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Cockle Bay Park Redevelopment

Appendix V - Noise & Vibration Impact Assessment

SSD-9978934

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1 INTRODUCTION

This report has been prepared to accompany a detailed State Significant Development (SSD) Development Application (DA) (Stage 2) for a commercial mixed use development, Cockle Bay Park, which is submitted to the Minister for Planning and Public Spaces pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The development is being conducted in stages comprising the following planning applications:

- Stage 1 – Concept Proposal setting the overall 'vision' for the redevelopment of the site including the building envelope and land uses, as well as development consent for the carrying out of early works including demolition of the existing buildings and structures. This stage was determined on 13 May 2019, and is proposed to be modified to align with the Stage 2 SSD DA.
- Stage 2 – detailed design, construction, and operation of Cockle Bay Park pursuant to the Concept Proposal.

1.1 RESPONSE TO SEARS

This report has been prepared in response to the Secretary's Environmental Assessment Requirements (SEARS) dated 12 November 2020 for SSD-9978934. Specifically, this report has been prepared to respond to those SEARS summarised in Table 1.

Table 1-1 – SEARS Requirements

Item	Description of Requirement	Section Reference
7 Amenity	Assess potential amenity impacts associated with the proposal within the site and on surrounding area, including… noise vibration.	Sections 5, 7 & 8
10 Noise and Vibration	The EIS must include a noise and vibration assessment in accordance with relevant NSW Environmental Protection Authority guidelines, including construction and operational noise impacts.	Sections 4, 5, 6, 7 & 8

This report has also been prepared in response to the following Stage 1 (SSD 7684) conditions of consent summarised in Table 2.

Table 1-2 - Concept approval of Conditions of Consent

Item	Description of Requirement	Section Reference
C30 Noise and Vibration	Reporting required to provide an assessment of potential noise and vibration impacts to ensure the amenity of sensitive land uses	This report forms the Noise and Vibration Impact Assessment (NVIA)
31 c) CBD Rail Link	Allowance for future rail activities of the CBD Rail Link (CBDRL)	Section 5
C34 c) Construction	Noise and vibration impacts from construction.	Section 8

1.2 REPORT OVERVIEW

DPT Operator Pty Ltd and DPPT Operator Pty Ltd (the Proponent) are seeking SSDA approval for the redevelopment of the Cockle Bay Wharf Building and the surrounding area to create new open space and a commercial, retail and tourist precinct in the heart of the CBD (now referred to as Cockle Bay Park). The amended Concept Proposal includes:

- Publicly accessible open space
- New retail outlets, including new food and beverage destinations
- New cultural and entertainment destinations, and
- A new commercial office tower.

This document addresses noise and impacts associated with the following:

- Retail and commercial usage (in principle)
- Noise emissions from mechanical plant to service the project site (in principle)
- Construction noise and vibration impacts
- Impacts to/from adjacent roadways and potential future rail corridors near to the site.

AL have utilised the following documents and regulations in the noise assessment of the development:

- Development consent for SSD 7684
- Planning Secretary's Environmental Assessment Requirements (SEARs) (*Ref: SSD-9978934*)
- NSW Environmental Protection Authority (EPA) *Road Noise Policy* 2011
- NSW EPA *Noise Policy for Industry* (NPI) 2017.
- NSW Department of Environment & Climate Change *Interim Construction Noise Guidelines* 2009
- State Environmental Planning Policy (Infrastructure) 2007
- Liquor & Gaming NSW (L&GNSW) acoustic requirements, and

An assessment of noise and vibration impacts associated with the development has determined that the proposal can achieve the requirements of the aforementioned authorities and regulations for all time periods of the day, evening and night.

2 SITE PROPOSAL, DESCRIPTION AND LOCATION

2.1 EXISTING USES AND ROAD NETWORK

The site is located at 241-249 Wheat Road, Sydney to the immediate south of Pyrmont Bridge, within the Sydney CBD, on the eastern side of the Darling Harbour precinct. The site encompasses the Cockle Bay Wharf development, parts of the Eastern Distributor and Wheat Road, Darling Park and Pyrmont Bridge. Refer to Figure 1 for detail.

The Darling Harbour Precinct is undergoing significant redevelopment as part of the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) including Darling Square and the IMAX renewal (W Hotel) projects. More broadly, the western edge of the Sydney CBD has been subject to significant change following the development of the Barangaroo precinct.

The existing Cockle Bay Wharf precinct generally encompasses:

- Small retail
- Licensed and unlicensed food and beverage, and
- Associated loading docks and parking.

The surrounding road network consists of:

- Western Distributor to the East of CBW, which carries high volumes of passenger, commercial and heavy vehicle traffic.
- Wheat Road to the East of CBW (underneath and joining into Western Distributor eastbound) which carries traffic typically from the City to the King Street Wharf precinct and Millers Point.
- Harbour Street to the East of CBW which typically carries traffic from the Western Distributer (westbound) to the Darling Harbour precinct.

2.2 SURROUNDING RECEIVERS

The nearest noise receivers around the site include the following:

- **R1:** Residential Receiver 1 – Astoria Tower at 222-228 Sussex Street east beyond Darling Park commercial towers
- **R2:** Residential Receiver 2 – Harbourside. Currently a retail/commercial, there is an approved concept plan (SSD 7874) to redevelop the site with a mixture of retail/commercial uses and a residential tower. We note that residences are contained within the tower portion of the proposed development, and that the podium areas contain a mixture of commercial/retail uses.
- **R3:** Residential Receiver 3 – Darling Harbour Views at 50 Murray Street to the far west behind Harbourside.
- Remaining development in the immediate vicinity of the site are commercial and hotel/serviced apartments.

A site map, measurement description and surrounding receivers are presented in Figure 2 below.

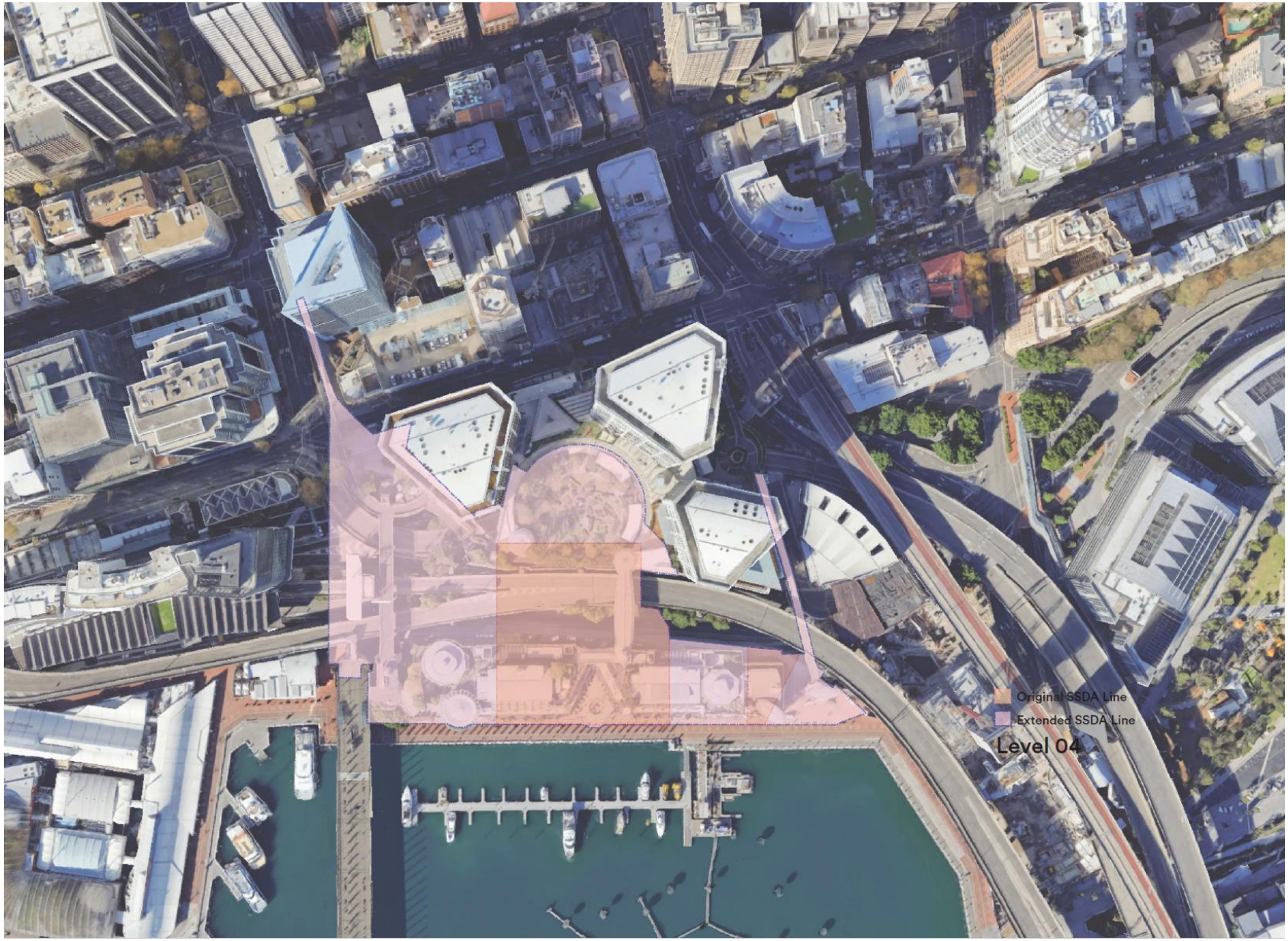


Figure 1 – Location Plan / Site Envelope

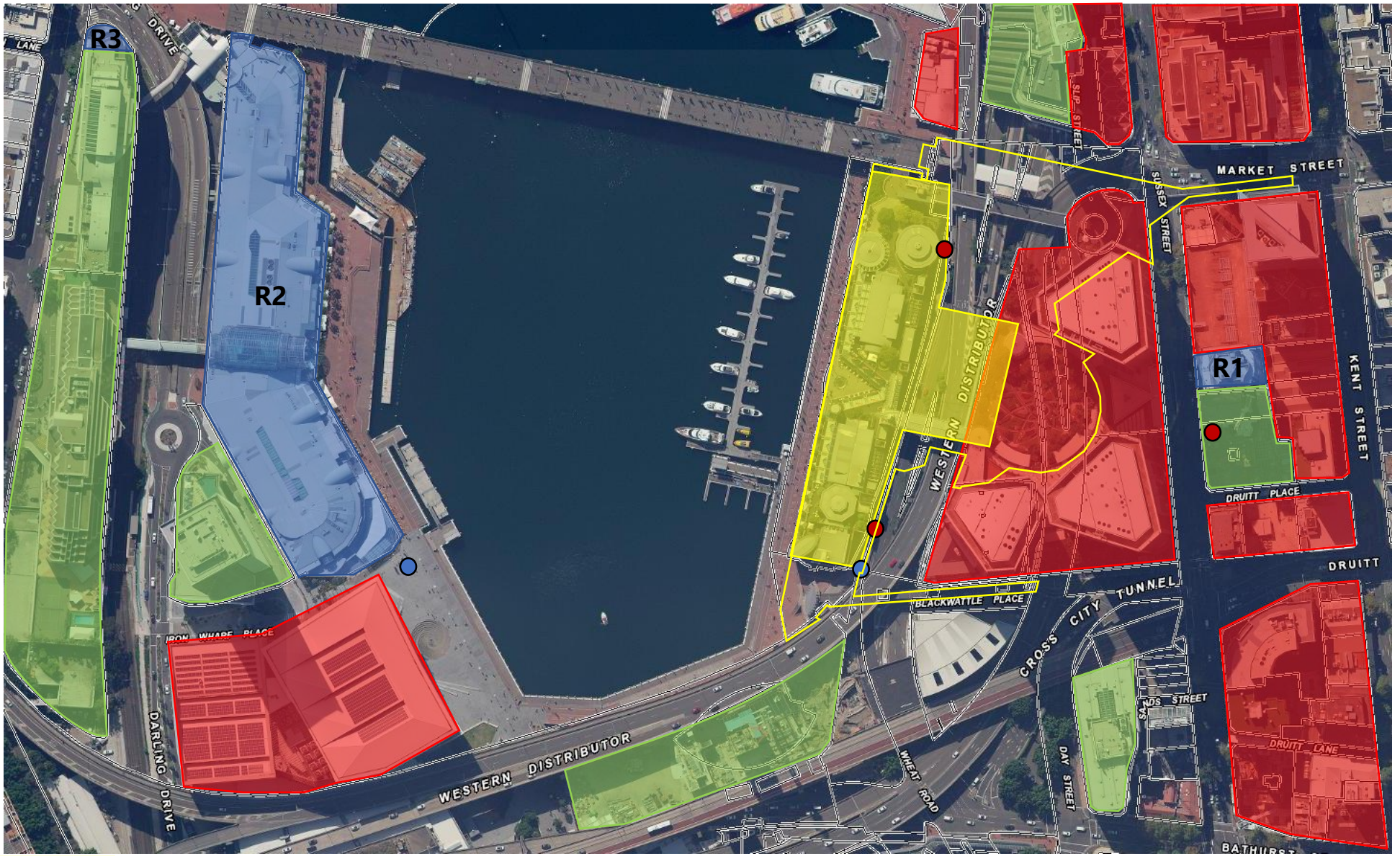


Figure 2 – Surrounding Receivers & Measurement Locations

3 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 principal 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 represents the highest sound pressure level during a measurement period.

4 ENVIRONMENTAL NOISE SURVEY

The existing acoustic environment is categorised by the following:

- High background noise levels during the day, evening and night due to direct and latent traffic noise from the Western Distributer.
- Consistent noise levels associated with urban hum.
- Moderate traffic noise levels associated with city streets.

4.1 AMBIENT NOISE MONITORING

NSW EPA's Rating Background Noise Level (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.

Appendices in this report present results of unattended noise monitoring conducted at the project site. Weather affected data was excluded from the assessment. The processed RBL (lowest 10th percentile noise levels during operation time period) are presented in Table 4-1.

4.1.1 Measurement Equipment

Equipment used consisted of an Acoustic Research Laboratories Pty Ltd noise logger. The logger was set to A-weighted fast response and was programmed to store 15-minute statistical noise levels throughout the monitoring period. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix One – Unattended Noise Monitoring.

Attended noise 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.

4.1.2 Measurement Position and Period

Multiple noise monitors have been used to determine appropriate background noise levels for surrounding receivers, as previously documented in the Noise Impact Assessment for the development prepared for Stage 1 (*Ref: 20161035.1/1808A/R5/JS*, dated 18th August 2017). Additional noise monitoring was conducted in 2021 as part of the documentation for Stage 2. The following locations and associated dates of monitoring have been used to determine background noise levels in the vicinity of site:

- 234 Sussex Street (Meriton Suites Serviced Apartments) – 10th November to 18th November 2015.
- Western boundary of W Hotel Project (near to International Convention Centre) – 31st of May and 12th of June 2019.
- Millennium Towers, located at 289-295 Sussex St. Monitor located on rooftop – 30th April 2019 and 7th of May 2019.
- North-eastern corner of Level 2 of the existing Cockle Bay Structure – 18th July to 26th July 2016, and 27th July to 3rd August 2021.
- South-eastern corner of Level 2 of the existing Cockle Bay Structure – 18th July to 26th July 2016, and 27th July to 3rd August 2021.
- North-eastern corner of ground level of the existing Cockle Bay Structure between Wheat Road and Western Distributor – 27th July to 3rd August 2021.

Attended noise measurements to supplement the above were undertaken on 18th July 2016, 26th July 2016, 31st of March 2019 and 27th July 2021. Refer to Figure 2 for detailed locations of monitor placements and attended noise measurement locations.

Noise levels for the residential receiver along Murray Street, Pyrmont (**R3**) have been adopted from noise monitoring conducted in 2013 prior to the demolition and construction of the Sydney International Convention, Exhibition and Entertainment Centre by Aecom for the SICEEP development. The monitor was located on a balcony of the Novotel Hotel, adjacent to the residential receiver.

Refer to Section 4.4 for detailed discussion on the establishment of relevant background noise levels at surrounding residential receivers, and applicability of noise monitoring data to residents surrounding site.

4.2 SUMMARISED RATING BACKGROUND NOISE LEVELS

Summarised rating background noise levels for the project site and immediate surroundings are presented below.

Table 4-1 – Measured Rating Background Noise Levels

Monitor Location	Rating Background Noise Level $dB(A)_{L90(Period)}$		
	Day (7am – 6pm)	**Evening (6pm – 10pm)**	**Night (10pm – 7am)**
Southern Terrace of Novotel (Receiver **R3**)*	58	59	52
234 Sussex Street (**R1**) (2015)*	63	60	54
International Convention Centre (**R2**) (2019)	67	58**	55
Millennium Towers (2019)	64	62	58
Cockle Bay – North-Eastern Corner Level 2 (2016)*	66	64	54
Cockle Bay – North-Eastern Corner Level 2 (2021)	68	60	52
Cockle Bay – South-Eastern Corner Level 2 (2016)*	71	70	58
Cockle Bay – South-Eastern Corner Level 2 (2021)	63	57	48
Cockle Bay – North-Eastern Corner Ground Floor (2021)	67	60	52

**Noise data provided as part of Stage 1 SSDA application for Cockle Bay Park Redevelopment.*
***Noise during the evening period affected by Vivid Live festival. Noise levels from the Novotel will be used for this period where required*

Weather affected monitoring data was excluded in line with Factsheets A & B of the NSW EPA Noise Policy for Industry. We note that upon review of the monitoring data, the measured L_{90} noise levels during high wind speed days do not increase background noise levels significantly as periods with little to no wind. This demonstrates that although wind speeds measured at Observatory Hill (the closest weather station) exceed EPA guidelines for some periods of monitoring, either:

- The wind speed on site at this time was significantly lower than at Observatory Hill (which is likely given Observatory Hill is located in a very exposed area) and/or
- The wind on site was not sufficiently consistent to increase background noise levels compared to calm periods.

Therefore, only periods of adverse weather that were determined to have affected the noise data have been eliminated when determining the rating background noise level at the site, which is presented above.

4.3 SUMMARISED TRAFFIC NOISE LEVELS

The following noise levels for the site have been established based on short term attended measurements and long-term noise monitoring.

Table 4-2 – Measured Ambient Noise Levels

Monitor Location	**Noise Level dB(A)$L_{eq(Period)}$**	
	Day $L_{eq(15hr)}$ (7am – 10pm)	**Night $L_{eq(9hr)}$ (10pm – 7am)**
Southern Terrace of Novotel (Receiver **R3**)*	67	62
234 Sussex Street (**R1**) (2015)*	58	52
Millennium Towers (2019)	67	64
Cockle Bay – North-Eastern Corner Level 2 (2016)*	71	68
Cockle Bay – North-Eastern Corner Level 2 (2021)	70	66
Cockle Bay – South-Eastern Corner Level 2 (2016)*	76	73
Cockle Bay – South-Eastern Corner Level 2 (2021)	69	64
Cockle Bay – North-Eastern Corner Ground Floor (2021)	74	68

**Noise data provided as part of Stage 1 SSDA application for Cockle Bay Park Redevelopment.*

4.4 DISCUSSION OF BACKGROUND NOISE MEASUREMENTS

With regard to the noise monitoring locations, results and time periods we note the following:

- Monitoring data collected during 2021 was during a period of NSW Government Public Health Orders (associated with COVID-19), which included restriction on movement and operation of particular businesses in the vicinity of Cockle Bay Park. This also presented challenges regarding access to occupied buildings to install monitoring equipment.
- As such, there were significantly lower traffic volumes during this period than would be considered typical. This is reflected in the monitoring results, which generally present lower background noise levels in equivalent locations.
- For commercial/hotel/industrial receivers, noise emissions are set with reference to an absolute, or amenity level. In these cases the background noise level is not applicable.
- For residential development, the NSW EPA Noise Policy for Industry (NPI) and NSW Liquor & Gaming (NSWL&G) establish noise emission limits with reference to background levels over particular time periods of the day. Therefore, the critical monitoring locations are those taken at, or representative of residential receivers.
- All monitors installed at residential locations were prior to the implementation of NSW Government restrictions, and so are representative of the long term noise level of the area. Further, noise monitoring for residential locations R1 & R3 were approved as part of the Stage 1 submission for the site.
- In light of the above, it is proposed to use the background levels from the following locations when determining appropriate noise emission goals to surrounding noise sensitive receivers:
    - 234 Sussex Street, Sussex Street - Monitoring at this location to be representative for Astoria Tower (228-228 Sussex Street, **R1**).
    - W Hotel/International Convention Centre – Monitoring at this location to be representative for the future Harbourside residential development
    - Southern Terrace of Novotel – Monitoring at this location to be representative for residents at 50 Murray Street, Pyrmont, adjacent to the monitoring location.

5 NOISE & VIBRATION IMPACTS TO SITE

Potential noise and vibration impact to the site from external roadways and potential rail tunnels are addressed within this section. Traffic and rail noise/vibration impacts on development adjacent major roads is addressed under the State Environment Planning Policy (Infrastructure) 2007.

5.1 STATE ENVIRONMENT PLANNING POLICY (INFRASTRUCTURE) 2007

The SEPP (Infrastructure) 2007 provides guidance for developments located near to major roads and railway corridors. Relevant clauses are reproduced below.

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

(1) 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) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, 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 residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,

(b) anywhere else in the residential accommodation (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

(1) 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 TfNSW) 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.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, 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 residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,

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

The proposal has provisions for retail and commercial uses, which are not considered under the SEPP (Infrastructure) 2007 requirements. On this basis, both traffic and rail noise/vibration intrusion need not be considered any further for compliance with Clauses 87 & 102 of the SEPP (Infrastructure) 2007.

Notwithstanding the above, and with specific reference to the rail corridor reserved for the CBD Rail Link (CBDRL) below Sussex & Kent Streets (refer Figure 3), we make the following comments:

- Whilst there are rail corridors reserved below both Sussex Street and Kent Street, there is no current proposal to utilise the allocated corridors to construct rail infrastructure.
- The Sydney Metro Chatswood to Sydenham line is currently under construction, which runs adjacent (further east from site than the CBDRL). This is currently scheduled to open in 2024. Given the recent upgrades to CBD rail infrastructure, it is likely that construction of the Cockle Bay Park development will be completed prior to the CBDRL, in the event it is ultimately utilised.
- The vast majority of retail and commercial facilities are contained on the western side of Wheat Road, significantly outside of the boundary of the Sussex Street (nearest) rail corridor.
- The extent of the proposed development which is contained above the Sussex Street corridor is limited to the land bridge over the Western Distributor to the existing Darling Park development. With regard to acoustics (noise and tactile vibration), this would not be considered as a sensitive space which may require any form of ameliorative measures (notwithstanding it would be excluded from the requirements of SEPP (Infrastructure) in any case).
- In the event the tunnels allocated for the CBDRL were ultimately to be used, it is expected that they would be subject to planning approval similar to that of the Metro lines currently under construction. It would be at this time that any sensitive land uses near to the tunnels would be identified, and any mitigation measures required to control noise and/or vibration from the proposed would be identified.
- We note that the existing development in the vicinity of the tunnels is predominantly retail/commercial, which is consistent with the proposal for Cockle Bay Park. Further, there is existing residential and hotel development located a similar distance from the corridors which would be subject to more stringent acoustic criteria and would likely determine the requirements for mitigation in the area, if any at all were ultimately required.
- On this basis, it can be concluded that the proposed Cockle Bay Park Redevelopment proposed is unlikely to be adversely impacted by the future construction of the CBDRL, and that the construction of the land bridge/connection to the existing Darling Park development would not present additional noise/vibration sensitive development in the vicinity of the corridor.

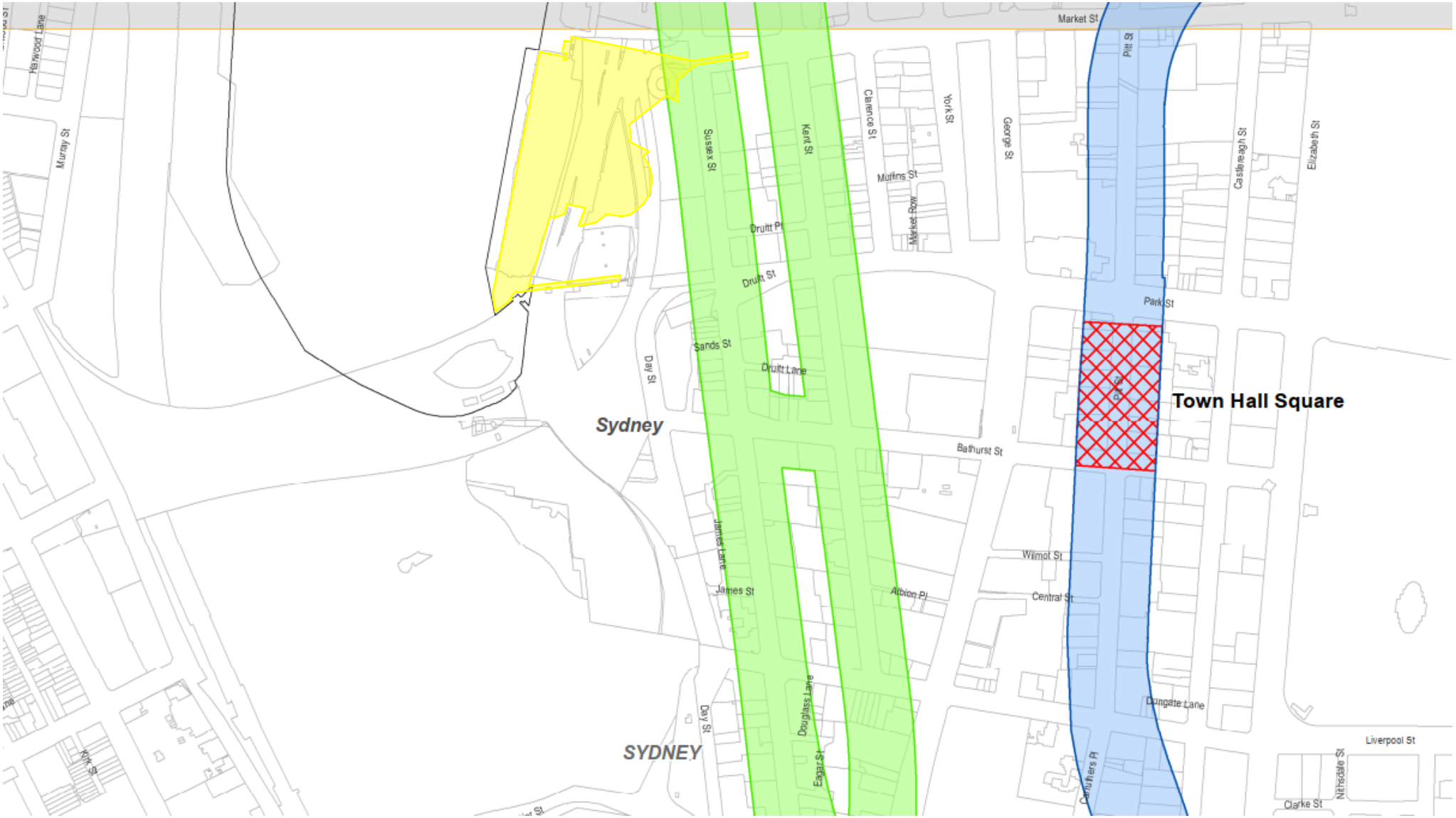


Figure 3 – Site Location Relative to CBD Rail Link Corridor

Project Site

CBD Rail Link Corridor

Sydney Metro Rail Corridor

6 NOISE EMISSION CRITERIA

Operational noise emissions from the project site have been assessed with reference to the following documents:

- NSW Environmental Protection Authority (EPA) *Road Noise Policy* 2011
- Liquor & Gaming NSW (L&GNSW) acoustic requirements, and
- NSW Environmental Protection Authority (EPA) *Noise Policy for Industry* (NPI) 2017.

6.1 NSW EPA ROAD NOISE POLICY 2011

For land use developments with the potential to create additional traffic on public streets the development should comply with the EPA *Road Noise Policy*. Noise levels generated by traffic should not exceed the noise levels set out in the table below when measured at a nearby property.

Table 6-1 – Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Freeway/ Arterial Roads (Western Distributor)	Day (7am to 10pm)	60 dB(A) $L_{eq(15hr)}$
	Night (10pm to 7am)	55 dB(A) $L_{eq(9hr)}$

However, if existing noise levels exceed those in the table above, Section 3.4 of the Road Noise Policy is applicable, which requires noise impacts are reduced through feasible and reasonable measures. However, in determining what is feasible/reasonable, the Policy notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible. Existing traffic noise levels are detailed in Table 4-2.

6.2 LIQUOR & GAMING NSW (L&GNSW)

When assessing noise emissions from licensed premises, Liquor & Gaming NSW typically apply the following license condition to a premises, which relate to operational noise from music and patrons:

- *The L_{10} noise level emitted from the premises shall not exceed 5dB above the background L_{90} sound level in any Octave Band Centre Frequency (31.5Hz to 8kHz inclusive) between the hours of 7.00am to 12.00 midnight when assessed at the boundary of the nearest affected residential premises.*
- *L_{10} noise level emitted from the premises shall not exceed the background L_{90} sound level in any Octave Band Centre Frequency (31.5Hz to 8kHz inclusive) after midnight when assessed at the boundary of the nearest affected residential premises.*

After midnight, noise emissions from the Place of Public Entertainment are to be inaudible within any habitable rooms in nearby residential properties.

The assessment criteria is typically applied externally, with an assumption that external windows or doors could be open. However, in the case of the Darling Harbour precinct we note it is likely that windows and doors would be required to be closed in order to achieve appropriate acoustic amenity within residential apartments. In particular, the acoustic report provided in support of the Harbourside Redevelopment, being the closest residential receiver to Cockle Bay Park, (SSD 7874, prepared by Renzo Tonin, ref: TH964-02F02, Revision 5, dated 23 January 2020) notes the following regarding the control of noise from retail premises:

> *To provide greater flexibility to the operation of the retail operations, the following approach is to be adopted through consultation with Mirvac during design development:*
>
> - *Set alternative noise criteria for operation times of restaurants*
> - *The alternative criteria to apply inside residential premises with windows and doors closed,*
> - *Façade and building envelope of the residential tower to be designed to provide noise reduction to external noise to meet established noise goals,*
> - *Retail external noise limit defined based on the established internal noise goals and residential façade design.*

Whilst clearly noise emissions from the Harbourside Redevelopment to apartments located above would be assessed differently that that from premises external to the site, it is clear that the acoustic design of the tower would need to consider entertainment noise from the precinct. As such, in the event there were marginal exceedances of the standard Liquor & Gaming requirements, it is likely that an acceptable level of acoustic amenity would be achieved.

For existing residential receivers (**R1**, Sussex Street and **R3**, Murray Street), strict compliance with the L&GNSW noise emission requirements should be achieved, given:

- They are not part of a larger mixed-use development, and
- They have not necessarily been designed with the same level of acoustic performance, as for a new development in the precinct.

We note that the assessment of licensed premises within this report is limited to demonstrating that noise from the proposed retail premises is capable of achieving the requirements identified above. It is expected that individual development applications would be submitted as part of tenant fitouts, at which time compliance with the relevant acoustic requirements for the site including management controls (specific tenancy patron numbers, locations, music noise levels, hours of operation etc.) are demonstrated.

6.3 NSW EPA NOISE POLICY FOR INDUSTRY (NPI) 2017

The EPA NPI has two criteria which both are required to be satisfied, namely Intrusiveness and amenity. The NPI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the urban criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

6.3.1 Intrusiveness Criterion

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

Background noise levels adopted are presented in Table 4-1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

6.3.2 Project 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 EPA's NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon the measured background noise levels at the sensitive receiver. Based on the measured background noise levels detailed in Table 4-1, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

For a hotel or holiday accommodation, the amenity level is set as 5dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day.

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

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

The amenity levels appropriate for the receivers surrounding the site are presented in Table 6-2.

Table 6-2 – EPA Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15\ minute)}$
Residential – Urban	Day	60	58
	Evening	50	48
	Night	45	43
Hotel / Serviced Apartments	Day	65	63
	Evening	55	53
	Night	50	48
Commercial Premises	When in Use	65	63

The NSW EPA Noise Policy for Industry (2017) defines:

- Day as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.
- Evening as the period from 6pm to 10pm.
- Night as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

6.3.3 Sleep Arousal Criteria

The Noise Policy for Industry recommends the following noise limits to mitigate sleeping disturbance:

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

- *$L_{eq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
- *L_{Fmax} 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 6-3 – Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night)	Emergence Level
Astoria Tower 222-228 Sussex Street (**R1**) Night (10pm – 7am)	52 dB(A) $L_{90(period)}$	57 dB(A)$L_{eq,\ 15min}$; 67 dB(A)L_{Fmax}
Harbourside Redevelopment (**R2**) Night (10pm – 7am)	54 dB(A) $L_{90(period)}$	59 dB(A)$L_{eq,\ 15min}$; 69 dB(A)L_{Fmax}
50 Murray Street, Pyrmont (**R3**) Night (10pm – 7am)	55 dB(A) $L_{90(period)}$	60 dB(A)$L_{eq,\ 15min}$; 70 dB(A)L_{Fmax}
Millennium Towers Night (10pm – 7am)	58 dB(A) $L_{90(period)}$	63 dB(A)$L_{eq,\ 15min}$; 73 dB(A)L_{Fmax}

6.4 SUMMARISED NOISE EMISSION CRITERIA

Table 6-4 – EPA NPI Noise Emission Criteria (Residents Surrounding Project Site)

Receiver	Time Period	Assessment Background Noise Level dB(A)L_{90}	Project Amenity Criteria dB(A) L_{eq}	Intrusiveness Criteria $L_{eq(15min)}$	NPI Criteria for Sleep Disturbance
Astoria Tower 222-228 Sussex Street (**R1**)	Day	63	**58**	68	
	Evening	60	**48**	65	
	Night	54	**43**	59	57 dB(A)$L_{eq, 15min}$; 67 dB(A)L_{Fmax}
Harbourside Redevelopment (**R2**)	Day	67	**58**	72	
	Evening	58	**48**	63	
	Night	55	**43**	60	59 dB(A)$L_{eq, 15min}$; 69 dB(A)L_{Fmax}
50 Murray Street, Pyrmont (**R3**)	Day	58	**58**	63	
	Evening	59	**48**	64	
	Night	52	**43**	57	60 dB(A)$L_{eq, 15min}$; 70 dB(A)L_{Fmax}
Millennium Towers	Day	64	**58**	69	
	Evening	62	**48**	67	
	Night	58	**43**	63	63 dB(A)$L_{eq, 15min}$; 73 dB(A)L_{Fmax}
Hotel / Serviced Apartments	Day	-	**63**	-	-
	Evening	-	**53**	-	-
	Night	-	**48**	-	-
Commercial Premises	When in Use	-	**63**	-	-

The project noise trigger levels are indicated by the bolded values in the table above.

Table 6-5 – L&GNSW Noise Emission Objectives (Operational Noise) – dB(A) $L_{10(15min)}$

Receiver	Time	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	A-wt
Astoria Tower 222-228 Sussex Street (**R1**)	Day (7am-6pm)	74	74	71	67	66	64	59	54	47	**68**
	Evening (6pm-10pm)	71	71	68	64	63	61	56	51	44	**65**
	Night (10pm-12am)	65	65	62	58	57	55	50	45	38	**59**
Harbourside Redevelopment (**R2**)*	Day (7am-6pm)	75	75	72	70	70	70	64	52	38	**73**
	Evening (6pm-10pm)	65	65	62	60	60	60	54	42	28	**63**
	Night (10pm-12am)	62	62	59	57	57	57	51	39	25	**60**
50 Murray Street, Pyrmont (**R3**)	Day (7am-6pm)	63	63	62	61	59	59	56	49	28	**63**
	Evening (6pm-10pm)	63	63	62	61	59	59	56	49	28	**63**
	Night (10pm-12am)	57	57	56	55	53	53	50	43	22	**57**
Millennium Towers	Day (7am-6pm)	72	72	68	67	66	65	61	55	45	**69**
	Evening (6pm-10pm)	70	70	66	65	64	63	59	53	43	**67**
	Night (10pm-12am)	66	66	62	61	60	59	55	49	39	**63**

**Refer comments Section 6.2 regarding noise emissions to Harbourside Redevelopment.*

7 NOISE EMISSION ASSESSMENT

Noise impacts from the development have been addressed for the following:

- Outdoor space associated with retail food and beverage uses
- Additional traffic noise on public roads, and
- Mechanical plant, in principle.

Each of these uses are to be addressed in greater deal with each individual use development application. Notwithstanding, commentary in this regard has been provided in principle.

Noise levels have been predicted at the receiver locations using SoundPlan™ modelling software implementing the ISO 9613-2:1996 "Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation" noise propagation standard.

7.1 ADDITIONAL TRAFFIC ON PUBLIC ROADS

Access to the site is provided by Wheat Road to the east of the site. Wheat Road runs continues to King Street Wharf with an off-ramp from the Western Distributor Northbound.

The primary thoroughfare of cars and commercial vehicles from the site will follow this path through to King Street and Shelley Street.

In this regard, we note that:

- There are no sensitive uses along the length of Wheat Road which may be impacted by traffic noise from the site.
- The residential dwellings on Shelley Street are heavily impacted by traffic noise from the Western Distributer. In comparison with the heavy traffic volumes and inherently traffic noise from the Western Distributer, potential increases associated with the site will be negligible.

On this basis, impacts from traffic noise generated by the development will be negligible in comparison with existing traffic noise levels and as such will be compliant with the EPA *Road Noise Policy*.

7.2 NOISE FROM MECHANICAL PLANT (IN PRINCIPLE)

Detailed plant selection and location has not been completed at this stage, however a preliminary design/selection of major plant items has been completed. Of these, the largest plant items are 3-4 cooling towers located on the tower rooftop, with a sound power level of approximately 100 dB(A) each. Based on the location of the cooling towers, these are capable of complying with the noise emission requirements detailed in Section 6.3.

Smaller fans and other ancillary items will be readily able to achieve the noise emission requirements for the site. Satisfactory levels will be achievable through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Detailed acoustic review should be undertaken throughout the design to determine acoustic treatments to control noise emissions to satisfactory levels.

7.3 RETAIL AND LICENSED PREMISES

Retail food and beverage uses will make up a significant component of the development. Noise emission goals from licensed premises are detailed in Section 6.2 and Table 6-5. Noise from licensed premises to residential dwellings are required to be comply with the requirements of L&GNSW.

The existing Cockle Bay Wharf incorporates licensed tenancies facing onto Darling Harbour. The redevelopment of the wharf would therefore not be out of context with existing noise emissions from the site.

7.3.1 Assumptions for Use

Noise from licensed food and beverage tenancies (i.e. restaurants and bars) will be typically associated with:

- Patron noise
- Music noise, and
- Mechanical plant.

Each of these noise sources will be addressed as part of the individual use development applications in compliance with the NSW EPA NPI and L&GNSW noise emission requirements.

Notwithstanding, the predominant source of noise from the uses will be associated with patrons utilising external dining areas. Noise from indicative external dining areas have been assessed in principle based on indicative outdoor areas/ terraces for retail spaces. In this regard, the likely cumulative noise impacts of the development can be determined. Noise emissions from these uses have been based on the following:

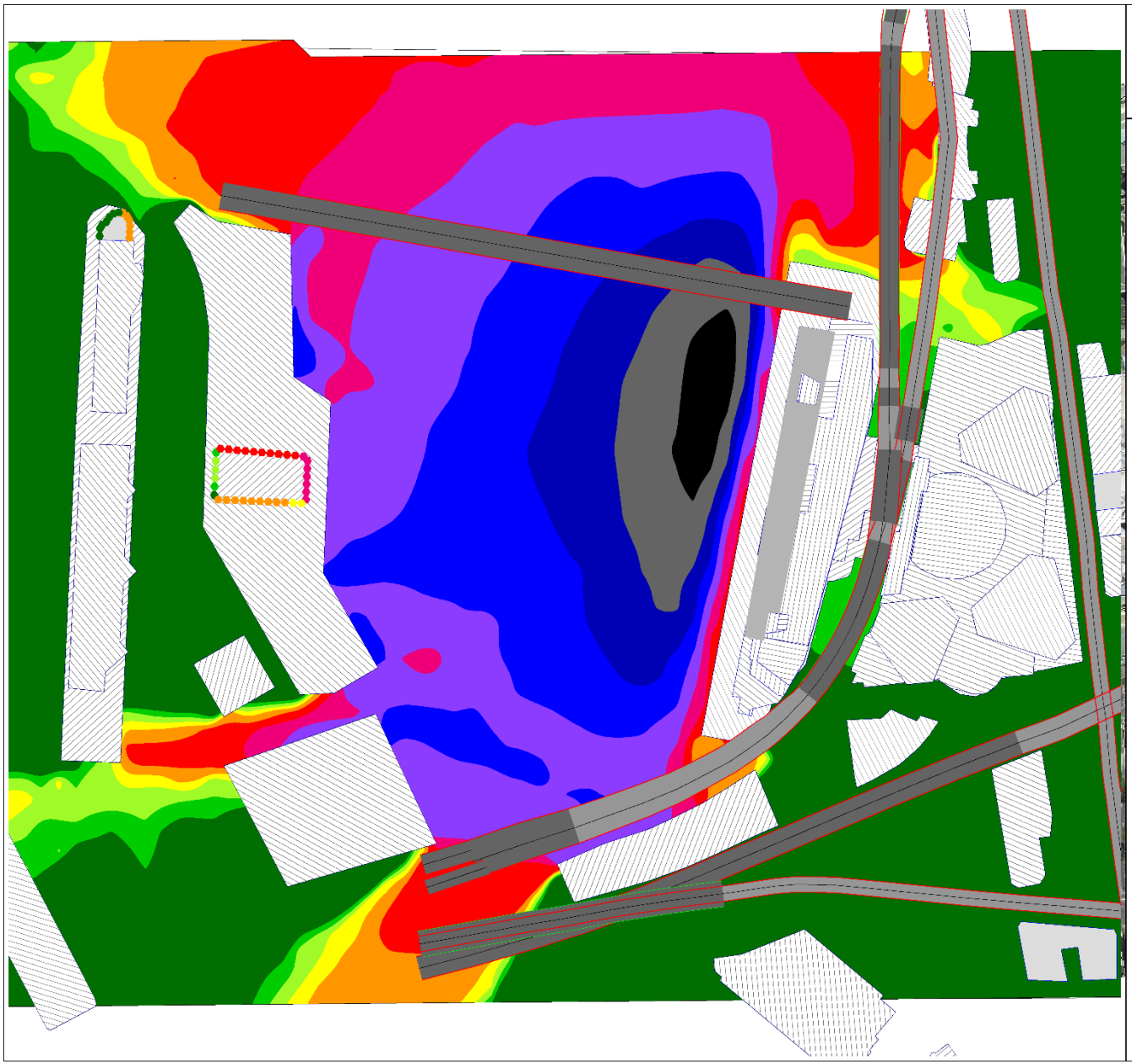
- A sound power level per patron of 77dB(A) L_{10} with 1 in 2 talking at any one time.
- Noise breakout from internal areas can be mitigated via acoustic treatments and management controls and as such will be minimal in comparison with outdoor patrons.
- Noise emissions associated with outdoor patrons has been provided in principle. The proposed numbers are not reflective of the final or proposed patron volumes but are included for insight into patron capacities.
- The location of outdoor dining areas including approximately 1 patron per square metre for external areas.

7.3.2 Predicted Noise Levels

Contour maps and predicted noise levels from the use of the licensed premises are detailed in the following figures. From the predicted noise levels, we note:

- Predicted noise levels at all residential receiver locations are significantly below the noise emission limits for the site.
- There will be some contribution from internal noise breakout and mechanical plant operation, however this would not be significant, likely in the order of 1-2dB at worst.
- Patron numbers have been provided in principle only to illustrate the capacity for external dining and outdoor areas. Detailed assessment of outdoor areas is expected to be conducted with further development of the proposal.

Based on the assumptions for the use, operational noise emissions from music and patrons within the podium areas of the Cockle Bay Park Redevelopment are able to meet the relevant noise emissions from the site. On this basis, noise emissions from the retail uses of the development can comply with the Liquor and Gaming noise requirements.



Cockle Bay Park

Noise Emissions Prediction

Patron Noise 77 dB(A) SWL

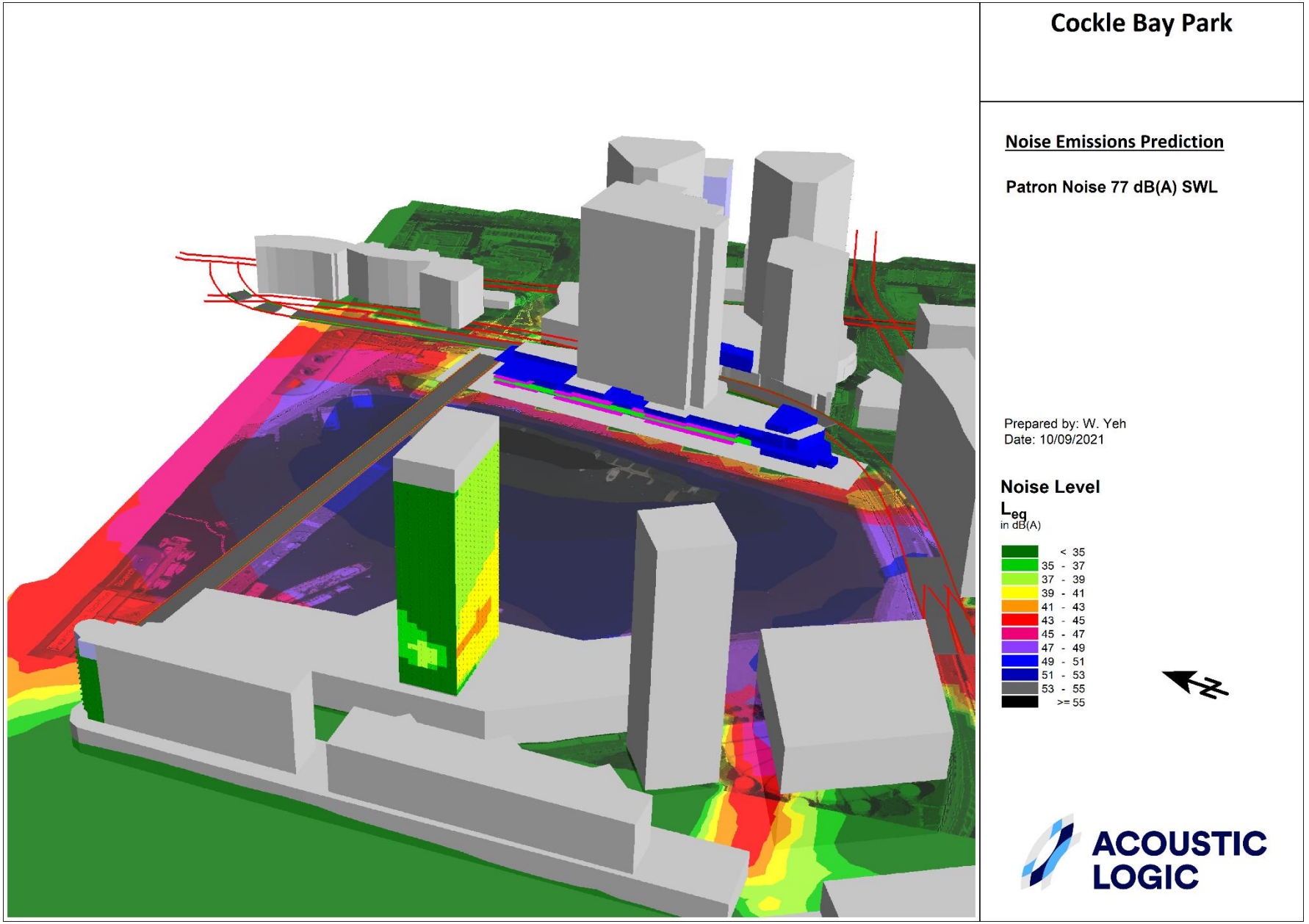
Prepared by: W. Yeh
Date: 10/09/2021

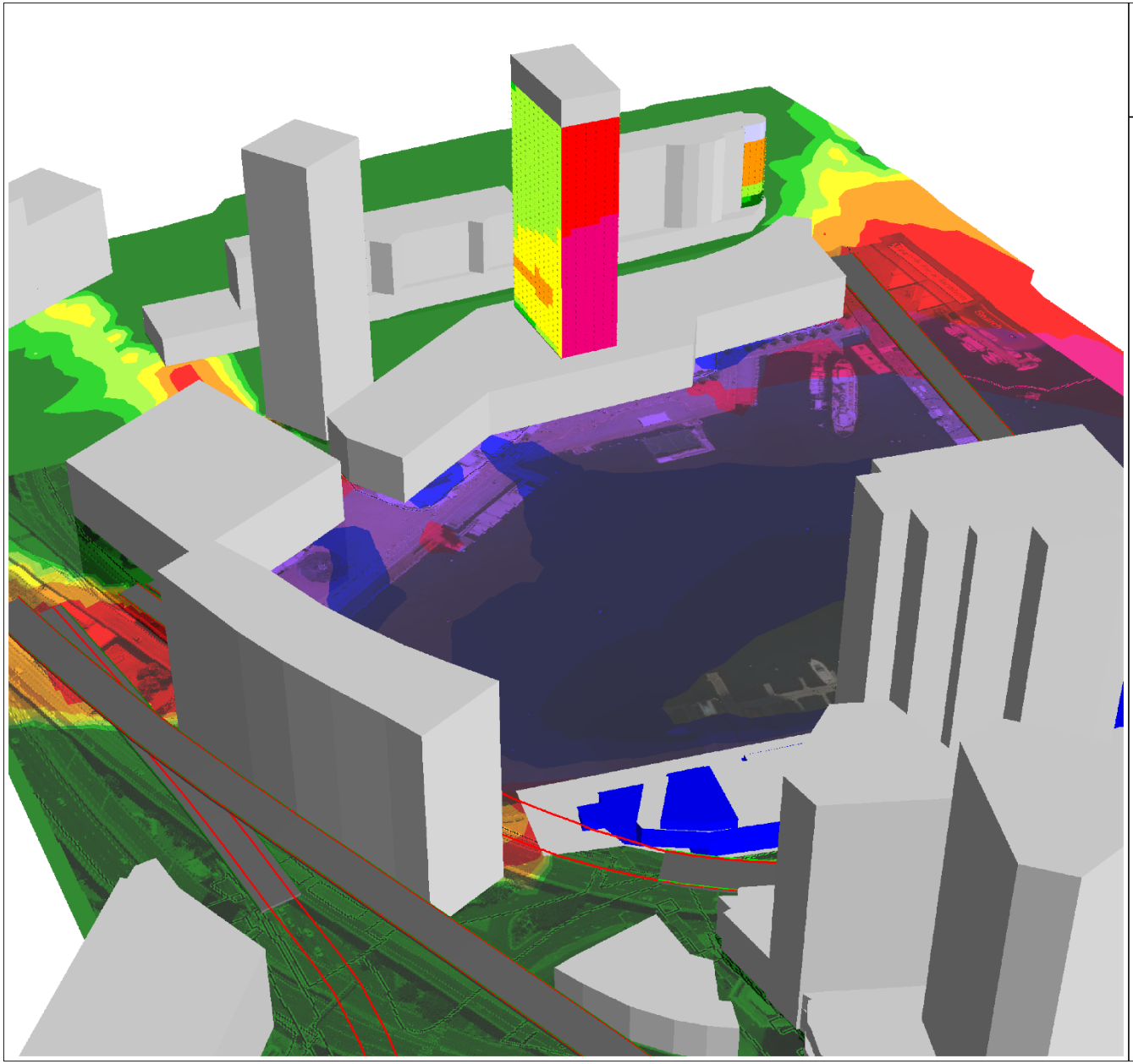
Noise Level
L_{eq}
in dB(A)

	< 35
	35 - 37
	37 - 39
	39 - 41
	41 - 43
	43 - 45
	45 - 47
	47 - 49
	49 - 51
	51 - 53
	53 - 55
	>= 55

N

ACOUSTIC LOGIC


Cockle Bay Park
Noise Emissions Prediction
Patron Noise 77 dB(A) SWL
Prepared by: W. Yeh
Date: 10/09/2021
Noise Level
L_{eq}
in dB(A)
< 35
35 - 37
37 - 39
39 - 41
41 - 43
43 - 45
45 - 47
47 - 49
49 - 51
51 - 53
53 - 55
>= 55
ACOUSTIC LOGIC



Cockle Bay Park

Noise Emissions Prediction

Patron Noise 77 dB(A) SWL

Prepared by: W. Yeh
Date: 10/09/2021

Noise Level
L_{eq}
in dB(A)

< 35
35 - 37
37 - 39
39 - 41
41 - 43
43 - 45
45 - 47
47 - 49
49 - 51
51 - 53
53 - 55
>= 55

ACOUSTIC LOGIC

8 CONSTRUCTION NOISE AND VIBRATION IMPACTS

Construction noise and vibration impacts during the demolition/construction phases of the development have been assessed with reference to the following documents.

- Development consent for SSD 7684
- AS2601-2001 – The demolition of structures
- Australian Standard AS2436:2010 - Guide to noise control on construction, maintenance and demolition sites
- City of Sydney Council – Code of Practice for Construction Hours/Noise within the Central Business District 1992
- NSW Department of Environment & Climate Change *Interim Construction Noise Guidelines* 2009 (ICNG)

8.1 CONSTRUCTION NOISE & VIBRATION CRITERIA

8.1.1 Development Consent for SSD 7684

A number of conditions are identified in Part C of the development consent for SSD 7684. Whilst they specifically apply to the demolition works associated with Stage 1 of the approved works, it is likely that similar conditions would ultimately be applied as part of the final development consent for the site. A summary of the conditions relating to noise and vibration during demolition works are presented below:

Demolition

C1. Demolition work must comply with Australian Standard AS 2601-2001 The demolition of structures (Standards Australia, 2001). The work plans required by AS 2601-2001 must be accompanied by a written statement from a suitably qualified person that the proposals contained in the work plan comply with the safety requirements of the Standard. The work plans and the statement of compliance must be submitted to the PCA before the commencement of works.

Hours of Demolition

C2. The hours of demolition, including the delivery of materials to and from the Subject Site, shall be restricted as follows:

- *a) Between 7 am and 7 pm, Mondays to Fridays inclusive*
- *b Between 7 am and 5 pm, Saturdays*
- *c) No work on Sundays and public holidays*
- *d) Works may be undertaken outside these hours where:*
  - *i) the delivery of materials is required outside these hours by the Police or other authorities,*
    or
  - *ii) it is required in an emergency to avoid the loss of life, damage to property and/or to prevent environmental harm, or*
  - *iii) a variation is approved, in advance, in writing, by the Planning Secretary or her nominee.*

C3. No construction vehicles involved in the demolition works shall arrive at the project site or in surrounding areas outside approved hours of demolition.

Demolition Noise Management

C4. Demolition works shall be undertaken with the aim of achieving the construction noise management levels detailed in the City of Sydney Construction Hours I Noise within the Central Business District Code of Practice 1992 and the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009). All feasible and reasonable noise mitigation measures shall be implemented and any activities that could exceed the construction noise management levels shall be identified and managed in accordance with the DNVMP, approved as part of the DEMP.

C5. If the noise from a demolition activity is substantially tonal or impulsive in nature (as described in Chapter 4 of the NSW Industrial Noise Policy), 5dB(A) must be added to the measured construction noise level when comparing the measured noise with the construction noise management levels.

C6. The Applicant shall schedule intra-day 'respite periods' for demolition activities identified in the Interim Construction Noise Guideline as being particularly annoying to surrounding residents and other noise sensitive receivers. Respite periods shall be scheduled at the same time each day (e.g. 8am to 11 am Monday to Saturday, 12pm to 3pm Monday to Friday and 4pm to 6pm Monday to Friday) unless otherwise negotiated with the most affected noise sensitive receivers.

C7. Respite periods shall be applied in accordance with the requirements of City of Sydney Construction Hours/Noise within the Central Business District Code of Practice 1992. Respite periods for the use of Category A appliances will be applied on the site such that operation of Category A appliances are not undertaken during the following periods:

a) 7am to 8am (Monday to Saturday)

b) 1pm to 2pm (Monday to Saturday).

C8. Any noise generated during the construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act, 1997 or exceed approved noise limits for the Subject Site.

C9. The Applicant shall undertake a safety risk assessment of demolition activities to determine whether it is practicable to use audible movement alarms of a type that would minimise the noise impact on surrounding noise sensitive receivers, without compromising safety.

Vibration Criteria

C10. Vibration caused by demolition at any residence or structure outside the Subject Site must be limited to:

a) for structural damage vibration, German Standard DIN 4150 Part 3 Structural Vibration — Effects of Vibration on Structures; and

b) for human exposure to vibration, the evaluation criteria presented in British Standard BS 6472- Guide to Evaluate Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) for low probability of adverse comment.

C11. These limits apply unless otherwise outlined in a DNVMP, approved as part of the DEMP.

8.1.2 AS2601-2001 – *The demolition of structures*

Section 1.7.2.3 – Noise Control of AS2601 states:

> *Noise shall be minimised, as far as practicable, by the selection of appropriate methods and equipment, and by the use of silencing devices. Attention is drawn to the recommendations contained in AS2436*

8.1.3 Australian Standard AS2436:2010 - Guide to noise control on construction, maintenance and demolition sites

Australian Standard AS2436 provides guidance on noise and vibration control in respect to construction and demolition sites, and the preparation of noise and vibration management plans, work method statements and impact studies. The Standard states that:

- "Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration."
- Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since

  (a) they are mainly carried on in the open;

  (b) they are often temporary in nature although they may cause considerable disturbance whilst they last;

  (c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work, and;

  (d) the sites cannot be separated by planning control, from areas that are sensitive to noise and vibration.

The Standard provides advice and guidelines for the prediction of impacts and the methods available to manage impacts. It guideline promulgates feasible and reasonable mitigation strategies and controls, and stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Develop a suitable noise criterion based on the NSW Department of Environment & Climate Change *Interim Construction Noise Guidelines* and City of Sydney *Code of practice for construction hours/noise within the central business district 1992*.
- Adopt management conditions as per AS 2436 in the event of an exceedance to the noise management levels.

8.1.4 City of Sydney Council – Code of Practice for Construction Hours/Noise within the Central Business District 1992

As nominated in condition C4, assessment of construction noise from the site will be made with reference to the Code of Practice for Construction Hours/Noise Within the Central Business District 1992.

The City of Sydney code of practice establishes various categories for construction works based on the time of day they are undertaken, as detailed below.

Table 8-1 – Categories of Working Hours and Noise Levels

Day	Time Zone	Category	Noise Requirement dB(A) $L_{Av, Max(15min)}$
Monday to Friday	00.00 – 07.00	4	Background + 0 dB(A)
	07.00 – 08.00	1	Background + 5dB(A)
	08.00 – 19.00	1	Background + 5dB(A) + 5 dB(A) (to be determined on a site basis)
	19.00 – 23.00	2	Background + 3 dB(A)
	23.00 – 24.00	4	Background + 0dB(A)
Saturday	00.00 – 07.00	4	Background + 0dB(A)
	07.00 – 08.00	1	Background + 5dB(A)
	08.00 – 17.00	1	Background + 5dB(A) + 5 dB(A) (to be determined on a site basis)
	17.00 – 23.00	2	Background + 3 dB(A)
	23.00 – 24.00	4	Background + 0dB(A)
Sundays and Public Holidays	00.00 – 07.00	4	Background + 0dB(A)
	07.00 – 17.00	3	Background + 3 dB(A)
	17.00 – 24.00	4	Background + 0dB(A)

A summary of the City of Sydney construction noise goals for the working hours identified in Condition C2 are detailed in the table below

Table 8-2 – Categories of Working Hours and Noise Levels

Receiver	Day	Time Zone	Category	Noise Requirement dB(A) $L_{Av, Max(15min)}$
Astoria Tower 222-228 Sussex Street (**R1**)	Monday to Friday	07.00 – 08.00	1	68
		08.00 – 19.00	1	73
	Saturday	07.00 – 08.00	1	68
		08.00 – 17.00	1	73
50 Murray Street, Pyrmont (**R3**)	Monday to Friday	07.00 – 08.00	1	63
		08.00 – 19.00	1	68
	Saturday	07.00 – 08.00	1	63
		08.00 – 17.00	1	68
Millennium Towers	Monday to Friday	07.00 – 08.00	1	69
		08.00 – 19.00	1	74
	Saturday	07.00 – 08.00	1	69
		08.00 – 17.00	1	74

8.1.5 NSW Department of Environment & Climate Change *Interim Construction Noise Guidelines* 2009

As nominated in condition C4, assessment of construction noise from the site will be made with reference to the *Interim Construction Noise Guideline*. The ICNG assessment requires:

- Determination of noise generation goals (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

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 effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected 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 effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of relevant construction noise management levels is presented below.

Table 8-3 – Noise Management Levels - Residential

Location	**"Noise Affected" Level - dB(A)$L_{eq(15min)}$**	**"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$**
Astoria Tower 222-228 Sussex Street (**R1**)	73	75
50 Murray Street, Pyrmont (**R3**)	68	
Millennium Towers	74	

For land uses other than residential, the ICNG proposes noise management levels to be applied when in use. In the case of commercial receivers (including retail premises) a noise management level of 70dB(A) is adopted.

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

8.1.6 Structure Borne Vibrations (Building Damage Criteria)

As nominated in Condition C10a, German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 8-4

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 8-4 – 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

All surrounding commercial structures would be considered as 'Type 1'

8.1.7 Assessing Amenity

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. This guideline draws on both the British Standard BS6472-1992 (nominated in Condition C10b), as well as Australian Standard AS2670.2-1990.

Relevant criteria are presented below.

Table 8-5 – EPA Recommended Vibration Criteria

		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 LEVELS

8.2.1 Noise Levels of Typical Construction Processes

Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation, structural works and piling.

A summary of the equipment/processes which typically generate the highest noise levels during demolition/construction are summarised below.

Table 8-6 - Sound Power Levels of Typical Equipment

Equipment /Process	Sound Power Level dB(A)*
Pneumatic Hammer	120
35 Tonne Excavator (in clay/soil)	110
Bored Piling Rig	110
Concrete Pump	110
Trucks	100
Electric Tower Crane	95

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

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

*Noise levels take into account correction factors (for tonality, intermittency where necessary).

8.2.2 Predicted Noise Levels

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken.
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

Predicted noise levels are presented in the following tables. Predictions take into account noise reduction as a result of distance, and barrier effects where applicable.

Table 8-7 – Predicted Noise Generation to Astoria Towers (R1)

Activity	Predicted Level dB(A)	Comment
Pneumatic Hammer	65-70	Below ICNG Noise Management Level (NML) at all times. Marginal exceedance of CoS guidelines between 7-8am.
35 Tonne Excavator (in clay/soil)	55-60	Below both IGNG NML's and CoS Guidelines at all times.
Bored Piling Rig	55-60	
Concrete Pump	55-60	
Trucks	45-50	
Electric Tower Crane	<45	

Table 8-8 – Predicted Noise Generation to 50 Murray Street, Pyrmont (R2)

Activity	Predicted Level dB(A)	Comment
Pneumatic Hammer	58-60	Below both IGNG NML's and CoS Guidelines at all times.
35 Tonne Excavator (in clay/soil)	48-50	
Bored Piling Rig	48-50	
Concrete Pump	48-50	
Trucks	38-40	
Electric Tower Crane	<40	

Table 8-9 – Predicted Noise Generation to Millennium Tower

Activity	Predicted Level dB(A)	Comment
Pneumatic Hammer	59-61	Below both IGNG NML's and CoS Guidelines at all times.
35 Tonne Excavator (in clay/soil)	49-51	
Bored Piling Rig	49-51	
Concrete Pump	49-51	
Trucks	49-51	
Electric Tower Crane	50	

Table 8-10 – Predicted Noise Generation to Hyatt Regency

Activity	Predicted Level dB(A)	Comment
Pneumatic Hammer	66-75	Expected to intermittently exceed both ICNG and CoS guidelines when working close to the northern boundary only.
35 Tonne Excavator (in clay/soil)	56-65	Below both IGNG NML's and CoS Guidelines at all times.
Bored Piling Rig	56-65	
Concrete Pump	56-65	
Trucks	46-55	
Electric Tower Crane	47	

Table 8-11 – Predicted Noise Generation to Adjacent Commercial

Activity	Predicted Level dB(A)	Comment
Pneumatic Hammer	66-75	Expected to intermittently exceed both ICNG and CoS guidelines when working close to adjacent commercial buildings. Note that the closest commercial building (Darling Park) is related to the Cockle Bay Park development, and as such noise impacts from construction may be separately managed
35 Tonne Excavator (in clay/soil)	56-65	Below both IGNG NML's and CoS Guidelines at all times.
Bored Piling Rig	56-65	
Concrete Pump	56-65	
Trucks	46-55	
Electric Tower Crane	47	

8.2.3 Discussion – Vibration

Given the distance and Type 1 vibration limits (from DIN-4150), vibration impacts to surrounding developments are not expected to require specific mitigation. Where a complaint is received, attended measurements of vibration may be undertaken to determine the cause and any further investigation or monitoring which should be undertaken.

8.2.4 Discussion – Noise

Noise levels from demolition/construction are generally expected to meet the requirements of the *Interim Construction Noise Guideline* and City of Sydney guidelines, with the exception of hammering during the 7-8am period. Consideration should be given to scheduling hammering activities so that they do not occur during this period.

8.3 WORKS OUTSIDE OF STANDARD CONSTRUCTION HOURS

The construction of the land bridge across the Western Distributer may require works to be conducted during the night period to minimise disruption and potential danger to the public. In this regard, construction noise emissions should be addressed for potential impacts on sensitive receivers potentially impacted during this period.

Works during this period are generally expected to encompass the following:

- Piling for foundations associated with the new landbridge.
- Use of tower cranes to lift precast concrete beams into place.
- In-situ construction of a concrete topping slab.

Night time works are currently expected to be undertaken between 9pm and 5am, Sunday to Friday nights, and be coordinated with road closures and other required approvals.

The figure below indicates the extent of the proposed land bridge construction works and the proposed location of cranes, as detailed in the *Construction Management Plan* prepared by Multiplex (Appendix I of submission).

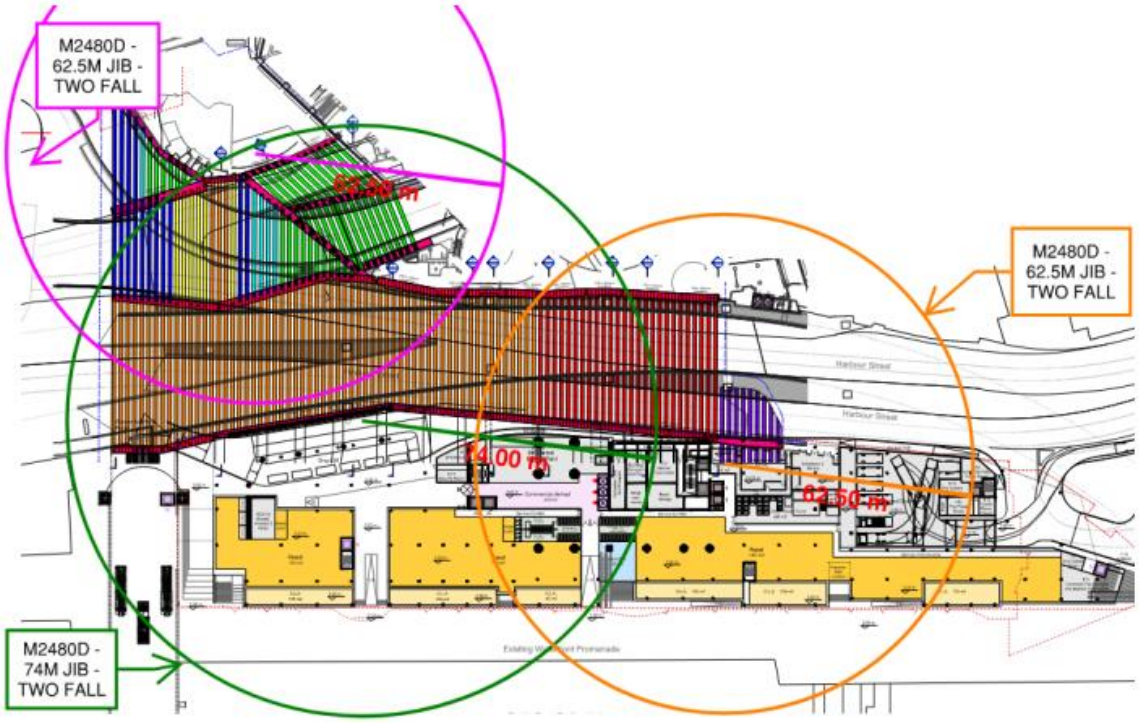


Figure 4 – Extent of Precast Beams for Land Bridge and Associated Crane Location

Noise predictions have been undertaken to the following locations as a worst case, given commercial development would not typically be occupied during the night works.

- Hyatt Regency hotel, located at 161 Sussex Street.
- Astoria Tower, located at 222-228 Sussex Street.

Refer also Figure 2 for detail.

The Hyatt Regency façade overlooks the Western Distributer and incorporates significant fixed acoustic glazing for traffic noise intrusion. Predicted noise levels are provided to this location in principle, however consideration to noise reduction across the façade would be considered as part of the detailed assessment.

For construction works outside of regular hours, the NSW EPA Interim Construction Noise Guideline (ICNG) recommends that a level of 'background + 5dB(A)' be adopted for residential receivers, which would be applicable for the full extent of night works. City of Sydney's Code of Practice (refer Section 8.1.4) recommends construction noise be limited to between 0 and 3 dB(A) above the background level for the likely construction hours, depending on the specific time period in question. The background noise level during the night time period of both receivers is 54 dB(A) $L_{90(period)}$.

Predicted noise levels have been based on the proposed tower crane locations, being the primary/highest source of likely noise during the night works.

Table 8-12 – Land Bridge Construction Works

Construction Plant	Plant Noise Level dB(A)	Receiver Location	Predicted Worst Case Noise Level dB(A) L_{eq}	Construction Noise Objective dB(A) L_{eq}
Tower Crane (Diesel)	110	Hyatt Regency	62	54 – 57 dB(A) (City of Sydney) 70 dB(A) ICNG
		Astoria Tower	60	54 – 57 dB(A) (City of Sydney) 59 dB(A) ICNG

Night time construction works (particularly use of cranes) have the potential to exceed the noise management levels of the ICNG and City of Sydney guidelines, however are below the 'highly noise affected level' of the ICNG at all times. It is recommended that reasonable and feasible mitigation measures be employed as part of the works.

In this regard, we note that the *Construction Management Plan* (Multiplex) details a number strategies which have already been considered to minimise the impact of noise and vibration during construction (refer Section 8.2 of Appendix I of submission). These measures include the incorporation of methodologies to minimise noise during the early phases of construction planning, as well as noise and vibration measurements at key stages and consultation with stakeholders as part of the works.

Further, it is likely that the traffic noise levels in the area would provide a level of screening to the construction works, which would further limit the potential impacts on amenity. A detailed assessment of construction works should be undertaken to ensure compliance with the recommendations of the ICNG once detailed construction methodologies are prepared.

9 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the Cockle Bay Park Redevelopment at Darling Harbour.

It has been concluded that:

- Traffic noise generation due to vehicles associated with the development will be negligible given the respective traffic volumes and inherent noise levels on surrounding roadways.
- A preliminary evaluation of noise associated with the cumulative impact of patrons utilising external dining areas indicate compliance with the requirements of the Independent Liquor and Gaming Authority during the day, evening and night time periods. A detailed analysis of noise emissions associated with each tenancy use should be conducted as part of the individual use development applications.
- Mechanical noise emanating from the site will be addressed upon selection of mechanical equipment and the finalisation of the mechanical scheme. Preliminary selections indicate that noise emissions from mechanical plant will be readily achievable at surrounding noise sensitive receivers.
- Potential impacts associated with construction noise and vibration emanating from the site have been assessed. Predicted noise levels indicate minor exceedances of the recommended management levels of the EPA *Interim Construction Noise Guideline* and only during the worst-case construction operations. Noise associated with the construction works are likely to be masked by traffic noise at these locations in any case.

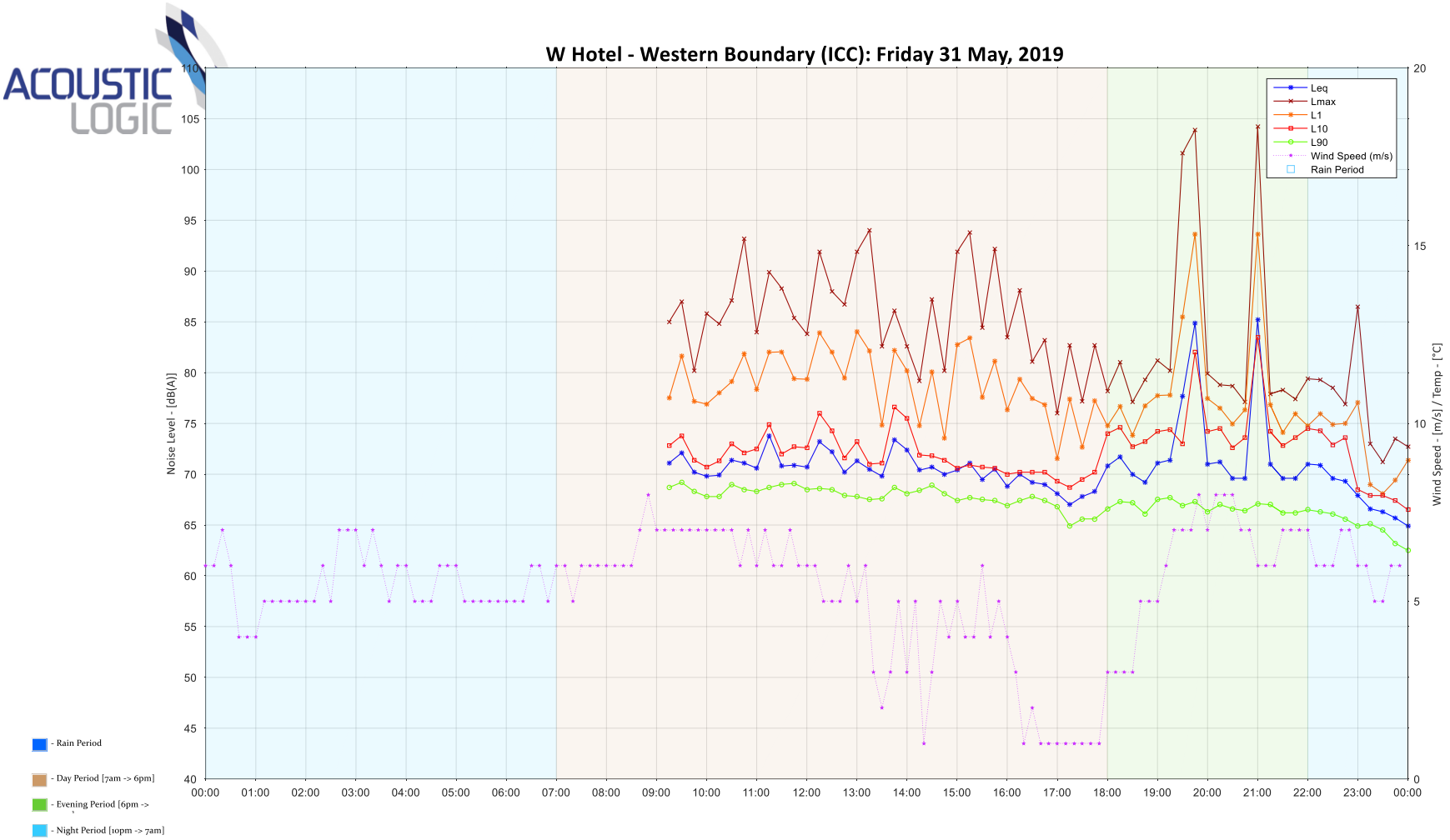
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Weber Yeh

APPENDIX ONE – UNATTENDED NOISE MONITORING

LOCATION 1 – INTERNATIONAL CONVENTION CENTRE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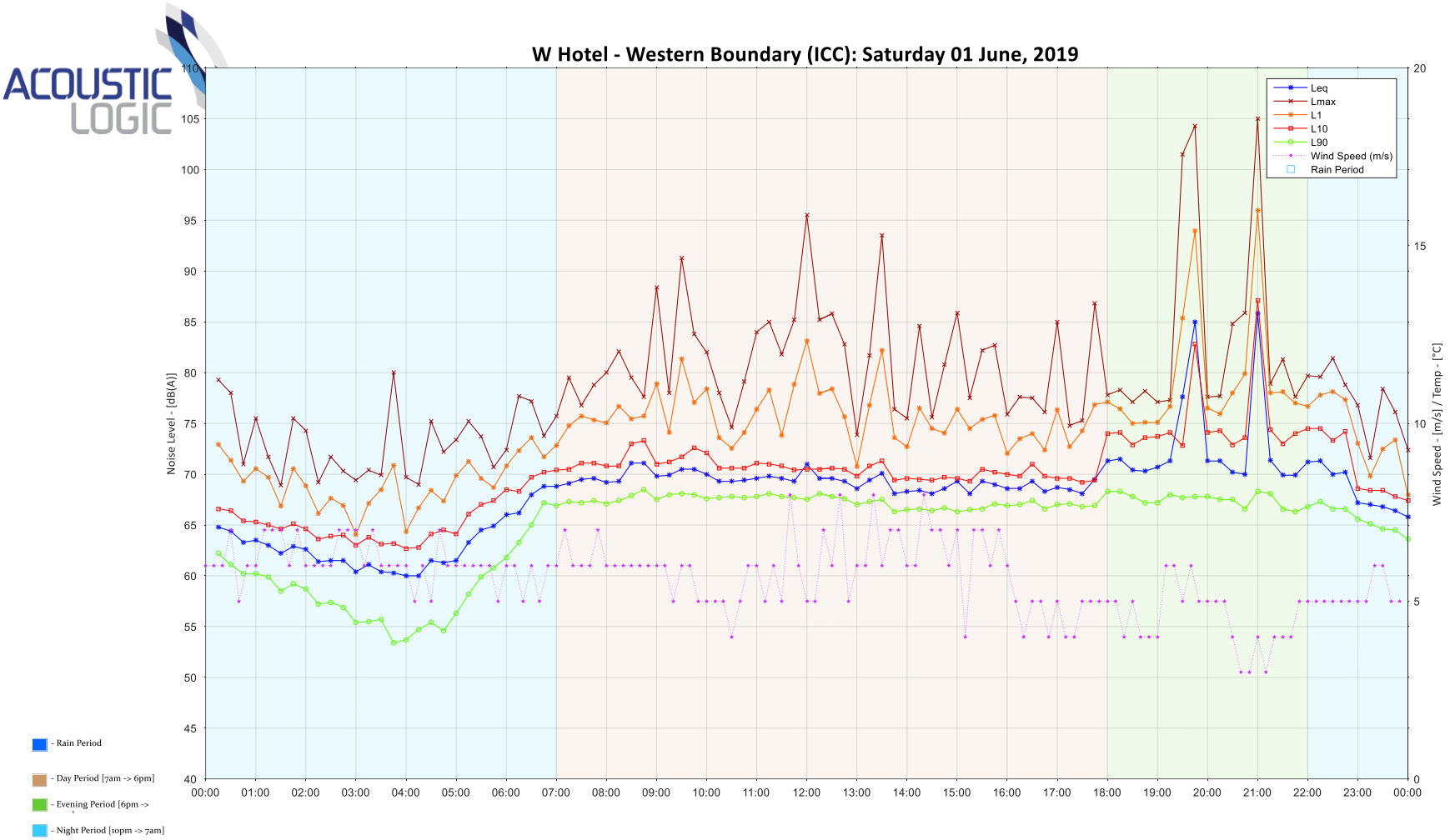
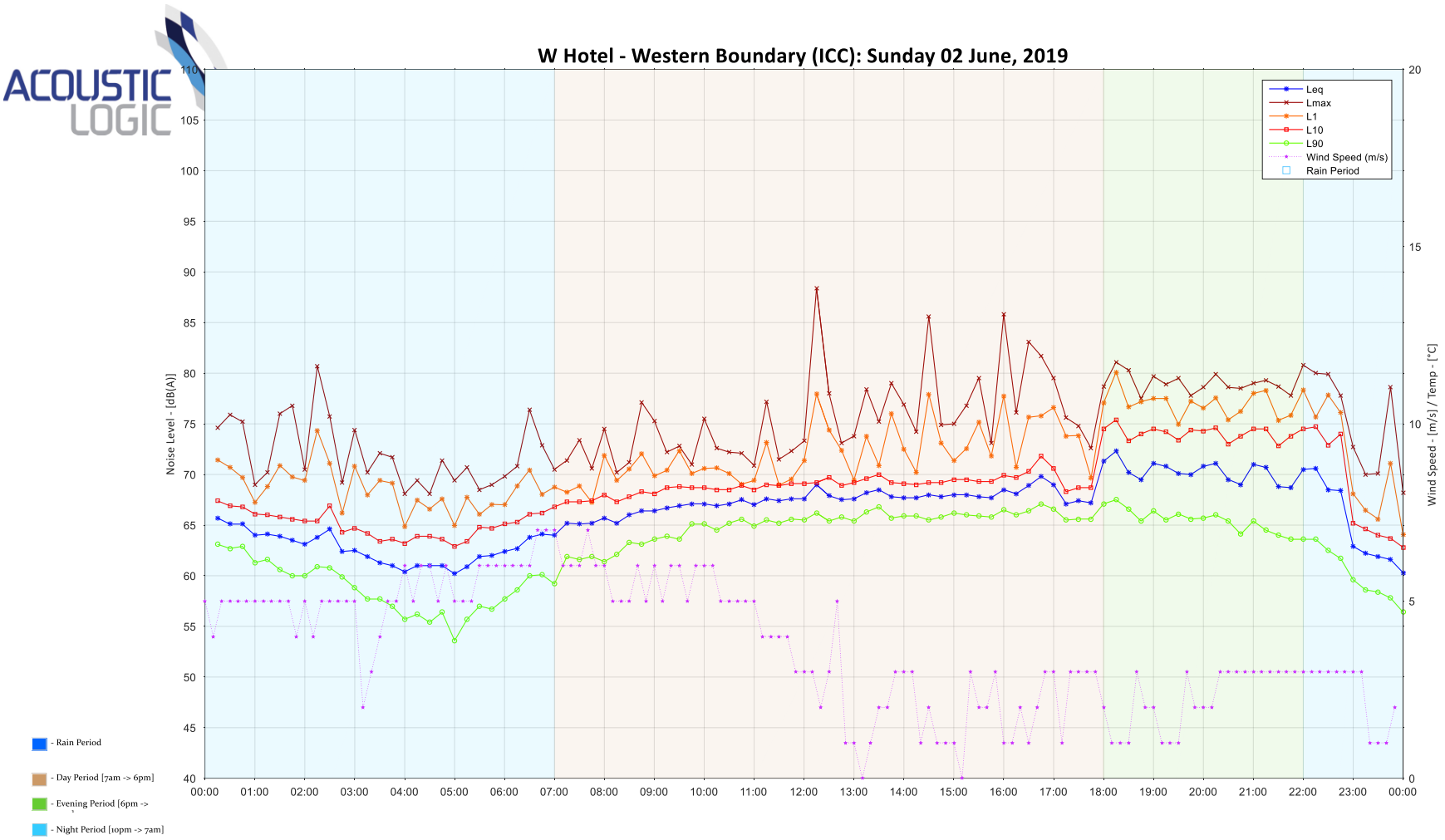
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]


W Hotel - Western Boundary (ICC): Saturday 01 June, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]


W Hotel - Western Boundary (ICC): Sunday 02 June, 2019
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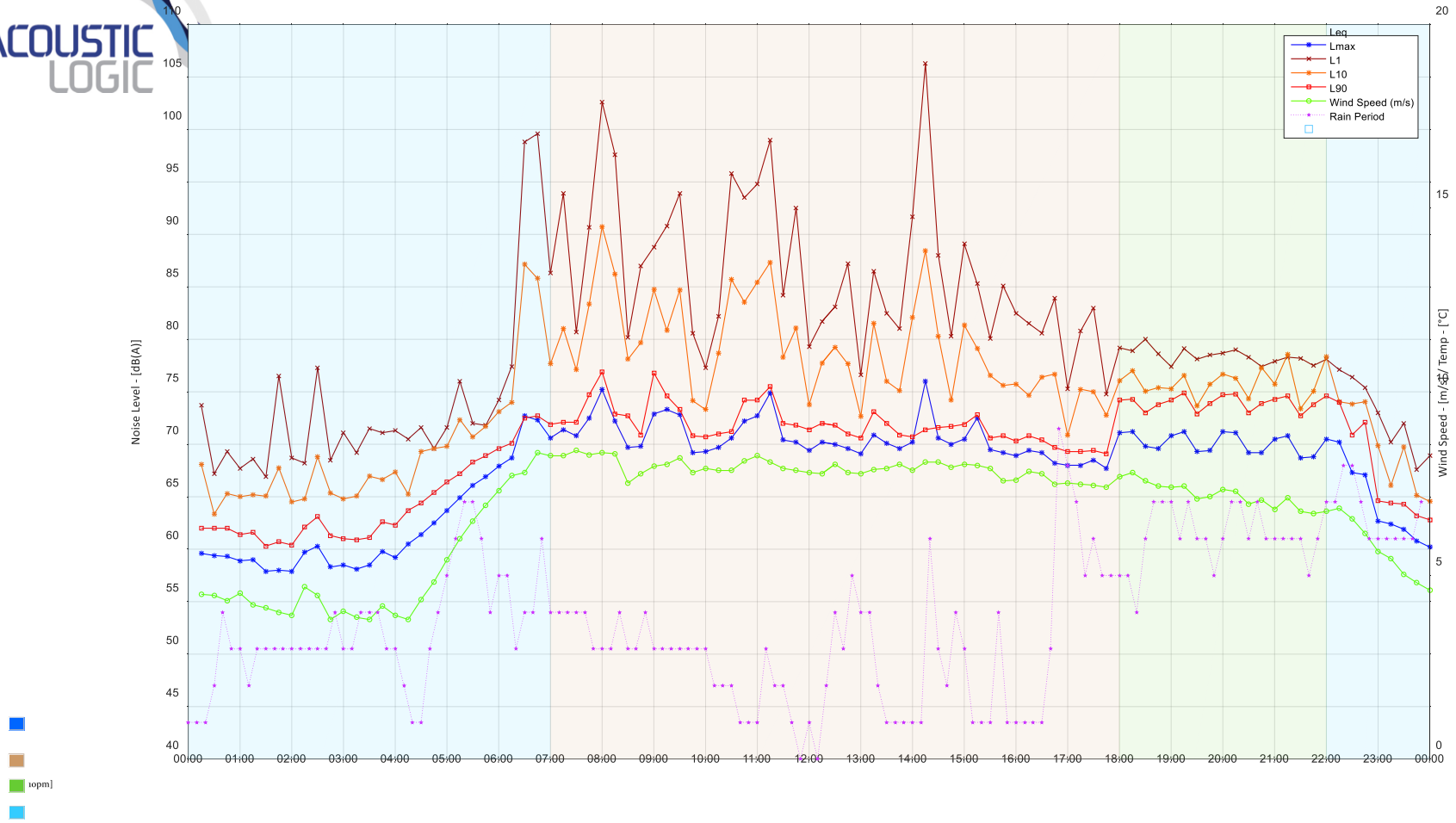
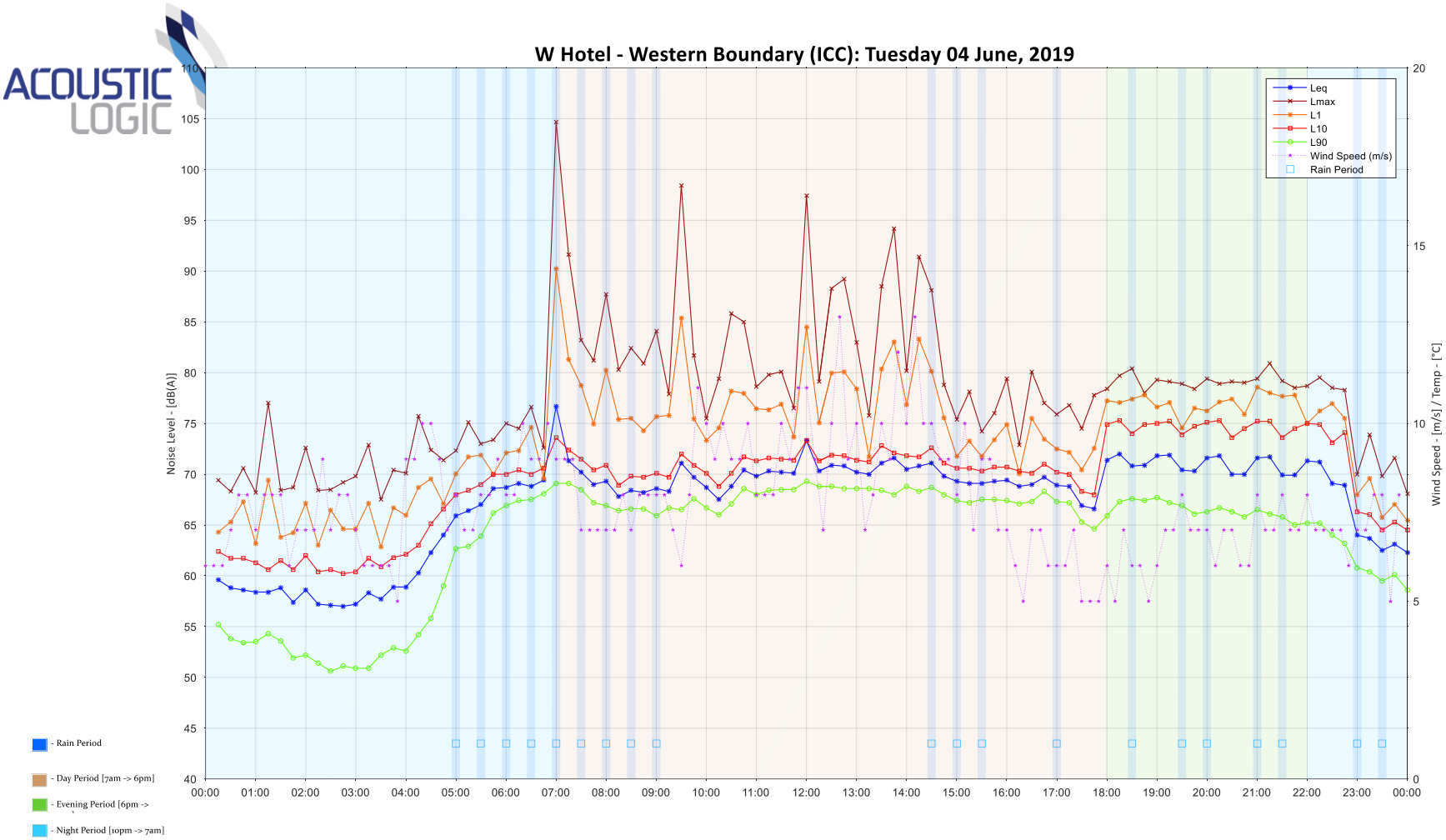
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]

W Hotel - Western Boundary (ICC): Monday 03 June, 2019

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Noise Level - [dB(A)]
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Leq
Lmax
L1
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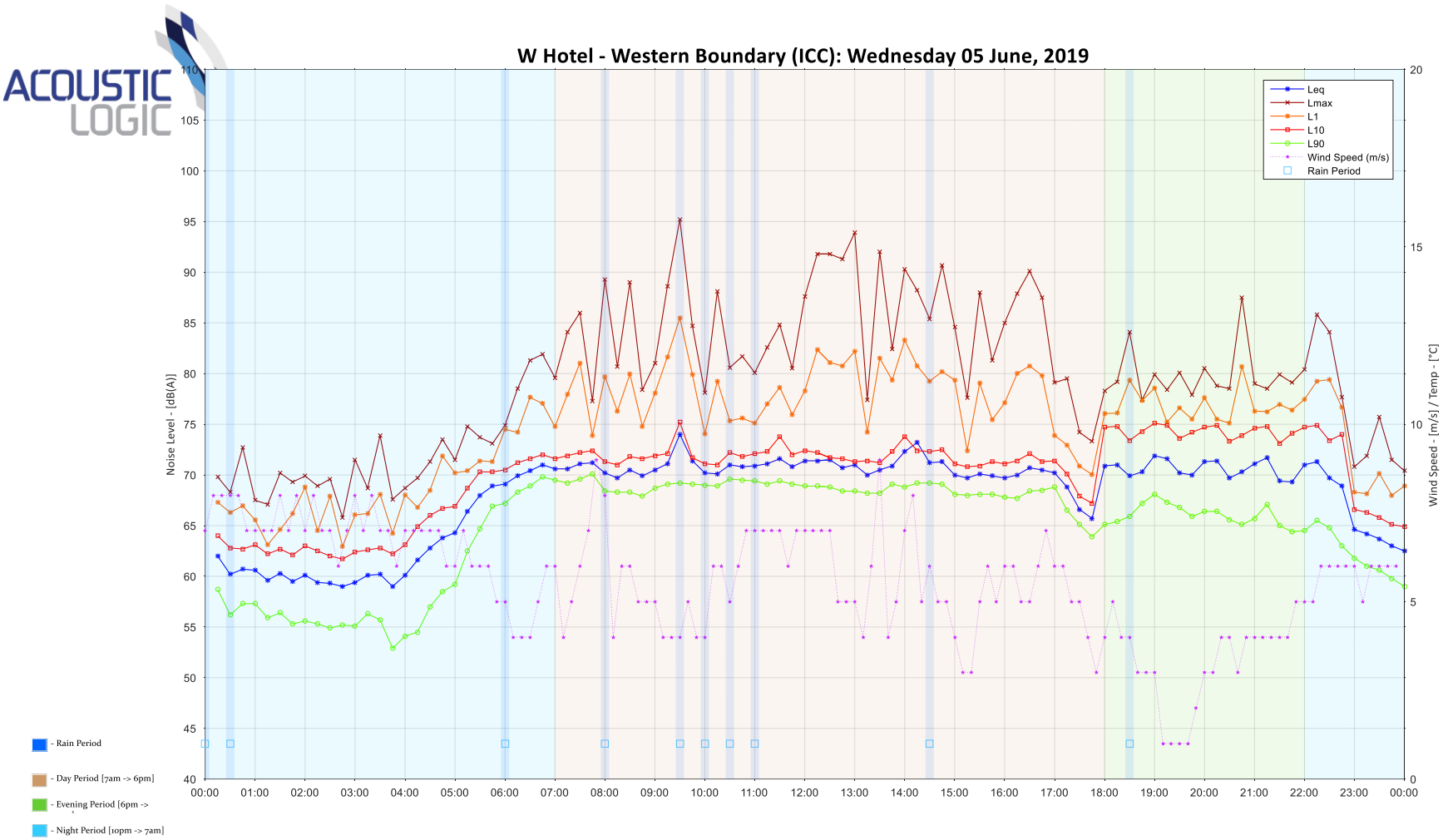
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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Leq
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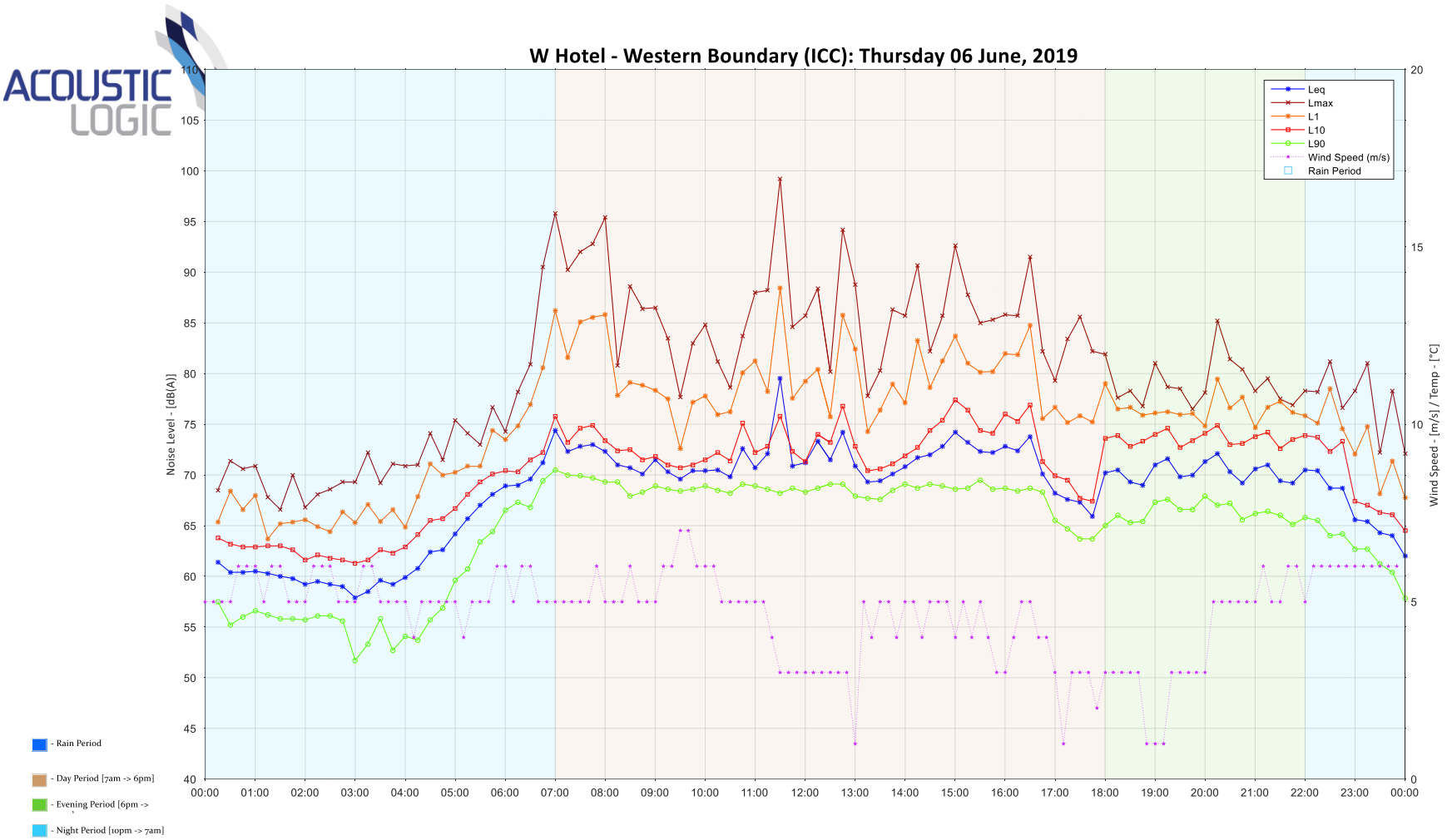
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]


W Hotel - Western Boundary (ICC): Thursday 06 June, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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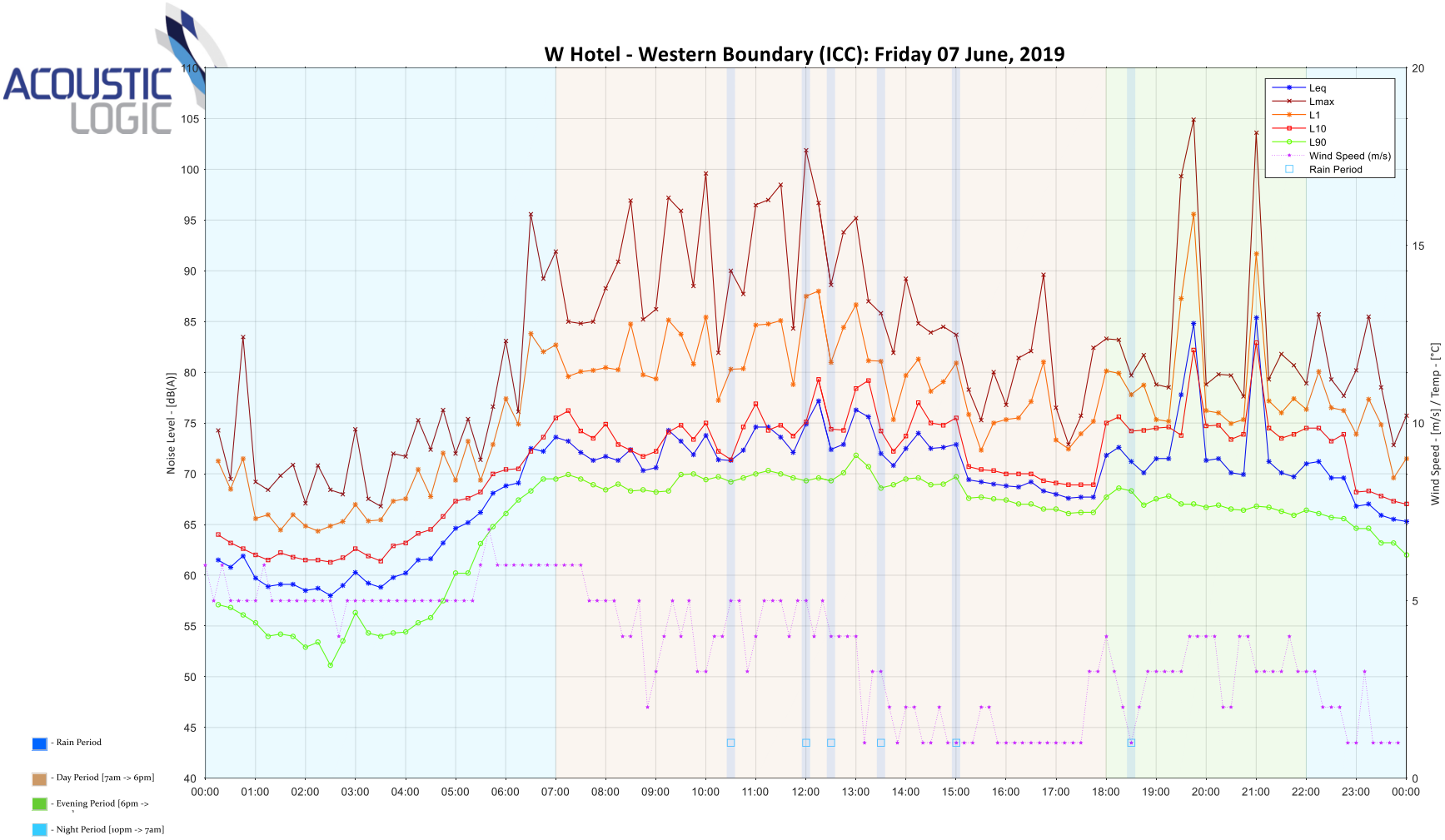
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]


W Hotel - Western Boundary (ICC): Friday 07 June, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
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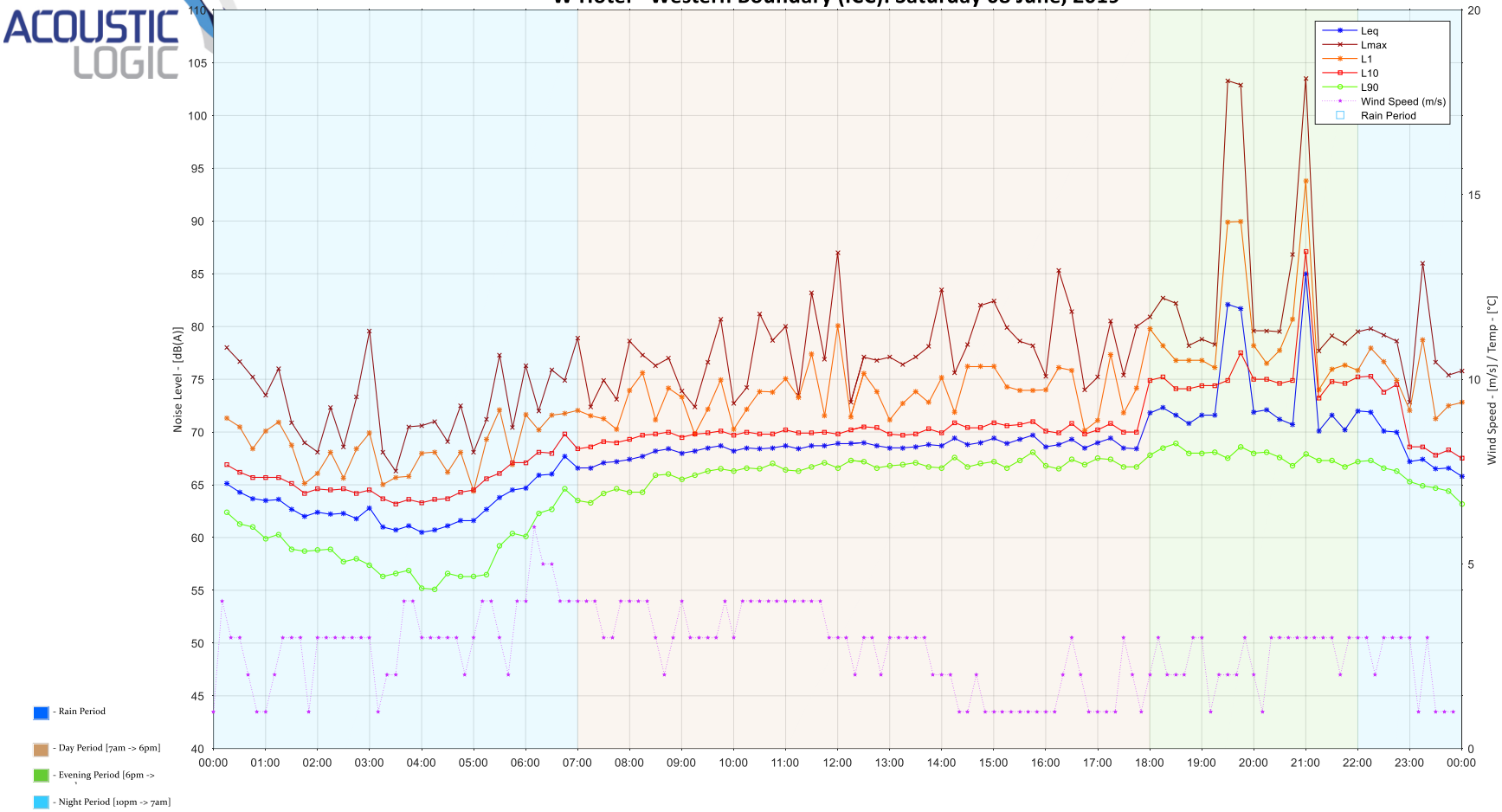
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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Leq
Lmax
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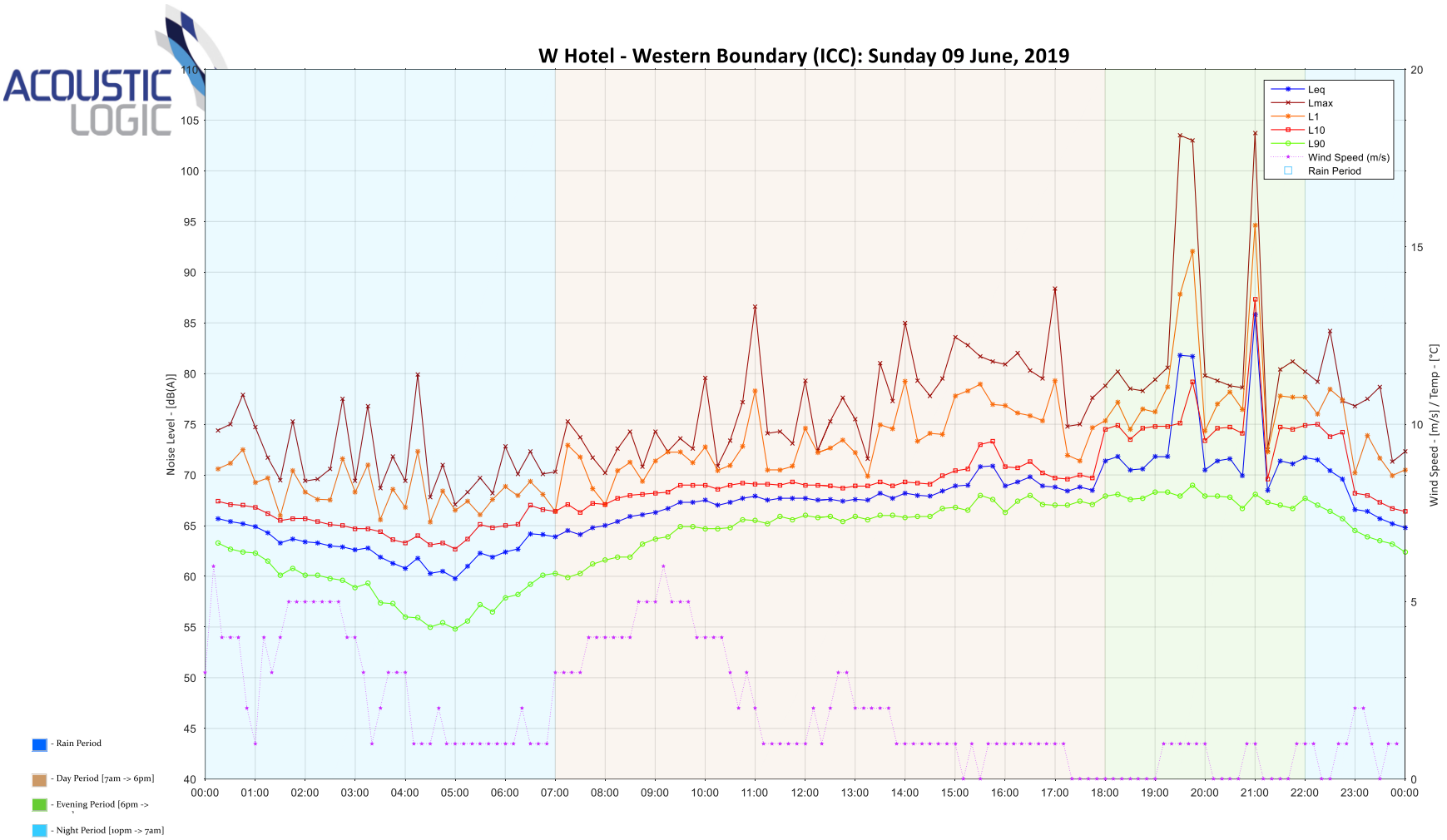
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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Wind Speed - [m/s] / Temp - [°C]
Leq
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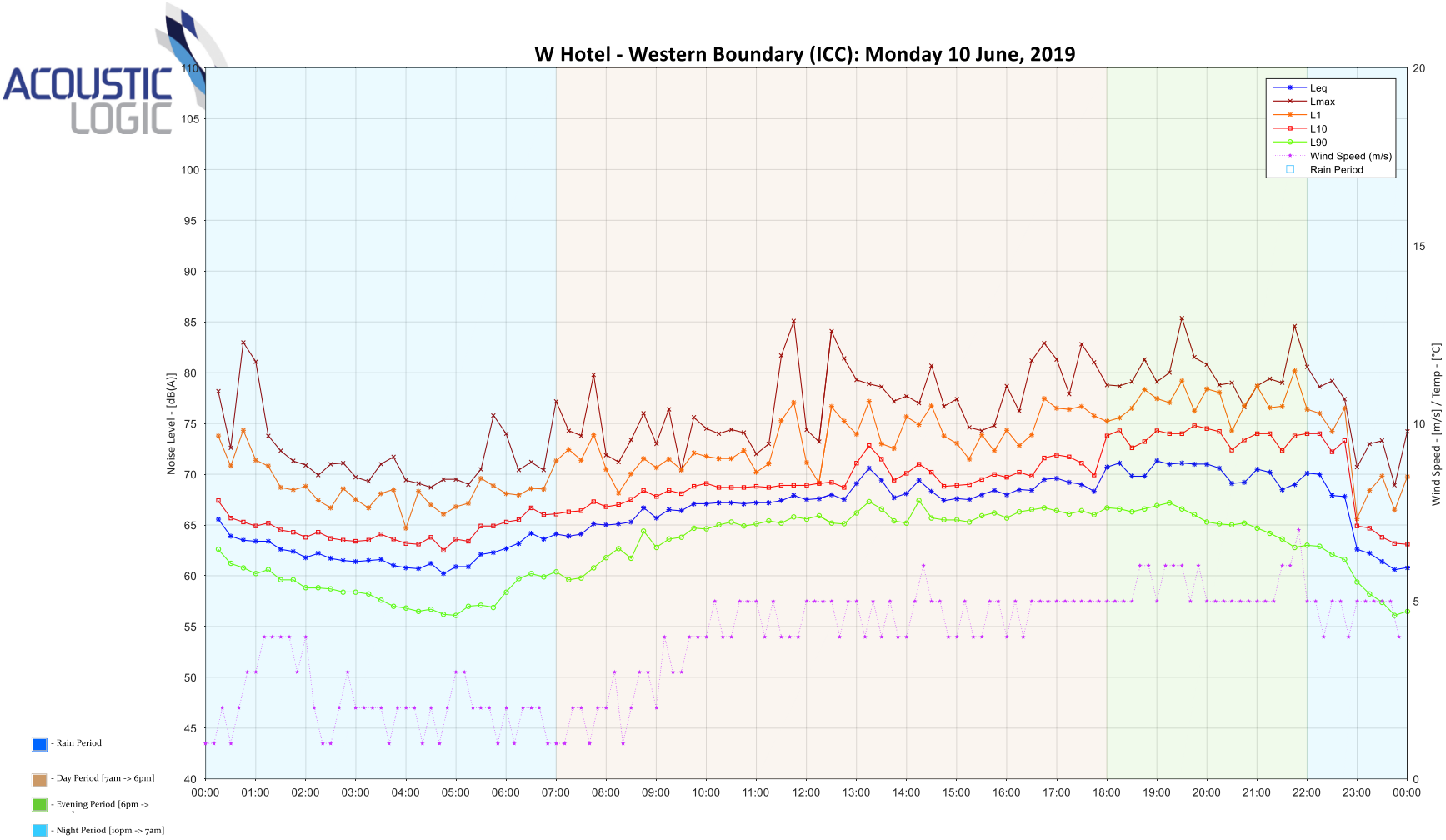
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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Wind Speed - [m/s] / Temp - [°C]
Leq
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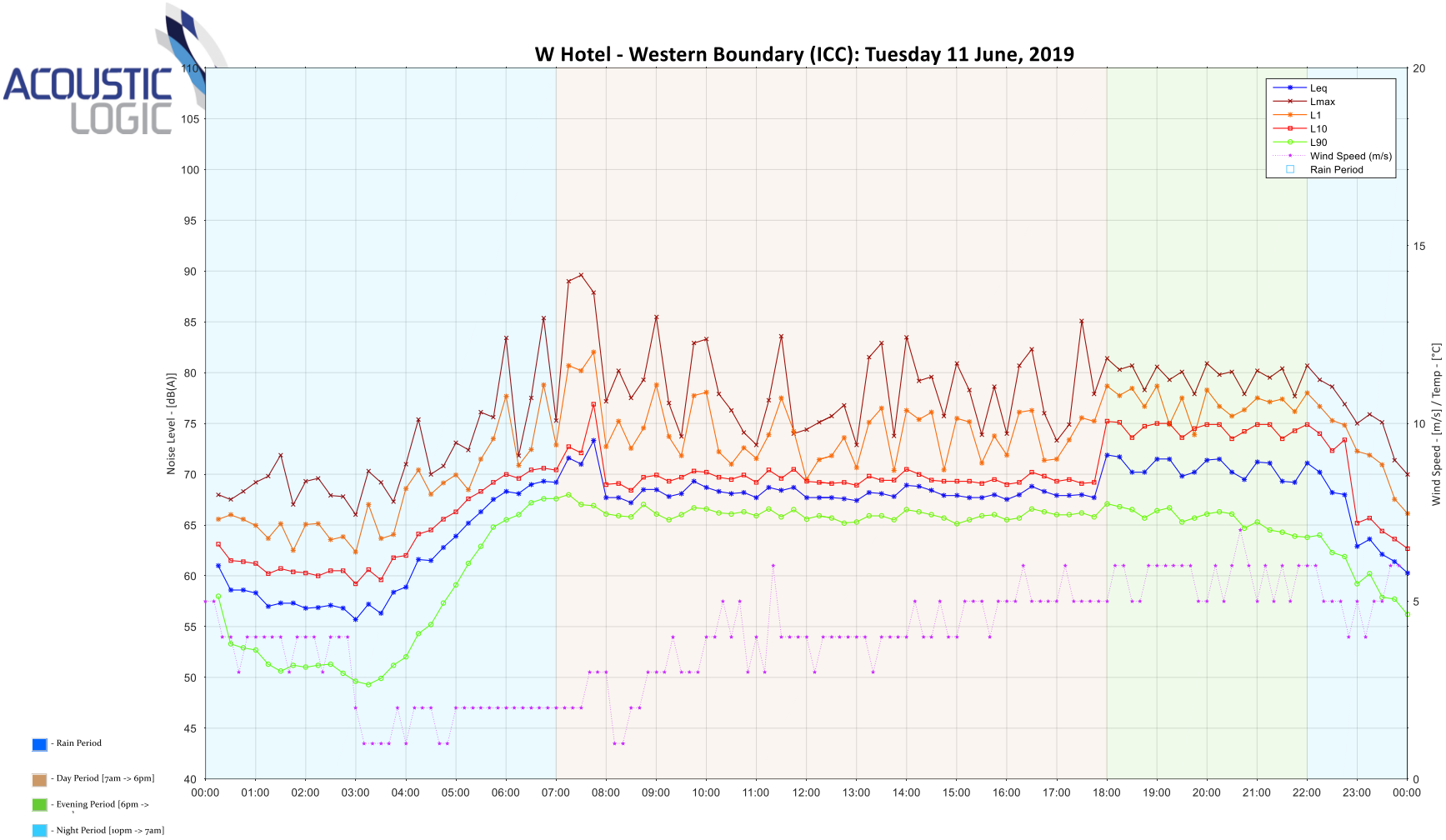
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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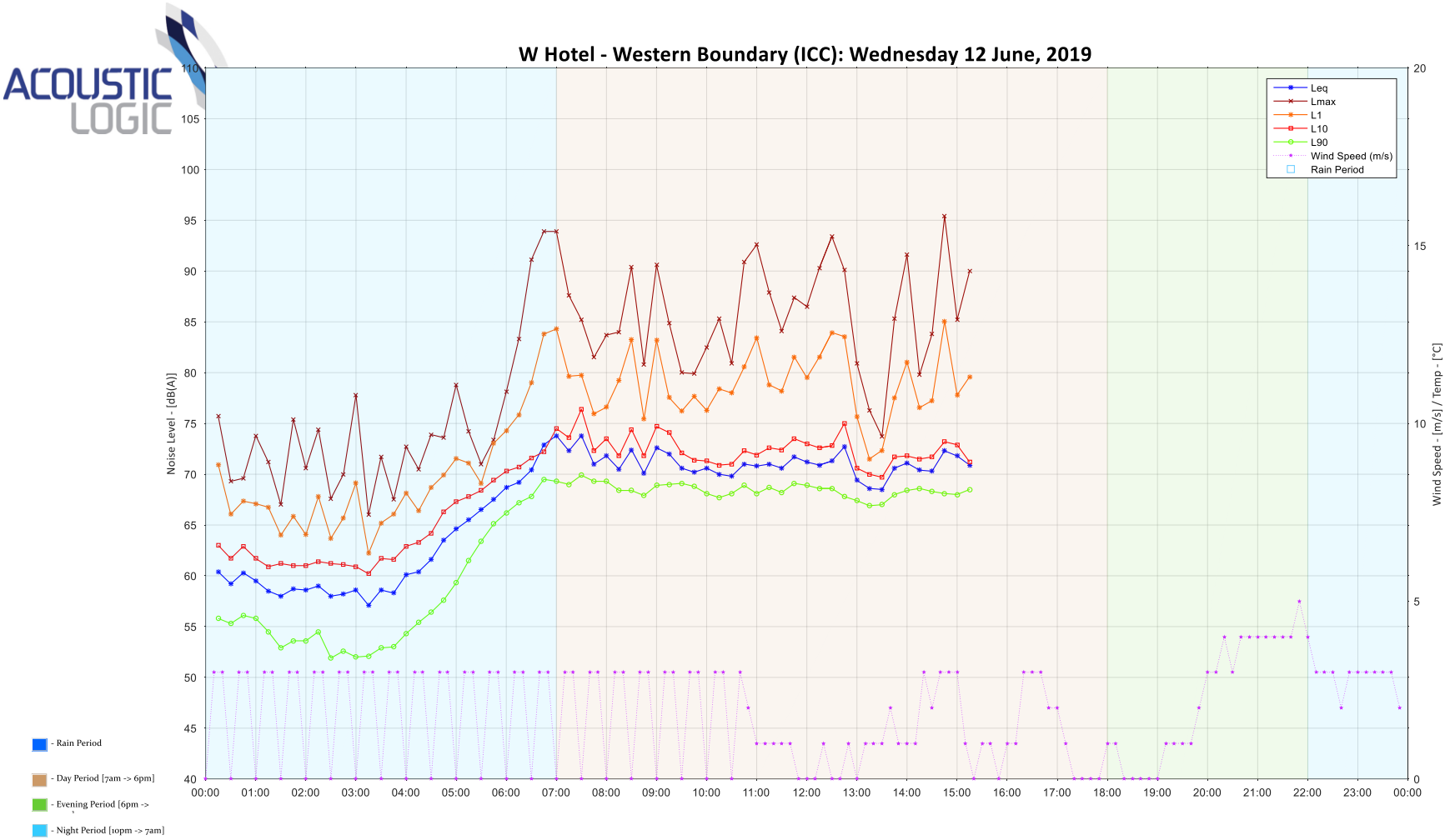
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]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Lmax
L1
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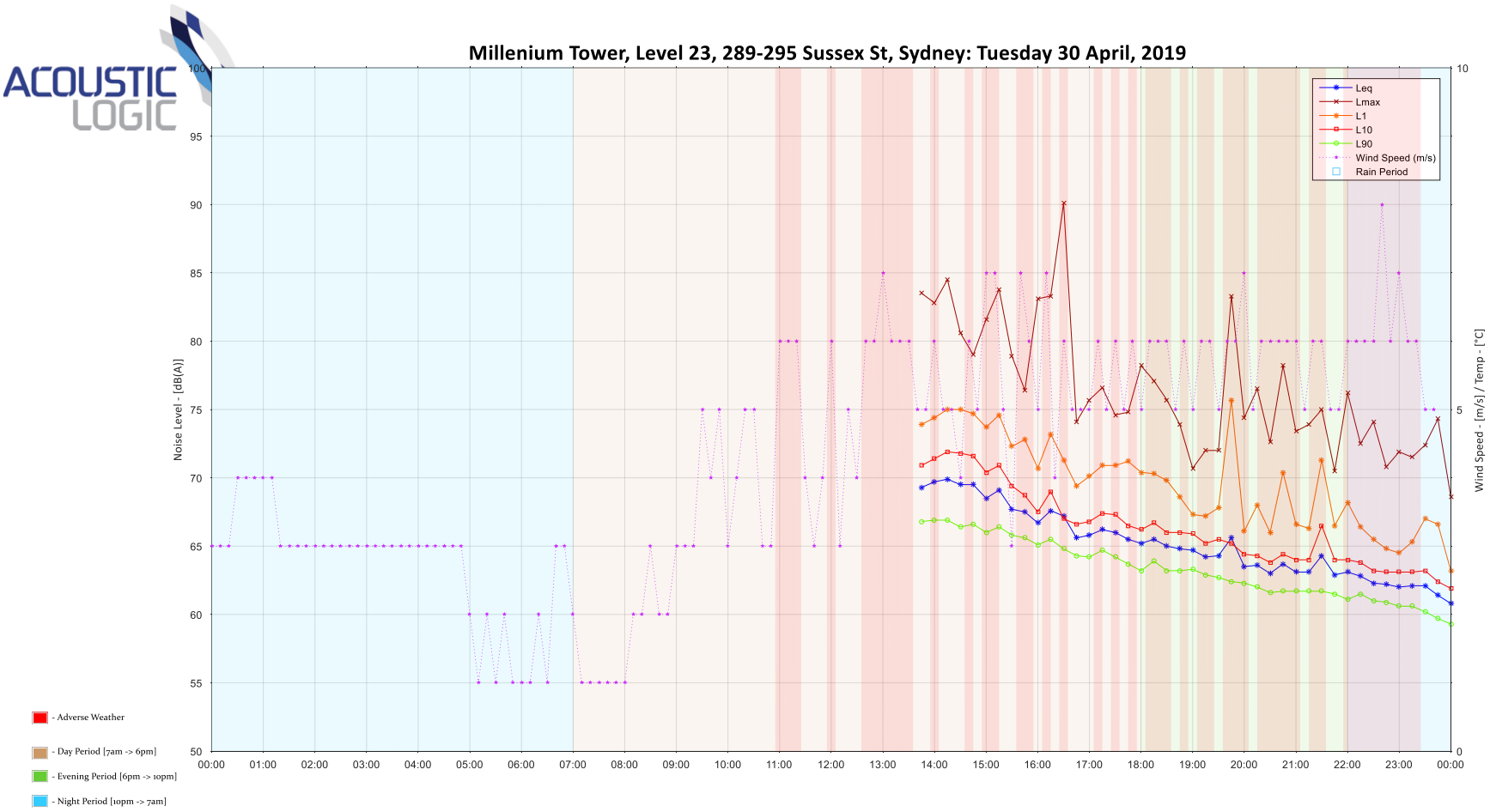
L90
Wind Speed (m/s)
Rain Period
- Rain Period
- Day Period [7am -> 6pm]
- Evening Period [6pm ->
- Night Period [10pm -> 7am]

LOCATION TWO – MILLENIUM TOWERS, 289 – 295 SUSSEX STREET, SYDNEY (ROOFTOP)


Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Tuesday 30 April, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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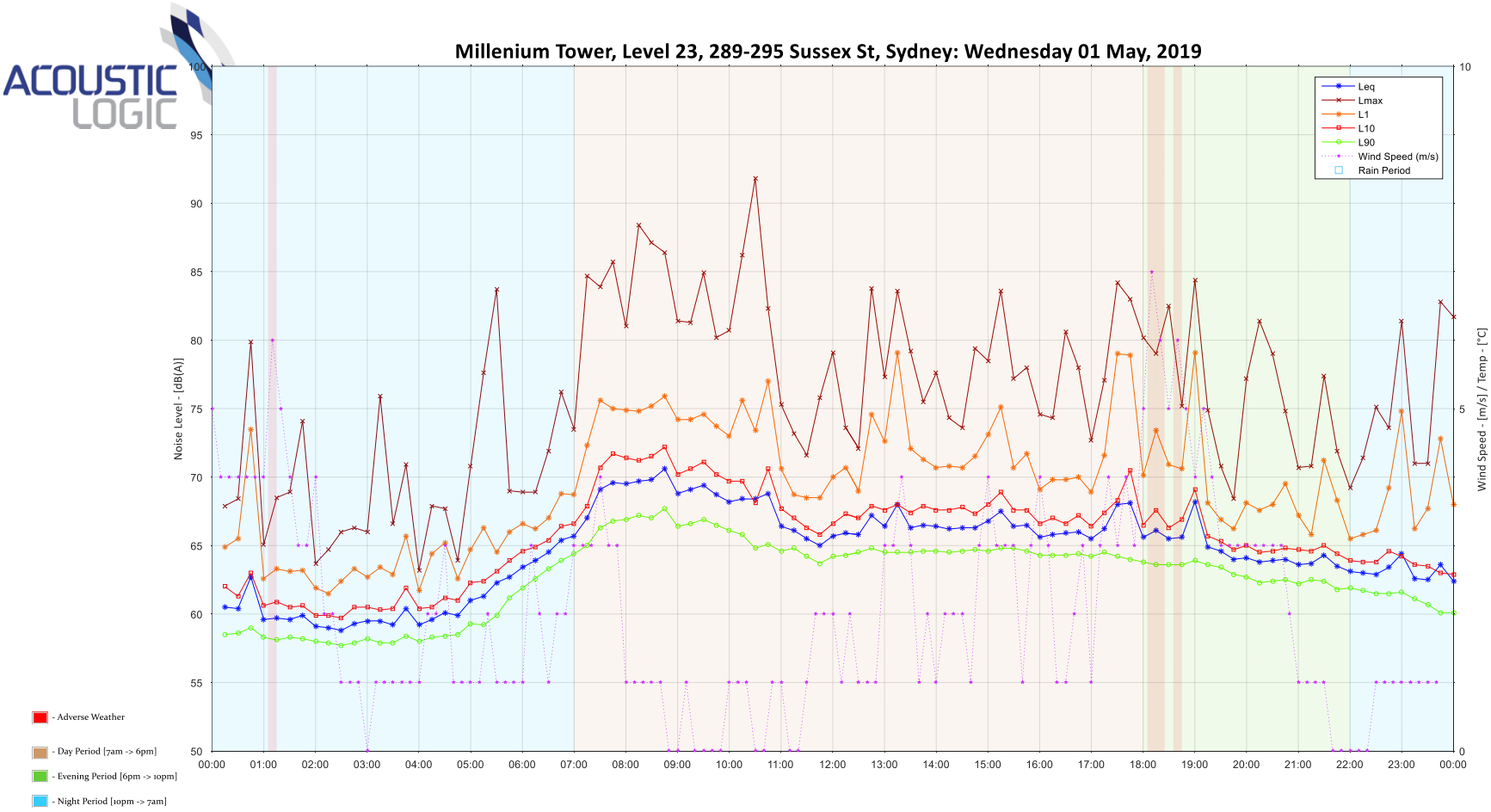
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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Wind Speed - [m/s] / Temp - [°C]
Leq
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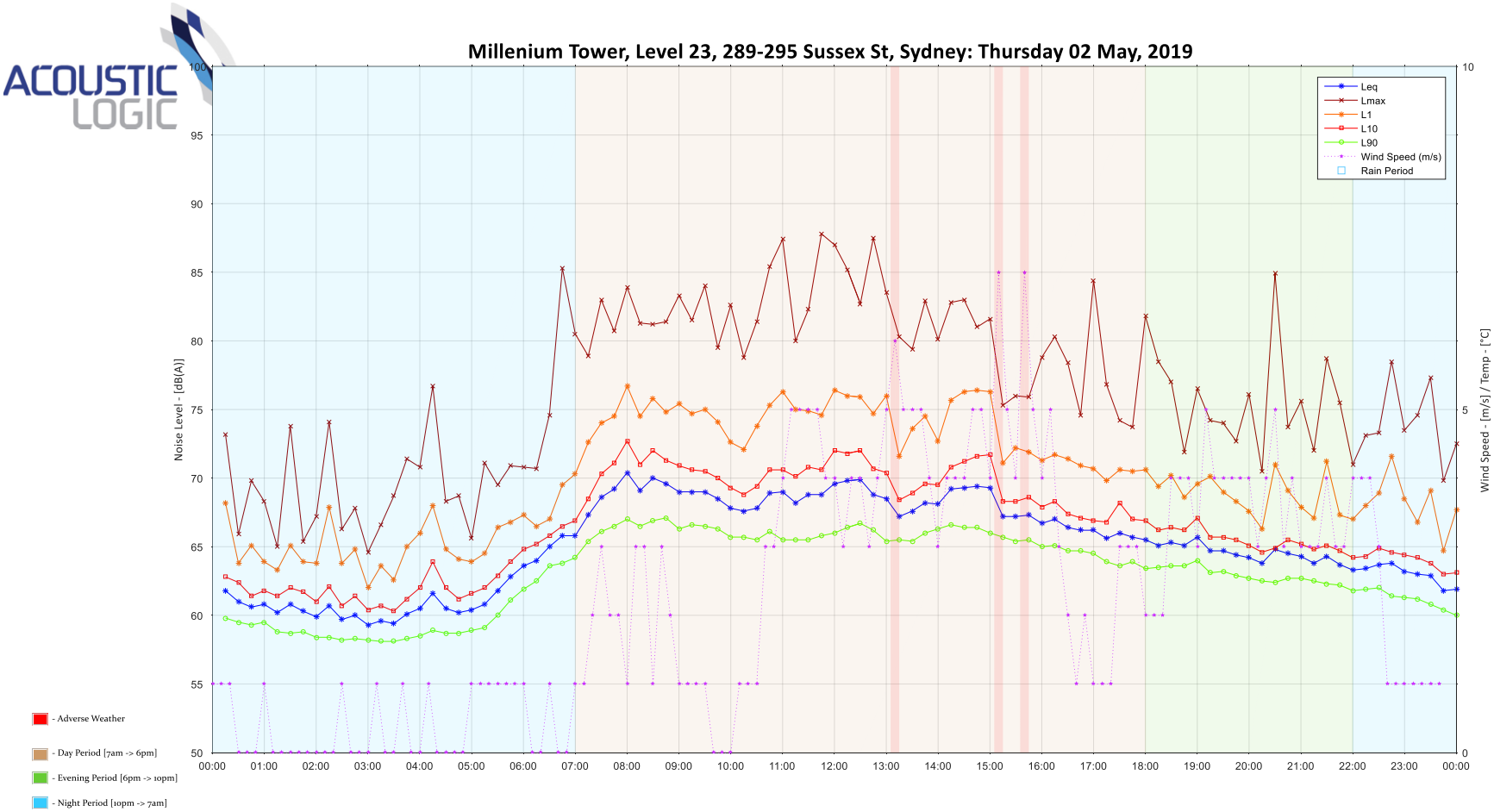
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Thursday 02 May, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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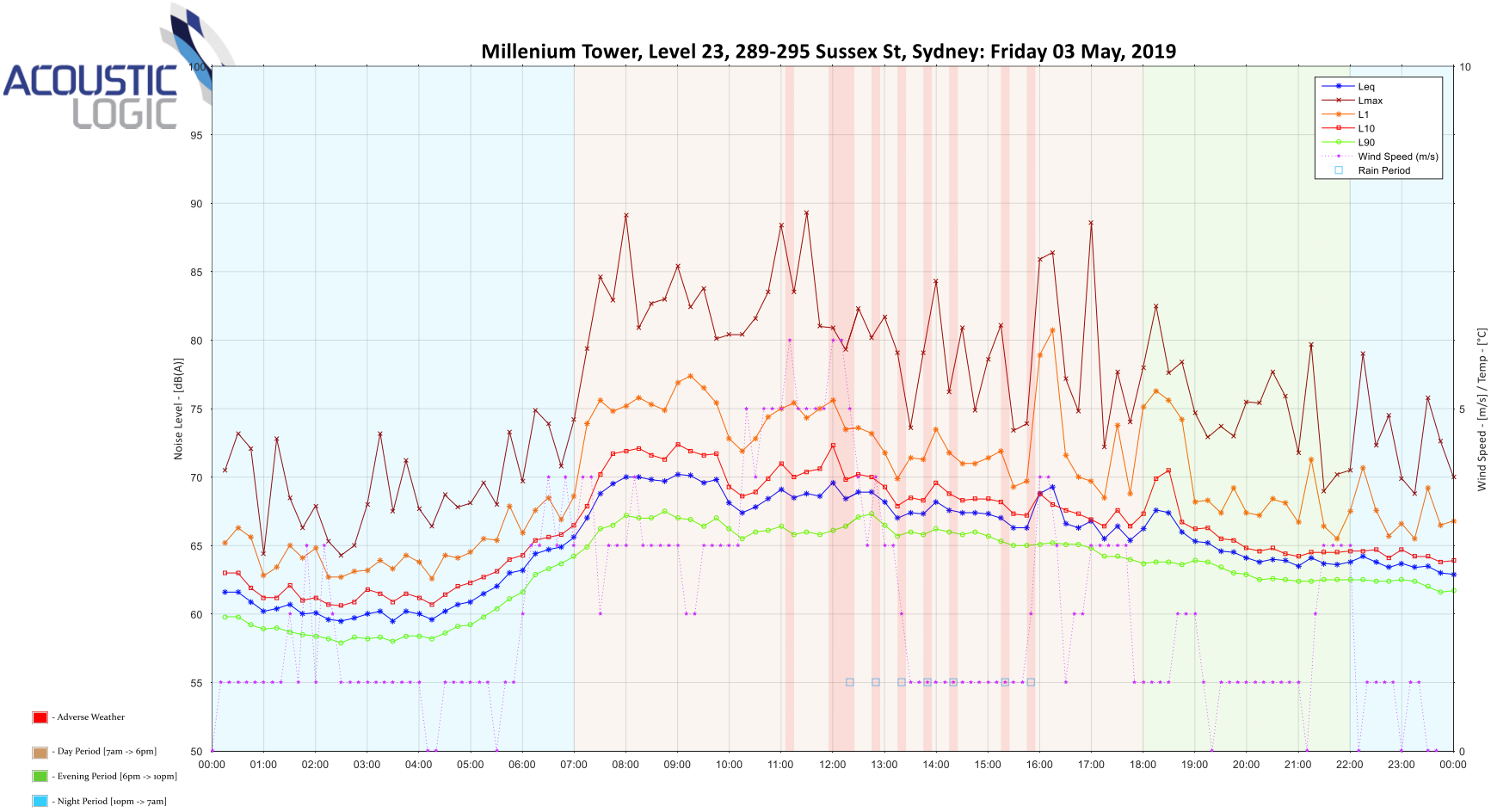
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Friday 03 May, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
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L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
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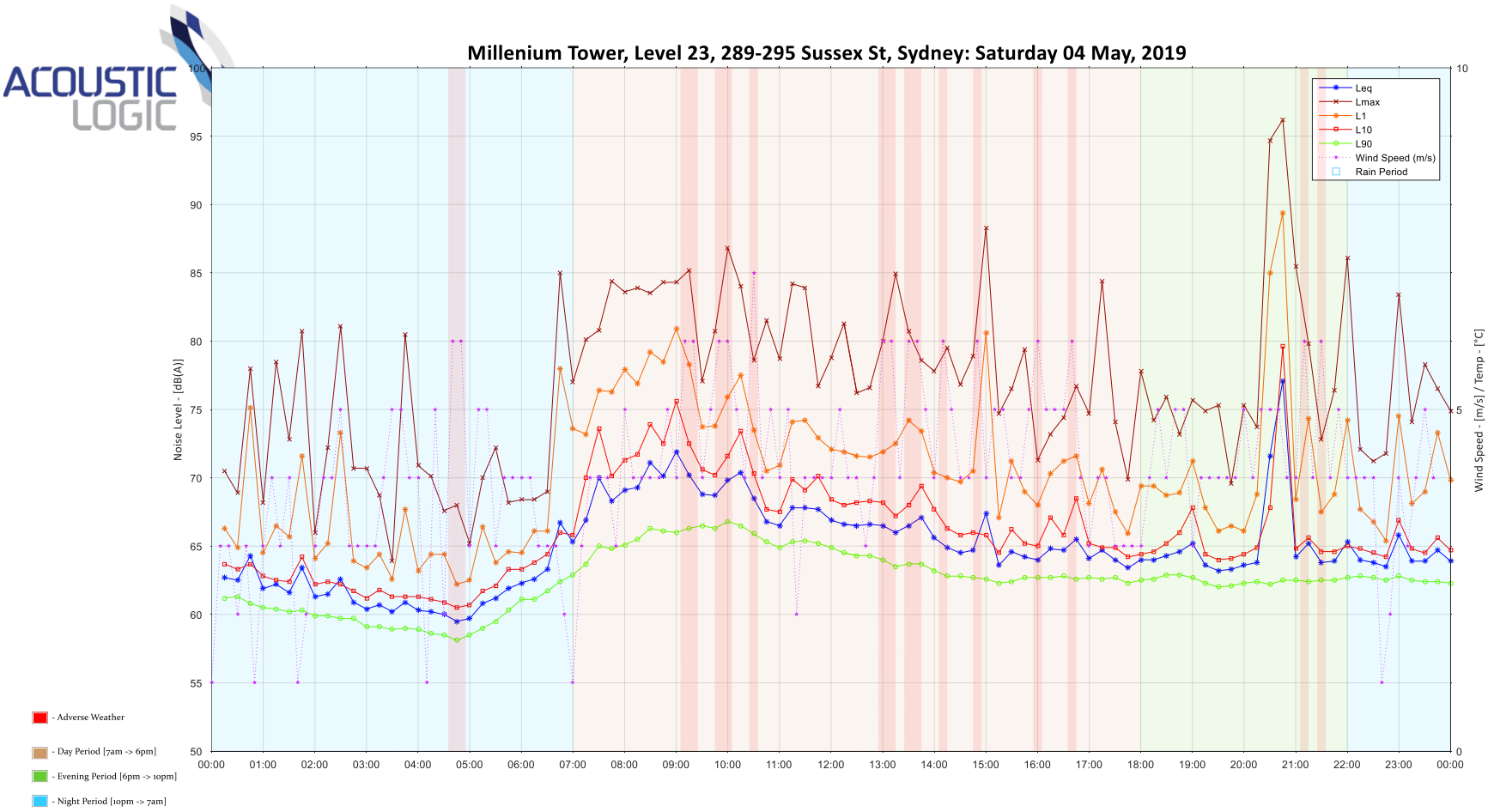
Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Saturday 04 May, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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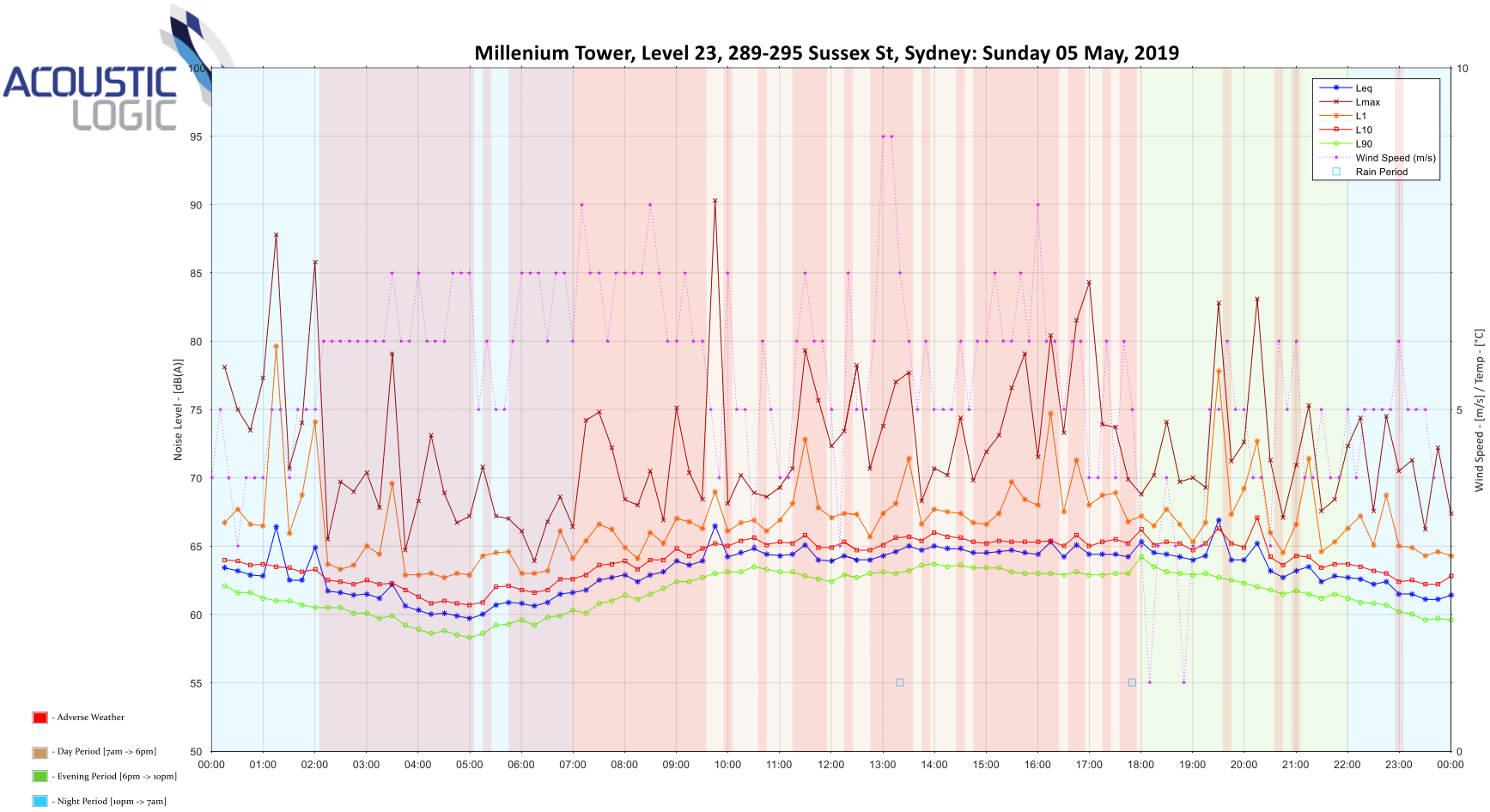
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Sunday 05 May, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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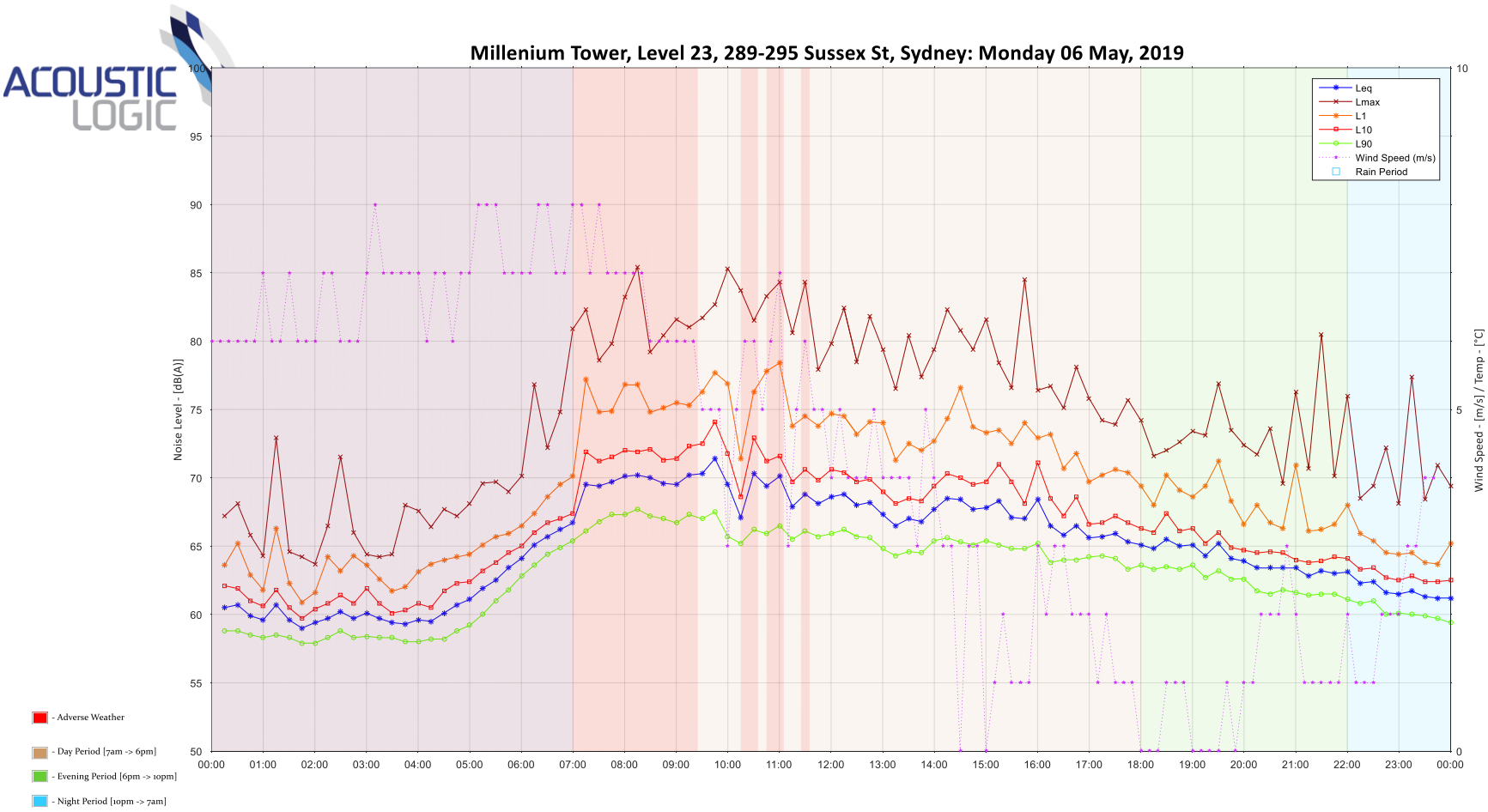
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
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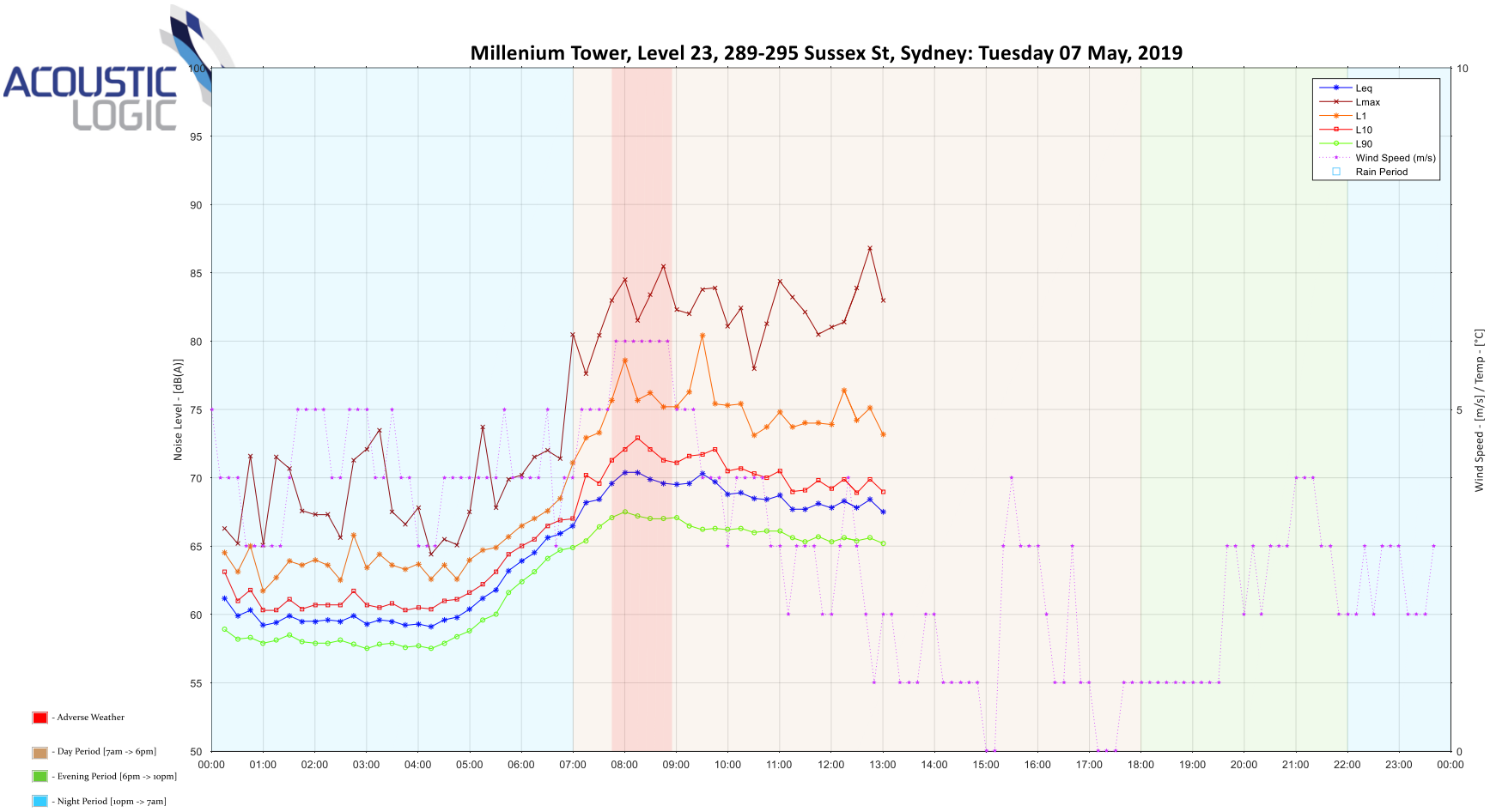
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Millenium Tower, Level 23, 289-295 Sussex St, Sydney: Tuesday 07 May, 2019
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
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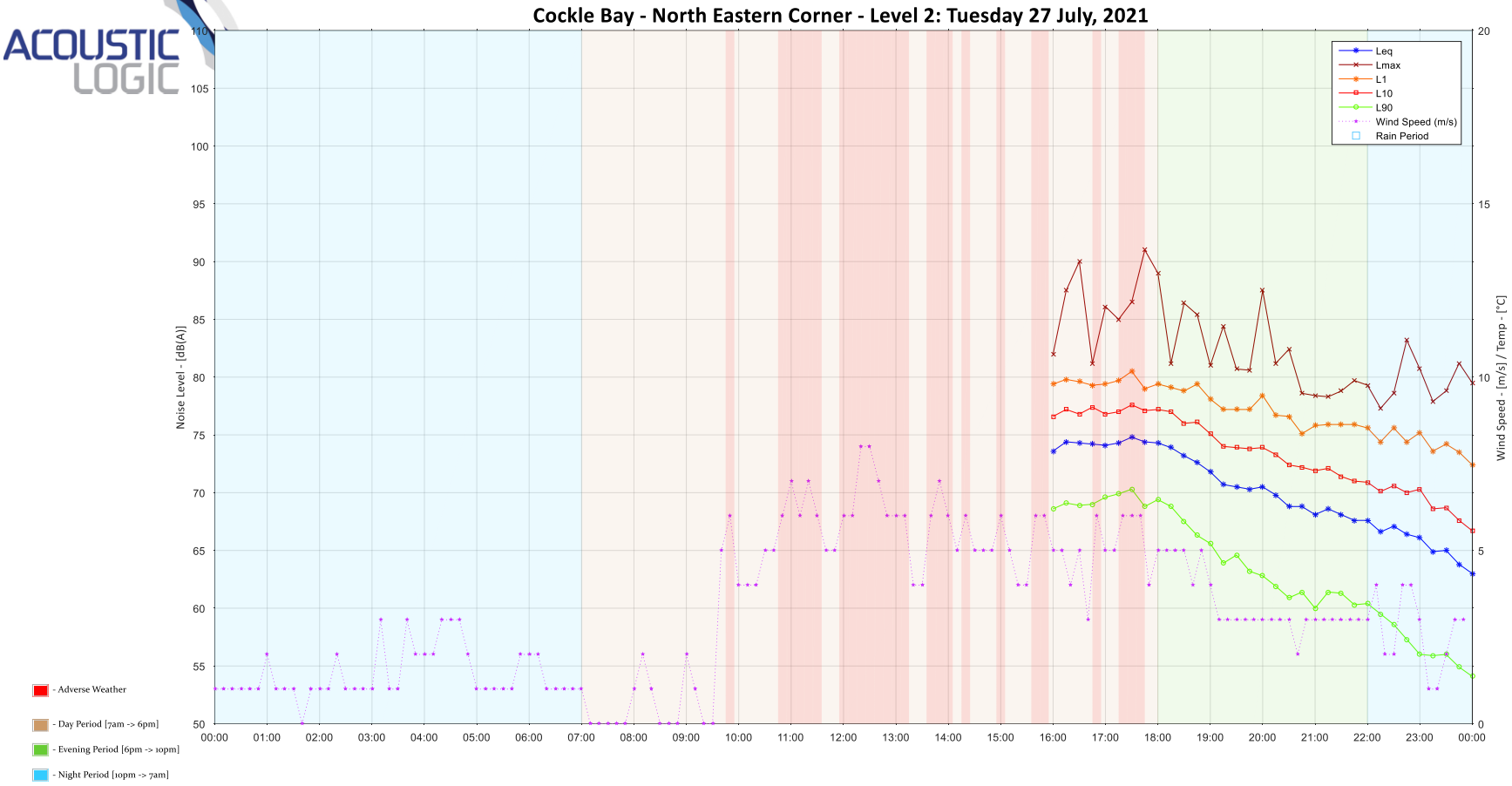
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

LOCATION THREE – NORTH-EAST CORNER OF COCKLE BAY PARK (LEVEL 2) - 2021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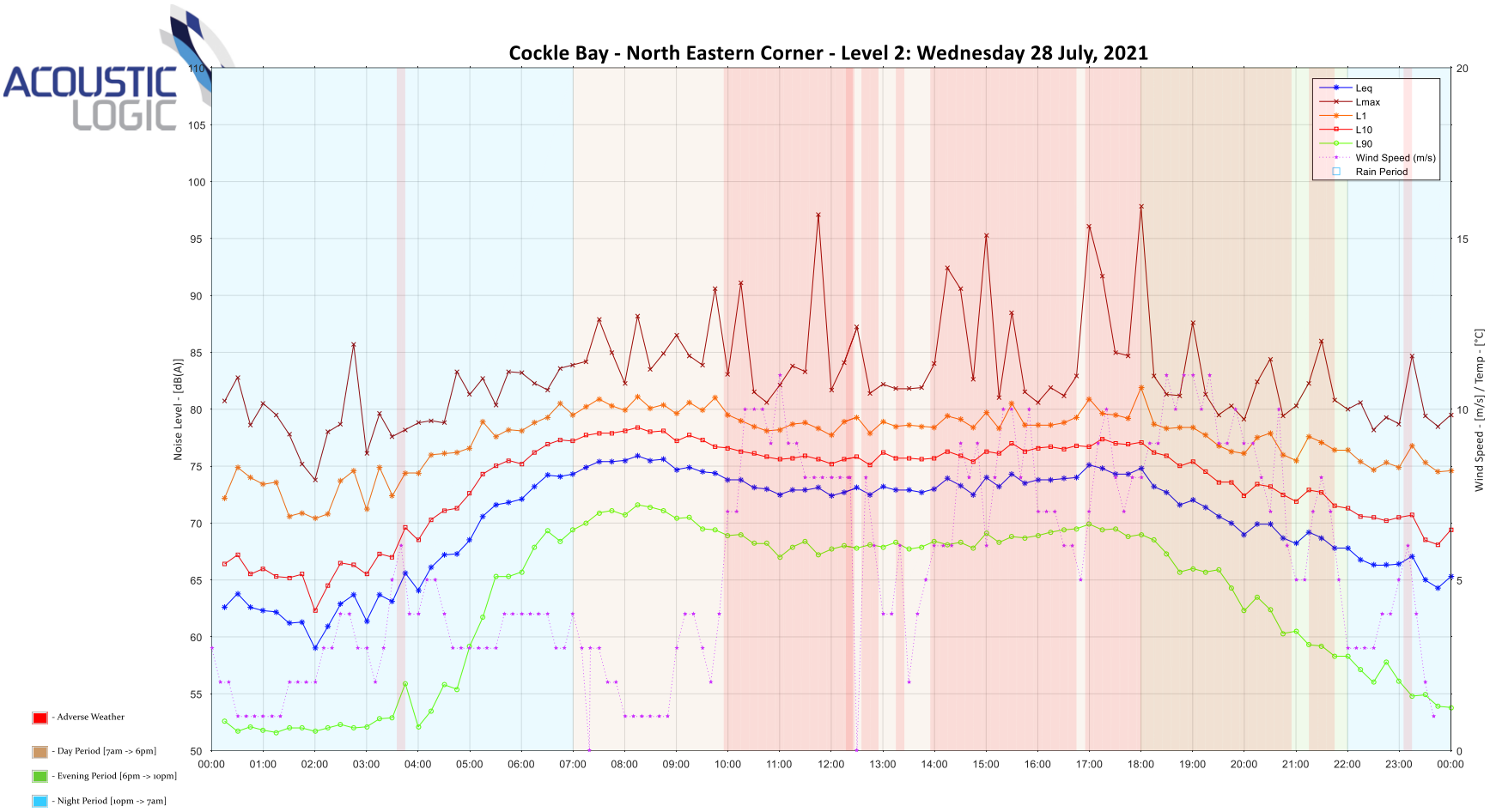
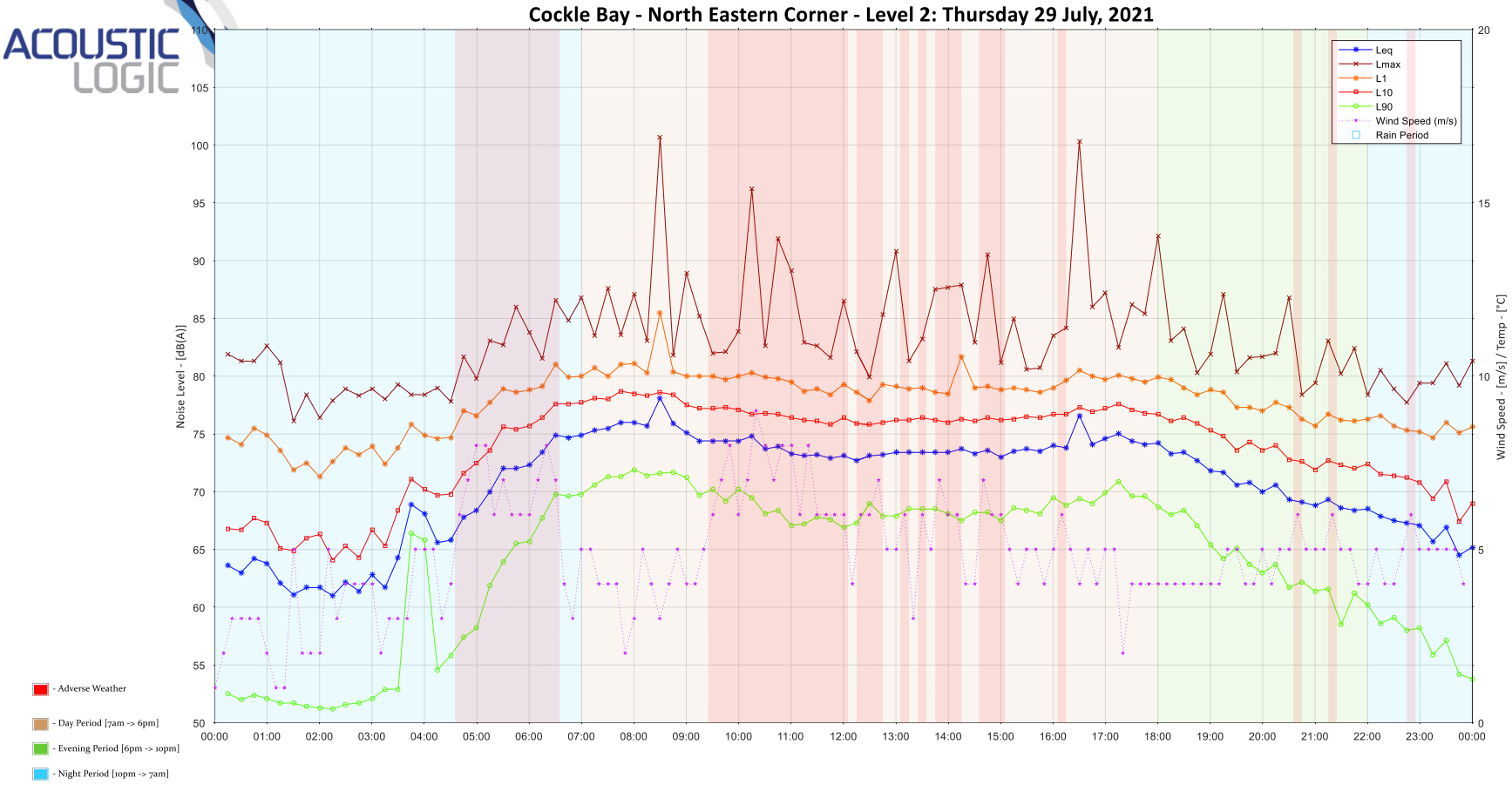
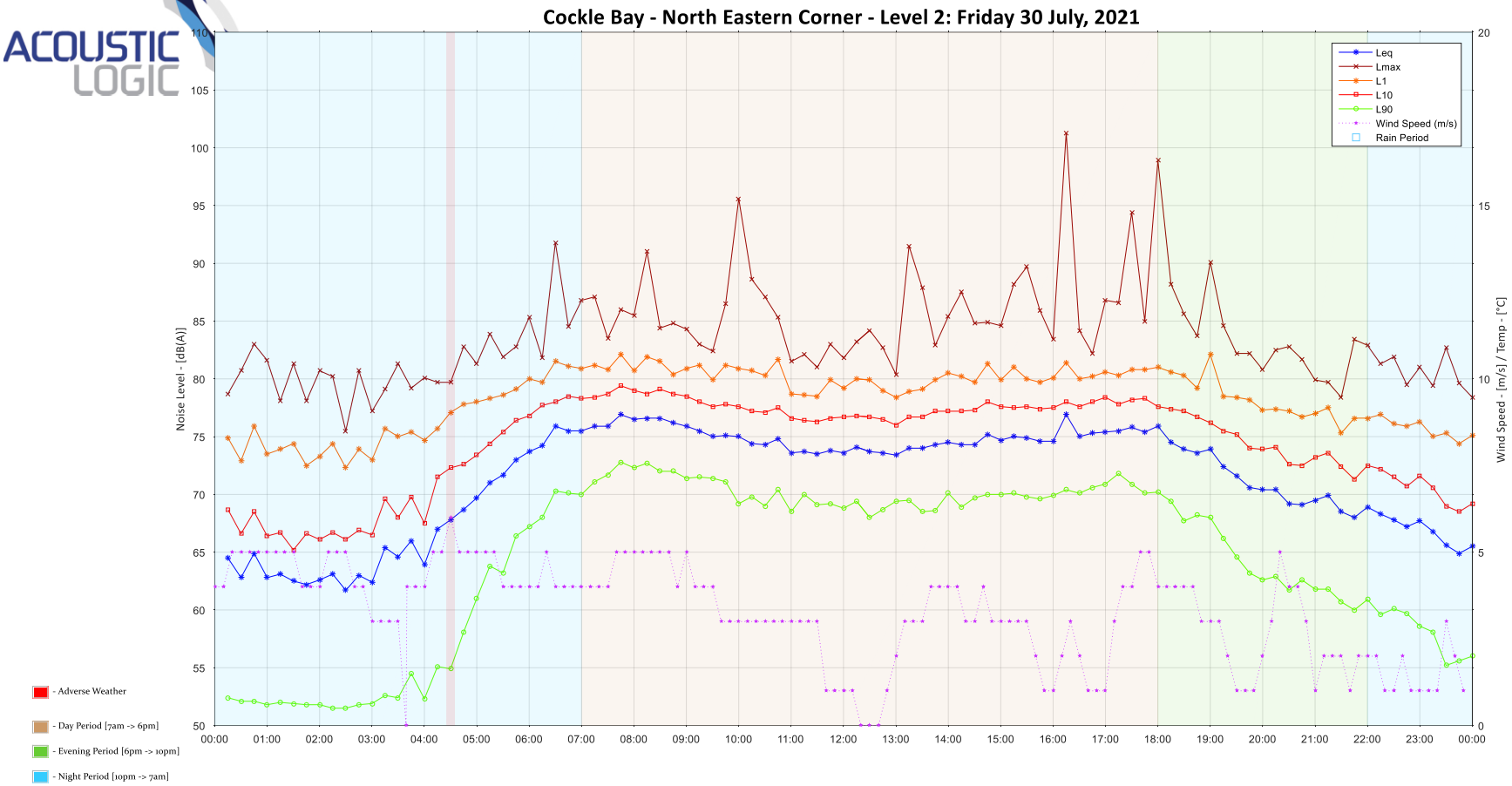
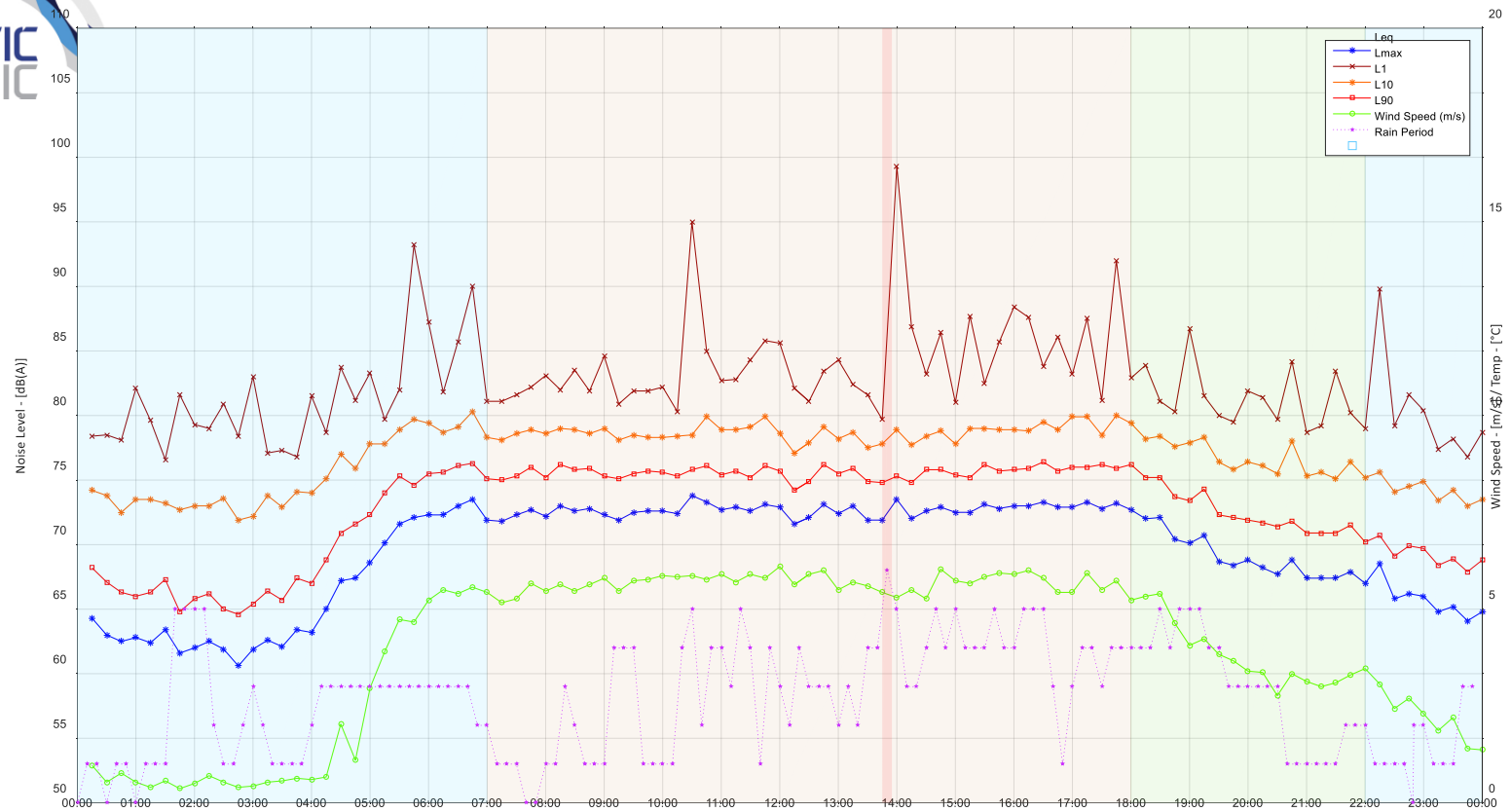
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

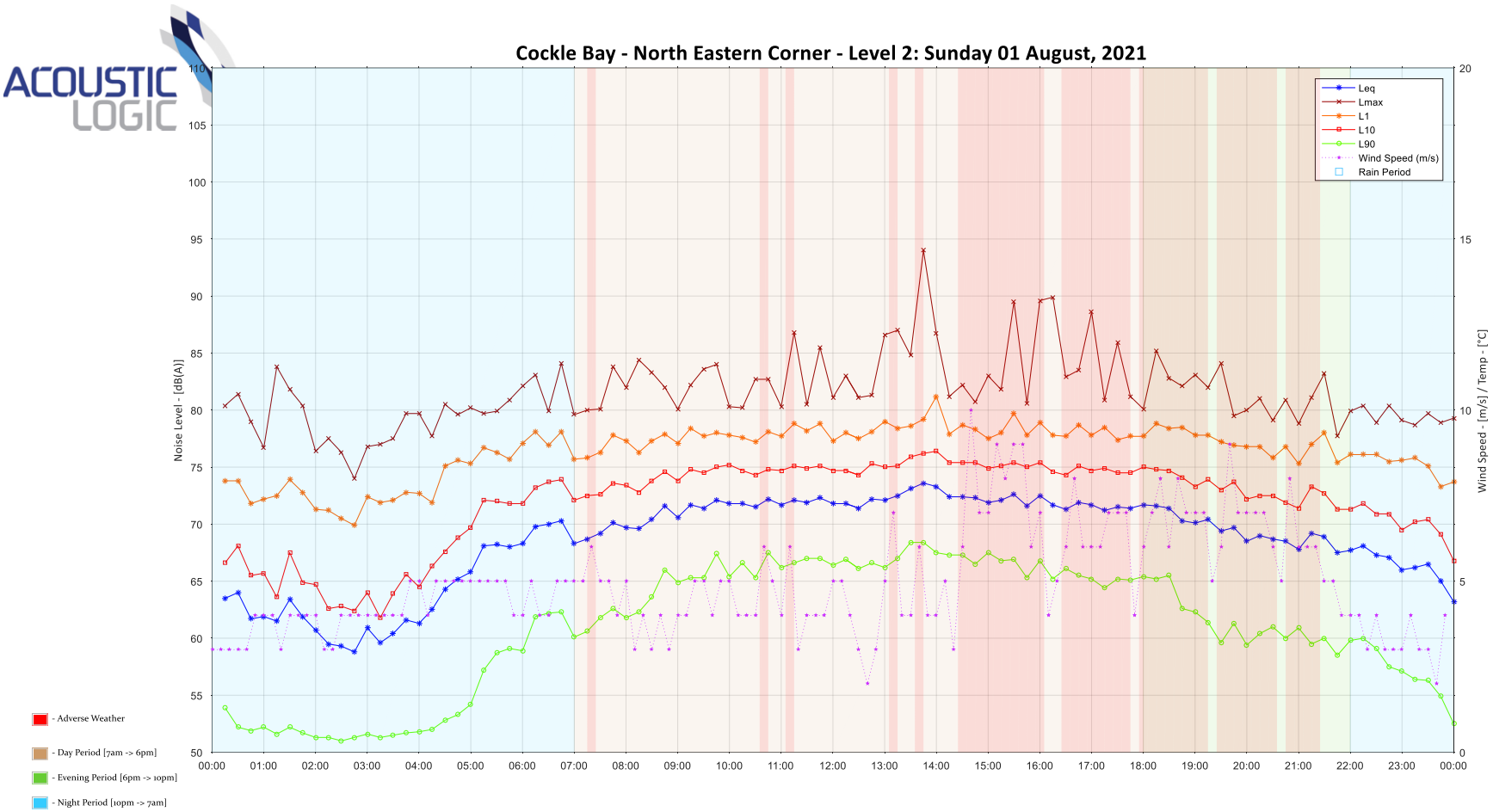

Cockle Bay - North Eastern Corner - Level 2: Wednesday 28 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

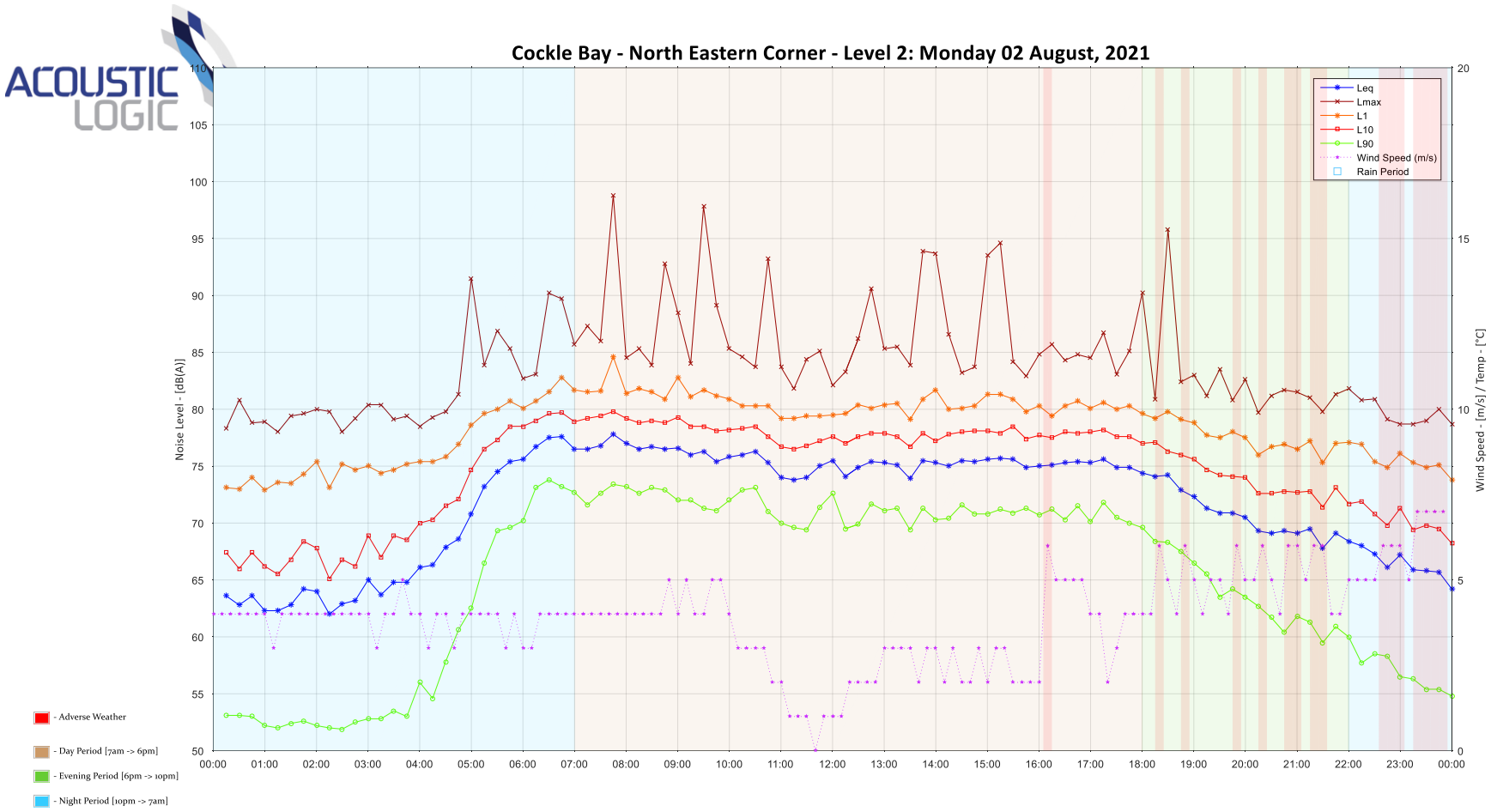

Cockle Bay - North Eastern Corner - Level 2: Thursday 29 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

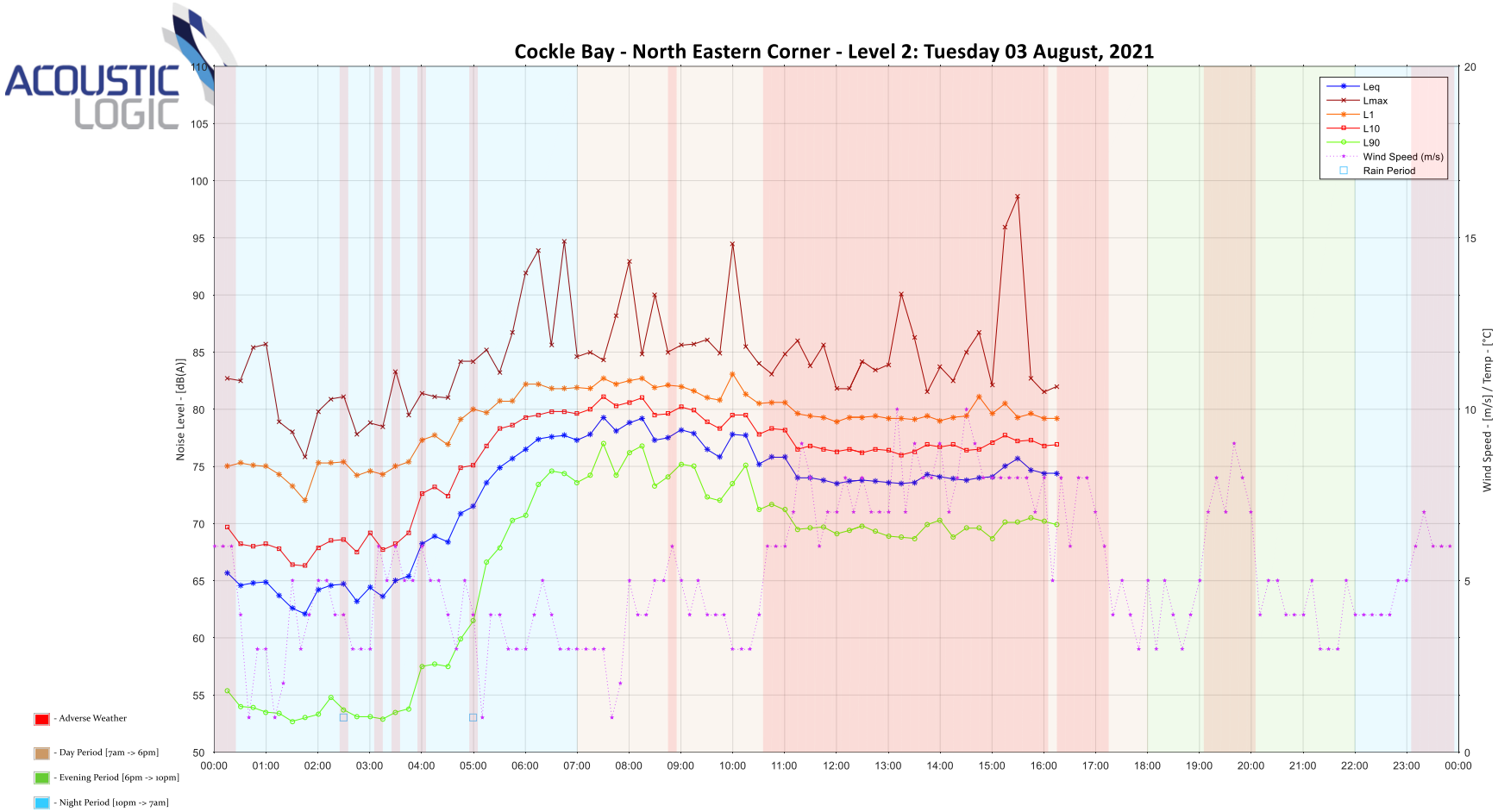

Cockle Bay - North Eastern Corner - Level 2: Friday 30 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Cockle Bay - North Eastern Corner - Level 2: Saturday 31 July, 2021

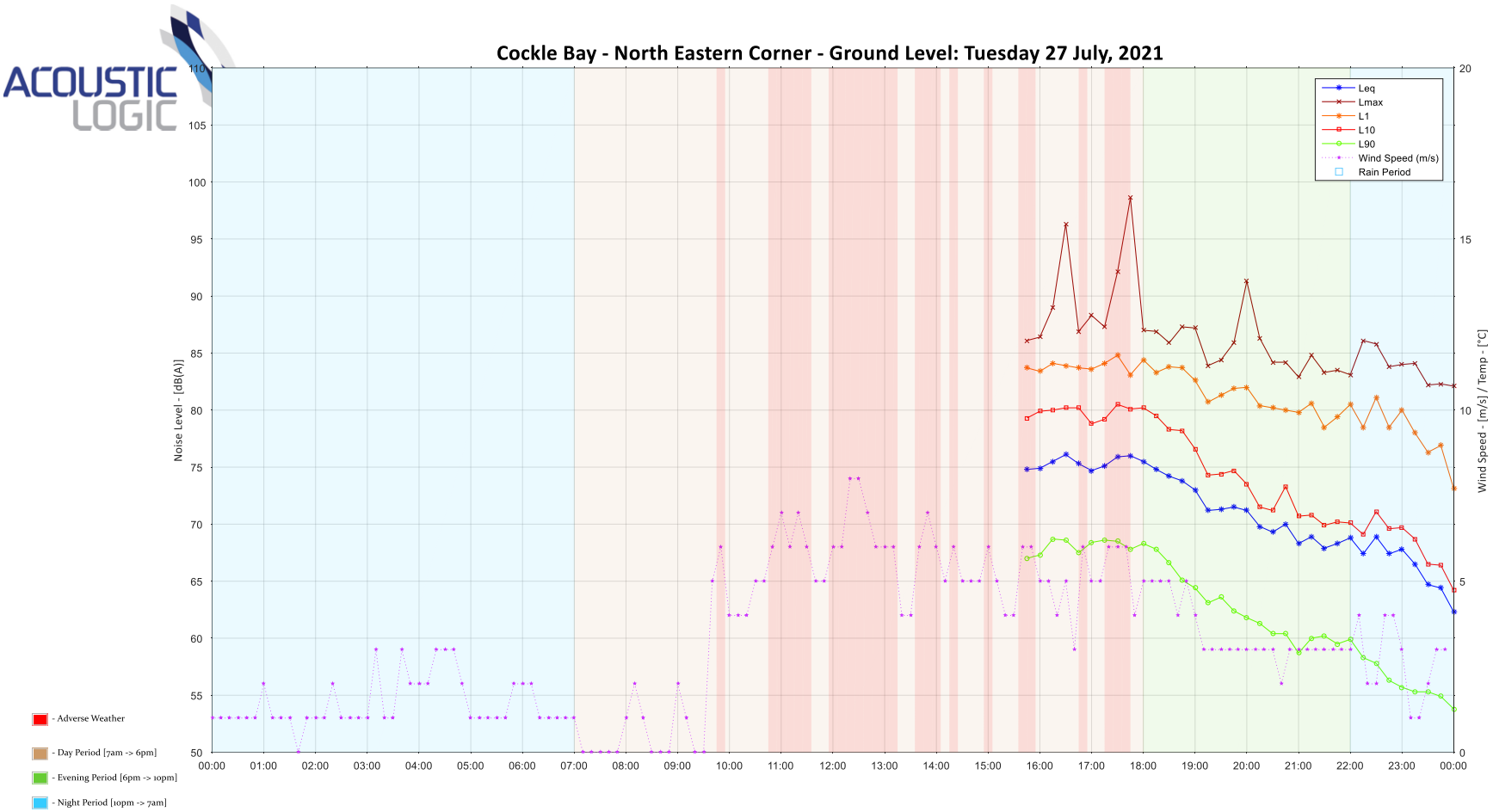


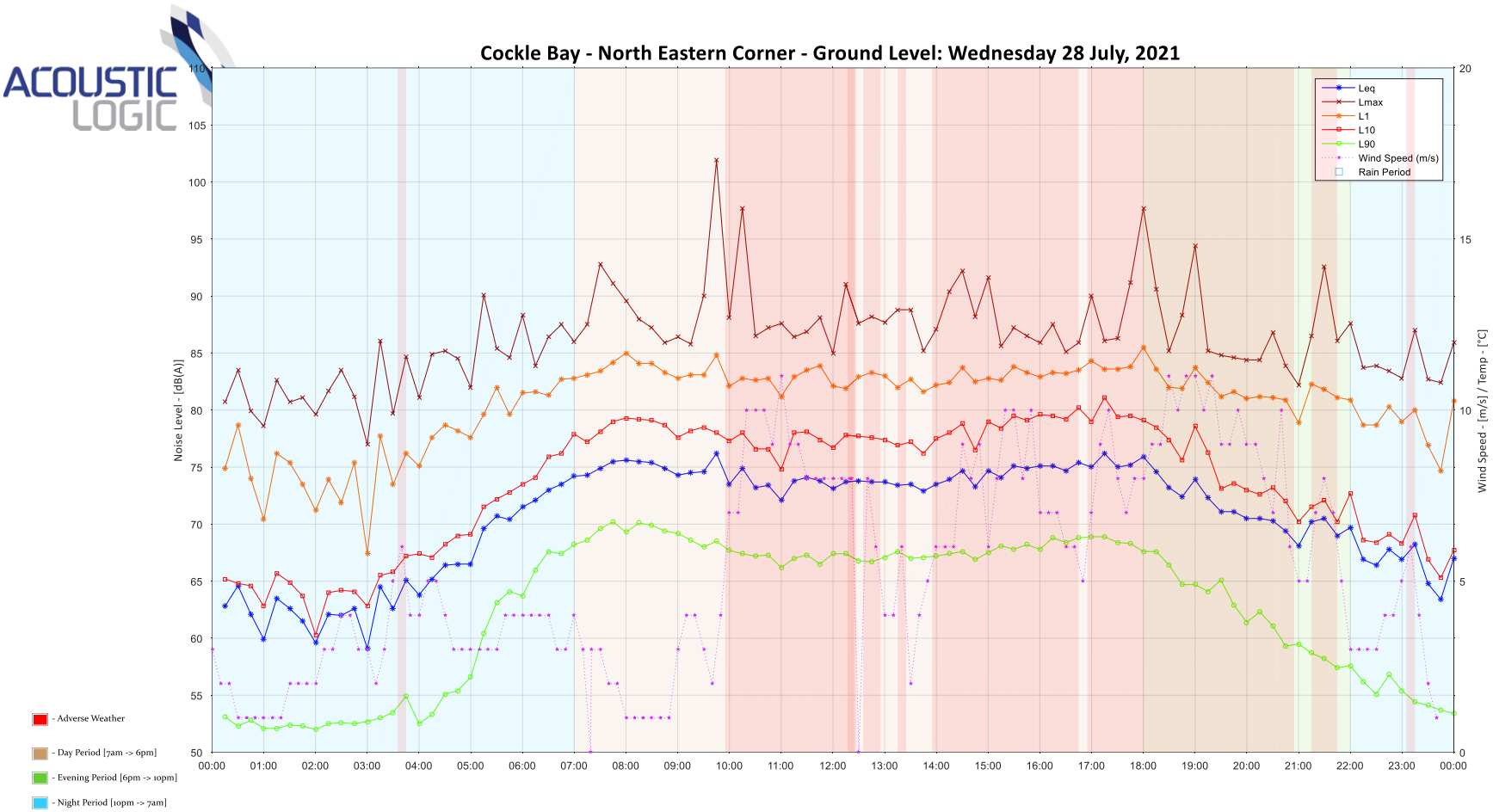

Cockle Bay - North Eastern Corner - Level 2: Sunday 01 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

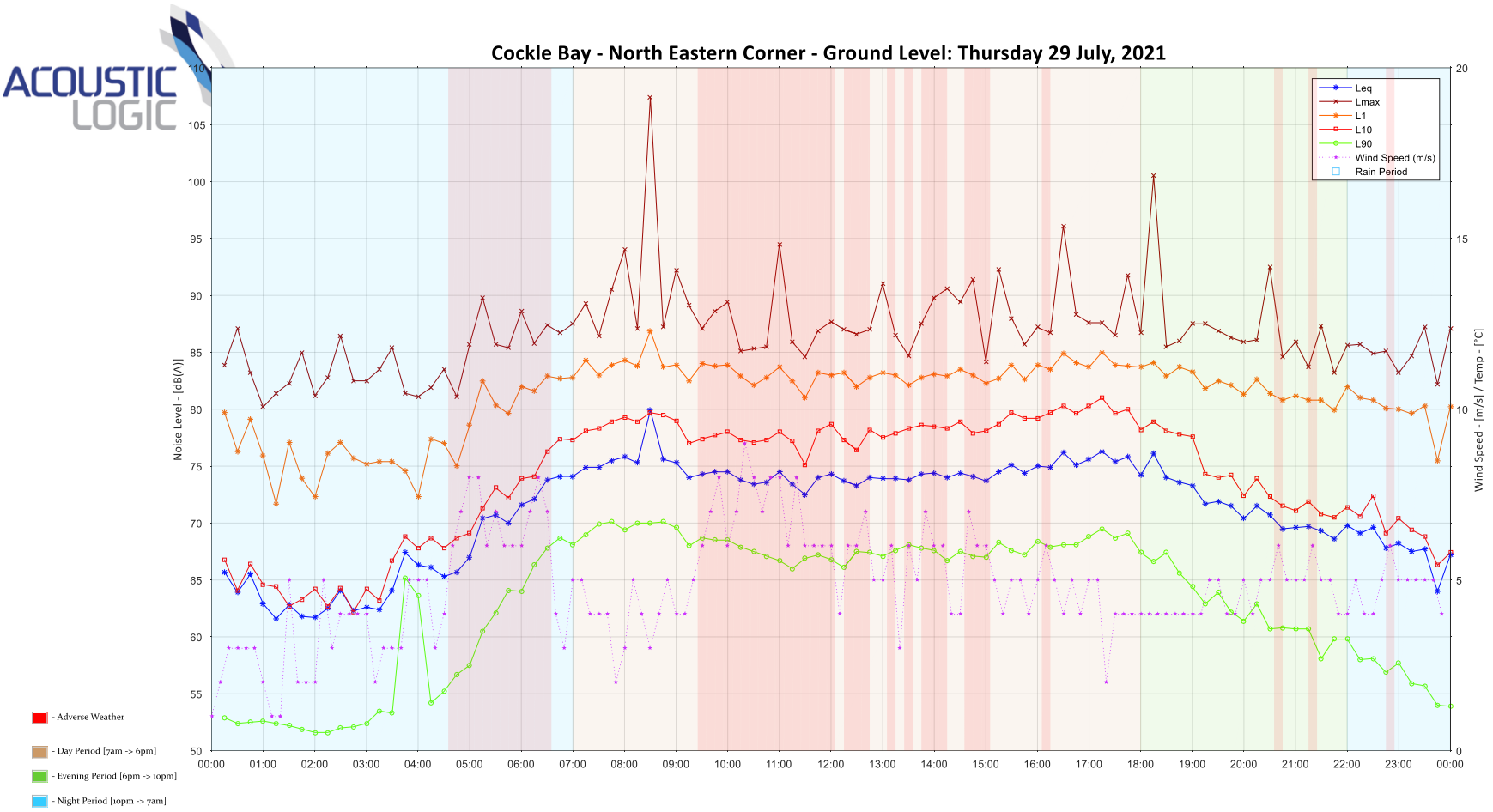

Cockle Bay - North Eastern Corner - Level 2: Monday 02 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

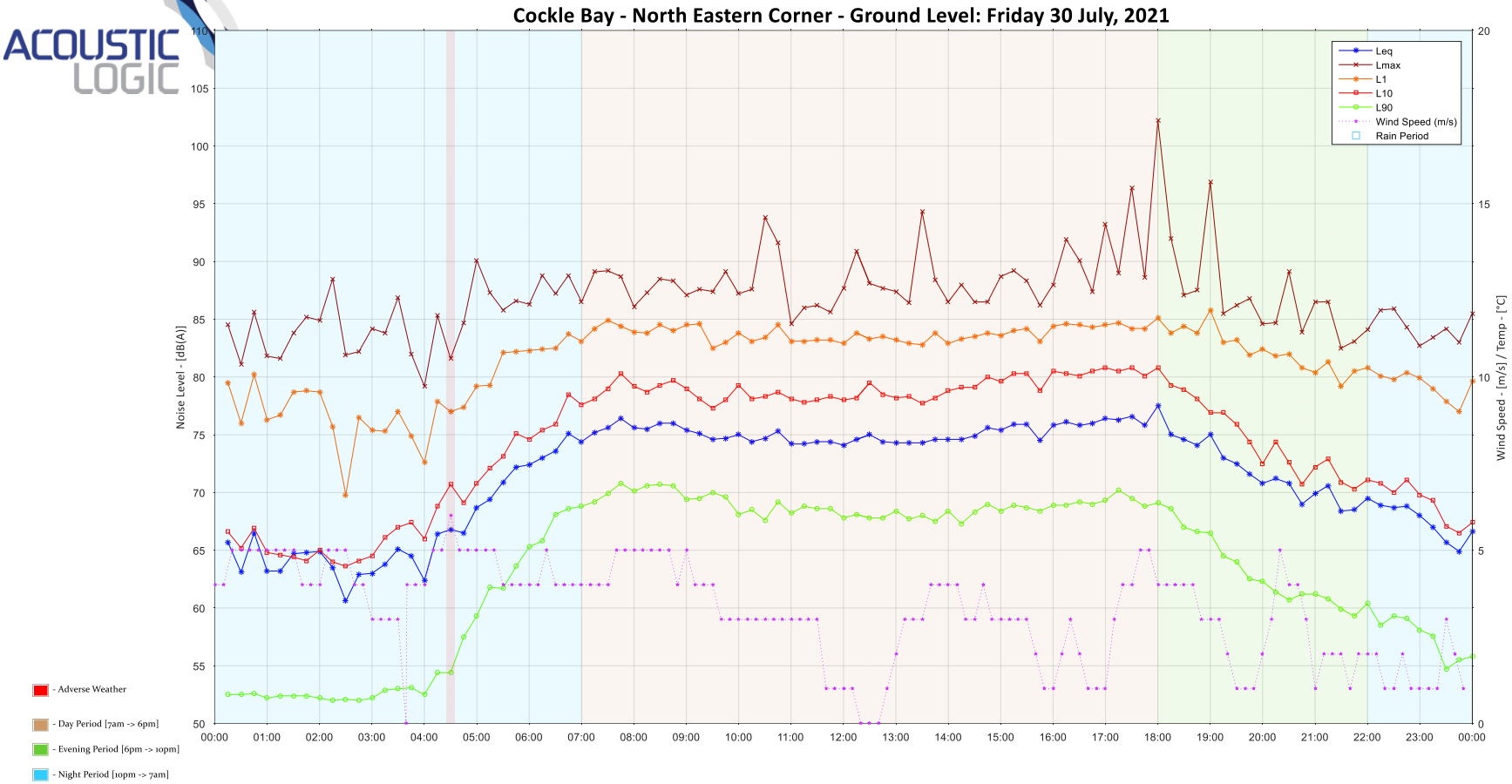

Cockle Bay - North Eastern Corner - Level 2: Tuesday 03 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

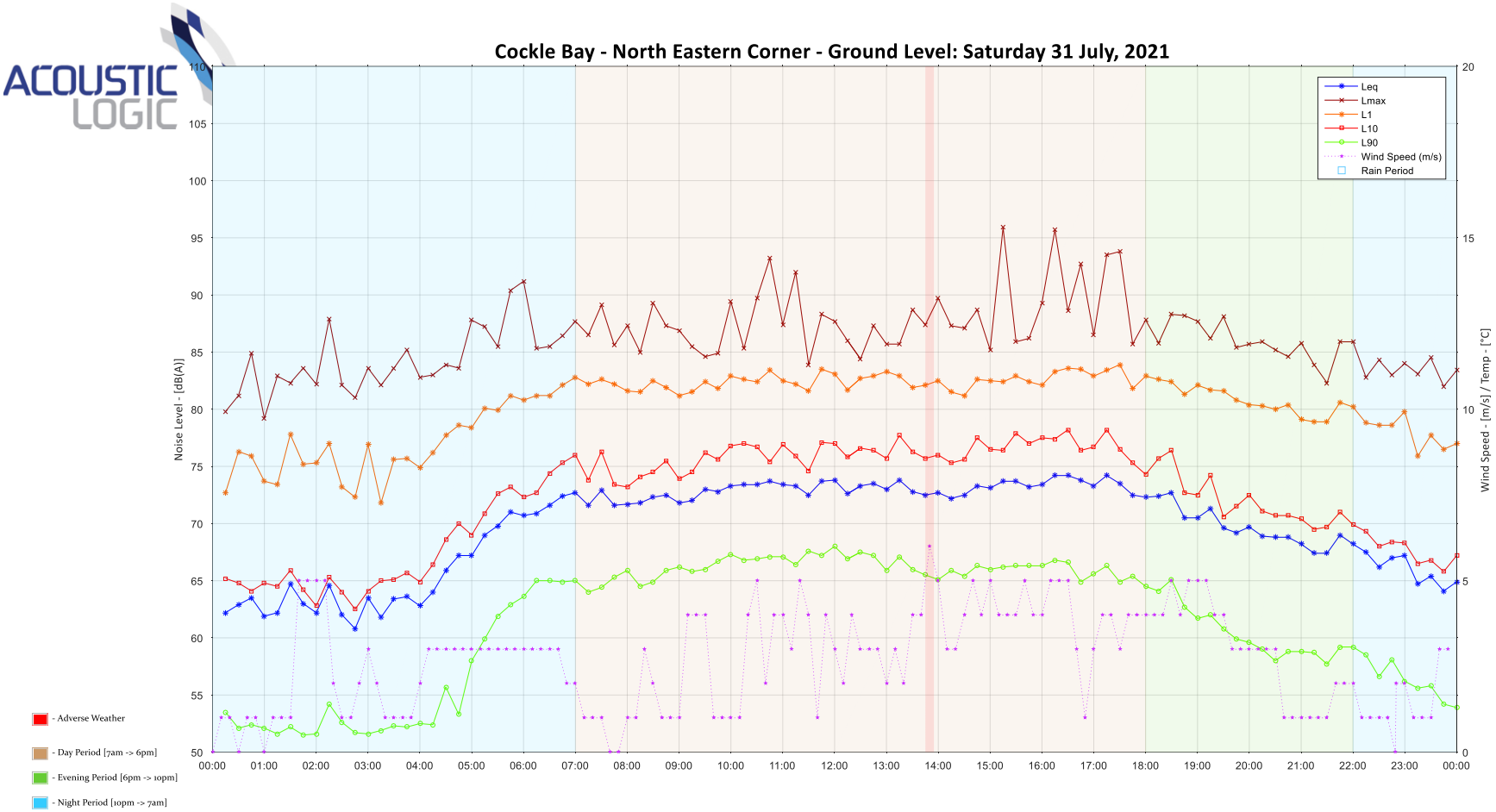
LOCATION FOUR – NORTH-EAST CORNER OF COCKLE BAY PARK (GROUND LEVEL) - 2021

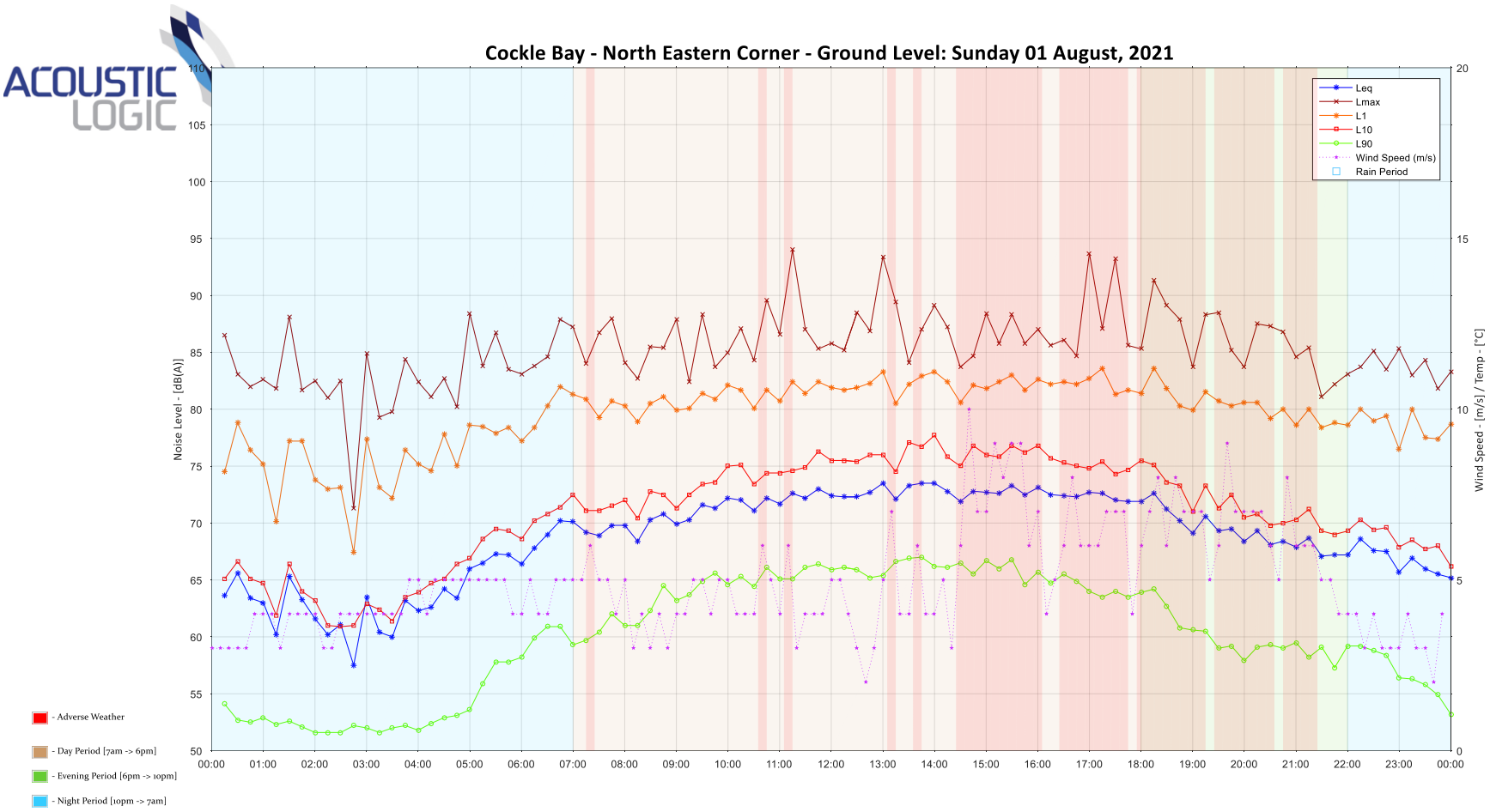

Cockle Bay - North Eastern Corner - Ground Level: Tuesday 27 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

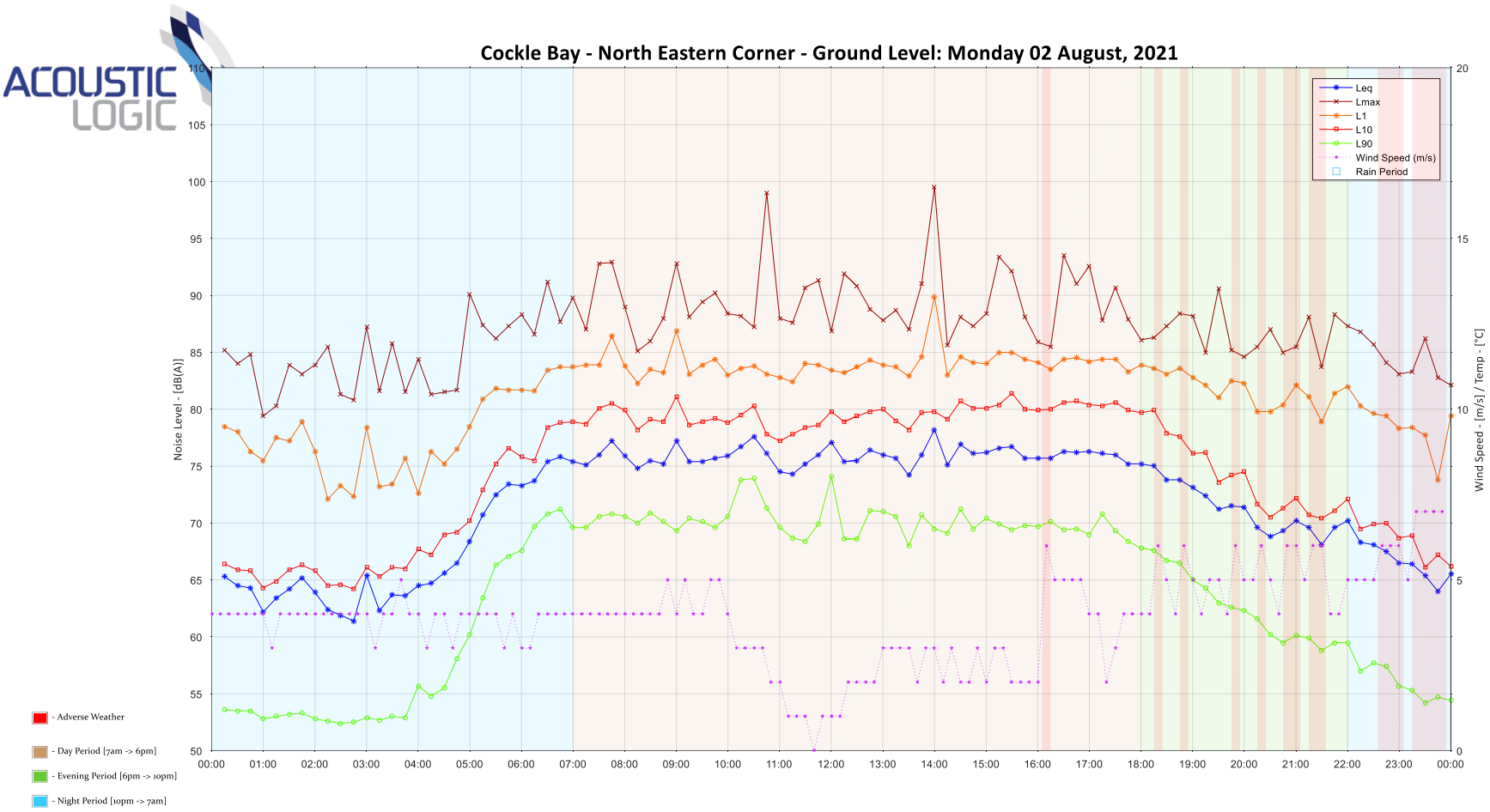

Cockle Bay - North Eastern Corner - Ground Level: Wednesday 28 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

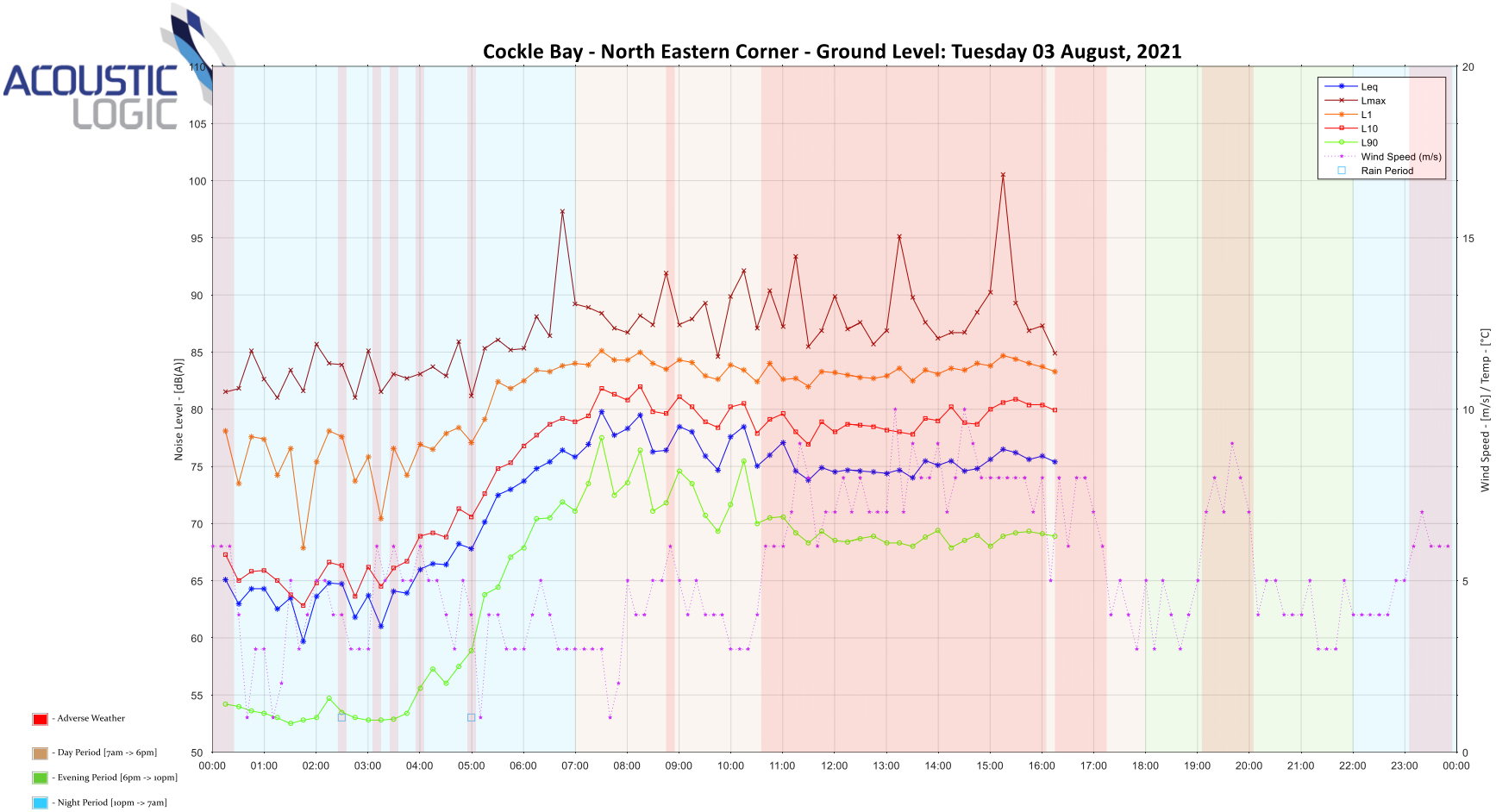

Cockle Bay - North Eastern Corner - Ground Level: Thursday 29 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Cockle Bay - North Eastern Corner - Ground Level: Friday 30 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

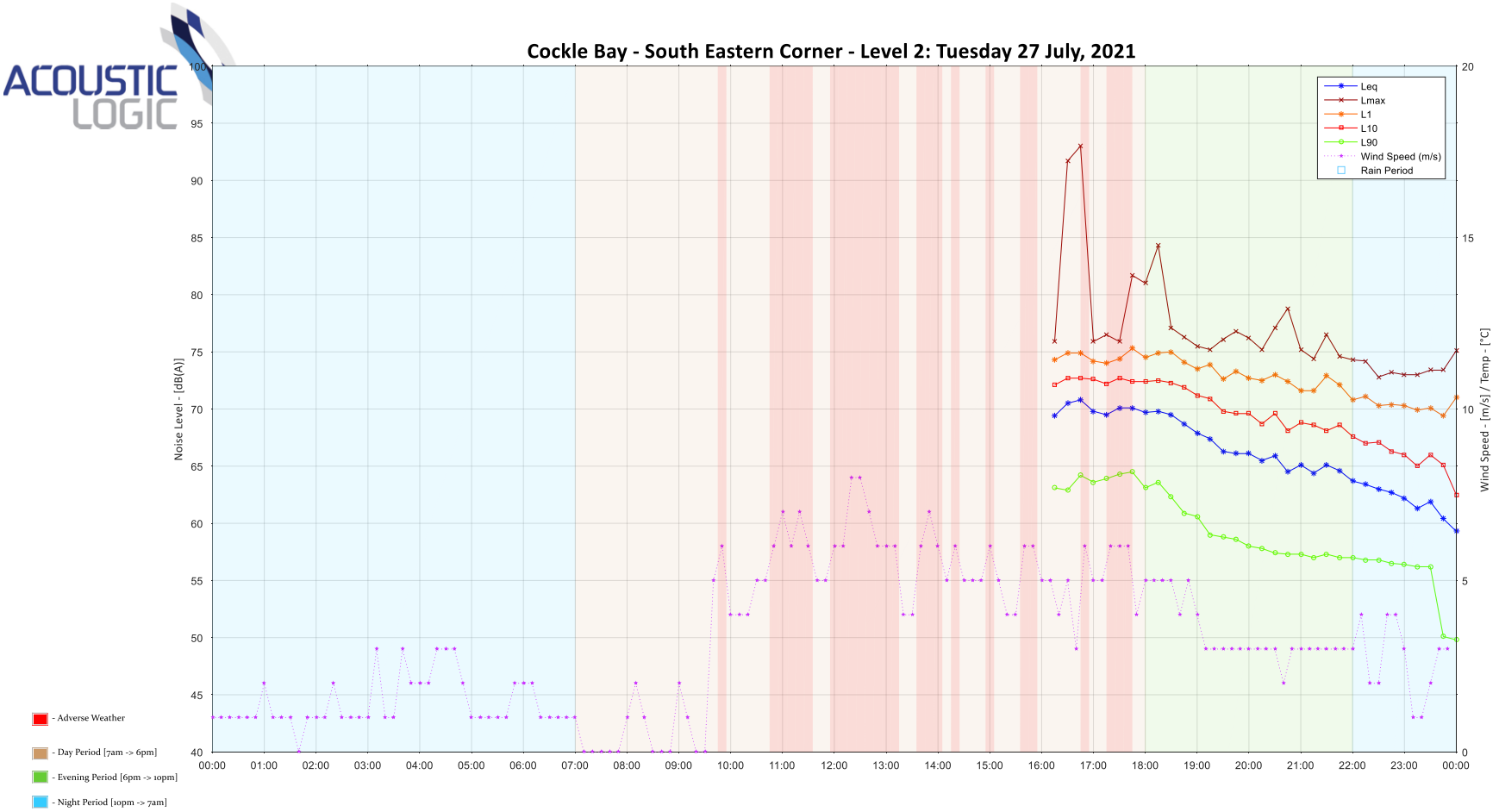

Cockle Bay - North Eastern Corner - Ground Level: Saturday 31 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

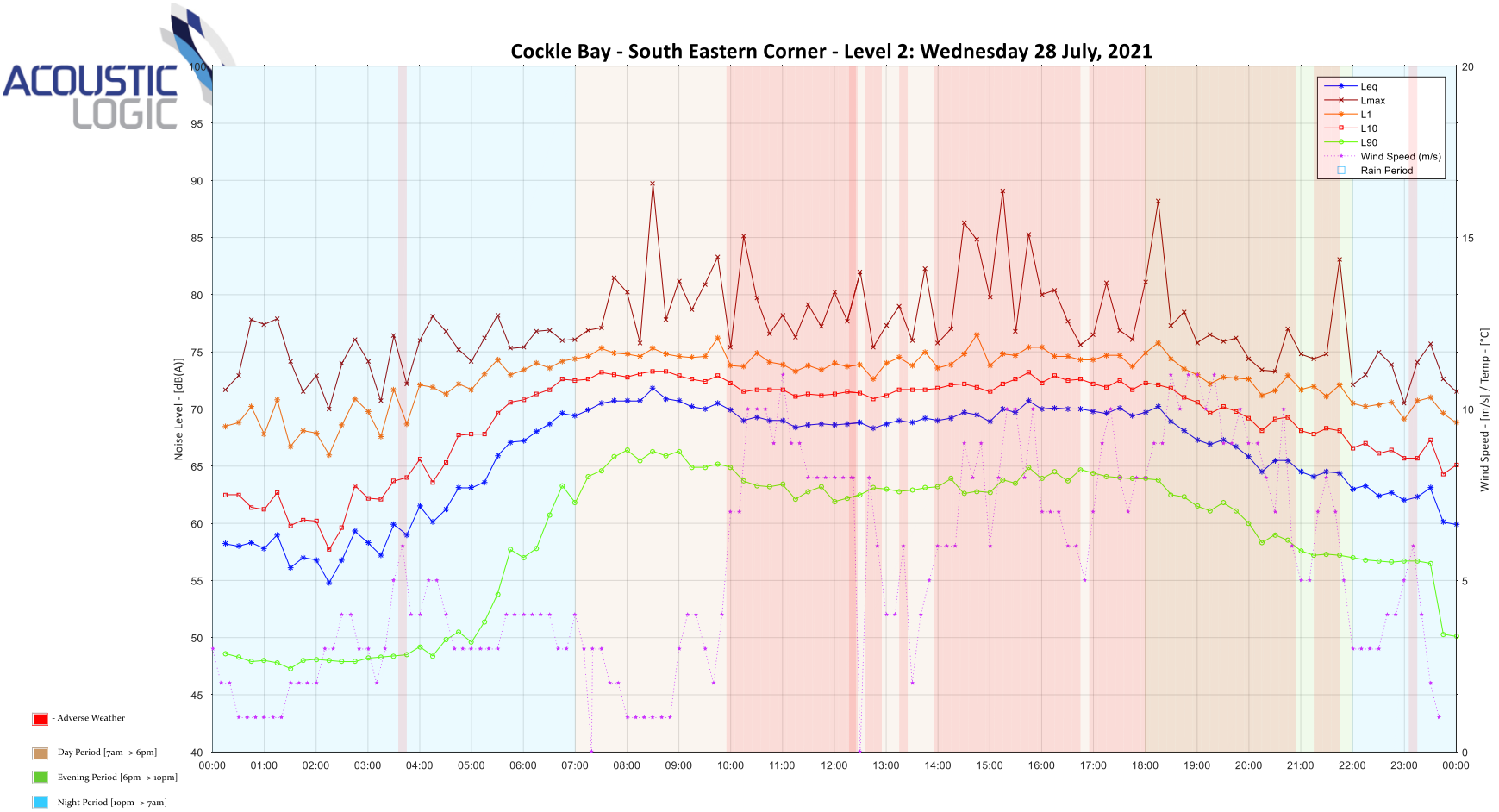

Cockle Bay - North Eastern Corner - Ground Level: Sunday 01 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

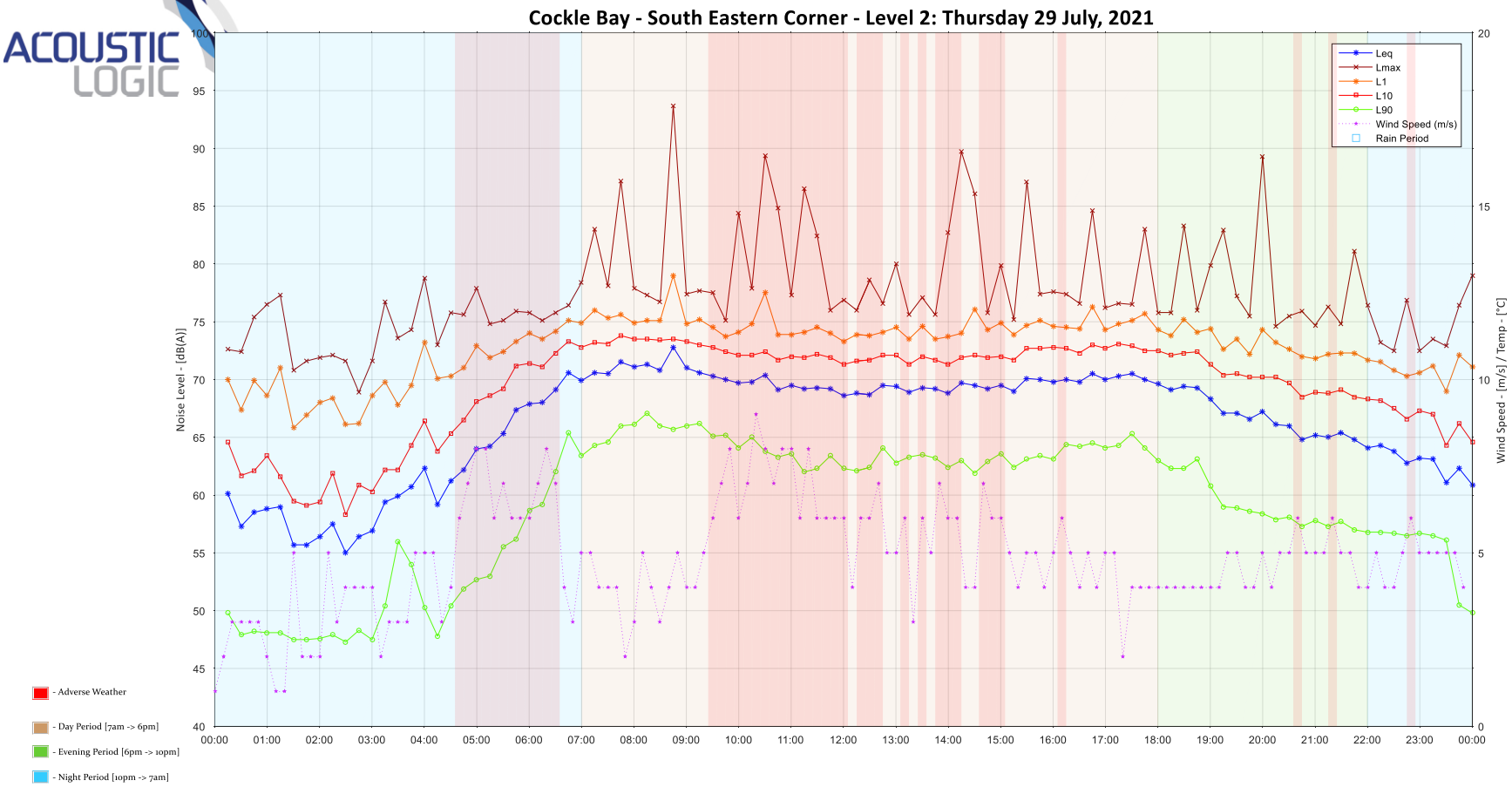

Cockle Bay - North Eastern Corner - Ground Level: Monday 02 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Cockle Bay - North Eastern Corner - Ground Level: Tuesday 03 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

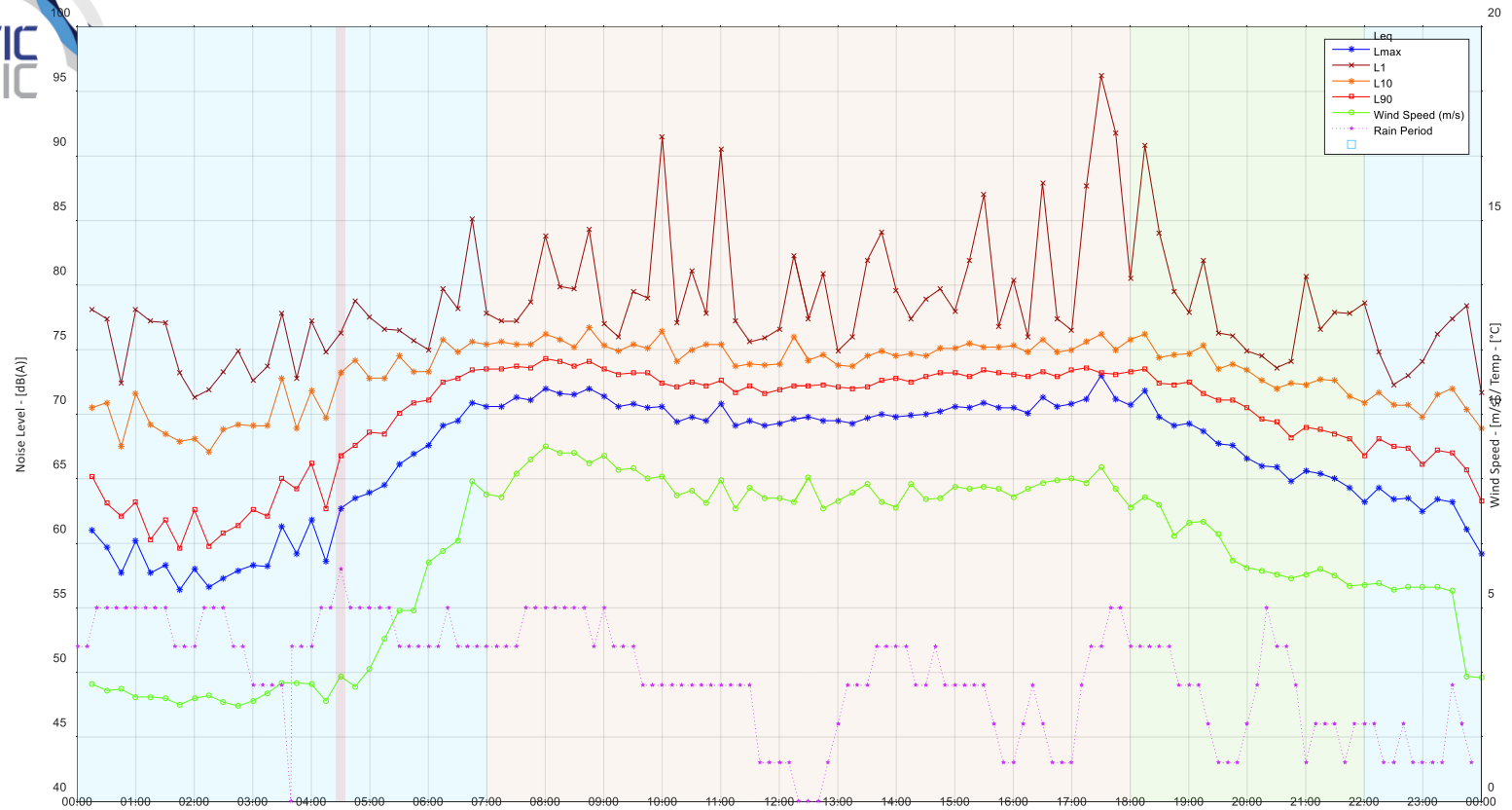
LOCATION FIVE - SOUTH-EAST CORNER OF COCKLE BAY PARK (LEVEL 2) - 2021

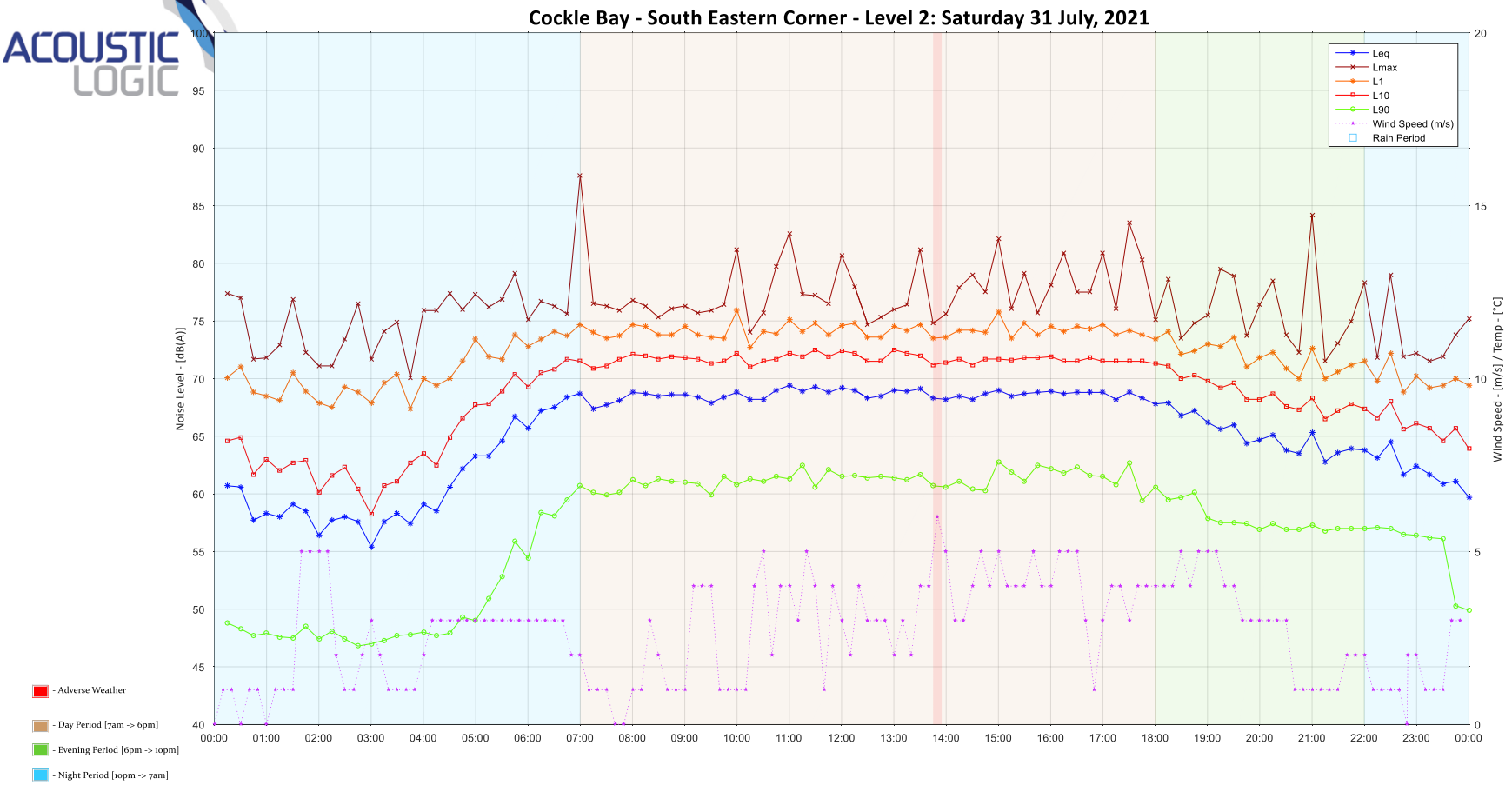

Cockle Bay - South Eastern Corner - Level 2: Tuesday 27 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

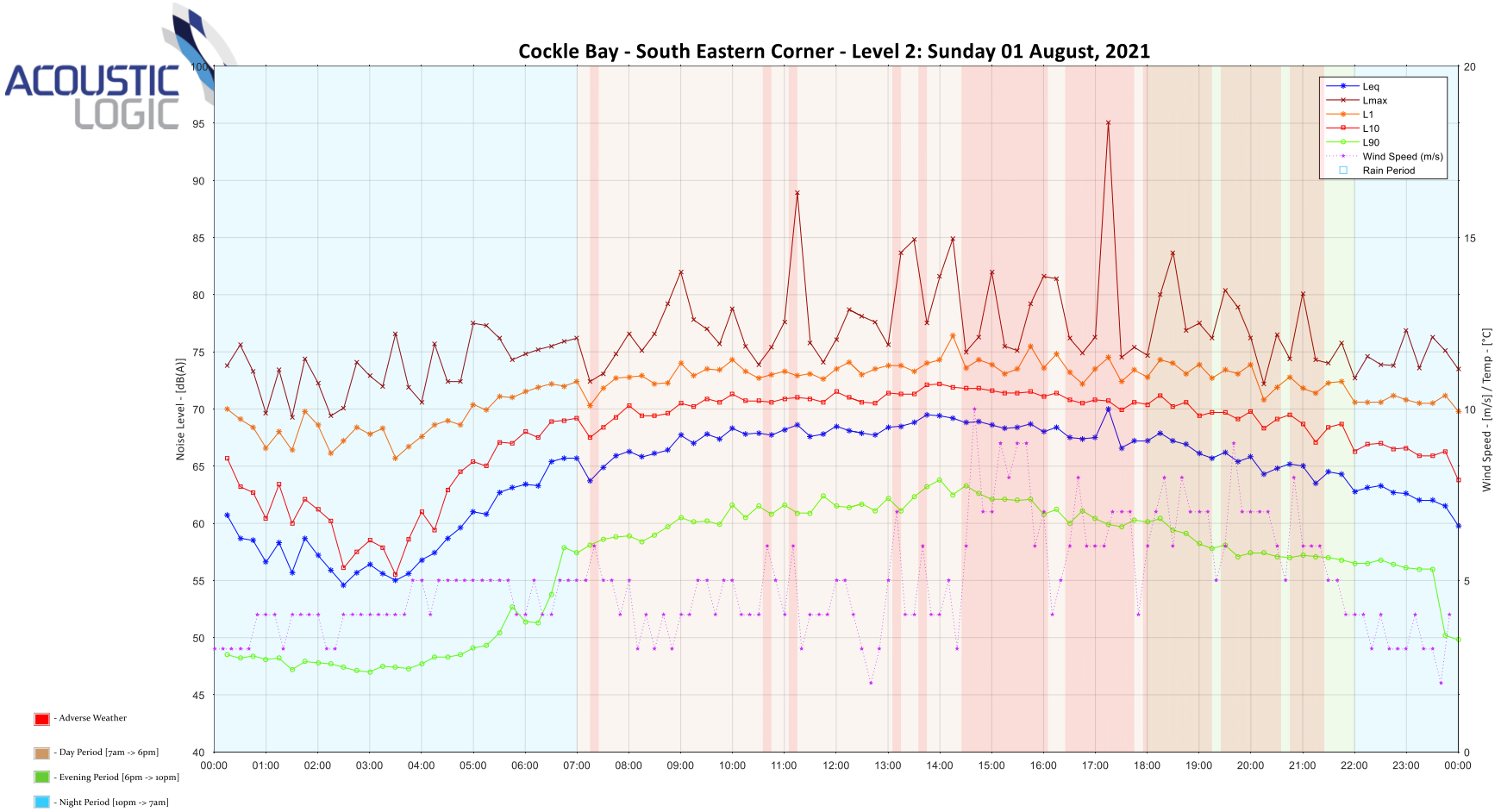

Cockle Bay - South Eastern Corner - Level 2: Wednesday 28 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Cockle Bay - South Eastern Corner - Level 2: Thursday 29 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

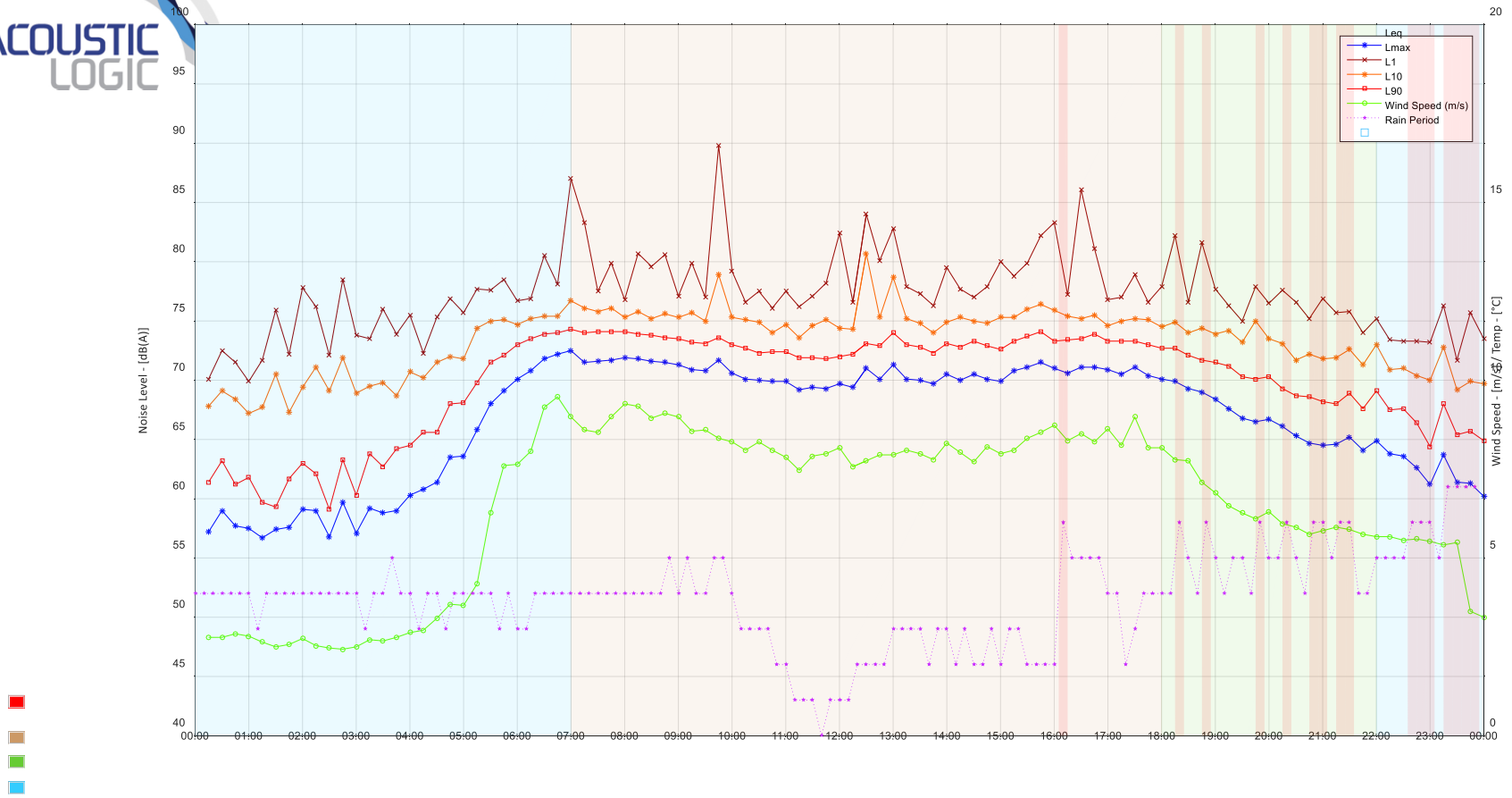
Cockle Bay - South Eastern Corner - Level 2: Friday 30 July, 2021




Cockle Bay - South Eastern Corner - Level 2: Saturday 31 July, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


Cockle Bay - South Eastern Corner - Level 2: Sunday 01 August, 2021
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
Lmax
L1
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

Cockle Bay - South Eastern Corner - Level 2: Monday 02 August, 2021



Cockle Bay - South Eastern Corner - Level 2: Tuesday 03 August, 2021