DAY DESIGN PTY LTD
CONSULTING ACOUSTICAL ENGINEERS

SUITE 17, 808 FOREST ROAD, PEAKHURST 2210 ABN 73 107 291 494
P. 02 9046 3800 ACOUSTICS@DAYDESIGN.COM.AU WWW.DAYDESIGN.COM.AU

Acoustic Assessment Report

New Wee Waa High School
105 – 107 Mitchell Street, Wee Waa, NSW

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EXECUTIVE SUMMARY

This acoustic report accompanies a State Significant Development Application which seeks consent for the construction of a new high school including a two-storey building, an Indigenous Cultural Centre, Agricultural and Environment Centre, sporting fields and associated civil and utilities works. For a detailed project description refer to the EIS prepared by Ethos Urban.

The new Wee Waa High School will service 200 students with potential to grow to a total capacity of 300 students, subject to further funding and service need, and 61 staff.

Acceptable noise limits are derived from the State Environmental Planning Policy (SEPP) (Educational Establishments and Child Care Facilities) 2017, the EPA's Noise Policy for Industry for intrusive noise impacts from mechanical plant and indoor noise, at each residence, and The Association of Australasian Acoustical Consultants (AAAC) *Technical Guideline for Child Care Centre Noise Assessment* noise criteria for students in outdoor areas.

Long term ambient noise measurements have been taken surrounding the proposed High School site as shown in Figure 1. Ambient noise levels are presented in Section 3 of this report. These locations have been chosen to represent the acoustic environment at the nearby residential neighbours.

Noise levels from students in the outdoor areas, public address system and use of the hall have been calculated at the nearest residential premises and are presented in Section 5.0.

Road traffic noise from Mitchell Street (Kamilaroi Highway) has been measured to determine the impact of road traffic noise on the proposed High School buildings. Noise control recommendations to reduce the level of road traffic noise from Mitchell Street (Kamilaroi Highway) are recommended in Section 8 of this report.

Measurements and calculations show that the level of noise emitted by the proposed new Wee Waa High School will be able to meet the acceptable noise level requirements of the EPA NSW Noise Policy for Industry for operation phase as detailed in Section 4 of this report.

The level of road traffic noise intrusion has been assessed and recommendations for façade construction has been provided to meet the recommended internal noise levels as detailed in Section 6 of this report.

The noise impact due to the proposed construction activities have been predicted at all nearby receptor locations. The Noise Management Level is predicted to be exceeded at times and therefore recommendations for noise controls have been provided in Section 12 of this report to reduce the level of construction noise using reasonable and feasible measures.

1.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by the Department of Education to carry out an acoustic assessment for the new Wee Waa High School to be located at 105-107 Mitchell Street, Wee Waa, NSW. The scope of work is as follows:

- Review the architectural drawings
- Prepare a site plan identifying the development and nearby noise sensitive locations
- Measure the background noise levels at critical locations and times
- Establish acceptable noise level criteria
- Quantify noise emissions from the School site
- Calculate the level of noise emission, taking into account building envelope transmission loss, screen walls, ground absorption and distance attenuation
- Provide recommendations for noise emission control (if necessary)
- Determine the road traffic noise level from nearby major roads
- Determine the acceptable noise level inside the School buildings
- Carry out noise intrusion analysis using the architectural drawings
- Design sound insulation of the School buildings to meet the requirements of Department of Planning's Development near Rail Corridors and Busy Roads
- Assess the impact of construction noise and provide noise control recommendations for noise management
- Prepare an Acoustic Assessment Report.

2.0 PROJECT DESCRIPTION

Students and staff were evacuated from the current Wee Waa High School site due to ongoing health issues in late 2020. Students are currently collocated within the town's primary school in an overcrowded site. A Ministerial announcement made on 3 June 2021 committed to the construction of a new High School at Wee Waa on existing Department of Education owned land and adjacent Crown land as an urgent priority. The site is located on Mitchell Street/Kamilaroi Highway and is legally described as Lot 1 DP577294, Lot 2 DP550633 and Lots 124-125 DP757125.

This acoustic report accompanies a State Significant Development Application which seeks consent for the construction of a new high school including a two-storey building, an Indigenous Cultural Centre, Agricultural and Environment Centre, sporting fields and associated civil and utilities works. For a detailed project description refer to the EIS prepared by Ethos Urban.

The school will service 200 students with potential to grow to a total capacity of 300 students, subject to further funding and service need, and 61 staff

The Secretary's Environmental Assessment Requirements (SEARs) issued 6 July 2021 for Application SSD-21854025 requires a noise and vibration assessment of the proposed development, extracted below:

> *10. Noise and Vibration*
>
> *Provide a noise and vibration impact assessment that:*
>
> - *includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction.*
> - *details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.*
> - *includes a quantitative assessment of the main sources of operational noise, including consideration of any public-address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities.*
> - *outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.*
> - *considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards.*
> - *demonstrates that the assessment has been prepared in accordance with polices and guidelines relevant to the context of the site and the nature of the proposed development.*

Relevant Policies and Guidelines:

- *NSW Noise Policy for Industry 2017 (NSW Environment Protection Authority (EPA).*
- *Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009).*
- *Assessing Vibration: A Technical Guideline 2006 (Department of Environment and Conservation, 2006).*
- *Development Near Rail Corridors and Busy Roads - Interim Guideline (Department of Planning, 2008).*
- *Australian Standard 2363 Acoustics - Measurement of noise from helicopter operations (AS 2363).*

The SEARs requirements are addressed in this report under the following sections as shown in Table 1.

Table 1 SEARs Requirements

Requirement	Section
Includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction.	Section 11
Details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.	Section 12
Includes a quantitative assessment of the main sources of operational noise, including consideration of any public-address system, school bell, mechanical services (eg air conditioning plant), use of any school hall for concerts etc (both during and outside school hours) and any out of hours community use of school facilities.	Section 5
Outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.	Section 6
Considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards.	Section 7 - 9
Demonstrates that the assessment has been prepared in accordance with polices and guidelines relevant to the context of the site and the nature of the proposed development.	Section 13

We are not aware of any helicopter movements for the locality of Wee Waa. The nearest airport is Narrabri Airport, approximately 38 km away. We have therefore not carried out any helicopter noise measurements outlined in *Australian Standard 2363 Acoustics - Measurement of noise from helicopter operations (AS 2363).*

Existing residences are located around the proposed High School site. Figure 2 and Table 1 show the assessment locations for residential premises used in this assessment. These residential locations are representative of the nearest affected premises. The residential premises located further away will experience a lower noise impact from the High School as a result of distance attenuation.

Table 2 Noise Sensitive Receptor Locations

Location	Address	Direction from Site
R1	94 Mitchell Street	South
R2	28 George Street	East
R3	41 George Street	East
R4	13 Tuckey Crescent	North
R5	7 Charles Street	West
R6	Wee Waa Public School	South

Figure 1 : Location Plan – Wee Waa High School

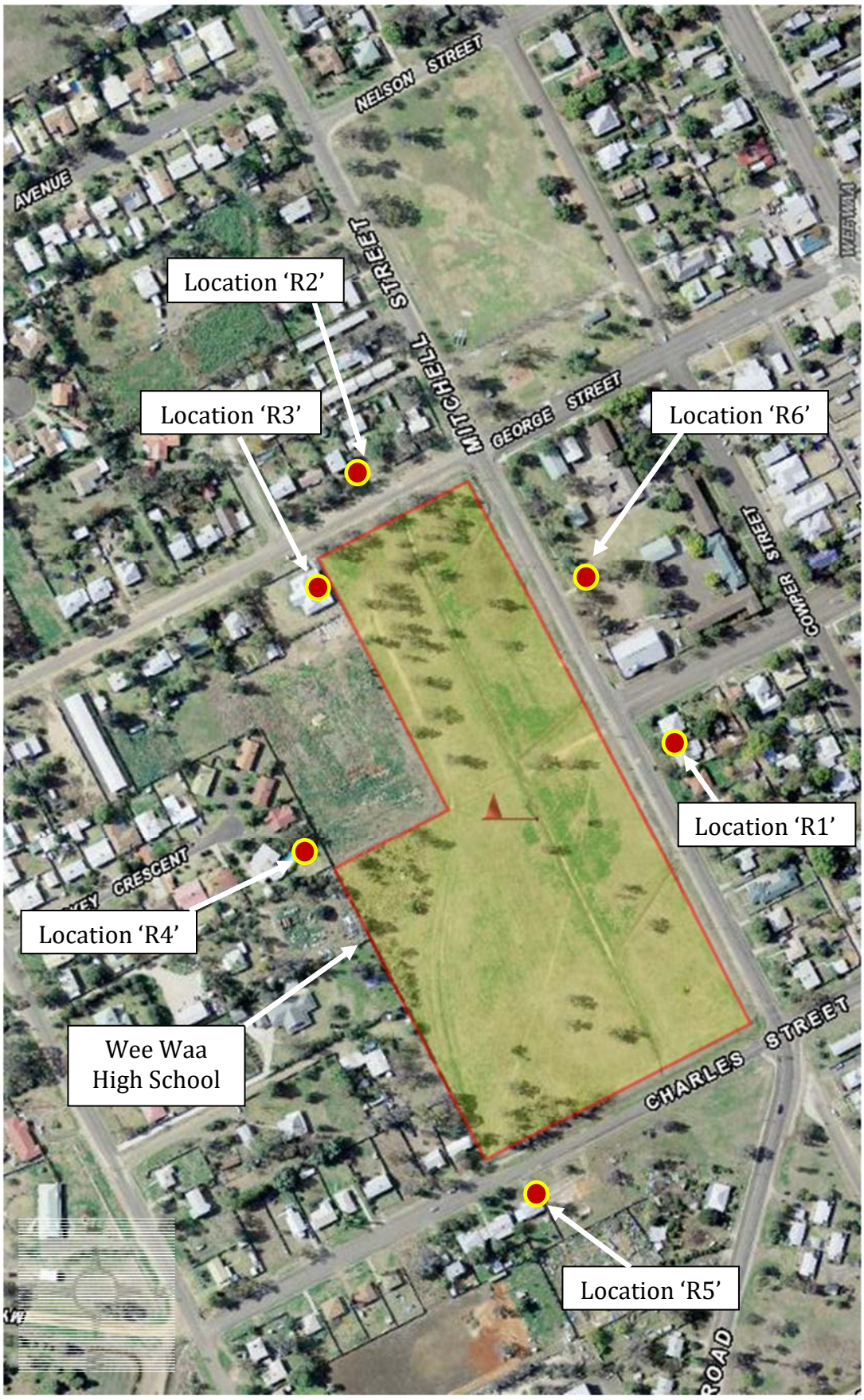


Figure 2 : Residential Locations – Wee Waa High School

3.0 NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis were made with instrumentation as follows in Table 2:

Table 3 Noise Instrumentation

Description	Model No	Serial No
Infobyte Noise Logger(Type 2) Condenser Microphone 0.5" diameter	iM4 MK 250	123 123
Infobyte Noise Logger(Type 2) Condenser Microphone 0.5" diameter	iM4 MK 250	124 124
Infobyte Noise Logger(Type 2) Condenser Microphone 0.5" diameter	iM4 MK 250	125 125

An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitor iM4 is a Type 2 precision environmental noise monitor meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than n 1 dB for unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

4.0 NOISE EMISSION CRITERIA

4.1 Background Noise Level

In order to assess the severity of a possible environmental noise problem in a residential area it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying.

The ambient L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measuring period (typically 15 minutes).

The Rating Background Level (RBL) is defined by the NSW EPA as the median value of the (lower) tenth percentile of L_{90} ambient background noise levels for the day, evening or night time periods, measured over a number of days during the proposed days and times of operation.

The places of worst possible annoyance are the residences identified in Table 1. These potentially affected locations can be seen in Figure 2. The times of greatest annoyance will be during the day time when students are outdoors for breaks. Three environmental noise loggers were placed surrounding the proposed High School site as shown on Figure 1, from Wednesday 28 July to Monday 9 August 2021.

The measured noise levels are presented in the attached Appendix A1 to A3 and also in Table 4.

Table 4 Ambient Noise Levels – Wee Waa

Location	Time Period	L_{90} Rating Background Level (dBA)	Existing Ambient L_{eq} Noise Level (dBA)
Location 'A' – 86 Mitchell Street, Wee Waa	Day (7 am to 6 pm)	**40**	**58**
	Evening (6 pm to 10 pm)	**32**	**55**
	Night (10 pm to 7 am)	**31**	**52**
Location 'B' – 36 George Street, Wee Waa	Day (7 am to 6 pm)	**39**	**55**
	Evening (6 pm to 10 pm)	**34**	**48**
	Night (10 pm to 7 am)	**32**	**44**
Location 'C' – 9 Charles Street, Wee Waa	Day (7 am to 6 pm)	**39**	**53**
	Evening (6 pm to 10 pm)	**34**	**46**
	Night (10 pm to 7 am)	**30***	**44**

*Actual measured ambient noise level was 35 dBA, however appears to be affected by extraneous noise. We have therefore applied the minimum background level of 30 dBA as a conservative measure.

Extraneous noise has been excluded from the measurements. Atmospheric conditions were ideal for noise monitoring. Noise measurements were therefore considered reliable and typical for the receptor area.

4.2 SEPP (Educational Establishments and Child Care Facilities) 2017

The NSW Department of Planning and Environment (DoPE) published the State Environmental Planning Policy (SEPP) (Educational Establishments and Child Care Facilities) 2017 on 1 September 2017. 'Schedule 4 Schools – design quality principles' of the SEPP requires the following:

'Principle 5. Amenity

> *Schools should provide pleasant and engaging spaces that are accessible for a wide range of educational, informal and community activities, while also considering the amenity of adjacent development and the local neighbourhood.'*

4.3 NSW EPA's Noise Guide for Local Government

The NSW Environment Protection Authority's (EPA) *Noise Guide for Local Government* was published in October 2010. The guide is specifically aimed at assessing noise from light industry, shops, entertainment, public buildings, air conditioners, pool pumps and other noise sources in residential areas.

The appropriate regulatory authority may, by notice in writing given to such a person, prohibit the person from causing, permitting or allowing:

(a) any specified activity to be carried on at the premises, or

(b) any specified article to be used or operated at the premises,

or both, in such a manner as to cause the emission from the premises, at all times or on specified days, or between specified times on all days or on specified days, of noise that, when measured at any specified point (whether within or outside the premises,) is in excess of a specified level.

4.4 NSW Noise Policy for Industry

The NSW Environment Protection Authority (EPA) published the *Noise Policy for Industry* (NPI) in October 2017, superseding the NSW Industrial Noise Policy. The NPI is specifically aimed at assessing noise from industrial noise sources listed in Schedule 1 of the Protection of the Environment Operations Act 1997 (POEO, 1997).

The High School is not a 'scheduled premises' under the Protection of the Environment Operations Act 1997 as it is not required to hold a licence under that Act for operations at the site.

The NPI provides a useful framework to assess noise emission from non-scheduled premises, whether that premises produces intrusive or non-intrusive noise.

While the NPI is not strictly applicable to this site, as the site is not scheduled, in the absence of other relevant standards the limits set out in the NPI will be used as a guide in determining whether the level of noise is considered intrusive or not.

4.4.1 Intrusiveness Noise Level

The EPA states in Section 2.3 of its NPI that 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, does not exceed the rating background noise level by more than 5 dB when beyond a minimum threshold (NPI, 2017, Section 2.3).

The representative Rating Background Levels were as shown in Table 4 above. Therefore the acceptable L_{eq} noise intrusiveness noise level for broadband noise at these locations are as shown in Table 5.

Table 5 Acceptable Intrusive Noise Levels – Wee Waa

Location	Time Period	L_{90} Rating Background Level (dBA)	Acceptable Intrusive Noise Level (dBA)
Location 'R1' – Residences Near Mitchell Street	Day (7 am to 6 pm)	40	(40 +5 =) **45**
	Evening (6 pm to 10 pm)	32	(32 +5 =) **37**
	Night (10 pm to 7 am)	31	(31 +5 =) **36**
Location 'R2', 'R3', – Residences Near George Street	Day (7 am to 6 pm)	39	(39 +5 =) **44**
	Evening (6 pm to 10 pm)	34	(34 +5 =) **39**
	Night (10 pm to 7 am)	32	(32 +5 =) **37**
Location 'R4', 'R5' – Residences Near Charles Street	Day (7 am to 6 pm)	39	(39 +5 =) **44**
	Evening (6 pm to 10 pm)	34	(34 +5 =) **39**
	Night (10 pm to 7 am)	30	(30 +5 =) **35**

4.4.2 Amenity Noise Level

Depending on the type of area in which the noise is being made, there is a certain reasonable expectancy for noise amenity. The NPI provides a schedule of recommended L_{eq} industrial noise levels that under normal circumstances should not be exceeded. If successive developments occur near a residential area, each one allowing a criterion of background noise level plus 5 dB, the ambient noise level will gradually creep higher.

The recommended L_{eq} noise levels in Table 6 below are taken from Section 2.2 of the INP.

Table 6 Amenity Noise Level

Receiver	Noise Amenity Area	Time of Day	L_{Aeq} Noise Level, dBA
			Recommended amenity noise level
Residential	Suburban	Day	55
		Evening	45
		Night	40
School Classroom – internal	All	Noisiest 1-hour period when in use	35
Active recreation area (eg school playground, golf course)	All	When in use	55

The project specific amenity noise level is then calculated to be the recommended amenity noise level minus 5 dB(A).

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. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes that the $\mathbf{L_{Aeq,15min}}$ will be taken to be equal to the $\mathbf{L_{Aeq,\,period}}$ **+ 3 decibels (dB)**.

Where the existing ambient noise level is dominated by high levels of road traffic noise, the level of industry noise may be effectively inaudible. In such cases, the project amenity noise level may be derived from the $L_{Aeq,\,period(traffic)}$ minus 15 dB. In this case, road traffic noise levels from Pacific Highway and Centennial Avenue are higher than the recommended amenity noise levels.

The existing L_{eq} noise level at Wee Waa is shown in Table 4. Therefore the acceptable L_{eq} amenity noise level for in this area is as shown in Table 7.

Table 7 Acceptable Amenity Noise Levels – Wee Waa

Location	Time Period	Existing Ambient L_{eq} Noise Level (dBA)	Acceptable Amenity L_{eq} Noise Level (dBA)
Location 'R1' – Residences Near Mitchell Street	Day (7 am to 6 pm)	**58**	(55 – 5 +3 =) **53**
	Evening (6 pm to 10 pm)	**55**	(45 – 5 +3 =) **43**
	Night (10 pm to 7 am)	**52**	(40 – 5 +3 =) **38**
Location 'R2', 'R3', – Residences Near George Street	Day (7 am to 6 pm)	**55**	(55 – 5 +3 =) **53**
	Evening (6 pm to 10 pm)	**48**	(45 – 5 +3 =) **43**
	Night (10 pm to 7 am)	**44**	(40 – 5 +3 =) **38**
Location 'R4', 'R5' – Residences Near Charles Street	Day (7 am to 6 pm)	**53**	(55 – 5 +3 =) **53**
	Evening (6 pm to 10 pm)	**46**	(45 – 5 +3 =) **43**
	Night (10 pm to 7 am)	**44**	(40 – 5 +3 =) **38**
Location 'R6' – School Classroom – internal	Noisiest 1-hour period when in use	**-**	(40 – 5 +3 =) **35**
Location 'R6' Active recreation area (eg school playground, golf course)	When in use	**-**	**55**

4.5 AAAC Noise Criteria for Outdoor Play Areas

In May 2008, the Association of Australasian Acoustical Consultants (AAAC) first published the *Technical Guideline for Child Care Centre Noise Assessment*. The guideline was updated in 2020 to assist both AAAC members and local councils to assess the noise impact from proposed child care centres both accurately and fairly, (see www.aaac.org.au).

Although the proposed development is a High School and therefore may produce different levels of noise than a childcare centre, there are similarities in noise emission from uses of outdoor play areas for schools and childcare centres. As students do not play outdoors continuously for long periods of time, and as the duration of time for students playing outside is reduced, the overall noise annoyance reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration.

The AAAC document states that a total time limit of 4 hours of outdoor play per day (eg 2 hours in the morning and 2 hours in the afternoon) should allow an additional 5 dB noise impact.

We recommend that the noise criteria detailed in *Technical Guideline for Child Care Centre Noise Assessment* be applied to outdoor areas of the School.

The relevant criteria is $L_{eq,\ 15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at any residential assessment location.

4.6 Road Traffic Noise Criteria

The NSW Road Noise Policy, in Section 2.3.1, sets out road traffic noise assessment criteria for residential land uses in Table 3. The information in that table is extracted below in Table 8.

Table 8 Road Traffic Noise Assessment Criteria - Residential

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial roads	$L_{Aeq, (15\ hour)}$ 55 (external)	$L_{Aeq, (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing new Freeway/arterial/sub-arterial roads	$L_{Aeq, (15\ hour)}$ 60 (external)	$L_{Aeq, (9\ hour)}$ 55 (external)
	3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments		
Local roads	4. Existing residences affected by noise from **new** local road corridors	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)
	5. Existing residences affected by noise from **redevelopment** of existing local roads		
	6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments		

Note: Land use developers must meet internal noise goals in the Infrastructure SEPP for sensitive developments near busy roads.

4.7 Project Specific Noise Emission Criteria

When all the above factors are considered, we find that the most stringent noise criterion at the nearby residential premises is shown in Table 9.

Table 9 Project Specific Noise Levels – Wee Waa

Location	Time Period	Acceptable Outdoor Play Noise Level (dBA)	Project Specific Noise Level (dBA)
Location 'R1' – Residences Near Mitchell Street	Day (7 am to 6 pm)	**50**	**45**
	Evening (6 pm to 10 pm)	**-**	**37**
	Night (10 pm to 7 am)	**-**	**36**
Location 'R2', 'R3', – Residences Near George Street	Day (7 am to 6 pm)	**49**	**44**
	Evening (6 pm to 10 pm)	**-**	**39**
	Night (10 pm to 7 am)	**-**	**37**
Location 'R4', 'R5' – Residences Near Charles Street	Day (7 am to 6 pm)	**49**	**44**
	Evening (6 pm to 10 pm)	**-**	**39**
	Night (10 pm to 7 am)	**-**	**35**
Location 'R6' – School Classroom – internal	Noisiest 1-hour period when in use		**33**
Location 'R6' Active recreation area (eg school playground, golf course)	When in use		**53**

These criteria apply at the most-affected point on or within the residential property boundary. For upper floors, the noise is assessed outside the nearest window.

With a typical noise reduction of 10 dB achieved through an open window, a noise criteria of (33 + 10 =) 43 dBA outside classrooms of the Public School has been used for this assessment.

5.0 SCHOOL NOISE EMISSION

The main sources of noise from the proposed Wee Waa High School will be from students playing outside, amplified music and speech in the hall and mechanical plant. Calculations are based on the building layout provided by SHAC Architects shown in Appendix D.

5.1 Students in Outdoor Areas

Students will be outside for a range of times, including before school, recess, lunch, PE classes and after school, however the outdoor areas are only likely to be at capacity during recess and lunch.

In order to model the worst case scenario of noise emission from students outdoors, we have assessed the school students at each site spread evenly between the central courtyard, outdoor play and sports ground areas.

5.1.1 Student Noise Levels at Play

Sound power levels of students at play were previously measured for other similar projects and are presented in Table 10. These levels represent the typical maximum noise levels of students at play and will be used in this noise assessment.

Table 10 Students at Play (outside) L_{eq} Sound Power Levels

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
1 person talking normally	**66**	57	57	63	66	59	55	51	46
1 person talking with a raised voice	**72**	61	61	67	72	67	63	58	51
1 student at play	**79**	54	64	69	73	76	73	68	65
200 students	**102**	77	87	92	96	99	97	91	88

Knowing the sound power level of a noise source, the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, sound barriers, etc.

5.1.2 Predicted Noise Levels from Outdoor Play

The predicted level of noise from all 200 students playing outside was used as a worst case scenario and is calculated to be as shown in Table 11 at the worst affected residences.

Table 11 Predicted L_{eq} Outdoor Noise Levels

Receptor Location	Predicted Noise Level (dBA)	Noise Criteria (dBA)
R1 - 94 Mitchell Street	57	50
R2 - 28 George Street	48	49
R3 - 41 George Street	56	49
R4 - 13 Tuckey Crescent	52	49
R5 - 7 Charles Street	43	49
R6 - Wee Waa Public School Playground	51	53
R7 - Wee Waa Public School Classrooms (outside)	49	43

The above predicted noise levels typically meet the acceptable noise level, with the exception of residential locations situated directly adjacent to the outdoor sports fields or common courtyard.

We have received guidance from the NSW Environment Protection Authority with regards to playground noise. The presentation makes reference to a legal proceeding *Meriden School v Pedavoli [2009] NSW LEC 183 (22 October 2009)* (http://www.austlii.edu.au/cgi-bin/viewdoc/au/cases/nsw/NSWLEC/2009/183.html) where reasonable noise emission from a school development during school hours is expected and considered acceptable.

In this case, given the limited duration of noise from outdoor play, and expectations of noise from students at a school site we are of the opinion that the exceedance of the noise criteria from outdoor play would be considered acceptable.

5.2 Public Address System and School Bell

The Wee Waa High School will likely be provided with a public address system and a bell to signal the start and end of classes. The locations of the speakers have not yet been determined however assuming up to 6 speaker locations are provided, with speakers facing inwards towards the School/downwards towards the ground, and positioned no closer than 40 metres from the nearby residences, the maximum sound pressure level should be no greater than **85 dBA** at 3 metres from each speaker in order to meet the residential noise criteria at the nearest residents to the north.

5.3 Waste Collection and Grounds Maintenance

As part of the school operation, waste collection and grounds maintenance, including the use of lawn mowers, leaf blowers and power tools for minor repairs, are to be restricted to the daytime hours of between 7 am and 6 pm Monday to Friday.

5.4 School Hall

The hall at Wee Waa High School will be located along the southern side of the site, near Mitchell Street.

The School Hall will be used by students and teachers during school hours for activities such as indoor sport and fitness, assemblies, drama and music rehearsal and production. The School Hall may be used infrequently outside of these hours for school or community events.

Based on previous experience of other High Schools in NSW, a typical use of the Hall outside of School hours is assumed to be as follows:

- Disco; 1 to 2 times a year from 3 pm to 7 pm;
- Band 1 to 2 times a week 8 am-9 am in hall;
- Year 12 farewell – 1 x per year;
- Presentation nights – 2 x per year.

We recommend that use of the School Hall be restricted to daytime and evening period of 7 am to 10 pm only.

A schedule of the sound power levels for loudest activities that may occur within the School Hall is presented in Table 12.

Table 12 Hall Activity L_{eq} Sound Power Levels

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Amplified music – concert	**98**	103	106	102	95	92	86	81	78
Fitness class – 30 students with amplified music	**87**	93	87	82	81	84	79	75	72
Indoor ball sports	**97**	71	74	79	84	94	92	87	81

The indoor sports and fitness class may occur during the daytime and are therefore compared against the daytime criteria. The amplified music during a concert/disco/function may occur during the evening and is therefore compared against the evening criteria.

The predicted level of noise from activities within the School Hall is calculated with the doors open during the day and evening as shown below in Table 13 and Table 14 below respectively at the worst affected residences.

Table 13 Predicted L_{eq} Hall Noise Levels During the Day

Receptor Location	Predicted Noise Level (dBA) Doors Open	Predicted Noise Level (dBA) Doors Closed	Noise Criteria (dBA)	Compliance (Yes/No)
R1 - 94 Mitchell Street				
- Fitness class	37	20	45	Yes
- Indoor ball sports	47	25	45	Yes*
R2 - 28 George Street				
- Fitness class	26	17	44	Yes
- Indoor ball sports	36	18	44	Yes
R3 - 41 George Street				
- Fitness class	26	18	44	Yes
- Indoor ball sports	36	19	44	Yes
R4 - 13 Tuckey Crescent				
- Fitness class	35	18	44	Yes
- Indoor ball sports	45	23	44	Yes*
R5 - 7 Charles Street				
- Fitness class	28	16	44	Yes
- Indoor ball sports	38	18	44	Yes
R6 - Wee Waa Public School Playground				
- Fitness class	42	23	53	Yes
- Indoor ball sports	52	29	53	Yes
R7 - Wee Waa Public School Classrooms (outside)				
- Fitness class	38	20	43	Yes
- Indoor ball sports	48	25	43	Yes*

*With Doors Closed

Table 14 Predicted L_{eq} Hall Noise Levels in the Evening

Receptor Location	Predicted Noise Level (dBA) Doors Open	Predicted Noise Level (dBA) Doors Closed	Noise Criteria (dBA)	Compliance (Yes/No)
R1 - 94 Mitchell Street				
- Concert/Disco/Function	49	37	37	Yes*
R2 - 28 George Street				
- Concert/Disco/Function	38	31	39	Yes
R3 - 41 George Street				
- Concert/Disco/Function	47	34	39	Yes*
R4 - 13 Tuckey Crescent				
- Concert/Disco/Function	47	33	39	Yes*
R5 - 7 Charles Street				
- Concert/Disco/Function	40	30	39	Yes*

*With Doors Closed

The levels of noise in Table 13 are typically within the acceptable noise criteria in Section 4.7 and are therefore acceptable during the daytime. To comply with the noise criteria for all activities, we recommend that half of the large glass doors be closed during noisy events during the daytime.

The levels of noise in Table 14 exceed the acceptable noise criteria in Section 4.7 during the evening with the glass doors open. To use the hall in the evening we recommend the large glass doors be kept closed during noisy events. As the external windows and doors need to be kept closed, an alternative form of ventilation will be required for the space. The noise emission from any mechanical plant serving the hall in the evening should be designed to meet the acceptable noise criteria.

5.5 Mechanical Plant

The type of mechanical plant has not yet been selected for the High School. Two air conditioning compounds have been marked on the site plan (adjacent to Building D and near Building E). Any new mechanical plant will typically only operate during day time and occasionally during the evening hours, Monday to Friday.

5.5.1 Mechanical Plant Sound Power Levels

The sound power level for typical equipment used at school sites is presented in Table 15.

Table 15 Mechanical Plant L_{eq} Sound Power Levels

Description	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Kitchen Exhaust Fan (Large)	**90**	91	89	89	87	87	81	71	68
Supply Air Fan	**83**	74	76	77	80	80	73	69	61
Toilet Exhaust Fan	**59**	48	48	56	57	54	53	45	38
Air Conditioner - Typical (Similar to RXYMQ9AY1)	**76**	77	78	76	73	71	68	61	55

Knowing the sound power level of a noise source, the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, sound barriers, etc.

5.5.2 Predicted Noise Levels – Mechanical Plant

Given the large separation distances and acoustic shielding from the school buildings, it is likely that the noise emission will be able to meet the noise criteria. The AC plant areas can be either positioned or acoustically treated to further reduce the level of noise emission.

We have assumed that there may be up to 10 condenser units located within each A/C compound, surrounded by privacy ventilation louvres (adjacent to Building D and near Building E). The predicted level of noise emission from the condenser units is shown in Table 16.

Table 16 Predicted L_{eq} Noise Levels from Condenser Units

Receptor Location	Predicted Noise Level (dBA)	Noise Criteria (dBA)	Compliance (Yes/No)
R1 - 94 Mitchell Street	41	45	Yes
R2 - 28 George Street	40	44	Yes
R3 - 41 George Street	43	44	Yes
R4 - 13 Tuckey Crescent	38	44	Yes
R5 - 7 Charles Street	34	44	Yes
R6 - Wee Waa Public School Playground	43	53	Yes
R6 - Wee Waa Public School Classroom	43	43	Yes

The air conditioning condenser units will be able to meet the acceptable noise level where they are currently located within the compounds.

Once the mechanical plant selection has been finalised, a final assessment should be made of the mechanical plant noise emission, prior to the issue of a Construction Certificate.

5.6 On Road Traffic Noise Emission

The traffic generated from the operation of the school site on the surrounding road network is assessed against the Road Noise Policy criteria of 60 dBA during the day on arterial/sub-arterial roads and 55 dBA on local roads.

The SEL (sound exposure level) sound power level and spectrum of car noise and L_{eq} sound power level of bus noise was previously measured by Day Design and is given in Table 17.

Table 17 SEL Levels of Car Noise and L_{eq} Levels of Bus Noise

Description	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
SEL level of car travelling 40 km/h	**95**	97	93	91	91	92	84	76	69
SEL level of car travelling 50 km/h	**97**	99	97	94	93	95	87	77	70
SEL level of car travelling 60 km/h	**99**	96	95	95	95	97	89	79	71
L_{eq} Bus – Volvo Idling	**90**	97	93	86	86	85	85	79	73
L_{eq} Bus – Volvo 30 km/h	**98**	105	101	94	94	93	93	87	81
L_{eq} Bus – Volvo 50 km/h	**101**	108	104	97	97	96	96	90	84

TTW Pty Ltd in their Traffic and Accessibility Impact Statement (reference 211022 TAAB) outlines in Section 4.2 outlines the trip generation as a result of the new Wee Waa High School on the surrounding road network, estimated to be 150 trips.

Based on the above car movements generated by the school site per day, and one bus every 15 minutes, the predicted level of traffic noise at the nearby residences is as shown in Table 18.

Table 18 Predicted L_{eq} Noise Levels from Traffic Generation

Receptor Location	Predicted Noise Level (dBA)	Noise Criteria (dBA)	Compliance (Yes/No)
R1 - 94 Mitchell Street	57	60	Yes
R2 - 28 George Street	50	55	Yes
R3 - 41 George Street	55	55	Yes
R4 - 13 Tuckey Crescent	38	55	Yes
R5 - 7 Charles Street	53	55	Yes
R6 - Wee Waa Public School Playground	55	60	Yes
R6 - Wee Waa Public School Classroom	49	50	Yes

The traffic generation as a result of the new Wee Waa High School, including use of the kiss and ride and bus bay, will be able to meet the acceptable noise level for on-road traffic noise and considered acceptable.

6.0 NOISE CONTROL RECOMMENDATIONS FOR NOISE EMISSION

6.1 Mechanical Plant

The mechanical plant has yet to be selected for this High School development. We recommend a detailed assessment be carried out once the plant selection is nearing completion, prior to the issue of a Construction Certificate to ensure the acceptable noise criteria is able to be met.

Some typical noise control solutions are detailed below.

6.1.1 Air Conditioning Plant Compound

The air conditioning plant should be enclosed using standard ventilation louvres.

The ventilation louvre screens should be selected such that they do not provide line-of-sight to the condenser units within the compound.

6.1.2 Acoustic Attenuators

We recommended any ventilation fan selected (including kitchen exhaust fan) be an in-duct fan such that acoustic attenuation measures can be installed.

Acoustic attenuators may be installed on the intake and discharge side of the ventilation fans. An example of an acoustic attenuator for a kitchen exhaust fan serving the culinary rooms is shown in Table 19.

Table 19 Attenuator Specification

Description	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Attenuator*	3	3	6	11	9	6	5	5

*Based on Fantech C1-080QS, 900 mm in length

6.2 Boundary Sound Barrier Wall to Driveway

Without a sound barrier wall the noise emission from use of the car park driveway would exceed the noise criteria by up to 7 dB at the nearest residential neighbour of 41 George Street.

To meet the noise criteria, we recommend that the car park driveway, that is located adjacent to 41 George Street, have a 2.1 metre high solid sound barrier wall constructed for a minimum length of 60 metres from the street boundary (to the approximate end of the car parking spaces and bike storage cage near Building E). The sound barrier wall may be constructed on the boundary or be located closer to the driveway bitumen.

The fence may be constructed from masonry or Colorbond, although alternative materials 3 rail ‘solid capped and lapped’ timber or masonry are also acceptable. The construction shall be free of visible air gaps to provide an impervious sound barrier.

An alternative would be to provide an earth mound 2.1 metre high (or combination of earth mound and solid fencing to the same height) in the landscaping area between the boundary and the driveway.

If noise controls measures at the school property are not feasible, or are not desired by the affected neighbouring resident(s), and an agreement can be made with the residential neighbour, alternative solutions possibly including vegetation screen and/or at property treatment (including providing air conditioning) may be considered with an acceptance of the noise criteria not being met.

6.3 PA Speaker System

The locations of the speakers has not yet been determined however assuming up to 6 speaker locations are provided, with speakers facing inwards towards the School/downwards towards the ground, and positioned no closer than 40 metres from the nearby residences, the maximum sound pressure level should be no greater than **85 dBA** at 3 metres from each speaker in order to meet the residential noise criteria at the nearest residences.

6.4 Waste Collection and Grounds Maintenance

As part of the school operation, waste collection and grounds maintenance, including the use of lawn mowers, leaf blowers and power tools for minor repairs, are to be restricted to the daytime hours of between 7 am and 6 pm Monday to Friday.

6.5 Hall Building Construction

We recommend that the construction of the hall be as follows:

6.5.1 External Walls

All external walls may be of brick (masonry) construction which is acceptable.

If lightweight clad walls are proposed at high level, we recommend the following construction:

- Selected external cladding on tophats,
- Moisture barrier as required,
- 13 mm thick fire rated plasterboard or 22 mm plywood or equivalent non-combustible lining to the inside of steel framing,
- 75 mm thick glasswool insulation (minimum density 10 kg/m^3) installed between the steel framing.

6.5.2 Ceiling and Roof System

- All roofs may be of metal deck construction with a heavy duty vapour barrier laid below the roof.
- Ceilings under the roof should comprise one layer of 10 mm plasterboard or 22 mm plywood or equivalent non-combustible lining.
- Insulation batts are to be placed between the ceiling joists. The recommended insulation specifications are a minimum 160 mm thick glasswool (min 10 kg/m^3 density).

6.5.3 Glazing and Glazed Doors

We recommend that the external glazing (including the large barn doors) be minimum 5 mm glass.

6.6 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claims of expertise in other areas of building construction and therefore the recommended noise controls should be implements into the building design in consultation with other specialists to ensure they meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

7.0 ACCEPTABLE NOISE INTRUSION LEVELS

7.1 NSW Road Noise Policy 2011

The NSW Road Noise Policy, in Section 2.3.2, sets out road traffic noise assessment criteria for land uses other than residential in Table 4. The information in that table is extracted below in Table 20.

Table 20 Road Traffic Noise Assessment Criteria – Non- Residential

Existing sensitive land use	Assessment Criteria – dB(A)		Additional considerations
	Day (7 am – 10 pm)	Night (10 pm – 7 am)	
1. School classrooms	$L_{Aeq, (1\ hour)}$ 40 (internal) when in use		In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard AS2107:2000

7.2 Educational Facilities Standards and Guidelines

The NSW Department of Education (DoE) document Educational Facilities Standards and Guidelines (EFSG) provides guidance on the acoustic performance requirements of the various areas and spaces within a school to encourage and foster an environment conductive to learning. Table 11.06.1 of the EFSG provides a list of recommended design sound levels for different areas of occupancy in school buildings.

The noise intrusion from outside and noise emission from air conditioning and ventilation, while the air conditioning system is operating at normal load, should not exceed the levels shown in Table 21 within rooms of the proposed School buildings.

Table 11.06.1 of the EFSG also provides a list of recommended design reverberation times for rooms within a school building with different usages. From the intended usage of the room, we recommend that the design reverberation times across the audible sound spectrum be as listed in Table 21.

Table 21 Guideline on Internal Noise Levels

Room	Internal noise level (dB L_{Aeq})	Reverberation time, s RT_{60} (Av 500Hz and 1000Hz)
Art/craft studios	40	<0.8
Assembly halls over 250 seats	35	see note 1
Audio-visual areas	35	<0.8
Computer rooms – Teaching	40	<0.6
Computer rooms – Laboratories	45	<0.6
Conference rooms	35	<0.7
Corridors and lobbies	45	Minimise
Dance Studios	40	< 1.2
Drama Studios	30	< 1
Duplicating rooms/stores	50	n/a
Engineering Workshops	50	Minimise
Gymnasiums	40	<1.5
Interview/counselling rooms	35	<0.6
Kitchens	50	n/a
Laboratories – Teaching	40	< 0.7
Laboratories - Working	45	< 0.8
Libraries – General areas	40	<0.6
Libraries – Reading areas	35	<0.6
Libraries – Stack areas	45	<0.6
Manual arts workshops	40	Minimise
Medical rooms (First aid)	40	<0.8
Office areas	40	<0.8
Open plan teaching areas	40	<0.8
Professional and Administrative offices	35	<0.8
Staff common rooms	40	<0.6
Study rooms	35	<0.8
Teaching spaces – Hearing impaired	30	<0.4
Teaching spaces – Primary Schools	35	<0.5
Teaching spaces – Secondary Schools	35	<0.6
Toilet/change/showers	50	n/a

Note 1: The appropriate reverberation time shall be influenced by the internal volume and intended use of the space. Guidance from an acoustical engineer shall be sought. Also refer to AS/NZS 2107:2016 Figure A1 for guidance values.

Reverberation Time curves from AS2107:2016 can be seen in the attached Appendix C.

7.3 Australian Standard AS2107:2016

Australian Standard AS2107:2016 "*Acoustics – Recommended design sound levels and reverberation times for building interiors"* provides a list of recommended design sound levels for different areas of occupancy in buildings. The recommended internal noise levels and reverberation times for various rooms in Educational buildings are shown below in Table 22.

Table 22 AS2107 Recommended Internal Noise Levels

Type of occupancy/activity	Design sound level L_{eq} dB(A)	Recommended Reverberation Time (T).s
EDUCATIONAL BUILDINGS		
Teaching spaces/single classrooms -		
Open plan teaching spaces	35 - 45	0.4 to 0.5
Primary Schools	35 - 45	0.4 to 0.5
Secondary Schools	35 - 45	0.5 to 0.6
Libraries -		
General areas	40 - 50	0.4 to 0.6
Reading areas	40 - 45	0.4 to 0.6
Office areas	40 - 45	0.6 to 0.8
Assembly Halls over 250 Seats	30 - 35	0.4 to 0.6

8.0 ROAD TRAFFIC NOISE LEVELS

8.1 Measured Road Traffic Noise Levels

The buildings within the proposed Wee Waa High School will possibly be affected by road traffic noise from Mitchell Street, which is the main thoroughfare of Wee Waa.

A noise monitor was placed at the front of a residence fronting Mitchell Street, designated Measurement Location 'A', as shown in Figure 1.

Over a period of seven days, from Wednesday 28 July to Monday 9 August 2021, noise data was gathered to determine the road traffic noise level from Mitchell Street.

The following noise levels were measured during the day time periods:

Table 23 Long Term Road Traffic Sound Pressure Levels (Fast response)

Location	Daytime $L_{Aeq, 11\ hour}$ Noise Level (7 am to 6 pm)	Daytime $L_{Aeq, 1\ hour}$ Noise Level (9 am to 3 pm)
Location 'A' – 86 Mitchell Street, Wee Waa (Front Yard)	58 dBA	60 dBA

Atmospheric conditions were ideal for noise monitoring. Noise measurements were therefore considered reliable and typical for the receptor area.

These measurements were carried out at approximately 10 metres from the nearest trafficable lane on Mitchell Street. The proposed High School buildings are proposed to be set back 40 metres from the road. The above measured noise levels have therefore been calculated to the front façade of the buildings.

Table 24 Road Traffic Sound Pressure Levels (Fast response) at School Facade

Location	Daytime $L_{Aeq, 11\ hour}$ Noise Level (7 am to 6 pm)	Daytime $L_{Aeq, 1\ hour}$ Noise Level (9 am to 3 pm)
High School Building A - C	52 dBA	54 dBA

We are of the opinion that the noise levels in Table 24 is typical for this area, and have adopted these values in the design of noise insulation for the proposed School buildings.

8.2 Required Road Traffic Noise Reduction

Based on the acceptable noise levels established in Section 6 of this report, the required noise reduction from road traffic for classrooms (internal level 35 dBA) is shown in Table 25:

Table 25 Required Road Traffic Noise Reduction (TNR)

Location	Room Description	Required TNR
Wee Waa High School *(Windows Closed)*	Classrooms	Up to 19 dB
Wee Waa High School *(Windows Open)*	Classrooms	Up to 9 dB

8.3 Mechanical Ventilation Requirements

For natural ventilation, with 20% of the windows and external doors open, the level of noise inside the rooms from road traffic should not exceed 10 dB above the internal noise criteria.

Up to 10 dB noise reduction can be achieved with the windows/doors open. A noise reduction of up to 9 dB is required for the classrooms closest to Mitchell Street.

Mechanical ventilation is not required to provide fresh air as the windows and doors may remain open and meet the internal open window acceptable noise level.

The noise emission from any ventilation plant, if installed, should be acoustically treated if necessary, to reduce the noise emission level inside the school buildings to levels complying with the recommended design sound levels in Australian Standard AS2107:2016.

9.0 RECOMMENDED ACOUSTICAL TREATMENT FOR TRAFFIC NOISE

We have modelled the proposed High School internal spaces based on preliminary architectural drawings by SHAC Architects and calculated the level of road traffic noise intrusion through the roof, walls, glazed doors and windows using the noise levels established in Section 8.1.

We have assumed that classrooms will be carpeted. We have assumed that all other areas (hallways, wet areas) will have hard, reflective floors such as tiles or vinyl.

The necessary noise reduction for the rooms can be achieved if the following noise control recommendations are complied with, and there are no gaps at construction joints, around plumbing penetrations in external walls, at window sills, door frames, etc., through which sound may penetrate.

9.1 External Walls

- All external walls may be of double brick or brick veneer construction.

If lightweight walls are proposed, we recommend the following wall construction:

- Hardies' 'Linea' or 'Stria' cement composite cladding (or alternative cladding with equivalent surface density) on battens fixed to,
- 9 mm fibre cement sheeting on the outside of 90 mm timber or 92 mm steel studs, and
- one layer of 13 mm thick plasterboard on the internal side, with joints staggered, and
- wall cavity lined with 100 mm thick glasswool insulation (min 10 kg/m^3 density).

9.2 Ceiling and Roof System

- All roofs may be of concrete slab construction, minimum 200 mm thick.

If roofs are proposed to be of metal deck construction, we recommend the following:

- All roofs may be of metal deck construction with a heavy duty vapour barrier laid below the roof,
- Ceilings under the roof should comprise one layer of 10 mm plasterboard with joints overlapped,
- Insulation batts are to be placed between the ceiling joists. The recommended insulation specifications are a minimum 160 mm thick glasswool (min 10 kg/m^3 density).

9.3 Glazing and Glazed Doors

Unless otherwise specified, window frames may be either sliding/awning, or hinged casement style and be of robust sound-barrier construction having interlocking stiles and neoprene (Q-lon or similar) or vinyl finned seals to minimise sound leakage.

A typical glazing specification is given in Table 26, however an alternative glazing specification may be used if the R_w is achieved or exceeded.

Table 26 Schedule of Glazed Windows and Door Constructions

Room Description	Min R_W	Typical Glazing Specification
Building A		
Office Areas facing Mitchell Street	29	5 mm glass with acoustic seals
Building B		
GLS/Seminar Room facing Mitchell Street	29	5 mm glass with acoustic seals
Building C		
Hall	29	5 mm glass with acoustic seals

This schedule of construction is typical and for general guidance to the architect in preparing final construction drawings and specifications. Other constructions that provide the same or better Sound Transmission Loss performance may also be acceptable.

It is most important that any sound leakage paths around the windows be sealed off. We recommend that prior to the fitting of the architraves around the windows, the space between the frames and the wall structure be sealed off with silicone or polyurethane mastic and backing rods installed behind. The window architraves can then be fitted.

9.4 Eligible Suppliers of Windows

The windows are the most critical sound paths in a building. Only those companies who have conducted laboratory testing of their windows should be considered as eligible suppliers. Companies that we are aware of having conducted satisfactory testing include:

- *Architectural Window Systems,* Wetherill Park, NSW Phone: 8783 7611
- *Micos Aluminium Pty Ltd,* Hillsdale, NSW Phone: 9661 5233
- *Christoffel Pty Ltd*, Glendenning, NSW Phone: 9627 4811
- *Aska Windows*, Greenacre, NSW Phone. 9642 8588
- *James Hardie (Trend) Windows*, Girraween, NSW Phone: 9840 2000
- *Boral Window Systems*, Smithfield, NSW Phone: 9757 0555
- *Stegbar (Windows) Pty Ltd*, Lansvale, NSW Phone: 9794 5200
- *Wideline Windows and Doors,* Rosebery, NSW Phone: 1300 943 354

Day Design should be consulted with before any other manufacturers' products are considered. R_w ratings claimed should be supported by acoustical laboratory test reports. We suggest that you obtain confirmation from the glazier that the glazing supplied will meet the required R_w rating above.

9.5 Mechanical Ventilation

To achieve the required internal noise levels many rooms need heavier than standard glazing with the windows and doors closed. These rooms may be seen from Table 26 and are to be ventilated to the standards set out in clause F4.5 of the Building Code of Australia and Australian Standards AS1668.2:1991.

An air conditioning system with fresh air supply may be used to provide fresh air while the windows and doors are closed.

The noise emission from the air conditioning system should be acoustically treated, if necessary, to reduce the noise emission level inside school buildings to levels complying with the criteria in Section 4.7 of this report.

9.6 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claim of expertise in other areas and draw your attention to the possibility that our recommendations may not meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. For example, a small crack between the top of a wall and a ceiling can reduce the effective sound transmission loss of a wall from R_w 50 to R_w 40. Therefore the use of contractors that are experienced in acoustic construction is encouraged. Furthermore, two insulation products may have the same thermal R rating but the sound absorption of one may be entirely deficient, therefore the use of materials and equipment that are supported by acoustic laboratory test data is encouraged.

10.0 CONSTRUCTION NOISE AND VIBRATION CRITERIA

10.1 EPA Construction Noise Guideline

The NSW Environment Protection Authority published the *Interim Construction Noise Guideline* in July 2009. While some noise from construction sites is inevitable, the aim of the Guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

The Guideline presents two ways of assessing construction noise impacts; the quantitative method and the qualitative method.

The quantitative method is generally suited to longer term construction projects and involves predicting noise levels from the construction phase and comparing them with noise management levels given in the guideline.

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts and may be used for short-term works, such as repair and maintenance projects of short duration.

In this instance, the quantitative method is the most appropriate and has been used in this assessment. Details of the quantitative method are given in Section 4 of the Guideline.

Normal construction hours are defined by the EPA as follows:

- 7.00 am to 6.00 pm Monday to Friday;
- 8.00 am to 1.00 pm Saturday; and
- No work on Sunday or Public Holiday.

Table 2 in Section 4 of the Guideline sets out noise management levels at affected residences and how they are to be applied during normal construction hours. The noise management level is derived from the rating background level (RBL) plus 10 dB in accordance with the Guideline. This level is considered to be the 'noise affected level' which represents the point above which there may be some community reaction to noise.

The 'highly noise affected' level of 75 dBA represents the point above which there may be strong community reaction to noise. This level is provided in the Guideline and is not based on the RBL. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Based on the RBL measured in the daytime as shown in Table 4, the recommended noise management level during all aspects of the construction program are summarised in Table 27.

Table 27 L_{eq} Noise Management Levels from Construction Activities

Receptor Location	Noise Management Level	How to Apply
All Residential Receptors	**R1 - 50 dBA** (40 + 10) **R2 – R5 - 49 dBA** (39 + 10)	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ noise level is greater than the noise affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Section 6, 'work practices' of The *Interim Construction Noise Guideline*, states: *"there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts.*

This approach gives construction site managers and construction workers the greatest flexibility to manage noise".

Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

The Interim Construction Noise Guideline recommends the following noise levels for land uses other than residential, as shown in Table 28. The external noise levels should be assessed at the most affected occupied point on the premises. A conservative estimate of 10 dB is generally applied as the difference between the external and internal level for noise sensitive uses that require internal noise measurement.

Table 28 Other Sensitive Land Uses

Land Use	**Noise Management Level, $L_{Aeq,(15\ minute)}$ Applies when properties are being used.**
Classrooms at schools and other educational institutions	45 dBA – Internal Noise Level (55 dBA external, windows open)

10.2 EPA Vibration Guideline

The NSW EPA published the *Assessing Vibration: a technical guideline* in February 2006. This guideline is based on the British Standard BS6472:1992 *"Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The guideline considers vibration from construction activities as Intermittent Vibration. Table 2.4 of the guideline sets out limits for Vibration Dose Values to assess intermittent vibration and is replicated in Table 29 for residential receptor locations.

Table 29 Vibration Dose Values (VDV) from Construction Activities

Receptor Location	Daytime	
	Preferred value ($m/s^{1.75}$)	Maximum value ($m/s^{1.75}$)
All Residences	0.20	0.40

The British Standard BS7385-2:1993 *"Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration"* provides guide values for transient vibration relating to cosmetic damage, replicated in Table 30 for residential buildings.

Table 30 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

In our opinion, an overall peak particle velocity of **15 mm/s** at the boundaries is an acceptable criterion for intermittent vibration to prevent cosmetic damage to the adjacent residential buildings.

11.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

The main sources of noise on the site during the construction of the school buildings will be from heavy machinery such as excavators, dump trucks and hand held pneumatic and electric power tools, etc. Activities that may cause particular annoyance, due to tonality, spectral content or impulsiveness include generator motors, hand tools such as grinders, jackhammering and other activities involving impacts. These activities will require particular attention with regard to mitigation.

As the site is a greenfield site no demolition works are required. There will be site preparation works including use of excavators and then construction of the school buildings.

11.1 Excavation and Bulk Earth Works

The excavation and bulk earth works is estimated to take 12 weeks and will involve the use of excavators and regular truck movements transporting waste materials from the site. The equipment likely to be used and their sound power levels are presented in Table 31.

Table 31 Typical Excavation/Bulk Earth Works Equipment - Sound Power Levels

Description	Sound Power Level, dBA
Excavator – Hitachi 330	110
Truck	107

(All sound power levels are based on previous noise measurements at various sites)

Given the large size of the site it is likely that the residences will be affected by high levels of noise for a short period of time as the excavators work nearby, however as they move further away across the site, the noise impact will be reduced.

The calculated noise levels at nearby residential receptors are presented in Table 32.

Table 32 Calculated Receptor Sound Pressure Levels from Excavation/Earth Works

Receptor Location	Calculated Sound Pressure Levels (dBA)	Noise Management Level (dBA)	Compliance
R1 - 94 Mitchell Street	55 - 72	50	No
R2 - 28 George Street	51 - 73	49	No
R3 - 41 George Street	52 - 90	49	No
R4 - 13 Tuckey Crescent	55 - 84	49	No
R5 - 7 Charles Street	51 - 72	49	No
R6 - Wee Waa Public School	52 - 72	55	No

11.2 Vibration Impacts

Past measurements of ground borne vibration show that vibration levels can vary significantly at different distances and receptor locations. Recommended safe working distances for various items of vibration generating plant are given in Section 6.3 of Transport for NSW Construction Noise Strategy 2012. This information is shown below in Table 33.

Table 33 Recommended Safe Working Distances for Vibration Generating Plant

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS7385)	Human Response (OH&E Assessing Vibration – A Technical Guideline)
Small Hydraulic Hammer	300 kg - 5 to 12T Excavator	2 m	7 m
Medium Hydraulic Hammer	900 kg - 12 to 18T Excavator	7 m	23 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

We recommend that compliance monitoring of ground borne vibration is carried out at the nearest residence, if required, when vibratory machinery such as pile drivers, jackhammers and the like are used on site. Refer to Section 12.12 for the mitigation measures to be engaged to reduce the impact of adverse vibration.

11.3 Construction Noise Assessment

The construction of the new buildings for Wee Waa High School will involve the use of power tools and portable mechanical plant such as generators and cement mixers. A crane may be used to locate and install precast panels for the school building. The equipment likely to be used and their corresponding sound power levels are presented in Table 34.

Table 34 Typical Construction Equipment - Sound Power Levels

Description	Qty	Sound Power Level, dBA^
Silenced Diesel Generator	Up to 2	Up to 89
Telehandler (3 ton)	1	Up to 99
Trucks (up to 40 ton)	Up to 2	107 to 110
Elevated Work Platforms	2	Up to 95
Pneumatic and Electric Hand Tools	Up to 5 simultaneous	Up to 110
Crane	1	Up to 110

^All sound power levels are based on AS2436:2010 and DEFRA database of various plant noise measurements.

Calculations consider distance attenuation only and the range of levels are based on the closest potential distance and furthest potential distance at which each item of plant may operate from each respective residential location.

The calculated noise levels at nearby residential receptors are presented in Table 35.

Table 35 Calculated Receptor Sound Pressure Levels from Construction

Receptor Location	Calculated Sound Pressure Levels (dBA)	Noise Management Level (dBA)	Compliance
R1 - 94 Mitchell Street	60 - 71	50	No
R2 - 28 George Street	60 - 64	49	No
R3 - 41 George Street	64 - 77	49	No
R4 - 13 Tuckey Crescent	62 - 64	49	No
R5 - 7 Charles Street	56 - 73	49	No
R6 - Wee Waa Public School	59 - 72	55	No

Note that once the school buildings begin to be erected, the buildings will act as a noise barrier to the adjoining receptor locations, reducing the level of construction noise as construction progresses.

12.0 CONSTRUCTION NOISE AND VIBRATION MITIGATION RECOMMENDATIONS

The predicted level of noise emission from the construction of the new buildings show that noise levels will at times exceed the Noise Management Levels established in Section 9.2 of this report. The highly affected noise level of 75 dBA could also be approached for the works carried out close to the nearby affected locations.

The following work practices are recommended to be implemented where necessary and practicable, to reduce noise emission as far as reasonably practicable:

- Impact noise to be limited where practicable,
- Substitution of equipment will be considered to minimise noise (Section 11.6),
- Impulsive and tonal noise to be restricted to the hours of 9.00 am to 4.00 pm Mon-Fri, and continuous blocks will not exceed three hours each with a minimum respite from those activities and works of not less than one hour between each block (Section 11.5),
- Management plan to ensure construction vehicles arrive and depart during construction hours only,
- Reversing alarms to be of "quacker" broadband alarm style.

12.1 Engineering and Practical Noise Controls

Australian Standard AS2436:2010, Appendix C, Table C3 provides the relative effectiveness of various forms of noise control that may be applicable and implemented on various construction sites and projects. Table C3 is replicated in Table 36 below.

Table 36 Relative Effectiveness of Various Forms of Noise Control

Control by	Nominal Noise Reduction Possible, dB
Distance	Approximately 6 dB for each doubling of distance
Screening	Normally 5 dB to 10 dB maximum 15 dB
Enclosure	Normally 5 dB to 25 dB maximum 50 dB
Silencing	Normally 5 dB to 10 dB maximum 20 dB

Distance

Where applicable, we recommend locating mechanical plant near the centre of the site such that it is as far as practically possible from the nearby existing residences.

Enclosure

Constructing acoustical enclosures around items of mobile plant such as generators is recommended where extended use for long periods of time is expected.

Screening

We recommend erecting temporary sound barrier screens along the boundaries of the construction site near the school buildings to remain throughout all construction phases, as far as reasonably practicable.

Temporary sound barrier screens should be erected up to a height of 1.8 m, and constructed from, for example 19 mm plywood on steel posts or attached to temporary construction fencing. All sound barriers should be designed by a structural engineer to resist wind loads.

Silencing

Consideration should be given to any mobile plant already acoustically treated when assessing tenders. All plant and machinery should be selected with consideration to low noise options where practicable and available.

Care should be taken to ensure that not more than one item of plant is operating simultaneously within close proximity of any given residence as far as reasonably practicable, to minimise cumulative noise impacts.

12.2 Noise Measurement Equipment

All acoustic instrumentation employed throughout the monitoring programme will comply with the requirements of AS IEC 61672.1:2004 *Electroacoustics – Sound level Meters-Specifications*. All sound level meters must have a current calibration certificate from a NATA accredited laboratory in accordance with NATA guidelines. Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB.

12.3 Attended Residential Noise Monitoring Procedure

Any attended noise measurements to be carried out as a result of a noise complaint should be conducted in accordance with the procedures outlined in Australian Standard AS1055 *Acoustics – Description and measurement of environmental noise* and in accordance with methods outlined in the NSW Industrial Noise Policy (INP). The following points should be followed when conducting noise monitoring:

- A field calibration should be conducted before and after measurements;
- The sound level meters must be set to A-weighting and Fast response;
- The sound level meters sample period should be set to 15 minutes;
- The following descriptors should be measured as a minimum: L_{A1}, L_{Aeq} and L_{A90}; and
- Measurements should be conducted a minimum of 3 metres from the nearest façade and/or solid fence/wall. If it is not possible to do this corrections for façade reflection should be applied to the measurement results.

12.4 Noise Monitoring of Equipment

In addition to the residential noise monitoring procedures described above, the following equipment measurements can be undertaken if a noise complaint arises:

- Noise emission levels of all critical items of mobile plant and equipment will be checked by the site environmental officer for compliance with noise limits appropriate to those items prior to the equipment going into regular service;
- For equipment and mobile plant used for construction works, L_{Aeq} measurements will be taken at an appropriate distance, normally 7 metres and converted to a Sound Power Level;
- An *Equipment Noise Certificate*, presenting relevant sound levels of the equipment tested, will be issued by the Construction Contractor's site environmental officer within the first week of the equipment commencing at the construction site.

The equipment sound power levels will be compared to the levels contained in Table 32. If noise checks on any equipment result in a prediction of non-compliance, quieter equipment or alternate construction methods should be substituted.

12.5 Periods of Respite

All activities associated with the construction shall take place within the proposed hours, as shown below:

- 7:00 am to 6:00 pm, Monday to Friday inclusive; and
- 8:00 am to 1:00 pm Saturdays;
- At no time on Sundays or public holidays.

Works that result in impulsive or tonal noise emissions shall only be undertaken:

- 9:00 am and 4:00 pm Monday to Friday inclusive;
- In continuous blocks, not exceeding 3 hours each, with a minimum respite from those activities and works of not less than one hour between each block.

12.6 Reducing Noise from Plant and Equipment

- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences.
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
- Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting less noisy plant.
- Pneumatic equipment is traditionally a problem – select supersilenced compressors, silenced jackhammers and damped bits where possible.
- Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.

12.7 Work Practices

Workers and contractors shall be trained in work practices to minimise noise emission such as the following:

- Avoid dropping materials from a height.
- Avoid shouting and talking loudly outdoors.
- Avoid the use of radios outdoors that can be heard at the boundary of residences.
- Turn off equipment when not being used.
- Carry out work only within the approved hours of operation.
- Construction vehicles to arrive and depart during construction hours only.

12.8 Heavy Vehicles and Staff Vehicles

- Truck drivers shall be informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
- Site vehicle entrances shall be located away from residences where practicable.
- The number of vehicle trips shall be configured to reduce the number of trips to and from the site – movements shall be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
- Parking and queuing of construction staff vehicles and other construction vehicles shall be avoided as far as is practicable on streets outside of the site.
- There shall be no access for construction vehicles to the site or park within residential areas prior to 7 am on any occasion, in order to avoid sleep disturbance.
- Vehicles shall be fitted with broadband reversing alarms or alternative, non-tonal proximity warning systems.
- For the duration of construction, use of compression braking shall not be permitted on the site or nearby the site, such as on access roads within close proximity to residential premises.

12.9 Community Relations

- A Community Liaison Officer shall to be appointed by the contractor prior to the commencement of any works.
- The officer will approach all potentially affected residents prior to the commencement of any works as an initial introduction and provide their contact details.
- The officer will explain the project, duration of works, potentially noisy periods as well as determine any particularly sensitive receivers or sensitive time periods and schedule works accordingly, as far as reasonably practical.
- A community information telephone number may be established to provide access and information about the project.
- Community notifications and newsletters shall be prepared and distributed, at least 7 days prior to commencement of any works, to the community in areas that are potentially affected by the project. The contents of the notifications shall include information on the nature of the works, location of works being carried out, possible impacts to amenity, traffic flow or services, and the contact details as listed above.
- Community drop-in sessions shall be organised to engage with the community and to provide a conduit for direct consultation between those affected, or with an interest in the project, and the project team. To encourage the widest attendance and accessibility to the community, drop-in sessions shall be arranged outside of business hours such as weeknights or on Saturday.
- Information cards with the above contact details shall be prepared and distributed to the project management team and other staff on site. These cards shall be given to members of the community or other interested parties should they approach staff on site for information.

Once works commence, communication with the community shall be maintained by the Community Liaison Officer. Communication shall be maintained via the aforementioned methods.

Consultation and cooperation between the contractor and the neighbours and the removal of uncertainty and rumour can help to reduce adverse reaction to noise.

12.10 Managing a Noise Complaint

The Liaison Officer shall receive and manage noise complaints and implement a Construction Complaints Management System.

All complaints shall be treated promptly and with courtesy.

In the event that a noise complaint is received, noise monitoring will be carried out at the affected receptor location and appropriate measures be taken to reduce the noise emission as far as reasonably practicable.

Where it is not practicable to stop the noise, or reduce the noise, a full explanation of the event taking place, the reason for the noise and times when it will stop shall be given to the complainant.

The following guidelines are recommended in Section 6 of the *Interim Construction Noise Guideline* to manage a noise complaint:

- Provide a readily accessible contact point, for example, through a 24 hour toll-free information and complaints line.
- Give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance.
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information.
- Implement all feasible and reasonable measures to address the source of complaint, which may include standing equipment down.
- Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area, time of verbal response and timeframe for written response where appropriate.

12.11 Noise Monitoring

In the event of a noise complaint, monitoring shall be carried out at the complainant's residence to determine which activities are generating excessive noise. If practicable, noise mitigation measures, such as those outlined above, shall be implemented and further monitoring shall then be employed to determine the efficacy of noise mitigation.

12.12 Vibration Monitoring

Vibration measurements may be carried out at a residence within each of the nearest receptor locations at the commencement of high impact activities to determine the maximum levels of vibration during these peak vibration generating events.

In the event of an exceedance of the Peak Particle Velocity (PPV) vibration criteria as defined in Table 30, unattended vibration monitor or monitors shall be installed at each residential location where an exceedance was measured.

Unattended vibration monitors shall have the capability to trigger an alert to make the site manager and/or plant operator aware immediately when the vibration limit is exceeded. The vibration monitor should be set to trigger the alert when the overall PPV exceeds the criteria within each frequency range, as stipulated in Table 30, at the nearest residential building.

In the event that levels of ground-borne vibration exceed the recommended acceptable levels for cosmetic damage vibration causing works should cease immediately and alternative methods shall be considered.

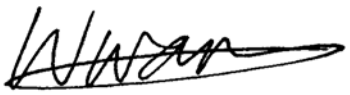
13.0 NOISE ASSESSMENT STATEMENT

Day Design Pty Ltd was engaged by Department of Education to provide acoustical advice for the proposed new Wee Waa High School at 105-107 Mitchell Street, Wee Waa, NSW.

Measurements and calculations show that the level of noise emitted by the proposed new Wee Waa High School will be able to meet the acceptable noise level requirements of the EPA NSW Noise Policy for Industry as detailed in Section 4 of this report.

The level of road traffic noise intrusion has been assessed and recommendations for façade construction has been provided to meet the recommended internal noise levels as detailed in Section 6 of this report.

The noise impact due to the proposed construction activities have been predicted at all nearby receptor locations. The Noise Management Level is predicted to be exceeded at times and therefore recommendations for noise controls have been provided in Section 12 of this report to reduce the level of construction noise using reasonable and feasible measures.



William Wang, BE (Mechatronics), MIEAust, MAAS
Senior Acoustical Engineer
for and on behalf of Day Design Pty Ltd

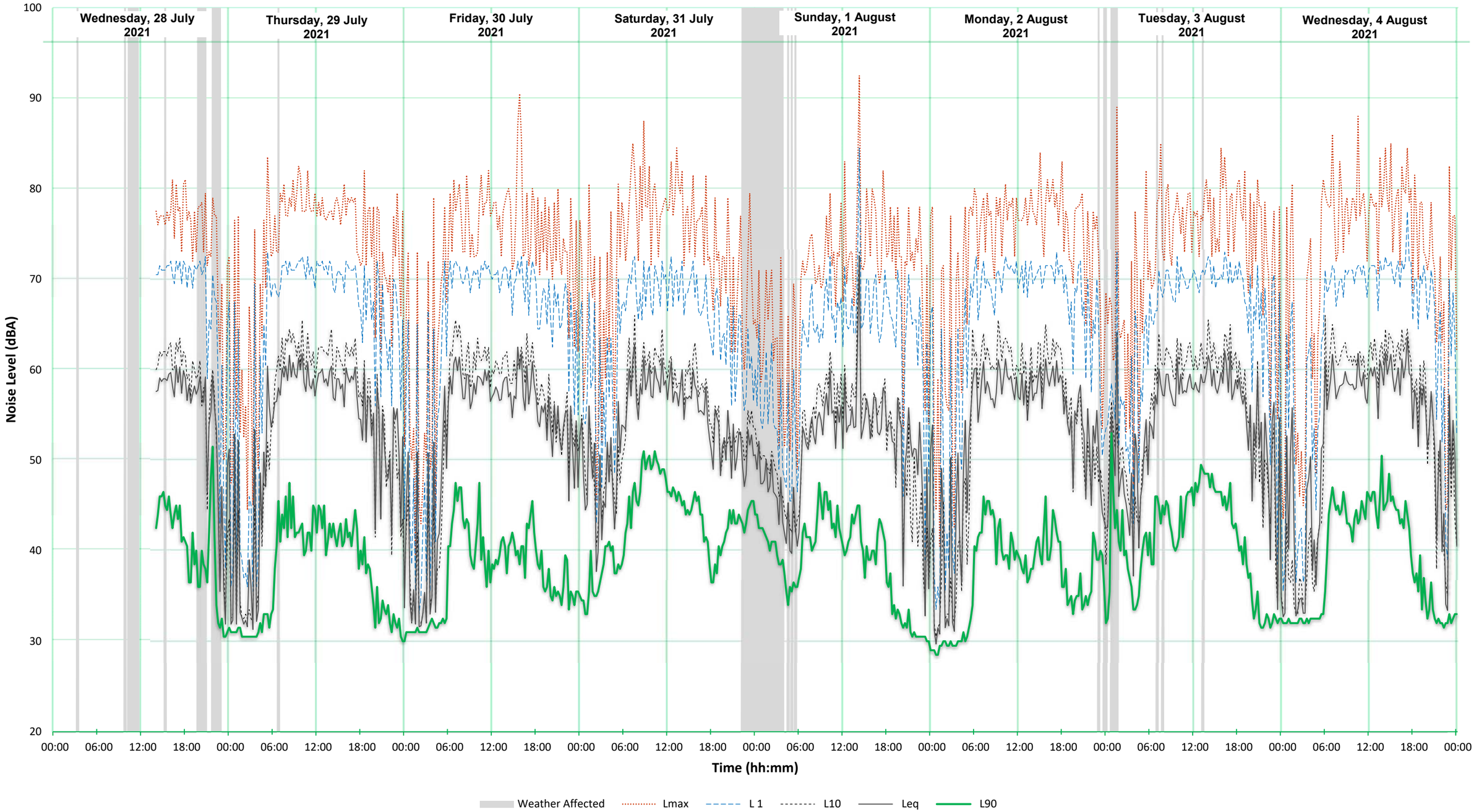
AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

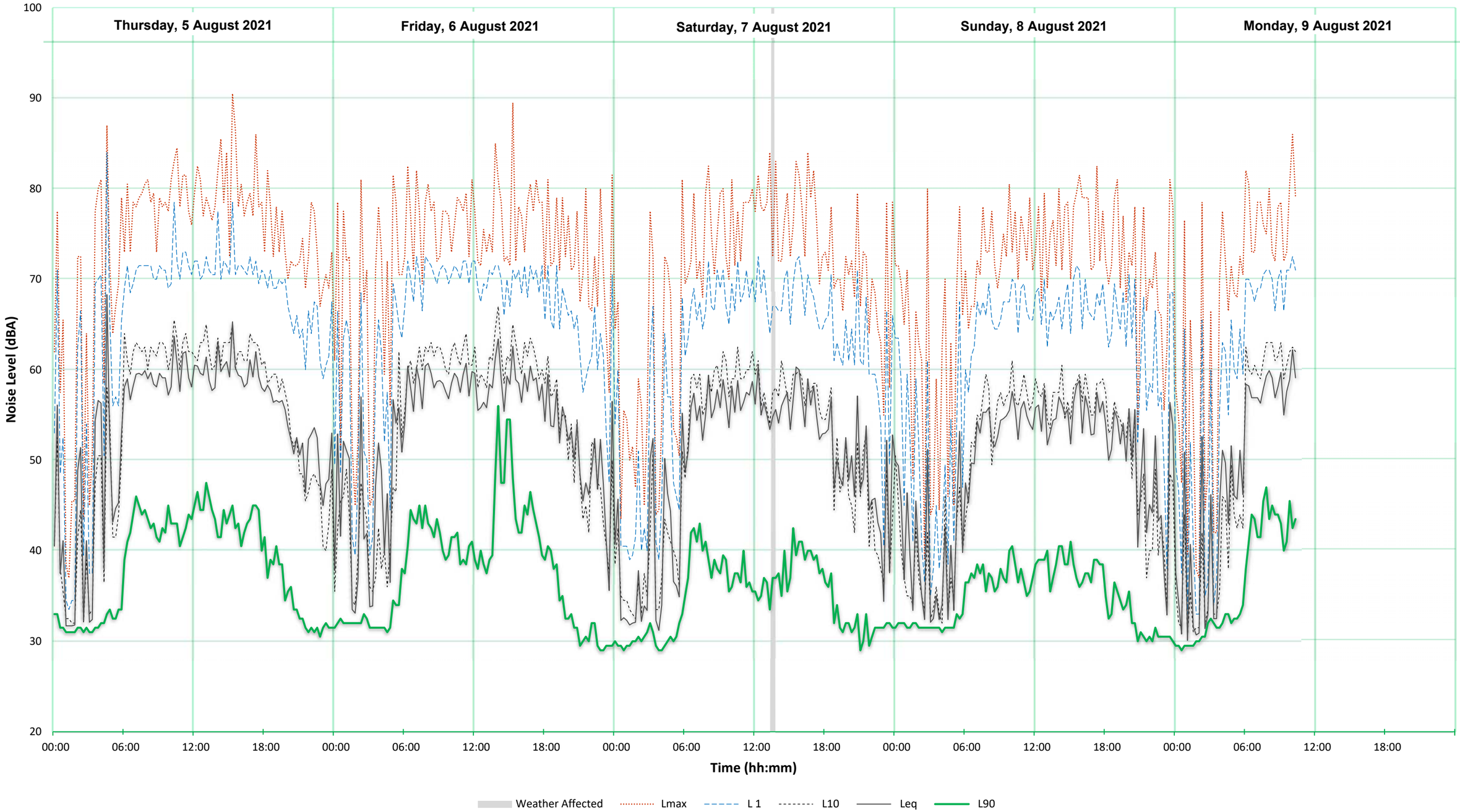
Attachments:

- Appendix A – Ambient Noise Surveys
- Appendix B – AS2107:2016 Reverberation Times for Selected Spaces
- Appendix C – Architectural Drawings
- AC108-1 to 4 – Glossary of Acoustical Terms
- AC500-10 – Modifying Factor Corrections

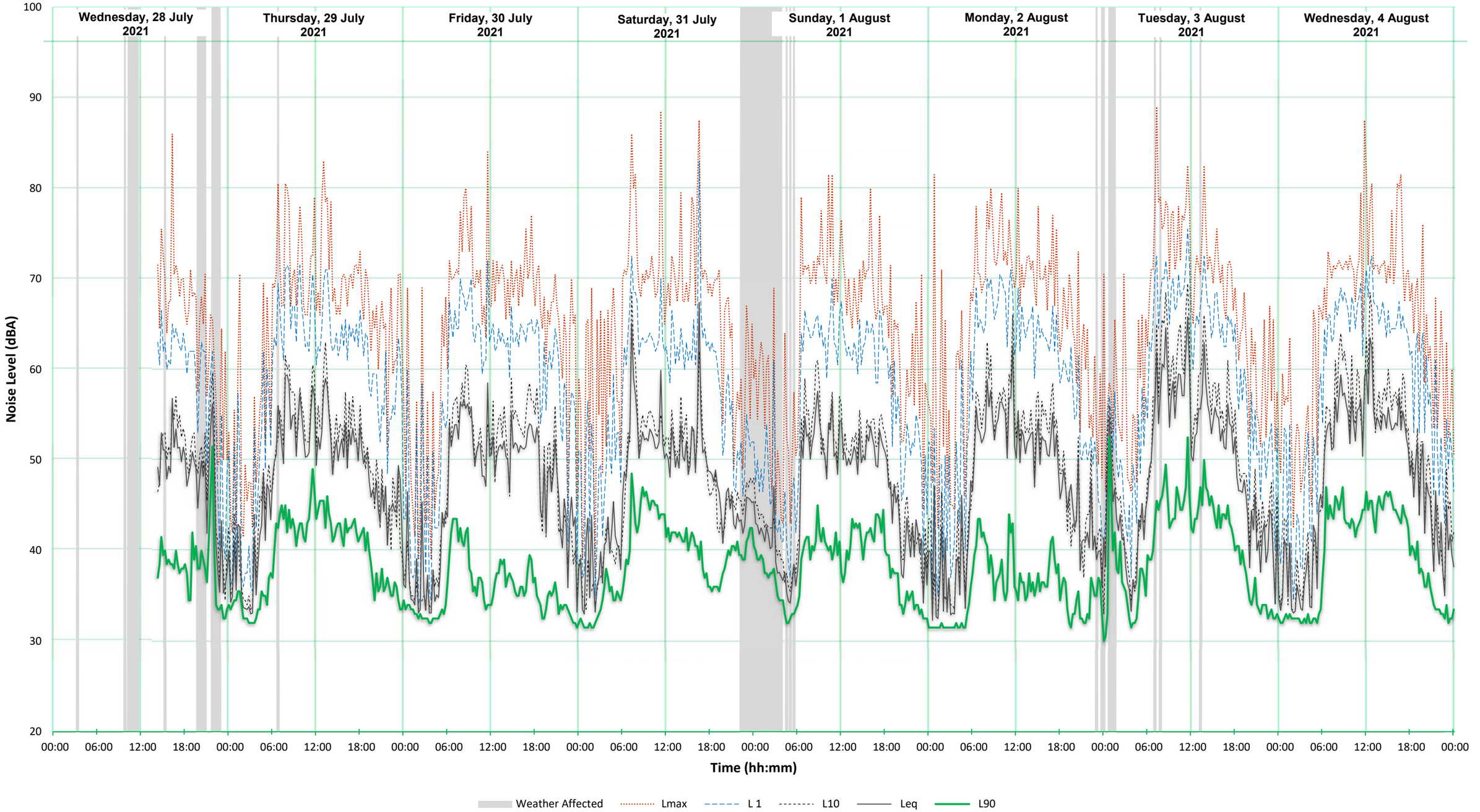
Located at 86 Mitchell Street, Wee Waa, NSW



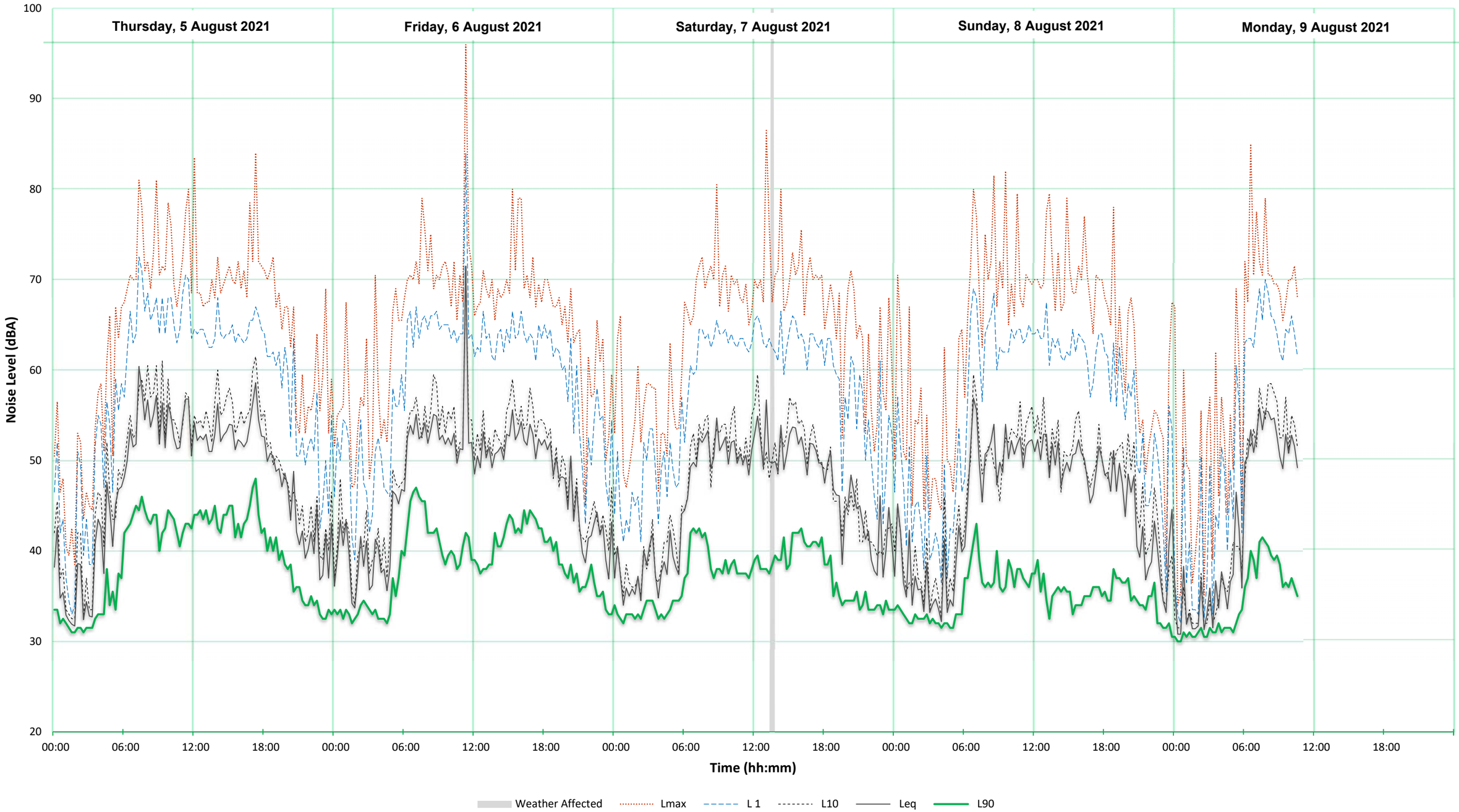
Located at 86 Mitchell Street, Wee Waa, NSW



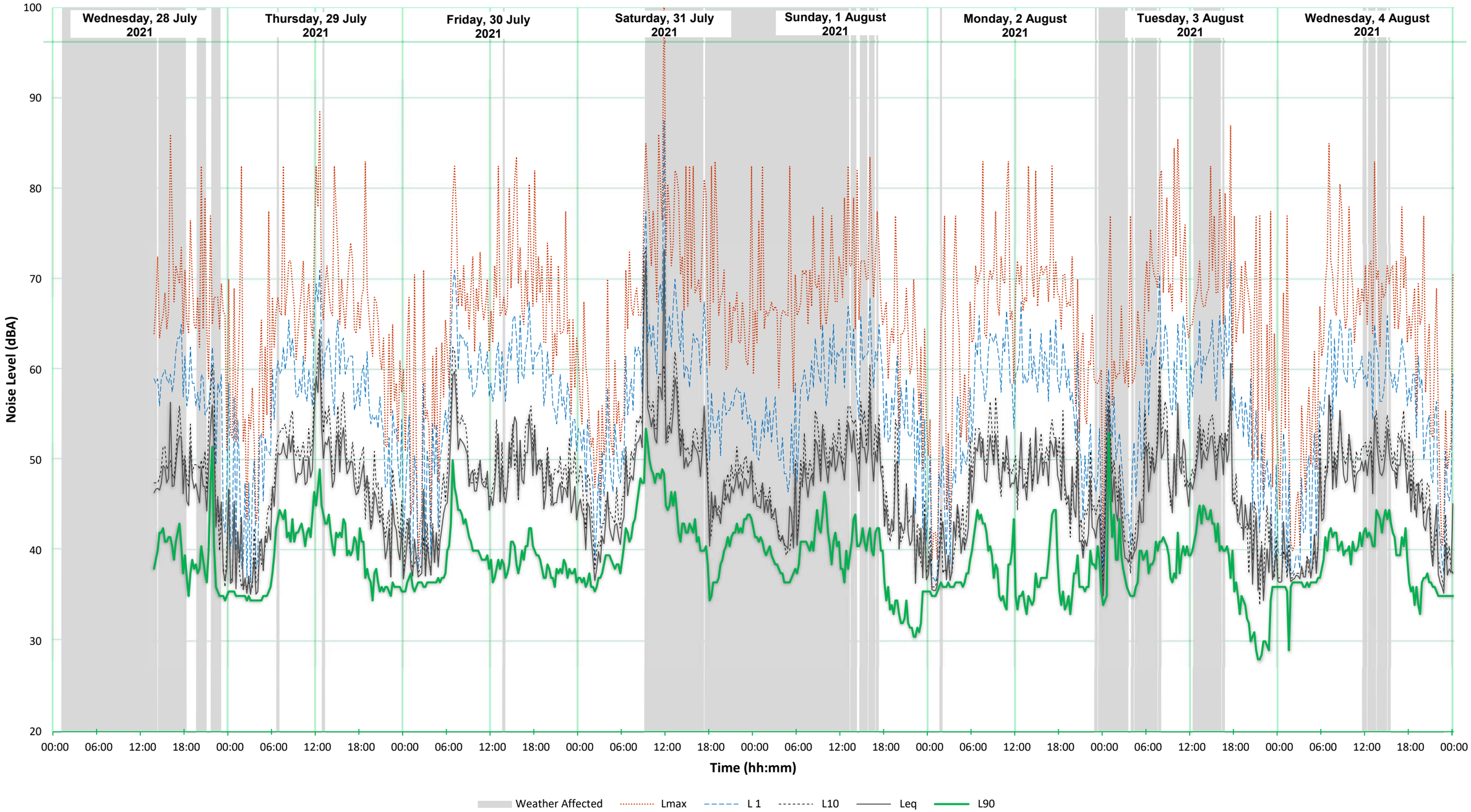
Located at 36 George Street, Wee Waa, NSW



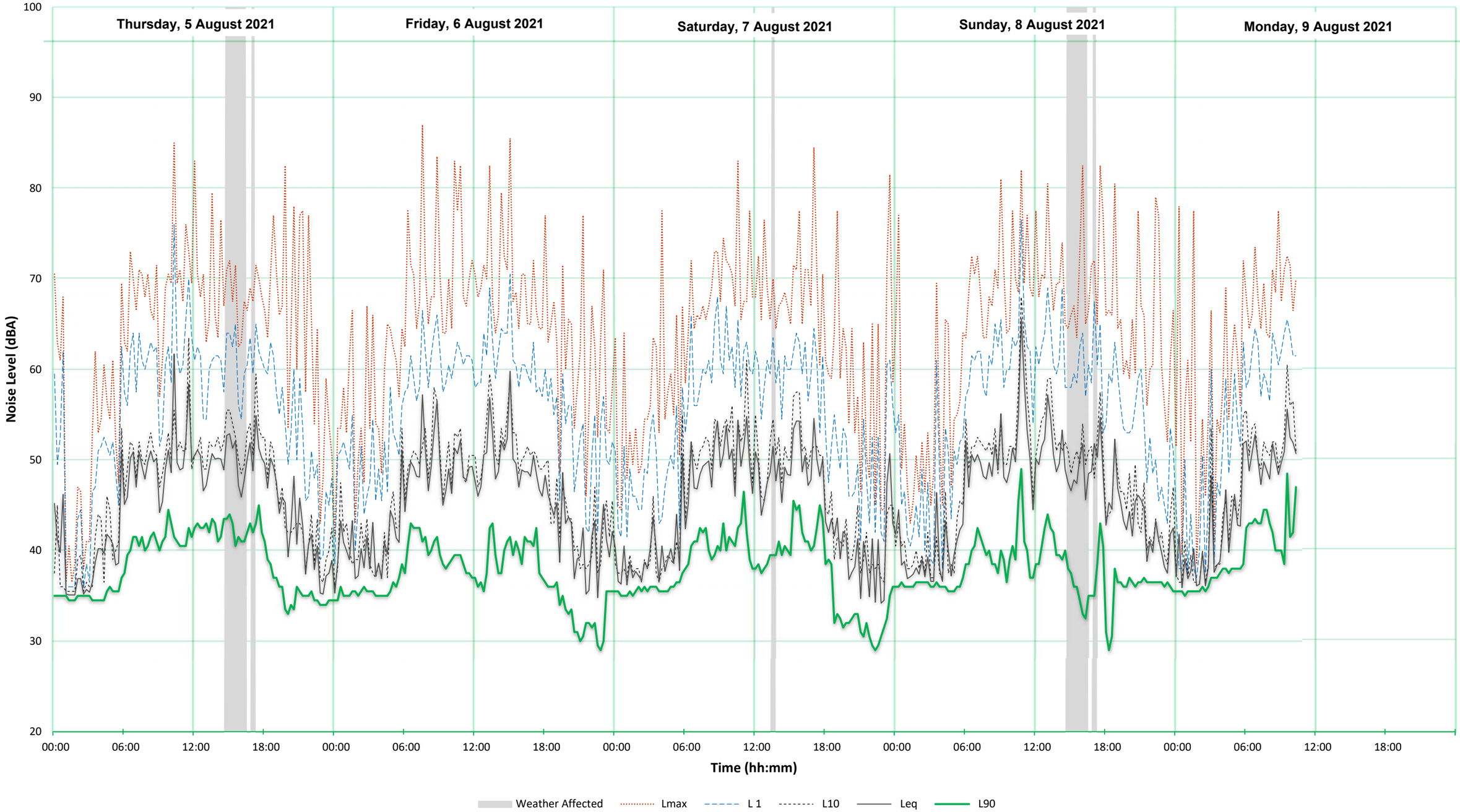
Located at 36 George Street, Wee Waa, NSW



Located at 9 Charles Street, Wee Waa, NSW



Located at 9 Charles Street, Wee Waa, NSW

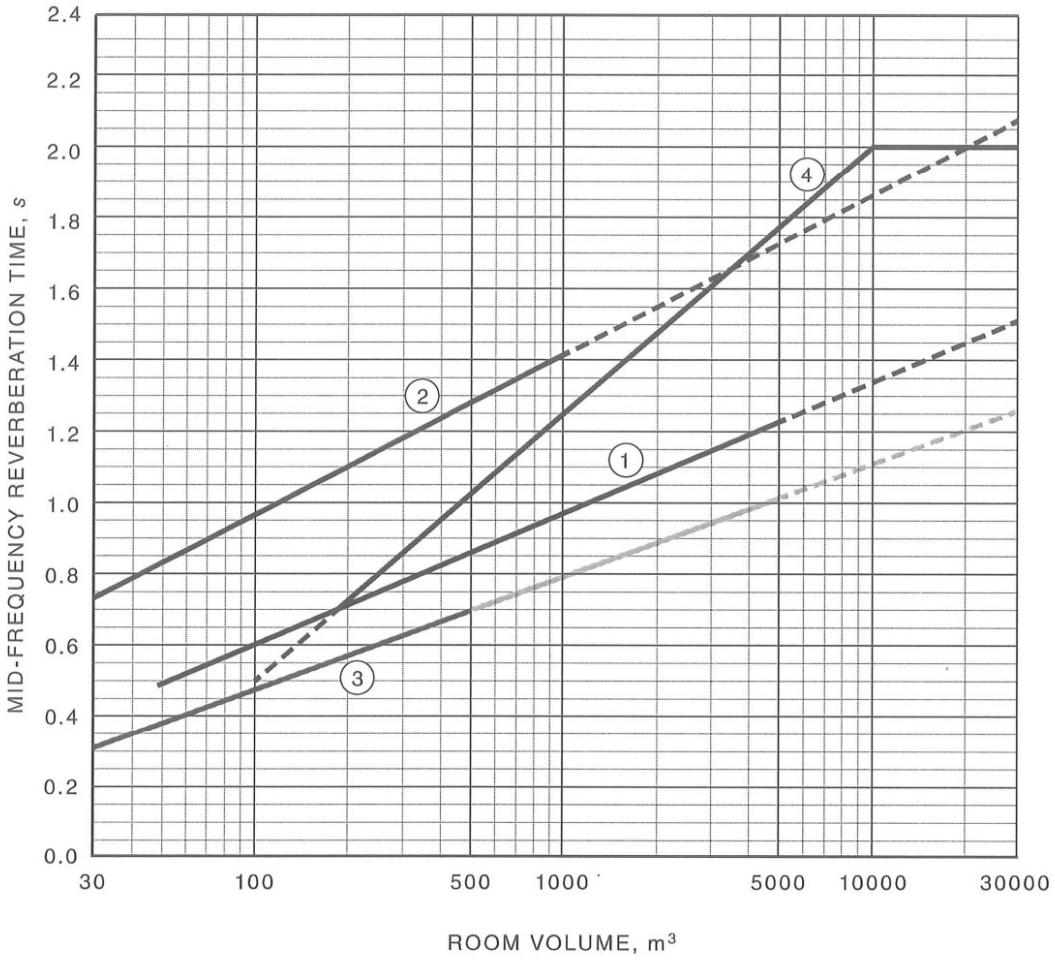


APPENDIX A

REVERBERATION TIMES FOR SELECTED SPACES

(Informative)

The curves in Figure A1 represent mean reverberation times of spaces which are considered to possess good acoustic qualities. They are intended only as guides since the scatter about these mean curves is large.

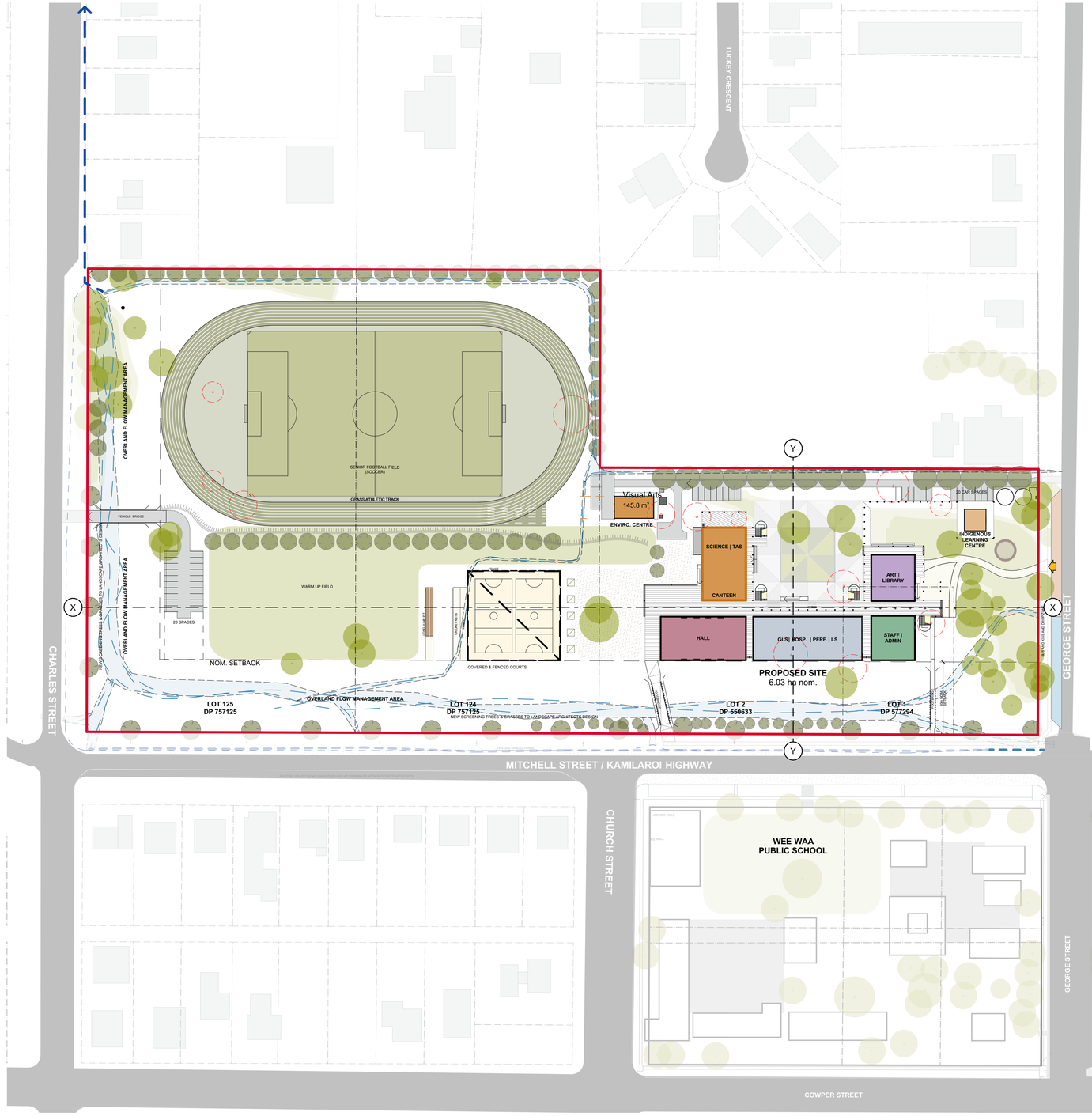


LEGEND:
Curve 1 = Speech/Lecture
Curve 2 = Music
Curve 3 = Teaching/Communication
Curve 4 = Sport

NOTE: The graphic in Figure A1 is based on DIN 18041.

FIGURE A1 MEAN REVERBERATION TIMES

7284-1 Appendix C



OFFSITE AGRICULTURE AND ENVIRONMENT CENTRE
EXISTING WEE WAA HIGH SCHOOL SITE, PURCELL AVE

LEGEND

- PROPOSED SCHOOL BUILDINGS
- PROPOSED SPORTS FIELDS
- PROPOSED GREEN SPACE / NATIVE GRASS MEADOW
- PROPOSED ONSITE ROADWAYS
- COURTS / PLAY AREA
- TREES TO BE REMOVED
- EXISTING TREES ON SITE TO BE RETAINED
- PROPOSED PLANTING

CONSULTANTS

CONSULTANT AREA Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
D	RT / GM	JH	16.06.21	Issue to Client - Early Contractor Involvement
E	RT / GM	JH	22.06.21	Issue to Client - for Civil input
F	RT / GM	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT	JH	28.07.21	Consultant coordination - Traffic
H	RT	JH	04.08.21	90% (pending client approval)
I	RT	JH	06.09.21	Town Planner
J	RT	JH	07.09.21	Town Planner
K	RT	JH	09.09.21	Revised site plan
ZE	RT	JH	15.09.21	Consultant coordination
ZF	RT	JH	22.09.21	Urban Planning Issue
ZG	RT	JH	23.09.21	Consultant Issue
ZH	RT	JH	28.09.21	Consultant Issue

NOTES

1. Dimensions are in millimetres unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME
School Infrastructure NSW
NSW GOVERNMENT Education School Infrastructure

SCALE
0m 10 20 30 40 50 1:1000 @A1

PROJECT NAME AND ADDRESS
Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN: RT
APPROVED: JH

STATUS

DRAWING TITLE
Proposed Site Plan - Option 1A

PROJECT NO.: 4474
DRAWING NO.: CD1101
REV.: ZH

SHAC
T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au
224 Maitland Road
Islington NSW 2296
Australia
Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

LEGEND

- PROPOSED SCHOOL BUILDINGS
- PROPOSED SPORTS FIELDS
- PROPOSED GREEN SPACE / NATIVE GRASS MEADOW
- PROPOSED ONSITE ROADWAYS
- SMALL & MEDIUM AGRICULTURAL PLOTS
- LARGE AGRICULTURAL PADDOCKS
- PROPOSED DRAINAGE SWALE SHOWING EXTENT
- PROPOSED ONSITE DRAINAGE DIRECTION
- PROPOSED DETENTION POND
- TREES TO BE REMOVED
- 191020 EXISTING TREES ON SITE TO BE RETAINED
- PROPOSED PLANTING

NEIGHBOURING RESIDENCE 22 CRADLES STREET
NEIGHBOURING RESIDENCE 32 BOUNDARY STREET
NEIGHBOURING RESIDENCE 34 BOUNDARY STREET
NEIGHBOURING RESIDENCE 44 BOUNDARY STREET
1.8m PALISADE FENCE ON BOUNDARY
SEWER POINT
SERVICE GATE
PERIMETER SERVICE / MAINTENANCE TRACK
OVERLAND FLOW MANAGEMENT AREA
2.1m PALISADE FENCE ON BOUNDARY
SERVICE GATE
SENIOR FOOTBALL FIELD (SOCCER)
GRASS ATHLETIC TRACK
VEHICLE BRIDGE
NEW SCREENING TREES & GRASSES TO LANDSCAPE ARCHITECTS DESIGN
WARM UP FIELD
20 SPACES
NOM. SETBACK
LONG JUMP PIT
CRICKET NETS
FENCE
COVERED SPORTS COURTS
PICNIC SHELTERS
COVERED & FENCED COURTS
FITNESS / WELLBEING EXERCISE EQUIPMENT
2.1m PALISADE FENCE ON BOUNDARY
SECURITY GATE
OVERLAND FLOW MANAGEMENT AREA
NEW SCREENING TREES & GRASSES TO LANDSCAPE ARCHITECTS DESIGN
2.1m FENCE ON BOUNDARY
EXISTING GRAVEL VERGE
CULVERT
NEW CONCRETE PAVEMENT
NEW POLE-MOUNTED TX SUBSTATION
2.1m PALISADE ON BOUNDARY
RESOURCE HUB WASTE, COMPOST, RECYCLING EDUCATION PROJECT
GARBAGE
SCREEN PLANTING ALONG BOUNDARY
1.8m PALISADE FENCE ON BOUNDARY
SECURITY GATE
ENVIRONMENT CENTRE
LPG
SEWER PUMP STATION
WATER TANK
WATER BORE
2 EMERGENCY SPACES / DELIVERY
FUTURE EXPANSION IF REQUIRED
WOOD AND METAL TECHNOLOGY
H.E. ENCLOSURE
TANK
RAMP
CANTEEN
SPORTS & PERFORMANCE
HEALTH / PE LEARNING UNIT
GENERAL LEARNING
SPECIAL EDUCATION LEARNING UNIT
VET + FOOD & TEXTILES LEARNING UNIT
COMP. LAB
LIFT
ADMINISTRATION
ENTRY
WT
PROPOSED SITE
6.03 ha nom.
PUBLIC ART
ENTRY GATE
FOOTBRIDGE
20 CAR SPACES
A/C COMPOUND
COVERED LINK
HYDRANT TANK
HYDRANT TANK
FIRE BOOSTER PUMP
MAIN WATER METER
SECONDARY PEDESTRIAN GATE
DRY RAIN GARDEN
A/C
INDIGENOUS CULTURAL CENTRE
FLAGPOLES
COVERED COLONNADE
YARNING CIRCLE
REFER LANDSCAPE ARCHITECTS DOCUMENTATION FOR DETAILED PLANTING & HARD LANDSCAPING
NEW LANDSCAPED PATH
ENTRY GATE
ENTRY GATE
EXISTING NATIVE FOREST & NATIVE GRASSES
2.1m PALISADE FENCE ON BOUNDARY
BUS AND KISS AND DROP ZONE
ROAD STRENGTHENING FOR NEW KISS AND DROP & BUS STOP
NEIGHBOURING RESIDENCE 41 GEORGE STREET
X
Y
MITCHELL STREET / KAMILAROI HIGHWAY
CHARLES STREET
GEORGE STREET
EXISTING GRADED ROAD SHOULDER USED AS PARKING FR BOTH RESIDENTS AND SCHOOL
JUNIOR HALL
WT

CONSULTANTS

CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA
Company Name	Company Name	Company Name	Company Name	Company Name	Company Name
T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
C	RT	JH	11.06.21	Draft - Work In Progress
D	RT / GM	JH	16.06.21	Issue to Client - Early Contractor Involvement
E	RT / GM	JH	22.06.21	Issue to Client - for Civil input
F	RT / GM	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT	JH	28.07.21	Consultant coordination - Traffic
H	RT	JH	04.08.21	90% (pending client approval)
ZE	RT	JH	15.09.21	Consultant coordination
ZF	RT	JH	23.09.21	Consultant Issue
ZG	RT	JH	28.09.21	Consultant Issue

NOTES

1. Dimensions are in millimetres unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME
School Infrastructure NSW
NSW GOVERNMENT Education School Infrastructure

SCALE
0m 5 10 15 20 25 @A1 1:500

PROJECT NAME AND ADDRESS
Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWING TITLE
Proposed Site Plan - Detailed

DRAWN	APPROVED	PROJECT NO.	DRAWING NO.	REV.
RT	JH	4474	CD1102	ZG

STATUS

SHAC
T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au
224 Maitland Road
Islington NSW 2296
Australia
Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

7284-1 Appendix C

CONSULTANTS

AMENDMENTS

No	Drn	Chk	Date	Comment
A			25.05.21	Weekly Project Meeting
B			28.05.21	Stakeholder Workshop
C	HS	JH	11.06.21	Draft - Work in Progress
D	HS	JH	16.07.21	Floor Plans
ZE	HS	JH	15.09.21	Consultant coordination
ZF	HS	JH	23.09.21	Consultant Issue
ZG	HS	JH	28.09.21	Consultant Issue

NOTES
1. Dimensions are in millimetres unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME: School Infrastructure NSW

NSW Government Education School Infrastructure

SCALE 1:200 @A1

PROJECT NAME AND ADDRESS: Wee Waa High School, 105-107 Mitchell St, Wee Waa NSW 2388

STATUS

DRAWING TITLE: Ground Floor Plan

DRAWN: HS | APPROVED: JH

PROJECT NO. 4474 | DRAWING NO. CD2103 | REV. ZG

SHAC

T +61 2 4961 5888 | F +61 2 4962 2577 | E info@shac.com.au
224 Maitland Road, Islington NSW 2296, Australia
Nominated Architect Justin Hamilton (6160) ABN 32 131 584 846


BUILDING F
BUILDING D
BUILDING E
BUILDING C
VOID OVER HALL
BUILDING B
BUILDING A
COVERED WALKWAY BELOW AWNING
AWNING ROOF
VOID OVER LIBRARY
AWNING ROOF OVER
ERED COURTS BELOW
Chemical HS404.08 17.8 m²
Botany Store HS404.09 17.1 m²
Apparatus Store room HS404.06 25.6 m²
GLS 3 HS404.01 84.5 m²
Science Prep HS404.05 29.8 m²
Chemistry Lab HS404.02 100.6 m²
Dark Lab HS404.02 100.6 m²
Science Seminar HS404.03 29.7 m²
Seminar HS401.04 22.1 m²
Comms HS611.04 8.4 m²
Store 8.4 m²
Boys WC HS603.01b 12.3 m²
A. WC HS603.06
Girls WC HS603.01a 12.3 m²
Stairs 27.9 m²
500.9 m²
+195.67
Comms HS611.04 5.8 m²
Lift 5 m²
188.5 m²
GLS 1 HS401.01 66.1 m²
GLS 1 HS401.01 65.6 m²
GLS 2 HS401.02 65.6 m²
Learning Commons HS401.03 83.4 m²
Seminar HS401.04 25.5 m²
Service Duct
Kiln HS503.03 10 m²
Pottery Store HS503.05 10.1 m²
Art Workshop HS405.03 100.8 m²
Dark Room HS405.06 28 m²
Project 3 HS405.05 25.2 m²
GLS 4 HS405.02 67 m²
Store HS405.04 20.8 m²
Comms HS611.04 8.7 m²
DBC HS611.03 2.4 m²
AWNING ROOF OVER
VOID
Girls WC HS603.01a 12.3 m²
Boys WC HS603.01b 12.3 m²
Preparation 2 HS602.18 30.4 m²
Lounge 4 HS602.05 60.6 m²
Int. / Meeting HS601.10 12.7 m²
Int. / Meeting HS601.10 13 m²
Study Type 02 HS602.02 140.9 m²
Stairs 27.9 m²

CONSULTANTS					
CONSULTANT AREA Company Name T 4927 5566	CONSULTANT AREA Company Name T 4927 5566	CONSULTANT AREA Company Name T 4927 5566	CONSULTANT AREA Company Name T 4927 5566	CONSULTANT AREA Company Name T 4927 5566	CONSULTANT AREA Company Name T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
A			25.05.21	Weekly Project Meeting
B			28.05.21	Stakeholder Workshop
C	HS	JH	11.06.21	Draft - Work In Progress
D	HS	JH	16.07.21	Floor Plans
ZE	HS	JH	15.09.21	Consultant coordination
ZF	HS	JH	23.09.21	Consultant Issue
ZG	HS	JH	28.09.21	Consultant Issue

NOTES

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4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME
School Infrastructure NSW

NSW GOVERNMENT Education School Infrastructure

SCALE 1:200 @A1

PROJECT NAME AND ADDRESS
Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN HS APPROVED JH

STATUS

DRAWING TITLE
First Floor Plan

PROJECT NO. 4474 DRAWING NO. CD2104 REV. ZG

SHAC
T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au
224 Maitland Road
Islington NSW 2296
Australia
Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

CONSULTANTS

CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA	CONSULTANT AREA
Company Name	Company Name	Company Name	Company Name	Company Name	Company Name
T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566	T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
A			25.05.21	Weekly Project Meeting
B			28.05.21	Stakeholder Workshop
C			11.06.21	Draft - Work In Progress
D	RT / HS / EF	JH	16.06.21	Issue to Client - Early Contractor Involvement
E	RT / HS / EF	JH	22.06.21	Issue to Client - for Civil input
F	RT / HS / EF	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT / HS / EF	JH	04.08.21	90% (pending client approval)
ZE	RT / HS / EF	JH	15.09.21	Consultant coordination
ZF	RT / HS / EF	JH	23.09.21	Consultant Issue
ZG	RT / HS / EF	JH	28.09.21	Consultant Issue

NOTES

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3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME
School Infrastructure NSW
NSW GOVERNMENT Education School Infrastructure

SCALE
1:200 @A1

PROJECT NAME AND ADDRESS
Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN: RT / HS / EF
APPROVED: JH

STATUS

DRAWING TITLE
Ground Floor Furniture Layout Plan

PROJECT NO.: 4474
DRAWING NO.: CD2105
REV.: ZG

SHAC
T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au
224 Maitland Road
Islington NSW 2296
Australia
Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

ERED COURTS BELOW

BUILDING F

BUILDING D

Botany Store HS404.09 17.1 m²
Apparatus Store room HS404.06 25.6 m²
GLS 3 HS404.01 54.5 m²
Chemical f HS404.08 17.8 m²
Science Prep HS404.05 29.8 m²
37.1 m²
4.3 m²
CDS HS605.06 3.1 m²
Chemistry Lab HS404.02 100.6 m²
Dark Lab HS404.02 100.6 m²
25.4 m²
Comms HS611.04 8.4 m²
Store 8.4 m²
Science Seminar HS404.03 29.7 m²
Seminar HS401.04 22.1 m²
Boys WC HS603.01b 12.3 m²
A. WC HS603.06 5.6 m²
Girls WC HS603.01a 12.3 m²
Stairs 27.9 m²

BUILDING C

VOID OVER HALL

BUILDING B

GLS 1 HS401.01 66.1 m²
Learning Commons HS401.03 83.4 m²
GLS 1 HS401.01 65.6 m²
GLS 1 HS401.01 65.6 m²
Learning Commons HS401.03 83.4 m²
GLS 1 HS401.01 66.1 m²
GLS 1 HS401.01 66.1 m²
GLS 2 HS401.02 65.6 m²
GLS 2 HS401.02 65.6 m²
GLS 1 HS401.01 66.1 m²
Service Duct
Service Duct
Seminar HS401.04 25.5 m²
Seminar HS401.04 25.5 m²
Comms HS611.04 8.6 m²
Lift 5 m²
+195.67
500.9 m²
188.5 m²

COVERED WALKWAY BELOW AWNING

COVERED WALKWAY BELOW AWNING

BUILDING E

AWNING ROOF

Kiln HS503.03 10 m²
Art Workshop HS405.03 100.8 m²
Pottery Store HS503.05 10.1 m²
VOID OVER LIBRARY
CDS HS405.06 4.8 m²
Dark Room HS405.06 28 m²
GLS 4 HS405.02 67 m²
9.3 m²
Project 3 HS405.05 25.2 m²
Store HS405.04 20.8 m²
Comms HS611.04 8.7 m²
DBC HS611.03 2.4 m²
AWNING ROOF OVER
VOID
AWNING ROOF OVER
Girls WC HS603.01a 12.3 m²
Boys WC HS603.01b 12.3 m²
A.WC HS603.04 5.2 m²
Staff WC HS602.11 13.4 m²
AWC HS602.12 15.9 m²
7.4 m²
SERV
Preparation 2 HS602.18 30.4 m²
1.6 m²
Lounge 4 HS602.05 60.6 m²
Int. / Meeting HS601.10 12.7 m²
Int. / Meeting HS601.10 13 m²
Study Type 02 HS602.02 140.9 m²
Stairs 27.9 m²

3000 3000 3000 3000 3000 3000 3000 3750 3750 3750 3750 3750 3750 3750 3750 3750 3750 3750 3750 3750 3750 3000 3000 3000 3000 3000 3000 3000
18000 3000 45000 6750 18000

3750 3750 3750 3750 3750 3750 3750 3750 3750 2250 3000 3750 3750 3750 3750 3750 3750 2250

A B C D Y E F G H
1 2 3 4 5 6 X

CONSULTANTS

CONSULTANT AREA Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566	**CONSULTANT AREA** Company Name T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
A			25.05.21	Weekly Project Meeting
B			28.05.21	Stakeholder Workshop
C			11.06.21	Draft - Work In Progress
D	RT / HS / EF	JH	16.06.21	Issue to Client - Early Contractor Involvement
E	RT / HS / EF	JH	22.06.21	Issue to Client - for Civil input
F	RT / HS / EF	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT / HS / EF	JH	04.08.21	90% (pending client approval)
ZE	RT / HS / EF	JH	15.09.21	Consultant coordination
ZF	RT / HS / EF	JH	23.09.21	Consultant Issue
ZG	RT / HS / EF	JH	28.09.21	Consultant Issue

NOTES

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2. Work to given dimensions. Do not scale from drawing
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

CLIENT NAME

School Infrastructure NSW

NSW GOVERNMENT Education School Infrastructure

SCALE

0m 2 4 6 8 10 1:200 @A1

PROJECT NAME AND ADDRESS

Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN: RT / HS / EF
APPROVED: JH

STATUS

DRAWING TITLE

First Floor Furniture Layout Plan

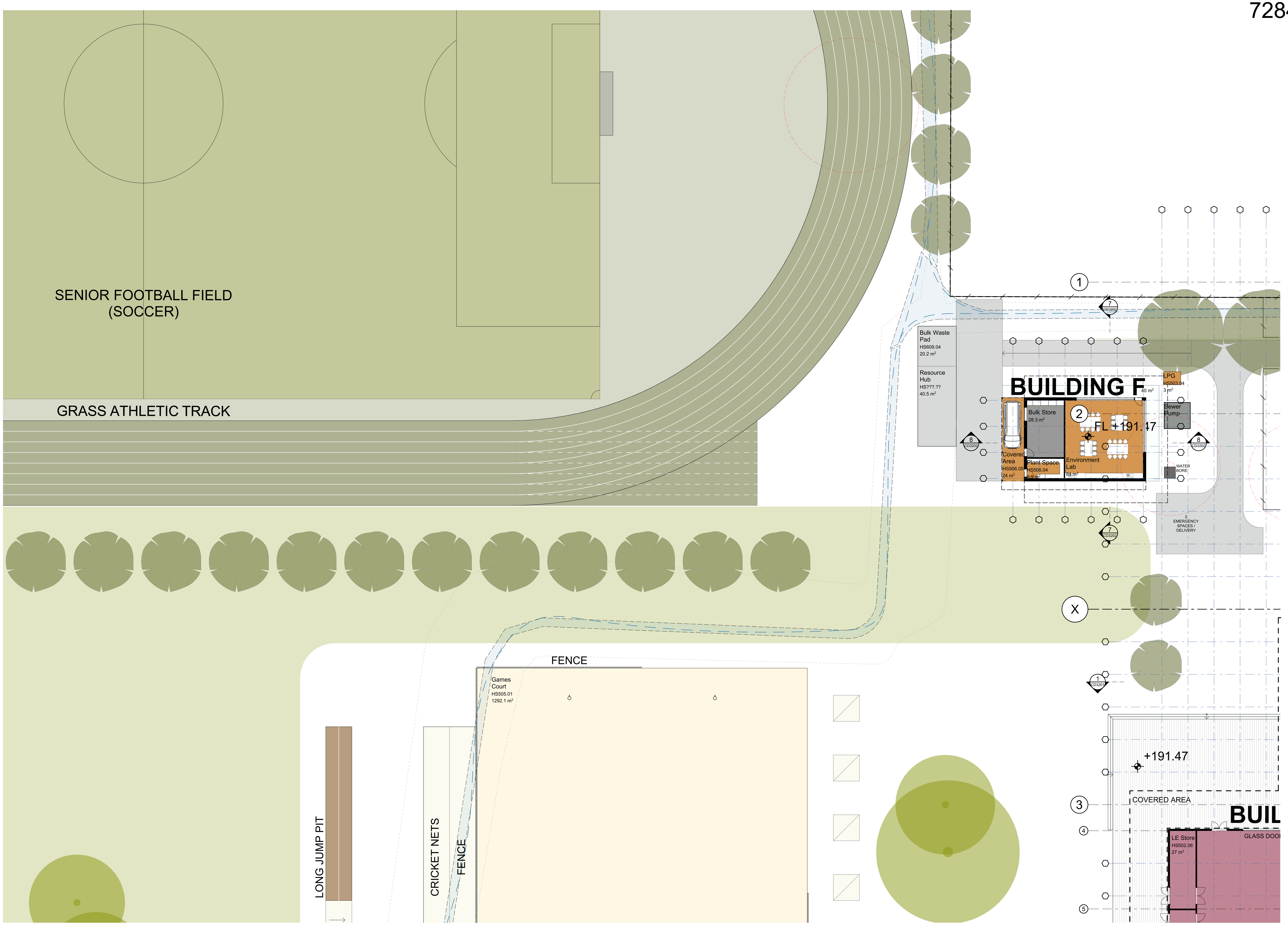
PROJECT NO. 4474 | DRAWING NO. CD2106 | REV. ZG

SHAC

T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au

224 Maitland Road
Islington NSW 2296
Australia

Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846



CONSULTANTS

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
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CONSULTANT AREA
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CONSULTANT AREA
Company Name
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CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
A			28.05.21	Stakeholder Workshop
C	EF	JH	11.06.21	Draft - Work In Progress
D	RT / HS / EF	JH	16.06.21	Issue to Client - Early Contractor Involvement
E	RT / HS / EF	JH	22.06.21	Issue to Client - for Civil input
F	RT / HS / EF	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT / HS / EF	JH	04.08.21	90% (pending client approval)
H	RT / HS / EF	JH	23.09.21	Consultant Issue
I	RT / HS / EF	JH	28.09.21	Consultant Issue

NOTES

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CLIENT NAME
School Infrastructure NSW

SCALE
0m 2 4 6 8 10
1:200 @A1

PROJECT NAME AND ADDRESS
Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN: RT / HS / EF
APPROVED: JH

STATUS

DRAWING TITLE
Agriculture / Environmental Centre Plans

PROJECT NO. 4474
DRAWING NO. CD2107
REV. I

SHAC

T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au
224 Maitland Road
Islington NSW 2296
Australia
Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

PHOTOVOLTAIC ARRAY (52 PANELS)
ROOF PITCH 2°
ROOF PITCH 15°
ROOF PITCH 2°
ROOF PITCH -2°
TAS EXHAUST
FUME CUP'D EXHAUST
ROOF PITCH 2°
ROOF PITCH 3°
ROOF PITCH 1°
ROOF PITCH 8°
ROOF PITCH 8°
ROOF PITCH 1°
ROOF PITCH 2°
ROOF PITCH 2°
ROOF PITCH 3°
ROOF PITCH 2°
PHOTOVOLTAIC ARRAY (200 PANELS) TOTAL
EXHAUST
ROOF PITCH 3°
ROOF PITCH 2°
ROOF PITCH 3°
ROOF PITCH 1°
ROOF PITCH 1°
ROOF PITCH -2°
ROOF PITCH 3°
ROOF PITCH 1°
ROOF PITCH 15°
ROOF PITCH 1°
ROOF PITCH 1°
ROOF PITCH 1°
ROOF PITCH 8°
ROOF PITCH 15°
ROOF PITCH 15°
ROOF PITCH 15°
ROOF PITCH 8°
ROOF PITCH 3°
ROOF PITCH 7°
VALLEY

CONSULTANTS

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

CONSULTANT AREA
Company Name
T 4927 5566

AMENDMENTS

No	Drn	Chk	Date	Comment
A			28.05.21	Stakeholder Workshop
C	RT	JH	11.06.21	Draft - Work in Progress
D	RT	JH	16.06.21	Issue to Client - Early Contractor Involvement
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F	RT	JH	08.07.21	Issue to Client - Early Contractor Involvement - Addendum 01
G	RT	JH	04.08.21	90% (pending client approval)
ZE	RT	JH	15.09.21	Consultant coordination
ZF	RT	JH	23.09.21	Consultant Issue
ZG	RT	JH	28.09.21	Consultant Issue

NOTES

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CLIENT NAME

School Infrastructure NSW

NSW GOVERNMENT Education School Infrastructure

SCALE

0m 2 4 6 8 10 1:200 @A1

PROJECT NAME AND ADDRESS

Wee Waa High School
105-107 Mitchell St, Wee Waa NSW 2388

DRAWN: RT
APPROVED: JH

STATUS

DRAWING TITLE

Roof Plan

PROJECT NO. 4474
DRAWING NO. CD2401
REV. ZG

SHAC

T +61 2 4961 5888
F +61 2 4962 2577
E info@shac.com.au

224 Maitland Road
Islington NSW 2296
Australia

Nominated Architect
Justin Hamilton (6160)
ABN 32 131 584 846

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(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 likely to be harmful to) a person who is outside the premise 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."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 µPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.

Table C.1 Modifying factor corrections
(See definitions in Section C2)

Factor	Assessment/ Measurement	When to apply	Correction[1]	Comments
Tonal noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (*ISO1996.2-2007 – Annex D*).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB [2, 3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note:** Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2dB(A) positive adjustment applies for the daytime period.	2 or 5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Table C.1 Modifying factor corrections – continued

Factor	Assessment/ Measurement	When to apply	Correction[1]	Comments
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level.	The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible.	5 dB	Adjustment to be applied for **night-time only**
Duration	Single-event noise duration may range from 1.5 min to 2.5 h.	One event in any assessment period.	0 to 20 dB(A)	The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).
Maximum Adjustment	Refer to individual modifying factors.	Where two or more modifying factors are indicated.	Maximum correction of 10 dB(A)[2] (excluding duration correction).	

Notes:

1. *Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.*
2. *Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.*
3. *Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.*