EPA Interim Construction Noise Guideline

The ICNG assessment procedure requires the following:

- Determination of noise management levels (based on ambient noise monitoring).
- Review of generated noise levels at nearby development.
- Recommendation of noise controls strategies when noise management levels are exceeded.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise affected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.

- "*Highly noise affected level"*. Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the "highly noise affected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

Section 4.1.3 of the guideline also specifies management levels for land used for commercial purposes. The guidelines recommend that external noise levels be assessed at the most affected occupied point of the premises.

A summary of the above noise management levels from the ICNG is presented below in Table 20.

Table 20 – Noise Management Levels

Receiver Type	Daytime Background Noise Level $dB(A)L_{90(period)}$	"Noise Affected" Level - $dB(A)L_{eq(15min)}$	"Highly Noise Affected" Level - $dB(A)L_{eq(15min)}$
Nearby Residences	53	63	75
Nearby Commercial Development	-	70 (External)	-

If noise levels exceed the exceed the management levels identified above, reasonable and feasible noise management techniques will be reviewed.

8.1.2 German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The vibration levels presented in DIN 4150-3 (1999-02) are detailed in Table 4.

It is noted that the peak velocity is the value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 21 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

	TYPE OF STRUCTURE	PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

The surrounding commercial buildings would be considered a Type 1 structures, whilst nearby residences would be classified as Type 2 structures. The heritage building at 118 Regent Street (Receiver 5) would be classified as a Type 3 structure. We also note that heritage structures are not necessarily structurally compromised, and as such a higher vibration level may be acceptable to the structure. In the event that vibration levels to the church building are proposed to be raised, we recommend that this be undertaken in consultation from both heritage and structural experts.

8.1.3 British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)*

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings and is used in the assessment of vibration impact on amenity. Relevant vibration levels are presented below.

Table 22 – EPA Recommended Vibration Levels

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	**Time**	**Preferred**	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous Vibration							
Residences	**Daytime**	0.01	0.02	0.2	0.4	0.28	0.56
Offices		0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Residences	**Daytime**	0.3	0.6	6.0	12.0	8.6	17.0
Offices		0.64	1.28	13.0	26.0	18.0	36.0
Workshops		0.64	1.28	13.0	26.0	18.0	36.0

8.2 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation/ground works and building structure works. The following table presents assessment noise levels for typical construction equipment expected to be used:

Table 23 – Sound Power Levels of Typical Equipment

Equipment/Process	Sound Power Level dB(A)
Dozer/Excavator with Bucket	112
Excavator with Hydraulic Hammering	120
Rock Saw/Concrete Saw	120
Concrete Pump	110
Concrete Vibrators	100
Trucks, Work Vehicles, Forklifts	105
Powered Hand Tools	95-100

The noise levels presented in the above table are derived from the following sources:

- Table A1 of Australian Standard 2436:2010; and
- Data held by this office from other similar studies.

8.3 PREDICTED NOISE LEVELS AND COMMENTS

Noise generated by plant and equipment will be managed to generally comply with the nominated acoustic criteria, and where this noise goal may be exceeded, noise will be managed based on principles consistent with Australian Standard 2436 and the recommendations of the ICNG. Noise levels will vary depending on where in the construction site the work is undertaken. To address this, a range of predicted noise levels is provided. Predicted noise levels are presented below. Predictions take into account the noise reduction as a result of distance only.

Table 24 – Predicted Noise Generation to Receiver R1 (External)

Activity	**Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)**	**Comment**
Dozer/Excavator with Bucket	70-92	Exceedance of highly noise affected level expected, primarily when working close to north western corner of the site.
Excavator with Hydraulic Hammering	78-100	Generally exceeds highly noise affected level expected, primarily when working close to north western corner of the site.
Rock Saw/Concrete Saw	78-100	Generally exceeds highly noise affected level expected, primarily when working close to north western corner of the site.
Concrete Pump	68-90	Exceedance of highly noise affected level expected, primarily when working close to north western corner of the site.
Concrete Vibrators	58-72	Intermittent exceedance of noise affected level expected when working close to north western corner of the site.
Trucks, Work Vehicles, Forklifts	63-77	Minor exceedance of highly noise affected level expected, primarily when working close to north western corner of the site.
Powered Hand Tools	58-72	Intermittent exceedance of noise affected level expected when working close to north western corner of the site.

Table 25 – Predicted Noise Generation to Receiver R2 (External)

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Dozer/Excavator with Bucket	71-92	Exceedance of highly noise affected level expected, primarily when working close to northern boundary.
Excavator with Hydraulic Hammering	72-100	Generally exceeds highly noise affected level expected, primarily when working close to northern boundary
Rock Saw/Concrete Saw	72-100	Generally exceeds highly noise affected level expected, primarily when working close to northern boundary
Concrete Pump	69-90	Exceedance of highly noise affected level expected, primarily when working close to northern boundary.
Concrete Vibrators	59-72	Intermittent exceedance of noise affected level expected when working close to close to northern boundary.
Trucks, Work Vehicles, Forklifts	64-77	Minor exceedance of highly noise affected level expected, primarily when working close to northern boundary.
Powered Hand Tools	59-72	Intermittent exceedance of noise affected level expected when working close to close to northern boundary.

Table 26 – Predicted Noise Generation to Receiver R3 (External)

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Dozer/Excavator with Bucket	74-92	Exceedance of highly noise affected level expected, primarily when working close to western boundary.
Excavator with Hydraulic Hammering	82-100	Generally exceeds highly noise affected level expected, primarily when working close to western boundary
Rock Saw/Concrete Saw	82-100	Generally exceeds highly noise affected level expected, primarily when working close to western boundary
Concrete Pump	72-90	Exceedance of highly noise affected level expected, primarily when working close to western boundary.
Concrete Vibrators	62-72	Intermittent exceedance of noise affected level expected when working close to close to western boundary.
Trucks, Work Vehicles, Forklifts	667-77	Minor exceedance of highly noise affected level expected, primarily when working close to western boundary.
Powered Hand Tools	62-72	Intermittent exceedance of noise affected level expected when working close to close to western boundary.

Table 27 – Predicted Noise Generation to Receiver R4 (External)

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Dozer/Excavator with Bucket	70-78	Minor exceedance of highly noise affected level expected when working close to eastern boundary.
Excavator with Hydraulic Hammering	78-86	Generally exceeds highly noise affected level expected, primarily when working close to eastern boundary
Rock Saw/Concrete Saw	78-86	Generally exceeds highly noise affected level expected, primarily when working close to eastern boundary
Concrete Pump	68-76	Exceedance of highly noise affected level expected, primarily when working close to eastern boundary
Concrete Vibrators	58-66	Intermittent exceedance of noise affected level expected when working close to close to eastern boundary
Trucks, Work Vehicles, Forklifts	63-71	Minor exceedance of highly noise affected level expected, primarily when working close to eastern boundary
Powered Hand Tools	58-66	Intermittent exceedance of noise affected level expected when working close to close to eastern boundary

Table 28 – Predicted Noise Generation to Receiver R5 (Commercial)

Activity	Predicted Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Dozer/Excavator with Bucket	70-86	Generally exceeds internal noise management level, primarily when working close to southern boundary.
Excavator with Hydraulic Hammering	78-94	Generally exceeds internal noise management level, primarily when working close to southern boundary.
Rock Saw/Concrete Saw	78-94	Generally exceeds internal noise management level, primarily when working close to southern boundary.
Concrete Pump	68-84	Intermittent exceedance of noise management level, primarily when working close to eastern boundary
Concrete Vibrators	58-72	Minor exceedance of noise affected level expected when working close to close to southern.
Trucks, Work Vehicles, Forklifts	63-77	Intermittent exceedance of noise management level when working close to southern boundary.
Powered Hand Tools	58-72	Minor exceedance of noise affected level expected when working close to close to southern.

8.4 DISCUSSION

With respect to noise generating sources and activities during construction works for the proposed development, the preliminary analysis above indicates the following:

- The construction activities with the greatest potential for noise and vibration impacts on surrounding receivers typically include use of the following:
    - Hammering (Excavator with Hydraulic Hammer, Jack Hammering)
    - Rock Saws and Concrete Saws
    - Piling activities (not known what type of piling is intended to be used)
- An exceedance of the highly noise affected level and noise management levels in general are predicted from typical construction activities.
- Typical measures to minimise and mitigate potential noise impacts on surrounding occupants may include the following:
    - Internal demolition works should be conducted as much as possible while leaving the façade intact to provide noise screening from internal works.

- Construction of hoarding around the site perimeter to provide noise screening to low level receivers.
- As much as practicable, use of alternative equipment (i.e., saws/munchers as opposed to hydraulic hammering). We note that while munchers are typically a lower sound power level, saws are equally as loud but are generally used for shorter periods.
- Work vehicles, trailers and concrete trucks should turn off their engines when on site (unless needed to remain on during concrete pumping).
- Use of silencing devices in the form of engine shrouding or industrial silencers fitted to exhausts may be considered.
- In the event continuous exceedances of the "highly noise affected level" are predicted, respite periods should be considered in accordance with the ICNG recommendations.

- Noise impacts from powered hand tools and general fit-out works internally will decrease once the building façade is erected and façade elements enclose the building (i.e., windows and doors are installed).
- Given the proximity of future residential receivers adjacent to the site, and the heritage building at 118 Regent Street, Redfern, vibration monitoring during vibration intensive stages (typically demolition and excavation) is recommended to minimise the risk of structural building damage.
- In the event of complaints, attended measurements of noise, or vibration monitoring may be considered where access is permitted.
- A detailed assessment of noise and vibration in a construction noise and vibration management plan is to be conducted once construction plans, construction equipment, and construction methodology are finalised. Reasonable and feasible control measures are to be adopted as per the ICNG.
- Vibration impacts to the new Sydney Metro tunnel may also need to be considered, pending the stage of construction for the tunnel. It is likely that vibration monitoring will need to be undertaken to ensure that vibration impacts to the tunnel are acceptable.

We note, with regards to the receivers surrounding the project site:

- With reference to Table 1, Receivers R1, R2 and R3 and currently going through early construction stages for their respective developments.
- These buildings are not currently occupied, and it is not known whether these buildings will be occupied with residents once the proposed works begin at the project site at 104-116 Regent Street, Redfern.
- The detailed assessment of noise and vibration to be conducted as part of a construction noise and vibration management plan prior to CC stage for the project site should take the above into consideration in determining reasonable and feasible acoustic controls to minimise the impacts of construction noise activities where necessary.

9 SUMMARY OF RECOMMENDATIONS

A summary of recommendations detailed within the report is provided below:

- Acoustically upgraded façade constructions will be required to achieve the internal noise level requirements of the Infrastructure SEPP. Indicative recommendations have been provided in Section 5.3, and it recommended that these be reviewed as part of the design development of the project.
- The potential for structure borne noise from adjacent rail corridors has been reviewed in line with the requirements of the Infrastructure SEPP. No additional acoustic treatments of the building are required.
- Noise emission requirements for the site have been established based on long term background noise monitoring. A review of proposed mechanical plant is recommended as part of the design development of the project to identify appropriate acoustic treatments to control noise to acceptable levels.
- Construction noise management levels have been established for surrounding noise sensitive developments. Preparation of a detailed Construction Noise Management Plan has been recommended, to be completed once detail of the construction methodology is known.

10 CONCLUSION

Noise emissions associated with the proposed mixed-use development to be constructed at 104-116 Regent Street, Redfern. The following documents/guidelines have generally been utilised in the assessment of noise intruding into and noise emanating from the development:

- NSW Department of Planning *State Environmental Planning Policy SEPP (Infrastructure)* 2007.
- NSW Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline*.
- NSW Environmental Protection Authority (EPA) document *Noise Policy for Industry (NPfI)* 2017.
- EPA Interim Construction Noise Guideline (ICNG).

In light of the information above, this report concludes the following:

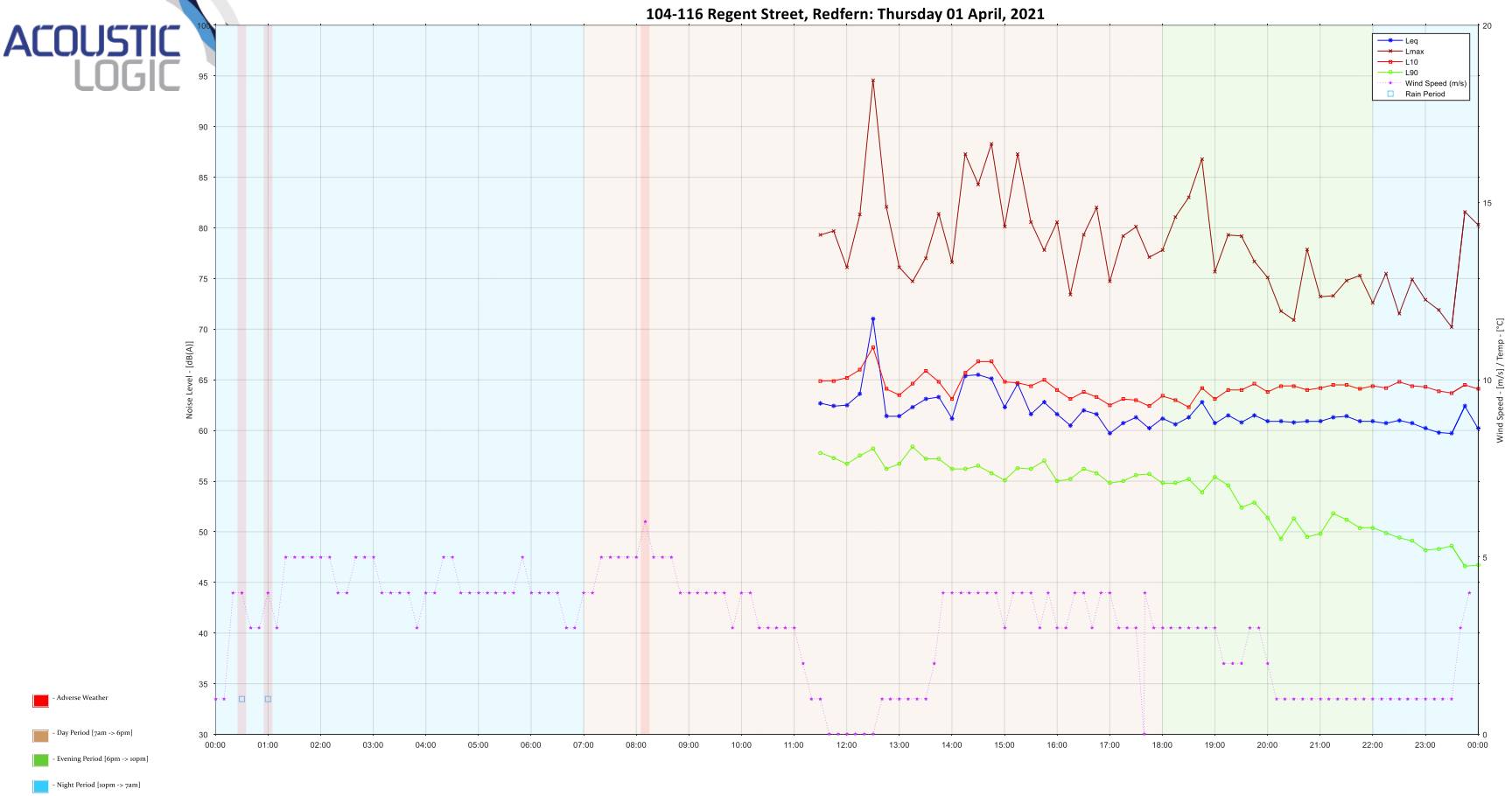
- Internal noise level criteria have been established based on the requirements of NSW SEPP (Infrastructure) and *Development near rail corridors and busy roads – Interim guideline*. Indicative recommendations for glazing construction have been nominated in Section 5.3.1 of this report. We recommend that these are reviewed as part of the design development for the project, in addition to any lightweight external walls that are proposed.
- In addition to the above, noise and vibration impacts of the existing T4 rail tunnel and future City & South West Metro line have been assessed against the requirements outlined in Section 6.1. Acoustic treatment is not required.
- External noise emission goals have been established based on the requirements of the NSW EPA *Noise Policy for Industry* in Section 7. A detailed assessment of noise emissions from mechanical plant and equipment is to be conducted once equipment selections and layouts have been finalised during the detailed design of the project.
- A preliminary assessment of construction noise impacts has been undertaken based on the procedure outlined in the NSW EPA *Interim Construction Noise Guideline*. Noise management levels have been established for nearby noise sensitive receivers, and noise levels have been predicted based on typical construction activities. Noting an exceedance in the "highly affected noise management level" typical mitigation measures have been presented. A detailed assessment is to be undertaken, taking into consideration the proposed construction methodologies, approved hours of work and the occupation status of nearby residential buildings.

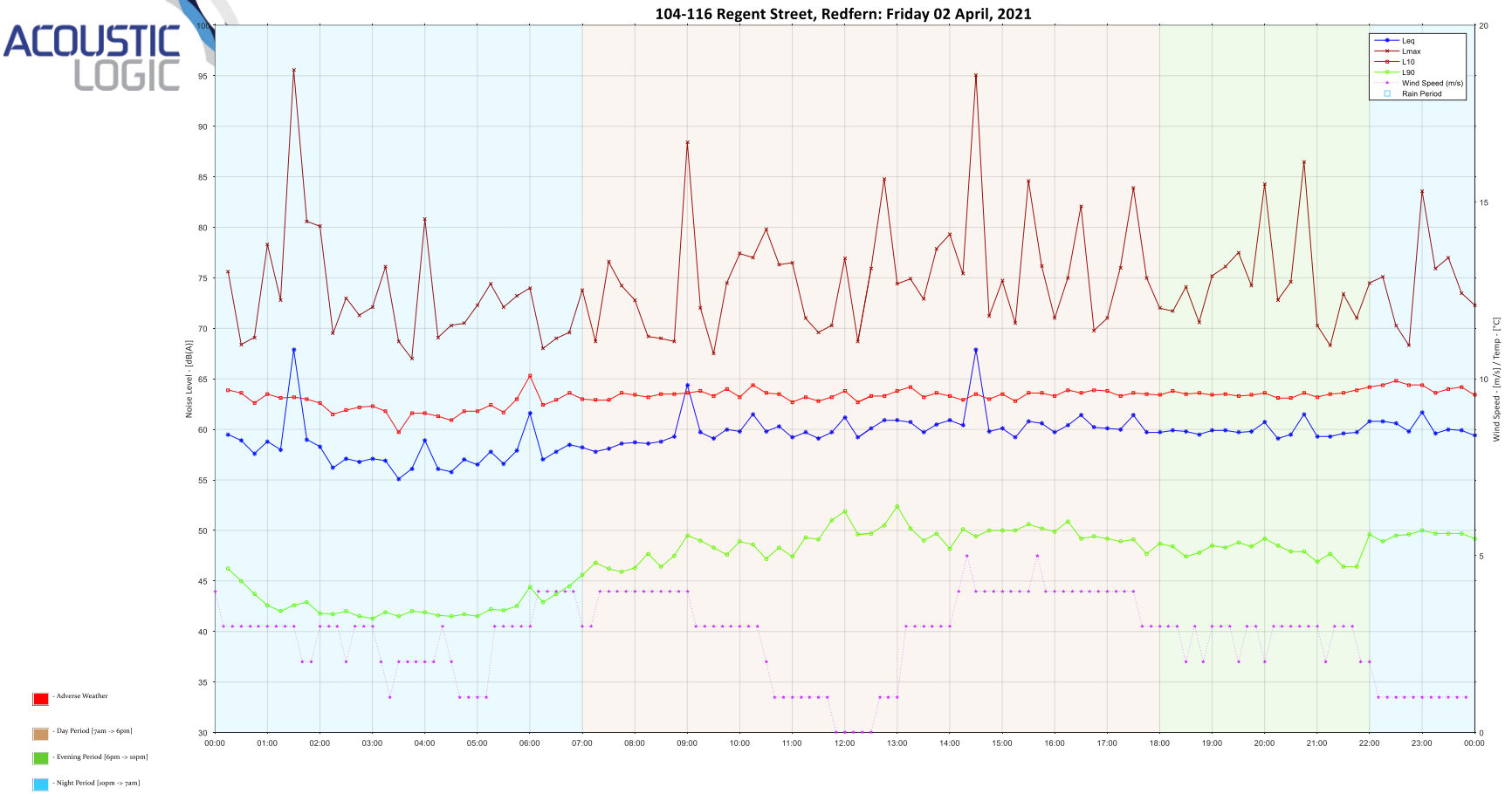
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

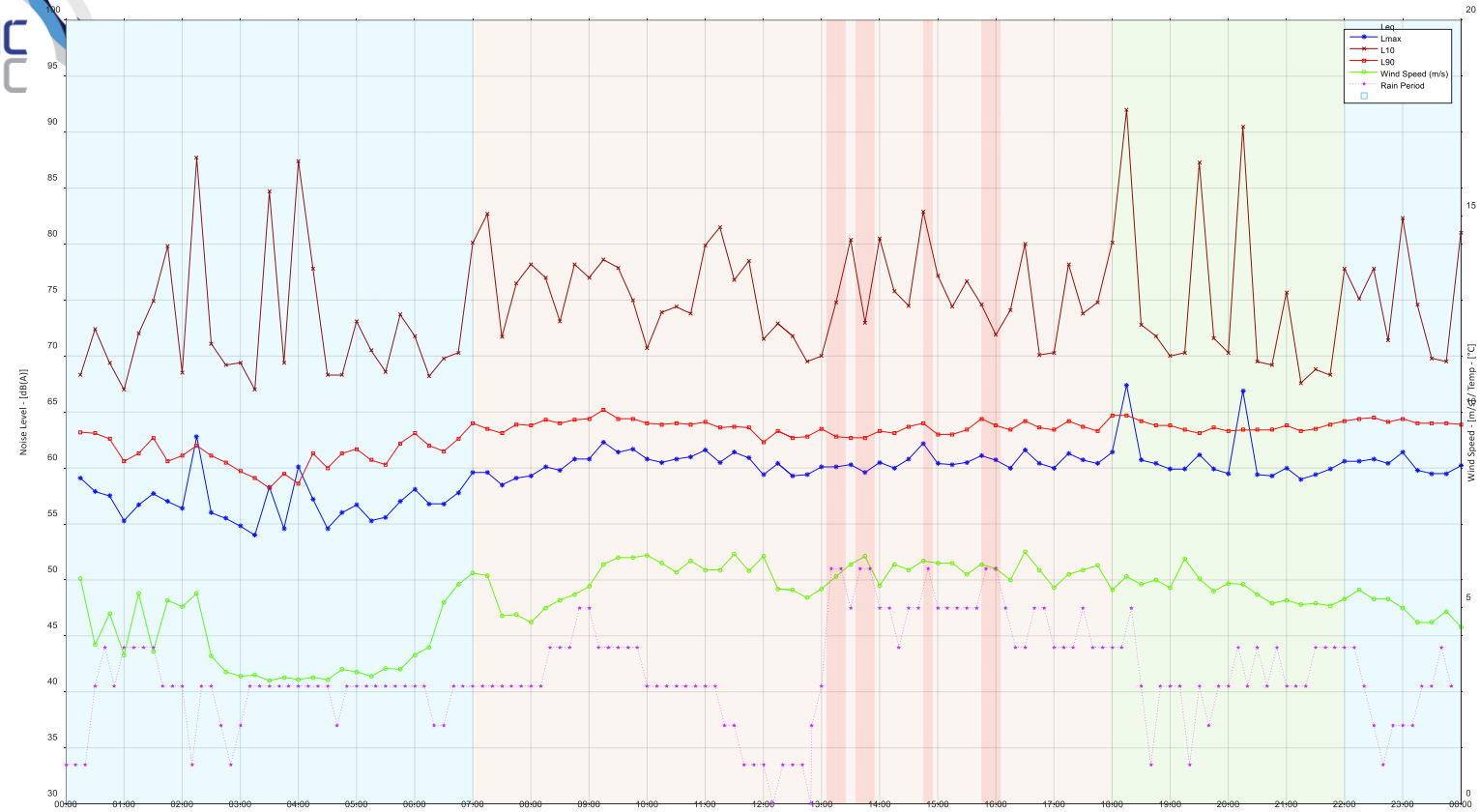
Acoustic Logic Pty Ltd
Artie Rattananikom

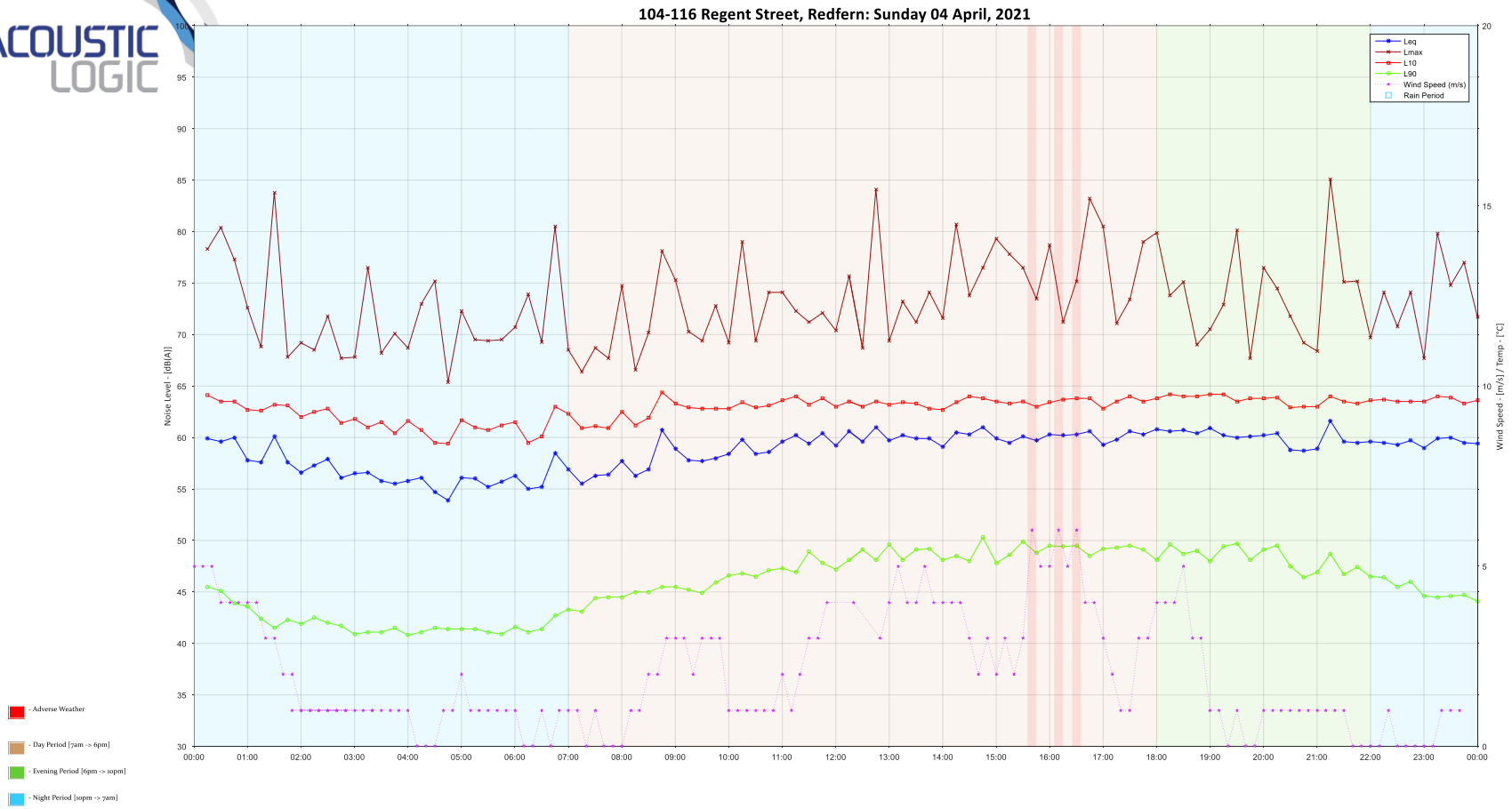
APPENDIX A – UNATTENDED NOISE MONITORING DATA

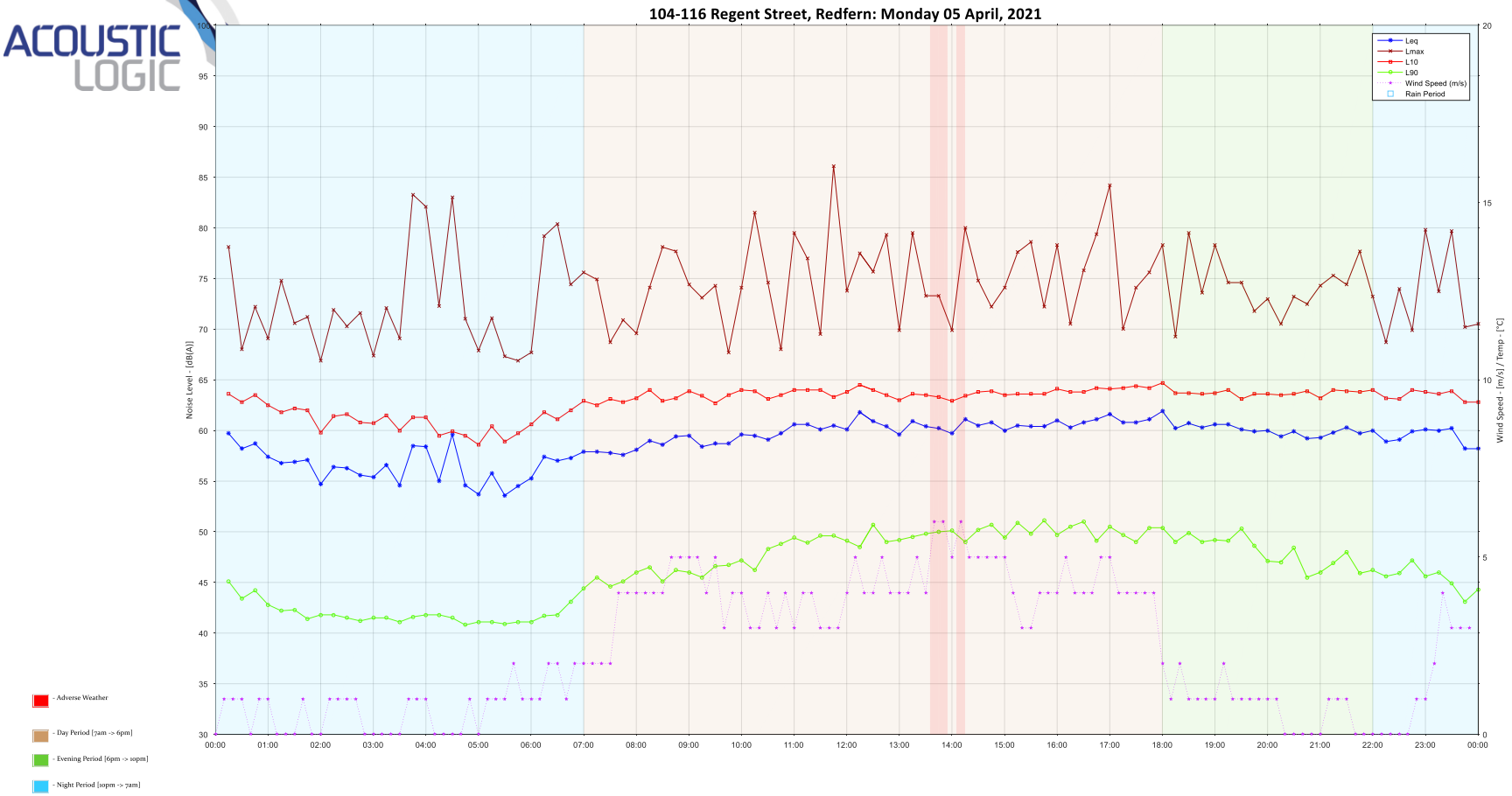

104-116 Regent Street, Redfern: Thursday 01 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

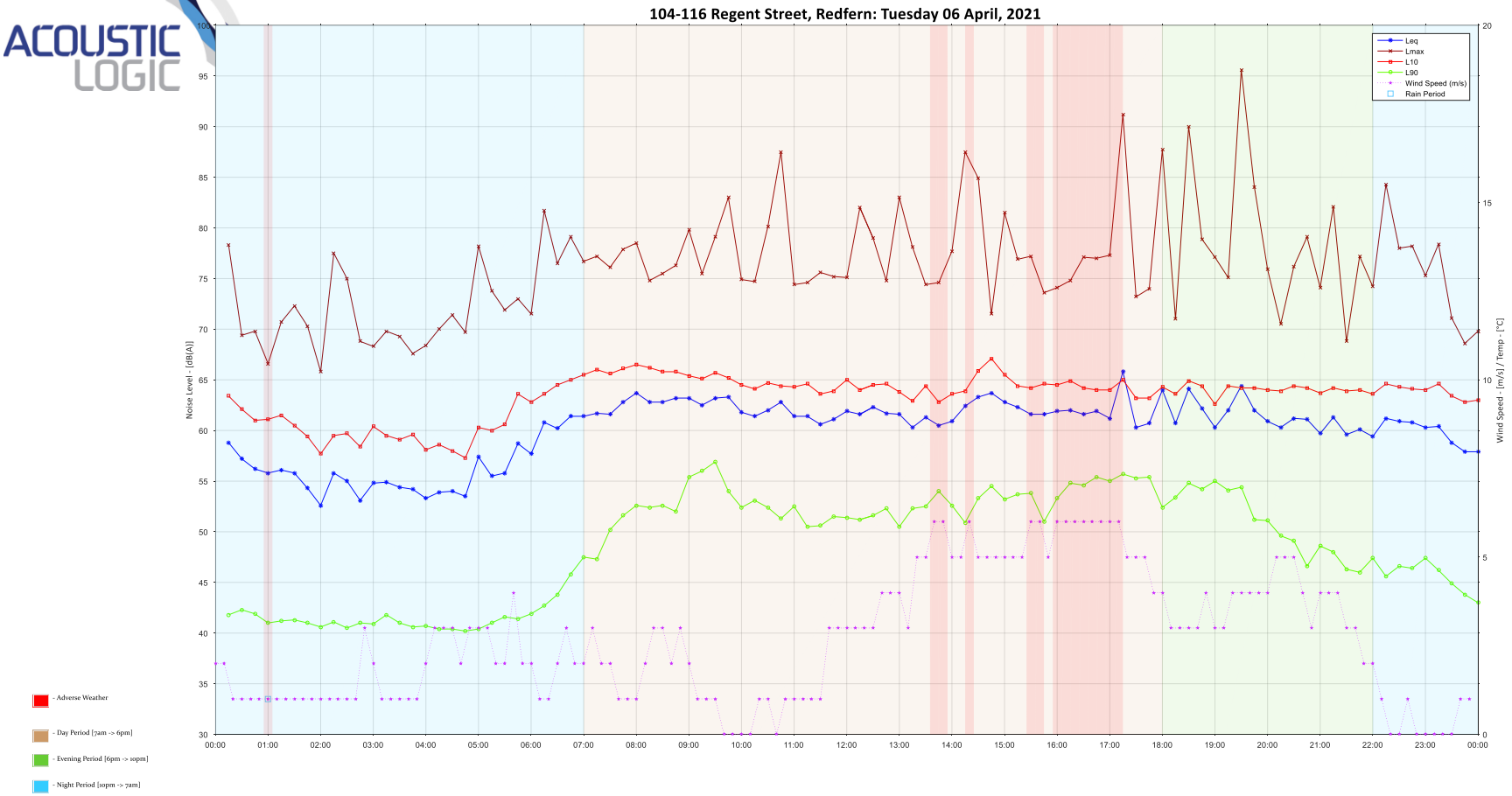

104-116 Regent Street, Redfern: Friday 02 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

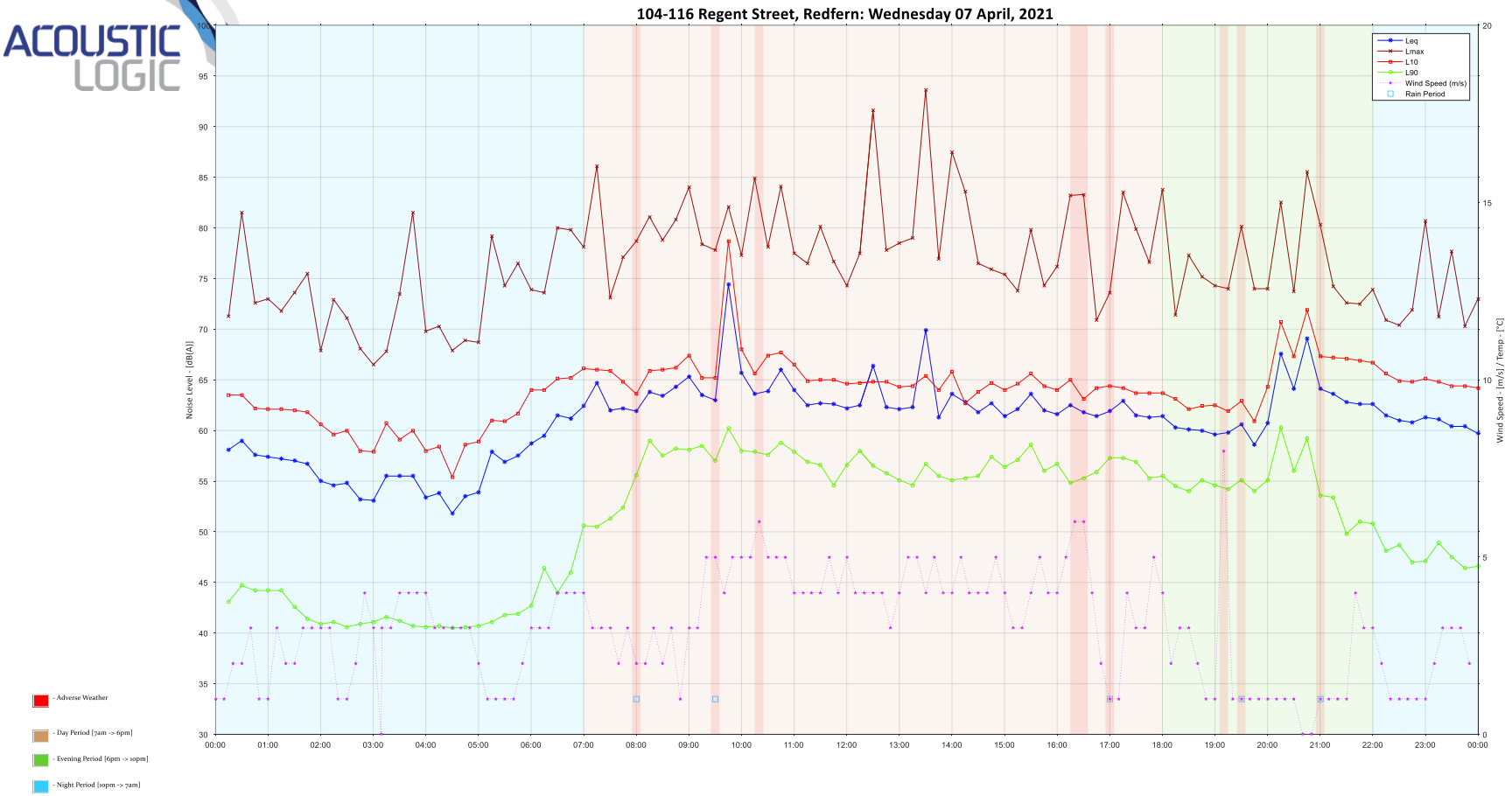
104-116 Regent Street, Redfern: Saturday 03 April, 2021

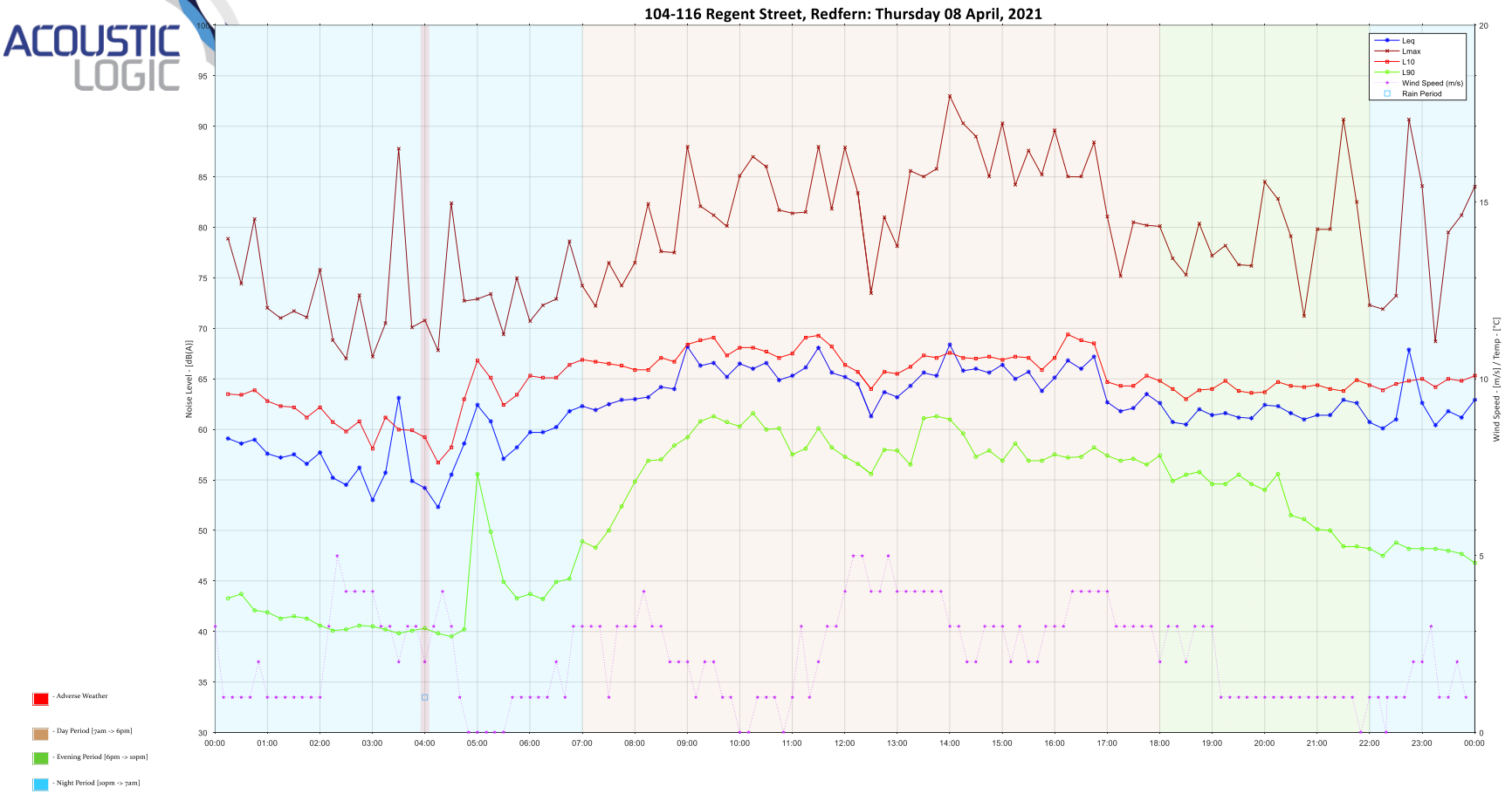


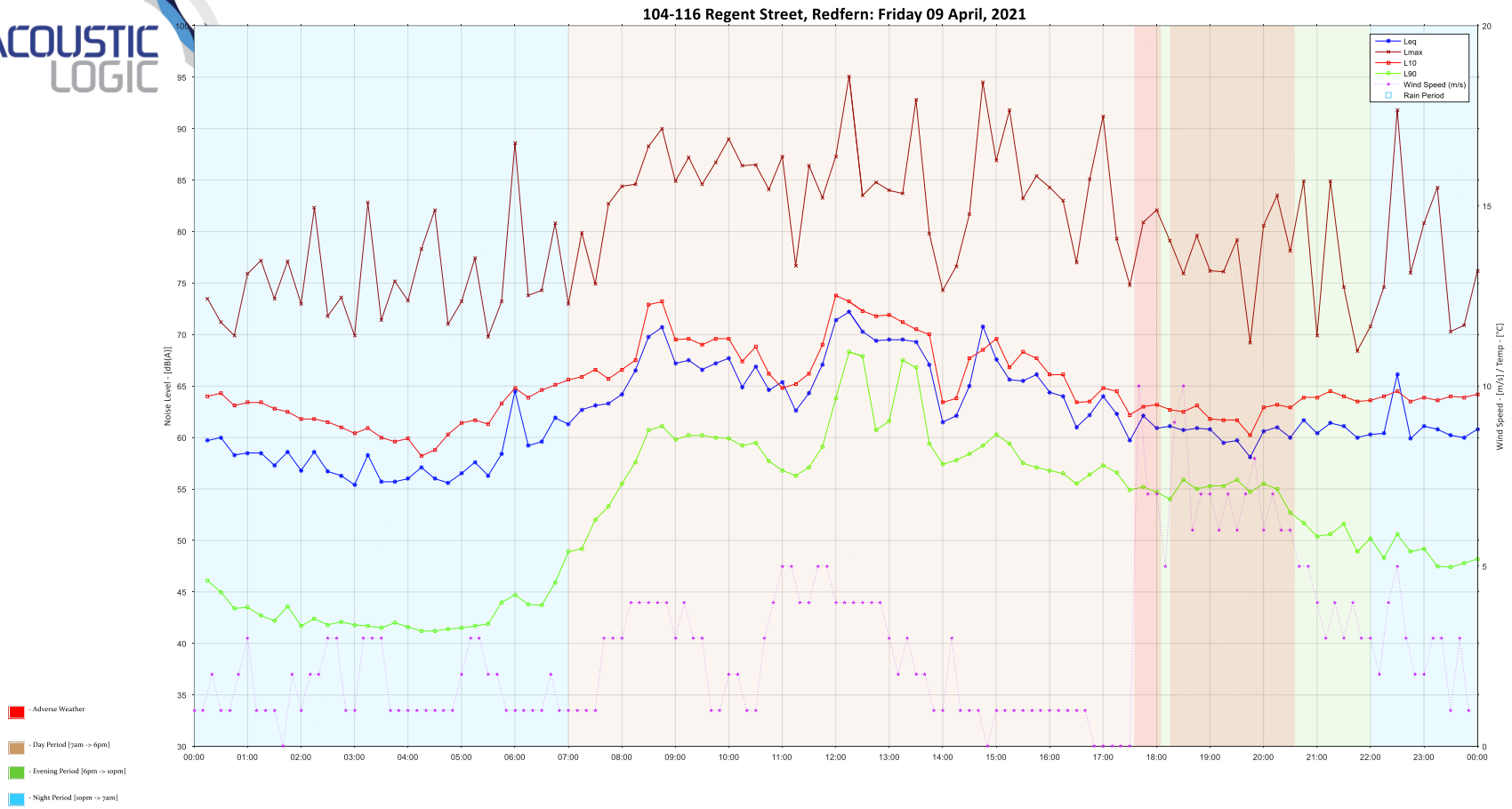

104-116 Regent Street, Redfern: Sunday 04 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

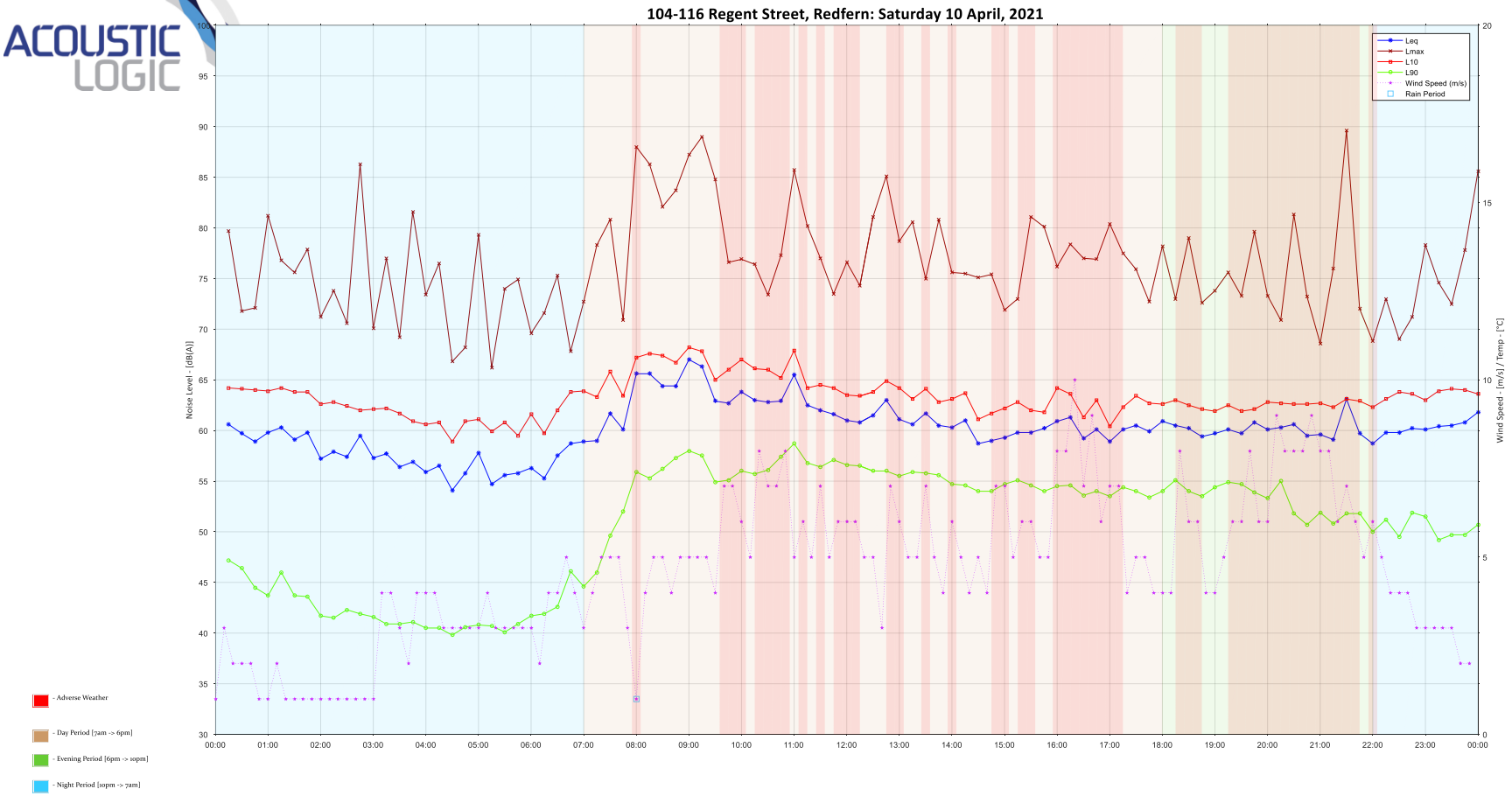

104-116 Regent Street, Redfern: Monday 05 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

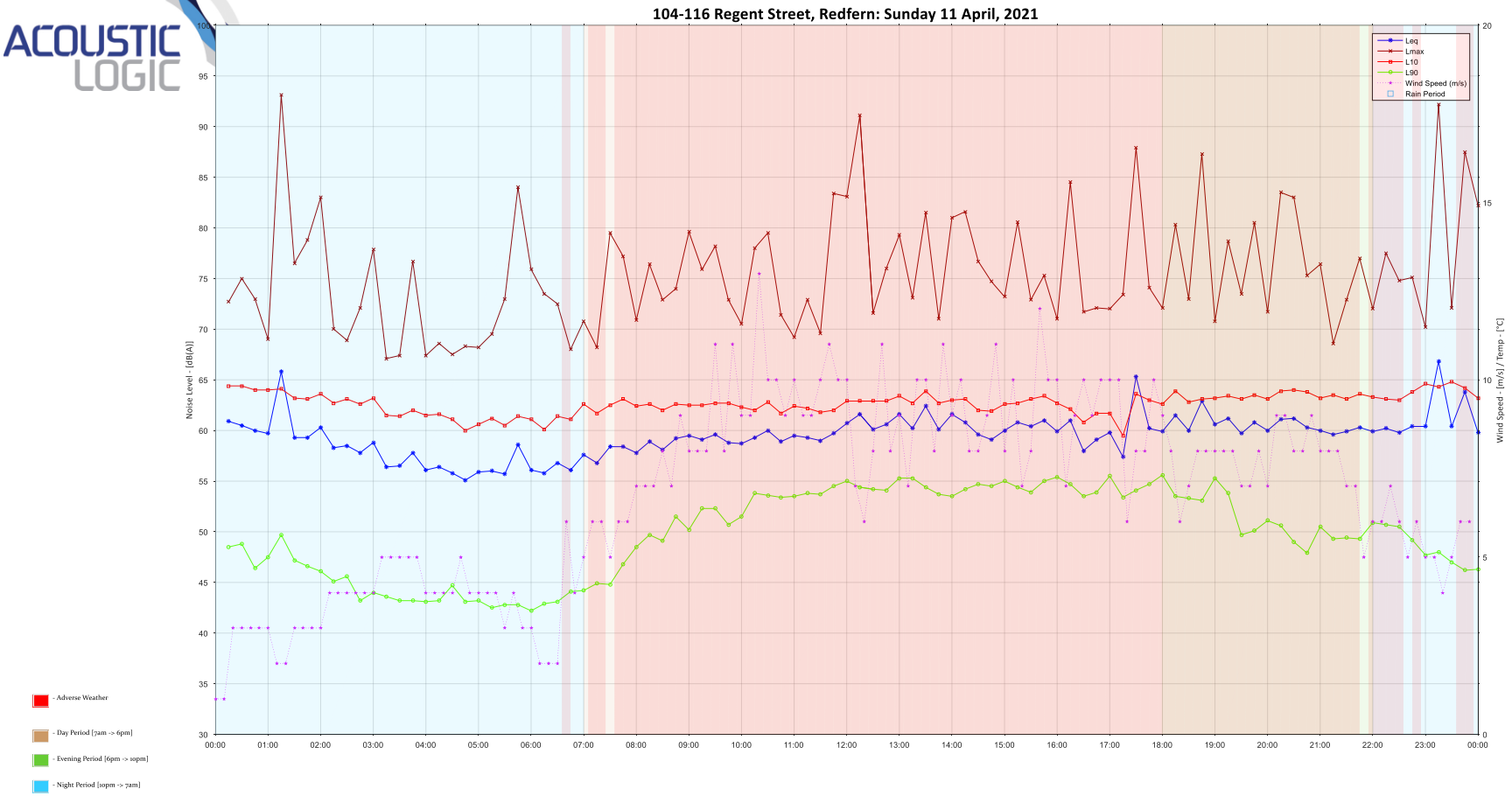

104-116 Regent Street, Redfern: Tuesday 06 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

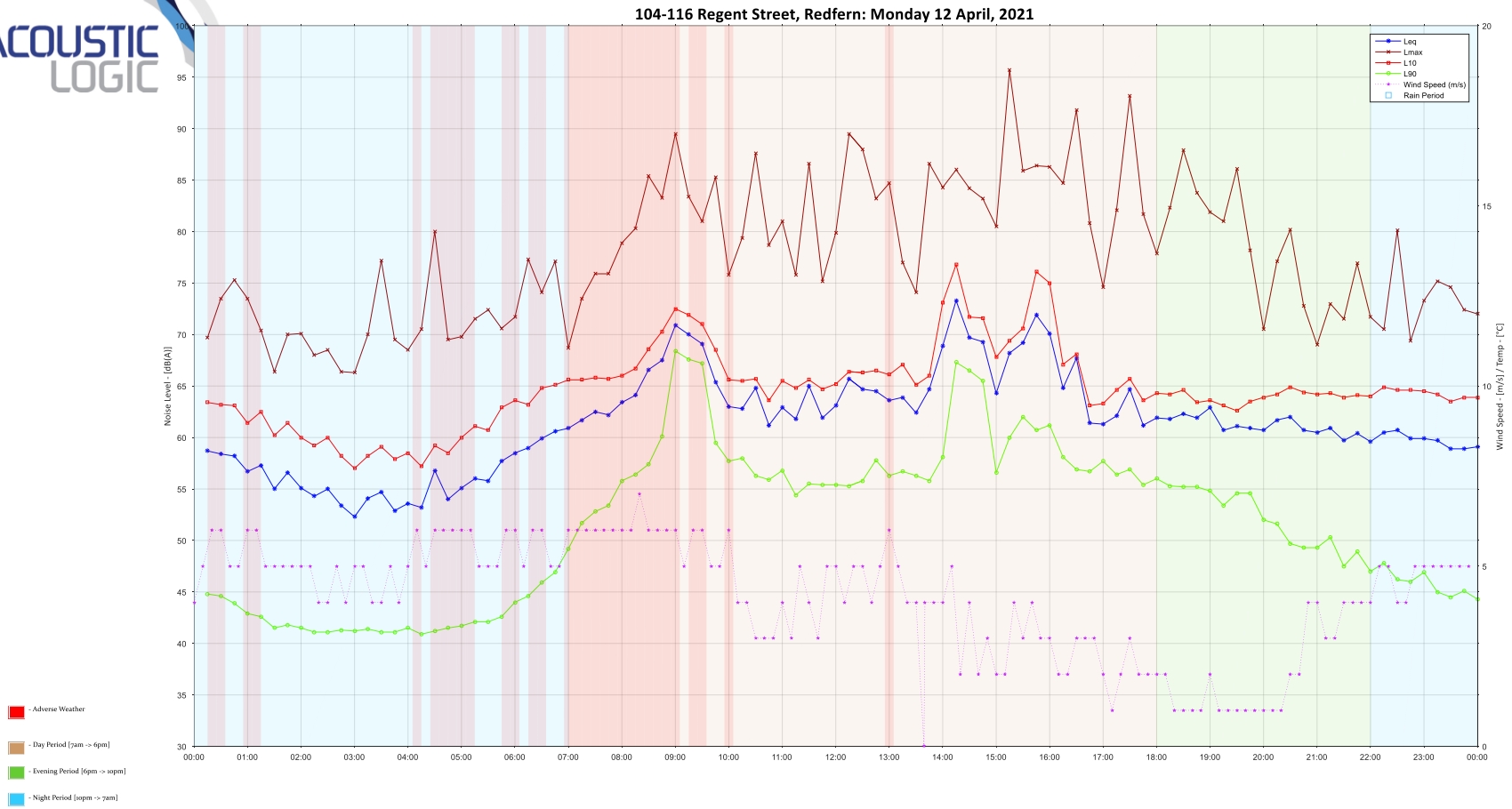

104-116 Regent Street, Redfern: Wednesday 07 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

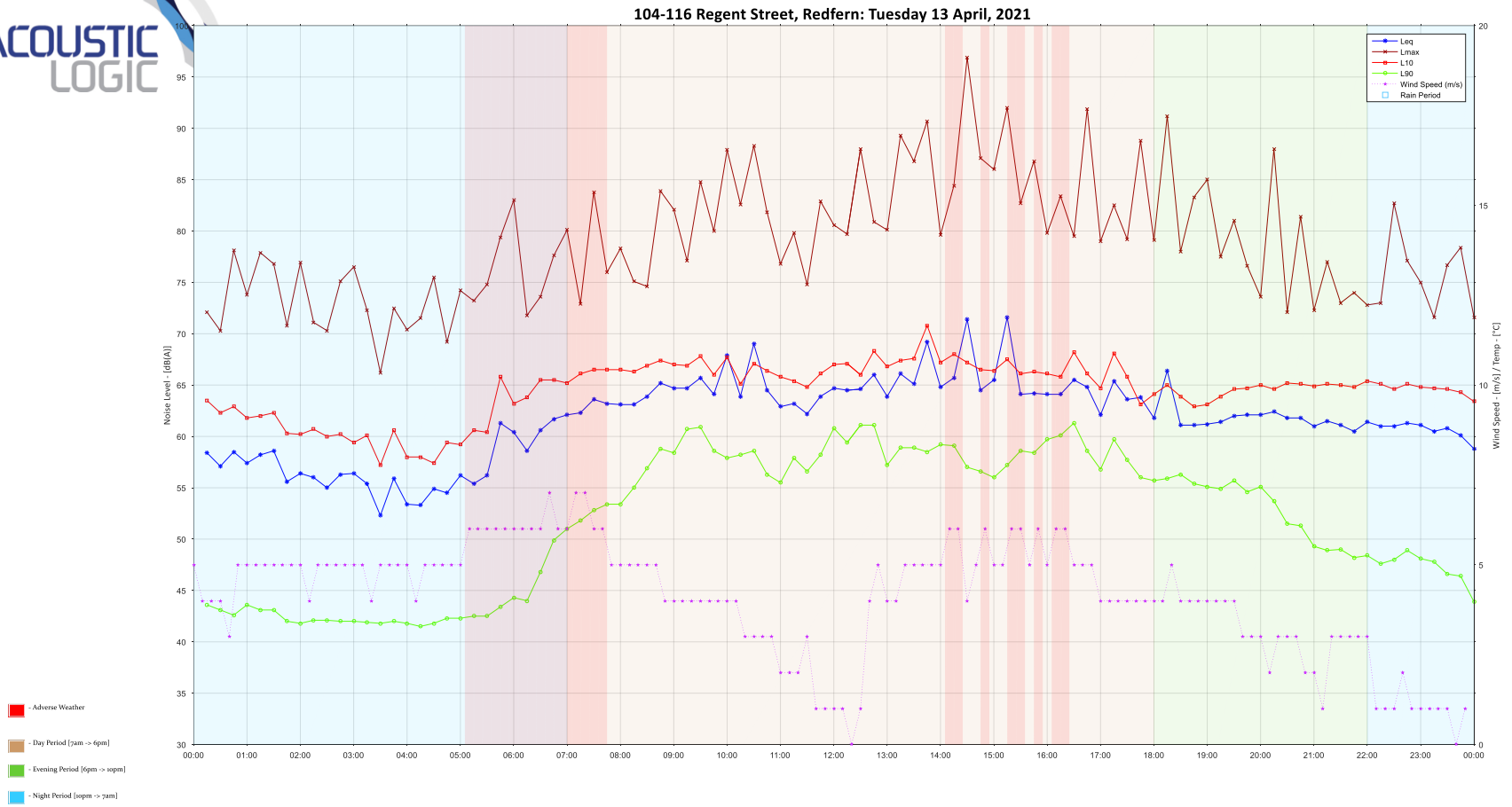

104-116 Regent Street, Redfern: Thursday 08 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

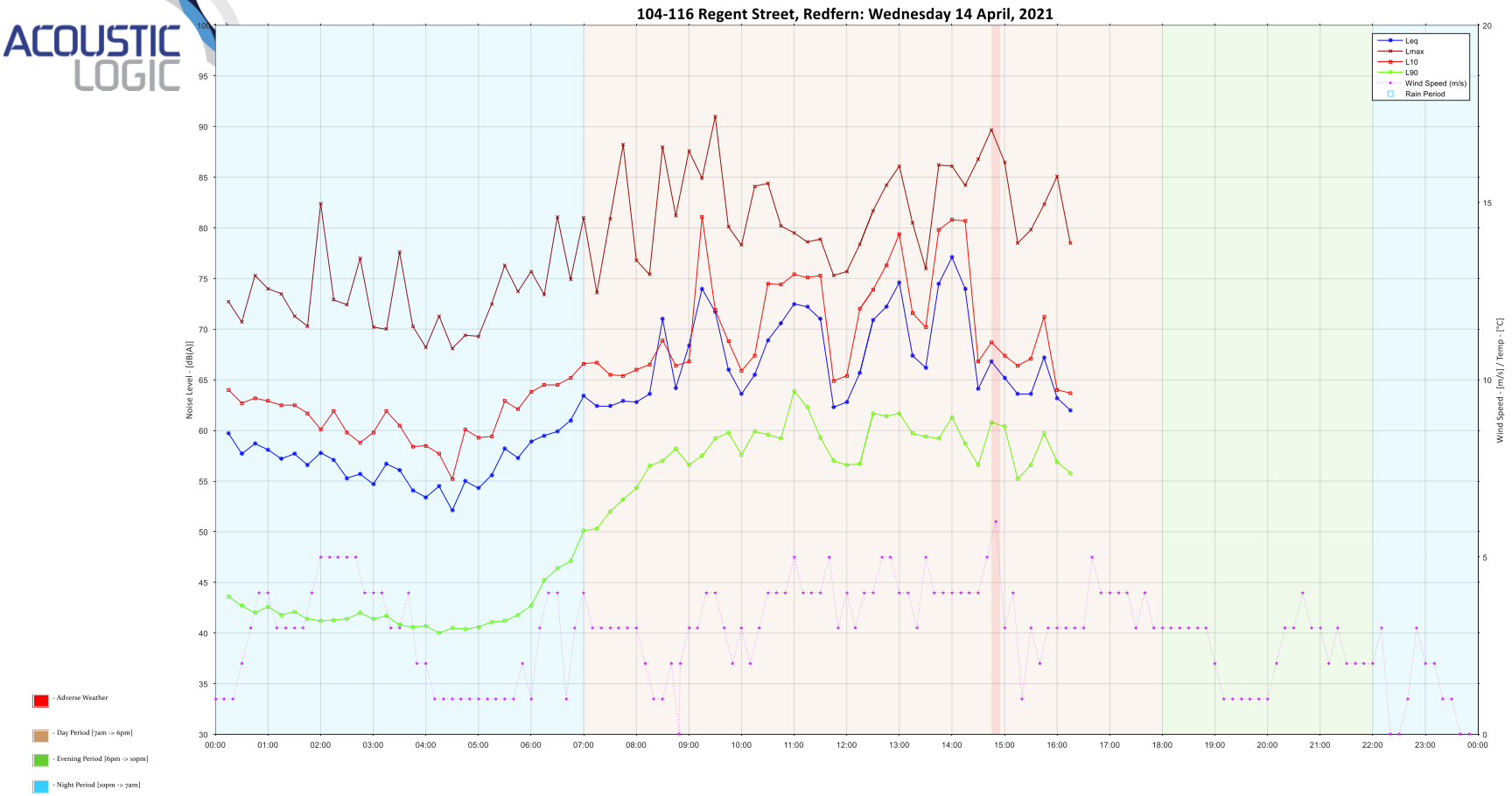

104-116 Regent Street, Redfern: Friday 09 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


104-116 Regent Street, Redfern: Saturday 10 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


104-116 Regent Street, Redfern: Sunday 11 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


104-116 Regent Street, Redfern: Monday 12 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


104-116 Regent Street, Redfern: Tuesday 13 April, 2021
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


104-116 Regent Street, Redfern: Wednesday 14 April, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]