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Noise Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy (ALC) has been engaged to conduct an acoustic assessment of potential noise impacts associated with the proposed residential development at 9-15 Northumberland Street, Liverpool.

This document addresses noise impacts associated with the following:

- Noise intrusion to project site from adjacent roadways.
- Noise emissions from mechanical plant to service the project site.

ALC have utilised the following documents and regulations in the noise assessment of the development;

- Liverpool Development Control Plan 2008;
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*
- NSW Department of Environment and Heritage, Environmental Protection Agency document – *Noise Policy for Industry* (NPI) 2017

This assessment has been conducted based on the architectural drawings provided by Group GSA Pty Ltd for this project detailed below:

Table 1 – Architectural Drawings for Assessment

Drawing No	Date
DA0000	5/12/2018
DA0001	5/12/2018
DA0002	5/12/2018
DA0003	5/12/2018
DA1001	5/12/2018
DA1100	5/12/2018
DA1101	5/12/2018
DA2000	5/12/2018
DA2001	5/12/2018
DA2002	5/12/2018
DA2003	5/12/2018
DA2004	5/12/2018
DA2005	5/12/2018
DA2006	5/12/2018
DA2007	5/12/2018
DA2008	5/12/2018
DA2010	5/12/2018

DA2450	5/12/2018
DA2451	5/12/2018
DA3000	5/12/2018
DA3001	5/12/2018
DA3002	5/12/2018
DA3100	5/12/2018
DA3101	5/12/2018
DA4000	5/12/2018
DA4001	5/12/2018
DA4100	5/12/2018
DA4101	5/12/2018
DA4102	5/12/2018
DA4103	5/12/2018
DA4104	5/12/2018
DA4105	5/12/2018
DA4106	5/12/2018
DA4107	5/12/2018
DA4108	5/12/2018
DA4109	5/12/2018
DA7001	5/12/2018

2 SITE DESCRIPTION

The proposed development comprises of two levels of basement parking, ground floor common/building management areas and 11 levels of independent living units.

Investigation has been carried out regarding the existing properties and noise impacts surrounding the proposed development, which is detailed below:

- Bounding the development to the east is Northumberland street. Further this across Liverpool Pioneer Memorial Park is Macquarie street.
- Bounding the site to the north, south & west are residential flat buildings.
- Predominant noise impacting the site is from traffic movements along Northumberland, Macquarie & Campbell Streets.

The nearest noise receivers within the site vicinity include:

- R1: Residential Receiver 1 – Multistorey Residential development bounding north to the site located at 17 Northumberland Street.
- R2: Residential Receiver 2 - Multi storey residential apartments to the West of site, located 6,10,18 Bathurst Street.
- R3: Residential Receiver 3 – Multi storey residential apartments bound south to the site located at 7 Northumberland Street.

A site map, measurement description and surrounding receivers are presented in Figure **1** below.

The unattended Noise monitor was placed next to the box hedges between 9 and 11 Northumberland Street, Liverpool, the photos location of the monitor is shown in Figure 2.

Figure 1 - Project Site
Source: NSW Six Maps

3 NOISE DESCRIPTORS

Environmental noise constantly varies constantly, thus 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 15-20-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis with statistical and integrating techniques are used to determine noise description parameters.

The analysis of environmental noise, encompasses three-principle measurement parameters, 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 an 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.

L_{Max} levels represents the loudest noise event during a measurement period.

4 AMBIENT NOISE SURVEY

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) are presented in Table 2.

4.1.1 Measurement Position

One unattended noise monitor was located along southern boundary of 15 Northumberland street with microphone located approximate 15m distance from the kerb. Detail monitor location has been marked on Figure 1 and the photo of noise monitor is below.

4.1.2 Measurement Period

Unattended noise monitoring was conducted from Friday 2nd of November to Friday 9th of November. Attended noise measurements were undertaken between the hours of 3:00pm and 4:00pm on 5th of November 2018.

4.1.3 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 1.

4.1.4 Summarised Rating Background Noise Levels

Summarised rating background noise levels for the project site and immediate surroundings are presented below. Refer to appendix 1 for unattended noise monitor data.

Table 2 – Measured Background Noise Levels

Time of day	Rating Background Noise Level $dB(A)_{L90(Period)}$
Day (7am – 6pm)	46
Evening (6pm – 10pm)	44
Night (10pm – 7am)	39

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Site investigation indicates that the major external noise sources around project site are from traffic movements along Northumberland, Campbell and Macquarie Streets.

5.1 NOISE INTRUSION CRITERIA

A noise intrusion assessment has been conducted based on the requirements of the following acoustic noise criteria and standards;

- Liverpool Development Control Plan 2008;
- Australian Standard AS 2107:2016 *'Recommended design sound levels and reverberation times for building interiors'*

5.2 LIVERPOOL DEVELOPMENT CONTROL PLAN (DCP) 2008

Part 3.7 – Residential Flat Buildings

Section 9 – Amenity and Environmental impact

Acoustic Impact

Control 1 - Noise attenuation measures should be incorporated into building design to ensure acoustic privacy between on-site and adjoining buildings.

Control 2 - Buildings having frontage to a Classified Road or a railway and impacted upon by rail or traffic related noises must incorporate the appropriate noise and vibration mitigation measures into the design in terms of the site layout, building materials and design, orientation of the buildings and location of sleeping and recreation areas.

The Liverpool DCP 2008 contains no specific numerical levels, thus internal sound level limits will be determined from the Australian Standard AS2107:2016 as detailed further within this section.

5.2.1 Australian Standard AS2107:2016 – *Recommended Design Sound Levels and Reverberation Times for Building Interiors*

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential buildings. Table 3 presents the sound levels applicable to the proposed redevelopment.

Table 3 – Recommended Design Sound Levels of AS2107:2016

Space /Activity Type	Recommended Maximum Design Sound Level
Residential – Living Areas	40 dB(A)L_{eq}
Residential – Sleeping Areas (night time)	35 dB(A)L_{eq}

5.3 EXTERNAL NOISE MEASUREMENTS

This section of the report details noise measurements conducted at the site to establish surrounding environmental noise levels impacting the development.

5.3.1 Measurement Equipment

Attended short term measurements of traffic noise were undertaken by this office to supplement the unattended noise monitoring. 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.

Unattended noise monitoring was conducting using one Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to continuously store statistical noise levels as well as audio files 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.

5.3.2 Measurement Location

One unattended noise monitor was located along southern boundary of 15 Northumberland street, detailed monitor location refers to Figure 1 afore.

Attended measurements were taken at the following locations;

- Northumberland Street – Attended noise measurement were conducted on both side of the street, the sound level meter had an unobstructed view of traffic and was approximately 5m from the kerb. Refer to Figure 1 for detailed location.

- Campbell Street -Attended noise measurement conducted along the street facing the traffic, the sound level meter had an unobstructed view of traffic and was approximately 5m from the kerb. Refer to Figure 1 for detailed location.

- Macquarie Street – Attended noise measurement conducted along the street facing the traffic, the sound level meter had an unobstructed view of traffic and was approximately 5m from the kerb. Refer to Figure 1 for detailed location.

5.3.3 Measurement Period

Unattended noise monitoring was conducted from Friday 2nd of November to Friday 9th of November. Attended noise measurements were undertaken between the hours of 3:00pm and 4:00pm on 5th of November 2018

5.3.4 Attended Noise Measurements

Attended noise measurements have been summarised below for each location.

Table 4 – Attended Noise Measurements

Location	Measure Noise Level dB(A) $L_{Aeq\ (15hour)}$
Northumberland St Measurement was conducted 5m from kerb of the Street	55 dB(A)$L_{eq(15min)}$
Campbell St Measurement was conducted 5m from kerb of the Street	64 dB(A)$L_{eq(15min)}$
Macquarie St Measurement was conducted 5m from kerb of the Street	60 dB(A)$L_{eq(15min)}$

5.3.5 Summarised External Noise Levels

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

Table 5 – Measured Traffic Noise Levels

Location	Time of Day	Noise Level – L_{eq}
Northumberland Street (5m from kerb)	Daytime 7am – 10pm	55dB(A) $L_{eq\ (15hr)}$
	Night Time 10pm – 7am	51 dB(A) $L_{eq\ (9hr)}$
Campbell Street (5m from kerb)	Daytime 7am – 10pm	64 dB(A) $L_{eq\ (15hr)}$
	Night Time 10pm – 7am	60 dB(A) $L_{eq\ (9hr)}$
Macquarie Street (5m from kerb)	Daytime 7am – 10pm	60 dB(A) $L_{eq\ (9hr)}$
	Night Time 10pm – 7am	56 dB(A) $L_{eq\ (9hr)}$

5.4 RECOMMENDED CONSTRUCTIONS

Assessment of facade requirements to achieve required indoor noise levels has been undertaken. Dimensions of rooms, setbacks from roadways, window openings and floor areas have been used.

5.4.1 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 Seals are unacceptable**).

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. The recommended constructions are detailed in Table 6.

Table 6 - Recommended Glazing Construction

Façade	Area	Glazing Thickness	Acoustic Seals
All Facade (Facing Northumberland St)	Bedrooms	6mm	Yes
	Living Spaces		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 areas. 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.

Table 7 - Minimum R_w of Glazing Assembly (with Acoustic Seals)

Glazing Assembly	Minimum R_w of Installed Window
6mm Float / Toughened	29

5.4.2 Entry Doors

Entry doors will be via internal corridors and subject to BCA requirements.

5.4.3 External Wall Construction

External walls are of masonry construction and acoustically acceptable without any further treatment. In the event any penetrations are required through the external lining of any of the system for other building services, gaps should be filled with acoustic sealant to ensure compliance with acoustic criteria stipulated within this report.

5.4.4 External Roof & Ceiling Construction

Roof is of masonry construction and acoustically acceptable without any further treatment. In the event any penetrations are required through the external lining of any of the system for other building services, gaps should be filled with acoustic sealant to ensure compliance with acoustic criteria stipulated within this report.

5.4.5 Mechanical Ventilation

With respect to natural ventilation of a dwelling, the NSW Department of Planning Document *Development near Busy Roads and Rail Corridors - Interim Guideline* dictates that:

- *"If internal noise levels with windows or doors open exceed the criteria by more than 10dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and to meet the ventilation requirements of the Building Code of Australia."*

With windows open, the allowable internal noise goal is permitted to be 10dB(A) higher than when the windows are closed (i.e. – allowable level in bedrooms becomes 45dB(A) $L_{eq(9hr)}$, and 50dB(A) $L_{eq(15hr)}$ in living rooms).

- All 4 facades of the development will be able to have windows or doors open to 5% of floor area and achieve required internal noise levels.

Mechanical consultant to confirm if any supplementary ventilation system is required. Any supplementary ventilation system proposed to be installed should be acoustically designed to ensure that the acoustic performance of the acoustic treatments outlined above is not reduced and does not exceed Council criteria for noise emission to nearby properties.

6 NOISE EMISSION CRITERIA

The noise emission from the project site shall comply with the requirements of the following documents;

- Liverpool Development Control Plan 2008;
- NSW Department of Environment and Heritage, *Environmental Protection Agency document – Noise Policy for Industry (NPI) 2017*.

6.1 LIVERPOOL DEVELOPMENT CONTROL PLAN 2008

Part 3.7 – Residential Flat Building

Section 9 – Amenity and Environmental impact

Acoustic Impact

Control 3 - The proposed buildings must comply with the Environment Protection Authority criteria and the current relevant Australian Standards for noise and vibration and quality assurance.

NSW EPA criteria relating to noise emissions is contained in the "Noise for Policy industry" as detailed further within this section

6.2 NSW EPA NOISE POLICY FOR INDUSTRY (NPI) 2017

The EPA NPI have two criteria that needs to 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 facade of an apartment.

6.2.1 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 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Table 2. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

6.2.2 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 2, the Noise Policy for Industry suggests the adoption of the 'urban' categorisation.

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 project site are presented in Table 8

Table 8 – EPA Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(15min)}$
Residential – Urban	Day	60	58
	Evening	50	48
	Night	45	43
Commercial premises	When in use	65	63
Industrial premises	When in use	70	68

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

6.2.3 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:*
>
> - *$L_{Aeq,15min}$ 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 9 - Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Residences Surrounding Site Night (10pm – 7am)	39 dB(A) L_{90}	44 dB(A)$L_{eq,\ 15min}$; 54 dB(A)L_{Fmax}

6.3 SUMMARISED NOISE EMISSION CRITERIA

Table 10 – EPA NPI Noise Emission Criteria (Residents Surrounding Project Site)

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
Day	46	58	51	N/A
Evening	44	48	49	N/A
Night	39	43	44	44 dB(A)$L_{eq,\ 15min}$; 54 dB(A)L_{Fmax}

Table 11 – EPA NPI Noise Emission Criteria (Non-Residential)

Receiver	Time of Day	Amenity Criteria dB(A) L_{eq}
Commercial	When in use	63
Industrial	When in use	68

7 NOISE EMISSION ASSESSMENT

7.1 NOISE FROM MECHANICAL PLANT WITHIN PROPOSED SITE GENERALLY

Detailed plant selection and location has not been undertaken at this stage. Satisfactory levels will be achievable through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers and enclosures.

Noise emissions from all mechanical services to the closest residential receiver should comply with the requirements of Section 6.3.

Detailed acoustic review should be undertaken at CC stage to determine acoustic treatments to control noise emissions to satisfactory levels.

8 CONCLUSION

This report presents an acoustic assessment of noise impacts associated with the development to be located at 9-15 Northumberland Street, Liverpool.

Provided that the recommendations presented in Section 5.4 are adopted, internal noise levels within independent living units of the proposed development will comply with the acoustic requirements listed in the following documents:

- Liverpool Development Control Plans 2008;
- Australian Standard AS 2107:2016 *Recommended design sound levels and reverberation times for building interiors*

External noise emissions criteria have been established in this report based on the requirements listed in the following documents;

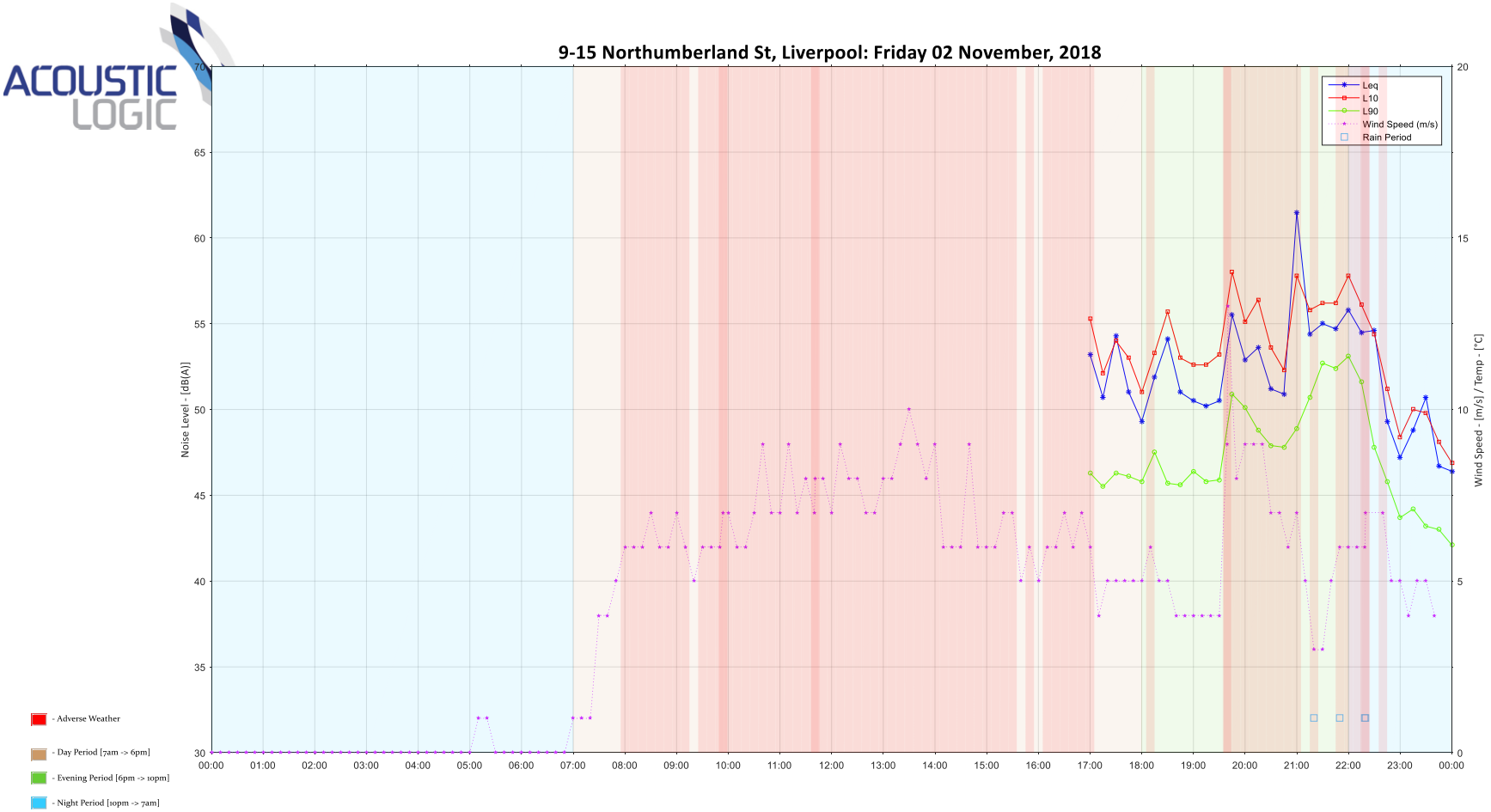
- Liverpool Development Control Plans 2008
- NSW Department of Environment and Heritage, Environmental Protection Agency document – *Noise Policy for Industry* (NPI) 2017

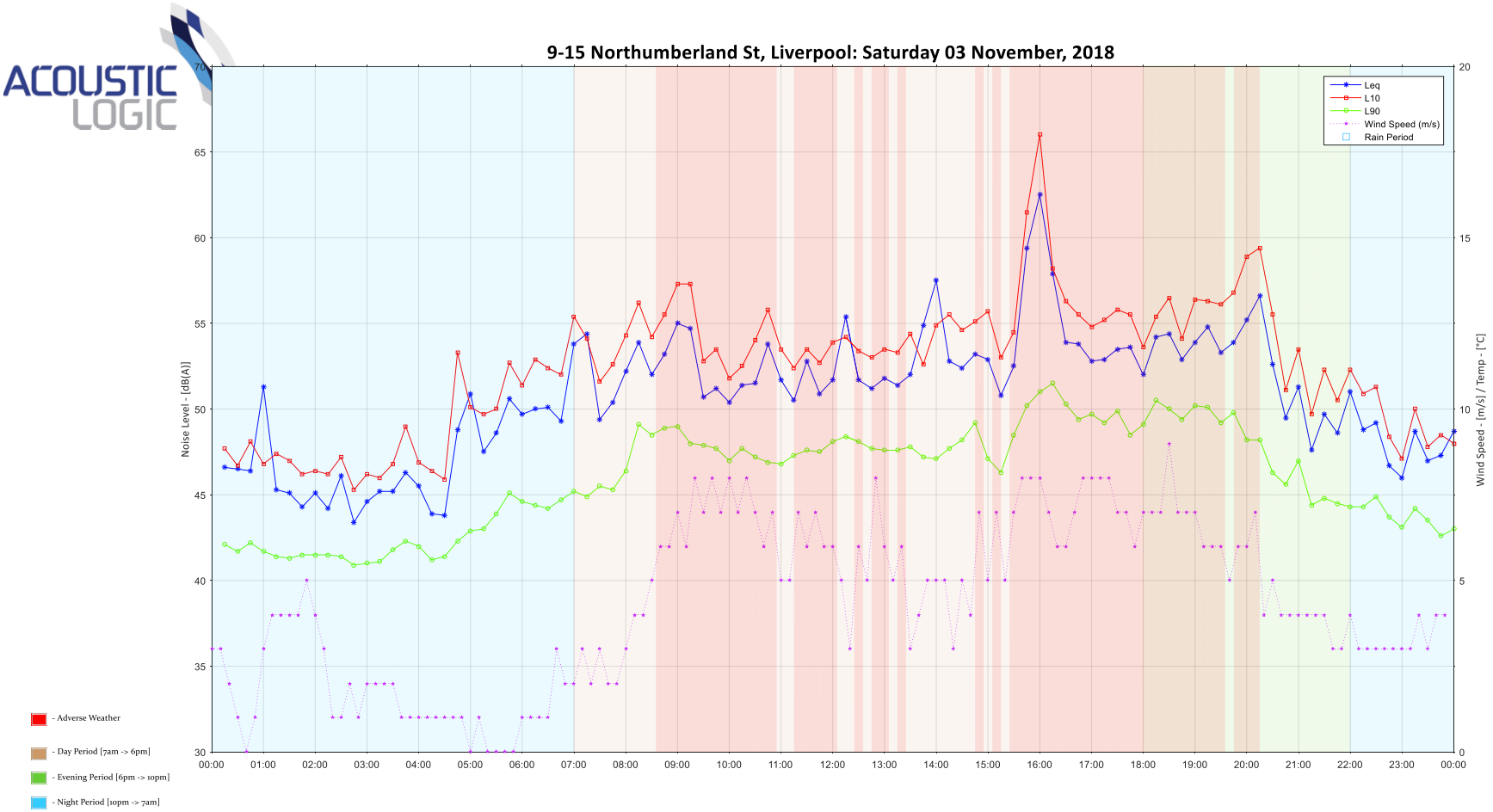
Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Robin Liu

APPENDIX 1 – UNATTENDED NOISE MONITOR DATA


9-15 Northumberland St, Liverpool: Friday 02 November, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
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
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
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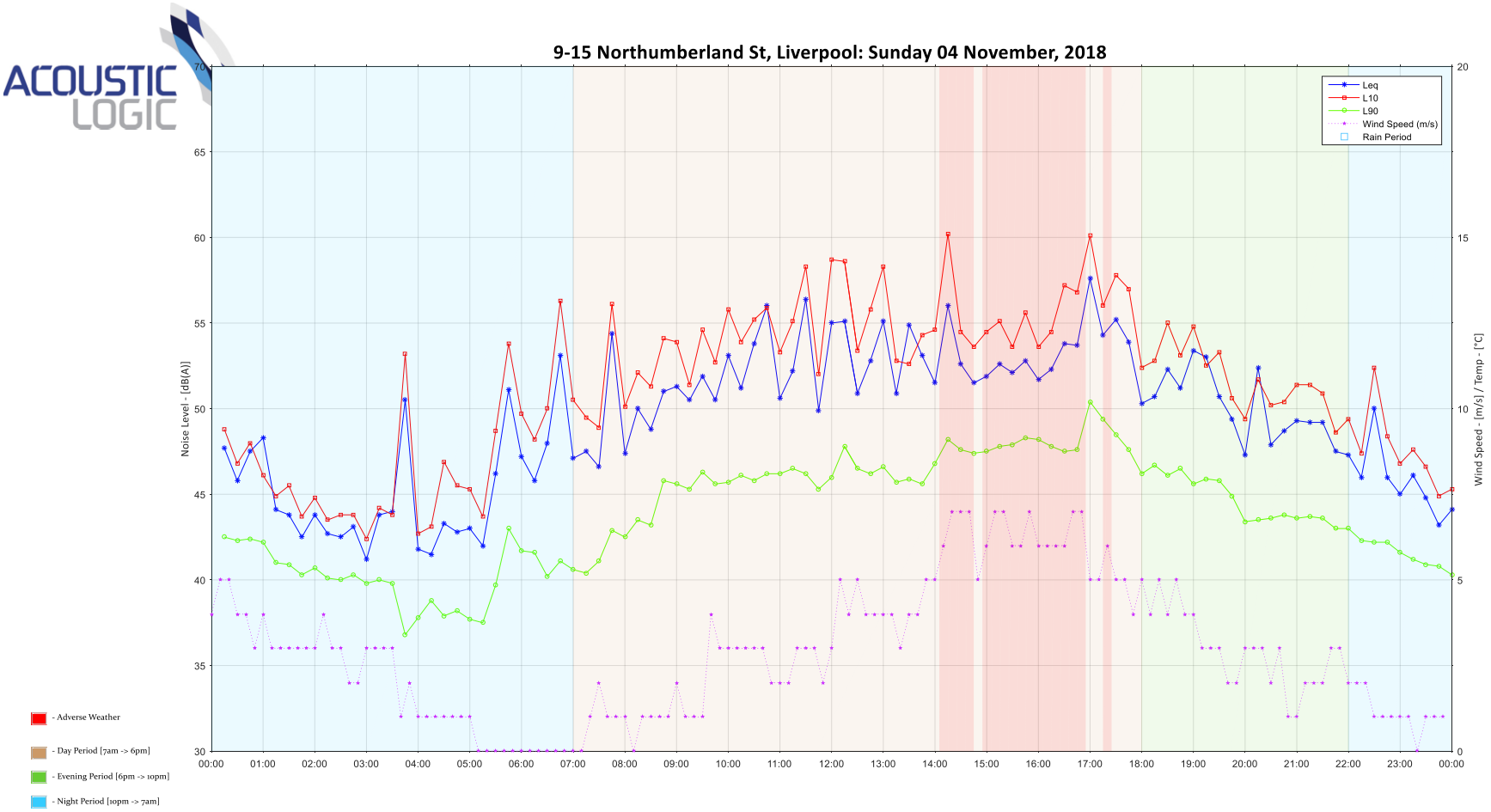
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


9-15 Northumberland St, Liverpool: Sunday 04 November, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
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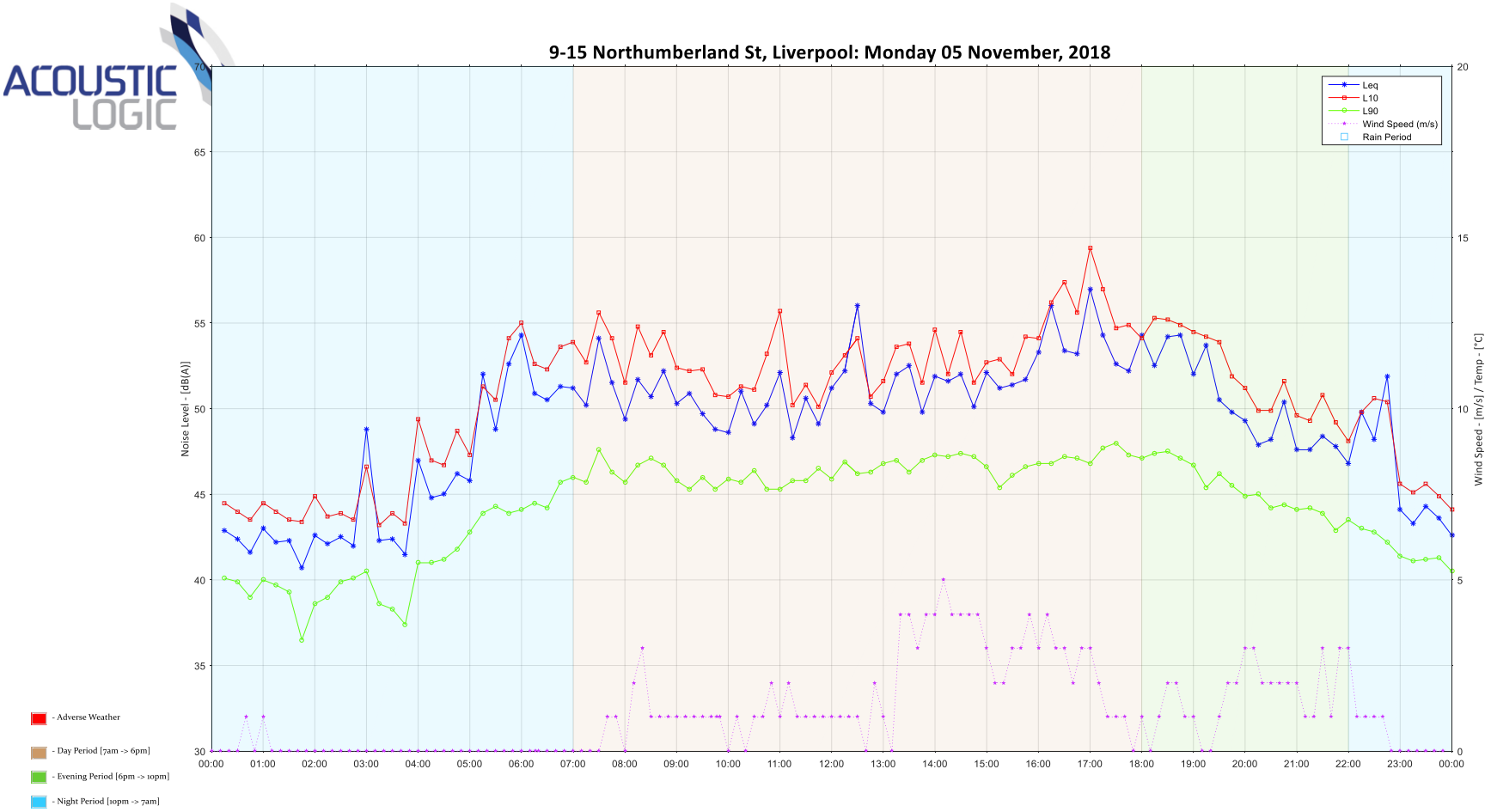
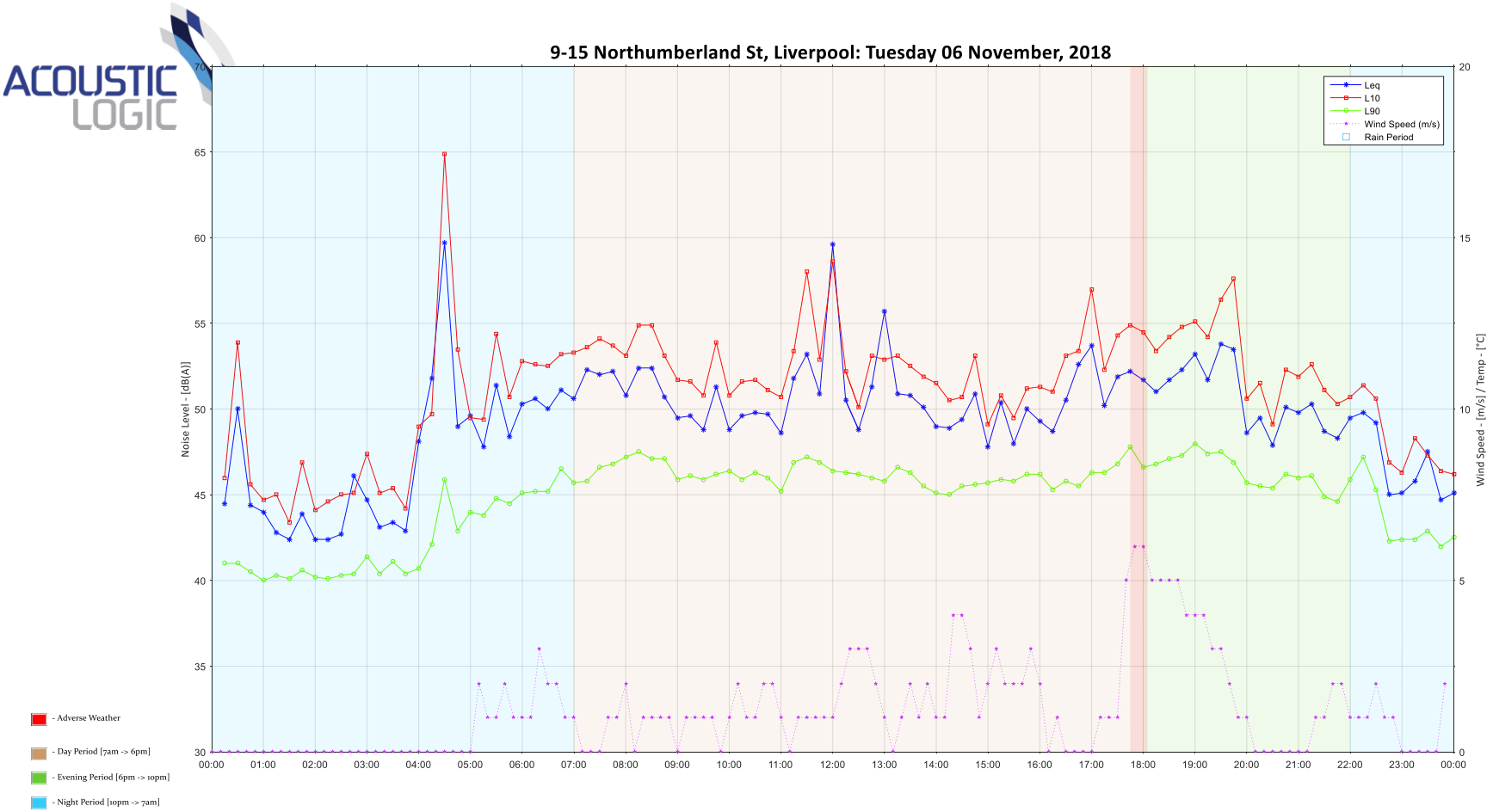
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


9-15 Northumberland St, Liverpool: Monday 05 November, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


9-15 Northumberland St, Liverpool: Tuesday 06 November, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
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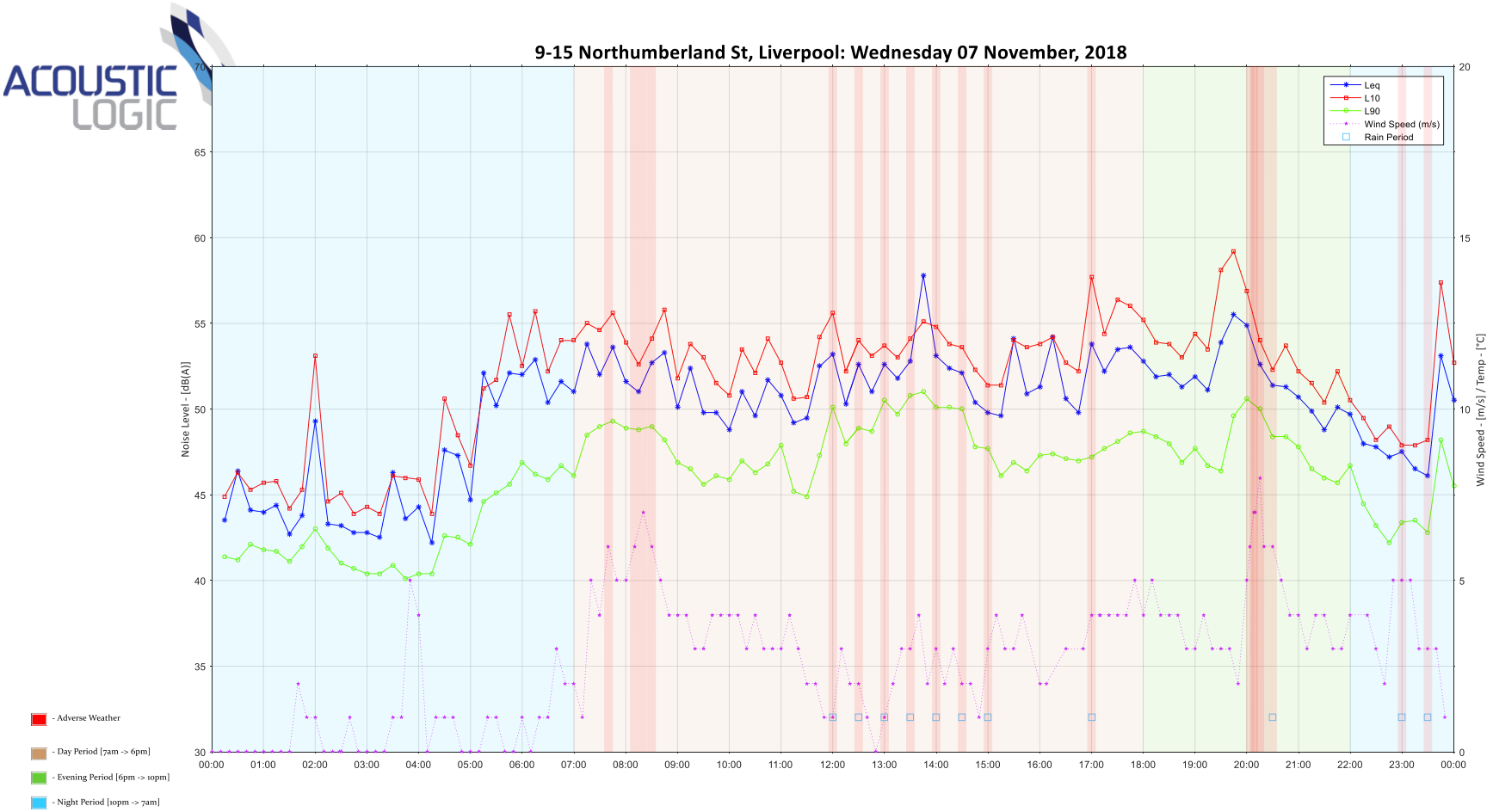
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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L90
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Rain Period
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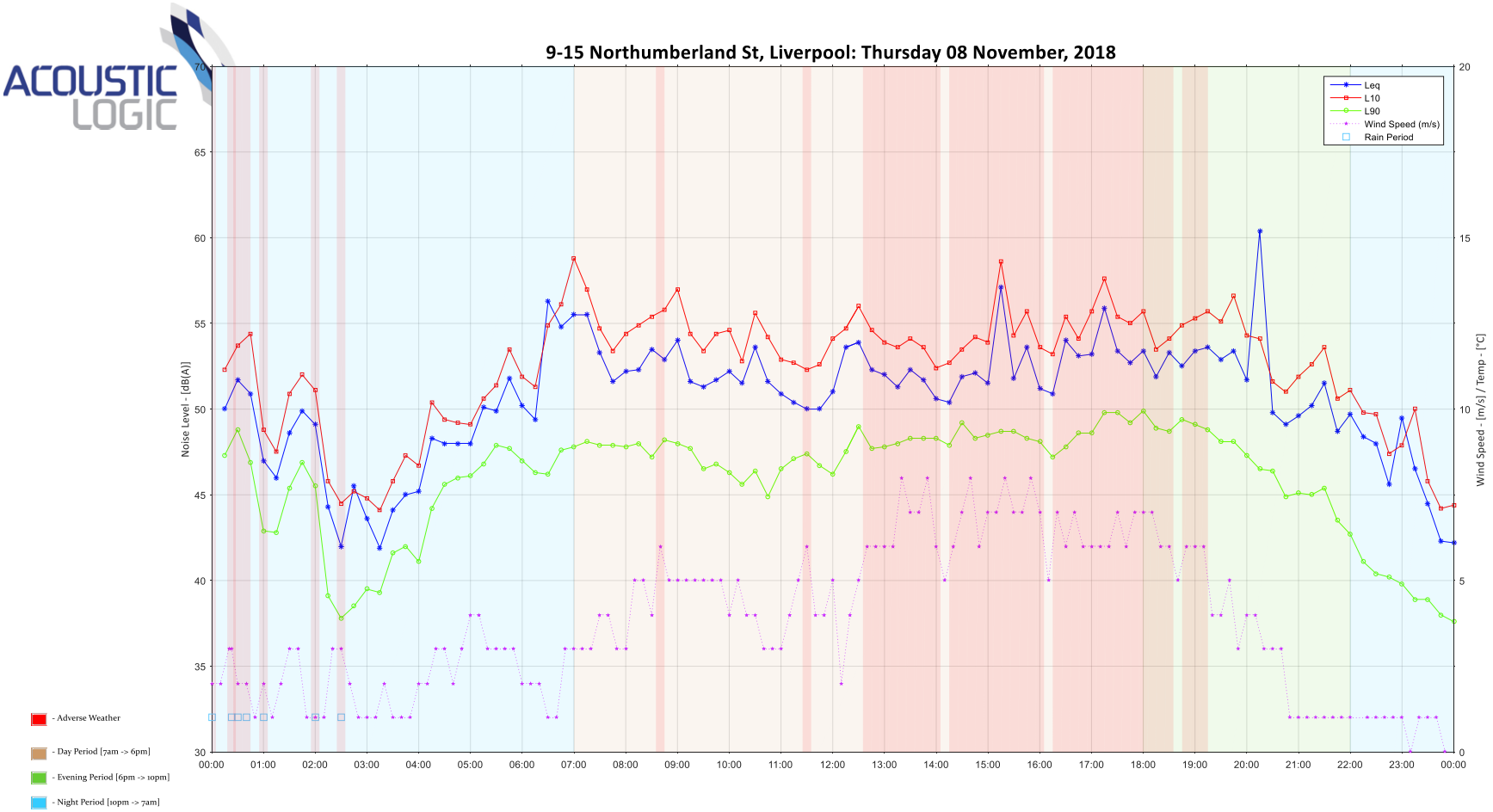
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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Leq
L10
L90
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Rain Period
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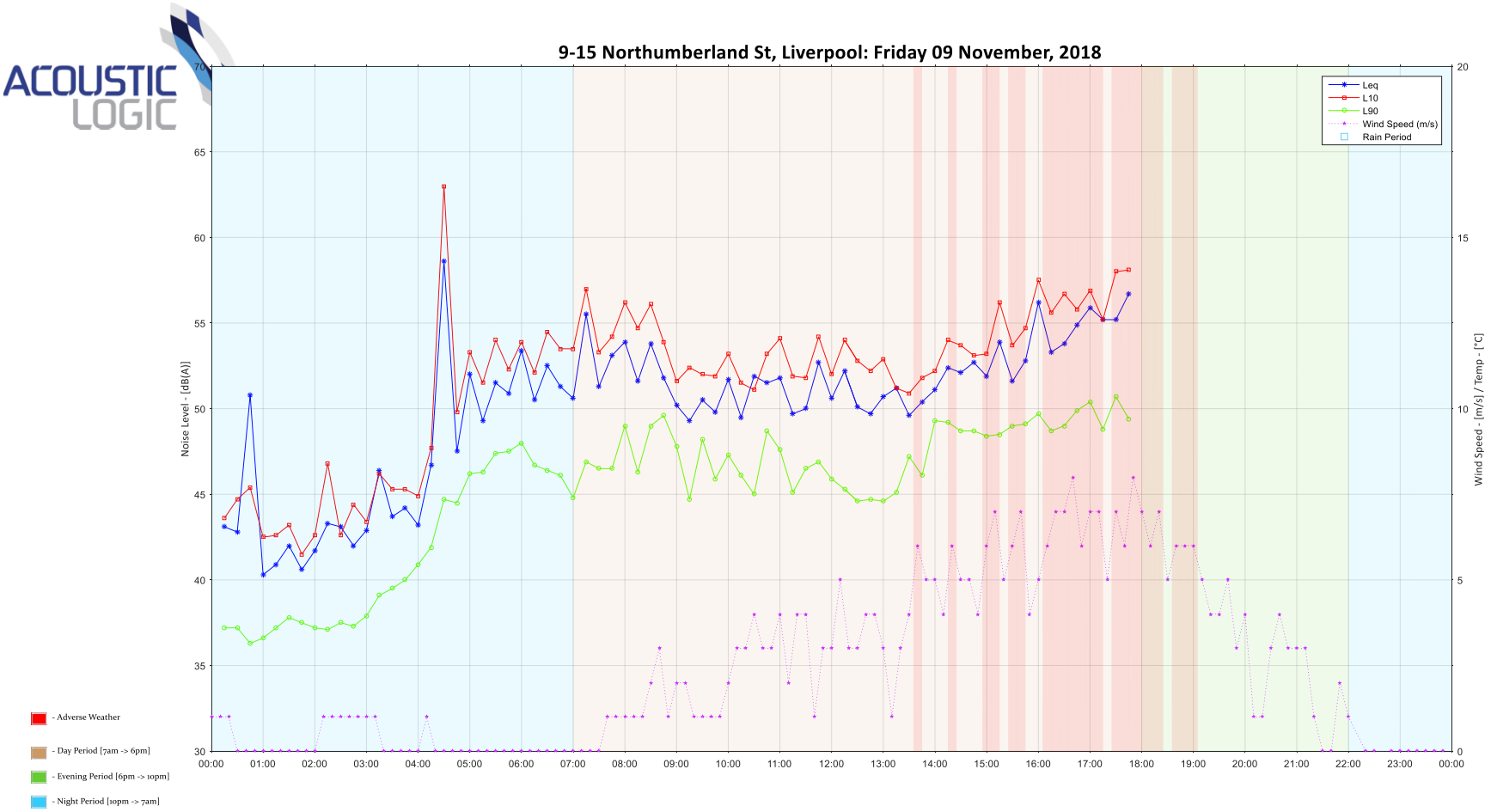
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


9-15 Northumberland St, Liverpool: Friday 09 November, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]