MATTHEW PALAVIDIS
VICTOR FATTORETTO
MATTHEW SHIELDS

Pacific Brook Christian School

Environmental Noise and Vibration Impact Assessment

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

ABN 11 068 954 343
www.acousticlogic.com.au

The information in this document is the property of Acoustic Logic Consultancy Pty Ltd 11 068 954 343 and shall be returned on demand. It is issued on the condition that, except with our written permission, it must not be reproduced, copied or communicated to any other party nor be used for any purpose other than that stated in particular enquiry, order or contract with which it is issued.

Project ID	20200518.1
Document Title	Environmental Noise and Vibration Impact
Attention To	Pacific Brook Christian School Ltd

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	9/07/2021	20200518.1/0907A/R0/AS	AS		VF
1	20/09/2021	20200518.1/2009A/R1/AS	AS		VF

TABLE OF CONTENTS

1 INTRODUCTION 5
2 RESPONSE TO SEARS 7
3 SITE DESCRIPTION AND SITE OPERATION 8
4 NOISE DESCRIPTORS 13
5 SURVEY OF AMBIENT NOISE 14
5.1 UNATTENDED, LONG TERM NOISE LOGGING 14
5.2 RESULTS 14
6 OPERATIONAL NOISE EMISSION CRITERIA 16
6.1 STATE ENVIRONMENTAL PLANNING POLICY (EDUCATIONAL ESTABLISHMENTS AND CHILD CARE FACILITIES) 2017 16
6.2 EPA NOISE POLICY FOR INDUSTRY (2017) 16
6.2.1 Intrusiveness Assessment 17
6.2.2 Amenity Assessment 17
6.2.3 Sleep Arousal Assessment 17
6.2.4 Summary of NPfI Trigger Levels 18
6.3 NSW ROAD NOISE POLICY (2011) (RNP) 19
6.4 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS –INTERIM GUIDELINE (DEPARTMENT OF PLANNING 2008) 19
7 SCHOOL USES - OPERATIONAL NOISE EMISSION ASSESSMENT 20
7.1 NOISE FROM INTERNAL SPACES 20
7.1.1 Learning and Admin Spaces 20
7.1.2 Multipurpose Centre 20
7.2 TRAFFIC GENERATION 21
7.2.1 Carpark 21
7.2.2 Kiss and Drop 21
7.3 WASTE REMOVAL 21
7.4 EXTERNAL ACTIVITIES 22
7.5 NON-SCHOOL USES, AND AFTER HOURS SCHOOL ACTIVITIES 23
7.6 NOISE FROM MECHANICAL PLANT, SCHOOL BUILDINGS PUBLIC ADDRESS SYSTEM AND SCHOOL BELL 24
8 OPERATIONAL VIBRATION EMISSION ASSESSMENT 24
9 NOISE INTRUSION ASSESSMENT 25
9.1 RAIL NOISE 25
9.2 TRAFFIC NOISE 25
10 NOISE INCREASE FROM TRAFFIC GENERATION ON LOCAL ROADS 25
11 CONSTRUCTION NOISE ASSESSMENT 26
11.1 SITE DESCRIPTION 26
11.2 RECEIVER LOCATIONS 26
11.3 NOISE AND VIBRATION GUIDELINES 27
11.3.1 EPA Interim Construction Noise Guideline 27
11.3.2 Vibration 28
11.4 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES 29
11.5 NOISE PREDICTIONS 30
11.6 DISCUSSION – NOISE 32
11.7 DISCUSSION - VIBRATION 32
11.8 RECOMMENDATIONS 32

11.9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS 34
11.10 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS 35
11.10.1 Selection of Alternate Appliance or Process 35
11.10.2 Acoustic Barriers 35
11.10.3 Material Handling 35
11.10.4 Treatment of Specific Equipment 35
11.10.5 Establishment of Site Practices 35
11.10.6 Combination of Methods 36
11.11 ADDRESSING COMPLAINTS 36
12 SUMMARY OF RECOMMENDATIONS 37
13 CONCLUSION 38
APPENDIX A – NOISE LOGGING DATA 39

1 INTRODUCTION

This environmental noise and vibration assessment has been prepared by Acoustic Logic (AL) on behalf of the Applicant. It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-16858710) for the new Pacific Brook Christian School at 72-74 Maitland Street, Muswellbrook. The site is legally described as Lot 100 in Deposited Plan (DP) 1261496.

Pacific Brook Christian School proposes the staged construction of a new school at 72-74 Maitland Street, Muswellbrook. This will involve site preparation work (including remediation), the removal of 96 trees (7 within Stage 1), civil works, infrastructure works, landscaping, signage and construction works in stages over the next 10 years.

The masterplan will support high-quality educational outcomes to meet the needs of students within the local community as follows:

- Administration building and Library;
    - One (1) staff and student amenities block;
- Junior School facilities;
    - Ten (10) General Learning Areas (GLAs);
    - Two (2) Specialist classroom;
    - One (1) Store; and
    - Covered Outdoor Learning Area (COLA)
- Middle School facilities;
    - Seven (7) General Learning Areas (GLAs);
    - One (1) Science classroom; and
    - Covered Outdoor Learning Area (COLA)
- Senior School facilities;
    - Eight (8) General Learning Areas (GLAs);
    - One (1) Specialist classroom;
    - Three (3) TAS classrooms;
    - Two (2) Food Tech classrooms;
    - One (1) Art classroom;
    - One (1) Drama classroom;
    - Four (4) amenities block;
    - Three (3) Store; and
    - Covered Outdoor Learning Area (COLA)
- Hope School (special needs) facilities;
    - Four (4) General Learning Areas (GLAs);
    - One (1) Specialist classroom;
    - Four (4) Shared Withdrawal rooms;
    - One (1) Office;
    - One (1) Staff room;
    - One (1) Interview + Therapy room;
    - Three (4) amenities block;
    - Three (3) Store; and
    - Covered Outdoor Learning Area (COLA)
- Multi-Purpose Hall;
- Maximum student capacity of 656;
- Maximum 65 staff;
- Agricultural teaching facility;
- Maintenance and bus area;
- On-site Parking (67 spaces, inclusive of 1 accessible);

- Bike parking x 36;
- Internal pathways;
- Kiss and drop off areas;
- Bus stop;
- Waste Storage and collection area;
- Signage;
- Bush Chapel
- Removal of 96 trees (total);
- Landscaping (including Bush Chapel);
- Infrastructure works;
- Earthworks;
- Secondary emergency vehicle/ large vehicle access;
- Acoustic and safety fence; and
- Widening of existing vehicular access from Maitland Street

Stage 1 of the masterplan consists of:

- Site remediation;
- Removal of 7 trees;
- Facilities for a maximum of 140 students and 16 staff, including:
    - One (1) administration and staff area;
    - One (1) staff and student amenities block (including one (1) end of trip facility);
    - Five (5) General Learning Areas (GLAs);
    - One (1) Science classroom; and
    - Covered Outdoor Learning Area (COLA)
- Internal pathways;
- On-site Parking (15 spaces, inclusive of 1 accessible);
- Bike parking x 6;
- Kiss and drop off areas;
- Bus stop;
- Bin storage and collection area;
- Signage;
- Infrastructure works; and
- Widening of existing vehicular access from Maitland Street.

The purpose of this assessment is to address the SEARs related to noise and vibration impacts, including an assessment of noise emissions during the construction and operational phases of the project and potential impacts from surrounding environmental noise sources.

2 RESPONSE TO SEARS

The environmental noise and vibration is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD-16858710. This table identifies the SEARs and relevant reference within this report.

Table 1- SEARs and Relevant Reference

SEARs Item	Report Reference
Item 11. Noise and Vibration • Provide a noise and vibration impact assessment that: o outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers. o considers sources of external noise intrusion in proximity to the site (including, road, rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards. o demonstrates that the assessment has been prepared in accordance with polices and guidelines relevant to the context of the site and the nature of the proposed development.	Section 6 to-0
• Provide a noise and vibration impact assessment for the first stage of the proposed development that: o includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction. o details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.	Section 11
o includes a quantitative assessment of the main sources of operational noise, including consideration of 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.	Section 6 to-0
Relevant Policies and Guidelines: o NSW Noise Policy for Industry 2017 (NSW Environment Protection Authority (EPA). o Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009). o Assessing Vibration: A Technical Guideline 2006 (Department of Environment and Conservation, 2006). o Development Near Rail Corridors and Busy Roads - Interim Guideline (Department of Planning, 2008).	

In this assessment we will:

- Identify nearby noise sensitive receivers and operational noise sources with the potential to adversely impact nearby development.
- Identify relevant Council and EPA noise emission criteria applicable to the development.
- Assess compliance with Infrastructure SEPP requirements.
- Predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to mitigate potential noise impacts.

3 SITE DESCRIPTION AND SITE OPERATION

The site is triangular in shape, with a northwest/southeast alignment and has an area of 2.432 ha. The site is bound by Muswellbrook Golf Course along the north eastern boundary, Maitland Street along the south western boundary and residential properties to the south eastern boundary. There are also residential properties past the golf course (along Victoria Street) and to the north east of the site across Maitland Street (see Figure 1). The site address is 72-74 Maitland Street and is legally described as Lot 100 in Deposited Plan (DP) 1261496.

72-74 Maitland Street was previously used for forestry plantation purposes and is mapped as Muswellbrook State Forest. The site is no longer used for this purpose and currently sits as an empty and underutilised site.

The main vehicular access to the site is from Maitland Street, as well as pedestrian access. Existing vehicular parking on site includes open air at grade parking spaces facing Maitland Street.

Figure 1 - Aerial Image of Site

The following table summarises how the school is proposed to be used.

Table 2- School Uses and Operating Times

Item	Use	Times
GENERAL	It is proposed that the site be used for an educational establishment and will house a mainstream Kindy to Year 12, as well as a special needs school, before and after school care, and other normal activities associated with schooling, including musical rehearsal spaces, school meeting spaces, indoor basketball for the school and the community and other school activities. The school will have the following capacity following completion of the development: • 65 full time staff • 656 students	General operating hours for the school will be: • Monday to Friday: 7:30am - 6:30pm • Saturday: 8:30am - 4:00pm • Sundays and Public Holidays – Nil There will be two staggered school bell time systems between 8:50am-3:10pm & 8:35am-2:55pm. Both bell systems times are shown below: Bell time 1: • Devotions – 8:50am • Class 1 - 9:10am • Class 2 - 10:00am • Recess - 10:50am (40 minutes) • Class 3 - 11:30am • Class 4 - 12:20am • Lunch - 1:10pm (20 minutes) • Class 5 - 1:30pm • Class 6 - 2:20pm • Finish - 3:10pm Bell time 2: • Devotions - 8:35am • Class 1 - 8:55am • Class 2 - 9:45am • Recess - 10:35am (40 minutes) • Class 3 - 11:15am • Class 4 - 12:05pm • Lunch - 12:55pm (20 minutes) • Class 5 - 1:15pm • Class 6 - 2:05pm • Finish - 2:55pm Before school care will commence at 7:30am, and after school care running until 6:30pm.

Table 2- School Uses and Operating Times (Cont.)

MULTIPURPOSE CENTRE	To have internal basketball court. Intended use by school during school hours. Occasional evening use for music performance, presentations, parent/teacher nights. Multipurpose centre to be made available to the community use upon prior written agreement with the school.	General operating hours for the school will be Monday to Friday: 7:30am - 6:30pm. For evening and community use the operating time will be in the following hours: • Monday to Friday: 6:30pm - 10:00pm (activities to cease at 9:30pm, with half hour to pack down/clean). • Saturday: 8:30am-10:00pm (activities to cease at 9:30pm, with half hour to pack down/clean).
OUTDOOR SPORTS COURTS	Intended to only be used by school during school operating hours. Occasional afternoon and weekend use for sports tournaments/competitions by community and school	• Monday to Friday: 3:10pm - 6:30pm (allow for additional half hour to pack down/clean). • Saturdays: 8.30am to 4.00pm • Sundays and public holidays – Nil
OOSH	Out of school hours (OOSH) use of the school facilities.	Before and after school care program to operate in the following hours: • Monday to Friday: 7:30am - 8:50am • Monday to Friday: 2:50pm – 6.30pm • Saturday, Sunday and Public Holidays - Nil
LIBRARY	Intended use for school only	Normal school hours only.

The assessment is based on NBRS Architecture drawings (Document Reference: 19055-NBRS-DR-A-SSDA-1000 (Revision 13), 19055-NBRS-DR-A-SSDA-1001 (Revision 13), 19055-NBRS-DR-A-SSDA-1002 (Revision 11), 19055-NBRS-DR-A-SSDA-2000 (Revision 15), dated 14/09/2021) and the noise measurements conducted at the site. Figure 2 shows the proposed site plan and Figure 3 shows the measurements locations.

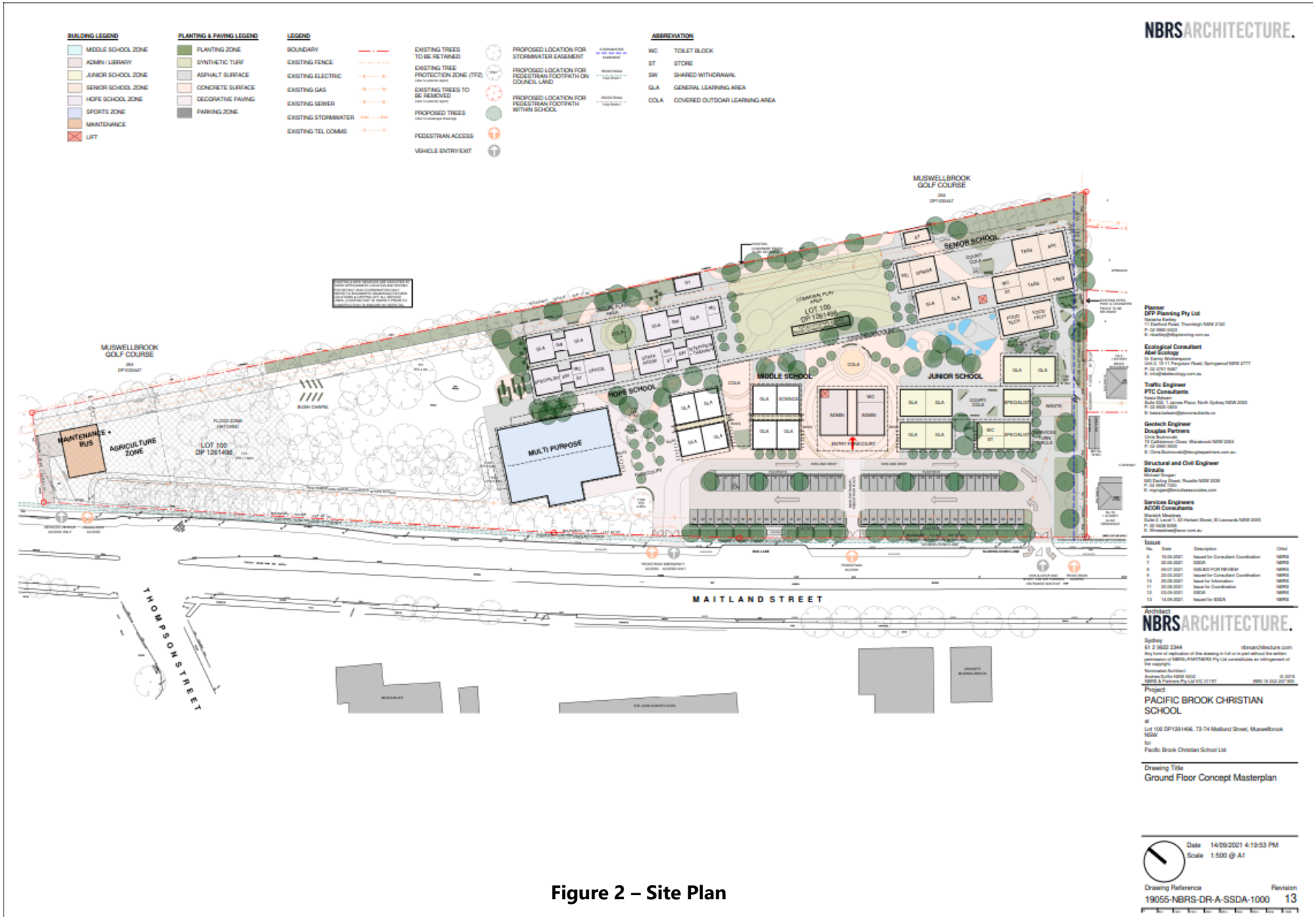


Figure 2 – Site Plan

Figure 3 – Site Location and Noise Measurement Location
(Map Sourced from SixMaps)

4 NOISE DESCRIPTORS

Ambient noise constantly varies in level from moment to moment, so it is not possible to accurately determine prevailing noise conditions by measuring a single, instantaneous noise level.

To quantify ambient noise, a 15 minute measurement interval is typically utilised. Noise levels are monitored continuously during this period, and then statistical and integrating techniques are used to characterise the noise being measured.

The principal measurement parameters obtained from the data are:

L_{eq} - 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 noise impact as it closely corresponds with how humans perceive the loudness of time-varying noise sources (such as traffic noise).

L_{90} – This is commonly used as a measure of the background noise level as it represents the noise level heard in the typical, quiet periods during the measurement interval. The L_{90} parameter is used to set noise emission criteria for potentially intrusive noise sources since the disturbance caused by a noise 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.

L_{10} is used in some guidelines to measure noise produced by an intrusive noise source since it represents the average of the loudest noise levels produced at the source. Typically, this is used to assess noise from licenced venues.

L_{max} is the highest noise level produced during a noise event and is typically used to assess sleep arousal impacts from short term noise events during the night. It is also used to assess internal noise levels resulting from aircraft and railway ground vibration induced noise.

L_1 is sometimes used in place of L_{max} to represent a typical noise level from a number of high level, short term noise events.

L_{max} is the loudest event recorded during the measurement period.

5 SURVEY OF AMBIENT NOISE

Long term unattended noise logging was conducted to quantify the existing acoustic environmental at the site. All monitoring and measurement locations are shown in Figure 3.

5.1 UNATTENDED, LONG TERM NOISE LOGGING

Unattended noise monitoring was conducted between 28th July and 6th August 2020 using Acoustic Research Laboratories monitors set on A-weighted fast response mode. The monitors were field calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded.

One noise monitor was placed to the rear of site near the golf course, this location was selected to represent the background noise level at the potentially most impacted receivers located away from Maitland Street. Monitor was also used to determine whether noise from the rail corridor was impacting the site.

Another noise monitor was placed on the project site near Maitland Street to capture the traffic noise levels impacting the site and the background noise levels for receivers located near Maitland Street.

5.2 RESULTS

Measurement results are presented below. The Rating Background Noise Level has been determined using NPfI guidelines with periods affected by excessive wind or rain (as noted on the attached graphs) excluded from the calculation. The day by day and median background noise levels are presented in the following tables. Where no level is indicated these periods were either incomplete or the period was weather affected and invalid. It is noted that the Scone AP weather station was used to obtain weather information.

The wind data obtained during the daytime period of the 4th and 5th of August exceeded 5 m/s however it is only the noise data obtained at the logger location set back from the road on the 4th shows any appreciable effect on background noise increase due to wind, and therefore only this data has been excluded. As a conservative measure, for the day period for the 4th and 5th the lowest recorded L_{90} during the day was used rather than the 90th percentile of the weather unaffected levels. It is noted that the 7 day median includes Sunday when the school would not generally operate, and background noise levels are generally lower.

Table 3 – Noise Monitoring Results (Near Golf Course)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday 28 July 2020	-	40	34
Wednesday 29 July 2020	43	40	34
Thursday 30 July 2020	42	42	34
Friday 31 July 2020	43	43	35
Saturday 01 August 2020	41	41	36
Sunday 02 August 2020	41	43	36
Monday 03 August 2020	44	39	35
Tuesday 04 August 2020	-	44	32
Wednesday 05 August 2020	45	39	35

Table 4 – Noise Monitoring Results (Near Maitland Street)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday 28 July 2020	-	43	38
Wednesday 29 July 2020	53	43	36
Thursday 30 July 2020	53	47	36
Friday 31 July 2020	54	46	38
Saturday 01 August 2020	50	45	38
Sunday 02 August 2020	47	46	38
Monday 03 August 2020	53	42	37
Tuesday 04 August 2020	53	46	36
Wednesday 05 August 2020	52	42	38

Table 5 - Summary Long Term Noise Logging (Near Golf Course)

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
North Eastern Side of Site - Logger Location in Figure 3	Day (7am-6pm)	43
	Evening (6pm-10pm)	41
	Night (10pm to 7am)	35

Table 6 - Summary Long Term Noise Logging (Near Maitland Street)

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
Southern Western Side of Site - Logger Location in Figure 3.	Day (7am-6pm)	53
	Evening (6pm-10pm)	45
	Night (10pm to 7am)	38

6 OPERATIONAL NOISE EMISSION CRITERIA

The SEARS require 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. Noise assessment goals for the various noise sources can be inferred from other guidelines.

6.1 STATE ENVIRONMENTAL PLANNING POLICY (EDUCATIONAL ESTABLISHMENTS AND CHILD CARE FACILITIES) 2017

Schedule 2 " Schools-complying development" of the Educational SEPP provides the following complying development requirements relating to setbacks and noise emissions:

3 Side and rear setback

> *A building (whether a new building, or an existing building as a result of an addition or alteration) or any part of a building (including a basement or any other part of a building that is constructed below ground):*
>
> *(a) that is 12m or less in height—must be located more than 5m from any side or rear property boundary with land in a residential zone or more than 1m from any side or rear property boundary with land in an industrial or a business zone, or*
>
> *(b) that is more than 12m but less than 15m in height—must be located more than 8m from any side or rear property boundary with land in a residential zone or more than 2.5m from any side or rear property boundary with land in an industrial or a business zone, or (c) that is more than 15m but no more than 22m in height—must be located more than 10m from any side or rear property boundary with land in a residential zone or more than 4m from any side or rear property boundary with land in an industrial or a business zone.*

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 LAeq of 5 dB(A) above background noise when measured at any lot boundary.*

It is noted that the "noise" complying development requirement for Universities and TAFE establishments includes an additional requirement for minimum setback between educational buildings and residential development. This implies such a setback (other than to comply with Clause 3) is not required to control noise emissions from school classroom buildings, other than a 5m separation.

6.2 EPA NOISE POLICY FOR INDUSTRY (2017)

Noise sources generally covered by this code are mechanical services and plant noise. Both the intrusiveness and the amenity criteria (as set out below) must be complied with. Emissions from activities carried out prior to 7am and after 10pm should also be assessed for potential impacts on sleep for residential receivers.

6.2.1 Intrusiveness Assessment

Intrusiveness criteria aim to limit noise generation to no more than 5dB(A) above existing background noise levels. The intent is to limit the audibility of noise emissions above the prevailing background noise level.

6.2.2 Amenity Assessment

The amenity criteria set additional criteria based on the land use of the noise sensitive receivers and time of day. The intent is to limit the absolute noise level to that is consistent with the prevailing land use.

The applicable recommended project amenity levels for residential receivers are Day -53 dB(A), Evening 43 dB(A) and Night – 38 dB(A) $L_{eq,15\ min}$. Given the residential receivers are not currently impacted by other "industrial" noise sources, nor are likely to in the future, the recommended levels can be adopted as trigger levels.

The Noise Policy for Industry provides dispensation for locations already impacted by elevated transportation noise levels. Where transportation L_{eq} noise levels exceed the amenity level by more than 15 dB(A) the amenity noise level can be set to 15 dB(A) lower than the traffic noise level. For the subject site, this will mean that residential receivers facing Maitland Street will have a higher evening and night amenity trigger level. However, a bypass is proposed that would significantly reduce traffic volumes on Maitland Street and for this reason we have assumed that no dispensation will apply for the purposes of the assessment.

6.2.3 Sleep Arousal Assessment

In addition to the above, the NSW EPA *NPfI* provides an assessment procedure for assessing any potential sleep arousal impacts for when any noise is generated between 10:00pm and 7:00am (i.e., night period). Sleep arousal is a function of both the noise level and the duration of the noise.

As recommended in the *NPfI*, to assess potential sleep arousal impacts a two-stage test is carried out:

- Step 1 – Section 2.5 *Maximum noise level event assessment* from the NPfI states the following:

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

  - *$L_{Aeq,15min}$ 40dB(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 greater,*

  a detailed maximum noise level event assessment should be undertaken.

- Step 2 - If there are noise events that could exceed the average/maximum criteria detailed in the tables above, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number of occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA *NPfI*, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

  For the research on sleep disturbance to date it can be concluded that:

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

6.2.4 Summary of NPfI Trigger Levels

Table 7 summarises the trigger levels determined using NPfI guidelines and the measured rating background noise levels. A general night time criterion is not required as there are no noise emissions during this period. It is noted that the early morning background noise level is higher than the "day" background noise level, as the background noise level is set by distant traffic noise, which is highest during the morning and afternoon peak periods and lowest (during the EPA "day" period) around lunch time.

The Noise Policy for Industry "minimum background noise levels" have been assumed at the Victoria Street residences for the purposes of this assessment.

The "active recreation" amenity noise level has been adopted for the gold course. Given there are no other likely future "industrial noise sources" impacting this location the uncorrected amenity level will be adopted.

Table 7 – Summary of NPfI Trigger Levels

Receiver	**Time**	**Intrusiveness** $L_{Aeq,15min}$	**Project Amenity** $L_{Aeq,15min}$	**Sleep** $L_{Aeq,15min}$ / L_{AFmax}
Away from Maitland Street (adjacent golf course)	Day (7am-6pm)	**48**	53	-
	Evening (6pm-10pm)	46	**43**	-
	Night (10pm-7am)	40	**38**	40/**52**
Residences On Maitland Street	Day (7am-6pm)	58	**53**	-
	Evening (6pm-10pm)	50	**43**	-
	Night (10pm-7am)	43	**38**	43/**53**
Victoria Street	Day (7am-6pm)	**40**	53	-
	Evening (6pm-10pm)	**35**	43	-
	Night (10pm-7am)	**35**	38	40/**52**
Golf Course	Day	-	58	-

**The adopted Project Noise Trigger Levels for "industrial" noise sources are presented in bold.*

6.3 NSW ROAD NOISE POLICY (2011) (RNP)

The RNP provides guidelines for assessing noise emissions from public roads, including the impact of traffic generated by developments.

According to the policy Maitland Street would be defined as an arterial road. The applicable assessment criteria for residential receivers are (measured at the façade of dwellings):

- Arterial – 60 dB(A) $L_{eq,15hr}$ (7am to 10pm) and 55 dB(A) $L_{eq,9hr}$ (10pm to 7am)

The policy also states that:

- Consideration of the noise increase should be made for arterial roads.
- Noise impacts from increases in noise levels of 2 dB(A) or less are minor, and by implication do not require mitigation.

6.4 DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS –INTERIM GUIDELINE (DEPARTMENT OF PLANNING 2008)

The guideline is used to assess the impact of adjacent road and rail corridors on noise sensitive development. The guideline recommends a maximum noise level within classrooms of 40 dB(A) $L_{eq,1hr}$.

7 SCHOOL USES - OPERATIONAL NOISE EMISSION ASSESSMENT

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

- Noise from internal areas
- Noise from Traffic generation (Carpark and Kiss and Drop)
- Waste Removal
- External activities
- Non-school uses, and after-hours school activities
- Noise from mechanical plant, PA system and school bells.

7.1 NOISE FROM INTERNAL SPACES

7.1.1 Learning and Admin Spaces

We note that for the Hope School and Middle School these areas are typically 100m from any residential receiver.

However, the Junior School and Senior school will have learning areas much closer to the residential receivers at the south east boundary.

To satisfy the SEPP intent we recommend no openable glazing is to be installed on the south east façade (facing the residential properties), or on the other facades within 5m of the boundary of the nearest residential properties.

7.1.2 Multipurpose Centre

The multipurpose centre contains the school hall/basketball court that may be used for presentations, performances and sport activities. The multipurpose centre opens out to the north east of the building (towards the golf course) to a covered outdoor area. The potentially most impacted receivers would be residential receivers to the south east and north east of the project site as well as the golf course located the north east.

Noise emissions to the surrounding properties was calculated based on the following:

- Multipurpose centre internal sound pressure level of 80 dB(A) $L_{eq,15min}$ representing the sound level during a music performance.
- Two double entry doors to be located north east facade. Doors to have minimum sound transmission loss of R_w 20 when closed.

The calculated noise levels are (north east doors open):

- Residences adjacent to the south east boundary – <35 dB(A) $L_{eq,15min}$
- Residences to the north east (Victoria Street) – <25 dB(A) $L_{eq,15min}$
- Golf course to the north east – <35 dB(A) $L_{eq,15min}$
- Residences to the north west (across Maitland Street) - – <20 dB(A) $L_{eq,15min}$

The calculated noise levels are (north east doors closed):

- Residences adjacent to the south east boundary – <20 dB(A) $L_{eq,15min}$
- Residences to the north east (Victoria Street) – <10 dB(A) $L_{eq,15min}$
- Golf course to the north east – <30 dB(A) $L_{eq,15min}$
- Residences to the north west (across Maitland Street) - – <20 dB(A) $L_{eq,15min}$

The background + 5 dB(A) noise emissions criteria applying to the use of the multipurpose centre are not exceeded during the day and evening at any location.

7.2 TRAFFIC GENERATION

7.2.1 Carpark

The school will use a carpark located on the south western side of the site. The projected car spaces required by the school is a maximum of 67 additional car park spaces (Document Reference: Pacific Brook Christian School, Muswellbrook, Traffic Impact Assessment by PTC, dated 12/07/2021 – Section 3.5.2). The school carpark will typically fill and empty once per day, and it is assumed it takes ½ hour to fill or empty.

From the assumptions above it would be expected that the noise level generated at the boundary of the nearest residential receiver to the south east of the site would be 35dB(A)$L_{eq(1hr)}$. This is less than the background noise level and will therefore not adversely impact any of the nearby receivers.

7.2.2 Kiss and Drop

A school parent/pupil drop off bay is proposed along the existing driveway with approximately 271 vehicles in peak periods of activity for both AM (8:15am-9:15am) and PM (3:00pm-4:00pm) peak hours as it is anticipated that students will utilise the same travel mode to and from school. This was a conservative estimate made by PTC and their Traffic Impact Assessment as it is also assumed that no students will attend Out of School Hours (OOSH) activities meaning that all students will be arriving and leaving the school during the peak periods.

From the assumptions above it would be expected that the noise level generated at the boundary of the nearest residential receiver to the south east of the site would be 54dB(A)$L_{eq(1hr)}$. This exceeds the background noise level by more than 5 dB(A). A 1.8m high imperforated boundary fence extending from the waste area to near the road boundary would prevent line of sight to the kiss and drop area and will be sufficient to achieve compliance with background + 5 dB(A).

7.3 WASTE REMOVAL

Waste would be stored near the south eastern boundary of the school adjacent to the Junior school buildings. The waste removal truck would park approximately 10m from the nearest residential building. Waste removal are scheduled to occur between 7am and 6pm and will also be outside of peak hours of the school. The proposed time restrictions adequately address noise impact from waste removal operations. The proposed boundary fence will also assist in managing noise impacts.

7.4 EXTERNAL ACTIVITIES

The expected external school activities include:

- Use of all external spaces immediately before school commencing and recess/lunch periods.
- Use of courts for sports lessons during the normal school day, plus occasional afternoon and Saturday use for sports tournaments/competitions.

There are no criteria to be met regarding normal activities conducted by the school, nor is its assessment a specific requirement of the SEARS. The external spaces are separated from nearby residential residences by distance and screening from proposed school building structures.

Noise emissions from the use of the outdoor play areas is predicted based on the following assumptions/information:

- Number of students:
    - 656 Students
- General Playground noise measurements:
    - Noise level per student of 83dB(A) (sound power level one in two students), based on measurements conducted at Anzac Park Public School.
- All play areas in operation at once (i.e., communal play area and court/COLA's).
- Sports courts noise measurements – Use of sports courts for competitive sports is a potentially more intensive use of these spaces compared to typical playground use. As a part of studies of play ground noise emission, AL have undertaken measurements noise created on sports courts. In our experience, noise from an intensive use of *one* sports court (competitive basketball, a louder than typical sporting activity) is approximately 61dB(A) $L_{eq,15min}$ when standing 10m from the edge of the court. This data is then used to predict noise levels at nearby properties (the relative position between the courts and the receivers). We note that only the Junior school, Senior schools will have outdoor courts and the multipurpose centre will have an enclosed court.
- The multipurpose centre has all doors/windows closed during sporting activities.

The predicted noise levels at the most impacted receivers surrounding the site are:

- For the nearest residential receivers at the south east boundary of the site:
    - General recess/lunch – 56dB(A) $L_{eq,15min}$
    - Sports courts in use – 47dB(A) $L_{eq,15min}$
- For the nearest residential receivers to the north east (across the golf course along Victoria Street):
    - General recess/lunch – 46dB(A) $L_{eq,15min}$
    - Sports courts in use – 29dB(A) $L_{eq,15min}$
- For the nearest residential receivers to the north west (across Maitland Street):
    - General recess/lunch – 42dB(A) $L_{eq,15min}$
    - Sports courts in use – 27dB(A) $L_{eq,15min}$

- For the golf course at the north east boundary:
    - General recess/lunch – 67dB(A) $L_{eq,15min}$
    - Sports courts in use – 53dB(A) $L_{eq,15min}$

The predicted noise levels comply for the residences across Maitland Street to the north west. Predicted noise levels exceed the daytime nominated rating background levels for the nearest receivers located at the south eastern boundary of the project site and nearest residences to the north east at Victoria Street by up to 8dB(A) and 2dB(A) respectively. Noise levels predicted to the golf course also exceed the amenity noise levels by to 9dB(A) for this receiver near the project sites north east boundary. The level of impact at all other residences and further into the golf course will be significantly lower due to the screening effects provide by the school buildings, and because of additional distance loss.

With respect to the above for playground use it is typical not to apply noise criteria given that it is present for short periods through the day, and it is regarded as "community" noise.

However, in our opinion, the predicted noise levels at the most exposed residences are not unreasonable for the following reasons:

- Noise from school playgrounds a noise source intended to be governed by documents such as the EPA Noise Policy for Industry (NPfI) 2017. It is common (and almost unavoidable) in school development that a playground is located in close proximity to residential development. In this regard we note that in *Meriden v Pedavoli [2009 NSWLEC 183]* the NSW Land and Environment Court noted "*All noise that emanates from the normal activities at a school is not offensive*". The Court had regard to the fact that there was other school development in the local government area in which playgrounds adjoin residential development and the fact the proposed use was permissible in the zone. This is consistent with the proposed development.

- As noted above, a playground located near a residential boundary is a common scenario in school developments. At the subject site, the main play areas are located away and/or screened from residential receivers by the school buildings.

- Given that there is already significant distance and barrier separation between the play areas and residences, the only way of minimising noise impact is to erect noise barriers around the school, However, these barriers have other negative impacts which, while technically feasible, may not be a reasonable response to a level of impact that typically occurs with schools placed within residential zonings and appears to be a generally accepted level of impact.

- The school is adjacent to a golf course and Muswellbrook showground and therefore "play" noise is already part of the normal noise environment.

7.5 NON-SCHOOL USES, AND AFTER HOURS SCHOOL ACTIVITIES

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

External activities by non-school uses may include use of the external spaces and the multipurpose centre as described in Table 2. The recommendations regarding the use of the multipurpose centre by the school should also be adopted for these uses. Use of the COLA and basketball courts should be limited to the hours specified in Table 2.

7.6 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 locations are finalised.

Given the proposed buildings are mostly remote from existing and future residential buildings, it is both possible and practical to treat noise from the operation of the proposed mechanical equipment to comply with the EPA NPfI criteria using appropriate siting and selection, standard acoustic treatments such as lined ductwork, silencers, screens and the like.

In regard to the school bell/PA system, the system should minimise noise spill to adjacent properties

- 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.
    - Where possible speakers should be placed in locations that are screened from surrounding nearest receivers

8 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.

9 NOISE INTRUSION ASSESSMENT

9.1 RAIL NOISE

The school has a rail corridor to the north east past the adjacent golf course approximately 350m away. We note that in accordance with the document Development Near Rail Corridors and Busy Roads - Interim Guideline (Department of Planning, 2008, Section 3.5.1) if a development is within 40m of an operational track and Passenger and Freight services are ≥80km/h a full noise assessment should be undertaken. It also states for rail corridors further away than 80m acoustic advice should be sought.

As the rail corridor to this development is much further in distance it is our opinion that with the noise attenuation from the distance loss and the use of typical building elements for a school the internal noise level requirement of 40dB(A) $L_{eq,1hr}$ within classrooms will be achievable.

The noise monitor located at the golf course boundary would include noise emissions from the railway and confirms that no specific treatment is needed to comply with DNRCBR.

9.2 TRAFFIC NOISE

The school will be impacted by traffic noise from Maitland Street which is classified as a state road and located at the south western boundary. The most impacted school buildings would be the classrooms within the middle school and junior school buildings nearest to the road and having a south western façade facing Maitland Street.

We note that the Traffic Impact Assessment by PTC states (Section 3.3 of their report) a New England Highway bypass is proposed to run east of Muswellbrook area, connecting the New England Highway southwest and north of the town, thus diverting through traffic away from the Muswellbrook Town Centre and the proposed school development. This along with the introduction of a school speed limit in front of the development (changing the speed limit from 50km/h to 40km/h) would mean that traffic noise in the future from Maitland Street will be reduced and therefore traffic noise levels captured and used for this assessment will be conservative.

Existing noise levels at the facades of the proposed buildings were predicted using the noise logger data obtained. The noise monitor measured a traffic noise level of 67 dB(A) $L_{eq,1hr}$. The predicted noise level at a point corresponding to the closest classroom façade to Maitland Street is 65 dB(A)$L_{eq,1hr}$.

With standard windows and constructions, the noise level in the classrooms would be expected to be reduced by approximately 20dB(A), meaning the 40dB(A) criterion would be exceeded, with the predicted external noise level of 65 dB(A) $L_{eq,\ worst\ 1hr}$. This indicates that, if the buildings are constructed prior to the road bypass being built, an acoustically upgraded façade would be needed that provides a traffic noise reduction of 25 dB(A) with windows closed.

For the multipurpose centre and the two rows of buildings closest to Maitland Street, if ventilation is needed to be provided through windows having a line of sight to Maitland Street an alternative ventilation system complying with the BCA is required, as the windows open noise levels are likely to exceed the level recommended in DNRCBR (i.e., 50 dB(A)).

10 NOISE INCREASE FROM TRAFFIC GENERATION ON LOCAL ROADS

Given the volume of existing traffic on Maitland Street, the movements generated by the proposed development would produce an inaudible change in noise, and the increase will be significantly below the 2 dB permitted by the RNP.

11 CONSTRUCTION NOISE ASSESSMENT

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

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

11.1 SITE DESCRIPTION

Construction works for the proposed school will consist primarily of three construction phases, namely site works, general construction activities and completion landscaping/external works. The proposal consists of a number of buildings including a multipurpose centre containing a basketball court, general teaching areas and administrative offices.

There are no below ground/basement levels proposed, meaning that significant excavation and piling will not be required. Construction works (and typical loudest plant/equipment) expected for the project are as follows:

- Clearing of the site and earthworks to level the site as required and excavate for footings and services (excavators, pneumatic hammers)
- Erection of building structure (powered hand tools for formwork, concrete pump, vibrators);
- Internal fit out.
- Landscaping (front end loaders etc);

Work hours for the site are proposed as follows:

- Monday to Friday: 7am – 6pm
- Saturday: 7:30am – 1pm
- Sundays or Public Holidays: No work.

We note that the above work hours may be altered in accordance with COVID-19 Health Orders at the time of construction.

11.2 RECEIVER LOCATIONS

Sensitive receiver locations are identified in Section 3.

11.3 NOISE AND VIBRATION GUIDELINES

11.3.1 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;
- If necessary, recommendation of noise controls strategies in the event that 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 11.

Table 11 – Noise Management Levels - Residential

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Receivers at the south east boundary	53	75
Residential receivers to the north east along Victoria Street (across the golf course)	50	75
Residential receivers to the north west (across Maitland Street)	63	75
Golf Course	58	-

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

11.3.2 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.

11.3.2.1 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 12 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

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

The surrounding commercial/industrial buildings would be considered a Type 1 structure, whilst nearby residences would be classified as a type 2 structure.

11.3.2.2 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 13 – 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

11.4 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

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

Table 14 - Sound Power Levels of the Typical Equipment

Equipment / Process	**Sound Power Level dB(A)***
Dozer/Excavator	112
Concrete Pump	110
Trucks	100
Bobcat	105
Crane (electric)	85
Powered Hand Tools	95-100

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).

11.5 NOISE PREDICTIONS

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

- The activity undertaken.
- The distance between the work site and the receiver. 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 the expected noise reduction as a result of distance only.

Table 8 – Predicted Noise Generation to Residential Receivers to the South East Boundary

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	58-80	Will generally exceed NML
Concrete Pump	56-76	Will generally exceed NML
Trucks	46-66	Will generally exceed NML when at south eastern boundary of site
Bobcat	51-77	Will generally exceed NML when at south eastern boundary of site
Crane/Hoist (electric)	31-51	Generally below NML
Powered Hand Tools (Externally)	41-72	Will generally exceed NML when at south eastern boundary of site

Table 9 – Predicted Noise Generation to Residential Receivers to the North East (Across the Golf Course Along Victoria Street)

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	50-52	Will generally exceed NML
Concrete Pump	48-50	Will generally exceed NML
Trucks	38-40	Generally below NML
Bobcat	43-45	Generally below NML
Crane/Hoist (electric)	23-25	Generally below NML
Powered Hand Tools (Externally)	35-40	Generally below NML

Table 10 – Predicted Noise Generation to Residential Receivers to the North West (Across Maitland Street)

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	54-62	Generally below NML
Concrete Pump	52-60	Generally below NML
Trucks	42-50	Generally below NML
Bobcat	47-55	Generally below NML
Crane/Hoist (electric)	27-35	Generally below NML
Powered Hand Tools (Externally)	37-50	Generally below NML

Table 11 – Predicted Noise Generation to Residential Receivers to the Golf Course

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	58-80	Will generally exceed NML
Concrete Pump	56-78	Will generally exceed NML
Trucks	46-68	Will generally exceed NML when at north eastern boundary of site
Bobcat	51-73	Will generally exceed NML when at north eastern boundary of site
Crane/Hoist (electric)	31-53	Generally below NML
Powered Hand Tools (Externally)	41-68	Will generally exceed NML when at north eastern boundary of site

11.6 DISCUSSION – NOISE

The greatest noise impact will be at the residences immediately to the south east of the site and to the golf course at the north east boundary. Noise levels will generally exceed the NML but will be less than the HNAL. Therefore, "reasonable and feasible" mitigation should be applied in accordance with the "Control of Construction Noise and Vibration – Procedural Steps" outlined in Section 11.9. However, for works near the south east boundary noise levels can exceed the highly noise affected NML therefore noise controls such as respite periods should be considered when carrying out the louder operations working close to the south eastern boundary.

11.7 DISCUSSION - VIBRATION

There are no significant sources of vibration envisaged. Given the distance from nearby receivers, vibration impacts on all receivers is expected to be within the recommended levels detailed in Section 11.3.2.

11.8 RECOMMENDATIONS

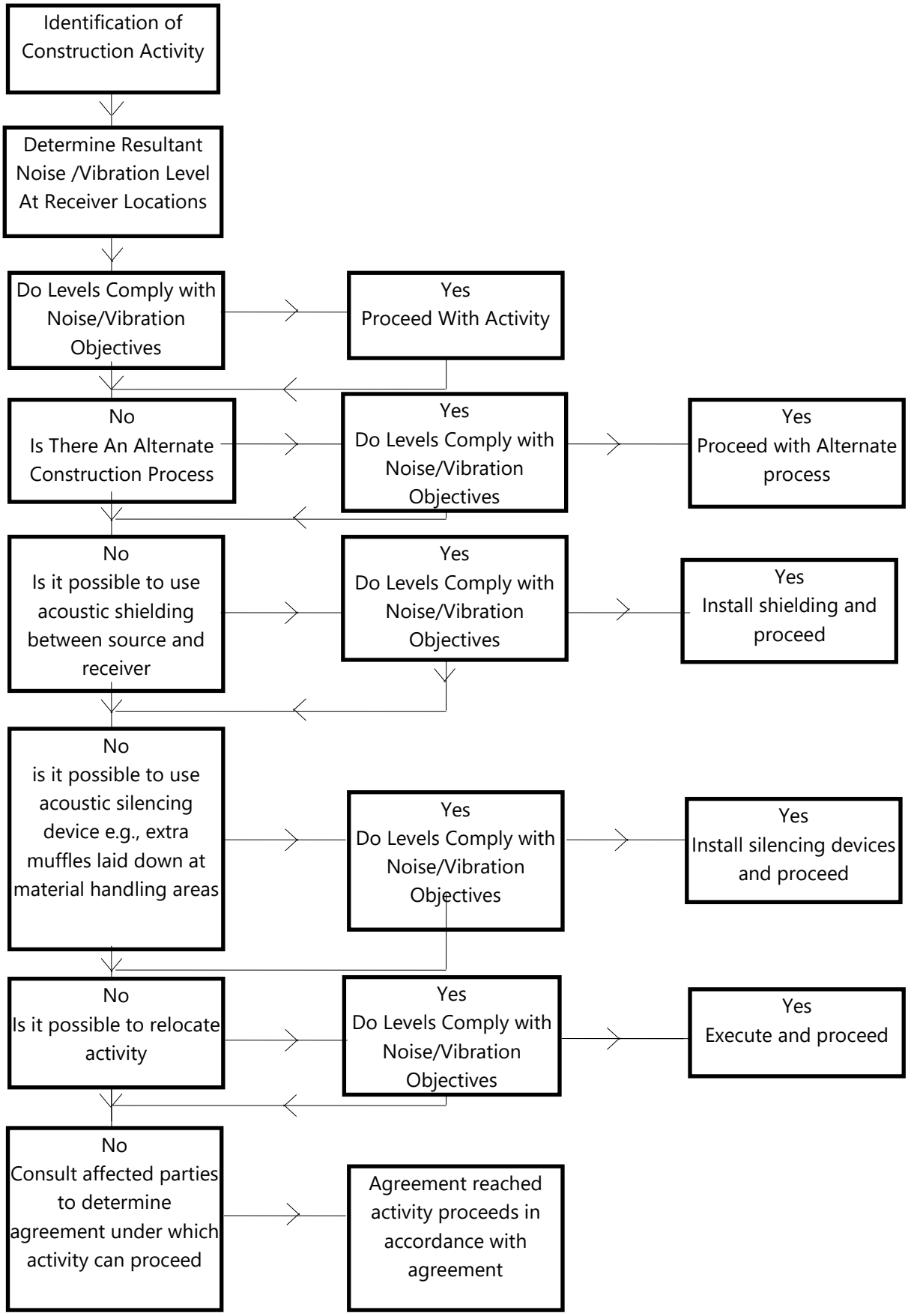
In light of the above, the following recommendations are made:

- Operation of large earthmoving equipment (bulldozers and excavators) between 7am and 8am within 30m of the south eastern site boundary should be avoided.
- Quiet work methods/technologies:
    - The primary noise generating activity at the site will be the ground work period. As much as practicable, use of quieter methods is adopted.
    - Concrete pump trucks should be located within the bounds of the site (rather than on nearby roads at the perimeter of the site) where possible.
    - Materials handling/vehicles:
        - Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.

        - Avoid careless dropping of construction materials into empty trucks.
        - Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).
- In respect of pneumatic/hydraulic hammering (if required) noise impacts should be addressed via the imposition of respite periods, typically limiting operation to:
    - 8am – 6pm, Monday to Friday
    - 8am to 1pm, Saturday
    - In any case maximum 3 hours operation with 1 hour uninterrupted respite.
- Noisy activities (exceeding the RBL by more than 5 dB(A)) should not be carried out after 1pm Saturdays. This would generally limit the activities to "quiet" trades such as internal fitout and maintenance activities.
- Complaint's handling - In the event of a complaint, the procedures outlined in Sections 11.9, 11.10 and 11.11 should be adopted.
- A detailed noise management plan should be developed by the main contractor that describes in detail the construction phases, programme, processes and equipment used, noise impact assessment and proposed mitigation and management.
- Site Induction:
    - A copy of the Noise Management Plan is to be available to contractors. The location of the Noise Management Plan should be advised in any site induction.
    - Site induction should also detail the site contact is to be notified in the event of noise complaint.

11.9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that will be followed in assessing construction activities.



11.10 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered.

The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

11.10.1 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. Undertaking this activity using bulldozers, ripping and/or milling machines will result in lower noise levels. This measure has the potential to reduce noise emissions by 10 dB(A) or more.

11.10.2 Acoustic Barriers

Given the position of adjacent development, it is unlikely that noise screens will provide significant acoustic benefit for commercial or residential receivers but will provide noticeable improvement for those on ground level.

The placement of barriers at the source is generally only effective for static plant. Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

11.10.3 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

11.10.4 Treatment of Specific Equipment

In certain cases, it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

11.10.5 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. A more detailed management plan will be developed for this project in accordance with the construction methodology outlining work procedures and methods for minimising noise.

11.10.6 Combination of Methods

In some cases, it may be necessary that two or more control measures be implemented to minimise noise.

11.11 ADDRESSING COMPLAINTS

Should ongoing complaints of excessive noise or vibration levels occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

If a noise complaint is received the complaint should be recorded. Any complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

12 SUMMARY OF RECOMMENDATIONS

We recommend the following acoustic treatments/management controls are implemented to mitigate acoustic impact as much as practicable:

- Operation of the school should be limited to the activities and times of operation indicated in Table 2 of this report, subject to additional mitigation of noise for certain activities and operating times as indicated below.

- Detailed acoustic review of all external plant items should be undertaken following equipment selection and duct layout design. All plant items will be capable of meeting noise emission requirements of Council and the EPA Noise Policy for Industry (2017) Trigger Levels, with detailed design to be done at CC stage.

- External speakers for PA and bells should designed to minimise noise spill, be directional facing away from residential receivers to comply with EPA Noise Policy for Industry (2017) guidelines (refer to Sections 6.2.4)

- Waste removal times are to be scheduled between 7am and 6pm and co-ordinated with the Junior school to avoid child rest periods. Waste removal should also occur outside of peak school traffic demand.

- Ground maintenance should only occur between 7am and 6pm, Monday to Friday.

- A 1.8m high imperforate boundary fence extending from the waste area to near the road boundary. The fence could be constructed from Sheet metal, FC sheet panels or plywood panels, or other imperforate material having a surface density exceeding 3.5 kg/m^2.

- The school multipurpose centre doors and other large ventilation openings should be closed after 6pm where the activity involves amplified music or competitive sporting activities. Events should cease by 9:30pm.

- Where music practice occurs within a school classroom outside of normal hours the windows of the rooms should be kept closed.

- Current levels of traffic noise exposure would require, for the buildings closer to Maitland Street, an acoustically attenuated building envelope and the provision of an alternative ventilation system to permit the windows to be closed. Prior to CC a detailed assessment should be undertaken to recommend the performance of the building envelope needed to comply with the internal noise level recommendations of "Development Near Rail Corridors and Busy Roads" Interim Guideline.

- The proposal would not produce adverse vibration impacts on nearby structures or impact the amenity of the surrounding property

- Construction noise impacts should be managed as outlined in Section 11 Construction noise assessment.

13 CONCLUSION

Noise emissions associated with the proposed Pacific Brook Christian School have been assessed with reference to relevant EPA and relevant acoustic guidelines presented in Section 6 of this report.

The operational noise emission have been assessed in Section 7 of the report along with recommendations where required for the following:

- Noise from internal areas
- Noise from Traffic generation (Carpark and Kiss and Drop)
- Waste Removal
- External activities
- Non-school uses, and after hours school activities
- Noise from mechanical plant, PA system and school bells.

Comments have been made regarding operational vibration emissions (Section 8), noise intrusion into the development (Section 9) and noise increase from traffic generation on local road (Section 10).

Finally, an assessment on construction activities has been undertaken in Section10 of the report.

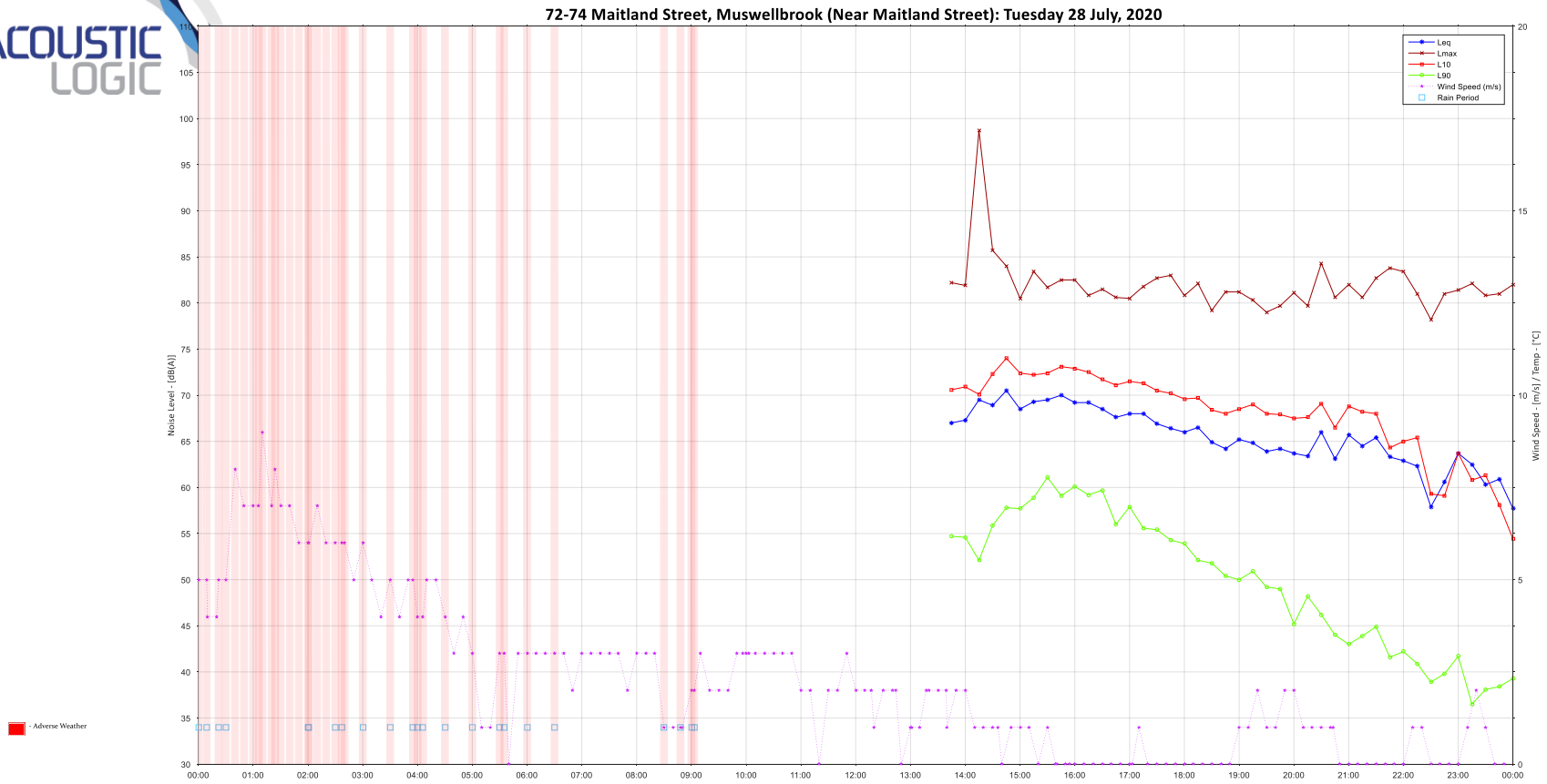
A summary of the recommendations to mitigate acoustic impact associated with the proposed development has been presented in Section 12. Recommendations have been made so that noise emissions from the school do not adversely impact the surrounding properties. Provided the recommendations within this report are adopted the proposed school will not adversely impact the acoustic amenity of surrounding receivers.

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

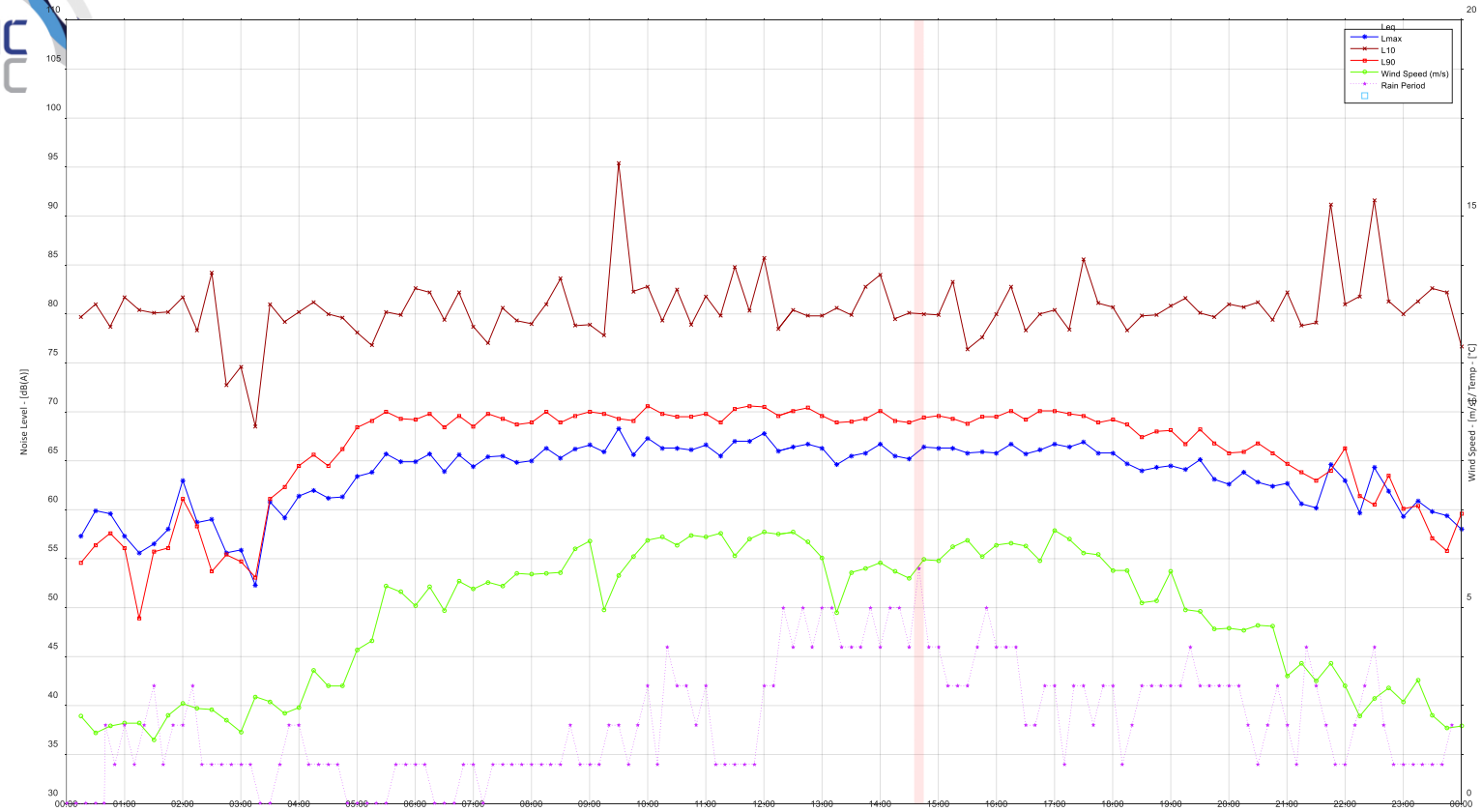
Yours faithfully,

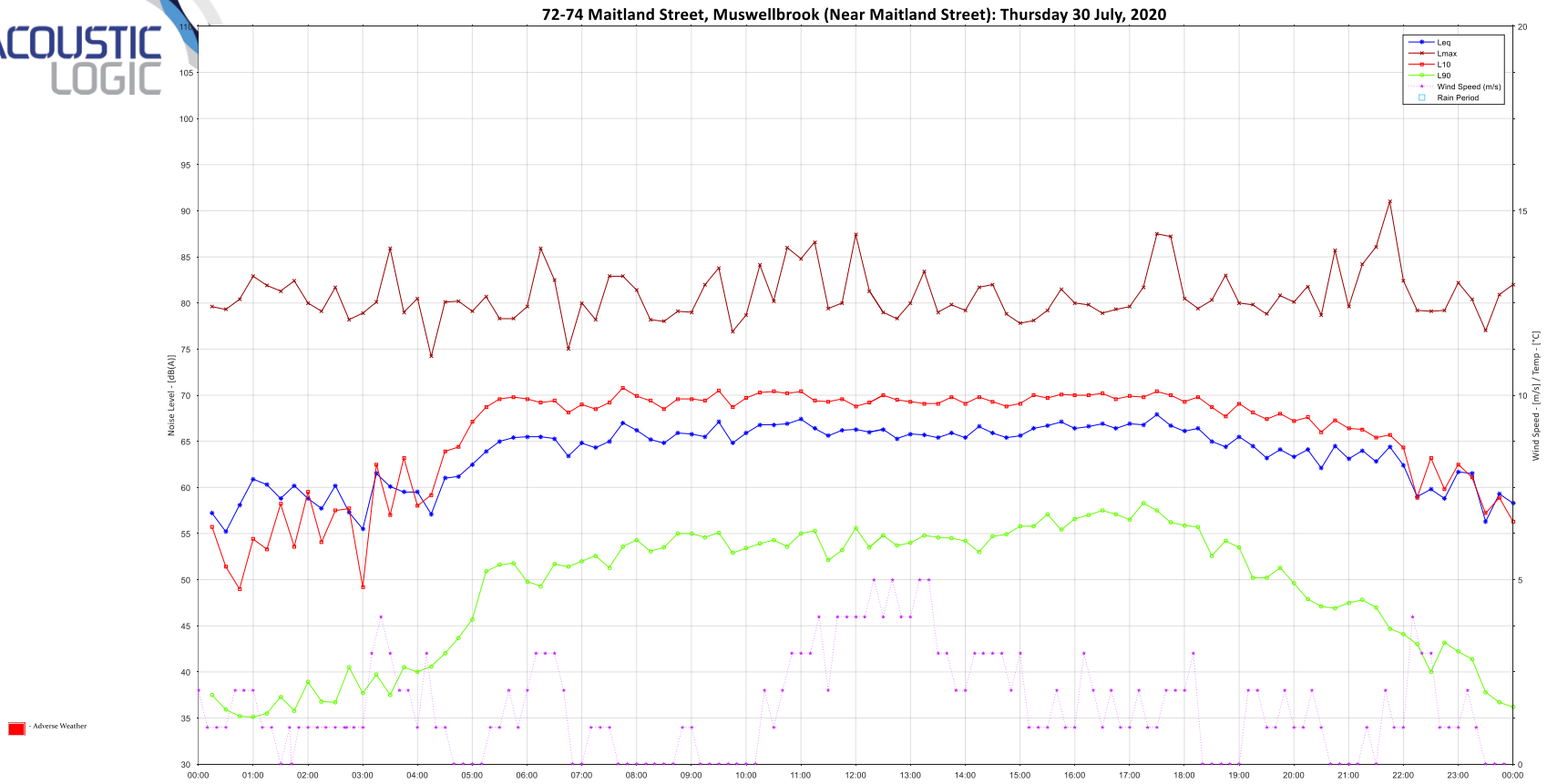
Acoustic Logic Consultancy Pty Ltd
Alex Salazar

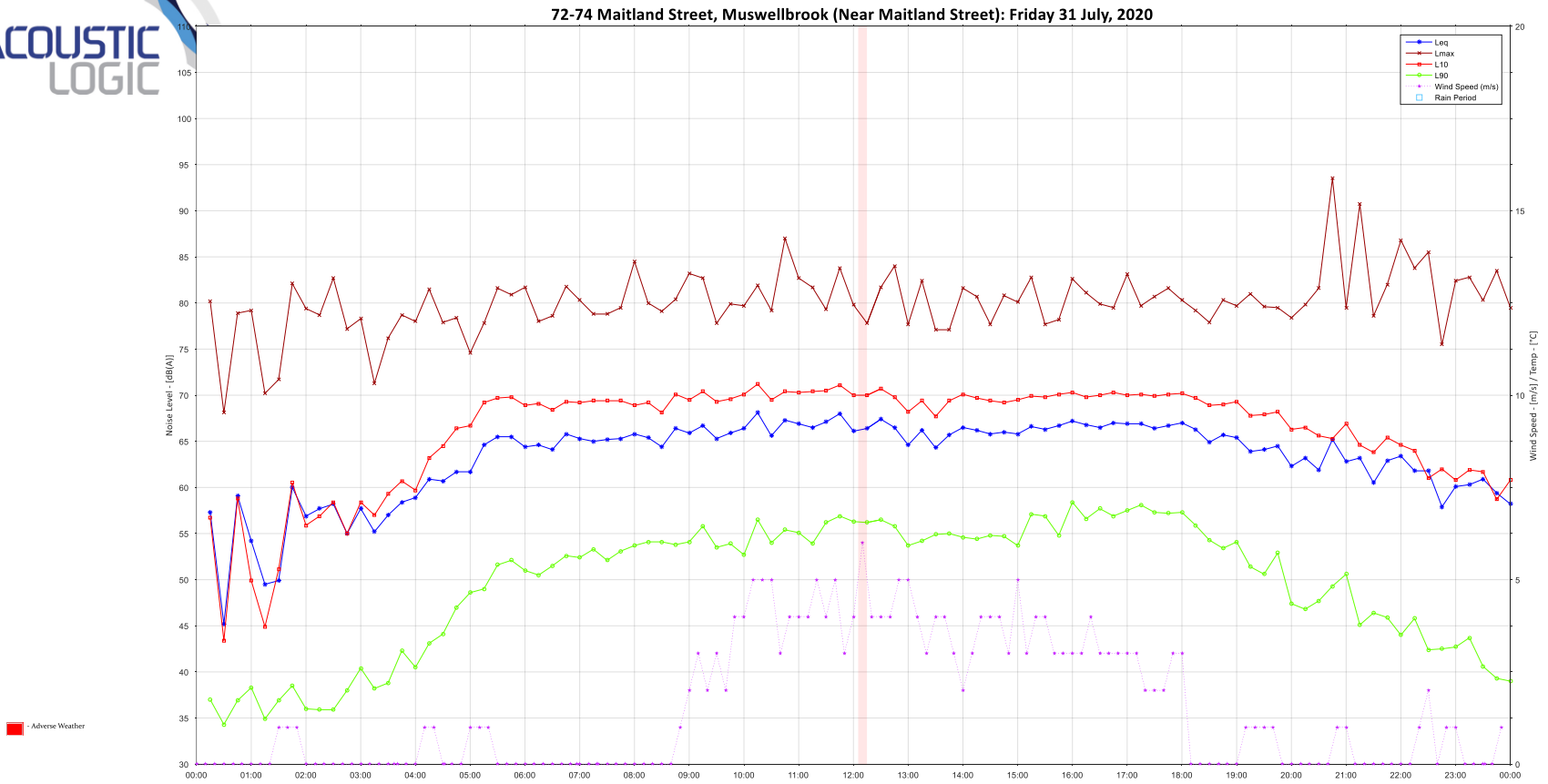
APPENDIX A – NOISE LOGGING DATA

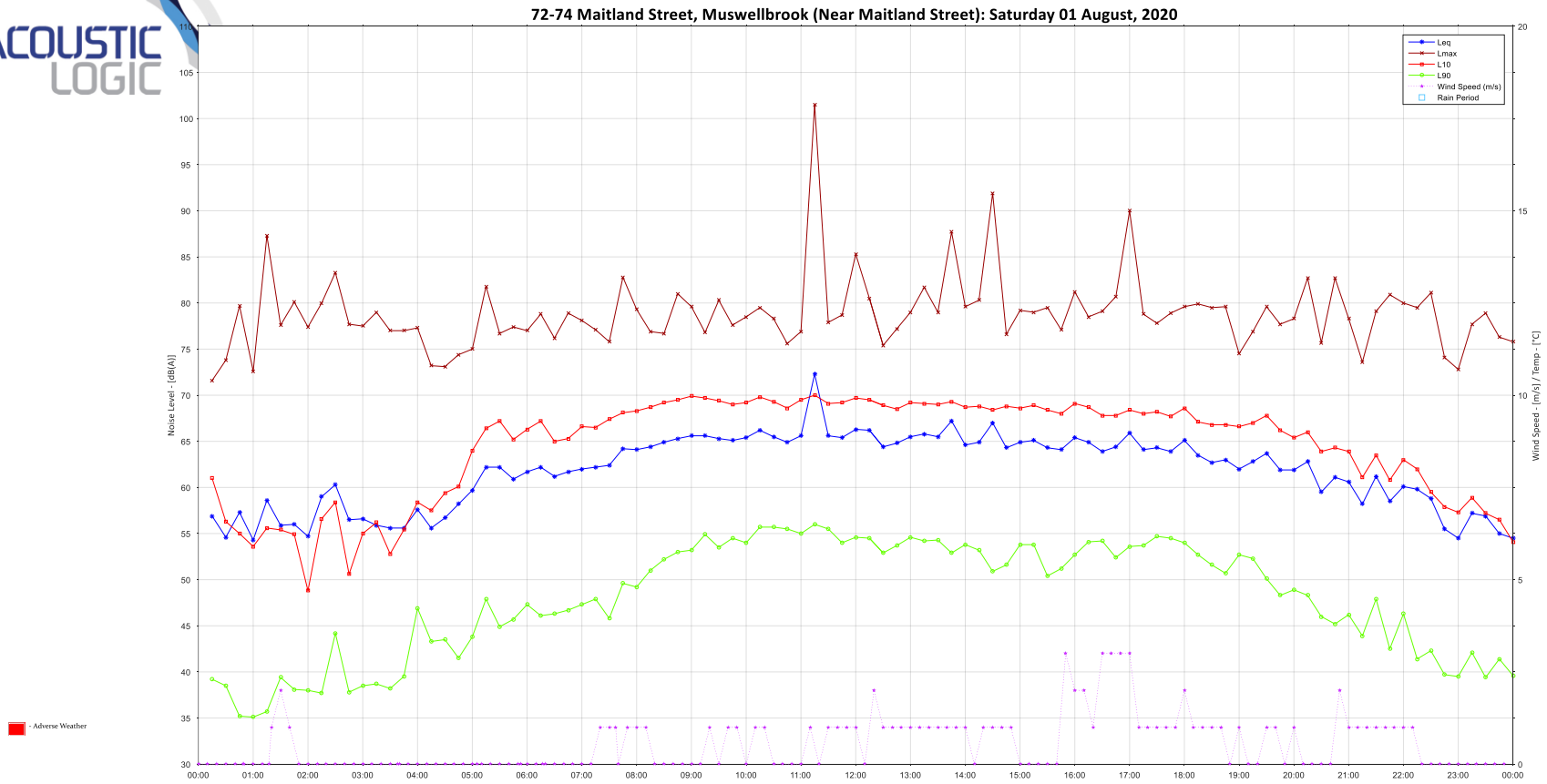

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Tuesday 28 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Wednesday 29 July, 2020

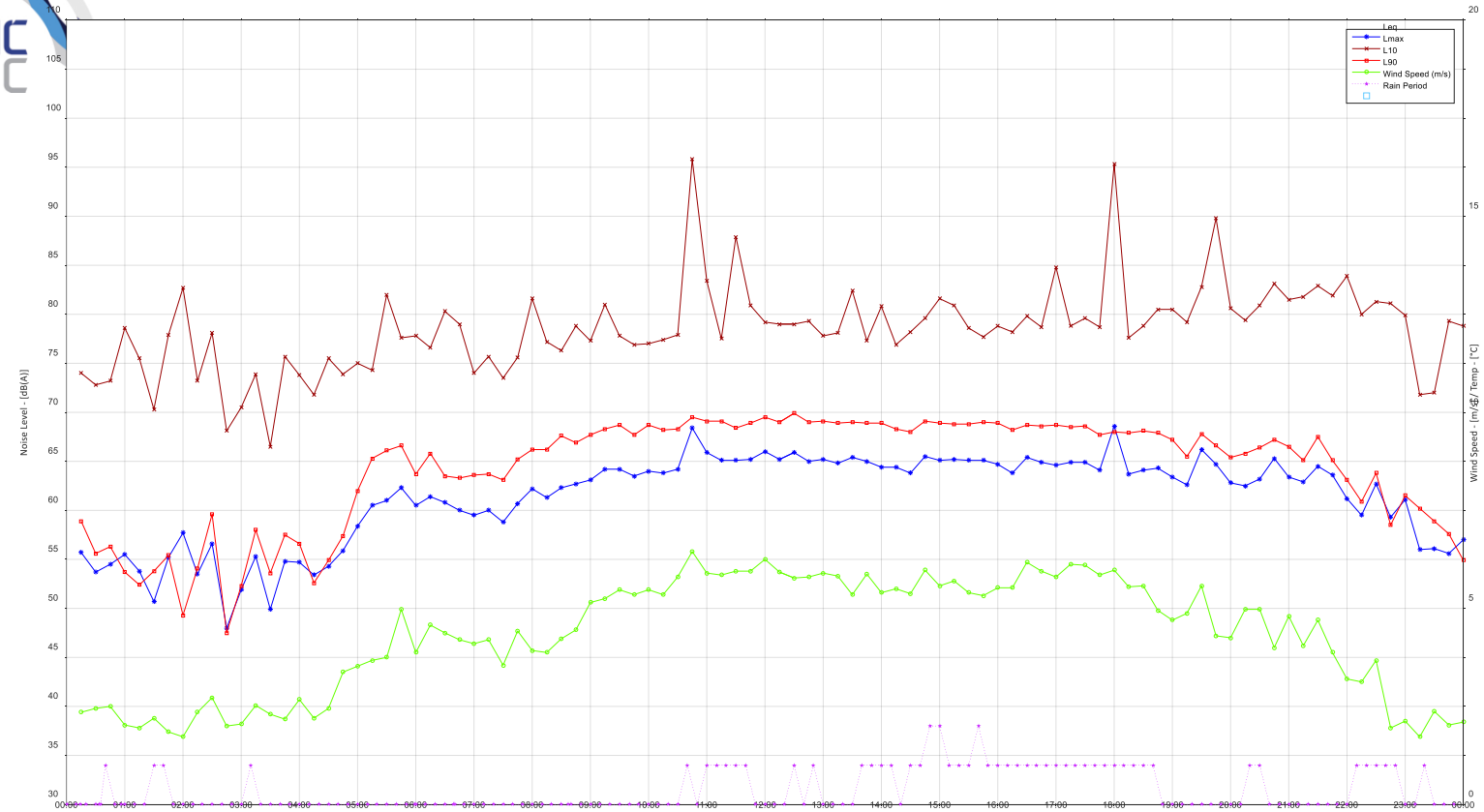


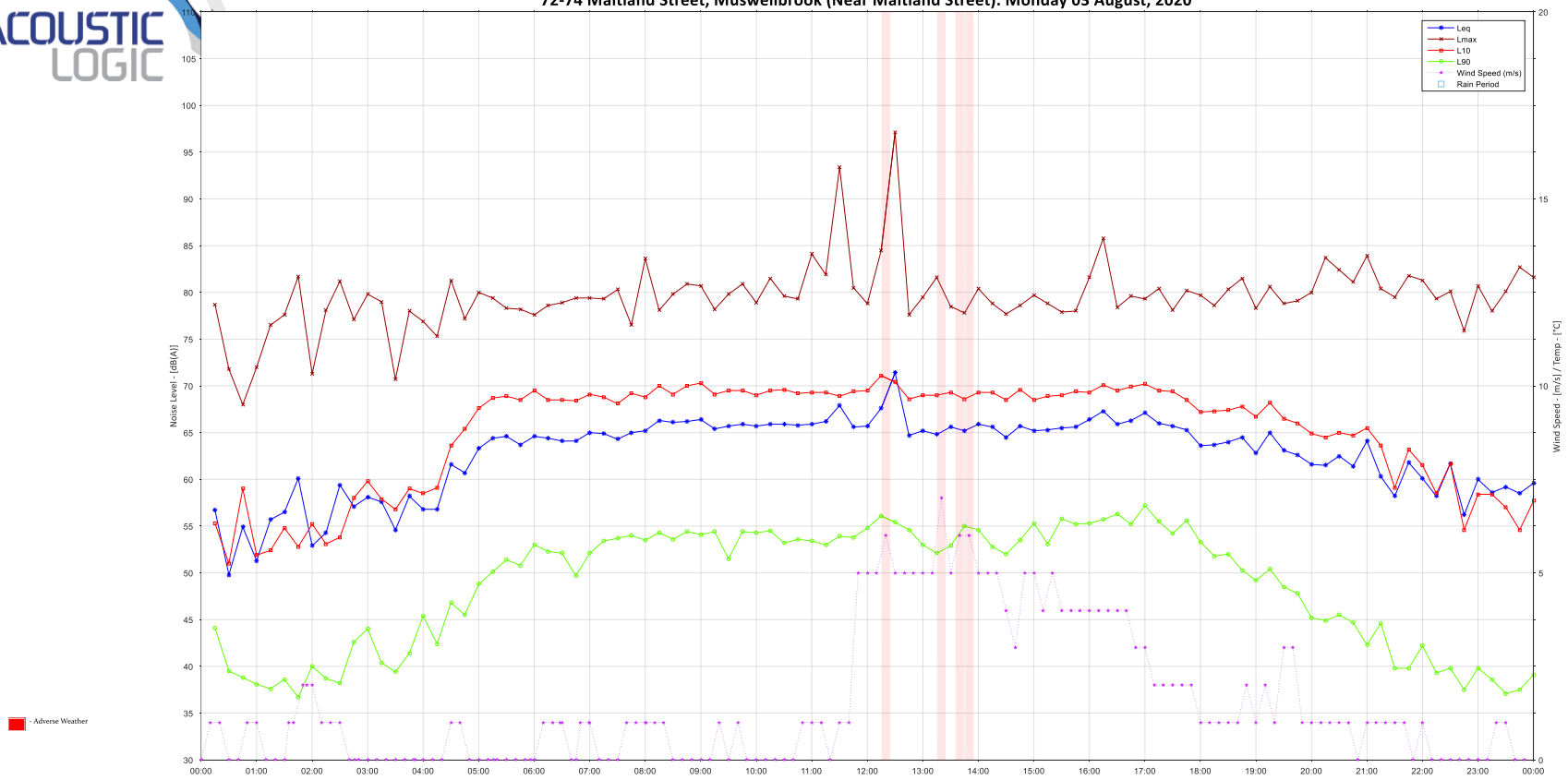

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Thursday 30 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

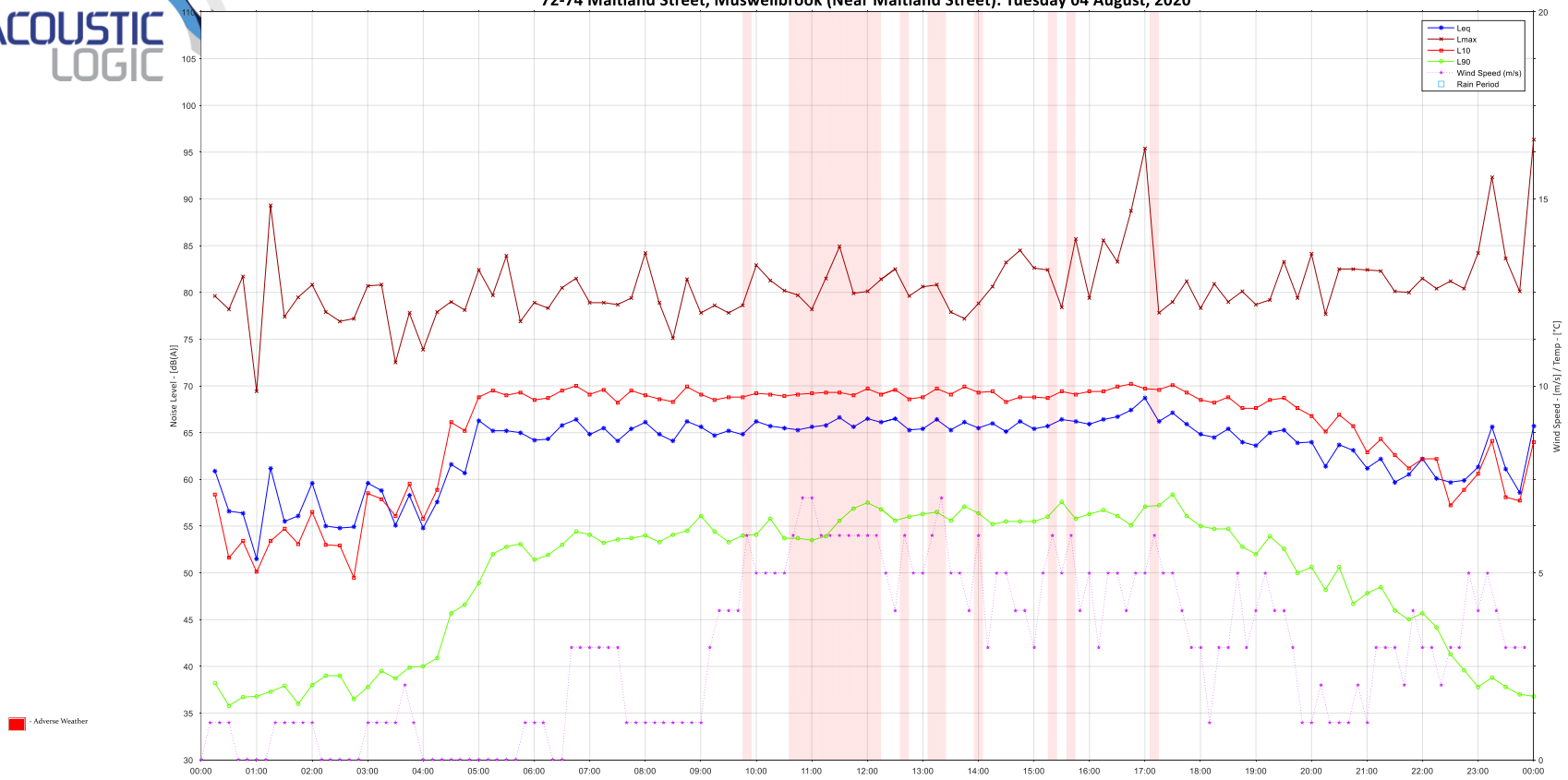

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Friday 31 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

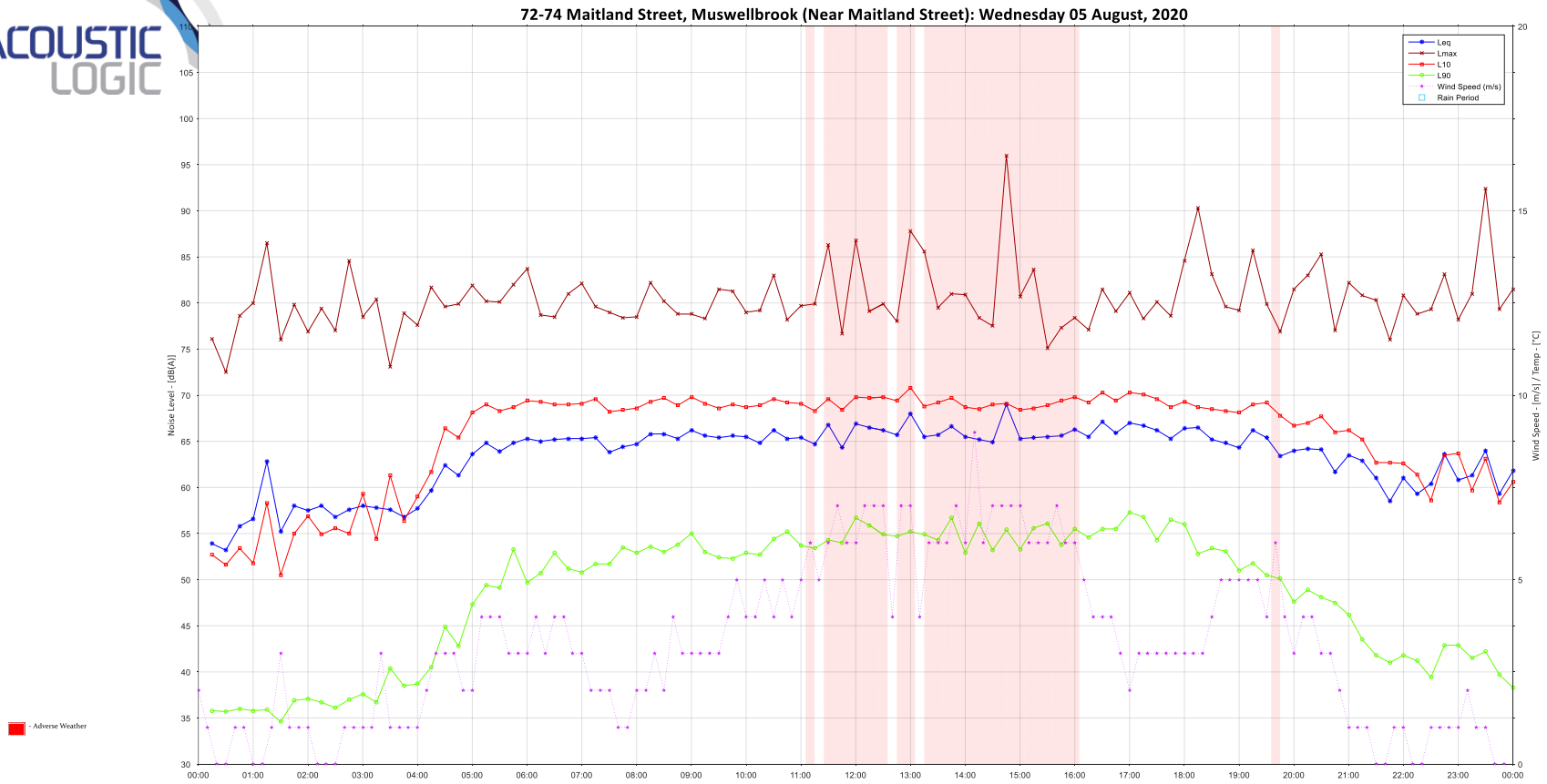

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Saturday 01 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

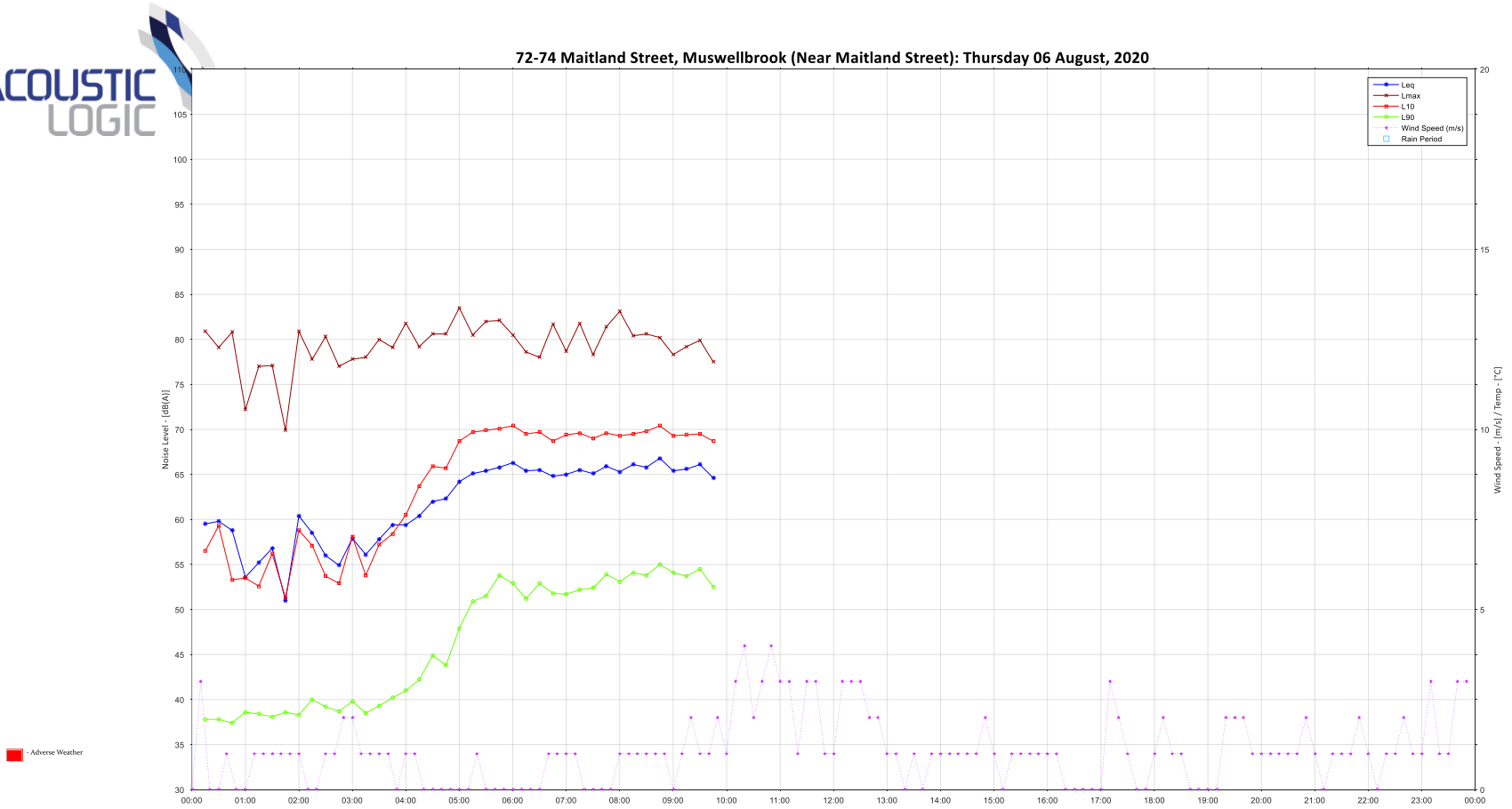
72-74 Maitland Street, Muswellbrook (Near Maitland Street): Sunday 02 August, 2020



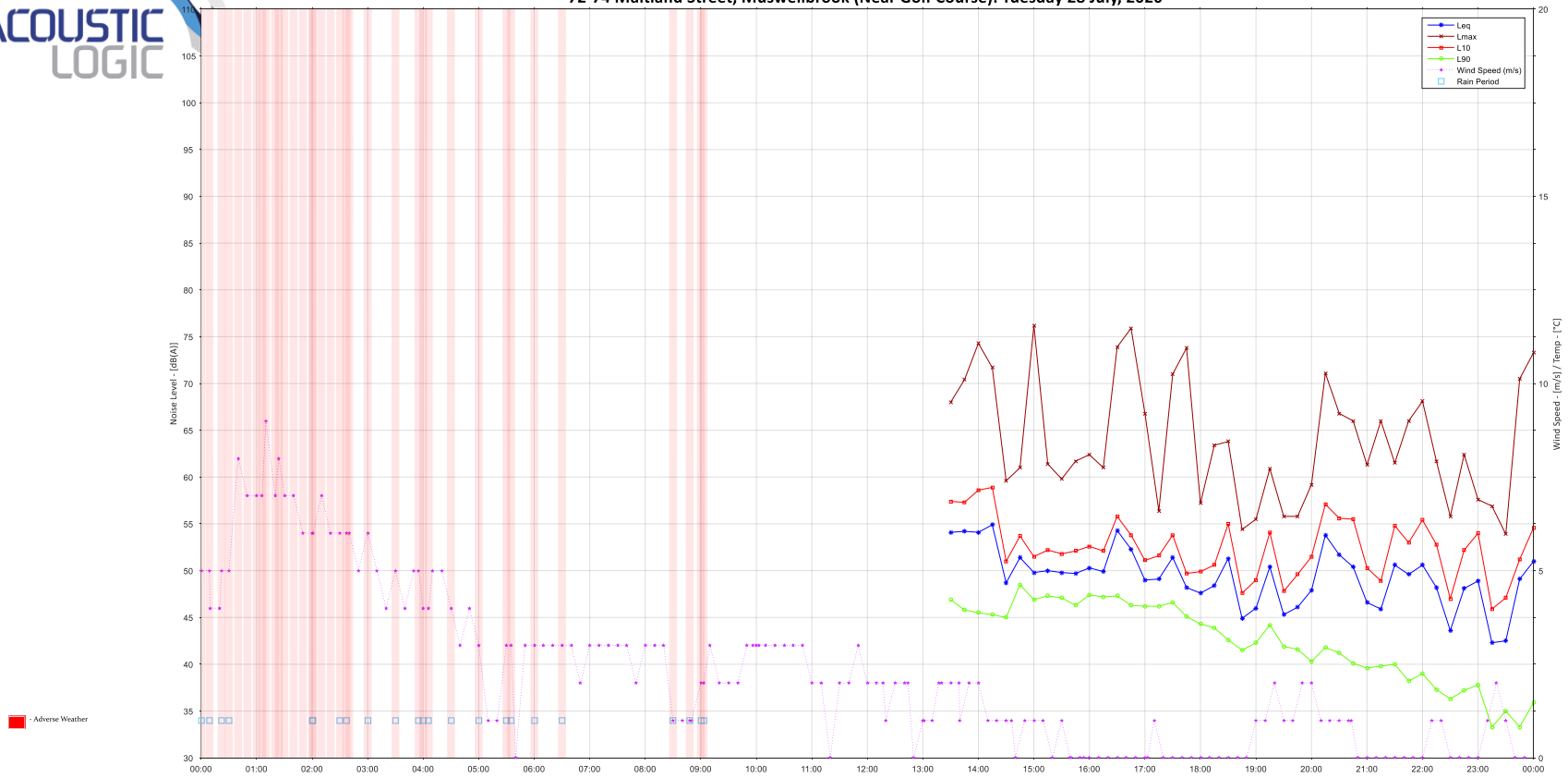

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Monday 03 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

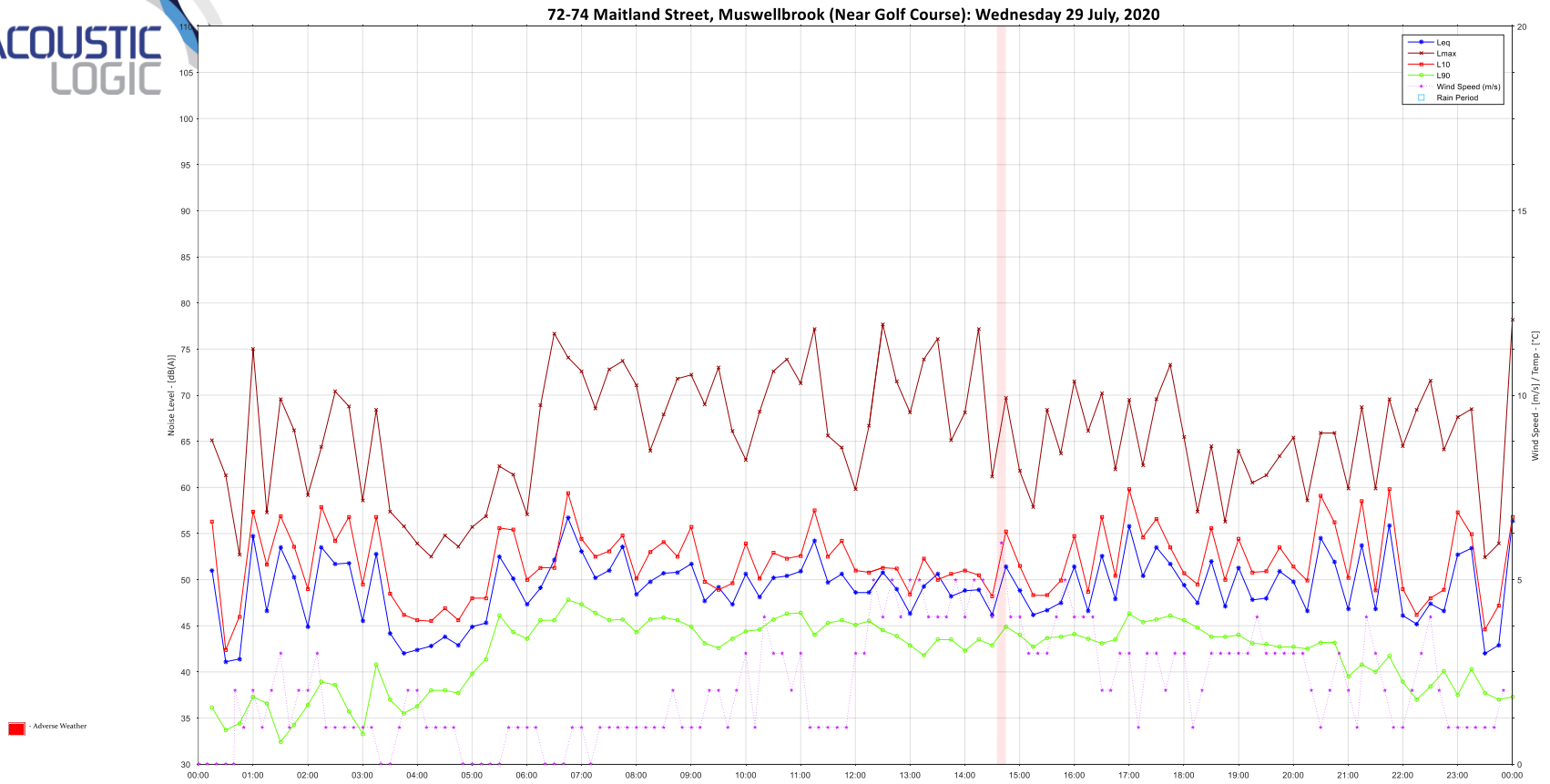

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Tuesday 04 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

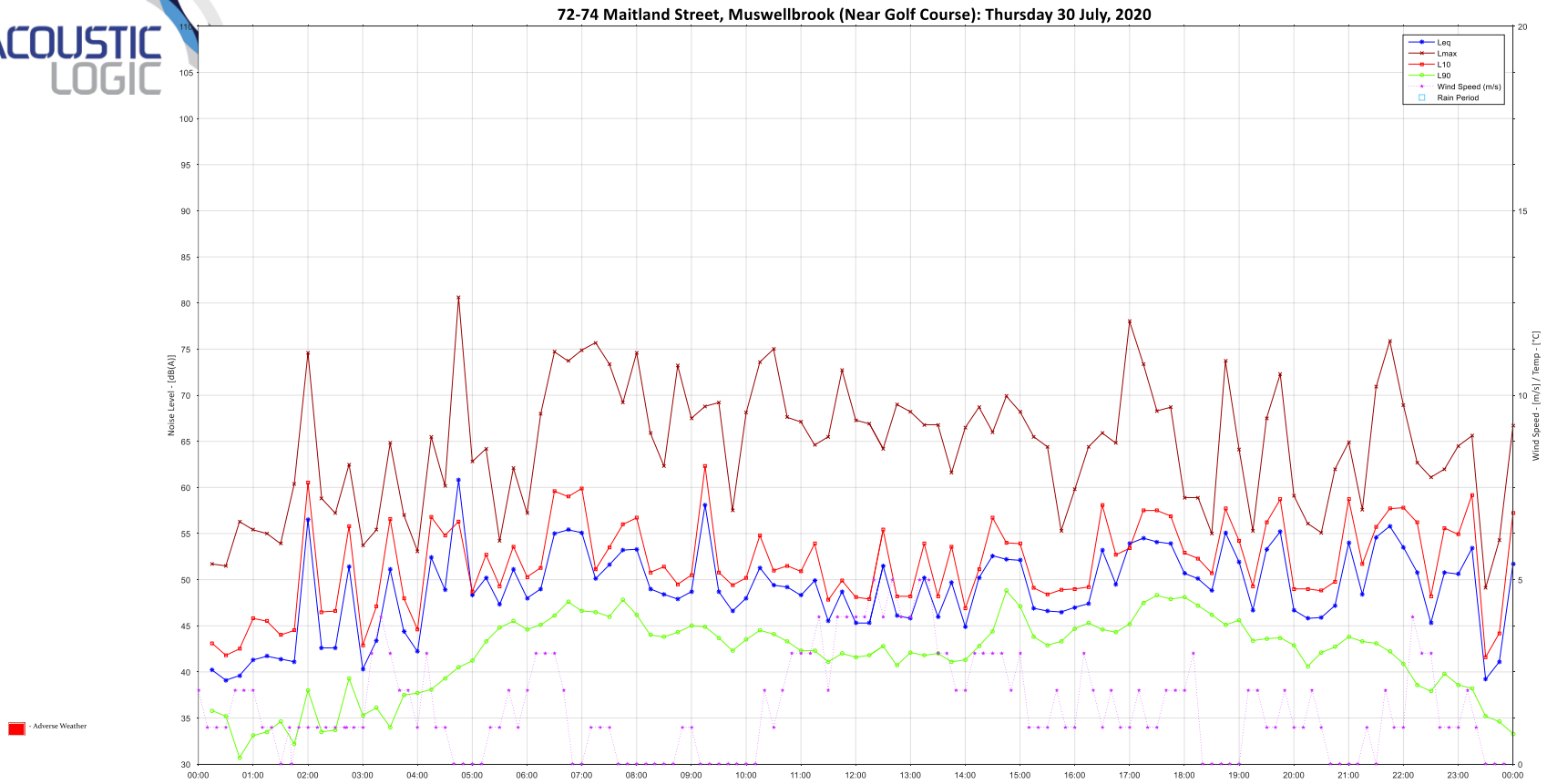

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Wednesday 05 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

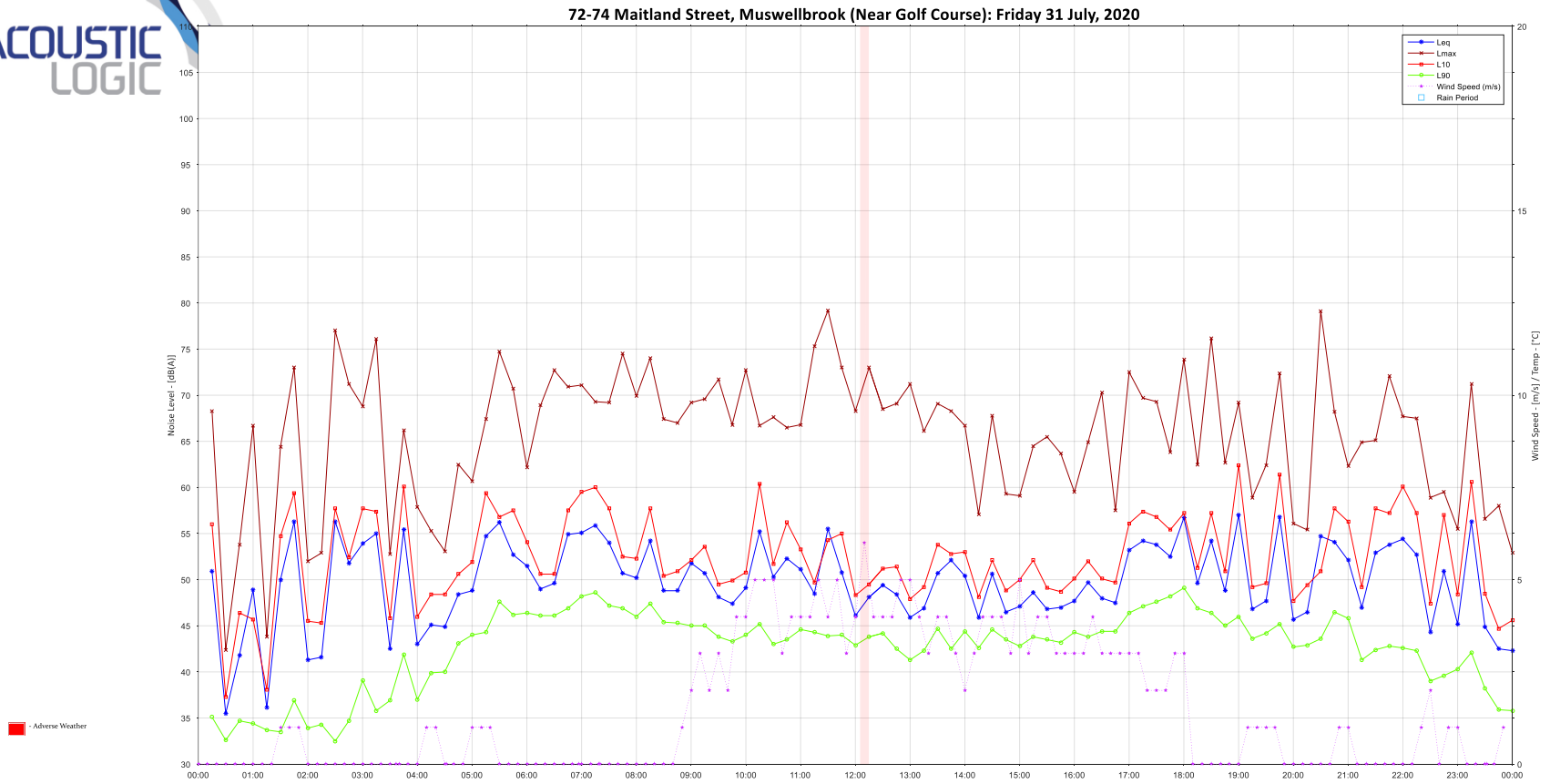

72-74 Maitland Street, Muswellbrook (Near Maitland Street): Thursday 06 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

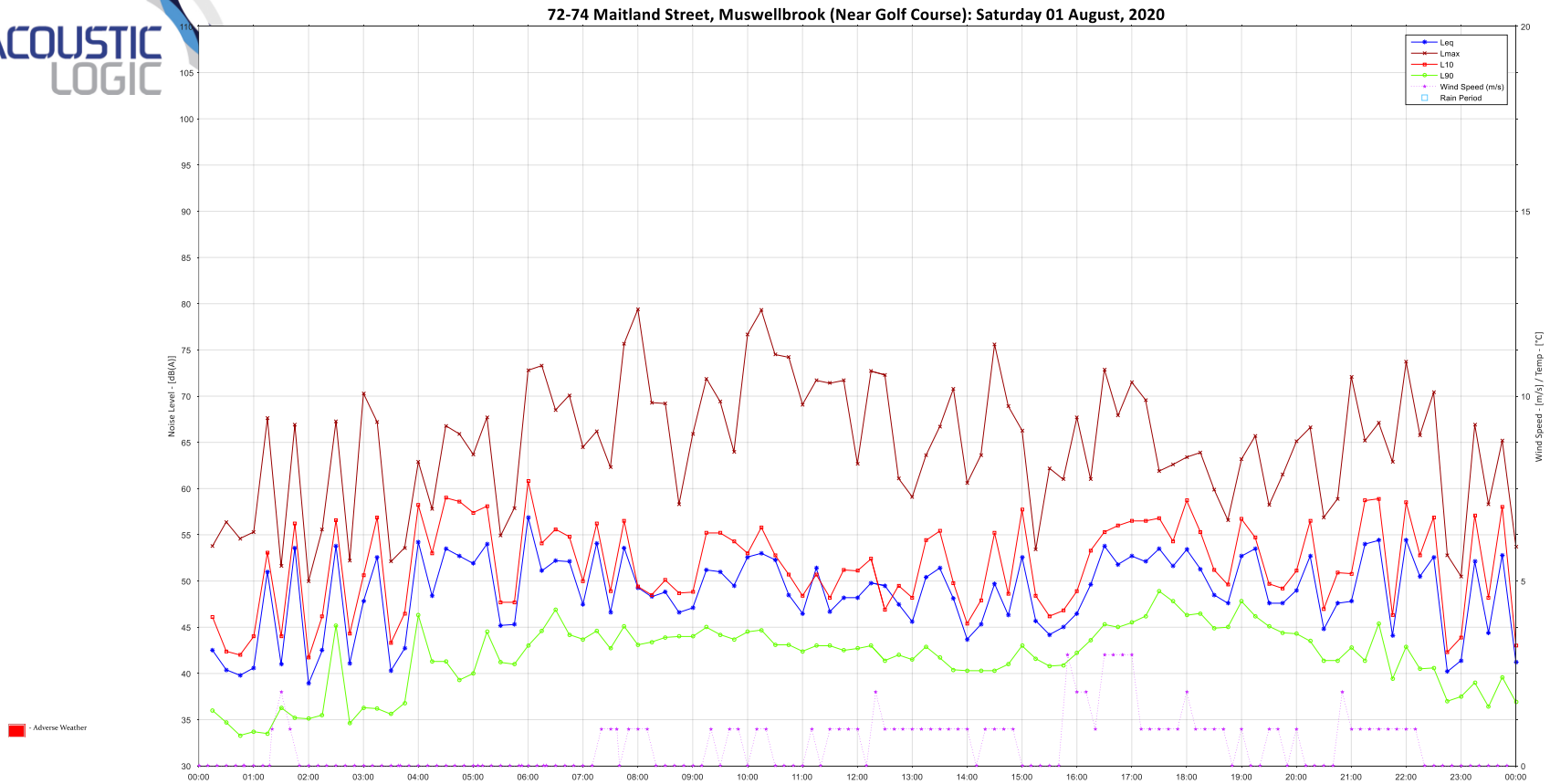
72-74 Maitland Street, Muswellbrook (Near Golf Course): Tuesday 28 July, 2020

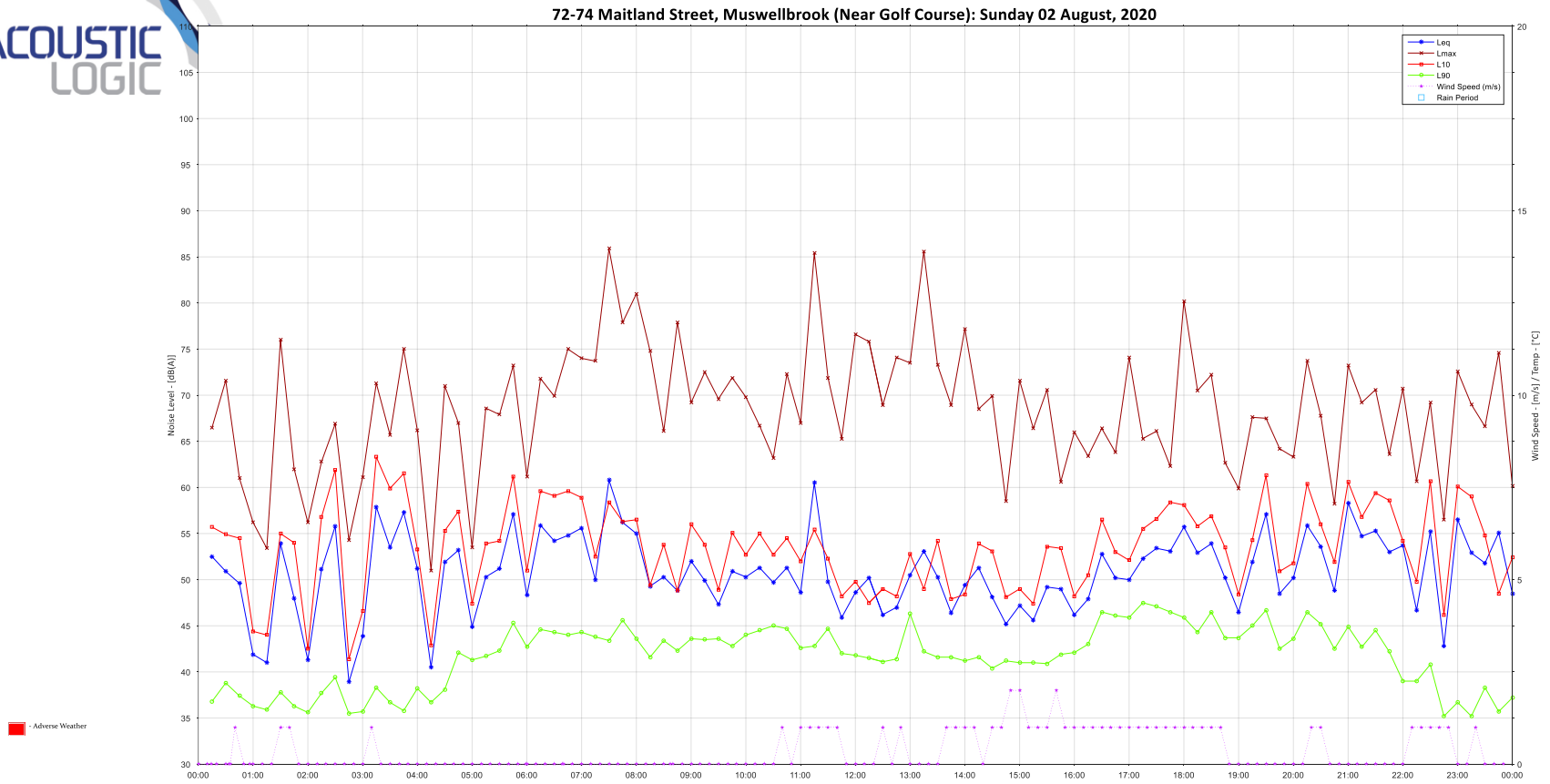



72-74 Maitland Street, Muswellbrook (Near Golf Course): Wednesday 29 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

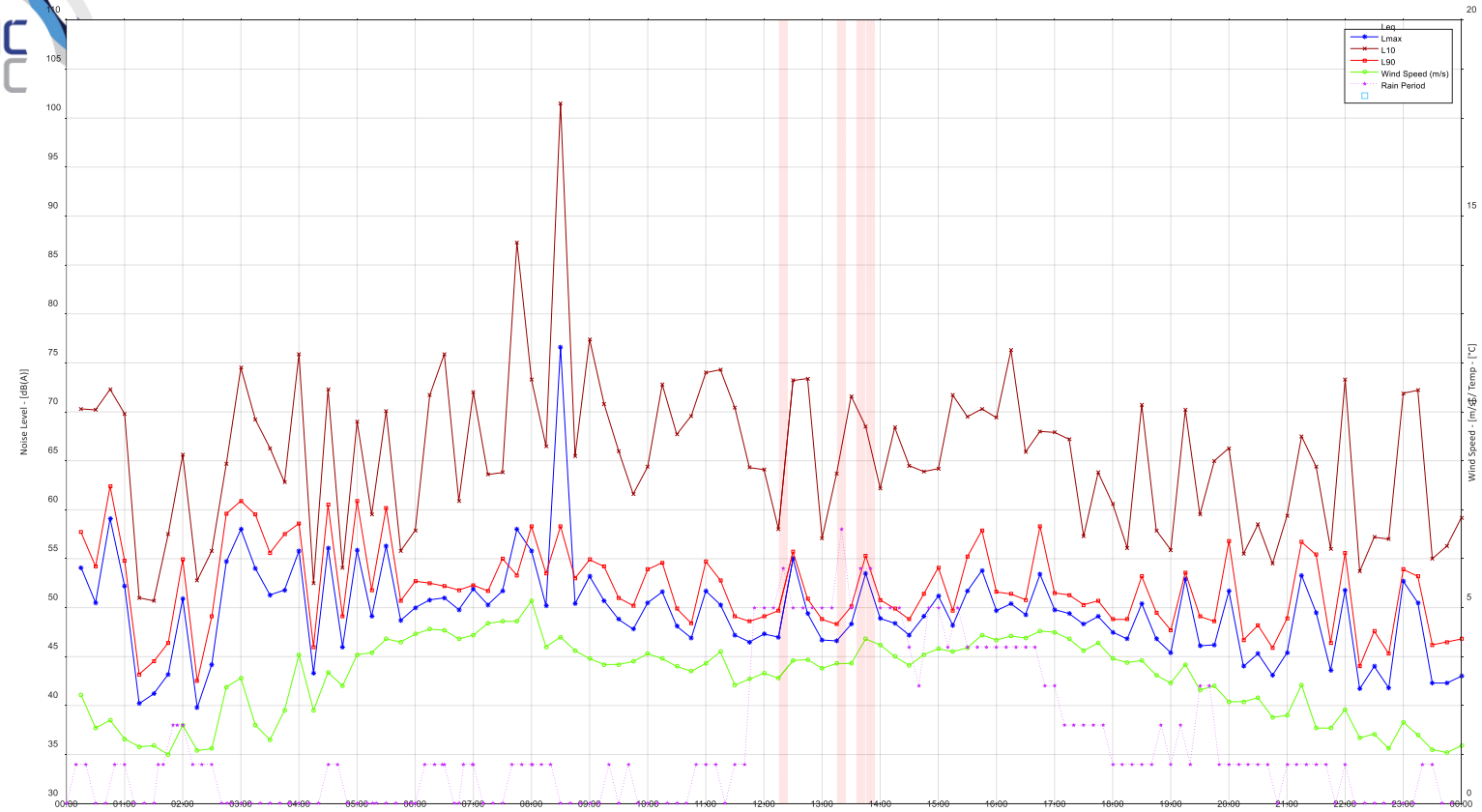

72-74 Maitland Street, Muswellbrook (Near Golf Course): Thursday 30 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

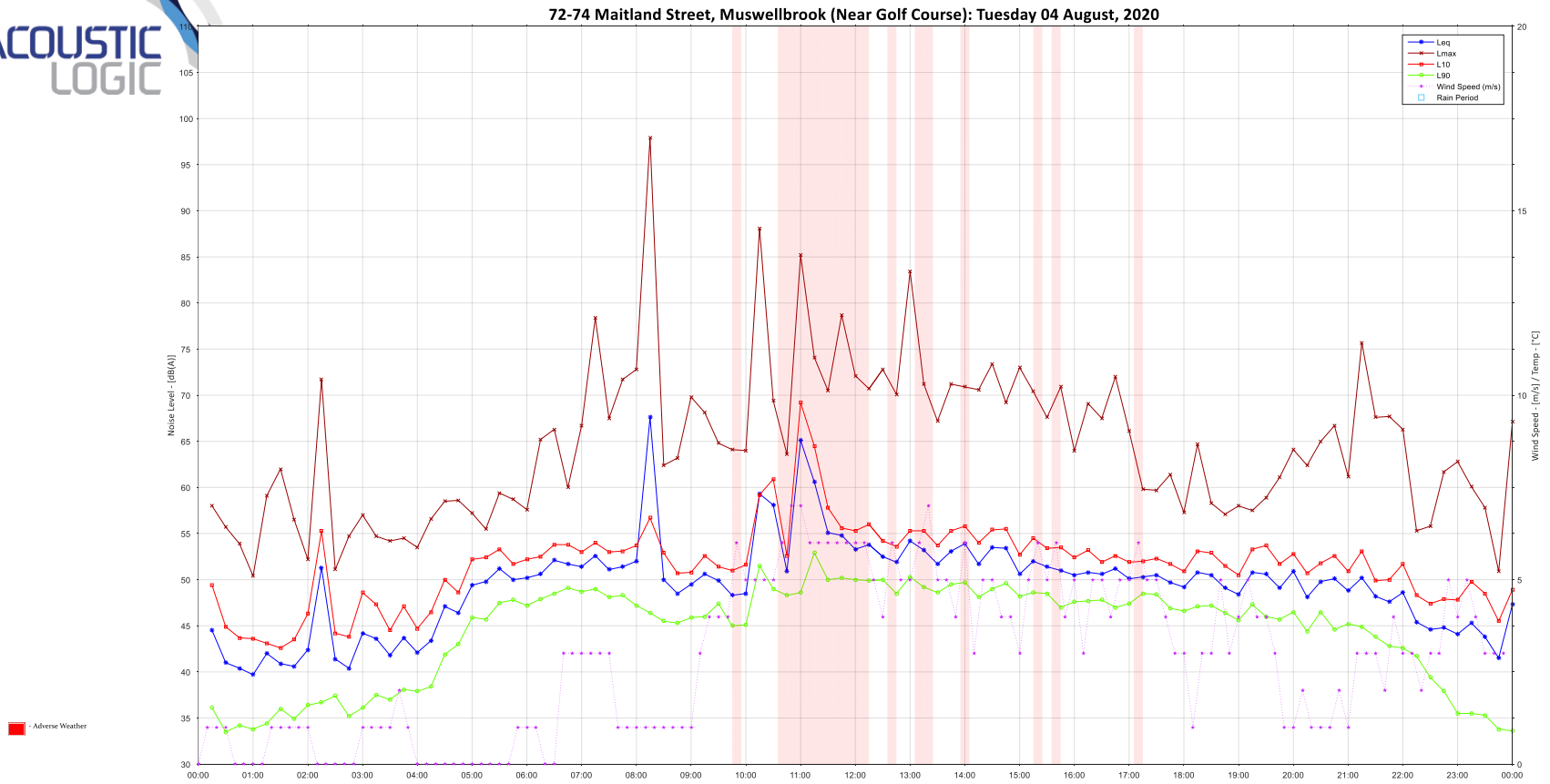

72-74 Maitland Street, Muswellbrook (Near Golf Course): Friday 31 July, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

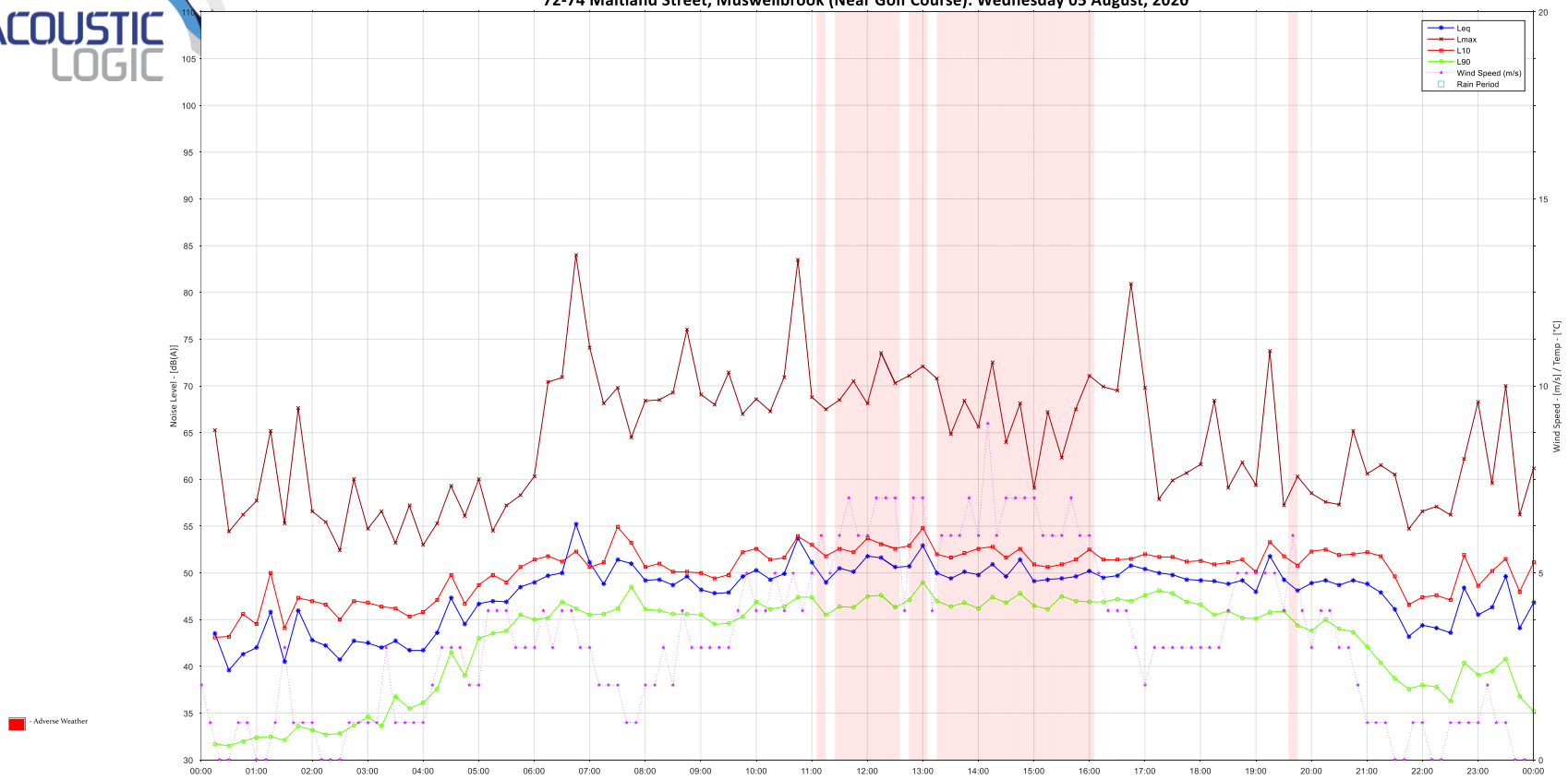
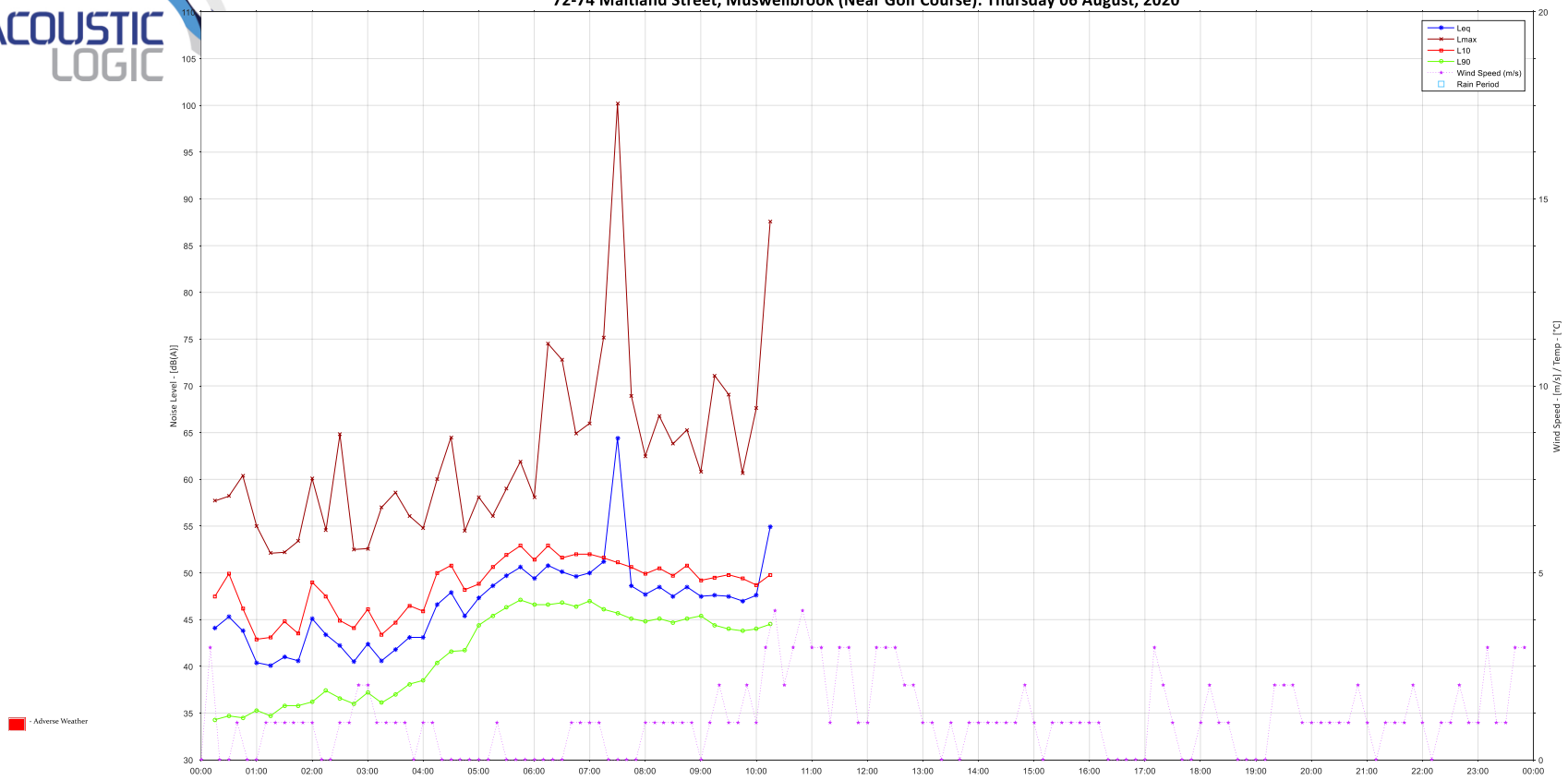

72-74 Maitland Street, Muswellbrook (Near Golf Course): Saturday 01 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather


72-74 Maitland Street, Muswellbrook (Near Golf Course): Sunday 02 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

72-74 Maitland Street, Muswellbrook (Near Golf Course): Monday 03 August, 2020




72-74 Maitland Street, Muswellbrook (Near Golf Course): Tuesday 04 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather


72-74 Maitland Street, Muswellbrook (Near Golf Course): Wednesday 05 August, 2020
Leq
Lmax
L10
L90
Wind Speed (m/s)
Rain Period
Noise Level - [dB(A)]
Wind Speed - [m/s] / Temp - [°C]
- Adverse Weather

72-74 Maitland Street, Muswellbrook (Near Golf Course): Thursday 06 August, 2020