ACOUSTICS AND AIR

ST MATTHEWS CATHOLIC COLLEGE MUDGEE

NOISE AND VIBRATION IMPACT ASSESSMENT

REPORT NO. 19120
VERSION B

APRIL 2020

PREPARED FOR

TSA MANAGEMENT
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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

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

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

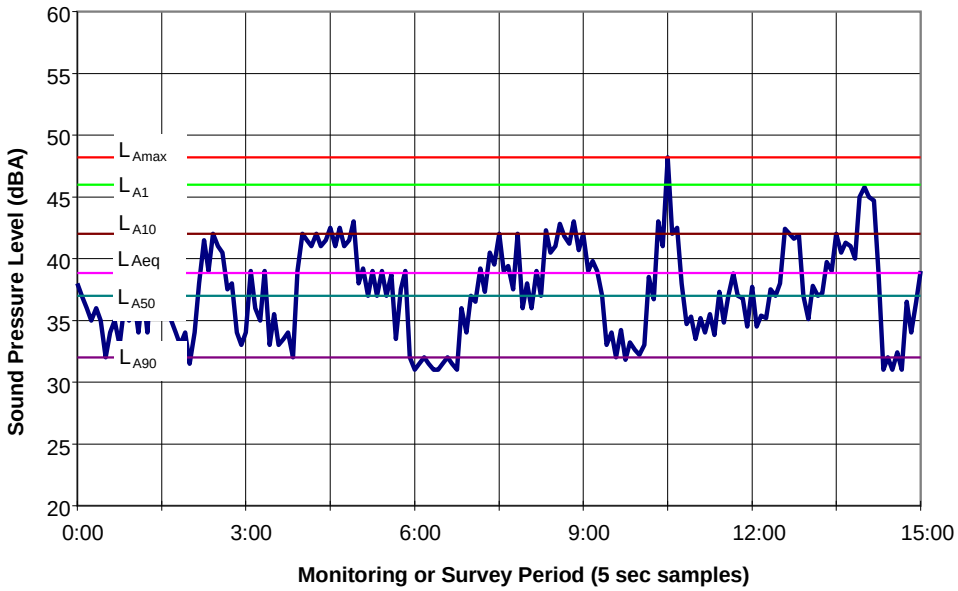
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

This Noise and Vibration Impact Assessment has been prepared by Wilkinson Murray Pty Limited on behalf of the Catholic Education Diocese of Bathurst (the 'Applicant'). It accompanies an Environmental Impact Statement (EIS) prepared in support of State Significant Development Application SSD 9872 for the development of St Matthews Catholic College, Mudgee (Stage 1).

The SSD DA seeks consent for the construction of a new 4-stream, year 7-12 catholic secondary school at Mudgee NSW. The school can accommodate a maximum population of 680 students plus associated staff.

The purpose of this report is to provide an assessment of the proposal as detailed within the EIS.

This report specifically determines the potential impacts of operational noise generated by school activities and mechanical plant and equipment upon nearby residential receivers. Noise and vibration generated during construction works and road traffic noise generated by the project are also addressed.

The acoustic assessment was conducted generally in accordance with the following environmental planning instruments, policies and guidelines:

- *SEPP (Infrastructure) 2007* (iSEPP);
- *Noise Policy for Industry (EPA 2017);*
- *Interim Construction Noise Guideline (DECC 2009);*
- *Assessing Vibration: A Technical Guideline (DECC 2006);*
- *NSW Road Noise Policy (DECCW 2011).*

The key issues to be addressed as identified in the Secretary's Environmental Assessment Requirements (SEARS), together with the relevant cross-reference, are documented in Table 1-1.

Table 1-1 SEARS – Key Issues

5. Environmental Amenity	Report Reference
Assess amenity impacts on the surrounding locality, including solar access, visual privacy**,** visual amenity, overshadowing and **acoustic impacts**.	Sections 4.4, 0, 4.6, 5.2, 5.3.
Identify any proposed use of the school outside of school hours (including weekends) and assess any resultant amenity impacts on the immediate locality and proposed mitigation measures.	Sections 5.2.2, 5.2.4, 5.2.10.
Detail amenity impacts including solar access, **acoustic impacts**, visual privacy, view loss, overshadowing and wind impacts. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.	Sections 4.5.1, 4.6, 5.2.1, 5.2.2, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.2.10, 5.3.

11. Noise and Vibration	
Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction demolition, site preparation, bulk excavation, construction. Outline measures to minimise and mitigate the potential noise impacts upon surrounding occupiers of land.	Section 4.
Identify and assess 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, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 5.

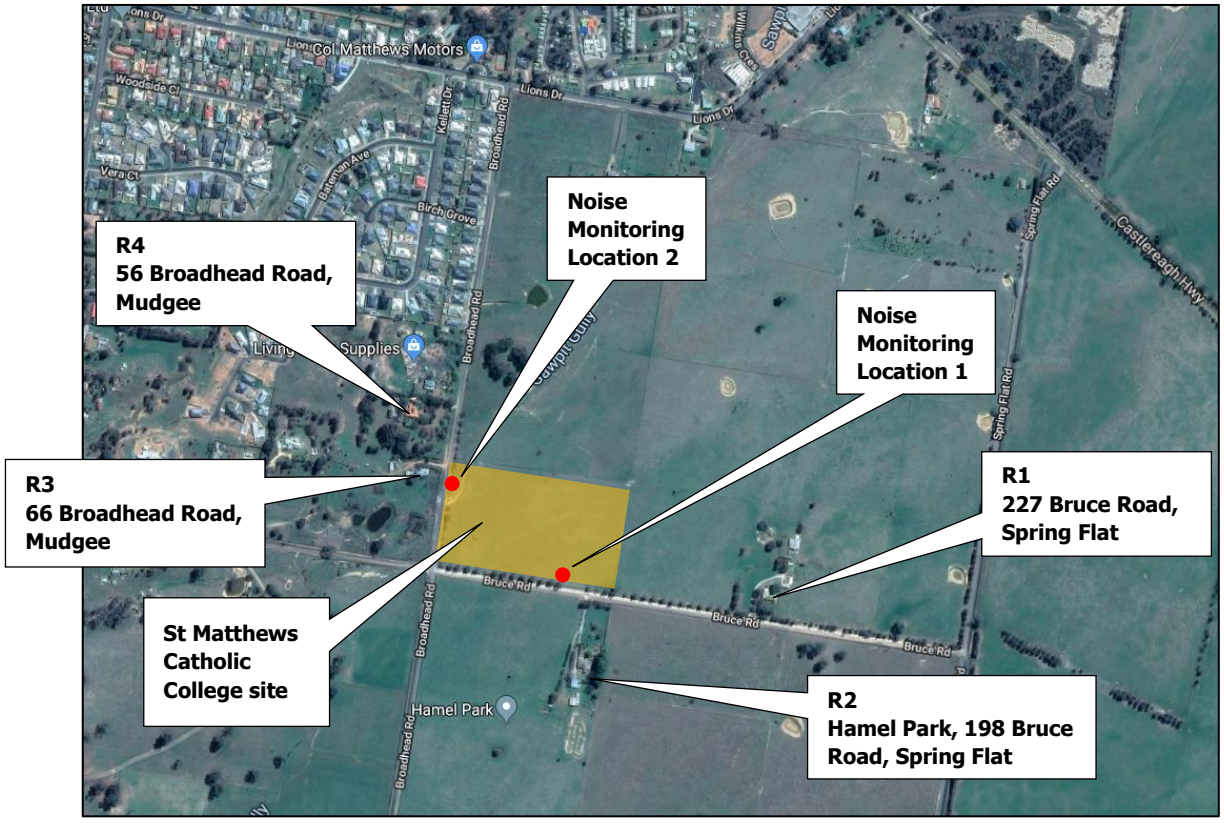
This report presents the assessment methodology, regulatory criteria relevant to operational, construction and road traffic noise and vibration. Where required, recommendations have been included to ensure operations do not result in any adverse noise impacts upon surrounding occupiers of land.

2 PROJECT OVERVIEW

2.1 Site Location

The Stage 1 development of St Matthews Catholic College will involve the construction of new school buildings and outdoor play/sports facilities to accommodate students from Years 7 to 12 on the site known as Lot 40 DP 756894 – 48 Broadhead Road, Spring Flat (Mudgee). The site location is shown in Figure 2-1.

Figure 2-1 Site Location



Aerial image courtesy of ©2019 Google

The proposed secondary College campus will be located on the north-eastern corner of the intersection of Broadhead Road and Bruce Road.

Surrounding land occupancy is primarily rural residential. The nearest residences to the future College are shown on Figure 2-1 as follows:

- R1 227 Bruce Road, Spring Flat (east);
- R2 Hamel Park 198 Bruce Road, Spring Flat (south);
- R3 66 Broadhead Road, Mudgee (west); and
- R4 56 Broadhead Road, Mudgee (north west).

2.2 Proposed Development

The SSD DA seeks consent for the construction of a new multi-purpose secondary education facility within the Mudgee Region that meets future demands for the developing region.

The new secondary school to be known as St Matthews Catholic High School Mudgee School will cater for 680 secondary school students (4-Stream Year 7-12) and will comprise of a cluster of five low-rise school buildings (1-2 storeys) including:

- Block A - Professional Hub (office and administration)
- Block B - Spiritual Hub (Chapel)
- Block C - Community Hub (Multi purpose hall, Music/Dance Studio and canteen)
- Block D – STEM Research Hub (teaching spaces)
- Block E - Knowledge and Learning Hubs (General Teaching spaces)
- Yarning Circle (Outdoor learning area)
- Outdoor Student Assembly Area and COLA
- Student free play area
- Staff and student amenities
- Associated site landscaping and public domain improvements
- On-site parking and access arrangements off Bruce Road, including:
    - On-grade car park for staff, students and visitors (75 spaces – including 2 accessible spaces)
    - A 12 bay student drop-off and pick-up area
    - A 3-bay bus drop-off and layover area
    - Bus turning area and servicing access
    - Dedicated separate driveway for service vehicles
    - Bicycle parking for 30 bicycles
- Associated earthworks, civil works, perimeter roadworks, fencing, services and utilities connections and augmentation, including:
    - Roadworks to Broadhead Road and Bruce Road to the full extent of the site frontages
    - Roadworks to the Broadhead Road and Bruce Road intersection to cater for bus movements
    - Footpath along the site frontage of Broadhead Road and suitable pedestrian crossing to connect to existing footpath.
    - Stormwater infrastructure upgrades adjacent to and within the site, including new culverts and drains, levee, and bioswale.
    - Connection to existing sewer line within the site
    - Electrical and water connections into the site.

The College campus will operate during normal school hours. After-hours access for outside community groups will be available for facilities in the Block C and Block D. Organisations permitted to use the school facilities will meet the requirements of the SEPP *(Education Establishment and Child Care Facilities)* 2017 (Education SEPP). Community use will be subject to the approved hours of operation. Hours of operations will be from 7.00am to 10.00pm when activities will cease.

The proposed floor plans for the educational development are included in **Appendix A**.

This assessment considers noise emissions associated with the development, and their potential impact on nearby residences, including:

- Noise and vibration generated during construction works;
- Noise from mechanical plant associated with the new buildings;
- Noise from activities and operations associated with the new buildings and facilities at the school including vehicular movements; and
- Road traffic noise generation.

3 EXISTING NOISE ENVIRONMENT

3.1 Ambient Noise Survey

In order to quantify the existing ambient noise environment of the area, noise monitoring was conducted at two locations on the site (refer Figure 2-1) as follows:

Location 1 Southern site boundary –opposite Hamel Park 198 Bruce Road, Spring Flat

Location 2 Western site boundary – opposite 66 Broadhead Road, Mudgee

Unattended environmental noise monitoring was conducted between Tuesday 14 May 2019 to Thursday 23 May 2019.

Instrumentation for the survey comprised an ARL Ngara and Type 316 Environmental Noise Loggers (serial numbers 8780F2 and 16-707-014, respectively) both fitted with microphone and windshield and set to A-weighted and fast response. Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The loggers continuously sampled noise levels over the entire survey period, and calculated relevant statistical indices for each 15-minute interval. All measurements were undertaken in general accordance with AS 1055:2018: *Acoustics – Description and Measurement of Environmental Noise* and the NSW EPA's *Noise Policy for Industry* (*NPfI*). Data measured during periods of adverse weather, established through consultation with historical weather reports provided by the Bureau of Meteorology (BOM), has been excluded. The survey results are included in **Appendix B**.

3.2 Noise Monitoring Results

To determine the project specific criteria on which to base assessment of operational noise emissions, the measured data was processed according to the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry* (NPfI) assessment time periods. Table 3-1 details the RBL (background) noise levels and the L_{Aeq} noise levels recorded during the daytime, evening and night-time periods.

Table 3-1 Measured Ambient Noise Levels

Monitoring Location	Noise Level – dBA re 20 µPa					
	Daytime 7:00am – 6:00pm		Evening 6:00pm – 10:00pm		Night-time 10:00pm – 7:00am	
	RBL [1]	L_{Aeq} [2]	RBL	L_{Aeq}	RBL	L_{Aeq}
Location 1, Bruce Road	29	56	28	50	24	49
Location 2, Broadhead Road	29	54	31	50	21	45

Note 1: The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 2: The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

The monitoring results have also been processed in accordance with the NSW *Road Noise Policy* (RNP) time periods to determine the daytime and night-time levels of road traffic noise. Table 3-2 details the $L_{Aeq(15hour)}$ daytime and the $L_{Aeq(9hour)}$ night-time noise levels recorded during the survey.

Table 3-2 Measured Road Traffic Noise Levels

Monitoring Location	Noise Level - dBA re 20 µPa	
	$L_{Aeq(15hour)}$	$L_{Aeq(9hour)}$
Location 1, Bruce Road	55	49
Location 2, Broadhead Road	53	44

4 CONSTRUCTION NOISE & VIBRATION

This section of the assessment relates to typical construction activities expected to occur during development works on the site, and their impact on the surrounding residential receivers.

4.1 Construction Noise Criteria – Residential Receivers

The following sections detail the applicable site-specific noise and vibration criteria based on the EPA's *Interim Construction Noise Guideline*.

4.1.1 Construction Noise Management Levels

The EPA released the "*Interim Construction Noise Guideline*" *(ICNG)* in July 2009. The guideline provides noise goals that assist in assessing the impact of construction noise.

For residences, the basic daytime construction noise goal is that the $L_{Aeq,15min}$ noise management level should not exceed the background noise by more than 10dBA. This applies to construction works conducted during standard hours which are defined as Monday to Friday 7.00am-6.00pm, and Saturday 8.00am-1.00pm. Outside the standard hours, where construction is justified, the noise management level applicable is background + 5dBA. Table 4-1 details the *ICNG* noise management levels.

Table 4-1 Construction Noise Management Levels at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. 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 75dBA	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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the guideline.

On the basis of the background noise logging results presented in Section 3.2 the noise management levels adopted for construction activities during standard hours at residential receivers are presented in Table 4-2. A minimum background level of 35dBA has been adopted for daytime, in accordance with NPfI convention.

Table 4-2 Standard Hours Construction Noise Management Level

Construction Noise Management Level $L_{Aeq,15\ min}$ (dBA)	Highly Noise-Affected Noise Level $L_{Aeq,15min}$ (dBA)
Day	
45	75

4.2 Hours of Operation

Construction works for this project will be undertaken during standard hours as follows:

- Monday to Friday 7.00am to 6.00pm
- Saturdays 8.00am to 1.00pm
- Sundays and Public Holidays No work

4.3 Vibration Criteria

Criteria for assessment of the effects of vibration on human comfort are set out in British Standard 6472-1992. Methods and criteria in that Standard are used to set "preferred" and "maximum" vibration levels in the document "*Assessing Vibration: A Technical Guideline*" (2006) produced by the NSW DECCW.

Acceptable values of human exposure to continuous vibration, such as that associated with drilling, are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous vibration is set out in Table 4-3.

Table 4-3 Criteria for Exposure to Continuous Vibration

Place	Time	Peak Particle Velocity (mm/s)	
		Preferred	Maximum
Residences	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2

In the case of intermittent vibration, which is caused by plant such as rock breakers, the criteria are expressed as a Vibration Dose Value (VDV) and are presented in Table 4-4.

Table 4-4 Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime		Night Time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Calculation of VDV requires knowledge of the number of events and their duration in the relevant time period.

4.3.1 Building Damage

In terms of the most recent relevant vibration damage objectives, Australian Standard AS 2187: Part 2-2006 *"Explosives – Storage and Use – Part 2: Use of Explosives"* recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2"*, as they "are applicable to Australian conditions".

The British Standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 4-5.

Table 4-5 Transient Vibration Guide Values – Minimal Risk of Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4 Hz and above	N/A
Un-reinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20mm/s at 15 Hz increasing to 50mm/s at 40 Hz and above

The Standard states that the guide values in Table 4-5 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

The British Standard goes on to state that *"Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity"*. In addition, a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.

4.4 Construction Equipment & Noise Source Levels

Sound Power Levels (L_W) for typical construction plant are identified in Table 4-6. These L_w are based upon archival data from measurements at other similar construction sites.

Table 4-6 Typical Construction Plant Sound Levels

Plant	Sound Power Level L_w dBA	Source
Concrete Truck	107	DEFRA
Concrete Pump	103	DEFRA
Mobile Crane	99	DEFRA
Dump Truck	108	WM
Compressor	103	WM
Hand Tools	100	WM
Bulldozer (CAT D11)	113	WM
Auger Piling Rig	107	WM /DEFRA
Excavator (40t)	107	DEFRA/SLR

4.5 Construction Noise Predictions – Residential Receivers

Assessment of likely noise generation at surrounding receivers has been undertaken for the proposed construction works.

Site-related noise emissions were calculated addressing the following factors:

- Equipment sound level emissions and location;
- Receiver locations;
- Ground topography;
- Distance between source and receiver;
- Ground absorption;
- Atmospheric absorption.

Modelling of the noise levels potentially generated during the three major works stages as summarised in Table 4-7 has been conducted using the computer program, CadnaA. This noise modelling software enables calculations to be performed using various recognised algorithms taking into account noise generated at the source, attenuation with distance and any shielding provided by intervening topography or structures. Modelling of construction noise was carried out in accordance with ISO 9613.1 procedures.

Table 4-7 Construction Works Scenarios

Stage	Description	Works
1	Bulk Excavation	Site preparation and excavation – mainly using excavators with dozers. Truck movements.
2	Building Construction	Bored piling, concreting and lifting. Bored piling rig, concrete pump & boom, compressor, crane are assumed to operate continuously over 15 minutes. Also, concrete trucks and normal delivery trucks.
3	Facade / Fitout	In the event that the construction of the facade occurs in isolation. Mobile crane and power tools assumed.

Calculations have been conducted for each stage with plant operating in "worst case" and "typical" locations across the construction site.

In all instances it has been assumed plant operates continuously and simultaneously. As such, predictions represent the noise levels that would likely occur during intensive periods of construction. The resulting noise levels can be considered in the upper range expected at surrounding receivers throughout the course of construction works.

The results of construction noise modelling are shown in Table 4-8. Exceedances of the NML (45dBA) are listed applicable to works during recommended standard hours. No exceedances of the "Highly Noise-Affected" 75dBA limit were identified.

Table 4-8 Predicted Construction Noise Levels at Residences – $L_{Aeq(15\ min)}$ – dBA

R1 227 Bruce Road, Spring Flat						
Stage	**Activities**	**Total L_w dBA**	**Maximum Noise Level**		**Exceedance NML**	
			Closest	**Typical**	**Closest**	**Typical**
1	Site Preparation and Excavation	118	48	47	+3	+2
2	Building Construction	115	44	43	0	0
3	Facade/Fitout	106	36	34	0	0
R2 Hamel Park, 198 Bruce Road, Spring Flat						
Stage	**Activities**	**Total L_w dBA**	**Maximum Noise Level**		**Exceedance NML**	
			Closest	**Typical**	**Closest**	**Typical**
1	Site Preparation and Excavation	118	52	51	+7	+6
2	Building Construction	115	49	48	+4	+3
3	Facade/Fitout	106	41	39	0	0
R3 66 Broadhead Road, Mudgee						
Stage	**Activities**	**Total L_w dBA**	**Maximum Noise Level**		**Exceedance NML**	
			Closest	**Typical**	**Closest**	**Typical**
1	Site Preparation and Excavation	118	57	55	+12	+10
2	Building Construction	115	54	51	+9	+6
3	Facade/Fitout	106	47	42	+2	0
R4 56 Broadhead Road, Mudgee						
Stage	**Activities**	**Total L_w dBA**	**Maximum Noise Level**		**Exceedance NML**	
			Closest	**Typical**	**Closest**	**Typical**
1	Site Preparation and Excavation	118	53	52	+8	+7
2	Building Construction	115	50	48	+5	+3
3	Facade/Fitout	106	42	39	0	0

4.5.1 Discussion of Results

A review of the predicted noise level range indicates maximum exceedances of up to 12dBA may occur during site preparation and excavation works. This exceedance is not unusual for construction works in a relatively quiet areas and can be mitigated by the construction noise management procedures detailed in the following sections. The maximum levels predicted are consistent with typical existing L_{Aeq} noise levels measured. The resultant noise levels within surrounding residences would not be likely to adversely impact upon normal daytime residential activities.

The adoption of reasonable and feasible noise management and mitigation is recommended. These measures should be determined in detail when a contractor, with defined construction techniques, has been engaged on the project. However, "in-principle" mitigation measures are detailed in the following sections.

4.6 Construction Vibration Assessment

Given the likely construction methodology involved and the distance between works and the closest surrounding residential and associated structures, ground vibration is not considered to be a potential issue.

Table 4-10 sets out the typical ground vibration levels at various distances for safe working distances. On review of the site layout and surrounding receivers, the minimum distance between any potentially vibration generating activities and surrounding residences will be a minimum of 100 metres. Safe working distances will be achieved and no further assessment of vibration is warranted.

Table 4-10 Recommended Safe Working Distances for Vibration-Intensive Plant

Item	Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Pile Boring	≤ 800mm diameter	2m (nominal)	N/A
Jackhammer	Hand held	1m (nominal)	Avoid contact with structure

4.7 Construction Noise & Vibration Mitigation Measures

When operating in closest proximity to the surrounding residential properties, noise levels from construction works are likely, at times, to exceed the applicable noise management levels. Noise control measures are recommended to ensure that noise is minimised where feasible and reasonable.

The following project-specific mitigation measures should be adopted:

- Selection of quietest feasible construction equipment;
- Use of rock saws and ripping in preference to rock breakers if rock removal is required (unlikely);
- Localised treatment, such as barriers, shrouds and the like around fixed plant, such as pumps and generators; and
- Provision of respite periods, particularly on Saturdays.

In addition, the following measures should be included in a Noise and Vibration Management Plan.

- *Plant Noise Audit* – Noise emission levels of all critical items of mobile plant and equipment should be checked for compliance with noise limits appropriate to those items prior to the equipment going into service. To this end, testing should be established with the Contractor.
- *Operator Instruction* – Operators should be trained to raise their awareness of potential noise problems and to increase their use of techniques to minimise noise emission.
- *Equipment Selection* – All fixed plant at the work sites should be appropriately selected, and where necessary, fitted with attenuators, acoustical enclosures and other noise attenuation measures to ensure that the total noise emission from each work site complies with EPA guidelines.
- *Site Noise Planning* – Where practical, the layout and positioning of noise-producing plant and activities should be optimised to minimise noise emission levels.

Adoption of these measures is aimed at working towards achieving the noise management levels established at surrounding receivers.

4.8 Community Liaison & General Approaches to Mitigation

An effective community relations programme should be put in place to keep the surrounding community informed of work progress, and to forewarn potentially affected receivers (e.g. by letterbox drop, meetings with surrounding owners / tenants, etc.) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms. This programme should include a *Community and Stakeholder Engagement Strategy* developed specifically for the Project.

Close liaison should be maintained between the residents surrounding the site and the parties associated with the construction works to provide effective feedback in regard to perceived emissions. In this manner, equipment selections and work activities can be coordinated where necessary to minimise disturbance to the neighbouring community, and to ensure prompt response to complaints, should they occur.

4.9 Noise & Vibration Management Plan

A Construction Noise and Vibration Management Plan should be prepared and implemented by the Contractor. The plan should reference the findings of this assessment. Areas to be addressed in plan include:

- Noise and vibration mitigation measures;
- Noise and vibration monitoring;
- Response to complaints**;**
- Responsibilities;
- Monitoring of noise emissions from plant items;
- Reporting and record keeping;
- Non-compliance and corrective action; and
- Community consultation and complaint handling.

5 OPERATIONAL NOISE ASSESSMENT

5.1 Assessment Criteria

5.1.1 Operational Noise Emissions

Operational noise may be generated by the following:

- Mechanical services plant;
- Teaching and practical activities, particularly (timber and metal) technology workshops and performing arts;
- Services in the Chapel;
- School announcements and bells;
- Sporting events and concerts in the Hall;
- Sporting activities in outdoor play areas.

Noise impact from the general operation of the proposed school development is to be assessed with respect to site-specific noise criteria based on ambient noise monitoring conducted at the site in accordance with the NSW *Noise Policy for Industry* (NPfI).

The NPfI is not intended to be applicable to schools, and there are no criteria specifically relating to noise emissions from primary and secondary schools. Some noise emissions will be consistent with those from industrial or commercial premises. These include external mechanical plant and activity-related noise generated during the use of such spaces as the hall, music facilities and performance spaces and industrial technology workshops. It is therefore reasonable and appropriate to consider these sources of noise in the context of the NPfI.

The NPfI recommends two noise criteria:

- Amenity Noise Level - 50dBA for a rural area during day and 45dBA during the evening, applying to the $L_{Aeq,11hour}$ and $L_{Aeq,4hour}$, respectively; and
- Intrusiveness Noise Level – Rating Background Level (RBL) plus 5dB, applying to the $L_{Aeq,15min}$ level.

Minimum RBLs apply in the NPfI, 35dBA for daytime and 30dBA for evening and night time periods.

Applying the NPfI guidelines, the project-specific goals for continuous operational noise emissions associated with the school facilities during the daytime and evening assessment periods at nearby residential receivers is shown in Table 5-1. The project noise trigger levels, being the lower of either the intrusiveness or amenity noise levels, are shown in bold.

The project-specific goals for continuous operational noise emissions associated with the school facilities are shown in bold in Table 5-1. Note that intrusiveness noise levels are evaluated over a 15-minute period, while amenity noise levels are evaluated over an entire day, evening or night period. As industrial noise sources do not determine (or influence) the existing ambient noise levels in the immediate area, and future development would be predominantly residential, it is appropriate to use the 'recommended amenity noise levels' specified in the NPfI for a rural area as the project amenity noise level for the development.

Table 5-1 Project Noise Trigger Levels for Continuous Operational Noise

Location	Area Classification	Period	ANL [1] $L_{Aeq(period)}$ dBA	RBL [2] $L_{A90(15min)}$ dBA	$L_{Aeq(period)}$ Noise Level dBA	Project Noise Level	
						Intrusive[4] $L_{Aeq(15min)}$	Amenity[5] $L_{Aeq(15min)}$
Bruce Road Residences	Rural	Day	50	35	56	**40**	53
		Evening	45	30	50	**35**	48
		Night	40	30	49	**35**	43
Broadhead Road Residences	Rural	Day	50	35	54	**40**	53
		Evening	45	30[3]	50	**35**	48
		Night	40	30	45	**35**	43

Note 1: Recommended - ANL Amenity Noise Level.
Note 2: RBL Rating Background Level. Actual RBLs are below assumed policy minimums; therefore assumed minimums are adopted.
Note 3: Where the measured RBL for the evening period is higher than the daytime RBL, the project intrusiveness level for evening is to be set at no greater than the project intrusiveness noise level for daytime.
Note 4: Intrusive criterion only applicable to residential receivers.
Note 5: Project amenity noise level (ANL) is rural ANL plus 3dBA to convert from a period level to a 15-minute level.

5.1.2 Road Traffic Noise

The *NSW Road Noise Policy* (2011) was released by the EPA to replace the *Environmental criteria for road traffic noise* (1999) from 1 July 2011. The key provisions of the policy are an emphasis on the use of land use planning, better road design and vehicle noise emission control to avoid or minimise road traffic noise impacts. The assessment criteria for residences potentially affected by additional traffic generated by land use developments on arterial, sub-arterial and local roads are summarised in Table 5-2.

Table 5-2 Road Traffic Noise Assessment Criteria for Residential Land Uses

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

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

5.2 Operational Noise Assessment

5.2.1 Mechanical Services

The noise emission of any mechanical plant associated with the proposed new buildings should be controlled so that the operation of such plant does not adversely impact upon surrounding residential properties. Air-conditioning will be provided throughout the general school with localised plantrooms and use of roof-mounted plant as required. Given the distance from the proposed campus buildings, Blocks A, B C D and E to surrounding residential properties, operational noise emissions from HVAC plant would achieve design limits at surrounding residential receivers.

Exhaust fans and dust extraction systems will likely be required for the TAS Food Technology and TAS Block D rooms.

Mechanical plant selection and location will be finalised during the detailed design phase. At this stage, potentially noise generating equipment will be examined to ensure compliance with the project noise trigger levels for mechanical noise emissions both to surrounding residential properties and at sensitive receiver locations within the College itself.

5.2.2 Classroom/Activities

Generally, it is anticipated that the noise levels throughout the secondary school general learning spaces, collaboration and collaborative teaching spaces, laboratories and passive social space will be relatively low. The technology-related workshops, performing arts, music rooms and multi-purpose hall are more likely to result in audible noise emissions.

Modelling to determine the indicative levels of noise received at surrounding residential properties due to activities typically conducted within these spaces has been conducted using the computer program, CadnaA.

5.2.3 Chapel

Liturgical services held in the Chapel may potentially contribute noise emissions to surrounding residential receivers. A worst-case acoustical scenario would involve the use of music with school congregation singing. The assumed reverberant sound pressure level within the space in this scenario is 90dBA (based upon a sound power level L_w 105dBA).

Modelling has been conducted for potentially worst-case emissions with operable doors open. The predicted results, together with the relevant assessment criteria, are shown in Table 5-3.

Table 5-3 Predicted Noise Emissions – Chapel

Receiver	Predicted Noise Level $L_{Aeq,15min}$ dBA	Noise Trigger Limit $L_{Aeq,15min}$ dBA Day[1]	Noise Trigger Limit $L_{Aeq,15min}$ dBA Evening[2]	Complies
R1 227 Bruce Road, Spring Flat	7	40	35	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	13	40	35	Yes
R3 66 Broadhead Road, Mudgee	20	40	35	Yes
R4 56 Broadhead Road, Mudgee	17	40	35	Yes

Note 1: Daytime is 7.00am to 6.00pm.
Note 2: Evening is 6.00pm to 10.00pm

These levels comply with the criteria applicable to operational noise during normal school and out of hours use.

5.2.4 Multi-purpose Hall

The multi-purpose hall building is located in the middle of Block C, with Food Technology and Hospitality on the eastern side and Performing Arts on the western side. The proposed building construction comprises a combination of fibre cement and metal sheet cladding with entry doors on the northern elevation and louvres at high level on the southern elevation.

Since the building will function as both a gymnasium and auditorium, noise will be generated by sporting activities, performances and presentations.

In sports mode, the highest noise-generating usage would likely be associated with competitive basketball games. An L_{Aeq} over 15 minutes of around 84dBA (reverberant sound pressure level) is typical during normal school basketball games, which includes the use of whistles.

When operating in event mode, the worst-case acoustical scenario would involve the use of amplified or live music. The assumed reverberant sound pressure level within the space in this scenario is 90dBA (based upon a sound power level L_w 115dBA).

Modelling has been conducted for potentially worst-case emissions with entry doors open. The predicted results, together with the relevant assessment criteria, are shown in Table 5-4.

Table 5-4 Predicted Noise Emissions – Multi-purpose Hall

Receiver	Predicted Noise Level $L_{Aeq,15min}$ dBA		Noise Trigger Limit $L_{Aeq,15min}$ dBA Day[1]	Noise Trigger Limit $L_{Aeq,15min}$ dBA Evening[2]	Complies
	Sports Mode	Event Mode			
R1 227 Bruce Road, Spring Flat	18	27	40	35	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	27	34	40	35	Yes
R3 66 Broadhead Road, Mudgee	18	28	40	35	Yes
R4 56 Broadhead Road, Mudgee	21	29	40	35	Yes

Note 1: Daytime is 7.00am to 6.00pm.
Note 2: Evening is 6.00pm to 10.00pm.

The most stringent project-specific noise trigger limit for residential receivers is $L_{Aeq,15min}$ 35dBA assuming an evening (out of school hours 6.00pm – 10.00pm) event. Use of the multi-purpose hall in both event mode (worst case scenario) and sports mode, including community use, will achieve the project specific noise trigger limits for environmental noise emissions during all operational periods and also during out of hours use.

5.2.5 Performing Arts

The performing arts unit, located on the western side of the multi-purpose hall, includes a music facility with two individual music practice rooms and a drama studio. The school orchestra is expected to practise within the music room and modelling has assumed this as a worst-case scenario with a reverberant sound pressure level of up to 94dBA (based upon a sound power level L_w 107dBA) with a typical school band playing within the space. For the drama studio, a reverberant sound pressure level of 77dBA (based upon a sound power level L_w 89dBA) has been adopted as typical of pre-recorded amplified background music.

Modelling of noise emissions have assumed open windows and doors along the western elevation. The predicted results, together with the relevant assessment criteria, are shown in Table 5-5.

Table 5-5 Predicted Noise Emissions – Performing Arts

Receiver	Predicted Noise Level $L_{Aeq,15min}$ dBA		Noise Trigger Limit $L_{Aeq,15min}$ dBA Day[1]	Noise Trigger Limit $L_{Aeq,15min}$ dBA Evening[2]	Complies
	Music	Drama			
R1 227 Bruce Road, Spring Flat	13	<10	40	35	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	21	<10	40	35	Yes
R3 66 Broadhead Road, Mudgee	27	<10	40	35	Yes
R4 56 Broadhead Road, Mudgee	25	<10	40	35	Yes

Note 1: Daytime is 7.00am to 6.00pm.
Note 2: Evening is 6.00pm to 10.00pm

These levels comply with the criteria applicable to operational noise during normal school and out of hours use.

5.2.6 TAS Timber and Metal Technology

Block D houses TAS Timber and Metal, TAS Science and Visual Arts. The Timber and Metal Technology facility is considered to be the only space of acoustic significance in Block D.

The proposed building construction comprises a combination of fibre cement and metal sheet cladding with windows and doors on the southern and eastern elevations.

Modelling of noise emissions has assumed open windows and doors. The predicted results, together with the relevant assessment criteria, are shown in Table 5-6.

Table 5-6 Predicted Noise Emissions – TAS Timber and Metal Technology

Receiver	Predicted Noise Level $L_{Aeq,15min}$ dBA	Noise Trigger Limit $L_{Aeq,15min}$ dBA Day[1]	Noise Trigger Limit $L_{Aeq,15min}$ dBA Evening[2]	Complies
R1 227 Bruce Road, Spring Flat	17	40	35	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	25	40	35	Yes
R3 66 Broadhead Road, Mudgee	<10	40	35	Yes
R4 56 Broadhead Road, Mudgee	<10	40	35	Yes

Note 1: Daytime is 7.00am to 6.00pm.
Note 2: Evening is 6.00pm to 10.00pm

These levels comply with the criteria applicable to operational noise during normal school and out of hours use.

5.2.7 Cumulative Operational Noise

Based upon the results of noise modelling, the cumulative noise levels at surrounding residential properties with all acoustically significant spaces functioning simultaneously are shown in Table 5-7. The overall levels have been predicted for both operational scenarios applicable to the multi-purpose hall.

Table 5-7 Cumulative Operational Noise from Classroom/Activities

Receiver	Predicted Noise Level $L_{Aeq,15min}$ dBA		Noise Trigger Limit $L_{Aeq,15min}$ dBA Day[1]	Noise Trigger Limit $L_{Aeq,15min}$ dBA Evening[2]	Complies
	Hall in Sports Mode	Hall in Event Mode			
R1 227 Bruce Road, Spring Flat	22	27	40	35	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	30	35	40	35	Yes
R3 66 Broadhead Road, Mudgee	28	31	40	35	Yes
R4 56 Broadhead Road, Mudgee	27	31	40	35	Yes

Note 1: Daytime is 7.00am to 6.00pm.
Note 2: Evening is 6.00pm to 10.00pm

When all potentially acoustically significant spaces are simultaneously operational in worst-case operational scenarios (with windows and doors open), the criteria applicable to operational noise during normal school and out of hours use will be achieved at all surrounding residential properties.

5.2.8 School Announcements and Bells

Announcements and school bells are typical activities associated with school operations. Typically, these are produced by the school PA system and can vary significantly depending on the final volume settings of the system.

At this stage, no design of the PA system has been determined. However, the following measures should be adopted to ensure that their impact at all surrounding residences is minimised:

- Speakers should be located and orientated to provide good coverage of the school areas whilst being directed away from residences. System coverage should be reviewed during the detailed design stage.
- The volume of the system should be adjusted on site so that announcements and bells are clearly audible on the school site without being excessive. The system should initially be set so that noise at surrounding residences does not exceed 40dBA during the daytime period.
- Once the appropriate level has been determined on site, the system should be limited to the acceptable level so that staff cannot increase noise levels.
- The system bell should be set so that it only occurs on school days.

5.2.9 Carpark and Vehicular Movements

Noise emissions will be generated by vehicles entering and leaving the carpark and vehicle-related activities, such as opening and closing of doors, vehicles starting, manoeuvring and the like.

The site plan shows parking spaces for 75 vehicles to accommodate staff, senior students and visitors within the carpark area accessed directly from Bruce Road. The carpark will also include a student drop off/pickup zone along the northern perimeter comprising 12 marked bays to be used before and after school. A bus lay-by would be provided off Bruce Road to accommodate three buses at any one time.

Based on the traffic report prepared by The Transport Planning Partnership (TTPP, ref 18472 version 05, dated 26 March 2020), the summary of peak vehicle trip generation during morning and afternoon peak periods is shown in Table 5-8. Note that the trips associated with staff and senior students would generate a single movement whereas parental drop off and pickup would generate two vehicle movements (one "in" trip plus one "out" trip). This is accounted for in Table 5-8.

Table 5-8 Peak Vehicle Trips

Peak Period	Peak Period Vehicle Trips			
	Staff	Senior Students	Student Drop off/Pickup	Total
AM	47	18	315	380
PM	6	20	350	376

An $L_{Aeq,15min}$ sound power level per vehicle of 70dBA has been adopted for modelling purposes, based upon the BayLfU method (Bavarian State Agency for the Environment 2007) and the study results published by Ron Rumble Renzo Tonin (Acoustics, 2011) which established sound power levels of 63dBA/hour and 64dBA/hour (70dBA per 15 minutes), respectively for vehicular movements in carparks. According to the traffic assessment, the bulk of students would depart in the initial 15 minutes after school finishes in the afternoon with the remainder gradually leaving over the next 15 minutes or so.

Schools typically have a prominent afternoon peak period while the morning period tends to be more staggered across the hour. Therefore, the afternoon peak is considered as the 'worst-case' for assessment purposes. Accordingly, the total afternoon vehicle trips have been assumed to occur over a 30 minute period, rather than a 1 hour period (as for the morning peak), for the purposes of predicting noise emission associated with peak arrivals and departures.

The predicted $L_{Aeq,15min}$ noise levels during peak carpark operational periods are summarised in Table 5-9.

Table 5-9 Predicted $L_{Aeq,15min}$ Carpark Noise Levels

Receiver	Predicted $L_{Aeq,15min}$ dBA		Assessment Criterion $L_{Aeq,15min}$ dBA	Complies
	AM	PM		
R1 227 Bruce Road, Spring Flat	16	23	40	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	23	30	40	Yes
R3 66 Broadhead Road, Mudgee	28	33	40	Yes
R4 56 Broadhead Road, Mudgee	24	29	40	Yes

From the results shown above, noise emissions due to carpark activity will comply with the applicable criterion for the assessment of continuous operational noise.

5.2.10 Outdoor Noise

Noise will be generated by students engaged in recreational activities for a short period prior to commencement of classes, during recess and lunch. The current proposal does not include any formal outdoor sporting fields however a student free play area has been assumed in the north-eastern area of the site with a smaller student assembly area located to the north of the Block C, in the area surrounded by the campus buildings.

Noise from school children engaged in outdoor play cannot be assessed in the same manner as noise generated by the use of learning facilities such as classrooms, technology workshops, gymnasium and hall. The EPA's *NPfI* has previously been referred to for the assessment of such classroom and activity noise emissions (and noise from mechanical plant) however, the policy does not present appropriate criteria for the assessment of noise from outdoor areas.

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

In general, the impact of outdoor activity noise from schools is considered to be sufficiently mitigated by the site zoning and the limited periods of outdoor recreational activities, that is during recess and lunch breaks and for a short time before school, occurring from Monday to Friday during the 40-week school year, and, as such, does not typically warrant quantitative assessment.

A guideline for the assessment of noise from child care centres has been prepared by the Association of Australasian Acoustical Consultants (AAAC) as a result of a NSW Australian Acoustical Society (AAS) Technical Meeting held in September 2007 on Child Care Noise. The document, *AAAC Guideline for Child Care Centre Acoustic Assessment*, *October 2013*, provides criteria for the assessment of noise associated with outdoor play. The guideline has been placed before the Land and Environment Court during matters involving Child Care Centre applications.

Since the time in which children are involved in outdoor play is limited, the potential impact associated with these noise emissions is minimised. The AAAC considers a total limit of 2 hours outdoor play per day at a child care facility reasonable to apply a criterion that the $L_{Aeq,15min}$ noise level emitted from the outdoor play area not exceed the background noise level by more than 10dB at the assessment location.

The 2-hour duration time limit applied by AAAC for child care centres should be viewed as a guideline rather than a set limit when applied to schools - *Best Western v Blacktown City Council* (2011). The time in which outdoor play can be expected throughout the school day would fall within this range and the 2-hour duration is considered reasonable as a practical guideline. A "background + 10dBA" criterion has also been applied to schools in other local government areas within the Sydney Metropolitan area.

In the case of *Al Faisal College Limited v Canterbury Bankstown Council* (2018), which involved the development of a new school, consistent with this application, whilst the Court accepted that the "background + 10dBA" approach may, be considered a 'datum' of acceptability when considering whether acoustical impacts arising from an educational establishment are reasonable in a merit assessment of the application, Commissioner Dixon found that this guideline was not intended to be directly applied to the assessment of noise from outdoor play at a school.

In the absence of any quantitative criterion for assessment of noise emissions from outdoor play, the "background + 10dBA" criterion will be applied as a 'yardstick' or 'datum' for determining the acceptability of noise from outdoor play at the proposed school.

Applying the AAAC guideline for the assessment of noise emissions from outdoor play, the relevant "guideline" limits are presented in Table 5-10.

Table 5-10 Emission Guidelines for Noise from Outdoor Play

Receiver Location	RBL [1] $L_{A90,(15min)}$ dBA	Emission Guideline $L_{Aeq,15min}$ dBA
Bruce Road and residences to south & east	35	45
Broadhead Road and residences to west & north	35	45

Note 1: A minimum background level of 35dBA has been adopted for daytime, in accordance with NPfI convention.

For prediction of noise emissions from outdoor play, students are assumed to be evenly distributed across the entire student free play and student assembly areas. For the purposes of modelling, we have divided the proposed total enrolment (680 students) equally across the six years (Years 7 to 12) and assumed that the junior students (Years 7 to 10) would occupy the larger student free play area and the senior students (Years 11 and 12) would occupy the student assembly area.

Based upon the results of previous measurements conducted by Wilkinson Murray of children engaged in outdoor play, an L_{Aeq} sound power level of 79dBA per student has been adopted. The sound power level (L_w) across each outdoor play area has been calculated according to the number of students (ie 453 students in the free play area and 226 students in the student assembly area).

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

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

The predicted noise levels ($L_{Aeq, 15min}$) at the surrounding residential receivers, are shown in Table 5-11.

Table 5-11 Predicted $L_{Aeq15min}$ Noise Level from Outdoor Play

Receiver Location	Predicted $L_{Aeq15min}$ dBA	Emission Guideline $L_{Aeq,15min}$ dBA
R1 227 Bruce Road, Spring Flat	35	45
R2 Hamel Park, 198 Bruce Road, Spring Flat	38	45
R3 66 Broadhead Road, Mudgee	37	45
R4 56 Broadhead Road, Mudgee	36	45

Noise emissions associated with outdoor activities (school and community use) are expected to be generally within the range of background L_{A90} + 10dBA.

In order to minimise the potential impact at residences the following recommendations made:

- Restrict the use of outdoor play areas prior to 7.00am.
- Minimise PA use and ensure speakers are appropriately located and limited to achieve acceptable levels.
- The L_{Amax} noise level from the PA system operation shall not exceed 45 dBA at the nearest residential boundary.
- The PA system should use small low-powered horn-type speakers oriented in such a manner to fire away from residential premises.
- Speakers should be mounted at a downward angle of 45^{o} and as close to ground level as possible.
- Only nominated persons, trained in the appropriate use of the system, should be permitted to operate the PA system.
- A sound limiter is to be installed to ensure that the maximum limiting criterion at residential boundaries is not exceeded.

It is recommended that management of noise be included in any site management plan.

5.3 Road Traffic Noise

The roads surrounding the project site include local and state roads as follows:

Bruce Road is a local road running east-west along the southern boundary of the Project site. It is unsealed between Broadhead Road and Spring Flat Road. The speed limit is 50km/h.

Broadhead Road is a local road running north-south along the western boundary of the Project site. The speed limit is 50km/h.

Springflat Road is a local road running north-south that provided access to/from Castlereagh Highway to the north and surrounding primary production zones to the south. The speed limit is 100km/h.

Lions Drive is a local road running east-west with access to/from Castlereagh Highway.

Castlereagh Highway is a State classified road running northwest-southeast with a speed limit of 80km/h.

Traffic surveys were carried out in February 2019 to capture typical weekday traffic turning movement at key surrounding intersections. The peak hourly traffic flows on the surrounding roads has been determined based upon this count data as presented in the TTPP traffic impact assessment.

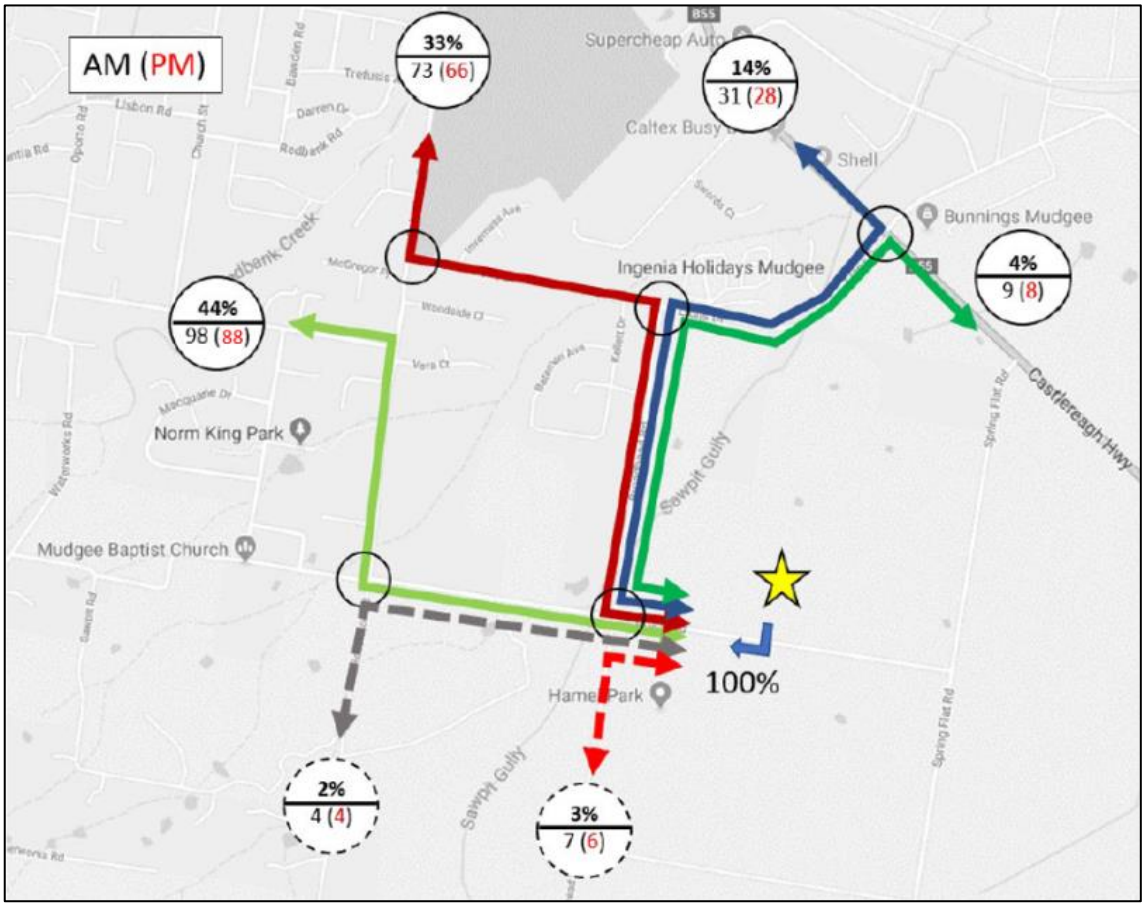
According to the traffic consultant's report, surrounding local roads mainly carry very low traffic numbers during the morning and afternoon (school) peak periods as summarised in Table 5-12.

Table 5-12 Traffic Volumes on Surrounding Road Network

Road	Vehicles during AM Peak	Vehicles during PM Peak
Bruce Road between Springflat Road and Broadhead Road	8	9
Bruce Road between Broadhead Road and Robertson Road	15	15
Broadhead Road between Lions Drive and Bruce Road	43	42
Lions Drive between Castlereagh Highway and Broadhead Road	281	254
Springflat Road between Castlereagh Highway and Bruce Road	25	22
Springflat Road south of Bruce Road	34	20

With the 380 and 376 vehicle trips generated by the Project during the morning and afternoon peak periods, respectively, a considerable increase in traffic volumes on local roads immediately surrounding the Project site will be experienced. The TTPP traffic assessment includes projected future traffic distribution based on the location of high school students' residences. These are generally concentrated within the Mudgee township and to the northwest of the Project site. Future trip distribution has recognised there is likely to be residential development across surrounding vacant lots and a conservative growth rate has been adopted, applying a 2% trip proportion to streets which lead to the southwest. The future trip distribution is shown in Figure 5-1.

Figure 5-1 Future Vehicle Trip Distribution



Source: Transport Planning Partnership *St Matthews High School, Mudgee Traffic, Parking and Transport Impact Assessment* (TTPP, ref 18472 version 05, dated 26 March 2020)

The expected noise levels at surrounding representative receiver locations due to Project-generated traffic have been predicted using the Calculation of Road Traffic Noise 1988 (CoRTN) procedure and based upon the future trip distributions shown in Figure 5-1. The predicted noise levels are shown in Table 5-13.

Table 5-13 Predicted Road Traffic Noise at Residences

Receiver Location	Predicted $L_{Aeq,1hr}$ Traffic Noise Level dBA	Criterion $L_{Aeq,1hr}$ dBA	Complies
	AM/PM Peak		
R1 227 Bruce Road, Spring Flat	37	55	Yes
R2 Hamel Park, 198 Bruce Road, Spring Flat	48	55	Yes
R3 66 Broadhead Road, Mudgee	55	55	Yes
R4 56 Broadhead Road, Mudgee	51	55	Yes
119 Bruce Road, Mudgee (west of Broadhead Road)	55	55	Yes

The predicted noise levels at existing residences affected by additional traffic on existing local roads generated as a result of the Project will achieve the RNP recommended limit for daytime.

6 CONCLUSION

An assessment of the noise and vibration impacts associated with the development of the St Matthews Catholic College, Mudgee has been conducted. This assessment has been carried out in accordance with NSW regulatory requirements and this report is forms part of the EIS submission to the NSW Department of Planning, Industry and Environment.

The scope of the assessment involved a survey of the existing noise environment; derivation and establishment of assessment criteria for noise emissions; a noise impact assessment relative to appropriate criteria; and recommendations for measures to minimise the potential for disturbance to surrounding residents. The findings are as follows:

Construction Noise and Vibration

No detailed construction plan or schedule is available at this stage of the project, therefore prediction of construction noise levels should be regarded as indicative. Three work stage scenarios have been considered, with an overall sound power level adopted for each based upon the likely plant operating throughout. Predictions for surrounding residential receivers have been carried out assuming the concurrent operation of all plant at worst case (closest) and typical locations.

The NMLs at nearby residential receivers can be expected to be exceeded, at times significantly, mainly during periods of intensive high noise level works associated with site preparation excavation and to a lesser extent during building construction involving bored piling, concrete pours and the like. During general construction works, for example facade and fitout, the NMLs would be generally achieved at all surrounding receivers.

Throughout the noisier work periods adoption of reasonable and feasible noise management and mitigation will be required to minimise impact at residences.

A Construction Noise Management Plan, to be implemented by the Contractor, should be prepared. This plan should clearly identify the strategies to be put in place to minimise potentially adverse noise impacts upon the surrounding community.

Vibration is unlikely to be an impact given the distances between surrounding receivers and plant exceed those recommended for safe work in terms of structural damage and human response.

Operational Noise

The predominant sources of potential operational noise were identified as the Chapel, multi-purpose hall, performing arts facilities (music and drama), TAS Timber and Metal technology workshop and future mechanical plant. The noise level emissions from assumed worst-case operational scenarios of the future potentially noise-generating activity/teaching spaces have been predicted to the nearest surrounding residential receivers.

The results of calculations of continuous operational noise sources were compared with design goals for environmental noise, determined in accordance with State Government guidelines. All relevant criteria can be achieved by the development. Detailed mechanical plant selection will take place during the detailed design phase. Acceptable noise levels due to plant operation are likely to be achieved given the location of plant within services zones and the distance between

plant locations and receivers. Further assessment should be carried out to confirm compliance when detailed mechanical services design and plant selection becomes available.

Noise from outdoor activities held on the site (school and community use) are expected to generally achieve a L_{A90} background + 10dBA emission 'guideline'. Operation of outdoor areas should be managed to minimise noise emissions to nearby residences by measures such as restricting use prior to 7.00am and limiting the use of whistles and PA system (where feasible).

Road Traffic Noise

Road traffic generated by the development will comply with the NSW *Road Noise Policy* (RNP) guidelines at all surrounding receivers.

APPENDIX A

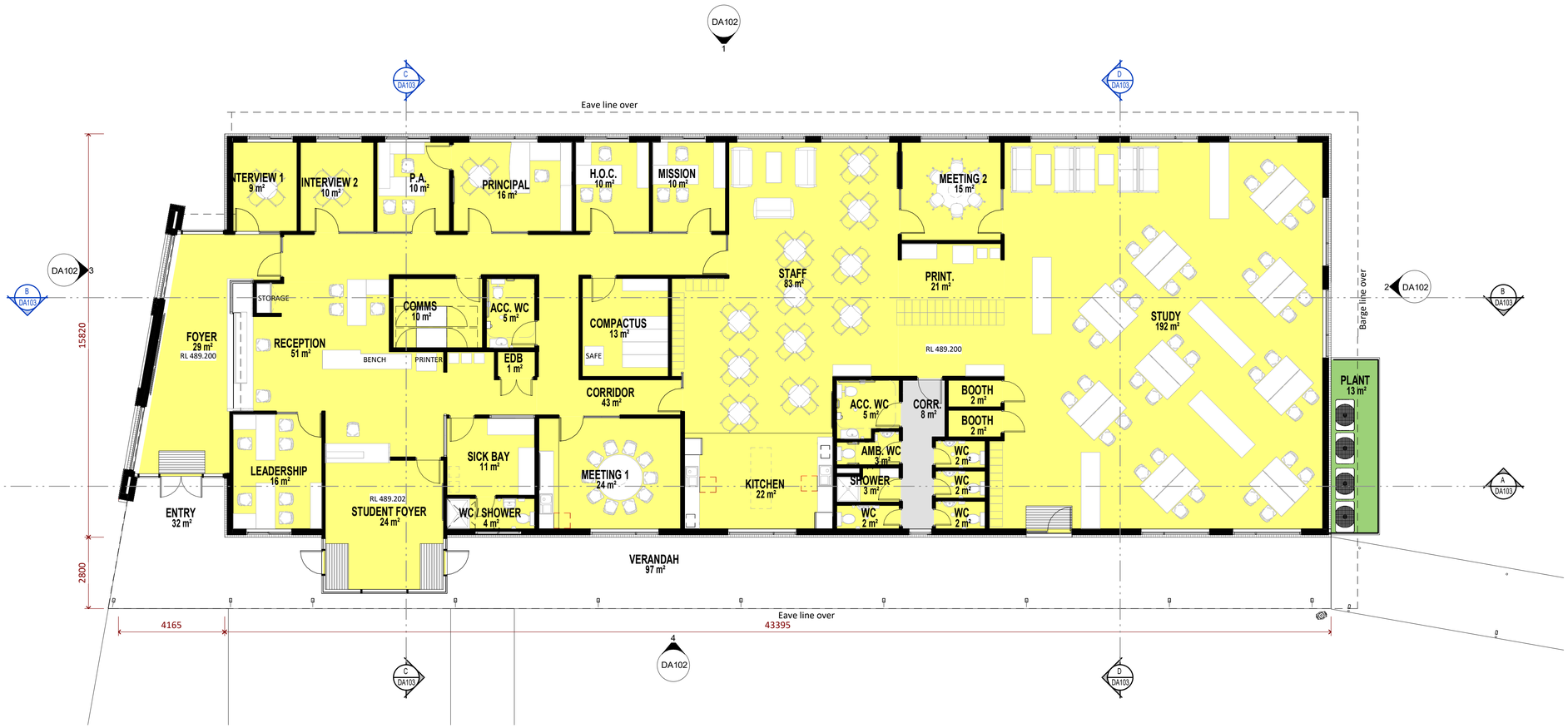
PROJECT PLANS

keyplan

- Administration
- Building Services
- Chapel
- Enclosed Circulation
- GLA-Secondary
- Multi-Purpose Hall
- Performing Arts
- Pupil Facilites
- Resource Centre
- TAS
- TAS Science
- TAS-Food Technology
- Visual Arts

Administration

Name	Area
ACC. WC	5 m²
ACC. WC	5 m²
AMB. WC	3 m²
BOOTH	2 m²
BOOTH	2 m²
COMMS	10 m²
COMPACTUS	13 m²
CORRIDOR	43 m²
EDB	1 m²
FOYER	29 m²
H.O.C.	10 m²
INTERVIEW 1	9 m²
INTERVIEW 2	10 m²
KITCHEN	22 m²
LEADERSHIP	16 m²
MEETING 1	24 m²
MEETING 2	15 m²
MISSION	10 m²
P.A.	10 m²
PRINCIPAL	16 m²
PRINT.	21 m²
RECEPTION	51 m²
SHOWER	3 m²
SICK BAY	11 m²
STAFF	83 m²
STUDENT FOYER	24 m²
STUDY	192 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC / SHOWER	4 m²
Grand total area	654 m²



SSDA Issue, Legend Updated	BLC	03.04.20	16
SSDA Issue, levels adjusted, dims added	BLC	01.04.20	15
GA NSW Issue	BLC	20.03.20	14
Preliminary SSDA Review	BLC	28.02.20	13
Block A Draft Single Storey	BLC	21.01.20	12
Design Development Sign off	CG	21.10.19	11
Access adjust, dis car added	BLC	31.07.19	10
SSDA Documentation 90% Completion	DO	03.06.19	9
Carpark, paths, Block B Adjusted	BLC	22.05.19	8
Client Workshop Presentation	BLC	14.05.19	7
purpose of issue	by	date	issue no.

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ALLEANZA ARCHITECTURE
NOMINATED ARCHITECT : CHARLES GLANVILLE NSW REGISTRATION No. 3130

CATHOLIC EDUCATION DIOCESE OF BATHURST
TSA MANAGEMENT

project

ST MATTHEW'S CATHOLIC SCHOOL

address

Corner of BROADHEAD and BRUCE RD. MUDGEE
Lot 40 of DP 756894

STATE SIGNIFICANT DEVELOPMENT APPLICATION

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BLOCK A - PLANS

sheet

project no.	sheet no.	issue
18150	DA101	16

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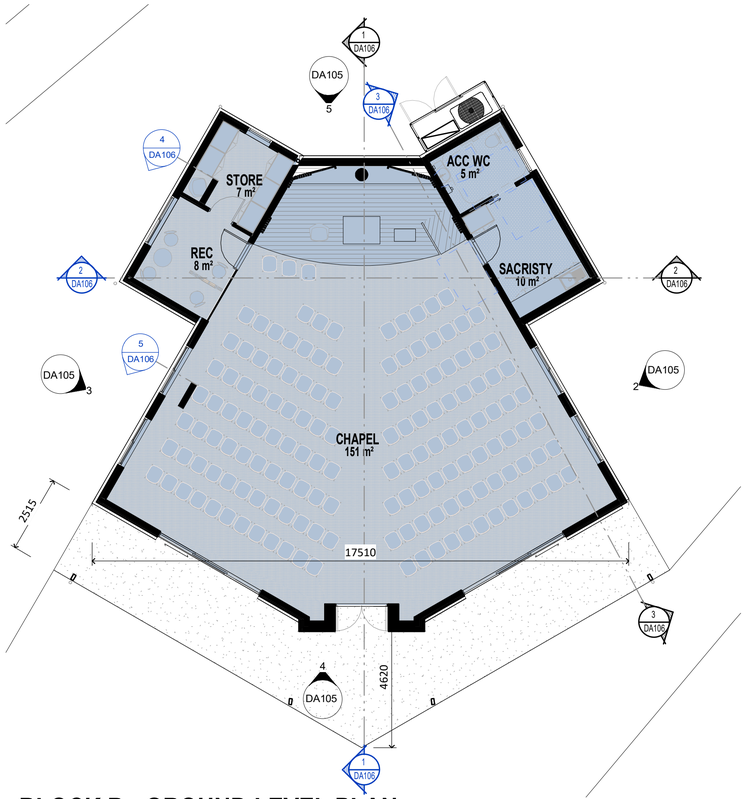
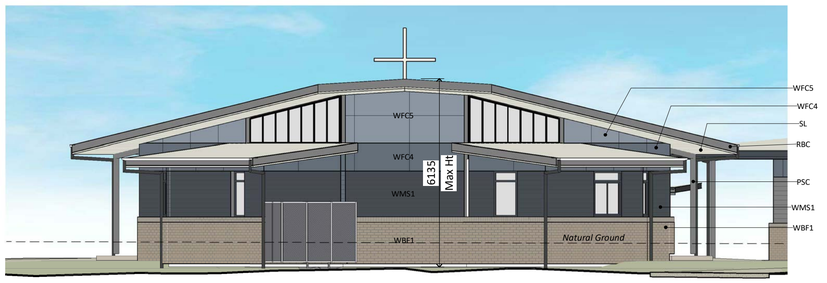


BLOCK B - GROUND LEVEL PLAN
1 : 100

BLOCK B - NORTH-WEST ELEVATION
1 : 100

BLOCK B - SOUTH-EAST ELEVATION
1 : 100

BLOCK B - NORTH-EAST ELEVATION
1 : 100



BLOCK B - SOUTH-WEST ELEVATION
1 : 100

Chapel	
Name	**Area**
CHAPEL	151 m²
SACRISTY	10 m²
STORE	7 m²
REC	8 m²
ACC WC	5 m²
Grand total	182 m²

- Administration
- Building Services
- Chapel
- Enclosed Circulation
- GLA-Secondary
- Multi-Purpose Hall
- Performing Arts
- Pupil Facilites
- Resource Centre
- TAS
- TAS Science
- TAS-Food Technology
- Visual Arts

LEGEND

CODE	DESCRIPTION
BAL-1	Balustrade & handrail - type 1 to details
DP	Downpipe
GT	Gutter refer to hydraulic engineer
LOC1	Lockers - Student
PCP	Painted concrete column
PSC	Painted steel column
RBC	Colorbond metal Barge capping
RGF	Colorbond metal gutter & fascia
RMS1	Colorbond profiled metal roof sheet - type 1
RMS2	Colorbond profiled metal roof sheet - type 2
RPS	Polycarbonate roof sheet
RWT	Rain water tank
SL	Metal profiled Soffit Lining
WBF	Face brickwork
WBF1	Face brickwork - type 1
WBF3	Face brickwork - type 3
WFC1	Painted fibre cement cladding type 1
WFC2	Painted fibre cement cladding type 2
WFC3	Painted fibre cement cladding type 3
WFC4	Painted fibre cement cladding type 4
WFC5	Painted fibre cement cladding type 5
WFC6	Painted fibre cement cladding type 6
WFC7	Painted fibre cement cladding type 7
WFC8	Painted fibre cement cladding type 8
WFC9	Painted fibre cement cladding type 9
WFC.1	
WLV1	Louvre screen - type 1
WLV2	Louvre screen - type 2
WMS1	Profiled metal sheet cladding - type 1
WMS2	Profiled metal sheet cladding - type 2
WPL4	Pinboard lining - type 4

keyplan

purpose of issue	by	date	issue no.
SSDA Issue, Legend Updated	BLC	03.04.20	11
SSDA Issue, levels adjusted, dims added	BLC	01.04.20	10
GA NSW Issue	BLC	20.03.20	9
Site Plan, Block B & F adjusted	BLC	19.09.19	8
Block B & F adjusted	BLC	30.08.19	7
SSDA Documentation 90% Completion	DO	03.06.19	6
Carpark, paths, Block B Adjusted	BLC	22.05.19	5
Client Workshop Presentation	BLC	14.05.19	4
Chapel Option 3	BLC	09.05.19	3

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TSA MANAGEMENT

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BLOCK B - FLOOR PLAN, ELEVATIONS & SECTIONS

project no.	sheet no.	sheet issue
18150	DA105	11

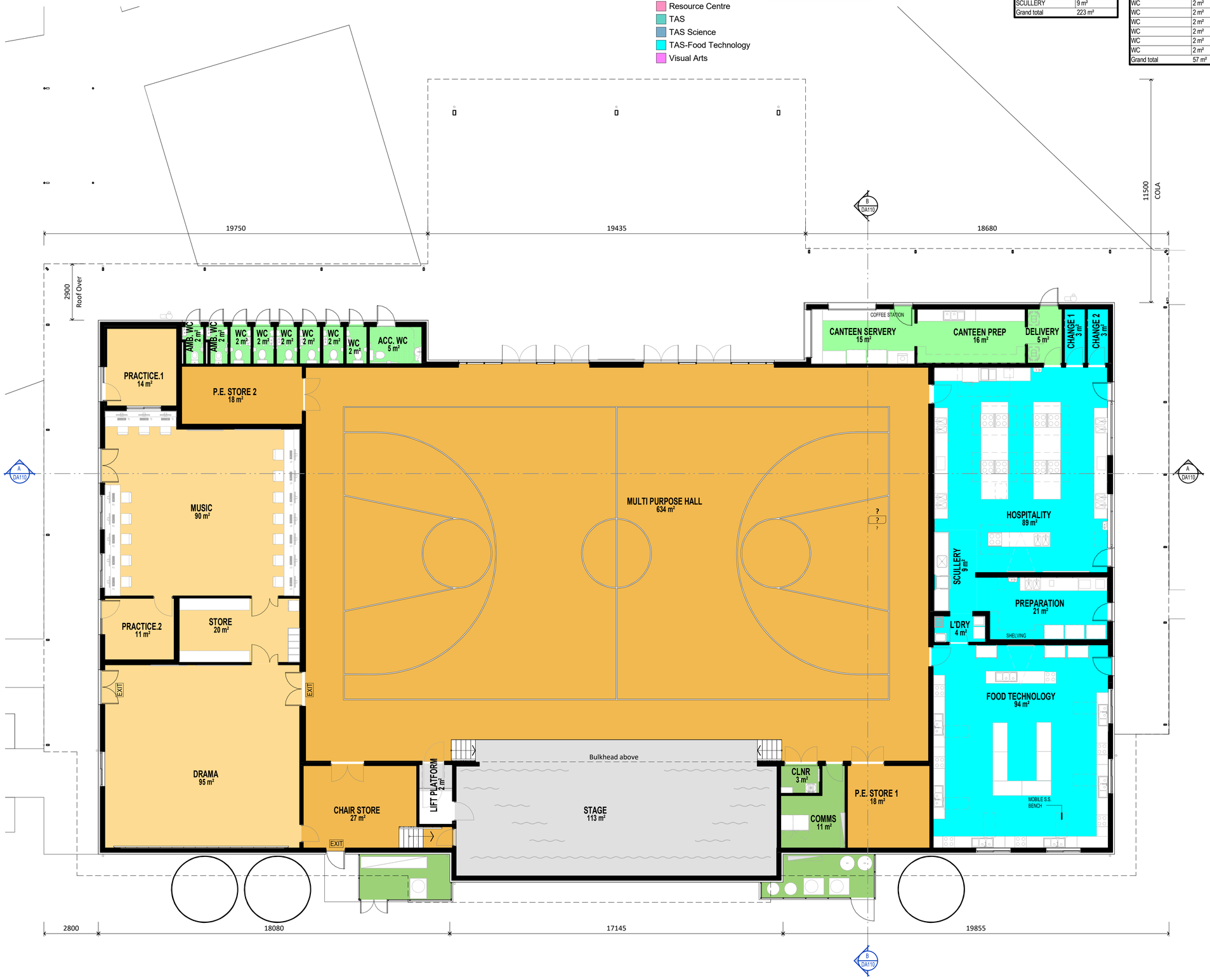
- Administration
- Building Services
- Chapel
- Enclosed Circulation
- GLA-Secondary
- Multi-Purpose Hall
- Performing Arts
- Pupil Facilites
- Resource Centre
- TAS
- TAS Science
- TAS-Food Technology
- Visual Arts

Performing Arts	
Name	Area
DRAMA	95 m²
MUSIC	90 m²
PRACTICE.1	14 m²
PRACTICE.2	11 m²
STORE	20 m²
Grand total	230 m²

Multi Purpose Hall	
Name	Area
MULTI PURPOSE HALL	634 m²
P.E. STORE 1	18 m²
CHAIR STORE	27 m²
P.E. STORE 2	18 m²
Grand total	697 m²

TAS Food Technology	
Name	Area
CHANGE 1	3 m²
CHANGE 2	3 m²
FOOD TECHNOLOGY	94 m²
HOSPITALITY	89 m²
L'DRY	4 m²
PREPARATION	21 m²
SCULLERY	9 m²
Grand total	223 m²

Pupil Facilities Block C	
Name	Area
ACC. WC	5 m²
AMB. WC	2 m²
AMB. WC	2 m²
CANTEEN PREP	16 m²
CANTEEN SERVERY	15 m²
DELIVERY	5 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
Grand total	57 m²



keyplan

LEGEND

CODE	DESCRIPTION
BAL-1	Balustrade & handrail - type 1 to details
DP	Downpipe
GT	Gutter refer to hydraulic engineer
LOC1	Lockers - Student
PCP	Painted concrete column
PSC	Painted steel column
RBC	Colorbond metal Barge capping
RGF	Colorbond metal gutter & fascia
RMS1	Colorbond profiled metal roof sheet - type 1
RMS2	Colorbond profiled metal roof sheet - type 2
RPS	Polycarbonate roof sheet
RWT	Rain water tank
SL	Metal profiled Soffit Lining
WBF	Face brickwork
WBF1	Face brickwork - type 1
WBF3	Face brickwork - type 3
WFC1	Painted fibre cement cladding type 1
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WFC3	Painted fibre cement cladding type 3
WFC4	Painted fibre cement cladding type 4
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WFC6	Painted fibre cement cladding type 6
WFC7	Painted fibre cement cladding type 7
WFC8	Painted fibre cement cladding type 8
WFC9	Painted fibre cement cladding type 9
WFC.1	
WLV1	Louvre screen - type 1
WLV2	Louvre screen - type 2
WMS1	Profiled metal sheet cladding - type 1
WMS2	Profiled metal sheet cladding - type 2
WPL4	Pinboard lining - type 4

purpose of issue	by	date	issue no.
SSDA Issue, Legend Updated	BLC	03.04.20	12
SSDA Issue, levels adjusted, dims added	BLC	01.04.20	11
GA NSW Issue	BLC	20.03.20	10
Block C Comms & Store Revised	BLC	07.02.20	9
Preliminary Cost Plan 2A Amendments	BLC	06.02.20	8
Design Development Sign off	CG	21.10.19	7
Access adjust, dis car added	BLC	31.07.19	6
SSDA Documentation 90% Completion	DO	03.06.19	5
Carpark, paths, Block B Adjusted	BLC	22.05.19	4
Client Workshop Presentation	BLC	14.05.19	3

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STATE SIGNIFICANT DEVELOPMENT APPLICATION

north

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BLOCK C - GROUND FLOOR PLAN

project no.	sheet no.	issue
18150	DA108	12

sheet

TAS Science	
Name	**Area**
COLLABORATIVE LEARNING	103 m²
MINI LAB.	37 m²
PREP ROOM	34 m²
SCIENCE 1	100 m²
SCIENCE 2	100 m²
Grand total	373 m²

TAS Block D	
Name	**Area**
3D PRINT	7 m²
CNC	7 m²
COURTYARD	56 m²
LASER CUT	7 m²
MACHINES	45 m²
MAJOR WORKS 3	24 m²
METAL	100 m²
PLANT	8 m²
STEM	100 m²
STORE	43 m²
WIP STORE 3	16 m²
WIP STORE 4	7 m²
WOOD	100 m²
Grand total	522 m²

Visual Arts	
Name	**Area**
ART 1	91 m²
ART 2	92 m²
ART SUPPLIES	13 m²
COURTYARD	29 m²
COURTYARD	47 m²
DESIGN	45 m²
MAJOR WORKS 1	63 m²
POTTERY	22 m²
WIP STORE 1	21 m²
WIP STORE 2	27 m²
Grand total	450 m²

Pupil Facilities Block D	
Name	**Area**
ACC. WC	6 m²
Grand total	6 m²

- Administration
- Building Services
- Chapel
- Enclosed Circulation
- GLA-Secondary
- Multi-Purpose Hall
- Performing Arts
- Pupil Facilites
- Resource Centre
- TAS
- TAS Science
- TAS-Food Technology
- Visual Arts

keyplan

LEGEND

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RGF	Colorbond metal gutter & fascia
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RMS2	Colorbond profiled metal roof sheet - type 2
RPS	Polycarbonate roof sheet
RWT	Rain water tank
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WLV2	Louvre screen - type 2
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WPL4	Pinboard lining - type 4

purpose of issue	by	date	issue no.
SSDA Issue, Legend Updated	BLC	03.04.20	10
SSDA Issue, levels adjusted, dims added	BLC	01.04.20	9
GA NSW Issue	BLC	20.03.20	8
Design Development Sign off	CG	21.10.19	7
Access adjust, dis car added	BLC	31.07.19	6
SSDA Documentation 90% Completion	DO	03.06.19	5
Carpark, paths, Block B Adjusted	BLC	22.05.19	4
Client Workshop Presentation	BLC	14.05.19	3
DRAW NUMBERS ADJUSTED, Buildings moved, Elevations adjusted	BLC	08.05.19	2

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BLOCK D - GROUND FLOOR PLAN

project no.	sheet no.	issue
18150	DA112	10

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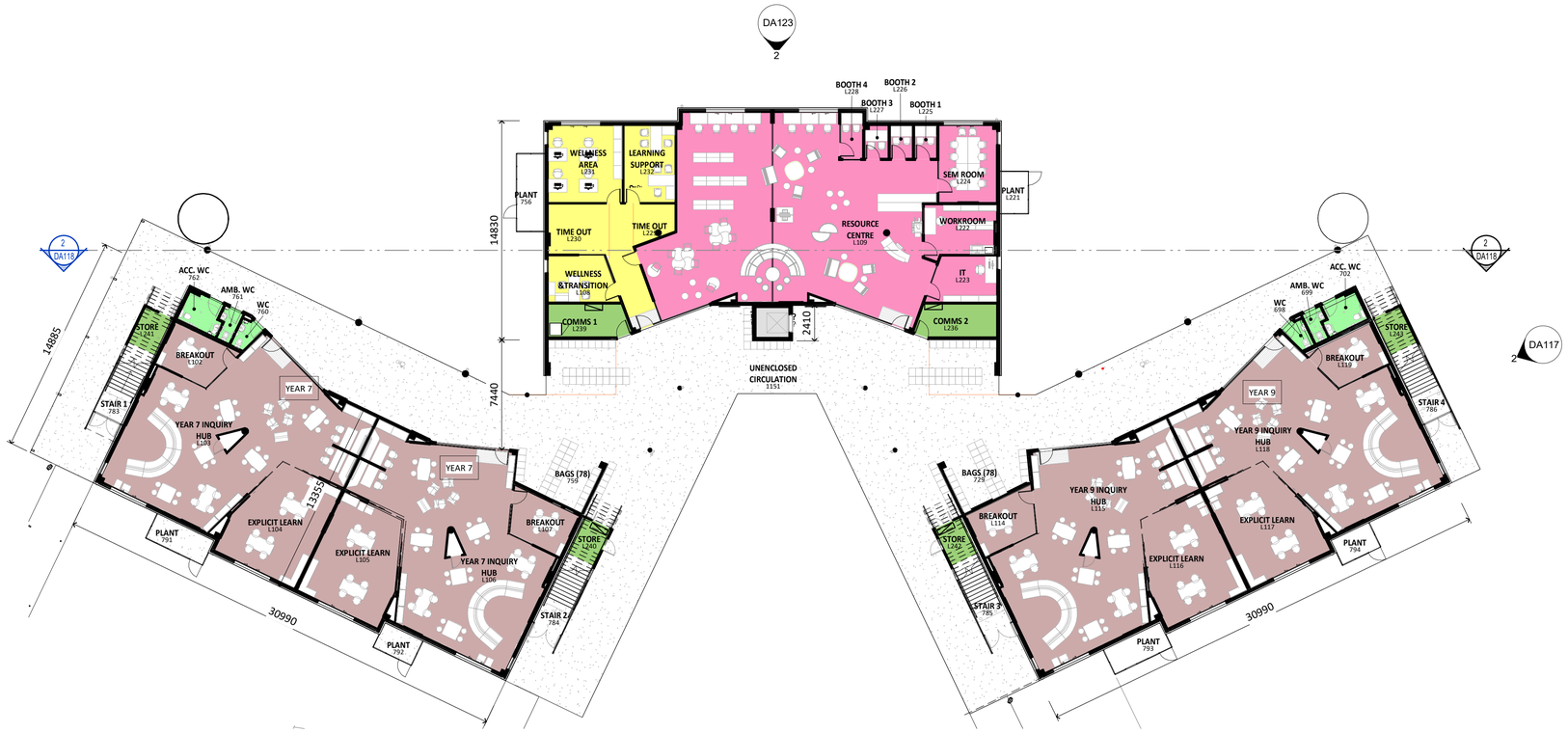

BLOCK E - LEVEL 1 FLOOR PLAN

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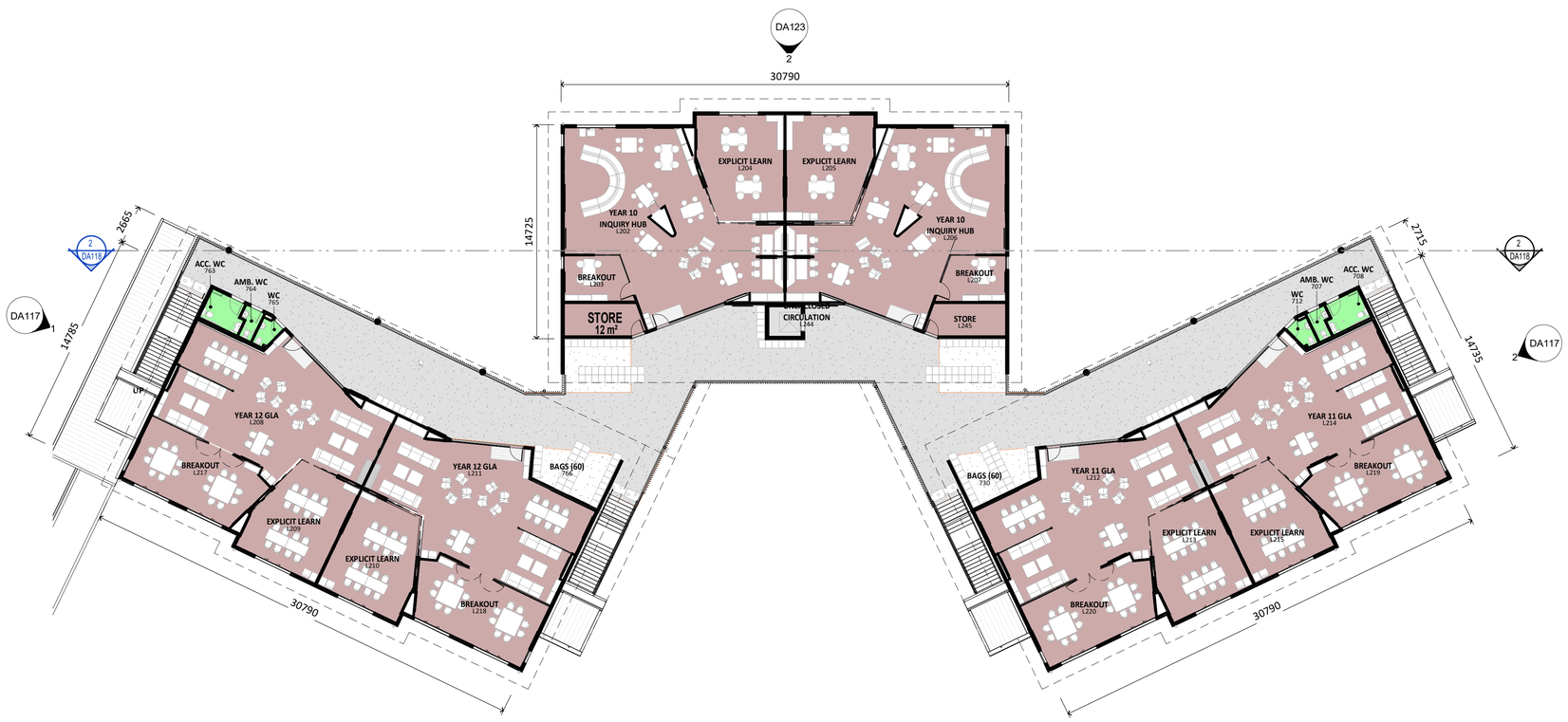

BLOCK E - LEVEL 2 FLOOR PLAN

1 : 200

GLA - Secondary	
vv	Area
YEAR 7 INQUIRY HUB	130 m²
YEAR 9 INQUIRY HUB	129 m²
YEAR 9 INQUIRY HUB	130 m²
BREAKOUT	13 m²
BREAKOUT	13 m²
BREAKOUT	14 m²
BREAKOUT	13 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
YEAR 10 INQUIRY HUB	131 m²
YEAR 10 INQUIRY HUB	130 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
BREAKOUT	14 m²
BREAKOUT	13 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
EXPLICIT LEARN	40 m²
YEAR 12 GLA	105 m²
YEAR 12 GLA	105 m²
YEAR 11 GLA	105 m²
YEAR 11 GLA	105 m²
YEAR 7 INQUIRY HUB	130 m²
BREAKOUT	41 m²
BREAKOUT	41 m²
BREAKOUT	41 m²
BREAKOUT	41 m²
STORE	12 m²
STORE	12 m²
Grand total	1864 m²

Pupil Facilities Block E	
Name	Area
ACC. WC	6 m²
ACC. WC	6 m²
ACC. WC	6 m²
ACC. WC	6 m²
AMB. WC	2 m²
AMB. WC	2 m²
AMB. WC	2 m²
AMB. WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
WC	2 m²
Grand total	42 m²

- Administration
- Building Services
- Chapel
- Enclosed Circulation
- GLA-Secondary
- Multi-Purpose Hall
- Performing Arts
- Pupil Facilites
- Resource Centre
- TAS
- TAS Science
- TAS-Food Technology
- Visual Arts

keyplan

LEGEND	
CODE	DESCRIPTION
BAL-1	Balustrade & handrail - type 1 to details
DP	Downpipe
GT	Gutter refer to hydraulic engineer
LOC1	Lockers - Student
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SSDA Issue, Legend Updated	BLC	03.04.20	11
SSDA Issue, levels adjusted, dims added	BLC	01.04.20	10
GA NSW Issue	BLC	20.03.20	9
Access adjust, dis car added	BLC	31.07.19	8
SSDA Documentation 90% Completion	DO	03.06.19	7
Carpark, paths, Block B Adjusted	BLC	22.05.19	6
Client Workshop Presentation	BLC	14.05.19	5
DRAW NUMBERS ADJUSTED, Buildings moved, Elevations adjusted	BLC	08.05.19	4
ESD Consult Issue	BLC	02.05.19	3
purpose of issue	by	date	issue no.

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BLOCK E - GROUP FLOOR PLANS

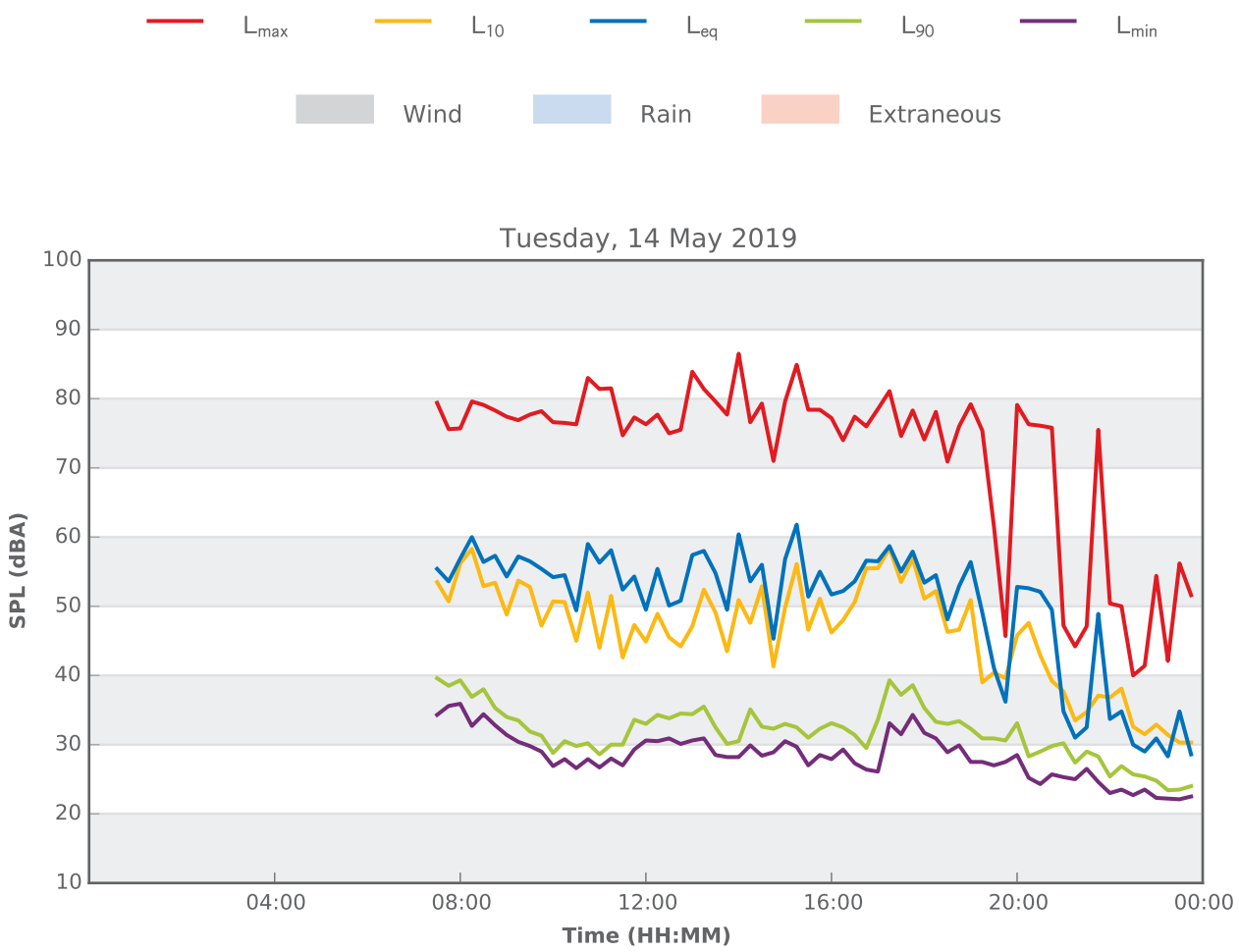
sheet

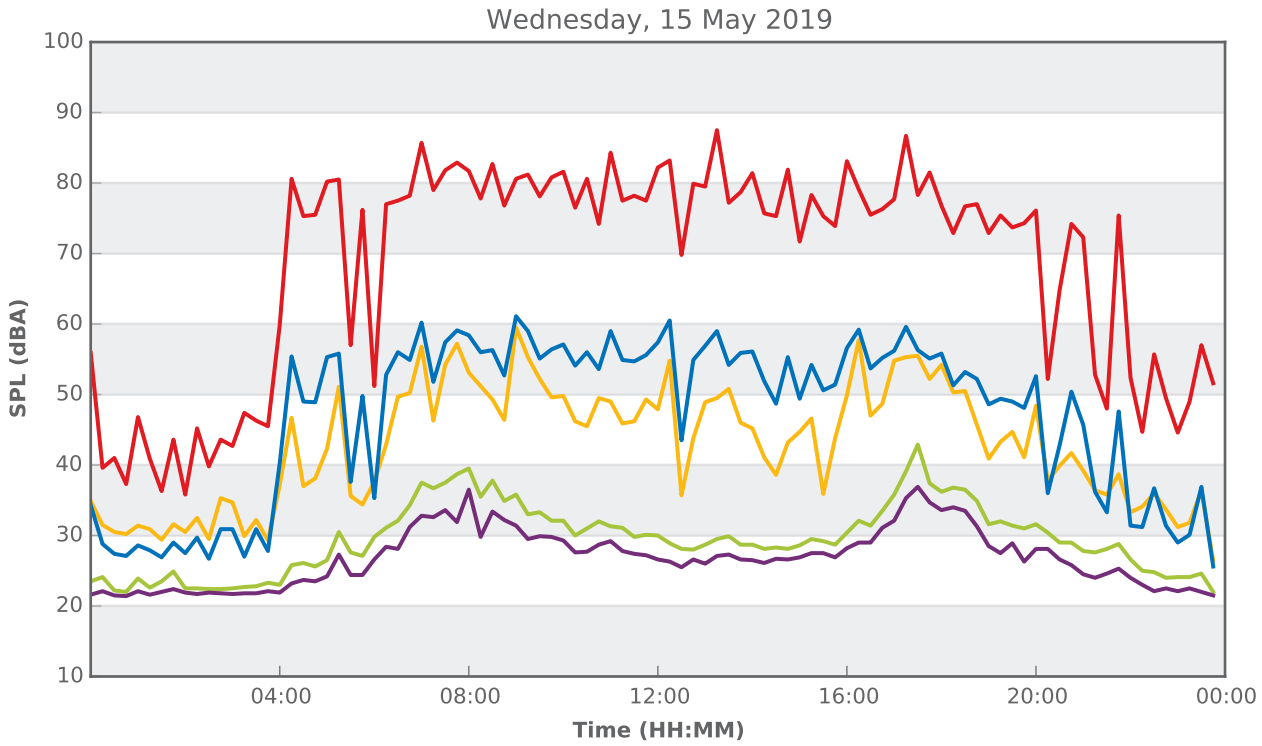
project no.	sheet no.	issue
18150	DA116	11

APPENDIX B

NOISE LEVEL MEASUREMENTS

227 Bruce Road, Mudgee





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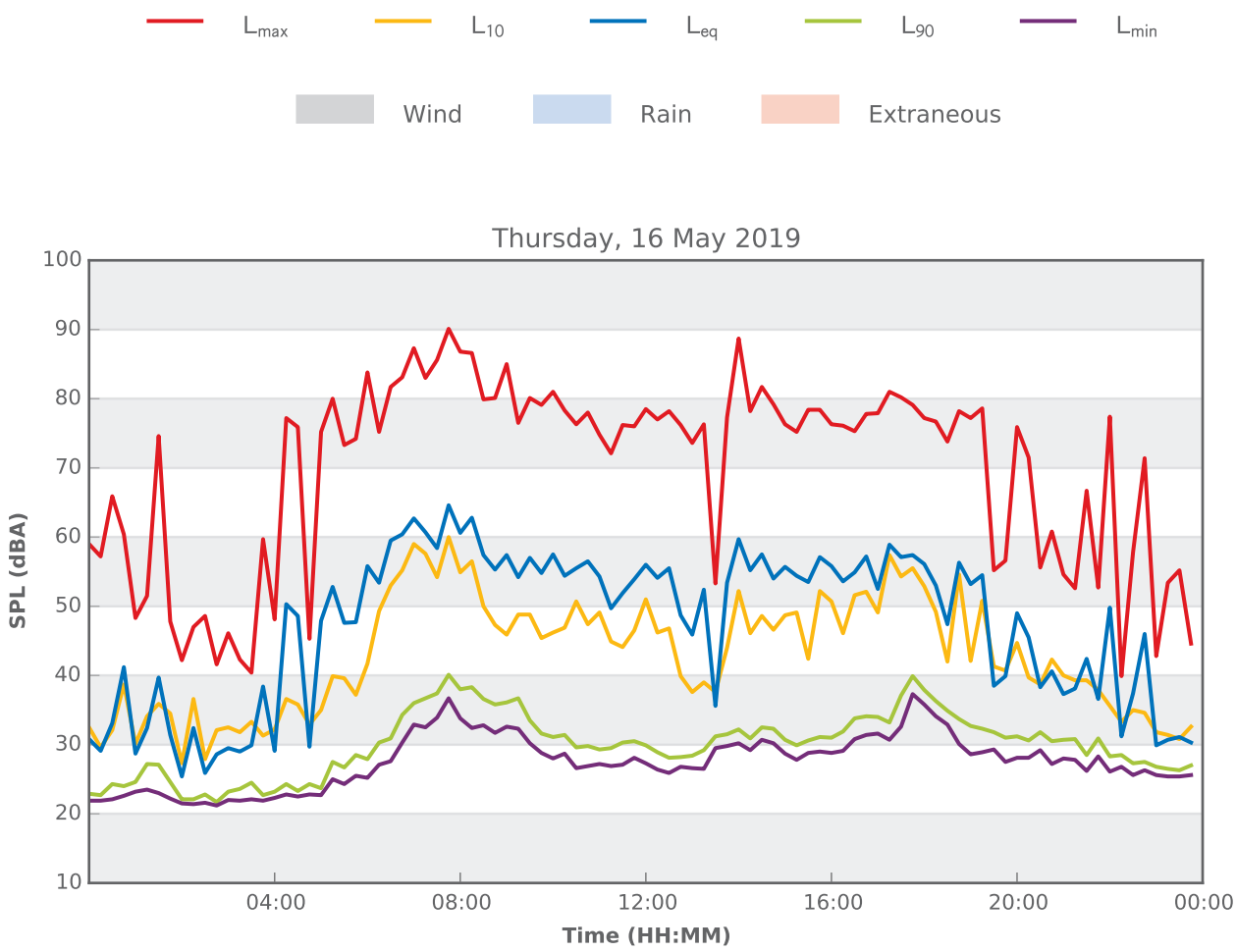

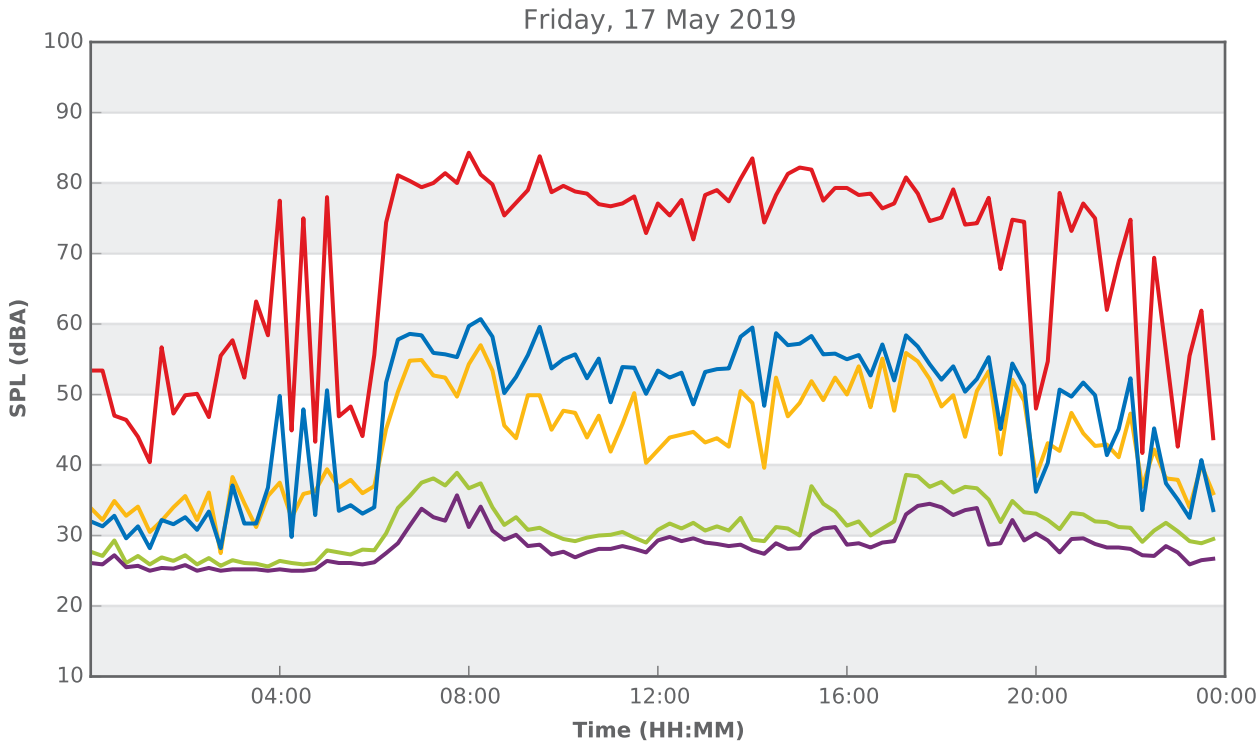

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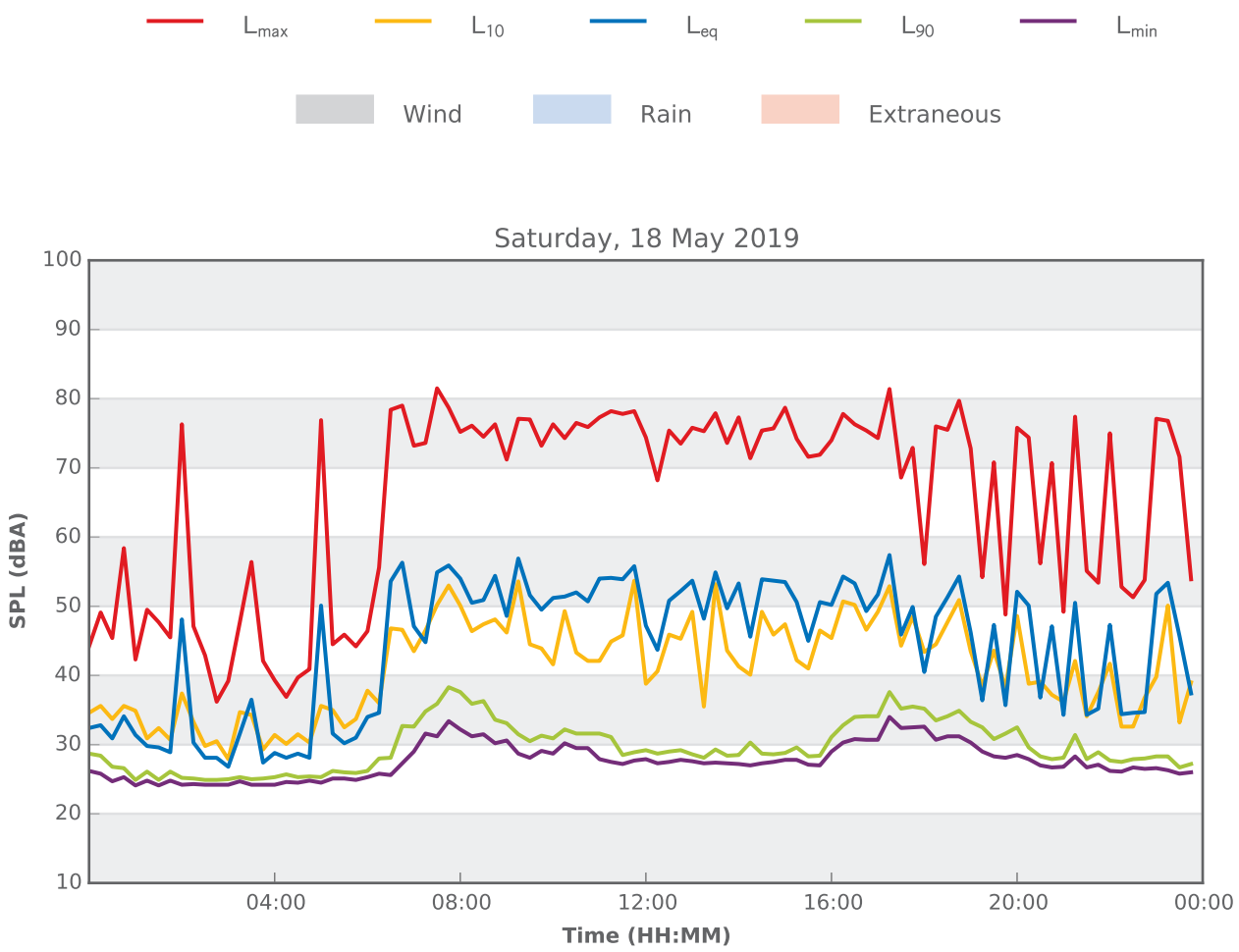

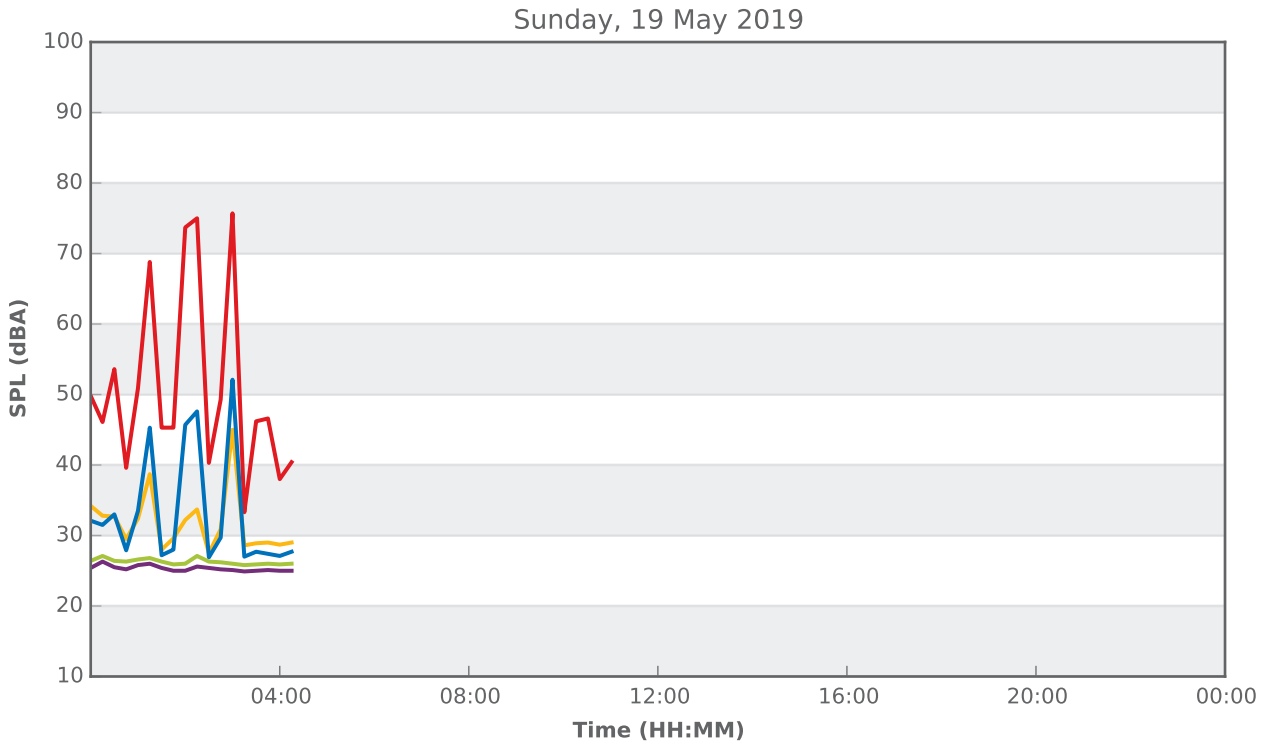

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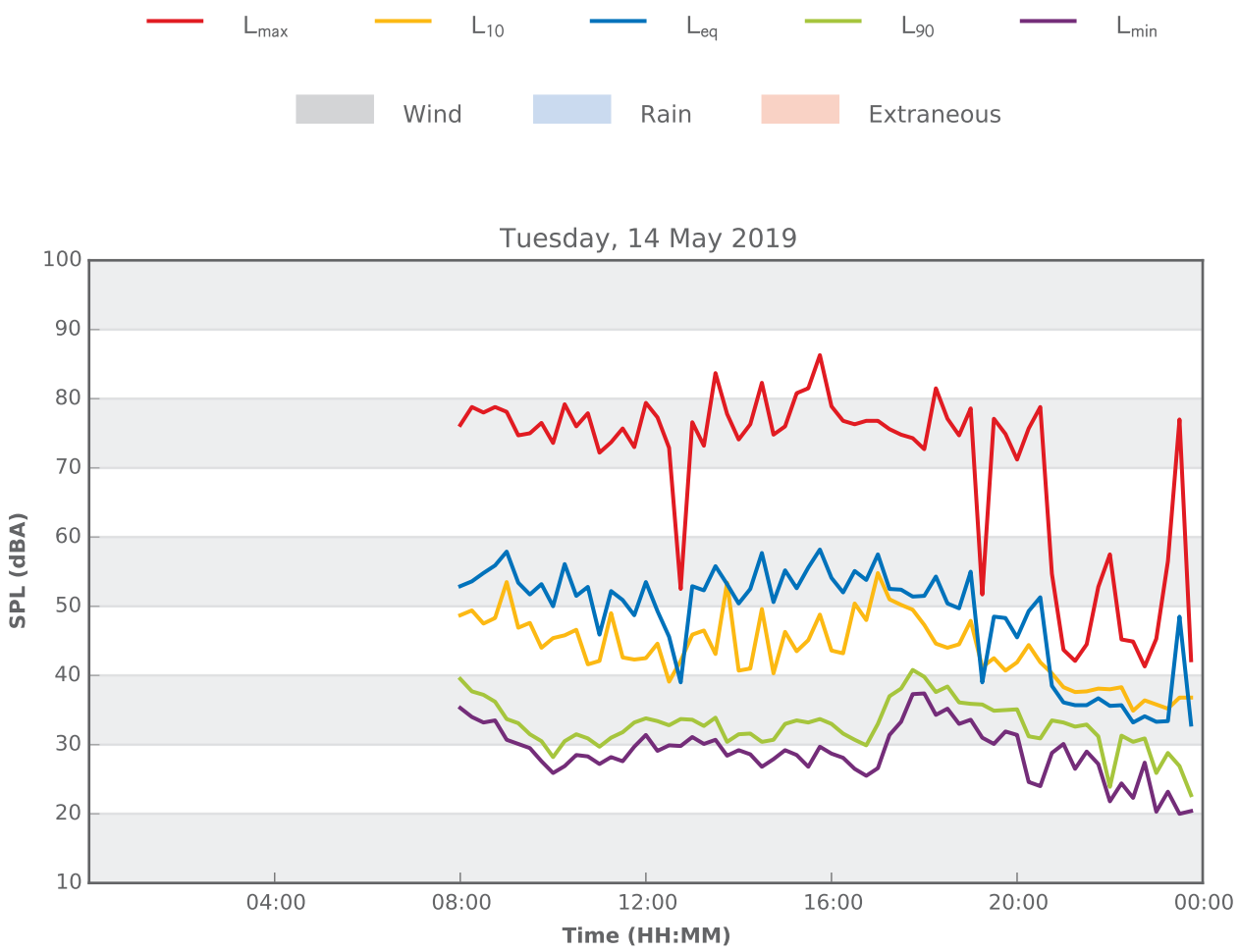

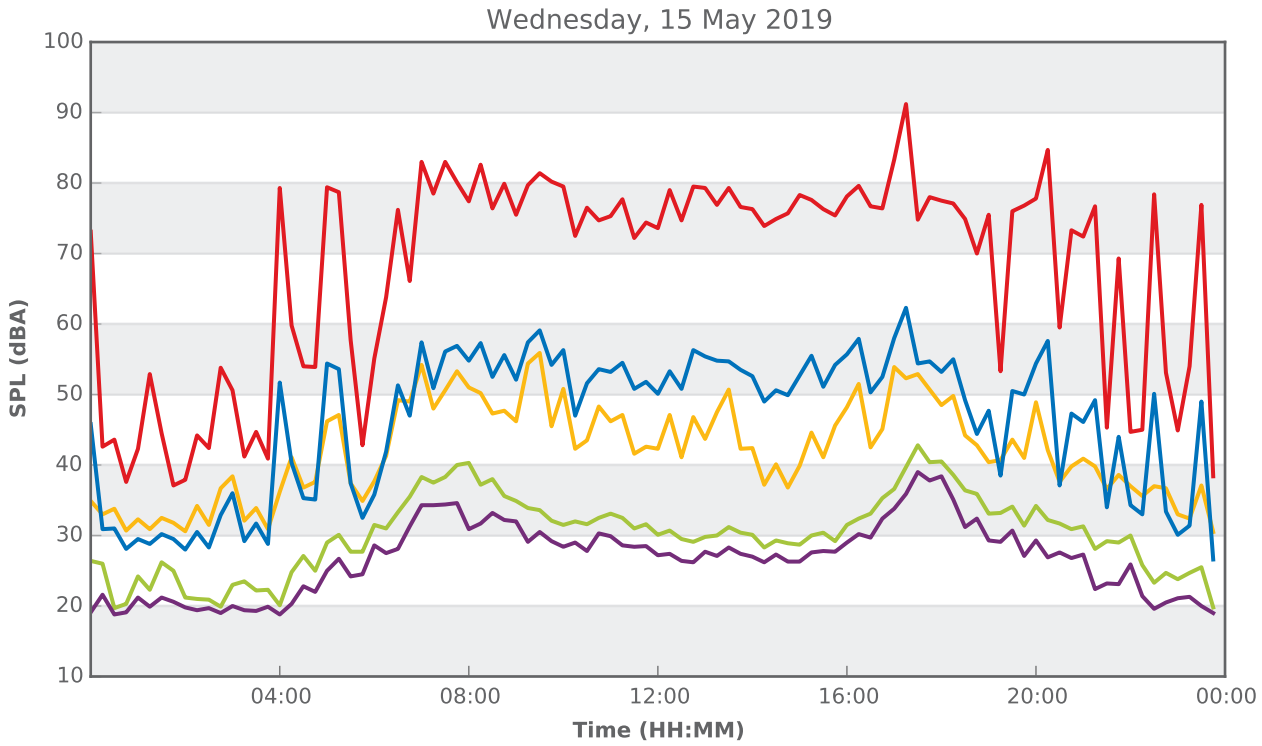

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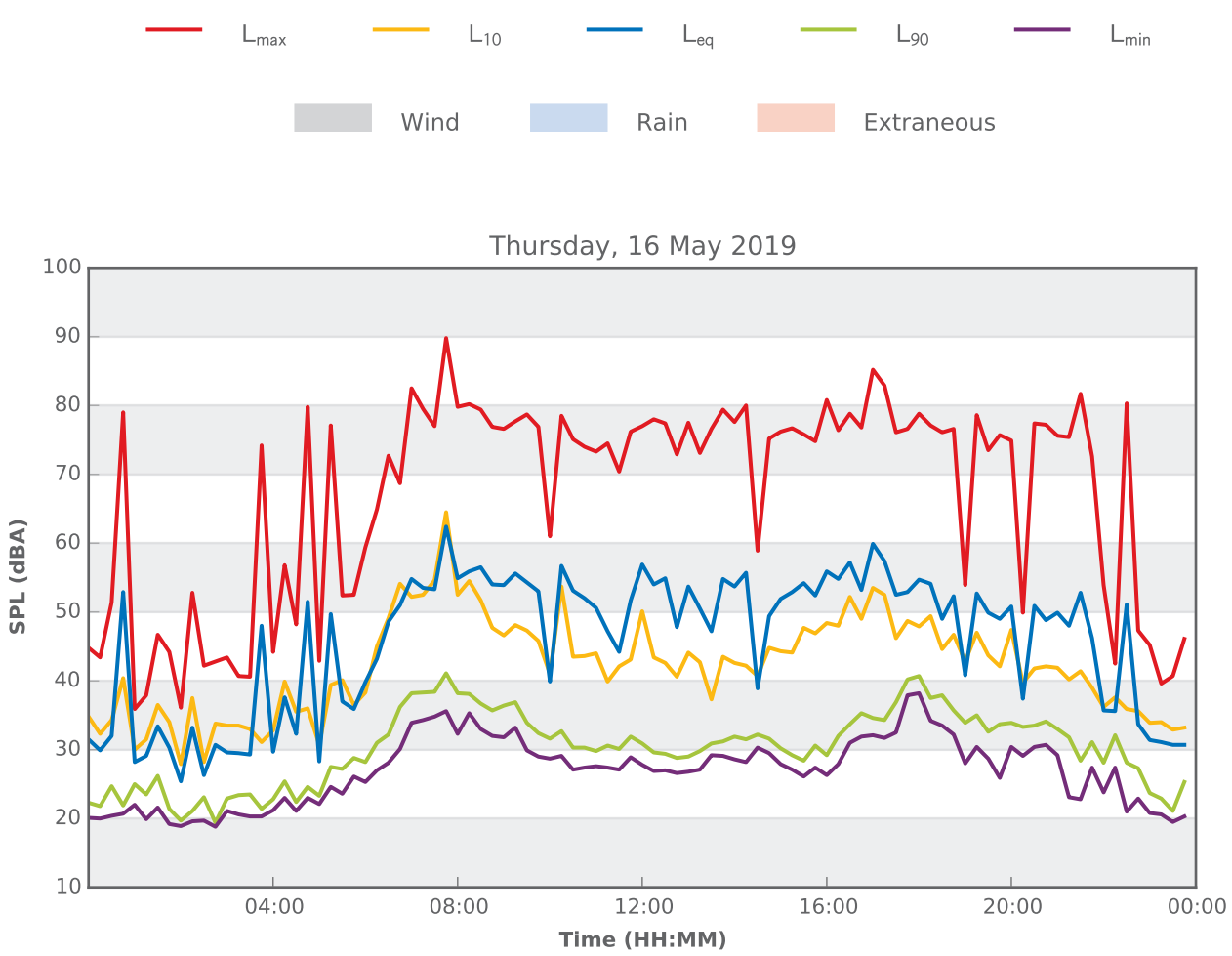

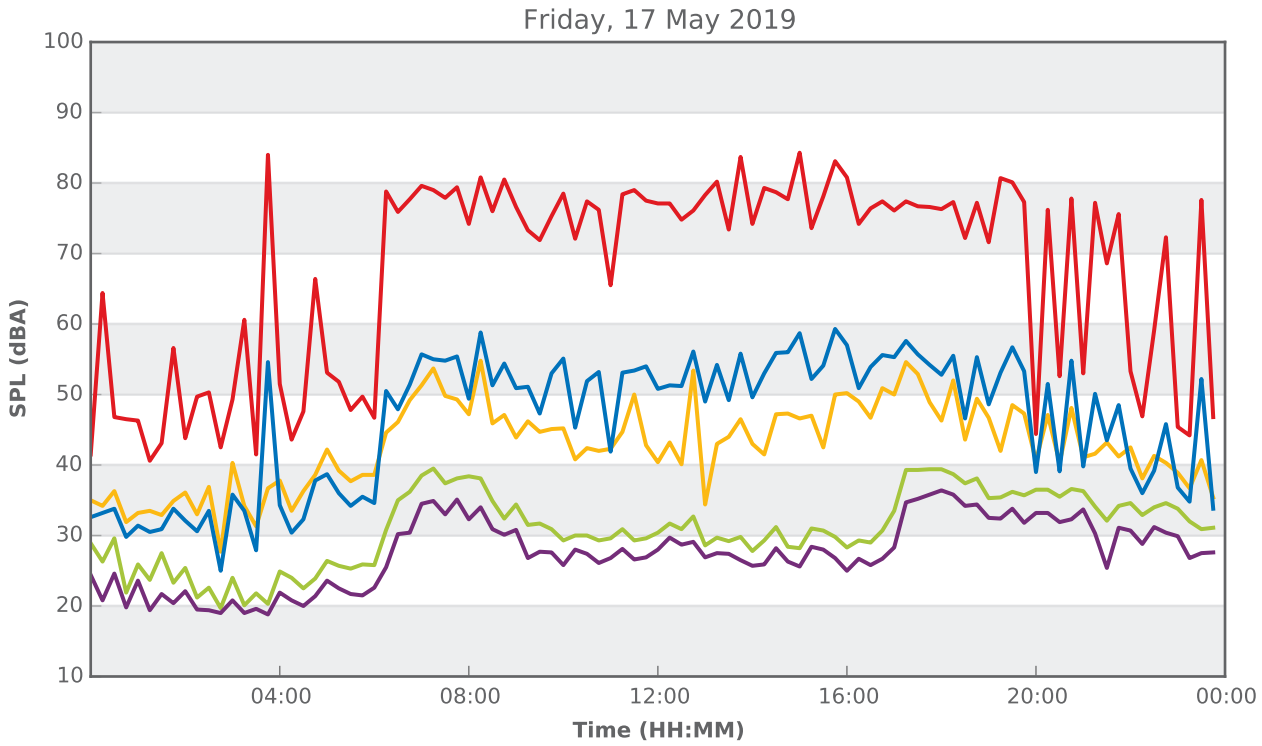

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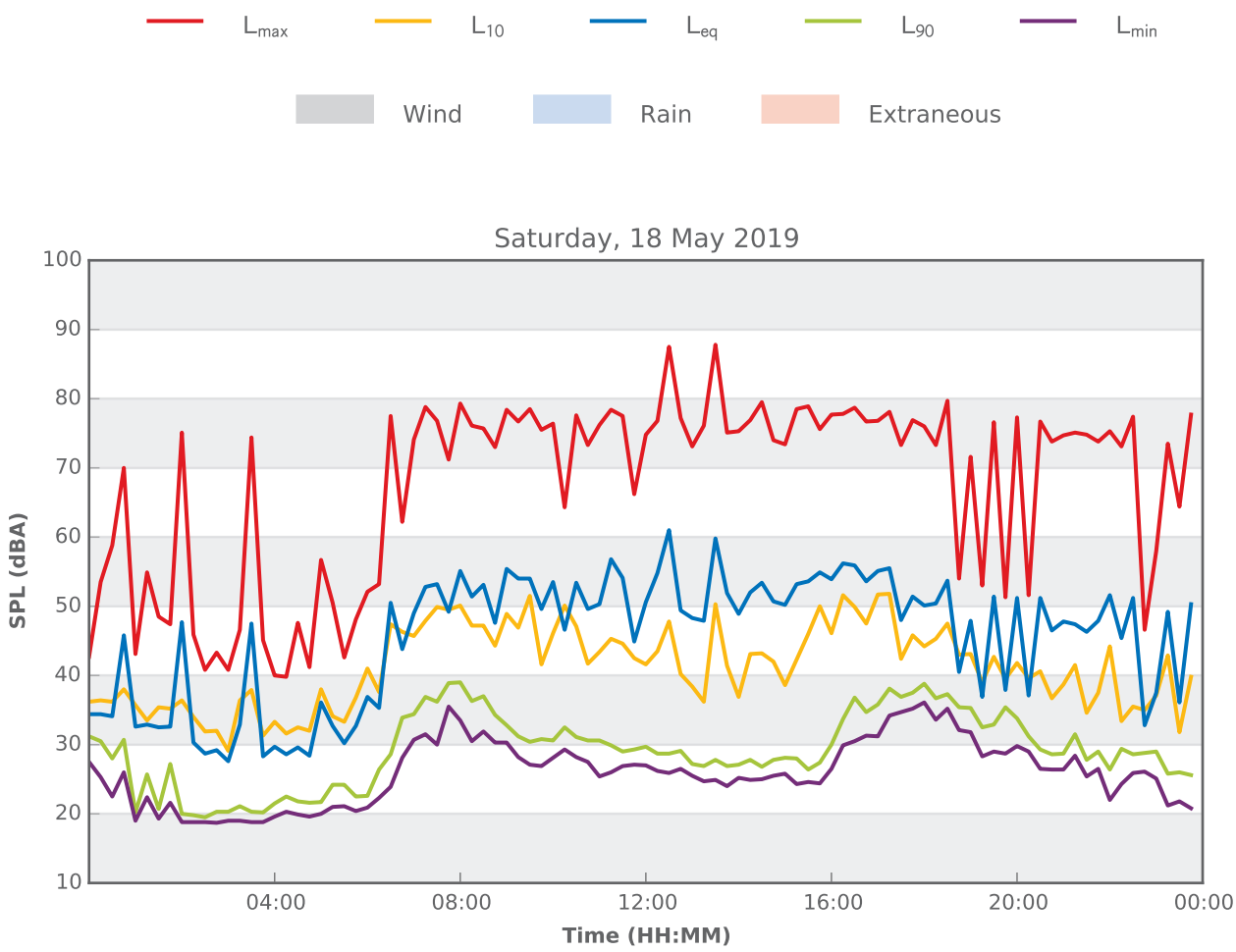
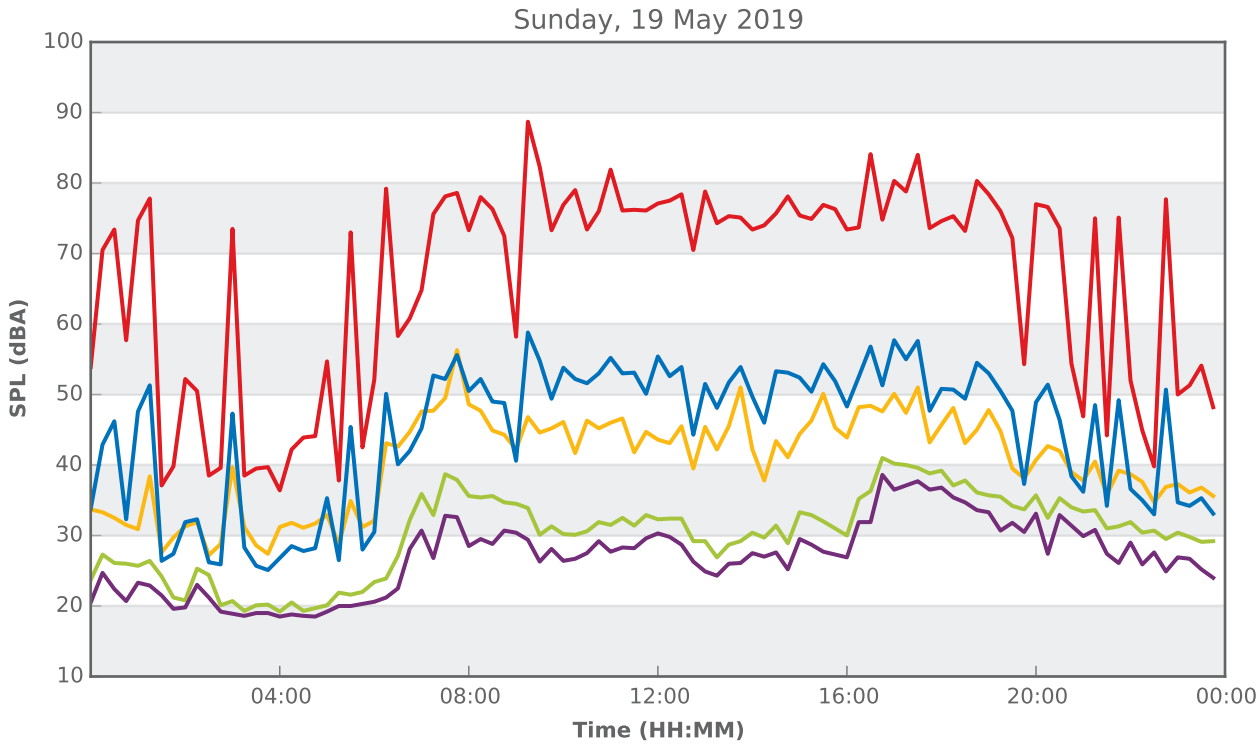
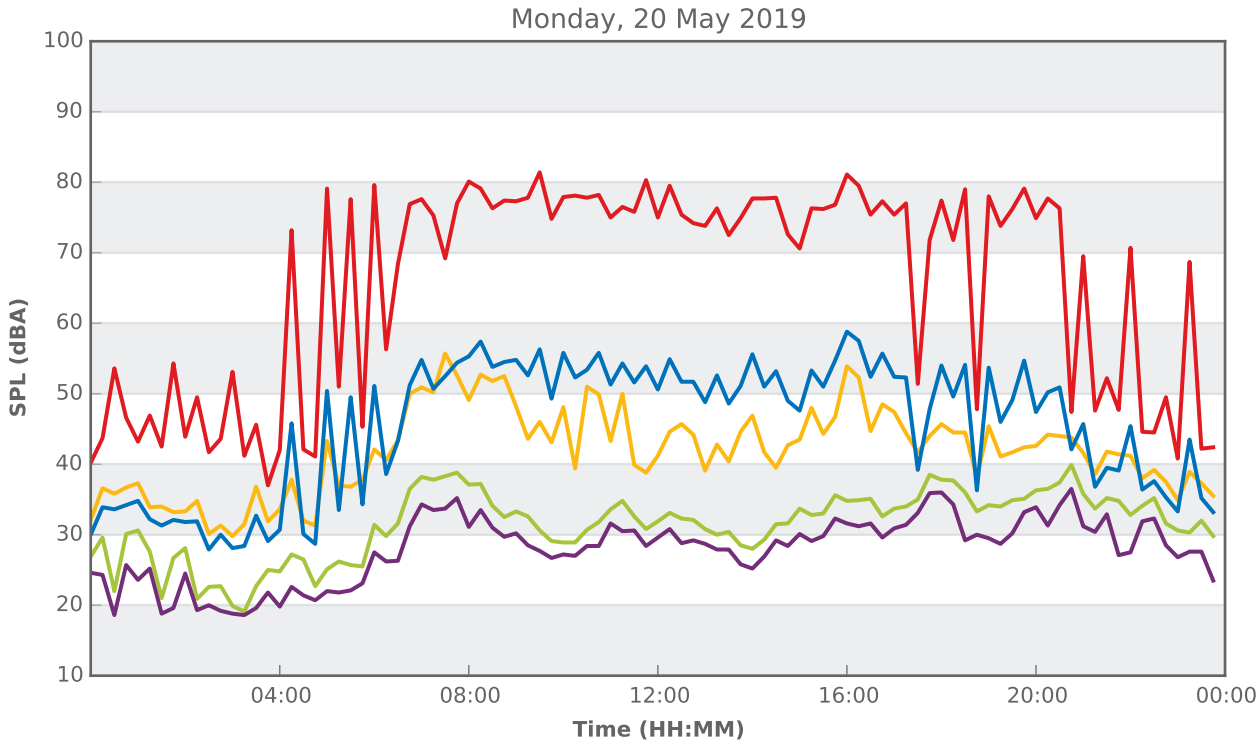
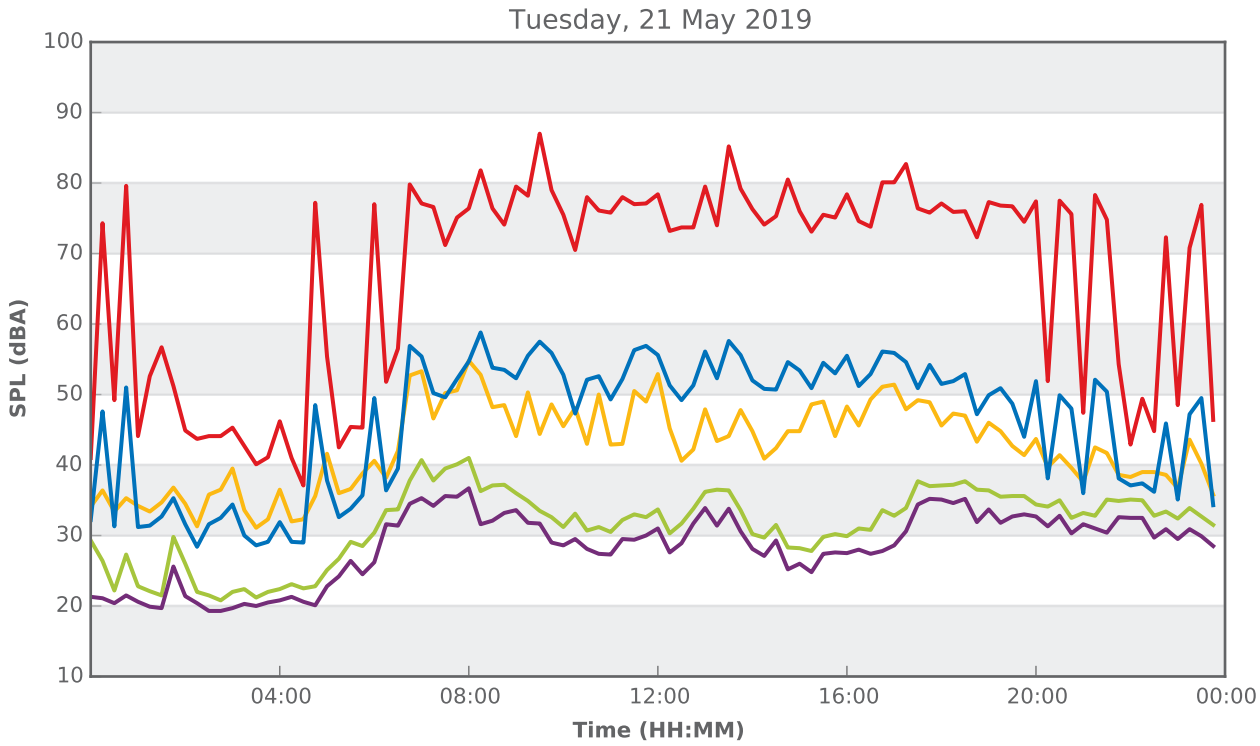




56 Broadhead Road, Mudgee





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