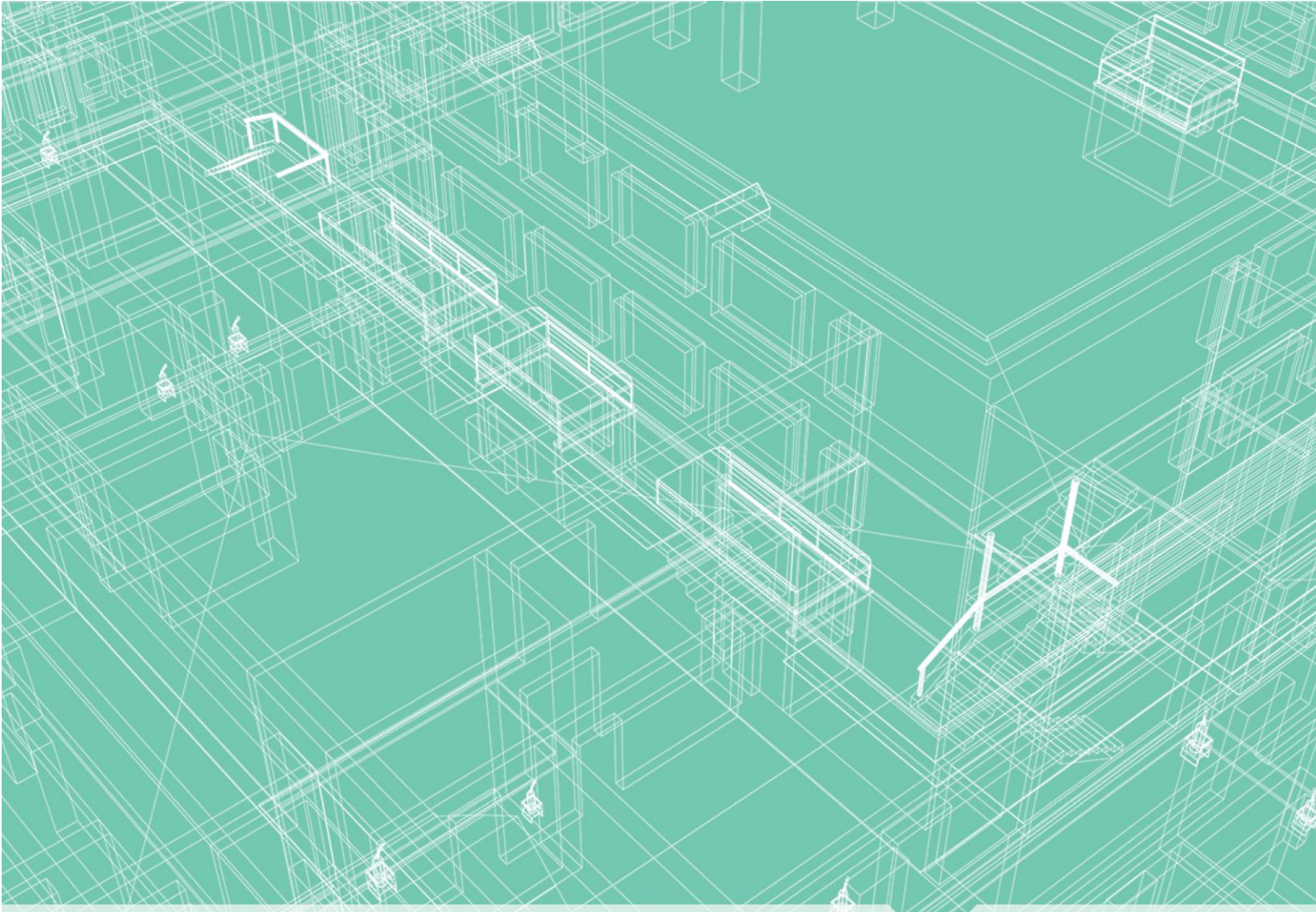

NOISE & VIBRATION IMPACT ASSESSMENT

IRRAWANG HIGH SCHOOL, 80 MOUNT HALL ROAD, RAYMOND TERRACE

ACOUSTIC SERVICES

JHA

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DOCUMENT CONTROL SHEET

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CONTENTS

1 INTRODUCTION

This noise & vibration impact assessment has been prepared by JHA Consulting Engineers on behalf of the APP group for School Infrastructure NSW (SINSW) (the Applicant) and it accompanies the Development Application for the new buildings plus alterations and additions of existing buildings, located within Irrawang High School at 80 Mount Hall Rd, Raymond Terrace NSW 2324.

The proposal seeks to upgrade the Irrawang High School to provide improved facilities to meet the educational needs of staff and students. This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Establish appropriate noise criteria based on previous noise surveys conducted by JHA Consulting Engineer, in accordance with the relevant standards, guidelines and legislation for the following noise emissions:
  - Mechanical plant from the development to the surrounding receivers.
  - Public address and school bell systems.
  - Traffic noise generation.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.

The following documentation has been used for the preparation of this report:

- Architectural drawings prepared by EJE Architects, dated 25/08/2022.
- Noise data collected on site through the use of noise loggers and a handheld spectrum analyser by JHA Consulting Engineers.
- Irrawang High School Transport Planning Services by Stantec, dated January 2023

This document and related work have been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015 respectively.

2 DESCRIPTION OF THE PROPOSAL

2.1 PROPOSED WORKS

The proposal seeks to upgrade the Irrawang High School to provide improved facilities to meet the educational needs of staff and students. The proposed upgrade plan is shown below in Figure 1. There will not be any increase in student number capacity.

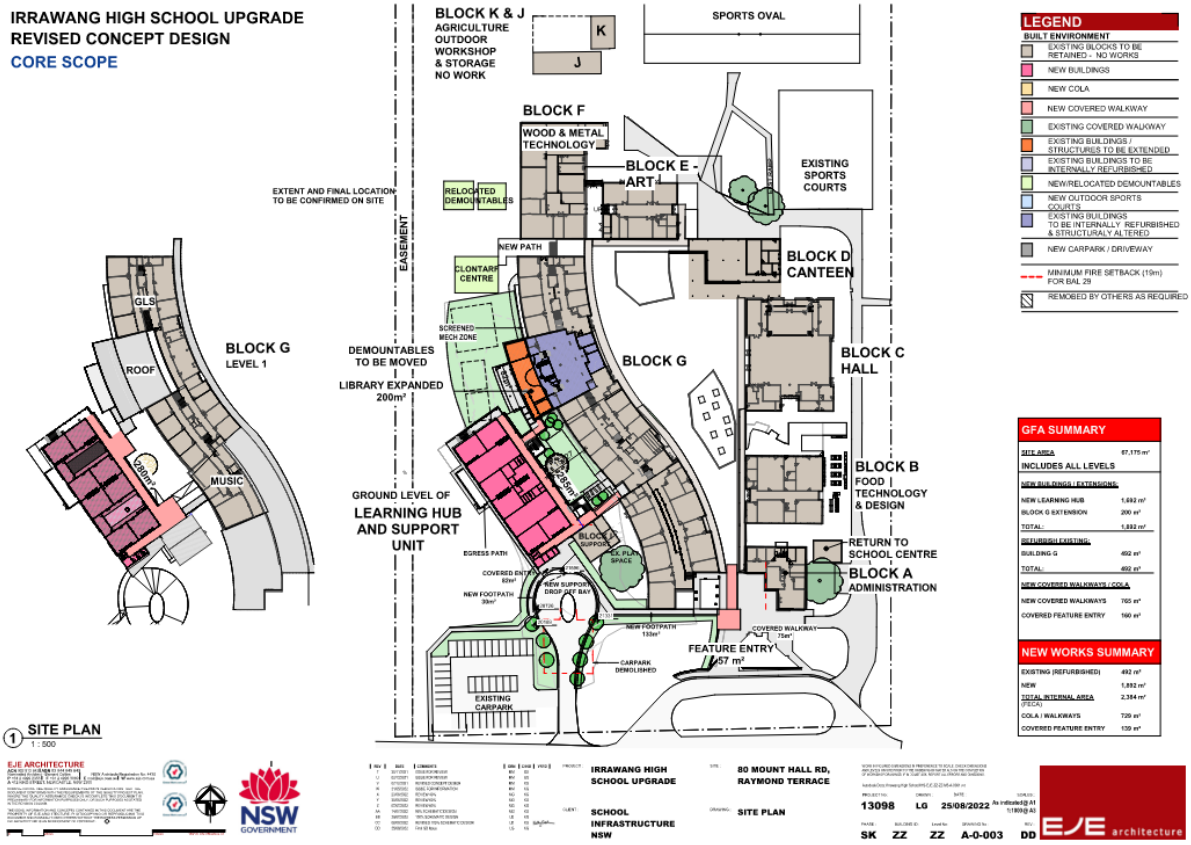


Figure 1: Proposed ground floor and level 1 architectural layout (Source: EJE Architecture).

2.2 LOCATION / SITE DESCRIPTION

Raymond Terrace is a town in the Hunter Region of New South Wales, Australia. The existing Irrawang High School site is located at 80 Mount Hall Rd, Raymond Terrace NSW 2324 and legally known as Lot 02/DP584122 and Lot 01/DP584122.

The site contains the existing Irrawang High School and is currently surrounded by low density residential receivers and public recreational areas. The surrounding land uses are as follows:

- *North*: (R2) Low Density Residential.
- *East:* (R2) Low Density Residential and (RE1) Public Recreation.
- *South:* (R2) Low Density Residential.
- *West:* (R2) Low Density Residential and (RE1) Public Recreation.

Figure 2 shows the site boundary of the Irrawang High School site and the surrounding sensitive receivers.

Figure 2: Nearest noise sensitive receivers surrounding the site location

2.3 SURROUNDING RECEIVERS

A summary of the nearest noise sensitive receivers surrounding the site is shown in Table 1 including approximate distances to the receiver boundaries.

ID	*Sensitive Receiver*	*Receiver Type*	*Approx. Distance, m*
1	23 Oxley Cl	Residential	<5
2	62 Mount Hall Rd	Active recreation	<5
3	83 Mount Hall Rd	Residential	20
4	2 Pyers Cl	Residential	<5
5	18 Macquarie Cl	Active recreation	<5
6	22 Robert Campbell Dr	Residential	<5
7	131 Benjamin Lee Dr	Residential	<5

Table 1: Nearest sensitive receivers surrounding the site.

It is noted that if noise impacts associated with the proposed development are controlled at the nearest noise-sensitive receivers (as identified above) then compliance with the recommended criteria at all noise-sensitive receivers will be achieved. The nearest residential receiver will be used for assessment purposes for the residential and public recreation catchments.

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys were conducted in the locations shown in Figure 3 to establish the ambient and background noise levels of the site and surrounds. JHA Consulting Engineers carried out the noise surveys, in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

Figure 3: Noise survey locations and boundary of the site.

3.2 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out from Tuesday 14th to 23rd February 2023 with Rion NL-52 noise loggers (Serial Numbers: 1173624). The noise loggers recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise loggers was checked before and after use and no deviations were recorded.

The noise logger location is shown in Figure 3. The location was secured and is considered to be representative of the typical ambient and background noise levels. The noise logger microphone was mounted 1.5 metres above the ground and windshields were used to protect the microphones. Weather conditions were monitored during the unattended noise monitoring period and generally were calm and dry during the unattended monitoring.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW EPA Noise Policy for Industry (NPI) 2017, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

The Rating Background Levels (RBLs) have been established in general accordance with the methodology described in the NSW NPI – i.e., 10th percentile background noise level (L_{A90}) for each period of each day of the ambient noise level. The median of these levels is then presented as the RBL for each assessment period.

These RBLs are shown in Table 2, together with the ambient noise levels (L_{Aeq}) measured for each period.

Location	*Rating Background Levels, dB(A)*		
	Day (7am-6pm)	*Evening (6pm-10pm)*	*Night (10pm-7am)*
M1	39	39	35

Table 2: Results of long-term noise monitoring.

3.3 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative third-octave band noise levels of the site on Thursday 23rd February 2023, during the day-time period. Short-term noise measurements were carried out with a NTi XL-2 hand-held Sound Level Meter (SLM) (Serial Number A2A-13742-E0). The calibration of the SLM was checked before and after each use, and no deviations were recorded.

The SLM microphone was mounted 1.5 metres above the ground, and a windshield was used to protect the microphone. Measurements were undertaken in the free field – i.e., more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB (re 20µPa)*								
			Overall dB(A)	*Octave Band Centre Frequency, Hz*							
				63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
L1	23rd February 2023, 12.25pm to 12.40pm	$L_{90,15min}$	**50**	53	48	45	45	46	43	41	37
		$L_{eq,15min}$	**64**	65	59	54	54	56	52	61	50
		$L_{10,15min}$	**69**	65	61	58	58	60	55	67	55
L2	23rd February 2023, 12.44pm to 12.59pm	$L_{90,15min}$	**51**	56	48	40	43	48	44	37	29
		$L_{eq,15min}$	**57**	65	57	49	49	51	48	53	45
		$L_{10,15min}$	**62**	67	59	50	51	53	49	59	51

Table 3: Results of short-term noise monitoring.

3.4 TRAFFIC NOISE MONITORING

The traffic noise monitoring from the surrounding road network were measured at location M1 (refer to Figure *3*) and is summarised in Table *4* below.

Location	*Measured Traffic Noise Levels, dB(A)*	
	Day (7am-10pm)	*Night (10pm-7am)*
M1	57	52

Table 4: Results of unattended long-term noise monitoring for traffic.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Noise Emissions
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - NSW Environment Protection Authority (EPA), Noise Guide for Local Government (NGLG) 2013.
  - Port Stephens Development Control Plan 2022 (PS-DCP).
  - Port Stephens Local Environmental Plan 2013 (PS-LEP).
  - NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017.
- Transport Noise
  - NSW DECCW, Road Noise Policy (RNP) 2011.
- Construction Noise and Vibration
  - NSW DECCW, Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC, Assessing Vibration: A Technical Guideline 2006.
  - NSW Road Maritime Service (RMS), Construction Noise and Vibration Guideline 2016.
  - Australian Standard AS 2436:2010 '*Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites*'.
  - NSW EPA, Draft Construction Noise Guideline 2020.

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"...

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

..."

4.3 NOISE GUIDE FOR LOCAL GOVERNMENT

NGLG 2013 is a guideline that is at aimed at councils and planners to provide guidance in the management of local noise problems and in the interpretation of existing policy and legislation.

Table 1.3 of NGLG 2013 contains the management for common neighbourhood noise issues and describes the Environmental Protection Agency (EPA) as the Appropriate Regulatory Authority (ARA) for public educational facilities.

NGLG 2013 provides a checklist to determine an "offensive noise". The offensive noise test aids in making a systematic judgment about the offensive nature of noise emissions. The NGLG 2013 offensive noise test considers that noise may be offensive in three ways, according to:

- Audibility.
- Duration.
- Inherently offensive characteristics.

4.4 PLANNING FRAMEWORK

PS-LEP 2013 sets the land zoning of the site and surroundings as shown in Figure 4. The land zoning category of the site is identified as R2 (low density residential) as per the information extracted from PS-LEP 2013 map 6400_COM_LZN_002C_020_20200616.

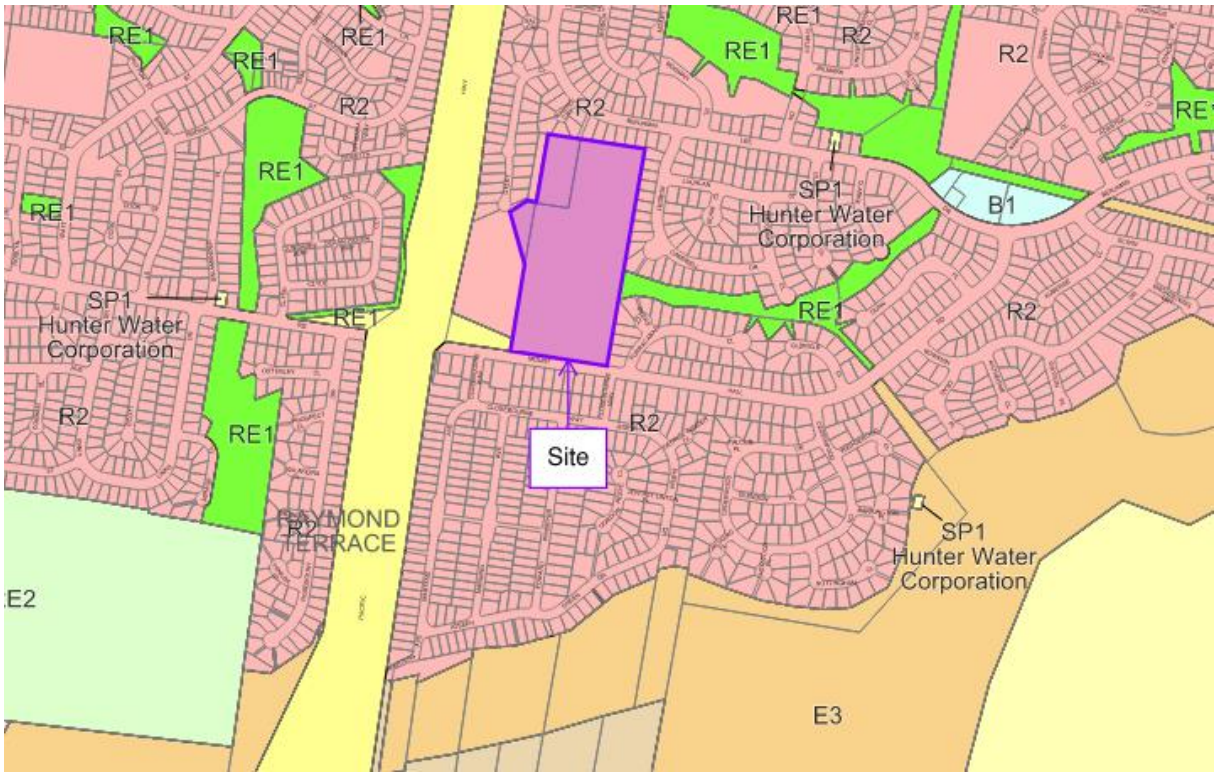


Figure 4: Land zoning of the site (purple outline) and surroundings.

PS-DCP 2022 has been reviewed for any relevant noise requirements or criteria for the proposed development. There are no specific noise level criteria, but rather sections of the DCP provide general planning strategies.

4.5 OPERATIONAL NOISE

4.5.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent of the two criteria sets the Project Noise Trigger Level (PNTL).

4.5.1.1 Intrusiveness Criteria

The NSW NPI defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, and does not exceed the background noise level by more than 5dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the measured background noise levels on site conducted, Table 5 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Rating Background Level dB(A)*	*Intrusiveness Criterion dB(A)*
Residential Properties (1, 3, 4, 6, 7)	Day	39	44
	Evening	39	44
	Night	35	40

Table 5: Determination of the intrusiveness criterion.

4.5.1.2 Amenity Criteria

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 6 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Recommended Amenity Noise Level ($L_{Aeq,period}$) dB(A)*	*Amenity Criterion ($L_{Aeq15min}$) dB(A)*
Suburban Residential Properties (R2)	Day	55	53 (55-5+3)
	Evening	45	43 (45-5+3)
	Night	40	38 (40-5+3)
Active Recreation	When In Use	55	53 (55-5+3)

Table 6: Determination of amenity criterion.

4.5.1.3 Project Noise Trigger Levels

The PNTL's are shown in Table 6 and have been obtained in accordance with the requirements of the NSW NPI. These shall be assessed to the most affected point of within the noise sensitive receiver boundary.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion dB(A)*	*Amenity Criterion dB(A)*
Residential Properties (1, 3, 4, 6, 7)	Day	44	53
	Evening	44	43
	Night	40	38
Active Recreation	When In Use	---	53

Table 7: PNTLs for noise sensitive receivers.

4.6 TRANSPORT NOISE

The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited up to 2.0dB above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

4.7 CONSTRUCTION NOISE AND VIBRATION

4.7.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the Management Level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. Table 8 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential Receivers	Noise affected / External	RBL+10	RBL+5
	Highly noise affected / External	75	N/A
Active Recreation	External	65	65
Existing Classrooms	Internal	45	45

Table 8: ICNG construction airborne noise criteria for noise sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) - internal
- Night: $L_{Aeq,15min}$ 35dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

4.7.2 VIBRATION CRITERIA

4.7.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document '*Assessing Vibration: A Technical Guideline*' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 '*Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting*'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 9 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-6}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 9: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 10 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, $m/s^{1.75}$*	
		Preferred	*Maximum*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80

Table 10: Intermittent vibration criteria applicable to the site.

4.7.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 *'Vibration in Buildings – Effects on Structures'* are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 11.

Structural type	*Vibration velocity, mm/s (Peak Particle Velocity - PPV)*				
	Foundation			*Plane of floor uppermost full storey in horizontal direction*	*Floor slabs, vertical direction*
	1Hz to 10Hz	*10Hz to 50Hz*	*50Hz to 100Hz*	*All frequencies*	*All frequencies*
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
Type 2: Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Type 3: Structures that because their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8	20

Table 11: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

5 NOISE INTRUSION ASSESSMENT

5.1 TRAFFIC NOISE

Traffic noise from Pacific Highway has the potential to impact upon the facades of the proposed development. In order to meet the EFSG DG11 internal noise levels requirements, JHA has carried out a review of traffic noise impacts and recommends the minimum glazing thickness for the buildings based on the noise monitoring conducted by JHA Consulting Engineers.

The following assumptions have been considered for the traffic noise impacts:

- Traffic noise levels for the assessment are as per measured levels on site. Refer to Section 0.
- Internal noise levels are predicted based on noise levels incident at the façade of each space, which are based on the above measurements.
- External glazing is the weakest elements of the façade, and solid sections of the façade are typically to provide a sound reduction index of R_W50.
- Calculations have been based on achieving the internal noise targets as per EFSG DG11.

To achieve the internal noise levels in accordance with EFSG DG11, based on the above assumptions, the following is required:

- External glazing to provide a minimum sound reduction index of R_W32. A 6.38mm laminated fixed single glazing system achieves the nominated sound reduction index.

Notwithstanding with the glazing recommendations provided above, the acoustic performance of the glazing and building façade shall be reviewed during the detailed design of the project once glazing and façade areas will be defined. The acoustic requirements are to be achieved based on the performance of the framing and glass together.

5.2 CONSTRUCTION NOISE

Currently a detailed construction program nor construction plant are not yet full defined. This section provides general recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed development.

Regarding likely noise impacts to the existing school premises, the NSW ICNG criterion is to achieve 45dB(A) internally. This can be approximated as an external noise level criteria of 55dB(A) with windows open. There are expected to be exceedances of the NSW ICNG criterion based on the noise level predictions which have assumed construction works within 15 metres as an onerous assumption. Noise levels to surrounding classrooms could potentially be up to 80-85dB(A) depending on how close the works are. A detailed CNVMP shall be prepared by the Head Contractor addressing the noise and vibration impacts during the construction stages when specific information around construction methodology and construction plant will be known, and to provide acoustic mitigation measures and management measures based on specific construction works, equipment and locations. The implementation of acoustic treatment to construction activities will reduce noise impacts.

Acoustic amelioration measures will be required due to the expected exceedances of the noise level criteria. Temporary shielding such as solid hoarding/acoustic curtains may reduce the expected noise impacts and is proposed as a noise control measure during construction. The location and extent of the shielding are to be defined in the detailed Construction Noise and Vibration Management Plan (CNVMP).

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.
  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Selecting plant and equipment with low vibration generation characteristics.
  - Operate plant in a quietest and most effective manner.
  - Where appropriate, limit the operating noise of equipment.
  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management*. Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling*. Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods, to reduce impact on examinations.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.

  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

6 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise emissions from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant.
- Noise emissions from School Bells & Public Address system.
- Noise emissions from traffic generation noise.

Each of these noise sources has been considered in the noise impact assessment. The noise impact assessments have also considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest background levels measured.

6.1 EXTERNAL MECHANICAL PLANT

Noise from mechanical plant from the proposed development should be controlled to ensure external noise emissions are not intrusive and do not impact the amenity of noise sensitive receivers. The noise emissions must meet the noise limits as set out in accordance with the NSW NPI.

Noise controls may need to be incorporated with the design of the mechanical plant to ensure that cumulative noise levels from plant to the nearest noise sensitive receivers meets the noise level criteria. Mechanical plant will operate continuously during school's operational hours and no night-time operation (10pm to 7am) has been considered for the noise assessment of the external mechanical plant.

At this stage, final mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest noise sensitive receivers meets the NSW NPI noise level criteria.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of mechanical plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation
  - Noise enclosures as required
  - Sound absorptive panels
  - Acoustic louvres as required
  - Noise barriers as required

Acoustic assessment of mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.

6.2 PUBLIC ADDRESS AND SCHOOL BELL SYSTEMS

Noise from proposed development public address and school bell systems should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of noise sensitive receivers. The school has an existing public address and school bell system which was included in the background noise measurements. No alteration is proposed for the systems.

At this stage, public address and school bell systems selections have been not made; therefore, it is not possible to undertake a detailed assessment of the public address and school bell noise emissions.

The EPA notes numerous reports of community concern arising from inadequate design and installation as well as inappropriate use of school public address and bell systems. EPA considers that appropriate design, installation and use of those systems can both:

- Meet the proponent's objectives of proper administration of the school and ensuring safety of students, staff and visitors, and
- Avoid interfering unreasonably with the comfort and repose of occupants of nearby residences.

The Public Address and School Bell Systems shall be designed, installed and operated such that the systems do not interfere unreasonably with the comfort and repose of occupants of nearby residences. It is anticipated that the noise impact to the nearest sensitive receivers will be negligible if following measures are implemented:

- Low-powered horn-type speakers shall be located and orientated to provide a good coverage of the school areas whilst being directly away from residences and near sensitive receivers. System coverage shall be reviewed during the detailed design phase.
- Speakers shall be mounted with a downward angle and as close to the floor as possible.
- The noise level of the systems shall be adjusted on site so they will be clearly audible on the school site without being excessive. The systems shall initially be set sot that the noise at nearby residences and sensitive receivers do not exceed noise level criteria.
- Once the appropriate noise level has been determined on site, the systems shall be limited to these noise levels so that staff cannot increase the noise levels.
- The systems shall be set so that it only occurs on school days.

6.3 STUDENT RELATED NOISE

There will not be any increase in student numbers at the school, therefore no additional noise impacts are expected due to student activities.

Based on the proposed upgrades, there is not expected to be any additional noise impacts to the surrounding residential receivers.

The potential addition of the northern entrance from Benjamin Lee Drive may result in additional noise impacts, depending on the number of students accessing it at any one time, and the noise levels generated. It is recommended that mitigation measures such as a solid fence screening to the adjacent residences and signage stating to minimise noise when using the entrance be considered.

It should be noted however the residences are currently exposed to noise from the existing playgrounds, and it is not expected the use of the northern entrance would result in offensive noise.

6.4 TRAFFIC GENERATION NOISE

As noted in Section 4.6, when considering land use redevelopment and the impact on sensitive land uses (residential / schools / hospitals / recreational) the NSW Road Noise Policy (RNP) states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant. The Irrawang High School Traffic Impact Assessment, prepared by Stantec[1], indicates no significant increase in traffic generation due to the development / extension of existing buildings in Irrawang High School. Therefore, the noise increase will be less than the maximum allowable increase of 2.0dB(A).

Based on the proposed development works and traffic impact assessment, it is not expected that there will be a significant increase in traffic volume and traffic related noise levels, and therefore the development should meet the NSW Road Noise Policy recommendations.

[1] Irrawang High School Traffic Impact Assessment, Rev 6, Stantec, 24 January, 2023

7 SUMMARY AND CONCLUSIONS

A noise and vibration impact assessment has been carried out for the Irrawang High School at Raymond Terrace, NSW. This report forms part of the documentation package to be submitted as part of the Development Application.

This report establishes relevant noise level criteria, details the acoustic assessment, and provides comments and recommendations for the proposed development. The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

Noise break-in from traffic noise has been assessed for the external glazing. A minimum sound insulation performance has been obtained to meet the internal noise level criteria as per EFSG DG11. Acoustic design of the façade, other external building elements and ventilation openings of the school will need to be considered throughout the design stages in order to meet the noise level criteria.

At this stage, mechanical plant selections have not been made. Therefore, a detailed noise assessment has not been able to be carried out. Acoustic assessment of the mechanical plant will be conducted during the design phase of the project in order to confirm any noise control measure requirements.

Recommendations have been provided to minimise the impact of external noise emissions associated with the public address and school bell systems of the proposed development to the nearest sensitive receivers. Note that there are no proposed alterations to the existing public address system.

Based on the proposed development works, it is not expected that there will be a significant increase in traffic volume and traffic related noise levels, and therefore the development should meet the NSW Road Noise Policy recommendations.

There will not be any increase in the number of students, therefore there will not be any additional noise impacts from students activities.

Based on the information presented in this report, relevant objectives will be satisfied, and therefore approval is recommended to be granted.

APPENDIX A: LONG-TERM NOISE MONITORING

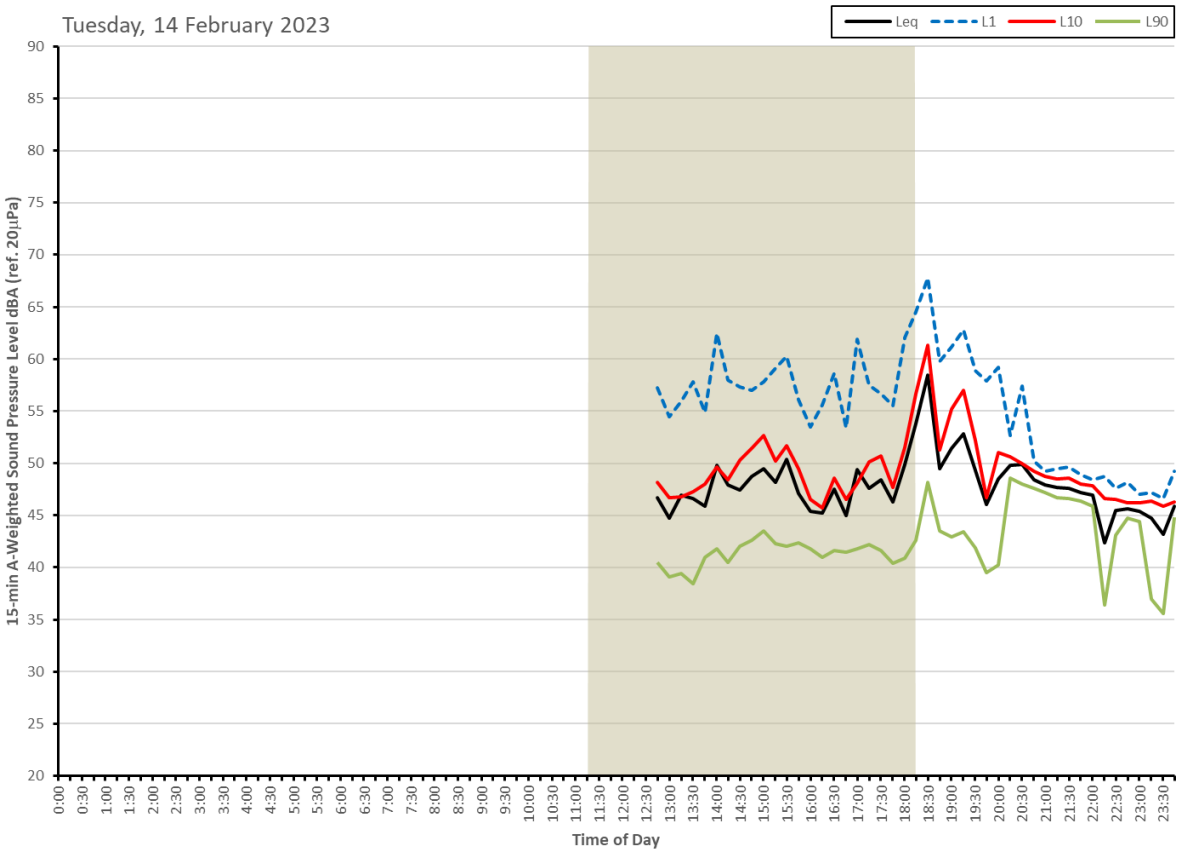
L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

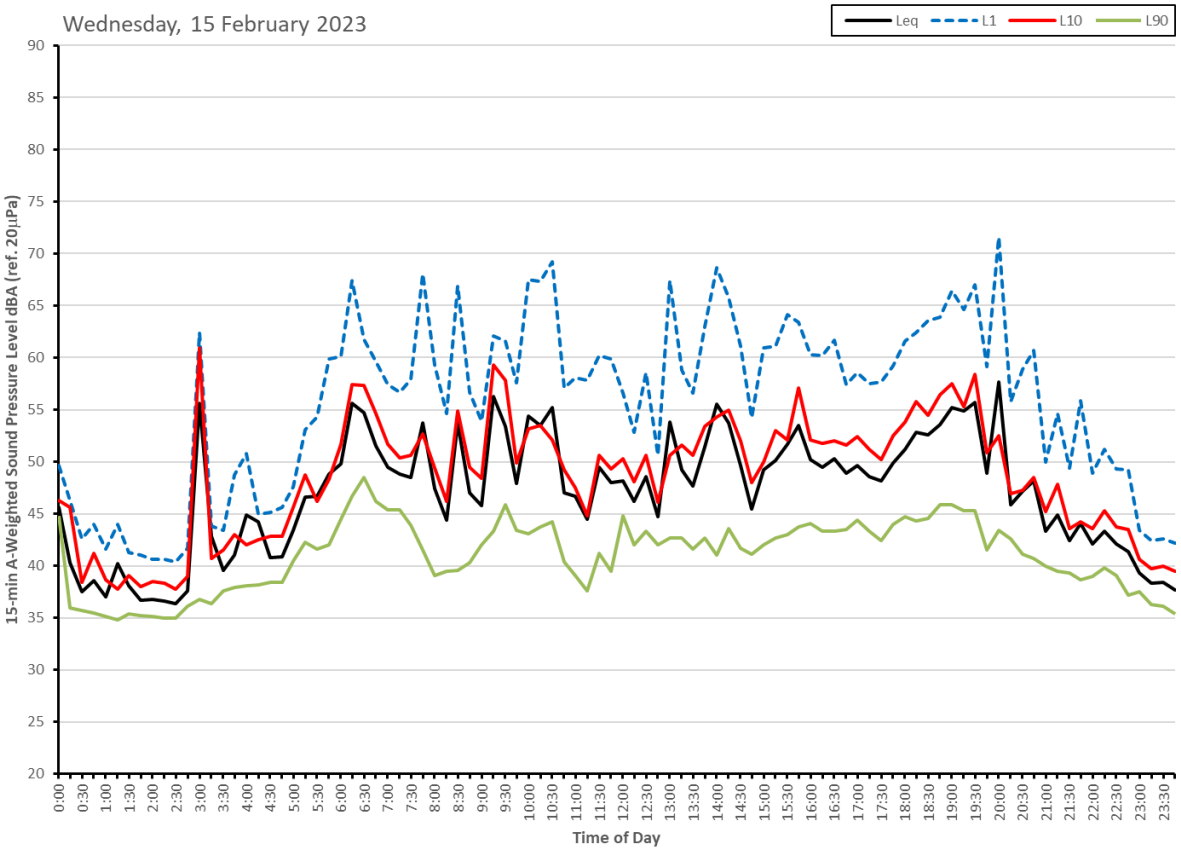
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

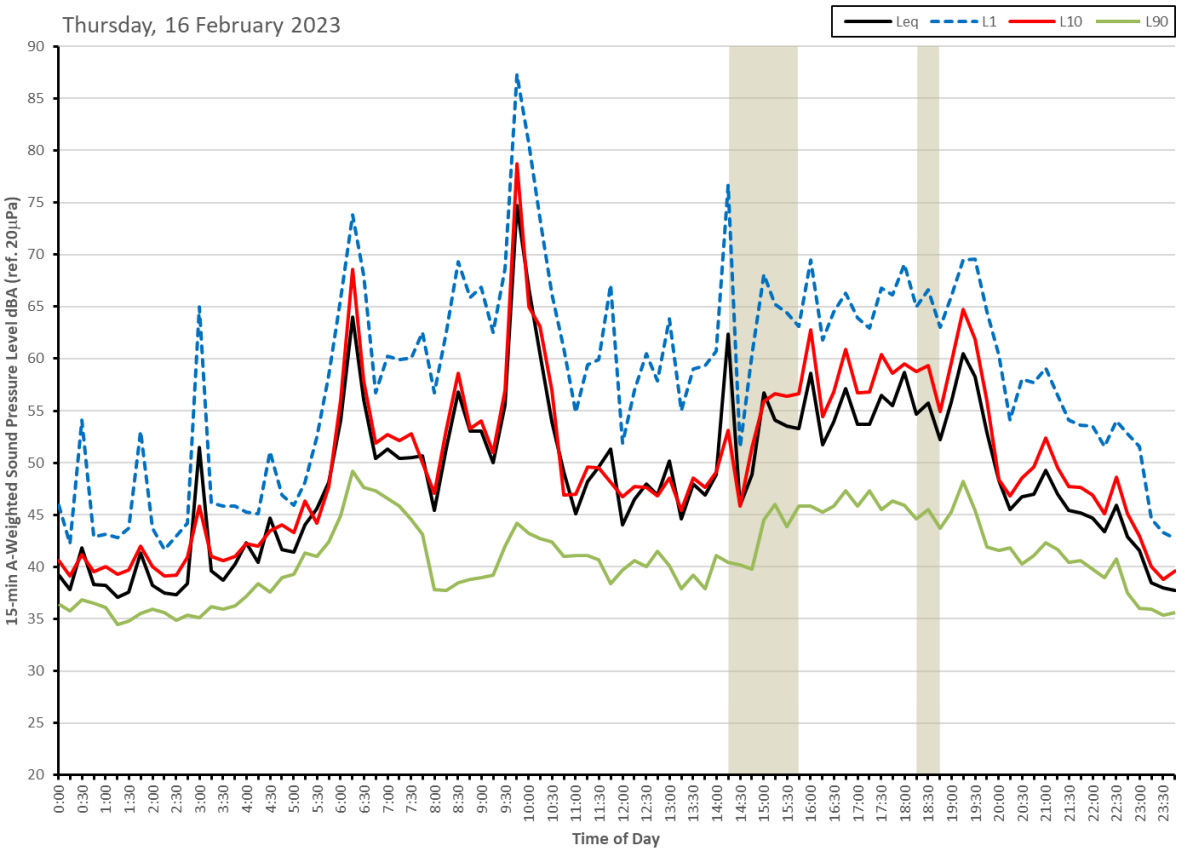
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

Noise Logger 1



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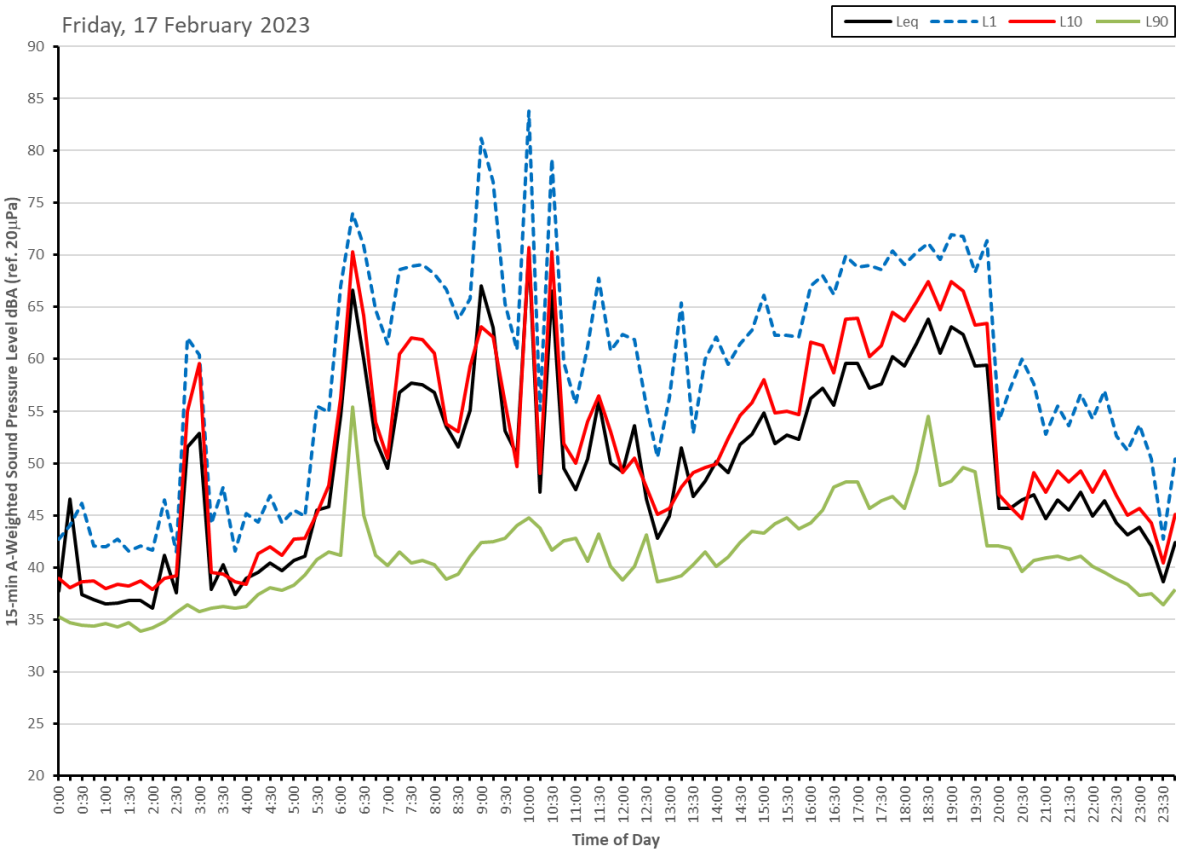
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day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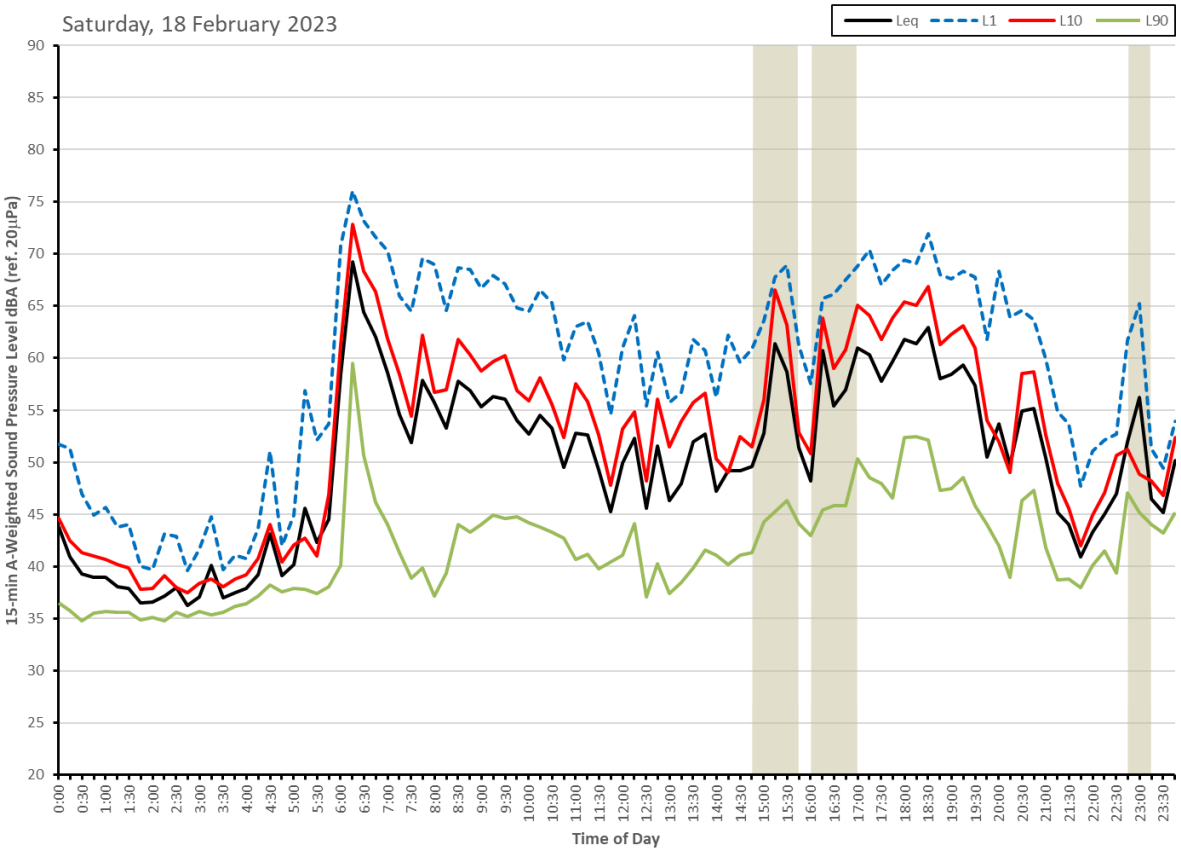
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day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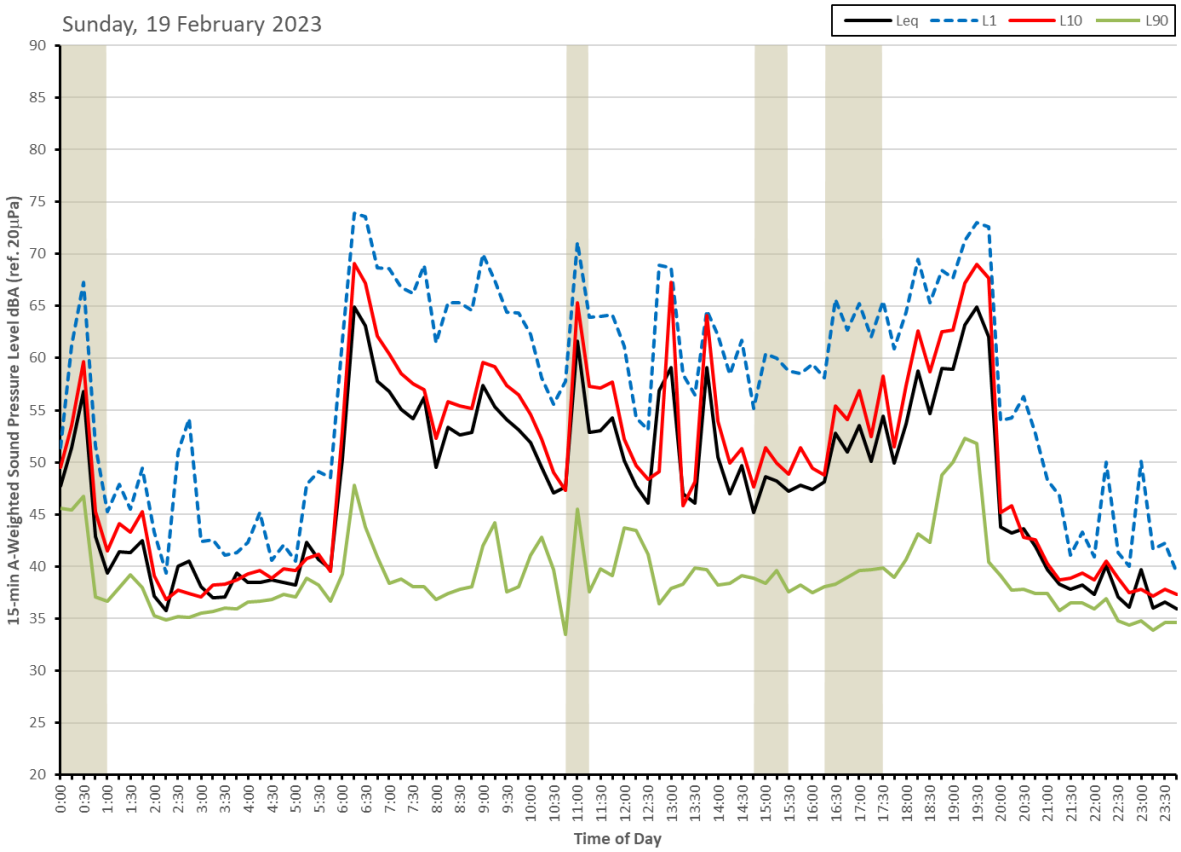
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day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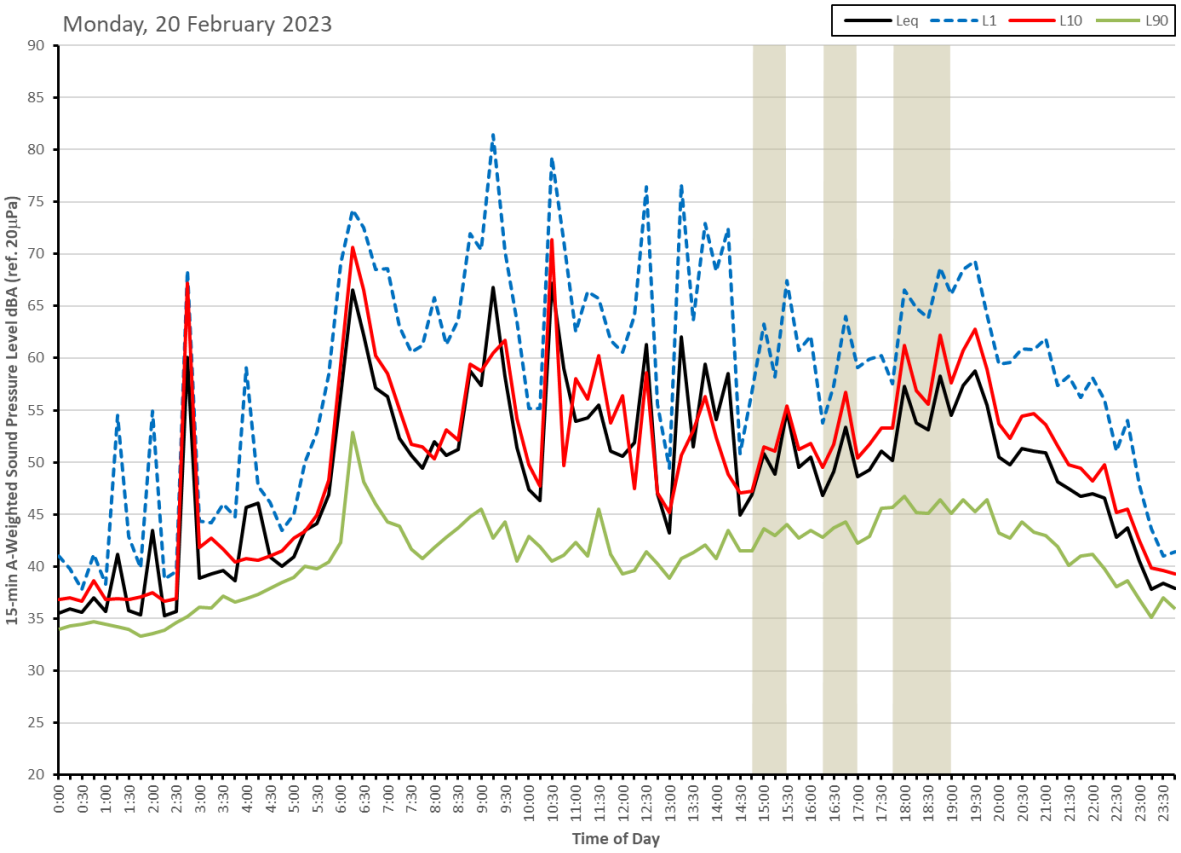
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day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L1
L10
L90
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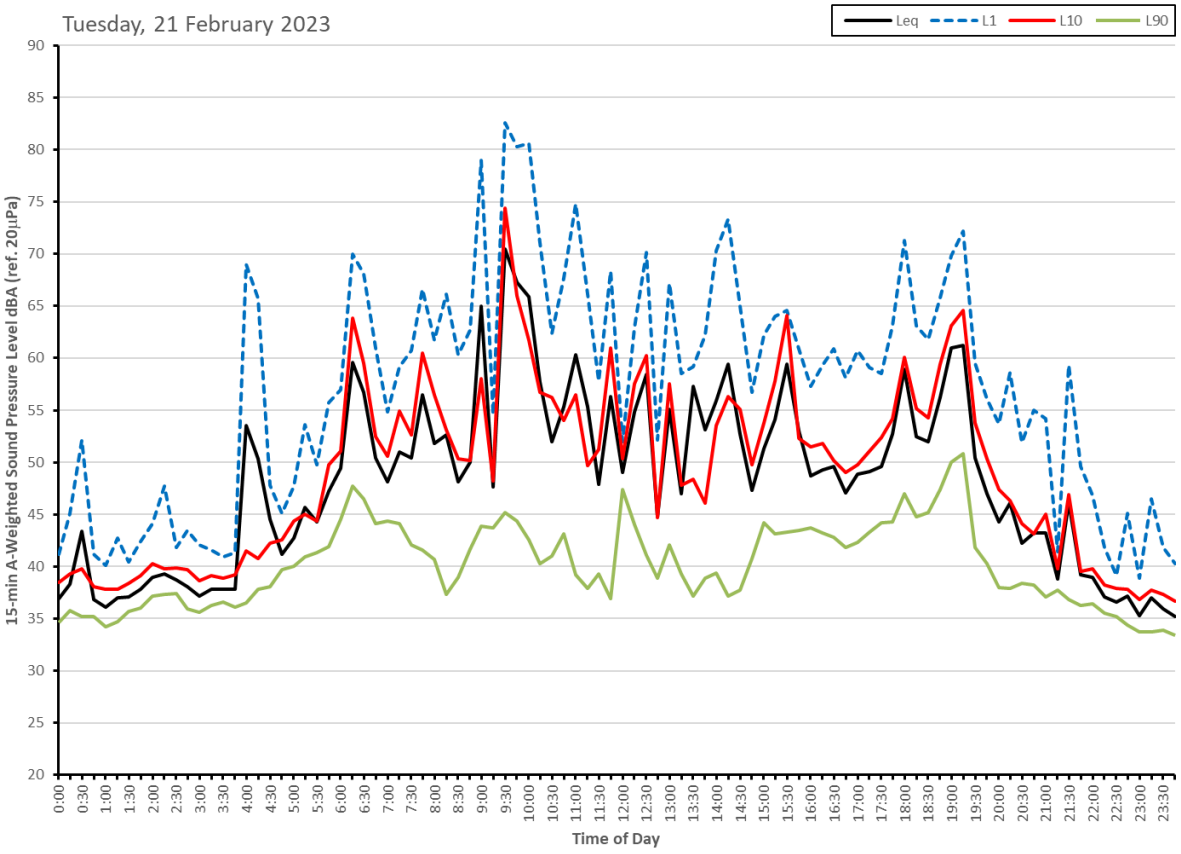
Time of Day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L1
L10
L90
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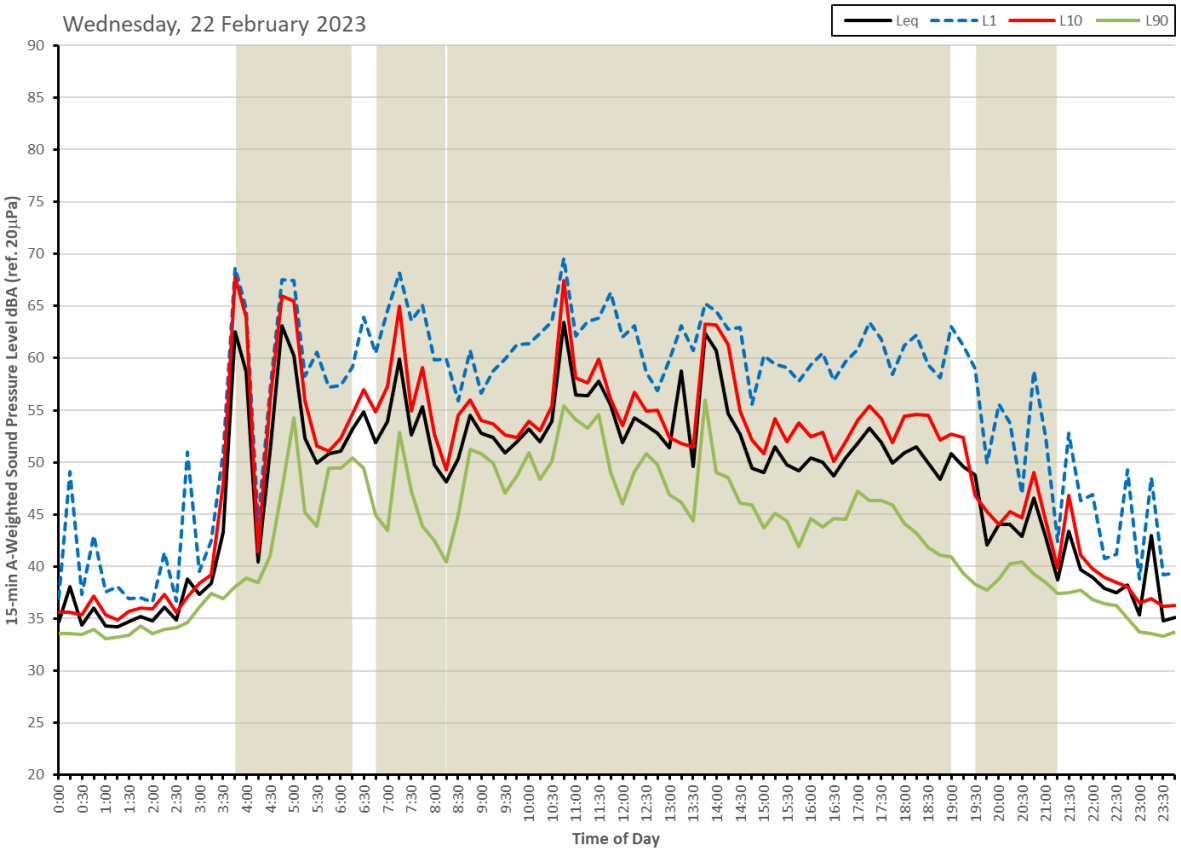
Time of Day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L10
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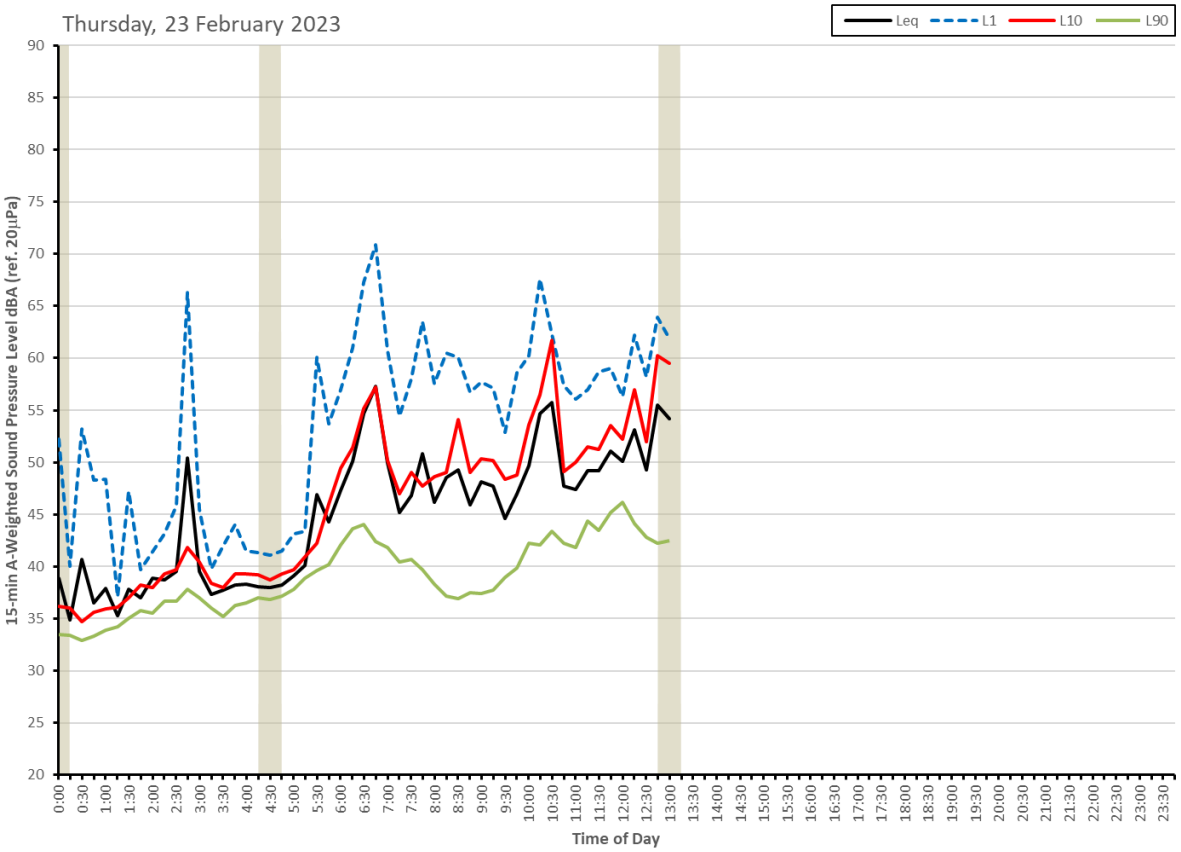
Time of Day


Thursday, 23 February 2023
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day