Lismore South Public School – Flood Recovery Build

Noise & Vibration Assessment Report

NSW Department of Education
105 Phillip Street
Parramatta NSW 2150

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1 INTRODUCTION

1.1 Proponent

The Department of Education (DoE) is the landowner, proponent and determining authority pursuant to Section 5.1 of the Environmental Planning and Assessment Act 1979 (the Act).

1.2 Introduction

This noise and vibration assessment report has been prepared to support a Review of Environmental Factors (REF) for the rebuild of Lismore South Public School (the activity). The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

The activity will be carried out at Lismore South Public School (LSPS) located 69-79 Kyogle Street, South Lismore (the site).

The purpose of this report is to assess the likely noise and vibration impacts from the proposal and recommend appropriate noise and vibration mitigation measures to achieve the sites legislative requirements. This assessment addresses the impacts from typical operational activities. The report also discusses preliminary measures aimed at minimising any possible acoustic impact from construction activities.

A list of acoustic terminology used in this report is included in Appendix A of this report.

1.3 Site Description

The site, located at 69-79 Kyogle Street, South Lismore, consists of two separate land parcels situated on either side of Wilson Street. The proposed activity will be undertaken on the eastern parcel, where most of the school's existing structures are located. The western parcel contains sports fields and temporary learning facilities. Figure 1 illustrates the school's boundary, covering approximately 2.5 hectares. Due to flood damage, the existing buildings on the eastern parcel are currently unused, and students are temporarily using facilities on the sports field and oval which is located on the western side of Wilson Street adjacent to the primary school.

1.4 Proposed Activity Description

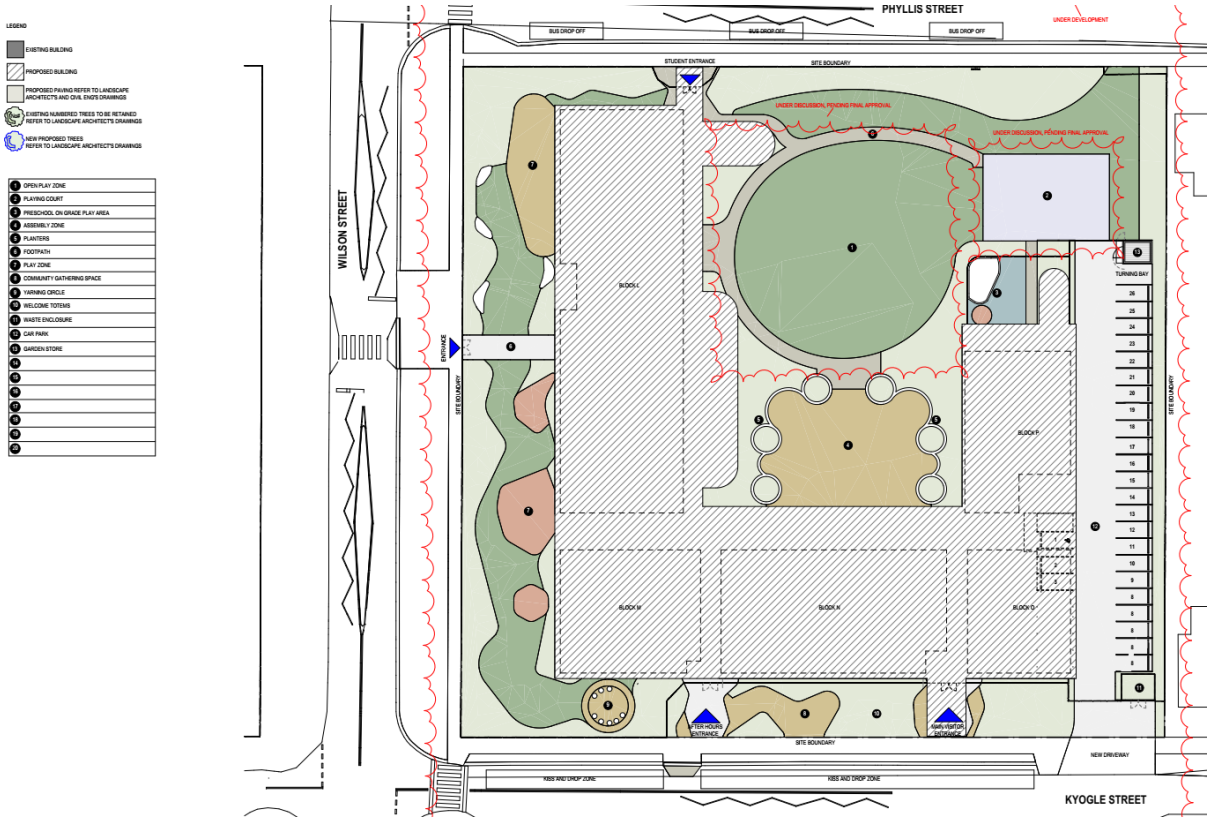
The proposed activity comprises the rebuild of the LSPS on the eastern parcel of the existing site, in South Lismore, and will be delivered in a single stage. The western parcel is out of the scope of the activity. Any works required on the western parcel (such as removal of demountable classrooms) will be subject to separate approval (if required).

A detailed description of the proposal is as follows:

- Retention of the existing play equipment, Building K and covered outdoor learning area (COLA) on the western parcel.
- Bulk earthworks, comprising fill and excavation and other site preparation works on the eastern parcel.
- Construction of a new building on the eastern parcel for LSPS including:
    - A one storey building (with undercroft areas below) fronting Kyogle Street containing a general learning space (GLS) hub, hall, library, support hub, administration, and pre-school.
    - Undercroft outdoor learning areas as well as amenities and storage located on ground level.

Figure 1 Aerial map of site (source: Nearmap)

Figure 2 Proposed site plan (source: Pedavoli Architects)



- Landscaping and public domain works, including tree planting, a games court in the northeast corner and an outdoor playing area adjacent to the preschool.
- A car park on the eastern side of the site, with access from Kyogle Street.
- Waste collection area access from Kyogle Street.
- Multiple entrance points, including:
    - Primary and secondary entries distributed on site frontages.
    - Vehicular access point to provide access to waste collection/delivery areas and car parking.
- Ancillary public domain mitigation measures.
- Primary school has a capacity of 230 students, with 28 staff. Pre-school has a capacity of 20 students, with 2 staff.

Figure 2 illustrates the scope of works.

1.5 Operational Times

1.5.1 Pre-School

The site would operate Monday to Friday. Presented below is the proposed operational hours for the pre-school and early education centre are the following.

- Welcome, arrival, check-in: 9:00am – 9:15am
- Educational workshop (typically indoors): 9:15am – 9:30am
- Morning break: 9:30am – 9:40am
- Outdoor play session: 9:40am – 11:15am
- Lunch time: 11:15am – 12:00pm
- Sleep, rest, quiet time: 12:00pm – 12:20pm
- Educational workshop (typically indoors): 12:20pm – 12:40pm
- Indoor play session: 12:40pm – 1:45pm
- Afternoon tea: 1:45pm – 2:00pm
- Outdoor play session: 2:00pm – 3:00pm

1.5.2 Primary School

For the outside of school hours care (OSHC), operational times are the following (Monday to Friday):

- Before school care: 6:30am till 9:00am
- After school care: 3:15pm till 6:00pm
- Vacation care: 8:00am till 6:00pm

School hours are 9:00am till 3:00pm, Monday to Friday; with the following bell times (2 minutes duration): 8:58am, 11:43am, 1:58pm and 3:00pm. Recess time is allocated at 11:43am.

School gates open between 8:00am and 9:30am for arrivals; and between 2:30pm and 4:00pm for departures.

1.6 Site Layout

The LSPS campus is located between Phyllis Street and Kyogle Street; with Wilson Street splitting the campus between an eastern and western part. The eastern part of the campus contains all new elevated educational buildings; with the western part of the campus consisting of outdoor playgrounds and the existing COLA building.

The nearest impacted receivers external to the site, illustrated in Figure 3 have been identified as:

- Residential buildings located along eastern and western property boundaries.
- Residential buildings also located along Phyllis Street, facing the northern property boundary (at approximately 20m from the property boundary in the eastern part of the campus and 6m from the property boundary in the western part).
- Industrial premises located south from the school campus (at approximately 60m from the property boundary).

A disused rail corridor is located south from the school campus; this runs parallel to Kyogle Street between the campus and the industrial premises.

Figure 3 Site layout

2 EXISTING ACOUSTIC ENVIRONMENT

2.1 Unattended Noise Monitoring

To determine the existing ambient noise levels on site and establish the operational noise level criteria for external noise emissions (refer to Section 3.1), unattended noise measurements were conducted between Friday 23 August and Sunday 8 September 2024.

The measurements were undertaken at the following locations within the eastern zone of the school campus (refer to Figure 3):

- Logger location 1: This is representative of residences located along Phyllis Street, and those positioned along the eastern site boundary. Instrumentation used: Svan 971 noise logger (serial number 74365).

  This logger location was selected to obtain measurements of existing ambient noise levels which are representative of residences along Phyllis Street.

- Logger location 2: This is representative of residences located along Kyogle Street. Instrumentation used: Rion NL-42 noise logger (serial number: 1000233).

  This logger location was selected for following reasons:

  - To obtain measurements of existing ambient noise levels which are representative of residences along Phyllis Street

  - To obtain façade incident noise levels which are likely to impact the building envelope construction.

Calibration of all noise loggers was checked prior to and following measurements using a Bruel & Kjaer Type 4230 sound calibrator (serial number 1275644). The calibrator emitted a calibration tone of 94 dB at 1 KHz. The drift in calibration did not exceed ±0.5 dB. All equipment carries appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in Appendix B. The charts present each 24 hour period and show the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods. This data has been filtered to remove periods affected by adverse weather conditions, based on weather information obtained from Lismore Airport AWS weather station (ID 058214).

Unattended noise measurements were undertaken in accordance with survey procedures discussed in the NSW Noise Policy for Industry (NSW NPI). Attended noise measurements were conducted for 15-minute periods at logger locations, during start of unattended noise survey. Measured noise levels from attended measurements were found to concur with those simultaneously obtained as part of unattended noise survey.

2.2 Noise Descriptors & Terminology

Environmental noise constantly varies in level with time. Therefore, it is necessary to measure environmental noise in terms of quantifiable time periods and statistical descriptors. Typically, environmental noise is measured over 15 minutes periods and relevant statistical descriptors of the fluctuating noise are determined to quantify the measured level.

Noise (or sound) consists of minute fluctuations in atmospheric pressure capable of detection by human hearing. Noise levels are expressed in terms of decibels, abbreviated as dB or dBA, the "A" indicating that the noise levels have been frequency weighted to approximate the characteristics of normal human hearing. Because noise is measured using a logarithmic scale, 'normal' arithmetic does not apply, e.g. adding two sound sources of equal values result in an increase of 3dB (i.e. 60 dBA plus 60 dBA results in 63 dBA). A change of 1 dB or 2 dB in the sound level is difficult for most people to detect, whilst a 3 dB – 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change roughly corresponds to a doubling or halving in loudness.

The most relevant environmental noise descriptors are the L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels. The L_{Aeq} noise level represents the "equivalent energy average noise level". This parameter is derived by integrating the noise level measured over the measurement period. It represents the level that the fluctuating noise with the same acoustic energy would be if it were constant over the measured time period.

The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period. These levels can be considered as the maximum noise level, the average repeatable maximum and average repeatable minimum noise levels, respectively.

Specific acoustic terminology is used in this assessment report. An explanation of common acoustic terms is included as Appendix A.

2.3 Noise Monitoring Results

The noise levels measured at logger locations have been used to assess the noise impact of the activity to the nearest noise affected receivers identified in Section 1.6. The time periods used are in accordance with those recommended in the NSW Noise Policy for Industry (NSW NPI). The measurement results are presented in Table 1 below.

Table 1 Measured ambient noise levels in accordance with the NSW NPI

Measurement Location	Daytime 7:00 am to 6:00 pm		Evening 6:00 pm to 10:00 pm		Night-time 10:00 pm to 7:00 am	
	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Logger Location 1: Facing Phyllis Street	39 dBA	54 dBA	35 dBA	49 dBA	24 dBA	44 dBA
Logger Location 2: Corner of Kyogle Street & Wilson Street	42 dBA	59 dBA	35 dBA	52 dBA	26 dBA	52 dBA

Notes:

1. *For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am*
2. *The L_{A90} noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level*
3. *The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

Furthermore, to determine the façade incident noise levels impacting the proposed activity, the measured noise levels at Logger Location 2 have been processed into the time periods discussed in the NSW Road Noise Policy (NSW RNP). The results are presented in Table 2 below.

Table 2 Measured noise levels for assessment of noise intrusion

Logger	Period	Measured Noise Levels (dBA)	
		Daytime/Night-time Periods	Max. 1 Hour Levels
Logger Location 2: Corner of Kyogle Street & Wilson Street	**Daytime: 7:00 am – 10:00 pm**	58 L_{Aeq} (15 hrs)	61 L_{Aeq} (1 hr)
	Night time: 10:00pm – 7:00 am	52 L_{Aeq} (9 hrs)	56 L_{Aeq} (1 hr)

3 OPERATIONAL ACOUSTIC CRITERIA

3.1 NSW Noise Policy for Industry

In NSW, the control of noise emissions is the responsibility of Local Governments and the NSW Environment Protection Authority (NSW EPA).

Consequently, the NSW EPA has prepared a document titled Noise Policy for Industry (NSW NPI) which provides a framework and process for determining external noise criteria and subsequent assessments. The NSW NPI criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other noise sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

3.1.1 Intrusive Noise Impacts (Residential Receivers)

The NSW NPI states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minutes period, does not exceed the background noise level measured in the absence of the source by more than 5 dBA. This forms the basis of the intrusiveness noise trigger level.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the NSW NPI. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.1.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.2 of the NSW NPI. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'background creep' and forms the basis of the amenity noise trigger level.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the NSW NPI sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

3.1.3 Area Classification

Table 2.3 of the NSW NPI defines "suburban" areas as summarised in Table 3 below. By comparing the measured L_{A90} noise levels listed in Table 1, and the defined RBL values in Table 3; we note the following:

- According to the NSW Planning Portal Spatial Viewer, residences along Phyllis Street and Kyogle Street are situated within a R2 zone. Based on Table 3, this zoning category are typically designated for "suburban" residences.
- The measured background noise levels for residences along Phyllis Street and Kyogle Street generally correspond to those defined for suburban areas. Therefore, these are categorised as "suburban" residences.
- Although the measured background noise levels closer approximate those corresponding to rural residences, the measured noise levels are more adequately described as per Table 3 (especially regarding the absence of natural sounds and road traffic noise levels).

Table 3 Definition for residential receiver categories

Receiver Category	Typical Planning Zoning – Standard Instrument	Typical Existing Background Noise Levels	Description
Suburban	RU5 – village RU6 – transition R2 – low density residential R3 - medium density residential E2 – environmental conservation E3 – environmental management	Daytime RBL< 45 dBA Evening RBL < 40 dBA Night RBL < 35 dBA	An area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the natural environment and human activity

Based on the information discussed above, the recommended amenity criteria are shown in Table 4 below.

Table 4 NSW NPI – Recommended L_{Aeq} noise levels from industrial noise sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level ($L_{Aeq, period}$)[2]
Residences Residences along Phyllis Street & Kyogle Street	Suburban	Day	55
		Evening	45
		Night	40
Industrial premises: Along Wilson Street and Bannister Street	All	When in use	70

Notes

1. *For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am*
2. *The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

3.1.4 Project Trigger Noise Levels

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in Table 5. These criteria are nominated for the purpose of determining the operational noise limits for mechanical plant that can potentially affect noise sensitive receivers.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 5.

Table 5 External noise level criteria in accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)	Amenity $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA) [4]
Residences along Phyllis Street	Day	50	39	54	**44**	53
	Evening	40	35	49	**40**	43
	Night	35	30 [5]	44	**35** [5]	38
Residences along Kyogle Street	Day	50	42	59	**47**	53
	Evening	40	35	52	**40**	45
	Night	35	30 [5]	52	**35** [5]	45
Industrial premises along Wilson Street and Bannister Street	When in use	65	-	59	-	**68**

Note 1: Project Amenity Noise Levels corresponding to "suburban" areas, equivalent to the Recommended Amenity Noise Levels (Table 4) minus 5 dBA

Note 2: L_{A90} Background Noise or Rating Background Level

Note 3: Project Noise Trigger Levels are shown in bold

Note 4: This is based on the assumption that the existing noise levels are unlikely to decrease in the future

Note 5: Measured RBLs are below the minimum assumed RBL as per Table 2.1 of the NSW NPI. Therefore, minimum assumed RBL and minimum project intrusiveness noise level are used in the acoustic assessment.

3.1.5 Sleep Disturbance

In accordance with the NSW NPI, sleep disturbance is to be assessed in two stages addressing the likelihood of sleep disturbance and sleep awakening.

For the criterion addressing the likelihood of sleep disturbance, the NSW NPI recommends that the maximum noise level event should not exceed the following:

- 40 dB $L_{Aeq, 15\ minutes}$ or the prevailing RBL plus 5 dB, whichever is the greater; and / or
- 52 dB L_{AFmax} or the prevailing RBL plus 15 dB, whichever is the greater

As a result, 52 dB L_{AFmax} and 40 dB $L_{Aeq, 15\ minutes}$ are adopted as the criteria for the likelihood of sleep disturbance at all residences.

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, an accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause an awakening from a sleep state.
- One or two noise events per night with maximum internal noise levels of 65–70 dBA are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50 - 55 dB L_{AFmax}. This criterion is applicable for noise emissions generated by short term events occurring during the night time period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60 - 65 dB L_{AFmax} external noise level at residential properties.

3.1.6 Emergency Plant / Infrequent Operational Activities

For emergency plant (such as stand-by generators) or activities which are conducted infrequently, such as waste collection; the NSW NPI allows for modifying factors that can be subtracted from the predicted noise levels. These modifying factors should be applied prior to assessing against the external noise level criteria. These duration modifying factors are summarised in Table 6 below.

Under the assumption that each waste collection event has a duration of between 15 minutes to 1 hour, and there is only one such event in a 24 hour period, then a modifying factor of 5 dB can be applied to the predicted noise levels. Alternatively, the modifying factor can be added to the relevant criterion (as a leniency factor) prior to the assessment.

Table 6 Modifying factors for duration

Allowable Duration of Noise (one event in any 24 hour period)	Allowable Exceedance at Receiver for the Period of Noise Event	
	Daytime and Evening (7am – 10pm)	Night time (10pm – 7am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
Less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project trigger noise level (PNTL), that is, less than 15 minutes, the allowable adjusted project noise trigger level (APNTL) is derived as follows:

$$APNTL = 10\log((10^{\frac{PNTL}{10}}\ x\ (\frac{900 - duration}{900})) + (10^{\frac{PNTL+allowable\ exceedance\ in\ table\ above}{10}}\ x\ duration))$$

3.2 Outdoor Noise Emissions (Play Areas & Multi-Purpose Hall)

In NSW, there is no mandatory legislation which addresses external noise emission from communal halls, or outdoor gatherings (generally caused by student activities such as talking, playing, etc). However, the *"Guideline for Child Care Centre Acoustic Assessment"* (version 3.0, dated September 2020, referred herein as the GCCC), issued by the Association of Australasian Acoustical Consultants (AAAC) provides guidance on how to assess similar activities in a primary school. Furthermore, it is relevant to the outdoor play areas which are part of the pre-school.

For outdoor play areas that have the potential to impact on residential receivers the guideline states:

> *The noise impact from children at play in a childcare centre differs from the domestic situation in that it is a business carried out for commercial gain, the number of children can be far greater than in a domestic situation and the age range of the children at the centre does not significantly vary over time as it would in a domestic situation. However, the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times the children play outside. Night-time, weekend or public holiday activity is not typical and childcare centres have considerable social and community benefit.*
>
> ***Base Criteria** – With the development of childcare centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed $L_{eq,15min}$ 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).*
>
> ***Background Greater Than 40 dB(A)** – The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (i.e. background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*
>
> ***Up to 4 hours (total) per day** – If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*
>
> ***More than 4 hours (total) per day** – If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.*
>
> - *The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be: 1.5 m above ground level;*
> - *On a balcony at 1.5 m above floor level;*
> - *Outside a window on the ground or higher floors*

We are of the opinion that assessing noise from children at play based on the NSW NPI criteria is overly restrictive. This type of noise emissions is different in both character and duration to that of industrial, commercial or even machine noise emissions. For example, noise generated by students playing is intermittent in character, as noise from mechanical services is typically constant.

Therefore, the noise targets discussed in the GCCC are adopted for the assessment of noise emissions from children at play. As previously noted, these noise targets are particularly relevant for outdoor play areas which are part of the pre-school.

Based on noise measurement results discussed in Section 2; these noise targets are summarised in Table 7. These noise targets are used for the assessment of noise emissions by children at play in outdoor areas (including those which are part of the pre-school), and inside the multi-purpose hall.

Table 7 Noise targets for assessment of noise emissions by children at play

Type of Receiver	Daytime Period 7:00 am – 6:00 pm (dB $L_{Aeq, 15\ minutes}$)	Evening Period 6:00 pm – 10:00 pm (dB $L_{Aeq, 15\ minutes}$)	Night time Period 10:00 pm – 12:00 am (dB $L_{Aeq, 15\ minutes}$)
Residences along Phyllis Street	45	45	45
Residences along Kyogle Street	47	45	45

In relation to the noise targets outlined in Table 7, it's important to note that these are intended/proposed as limits (i.e., like those established above for mechanical plant and the like). The noise targets are established to provide a framework to enable the management of noise from these areas.

In many cases across NSW, school playgrounds are located directly adjacent to surrounding residential receivers. During the initial site planning phase, the project team considered several elements before determining the proposed layout being most suitable, including noise emissions, noise intrusion, bulk and scale, security, visual impacts, etc. As a result, the current site planning provided the best possible outcome for the community and future school occupants.

Furthermore, we also note the following:

- Measured ambient noise levels were conducted in the absence of school activities in the eastern portion of the school campus. Therefore, these measured noise levels are expected to increase once the new LSPS is operational. However, this is expected to be not higher than the LSPS campus prior to the flood events.

- Layout of the new outdoor playgrounds do not differ much from those previously implemented. Therefore, we expect the noise impact from new playgrounds to be equivalent to the noise impact from previous playgrounds.

Finally, we do note that in an NSW Land and Environment Court (LEC) proceeding (Meriden School vs Pedavoli) on 22 October 2009, case NSW LEC 183, the court noted: *"All noise that emanates from the normal activities at a school is not offensive"*.

3.3 Noise Emissions from Carpark

It is likely that all traffic activity related to the new LSPS (i.e. transportation for students and parking within the school premises) will be produced by light vehicles. It is considered feasible to assess car park noise impacts with reference to the NSW NPI as it is forecast that traffic movements in and out of the car park will occur during distinct time periods, i.e. in the morning before school commences and again in the afternoon following the end of school hours. Therefore, the criteria used for the assessment of carpark noise emissions should be as discussed in Section 3.1 (refer to Table 5).

The carpark will also be accessed for waste collection. Due to the frequency that waste collections are conducted, noise emissions related to these activities are assessed in accordance with criteria discussed in Section 3.1.6.

3.4 Internal Noise Level Criteria

3.4.1 The State Environmental Planning Policy (Transport & Infrastructure) 2021

The State Environmental Planning Policy (Transport & Infrastructure) 2021 (referred in this report as the *T&I SEPP*) provides conditions for noise intrusion generated by road and rail traffic noise. The guidelines for the assessment of noise intrusion are discussed in the document prepared by the Department of Planning of the NSW Government and which is titled *"Developments Near Rail Corridors and Busy Roads – Interim Guideline"* (DNRC & BR-IG).

The DNRC & BR-IG applies to development adjacent to rail corridors and busy roads. It can also provide a useful guide for all development that may be impacted by, or may impact on, rail corridors or busy roads.

Chapter 2, Part 2.3, Sections 2.119 and 2.120 of the T&I SEPP, state the following regarding traffic noise or vehicle noise emissions:

2.119 Development with frontage to classified road

(2) The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that -

(c) The development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

2.120 Impact of road noise or vibration on non-road development

(1) This section applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

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

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

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

(a) In any bedroom in the residential accommodation—35 dBA at any time between 10 pm and 7 am,

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

To address the requirements in clause (2) of condition 2.120, the following additional information is discussed:

- NSW Government Gazette No. 501 – Planning and Heritage (dated 1 October 2021); otherwise also known as the "*Child Care Planning Guideline*", referred herein as the CCPG. This guideline is relevant to the pre-school area of the LSPS. This is further discussed in Section 3.4.2.

- The DNRC & BR-IG (dated December 2008). This is further discussed in Section 3.4.3.

In accordance with clause (3) of condition 2.120, for the purpose of residential accommodation, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded (with windows and doors closed):

- In any bedroom in the building – 35 dB $L_{Aeq\ (9hour)}$ between 10:00 pm and 7:00 am

- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB L_{Aeq} at any time (i.e. $L_{Aeq\ (15hour)}$ and $L_{Aeq\ (9hour)}$).

We understand that the rebuilt LSPS is not to be used as residential accommodation. Therefore, these requirements do not apply. However, the internal noise level criteria are still required to be in accordance with the requirements discussed in Section 3.4.3 and 3.4.4.

3.4.2 Child Care Planning Guideline

As previously mentioned, the considerations discussed in the CCPG are relevant to the pre-school area of the LSPS.

According to Section 3.6 of the CCPG, childcare facilities located near major roads, rail lines, and beneath flight paths are likely to be subject to noise impacts. Other noisy environments such as industrial areas and substations may impact on the amenity and well-being of the children and staff. The location of childcare facilities should be selected to avoid or minimise the potential impact of external sources of significant noise.

Hence, consideration C24 of the CCPG, states the following:

Adopt design solutions to minimise the impacts of noise, such as:

- *Creating physical separation between buildings and the noise source*
- *Orienting the facility perpendicular to the noise source and where possible buffered by other uses*
- *Using landscaping to reduce the perception of noise*
- *Limiting the number and size of openings facing noise sources*
- *Using double or acoustic glazing, acoustic louvres or enclosed balconies (wintergardens)*
- *Using materials with mass and/or sound insulation or absorption properties, such as solid balcony balustrades, external screens and soffits*
- *Locating cot rooms, sleeping areas and play areas away from external noise sources*

The design solutions can be considered in more detail at later design stages of the project. These will be evaluated based on their effectiveness and the existing ambient noise impact.

Additionally, consideration C25 of the CCPG, states the following:

An acoustic report should identify appropriate noise levels for sleeping areas and other non-play areas and examine impacts and noise attenuation measures where a childcare facility is proposed in any of the following locations:

- *On industrial zoned land*
- *Where the ANEF contour is between 20 and 25*
- *Along a railway or mass transit corridor, as defined by State Environmental Planning Policy (Infrastructure) 2007*
- *On a major or busy road*
- *Other land that is impacted by substantial external noise*

As discussed in Sections 1.6 and 3.1.3, the future LSPS, and the pre-school by default, are not located within the an industrial zone, or near a railway or major busy road. Also the existing rail line located south of the project site is currently disused.

Furthermore, as discussed in Section 3.5, the project site is exposed to less than an ANEF 20 noise contour. Therefore, an aircraft noise intrusion assessment is not required.

Finally, based on noise survey of existing ambient noise levels (refer to Section 2, Section 3.1, and Appendix B), we find that the project site is not subject to substantial external noise levels.

As a result, the location of the pre-school is deemed to be satisfactory in terms of ambient noise levels, provided adequate noise intrusion measures are implemented. These measures are likely to include conventional building constructions.

3.4.3 Developments Near Rail Corridors and Busy Roads – Interim Guideline

As previously discussed, the DNRC & BR-IG has been developed to support specific rail and road acoustic provisions discussed in the T&I SEPP 2021 (i.e. condition 2.119 and 2.120).

Section 3.6.1 of the DNRC & BR-IG states that for educational institutions, including childcare centres, the road traffic noise assessment criterion is **40 dB $L_{Aeq\ (1\ hr)}$ for internal spaces when in use**. That criterion is interpreted as follows for the following for external areas immediately outside internal sensitive spaces:

- 50 dB $L_{Aeq\ (1\ hr)}$ based on a slightly open window or door
- 65 dB $L_{Aeq\ (1\ hr)}$ based on a non-openable window or door (assuming a noise reduction of 25 dB for such non-openable window or door).

3.4.4 Project Specific Requirements

Noise from air-conditioning plant and traffic noise intrusion are generally the principal contributors to the overall internal noise levels. It is important that an appropriate ambient noise level is established in an educational development.

A reduced level of ambient noise is required in certain spaces to achieve good communication throughout the space. A higher level of ambient noise is generally preferable in open plan spaces to ensure a moderate level of acoustic privacy between workstations. Too loud a background noise level may, however, lead to communication difficulties and fatigue.

The new school is subject to the internal noise level requirements discussed in the Engineering Facilities Standards & Guidelines 2.0 (EFSG 2.0), issued by School Infrastructure NSW (SI NSW). However, certain departures from the EFSG 2.0 criteria have been submitted to SI NSW for approval. The criteria which have been approved by SI NSW, are summarised in Table 8.

Table 8 Internal noise level criteria

Occupancy	**Internal Noise Level Criteria, Approved EFSG Departure** Based on Standard AS/NZS 2107:2016
Teaching Spaces, Primary School: General Learning Spaces (GLS) Multi-Purpose Spaces (MPS) Support GLS, 1 to 3 Learning Commons Support Learning Commons Special Programs Playroom 1	35 - 45
Interview/ Counselling Rooms: Counsellor Office Interview Room Office / Interview	40 - 45

Occupancy	Internal Noise Level Criteria, Approved EFSG Departure Based on Standard AS/NZS 2107:2016
Office Areas (Enclosed): Office (enclosed spaces) Shared Deputy Office OSHC Office Wellbeing Office Library Office Admin / Staff Principal Office / Meeting Room	40 - 45
Office Areas (Open): Clerical	40-45
Assembly Halls (up to 250 seats): Hall / Mini Basketball Court & Stage	30 - 40
Libraries – General Areas: Library Main Area	40 - 50
Staff Common Rooms: Staff Lounge	40 - 45
Medical Rooms (First Aid): Sick Bay	40 - 45
Toilet/Change/Showers: Male toilets Female toilets Acc. Toilets Acc. Shower Staff WC Amenities	< 55
Kitchens: Canteen Kitchenette OSHC Kitchenette Kitchen	< 55
Corridors & Lobbies: Circulation	< 50
Duplicating Rooms/Stores: Store PE Store Chair & Sport Store Perform. Store Bulk Store OSHC Store KLA Store Security Store Canteen & Office Store Cleaners	N/A

Therefore, we recommend that mechanical services should be designed to achieve overall compliance with the approved EFSG 2.0 criteria. This overall compliance should account for the intrusion of external noise sources such as local road traffic.

3.5 Aircraft Noise Intrusion

ANEF contours for Lismore Regional Airport are provided in document titled *"Lismore City Council – Lismore Development Control Plan"* (applying to land addressed in the Lismore Local Environmental Plan 2012, referred herein as the *Lismore DCP*). An extract of the ANEF contours is shown in Figure 4, with the project site indicated within a yellow circle.

From Figure 4, we note that the project site will be exposed to less than an ANEF 20 noise contour. According to standard AS 2021:2015 *"Acoustics - Aircraft noise intrusion - Building siting and construction"*, the location of a school site is acceptable if it is in an area exposed to less than ANEF 20, and conditionally acceptable if it is within ANEF 20 and 25.

The project site is within an acceptable zone for aircraft noise intrusion. As a result, the site does not require an aircraft noise intrusion assessment.

Figure 4 ANEF contour map for Lismore Regional Airport showing project site location

3.6 Noise Impact on Local Roads

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, it may not be considered reasonable and feasible to mitigate where the change in noise is less than 2.0 dB. Also, we note that an increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

Also, the NSW RNP recommends the criteria summarised in Table 9 which is applicable to residential land uses.

Table 9 Road traffic noise assessment criteria for residential land uses according to the NSW RNP

Road Category	Type of project/land use	Assessment Criteria	
		Day (7:00 am – 10:00 pm)	Night (10:00 pm – 7:00 am)
Local roads	Existing residences affected by noise from new local road corridors Existing residences affected by noise from redevelopment of existing local roads Existing residences affected by additional traffic on existing local roads generated by land use developments	55 dB $L_{Aeq,\ 1\ hour}$ (external)	50 dB $L_{Aeq,\ 1\ hour}$ (external)

3.7 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration - from uninterrupted sources (refer to Table 10).
- Impulsive vibration - up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 11).
- Intermittent vibration - such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 12).

Table 10 Continuous vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions, and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 11 Impulsive vibration acceleration criteria (m/s^2) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions, and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 12 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions, and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

4 CONSTRUCTION ACOUSTIC CRITERIA

4.1 Construction Noise Criteria

4.1.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in Table 13 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended 'management levels', are presented in Table 14.

Based on the measured background noise levels summarised in Section 2.3, the NMLs to be used in this assessment are listed in Table 15.

We assume that construction works will be conducted under typical standard construction hours.

Table 13 NMLs for quantitative assessment at residences (from ICNG)

Time of Day	Noise Management Level $L_{Aeq(15minute)}$[1,2]	How to Apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Note 1 *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.*

Note 2 *The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).*

Table 14 NMLs for quantitative assessment at non-residential receivers

Land Use	$L_{Aeq(15minute)}$ Construction NML
Industrial premises: Along Wilson Street and Bannister Street	75 (external)

Note 1: External noise level criterion estimated from internal noise level criterion assuming a 25 dB noise level difference for non-openable facade windows

Note 2: External noise level criterion estimated from internal noise management level of 45 dB $L_{Aeq,\ 15\ minutes}$ for construction activities within private enclosed offices

Table 15 NMLs as basis for the acoustic assessment

Receiver Types	NML, dB $L_{Aeq(15minute)}$	
	Standard Hours **Monday to Friday: 7 am to 6 pm** **Saturday: 8 am to 1 pm**	**Outside Standard Hours**
Residences: Along Phyllis Street	49 (external)	N/A
Residences: Along Kyogle Street	52 (external)	N/A
Industrial premises: Along Wilson Street and Bannister Street	75 (external)	N/A

Note 1: External noise level criterion estimated from internal noise level criterion assuming a 25 dB noise level difference for non-openable facade windows

Note 2: External noise level criterion estimated from internal noise management level of 45 dB $L_{Aeq,\ 15\ minutes}$ for construction activities within private enclosed offices

4.1.2 Sleep Disturbance

At this stage it is noted that construction works will be undertaken during standard construction hours. These standard hours are only part of the daytime period. Therefore, a sleep disturbance assessment is not required.

4.2 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.3 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 3.7.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 4.3.1.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 4.3.1.

4.3.1 Vibration Criteria – Building Contents & Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration"* (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 *"Effects of Vibration on Structure"* (DIN 1999).

4.3.1.1 Standard BS 7385 Part 2 – 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 16 and illustrated in Figure 5.

Table 16 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure 5	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 16 relate to transient vibration which does not cause resonant responses in buildings.

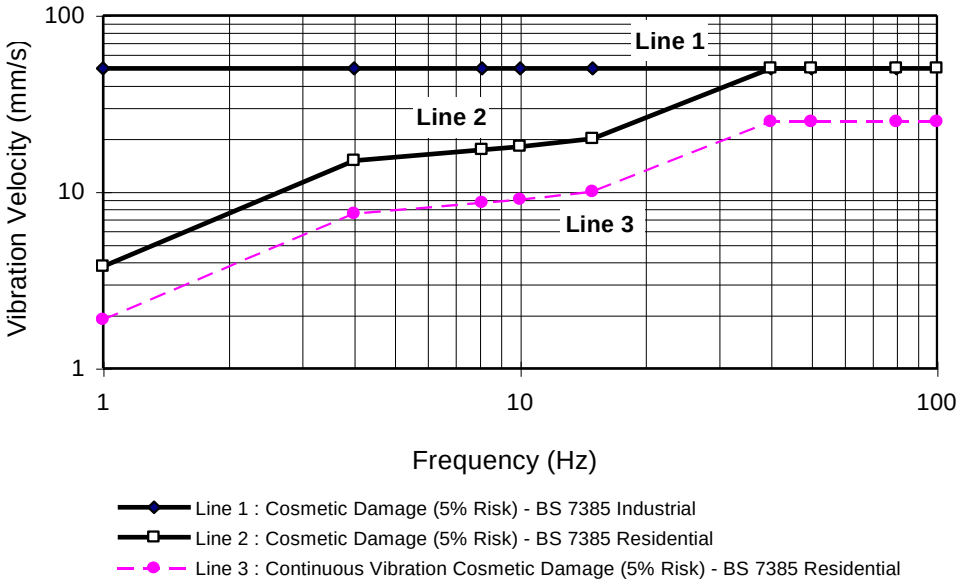
Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 16 may need to be reduced by up to 50% (refer to Line 3 in Figure 5).

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 16, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 16 should not be reduced for fatigue considerations.

Figure 5 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage



4.3.1.2 Standard DIN 4150 Part 3 – 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 17. The criteria are frequency dependent and specific to particular categories of structures.

Table 17 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s Vibration at the foundation at a frequency of			
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	Vibration of horizontal plane of highest floor at all frequencies
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.

4.4 Ground-Borne Noise Criteria

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. The following ground-borne limits for residences are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

- Evening (6 pm to 10 pm) - Internal: $L_{Aeq\ (15\ min)}$ 40 dBA
- Night-time (10 pm to 7 am) - Internal: $L_{Aeq\ (15\ min)}$ 35 dBA

Mitigation options to deal with ground-borne noise may include extensive community consultation to determine the acceptable level of disruption and the provision of respite accommodation in some circumstances, not just restriction of work hours.

It is noted that no construction works are currently proposed for the evening and night-time periods, therefore, an assessment of ground-borne is not currently required for the new LSPS.

5 OPERATIONAL ACOUSTIC ASSESSMENT

5.1 External Noise Emissions – Building Services

No further acoustic treatment is required for AC outdoor units provided the following is implemented:

- Noise emissions from AC outdoor units should not exceed the maximum allowable sound pressure levels as listed in Table 18 below.

Table 18 Maximum allowable sound pressure levels for AC outdoor units

Outdoor Unit	Sound Pressure Level at 1m Under Free Field Conditions, dBA
CU-1.1, CU-1.2	69
CU-2.1	66
CU-2.2	63
CU-3.1, CU-5.1, CU-7	64
CU-3.2	61
CU-4	57
CU-5.2, CU-8, CU-6	62

- AC outdoor units should be located as shown in Figure 6 and Figure 7. These figures are extracted from mechanical drawings LPS-PEDA-ZZ-RF-DR-M-1001 and 1002 (revision P1).

Figure 6 Location of AC outdoor units

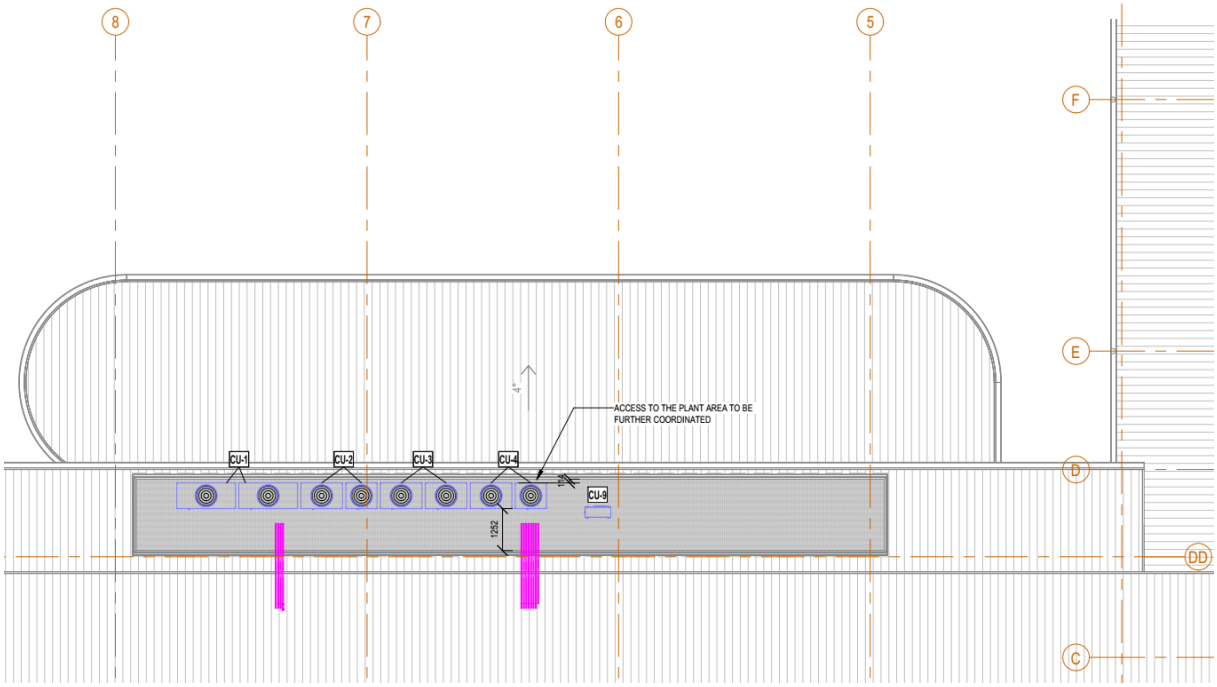
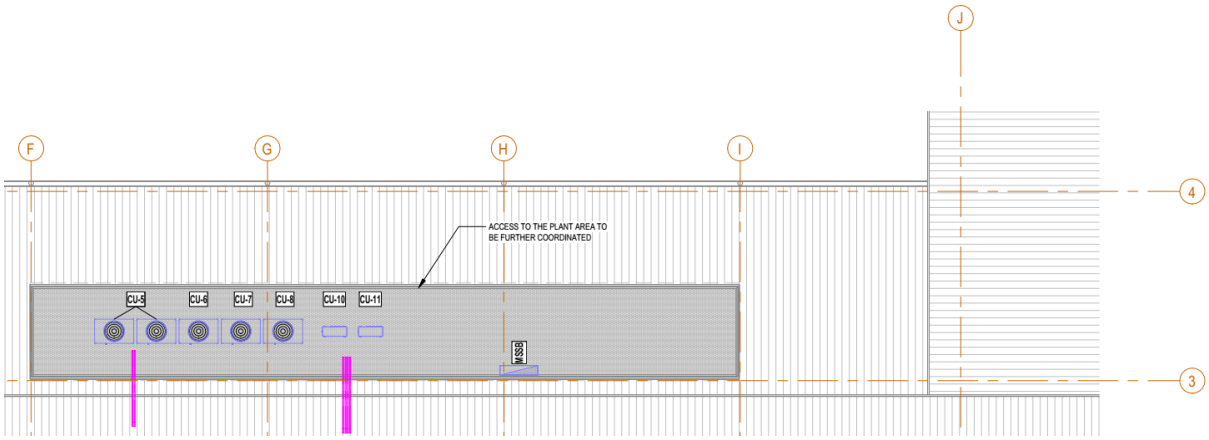


Figure 7 Location of AC outdoor units



Generally, it is advised the mechanical plant design and equipment selection should be made so that the aggregate noise level from all external emissions, comply with the external noise level criteria discussed in Section 3.1.

This should be conducted as part of the detailed assessment of mechanical noise emissions which is required to be undertaken during the later design stages.

The following design measures could be considered as part of the detailed design stage to achieve compliance:

- If airflow paths are required to/from outside (such as outside air, exhaust air, relief air, etc) these paths should be fully ducted and include minimum 50 mm thick internal insulation; and / or include acoustic louvres. When the extent of ductwork is not sufficient for treatment, then rectangular silencers may be required (this especially applies to fans and AHUs).

- Façade external louvres should be ducted with internally lined transfer ductwork (typically 1m minimum length). If these louvres are not required for mechanical ventilation, then this should be blanked off with 9mm FC sheeting (14 kg/m^2 minimum mass density).

- AHUs and FCUs should include return air / outside air plenums which are in internally lined with minimum 50 mm thick insulation.

- Variable speed drives should be implemented whenever possible.

- Reduce the number of operational plant items between 6:00 pm and 7:00 am (and generally during the night-time period).

The above recommendations should be considered as in-principle, best practice acoustic treatment that will need to be confirmed during detailed design stages.

5.2 Internal Noise Levels – Building Services & External Building Constructions

As discussed in Section 5.1, the mechanical ventilation design is still ongoing at the time of issuing this report. Nevertheless, it is advised that this should be designed to achieve the internal noise level criteria discussed in Sections 3.4.3 and 3.4.4.

The assessment of internal noise levels should account for noise emission by building services, as well as noise intrusion from external noise sources such as local road traffic. Therefore, external building constructions should be designed to address noise intrusion from external noise sources (such as local road traffic).

Mechanical plant should be resiliently mounted. Vibration isolation mounts and supports should be designed to achieve compliance with vibration criteria discussed in Section 3.7.

5.3 Outdoor Noise Emissions - Playgrounds

For the prediction of outdoor noise emissions due to students playing in outdoor areas, a typical lunch / recess period has been considered. In this scenario, it is assumed all students are in the designated playground areas as summarised in Table 19, Figure 8 and Figure 9. This distribution of students is consistent with providing each student the required minimum area of 5-10 m^2. It is also assumed that all 250 students are in the outdoor play areas during recess periods.

Although, the operational hours for the school start at 6:30am for OSHC, we assume that students are kept indoors between 6:30am and 7:00am (i.e outdoor playgrounds are not used between 6:30am and 7:00am). This will prevent the occurrences of sleep disturbance at nearest residences.

Figure 8 Distribution of students during outdoor activities, Ground Level (for noise modelling purposes)

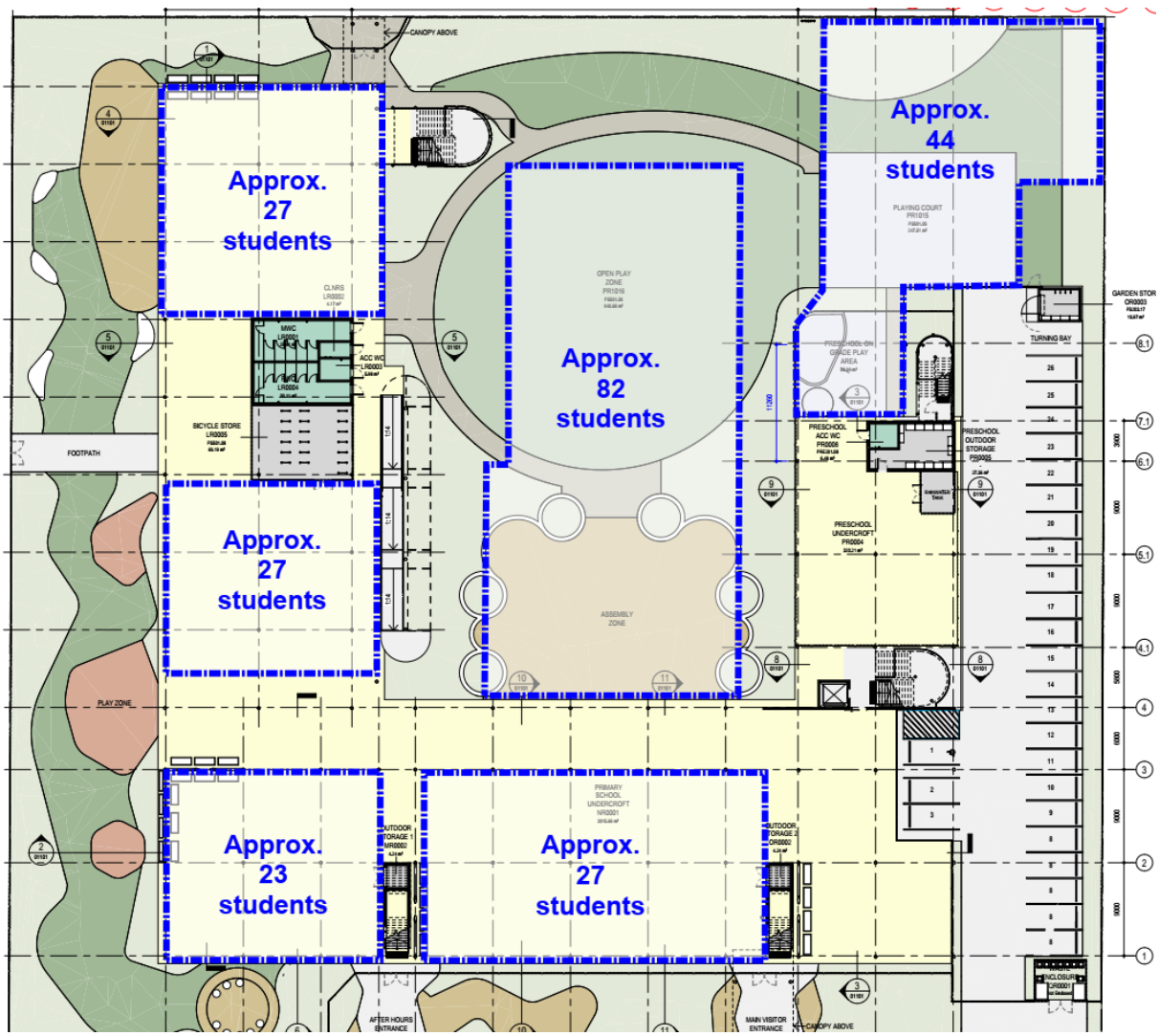


Figure 9 Distribution of students during outdoor activities, Level 1 (for noise modelling purposes)

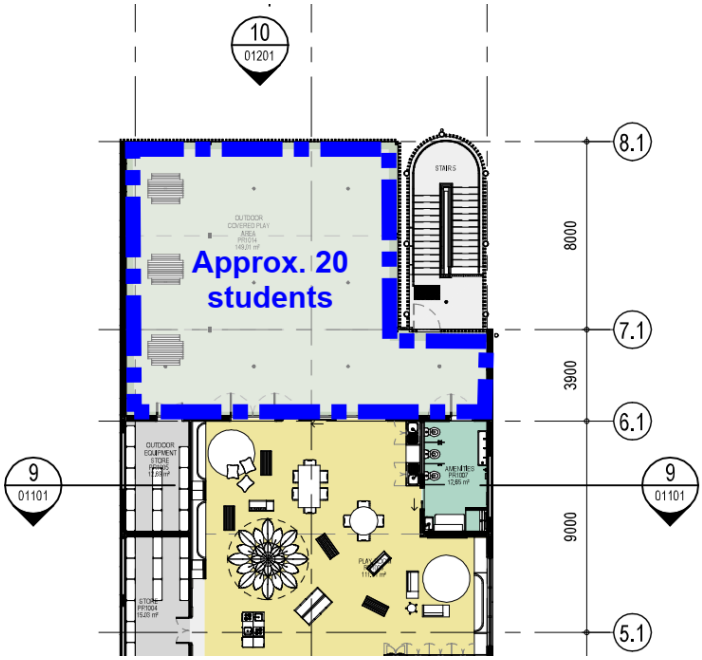


Table 19 Summary of noise modelling assumptions

Outdoor Area	Approximate Number of Students	Sound Power Level dB $L_{Aeq,\ 15\ minutes}$ (plane source across area of play)
Ground Level		
North-western, western, southern play area	27	91
Northern play area	52	94
North-eastern play area	44	93
South-western play area	23	91
Level 1		
Pre-school: Undercover outdoor play area	30	92

Based on the assumptions discussed above, predicted noise levels during outdoor play, are predicted at the nearest impacted receivers. These predicted noise levels are summarised in Table 20.

Table 20 Predicted noise emissions for a typical lunch / recess period

Residential Receiver	Predicted Noise Levels (dB $L_{Aeq,\ 15\ minutes}$)	Daytime Noise Emission Target (dB $L_{Aeq,\ 15\ minutes}$)	Assessment Outcomes
72 Phyllis Street 67 Kyogle Street	65	45	Noise mitigation measures to be considered
85 Phyllis Street	62	45	Noise mitigation measures to be considered

In relation to Table 20, we note:

- Predicted noise levels during periods of the day when all students are utilising the outdoor play areas (i.e., recess and lunch), are likely to intermittently exceed the formulated noise target levels in a worst-case scenario assessment.
- However, in our experience, the noise levels emitted are equivalent to those found in a community's public park. Therefore, these levels could be considered typical of a large open space of this nature.
- As discussed in Section 3.2, in NSW there is no defined acoustic criteria for the operational use of school playgrounds (indoors or outdoors). As such, we developed target noise levels based on most relevant guidelines.
- Notwithstanding the discussion above, the following management mitigation measures should be implemented by the school to minimise impacts to surrounding residential receivers:
    - All use of the school playground is to be supervised by school staff to ensure no excessive yelling or screaming occurs.
    - Use of the school playground is limited to the school hours during the daytime period as proposed.
    - Use of the Public Address (PA) system is in accordance with Section 5.5.
    - All of the listed mitigation measures are to be reflected in the School's Operation Management Plan (OMP).

Therefore, in our professional opinion we believe the outdoor play area of the school is acoustically acceptable and justified.

5.4 Outdoor Noise Emissions – Multi-Purpose School Hall

The school multi-purpose hall is proposed to be used for regular school activities during typical school hours; as well as during OSHC. Nevertheless, operation during regular school hours is assumed to be the worst-case scenario since this is likely to be used at its full capacity.

As such an acoustic assessment of the hall is undertaken during the daytime representing use by the school between 9:00am and 3:00pm. This assessment assumes all students are within the hall and the installed PA system is in operation. This also assumes sound pressure levels within the hall do not exceed 87 dB $L_{Aeq\ (15\text{-}minute)}$.

Based on this information, noise levels are predicted at the nearest impacted residential receivers. These predicted noise levels are summarised in Table 21 below.

Hence, we note the following from predicted noise levels summarised in Table 21:

- Noise levels within the school hall should not exceed 87 dB $L_{Aeq\ (15\ minutes)}$. Therefore, PA system should be designed not to exceed this maximum allowable noise level. Hence PA system is likely to include a noise limiter.
- Hall doors should be maintained closed for school events, especially if these events are conducted during the evening and night-time periods.
- Doors should achieve a minimum sound insulation performance of Rw 20. This implies that although door can be foldable, this should comprise non-perforated finishes.
- External building construction for school hall should be designed as to not provide additional flanking paths for breakout noise emissions.

Table 21 Predicted noise levels from school activities in multi-purpose hall

Residential Receiver	Predicted Noise Levels ($dB L_{Aeq, 15\ minutes}$)		Daytime Noise Emission Target ($dB L_{Aeq, 15\ minutes}$)	Assessment Outcomes
	Hall Doors Open	Hall Doors Closed		
72 Phyllis Street 67 Kyogle Street	55	< 40	45	Hall doors open: Noise mitigation measures to be considered Hall doors closed: Compliance with noise target levels subject to implementation of other mitigation measures.
83 Phyllis Street	55	< 40	45	Hall doors open: Noise mitigation measures to be considered Hall doors closed: Compliance with noise target levels subject to implementation of other mitigation measures.

5.5 Outdoor PA System

The location and design of the public address/bell system has not been undertaken at this stage. However, this will be required from an operation perspective. Therefore, we recommend that noise levels emitted by the outdoor PA system should not exceed the intrusiveness criteria at nearest impacted residences (i.e. noise emissions should not exceed the RBL + 5 dB). The intrusiveness criteria are summarised in Table 5.

A detailed review should be undertaken during the detailed design phase to ensure compliance with this criterion. The following it is advised that should be considered during this detailed design stage:

- Outdoor PA system should only operate between 9:00am and 3:00pm.
- Low-powered horn-type speakers should be located and orientated to provide a good coverage of the school areas whilst being directly away from residences and sensitive receivers. System coverage shall be reviewed during the design phases.
- Speakers should be mounted with a downward angle and as close to the floor as possible. Speakers should be mounted below the height of school buildings and include directional speakers to mitigation noise spill to neighbouring receivers.
- Once appropriate noise levels from the speakers are obtained within school premises and at nearest affected receivers, the system gain should be limited so that staff cannot increase the noise levels.
- During compliance survey, noise levels measured from PA system should be obtained in the absence of noise reflections from walls or vertical structures.

5.6 Carpark Noise Emissions

For assessment of carpark noise emissions, the following reports are used:

- Report titled *"School Transport Plan, Lismore South Public School – Flood Recovery Rebuild"* (revision 03, dated 6 December 2024, issued by Crossley Transport Planning, referred herein as the *STP Report*).
- Report titled *"Transport and Access Impact Assessment, Lismore South Public School – Flood Recovery Rebuild"* (revision 03, dated 20 January 2025, issued by Crossley Transport Planning, referred herein as the *Traffic Report*)

According to the Traffic Report, the carpark will accommodate 26 standard parking spaces and 1 accessible parking space. Access to the carpark will be from Kyogle Street. This carpark will only be available to school staff, with swipe cards to be used to manage access.

Assuming carpark is used to capacity, expecting 26 vehicle movements in a 1.5 hour period (i.e. same time period school gates are open for arrival or departures, refer to Section 1.5), then a noise level of 45 dB $L_{Aeq,15min}$ is predicted at nearest impacted residence (i.e. 67 Kyogle Street).

This predicted noise level is found to be compliant, the daytime project specific noise level for residences along Kyogle Street (i.e. 47 dB $L_{Aeq,\ 15\ minutes}$). This project specific noise level is listed in Table 5.

Therefore, no further acoustic treatments are recommended for the carpark.

5.7 Waste Collection

It is recommended, as an operational measure, that waste collection should only be conducted between 7:00 am and 10:00 pm. This is recommended to minimise noise impact to local residences; as well as to prevent sleep arousal events at these residences.

5.8 Noise Impact on Local Roads

The STP Report and Traffic Report provide information regarding traffic generation by the new LSPS.

According to the Traffic Report, kiss and drop off locations are positioned along eastbound kerb of Kyogle Street, adjacent to gates 3 and 4. These zones will be used between 8:00am and 9:30am; and between 2:30pm and 4:00pm (i.e. during daytime period). These zones will allow for up to 8 cars at a time, and assuming a stay of up to 2 minutes.

Also, for our assessment, the sound power levels summarised in Table 22 are considered. It is also assumed the kiss and drop location will only be used by light vehicles.

Table 22 Sound power levels for vehicle movements and activities

Vehicular Activity	Sound Power Level (dB re 1pW) [1]
Light vehicle pass-by	91 dB L_{Amax}
Car door closing	98 dB L_{Amax}
Engine start	93 dB L_{Amax}

Note 1: Noise information used for the prediction of $L_{Aeq,15\ minutes}$ noise levels

Therefore, based on the information above, road traffic noise levels related to the development, are predicted at the nearest impacted residences. These predicted levels are summarised in Table 23. From these predicted levels, we note compliance is achieved with the criteria discussed in Section 3.6. Therefore, it is expected that impact from road traffic noise levels generated by the development; will be negligible.

Figure 10 Proposed kiss and drop locations

Table 23 Noise emissions from vehicular activities on local roads

Receiver	Predicted Noise Levels (dB $L_{Aeq, 1\ hour}$)	Noise Emission Criteria (dB $L_{Aeq, 1\ hour}$)	Assessment Outcomes
67 Kyogle Street	48	Day: 55	Compliance

6 CONSTRUCTION ACOUSTIC ASSESSMENT

6.1 Construction Noise & Vibration Management Plan

At the time of issuing this report, detailed information of the construction program is not available. Therefore, an impact assessment of construction noise and vibration has not been conducted.

Nevertheless, due to the size of the project and extent of works (as discussed in Section 1.4), it is envisaged that a construction noise and vibration management plan (CNVMP) will be required.

The following works should be provided as part of the required CNVMP:

- An on-site noise monitoring is recommended in order to confirm the existing ambient noise levels. This can influence how the NMLs are established, and as a result, the management procedures to undertake;
- A detailed construction program should be provided which should include the following:
    - Schedule of construction activities (classified into scenarios if applicable)
    - List of construction equipment per activity
    - Location of construction equipment
    - Duration of construction activities, as well as proposed construction hours
- Assess predict noise levels in accordance with the procedures discussed in Section 4.
- Based on the outcome of the assessment, establish management and operational procedures to address noise and vibration mitigation measures and complaints. Refer to Section 6.2 for typical noise mitigation measures to be considered.
- For vibration generating equipment, we recommend that safe working distances be determined to maintain compliance with the appropriate human comfort criteria (refer to Section 3.7) as well as to minimise impact on buildings (refer to Section 4.3). Indicative safe working distances are provided in Table 24. These indicative distances should be confirmed during detailed design stages of the project by undertaking vibration validation tests involving the actual equipment to be used. These validating tests should be performed at the commencement of works.

Table 24 Recommended indicative safe working distances for vibration intensive plant

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Vibratory roller	< 50 kN (Typically 1 – 2 tonnes)	5	15 – 20
	< 100 kN (Typically 2 – 4 tonnes)	6	20
	< 200 kN (Typically 4 – 6 tonnes)	12	40
	< 300 kN (Typically 7 – 13 tonnes)	15	100
	> 300 kN (Typically more than 13 tonnes)	20	100
Small hydraulic hammer	300 kg, typically 5 – 12 tonnes excavator	2	7
Medium hydraulic hammer	900 kg, typically 12 – 18 tonnes excavator	7	23
Large hydraulic hammer	1600 kg, typically 18 – 34 tonnes excavator	22	73
Vibratory pile driver	Sheet piles	2 – 20	20

Plant	Rating / Description	Safe Working Distances (m)	
		Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3)	Human Comfort (AVTG)
Jackhammer	Hand held	1	Avoid contact with structure and steel reinforcements

- Identify heritage structures as well as vibration sensitive premises (such as those containing scientific and surgery equipment). Safe working distances from vibration generating equipment should be established to achieve compliance with the criteria discussed in Section 4.3.

- Identify of other vibration sensitive structures such as tunnels, gas pipelines, fibre optic cables, Sydney Water retention basins. Specific vibration goals should be determined on a case-by-case basis by an acoustic consultant which is to be engaged by the construction contractor.

- Undertake an assessment of road traffic noise generated by light and heavy vehicle movements which are associated with the construction works for the development. A construction traffic study should be provided to determine the relevant traffic flows. These predicted noise levels of construction traffic will then be assessed in accordance with the criteria discussed in Section 4.2.

6.2 Typical Noise & Vibration Mitigation Procedures

The following are typical mitigation measures which can be considered in the CNVMP, these are to be confirmed once detailed information of the construction program becomes available and further noise measurements have been conducted on site:

- Undertake all feasible and reasonable measures to minimise noise impacts and achieve compliance with the NMLs

- Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal. This can be conducted as part of a community consultation process.

- A potential approach would be to schedule a respite period of one hour for every three hours of continuous construction activity, or undertaking high noise generating works at less sensitive times such as 9:00 am to 12:00 pm and / or 2:00 pm to 5:00 pm

- Undertake following operational procedures:

    - Maximise the offset distance between plant items and nearby noise sensitive receivers.

    - Prevent noisy plant working simultaneously and adjacent to sensitive receivers.

    - Minimise consecutive works in the same site area.

    - Orientate equipment away from noise sensitive areas.

    - Carry out loading and unloading away from noise sensitive areas.

    - Minimise noise emissions from reversing alarms by the use of "forward only" traffic flows through the site, broadband alarms (rather than tonal alarms), maintaining occupational safety standards, etc.

    - No use of PA systems on site.

  - Site induction training to include noise awareness component
  - Site deliveries to be conducted during standard construction hours

- Conduct supplementary noise and structural damage and/or human comfort vibration monitoring to confirm compliance with the adopted construction noise and vibration criteria. These measurements can also be carried out in response to complaints, exceedances or for the purpose of refining construction techniques to minimise noise and vibration emissions.
- Establish a complaint handling procedure to address complaints, identify corrective action and implement if possible. The corrective action may involve supplementary monitoring to identify the source of the non-conformance and/or may involve modification of the construction techniques or programme to avoid any recurrence or minimise its adverse effects.
- Any vibration generating plant and equipment is to be located in areas within the site in order to lower the vibration impacts.
- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.
- Use lower vibration generating items of construction plant and equipment, that is, smaller capacity plant.
- Minimise performing vibration generating works consecutively in the same area (if applicable).
- Schedule respite periods, these are to be determined based on the outcomes of detailed construction noise assessment and in coordination with the contractor.
- Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site, and monitor the profiles in use.

7 CONCLUSIONS

Pulse White Noise Acoustics (PWNA) has been engaged to undertake a noise and vibration assessment for the rebuild of Lismore South Public School (LSPS). This assessment is conducted to support a submission for Review of Environmental Factors (REF) in accordance with Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

From the operational noise and vibration assessment, the following findings and mitigation measures are summarised in Table 25.

Table 25 Summary of findings and mitigation measures

Mitigation Name	Aspect	Mitigation Measure
Aircraft noise intrusion	Project site location	The project site is exposed to a less than 20 ANEF contour. Therefore, the site is not subject to the aircraft noise intrusion assessment
External noise emissions from mechanical services	Mechanical services	Mechanical plant should be designed to achieve compliance with external noise level criteria discussed in Section 3.1. Conceptual recommendations are presented in Section 5.1 for consideration during detailed design stages.
Internal noise levels	Mechanical services Architectural design	Mechanical plant should also be designed to achieve compliance with internal noise level criteria discussed in Section 3.4. The assessment of internal noise levels should account for noise emission by building services, as well as noise intrusion from external noise sources such as local road traffic. Therefore, external building constructions should be designed to mitigate against noise intrusion from external noise sources Additionally, all mechanical plant should be resiliently vibration mounted to achieve compliance with vibration criteria as per Section 3.7
Noise emissions from outdoor playgrounds	Operational procedures	Management mitigation measures should be implemented to manage noise emissions from outdoor playgrounds. These measures should be included as part of the School's Operation Management Plan (OMP). Outdoor playgrounds should not be used between 6:30am and 7:00am. This measure should also be included as part of the OMP.
External noise emissions from multi-purpose hall	PA system, architectural design	PA system should be designed so internal noise levels do not exceed 87 dB $L_{Aeq\ (15\ minutes)}$. Additionally, refer to Section 5.4 for preliminary architectural treatments for hall doors and building envelope treatments. Hall doors should be maintained closed for school events, especially if these events are conducted during the evening and night-time periods.
Noise emissions from outdoor PA system	PA system	Outdoor PA system should be designed so noise emissions do not exceed the intrusiveness criteria at nearest impacted residences. Also, refer to Section 5.5 for conceptual treatments to be considered during detailed design. Outdoor PA system should only operate between 9:00am and 3:00pm
Noise emissions from waste collection services	Waste collection, operational procedures	Waste collection should only be conducted between 7:00 am and 10:00 pm

Mitigation Name	Aspect	Mitigation Measure
Outside of school hours care	Operational procedures	Students and carers should be located indoors between 6:30 am and 7:00 am
Construction noise and vibration management plan (CNVMP)	Prior to start of construction works	A construction noise and vibration management plan (CNVMP) is advised due to the size of the project and extent of construction works. Conceptual mitigation measures are recommended in Section 6 to address the acoustic impact from such construction activities. These measures should be considered when developing the CNVMP.

Subject to adopting the mitigation measures outlined in this report, it is our opinion there will not be significant noise and vibration impact on the surrounding environment.

APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:
	0dB(A) Threshold of human hearing 30dB(A) A quiet country park 40dB(A) Whisper in a library 50dB(A) Open office space 70dB(A) Inside a car on a freeway 80dB(A) Outboard motor 90dB(A) Heavy truck pass-by 100dB(A) Jackhammer/Subway train 110 dB(A) Rock Concert 115dB(A) Limit of sound permitted in industry 120dB(A) 747 take off at 250 metres
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ambient sound	The all-encompassing sound at a point composed of sound from all sources near and far.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Reverberation	The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB)
Air-borne sound	The sound emitted directly from a source into the surrounding air, such as speech, television or music
Impact sound	The sound emitted from force of one object hitting another such as footfalls and slamming cupboards.
Air-borne sound isolation	The reduction of airborne sound between two rooms.
Sound Reduction Index [R] (Sound Transmission Loss)	The ratio the sound incident on a partition to the sound transmitted by the partition.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.
Level difference [D]	The difference in sound pressure level between two rooms.

Normalised level difference [D_n]	The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room.
Standardised level difference [D_{nT}]	The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room.
Weighted standardised level difference [$D_{nT,w}$]	A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site.
C_{tr}	A value added to an R_w or $D_{nT,w}$ value to account for variations in the spectrum.
Impact sound isolation	The resistance of a floor or wall to transmit impact sound.
Impact sound pressure level [L_i]	The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine.
Normalised impact sound pressure level [L_n]	The impact sound pressure level normalised for the absorption area of the receiving room.
Weighted normalised impact sound pressure level [$L_{n,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory.
Weighted standardised impact sound pressure level [$L'_{nT,w}$]	A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site.
C_I	A value added to an L_{nW} or $L'_{nT,w}$ value to account for variations in the spectrum.
Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$]	'A' weighted, energy averaged sound pressure level over the measurement period T.
Percentile Sound Pressure Level [$L_{Ax,T}$]	'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

APPENDIX B: UNATTENDED NOISE MEASUREMENTS

Logger Location 1: Facing Phyllis Street

73 Phyllis St, Lismore

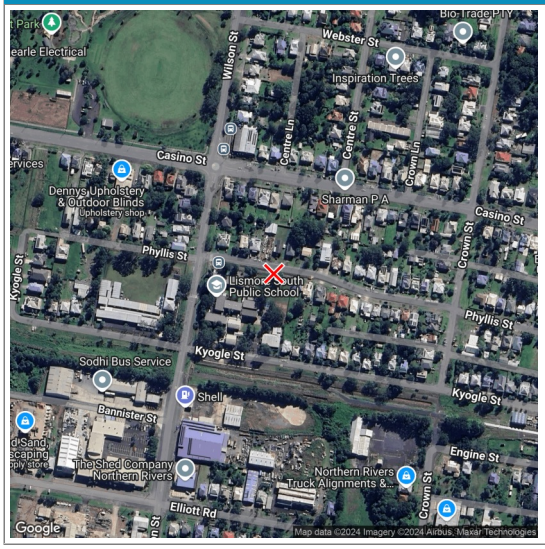
Ambient noise monitoring report

Item	Information
Logger Type	SVAN 971
Serial number	74365
Address	73 Phyllis St, Lismore
Location	73 Phyllis St, Lismore
Facade / free field	Free field
Environment	

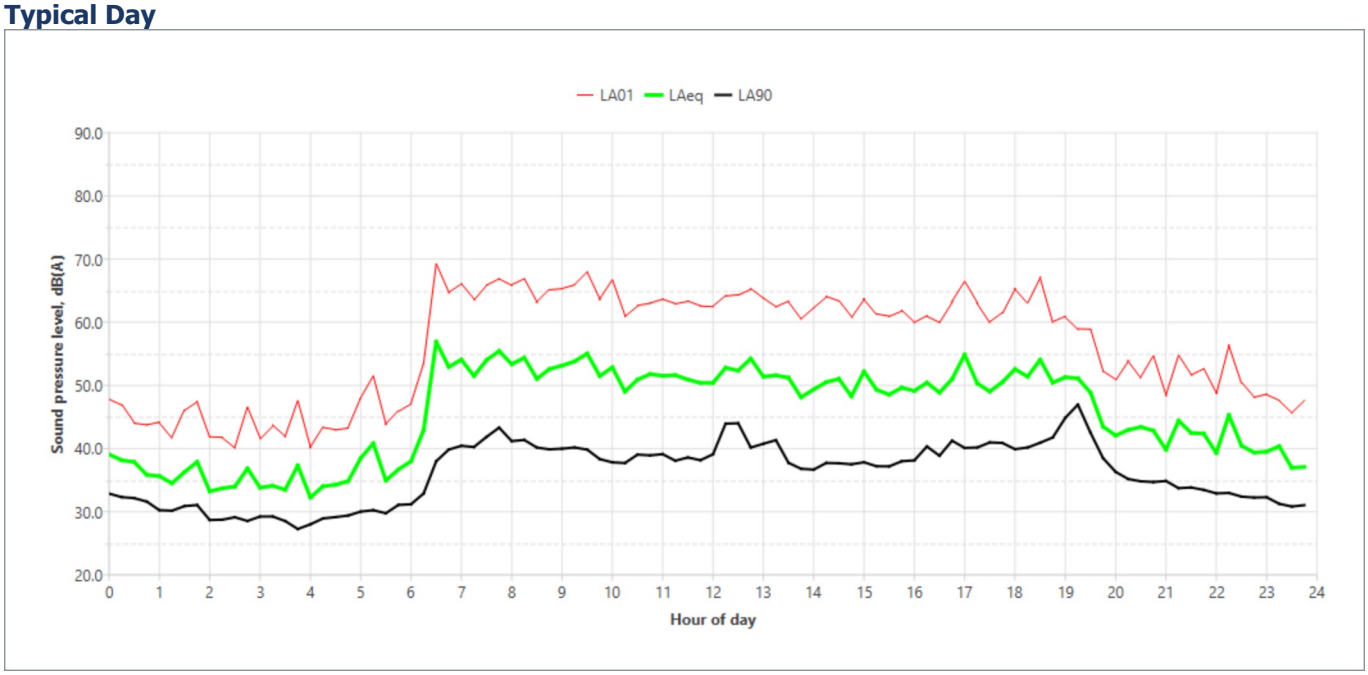
Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Fri 23 Aug 2024	-	-	-	-	-	-
Sat 24 Aug 2024	-	36	-	52	48	43
Sun 25 Aug 2024	-	38	25	50	49	41
Mon 26 Aug 2024	-	-	-	54	-	43
Tue 27 Aug 2024	-	37	-	54	50	43
Wed 28 Aug 2024	-	-	-	54	-	42
Thu 29 Aug 2024	-	37	-	59	48	40
Fri 30 Aug 2024	-	-	-	54	-	46
Sat 31 Aug 2024	-	-	-	-	47	45
Sun 01 Sep 2024	36	34	24	50	46	43
Mon 02 Sep 2024	-	-	25	55	38	46
Tue 03 Sep 2024	-	34	23	55	50	46
Wed 04 Sep 2024	39	35	24	54	50	45
Thu 05 Sep 2024	39	35	23	54	52	45
Fri 06 Sep 2024	39	-	26	53	46	47
Sat 07 Sep 2024	-	35	-	52	49	41
Sun 08 Sep 2024	35	32	27	52	49	44
Summary	**39**	**35**	**24**	**54**	**49**	**44**

Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo
	

Typical Day



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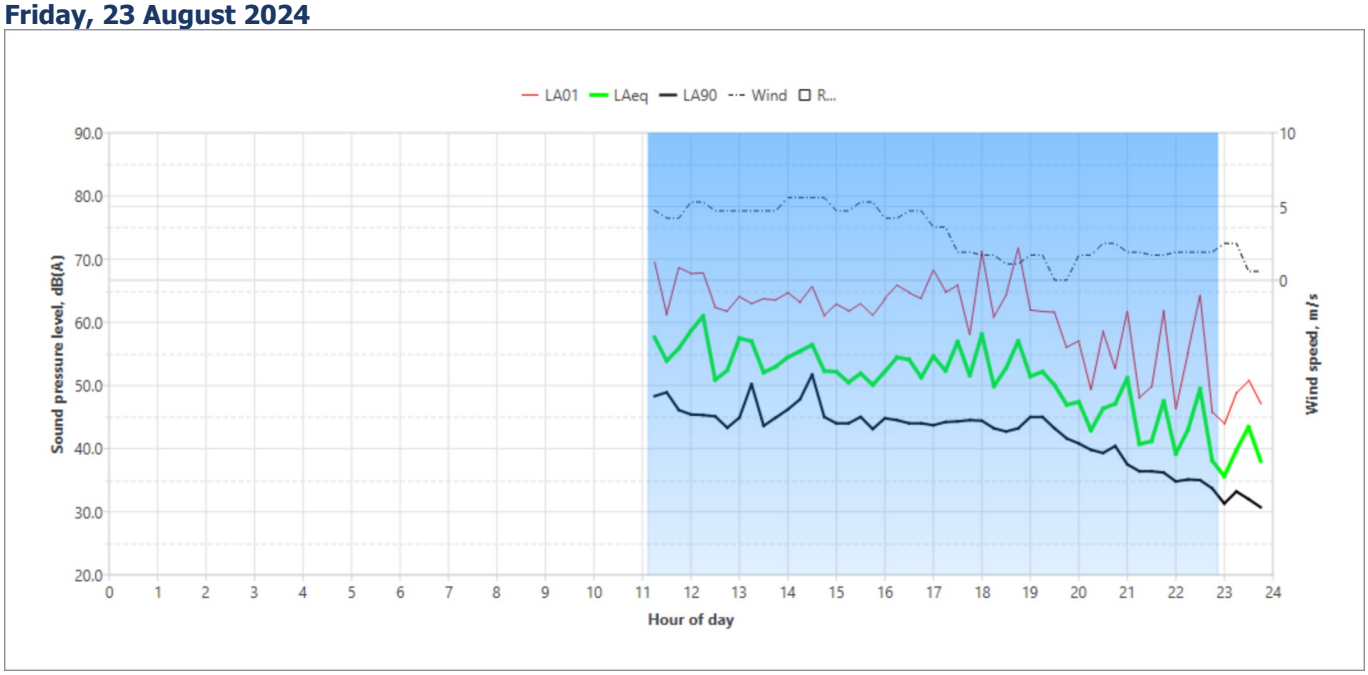

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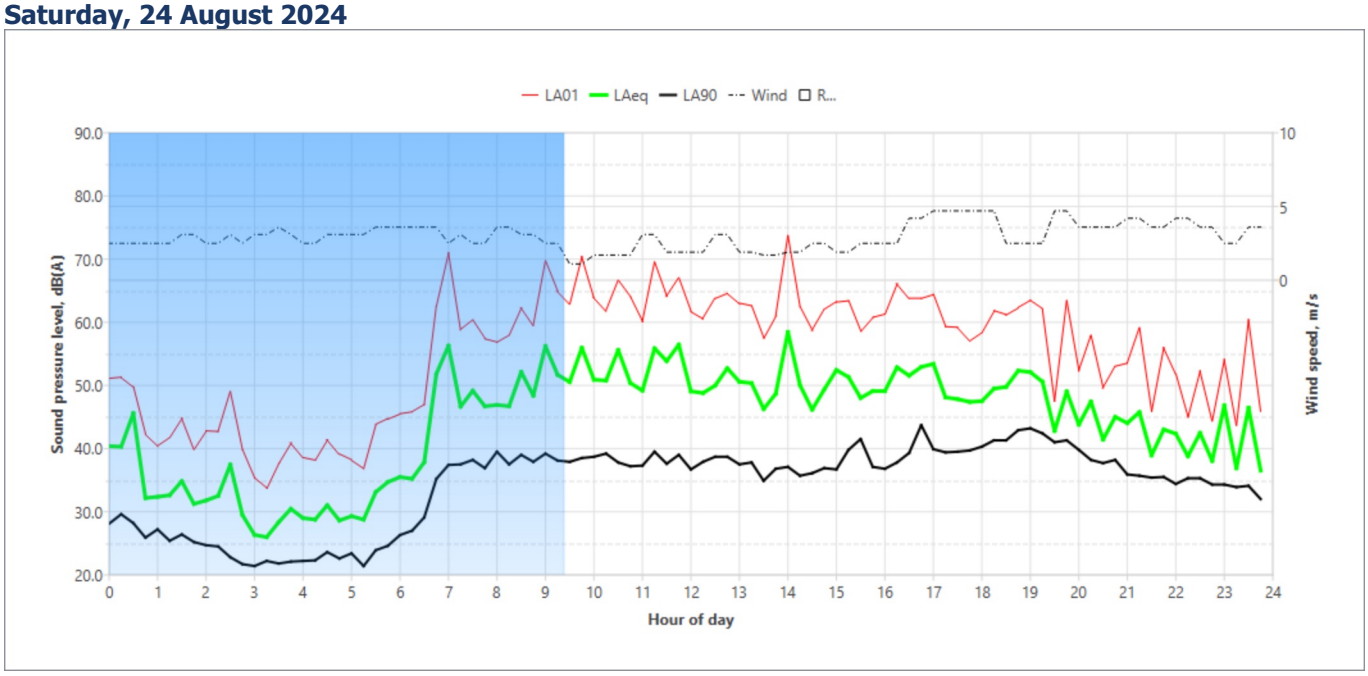

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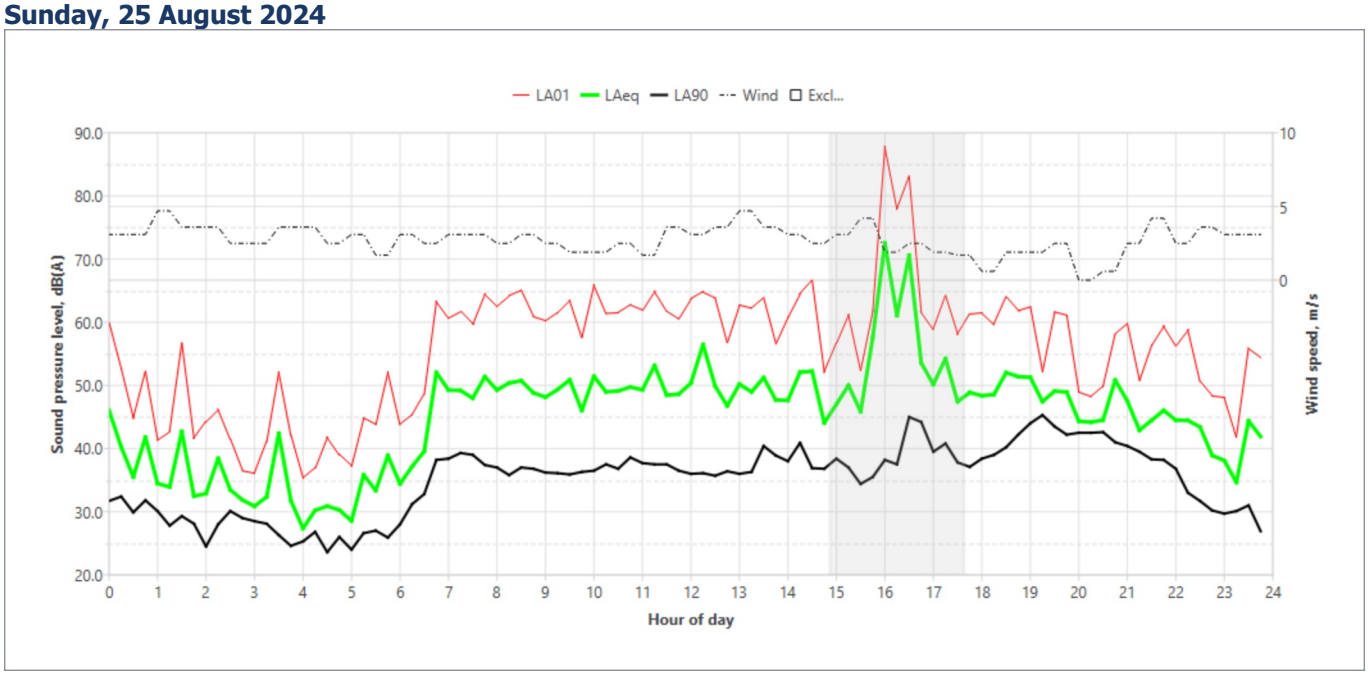

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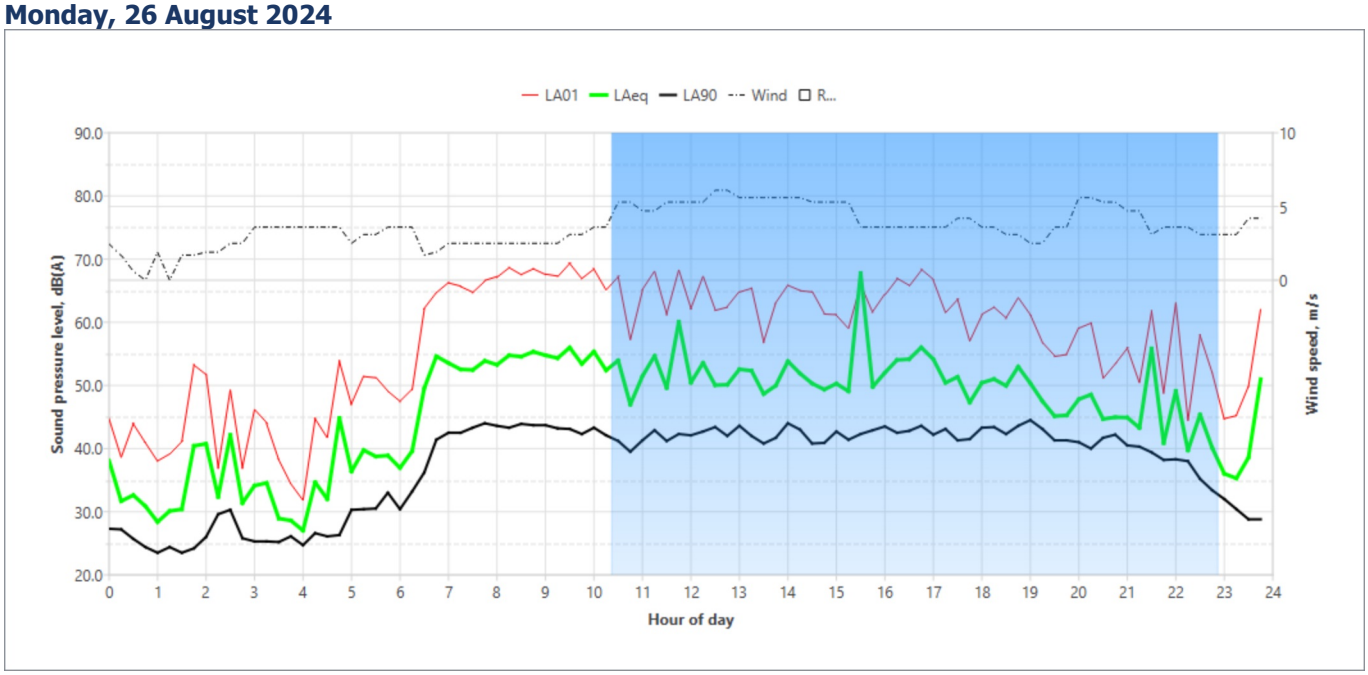

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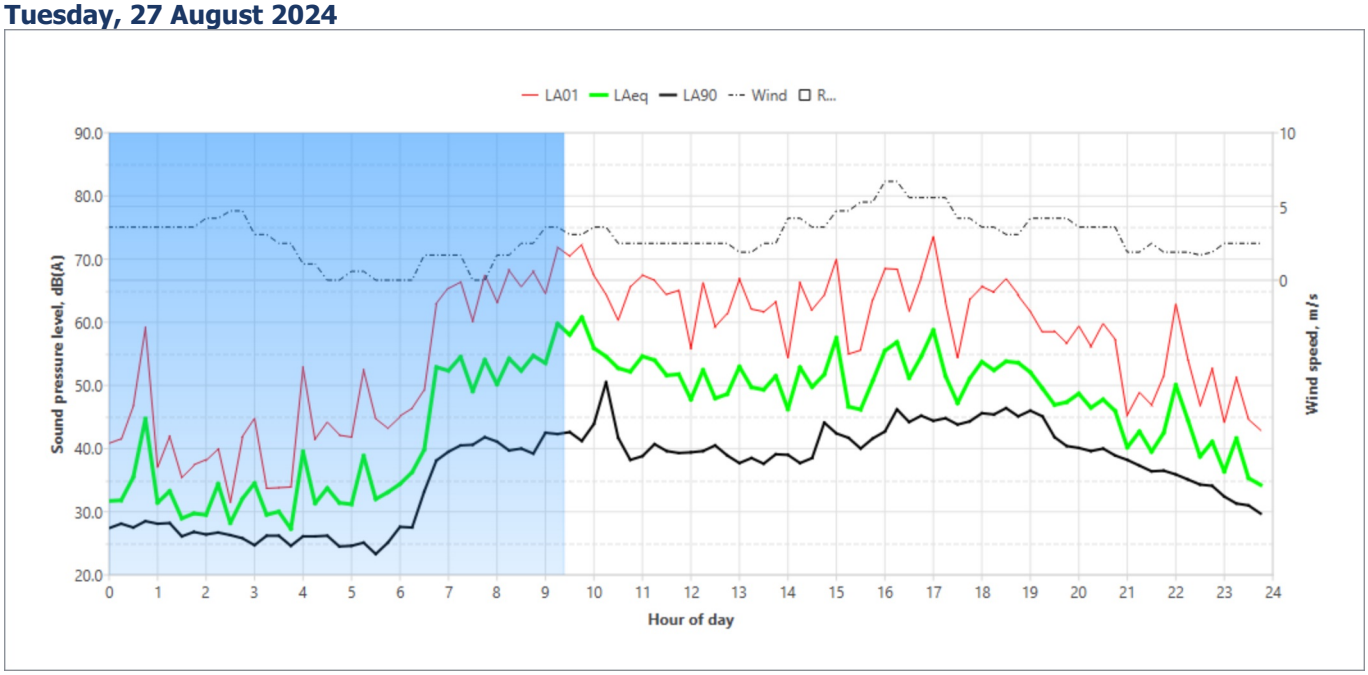

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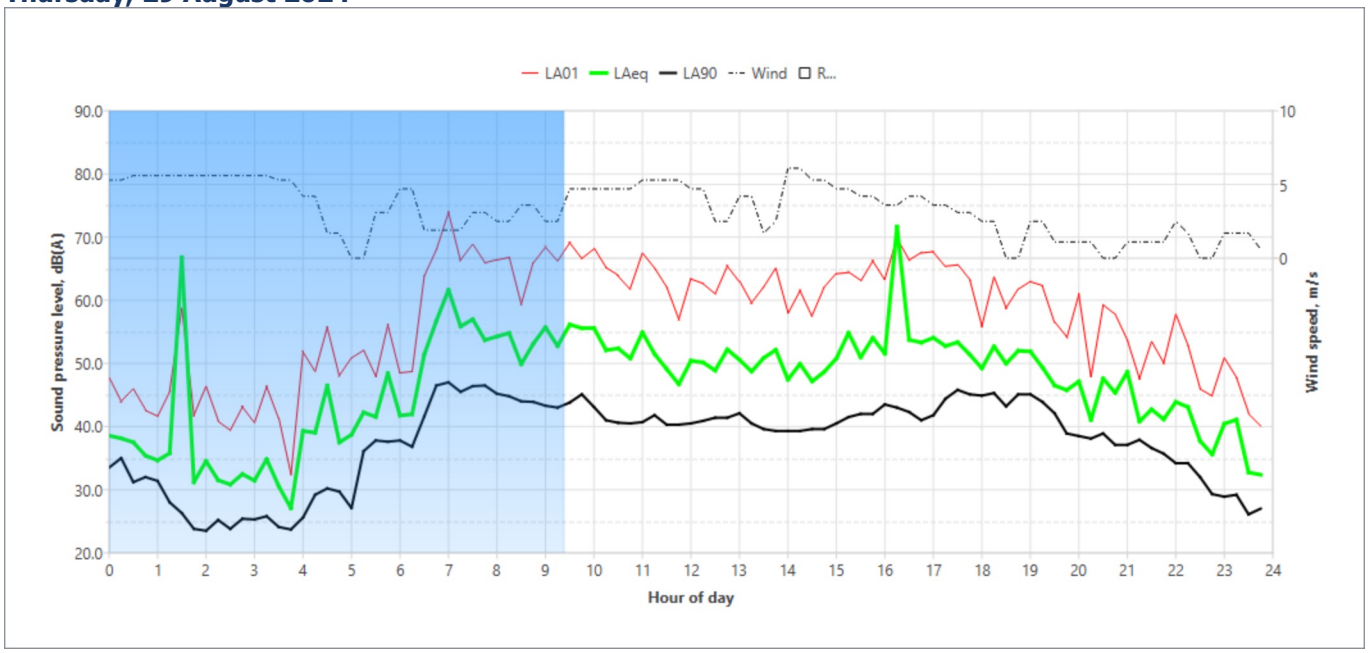

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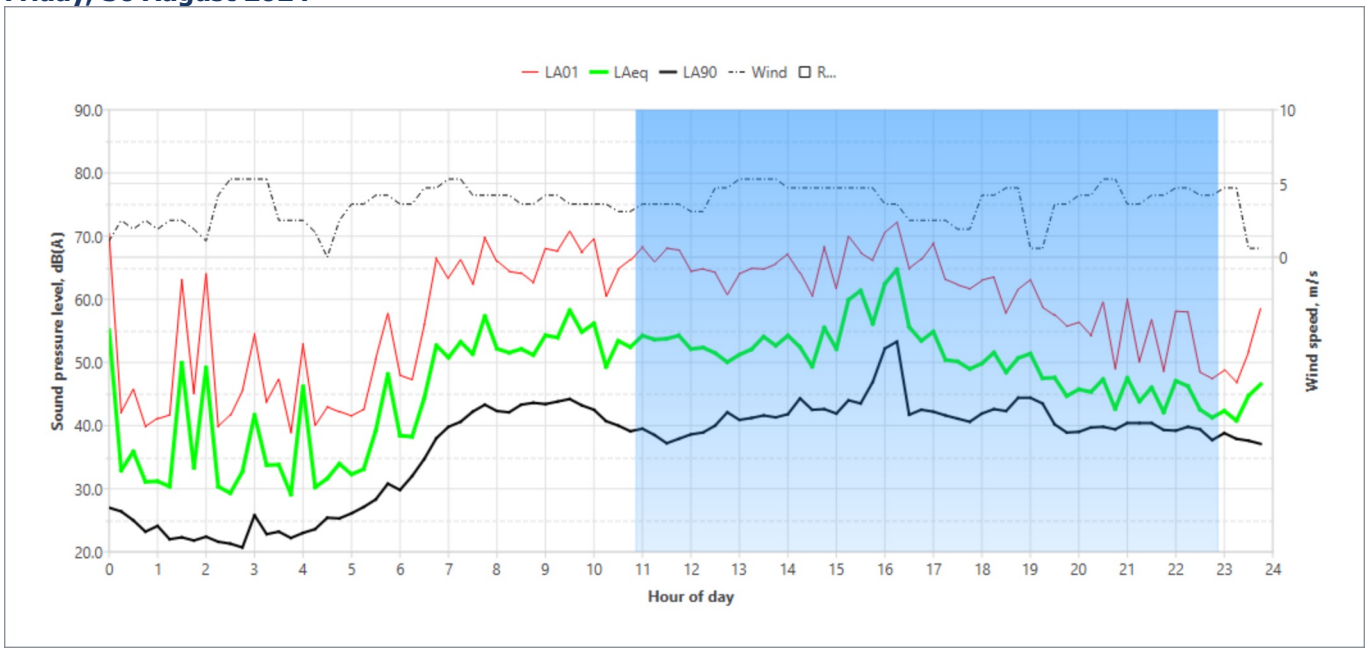

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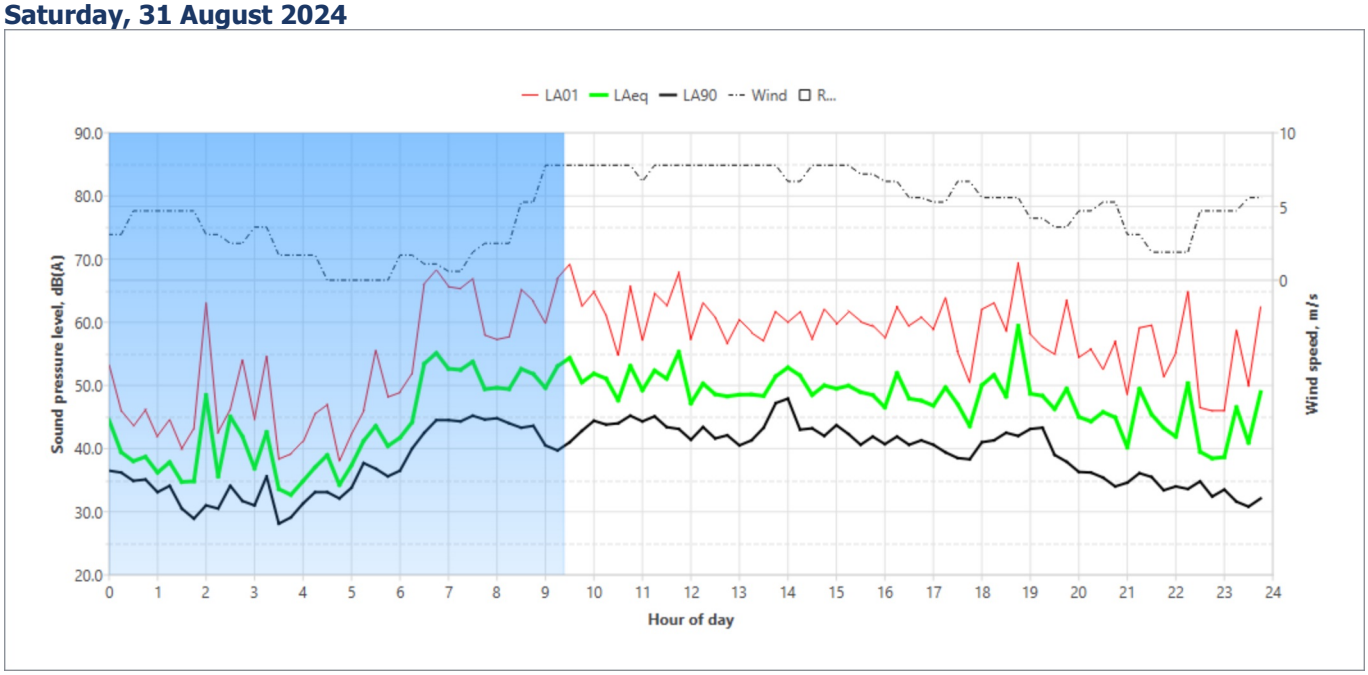

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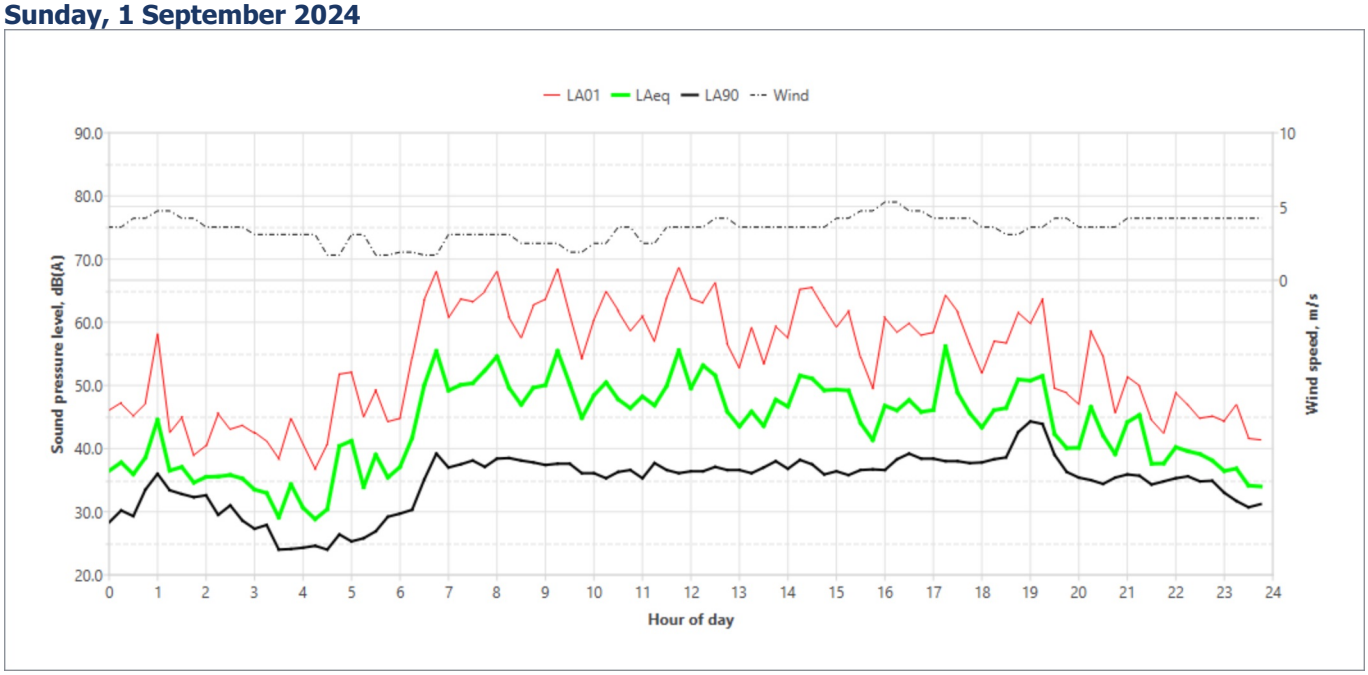

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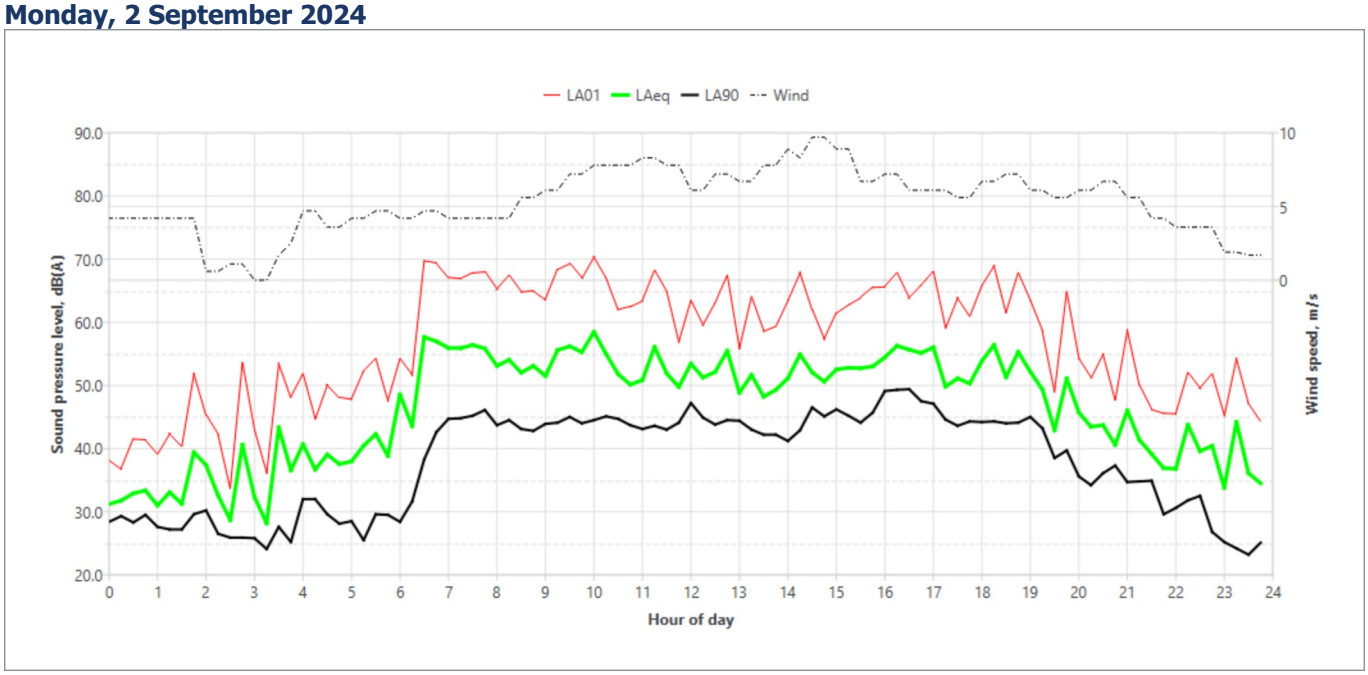

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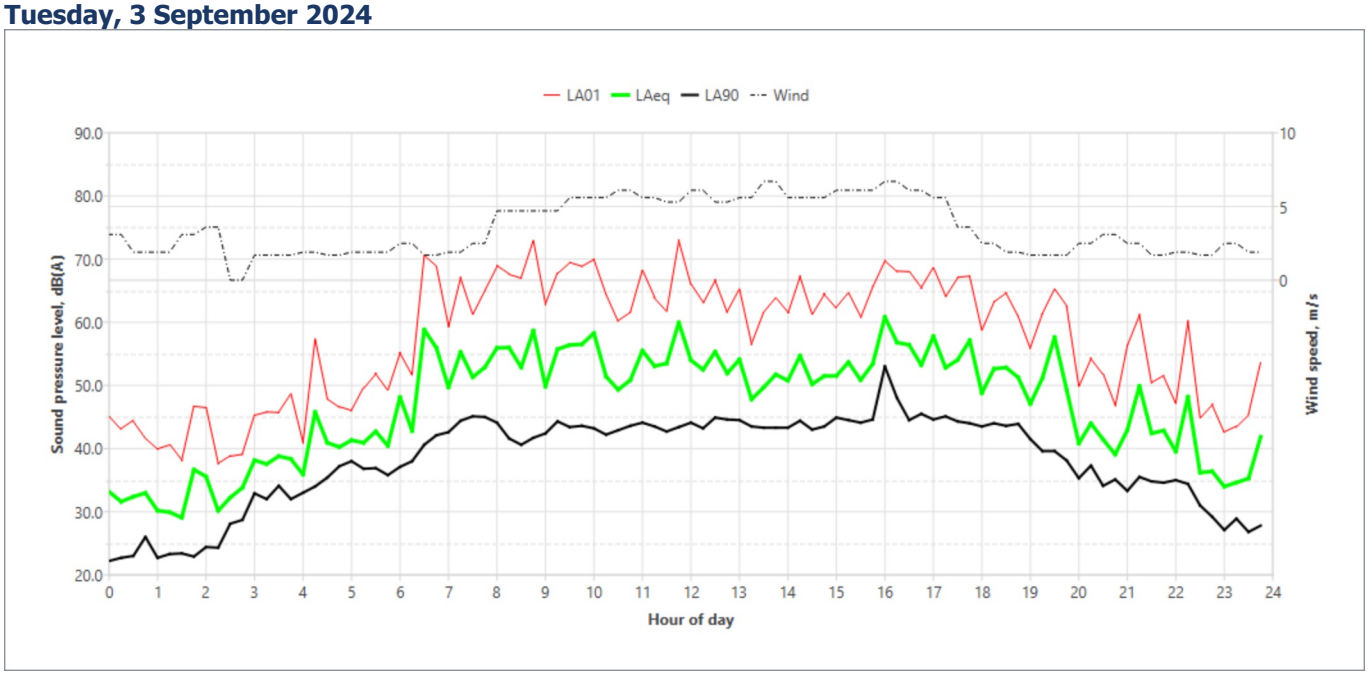

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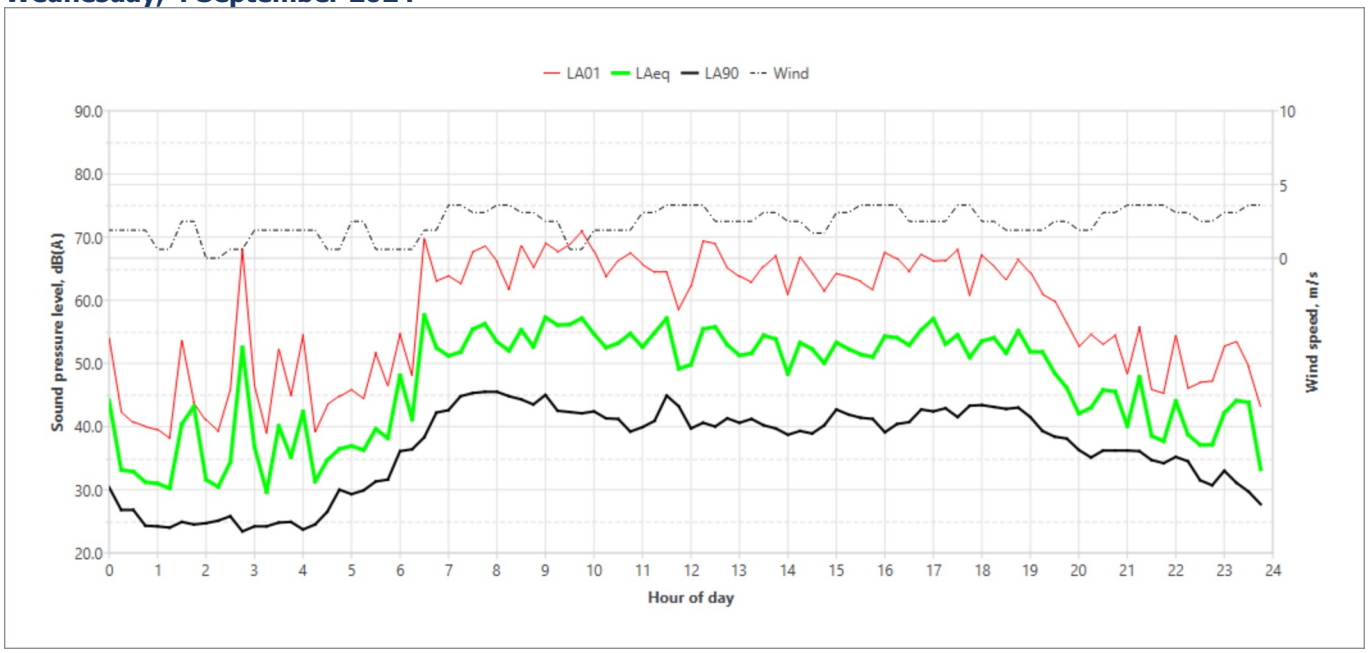

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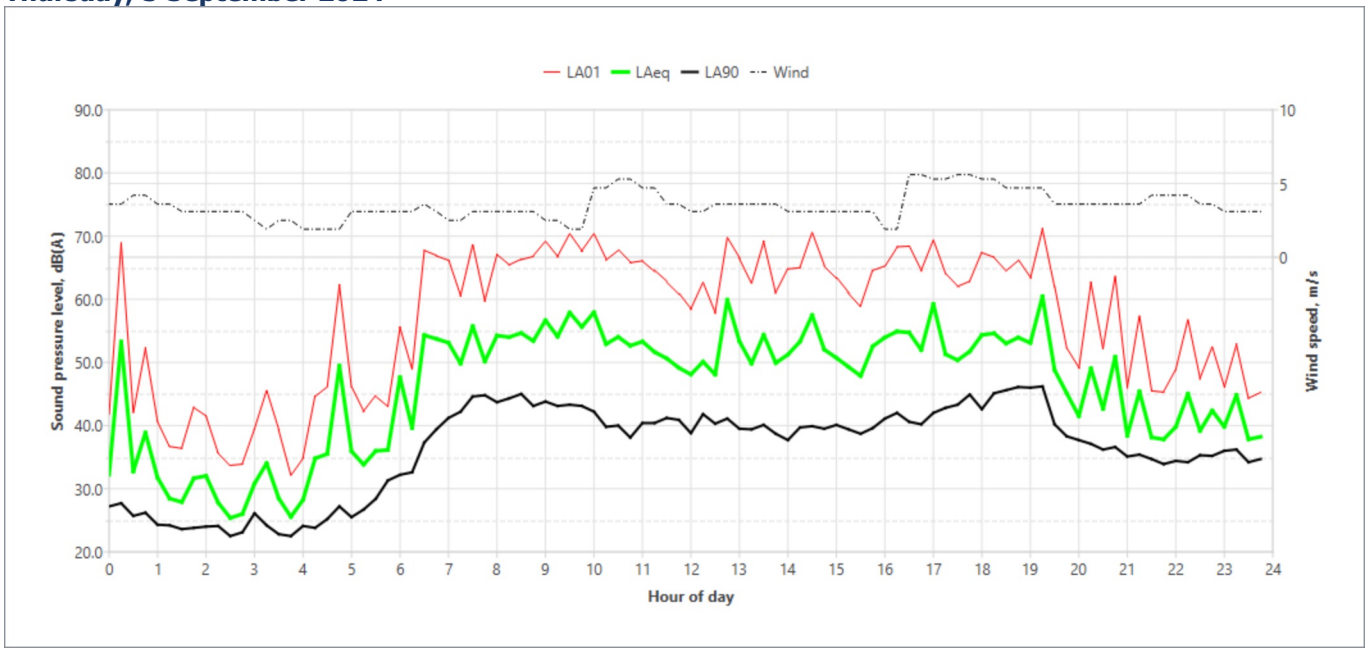

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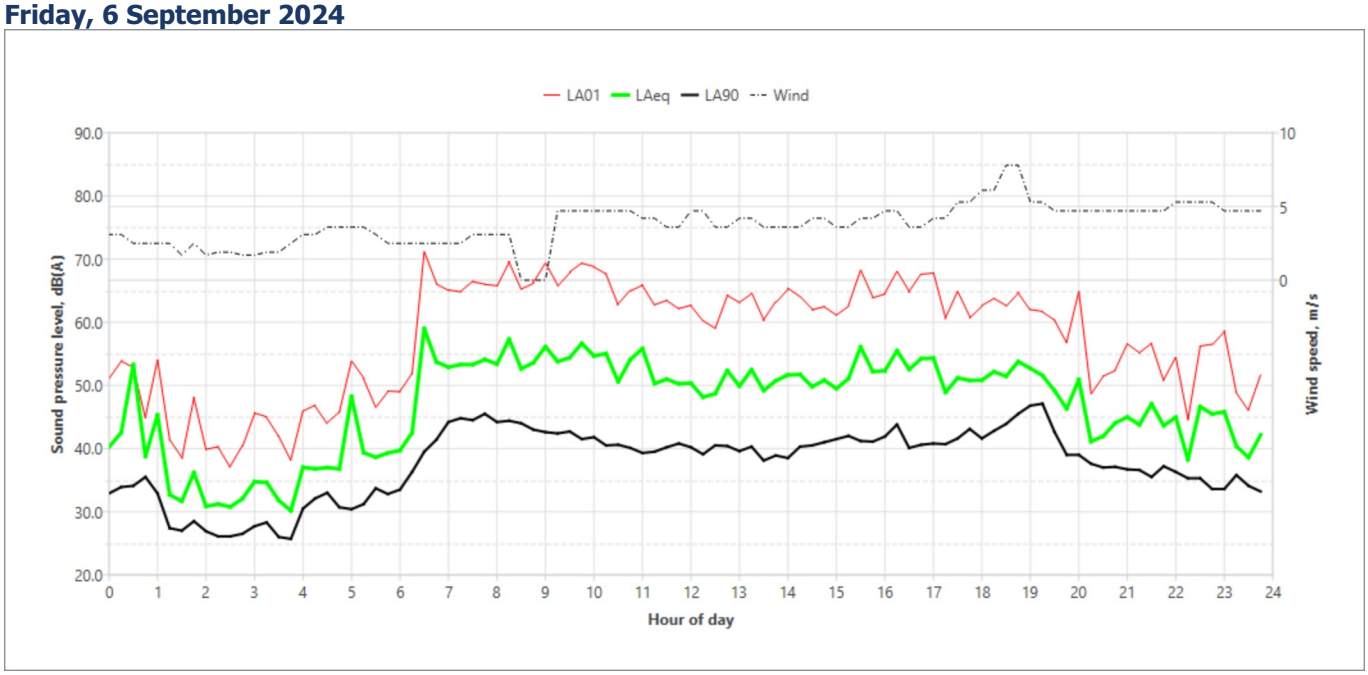

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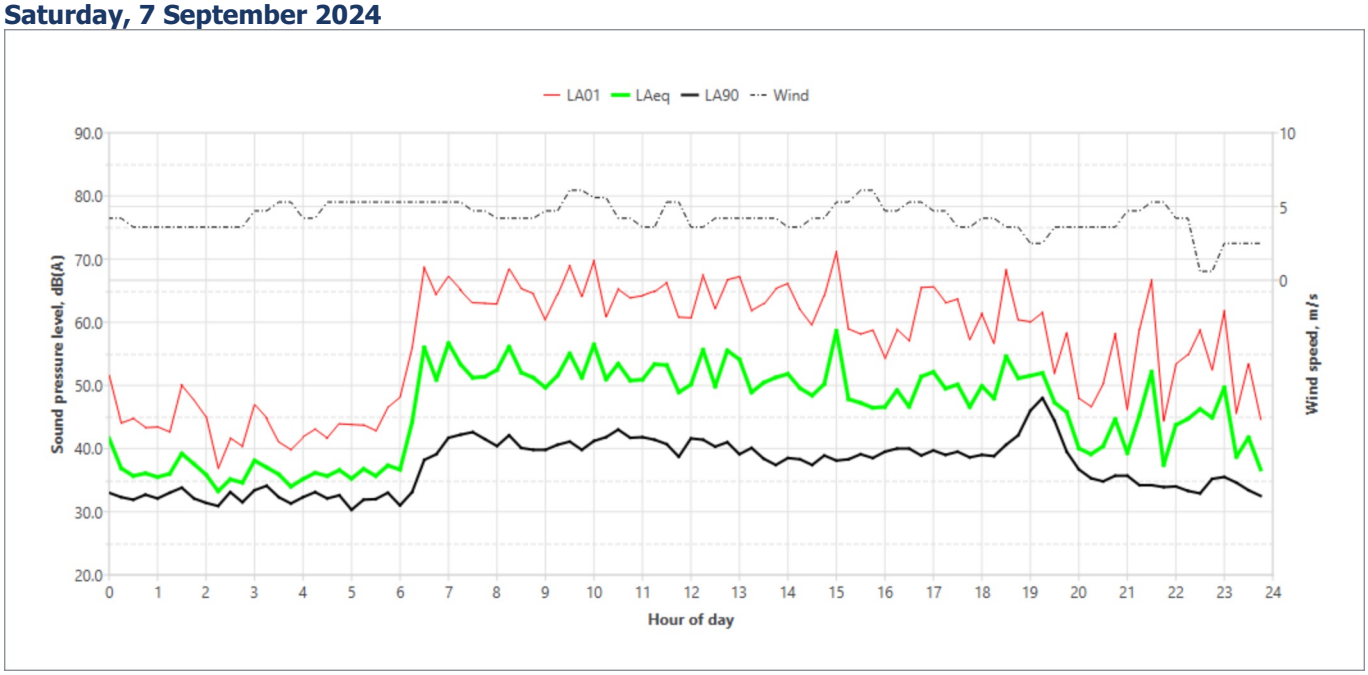

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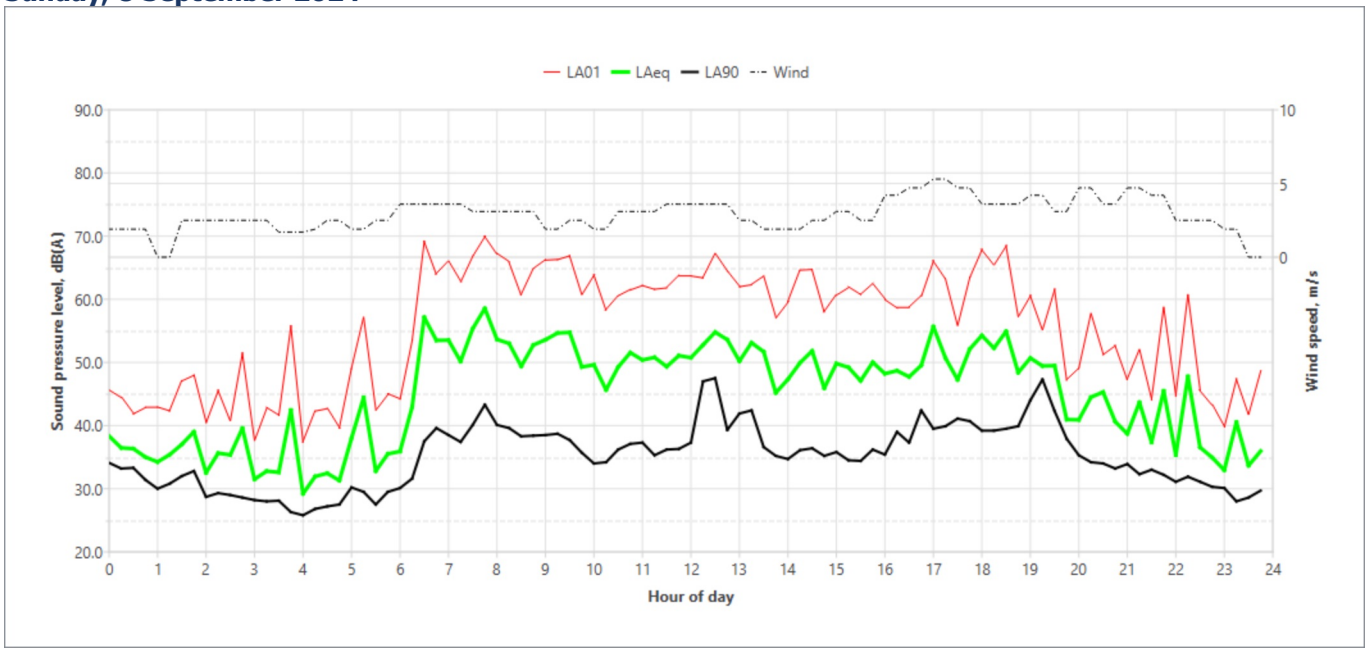


Logger Location 2: Corner of Kyogle Street & Wilson Street

7 Kyolge Street, Lismore

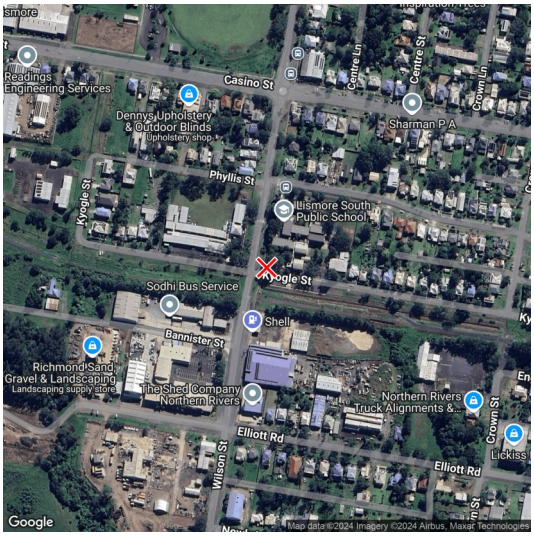
Ambient noise monitoring report

Item	Information
Logger Type	NL-42
Serial number	1000233
Address	7 Kyolge Street, Lismore
Location	7 Kyolge Street, Lismore
Facade / free field	Free field
Environment	

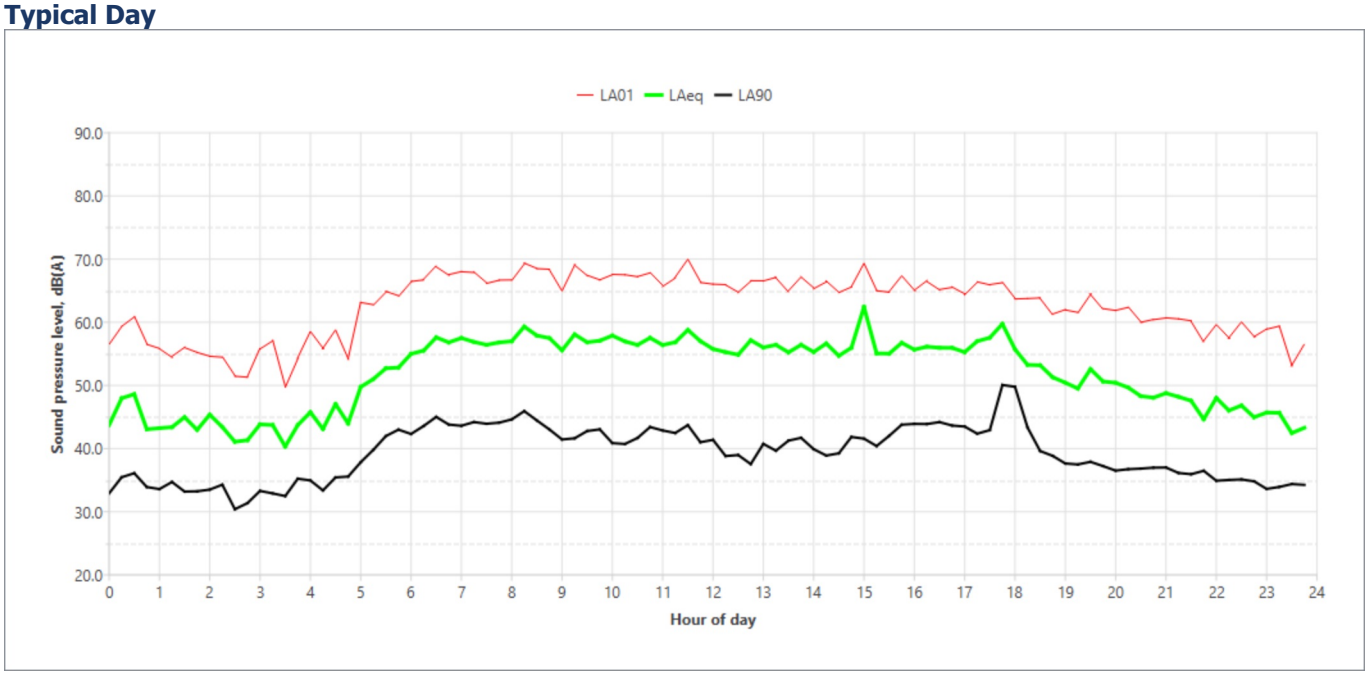
Measured noise levels

Logging date	Rating Background Level			$L_{Aeq,period}$		
	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am	Daytime 7am-6pm	Evening 6pm-10pm	Night-time 10pm-7am
Fri 23 Aug 2024	-	-	-	61	-	-
Sat 24 Aug 2024	-	36	-	57	52	47
Sun 25 Aug 2024	39	30	27	56	52	47
Mon 26 Aug 2024	-	-	-	60	-	55
Tue 27 Aug 2024	-	35	-	60	56	45
Wed 28 Aug 2024	-	-	-	61	-	54
Thu 29 Aug 2024	-	30	-	60	53	49
Fri 30 Aug 2024	-	-	-	60	-	55
Sat 31 Aug 2024	-	-	-	-	50	47
Sun 01 Sep 2024	40	37	26	56	51	47
Mon 02 Sep 2024	-	-	24	60	47	55
Tue 03 Sep 2024	-	32	26	60	54	53
Wed 04 Sep 2024	45	34	27	60	53	54
Thu 05 Sep 2024	44	38	26	60	52	53
Fri 06 Sep 2024	44	-	30	61	51	54
Sat 07 Sep 2024	-	37	-	58	52	46
Sun 08 Sep 2024	36	36	30	57	50	48
Summary	**42**	**35**	**26**	**59**	**52**	**52**

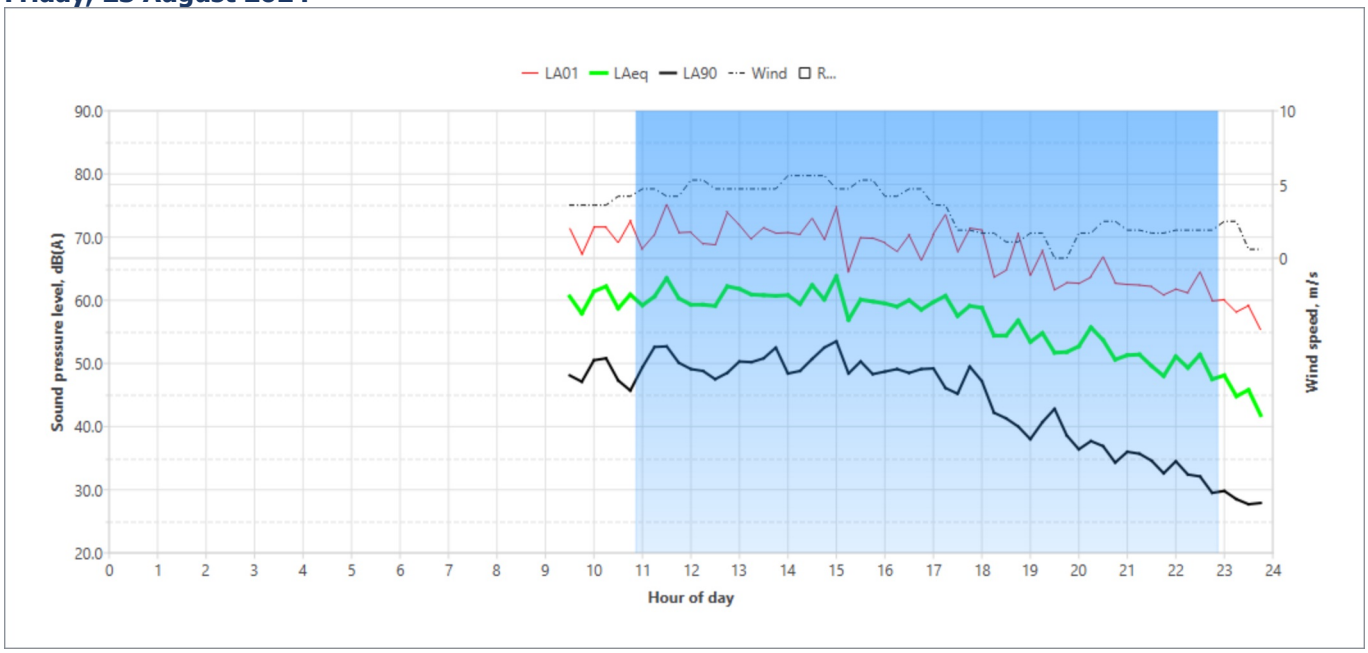
Note: Results with a '-' identify that there were not enough measurements available to correctly calculate the level, in accordance with the Noise Policy for Industry. The data has been excluded either from weather or manual exclusions. See the charts for more information

Logger location	Logger deployment photo
	

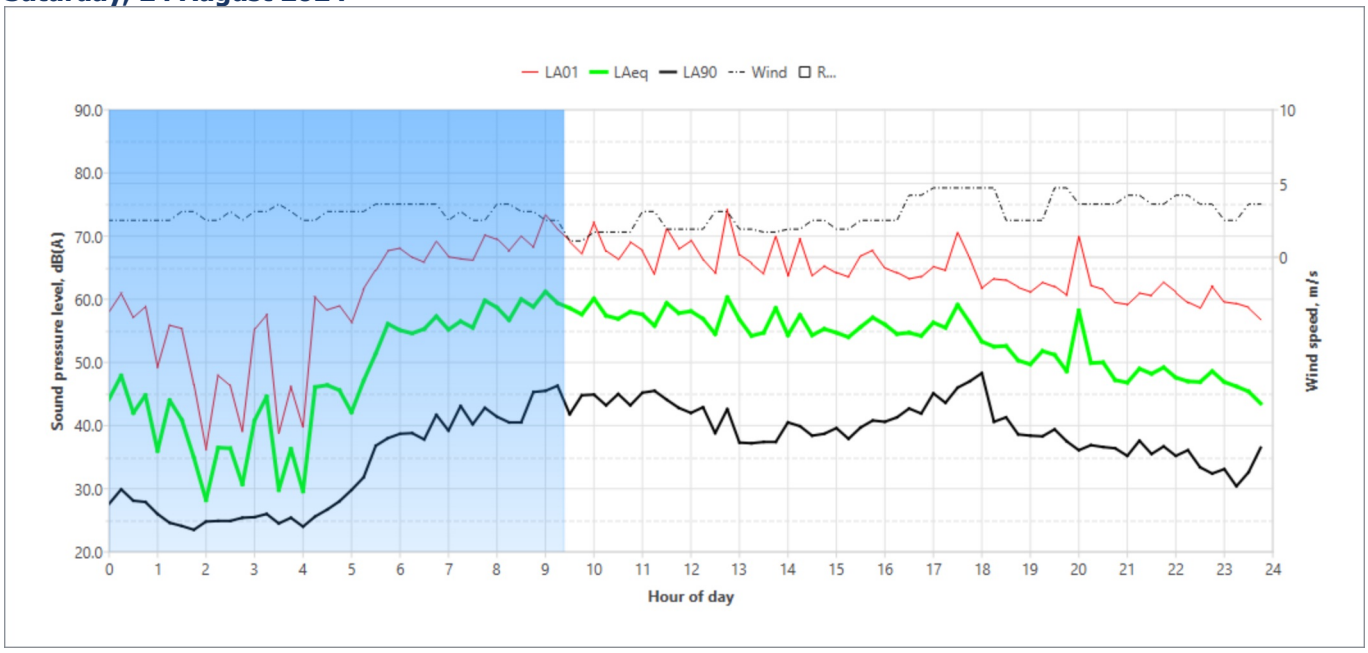
Typical Day



Friday, 23 August 2024

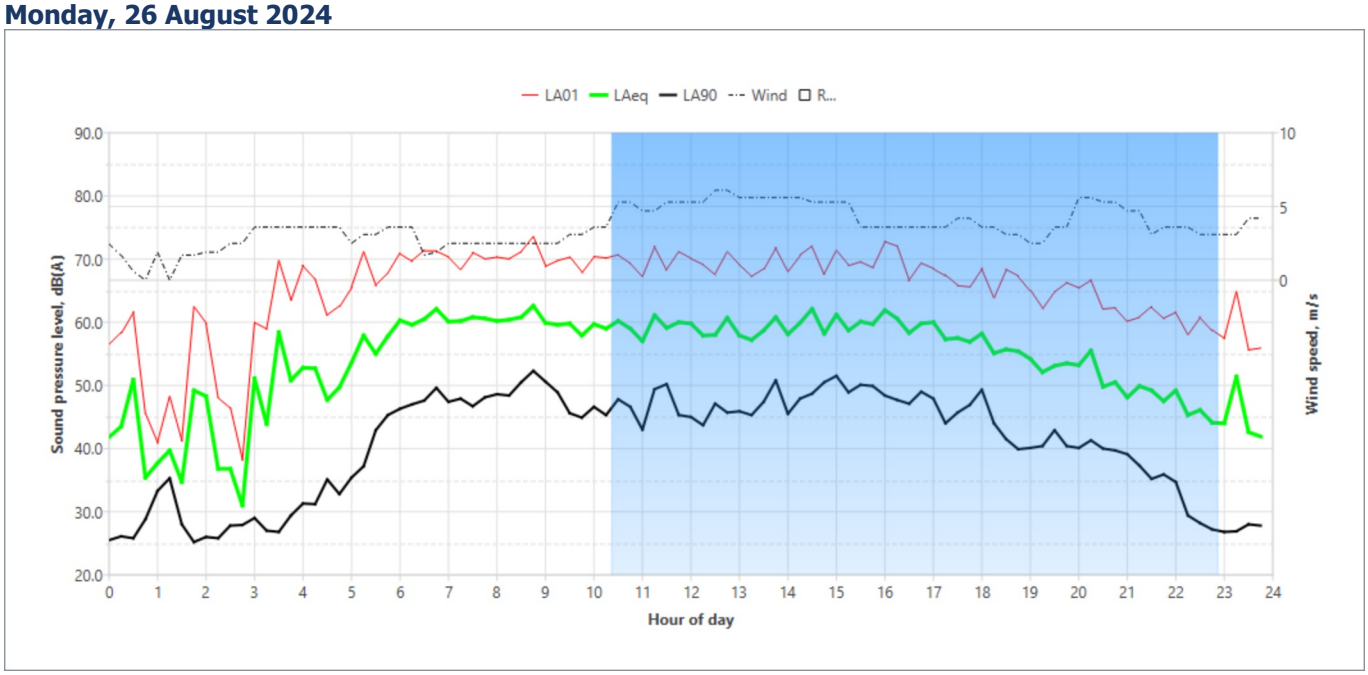


Saturday, 24 August 2024

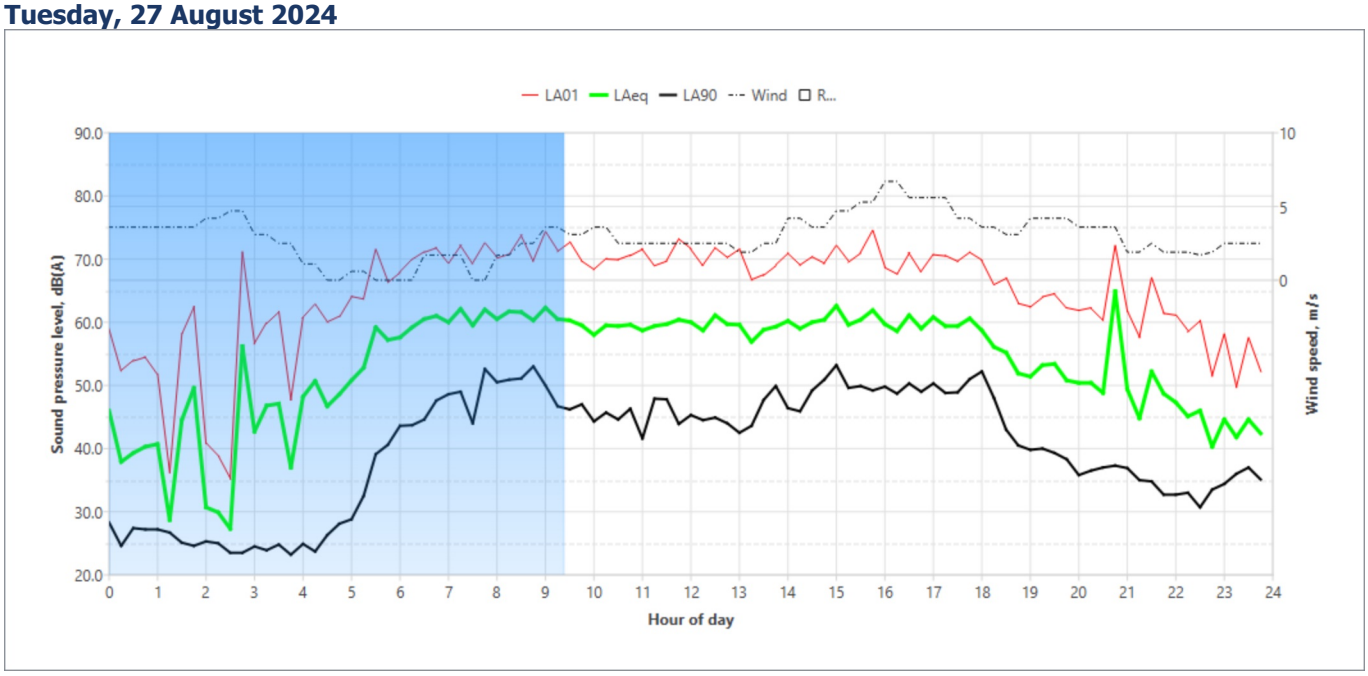


Sunday, 25 August 2024

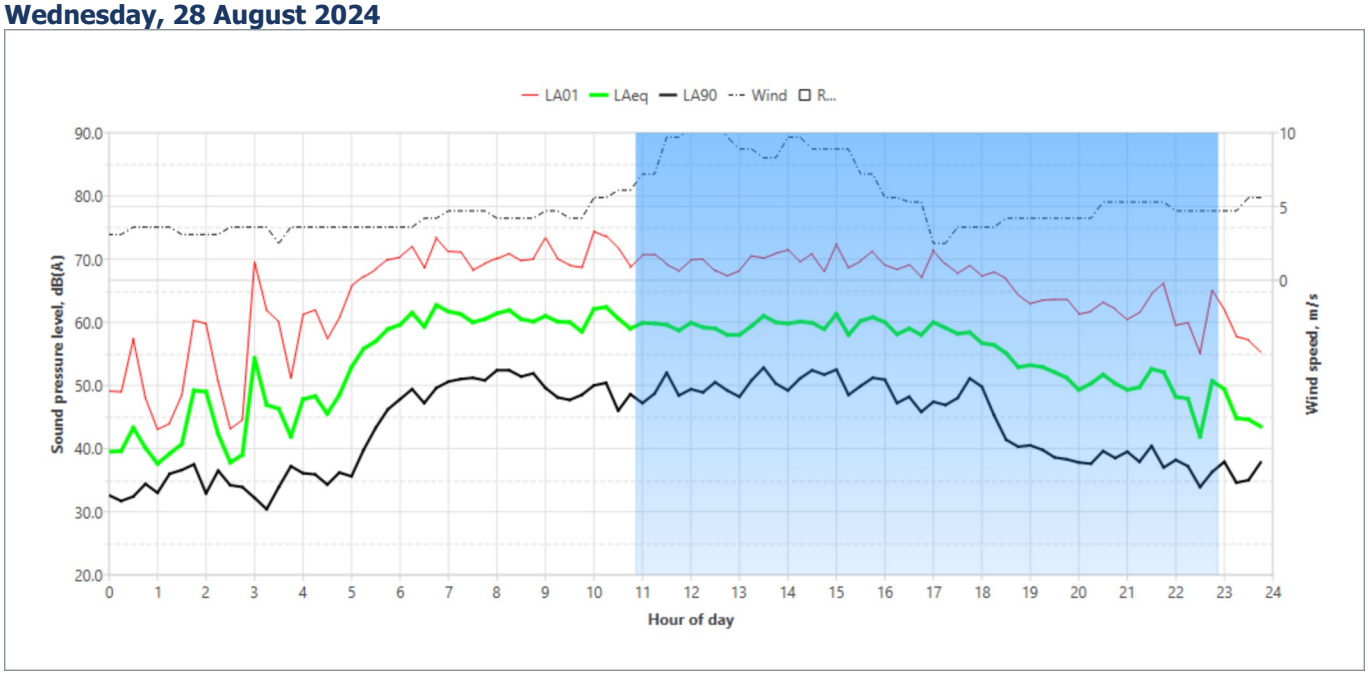
Monday, 26 August 2024



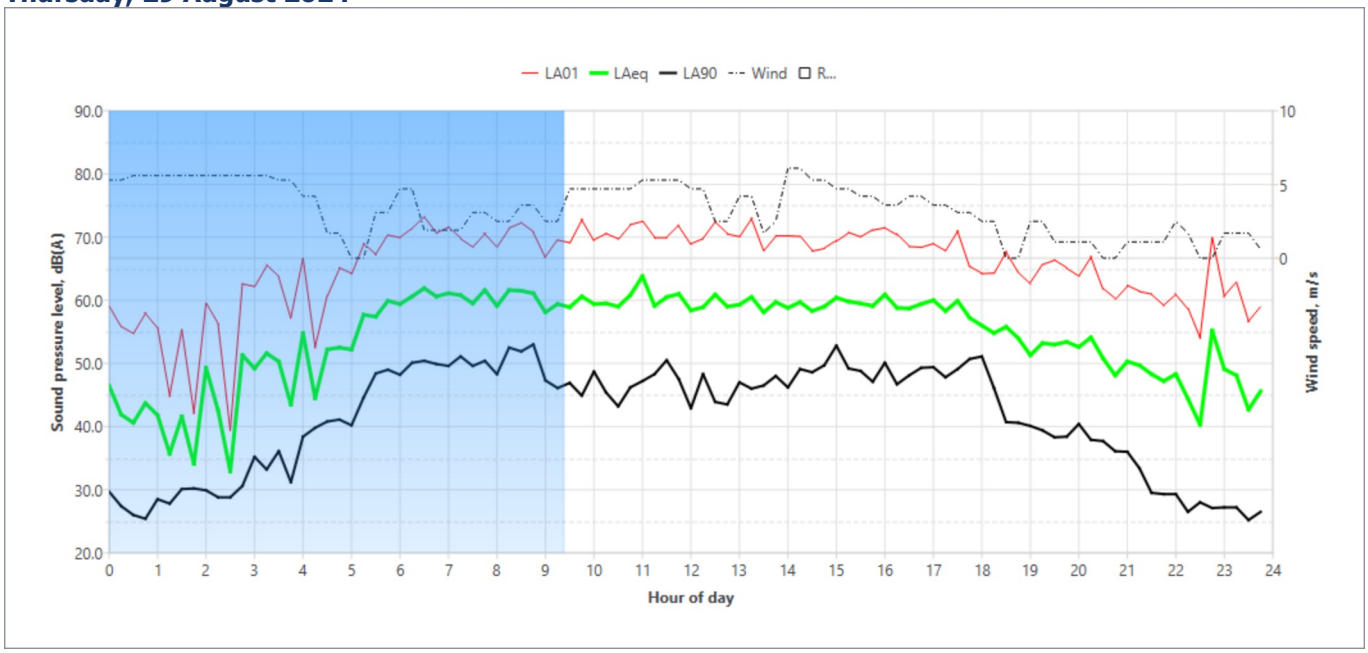
Tuesday, 27 August 2024



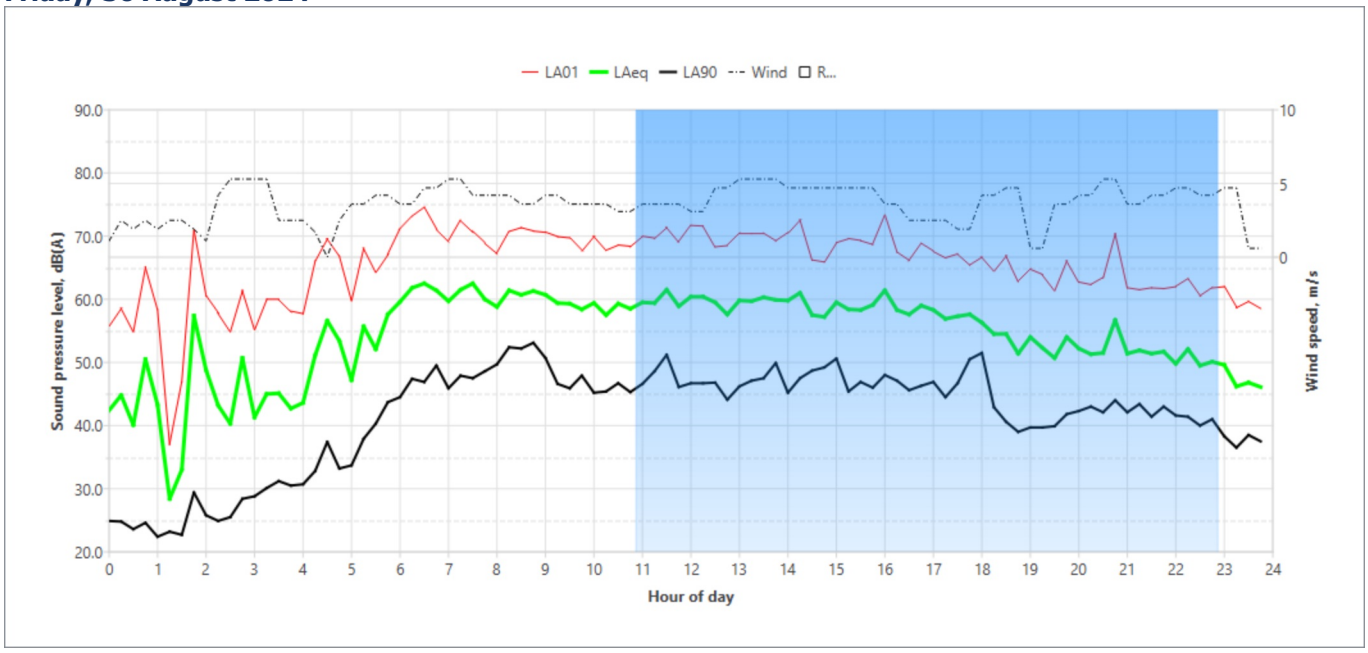
Wednesday, 28 August 2024



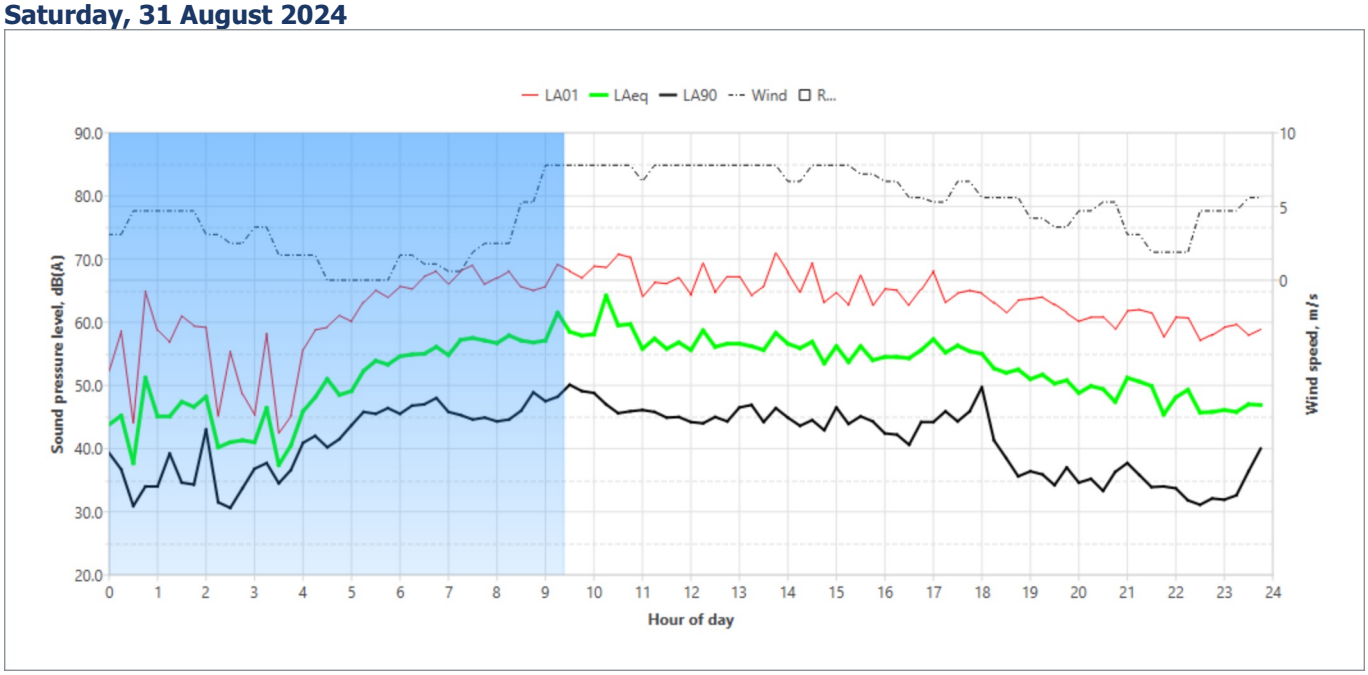
Thursday, 29 August 2024



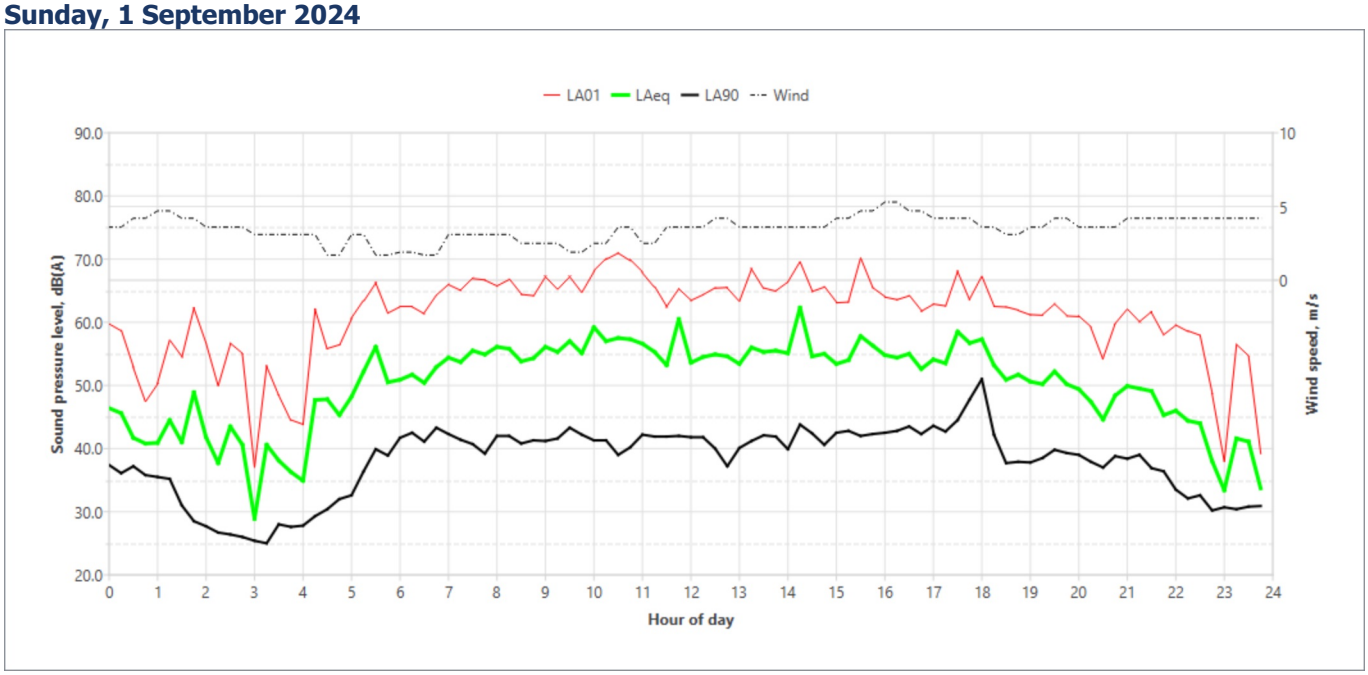
Friday, 30 August 2024



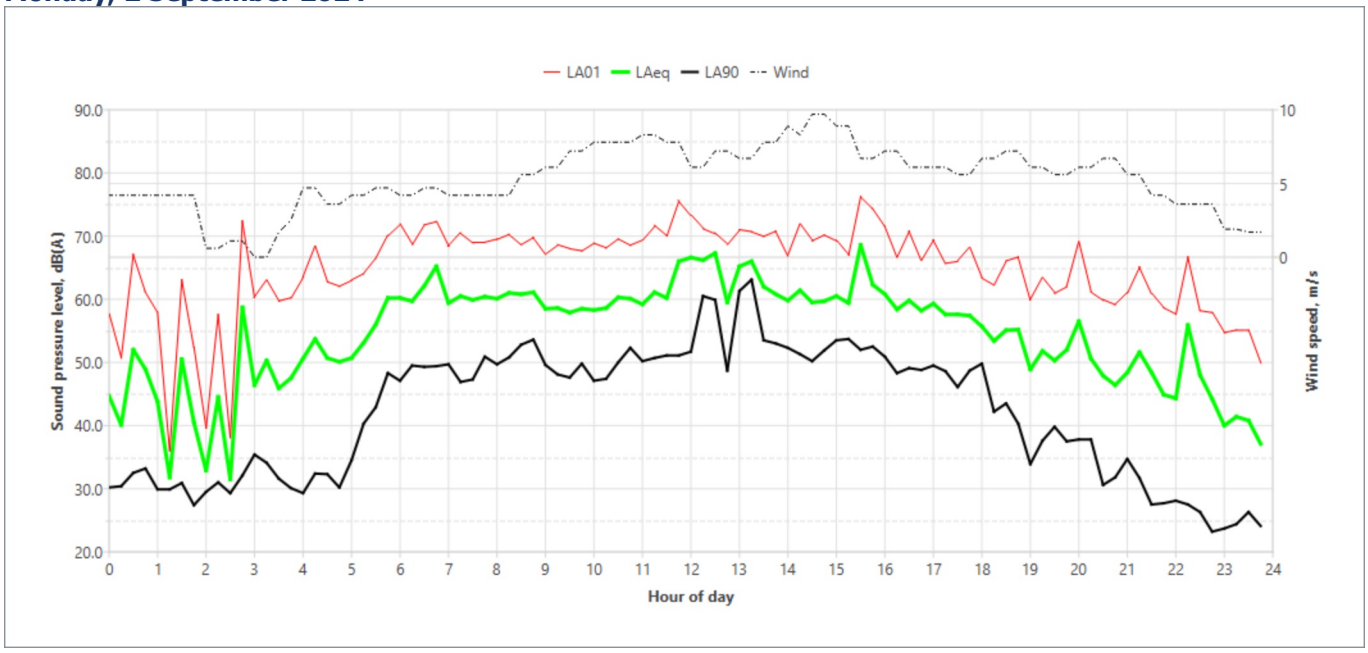
Saturday, 31 August 2024



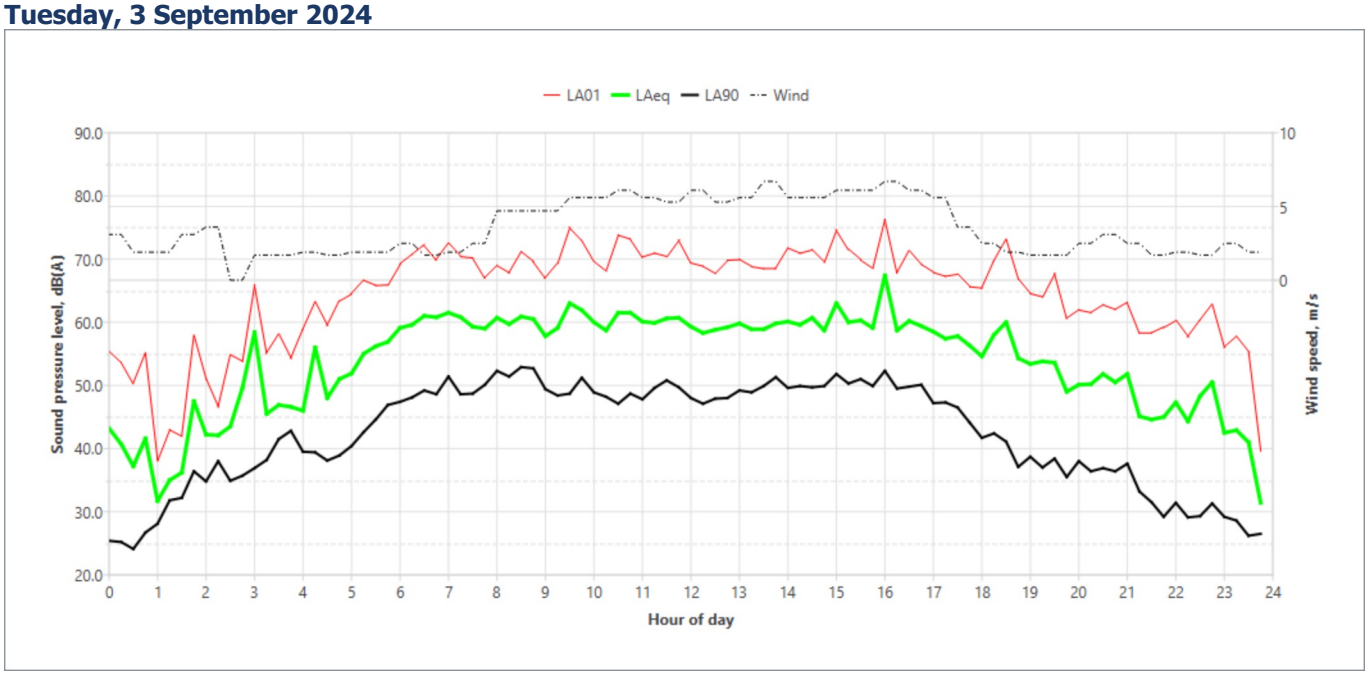
Sunday, 1 September 2024



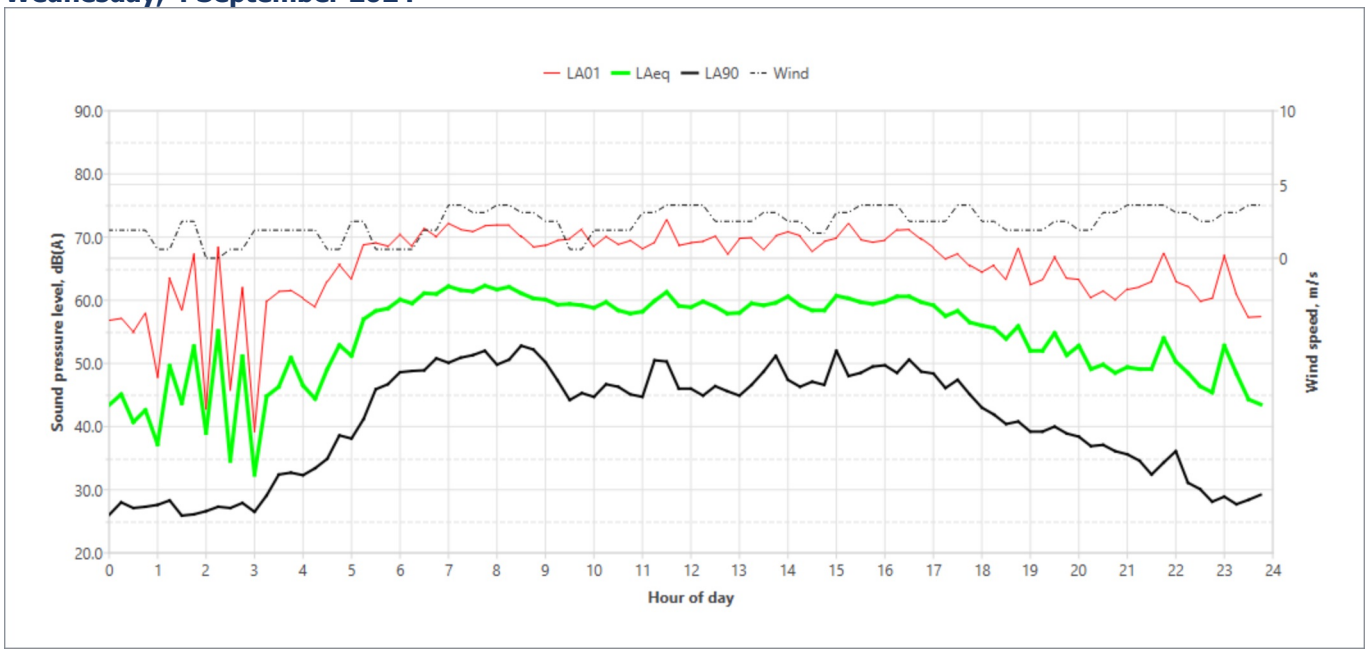
Monday, 2 September 2024



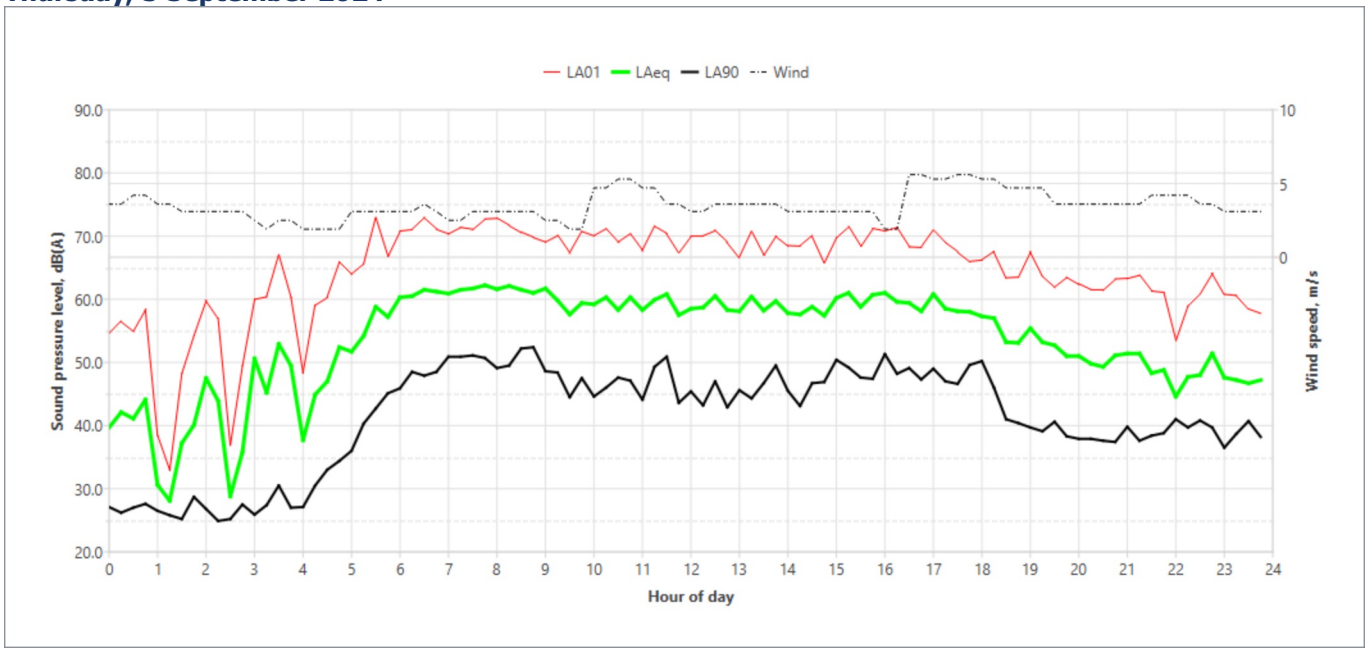
Tuesday, 3 September 2024



Wednesday, 4 September 2024

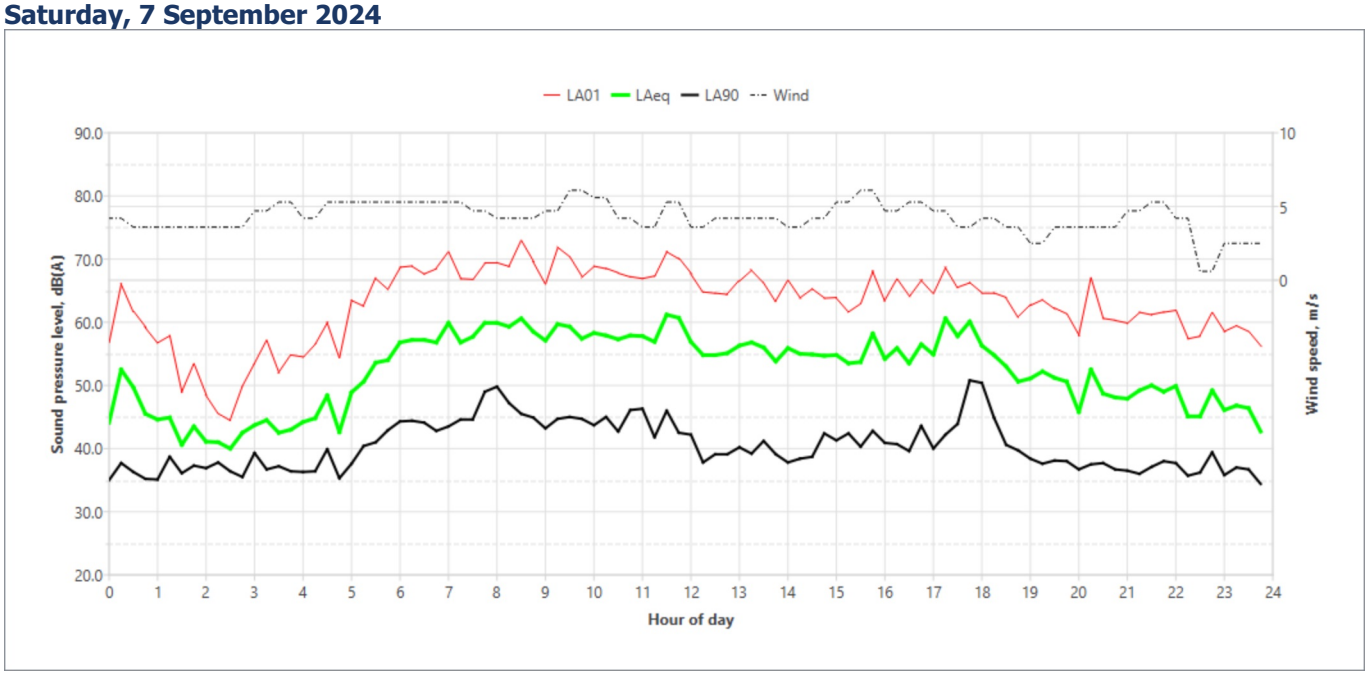


Thursday, 5 September 2024



Friday, 6 September 2024

Saturday, 7 September 2024



Sunday, 8 September 2024