MARSHALL DAY Acoustics

GEORGES RIVER GRAMMAR SCHOOL
DA ACOUSTIC ASSESSMENT
P TO YEAR 2 BUILDING

Rp 002 20240966 | 19 December 2024

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Project: **GEORGES RIVER GRAMMAR SCHOOL**

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1.0 INTRODUCTION

Marshall Day Acoustics Pty Ltd (MDA) has been commissioned by ICR Design on behalf of Georges River Grammar to undertake an assessment of a proposed new Preschool to Year 2 building and external facilities on the existing outdoor play area located at 3A - 5 Haig Avenue, Georges Hall.

This Development Application (DA) acoustical assessment considers noise emissions associated with the proposed development, and their potential impact on nearby residential receivers, including:

- Noise from mechanical plant associated with the new building
- Noise from activities and operations associated with the new building and facilities including vehicular movements
- Road traffic noise generation.

The following plans/ reports identified in Table 2 have been reviewed to inform the assessment contained within this report:

Table 1: Plans and Reports Reviewed

Source	Document name	Revision	Date
nettletontribe	• Georges River Grammar P-Y2 Building For Development Application	A	December 2024
Canterbury Bankstown Council	• *Canterbury-Bankstown Development Control Plan 2023*		June 2023 Amended August 2024
AS 1055:2015	• *Acoustics – Description and measurement of environmental noise*		
AS 2021:2015	• *Acoustics – Aircraft noise intrusion – Building siting and construction*		
AAAC	• *Guideline for Child Care Centre Acoustic Assessment* V3.0	V3.0	September 2020
Bankstown Airport Limited	• *Bankstown Airport Master Plan 2019*		7 November 2019
NSW DoE & SI	• *Education Facilities Standards and Guidelines*	EFSG 2.0	
NSW DoE & SI	• *Education Facilities Standards and Guidelines* - Technical Standards	EFSG 2.0	
NSW EPA	• *NSW Road Noise Policy*		2011
NSW EPA	• *NSW Noise Policy for Industry*		2017
NSW Govt	• *SEPP (Transport and Infrastructure) 2021*		2021
NSW RMS	• *Guide to Traffic Generating Development*	2.2	October 2002

A glossary of the acoustical terminology used throughout this report is contained within Appendix A.

2.0 THE PROJECT

2.1 Site Location

Georges River Grammar is located 53 Georges Crescent, Georges Hall, as shown in Figure 1. The site is approximately 650m north of Bankstown Airport.

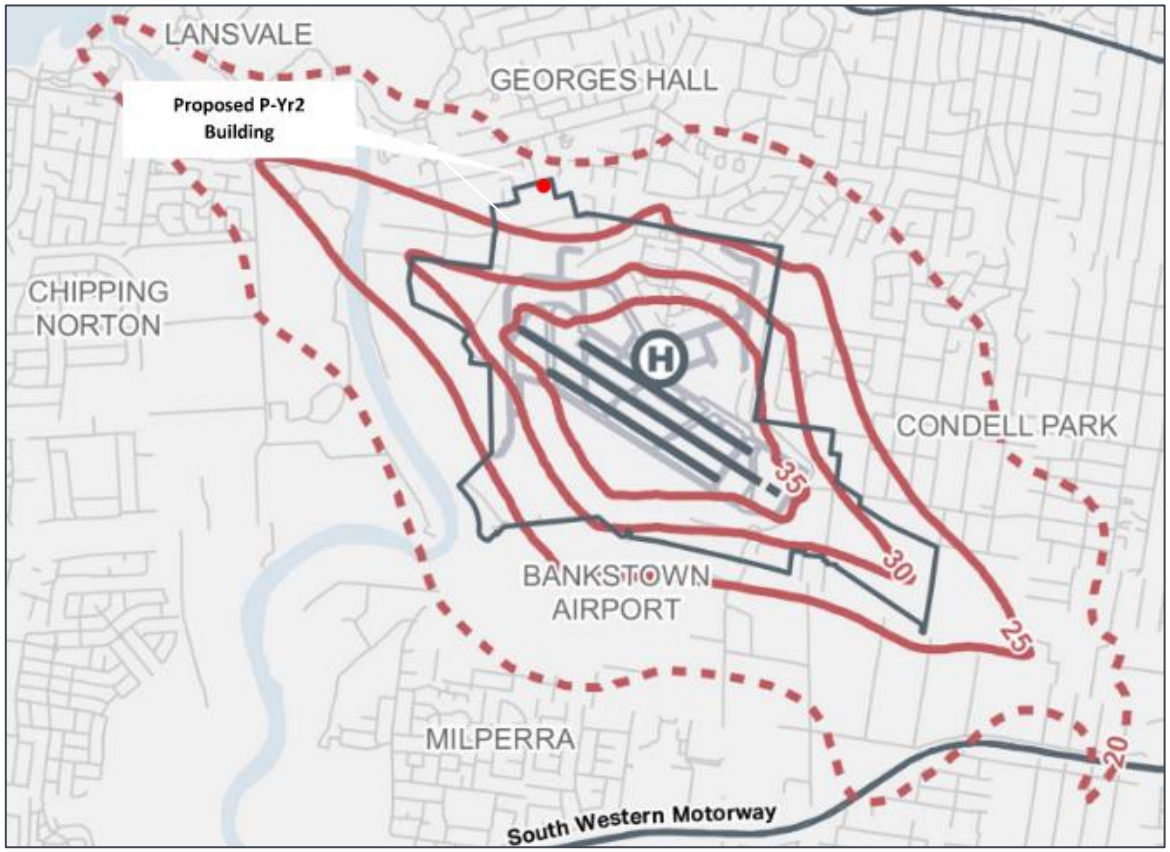
The site falls between the ANEF 20 and 25 contours as defined by the Endorsed ANEF 2039 which forms part of the Bankstown Airport Master Plan 2019.

The proposed P-Year 2 building will be located at 3A – 5 Haig Avenue. The site is currently vacant and used as an outdoor play area. The airport boundary is located to the south, on the southern side of Link Road. The nearest receivers to the project site are residential properties adjacent to the western and southern boundaries and on the northern side of Haig Avenue. The property adjacent the eastern boundary is a commercial operation.

The site and surrounding receivers are shown in Figure 1. The site location relative to the Endorsed ANEF 2039 is shown in Figure 2.

Figure 1: Site Location (Source: Metro Maps)

Figure 2: Site Location Relative to the Endorsed ANEF 2039 (Source: Bankstown Airport Master Plan 2019)



2.2 Development Design

The new facilities are designed to provide 13 Kindergarten to Year 2 classrooms to accommodate approximately 330 students. Generally, the 330 would be evenly divided across the year cohorts. An additional 40-place pre-school is also proposed. The documented capacity is the anticipated maximum enrolment. Initial enrolments would be lower to allow for future expansion.

The pre-school will provide long day care and operate between the hours of 7.00 am and 6.00 pm weekdays.

The school will operate during normal school hours between 8.00am and 4.30 pm.

The proposed building will comprise two levels of learning and staff spaces. The ground floor includes classrooms for Preschool and Year 2, together with open shared learning and separate staff spaces. There are extensive outdoor areas for learning, play and an amphitheatre.

The first floor comprises classrooms for Kindergarten, Year 1, shared learning and outdoor play areas.

An at-grade carpark and drop-off providing 18 car spaces (13 staff and 5 visitor) and 5 drop-off spaces, is located at the northern end of the site, adjacent to Haig Avenue.

The exterior façade will feature primarily masonry construction. The roof will comprise profiled sheet metal (custom orb or similar). Glazing will consist of slab to slab window walls. Vision glazing will comprise glass to meet Section J requirements.

Figure 3: Ground Floor Plan (Source: nettletontribe)

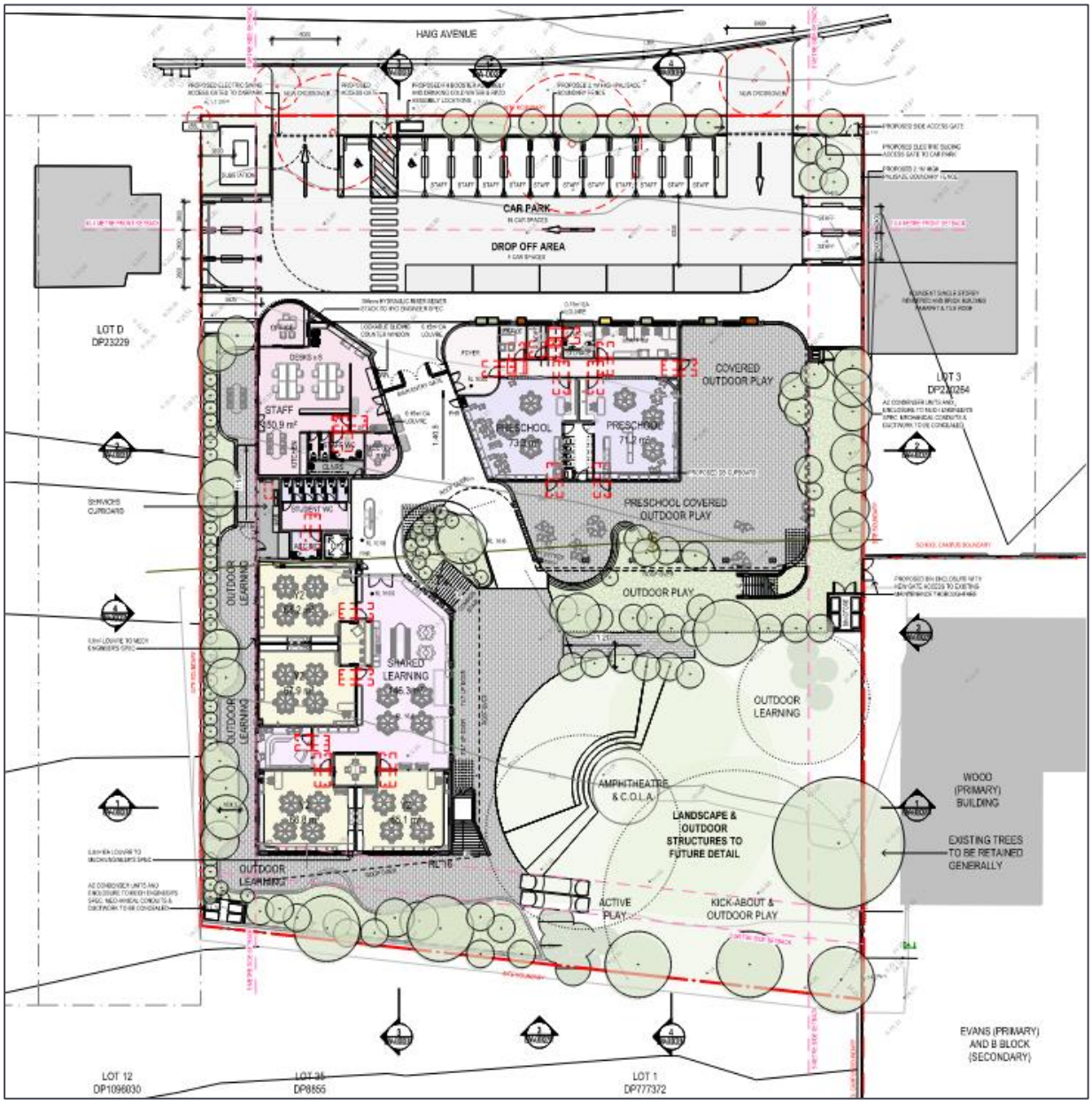


Figure 4: First Floor Plan (Source: nettletontribe)

3.0 EXISTING NOISE ENVIRONMENT

3.1 Background and Ambient Noise Levels

3.1.1 Unattended noise monitoring

Existing noise levels have been previously established for the site during assessment of the proposed outdoor play area. The results are documented in the Marshall Day Acoustics report *Rp 001 R01 20224 0309 – Georges River Grammar New Outdoor Play Area,* dated 3 September 2024. In summary, and based on the results of attended and unattended monitoring, the RBLs shown in Table 2 have been determined in accordance with the procedures documented in the NPfI to apply for the assessment of noise from the future development at the residential receivers considered.

Table 2: RBLs Adopted for Noise Assessment

Receiver		RBL Day 7.00am – 6.00 pm L_{A90} dB
R1	7 Haig Ave (rear)	43
R2	8A Endeavour Rd (rear)	43
R3	4A Endeavour Rd (rear)	43
R4	4 Haig Ave (front)	47

3.1.2 Attended noise monitoring

In addition to the unattended monitoring conducted at the time of the preparation of the report *Rp 001 R01 20224 0309 – Georges River Grammar New Outdoor Play Area* attended measurements were carried out over 15-minute periods at locations representative of the residential receiver areas to the north and west. Details are provided in the report, with the measurements results summarised in Table 3.

Table 3: Attended Noise Monitoring Results

Location		Date	Time	Noise Level - dB		Notes	Level at Logging Location NM2 for same period	
				L_{Aeq}	L_{A90}		L_{Aeq}	L_{A90}
AM1	Residential receiver Front boundary 2 Haig Avenue 3m to kerb	21.08.2024	14.15	64	54	Traffic, aircraft	59	47

Location		Date	Time	Noise Level - dB		Notes	Level at Logging Location NM2 for same period	
				L_{Aeq}	L_{A90}		L_{Aeq}	L_{A90}
AM2	Residential receiver Western boundary 5 Haig Avenue Adjacent 7 Haig Avenue 15m to kerb	21.08.2024	15.00	62	50	Traffic, aircraft	60	51
AM3	Residential receiver Front boundary 4 Haig Avenue 4 m to kerb	21.08.2024	15.30	63	53	Traffic, aircraft	56	49

The unattended background noise level measured during Survey 2 at NM2, was considered a conservative representation of the typical daytime background level at receivers in an area not exposed to road traffic.

At AM 1 and AM 3 (representing receiver R4) on Haig Avenue, the background noise level experienced was higher than that at NM 2 due to the proximity and influence of reasonably continuous road traffic on Haig Avenue.

3.2 Aircraft Operations – Maximum Noise Levels

AS 2021:2015 provides a procedure for determining the maximum aircraft noise levels at a development site based on a database of typical Australian aircraft and their estimated noise emissions at locations relative to an airport.

The site is located approximately 770m north of the centre runway 11C/29C and approximately 860 north of the northern runway 11L/29R.

Aircraft noise levels for the Georges River Grammar School site were examined in detail in Marshall Day Report Rp *20220401 Noise Assessment Report - Georges River Grammar Auditorium - Aircraft Noise Assessment.*

Maximum aircraft noise levels at the subject site have been calculated in accordance with AS 2021. The calculated maximum noise level at the site based upon the expected fleet mix in 2039 was 81 dB $L_{Amax(slow)}$ during a BAE 146 departure. A level of 80 dB $L_{Amax(slow)}$ was calculated during a Cessna 182 departure.

The data recorded during continuous noise monitoring was further analysed to determine the representative maximum noise level from aircraft events at the site of the future building. It is not reasonable or statistically valid to adopt the absolute maximum noise level measured during the survey. Instead, the average maximum, or 90th percentile level was determined (ie 90% of the L_{Amax} noise level events measured were equal to or lower than this level). Based on the data recorded throughout the survey period, the 90th percentile level is 89 dB L_{Amax}.

From the attended measurements, the maximum level during the noisier events involving general aviation (large propeller or jet) was 82 dB L_{Amax}. Review of the logger data shows daily events frequently exceeding the calculated 81dB L_{Amax} maximum level with several instances where the maximum level corresponds with the 90th percentile level of 89 dB L_{Amax}. The more typical noise level due to aircraft noise event at the site is however 82 dB L_{Amax} and it is considered reasonable to adopt this level as a basis for considering aircraft noise impacts.

4.0 ASSESSMENT CRITERIA

4.1 Noise from Continuous and Semi-continuous Sources

Operational noise from the proposed new school facilities may be generated by the following:

- mechanical services plant
- internal and external learning activities
- school announcements and bells
- active and passive outdoor play
- vehicular movements within the carpark area during morning arrivals and afternoon departures.

The NSW *Noise Policy for Industry* (NPfI) does not provide specific assessment requirements for schools. Some of the sources of noise from schools operate in a continuous or near-continuous manner and on that basis may be considered in a similar way to the sources that are explicitly addressed under the NPfI. Such sources include external mechanical plant and activity-related noise generated during the use of internal and external learning areas. It is therefore reasonable and appropriate to consider these sources of noise in the context of the NPfI.

The NPfI documents a procedure for assessment and management of industrial noise which involves determining the project noise trigger levels for a development. The project noise trigger level is a benchmark level above which noise management measures are required to be considered. They are derived by considering short-term intrusiveness due to changes in the existing noise environment (applicable to residential receivers only) and maintaining noise amenity levels for particular land uses for residents and other sensitive receivers.

Intrusiveness noise level

For assessing intrusiveness, the background noise level (L_{A90}) is measured and the Rating Background Level (RBL) determined in accordance with the NPfI procedures. The intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous noise level (L_{Aeq}) of the source (measured over a 15-minute period) does not exceed the background noise level L_{A90} (RBL) by more than 5 dB.

Amenity noise level

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include transportation noise (when on public transport corridors), noise from motor sport, construction noise, community noise, blasting, shooting ranges, occupational workplace noise, wind farms or amplified music/patron noise.

The amenity noise level aims to limit continuing increases in noise levels which may occur if the intrusiveness level alone is applied to successive developments within an area.

The recommended amenity noise level represents the objective for total (industrial or other applicable sources) noise at a receiver location. The project amenity noise level represents the objective for noise from a single (industrial) development at a receiver location.

To prevent increases in the overall ambient noise environment due to the cumulative effect of several developments, the project amenity noise level for each new source is set at 5 dB below the recommended amenity nose level.

The following exceptions are applicable to determining the project amenity noise level:

- For high traffic areas the amenity criterion for industrial noise becomes the $L_{Aeq,period(traffic)}$ minus 15 dB.

- Where cumulative industrial noise is not a consideration because no other industries are present in, or likely to be introduced into the area, the relevant amenity noise level is assigned as the project amenity noise level for the development.

Amenity noise levels are not used directly as regulatory limits. They are used in combination with the project intrusiveness noise level to assess the potential impact of noise, assess mitigation options and determine achievable noise requirements.

An extract from the NSW NPfI that relates to the amenity noise levels for surrounding receivers is given in Table 4.

For determining the assessment criteria applicable at surrounding receivers, noise catchment areas have been defined as follows and are shown in Figure 5:

NCA 1 – Residential receivers to the north (ie fronting Haig Avenue)

- 4 Haig Avenue - frontage
- 7 Haig Avenue - frontage

NCA 2 - Residential receivers to the south and east

- 7 Haig Ave (rear)
- 8A Endeavour Rd (rear)
- 4A Endeavour Rd (rear)

Commercial

- 3 Haig Avenue

Figure 5: Residential Receiver Noise Catchment Areas

Table 4: NPfI Amenity Noise Levels

Receiver	Noise Amenity Area	Time of Day[1]	Recommended Amenity Noise Level L_{Aeq} (dBA)
Residential	Urban[2]	Day	60
		Evening	50
		Night	45
	Suburban[2]	Day	55
		Evening	45
		Night	40
Commercial	All	When in use	65

Note 1: Daytime 7.00 am–6.00 pm; Evening 6.00 pm–10.00 pm; Night 10.00 pm-7.00 am.

Note 2: Urban noise amenity area represented by NCA 1, Suburban noise amenity areas represented by NCA 2 (refer Figure 5)

4.2 NPfI Project Noise Trigger Levels

The amenity and intrusiveness noise levels and resulting project trigger levels (shown in bold) applicable to sources of continuous operational noise associated with the project are shown in Table 5.

The current noise environment is principally controlled by the existing school, local road traffic, airport operations, community-based and environmental sources.

Table 5: Project Noise Trigger Levels – Continuous Operational Sources

Receiver Noise Catchment Area	Period	Intrusiveness Noise Level $L_{Aeq,15min}$ (dBA)	Project Amenity Noise Level $L_{Aeq,15min}$ (dBA)[2]
NCA 1	Day	**52**	58
NCA 2	Day	**48**	53
Commercial	All	-	63

Note 1: The L_{Aeq} descriptor is used for both the intrusiveness noise level and the amenity noise level. The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. To standardise the time periods for the intrusiveness and amenity noise levels the $L_{Aeq,15min}$ is taken to be equal to the $L_{Aeq,period}$ + 3 dB. To prevent increases in the overall ambient noise environment due to the cumulative effect of several developments, the project amenity noise level for each new source is set at 5 dBA below the recommended amenity nose level.

4.3 Noise from Outdoor Play

Noise will be generated by children engaged in outdoor play and recreational activities at various times throughout the day. The maximum duration and intensity of these periods is likely to occur during recess (30 minutes) and lunch (30 minutes).

Noise from school students engaged in outdoor play and recreational activities cannot be assessed in the same manner as noise generated by the use of learning facilities that are more likely to be in continuous use. The EPA's NPfI has previously been referred to for the assessment of such classroom and activity noise emissions (and noise from mechanical plant) however, the policy does not present appropriate criteria for the assessment of noise from outdoor areas and sporting fields.

Schools traditionally form an essential part of all residential communities. Noise emissions from students engaged in active outdoor games are unlikely to achieve a "background + 5dBA" criterion adjacent to the site boundary. This is common across all educational facilities, particularly if the students are located near the boundary, and is often the case, in close proximity to residences.

In general, the impact of outdoor activity noise from schools is considered to be sufficiently mitigated by the site zoning and the limited periods of outdoor recreational and physical activities, during the school year, and, as such, does not typically warrant quantitative assessment.

In order to provide a guideline for the assessment, reference is made to a "background + 10dBA" criterion, based upon the guideline for the assessment of noise from child care centres prepared by the Association of Australasian Acoustical Consultants (AAAC) which has been applied to schools in other local government areas within the Sydney Metropolitan area. This criterion has also been accepted in the NSW Land & Environment Court as representing a 'datum' of acceptability. However, when considering whether acoustical impacts arising from a school are reasonable in a merit assessment, the L&E Court found this guideline was not intended to be directly applied to the assessment of noise from outdoor play.

Canterbury-Bankstown Development Control Plan 2023 Chapter 10.2 includes objectives and controls for Schools are addressed specifically in Section 10.2.

Section 6 addresses acoustic privacy and management with the objective of minimising noise impact on the amenity of residential receivers and the surrounding area.

Consideration must be given to the implementation of planning and design measures that will mitigate adverse noise impacts on the residential amenity of adjoining land. Development control 6.2(c) requires the following to be determined:

> *Whether the development must apply measures to ensure the noise of students does not exceed 10dB(A) above the background noise level.*

Table 6: Guideline Assessment Criteria for Noise from Outdoor Play

Receiver	RBL [1] $L_{A90,(15min)}$ dB	Emission Guideline $L_{Aeq,15min}$ dB
NCA 1	47	57
NCA 2	43	53

Note 1: Outdoor use during daytime period only

4.4 Road Traffic Noise

The NSW Road Noise Policy (2011) was released by the EPA to replace the *Environmental criteria for road traffic noise* (1999) from 1 July 2011. The key provisions of the policy are an emphasis on the use of land use planning, better road design and vehicle noise emission control to avoid or minimise road traffic noise impacts. The assessment criteria for residences potentially affected by additional traffic generated by land use developments on arterial, sub-arterial and local roads are summarised in Table 7.

Table 7: Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Development	Assessment Criteria – dBA	
		Day (7 am-10 pm)	**Night (10 pm-7 am)**
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)
	Relative Increase Criteria	Existing traffic $L_{Aeq,15hr}$ + 12 dB (external)	Existing traffic $L_{Aeq,9hr}$ + 12 dB (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,(1hour)}$ 55 (external)	$L_{Aeq,(1hour)}$ 50 (external)

Where predicted noise levels exceed the project-specific noise criteria, an assessment of all feasible and reasonable mitigation options should be considered. The RNP states that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

4.5 Aircraft Noise

The new building is located between the ANEF 20 and ANEF 25 noise contours for Bankstown Airport and will be exposed to aircraft operations.

Australian Standard AS 2021:2015 *Acoustics - Aircraft noise intrusion - Building siting and construction* (AS 2021) documents guidelines for the assessment of site suitability for proposed developments near airports and provides recommendations for acceptable internal noise levels within various areas of occupancy inside buildings during aircraft flyovers. The AS 2021 recommended internal (L_{Amax}) design levels for spaces within educational establishments are documented in Table 8.

Table 8: AS 2021:2015 Recommended Indoor Design Sound Levels

Building Type and Activity	Indoor Design Sound Level, dB $L_{Amax(slow)}$
Schools, universities	
Libraries, study areas	50
Teaching areas, assembly areas	55
Workshops, gymnasia	75

The recommendations within AS 2021 therefore indicate an internal level of 50 dB to 55 dB $L_{Amax(slow)}$ would be acceptable for noise sensitive spaces.

5.0 ASSESSMENT OF NOISE IMPACTS GENERATED BY THE SCHOOL USE

5.1 Noise Modelling

Prediction of airborne noise emissions potentially generated from the development proposal has been undertaken based on the ISO 9613-2:1996 *Acoustics – Attenuation of sound propagation outdoors – Part 2: General method of calculation* (ISO, 1996) algorithms as implemented in Minerva Software v7.0.5.0, an acoustic modelling program developed by MDA. The model incorporates factors such as source sound level emissions and location, screening effects where relevant, receiver locations, distance attenuation and ground and atmospheric absorption effects.

It is noted that although ISO 9613-2:2024 has been recently released, this calculation method as previously documented and implemented in the model provides a suitable methodology for the purposes of predicting environmental noise levels from industry and other sources and has been adopted for this assessment.

A 2.1m high Colorbond metal fence has been included along the eastern, western and southern boundaries adjacent neighbouring receivers as documented in the ICR Design Development Application issue Site Plan drawing number A.01 rev A dated 11/12/2023.

5.2 Noise Sources

The sources and associated noise levels input to the model for the assessment of continuous and semicontinuous operational noise from the proposed new facility are summarised in Table 9. The noise levels included have been based on air conditioning plant manufacturers data, AAAC *Guideline for Child Care Centre Acoustic Assessment version 3.0* and previous measurements conducted by MDA.

Table 9: Noise Modelling L_{eq} Source Data

Source	Octave Band Centre Frequency (Hz)								dB L_{Aeq}
	63	125	250	500	1000	2000	4000	8000	
Outdoor CU Daikin RXYMQ9AY1 Lw	78	79	76	74	71	68	62	56	76
Carpark Lw per vehicle	100	94	86	82	81	80	77	74	87
Classroom Lp reverb	64	53	59	64	70	72	69	65	75
Children group of 10 Active play Lw	64	70	75	81	83	80	76	72	87
Children group of 10 Passive play Lw	58	64	69	75	77	74	70	66	81

5.3 Noise Predictions & Assessment

5.3.1 Mechanical Services

The noise emissions from mechanical plant must be controlled so that the operation of such plant does not adversely impact upon surrounding residential properties. Air-conditioning will be provided throughout the school with reverse-cycle, heat-pump type variable refrigerant flow (VRF) systems likely. Outdoor units will be located in a plant enclosure in the south-western corner of the site. Indoor units will be either ducted fan coil units, ceiling cassette or wall-mounted units.

Louvres on the external perimeter walls are provided for relief air. These will require coordination with acoustic performance requirements for the building envelope.

Exhaust ventilation will be provided by roof-mounted fans. Noise emissions from these roof-mounted units are generally low and are unlikely to contribute significantly at neighbouring receivers. Contributions must however be confirmed when plant selection has been finalised.

Preliminary assessment of noise emissions from external plant has been conducted based on an assumed typical plant selection as shown in Table 10. Mechanical services design and plant selection are yet to be finalised and equipment schedules will be subject to revision.

Table 10: Typical Outdoor Mechanical Plant

Plant Item	Location	L_{AWeq} (per unit)
Daikin RXYMQ9AY1 4 off	Plant compound SW corner	76

Based on the manufacturer's noise level data, the noise levels predicted at surrounding receivers are shown in Table 11.

Table 11: Predicted $L_{Aeq(15minute)}$ Operational Noise Emissions from Outdoor Units

NCA	Receiver Address	Predicted Noise Level dB	Project Trigger Level 7.00 am – 6.00 pm	Compliance
NCA 1	4 Haig Avenue	< 20	52	Yes
NCA 1	7 Haig Ave (front)	< 20	52	Yes
NCA 2	7 Haig Ave (rear)	30	48	Yes
NCA 2	8A Endeavour Rd (rear)	36	48	Yes
NCA 2	4A Endeavour Rd (rear)	32	48	Yes
Commercial	3 Haig Avenue	< 20	63	Yes

The preliminary review indicates that acceptable noise levels, not exceeding the criteria applicable for operational noise emissions during the day, will be achieved with the typical mechanical selection adopted for assessment. Detailed assessment should be conducted during the design development stage of the project to confirm compliance or the requirement for additional treatment of the plant area in the event higher noise level plant is installed.

5.3.2 Activity Noise

Noise emissions from internal and external teaching activities are unlikely to be significant, particularly given the provision of air conditioning allowing glazing to remain closed.

For the acoustic modelling the following operational scenario has been developed as representative of typical operations and associated noise emissions:

- Two groups of 10 children engaged in the outdoor learning areas at ground level adjacent the western boundary (this excludes play activities, refer Section 5.4)
- Two Year 2 classrooms engaged in active learning
- First Floor classrooms engaged in active learning

Glazing to classrooms on the western and southern elevations has been assumed to be fixed or closed.

The shared learning areas face inwards and are substantially shielded from surrounding receivers. On this basis they were excluded from the modelling.

The noise levels predicted by the model at the surrounding receivers of the operational scenarios summarised above are presented in Table 12.

Table 12: Predicted $L_{Aeq(15minute)}$ Operational Noise Emissions – Learning Activities

NCA	Receiver Address	Predicted Noise Level $L_{Aeq(15\ minute)}$ dB	Project Trigger Level $L_{Aeq(15\ minute)}$ dB 7.00 am – 6.00 pm	Compliance
NCA 1	4 Haig Avenue	39	52	Yes
NCA 1	7 Haig Ave (front)	24	52	Yes
NCA 2	7 Haig Ave (rear)	43	48	Yes
NCA 2	8A Endeavour Rd (rear)	39	48	Yes
NCA 2	4A Endeavour Rd (rear)	36	48	Yes
Commercial	3 Haig Avenue	19	63	Yes

Based on the results of the noise modelling, noise generated by the school activities during typical learning activities will achieve the applicable criteria for the daytime operational period at all nearby receivers.

5.3.3 Carpark Noise

The carpark is accessed from Haig Avenue via an entry at the eastern end and an exit via a driveway at the western end. The proposed on-site carpark layout allows for 13 staff spaces, 5 visitor spaces (including 2 accessible spaces) and 5 drop-off spaces.

In the absence of an available traffic assessment, reference has been made to the TTR-002 *Guide for Traffic Generating Developments* v 2.2 (RTA 2002) for modelling of vehicle activity within the carpark. According to Table 3.6 of the Guide, Day Care centres generate 0.8 vehicle trips per child during the morning peak period. The Guide does not specifically document traffic generation for schools, however the Before/After School Care peak vehicle trip rate was reported as 0.5 per child during the morning peak. This has been adopted as the basis for assessing vehicle movements in the carpark during morning kindergarten to Year 2 student drop-offs.

The predicted $L_{Aeq(15min)}$ level generated at the neighbouring properties most potentially exposed to vehicle movements on the driveway are shown in Table 13.

Table 13: Predicted L_{Aeq} dB Noise Levels – Vehicular Movements On-site

NCA	Receiver Address	Estimated vehicle movements[1] Peak am	Predicted Noise Level $L_{Aeq(15\ minute)}$ dB	Project Trigger Level $L_{Aeq(15\ minute)}$ dB 7.00 am – 6.00 pm	Compliance
NCA 1	4 Haig Avenue	210	40	52	Yes
NCA 1	7 Haig Ave (front)	210	38	52	Yes
NCA 2	7 Haig Ave (rear)	210	34	48	Yes
NCA 2	8A Endeavour Rd (rear)	210	23	48	Yes
NCA 2	4A Endeavour Rd (rear)	210	< 20	48	Yes
Commercial	3 Haig Avenue	210	28	63	Yes

[1]subject to verification by the traffic consultant

Based on the results of the noise modelling, noise generated under the assumed vehicle movement scenarios achieve the applicable criteria at the surrounding receivers considered.

5.3.4 Cumulative Noise

The overall noise levels from all sources except outdoor play (refer separate noise criteria Section 5.4 below) received at surrounding properties are presented in Table 14. The contributions from vehicular activities associated with arrivals (and departures) have been included however these would generally occur outside periods of normal classroom activities.

cumulative noise

Table 14: Predicted L_{Aeq} dB Noise Levels – Cumulative

NCA	Receiver Address	Predicted Overall Noise Level $L_{Aeq(15\ minute)}$ dB	Project Trigger Level $L_{Aeq(15\ minute)}$ dB 7.00 am – 6.00 pm	Compliance
NCA 1	4 Haig Avenue	39	52	Yes
NCA 1	7 Haig Ave (front)	24	52	Yes
NCA 2	7 Haig Ave (rear)	43	48	Yes
NCA 2	8A Endeavour Rd (rear)	41	48	Yes
NCA 2	4A Endeavour Rd (rear)	38	48	Yes
Commercial	3 Haig Avenue	19	63	Yes

5.4 Outdoor Play

For prediction of noise emissions from outdoor play, children are assumed to be distributed across the various outdoor play areas. Calculations of the potential noise emissions generated have been based on the following assumptions:

- 40 pre-school children in groups of 10 playing in the preschool outdoor play area (50% active play and 50% passive play)
- 55 kindergarten children in groups of 10 playing in the first-floor kindergarten outdoor play area (50% active play and 50% passive play). We have assumed the kindergarten cohort would be split for breaks.
- 210 Year 1 and Year 2 children playing over the outdoor play area (50% active play and 50% passive play)

The AAAC's sound power level of 87 dB $L_{WAeq(15min)}$ and 81 dB $L_{WAeq(15min)}$ for children (aged 3 to 6 years) in groups of 10 engaged in active and passive play, respectively, have been applied across the outdoor play areas and the noise level emissions potentially generated at the surrounding receiver locations have been predicted. We note the sound power levels given by the AAAC are for children aged 3 to 6 years, whilst the school children will range between 4 to 8 years. Whilst the sound power levels of older children may be slightly higher, they generally do not uniformly engage in active play and we believe the calculated noise levels are still representative.

Based upon the results of previous measurements conducted of children engaged in outdoor play at a combined primary and secondary campus, an L_{Aeq} sound power level of 79 dB per student has been adopted. The sound power level (L_w) across each outdoor play area has been calculated according to the number of students included (500 students – refer Table 9).

The noise levels generated during outdoor play periods will vary according to the following factors:

- the number of students in the area – students will be spread around the outdoor areas
- the level of noise made by each student – this is obviously different from individual to individual, and various factors such as age, personality, mood, activity will play a part. The louder events are not capable of being sustained over an extended period
- the location of the students relevant to the residences – as the distance between the students and the receiver increases, the noise level at the receiver will decrease.

The predicted levels noise from outdoor play activities at surrounding receiver locations considered are shown, together with the relevant assessment criterion, in Table 15.

Table 15: Predicted $L_{Aeq(15min)}$ Noise Levels Scenario 1 – Outdoor Play

NCA	Receiver Address	Predicted Noise Level $L_{Aeq(15\ minute)}$ dB	Project Trigger Level $L_{Aeq(15\ minute)}$ dB 7.00 am – 6.00 pm	Compliance
NCA 1	4 Haig Avenue	41	52	Yes
NCA 1	7 Haig Ave (front)	29	52	Yes
NCA 2	7 Haig Ave (rear)	30	48	Yes
NCA 2	8A Endeavour Rd (rear)	46	48	Yes
NCA 2	4A Endeavour Rd (rear)	51	48	+3 exceedance
Commercial	3 Haig Avenue	49	63	Yes

Based on the results of the noise modelling, the daytime objective is mostly achieved at the existing receivers considered.

Exceedance of the emissions guideline of up to 3 dB may occur at the rear of 4A Endeavour Road when the larger student cohort are outside during recess and lunch breaks.

The noise levels received will vary considerably. The projected noise levels assume all students are engaged in either active or passive play to represent a worst-case scenario. In reality, many of the students, may not be engaged in noise generating pursuits.

The predicted noise levels during periods of informal outdoor play are below the daytime project amenity level for suburban residential receivers (L_{Aeq} 55dB) and can be expected to occur during limited periods throughout the day (ie recess and lunch breaks). For context, a 3 dB residual exceedance is considered according to NPfI procedures to be marginal.

If required and where feasible, additional noise reduction to allow compliance with the Project Trigger Level could be achieved with a 2.4 m high solid perimeter fencing along the southern boundary.

5.5 Road Traffic Noise

Based on the proposed 370 total student capacity (including the day care), and applying the trip generation rates detailed in Section 5.3.3, the morning peak hour traffic generation could be approximately 210 vehicles entering the school and 210 vehicles leaving.

Based on a typical setback distance of 15 m between the nearside traffic lane and front façade for residences along Haig Avenue, the predicted noise level for the peak morning period, assuming a 50% split eastbound and westbound, is expected to be in the order of $L_{Aeq,1hour}$ 46 dB. This level is less than the RNP recommended daytime level of $L_{Aeq,1hour}$ 55 dB and is below the existing level of road traffic noise along Haig Avenue (refer Table 3). No perceptible increase in existing levels of road traffic noise is expected.

5.6 Aircraft Noise

The building is located between the Bankstown Airport ANEF 20 and ANEF 25 contours. According to Australian Standard AS 2021:2015 *Acoustics - Aircraft noise intrusion - Building siting and construction* (AS 2021) schools are considered "conditionally acceptable" between ANEF 20 and ANEF 25. In this location incorporation of noise control features may be appropriate.

AS 2021 refers to Aircraft Noise Reduction (ANR) which is a calculated or measured value of sound insulation provided by a building. For design purposes, it is the arithmetic difference between the predicted external aircraft noise level at a site and the indoor design level.

Based on the external and indoor design noise levels, the calculated ANR required according to AS 2021 is shown in Table 16 for each space type.

Table 16: Required Aircraft Noise Reduction

Building Type and Activity	Aircraft Noise Level dB L_{Amax}	Indoor Design Sound Level dB $L_{Amax(slow)}$	ANR dB
Schools, universities			
Libraries, study areas, other noise sensitive areas	82	50	32
Teaching areas, assembly areas (less noise sensitive)	82	55	27
Workshops, gymnasia	82	75	7

Typically, where external windows are open for natural ventilation, a loss of approximately 10 dBA from outside to inside can be expected (depending on the window type and area of opening).

On this basis, the recommended internal design levels would be exceeded in learning and other sensitive spaces with external glazing open during the noisier aircraft events.

External windows and doors would be required to be closed to achieve an acceptable internal noise environment within sensitive spaces such as most learning and study areas, staff and administration offices. An alternative ventilation system (e.g. air-conditioning with suitable ducted outside air provisions) will be required to serve these spaces. Specialist mechanical services advice will be required to determine the ventilation requirements for affected spaces. Ventilation pathways will require acoustical treatment to control aircraft noise break-in and ensure that the sound insulation performance of the building envelope is not compromised.

To achieve AS 2021 requirements acoustic controls would be required for the external envelope. The minimum sound insulation performance for the roof/ceiling would be R_w 45 with R_w 33 required for external glazing (10.38 mm laminate). Acoustic controls to comply with the requirements of AS 2021 have not previously been included within classroom buildings at the school to date.

Further, we note that the NSW Department of Education Educational Facilities Standards and Guidelines (EFSG) requires assessment of aircraft noise impacts under certain circumstances as follows:

Aircraft noise for general learning areas, music, drama, movement studios and hall is to be assessed where the school site lies within the Australian Noise Exposure Forecast (ANEF) 25 (or higher) as shown on the airport planning instruments. The procedures in AS 2021 are to be followed in the assessment.

As the site is located outside the ANEF 25 zone, an acoustic assessment of aircraft noise would not be required under the EFSG.

6.0 CONCLUSION AND RECOMMENDATIONS

MDA has assessed the potential noise impact associated with the construction of a new Preschool to Year Building and associated facilities for Georges River Grammar at 5 Haig Avenue, Georges Hall. The assessment has included a review of the site and surrounding area, results of acoustical measurements to characterise the ambient noise environment, establishment of noise criteria, development of a noise model to predict potential noise emissions to surrounding potentially sensitive properties and a comparison of predicted noise levels with regard to recommended guidelines.

6.1 Recommendations

The proposed P – Year 2 Building can be supported provided the following noise control measures are adopted during subsequent detailed design stages:

- The air conditioning, mechanical plant and equipment is selected and designed to comply with the Noise Policy for Industry project noise trigger levels outlined in this report.
- An acoustic screen fence of 2.4 metre height is constructed along the southern boundary. The fence shall be constructed of a durable, continuous material of minimum R_w 25 without gaps.

6.2 Operational Noise Impacts

Details of mechanical plant are unavailable at this stage. Based on an assumed typical outdoor plant selection, acceptable noise levels will be achieved, subject to detailed acoustic assessment and design once the mechanical plant selection is finalised. Confirmation of plant noise levels will be required when detailed mechanical services design becomes available.

The noise level emissions from assumed typical worst-case operational scenarios of the future teaching spaces have been predicted to surrounding properties.

The results of calculations of continuous operational noise sources, including the carpark, were compared with the project specific trigger limits, determined in accordance with the EPA *Noise Policy for Industry*, with compliance the Project Trigger Levels able to be demonstrated.

The noise emissions associated with outdoor play are expected to be generally within the emission guideline of background L_{A90} + 10 dBA and less than the recommended Acceptable Noise Level (ANL) for 'Suburban' acoustic amenity at existing residential receivers. During outdoor play a marginal exceedance of the emission guideline may occur at the rear of the residential property to the south (4A Endeavour Road), although this can be addressed with an acoustic fence where feasible

The levels of noise generated during outdoor play do not exceed the amenity criterion at any of the surrounding receivers.

6.3 Road Traffic Noise

Noise levels from additional traffic generated by the proposed development will be less than those recommended in the NSW *Road Noise Policy*.

6.4 Aircraft Noise

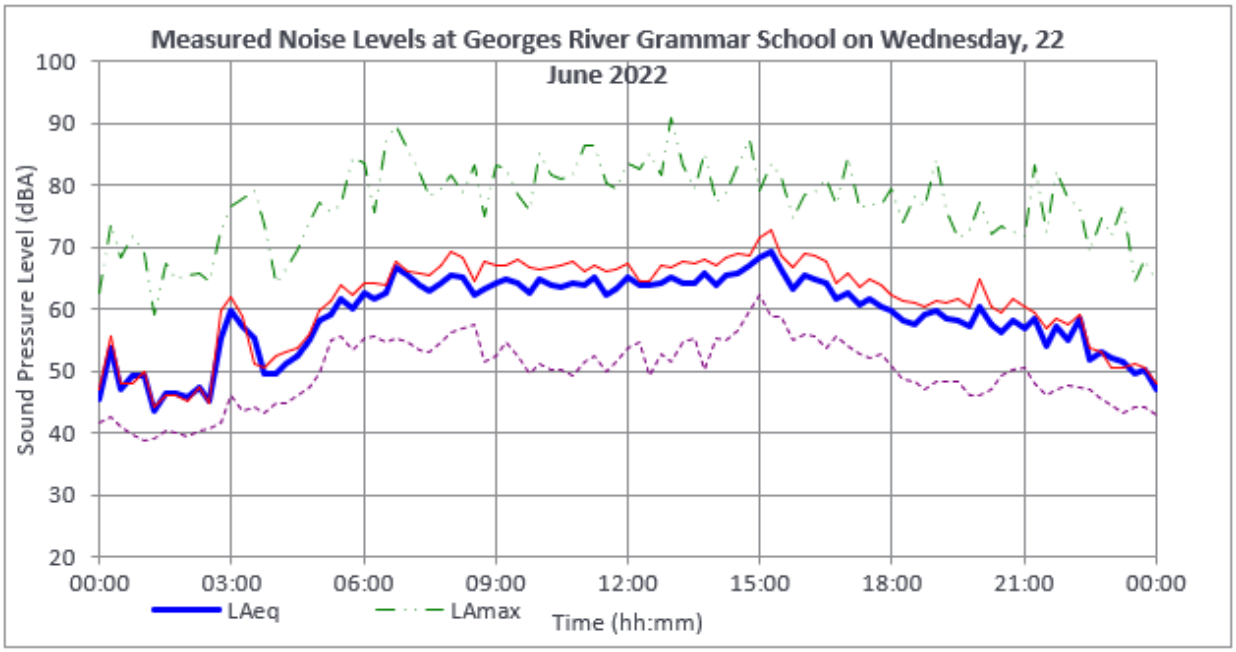
If required to achieve compliance with AS 2021, external windows and doors would need to remain closed and an alternative means of ventilation be provided in consultation with a mechanical services consultant. Additionally, the external building envelope would require upgraded construction to achieve improved acoustic performance.

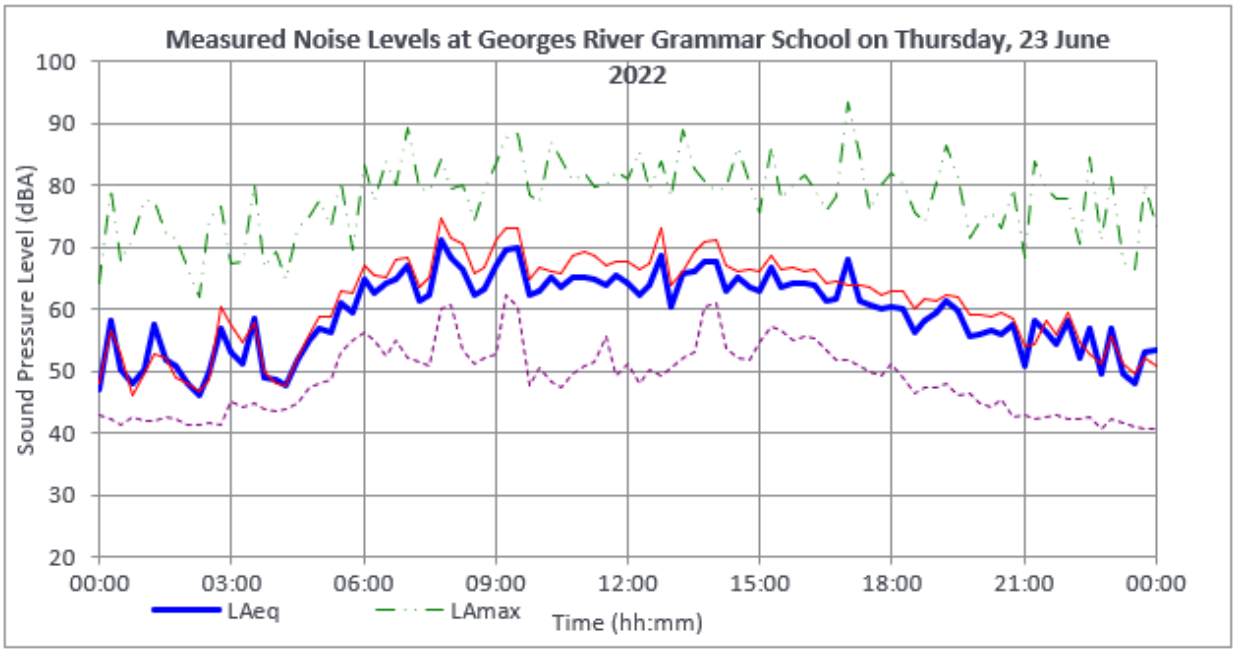
Implementation of design measures to achieve the requirements of AS 2021 have not previously been included in classroom buildings at the school. Furthermore, under the requirements of the NSW EFSG, the location of the building outside the ANEF 25 contour would preclude assessment of aircraft noise.

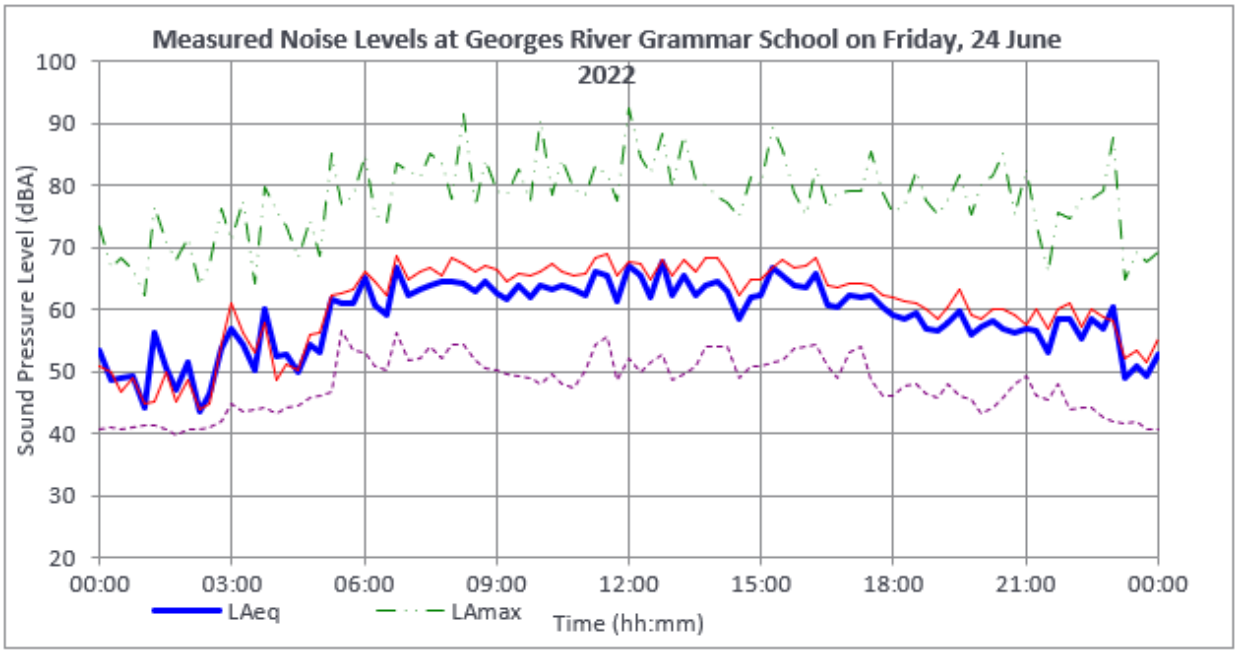
APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	Decibel The unit of sound level.
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
L_{A90}	The noise level exceeded for 90 per cent of the measurement period, measured in dB. This is commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous sound level. This is commonly referred to as the average noise level and is measured in dB.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{A10}	The A-weighted noise level equalled or exceeded for 10 per cent of the measurement period. This is commonly referred to as the average maximum noise level.
L_w (or SWL)	Sound Power Level. The level of total sound power radiated by a sound source.
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.
Rating background level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hr period used for the assessment background level). This level is used for assessment purposes. It is defined as the median value of all the assessment background levels over the monitoring period for the day, evening and night.

APPENDIX B AMBIENT NOISE MONITORING RESULTS



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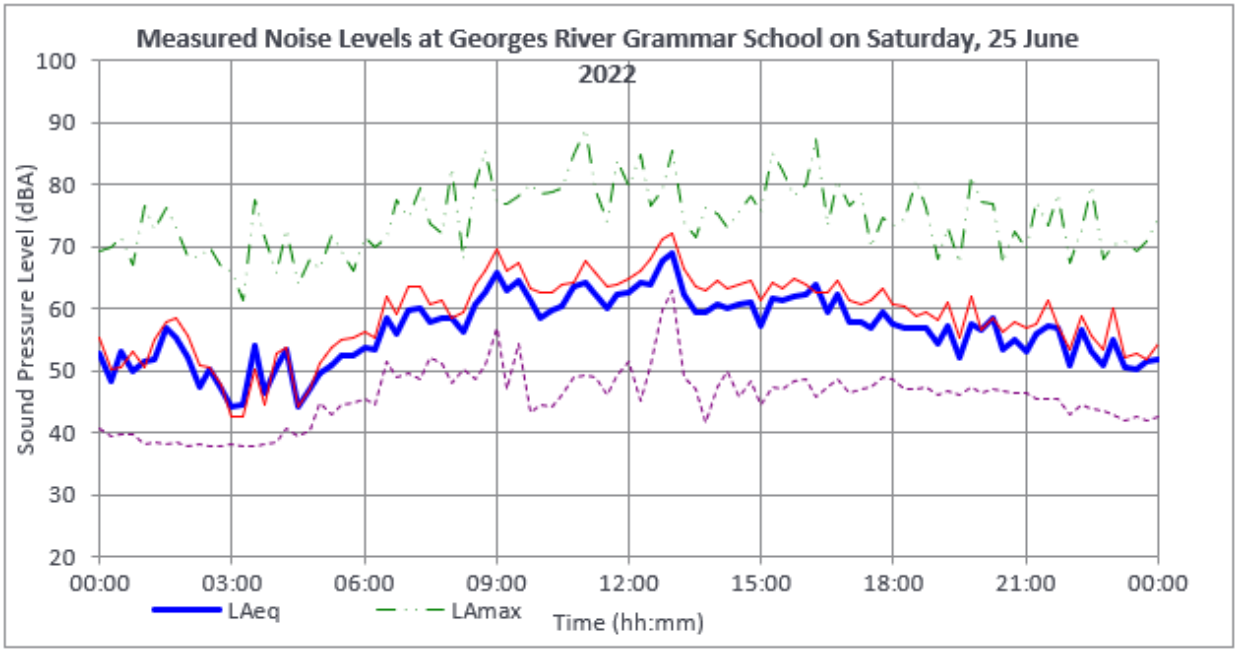
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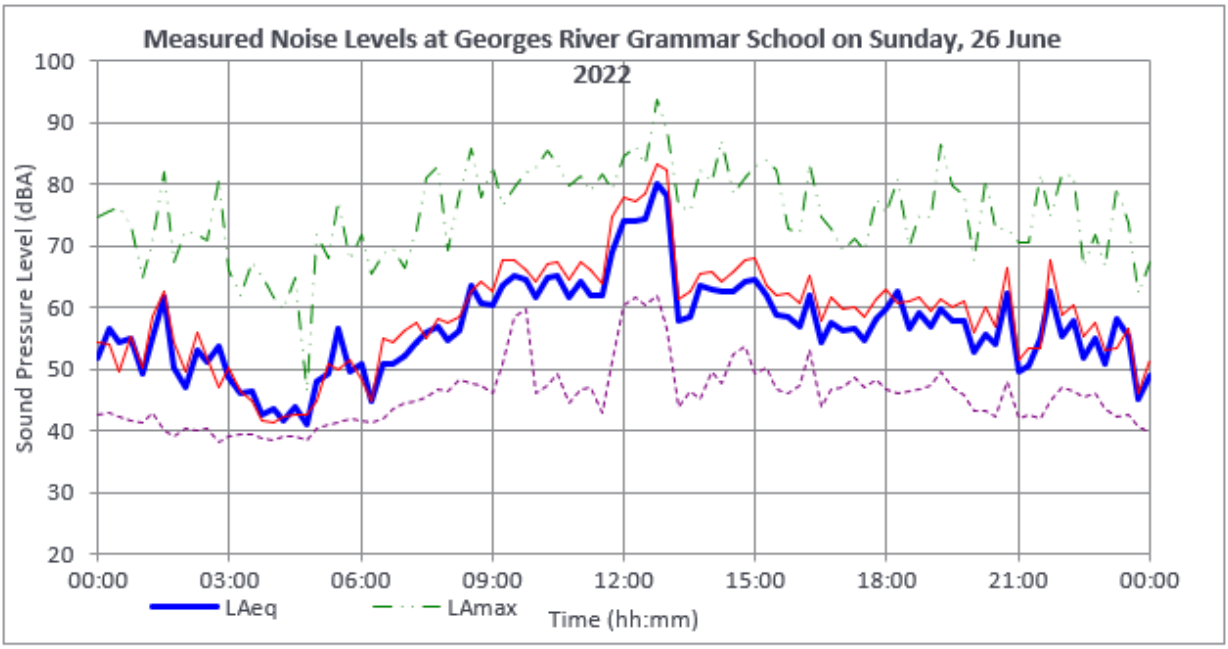
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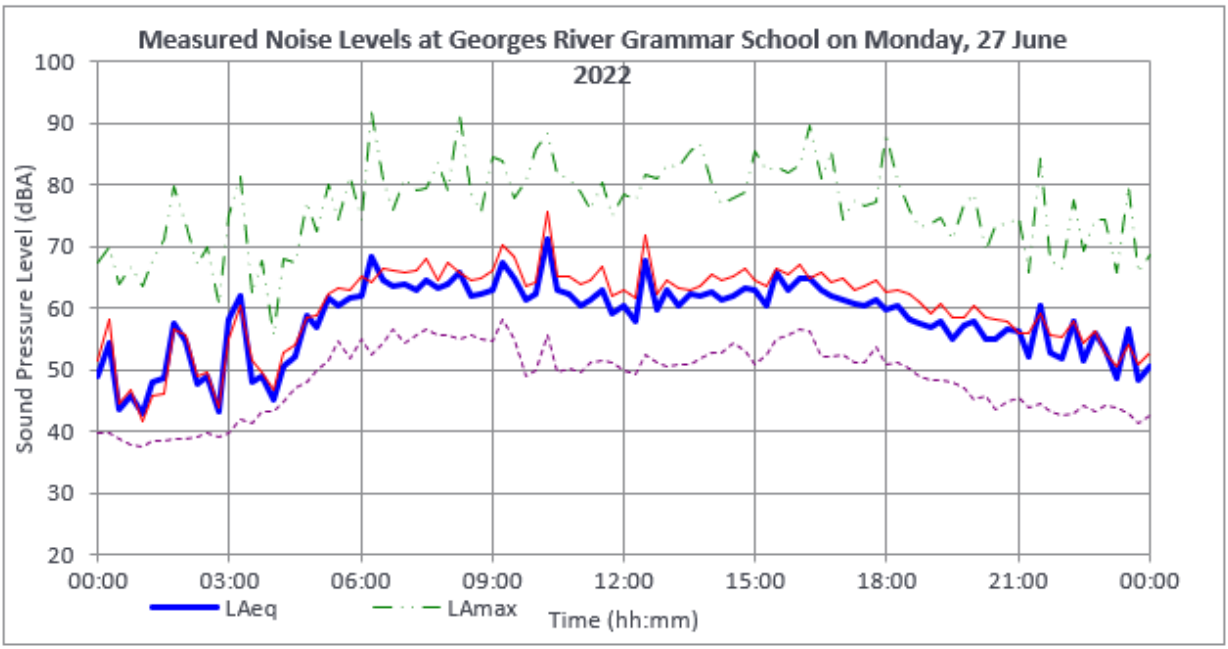
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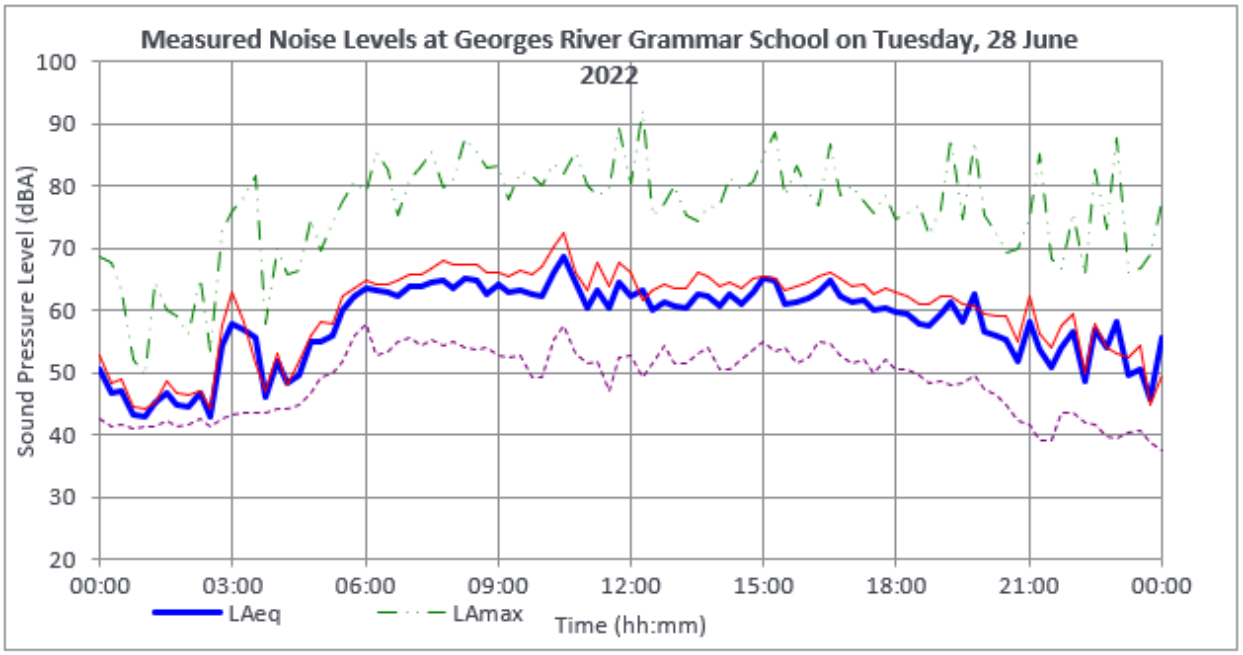
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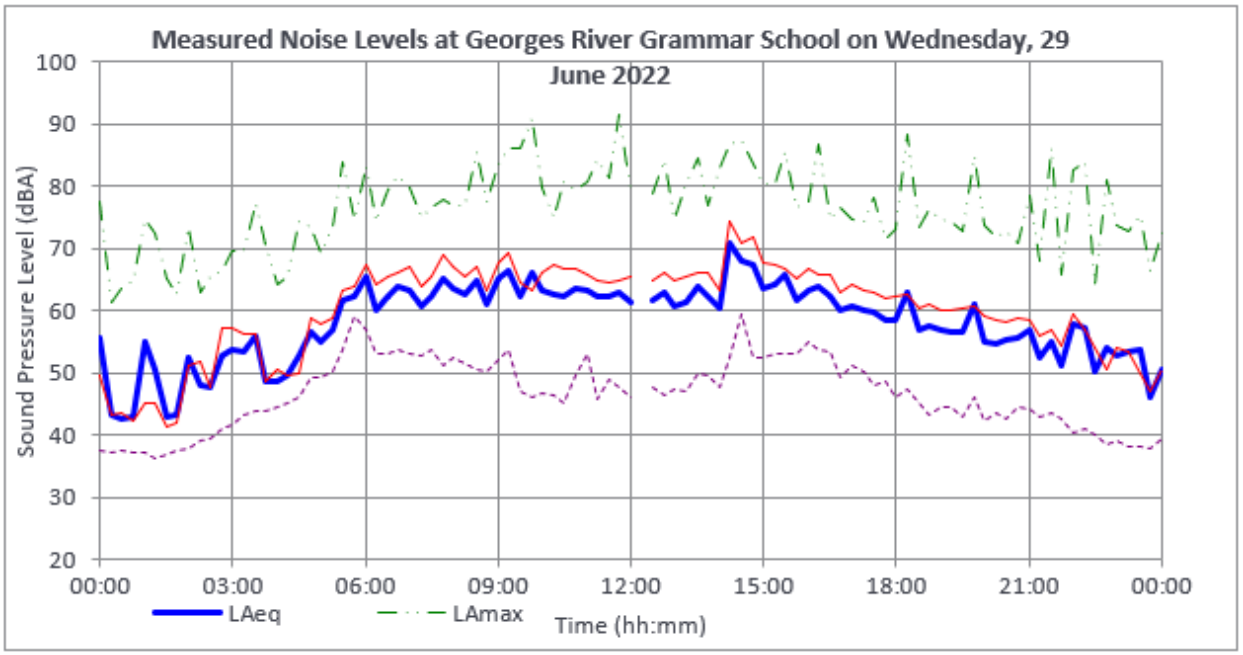
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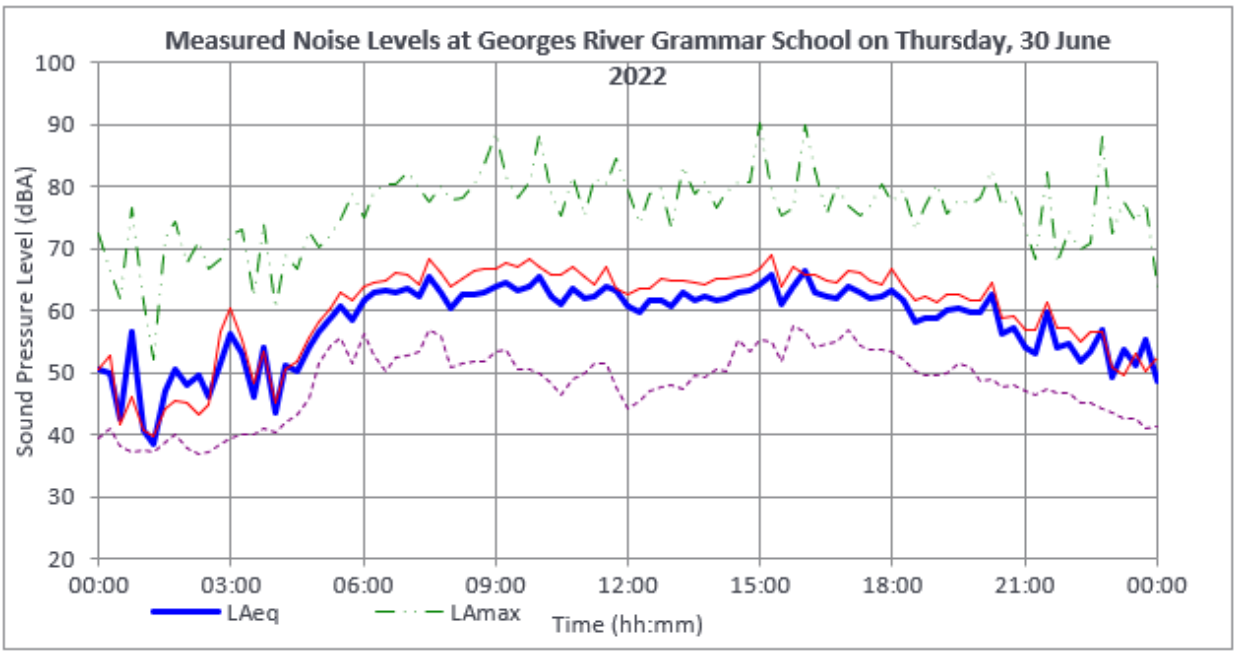
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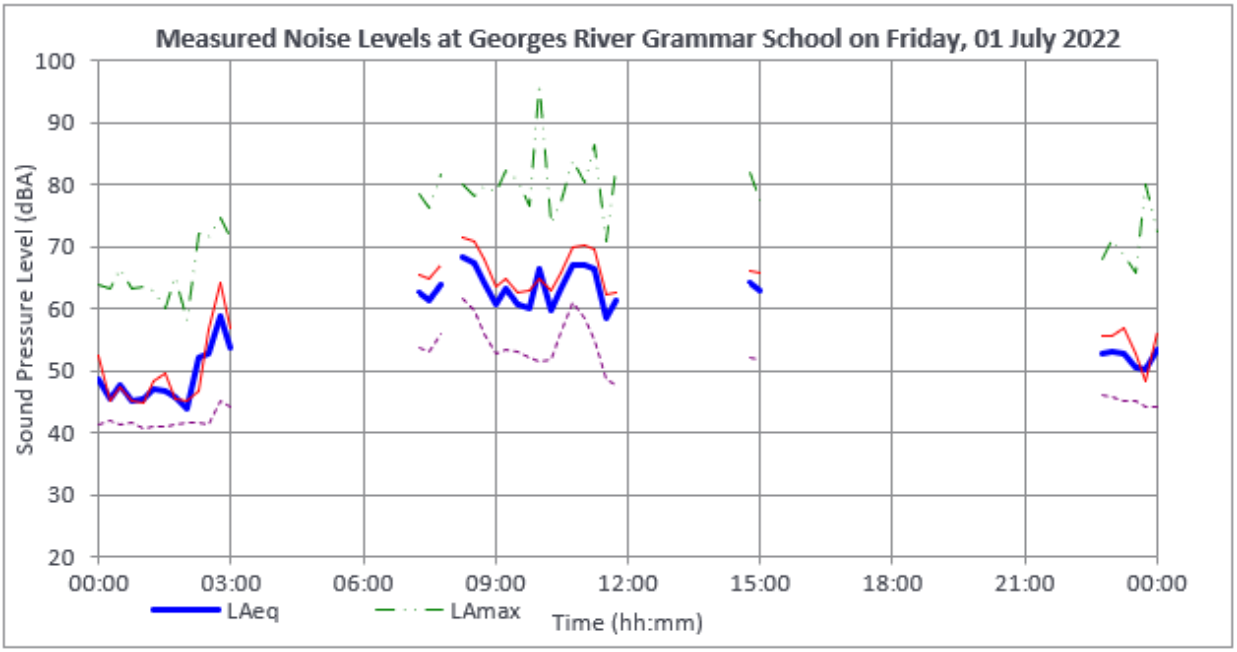
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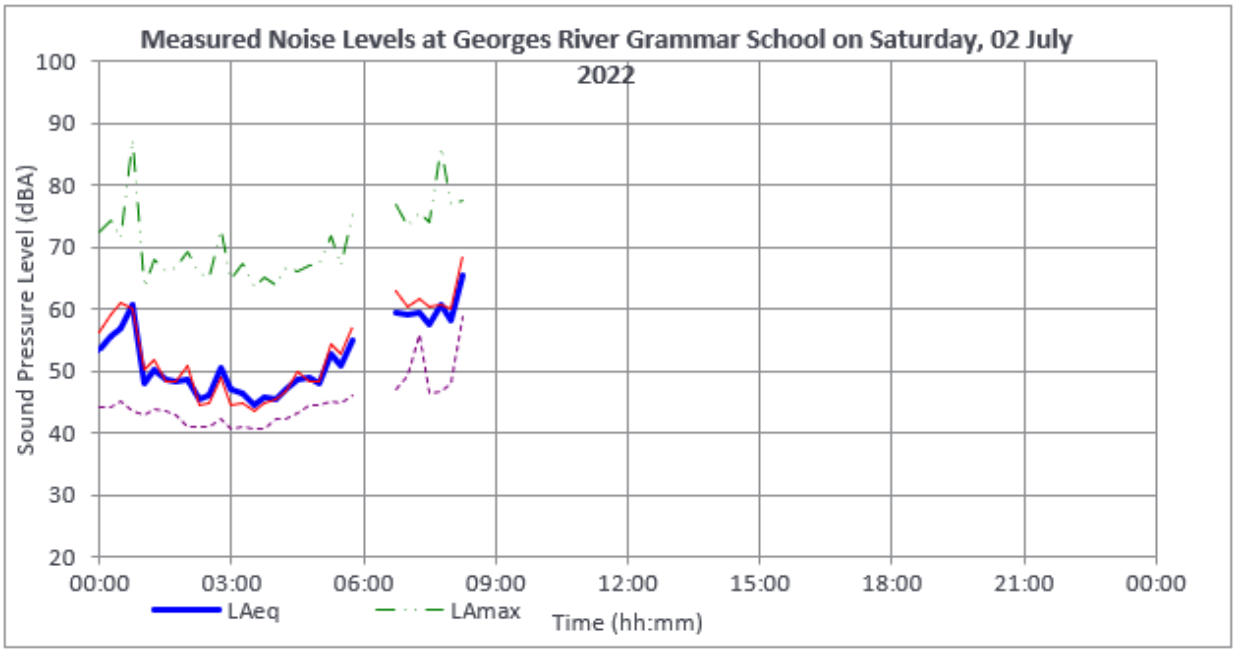
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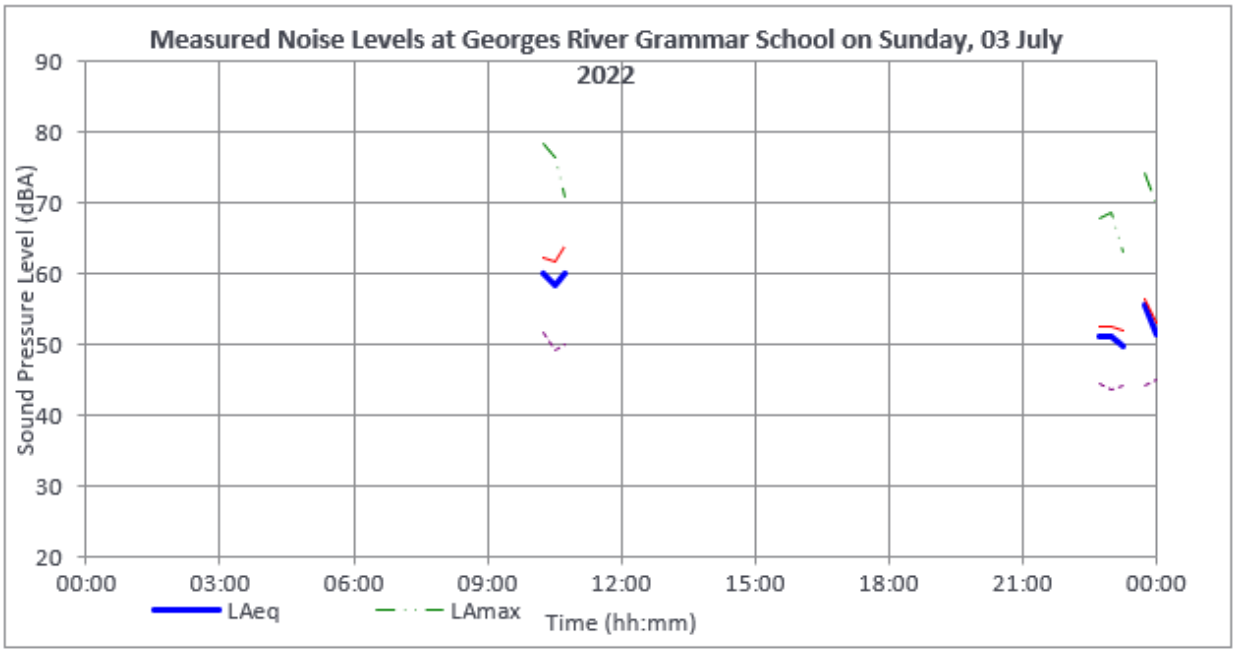
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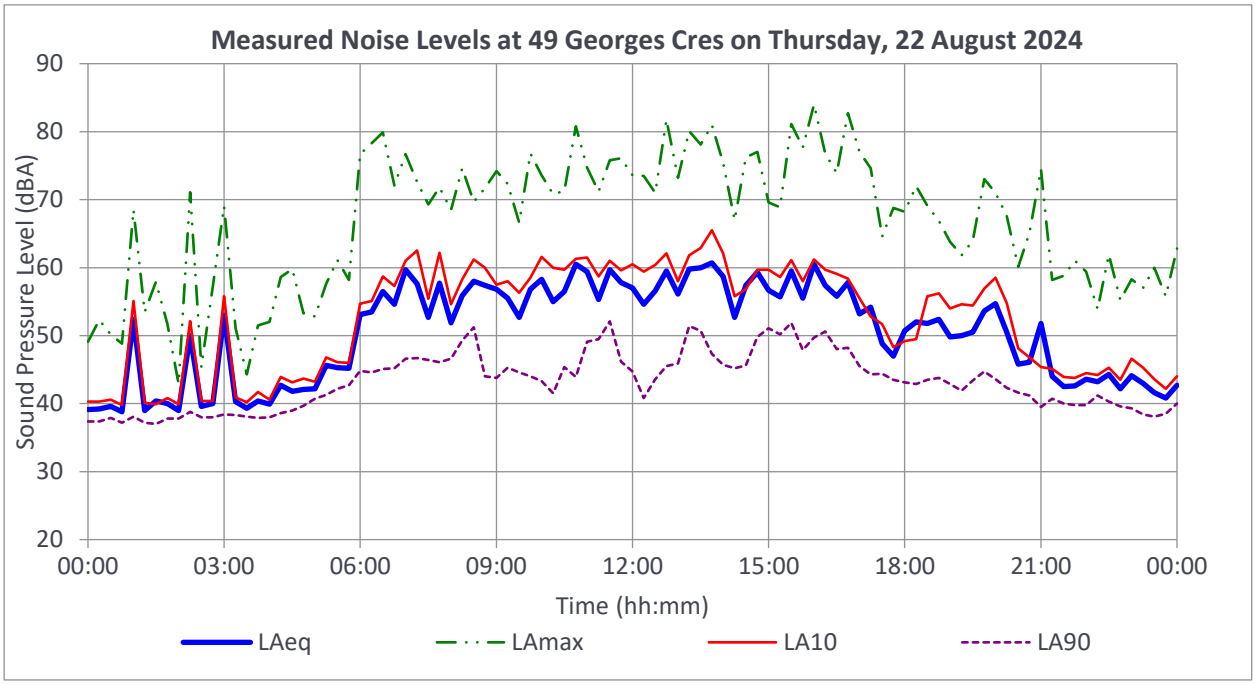
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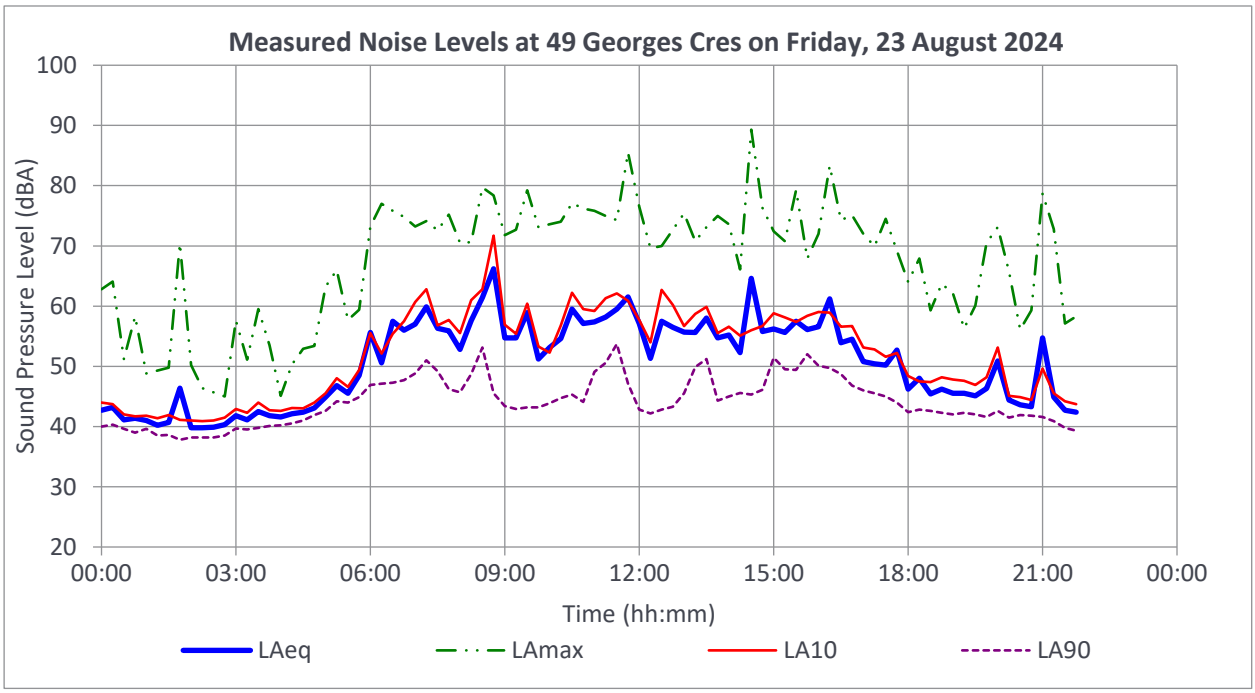
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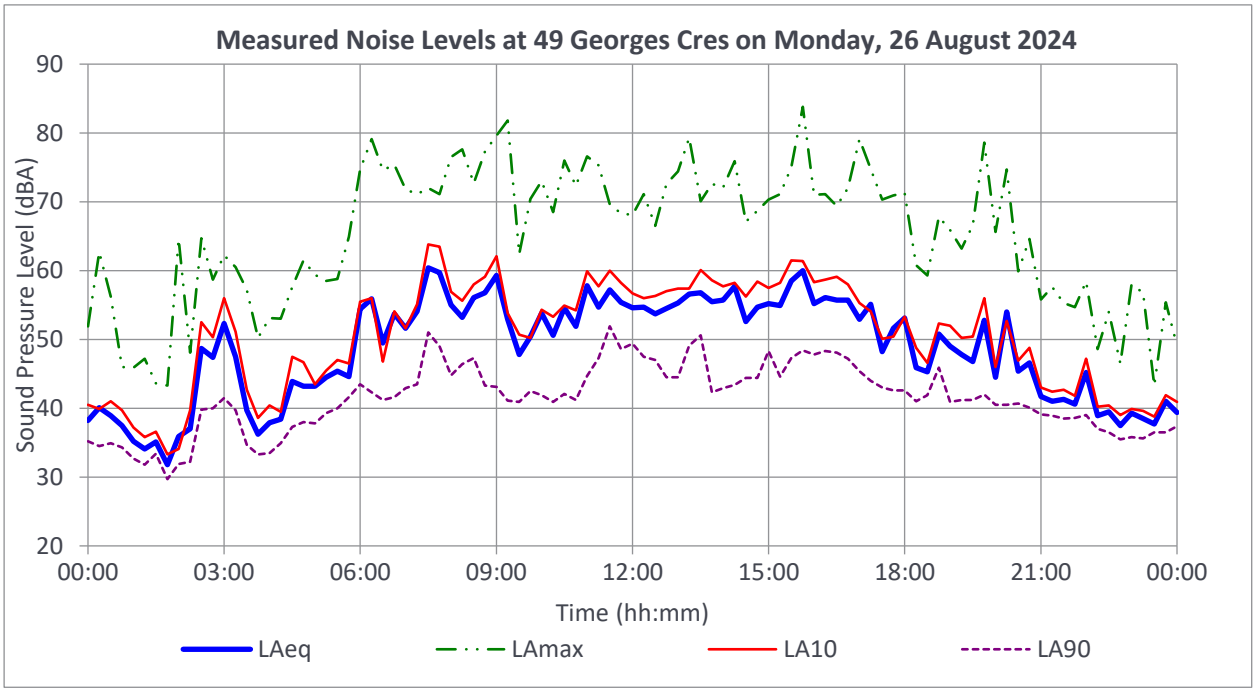
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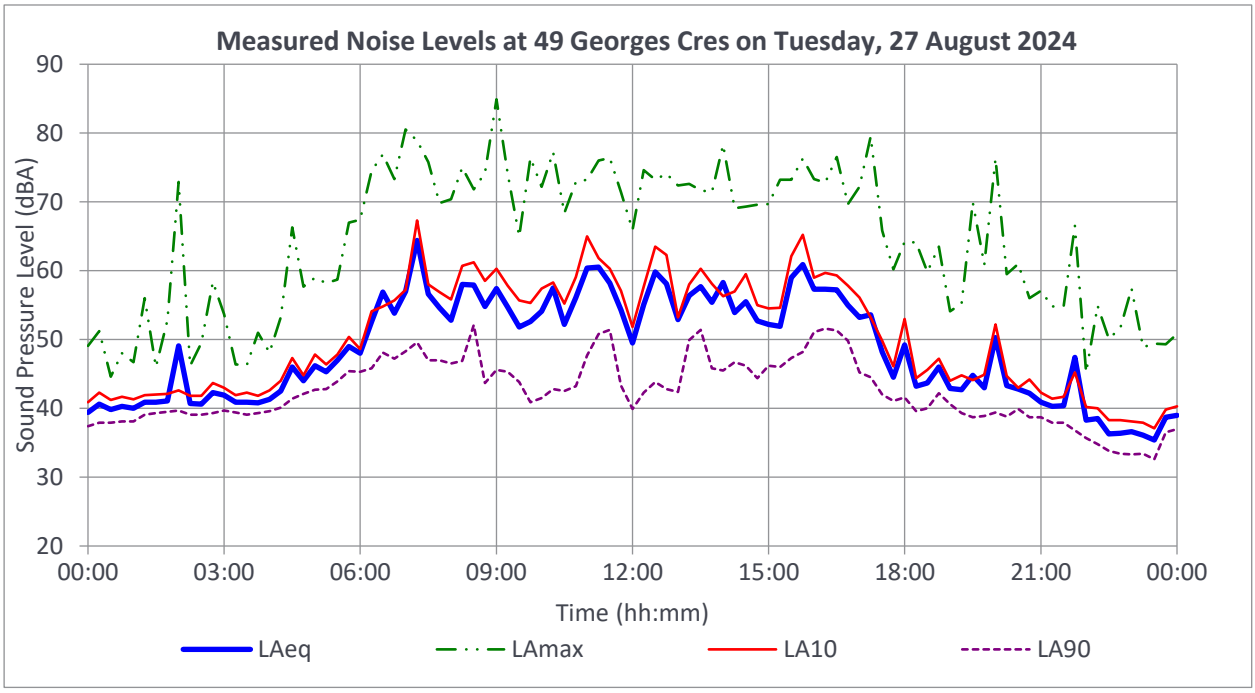
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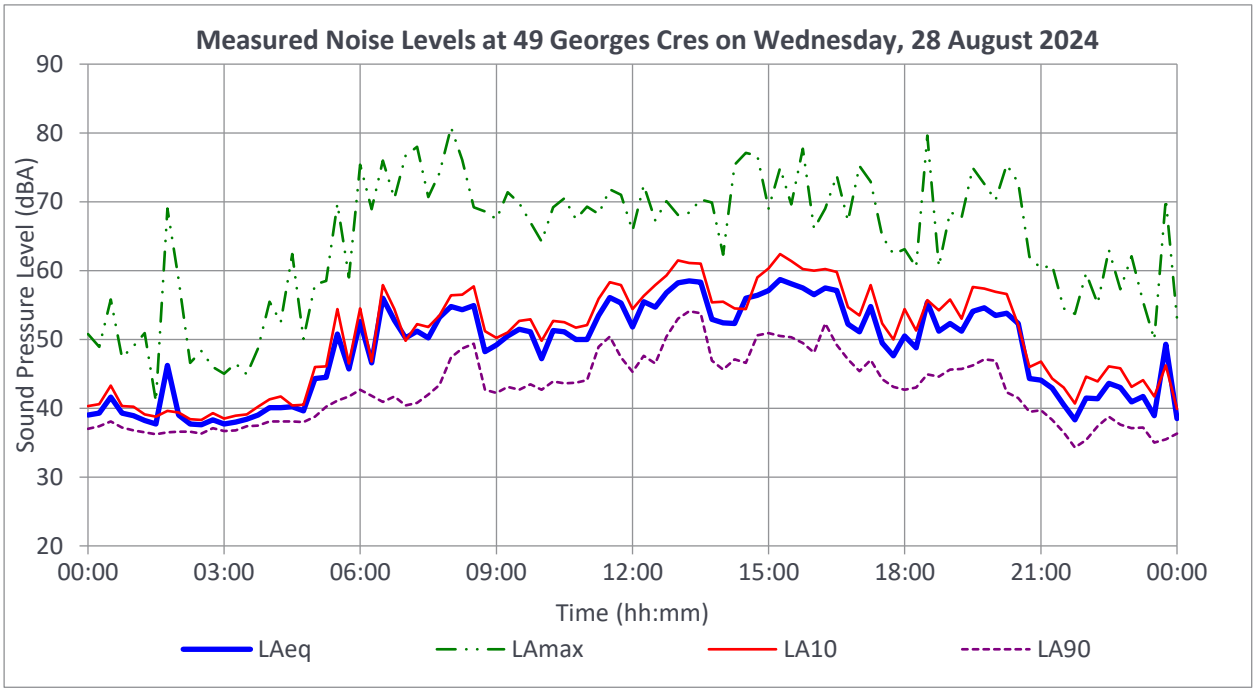
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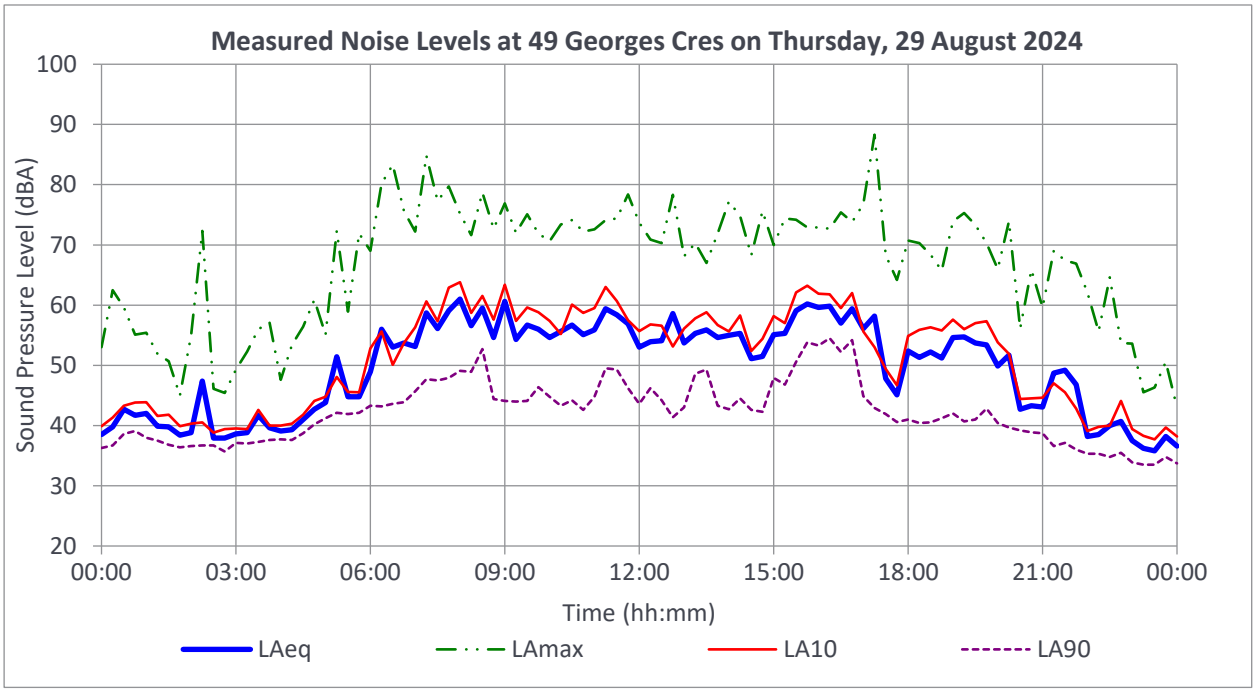
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