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The New Primary School at Warnervale

Noise & Vibration Impact Assessment

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EXECUTIVE SUMMARY

An assessment of noise and vibration impacts associated with the construction and ongoing use of the New Public School at Warnervale has been conducted. The potential impacts from these activities have been assessed in accordance with the requirements detailed in the SEAR issued for SSD 9439. Results of this assessment have been used to develop controls that will be used to manage potential noise impacts.

The objective of this study is to investigate if the proposed works may be undertaken without having a negative acoustic impact and to protect the amenity of the sensitive receivers surrounding the site. Based on this analysis, controls for the management of noise & vibration have been proposed, which will minimise the potential impacts on the amenity of nearby sensitive receivers.

ALC have concluded from this assessment that based on the proposal, construction and ongoing operation of the New Public School at Warnervale may achieve the requirements detailed in the SEARS for the project.

1 INTRODUCTION

This report presents an analysis of noise impacts associated with the proposed New Primary School at Warnervale to be located at 75 Warnervale Road, Warnervale.

In this report we will assess:

- Acoustic Impacts from the surrounding environment on the development.
- Impacts on the surrounding receivers from the proposed School.

Traffic noise intrusion into the development has been assessed in accordance with;

- Central Coast Council Development Control Plan (DCP);
- NSW Department of Education's *Educational Facilities Standards & Guidelines* (EFSG);
- Australian Standard AS2107:2016.

Noise emission criteria from the development will be set based on;

- Central Coast Council Development Control Plan (DCP);
- The NSW Environmental Protection Authority *Industrial Noise Policy* (INP)
- The Protection of the Environment Operations (Noise Control) Regulation 2008
- The NSW Environmental Protection Authority Road Noise Policy

This assessment is based on the architectural drawings supplied by Billard Leece Partnership, project number 17070, dated 01.08.2019.

2 SITE DESCRIPTION / PROPOSED DEVELOPMENT

The site is located at 75 Warnervale Road, Warnervale. Potential noise impacts on the site are primarily traffic noise from Warnervale Road to the immediate north of the site, which carries low to medium volumes of traffic.

The current proposal relates to the construction of a primary school comprising the following:

- 20 teaching spaces (460 students).
- School Hall
- Library Facility;
- Administration and Staff Building;
- Outdoor Play Areas towards the southern and eastern boundaries of the site.

Noise sensitive receivers in the vicinity of the proposed school development are as follows:

- Receiver 1 (R1): Single storey residential receiver to the immediate east of the site.
- Receiver 2 (R2): Single and two storey residential development to the north of the site, across Warnervale Road.
- Receiver 3 (R3): Single storey residential development located approximately 140m west of the site.

See figure 1 below, which is an aerial photo of the site and surroundings.

Figure 1 - Aerial View of Site and Surroundings

Unattended Noise Monitoring Locations

Attended Noise Monitoring Locations

3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-20 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. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise, three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

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

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 measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of traffic noise.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise intrusion.

4 NOISE INTRUSION ASSESSMENT

The main external noise impact on the proposed development is traffic noise from Warnervale Road to the immediate north of the site, which carried low to medium volumes of traffic.

Noise impacts should comply with the requirements of the Central Coast Council Development Control Plan (DCP) and the NSW Department of Education's *Educational Facilities Standards & Guidelines* (EFSG).

4.1 INTERNAL NOISE CRITIERA

4.1.1 Central Coast Council DCP

There are no quantitative acoustic criteria stated in the Central Council DCP relating to external noise intrusion for school developments. Given this, external noise intrusion criteria for the proposed development will be formulated with reference to the NSW Department of Education's *Educational Facilities Standards & Guidelines* (EFSG).

4.1.2 NSW Department of Education's EFSG.

Table 11.06.1 of the EFSG presents recommended internal noise criteria for various spaces within school developments. The relevant criteria are presented in the table below.

Table 1 – EFSG Recommended Internal Noise Criteria

Room	Internal Noise Criteria
Teaching Spaces, Primary Schools	35 dB(A) $L_{eq(15hr)}$
Office Areas	40 dB(A) $L_{eq(15hr)}$
Libraries – General Areas	40 dB(A) $L_{eq(15hr)}$
Libraries – Reading Areas	35 dB(A) $L_{eq(15hr)}$
Assembly Halls	35 dB(A) $L_{eq(15hr)}$

4.1.3 NSW Environmental Protection Authority (EPA) – *Road Noise Policy (RNP) 2011*

Table 4 of the *Road Noise Policy* states the following noise levels for areas on the proposed school.

Table 2 – Assessment Noise Levels for Schools – Road Noise Policy

Land Use	Internal noise level
School Classrooms	40 dB(A) $L_{eq(1hour)}$
Open Space (Active Use)	60 dB(A) $L_{eq(15hour)}$
Open Space (Passive Use)	55 dB(A) $L_{eq(15hour)}$

In addition, the following comments are made within the policy relating to open spaces:

> *Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.*
>
> *Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.*
>
> *In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the most stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.*

4.1.4 NSW Department of Planning - *Development Near Rail Corridors and Busy Roads-Interim Guideline*

Section 3.6 of the interim guideline details internal noise level requirements for land uses adjacent to rail corridors and busy roads as detailed in the Infrastructure SEPP. While the requirements for noise requirements for residential buildings are specified in SEPP (Infrastructure) 2007, the requirements for other building types are based on the *Environmental Criteria for Road Traffic Noise* (EPA 1999) and detailed in Table 3.

Table 3 – Requirements of Development near Rail Corridors and Busy Roads

Space	Recommended Max Level
Educational Institutions	40 dB(A) $L_{eq(1hour)}$

4.1.5 Storm Water Noise

EFSG states:

Rain noise is to be assessed only for general learning areas, music, drama, movement studios and halls or as otherwise directed. Rain is to be assessed using the one-year annual recurrence, one-hour event for the region as reported by the Bureau of Meteorology. A recognised rain noise calculation procedure (such as Dubout, 1969 or Griffin, Ballagh, 2012) shall be used

Roofs are to be specified during the detailed design phase of the project such that the levels of rain noise at 15 mm/hr rainfall rate (defined as 'intense' rain in ISO 10140-5:2010/Amd 1:20141) do not exceed the maximum noise levels for normal operations by more than 5 dB. Assessment is to apply to rain noise only not including other noise contributions such as building services.

Any external façade features, such as solar shading devices are to be assessed during detailed design so that the levels of rain noise at 15 mm/hr rainfall rate (defined as 'intense' rain in ISO 10140-5:2010/And 1:2014) do not exceed the internal noise limits for normal operations by more than 5 dB. Assessment is to apply to rain noise only not including other noise contributions such as building services.

4.1.6 Wind noise

- External elements on the building such as façade details, louvres, shading devices etc. shall not result in creaking, audible tones, whistling etc.
- Noise from wind of < 8 m/s shall not result in the internal noise criteria being exceeded.

4.2 TRAFFIC NOISE MONITORING

As part of this investigation, traffic noise from the surrounding perimeter roadways has been measured. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Noise levels measurements conducted at the location as detailed in Figure 1 above.

4.2.1 Unattended Noise Measurements

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

One noise monitor was set up at 30-52 Warnervale Road to the east of the site. A second monitor was installed at 32 Wyreema Road to the north of the site, across Warnervale Road. Both noise monitors were on site from the 26th September to the 4th October 2018.

Refer to Appendices 1 and 2 for the unattended noise monitoring data.

4.2.2 Attended Noise Measurements

Attended noise measurements were carried out to supplement unattended noise monitoring between the hours of 1:00pm-2:30pm on the 4th October 2018. Noise was measured from the use of surrounding roadways. Measurements were undertaken using a Norsonics Type 140 precision sound level analyser, set to A-weighted fast response. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 precision sound level calibrator. No significant drift was recorded.

4.2.3 Traffic Noise Levels

The following table presents the resultant noise levels from undertaken measurements.

Table 4 – Measured Traffic Noise Levels

Location	7am to 10pm dB(A)
Warnervale Road 5m from kerb	60dB(A)$L_{eq(15hr)}$ 63dB(A)$L_{eq(worst\ 1hr)}$

4.3 RECOMMENDATIONS

Traffic noise intrusion into the proposed development was assessed using the measured external noise levels reported above as a basis.

Calculations were performed taking into account the orientation of windows, the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted. Acoustic treatment required to ensure compliance with the assessment criteria are detailed in this section.

Internal noise levels will primarily be as a result of noise transfer through the windows and doors as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through the masonry elements will not be significant and need not be considered further.

The constructions necessary to achieve the noise levels are detailed below. The predicted noise levels have been based on the expected level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

4.3.1 Glazed Windows and Doors

Minimum glazing thickness proposed for teaching areas is 6mm Float without acoustic seals. This is acoustically acceptable. Thicker glazing may be necessary to satisfy other requirements such as structural, safety or other considerations.

4.3.2 External Walls

External walls are proposed to be of both a masonry and lightweight construction.

Walls of a masonry construction will not require further acoustic treatment

Lightweight walls will require to have a minimum 92mm stud with 75mm thick 11kg/m^3 insulation within the cavity, with minimum 6mm fibrous cement cladding externally and 13mm plasterboard lining internally. Note that the final construction of the external walls will be determined during detailed design. If there are any changes to the lightweight external walls, this would need to be reviewed acoustically.

4.3.3 Roof / Ceiling Construction

Metal deck roofing is currently proposed. 1 x 13mm thick imperforate plasterboard ceiling (or equivalent) will be required internally with 75mm thick 11kg/m^3 insulation is required within the cavity for the control of environmental noise intrusion.

Note that the final construction of the roof/ceiling construction will be determined during detailed design. If there are any changes to the above details, this would need to be reviewed acoustically.

5 NOISE EMISSION CRITERIA

The SEARS requires a consideration of noise emissions including any public address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.

There are no specific EPA criteria applicable to the acoustic assessment of schools. The NSW Educational SEPP requirement relating to noise emissions is:

> ***6. Noise***
>
> *A new building or (if the development is an alteration or addition to an existing building for the purpose of changing its use) an existing building that is to be used for the purpose of a school or school-based child care must be designed so as not to emit noise exceeding an L_{Aeq} of 5 dB(A) above background noise when measured at any lot boundary.*

Guidelines referenced in the SEARS, as well as other guidelines are provided below:

- EPA Noise Policy for Industry 2017 (applicable for plant/equipment noise)
- EPA Road Noise Policy (for the assessment of noise from traffic generation by the site).
- Development Near Rail Corridors and Busy Roads –Interim Guideline (Department of Planning 2008) (to assess noise from traffic on the subject development)
- NSW EPA Interim Construction Noise Guideline.
- Assessing Vibration: A Technical Guideline (EPA, 2006)

We note that the EPA Noise Policy for Industry noise trigger levels are not strictly applicable to school developments. They are primarily intended to assess noise emissions from industrial/commercial developments. However, it is the most useful guideline policy for the assessment of plant and equipment noise impact to surrounding receivers.

In our experience it is extremely common in the assessment of noise generation by schools that compliance with acoustic guidelines (in particular noise from playgrounds and during pick up/drop off) is not required (and for schools located in residential areas, it is in fact generally not achievable). The NSW Educational SEPP requires noise emissions from school buildings to be limited, and there is no requirement related to external uses.

An outline of relevant acoustic criteria is presented below.

5.1 BACKGROUND NOISE MONITORING

5.1.1 Unattended Noise Measurements

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

One noise monitor was set up at 30-52 Warnervale Road to the east of the site. A second monitor was installed at 32 Wyreema Road to the north of the site, across Warnervale Road. Both noise monitors were on site from the 26th September to the 4th October 2018.

Refer to Appendices 1 and 2 for the unattended noise monitoring data.

Measured background noise levels are presented below.

Table 5 - Measured Background Noise Levels

Location	Period/Time	Background Noise Level dB(A) L_{90}
Nearby Residences to the East and West (R1 & R3)	Day (7am-6pm)	36
	Evening (6pm-10pm)	34
	Night (10pm-7am)	30
Nearby Residences to the North (R2)	Day (7am-6pm)	38
	Evening (6pm-10pm)	35
	Night (10pm-7am)	30

5.2 EDUCATIONAL SEPP

The following table outlines the criteria to assess noise emissions from school buildings:

Table 6- NSW Educational SEPP Criteria

Location	Time of Day	Rating Background Noise Level dB(A)L_{90}	Intrusiveness Noise Objective dB(A) $L_{eq(15min)}$ (Background + 5dB)
Nearby Residences to the East and West (R1 & R3)	Day Time (7am – 6pm)	36	41
	Evening (6pm-10pm)	34	39
Nearby Residences to the North (R2)	Day Time (7am – 6pm)	38	43
	Evening (6pm-10pm)	35	40

5.3 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS/DROP OFF ZONE

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 7 - Criteria for Traffic Noise Generated by New Developments

Road Type	Time of day	Permissible Noise Generation
Local Road (Warnervale Road)	Day (7am to 10pm)	55 dB(A)$L_{eq(1hr)}$
	Night (10pm to 7am)	50 dB(A)$L_{eq(1hr)}$

However, if existing noise levels exceed those in the table above, section 3.4 of the Road Noise Policy is applicable, which states that an increase in the existing noise level of 2dB(A) would be considered a barely perceptible increase to the average person.

5.4 NSW EPA NOISE POLICY FOR INDUSTRY (MECHANICAL PLANT & CAR PARK NOISE)

The NSW EPA Noise Policy for Industry 2017, has two criteria which need to be satisfied; namely the Intrusiveness noise level criteria and the Project amenity noise level criteria. The project noise trigger level is then established based on the lower of the intrusiveness and project amenity levels.

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

5.4.1.1 Intrusiveness Noise Level Criteria

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 do 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 Section 5.1.1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

Table 8 – Intrusiveness Noise Level Criteria

Location	Period/Time	Intrusiveness Noise Level Criteria dB(A) $L_{eq(15min)}$
Nearby Residences to the East and West (R1 & R3)	Day (7am-6pm)	41
	Evening (6pm-10pm)	39
	Night (10pm-7am)	35
Nearby Residences to the North (R2)	Day (7am-6pm)	43
	Evening (6pm-10pm)	40
	Night (10pm-7am)	35

5.4.1.2 Project Amenity Noise Level Criteria

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 NSW EPA Industrial noise policy sets out acceptable noise levels for various localities. Table 2.2 on page 11 of the policy indicates 3 categories to distinguish different residential areas. They are rural, suburban, urban. This site is categorised by rural receivers.

For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm.
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

The project amenity noise level is calculated by taking the recommended amenity noise level (as presented in table 2.2 of the policy), subtracting 5dB(A) and then adding 3dB(A) to convert from $L_{Aeq,\ period}$ to a $L_{Aeq,\ 15\ minute}$ descriptor. The project amenity noise level criteria are presented in the table below.

Table 9 – Project Amenity Noise Level Criteria

Location	Period/Time	Project Amenity Noise Level Criteria dB(A) $L_{eq(15min)}$
Nearby Residences – Rural Receiver	Day (7am-6pm)	48
	Evening (6pm-10pm)	43
	Night (10pm-7am)	38

5.4.1.3 Project Noise Trigger Level

The project noise trigger level (as outlined in section 2.1 of the policy) is the lower of the intrusiveness and project amenity noise levels. The project noise trigger levels are presented in the table below.

Table 10 – Project Noise Trigger Level Criteria

Location	Period/Time	Project Noise Trigger Level Criteria dB(A) $L_{eq(15min)}$
Nearby Residences to the East and West (R1 & R3)	Day (7am-6pm)	41
	Evening (6pm-10pm)	39
	Night (10pm-7am)	35
Nearby Residences to the North (R2)	Day (7am-6pm)	43
	Evening (6pm-10pm)	40
	Night (10pm-7am)	35

6 ASSESSMENT OF NOISE EMISSIONS

An assessment of operational noise emissions is presented. The following noise sources are assessed:

- Noise from internal areas
- Noise from mechanical plant, PA system and school bells.
- Traffic generation
- Waste Removal
- External activities

6.1 NOISE FROM INTERNAL SPACES

The administration and teaching spaces generate low to medium levels of noise. The teaching spaces are typically at least 30m from any residential receiver and emissions from these spaces would clearly not exceed the Educational SEPP criteria.

6.1.1 Community Hall

A community hall located in the north-eastern portion of the site may be used for presentations and performances. The hall opens to the west and south (facing internal courtyard of the school). There are no proposed openings on the northern façade. Noise emissions to the surrounding properties was calculated based on the following assumptions:

- Hall internal noise level of 80 dB(A) $L_{eq,15min}$ representing the sound level during a music performance.
- Doors located on the western elevation of the hall (closest to residents) are either open or partially closed, with doors having a minimum acoustic rating of R_w 20 when closed.
- Doors located on the southern façade are open at all times.

Table 11 – Predicted Noise Levels from Community Hall Use

Doors Open/Closed	Receiver Location	Predicted Noise Level	Timer Period	Noise Objective (Education SEPP - BG + 5 dB(A))	Comments
Doors Open to 40% of Total Area	Residents to the West (R2)	43 dB(A) $L_{eq(15min)}$	Daytime (7am – 6pm)	≤ 43 dB(A) $L_{eq(15min)}$	Achieves Noise Objective
			Evening (6pm – 10pm)	≤ 40 dB(A) $L_{eq(15min)}$	Marginal Exceedance of Noise Objective
	Residents to the East (R1)t	<30 dB(A) $L_{eq(15min)}$	Daytime (7am – 6pm)	≤ 41 dB(A) $L_{eq(15min)}$	Achieves Noise Objective
			Evening (6pm – 10pm)	≤ 39 dB(A) $L_{eq(15min)}$	
Doors Closed with Minimum R_w 20 Glazing Installed	Residents to the West (R2)	<30 dB(A) $L_{eq(15min)}$	Daytime (7am – 6pm)	≤ 43 dB(A) $L_{eq(15min)}$	Achieves Noise Objective
			Evening (6pm – 10pm)	≤ 40 dB(A) $L_{eq(15min)}$	
	Residents to the East (R1)t	<30 dB(A) $L_{eq(15min)}$	Daytime (7am – 6pm)	≤ 41 dB(A) $L_{eq(15min)}$	Achieves Noise Objective
			Evening (6pm – 10pm)	≤ 39 dB(A) $L_{eq(15min)}$	

Findings:

If the open area of the western façade is reduced to 40% of the total area, then noise objectives are achieved to all residents during the daytime period.

Use of the community hall in the evening period for events involving the use of a sound system would require that western façade was fully closed. The southern façade may remain open during this time.

6.2 NOISE FROM MECHANICAL PLANT, SCHOOL BUILDINGS PUBLIC ADDRESS SYSTEM AND SCHOOL BELL

Detailed acoustic design of mechanical plant cannot be undertaken at approval stage, as plant selections and locations are not finalised. However, detailed acoustic assessment of all ventilation or other plant items should be undertaken at CC stage, once equipment items are selected and location is finalised.

Given the proposed buildings are remote from existing residential buildings, it is both possible and practical to treat noise from the operation of the proposed mechanical equipment to comply with the EPA NPI criteria detailed in Section 5.4 using standard acoustic treatments such as lined ductwork, silencers, screens and the like.

With regard to the school bell/PA system, the system should minimise noise spill to adjacent properties. General design principles which could be used to manage this noise include the following:

- Speaker positioning/selection:
    - Speaker location and direction can be used to reduce noise spill to neighbouring properties while still maintaining suitable noise levels within the school grounds (typically 70-75dB(A)).
    - Broadly speaking, more speakers, closer to the noise receiver is a more effective way to provide coverage of the external areas while reducing noise spill to neighbouring properties.
    - Similarly, highly directional speakers (angled downwards) will also reduce noise spill. Speakers with a drop of at least 5dB(A) for mid-frequencies noise for each 10 degrees in the horizontal plane outside of the coverage area should be considered.

6.3 TRAFFIC GENERATION

Two carparks are proposed for the site, with a total 21 staff spaces, 5 visitor & 2 accessible spaces allocated. 21 staff spaces are allocated on the western side of the school, with 5 visitor and two disabled on the eastern side accessed from the service delivery road. In addition, a drop off/pick up area for students is located on the western portion of the site, with access via a roundabout from Warnervale Road. Bus drop off for students will be located along Warnervale Road at the main entrance to the school.

For the purposes of the assessment, Warnervale road is considered to be a local road and as such the $L_{eq(1hr)}$ noise descriptor is appropriate as described in the NSW Road Noise Policy.

A traffic assessment has been prepared for the site, which predicts the likely traffic generation and peak hour vehicle movements to the school (pick up and drop off). The predicted peak traffic generation during the morning or afternoon peak to/from the school is 306 vehicles for a school capacity of 500 students, representing the highest volume of likely traffic generation to the site.

Using a sound power level for a car travelling at 40km/of 93 dB(A), the 306 predicted traffic movements in a peak one hour period would result in a traffic noise level from the additional traffic of approximately 58 dB(A)L_{eq1hr}.

Combining the predicted future traffic noise generation for the site with the existing noise levels from traffic, the predicted noise level to the façade of nearby residents along Warnervale Road would be approximately 64dB(A) $L_{eq(1hr)}$, which meets the 2dB(A) noise increase requirement, and as such meets the requirements of the NSW EPA Road Noise Policy for additional traffic generation from new development (as detailed in Section 5.3).

6.4 WASTE REMOVAL

Waste collection should be scheduled to occur during the day time period only (7am – 6pm) to avoid disturbance to nearby residents outside of these hours. In particular, there should be no collection of waste during the night time period (10pm - 7am).

6.5 NORMAL SCHOOL EXTERNAL ACTIVITIES

There are no criteria to be met regarding normal activities conducted by the school. Excepting sporting fields, a majority of outdoor play areas are semi-enclosed by the proposed building form, creating a barrier between nearby residents and external play areas.

Sporting fields are generally located on the south-western portion of the school and are separated from residents to all surrounding residents by distance buffers of approximately 100m.

6.6 NON-SCHOOL USES, AND AFTER-HOURS SCHOOL ACTIVITIES

After hour school activities would largely relate to use of the school hall as assessed above. There could also be other “quiet” activities that may occur externally or within the buildings that would not result in significant emissions. This would include parent/teacher nights, election activities, etc. Where music practice occurs within a school classroom outside of normal hours the windows of the rooms should be kept closed.

It is proposed that there would be an outside of hours school care facility which operated from the school both before and after regular school hours. This facility would typically operate between 7am – 9am (before school) and 3pm – 6pm (after school). During these times it would be expected that students would make use of external areas of the school as well as internal activities within the hall.

Specific details of the operational requirements for the out of hours care (such as student capacity) are not currently available. It is recommended that a management plan for the out of hours care be prepared detailing the measures required to meet the noise emission requirements in Section 5 of this report – an acoustic assessment may be required to confirm the appropriateness of these measures. Provided that suitable management controls are implemented, it expected that operation of the out of school hours facility would be able to achieve the noise emission criteria.

6.7 OPERATIONAL VIBRATION EMISSION ASSESSMENT

There would be no vibration impact from the proposal as there would be no vibration sources that would produce perceptible vibration on any surrounding property.

7 CONSTRUCTION NOISE ASSESSMENT

7.1 CONSTRUCTION CRITERIA

7.1.1 Construction Noise

7.1.1.1 EPA Interim Construction Noise Guideline

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

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

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

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

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

A summary of the above noise management levels from the ICNG is presented below in Table 12. In order to present a conservative assessment, the lowest daytime rating background noise level determined from monitoring has been used as a basis for calculation of the 'Noise Affected Level'.

Table 12 – Noise Management Levels - Residential

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Nearby Residences to the East and West (R1 & R3)	46	75
Nearby Residences to the North (R2)	48	75

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

7.1.2 Construction Vibration

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*

- For human exposure to vibration, the evaluation levels presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

7.1.2.1 Structure Borne Vibrations (Building Damage Levels)

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

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

Table 13 – 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

Nearby residences would be classified as a type 2 structure.

7.1.2.2 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. Relevant vibration levels are presented below.

Table 14 – EPA Recommended Vibration Levels

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

7.2 CONSTRUCTION IMPACTS

7.2.1 Noise Impacts

Primary noise generating activities which are a part of this application are land clearing, localised excavation for building structures and structural works (formwork construction, concrete pumps, slab finishing works). Use of hand tools, particularly in external areas will also have the potential to result in noise levels intermittently exceeding EPA guidelines.

Typically, construction noise and vibration would be reviewed in detail after approval stage (once a contractor is appointed and construction methods and durations have been agreed on). It is common practice that a condition of consent be imposed requiring that a Construction Noise and Vibration Management Plan be prepared prior to commencement of works.

However, based on preliminary review, we note:

- Exceedance of the “background+10dB(A)” noise goal will be unavoidable at times given the proximity to the nearby residences.
- Acoustic treatments such as noise screens around work areas may provide some benefit to surrounding residents pending the relative height of the worksite to adjacent residents.

In light of the above, a noise management plan will be critical to ensure reasonable amenity for the nearby residents. We recommend that any construction noise management plan should consider:

- Notification of the noisy works (excavation, concrete pours) should be provided to the nearby residents. The notification should outline the expected duration of the activity and provide contact details in the event of complaint.
- Dumping/loading of waste material should be done as far as practicable from the residential properties.
- Location of concrete pumps as far as practicable from residential property boundaries.

7.2.2 Vibration Impacts

Primary vibration generating activities are bulk excavation (if in rock) and demolition. We note that significant excavation is not expected to be required for this project..

Excavation in soil is not typically expected to create vibration levels exceeding EPA guidelines.

Given the distance between proposed construction works on site and nearby receivers, exceedance of vibration criteria is not likely.

8 CONCLUSION

Noise intrusion impacts on the proposed Warnervale Public School at 75 Warnervale Road, Warnervale have been assessed.

Provided that the acoustic treatments set out in Section 4.3 of this report are adopted, traffic noise impacts on the development will comply with the requirements of;

- Central Coast Council DCP
- NSW Department of Education's EFSG.
- NSW Environmental Protection Authority (EPA) – *Road Noise Policy (RNP) 2011*
- NSW Government Depart of Planning - *Development Near Rail Corridors and Busy Roads-Interim Guideline*

Noise & vibration emission criteria have been established in Section 5 of this report based on the requirements of the following documents;

- EPA Noise Policy for Industry 2017 (applicable for plant/equipment noise)
- EPA Road Noise Policy (for the assessment of noise from traffic generation by the site).
- Development Near Rail Corridors and Busy Roads –Interim Guideline (Department of Planning 2008) (to assess noise from traffic on the subject development)
- NSW EPA Interim Construction Noise Guideline.
- Assessing Vibration: A Technical Guideline (EPA, 2006)

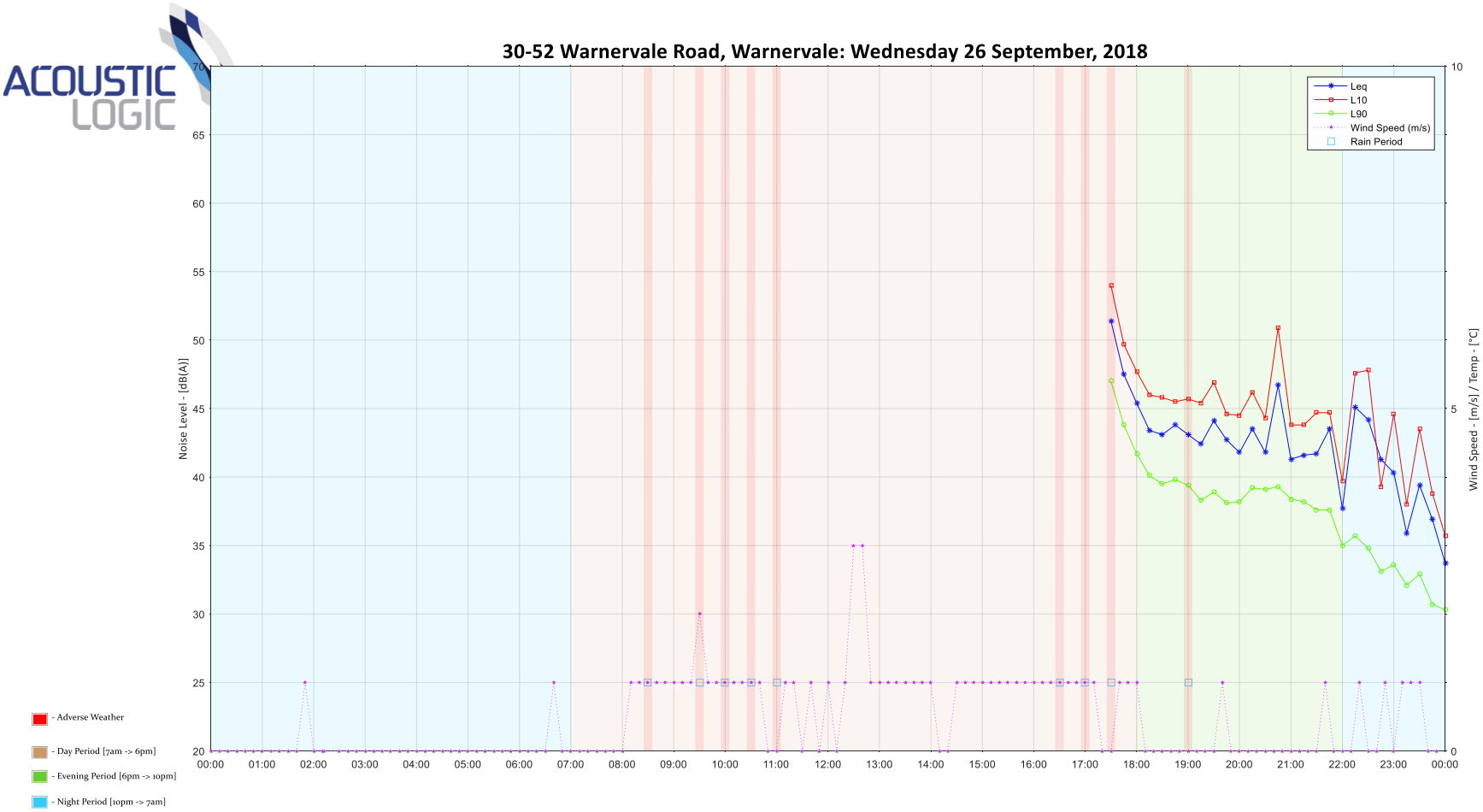
No particular engineering controls are recommended in the management of noise emissions from children playing, or use of the on site carpark. Detailed acoustic treatment to mechanical plant and equipment and to PA/bell system will be determined at CC Stage (if required).

Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Alex Washer

APPENDIX ONE – UNATTENDED NOISE MONITORING DATA – LOCATION ONE - 30-52 WARNERVALE ROAD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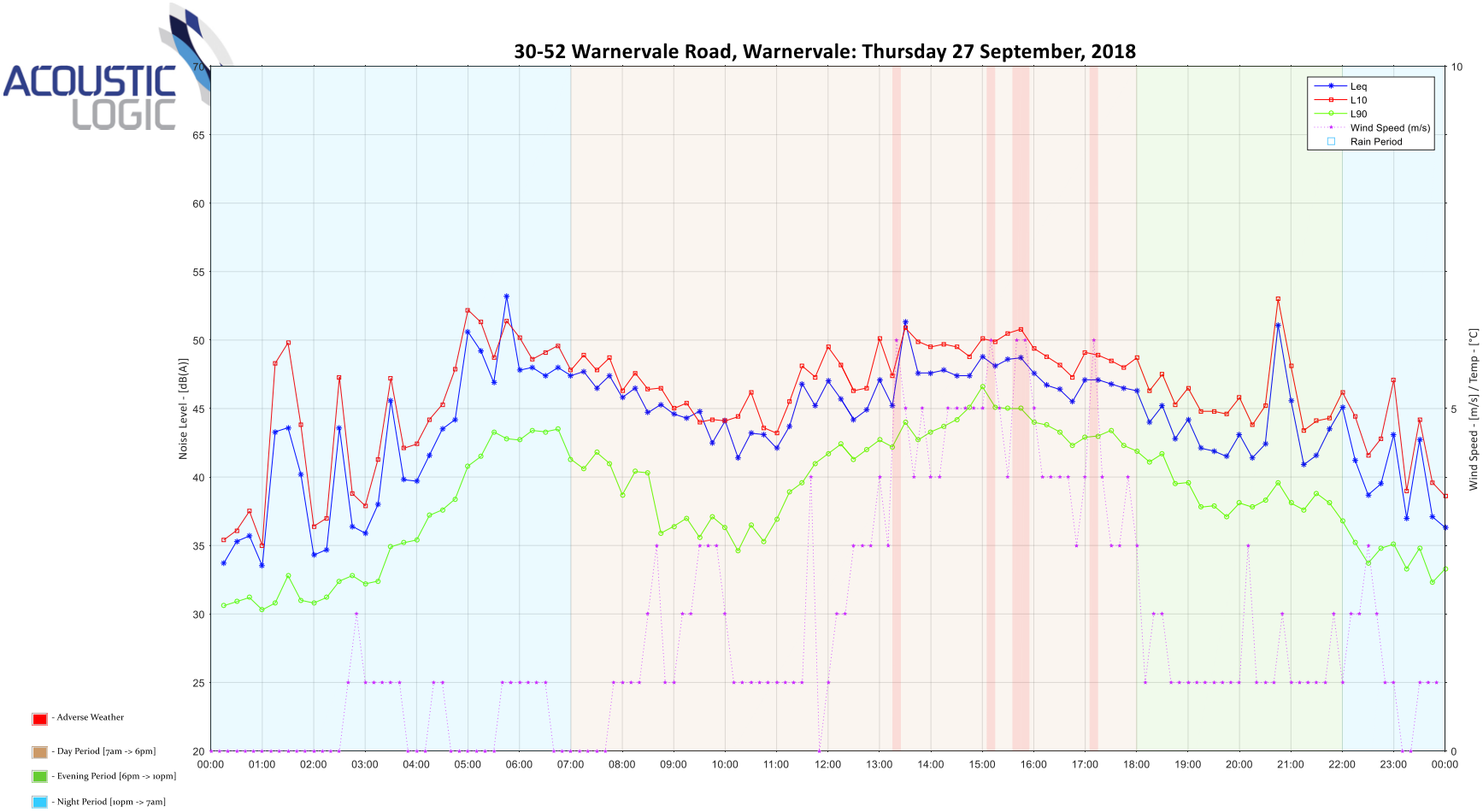
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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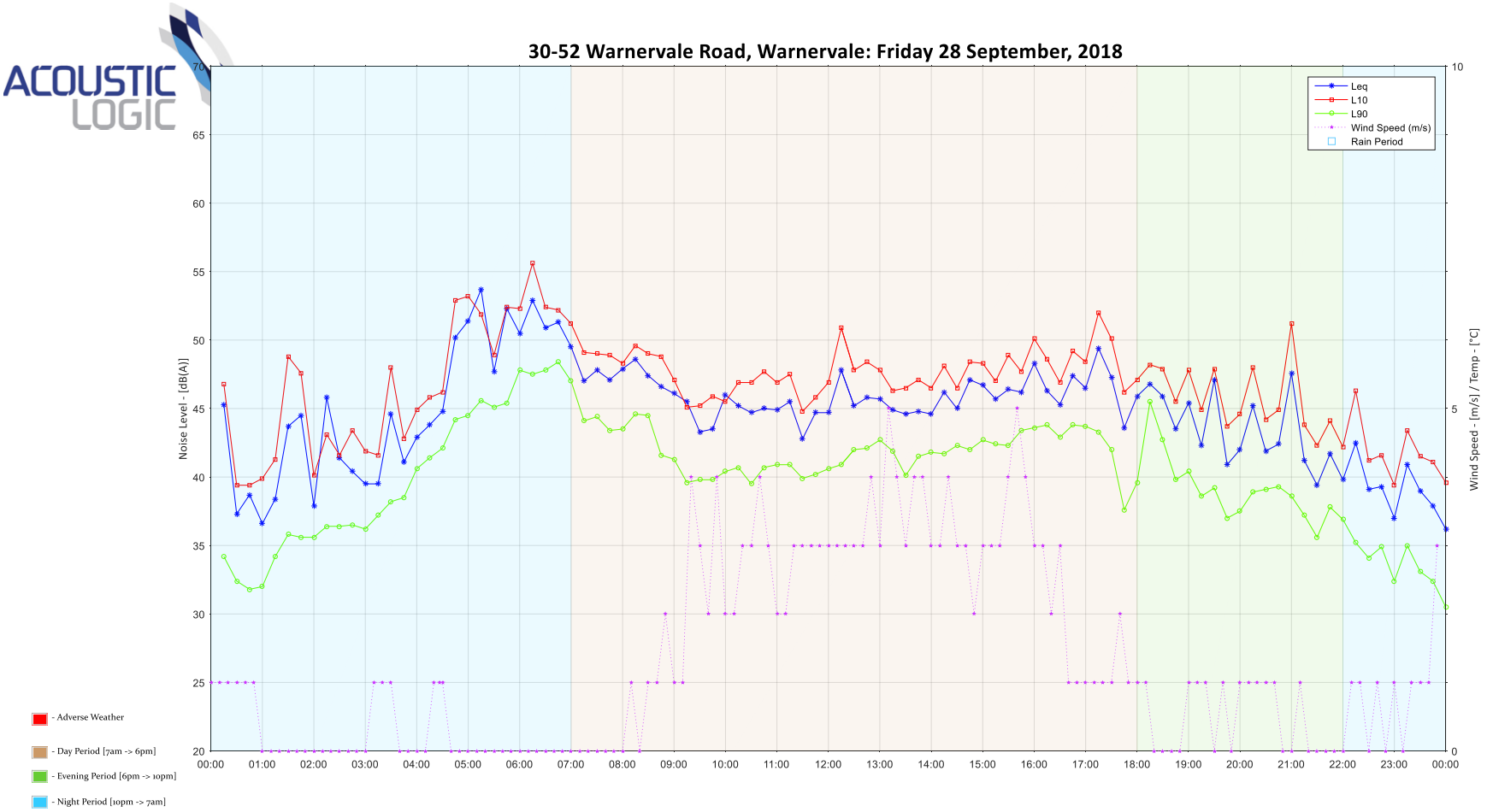
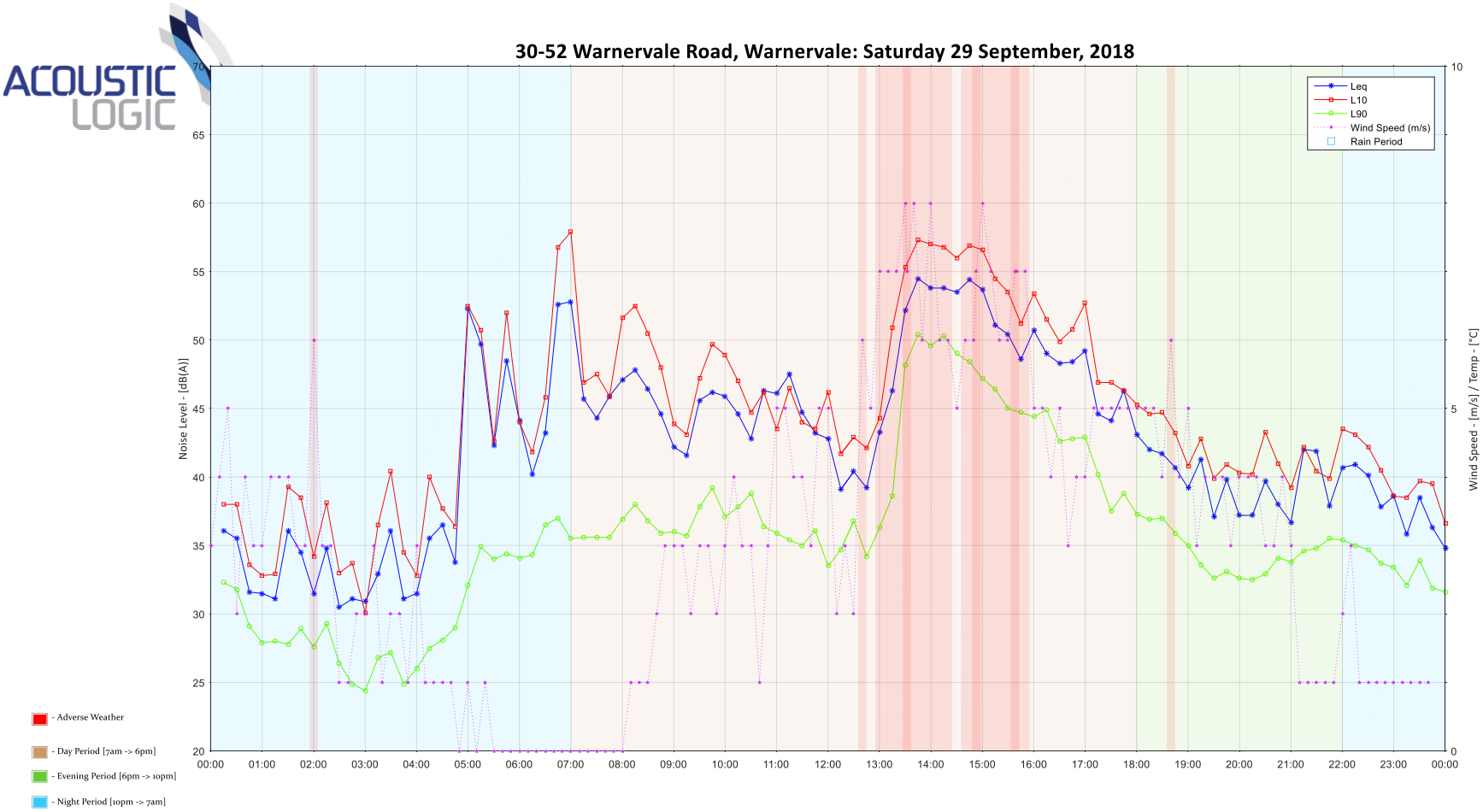
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


30-52 Warnervale Road, Warnervale: Friday 28 September, 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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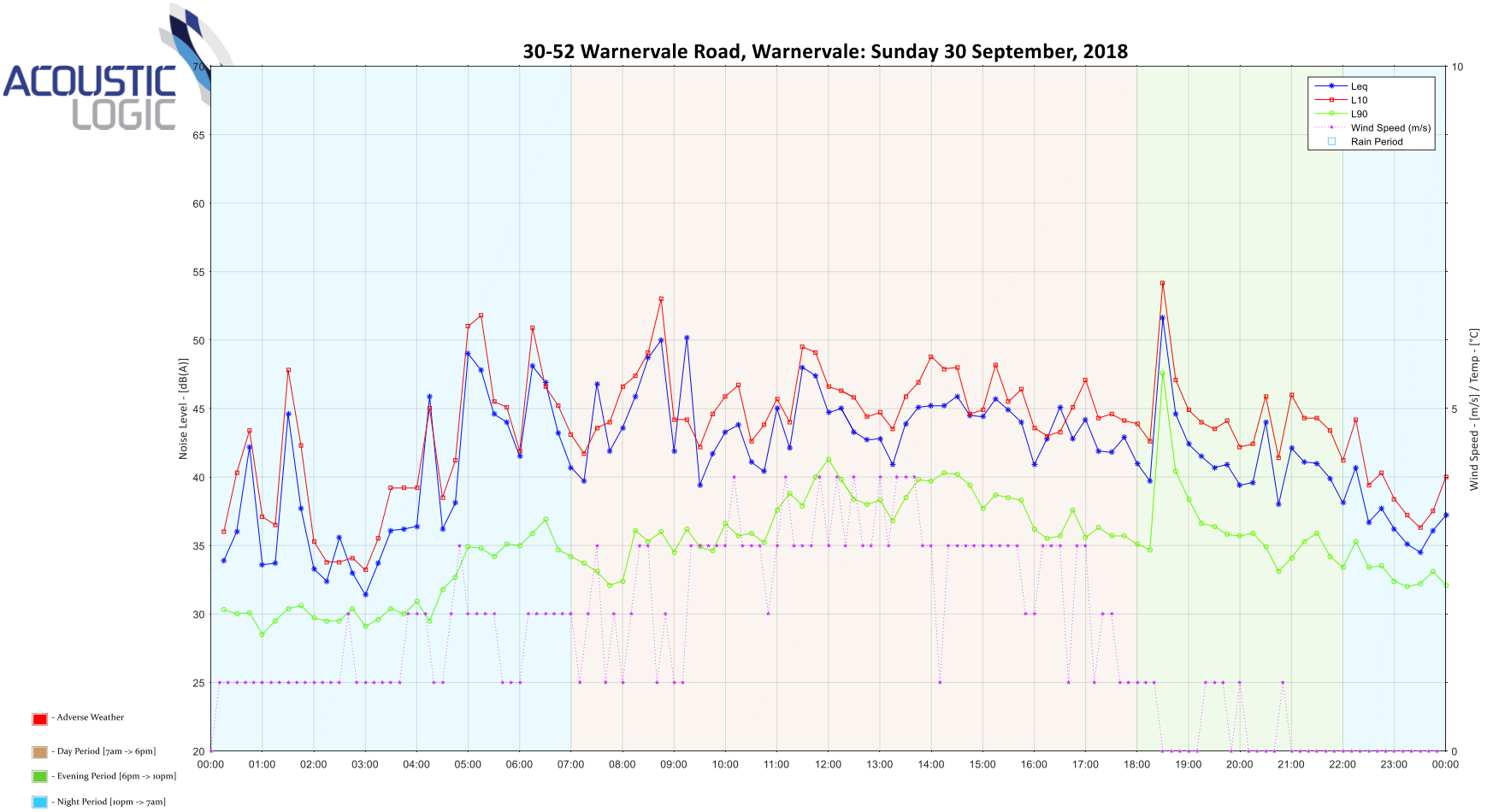
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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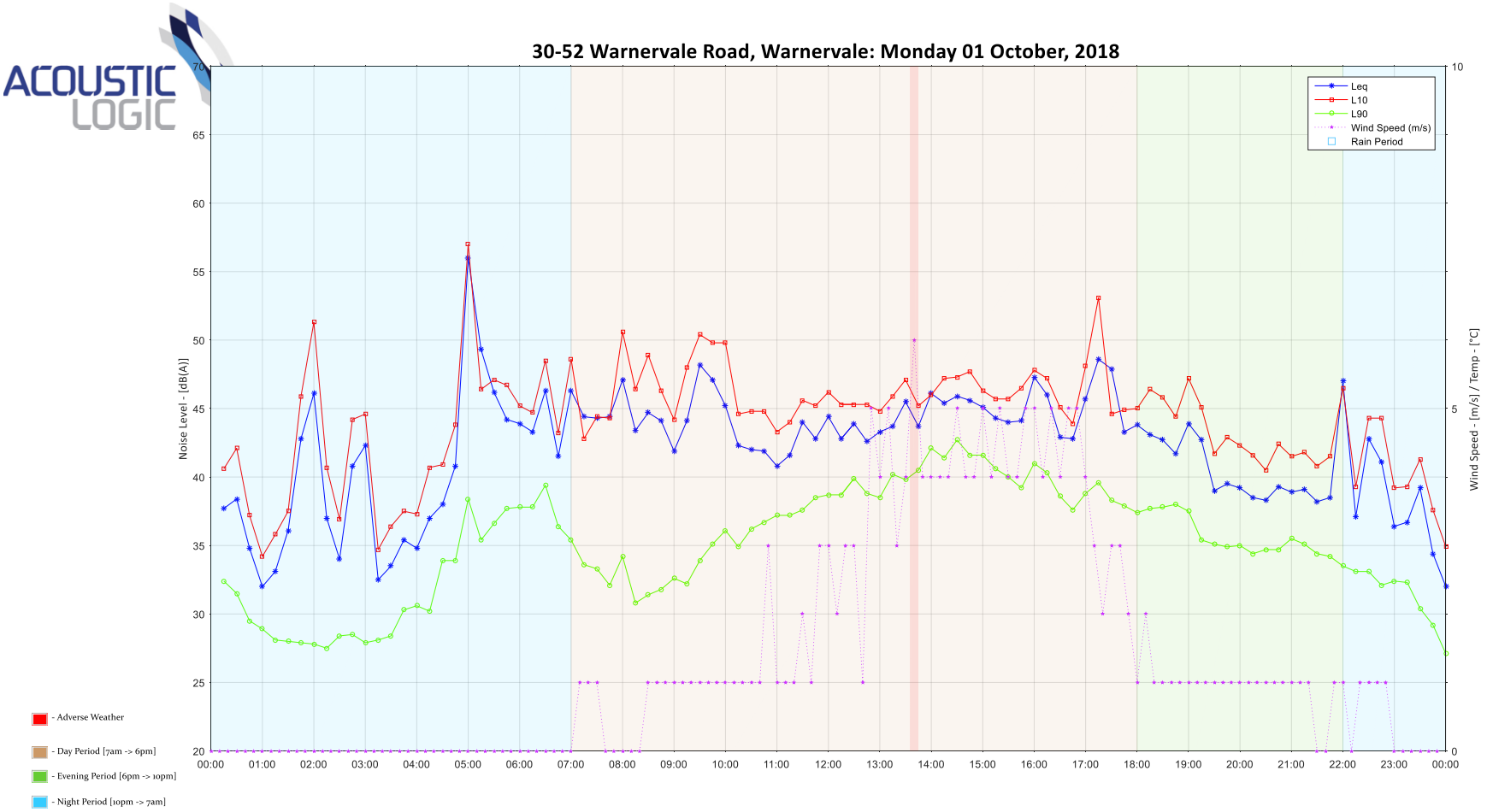
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]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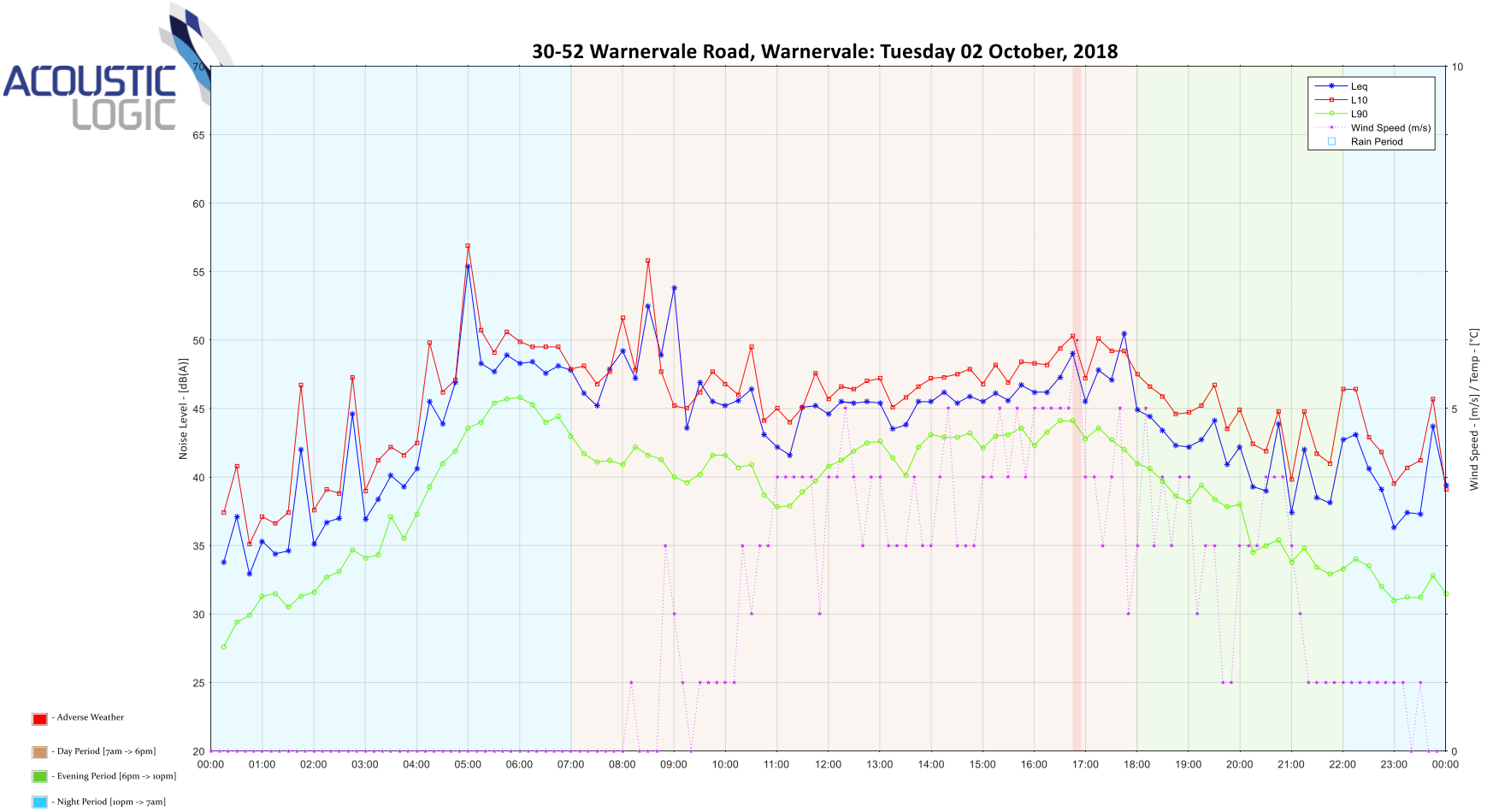
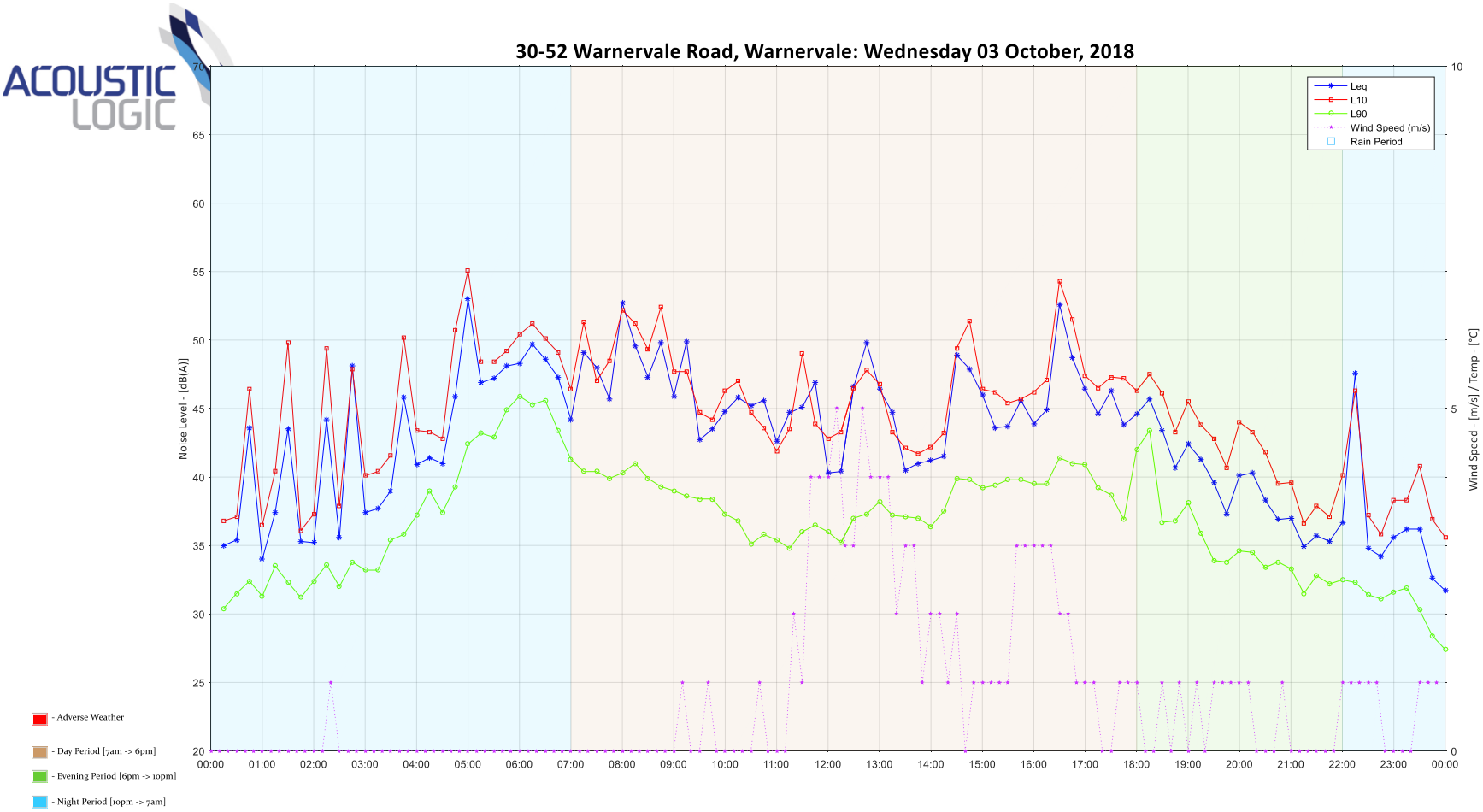
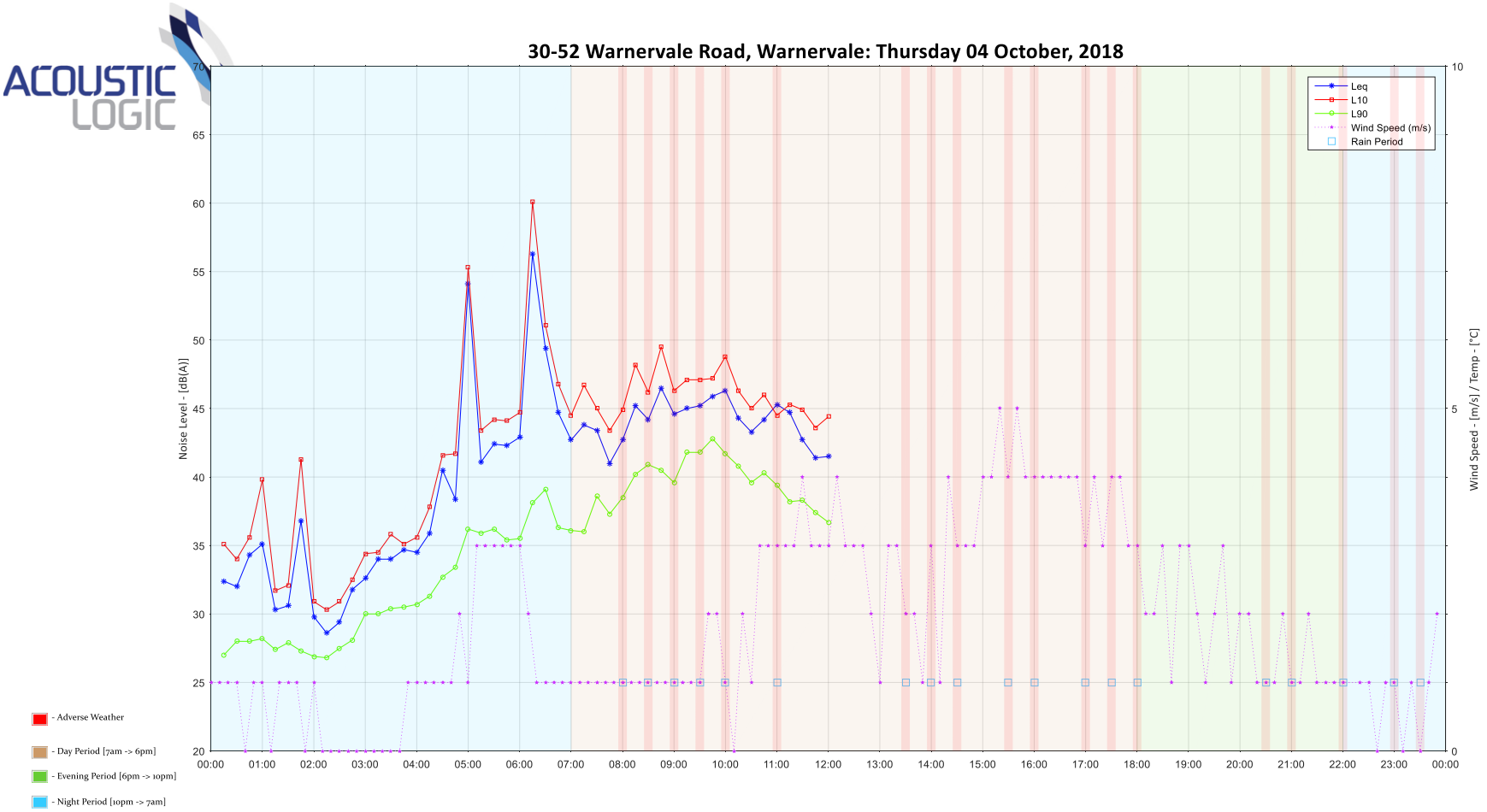
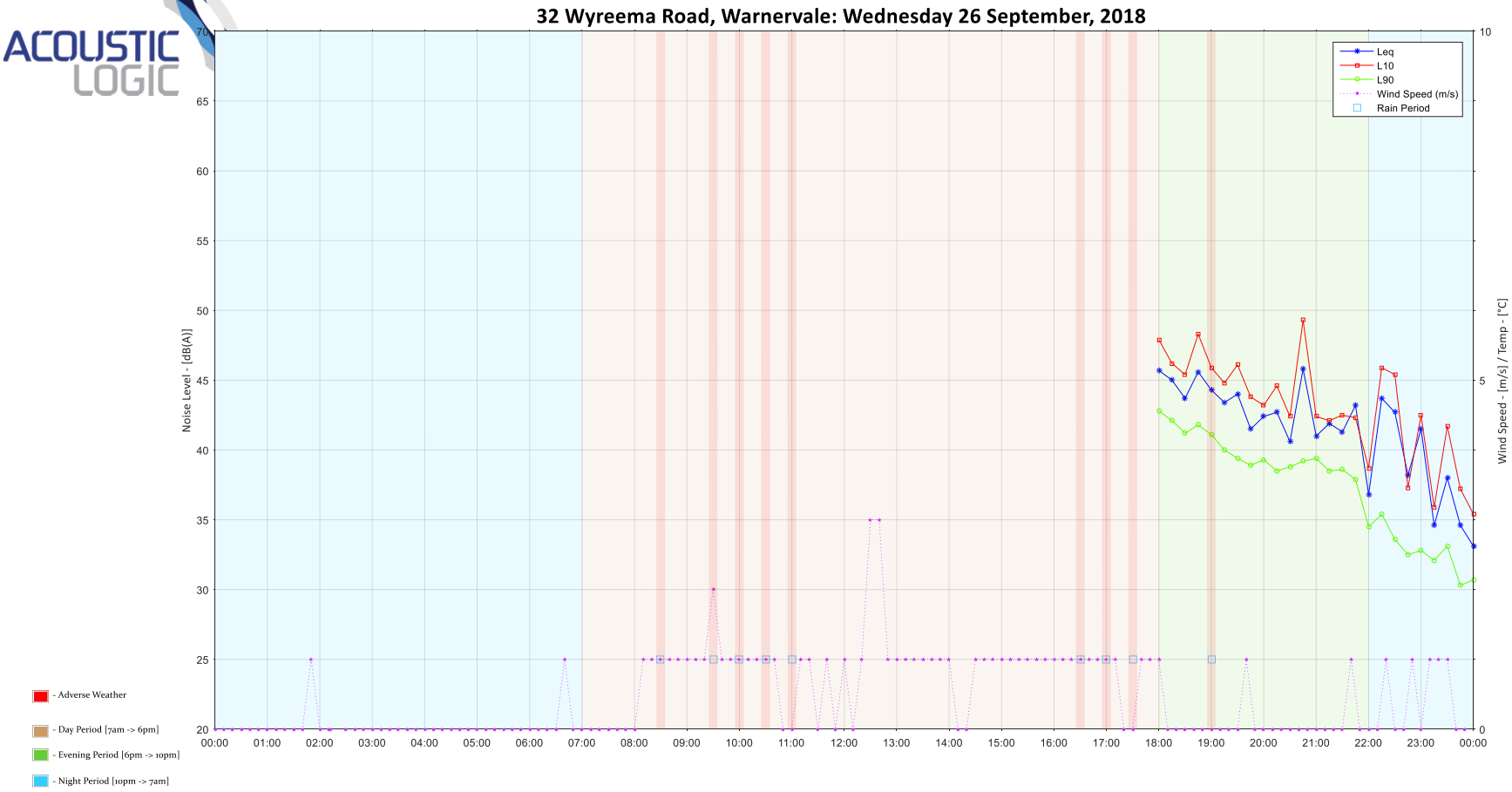
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

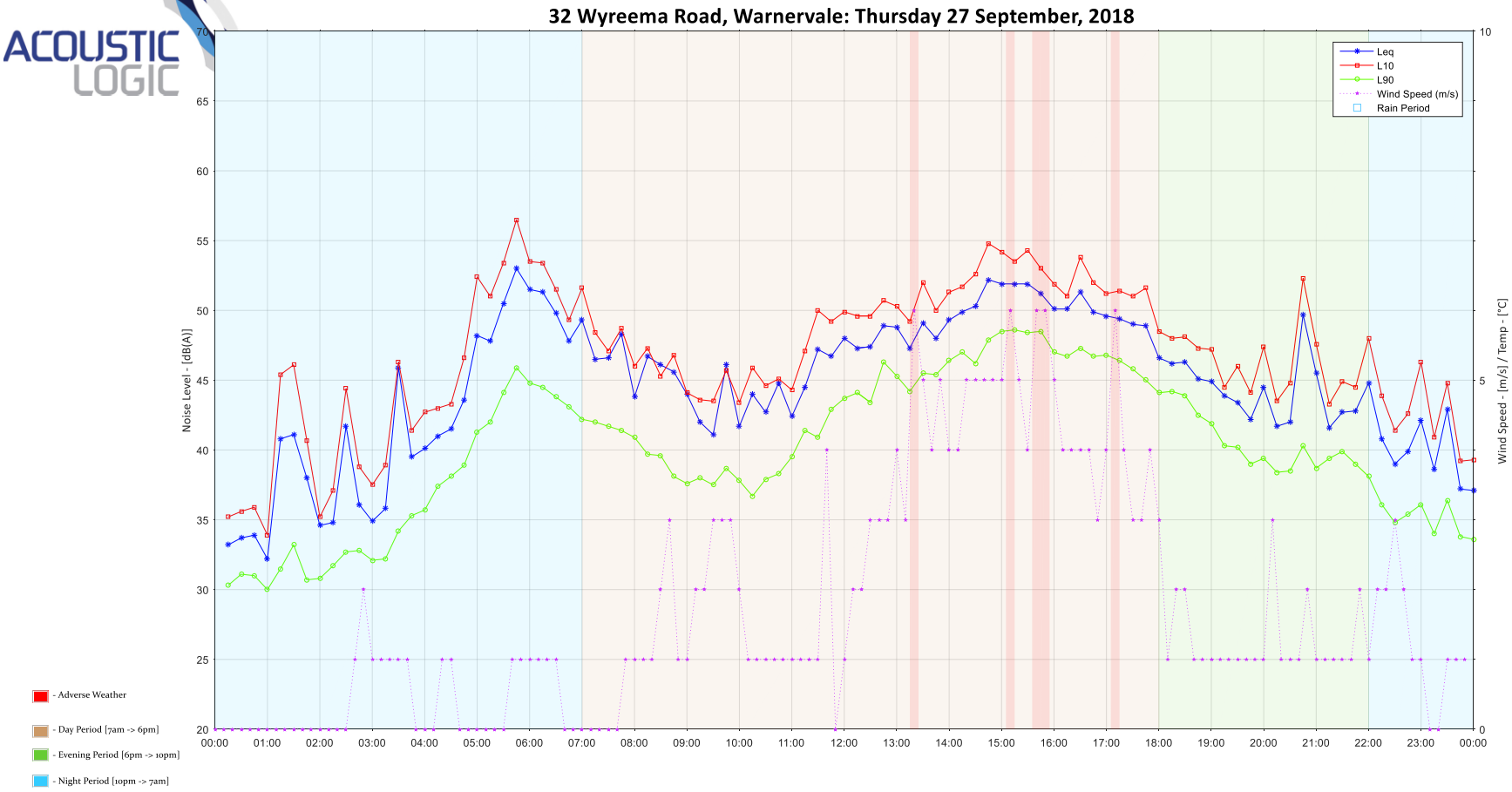

30-52 Warnervale Road, Warnervale: Tuesday 02 October, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

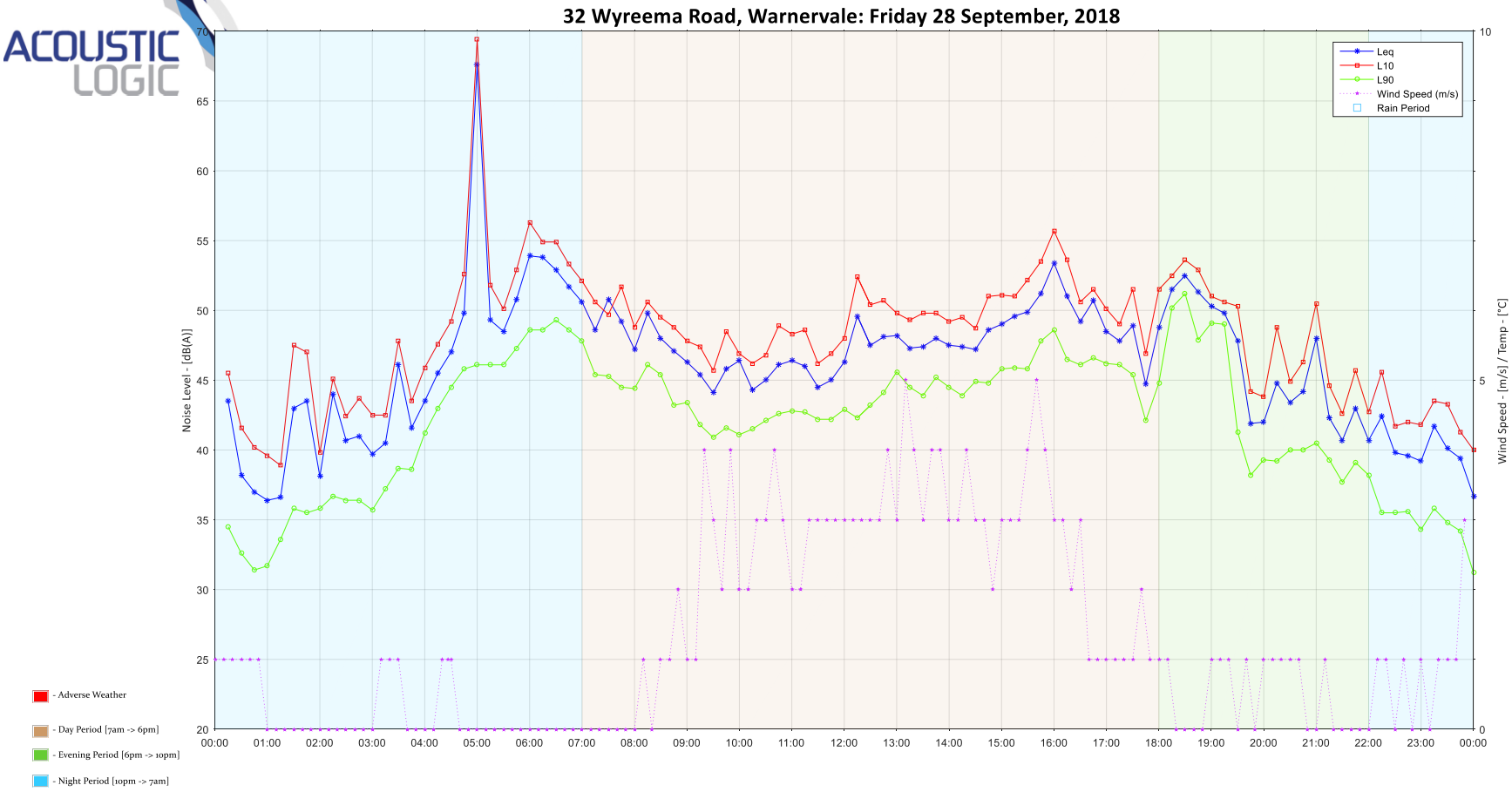

30-52 Warnervale Road, Warnervale: Wednesday 03 October, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

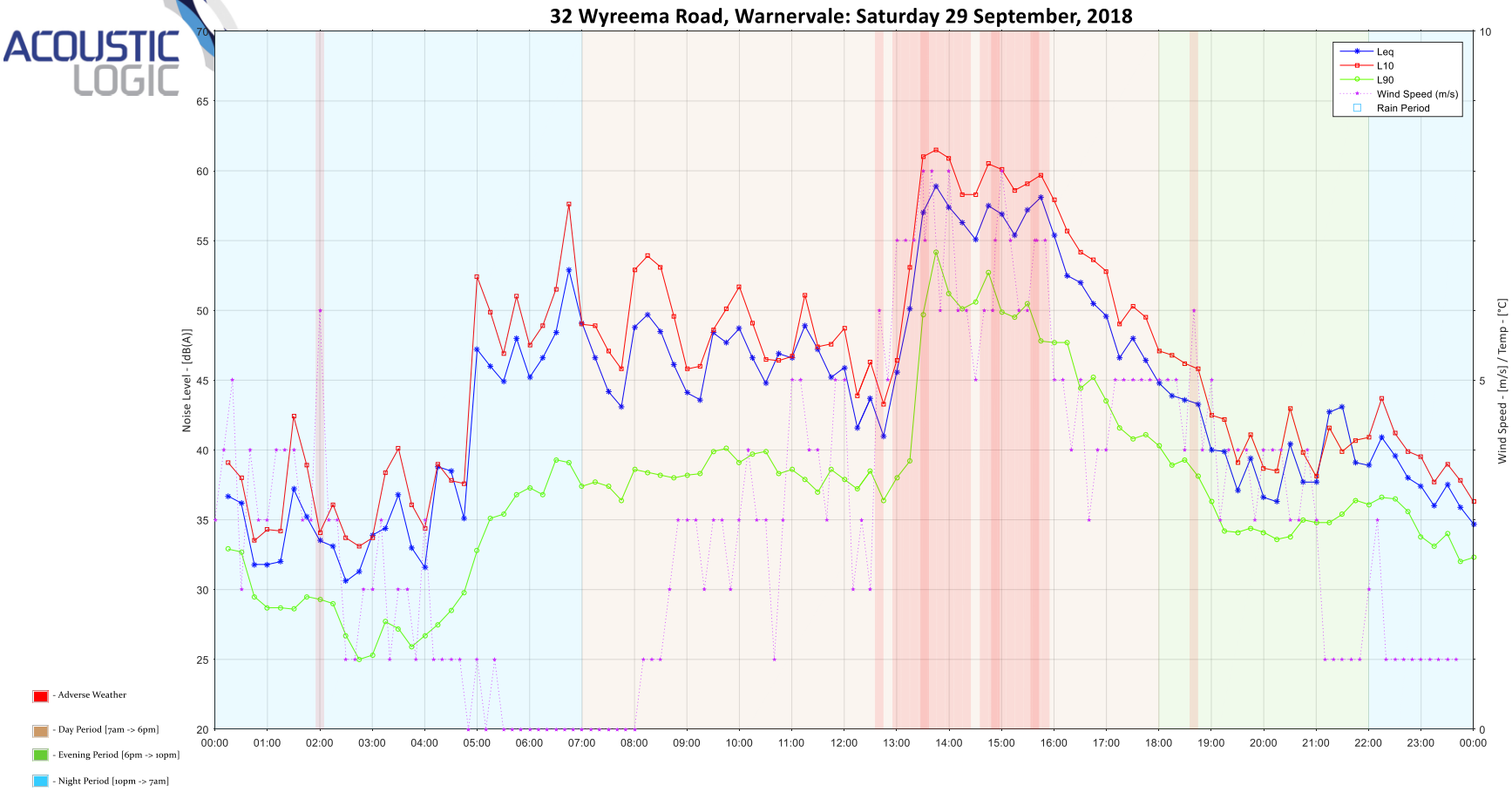

30-52 Warnervale Road, Warnervale: Thursday 04 October, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]

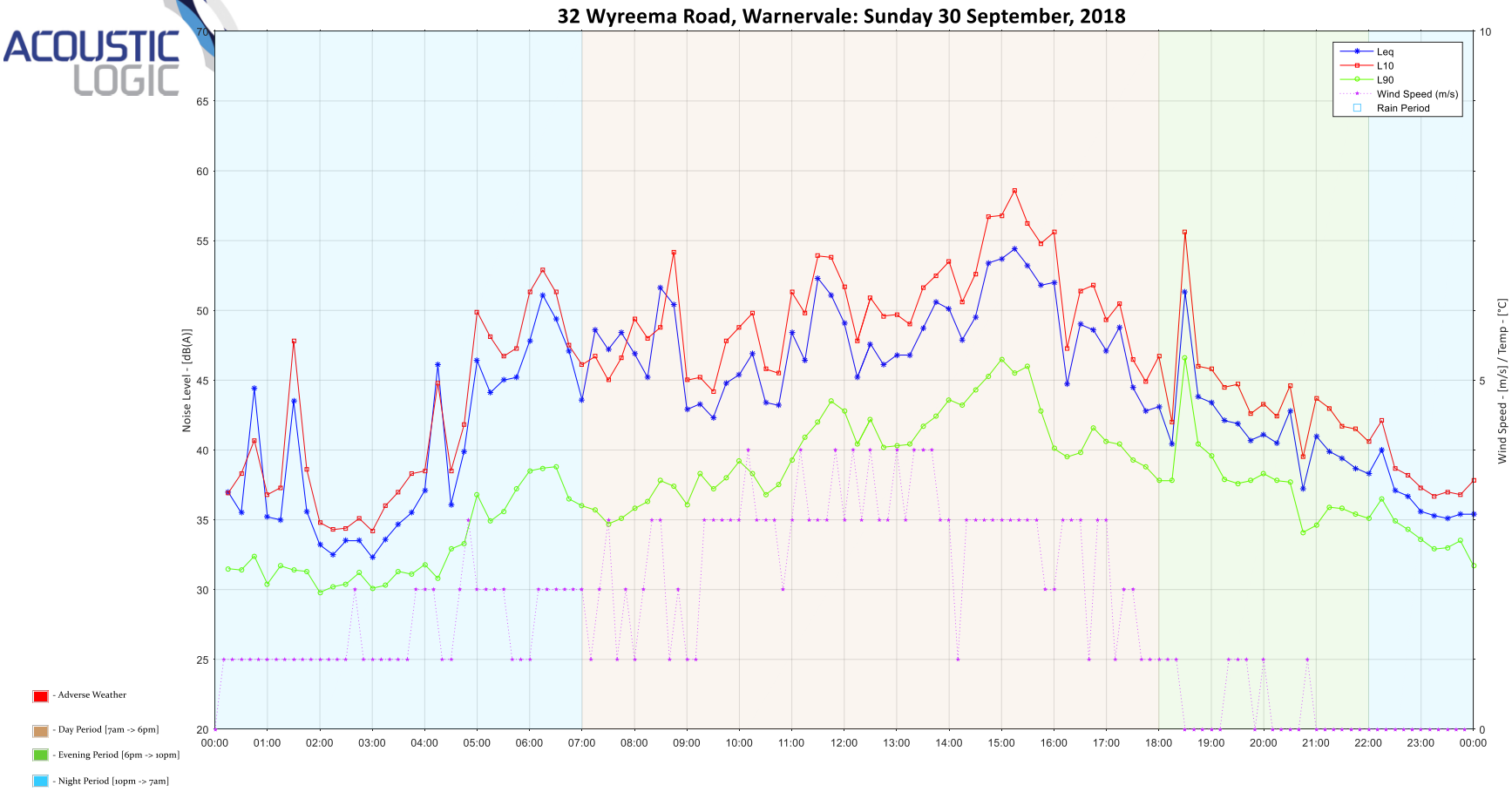
APPENDIX TWO – UNATTENDED NOISE MONITORING DATA – LOCATION TWO - 32 WYREEMA ROAD

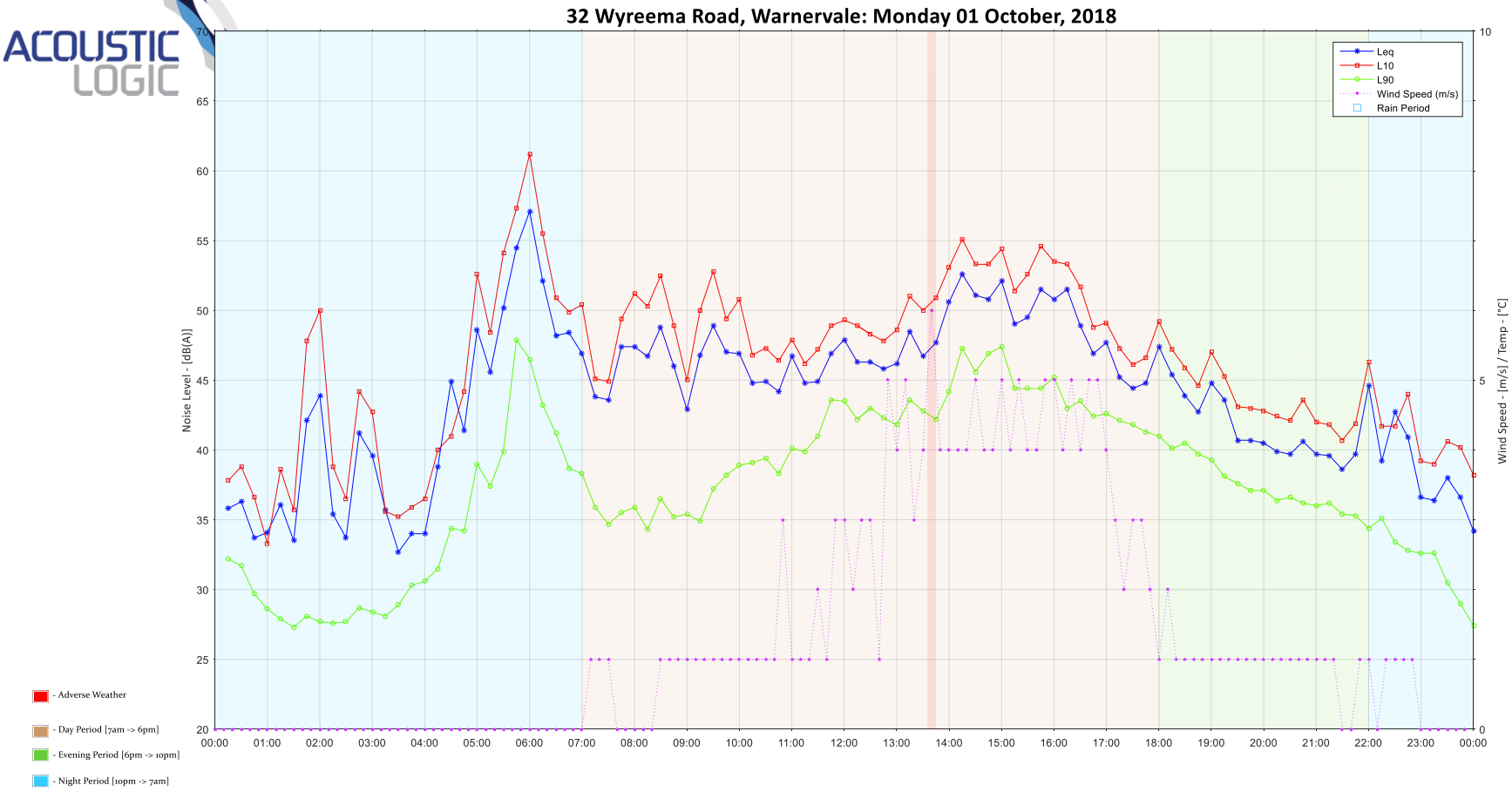

32 Wyreema Road, Warnervale: Wednesday 26 September, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


32 Wyreema Road, Warnervale: Thursday 27 September, 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]


32 Wyreema Road, Warnervale: Friday 28 September, 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]


32 Wyreema Road, Warnervale: Saturday 29 September, 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]


32 Wyreema Road, Warnervale: Sunday 30 September, 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]


32 Wyreema Road, Warnervale: Monday 01 October, 2018
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]
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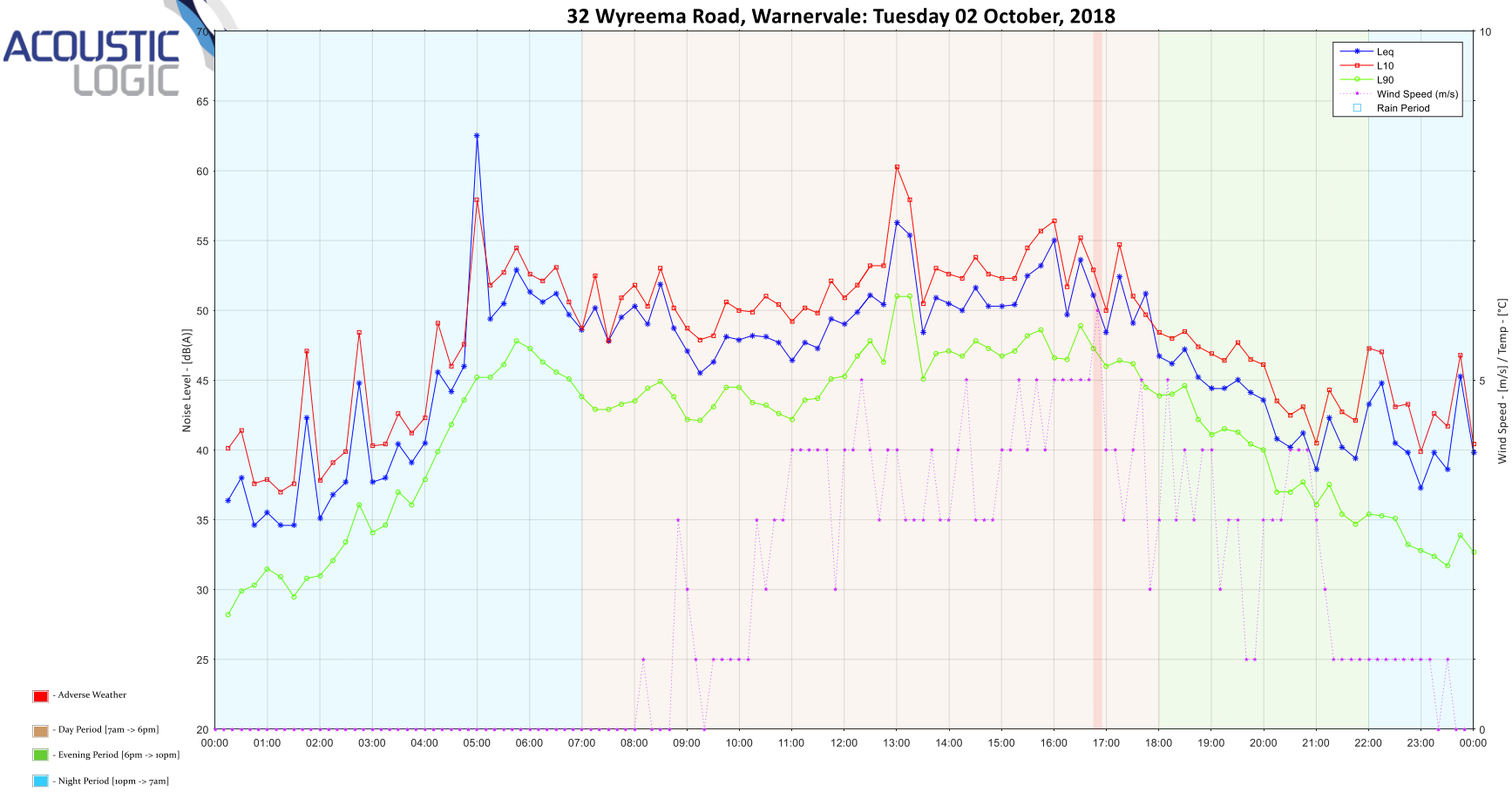
32 Wyreema Road, Warnervale: Tuesday 02 October, 2018
Leq
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
70
65
60
55
50
45
40
35
30
25
20
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
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- Day Period [7am -> 6pm]
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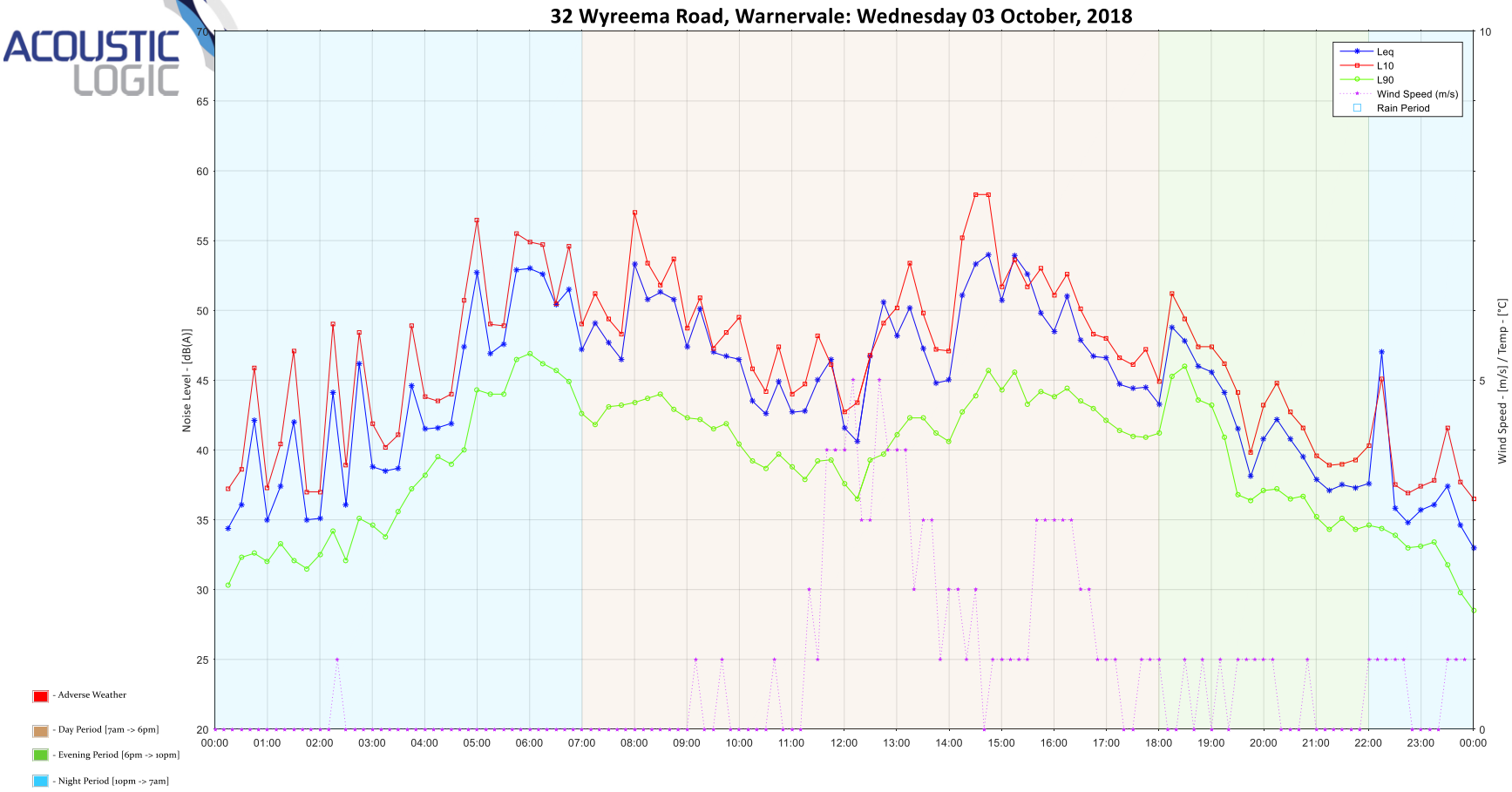
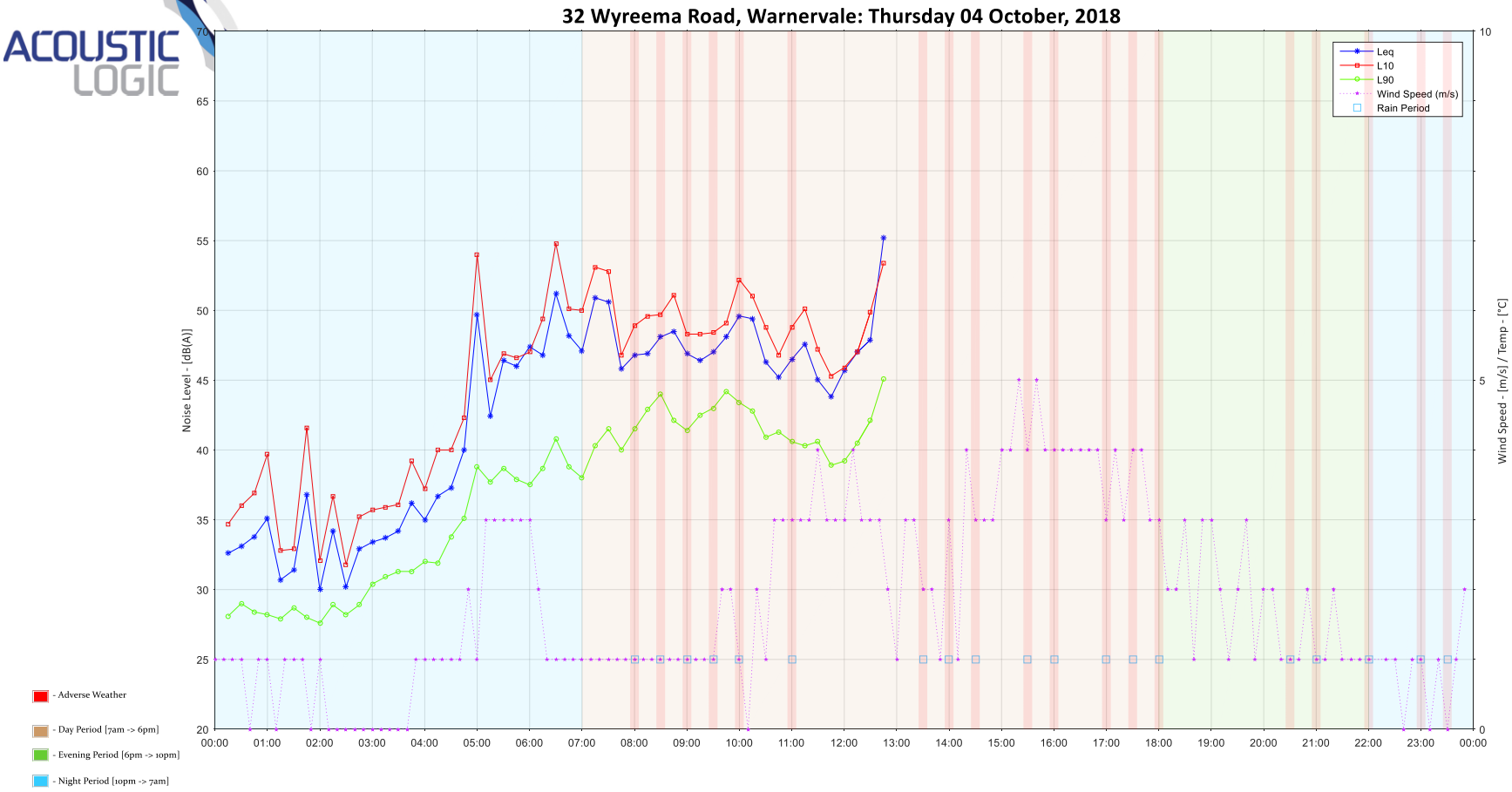

32 Wyreema Road, Warnervale: Wednesday 03 October, 2018
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
Leq
L10
L90
Wind Speed (m/s)
Rain Period
- Adverse Weather
- Day Period [7am -> 6pm]
- Evening Period [6pm -> 10pm]
- Night Period [10pm -> 7am]


32 Wyreema Road, Warnervale: Thursday 04 October, 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]