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New Bungendore High School Environmental Noise and Vibration Assessment

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1 INTRODUCTION

This Environmental Noise and Vibration impact Assessment accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD No 14394209). The SSDA is for a new high school located at Bungendore.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

Table 1- SEARs and Relevant Reference

SEARs Requirement	Response/ Report Reference
Item 4. Assess amenity impacts on the surrounding locality, including … and acoustic impacts.	Sections 7 to 11
Item 10 • Provide a noise and vibration impact assessment that: ○ 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 7 to 11
○ 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.	Section 11
○ Explores rail induced ground borne vibration and includes a quantitative assessment	Section 12
○ includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction.	Section 13
○ 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. These include - Mon-Fri 7am to 6pm - Saturday 8.00am-1.00pm - Sun no work - No works proposed outside standard hours	Section 13.1
○ Outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.	Section 13.8

SEARs Requirement	Response/ Report Reference
○ Demonstrates that the assessment has been prepared in accordance with standards and guidelines referenced throughout relevant to the context of the site and the nature of the proposed development. Relevant Policies and Guidelines: •NSW Noise Policy for Industry 2017 (EPA) •Interim Construction Noise Guideline (DECC) •Assessing Vibration: A Technical Guideline 2006 •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.
- Predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to mitigate potential noise impacts.

2 PROPOSAL

The proposed development is for the construction of a new high school in Bungendore. The proposal has been designed as a stream 3 high school to initially provide for approximately 450 students with core 4 facilities aimed to future proof demand forecasted to 2036.

The site is located adjacent to the existing Bungendore Public School to the south enabling the creation of an education style precinct that will enable a cohesive connection between the two schools as well as the wider Bungendore community.

The proposal will include the demolition of the Bungendore Swimming Pool (to be relocated to Queanbeyan-Palerang Regional Council's proposed new Bungendore Sports Hub) and the Bungendore Community Centre; repurposing of existing council buildings; and the construction of new school buildings. New facilities for the high school will comprise of 24 general learning spaces; dedicated science and technology spaces; a gymnasium; library; canteen; outdoor learning and play areas that include two games courts.

A new agricultural plot is also proposed to the north of the main school site including a new agricultural building and scout storage shed, adjacent to the existing scout hall.

The proposal will also provide for shared administration and staff facilities between the high school and existing primary school and construction of a warm shell for community facilities including a community library, council shopfront and community health hub.

Additionally, miscellaneous off-site works, including upgrades to nearby road intersections and infrastructure, crossings, footpaths and the like will be provided to encourage active transport opportunities and respond to changing traffic conditions.

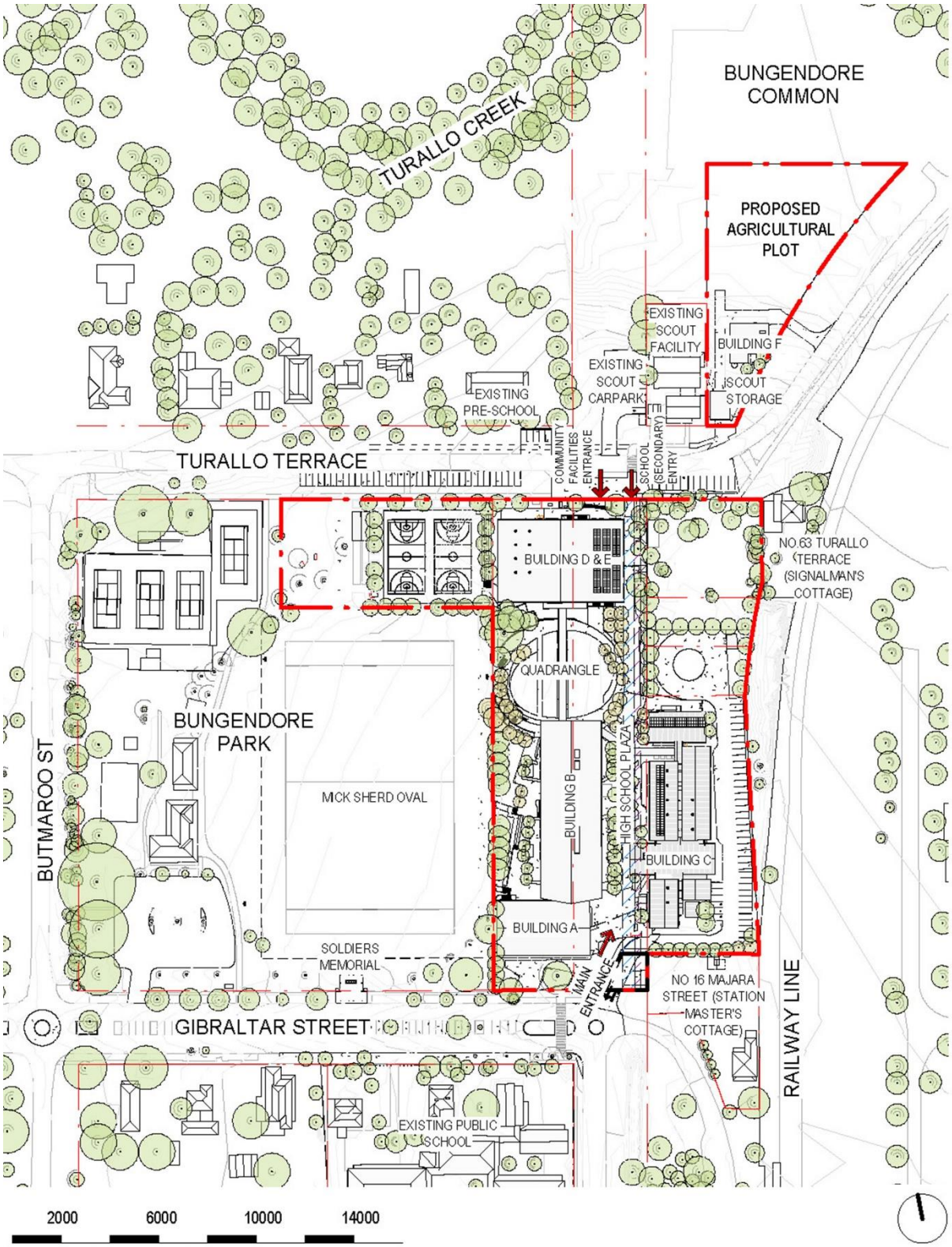


Figure 1: Proposed site plan
Source: TKD Architects

3 SITE DESCRIPTION

The proposed development is located within the Bungendore Town Centre within the local government area of Queanbeyan-Palerang Regional Council. The proposal involves the use of land which includes Bungendore Park bounded by Gibraltar Street, Majara Street, Turallo Terrace and Butmaroo Street, the existing former Palerang Council site at 10 Majara Street, the Majara Street road reserve bounded by Turallo Terrace and Gibraltar Streets and Nos. 2, 4 and 6 Majara Street (Refer to Table 1 below).

The site is approximately 29,205m2 in area and consists of a relatively flat topography. It contains part of Bungendore Park, existing Council buildings and maintained public open space areas. The land is mostly cleared of vegetation with some mature trees intersperse throughout subject lots.

The surrounding area generally includes low density residential developments to the north and west, an existing rail line to the east and Bungendore Public School and the Bungendore train station to the south and south west respectively.

Table 2 -New High School in Bungendore Legal Descriptions

Property Address	Lot Numbers
6-14 Butmaroo Street	Part Lot 701 DP1027107
2 Majara Street	Lot 12 DP1139067
4-6 Majara Street	Lot 13 DP1139067 Lot 14 DP1139067
10 Majara Street	Lot 3 DP830878
Butmaroo Street	Part Lot 701 DP96240
Portion of Majara Street (between Turallo Terrace and Gibraltar Street)	N/A

Figure 2 Site aerial depicting the land subject to the proposed High School.
Source: TKD Architects

4 SITE OPERATION

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

Table 3- School Uses and Operating Times

Item	Use	Times
GENERAL	The new high school in Bungendore will cater for students Year 7 - Year 12. The school will have the following capacity following completion of the development: - 63 full time staff - 450 students	Monday to Friday between 8am and 5pm
HALL/GYM	Generally used during standard school hours. The application contemplates the use of the hall for community use, whether for one-off or periodic events. This will be subject to reaching a shared use agreement in the future.	Monday to Friday between 8am and 5pm. If a shared use agreement is reached, from time to time use of the school hall may be used for out of hours community use. Sat, Sun and Public Holidays between 8am and 10pm
OUTDOOR SPORTS COURTS	Intended to only be used by School during standard school operating hours.	Monday to Friday between 8am and 5pm
SCHOOL LIBRARY	Intended use for school only during standard school hours.	Monday to Friday between 8am and 5pm
COMMUNITY BUILDING	Health Hub and Community Library	As per the existing council hours of operation. Monday to Friday between 8:30am and 4:30pm.

The assessment is based on TKD Architect drawings reference AR DA HS 0000, AR SD HS 0100, AR DA HS 0500, AR DA HS 0501, AR DA HS 1005, AR DA HS 1010, AR DA HS 2000, AR DA HS 2001, AR DA HS 2010, AR DA HS 2020, AR DA HS 2021, AR DA HS 3000, AR DA HS 3001, AR DA HS 3002, AR DA HS 3400, AR DA HS 3410, AR DA HS 8000, AR DA HS 8200, AR DA HS 9000 and AR DA HS 9100, dated 03/06/2021 Revision A. Figure 3 shows the proposed site plan.

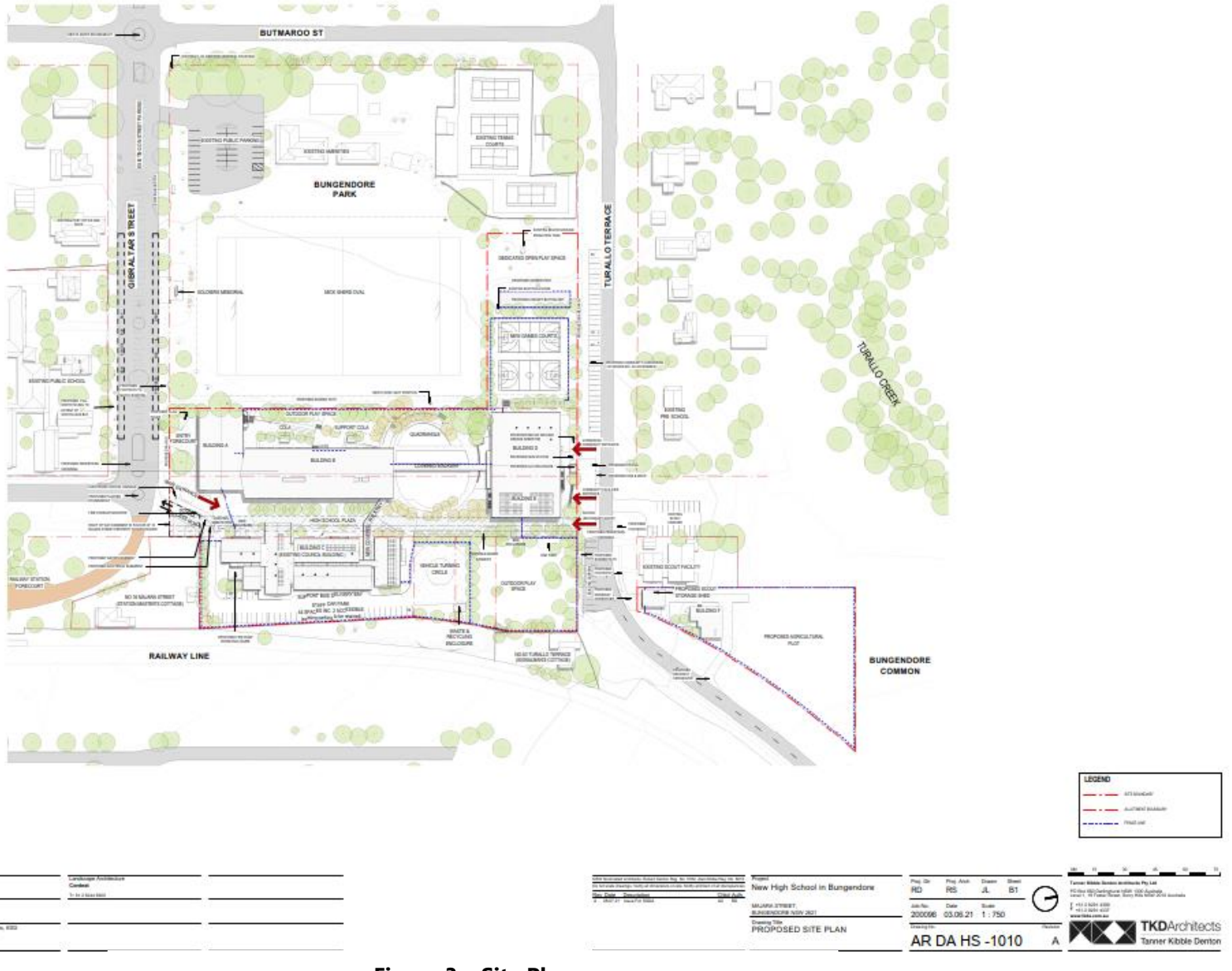


Figure 3 – Site Plan

● Unattended noise logging locations

Figure 4 – Site Location and Noise Measurement Locations

5 NOISE DESCRIPTORS

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

To accurately determine the environmental noise a 15-20 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.

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

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

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

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

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

L_1 levels represent is the loudest 1% noise events during a measurement period.

6 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.

6.1 UNATTENDED, LONG TERM NOISE LOGGING

Unattended noise monitoring was conducted between 27th April and 10th May 2021 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.

The monitoring locations were selected to represent the background noise level at the potentially most impacted receivers. The source of ambient noise was noted as being distant traffic noise.

Logger 2, Logger3 and Logger 4 monitor could not be placed closer to the proposed school site due to the existing school being close by. The monitoring location used would therefore be more closely representative of the "true" ambient level.

Logger 2 Location was selected to be indicative of the "true" ambient noise level of residential receivers to the north of the site in the absence of noise from existing surrounding commercial premises and existing school noise.

Logger 3 Location was selected to be indicative of the "true" ambient noise level of residential receivers to the south and west of the site in the absence of noise from the existing surrounding commercial premises and existing school noise.

Logger 4 Location was selected to be indicative of the "true" ambient noise level of residential receivers to the east of the site (on the eastern side of the rail line) in the absence of noise from the existing surrounding commercial premises and existing school noise.

As all affected sensitive receivers have been presented as part of the assessment no further noise monitoring will be required for the purposes of this assessment.

6.2 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 Canberra Airport weather station was used to obtain weather information.

The wind data obtained during the daytime period of the 4th to the 6th May exceeded 5 m//s however the noise data obtained does not show any increase due to weather (the background noise levels were close to the minimum recorded) and therefore has been retained.

Table 4 – Noise Monitoring Results Eastern Boundary (Location 1)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday - 27 April 2021	-	35.8	35.2
Wednesday - 28 April 2021	37.2	37.5	35.3
Thursday - 29 April 2021	37.1	36.9	35.4
Friday – 30 May 2021	37.1	36.4	34.9
Saturday - 1 May 2021	37.9	37	35
Sunday - 2 May 2021	38.7	36.2	34.9
Monday - 3 May 2021	38.6	36.8	35.6
Tuesday - 4 May 2021	39.4	36.4	36.2
Wednesday - 5 May 2021	41.9	37.6	36.1
Thursday - 6 May 2021	42.9	37.1	36.1
Friday - 7 May 2021	39.1	37.1	35.8
Saturday - 8 May 2021	39.6	36.3	35.7
Sunday - 9 May 2021	38.1	36.9	36.3
Monday - 10 May 2021	38.2	-	-

Table 5 – Noise Monitoring Results to the North (Location 2)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday - 27 April 2021	-	23.9	19
Wednesday - 28 April 2021	31.7	33.1	19.6
Thursday - 29 April 2021	31.4	30.4	20.8
Friday – 30 May 2021	32	28	19.9
Saturday - 1 May 2021	32.8	30.8	21.5
Sunday - 2 May 2021	35.4	29.9	20.7
Monday - 3 May 2021	35.5	31	20.3
Tuesday - 4 May 2021	35.7	28.8	25.7
Wednesday - 5 May 2021	39.2	34.3	24.1
Thursday - 6 May 2021	41.2	30.7	23.5
Friday - 7 May 2021	36	33.7	22.4
Saturday - 8 May 2021	37.4	29.2	20.7
Sunday - 9 May 2021	33.4	31.3	21.5
Monday - 10 May 2021	33	-	-

Table 6 – Noise Monitoring Results to the South West on Ellendon Street (Location 3)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday - 27 April 2021	-	28.4	27.3
Wednesday - 28 April 2021	37.3	33.3	27.7
Thursday - 29 April 2021	35.6	32.1	37.4
Friday – 30 May 2021	35.8	34.2	37.1
Saturday - 1 May 2021	35.2	33.5	27.2
Sunday - 2 May 2021	35.6	32.4	27.2
Monday - 3 May 2021	38.5	30.8	28.5
Tuesday - 4 May 2021	37.2	30.1	32
Wednesday - 5 May 2021	38.4	34.2	31
Thursday - 6 May 2021	41.1	30.2	29.9
Friday - 7 May 2021	36.4	31.4	30
Saturday - 8 May 2021	36.9	29.2	38.3
Sunday - 9 May 2021	32.8	31.7	28.9
Monday - 10 May 2021	32	-	-

Table 7 – Noise Monitoring Results to the South East on Osborne Street (Location 4)

Date	Day L_{90}	Evening L_{90}	Night L_{90}
Tuesday - 27 April 2021	-	20.1	17.6
Wednesday - 28 April 2021	34.4	28.1	18.1
Thursday - 29 April 2021	33.9	24.9	18.4
Friday – 30 May 2021	33.8	23.8	17.9
Saturday - 1 May 2021	34.6	27.1	18.6
Sunday - 2 May 2021	34.9	27.1	18.5
Monday - 3 May 2021	35.3	28	19
Tuesday - 4 May 2021	34.3	22.5	20.4
Wednesday - 5 May 2021	35.9	29	25
Thursday - 6 May 2021	40.6	38.2	20.2
Friday - 7 May 2021	34.1	29.8	19.2
Saturday - 8 May 2021	36.4	27.1	17.9
Sunday - 9 May 2021	31.4	28.4	19.6
Monday - 10 May 2021	39.8	-	-

Table 8 - Summary Long Term Noise Logging – Location 1

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
Logger Location 1	Day (7am-6pm)	39
	Evening (6pm-10pm)	37
	Night (10pm to 7am)	36
	Early Morning (6:30 to 7am)	42

Table 9 - Summary Long Term Noise Logging- Location 2

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
Logger Location 2	Day (7am-6pm)	36
	Evening (6pm-10pm)	31
	Night (10pm to 7am)	30*
	Early Morning (6:30 to 7am)	39

*Note: As per the EPA Noise Policy for Industry *"Where the rating background noise level is found to be less than 30 dB(A) for the night periods, then it is set to 30 dB(A)"*

Table 10 - Summary Long Term Noise Logging – Location 3

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
Logger Location 3	Day (7am-6pm)	37
	Evening (6pm-10pm)	32
	Night (10pm to 7am)	30*
	Early Morning (6:30 to 7am)	41

*Note: As per the EPA Noise Policy for Industry *"Where the rating background noise level is found to be less than 30 dB(A) for the night periods, then it is set to 30 dB(A)"*

Table 11 - Summary Long Term Noise Logging – Location 4

Location	Time of Day	Rating Background Noise Level – dB(A)L_{90}
Logger Location 4	Day (7am-6pm)	35
	Evening (6pm-10pm)	30*
	Night (10pm to 7am)	30*
	Early Morning (6:30 to 7am)	40

*Note: As per the EPA Noise Policy for Industry *"Where the rating background noise level is found to be less than 30 dB(A) for the evening and night periods, then it is set to 30 dB(A)"*

The monitoring results of location 2, 3 and 4 indicate that there is very little variation in background noise levels at the nearest receivers around the subject site.

The logger at location 1 achieved higher background noise levels than the other locations due to its location adjacent to the existing rail corridor and QPRC building with mechanical plant that may have affected the results.

It is noted that the location for the logger at location 1 was primarily chosen to record rail corridor noise levels for the purposes of noise intrusion to the proposed site, so will not been used for RBL for receivers or to set trigger noise levels as part of this assessment.

7 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.

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

Schedule 2 - "Schools- Complying Development" of the Educational SEPP 2017 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.

Table

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.

7.2 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.

7.2.1 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.

7.2.2 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 amenity levels for residential receivers are Day -55 dB(A), Evening - 45 dB(A) and Night – 40 dB(A). 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.

7.2.3 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.*

7.2.4 Summary of NPfI Trigger Levels

Table 12 summarises the trigger levels determined using NPfI guidelines and the measured rating background noise levels. It is noted that where the evening or early morning RBLs were higher than the day RBL, the intrusiveness trigger level adopted was based on the day RBL. 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.

Table 12 – Summary of NPfI Trigger Levels

Receiver	Time	Intrusiveness $L_{Aeq,15min}$	Amenity $L_{Aeq,period}$	Sleep $L_{Aeq,15min}$ / L_{AFmax}
Northern Boundary (Based on Logger Location 2 RBL to the north)	Early Morning (6:30am-7am weekdays)	44	40	35/45
	Day (7am-6pm)	41	55	-
	Evening (6pm-10pm)	36	45	-
Southern and Western Extent Boundaries (Based on Logger Location 3 RBL to the south west on Ellendon Street)	Early Morning (6:30am-7am weekdays)	46	40	35/45
	Day (7am-6pm)	42	55	-
	Evening (6pm-10pm)	37	45	-
Eastern Boundary (Based on Logger Location 4 RBL to the east on Osborne Street)	Early Morning (6:30am-7am weekdays)	45	40	35/45
	Day (7am-6pm)	40	55	-
	Evening (6pm-10pm)	35	45	-

7.3 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 Gibraltar Street and Majara street would be defined as a Collector Road and Turallo Terrace has some characteristics of a Collector Road and some of a local road. The applicable assessment criteria for residential receivers are (measured at the façade of dwellings):

- Sub-arterial – 60 dB(A) $L_{eq,15hr}$ (7am to 10pm) and 55 dB(A) $L_{eq,9hr}$ (10pm to 7am)
- Local – 60 dB(A) $L_{eq,1hr}$ (7am to 10pm) and 55 dB(A) $L_{eq,1hr}$ (10pm to 7am)

The policy also states that:

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

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

The interim guideline is used to assess the impact of noise form adjacent road and rail corridors on noise sensitive development such as educational institutions. Table 3.1 of the interim guideline recommends a maximum noise level within classrooms of 40 dB(A) $L_{eq,1hr}$.

8 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 mechanical plant, PA system and school bells.
- Traffic generation
- Waste Removal
- External activities

8.1 NOISE FROM INTERNAL SPACES

8.1.1 Learning and Admin Spaces

The administration and teaching spaces generate low to medium levels of noise. The building A and B administration and teaching spaces are typically at least 50m from any residential receiver and emissions from these buildings, or the Building C teaching workshop building, would not exceed the Educational SEPP criteria.

8.1.2 Hall

Block D/E contains the school hall/gym that may be used for presentations and performances. The hall opens out to the west and south of the building to a covered outdoor area. The potentially most impacted receivers would be the residential receivers to the north.

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

- Hall internal noise level of 80 dB(A) $L_{eq,15min}$ representing the sound level during a music performance.
- West facing door open and closed. Door to have minimum sound transmission loss of R_w 20 when closed.

The calculated noise levels are (west door open):

- Residences to the north – 40 dB(A) $L_{eq,15min}$

The calculated noise levels are (west door closed):

- Residences to the north– 33 dB(A) $L_{eq,15min}$

The background + 5 dB(A) noise emissions criteria are not exceeded.

8.2 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 Crown Certification stage, once equipment items are selected and location is finalised.

Given the proposed buildings are 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 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.

8.3 TRAFFIC GENERATION

The school will use a carpark located on the northern side of the site. The projected car spaces required by the school is a maximum of 37 additional car park spaces (ref: New Bungendore High School, school Transport Plan (GHD (July 2021, Section 3). The school carpark will typically fill and empty once per day.

A school parent/pupil drop off bay is proposed along the southern side of Turrallo Avenue and the northern side of Gibraltar Street (which are defined as a local road in the RNP). The Eastern end of Gibraltar St, location will be shared with the public school and a public school bus bay on Majara St will be moving to Gibraltar St. There will also be other general traffic movements generated by the school.

A future bus bay is proposed to be moved to the eastern end of Gibraltar St. Given the distance to the nearest residential receiver, no significant additional impact to the existing noise impacts from the bus bay is anticipated.

The primary period of traffic generation on Kings Hwy and Gibraltar Street is the AM peak period. As identified in section 4.3.3 *of the Transport Plan* a total of 330 vehicle movements are expected to be generated by the site, with approximately 77% of these expected to use Kings Hwy and Gibraltar Street. Assuming a 50/50 split of vehicles heading east/west, it would be expected that the noise level generated at the façade of the Kings Hwy and Gibraltar Street residences would be up to 55dB(A)$L_{eq(1hr)}$. This is quieter than the 60dB(A)$L_{eq(1hr)}$ limit for road traffic noise generation on Kings Hwy and Gibraltar Street identified in Section 7.3.

8.4 WASTE REMOVAL

Waste would be stored near the eastern boundary of the school adjacent to Building C. The waste removal truck would park approximately 70m from the nearest residential building. Waste removal times should time to occur between 7am and 6pm. This distance separation and the proposed time restrictions adequately address noise impact from waste removal operations.

8.5 EXTERNAL ACTIVITIES

The expected external school activities include:

- Use of all external spaces immediately before school commencing and recess/lunch periods.
- Use of courts and Mick Sherd Oval 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 any existing and future activities by significant distance buffers, as well as, for the receivers to the west and north, screening from structures.

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

- Number of students:
    - High School –450 Students
- General Playground noise measurements:
    - Secondary School - 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.
- 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 noise level is from noise data that has previously been measured by this office on similar projects and is deemed acceptable to be used to predict noise levels at nearby properties (the relative position between the court and the receivers).

The most impacted residential receivers from general playground activity would be those to the north of the site having direct line of sight to parts of the oval and the courts. The remainder of the residential receivers would have much lower levels of noise exposure.

The predicted noise levels at the most impacted residential receivers to the north are:

- General recess/lunch – 57dB(A) $L_{eq,15min}$
- Sports courts in use - 45dB(A) $L_{eq,15min}$

The predicted noise levels at the most impacted residential receivers to the south are:

- General recess/lunch – 53dB(A) $L_{eq,15min}$
- Sports courts in use - 40dB(A) $L_{eq,15min}$

The predicted noise levels at the most impacted residential receivers to the west are:

- General recess/lunch – 53dB(A) $L_{eq,15min}$
- Sports courts in use - 40dB(A) $L_{eq,15min}$

The predicted noise levels at the most impacted residential receivers to the east are:

- General recess/lunch – 51dB(A) $L_{eq,15min}$
- Sports courts in use - 39dB(A) $L_{eq,15min}$

The predicted noise levels exceed the rating background level by up to 16 dB(A). The level of impact at all other residences 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 to apply a less stringent indicator of noise impact than "background + 5 dB(A)" given that it is present for short periods through the day and it is regarded as "community" noise.

However, in our opinion, the higher exceedances for the most exposed residences are not unreasonable for the following reasons:

- Noise from school playgrounds is 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 well away from residential receivers.

- 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 Council operated sporting fields and existing public swimming pool so therefore "play" noise is already part of the normal noise environment.

9 COMMUNITY USES

9.1 SCHOOL BUILDINGS

The building E community building would generate low to medium levels of noise. The building E Community library and health hub spaces are typically at least 50m from any residential receiver and emissions from these buildings would not exceed the Educational SEPP criteria

9.2 COURTS

Generally, community use of the courts and hall is not proposed.

The application contemplates the use of the hall for community use, whether for one-off or periodic events. This will be subject to reaching a shared use agreement in the future.

10 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.

11 NOISE INTRUSION ASSESSMENT

The school is not impacted by any local environmental noise source except local traffic on the surrounding streets and the rail line to the east. The most impacted buildings would be those facing the rail line to the east. Noise levels were calculated based on attended noise measurements and unattended noise monitoring at logger location 1 as detailed in figure 3 above.

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. The logger was on site from the 27th April 2021 to 10th May 2021. Refer to Appendix 1 for unmanned noise monitoring data.

Attended measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded. Measurements were taken on 27th February 2017 between 10:00am and 2:00pm (it is noted that there are approximately 3 train passbys during school hours daily). There were no periods of adverse weather during the measurement.

The following table presents the resultant noise levels at the proposed eastern facade of the development. The noise levels are based on both the attended and unattended noise measurement results conducted by this office. The noise levels are based on the unattended background noise measurement results adjusted by the difference with the noise monitor results of similar time periods and distance attenuation.

Table 13 – Measured Existing Environmental Noise Levels

Locations	**Rail Noise Levels**
	Daytime (7am-10pm)
Eastern Facade (Facing Rail Corridor)	53 dB(A) $L_{eq(15\ hour)}$ – SEPP (Rail) 60 dB(A) $L_{eq(1\ minute)}$– Single Rail Pass by

The measured noise level of rail noise was 60 dB(A) $L_{eq\ (1\ minute)}$ with a single train passby to the closest eastern façade.

Long term monitoring found the measured train noise to be 53dB(A) $L_{eq\ (15hr)}$ when averaged during the daytime periods of the unattended monitoring duration. Based on these measurements, with standard windows the noise level in the classrooms would be expected to be reduced by at least 20 dB(A), meaning the 40 dB(A) criterion would be achieved. Noise levels at other buildings and facades would be lower and would clearly comply.

Therefore, specific measures to control noise intrusion are not required.

12 RAILWAY VIBRATION ASSESSMENT

Train induced ground borne vibration is transmitted through the subsoil. These vibrations can be perceptible close to railways, as tactile vibrations and as structure borne noise.

12.1 PROJECT VIBRATION OBJECTIVES

12.1.1 Tactile Vibration

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

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

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

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

This standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (6am-10pm) and "Night time" (10pm-6am). The overall value is then compared to the levels in Table 14. For this project the aim will be for a low probability of adverse comment.

Table 14 - Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Offices, schools, educational institutions and places of worship (Day)	0.4 to 0.8	0.8 to 1.6	1.6 to 3.2

12.1.2 Ground Borne Noise.

Typically, the structure borne noise component of train noise when a site lies adjacent to an above ground rail is masked by the airborne noise component of the train pass by. In this regard, we note that the Department of Planning document '*Development Near Rail Corridors and Busy Road – Interim Guideline*' (the Interim Guidelines) stated in Section 3.6.2:

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

As the proposed development is not located over or adjacent to railway tunnels, no additional assessment of structure borne vibration is required for the proposed development.

12.2 RAIL VIBRATION MEASUREMENTS

12.2.1 Vibration Dose Values

Rail noise measurements were conducted in line with the future proposed northern boundary, which is the potentially worst affected area as detailed in Figure 3 of this report above.

Attended train vibration measurements were conducted by Acoustic Logic on 27th February 2017 between 1:00pm and 6:00pm. A Svan 958A Vibration Analyser was used for the vibration measurements. The analyser was fitted with a Dytran triaxial accelerometer. Measurements were performed in compliance with the International Standard ISO 14837 "*Mechanical vibration — Ground-borne noise and vibration arising from rail systems —*"

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

Table 15 - Vibration Dose Values

Time Period	Calculated VDV $m/s^{1.75}$	Criteria VDV $m/s^{1.75}$	Complies
Day (8am to 4pm)	<0.0002	0.4 to 0.8	Yes

It is noted that in the NSW Transport Southern NSW timetable dated November 2017 to the current timetable in use dated October 2020, there was no notable change in rail services provided to Bungendore. That said, in the event the future train use increases, say by 10%, predicted eVDV will not increase significantly (no more than approximately 0.00002 more than the levels predicted in the table above) and will not impact recommended vibration isolation treatments.

The calculated levels comply with the tactile vibration requirements listed in Table 14.

12.2.2 Structure Borne Noise

The predicted structure borne noise to the classrooms facing away from the train line (and therefore less impacted by airborne noise) is as follows;

Table 16 – Predicted Structure Borne Noise Levels

Location	Predicted dB(A) L_{max}	Criteria dB(A) L_{max}	Complies
Ground Floor Northern Side	<35dB(A)L_{max}	≤ 40 dB(A) Day	Yes

The results above indicate full compliance with the project criteria.

13 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.

13.1 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 hall, 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: 8:00am – 1:00pm
- Sundays or Public Holidays: No work.

13.2 RECEIVER LOCATIONS

Sensitive receiver locations are identified in Section 13.1.

13.3 NOISE AND VIBRATION GUIDELINES

13.3.1 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 17.

Table 17 – Noise Management Levels - Residential

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Receivers (Northern Boundary – Turrallo Terrace)	46	75
Retail Receivers (Southern Boundary – Gibraltar Street)	70 (External)	75
Residential Receivers (Eastern Boundary – Powell street across from rail)	45	75
Residential Receivers (Western Boundary – Powell street across from rail)	42	75

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

13.3.2 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.

13.3.2.1 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 18.

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 18 – 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.

13.3.2.2 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 19 – 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

13.4 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 20 - 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).

13.5 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 21 – Predicted Noise Generation to Residential Receivers Northern Boundary of Site (Turrallo Street)

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	53-65	Will generally exceed NML
Concrete Pump	51-63	Will generally exceed NML
Trucks	41-53	Will generally exceed NML when at northern boundary of site
Bobcat	46-58	Will generally exceed NML
Crane/hoist (electric)	26-38	Generally Within NML
Powered Hand Tools (Externally)	41-53	Will generally exceed NML when at northern boundary of site

Table 22 – Predicted Noise Generation to Residential Receivers Southern Boundary Site

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	53-65	Generally Within NML
Concrete Pump	51-63	Generally Within NML
Trucks	41-53	Will comply with NML
Bobcat	46-58	Will comply with NML
Crane/hoist (electric)	26-38	Will comply with NML
Powered Hand Tools (Externally)	41-53	Will comply with NML

Table 23 – Predicted Noise Generation to Residential Receivers Eastern and Western Sides from Boundary of Site

Activity	Predicted Level dB(A) $L_{eq(15min)}$ (External)	Comment
Dozer/Excavator	53-61	Will generally exceed NML
Concrete Pump	51-59	Will generally exceed NML
Trucks	41-49	Will generally exceed NML when close to the relative east and west boundaries
Bobcat	46-54	Will generally exceed NML
Crane/hoist (electric)	26-34	Will comply with NML
Powered Hand Tools (Externally)	41-49	Will generally exceed NML when close to the relative east and west boundaries

13.6 DISCUSSION – NOISE

The greatest noise impact will be at the residences immediately to the north, east and west of the site. Noise levels will generally exceed the NML but (except for brief periods where the loudest plant will be operating at the northern school boundary) 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 below or will be discussed with Hindmarsh to confirm which of the recommendations is feasible to be used in practice.

13.7 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 13.3.1.

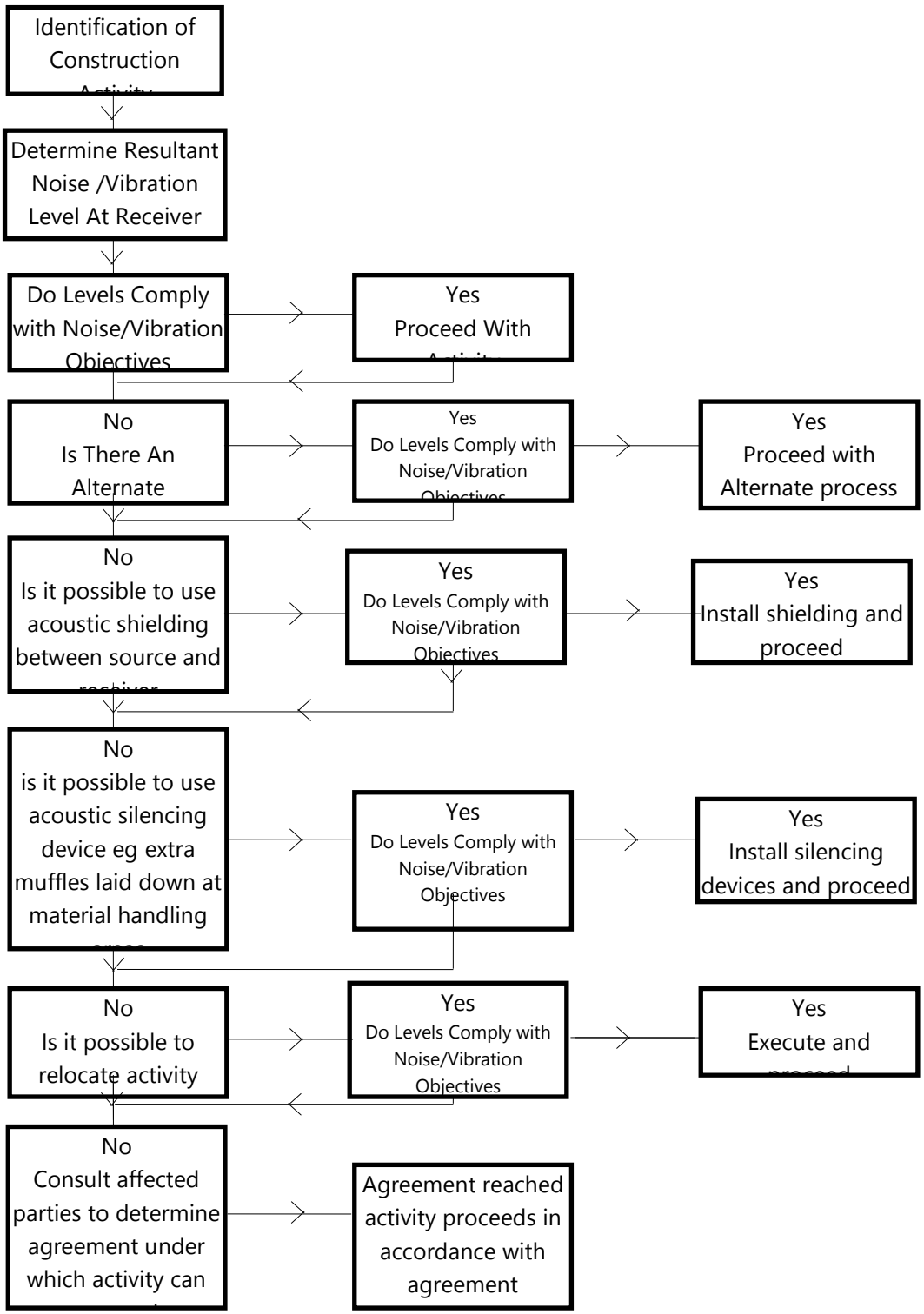
13.8 RECOMMENDATIONS

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 northern, eastern and western 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.
- Complaints handling - In the event of complaint, the procedures outlined in Sections 13.9, 13.10 and 13.11 should be adopted.
- A detailed noise management plan will 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.

13.9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

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



13.10ADDITIONAL 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.

13.10.1 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.

13.10.2 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. The extent and height of the barrier will be provided as part of the detailed noise management plan once final construction phase details are provided.

13.10.3 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).

13.10.4 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.

13.10.5 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 to the construction methodology outlining work procedures and methods for minimising noise.

13.10.6 Combination of Methods

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

13.11 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.

14 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 3 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 Section 6 for noise mission trigger levels for air condition, ventilation plant, etc and PA and school bell systems.
- Waste removal times should be scheduled between 7am and 6pm.
- Ground maintenance should only occur between 7am and 6pm, Monday to Friday.
- Where music practice occurs within a school classroom outside of normal hours the windows of the rooms should be kept closed.
- The proposal would not produce adverse vibration impacts on nearby structures or impact the amenity of the surrounding properties.
- The glazing to teaching spaces directly facing the future rail corridor should have a minimum R_w 22 transmission loss.
- Construction noise impacts should be managed as outlined in Section 13.
- Waste removal times should be scheduled between 7am and 6pm.
- Ground maintenance should only occur between 7am and 6pm, Monday to Friday.

15 CONCLUSION

Noise emissions associated with the proposed Bungendore High School have been assessed with reference to relevant EPA and relevant acoustic guidelines.

The following noise emission sources have been addressed:

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

Recommendations have been made to ensure that noise emissions from the school do not adversely impact the surrounding properties. Provided the recommendations 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.

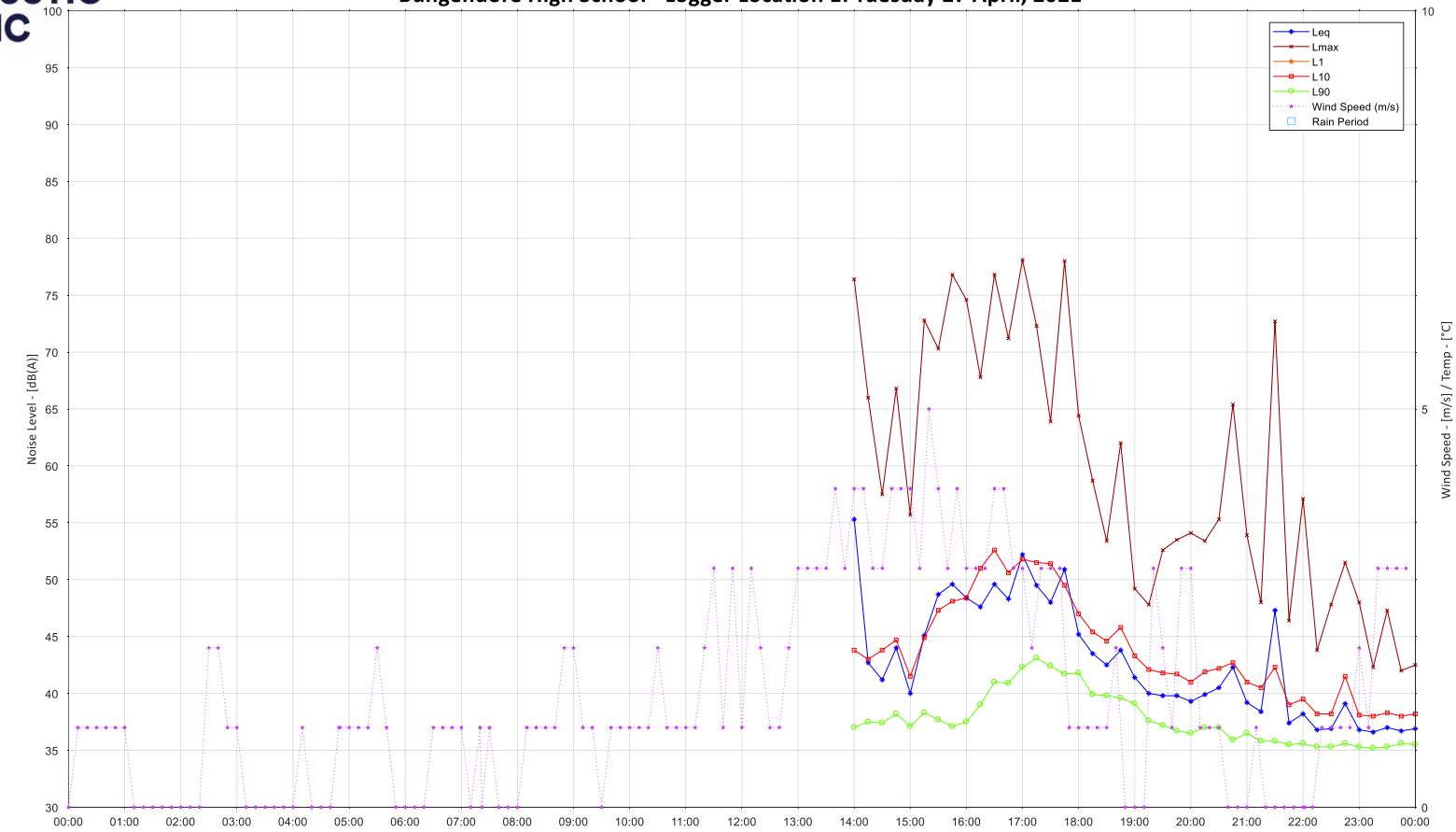
Yours faithfully,

Acoustic Logic Pty Ltd
Glen Campbell

Appendix A – Noise Logging Data

ACOUSTIC LOGIC

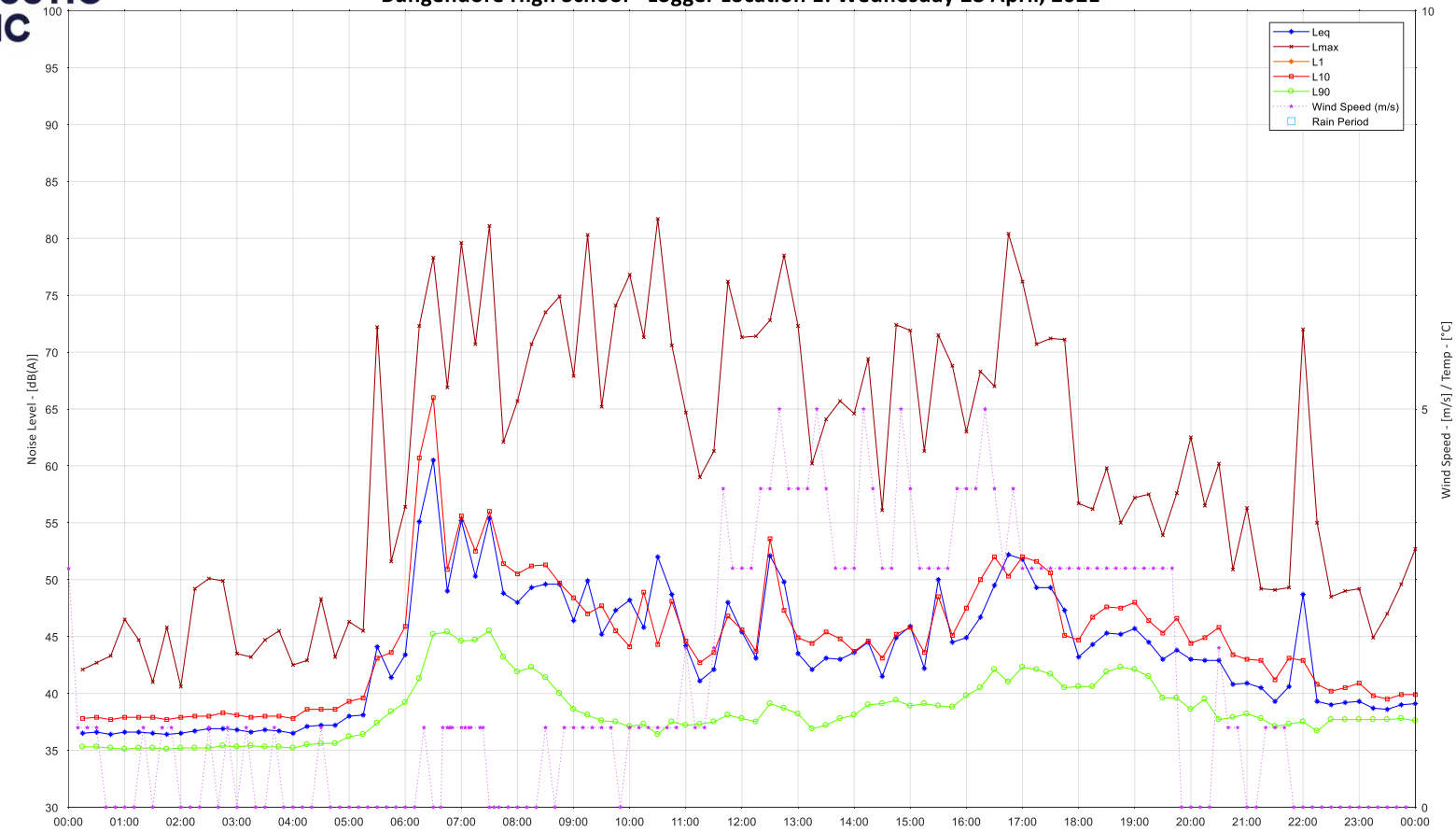
Bungendore High School - Logger Location 1: Tuesday 27 April, 2021



- Rain Period

ACOUSTIC LOGIC

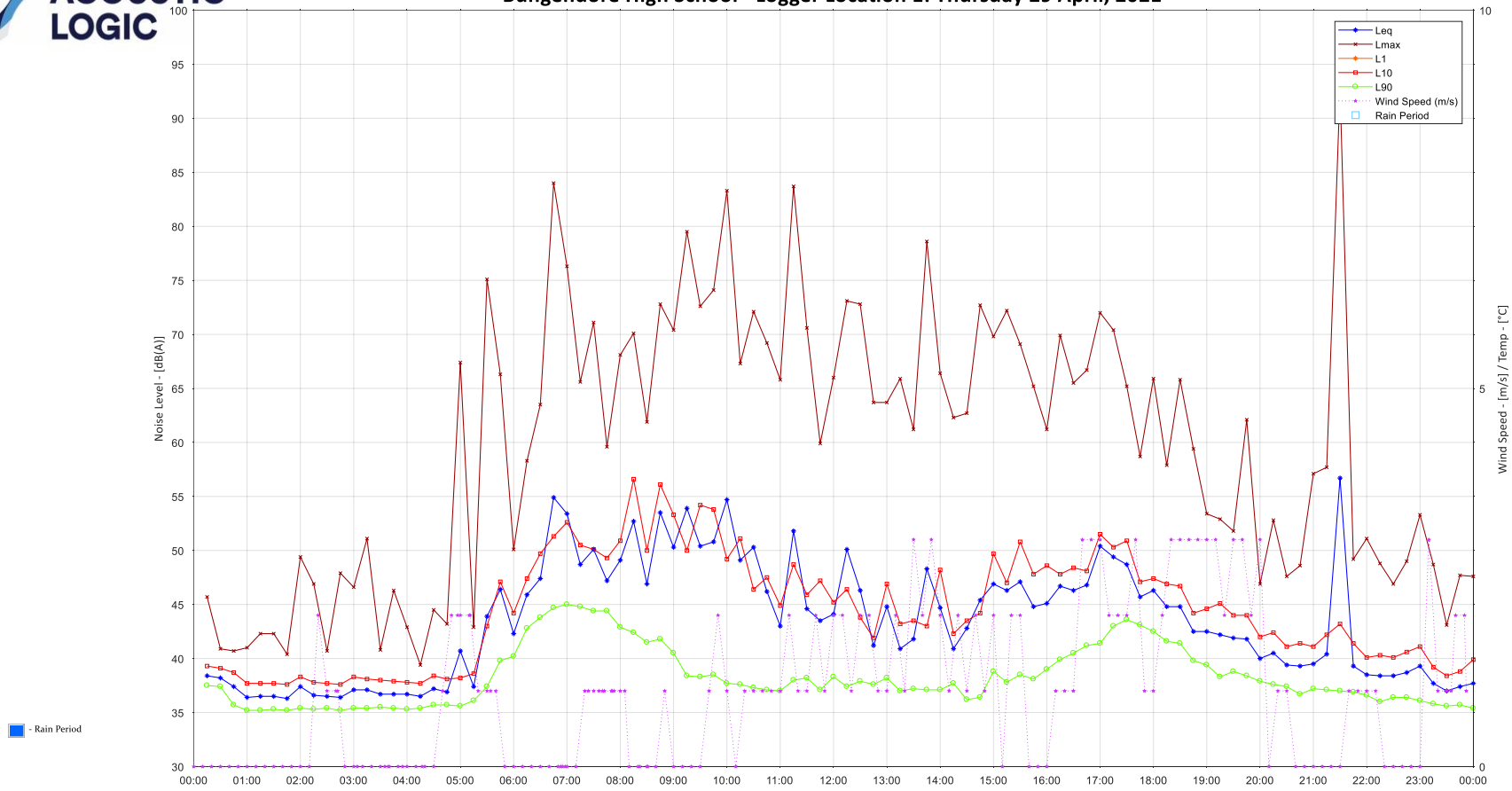
Bungendore High School - Logger Location 1: Wednesday 28 April, 2021



- Rain Period

ACOUSTIC LOGIC

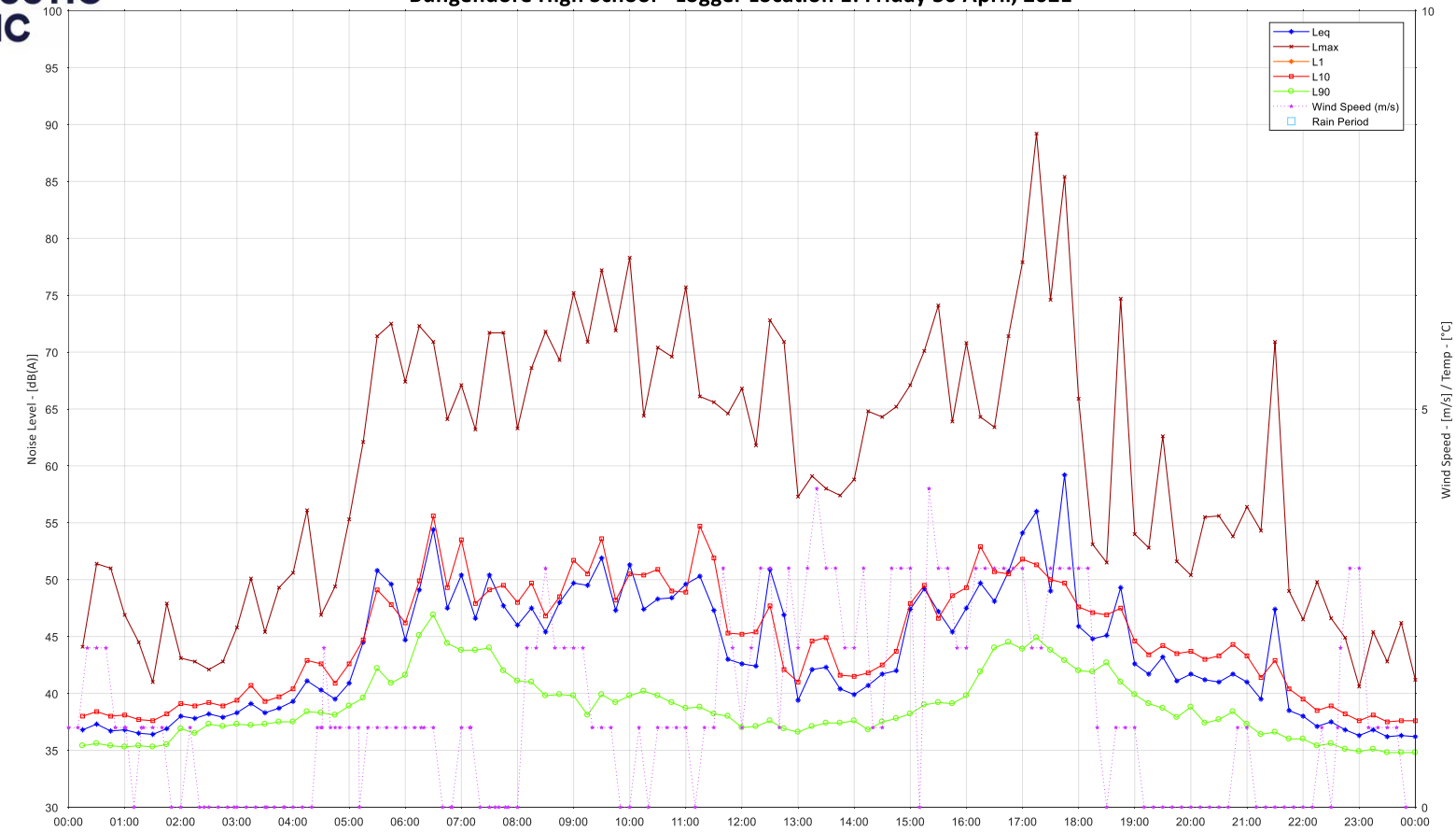
Bungendore High School - Logger Location 1: Thursday 29 April, 2021



- Rain Period

ACOUSTIC LOGIC

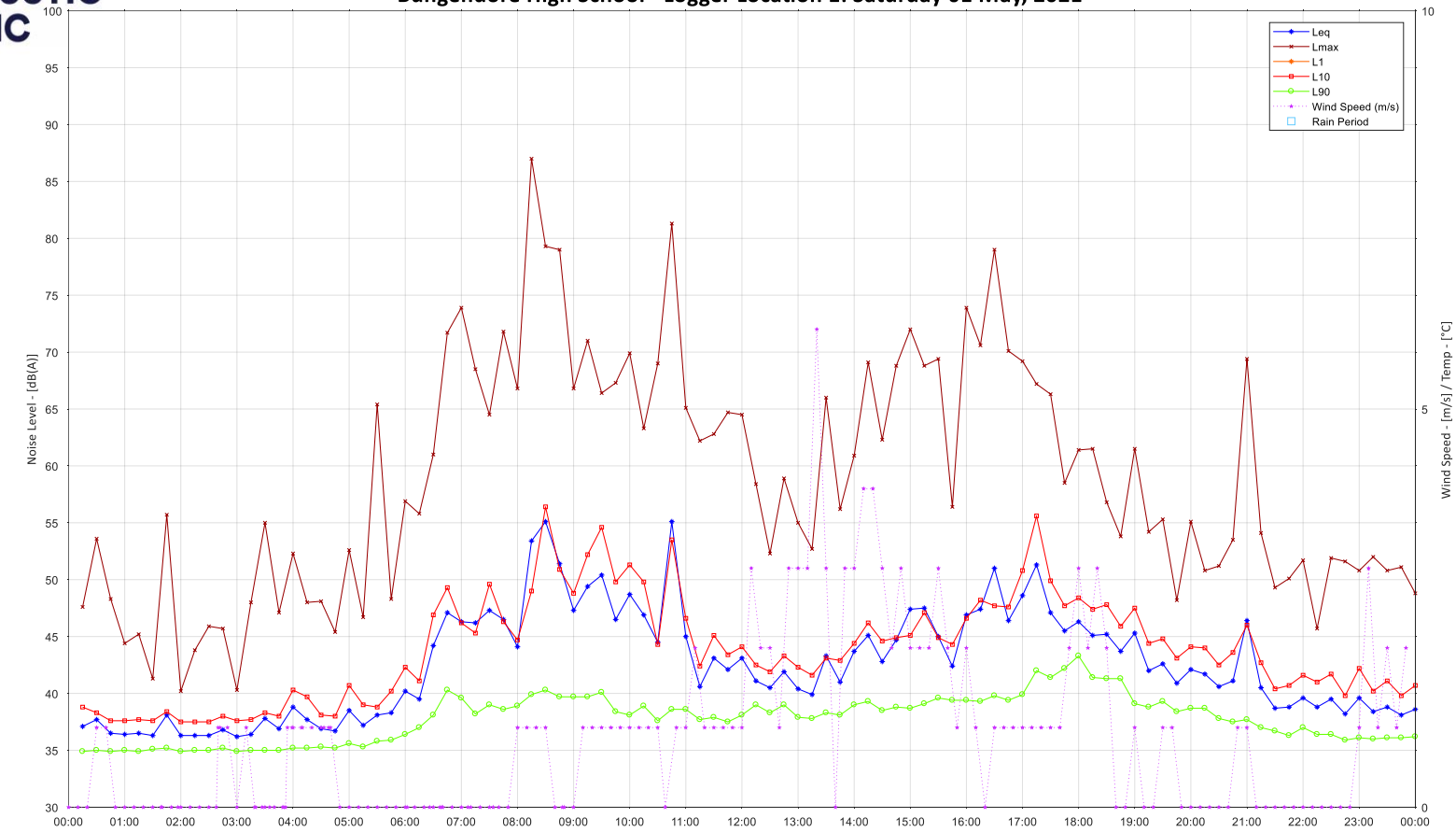
Bungendore High School - Logger Location 1: Friday 30 April, 2021



- Rain Period

ACOUSTIC LOGIC

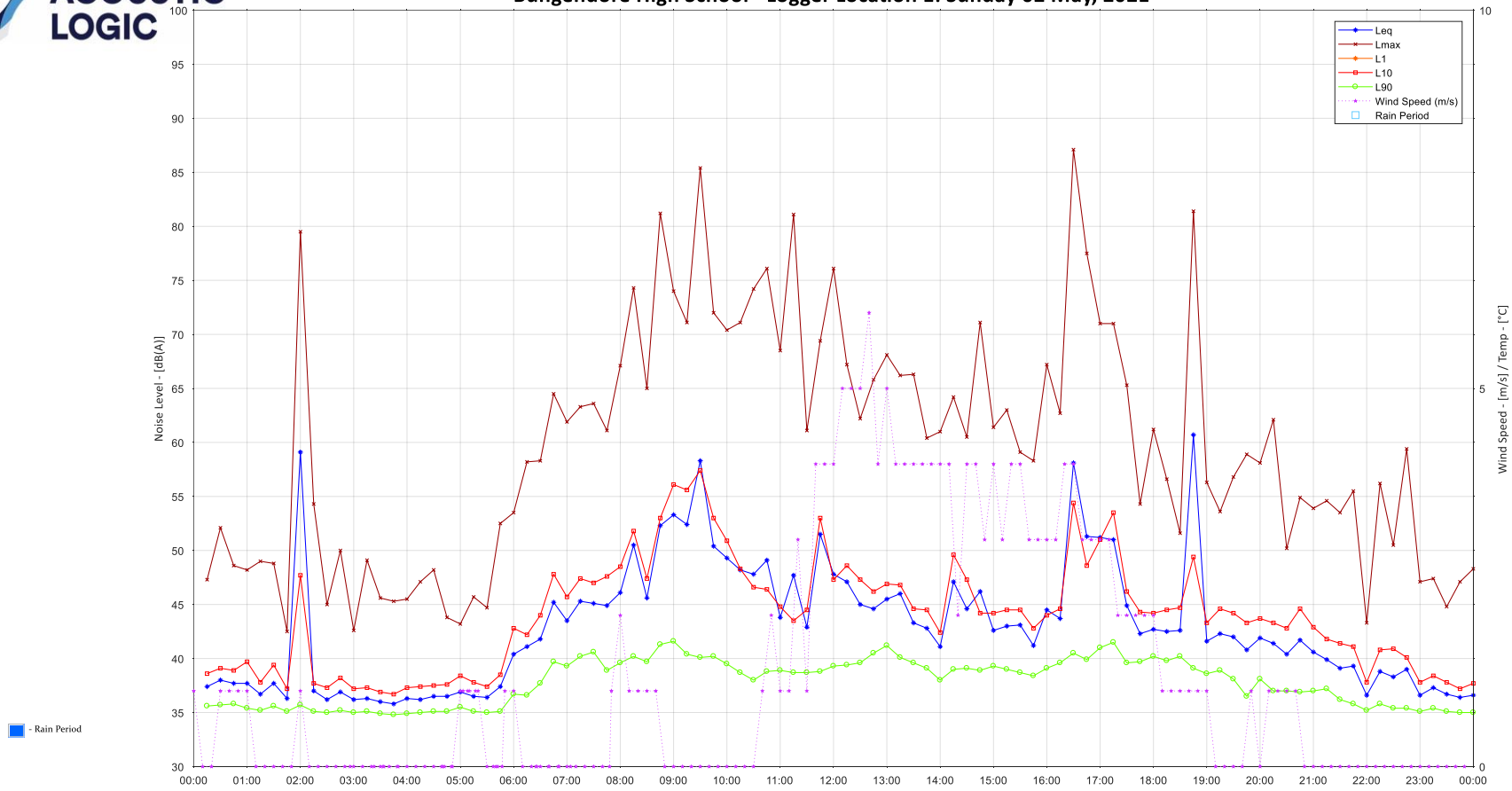
Bungendore High School - Logger Location 1: Saturday 01 May, 2021



- Rain Period

ACOUSTIC LOGIC

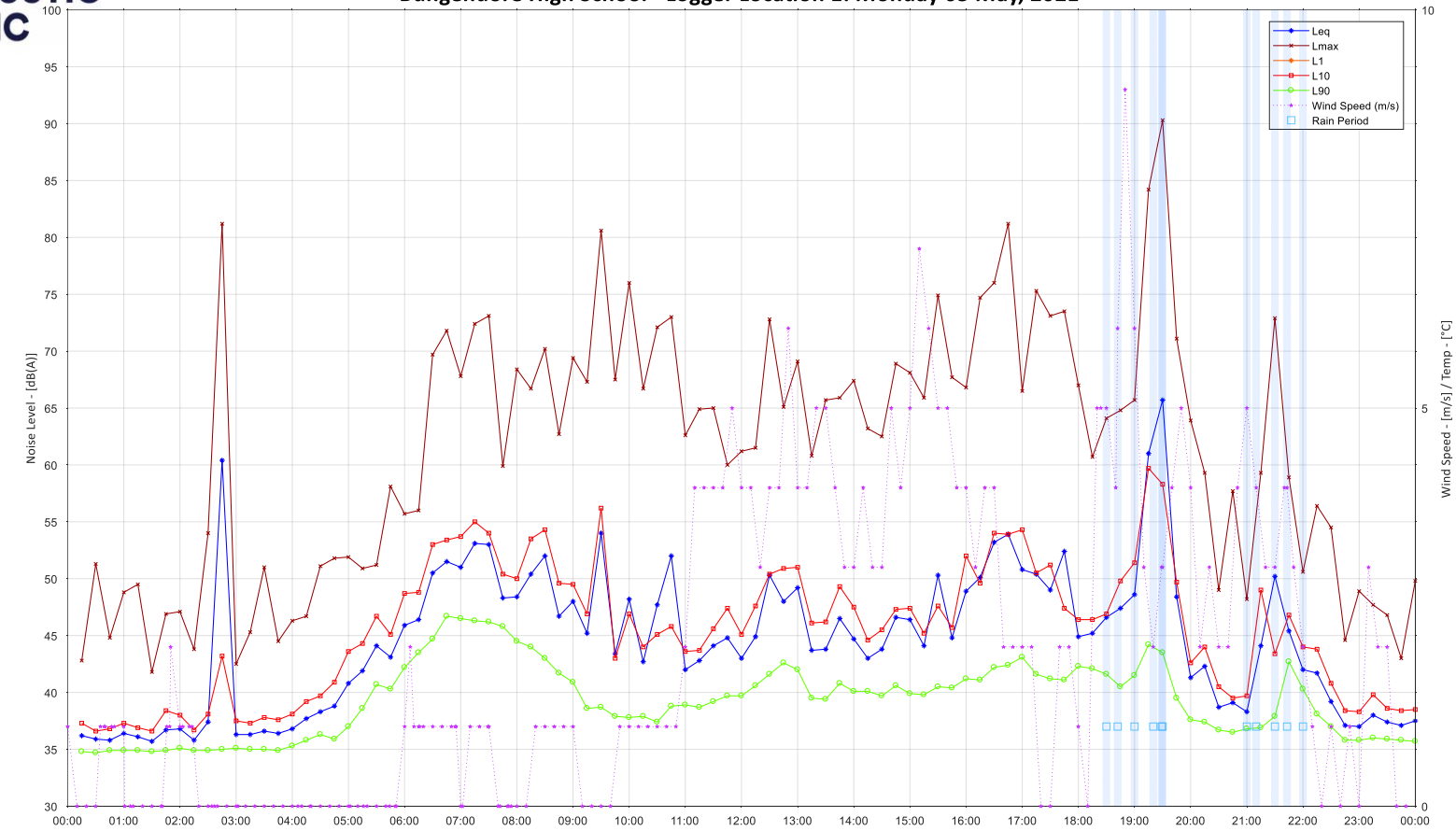
Bungendore High School - Logger Location 1: Sunday 02 May, 2021



- Rain Period

ACOUSTIC LOGIC

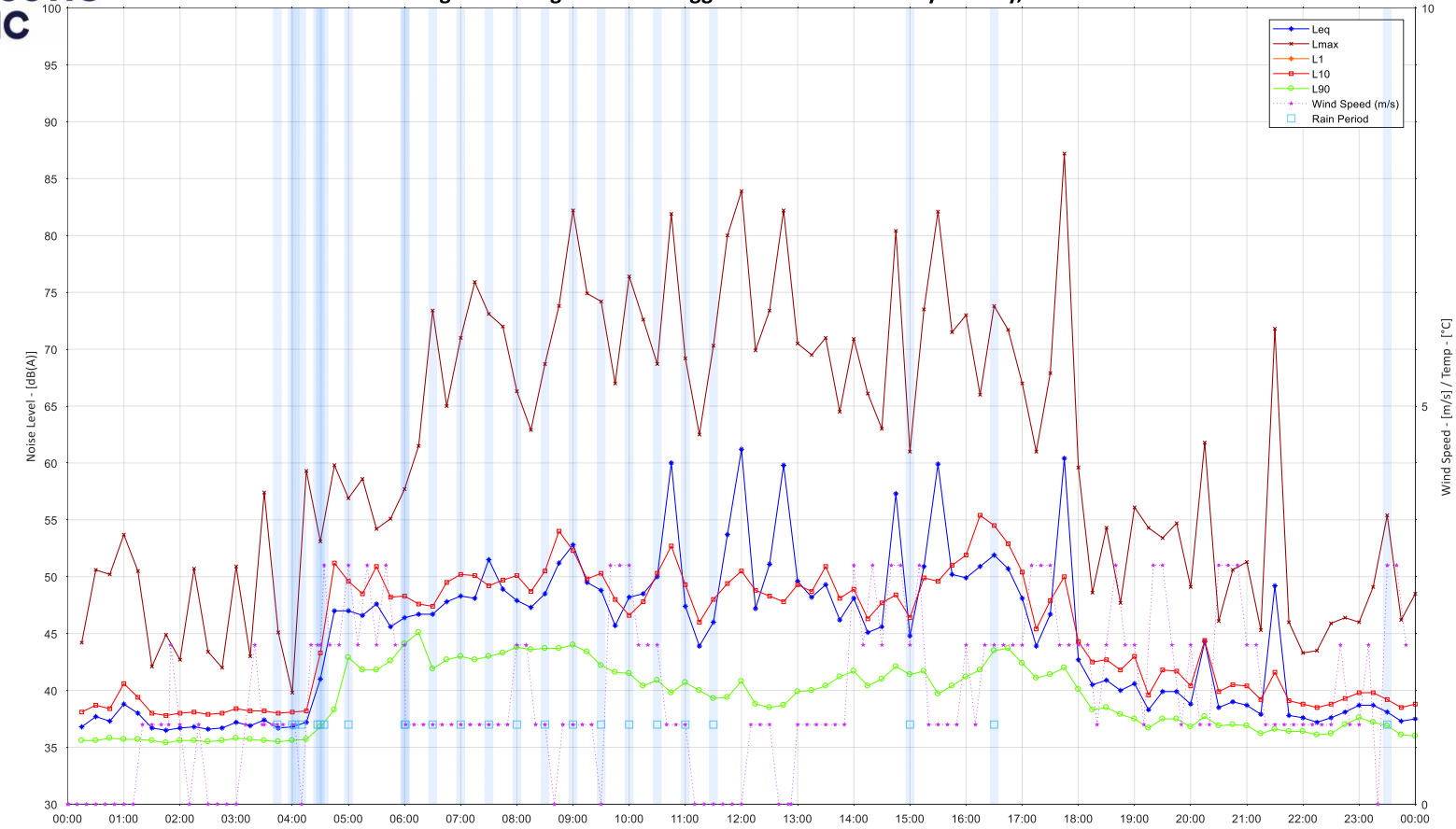
Bungendore High School - Logger Location 1: Monday 03 May, 2021



- Rain Period

ACOUSTIC LOGIC

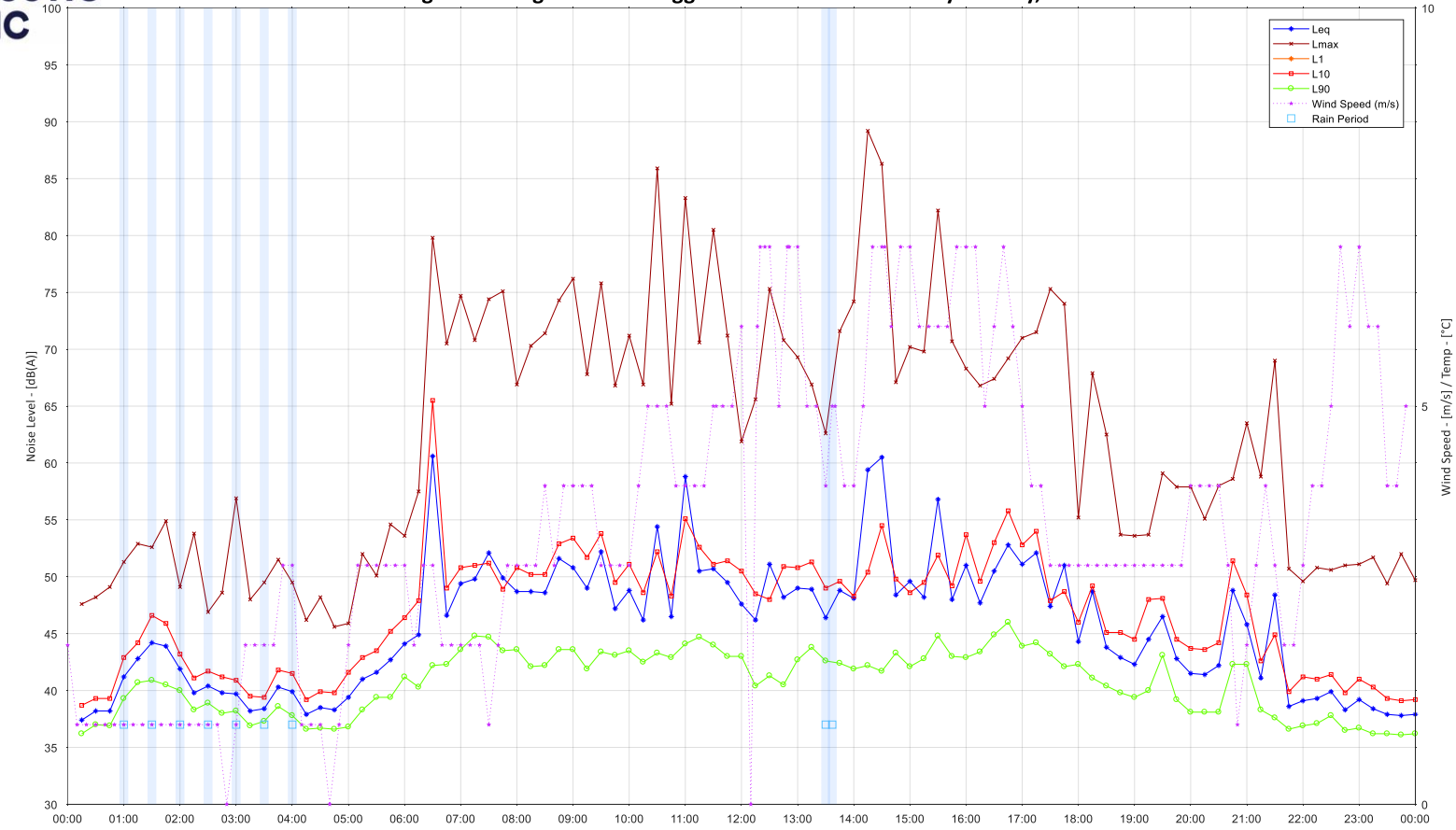
Bungendore High School - Logger Location 1: Tuesday 04 May, 2021



- Rain Period

ACOUSTIC LOGIC

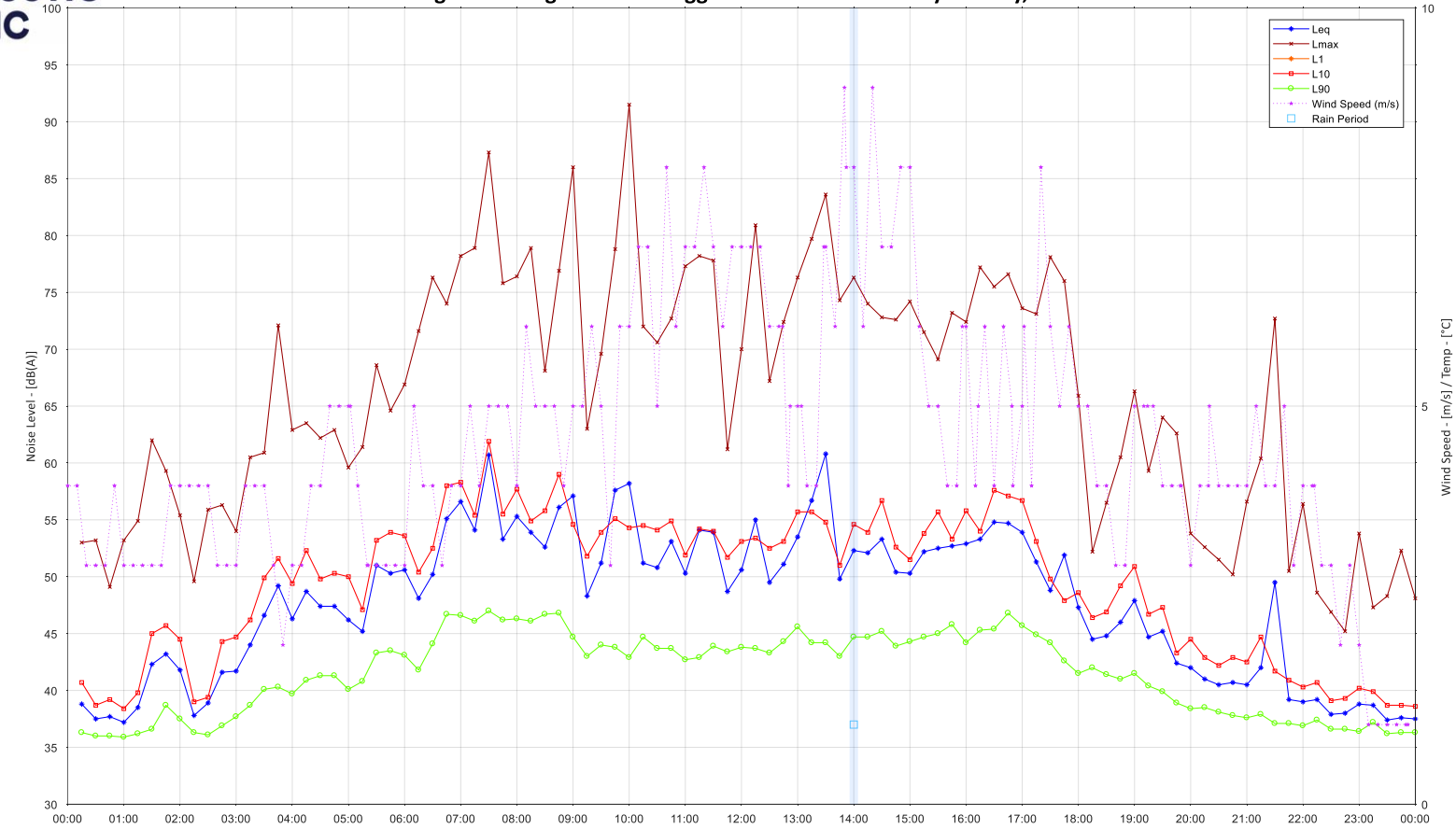
Bungendore High School - Logger Location 1: Wednesday 05 May, 2021



- Rain Period

ACOUSTIC LOGIC

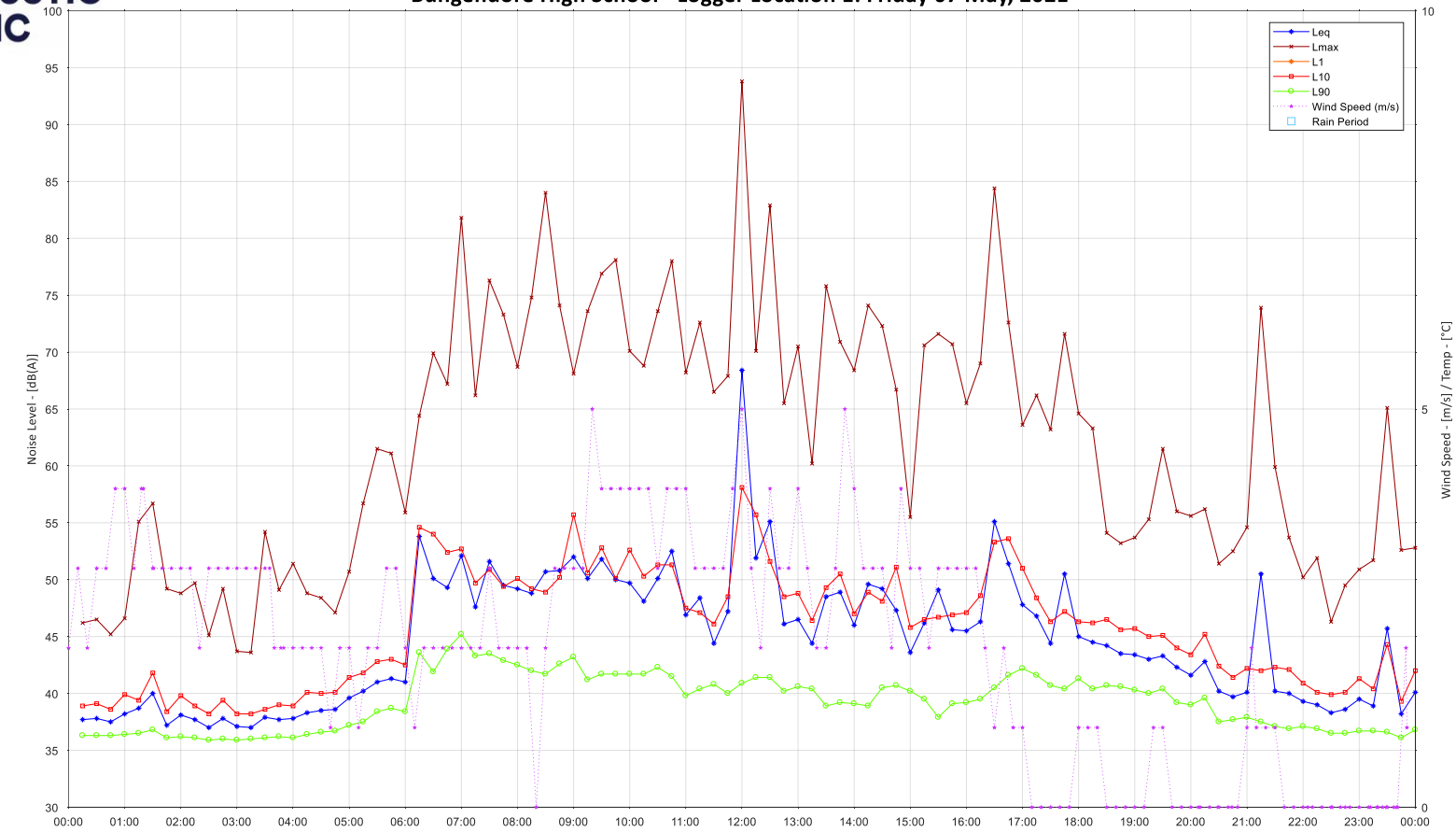
Bungendore High School - Logger Location 1: Thursday 06 May, 2021



- Rain Period

ACOUSTIC LOGIC

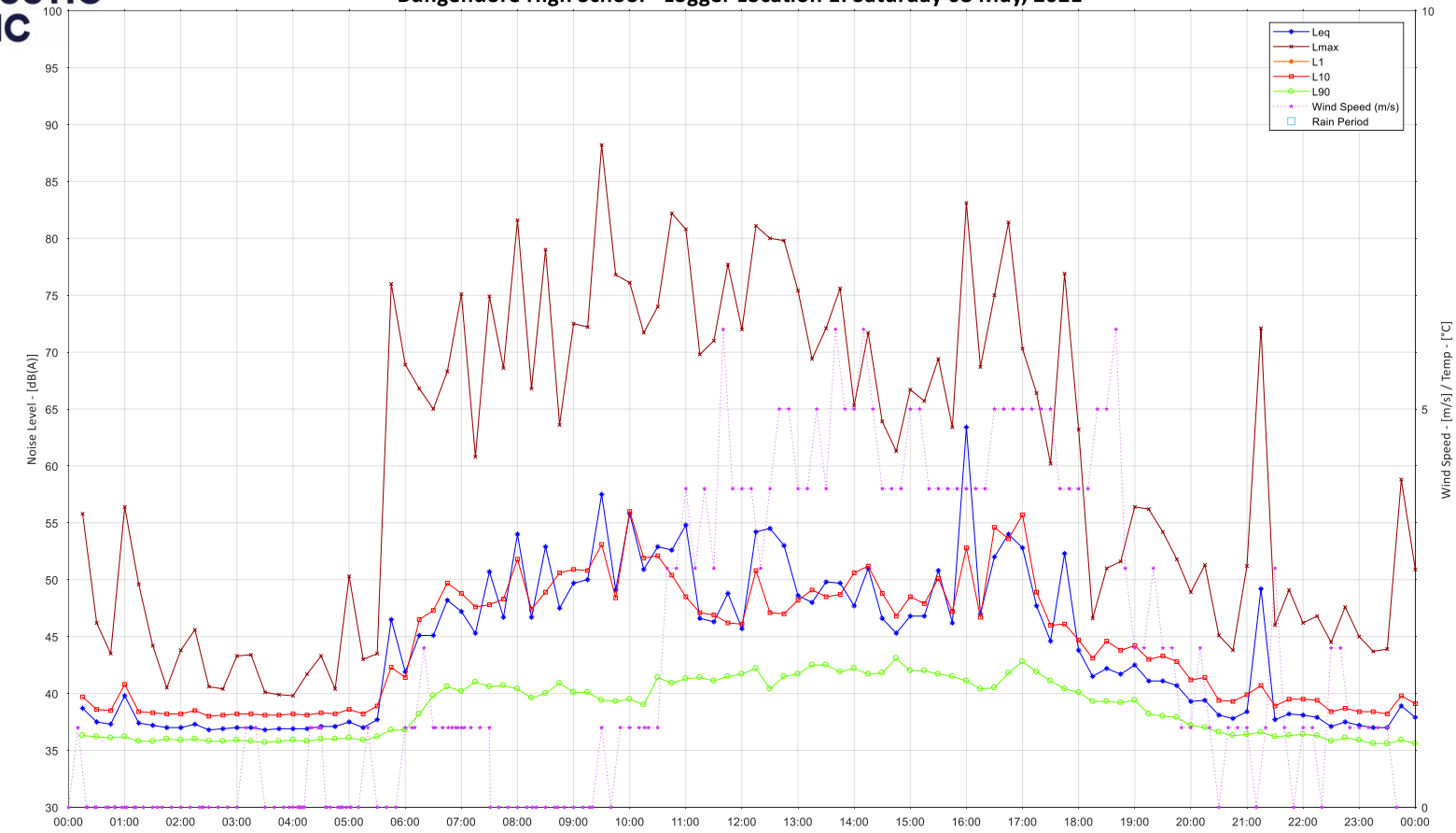
Bungendore High School - Logger Location 1: Friday 07 May, 2021



- Rain Period

ACOUSTIC LOGIC

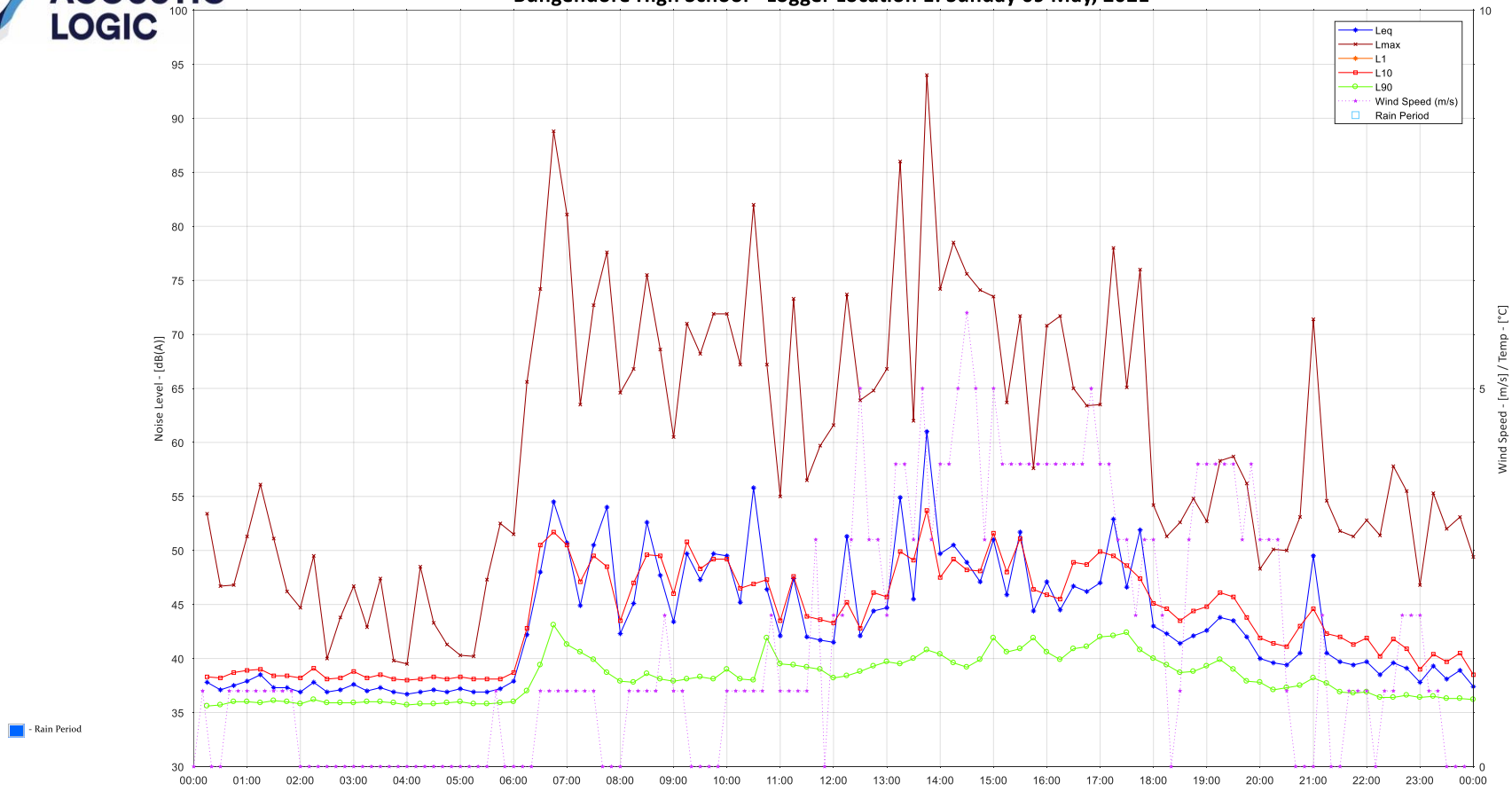
Bungendore High School - Logger Location 1: Saturday 08 May, 2021



- Rain Period

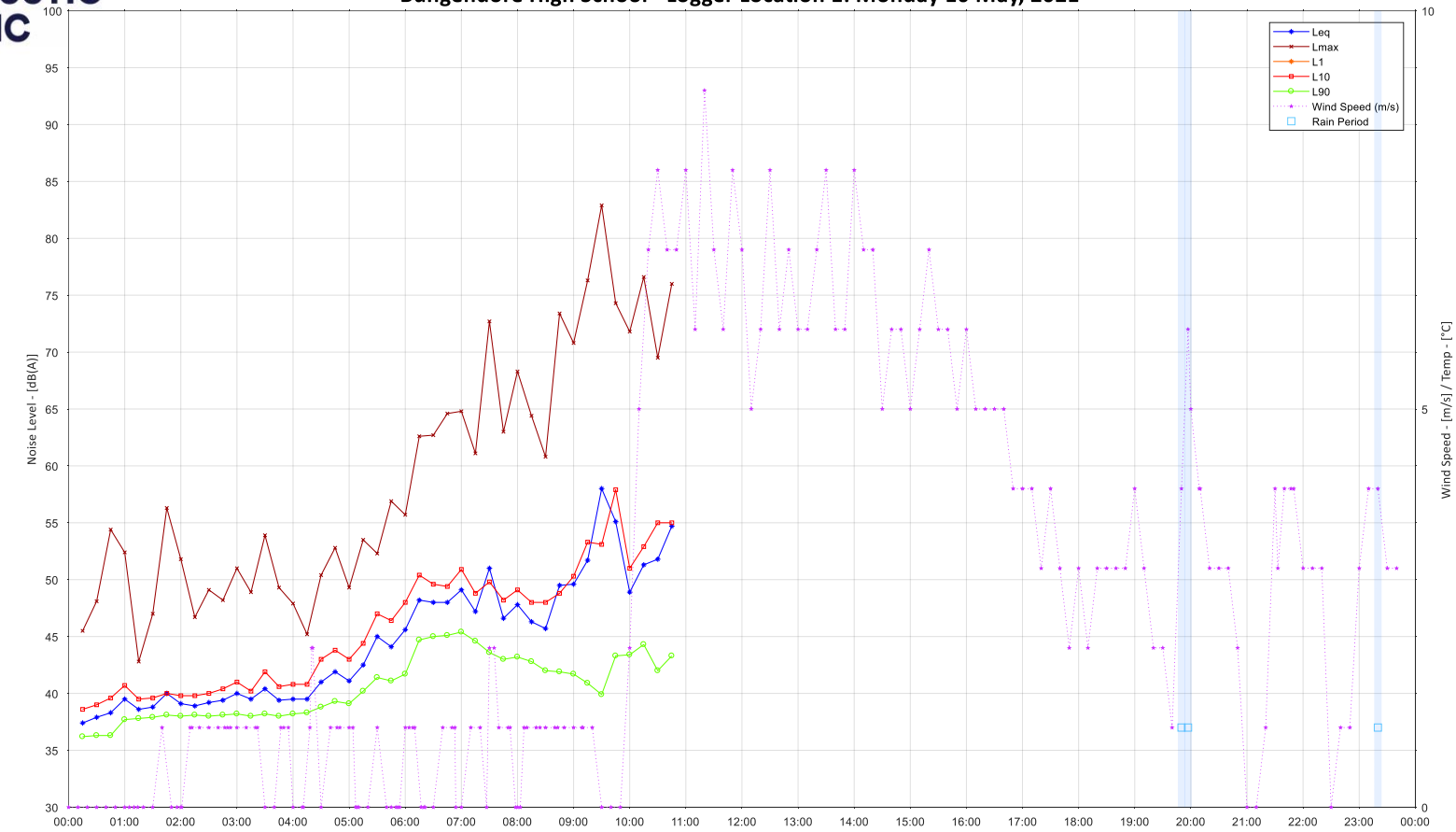
ACOUSTIC LOGIC

Bungendore High School - Logger Location 1: Sunday 09 May, 2021



ACOUSTIC LOGIC

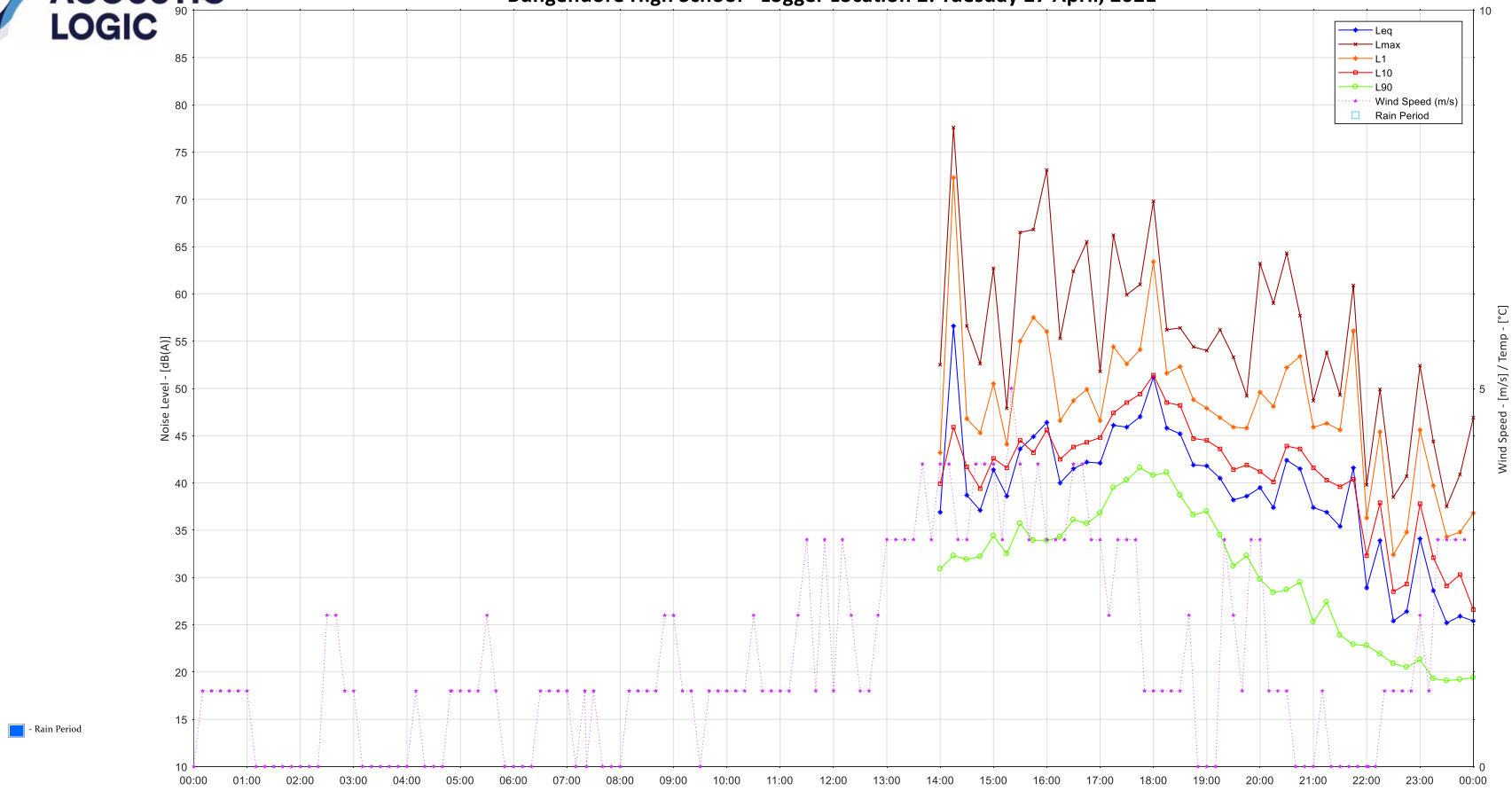
Bungendore High School - Logger Location 1: Monday 10 May, 2021



- Rain Period

ACOUSTIC LOGIC

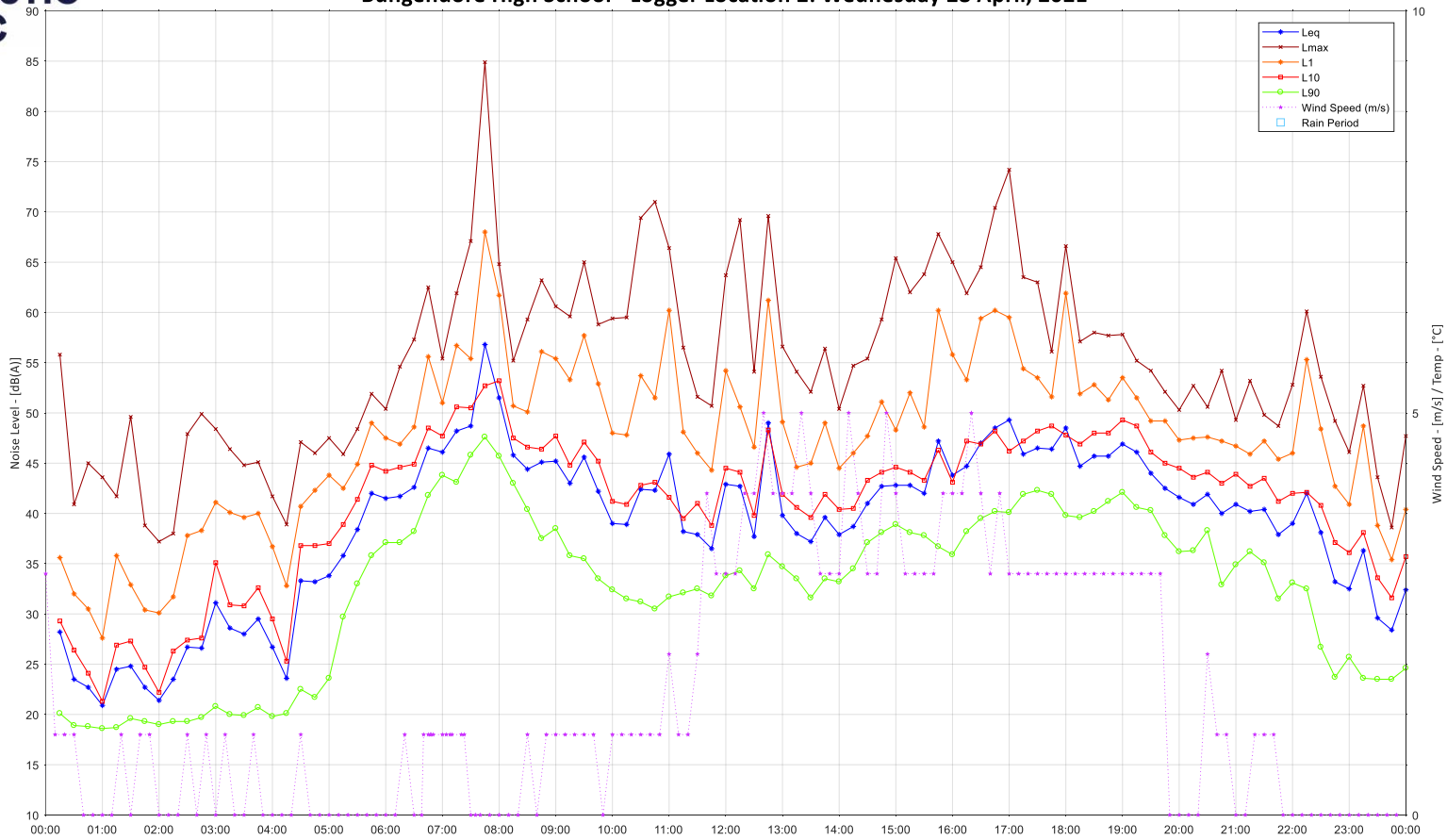
Bungendore High School - Logger Location 2: Tuesday 27 April, 2021



- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 2: Wednesday 28 April, 2021



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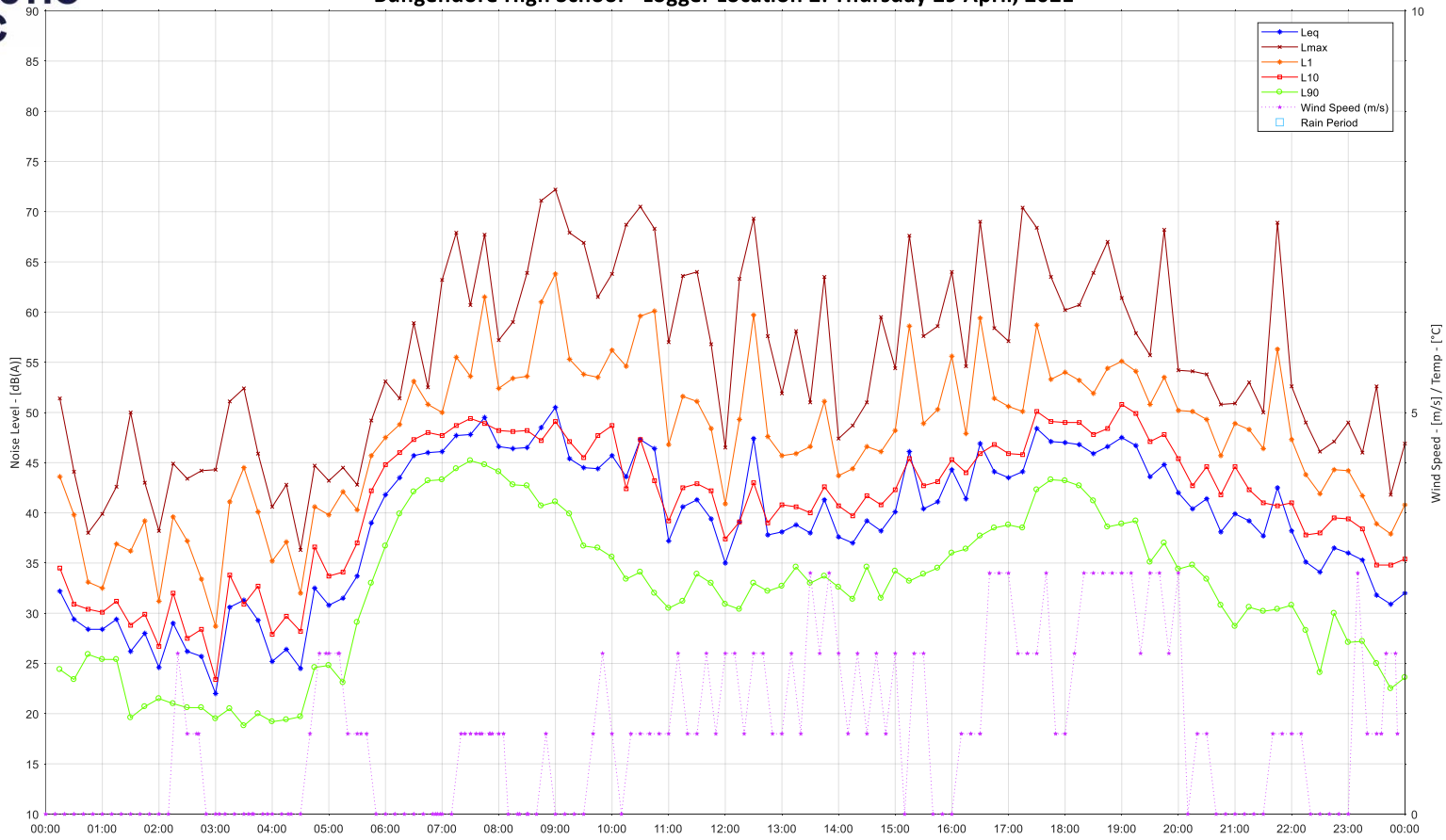

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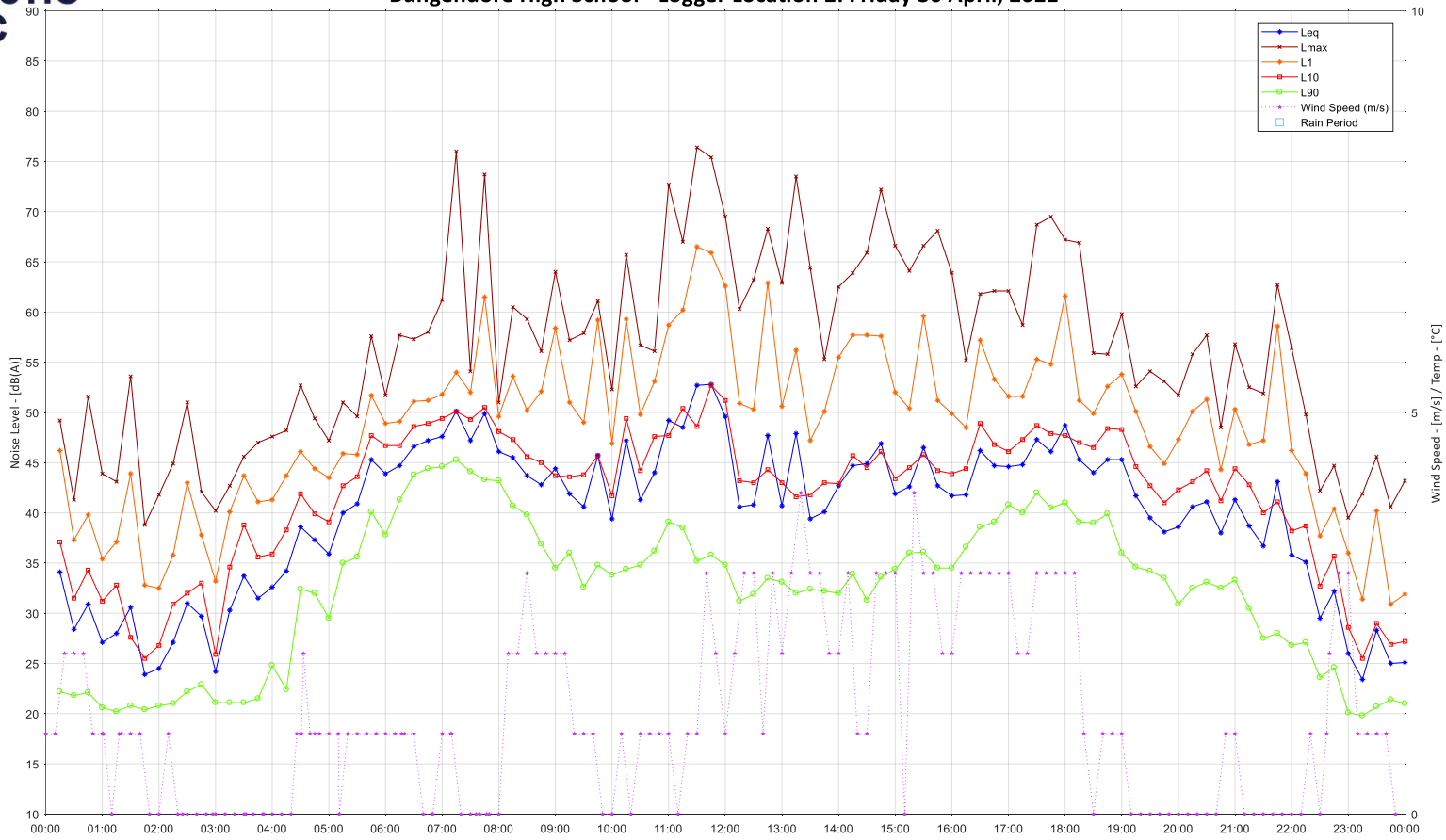

- Rain Period

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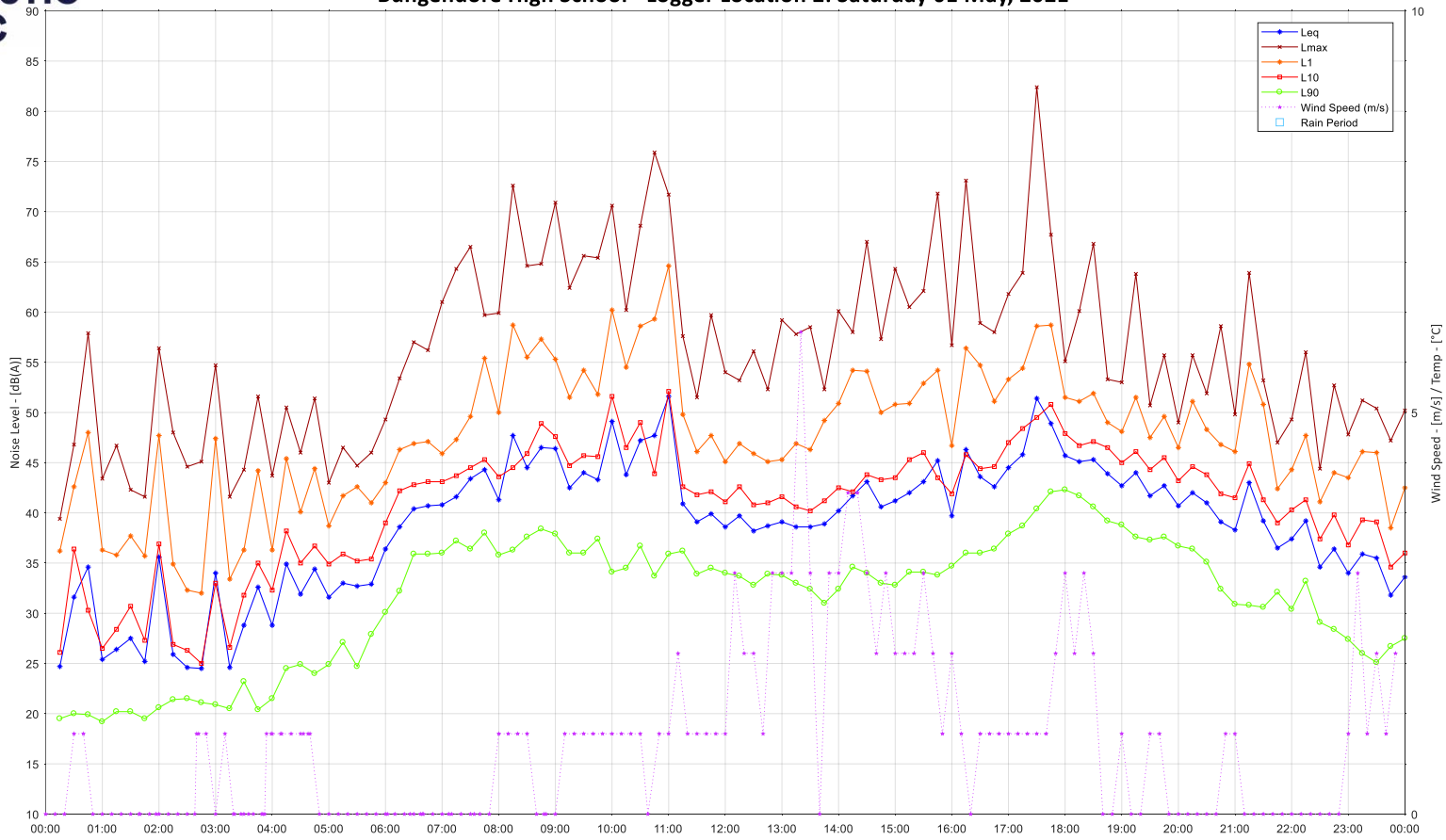
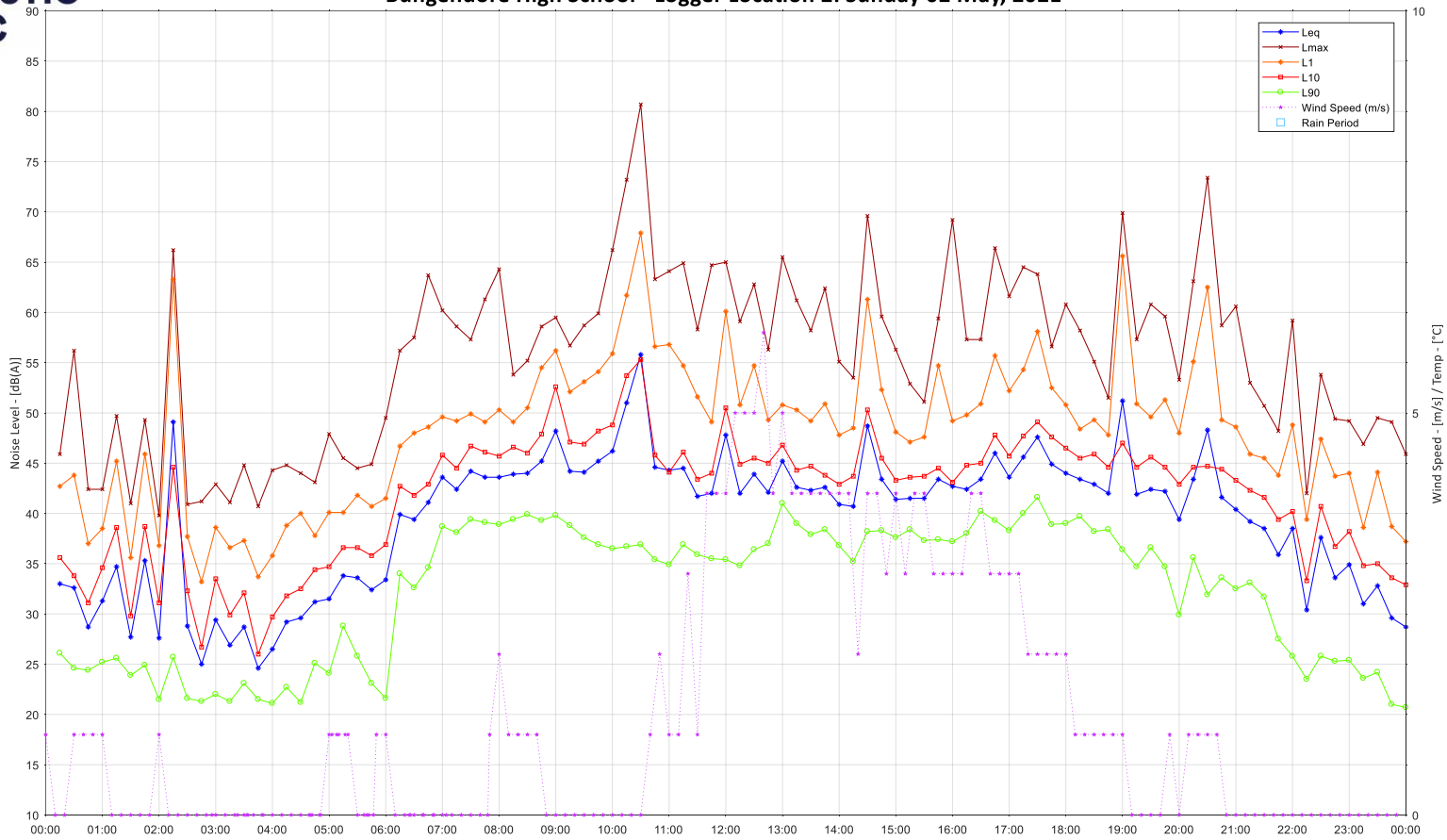


- Rain Period

ACOUSTIC LOGIC

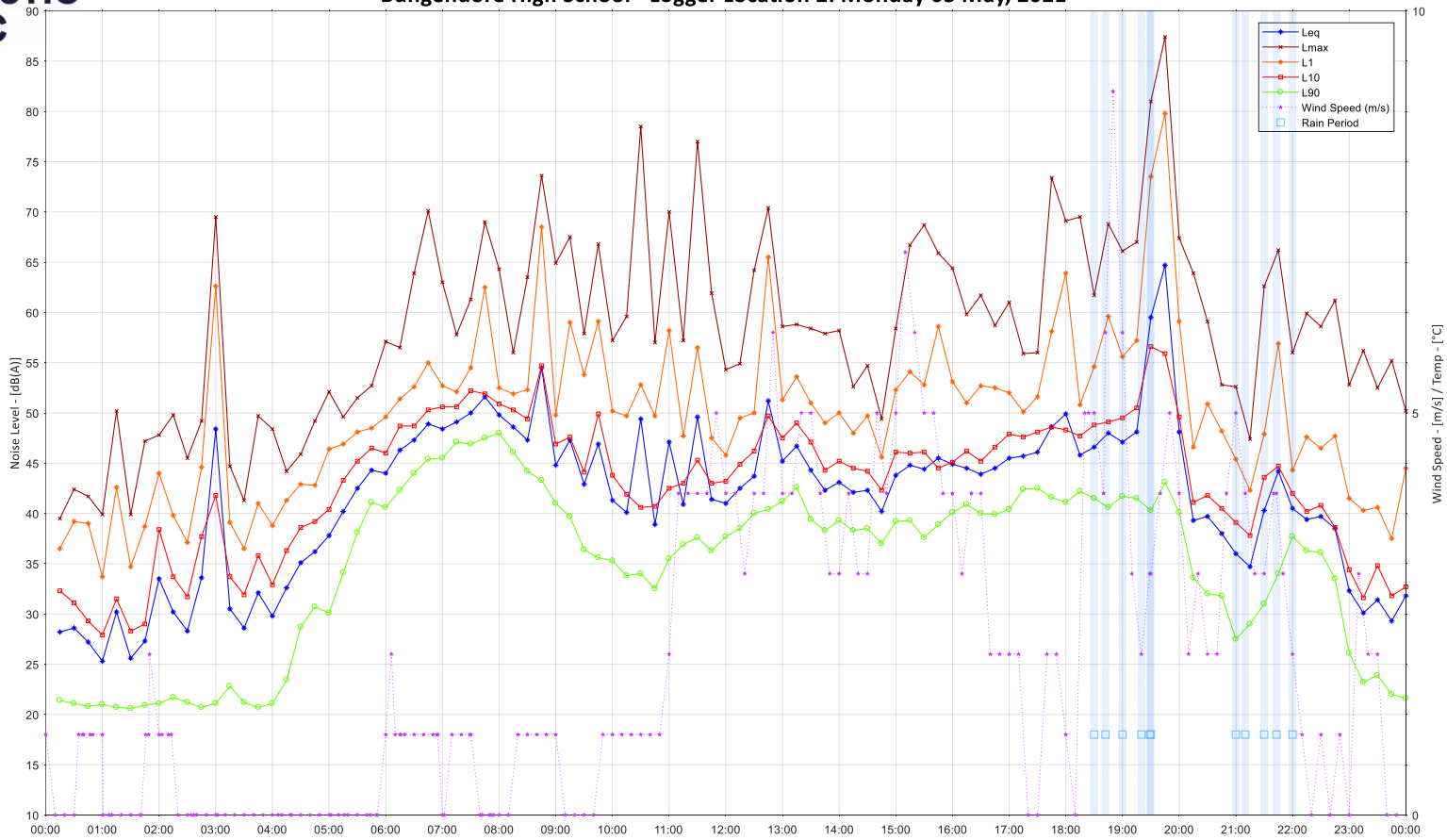
Bungendore High School - Logger Location 2: Sunday 02 May, 2021



- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 2: Monday 03 May, 2021



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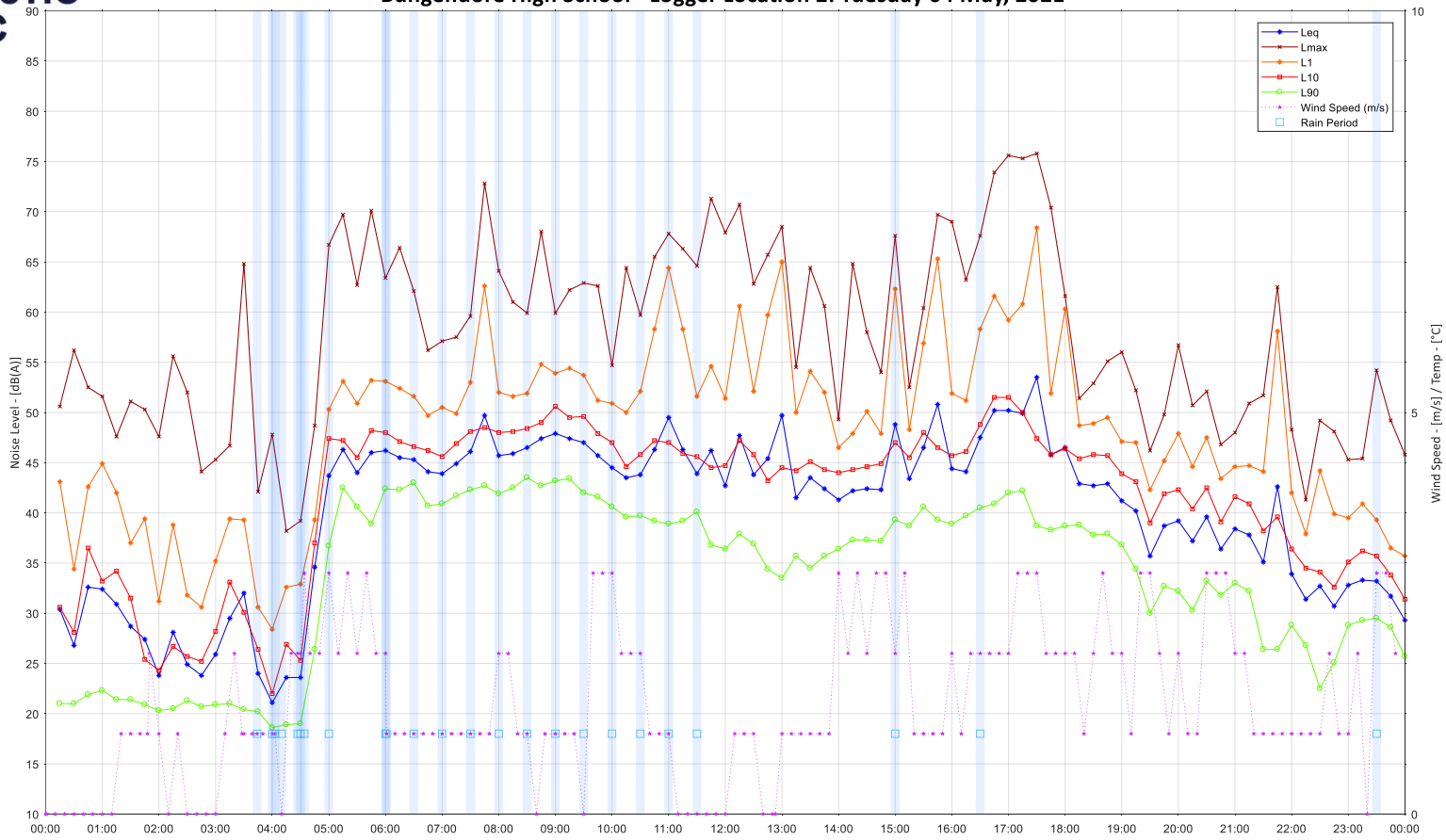

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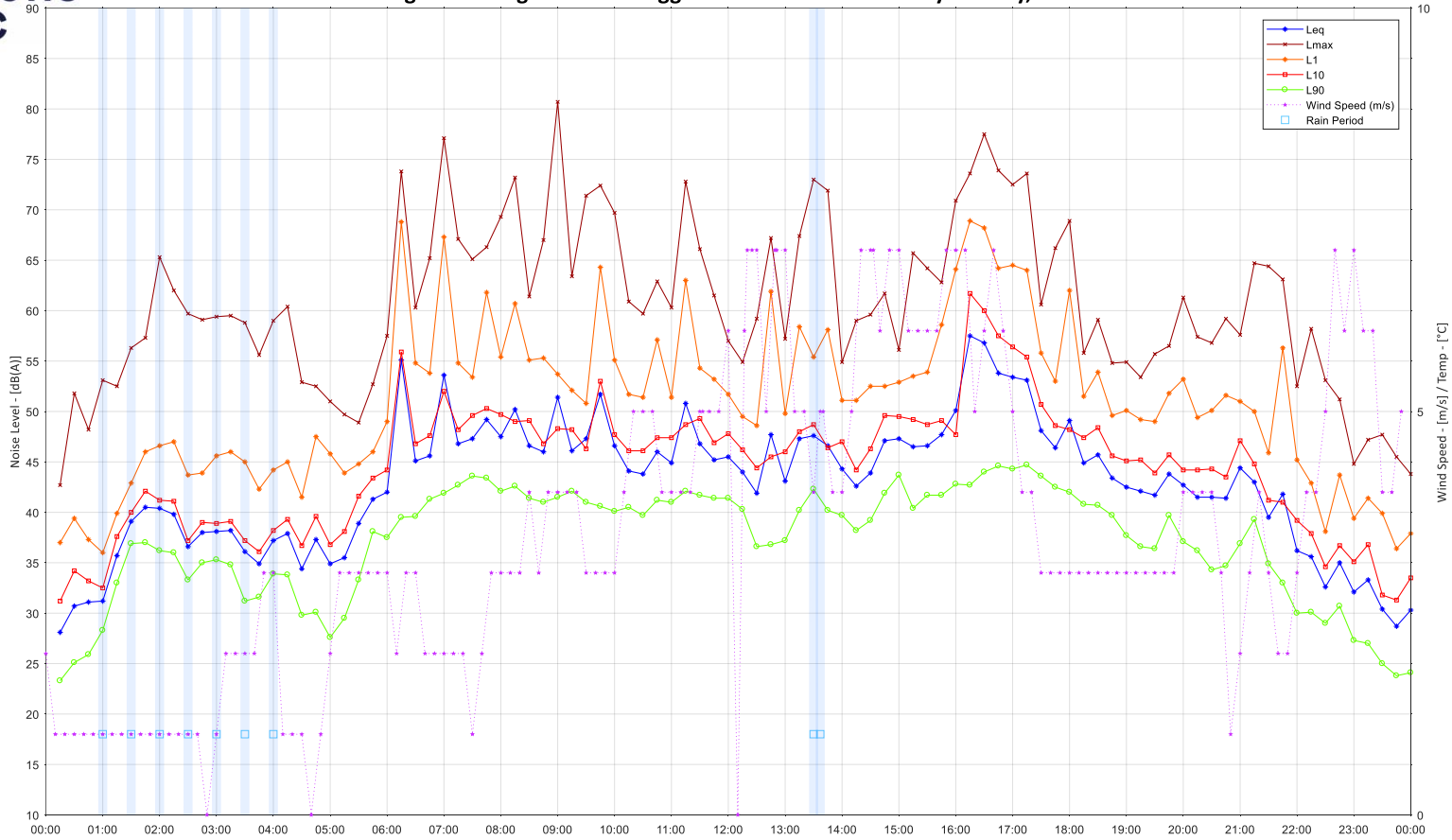

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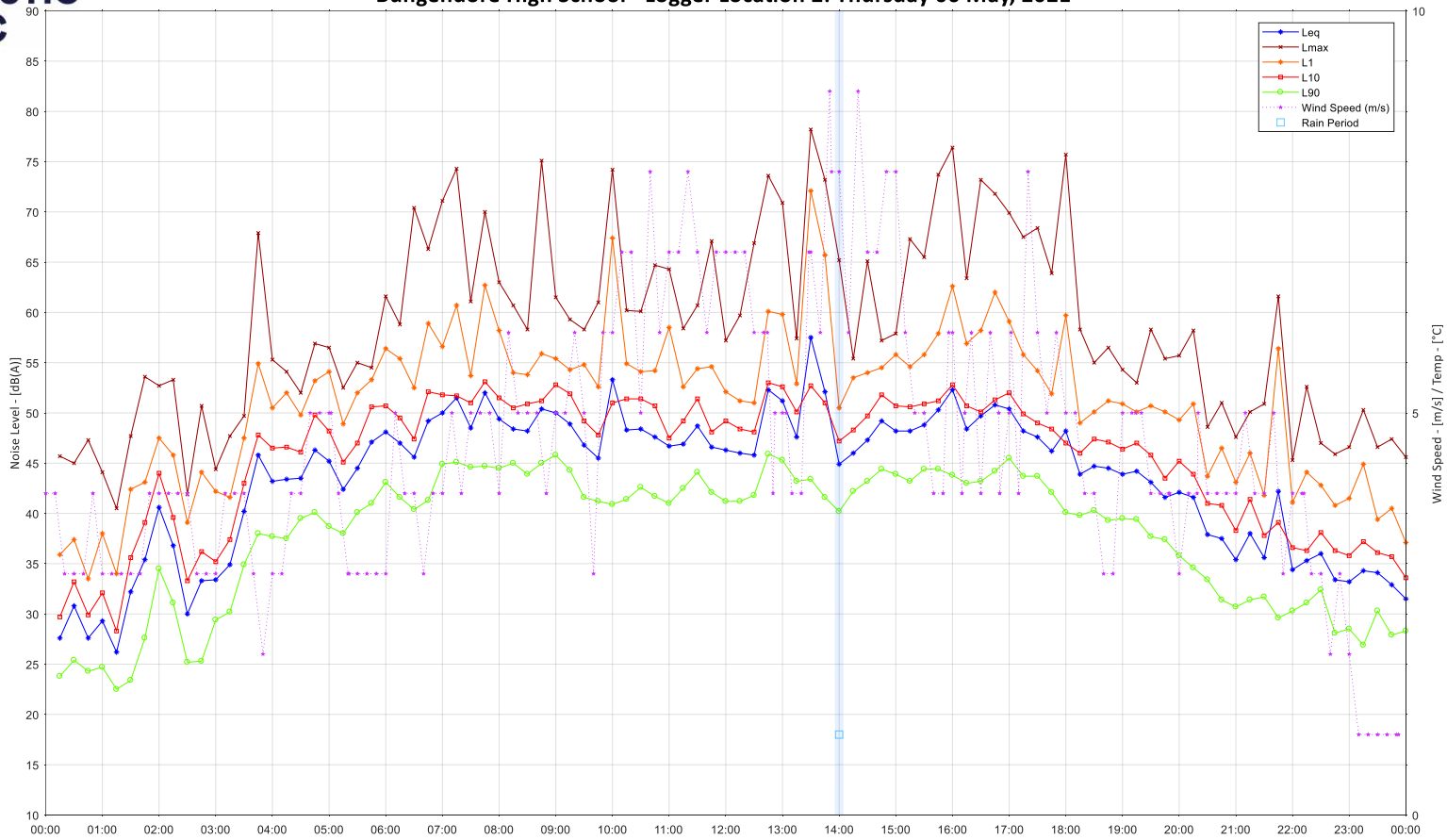

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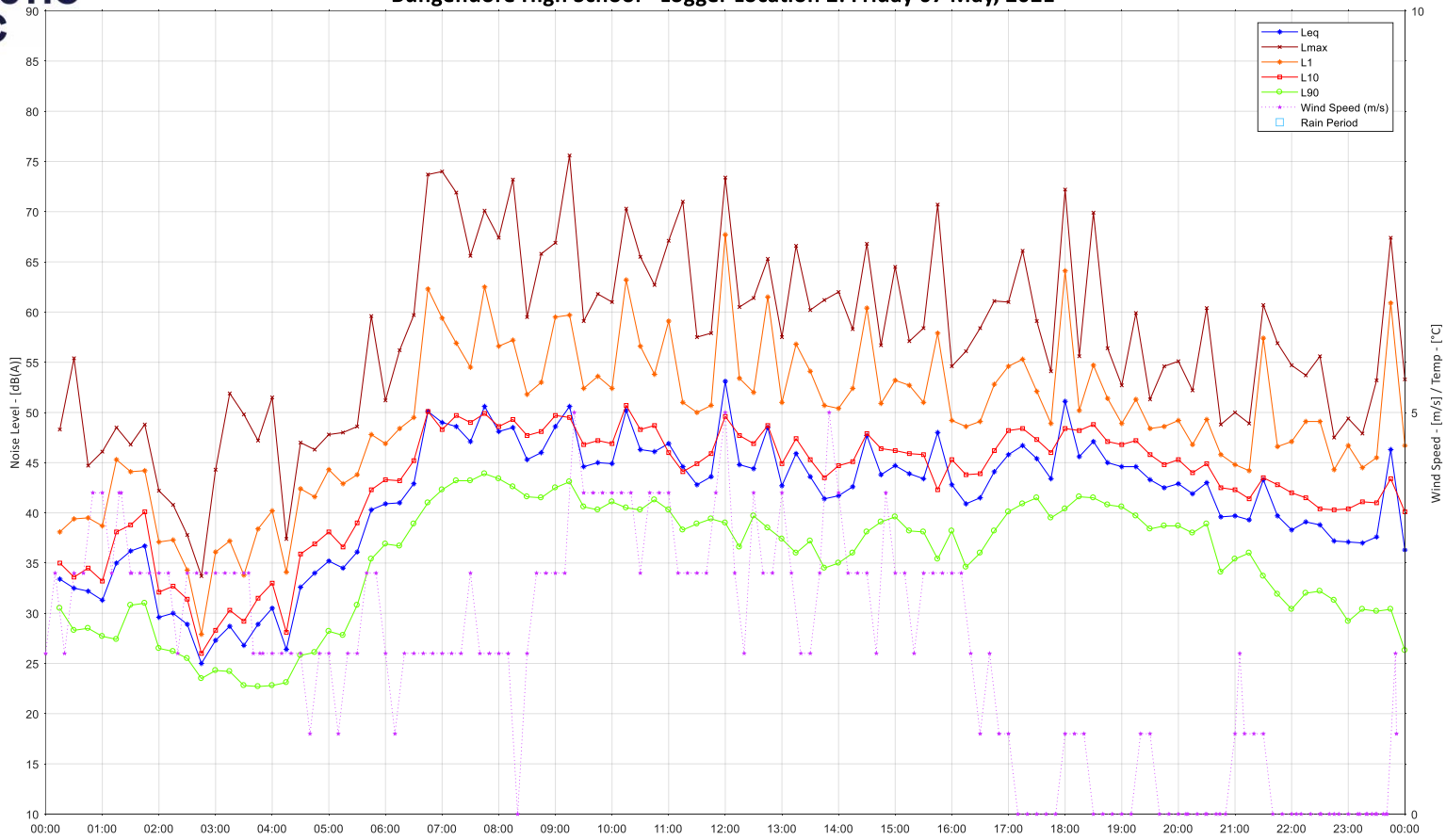

- Rain Period

ACOUSTIC LOGIC

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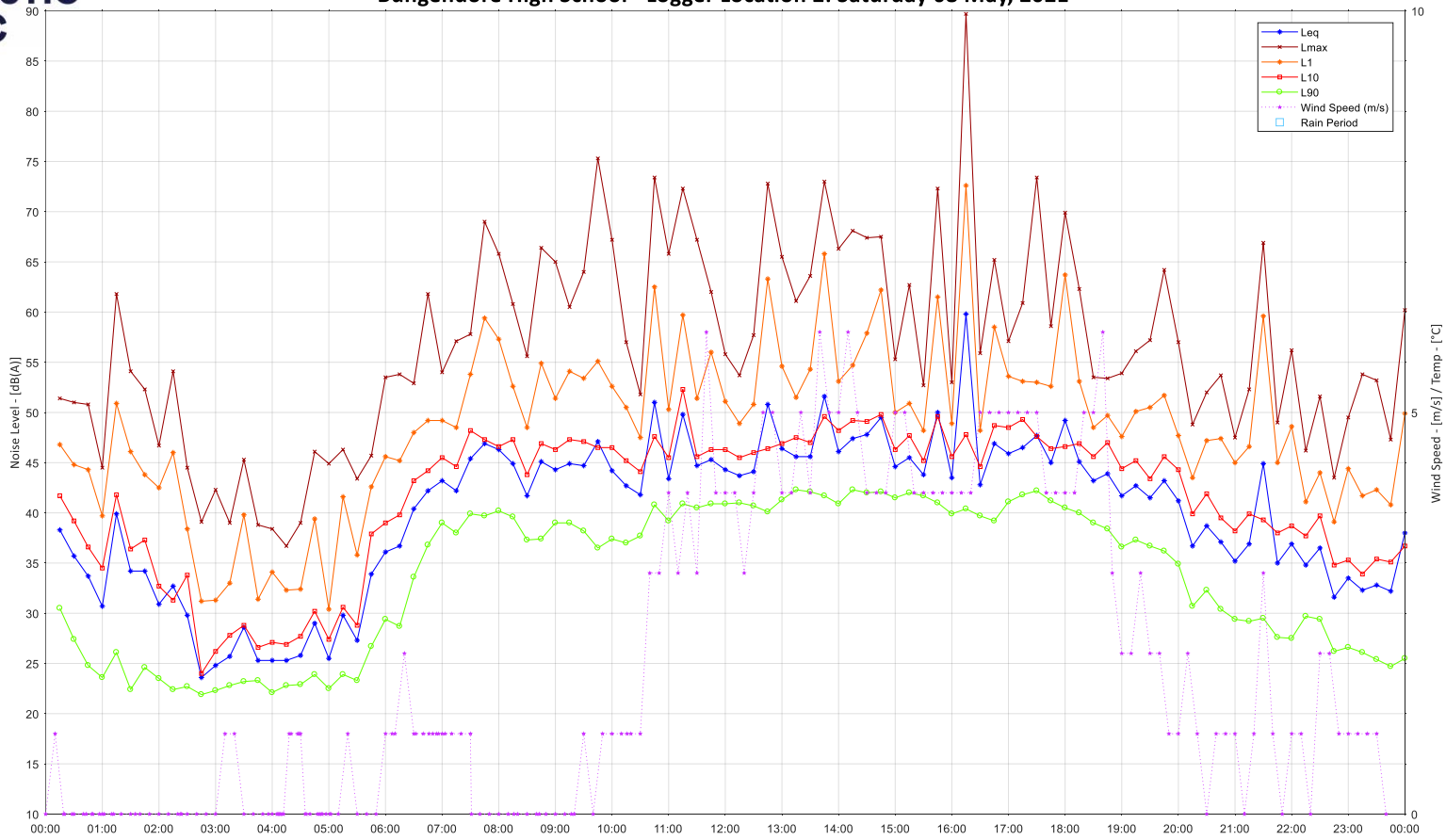

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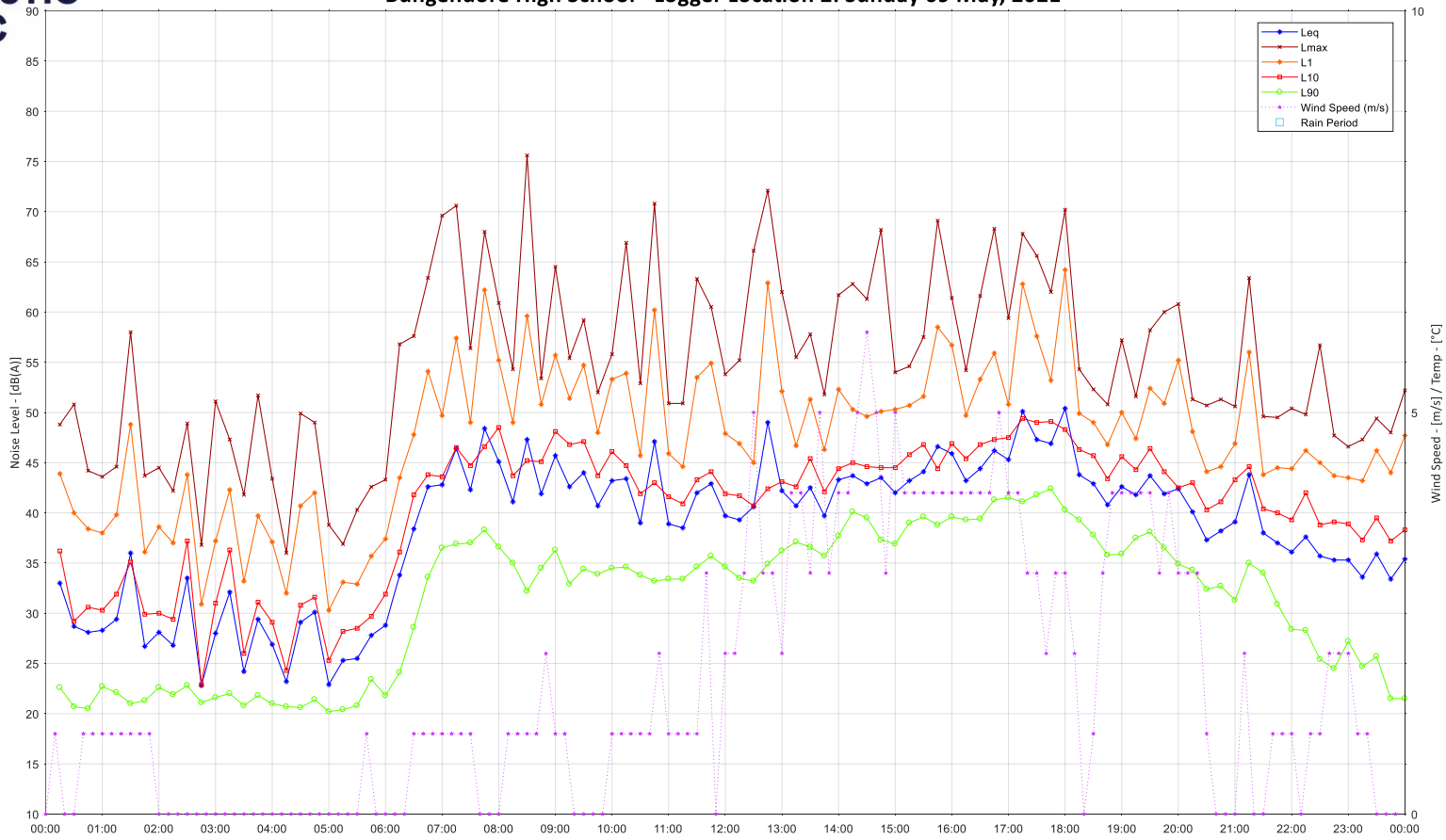
ACOUSTIC LOGIC

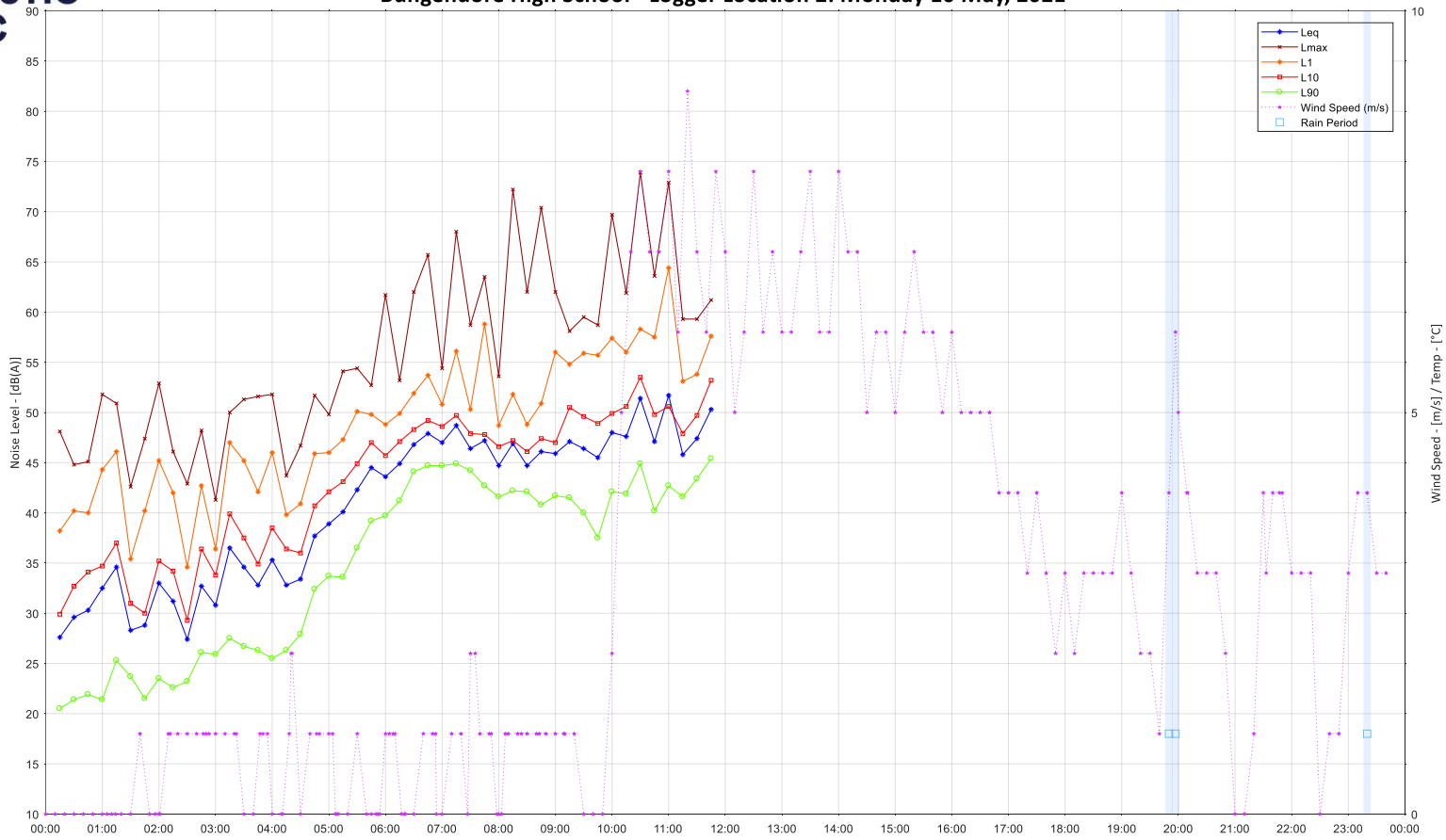
Bungendore High School - Logger Location 2: Sunday 09 May, 2021



- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 2: Monday 10 May, 2021



- Rain Period

ACOUSTIC LOGIC

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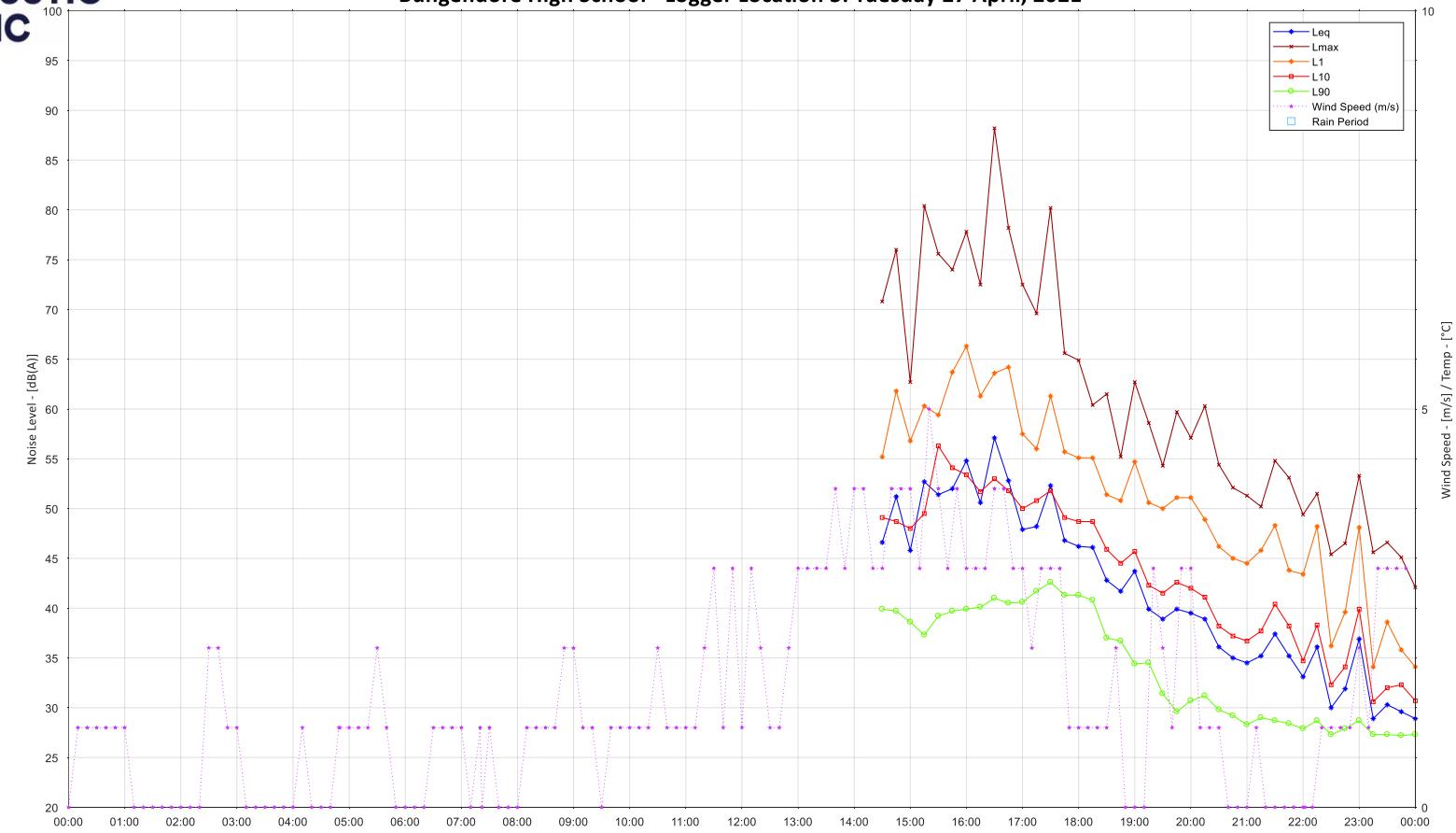
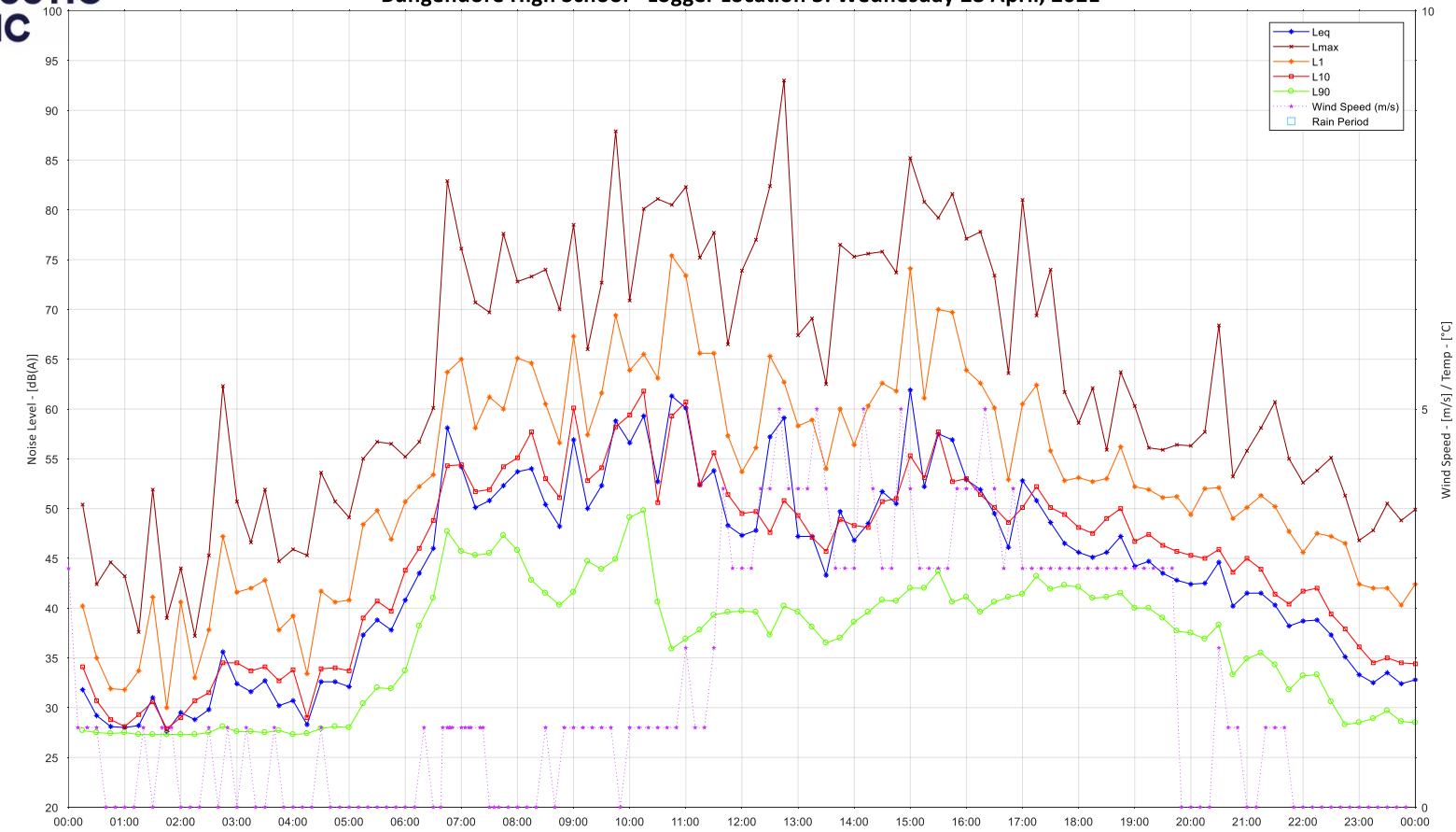


- Rain Period

ACOUSTIC LOGIC

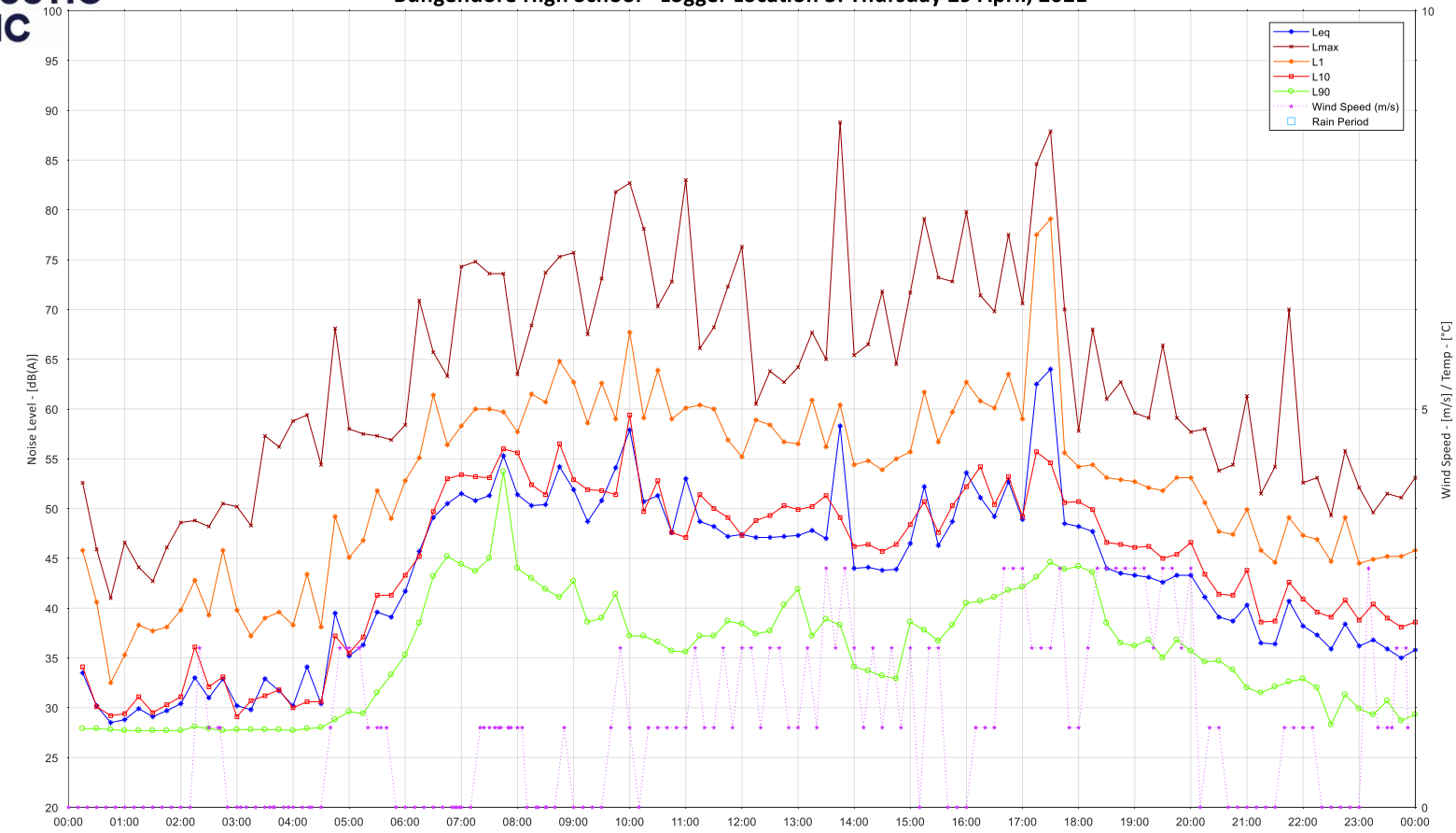
Bungendore High School - Logger Location 3: Wednesday 28 April, 2021



- Rain Period

ACOUSTIC LOGIC

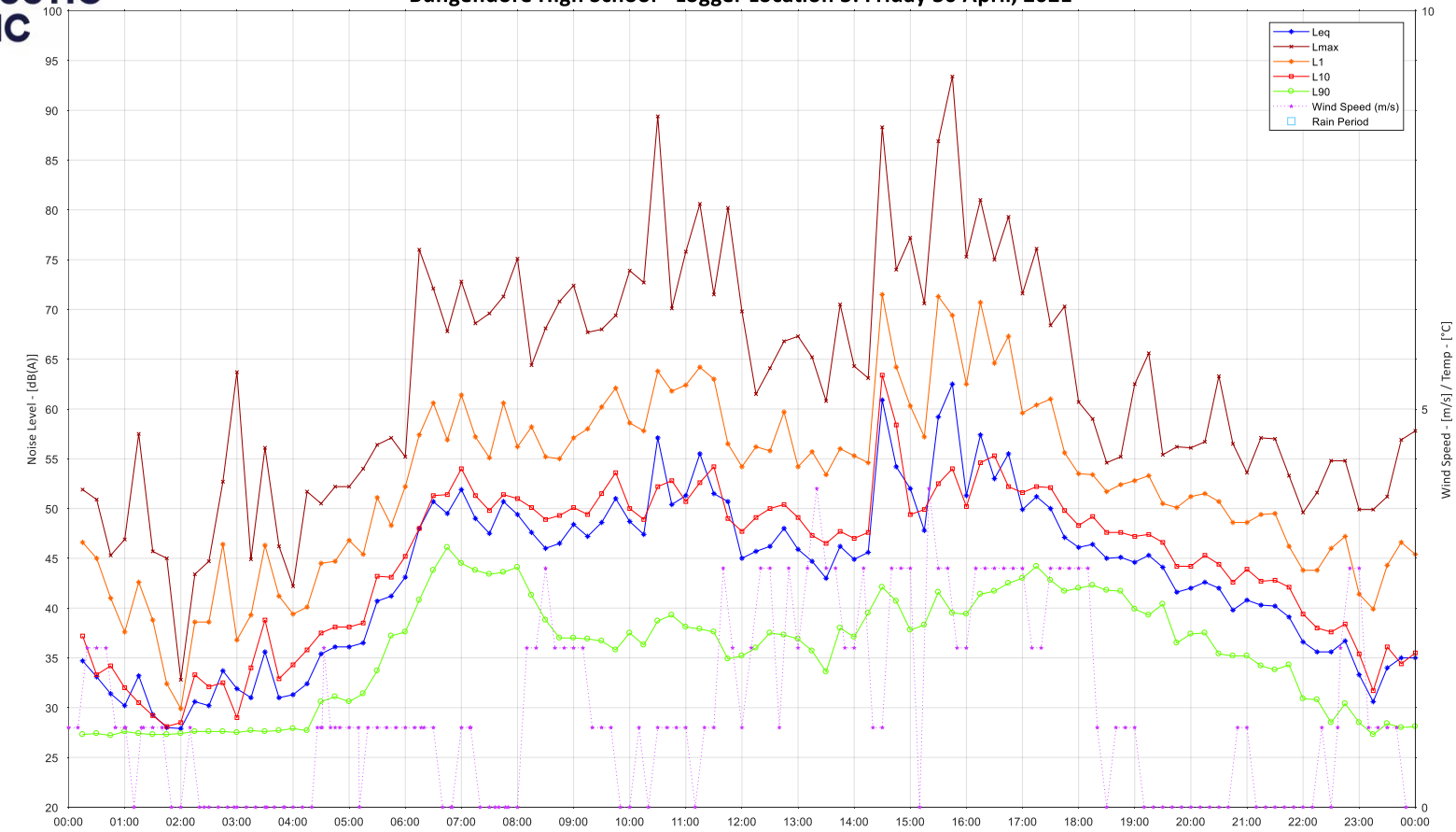
Bungendore High School - Logger Location 3: Thursday 29 April, 2021



- Rain Period

ACOUSTIC LOGIC

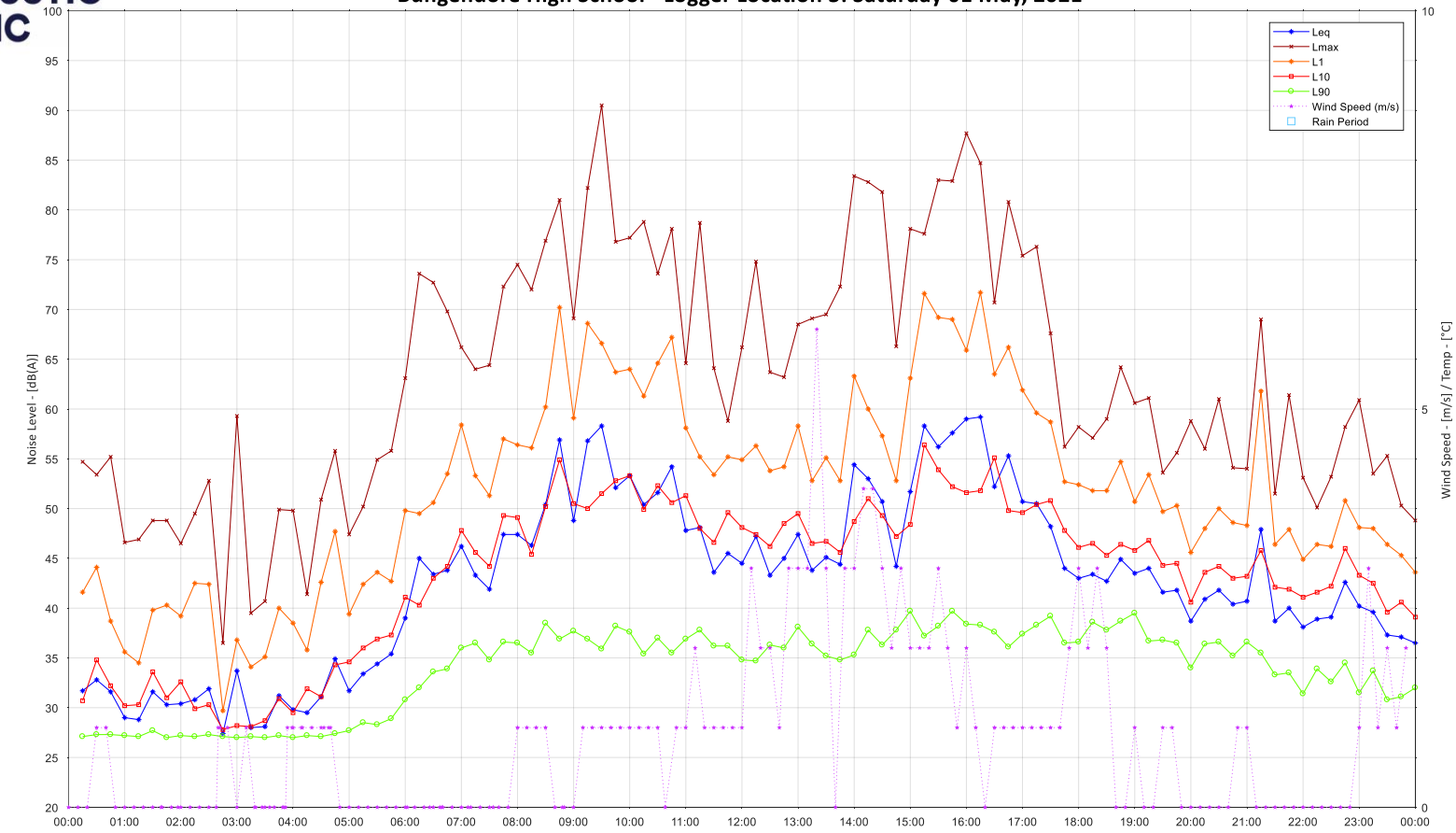
Bungendore High School - Logger Location 3: Friday 30 April, 2021



- Rain Period

ACOUSTIC LOGIC

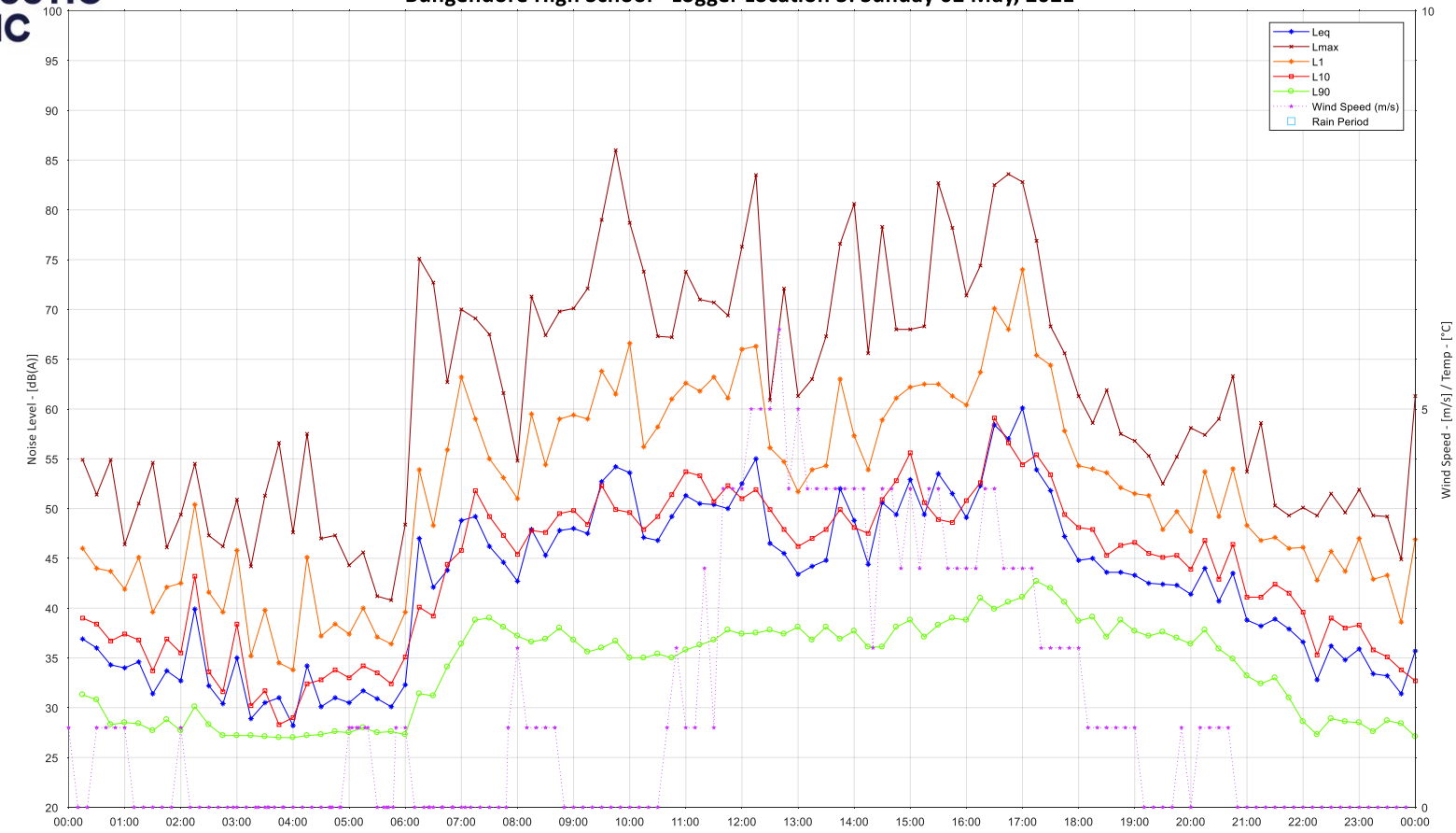
Bungendore High School - Logger Location 3: Saturday 01 May, 2021



- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 3: Sunday 02 May, 2021



- Rain Period

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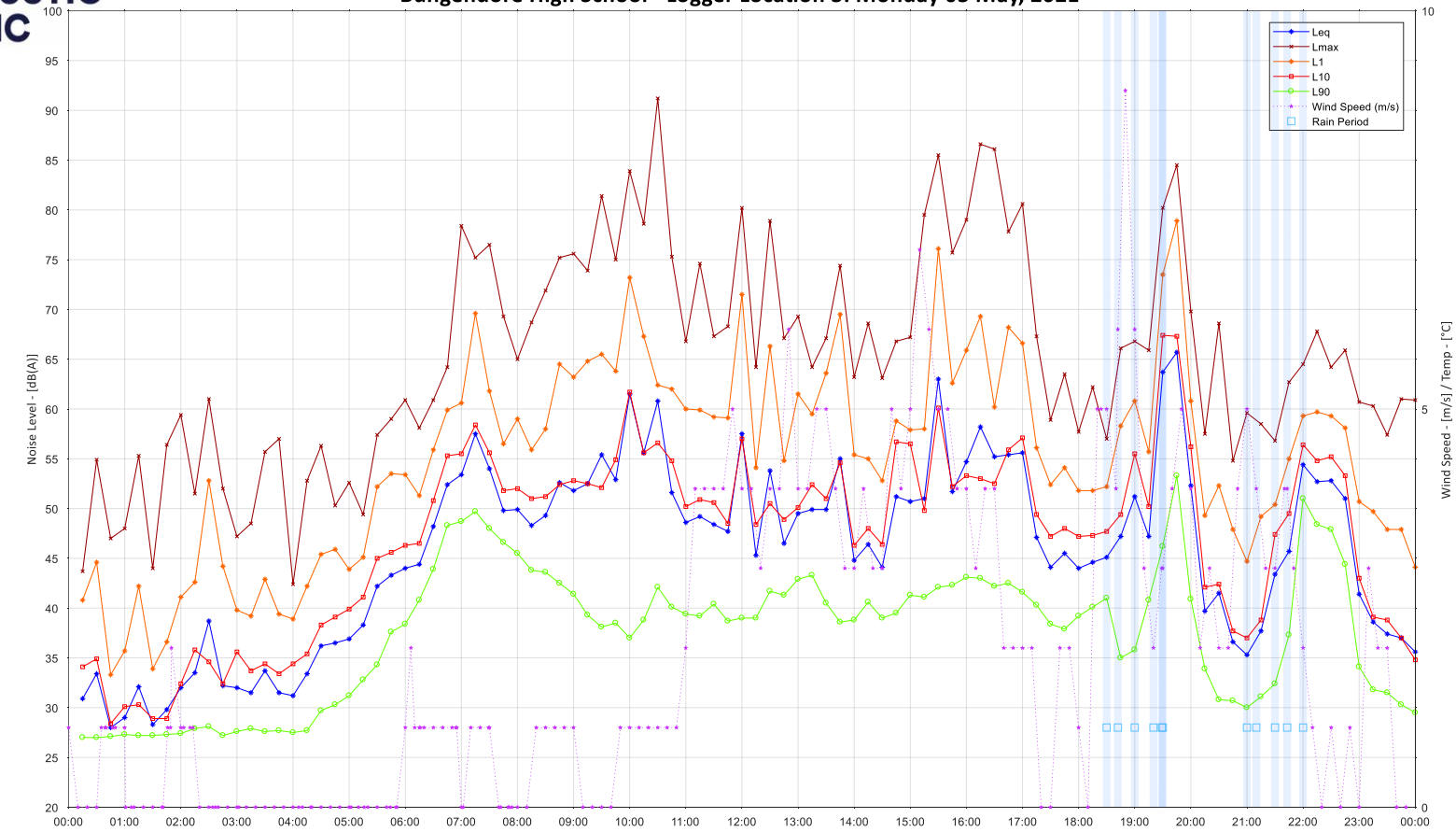

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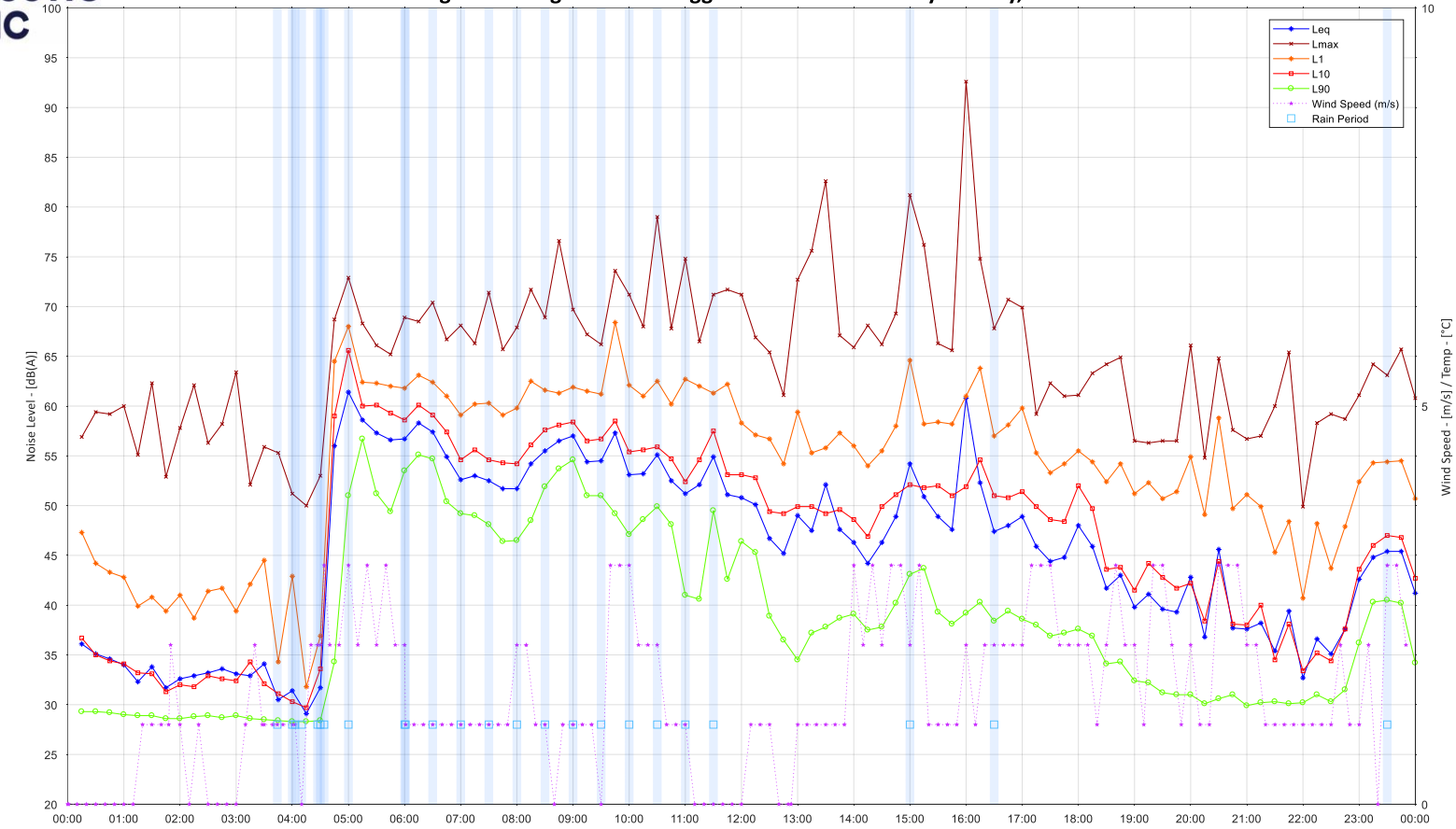
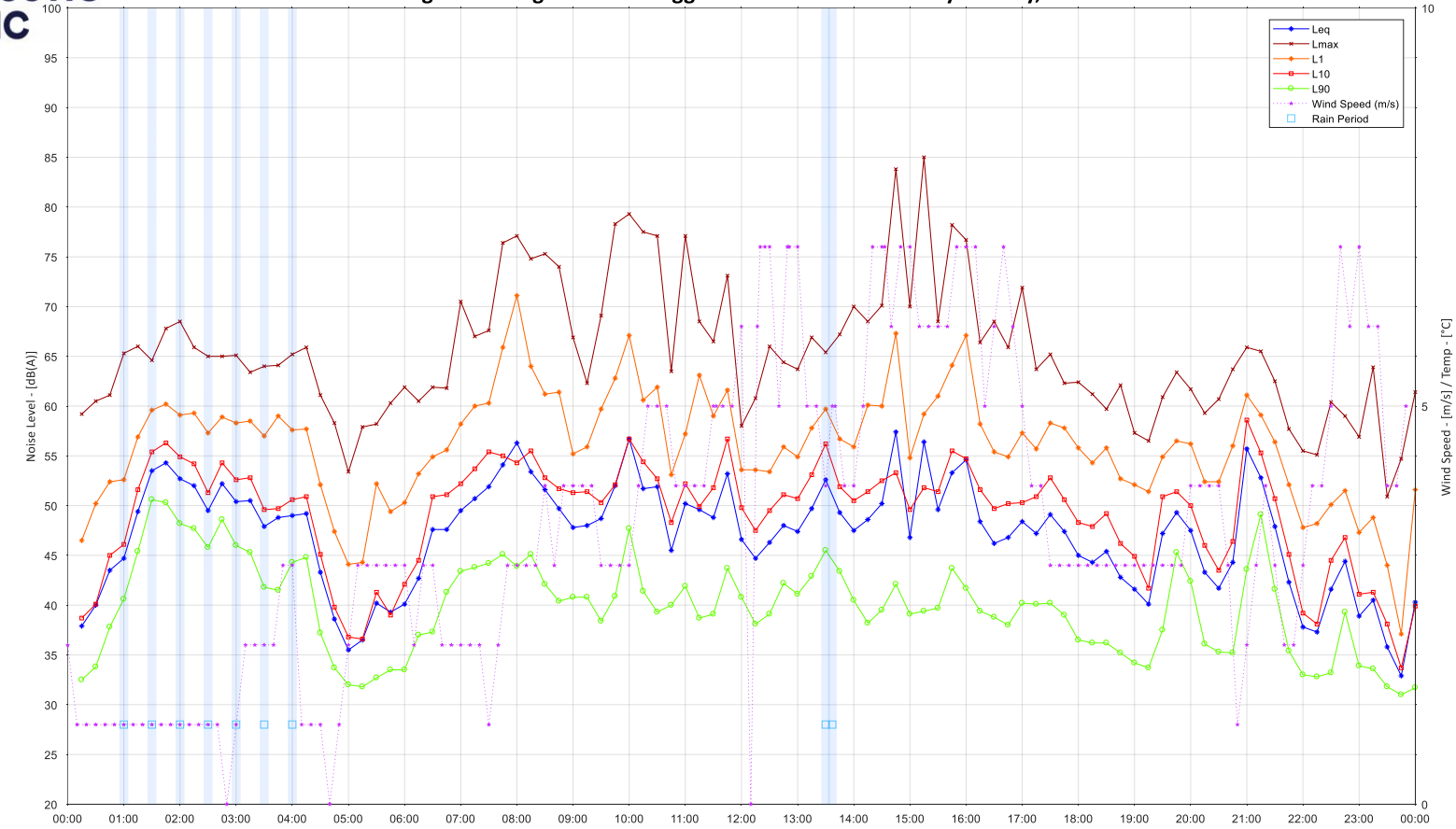


- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 3: Wednesday 05 May, 2021



- Rain Period

ACOUSTIC LOGIC

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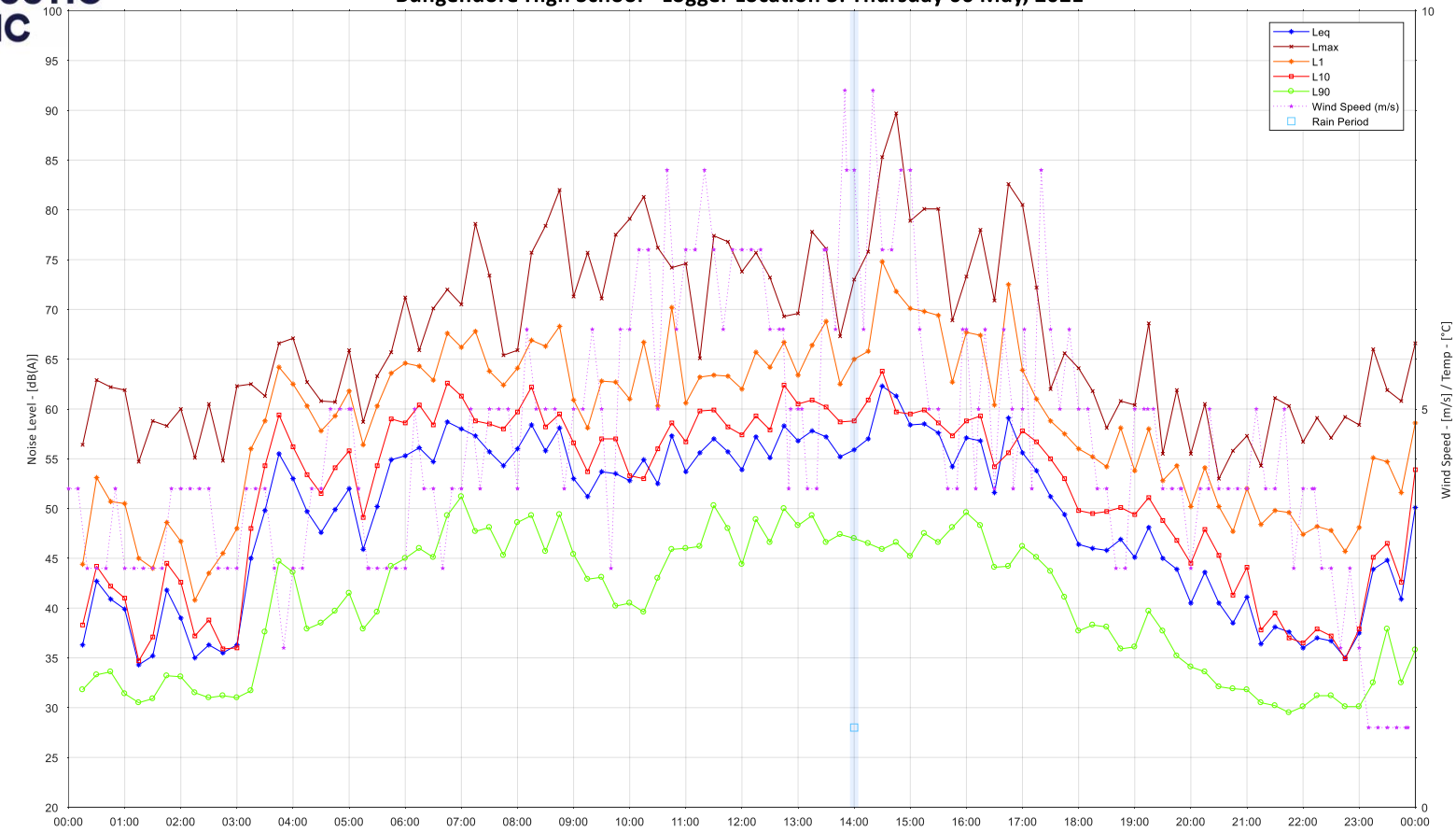

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ACOUSTIC LOGIC

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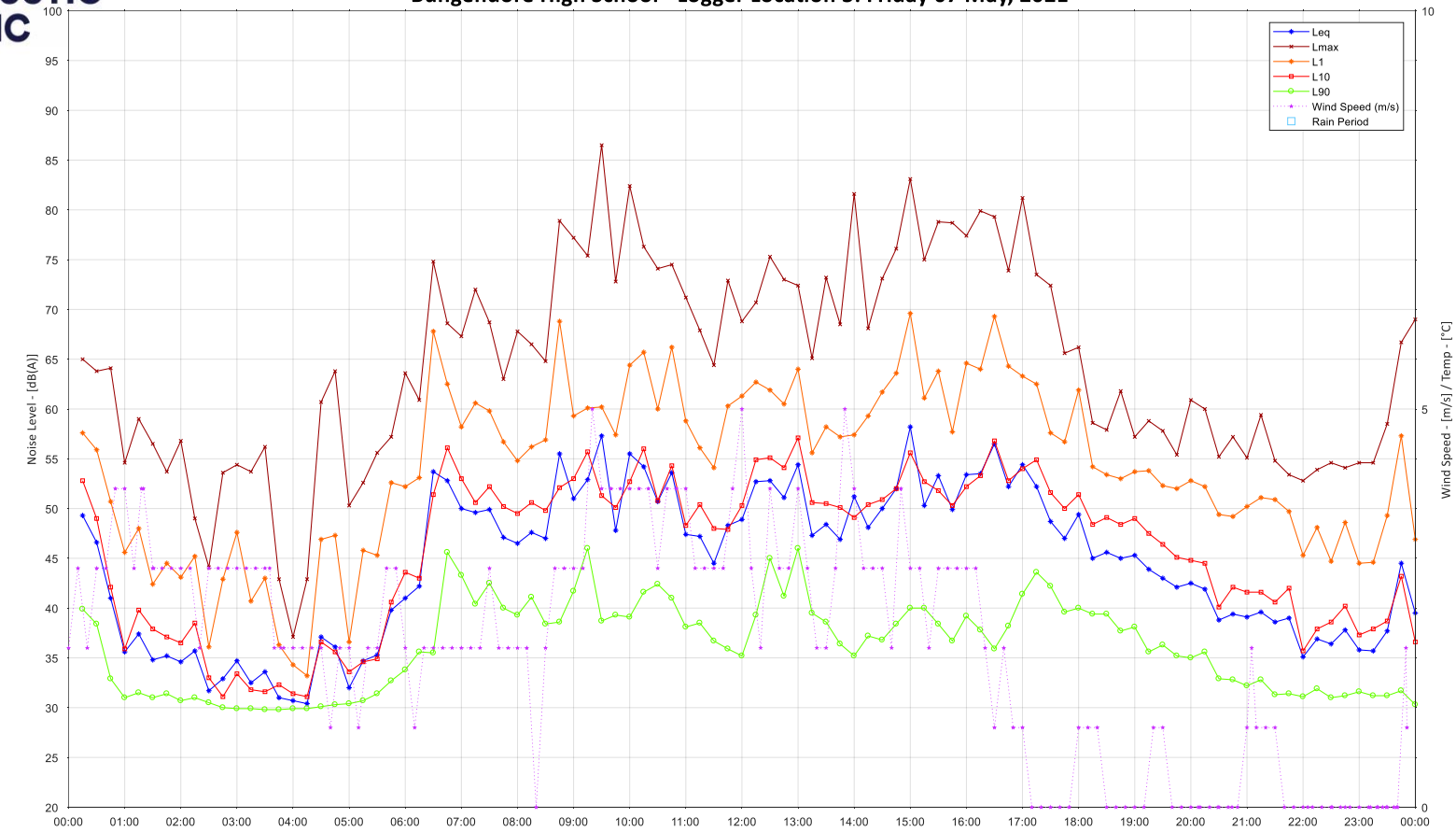

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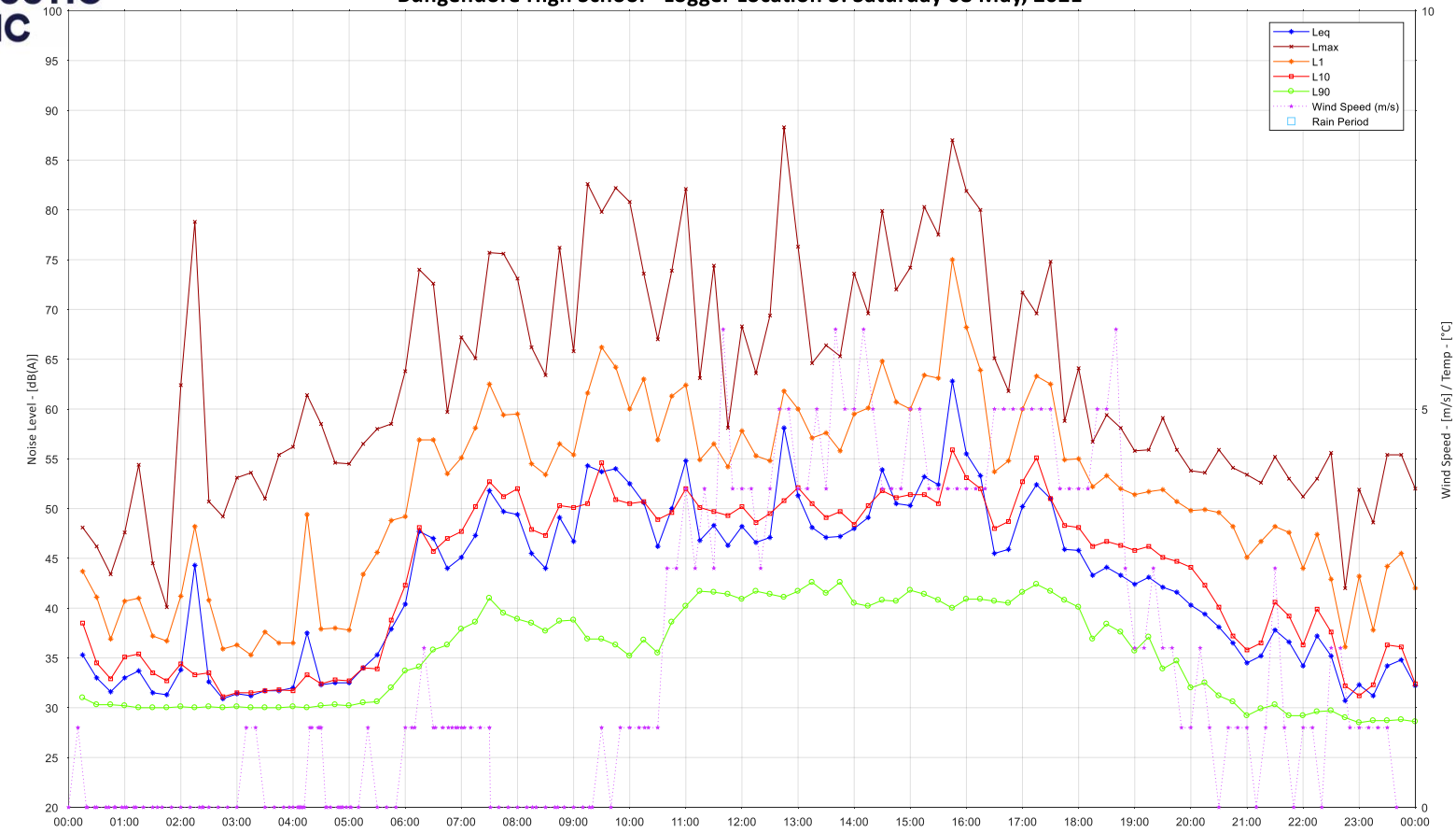

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ACOUSTIC LOGIC

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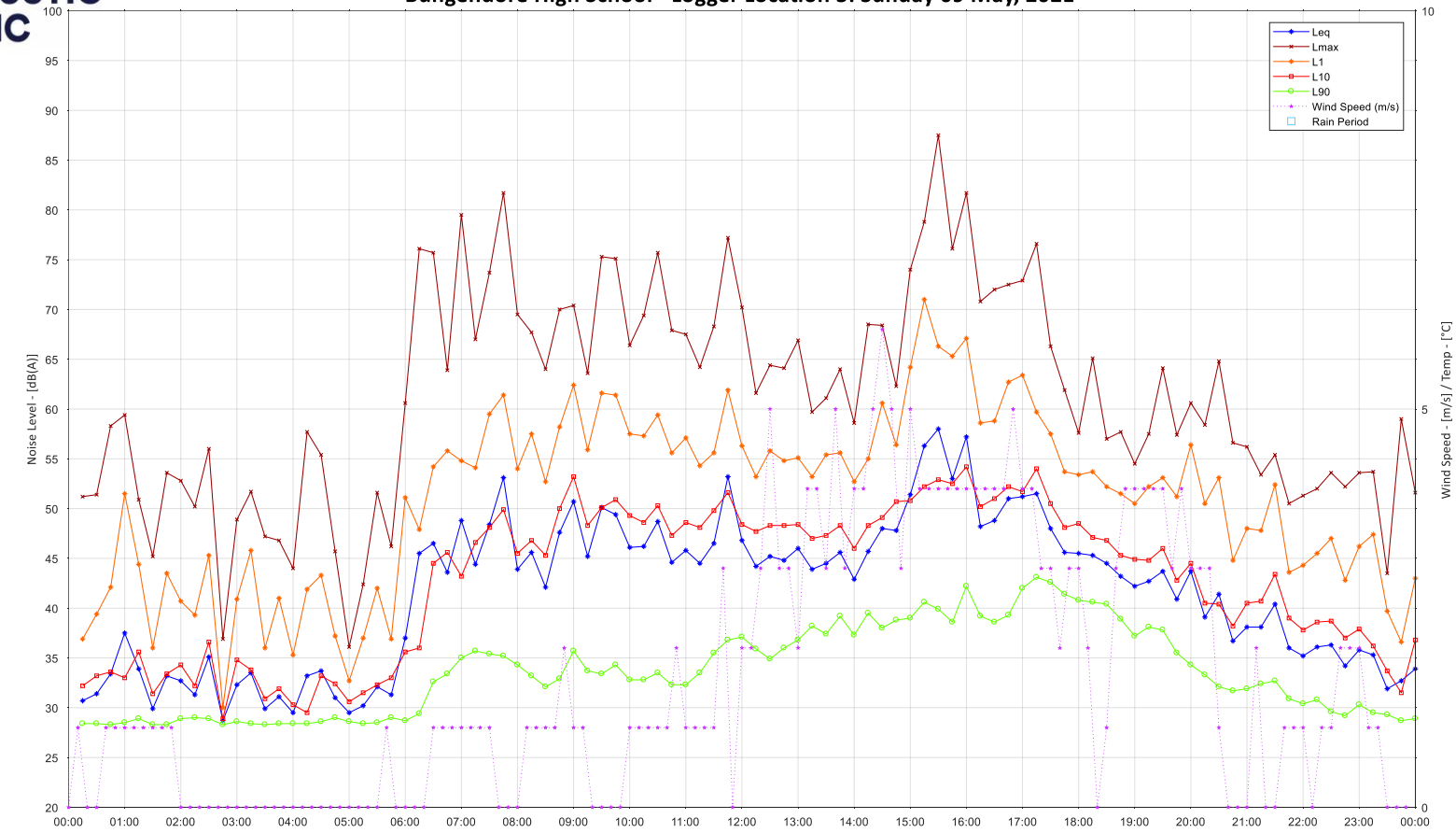
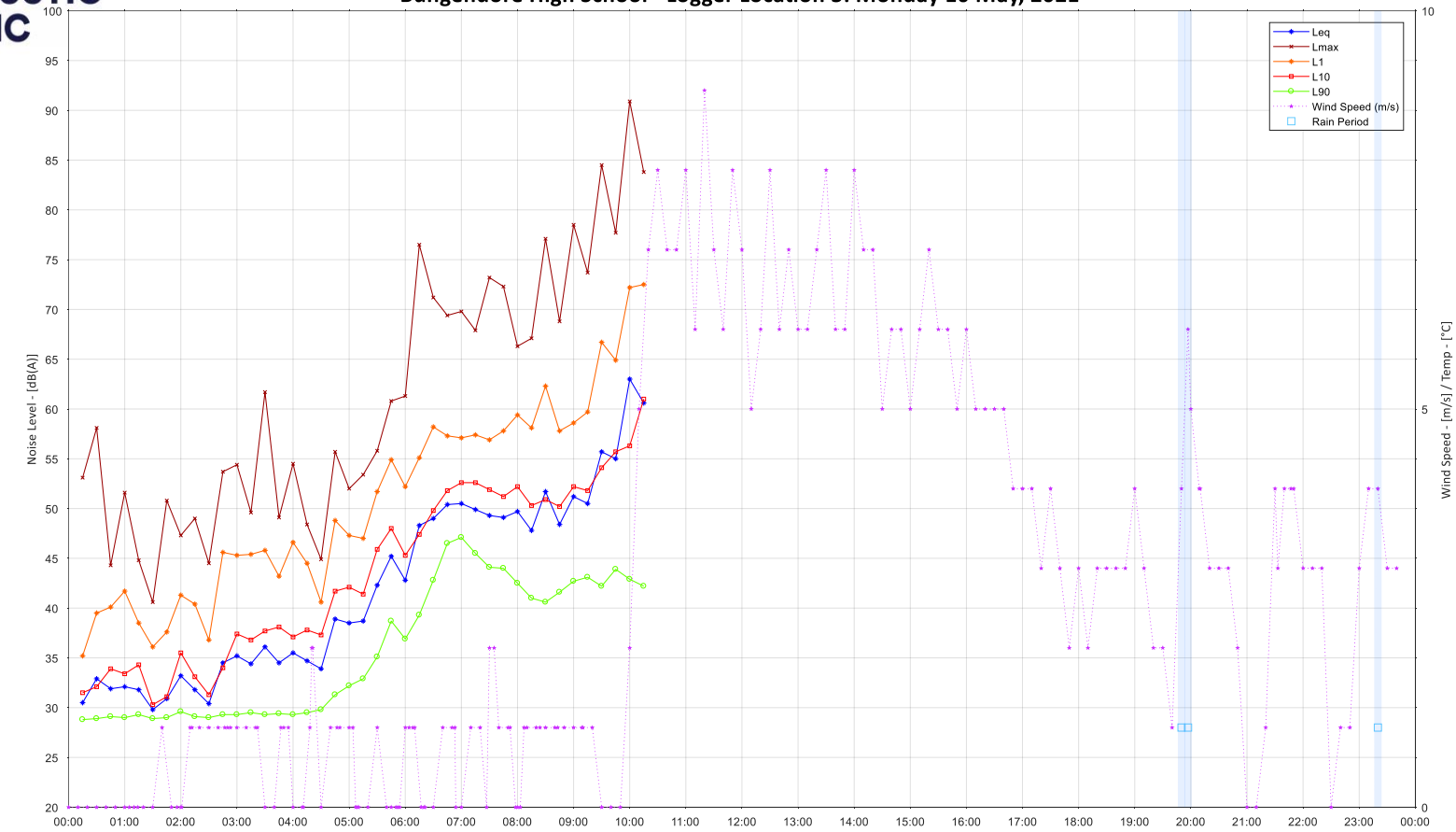


- Rain Period

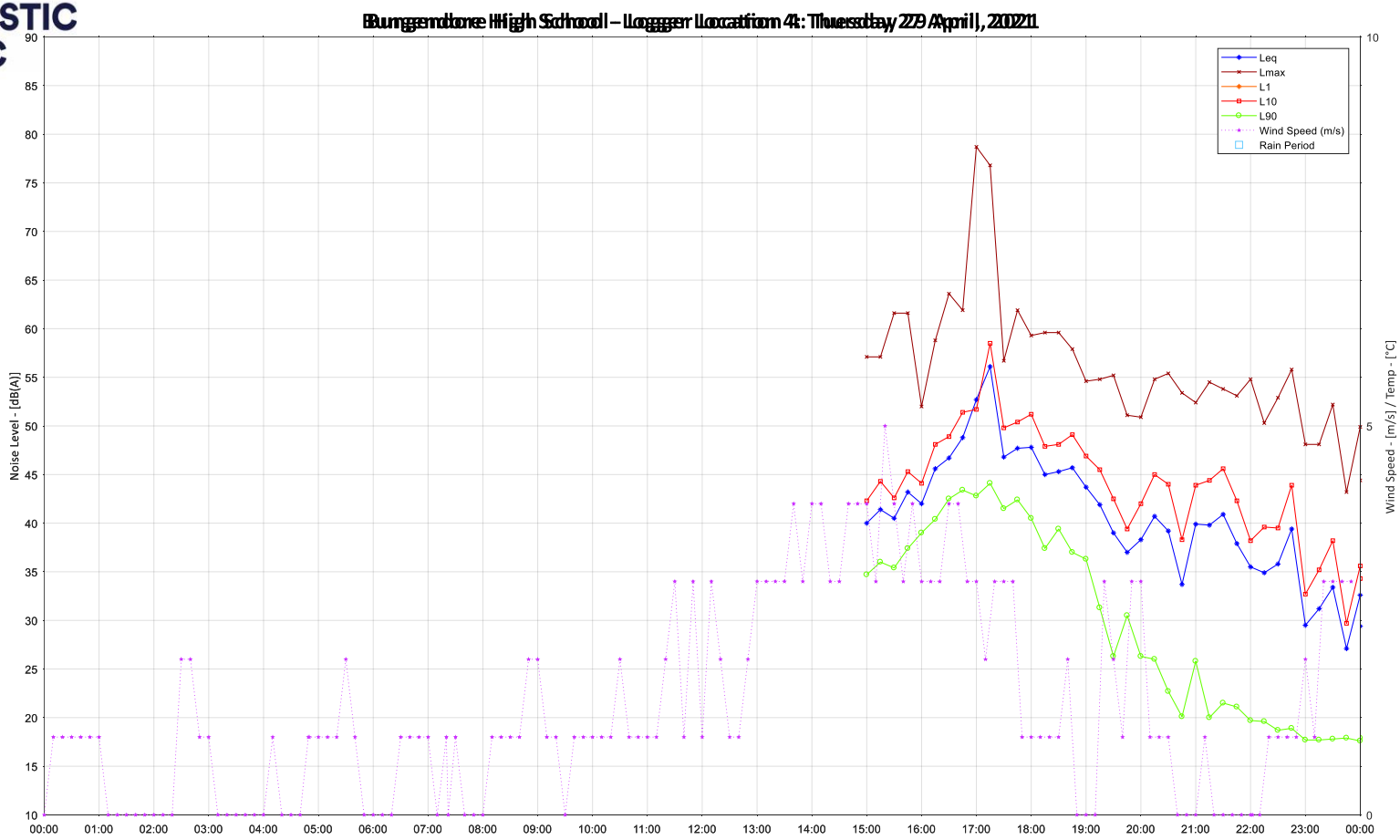
ACOUSTIC LOGIC

Bungendore High School - Logger Location 3: Monday 10 May, 2021



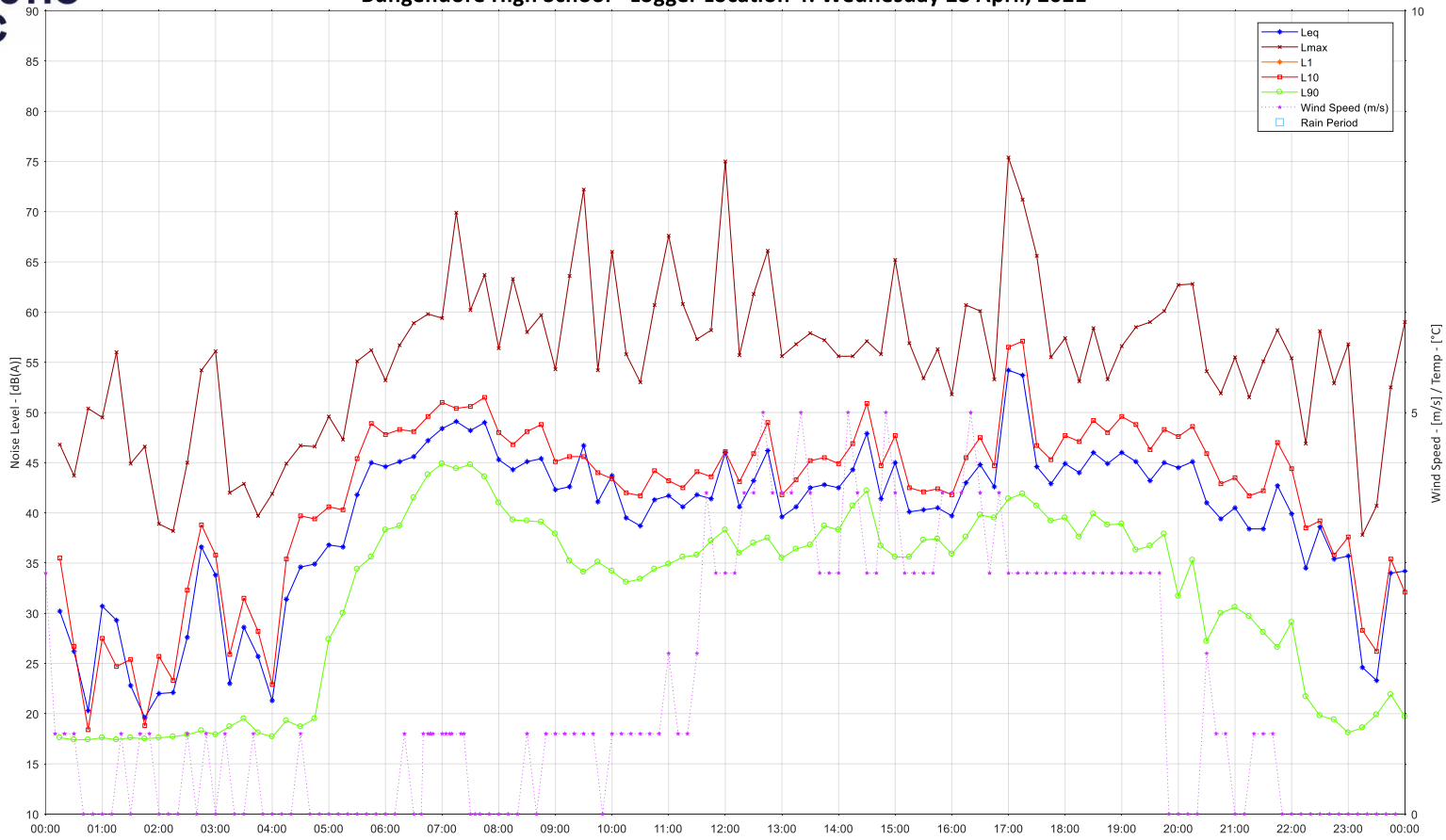
- Rain Period

ACOUSTIC LOGIC



ACOUSTIC LOGIC

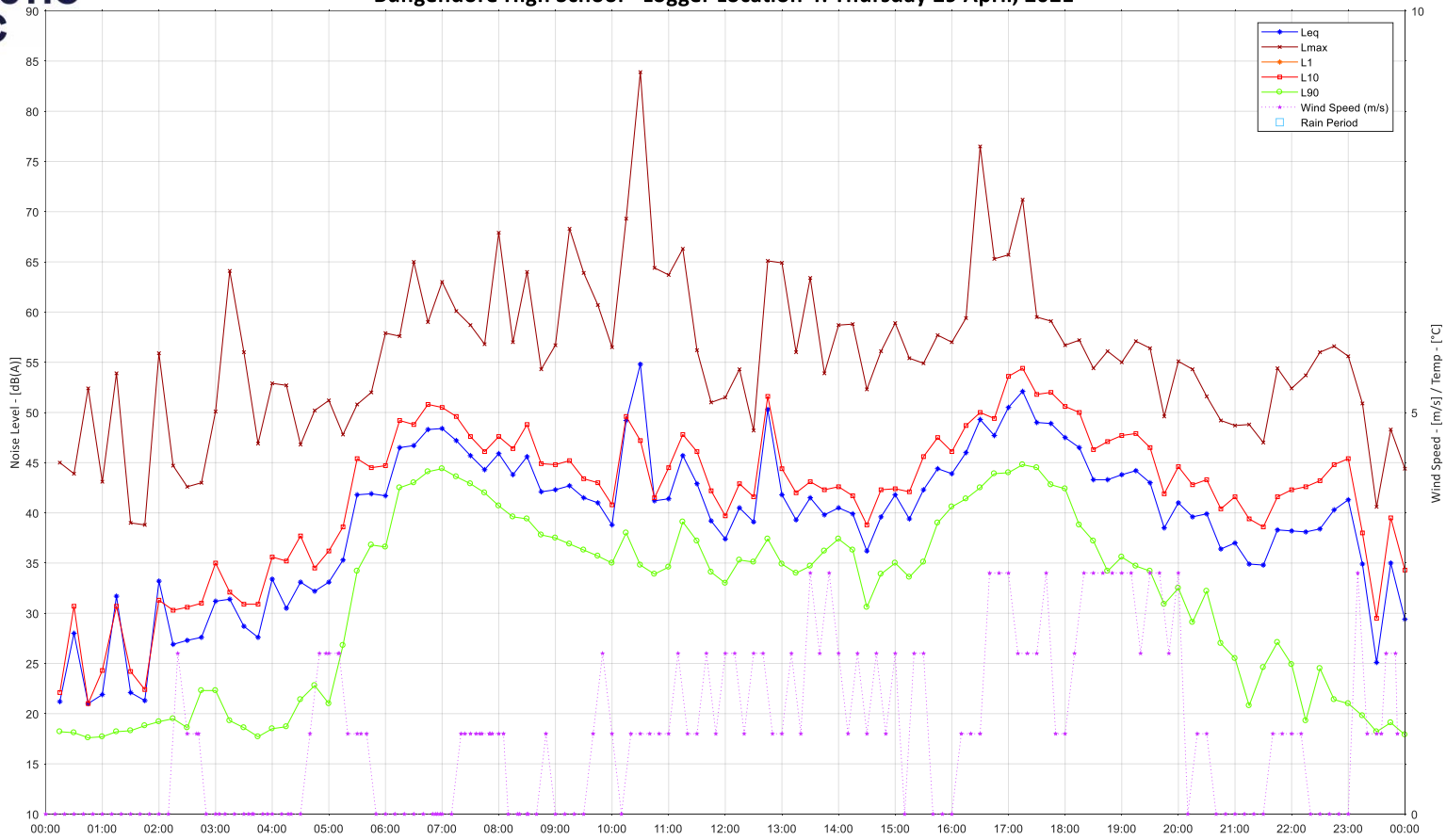
Bungendore High School - Logger Location 4: Wednesday 28 April, 2021



- Rain Period

ACOUSTIC LOGIC

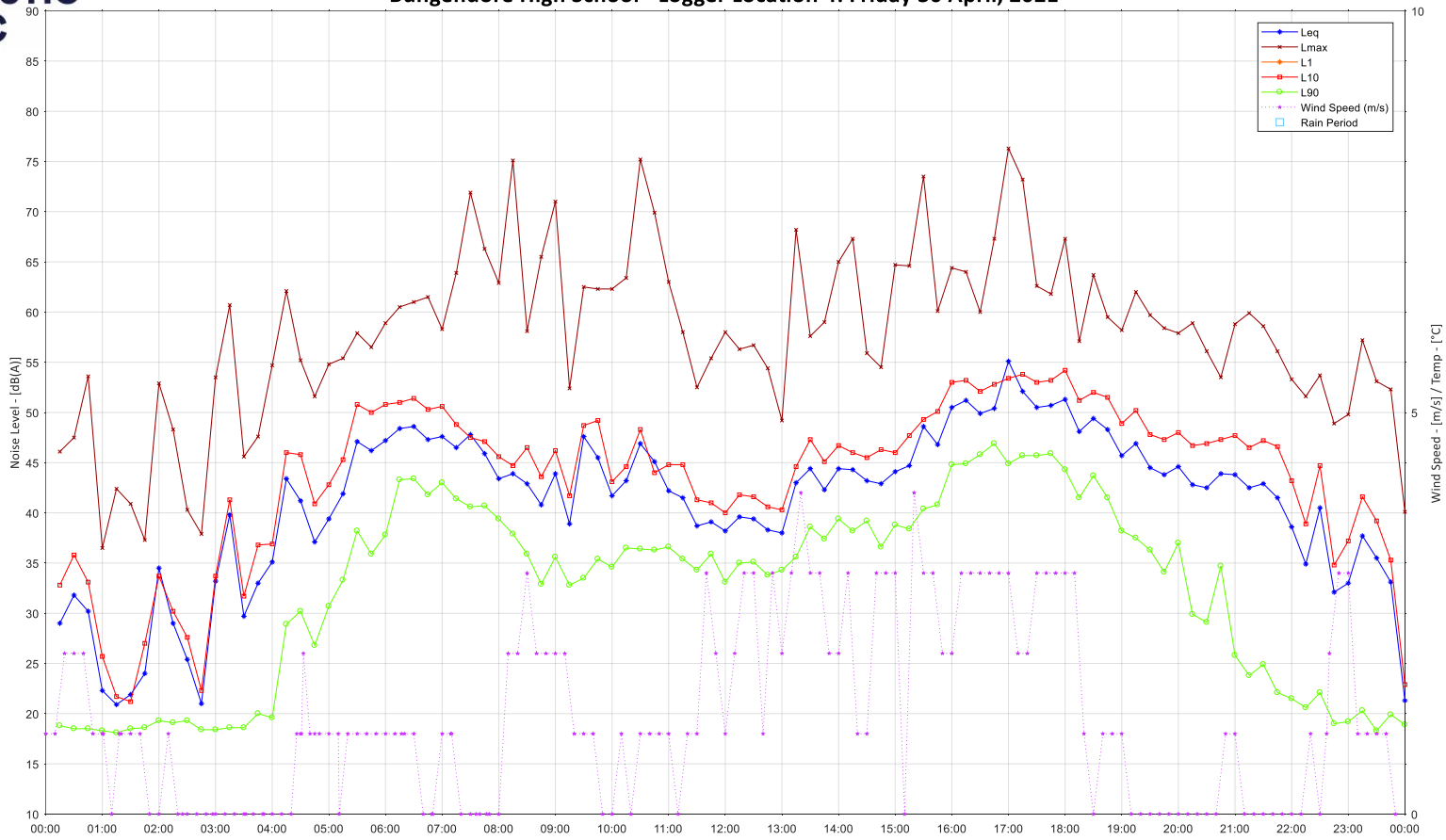
Bungendore High School - Logger Location 4: Thursday 29 April, 2021



- Rain Period

ACOUSTIC LOGIC

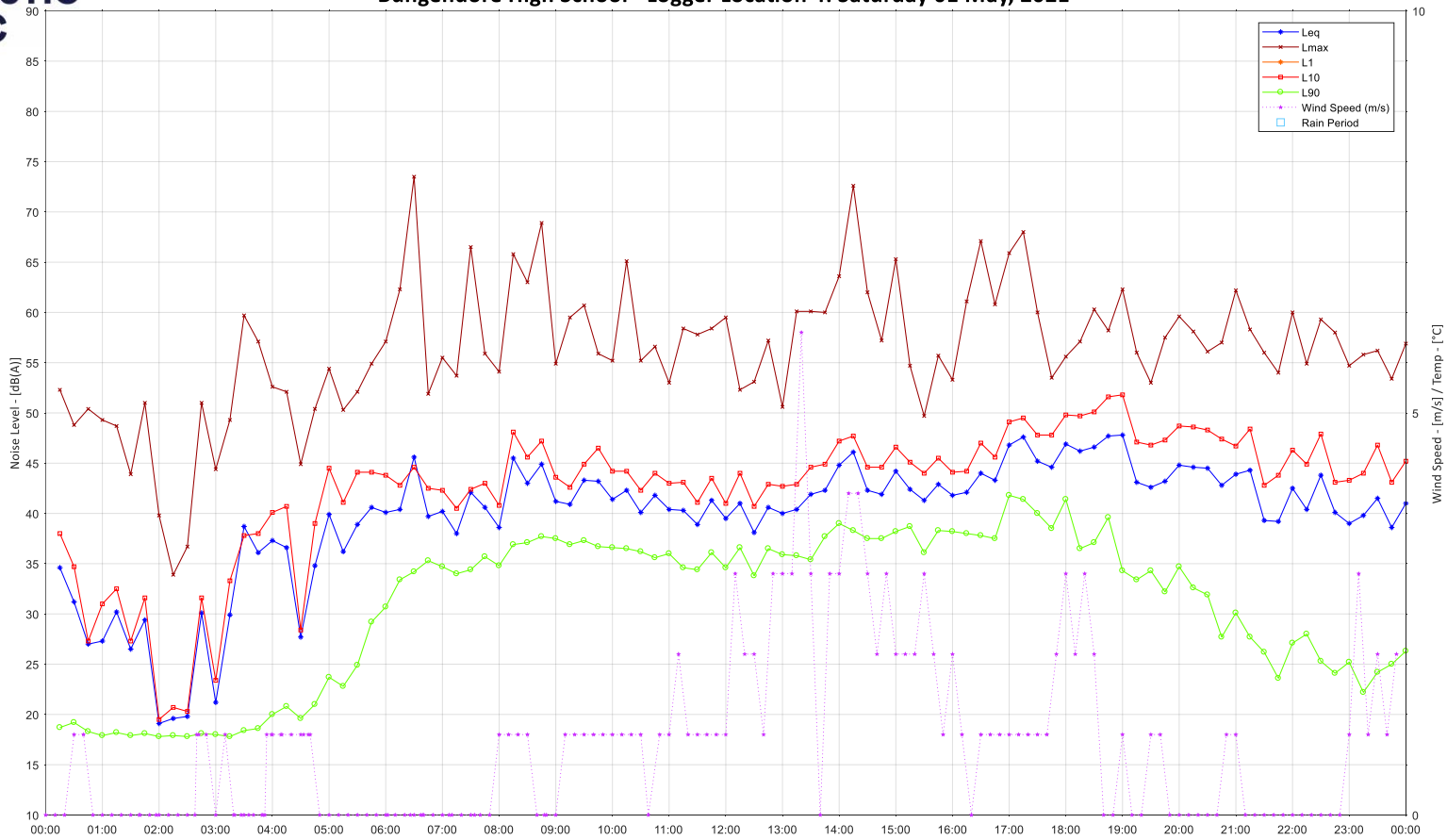
Bungendore High School - Logger Location 4: Friday 30 April, 2021



- Rain Period

ACOUSTIC LOGIC

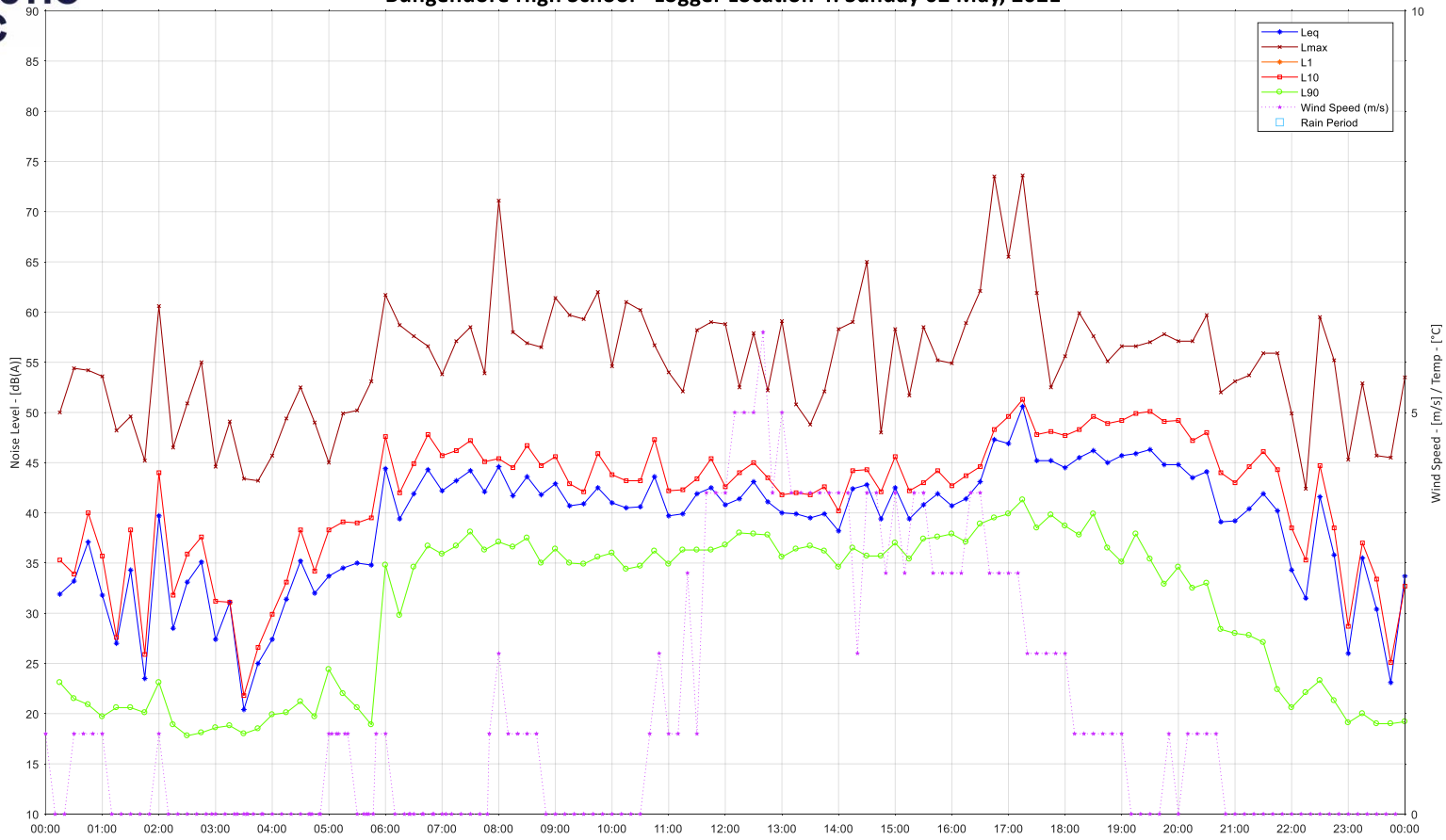
Bungendore High School - Logger Location 4: Saturday 01 May, 2021



- Rain Period

ACOUSTIC LOGIC

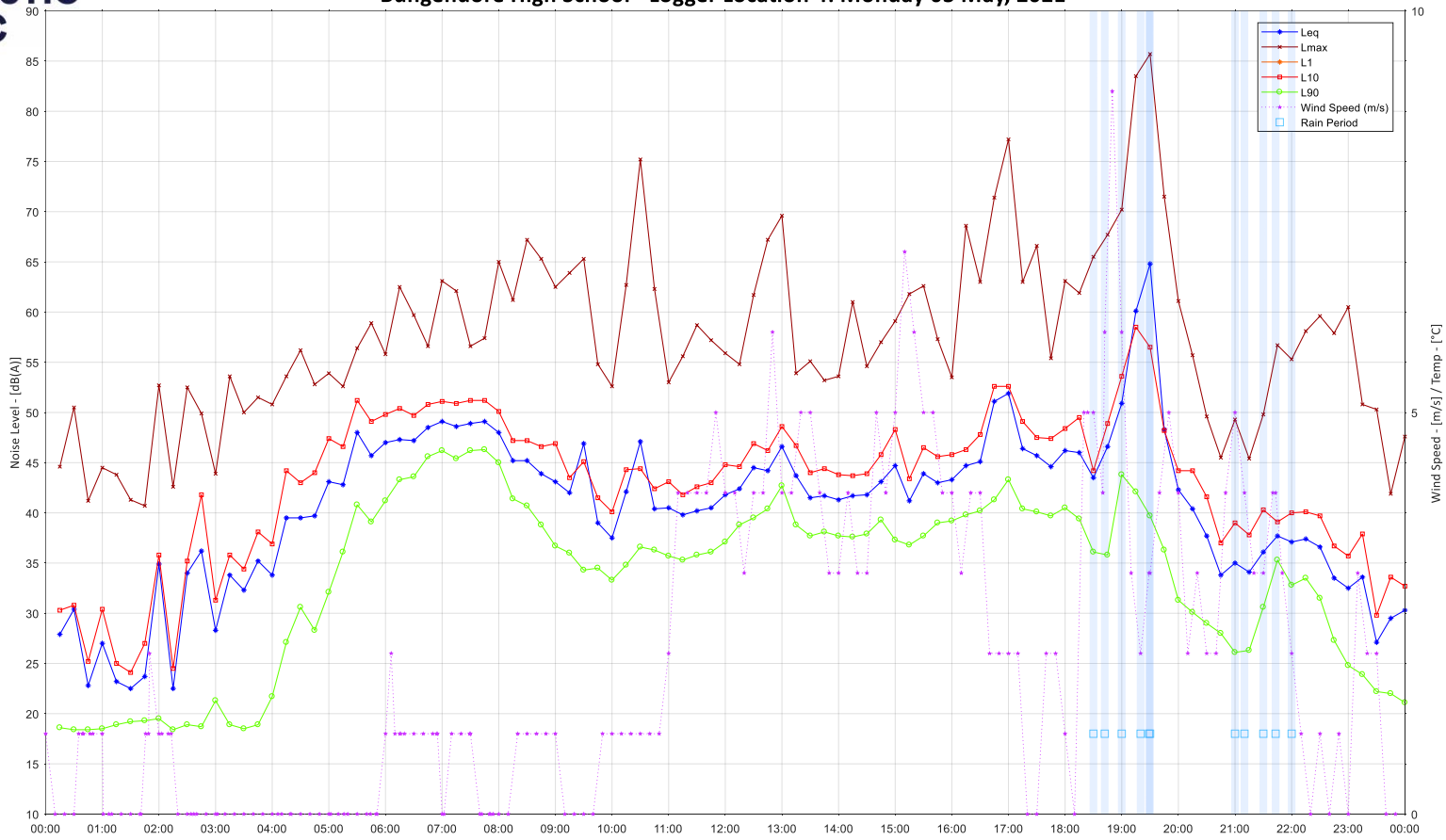
Bungendore High School - Logger Location 4: Sunday 02 May, 2021



- Rain Period

ACOUSTIC LOGIC

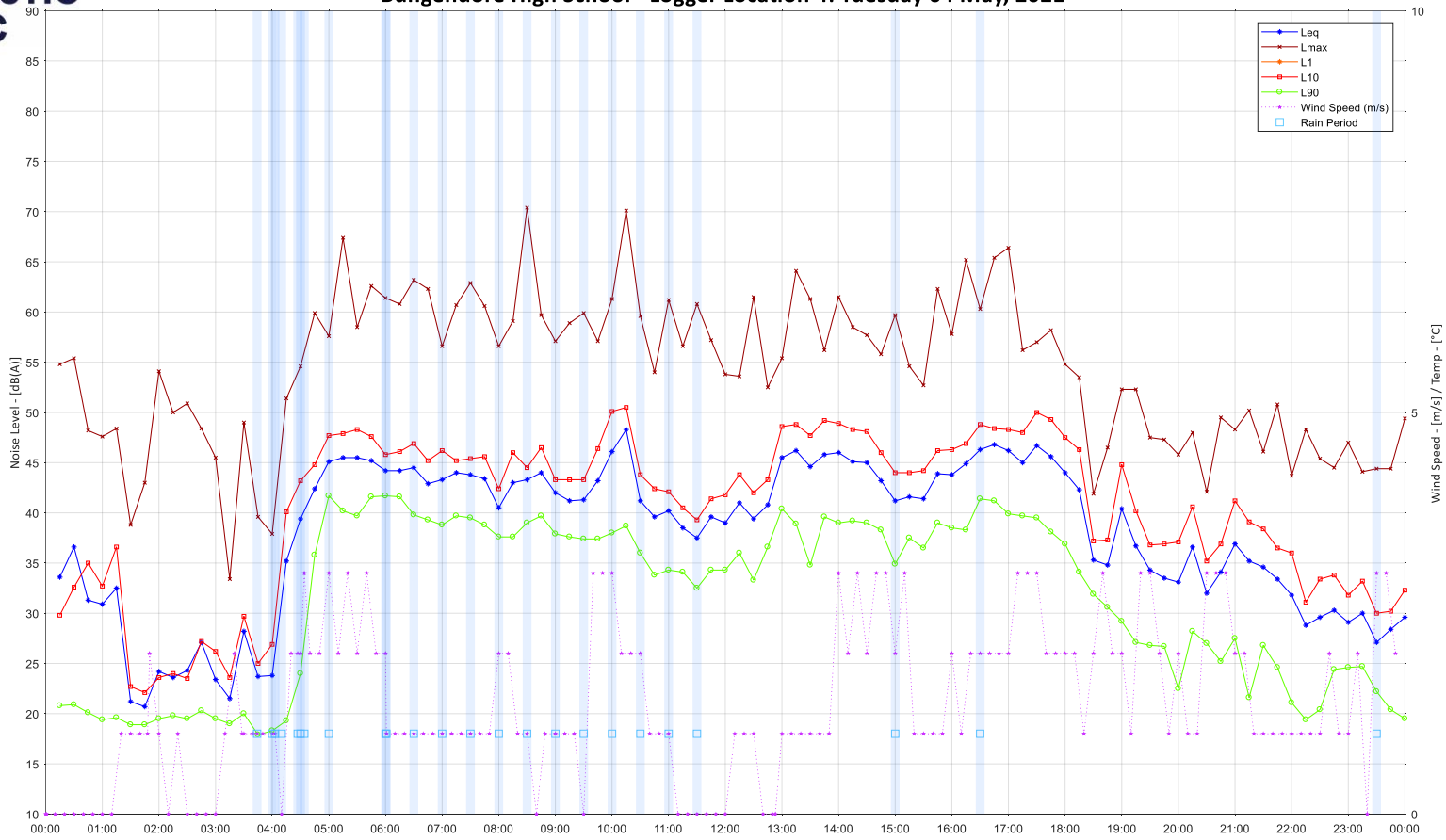
Bungendore High School - Logger Location 4: Monday 03 May, 2021



- Rain Period

ACOUSTIC LOGIC

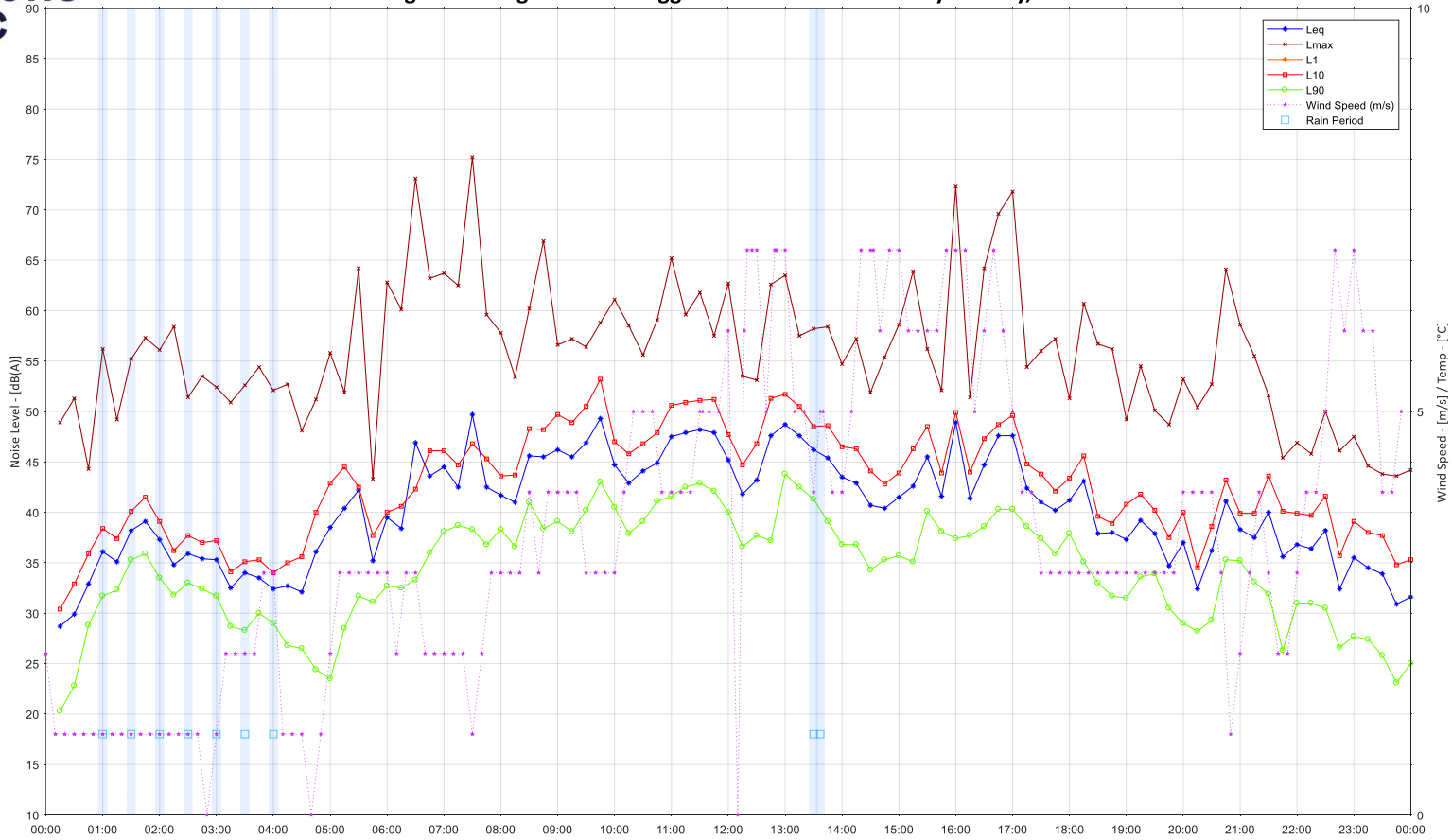
Bungendore High School - Logger Location 4: Tuesday 04 May, 2021



- Rain Period

ACOUSTIC LOGIC

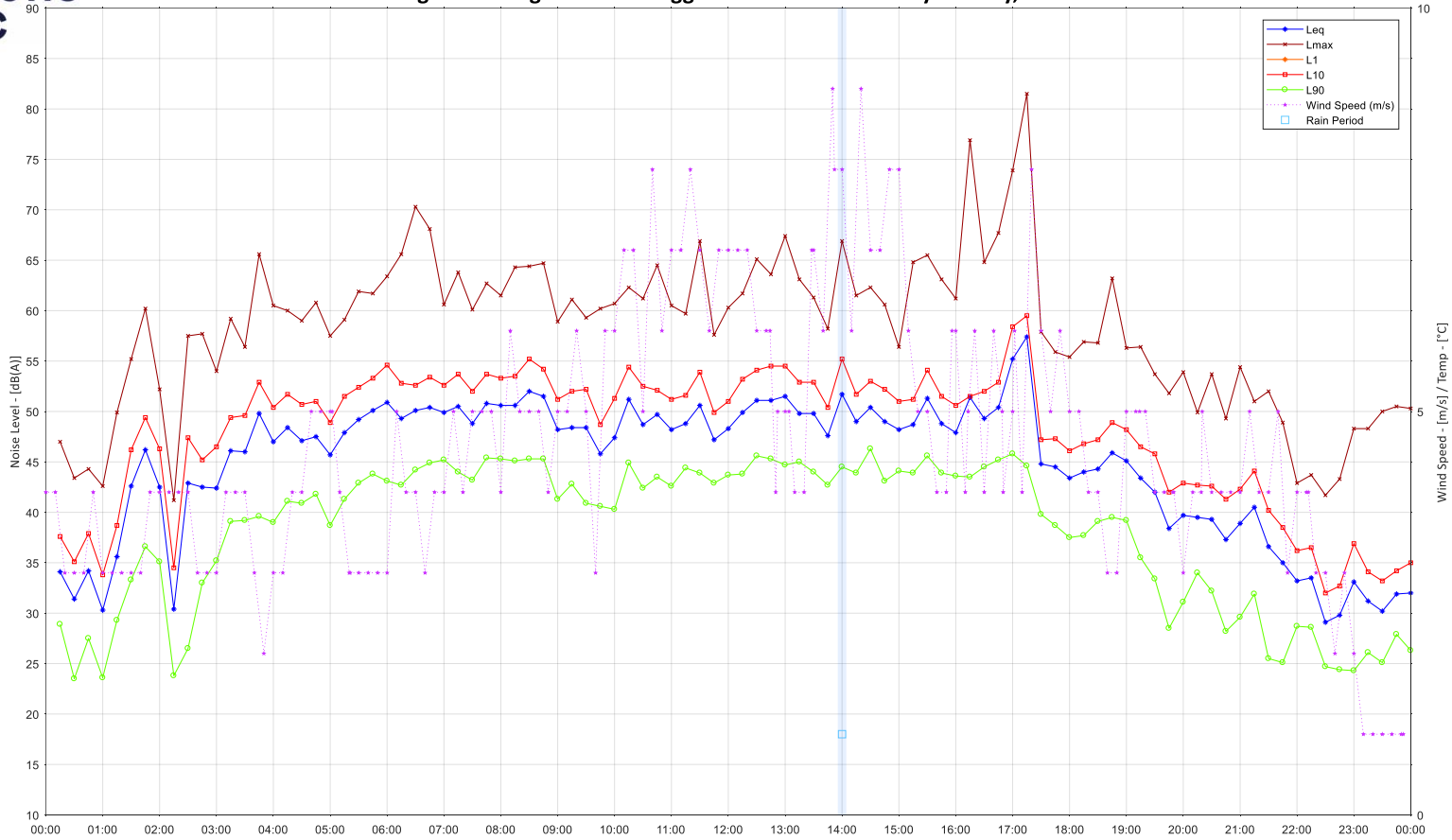
Bungendore High School - Logger Location 4: Wednesday 05 May, 2021



- Rain Period

ACOUSTIC LOGIC

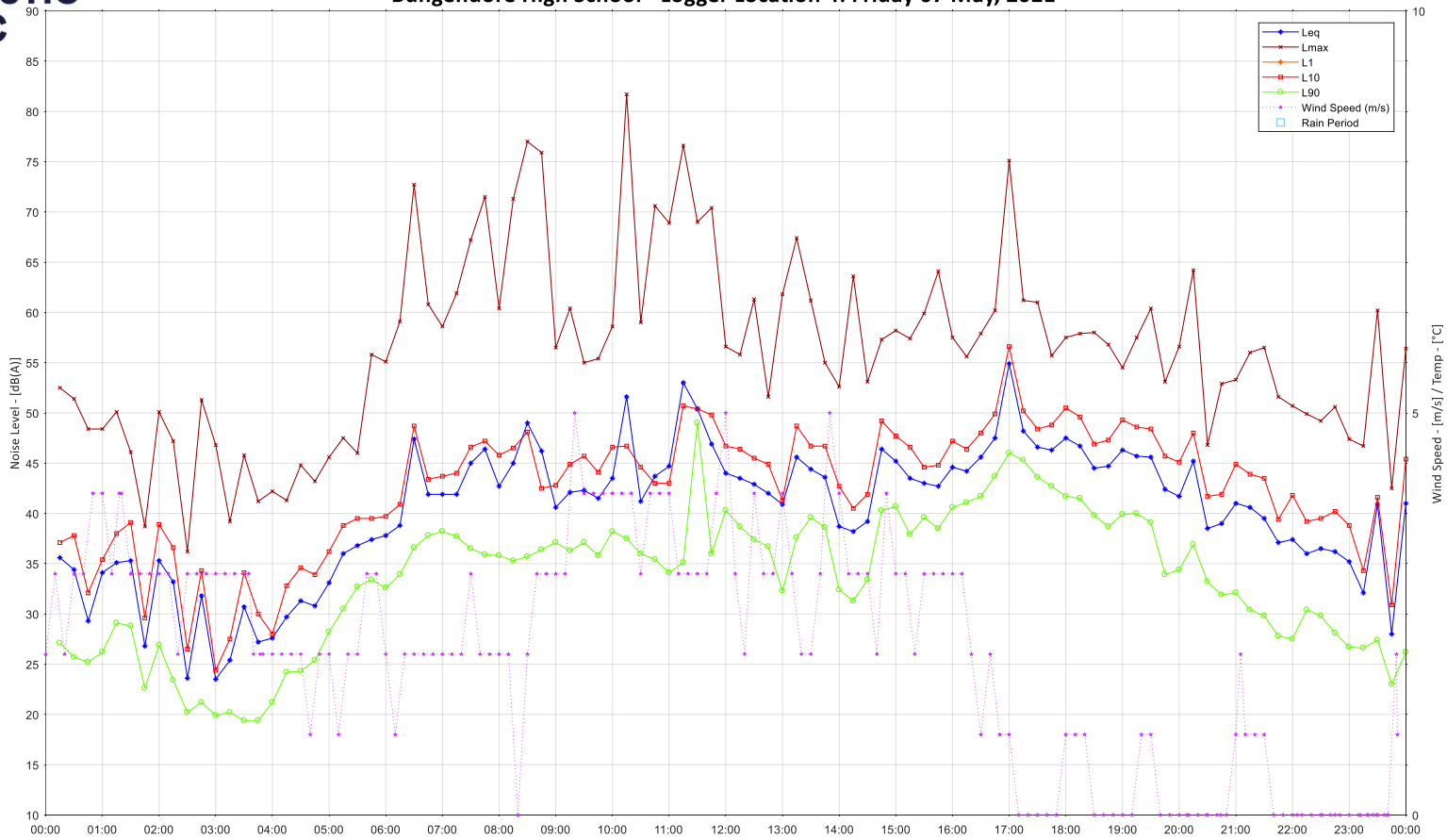
Bungendore High School - Logger Location 4: Thursday 06 May, 2021



- Rain Period

ACOUSTIC LOGIC

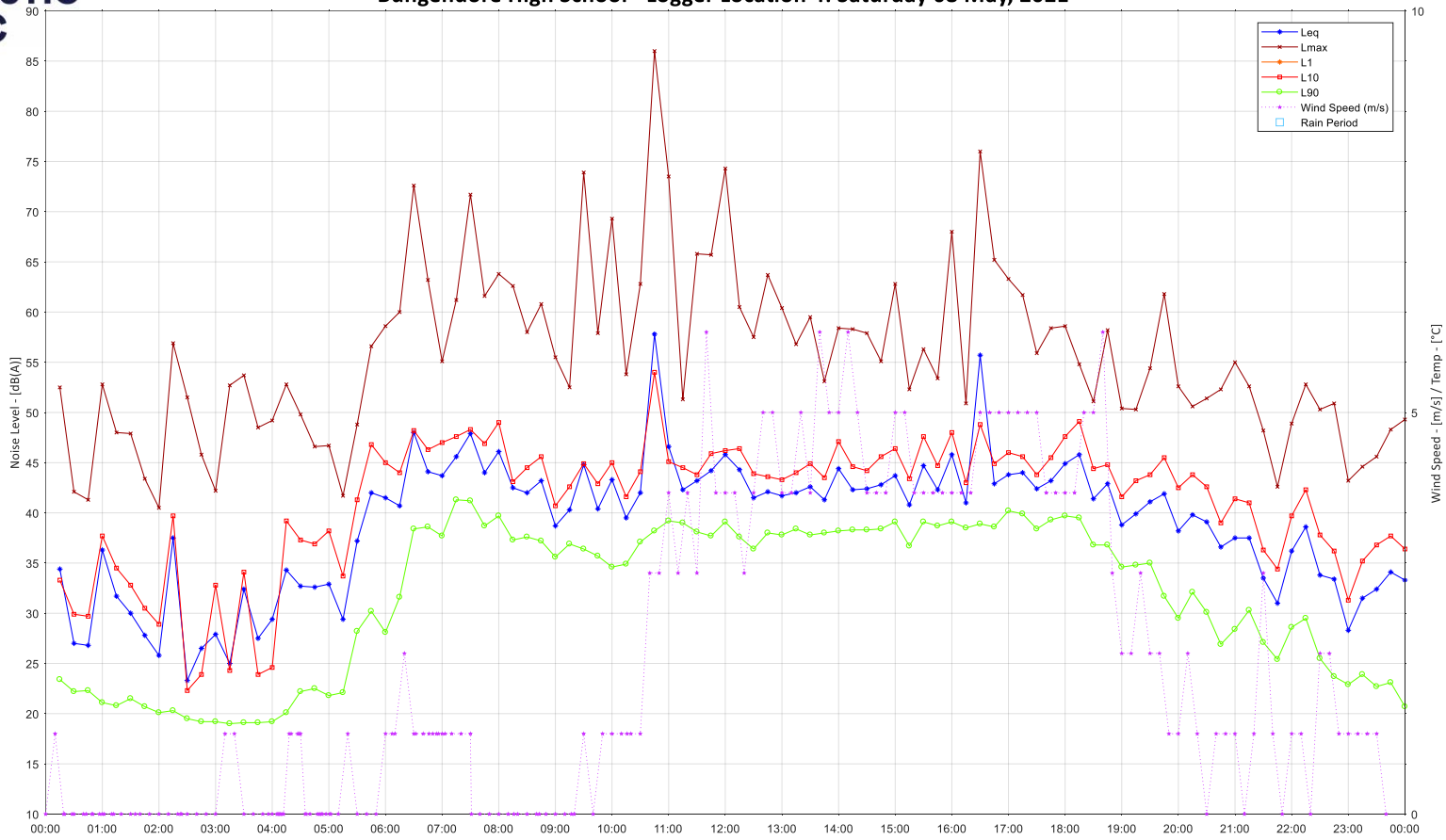
Bungendore High School - Logger Location 4: Friday 07 May, 2021



- Rain Period

ACOUSTIC LOGIC

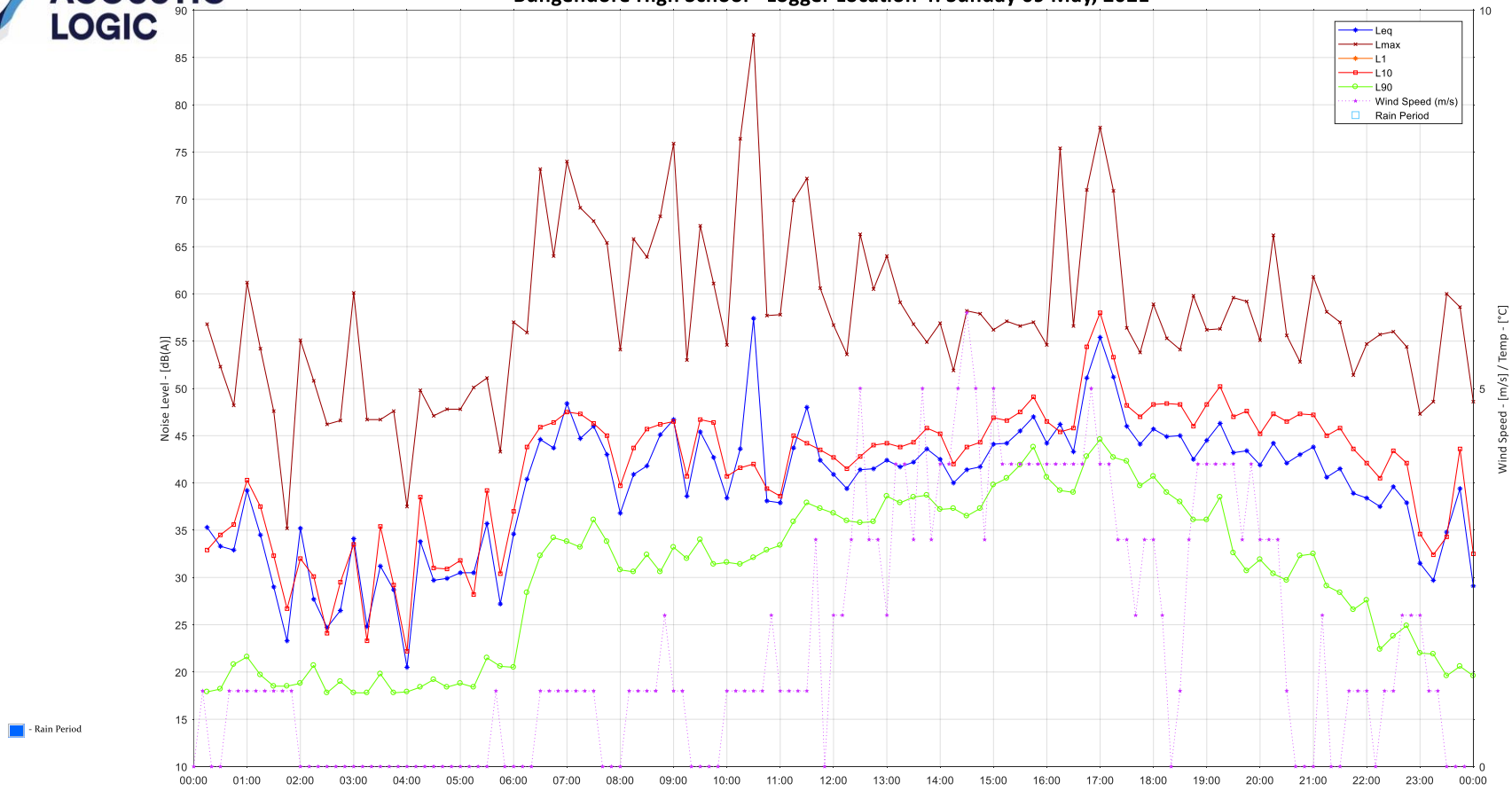
Bungendore High School - Logger Location 4: Saturday 08 May, 2021



- Rain Period

ACOUSTIC LOGIC

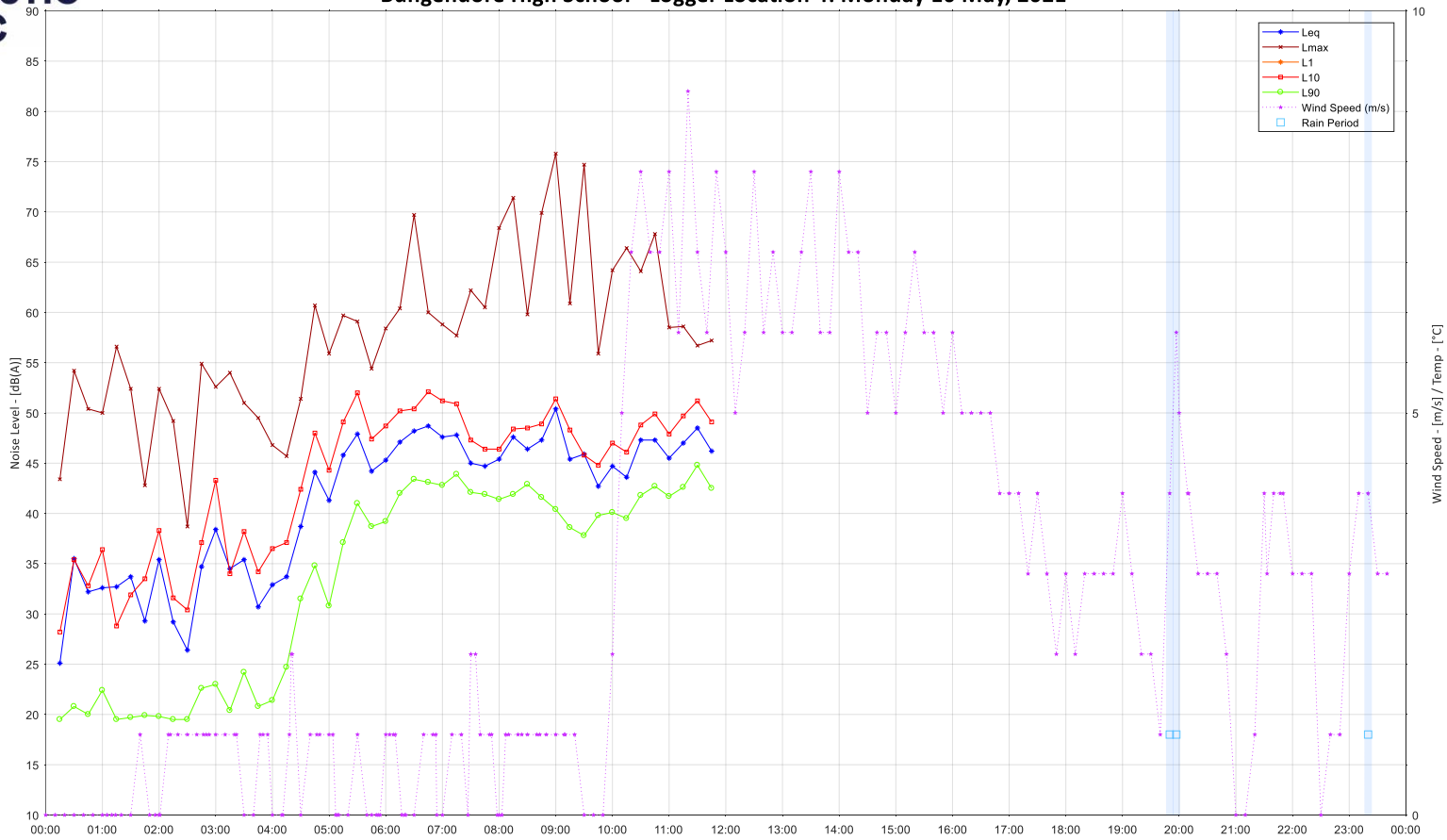
Bungendore High School - Logger Location 4: Sunday 09 May, 2021



- Rain Period

ACOUSTIC LOGIC

Bungendore High School - Logger Location 4: Monday 10 May, 2021



- Rain Period