REPORT

Acoustics

Gledswood Hills High School REF
NSW Department of Education

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NDY
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VERIFICATION

REVISION	DATE ISSUED	PREPARED BY	VERIFIED BY	AUTHORISED BY	COMMENT
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3.1	9.07.25	Thomas Warren (minor updates)			

STAKEHOLDERS

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1 INTRODUCTION

This Review of Environmental Factors has been prepared by NDY on behalf of the NSW Department of Education (DoE) to assess the potential environmental impacts that could arise from the proposed Gledswood Hills High School (the **Proposal**) at 9 Gregory Hills Dr., Gledswood Hills (the **site**). The works are proposed by the DoE to meet the growth in educational demand in Gregory Hills and Gledswood Hills, and the broader South West Growth Area.

This report has been prepared to assess the potential noise and vibration environmental impacts that could arise from construction and operation of the above project.

The proposed activity is being undertaken as proposed new school without consent subject to Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The NSW Department of Education (DoE) is the proponent and determining authority pursuant to Section 5.1 the EP&A Act.

This report shall not be relied upon as providing any warranty or guarantee of the building, it's services or equipment.

SUMMARY OF THE ACTIVITY

The proposed activity involves the construction and operation of a new high school at the site accommodating 1000 students, including:

- A series of school buildings along the northern, eastern and southern site boundaries.
- A school hall.
- An assembly area, sports field and multi sports courts.
- Car parking and a Kiss and Drop zone.
- Associated on and off-site infrastructure to support the school, including a new pedestrian crossing and relocation of the existing bus stop on Gregory Hills Dr. to the site frontage.

The Review of Environmental Factors prepared by Ethos Urban provides a full description of the proposed works.

SITE DESCRIPTION

The site is located at 9 Gregory Hills Dr., Gledswood Hills, within the Camden Local Government Area (LGA), approximately 60km southwest of the Sydney CBD and approximately 3.5km from Narellan Town Centre. It comprises one lot, legally described as Lot 2 in DP 1262720, that measures approximately 4.15ha in area. The site is bound by Digitaria Dr. to the north and Gregory Hills Dr. to the south. To the east lies two vacant lots, a childcare centre and a fast food outlet. To the west lies another childcare centre and a vacant lot (which also has approval for a childcare centre).

An aerial image of the site is shown below

FIGURE 1: SITE AERIAL

FIGURE 2: SITE PLAN

CONCEPT DA

The site of the proposed school forms part of a larger site that is made up of eight separate lots. All eight lots are subject to an approved Concept Development Application (DA) (DA/2017/45/1) for a mixed-use proposed new school comprising bulky goods premises, business premises, food and drink premises, indoor recreation facilities, two hotels and a cinema.

The Concept DA has been modified several times and work has commenced on the broader site under detailed proposed new school approvals.

Section 5.5 of the EP&A requires consideration "to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity". This includes consideration of the proposed new school approved by the Concept Consent and the conditions of the Consent.

LARGER SITE INFORMATION

The site of the proposed school forms part of a larger site that is made up of eight separate lots. All eight lots are subject to an approved Concept Proposed new school Application (DA) (DA/2017/45/1) for a mixed-use proposed new school comprising bulky goods premises, business premises, food and drink premises, indoor recreation facilities, two hotels and a cinema.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed new school, it is determined that:

- The extent and nature of potential impacts are moderate and will not have significant impact on the locality, community and/or the environment, considering the mitigation measures proposed in this report.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal impact on the locality, community and/or the environment.

1.1 AUTHORS

This report was prepared by Victoria Rastelli, Member of the Acoustical Society of New Zealand. Quality assurance was carried out by Thomas Warren, Associate Director. NDY holds membership of the Association of Australasian Acoustical Consultants

1.2 PURPOSE

The purpose of this report is to provide acoustic design input into the following areas:

- Baseline noise survey of the area
- Statement of environmental effect such as noise emissions to the boundary from onsite plant equipment
- Construction Noise and vibration assessment to the boundary
- Control of external noise intrusion and facade design
- Architectural acoustic considerations for façade design

1.3 AUTHORITY

Authority to undertake this report was provided by Johnny Nguyen of NSW Education Infrastructure Delivery on 30.04.24.

1.4 INFORMATION SOURCES

The report is based upon the following information:

- NSW Noise Policy for Industry (NPfI) 2017
- NSW Interim Construction Noise Guideline (ICNG) 2009
- NSW Road Noise Policy (RNP) 2011
- NSW Government Department of Planning Proposed new school Near Rail Corridors and Busy Roads – Interim Guidelines (2008)
- NSW EPA Assessing Vibration: A Technical Guideline 2006

- State Environmental Planning Policy (Transport and Infrastructure) 2021
- AS / NZS 2107:2016 Acoustics, Recommended design sound levels and reverberation times for building interiors
- NSW Department of Environment & Climate Change (DECC), Interim Construction Noise Guideline, 2009
- DEFRA 2005 Data base, including the existing construction noise database on BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration control on construction and open sites Part 1 Noise and Part 2 Vibration
- NSW Interim Construction Noise Guideline 2009
- German DIN 4150: Part 3 – 1999 "Effect of Vibration on Structure" (DIN 1999)
- Australian Standard AS 2670.2 1990 – Evaluation of Human Exposure to Whole Body Vibration – Part 2: Continuous and Shock Induced Vibration in Building (1 Hz to 80 Hz)
- British Standard BS 6472 – 2008 – Evaluation of Human Exposure Vibration in Buildings (1 Hz to 80 Hz)
- NSW Government Concept masterplan – Gregory Hills – Gledswood Hills high school, rev 5, dated March 2024.
- Turner Road Precinct DCP, 2018.
- DJRD Architects Plans, Final draft issue for REF, issue 01, dated 29.11.24.
- Steensen Varming mechanical services – Part B Schematic Design Report & Sistems description, dated 15.11.24.
- Steensen Varming electrical services – Final Draft issue, dated 22.11.24.
- WSce Hydraulic services, 100% concept design dated 20.09.24
- WSce Fire services, 100% concept design markups dated 20.09.24
- Stantec DA report on Lot 4 Gregory Hills Dr, Gledswood Hills, dated 01.11.2021.
- Acoustic Logic Gregory Hills Corporate Park, DA Acoustic report – Bulky Goods & Leisure Precinct, rev 2, dated 13.07.17.
- Waste pad and kiss and drop sketches, issue P02, For information, dated 13.08.24.
- Elephants Foot Consulting (EFC) Operational waste management plan rev. C, dated 13.12.24
- 2040 ANEF zones of the Camden Airport.
- Western Sydney International (Nancy – Bird Walton) airport ANEF zones.
- SCT, Gregory Hills High School, Transport Working Group #2, dated 14.08.24.
- SCT Transport access impact assessment, dated 01.10.24.
- Geotechnique Pty Ltd Preliminary Geotechnical desktop study and intrusive Geotechnical Investigation report proposed new high school 9 Gregory Dr., Gledswood Hills. Dated 28.02.24.
- Camden Council Notice of Modification of proposed new school consent no 2017/45/12, date 22.02.2024
- Camden Council Modification Application Assessment Report, App number 2017/45/5
- State Environmental Planning Policy (Precincts - Western Parkland City) 2021

2 PROJECT INFORMATION

Gledswood Hills High School, stage 1 will host approximately 1,000 students and the project consists of four buildings A, B, C and D (hall building), a sports field, 3 x multi-sport courts a cricket net and a carpark with 78 spaces.

We understand the mechanical services design for the project is still in the masterplanning stages, and detailed equipment types and selections are therefore not available. The new buildings will likely have outdoor plants comprising ODU units and fans.

The electrical design includes a 1500 kVA kiosk transformer located on the Gregory Hills Dr. side. We understand there will not be a backup electric generator.

There is a fire services pump room located no less than 6 m from buildings, between building B1 and B2 on Digitaria Dr. side (location to be finalised).

The kiss and drop location is on the south side of Digitaria Dr. side (10 spaces) and the waste pads are located at the end of the service road, at the carpark entrance.

2.1 SITE LOCATION AND DESCRIPTION

The project is zoned B5 business Proposed new school, with nearby receivers in the same zone, within Camden council. The proposed new school will be exposed to traffic noise from Digitaria Dr. (to buildings A, B, D) and Gregory Hills Dr. (to building C).

- No rail lines will affect this proposed new school (superficial or underground)
- The proposed new school is outside the 2040 ANEF zones of the Camden Airport and the ANEF zones of the Western Sydney International (Nancy-Bird Walton) airport.

FIGURE 3: SITE LOCATION (USE NSW PLANNING PORTAL SPATIAL VIEWER)

The site is located close to commercial properties to the north across Digitaria Dr. (Gregory Hills Health and Business Centre) and to the south across Gregory Hills Dr. (Aquabliss Swimming school).

2.2 SCHOOL OPERATION HOURS

We understand that the school operating hours will be as per below:

- Operating hours: it is assumed that the school operating hours will be day time from 7:00 am – 6:00 pm with a limited operation during evening time from 6:00pm to 10:00 pm.
- Limited activity during night time: there should be limited operation during night time (after 10 pm), restricted to some events at the school hall with reduced operation of the HVAC plant and reduced carpark occupancy.

2.3 SENSITIVE RECEIVERS

The most sensitive receivers for this project are located as per table below:

TABLE 1: SENSITIVE RECEIVERS

RECEIVER	ADDRESS	DISTANCE (APPROXIMATE) IN M	TYPE OF RECEIVER / ZONE
1 Gregory Hills Health and Business Centre	Unit 10/13 Digitaria Dr., Gledswood Hills	35 m	Commercial
2 Aquabliss Swimming school	67-77 Lasso Rd., Gregory Hills	35 m	
3 Gregory Hills Hotel	Central Hills Dr., Gregory Hills	76	Hotel
3* Approved Hotel	10 Digitaria Dr., Gledswood Hills	20	
4 Raising stars Gregory Hills Early Learning Centre	4 Digitaria Dr., Gledswood Hills	15.7	School
5 Futuro Gledswood Hills Childcare and Education	10 Digitaria Dr., Gledswood Hills	16	School
6 commercial receiver	11 Gregory Hills Dr., Gledswood Hills	20 m	Commercial

Notes:

- Residential receivers are approximately 350 m north beyond Digitaria Dr.

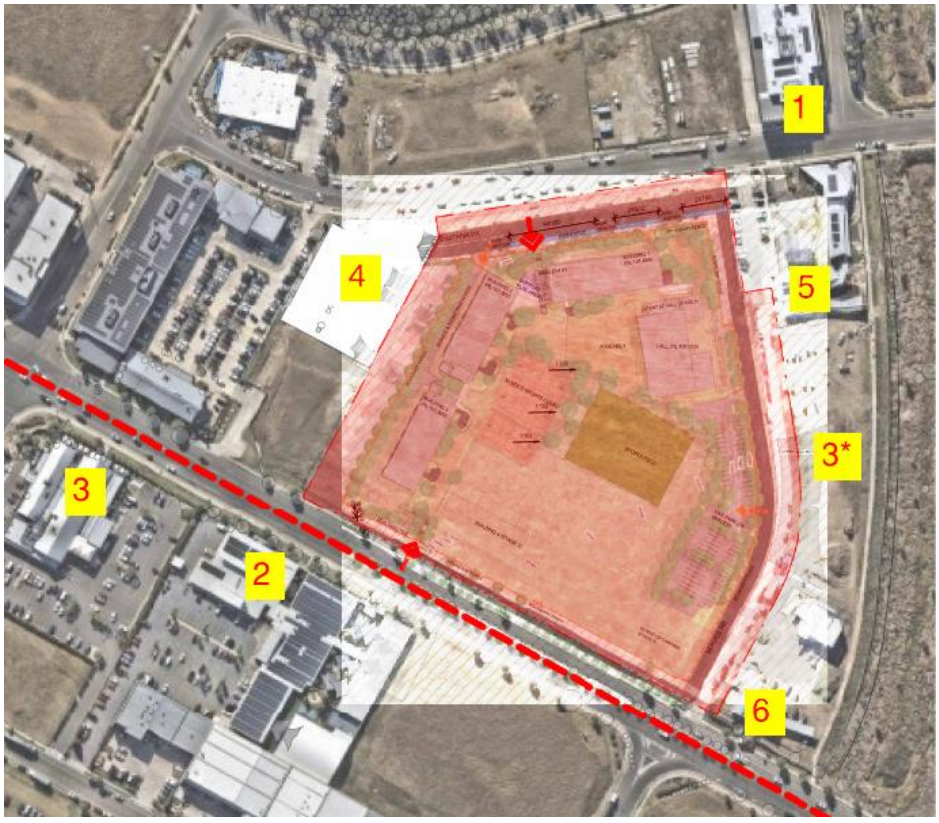

FIGURE 4: SENSITIVE RECEIVERS LOCATIONS

2.4 PREVIOUS PLANNIG REPORTS

2.4.1 DA ACOUSTIC REPORT – BULKY GOODS & LEISURE

The 2017 acoustic report found high noise levels associated with traffic of Gregory Hills Dr. reporting noise of LAeq 57 dBA (9 hour) and rated background noise levels of 40 – 44 dBA (day time), 37 – 44 dBA (evening time) and 30 – 33 dBA (night time).

The report found that noise impacts associated with the activity would be in full compliance with EPA noise Industrial policy. Loading dock was recommended not to operate between 10 pm and 7 am, and to not exceed 78 vehicle movements per day. If the loading dock required additional operation, a separate acoustic report was needed.

The 2017 report also has some requirements for hotel and cinema uses, which are not relevant to this advice.

It is to be noted that this assessment was conducted in 2017 and the area has changed since this date, also some regulations used for this report have been superseded and updated.

2.4.2 LOT 4 GREGORY HILLS DR. ACOUSTIC REPORT

The 2021 Stantec acoustic report on lot 4 Gregory Hills Dr. Gledswood Hills (dated 2021) shows a previous background noise assessment conducted in September 2021 in the area located to the east of the proposed new school, approximately in the middle point between the main roads (Digitaria and Gregory Hills Dr.). Results are shown as a reference in the below tables:

TABLE 2 – LONG TERM NOISE MEASUREMENTS (PREVIOUS STUDY 2021)

LOCATION	LAeq DBA			RBL DBA		
	Day	Evening	Night	Day	Evening	Night
L1 middle point between Digitaria and Gregory Hills Dr.	49	48	45	40	38	32

TABLE 3 – SHORT TERM TRAFFIC NOISE MEASUREMENTS (PREVIOUS STUDY 2021)

LOCATION	Time and date	LAEQ DBA	LA90 DBA	comments
P1 Gregory Hills Dr.	17.09.21 15:00 – 15:15	67	48	Traffic noise dominating ambient noise levels
P2 Digitaria Dr.	17.09.21 15:30– 15:45	64	48	

These noise levels are consistent with the 2017 report, slightly increased in some cases due to changes in the area and the local traffic. This report PNTL levels for day, evening and night are included below:

- Day time 7 am – 6 pm: 45 dBA.
- Evening time 6 pm – 10 pm: 43 dBA.
- Night time 10 pm – 7 am: 37 dBA.
- For commercial receivers: 65 dBA when in use.

The report concludes that a detailed assessment is needed for mechanical plant and standard noise control methods should be sufficient to meet criteria. Additional traffic is not expected to generate adverse noise impacts to nearest sensitive receivers, loading dock predicted noise levels are not expected to exceed NSW NPI requirements, and licensed premises mitigation measures were included to meet the criteria.

3 METHODOLOGY

This report was prepared using the below methodology:

- Participating at kick-off and design meetings
- Review of the NSW standards, NPfI regulations and local requirements for noise and vibration (local council DCP / SEPP).
- Review of the site location, zoning and most affected receivers for all stages.
- Review of possible busy roads near the site and location of rail corridors.
- Review of previous DA studies in the area and their background noise assessment.
- Selection of logger location was based on:
  - Critical receivers
  - Location of the receivers
  - A preliminary meeting with planners discussing the proposed location
- Acoustic logger deployment at strategic locations as per requirements from the NPfi.
- Two hand held noise measurements were conducted to capture the noise in octave bands from both Digitaria and Gregory Hills Dr.
- To assess the operative noise and vibration sources, a coordination was undertaken with the mechanical, electrical and fire protection teams to understand their noise sources locations and operating times. Other consultants involved were included such as traffic and garbage collection.
- To assess the construction noise and vibration sources, coordination was done with the client and project manager to understand the approximate construction programme and phases.
  - Note that for construction noise assessment, the REF Phase includes a preliminary estimation, using the information existing at the time. If predicted noise levels exceed 75 dBA, then it is necessary to carry out a detailed construction noise and vibration management plan.

4 ACOUSTIC ASSESSMENT OF THE EXISTING ENVIRONMENT

4.1 METEOROLOGICAL DATA

To verify that the noise data was obtained during suitable meteorological conditions, weather data such as rain and wind speed were obtained from the Bureau of Meteorology Camden Station IDN60901 as a representative site located approx. 8 km away from the site.

Noise data is excluded (as per the NSW NPfI methodology) from the results in case of:

- Rain observed during any 15-minute noise measurement period and/or;
- Wind speeds exceeded 5 m/s during any 15-minute noise measuring period.

4.2 INSTRUMENTATION

Noise levels were measured using noise loggers, deployed from 27.08.24 to 06.09.24. Table 4 provides information relating to each noise logger/sound level meter.

TABLE 4: NOISE LOGGER AND SOUND LEVEL METER INFORMATION

NOISE LOGGER/SOUND LEVEL METER	TYPE	SERIAL NUMBER	DATE OF LAST CALIBRATION
Svantek 977/ 95 Series Sound Level Meter with Logging cases	Class 1	99735	23/08/2024
Svantek 977/ 95 Series Sound Level Meters with Logging cases	Class 1	99761	23/08/2024

The equipment calibration was checked prior to and after the noise survey using a 94 dB external calibration tone at 1 kHz.

The noise loggers were configured to record all relevant noise parameters including background noise (L_{A90}) and equivalent continuous noise levels L_{Aeq}. Samples were recorded at 15-minute A-weighted continuous intervals. The noise monitor responses were set to fast response. The analysers are Class 1 and Class 2 compliant with AS IEC 61672.2-2004.

4.3 NOISE LOGGERS LOCATIONS

The noise logger locations that were agreed with the project team and project planner are as follows, which were selected to represent the most affected sensitive receivers:

- Logger 1 Digitaria Dr.: 99735
- Logger 2 Gregory Hills Dr.: 99761

Below is a layout of the noise logger and measurement location, which based on our assessment is appropriate in representing noise levels of sensitive receivers surrounding the site.

FIGURE 5: LOGGERS DEPLOYMENT AREAS

4.3.1 SHORT TERM NOISE MEASUREMENTS

In addition to the long-term noise monitoring, short term measurements were conducted on 06.09.24, in the below locations:

TABLE 5 – SHORT TERM NOISE MEASUREMENTS IN OCTAVE BANDS

LOCATION	SOUND PRESSURE LEVEL (dB) PER FREQUENCY BAND (HZ)								
	63	125	250	500	1000	2000	4000	8000	dBA
Measurement 1 Digitaria Dr.	70	74	71	66	60	55	50	43	**68**
Measurement 2 Gregory Hills Dr.	71	71	65	63	67	63	55	46	**70**

TABLE 6: EXISTING NOISE LEVELS (ATTENDED), DBA

SHORT TERM MONITORING LOCATION	DATE AND TIME	SHORT TERM ATTENDED MEASUREMENT	
		LAeq	L90
Measurement 1 Digitaria Dr.	6/09/2024 17:18	68	49
Measurement 2 Gregory Hills Dr.	6/09/2024 17:45	70	60

FIGURE 6: SHORT TERM NOISE MEASUREMENTS LOCATIONS

These measurements show a consistent increased background noise from the previous study conducted in the area (2021) from 64 dBA to 68 dBA at Digitaria Dr. and from 67 dBA to 70 dBA at Gregory Hills Dr.

5 NOISE AND VIBRATION CRITERIA

5.1 TURNER ROAD PRECINCT DCP REQUIREMENTS

The NSW EPA Noise Policy for Industry NPfI 2017 will be the main regulation document used for this REF report.

Turner Road Precinct DCP 2018 refer that for non-residential activities, all new commercial premises are to comply with the council Environmental Noise Policy the EPA Industrial noise policy. The regulation does not include explicit noise or vibration requirements for non residential activities such as the proposed new school.

5.2 NSW DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS AND SEPP

The proposed new school is not located near existing or future superficial or underground rail lines. However, it is located near two high traffic roads: Digitaria Dr. to the north and Gregory Hills Dr. to the south.

These guidelines support specific rail and road provisions of the State Environmental Planning Policy (Infrastructure) SEPP Clauses 85, 86, 87,102 and 103 and section 3.5.2 for rail and busy roads.

***SEPP Clause 102 (Road)**: This clause applies for any proposed new school for any of the following purposes that is on the land in or adjacent to the road for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*

- a building for residential use
- a place of public worship,
- a hospital,
- **an educational establishment** or childcare centre.

As per SEPP clause 3.5.2 for busy roads, an Educational institution such as this proposed new school should ensure an internal noise level of 40 dBA.

General recommendations on façade constructions will be included for buildings:

- Buildings A and B: 22 m and 30 m from Digitaria Dr. respectively.
- Buildings C: 24 m and 21 m from Gregory hills Dr. respectively.
- Building D is located further away from Digitaria Dr. with non sensitive activities and partially shielded by Building A.

5.3 CONCEPT DA

The approved concept development consent (2017/45/12) that applies to the site has been reviewed insofar as it relates to Acoustic conditions for the purposes of this report. The following conditions relating to noise and vibration were noted to apply to development subject to the concept DA:

- General (23) all must be designed and operated to comply with the requirement of the "project criteria – 10 dB" to residential receivers.
- Prior to issue of a construction certificate (24) Car park noise control all carparks must have a coved finish with Slabseal 2000 SR sealant or equivalent applied to the concrete floor. The coved finish and sealant must be suitably maintained on the floor at all times to a standard that eliminates tyre squeal noise from being audible.
- During works (15) noise during work; Noise levels emitted during works shall be restricted to comply with the construction noise control guidelines set out in Chapter 171 of the NSW Environment Protection Authority's Environmental Noise Control Manual.
- During works (20) All work shall not give rise to offensive noise, dust, odour or vibration as defined in the Protection of the Environment Operations Act 1997 when measured at the property boundary.
- Ongoing use (9) The use and occupation of the premises including all plant and equipment shall not give rise to any offensive noise within the meaning of the Protection of the Environment Operations Act 1997 and shall comply with the NSW Industrial Noise Policy 2000 (as amended).

These form a benchmark for limiting acoustic impact to surrounding receivers, and hence have formed part of the noise and vibration criteria for this assessment. The performance of the proposed school against these criteria is included in Sections 7 and 8.

5.4 NSW NOISE POLICY FOR INDUSTRY (NPFI) 2017

For the purpose of the assessment, the measured noise data was processed into the following time periods:

- Daytime: 0700 to 1800 hrs.
- Evening: 1800 to 2200 hrs.
- Night-time: 2200 to 0700 hrs.

The measured background (L_{A90}) and equivalent continuous (L_{Aeq}) noise levels during these defined time periods. The L_{A90} noise levels presented are *Rating Background Levels* (RBLs), being the median of the background L_{A90} (i.e. of the lowest 10th percentile of samples) in each daytime, evening and night-time measurement period, for each 24-hour period during the noise survey.

The L_{Aeq} noise levels presented are the logarithmic average of all the L_{Aeq} samples taken in each of the daytime, evening and night-time periods.

TABLE 7: AMENITY NOISE LEVELS FOR NOISE LOGGERS, DBA

LOCATION	NOISE INDEX	NOISE LEVEL, DB RE 20 µPA		
		Daytime 0700 to 1800	Evening 1800 to 2200	Night - time 2200 to 0700
Logger 1 99735 Digitaria Dr.	L_{A90} (RBL)	63	58	54
	$L_{Aeq,period}$	63	61	56
Logger 2 99761 Gregory Hills Dr.	L_{A90} (RBL)	70	68	52
	$L_{Aeq,period}$	71	70	64

5.4.1 AMENITY AND INTRUSIVENESS CRITERIA

The NSW NPfI provides assessment methodologies, criteria and detailed information on the assessment of environmental noise emissions in NSW. The NSW NPfI criteria for noise sources consider two (2) components:

- Controlling intrusive noise impacts for residential receivers. Assessing intrusiveness generally requires noise measurements to quantify background (LA90) noise levels at a location considered representative of the most potentially affected residential receiver(s). The intrusiveness criterion essentially means that the equivalent continuous noise level (LAeq) of the source(s) under consideration should be controlled to not exceed background noise levels by more than 5 dB(A).
- Maintaining noise amenity for various categories of land use (including residential receivers and other sensitive receivers). The amenity criterion is based on the sensitivity of a particular land use to industrial-type noise. The recommended amenity noise levels detailed in Table 2.2 of NSW NPfI represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial proposed new school at a receiver location. This is to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area. The project amenity criteria for each new source of industrial noise is equalled to recommended amenity noise level minus 5dB(A).
- A +3dB(A) to be added to project amenity noise level for conversion from a period level to a 15-minutes level. Where the resultant project amenity noise level is 10dB or more below the existing industrial noise level, the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

TABLE 8: PROJECT SPECIFIC NSW NPFI AMENITY CRITERIA / TAKEN FROM TABLE 2.2 NPFI

TYPE OF RECEIVER	INDICATIVE NOISE AMENITY AREA	PERIOD OF TIME	L_{AEQ} DB(A)	AMENITY CRITERIA LAEQ DB(A) – 5 DB + 3 DB
Residential	Urban	Day 7:00 to 18:00	60	58

TYPE OF RECEIVER	INDICATIVE NOISE AMENITY AREA	PERIOD OF TIME	L_{AEQ} DB(A)	AMENITY CRITERIA LAEQ DB(A) – 5 DB + 3 DB
		Evening 18:00 to 22:00	50	48
		Night 22:00 to 7:00	45	43
Commercial		When in use	65	63
Hotel	Urban area	Day 7:00 to 18:00	5 dBA above the amenity noise level for a residence on the area (urban) / 60+5	63
		Evening 18:00 to 22:00	5 dBA above the amenity noise level for a residence on the area (urban) / 50+5	53
		Night 22:00 to 7:00	5 dBA above the amenity noise level for a residence on the area (urban) / 45+5	48
School / Childcare – internal		When in use	Noisiest period when in use	35 (internal) / 45 (external)

The NSW NPfI characterise the above areas as per the below description:

Urban residential	R1 – general residential R4 – high density residential B1 – neighbourhood centre (boarding houses and shop-top housing) B2 – local centre (boarding houses) B4 – mixed use	Daytime RBL> 45 dB(A) Evening RBL> 40 dB(A) Night RBL >35 dB(A)	**Urban** – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

FIGURE 7: NPFI EXTRACT – TABLE 2.3 DETERMINING WHICH OF THE RESIDENTIAL RECEIVER CATEGORIES APPLIES

We believe the Urban area description above is the most suitable for this project location.

The NPfI recommends "Intrusive noise levels are only applied to residential receivers (residences)". For other receiver types identified in Table 2.2, only the amenity levels apply. The project amenity and intrusive noise levels are be listed below.

TABLE 9: PROJECT INTRUSIVENESS AND AMENITY NOISE CRITERIA

LOGGER	NOISE LEVEL, $L_{EQ,15MINS}$ [DBA]		
	Daytime 0700 to 1800	Evening 1800 to 2200	Night - time 2200 to 0700
Logger 1 99735 Digitaria Dr.	**Project Amenity Assessment, $L_{Aeq, 15min}$**		
	58	51	46
	Project Intrusiveness Assessment, $L_{Aeq, 15min}$		
	68	63	59
Logger 2 99761 Gregory Hills Dr.	**Project Amenity Assessment, $L_{Aeq, 15min}$**		
	61	60	54
	Project Intrusiveness Assessment, $L_{Aeq, 15min}$		
	75	73	57

5.4.2 DETERMINATION OF PROJECT SPECIFIC NOISE TRIGGER LEVEL (PNTL)

The Project Noise Trigger Levels (PNTL) are the most stringent noise levels of the NSW NPfI project intrusiveness and project amenity noise levels for day, evening and night-time periods and are project specific, as shown below:

TABLE 10: EXTERNAL PROJECT NOISE TRIGGER LEVEL (PNTL) FOR OPERATION NOISE

LOCATION / AFFECTED	TIME	DESCRIPTOR	EXTERNAL PNTL [DBA]
Logger 1 99735 Digitaria Dr.	0700 to 1800	$L_{Aeq, Day}$	58
	1800 to 2200	$L_{Aeq, Evening}$	51
	2200 to 0700	$L_{Aeq, Night}$	46
Logger 2 99761 Gregory Hills Dr.	0700 to 1800	$L_{Aeq, Day}$	61
	1800 to 2200	$L_{Aeq, Evening}$	60
	2200 to 0700	$L_{Aeq, Night}$	54

5.4.3 MODIFYING FACTOR ADJUSTMENTS

Penalties may be applied if the noise from the proposed new school "... contains certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."

To take into account the potential annoying character of the noise an adjustment of +2dB(A) or +5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), may be added to the measured value to penalise the noise for its potential greater annoyance aspect.

Table C1 of the NSW NPfI provides procedures for determining whether an adjustment should be applied for greater annoyance aspect.

5.4.4 FACT SHEET C NPFL CORRECTIONS FOR ANNOYING NOISE CHARACTERISTICS

When a single event noise is continuous for a period less than two hours in any assessment period (24 hours), the allowable exceedance of the $L_{Aeq(15\ min)}$ equivalent noise criterion is relaxed as per below table.

TABLE 11: TABLE C3, FACT SHEET C (NPFI) ALLOWABLE EXCEEDANCE OF $L_{Aeq(15min)}$

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15min}$ equivalent project noise trigger level at receptor for the period of the noise event, dB(A)	
	Daytime and evening (7 am–10 pm)	Night-time (10 pm–7 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

This applies to garbage collection, fire services pump room testing times, carpark noise.

5.4.5 SLEEP DISTURBANCE NOISE LIMITS

We are assuming this proposed new school will have limited night time operations (after 10 pm is called night time according to NSW NPfI). If the proposed school will undertake out of hours activities, not included in this assessment, we recommend an out of hours management plan.

5.5 EPA NSW ROAD NOISE POLICY (RNP) 2011

Noise from the vehicles associated with the Gledswood Hills High School will be assessed using NSW Road Noise Policy. This presents the noise assessment criteria for the land use proposed new school s with potential to create additional traffic on existing local roads.

Existing sensitive land use	Assessment criteria – dB(A)		Additional considerations
	Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)	
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 2107:2000 (Standards Australia 2000).
2. Hospital wards	$L_{Aeq, (1\ hour)}$ 35 (internal)	$L_{Aeq, (1\ hour)}$ 35 (internal)	
6. Isolated residences in commercial or industrial zones	–	–	For isolated residences in industrial or commercial zones, the external ambient noise levels can be higher than those in residential areas. Internal noise levels in such residences are likely to be more appropriate in assessing any road traffic noise impacts, and the proponent should determine suitable internal noise level targets, taking guidance from Australian Standard 2107:2000 (Standards Australia 2000).
7. Mixed use development	–	–	Each component of use in a mixed use development should be considered separately. For example, in a mixed use development containing residences and a childcare facility, the residential component should be assessed against the appropriate criteria for residences in **Table 3**, and the childcare component should be assessed against point 8 below.
8. Childcare facilities	Sleeping rooms $L_{Aeq, (1\ hour)}$ 35 (internal) Indoor play areas $L_{Aeq, (1\ hour)}$ 40 internal) Outdoor play areas $L_{Aeq, (1\ hour)}$ 55 (external)	–	Multi-purpose spaces, e.g. shared indoor play/sleeping rooms should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.

FIGURE 8: RNP TABLE 4 EXTRACT – NOISE ASSESSMENT CRITERIA FOR NON- RESIDENTIAL LAND USES AFFECTED BY PROPOSED ROAD PROJECTS AND TRAFFIC GENERATING PROPOSED NEW SCHOOL S

5.6 SUMMARY OF OPERATIONAL NOISE CRITERIA

TABLE 12: SUMMARY OF NOISE CRITERIA

REGULATION	CRITERIA
EPA NSW Road Noise Policy (RNP) 2011	• Childcare centres: Sleeping rooms 35 dBA (internal) / Indoor play areas 40 dBA (internal)/ outdoor play areas 55 dBA (external)
PTNL and fact sheets A / C (NPfI 2017)	• PTNL Day: • Logger 1 Digitaria Dr: 58 dBA / Evening: 51 dBA / Night: 46 dBA • Logger 2 Gregory Hills Dr: 61 dBA / Evening: 60 dBA / Night: 54 dBA • Fact sheets A and C of NPfI
Concept DA	• Activity must be designed and operated to comply with the requirement of the "project criteria – 10 dB" to residential receivers.

5.7 CONSTRUCTION NOISE AND VIBRATION CRITERIA

5.7.1 INTERIM CONSTRUCTION NOISE GUIDELINE

The NSW Interim Construction Noise Guideline was developed by the NSW-Department of Environment & Climate Change DECC, NSW which incorporates the EPA. The Guideline contains detailed procedures for the assessment and management of construction noise impacts.

The guideline presents two ways of assessing construction noise impacts – the quantitative method, which is generally suited to longer term construction works and the qualitative method, which is generally suited to short term works (usually not more than 3 weeks) such as infrastructure maintenance.

It is expected that the length of the construction works associated with the proposed new school would be more than 3 weeks and therefore a quantitative method has been used for this assessment.

Table 13 set out the management levels for noise at residence and sensitive land uses, respectively. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected management level' which is >75dBA.

Affected properties above 75 dBA might require community consultation and a Construction Noise & Vibration Management Plan (CNVMP). Based on the RBL of 38 – 39 dBA in the daytime, the recommended noise management level during all aspects of the construction program are summarised in Table 14 below.

TABLE 13: NOISE AT AFFECTED USING QUANTITATIVE ASSESSMENT

RECOMMENDED HOURS	EXTERNAL NOISE MANAGEMENT LEVEL (NML) $L_{EQ,15MIN}$ [dBA]	HOW TO APPLY
Recommended standard hours **Monday – Friday 7am to 6pm** **Saturday 8am to 1pm** **No work on Sundays or Public Holidays**	Noise Affected 63 + 10 = 73	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ minutes)}$ noise level is greater than the 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 dB(A)	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 period by restricting hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended standard hours	43 dBA (63 + 5 = 68) RBL from night time	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.

RECOMMENDED HOURS	EXTERNAL NOISE MANAGEMENT LEVEL (NML) $L_{EQ,15MIN}$ [dBA]	HOW TO APPLY
		Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.22

*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 14 below. 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.

5.7.2 NOISE MANAGEMENT LEVELS

Noise Management Levels (NML) associated with the construction works on the project site are presented in Table 14.

TABLE 14: CONSTRUCTION NOISE MANAGEMENT LEVELS, $L_{EQ\ 15MIN}$

RECEIVERS	RECOMMENDED HOURS	PERIOD	RBL $L_{A90,15MINS}$ [dBA]	EXTERNAL NOISE MANAGEMENT LEVEL [dBA]
Receivers logger 1	Day time (standard construction hours)	When in use	63	(63 + 10) = 73 dB(A) (Noise affected) 75 dB(A) (highly noise affected)
Receivers logger 2	Day time (standard construction hours)	When in use	70	75 dB(A) (highly noise affected)

For other sensitive land users different from residential, the below table applies:

Table 3: Noise at sensitive land uses (other than residences) using quantitative assessment

Land use	Management level, $L_{Aeq\ (15\ min)}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benfefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

Figure 9: EPA CONSTRUCTION NOISE AND VIBRATION GUIDELINE, 2016 / EXTRACT NOISE AT SENSITIVE USERS

In this case this applies to childcare facilities (considered as educational institutions) and hospital guards.

5.7.3 CONSTRUCTION VIBRATION CRITERIA

The effects of construction vibration upon buildings can be separated into three main categories:

- Perceptibility of the occupants to the vibration and the possibility of them being disturbed or annoyed.
- Vulnerability of the building structures to vibration induced damaged.
- Vulnerability of the contents of the building that includes types of equipment, activities and processes.

5.7.3.1 Human Response to Vibration

Humans are very sensitive to vibration, and they can be disturbed, annoyed and have their work activities interfered with if the levels are too high. The Interim Construction Noise Guideline references "Assessing Vibration: a technical guideline" (Vibration Guideline) issued by the Department of Environment and Conservation NSW for measurement and assessment of vibration. The Vibration Guideline provides vibration criteria for continuous, impulsive and intermittent vibration.

Continuous vibration	Impulsive vibration	Intermittent vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990).	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer this would be assessed against impulsive vibration criteria.

The criteria are discussed in more detail in the following sections.

5.7.3.2 Continuous and impulsive vibration (1-80 Hz)

According to the Vibration Guideline for continuous and impulsive vibration, assessment of impact should be considered on the basis of weighted root-mean-square acceleration values and results are to be compared against the following preferred and maximum values given for each orthogonal axis. The frequency weightings as per BS6841:1987 (reproduced in Appendix B3 of the guideline) are to be applied to the RMS measurement values (1-80Hz).

The criteria in the Vibration Guideline are derived from the limiting values of the assessment curves and multiplying factors from BS 6472:1992 (the curves are no longer referenced in the superseded version of the standard BS 6472:2008).

Table 2.2 Preferred and maximum weighted rms values for continuous and impulsive vibration acceleration (m/s^2) 1–80 Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration					
Critical areas[2]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas[2]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am

2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472–1992

The Vibration Guideline notes "Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short-term duration. An example is a construction or excavation project."

5.7.3.3 Intermittent vibration (1-80 Hz)

According to the Vibration Guideline for intermittent vibration, assessment of impact should be considered on the basis of vibration dose values (VDV). Acceptable values of vibration dose are given as follows.

Table 2.4 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas[2]	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

1 Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.
Source: BS 6472–1992

5.7.3.4 Vibration Criteria – Building Contents and Structure

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

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

5.7.3.5 Standard BS 7385 Part 2 – 1993

For transient vibration, as discussed in standard BS 7385 Part 2- 1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 15 and illustrated in Figure 10.

TABLE 15: TRANSIENT VIBRATION CRITERIA AS PER STANDARD BS 7385 PART 2 – 1993

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

Standard BS 7385 Part 2 – 1993 states that the value in **Table 15** relate to transient vibration which does not cause resonant response in buildings. Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in **Table 15** may need to be reduced by up to 50% (refer to Line 3 in Figure 10).

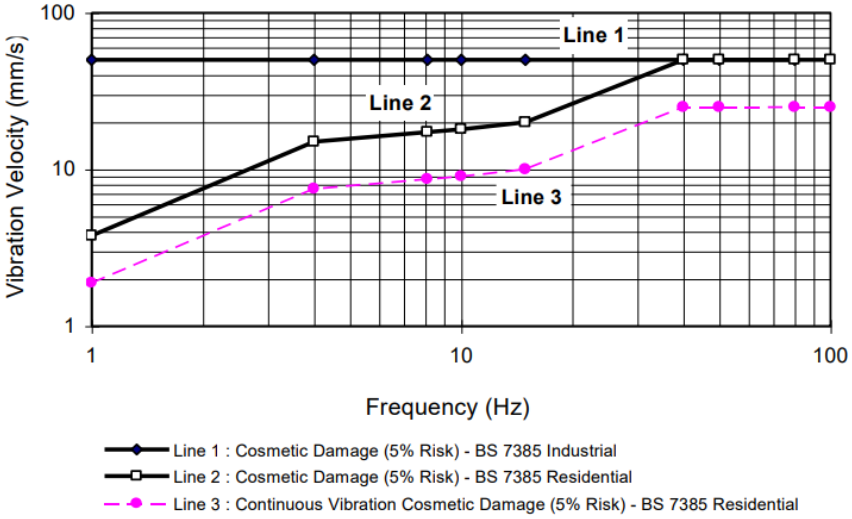

FIGURE 10 – BS 7385 PART 2 – 1993, GRAPH OF TRANSIENT VIBRATION VALUES FOR COSMETIC DAMAGES

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

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 15**, and major damage to a building structure may occur at values greater than four times the tabulate values.

Fatigue considerations are also addressed in the standard and it is concluded that unless the calculation indicated that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in **Table 15** should not be reduced for fatigue considerations.

5.7.3.6 Structural Response to Vibration - German Standard DIN 4150-3:1999

The German Standard DIN 4150-3 Structural Vibration Part 3: Effects on building and structures is commonly used in Australia to evaluate the effects of vibration on structures primarily used for static loading.

The response of a building to vibration is affected by several factors that include its type of foundation, the underlying ground conditions, its construction and the state of the building. Please note the construction vibration limits are designed to ensure the structural integrity of nearby buildings and are not for human comfort. the limits are well above perceptibility.

According to DIN 4150 short term vibration refers to vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance in the structure being evaluated. Long-term vibration refers to all types of vibration not covered by the definition of 'short-term vibration'. The criteria for short-term and long-term vibration are listed in the following.

5.7.3.7 Guideline Values for evaluation of short-term vibration - DIN 4150-3:1999

The vibration limits of table 1 in DIN 4150-3:1999 (replicated in **Table 16** below) refer to the evaluation of the effects of short-term vibration on structures.

It should however be noted that compliance with the vibration limits to avoid structural damage of buildings, cannot provide certainty. If damage occurs despite compliance with the standard, it is to be assumed that other causes are responsible, however, further investigations are necessary. And on the other hand, exceeding the limits does not necessarily lead to damage.

TABLE 16: DIN 4150-3 CONSTRUCTION VIBRATION LIMITS – SHORT TERM

TYPE OF STRUCTURES	GUIDELINE VALUES FOR VIBRATION VELOCITY (MM/S)			
	Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor at all frequencies
	1Hz to 10Hz	10 to 50 Hz	50 to 100Hz (and above)	
Buildings for commercial purposes, Industrial building and building of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that because of their particular sensitivity to vibration, cannot be classified as above and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

5.7.3.8 Guideline Values for evaluation of long-term vibration - DIN 4150-3:1999

The vibration limits of Table 3 in DIN 4150-3:1999 refer to the evaluation of the effects of long-term vibration on structures.

The criteria are the peak particle velocities measured on the uppermost full storey of any building not related to the site and are listed in **Table 17**.

According to the standard, *exceeding the values listed below does not necessarily lead to damage*.

If a building is subject to harmonic vibration, then maximum values can occur in floors other than the top floor, or in the foundation. The values given also apply in these cases.

TABLE 17: DIN 4150-3 CONSTRUCTION VIBRATION LIMITS – LONG TERM

TYPE OF STRUCTURES	GUIDELINE VALUES FOR VELOCITY, VI, IN MM/S OF VIBRATION IN HORIZONTAL PLANE OF HIGHEST FLOOR, AT ALL FREQUENCIES
Buildings for commercial purposes, Industrial building and building of similar design	10
Dwellings and buildings of similar design and/or occupancy	5
Structures that because of their particular sensitivity to vibration, cannot be classified as above and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

5.7.4 SUMMARY OF CONSTRUCTION NOISE AND VIBRATION CRITERIA

Construction noise criteria for the areas surrounding the project are NML levels (between RBL + 10 dBA and max. 75 dBA) for standard construction hours. As per below:

- Logger 1 receivers: 73 – 75 dBA
- Logger 2 receivers: 75 dBA
- Childcare receivers: internal noise of 45 dBA / external noise of max. 55 dBA

We consider that for this project the vibration criteria will be as per DIN 4150 – 3:1999 construction vibration limits – long term. Residential receivers in the area will have a maximum vibration velocity criterion of 5 mm/s[2] and commercial buildings of 10 mm/s peak particle velocity criteria.

REF construction noise assessment will utilize the information provided by the team at this stage and conduct a preliminary construction noise and vibration assessment. If predicted construction noise and vibration levels are not exceeding the limits, there is no need for a future construction noise and vibration management plan.

6 FACADE ACOUSTIC ADVICE

Based on the noise loggers results and the hand held noise analyser results for Digitaria and Gregory Hills Dr., the minimum façade recommendations per building are shown in tables below.

Building A is directly affected by the noise coming from Digitaria Dr., hence Minimum façade construction recommendations are as per table below:

TABLE 18 – MINIMUM FAÇADE CONSTRUCTIONS PER BUILDING TO MEET INTERNAL NOISE LEVELS / BUILDING A

EQUIPMENT	MNIMUM FAÇADE CONSTRUCTION TL PER FREQUENCY BAND (HZ)							
	63	125	250	500	1000	2000	4000	8000
Glazed façade construction: 6.38 mm Laminated	18	24	29	31	36	33	38	38
Non glazed façade construction: external cladding (7 Kg/m2) /64 mm stud + insulation /13 mm Pb) internal lining	17	19	38	54	64	68	59	59

Buildings B, C and D are indirectly affected by the traffic, however they will also need the minimum façade construction recommendations are as per table below:

TABLE 19 – MINIMUM FAÇADE CONSTRUCTIONS PER BUILDING TO MEET INTERNAL NOISE LEVELS / B, C AND D

EQUIPMENT	MNIMUM FAÇADE CONSTRUCTION TL PER FREQUENCY BAND (HZ)							
	63	125	250	500	1000	2000	4000	8000
Glazed façade construction: 6 mm float glass	16	22	24	28	32	28	34	34
Non glazed façade construction: external cladding (7 Kg/m2) /64 mm stud + insulation /13 mm Pb) internal lining	17	19	38	54	64	68	59	59

We are aware that at this stage there is no provided façade preferences, so the above are to be used as a guidance. They are included in this specific REF report because this proposed new school needs to comply with the NSW Proposed new school near Rail Corridors and Busy Roads - interim Guidelines for educational institutions (40 dBA Max. internal noise level in dBA).

7 OPERATIONAL NOISE & VIBRATION IMPACT ASSESSMENT

The following sections present our assessment of noise emission impacts from operational noise sources from the project. Predicted noise levels and associated mitigation measures are also provided according to the noise assessment and criteria.

7.1 WASTE COLLECTION

As per the EFC operational waste management plan, Location of the waste pads is at approx. 37 m from the neighbouring property as per the figure below. Collection frequencies are proposed to be 2x weekly for general waste (2x 4.5m^3 bins), and 2x weekly for recycling (2x 4.5m^3 bins). Collection vehicles will enter via the car park and park at the waste pad.

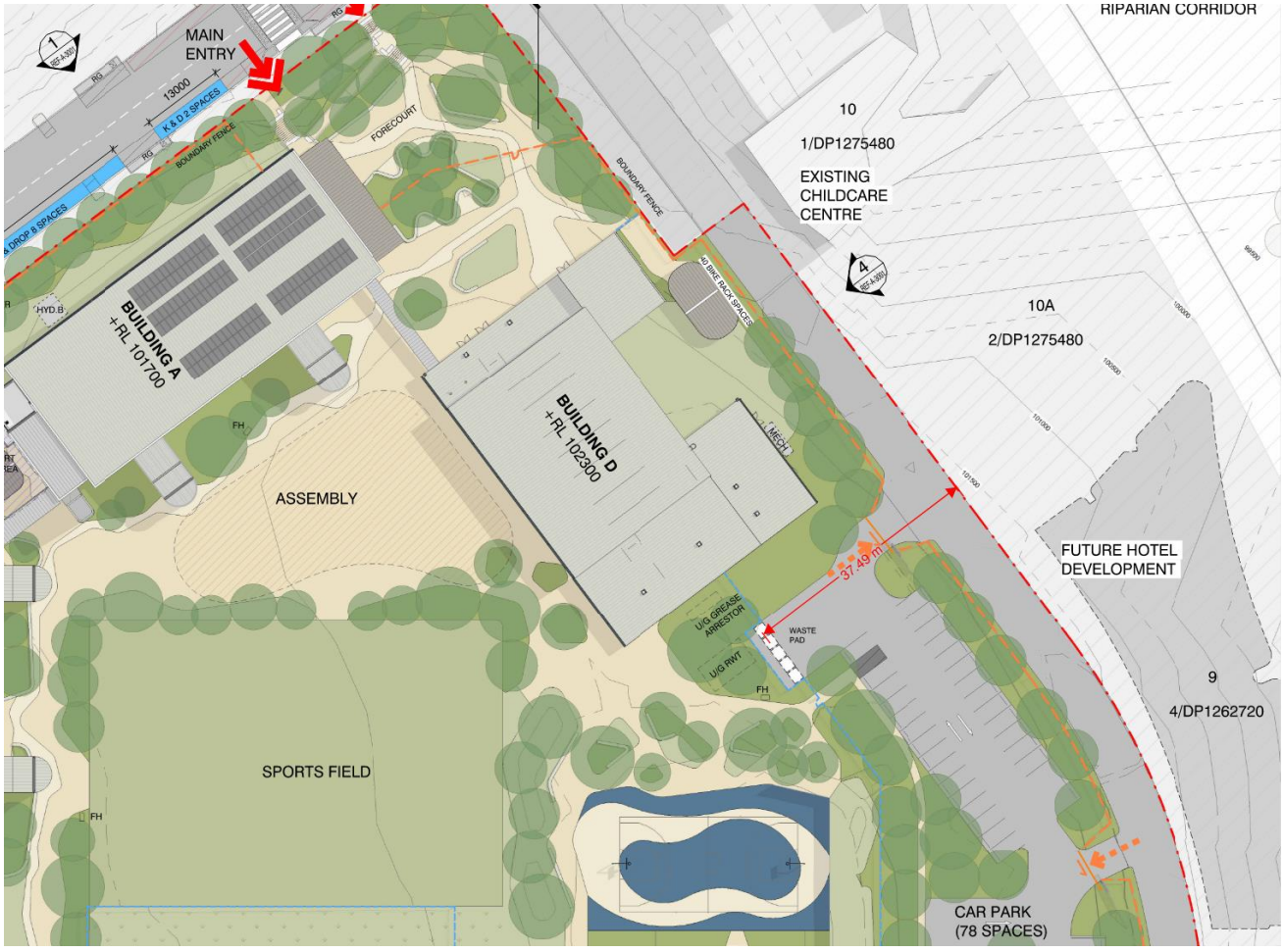

Figure 11 – WASTE PADS LOCATION

The critical receiver in this case would be the childcare centre (Futuro – Gledswood Hills located at 10 Digitaria Dr., Gledswood Hills NSW 2557) at approximately 36 m from the waste pads and 16- 20 m from the new access road, the traverse distance from the road to the waste pads location is approx. 100 m.

As per the operational waste management plan, medium to large collection vehicles should be expected for waste collection. Assuming a noise of 101 SWL of the waste collection truck and 97 SWL for the truck emptying bin, only during daytime hours and a speed of 15 km/hr for the waste truck, our calculations estimate that this would meet the project PNTL levels for daytime, with a 44 dBA propagated into the critical receiver.

This would also meet the internal noise levels for daycare (35 dBA internal / 45 dBA at façade) if the garbage collection happens during day time. However, to protect the daycare centre, we propose that the waste truck

enters via Gregory Hills Dr. instead of Digitaria Dr., to provide further distance attenuation to the noise. An evening garbage collection could also be considered (at 6 pm, out of daycare centre hours), as the estimated noise level can meet the evening PNTL levels.

7.2 NOISE EMISSION FROM PA SYSTEMS AND SCHOOL BELLS

At this stage of the design, we do not know the type, SWL level or location of the PA system. We recommend locate them as far as practicable from external neighbouring properties to the internal sides of the proposed school buildings and oriented to the school buildings and not to the surrounding spaces.

We do not expect this to be an issue that would exceed the project PNTL levels.

7.3 NOISE EMISSION FROM OUTDOOR AREAS

The project envisages 3 multi-sport courts and cricket nets located between the carpark and building D and a general sports field in the centre between buildings B and D. The multi sports courts are at 58 m from east receivers and 55 m from Gregory Hills Dr., and the general sport field is located at 132 m from east receivers and is shielded by buildings B and C to west receivers.

Noise predictions made with the critical distance to east receivers predict that noise from up to 50 children playing and shouting would meet the day and evening PNTL levels without any noise mitigation measure in place.

The noise from traffic from Gregory Hills Dr. would exceed the noise from the sport field and children playing and the sport field will be located a considerable distance to the neighbours across the service road, also partially shielded by two rows of trees. The sport field and multi-sport courts are not predicted to exceed the project PNTL levels.

7.4 NOISE EMISSION FROM KISS AND DROP LOCATIONS

According to the traffic study, there will be a 10 space kiss and drop area along the southern of Digitaria Dr. as per below image.

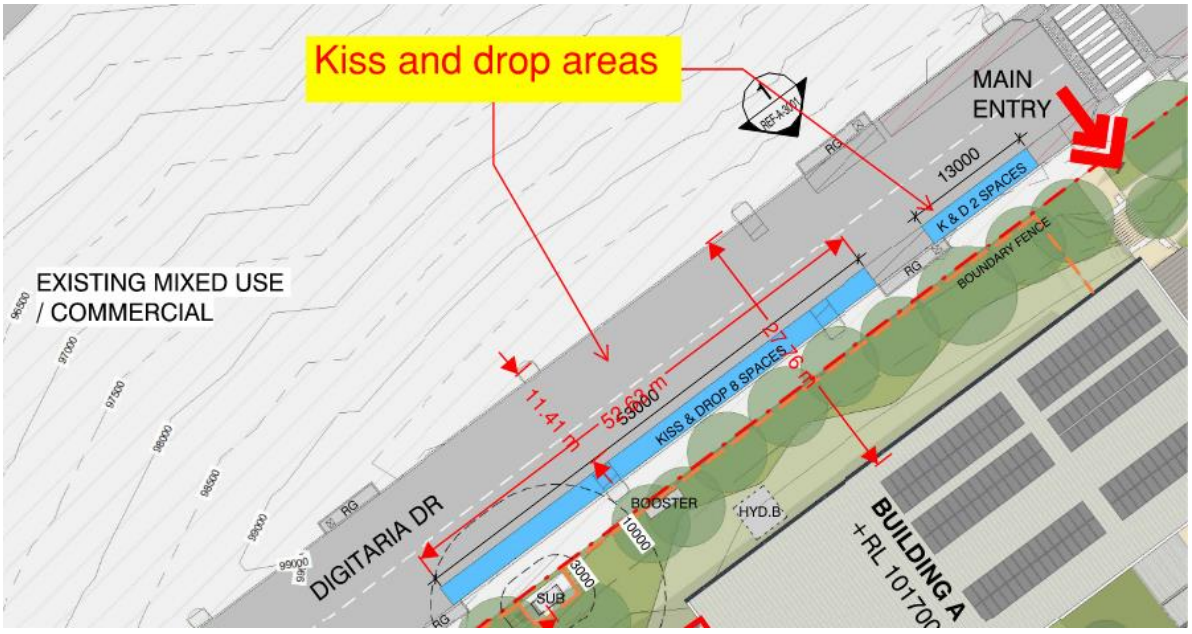

Figure 12 – KISS AND DROP LOCATION (SCT CONSULTING TRAFFIC STUDY).

The estimated noise levels from the 100% capacity of the kiss and drop, propagated into the closest receiver (Health and Business Centre) is 58 dBA during the day, which meets the PNTL levels for day time and 57 dBA for evening time, which meets the PNTL levels if the peak use of the kiss and drop is no longer than 1 hour in any 24 hour period.

We are not expecting that the kiss and drop will be used at 100% occupancy during the evening time.

7.5 NOISE EMISSIONS FROM CARPARK

There is a carpark with a max capacity of 78 spaces located next to the service road, at approximately 24 m from the neighbours across the service road as shown in figure below:

Figure 13 – CARPARK LOCATION

The noise impact was calculated using a time averaged L_{Aeq} for an assumed 60 mins of the peak time, propagated into the critical properties, also assuming a 15 km/hr velocity for the cars. For the calculation, typical sound pressure levels data for car noise sources (pass by, ignition and door slamming) is as shown below:

TABLE 20: TYPICAL SOUND PRESSURE LEVELS DATA FOR CARS MAIN NOISE SOURCES

ACTIVITY	HEIGHT OF SOURCE	SINGLE EVENT NOISE LEVEL LAEQ DB AT 10 M
Car pass by	0.5	67
Car ignition and pull out	0.5	72

ACTIVITY	HEIGHT OF SOURCE	SINGLE EVENT NOISE LEVEL LAEQ DB AT 10 M
Door slamming	0.5	64

Assuming a normal peak occupancy of 75% of the carpark, the noise propagated into the closest receiver across the service road, the carpark noise meets the Day PNTL level and slightly exceeds the evening PNTL level.

For the evening time we assume a limited operation of the school and hence the carpark is assumed to be max. 40% occupied during the evening for the occasional event at this time of the day. For this case, the carpark noise would still comply with the PNTL level for the evening time, considering the Fact Sheet C allowable exceedance for events of the carpark generating noise before or after a certain event in not more than 1 hour.

Also must have a coved finish with Slabseal 2000 SR sealant or equivalent applied to the concrete floor. The coved finish and sealant must be suitably maintained on the floor at all times to a standard that eliminates tyre squeal noise from being audible.

We believe that implementing the above mitigation measures, there will be no requirements for acoustic barriers.

7.6 NOISE EMISSIONS FROM SERVICES

7.6.1 MECHANICAL SERVICES

We understand the mechanical design will consist of the below elements:

- Each building will have internally ducted units (ducted type VRF or cassette and dedicated split systems) internal fan coil units, and fans for air supply and extraction.
- Each building will have a plant space on the rooftop (open) with ODU units and fans exhaust (outside air, extraction, toilets extractors, labs extractors and kitchen extractors).
- Some buildings will have some ducted fans on the roof level.
- The Hall will have roof fans and an external ODU plant.
- Smoke management systems (extraction fans).
- Dust collectors and dust extraction units.

The Hall ODU plant would be the closest to receivers (20 m), mech equipment in the Buildings A, B, C are located on each building's rooftop, at approx. 19 – 22 m away from other receivers. We are assuming the mechanical plant will operate 100% during day time and a limited % during evening times, no operation during night times.

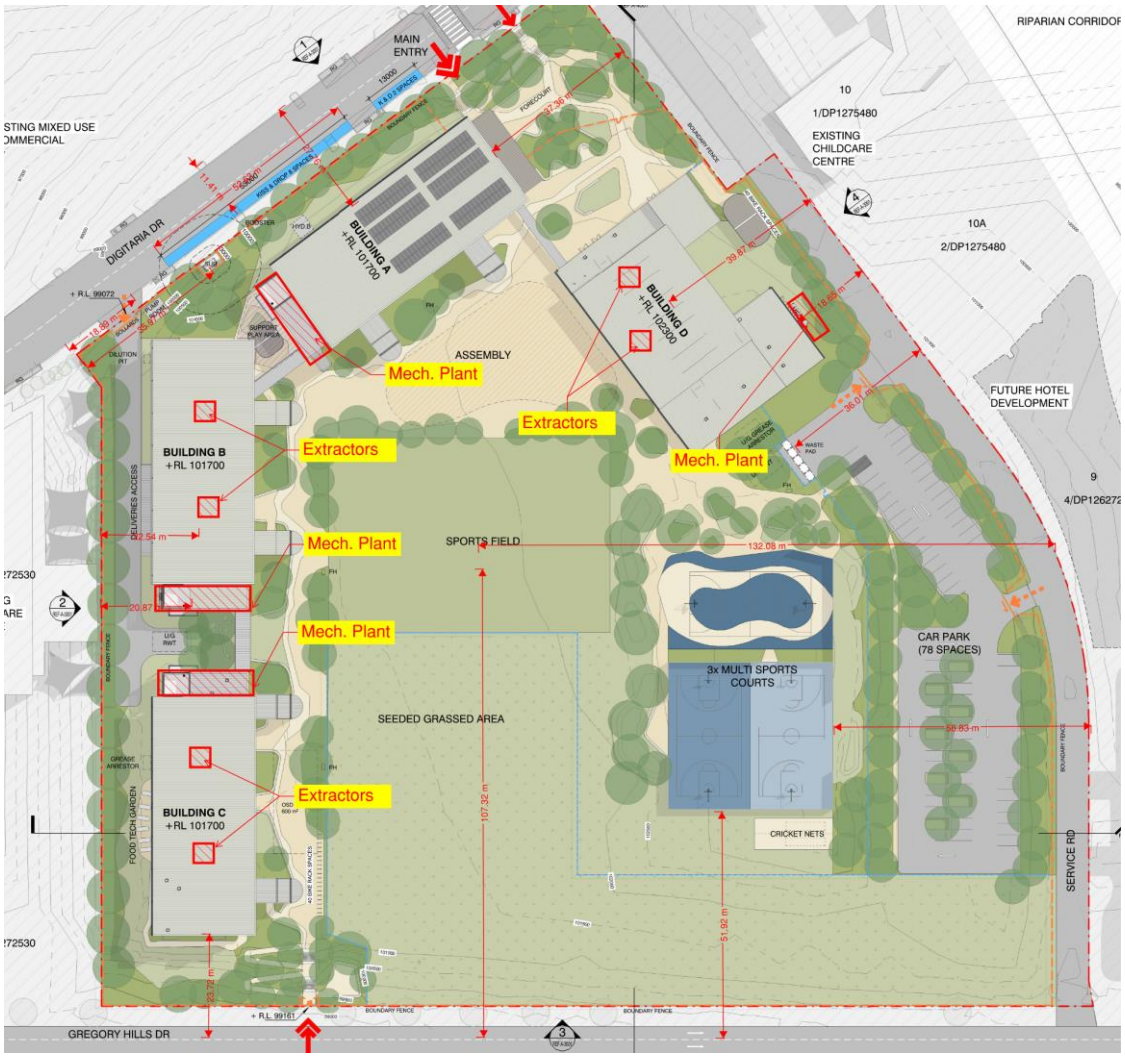

Figure 14 – MECHANICAL PLANT LOCATION

We understand that final equipment selections are not available at this stage, however a preliminary mechanical equipment assessment was conducted with equipment noise data used for similar projects. Mechanical noise sources at 1 m are shown in table below:

TABLE 21 - MAXIMUM IN-DUCT SOUND POWER LEVELS FOR MECHANICAL EQUIPMENT / ASSUMED

EQUIPMENT	SWL SOUND PRESSURE LEVEL (dB) AT 1 M PER FREQUENCY BAND (HZ)								
	63	125	250	500	1000	2000	4000	8000	dBA
Total SPL for each ODU	83	79	78	74	72	68	66	62	77
Total SPL per Fan	72	76	76	73	71	69	66	57	76
Total max noise (fans per building)	84	82	82	78	76	73	71	64	82

EQUIPMENT	SWL SOUND PRESSURE LEVEL (dB) AT 1 M PER FREQUENCY BAND (HZ)								
	63	125	250	500	1000	2000	4000	8000	dBA
Total max noise in Halls ODU Plant	76	72	71	67	65	61	59	55	70

Notes:

- Each building plant should limit to the above max total SPL at 1 m to be able to meet the project PNTL levels at the boundary.
- If the building's ODU plant exceeds the above total levels, the ODU units should be surrounded by acoustic louvers.
- If any fan exceeds the above table levels, they should install acoustic attenuators on both ends.
- Smoke extractor fans and fume extractor fans will need acoustic attenuators fitted to both ends to meet the boundary noise levels (at this stage medium attenuators of 1 – 1.5 m long are expected for these fans).
- The REF treatment included in this report only assesses the noise from the boundary. The internal noise levels will need to be assessed by the acoustic consultant to meet the school ESFG requirements.
- If the hall ODU plant exceeds the above max. SPL at 1 m, it will need to be surrounded by acoustic louvers as this plant is on ground level and close to the boundary (closer to critical receiver 5 Childcare centre at 10 Digitaria Dr.). We recommend relocating the Halls ODU plant away from the east boundary on the other side of the hall building facing the sport fields, this way its impact will be minimized towards the childcare facility.

7.6.2 ELECTRICAL SERVICES / FIRE PROTECTION SERVICES

We understand that for this project a standby generator is not required.

We have confirmation of a fire pump (model is to be confirmed), is intended to be located between Buildings A and B, next to the support play area. For this noise source the most affected receiver would be the existing childcare at 4 Digitaria Dr., located at approx. 20 m away. The electrical substation is located further away from the west boundary at approximately 36 m.

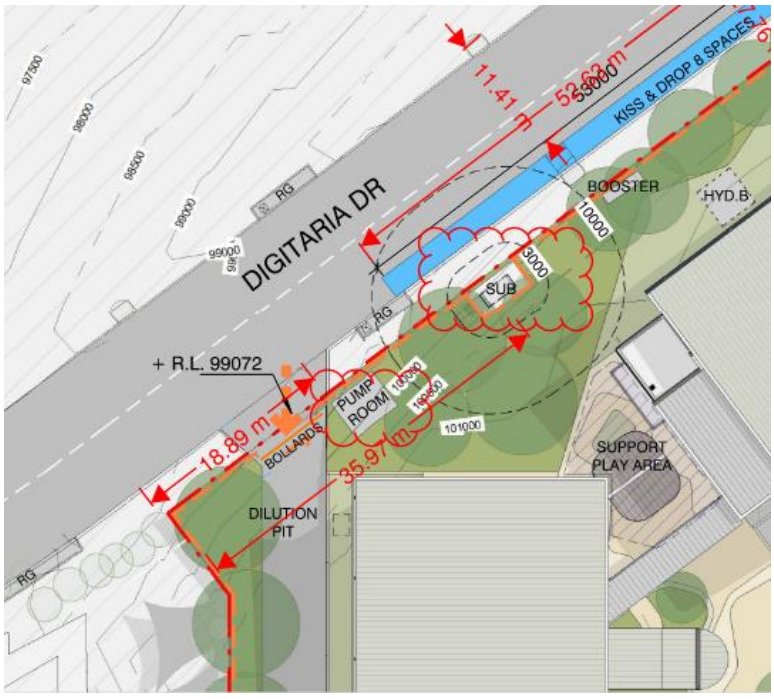

Figure 15 – FIRE PLANT LOCATION / ELECTRICAL SUBSTATION LOCATION

Final selection is to be confirmed; however it is assumed that the expected pump should be similar to an Aline Single diesel engine fire pump as per below:

- type SD 380 100X65-200
- 21kW engine
- 3,000 rpm
- Naturally aspirated
- Air consumption 2.03 m3/min
- Provided noise level (just for the engine) 100 dBA / does not indicate if SWL level or SPL level
- Proposed pump room dimensions: 5500 W x 3000 L x 2100 H

Based on the above technical information, we estimated that the noise produced by this type of pump would be as per below:

TABLE 22 – NOISE LEVELS OF THE FIRE PUMP (ESTIMATED BASED ON RECEIVED INFORMATION)

EQUIPMENT	SPL SOUND POWER LEVEL (dB) PER FREQUENCY BAND (HZ)								
	63	125	250	500	1000	2000	4000	8000	dBA
Inlet + casing	94	99	99	99	101	100	95	87	105
Exhaust	120	126	122	114	110	104	94	86	118

Fire pumps are particularly noisy, and they need to be located in an acoustically designed enclosure with the below items:

- Acoustic walls and ceilings: min. 190 mm blockwork construction for walls and ceiling.
- Exhaust muffler type super critical with 50 dB attenuation.
- Acoustic solid core access door with acoustic seals, min. Rw 36.
- Internal absorption to mitigate reverberation (min 20 sqm with min. NRC 0.8, on walls / ceilings, where available).
- Pump must be tested only during day time (7 am to 6 pm).
- Acoustic louver for ventilation (if needed) max 3 sqm, not oriented towards the existing childcare at 4 Digitaria Dr. and min acoustic rating as per below:

TABLE 23 – MIN REQUIRED PERFORMANCE FOR ACOUSTIC LOUVER

EQUIPMENT	MIN ACOUSTIC PERFORMANCE, TL OF LOUVER/ PER FREQUENCY BAND (HZ)							
	63	125	250	500	1000	2000	4000	8000
IAC slimshield or similar / 300 mm thick	6	7	10	12	18	18	14	13

This is a critical item, as soon as the design progresses, this should be reviewed by the engaged acoustic consultant for design and construction phases.

Regarding the electrical substation, the noise levels of these equipment is usually around SPL 58 dBA at 1 m, which will easily comply with the boundary requirements. We do not expect noise impacts from the electrical substation.

7.7 OPERATIONAL VIBRATION

For controlling vibration emissions from mechanical plant (VRF, condensers and similar), it would be recommended that all condensers are installed on Embelton Supershearflex pads, Mason Super W Waffle Pads

or equal. Ensuring compliance with the NSW EPA document Assessing Vibration: A technical guideline. However, as ODU units are small, we do not consider this will be a noticeable impact on school grounds or residential areas.

Operational vibration is not within the scope of REF reports and will have to be reviewed during the design phase by the engaged acoustic consultant of the project. The acoustic consultant will have to review the final selected mechanical plant, brands models, RPM, locations and types of support (beams, concrete roofs or lightweight roofs) and recommend antivibration pads, mounts or springs where appropriate.

7.8 OPERATIONAL NOISE AND VIBRATION COMPLIANCE

As per the assessments in the above sections, the proposed Gledswood Hills High School will comply with the acoustic requirements of the Concept DA.

8 CONSTRUCTION NOISE & VIBRATION IMPACT ASSESSMENT

We understand the construction will be conducted on standard hours as per below:

- Weekdays 0700 to 1800
- Saturdays 0800 to 1300
- Sundays and public holidays: no work

Note: in case the contractor identifies a need for out of hours construction, a revised construction noise and vibration impact assessment is recommended to address the appropriate mitigation measures for the activities proposed outside standard hours.

8.1 CONSTRUCTION PLANT NOISE LEVELS

Minimum construction equipment for the estimated construction phases is described below:

TABLE 24 TYPICAL EXTERNAL NOISE LEVELS OF DEMOLITION AND CONSTRUCTION MACHINERY/ACTIVITY

ITEM #	ACTIVITY/MACHINERY	SOURCE AND REFERENCE NUMBER (BS 5228 – 1:2009)	L_{eq} SOUND PRESSURE LEVEL AT 10m (dBA)
Excavation and Demolition			
1	Tracked excavator 14t / 66kW	Table C2 Ref 25	69
2	Dumper truck 9T / 75 kW	Table C4 / Ref 4	76
Structural Phase			
3	Tracked excavator 14t / 66kW	Table C2 Ref 25	69
4	Dumper truck 9T / 75 kW	Table C4 / Ref 4	76
5	Mini piling rig (rock bolt) 250mm auger	Table C3 / Ref 18	74
6	Concrete pump + cement mixer truck (discharging) 8 T / 350 bar	Table C4/ Ref24	68
Construction & Fitout works			
7	Handheld circular saw 3 Kw	Table C4 / Ref 72	79
8	Handheld cordless nail gun	Table C4 / Ref 95	73
9	Diesel generator	Table C4 / Ref 76	61
Carpark Construction			
10	Compactor 60kg / 3kW	Table C5 / Ref 29	83
11	Vibratory Roller passby, 3t / 20kW	Table C5 / Ref 27	73
12	Asphalt paver and tipper lorry 112kW / 12t hopper	Table C5 / Ref 30	76

Notes:

- The above equipment shows every equipment noise level as per BS 5228 – 1:2009, the equipment inclusion in each phase is the general equipment that is used in this type of construction. A more detailed assessment will only be done if the preliminary assessment exceeds 75 dBA, if not, the above assessment is adequate for this type of report.
- NSW DECC 2009 Construction noise Guideline quotes on Appendix B Equipment Noise levels, the DEFRA 2005 database, which includes the above referenced BS 5228 – 1:2009 noise levels.

8.2 PREDICTED CONSTRUCTION NOISE

Based upon the above plant sound power levels, predicted construction noise levels for the critical receivers (closest) are presented below:

TABLE 25 PREDICTED CONSTRUCTION NOISE $L_{EQ,15MIN}$

RECEIVERS	RECOMMENDED HOURS	PERIOD	PREDICTED CONSTRUCTION NOISE LEVEL	EXTERNAL NOISE MANAGEMENT LEVEL
Excavation and Demolition Phase				
Receiver 5 Futuro Childcare (16 m) / Receiver 4 Raising stars Childcare (15.7 m)	Monday Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Day	55 dB(A)*	73 dB(A)(noise affected)/ 45 dBA internal for Childcare facilities 75dB(A) (highly noise affected)
Receiver 3 Approved Hotel (20 m)			72 dB(A)	
Receivers 1 and 2 (35 m)			67 dB(A)	
Structural Phase				
Receiver 5 Futuro Childcare (16 m) / Receiver 4 Raising stars Childcare (15.7 m)	Monday Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Day	55 dB(A)*	73 dB(A)(noise affected)/ 45 dBA internal for Childcare facilities 75dB(A) (highly noise affected)
Receiver 3 Approved Hotel (20 m)			74 dB(A)	
Receivers 1 and 2 (35 m)			70 dB(A)	
Construction & Fitout Works Phase				
Receiver 5 Futuro Childcare (16 m) / Receiver 4 Raising stars Childcare (15.7 m)	Monday Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Day	55 dB(A)*	73 dB(A)(noise affected)/ 45 dBA internal for Childcare facilities 75dB(A) (highly noise affected)
Receiver 3 Approved Hotel (20 m)			71 dB(A)	
Receivers 1 and 2 (35 m)			71 dB(A)	
Carpark Construction Phase				
Commercial receiver 6 (20 m)	Monday Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Day	73 dB(A)	73 dB(A)(noise affected)/ 45 dBA internal for Childcare facilities 75dB(A) (highly noise affected)
NB: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.				

8.2.1 CONSTRUCTION NOISE MITIGATION MEASURES

The main construction noise mitigation measure would be a solid construction perimeter hoarding (min 2 m height, solid with min 17 kg/m^2 density) located to shield the childcare centres each side of buildings A and D (Hall) and buildings B and C on the other side. The hoarding is proposed only on the proposed school lot, not blocking the shareway as shown below:

Figure 16 – CONSTRUCTION PERIMETER HOARDING LOCATION

- To meet the construction NML some time management of the equipment is required, only for the activities happening near the sensitive receivers, such as:
  - Excavation and structural phase works near critical receivers of building B and C on the west boundary (existing Childcare on the west boundary) and excavation and structural phase works near critical receivers of building D and carpark on the East boundary (existing Childcare on the east boundary).

- We assume that noise during fitout phase will be kept inside the buildings, hence shielded from receivers, hence no time management for internal fitout construction works.
- During excavation phase near the daycare facilities, the trucks need to be located as far as practicable from the critical receivers and the excavator will need to be managed for 50% of the time.
- During structural phase near the childcare facilities, the trucks need to be located as far as practicable from the critical receivers and the piling rig and concrete pumps will need to be managed for 50% of the time.
- It is also recommended a direct liaison between the construction team and both childcares to notify previously to noisy activities near those boundaries and to handle any complaints.
- The site is large and not all machinery is expected to be located at the same distance when assessing to a particular boundary.
- Not all machinery is expected to be working simultaneously.
- The above estimations are the critical scenario for construction noise.
- Carpark construction will only affect receiver 6 located at Gregory Hills Dr. An additional perimeter hoarding will need to be erected (only during carpark construction) as per below.

As shown, with the above noise mitigation measures, construction noise levels during all stages phases were predicted below 75 dB(A). Under the ICNG, there is no requirements for construction noise to be managed as part of a construction noise and vibration management plan.

8.3 PREDICTED CONSTRUCTION VIBRATION

It is important to note that construction vibration levels depend on several factors, such as: activity, type of machine, geology of the ground and the distance between the affected buildings and the source. Surface works are expected to have a lower vibration impact than ground compacting/breaking works.

For the proposed new school, activities likely to cause some vibration are piling, earthworks and reinstatement works (carpark or roads pavement construction and earth compaction).

As per the geotechnical report, the subsurface profile across the site comprises a sequence of fill, residual soils (4.5 m to 7.5 m) and bedrock shale (6 m – 13 m). Earthworks is likely to involve conventional earth moving equipment. The type of bedrock is shale, extremely weathered low to medium strength. Hence our estimations of vibration levels were done based on a medium cohesive soil, which is conservative relative to the results from the geotechnical study.

Compliance with vibration limits for building damage is expected based on ensuring ground compacting equipment is selected to adherer to minimum safe working distances. While these magnitudes do not predict cosmetic/structural damage, it is anticipated that human response/comfort would be impacted at these distances.

The current RMS Construction Noise and Vibration Guideline sets safe working distances for vibrating plant and equipment. These are summarised below in Table 26. For this size of works, the use of large hydraulic hammers would not be recommended for these works. Hence it is recommended that the use of smaller rock breakers and handheld jackhammers are used for activity close to the nearest affected sensitive receivers.

TABLE 26 RMS PLANT VIBRATION SAFE OPERATING DISTANCES - *Construction Noise and Vibration Guideline 2016*

PLANT ITEM	RATING/DESCRIPTION	MINIMUM WORKING DISTANCE	
		Cosmetic Damage (BS 7385)	Human Response (OH&E Vibration Guideline)
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Jackhammer	Handheld	1 m (nominal)	2 m

Vibration predictions on piling and reinstatement works are included below, using Table E.1 Empirical Predictors for groundborne vibration arising from mechanized construction works of the BS 5228 – 2.2009 part II Vibration.

TABLE 27 PILING AND REINSTATEMENT WORKS ESTIMATED VIBRATION LEVELS AS PER TABLE E.1 OF THE BS 5228-2.2009

EQUIPMENT	VIBRATION LEVEL PPV (mm/s)	SOURCE
Percussive piling, piles at 10 m depth with cohesive soils. Critical receivers at 16.5 m	0.12 mm/s	Table E1. BS 5228-2:2009
Steady state for vibratory compaction. Include distance to critical receiver in Gregory Hills Dr. (20 m).	3.1 mm/s	

Notes: These levels were calculated (based on the below:

- Piling at 10 m depth with a W factor of 85Kj for percussive piling.
- **Cohesive soil** was used for calculations. This is in line with the geotechnical findings.
- No vibratory piling.
- Reinstatement vibration was calculated based on Ks 143 scalling factor and Max. amplitude vibration of 1.72 mm. For a commercial receiver 3.1 mm/s is acceptable.

The above levels meet the construction vibration criteria as per DIN 4150 – 3. These values are not likely going to produce complains on the neighbours and are below all the maximum recommended vibration values as depicted in the criteria section.

8.4 GENERAL RECOMMENDATIONS ON CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

Predicted construction noise levels were determined not to exceed the 'Highly Noise Affected' noise levels, which have been specified in the Interim Guide for Construction Noise (ICNG). However, the Interim Guide for Construction Noise (IGCN) list a number of typical best practice measures which can be used to reduce construction related impacts. In addition, Australian Standards 2436-2010 provides best practice measures to mitigate construction noise and vibration.

The following recommendations should be also considered in the proposed new school of a construction noise and vibration management plan for the site, when details of the contractor works methodology become finalised.

8.4.1 GENERAL/SITE MANAGEMENT ISSUES

- All employees, contractors and subcontractors are to receive an environmental induction and should instruct all persons at the site with regard to all relevant project specific and standard noise mitigation measures, including but not limited to permissible hours or work, limitation of high noise generating activities, location of nearest affected noise receivers, construction employee parking areas, designated loading/unloading areas and procedures, site opening/closing times (including deliveries) and environmental incident procedures.
- A dedicated person will form a point of contact for dissemination of general information regarding site operations. Contact persons will also be defined to receive comment or complaints from the community.

8.4.2 CONSTRUCTION ACTIVITIES AND NOISE MITIGATION

The following general construction noise source control measures may be required:

- If any extended construction hours are required, a detailed plan should be prepared to mitigate the noise effects. For evening hours, less intrusive works will be scheduled to be carried out and/or works will be carried out away from sensitive receivers;
- Activities that approach the highly noise affected criteria for the sensitive receivers to be carried out during times where receivers are less sensitive to noise;
- Avoid unnecessary revving of engines and turn off plant that is not being used/required;

- Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms;
- Where possible, avoid using tonal reverse alarm outside standard construction hours;
- Organise and schedule the equipment operations to limit the noisiest machines operating simultaneously;
- Site set up/ movement of plant / delivery of material/ waste removal to site should generally be restricted to day period;
- Truck drivers are to be informed of site access routes, acceptable delivery hours and must minimise extended periods of engine idling;
- Ensure there is no unnecessary shouting or loud stereo/radios on site. There must be no dropping of metal from heights, throwing of metal items or slamming of doors;
- Use less noise intensive equipment where reasonable and feasible;
- Where practical fixed plant should be positioned as far as possible from the sensitive receivers;
- Use temporary site buildings and material stockpile a additional noise barriers;
- Employ the use of solid barrier plywood hoardings as required;

9 CONCLUSIONS

This Acoustic Report as part of the Review of Environmental Factors for Gledswood Hills High School, located at 9 Gregory Dr., Gledswood Hills, NSW 2557, find the potential noise and vibration environmental impacts that could arise from construction and operation of the above project can be appropriately mitigated.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed new school, it is determined that:

- The extent and nature of potential impacts are moderate and will not have significant impact on the locality, community and/or the environment, considering the mitigation measures proposed in this report.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal impact on the locality, community and/or the environment.

9.1 NOISE AND VIBRATION MITIGATION MEASURES – OPERATION

PROJECT STAGE *DESIGN (D) OPERATION (O)*	MITIGATION MEASURE	REASON FOR MITIGATION MEASURE	RELEVANT SECTION OF REPORT
D	• Provide minimum facade constructions as per Table 18 and Table 19 of the acoustic report	To meet mandatory internal noise criteria by NSW Proposed new school near Rail Corridors and Busy Roads - Interim Guidelines.	Section 6
O	• Waste truck enters via Gregory Hills Dr. instead of Digitaria Dr., or to collect during evening hours.	Minimise garbage collection noise emission to daycare centre.	Section 7.1
D & O	• Locate PA systems as far as practicable from external neighbouring properties to the internal sides of the proposed school buildings and orienting the speakers towards the school buildings and not to the surrounding spaces.	Reduction in PA noise propagation to neighbouring properties	Section 7.2
O	• Car park peak movements during evening events to be limited to 1 hour (i.e. 1 event in an evening). • Car park must have a coved finish with Slabseal 2000 SR sealant or equivalent applied to the concrete floor.	Mitigate car park noise to neighbouring properties to comply with the PTNL.	Section 7.5
D	• Provide appropriate mitigation such as attenuators, louvres, screening to all mechanical systems including fans, outdoor units, smoke fans.	Mitigate noise emission from mechanical plant equipment to comply with the PTNL.	Section 7.6.1
D / O	• Implement any required acoustic mitigations based on final fire pump	Limit fire pump noise to comply with PTNL.	Section 7.6.2

PROJECT STAGE *DESIGN (D) OPERATION (O)*	MITIGATION MEASURE	REASON FOR MITIGATION MEASURE	RELEVANT SECTION OF REPORT
	selection during the detailed design and operation stages.		

9.2 NOISE AND VIBRATION MITIGATION MEASURES – CONSTRUCTION

PROJECT STAGE *CONSTRUCTION (C)*	MITIGATION MEASURE	REASON FOR MITIGATION MEASURE	RELEVANT SECTION OF REPORT
C	• Install perimeter hoarding:(min 2 m height, solid with min 17 kg/m^2 density, located to shield the childcare centres each side of buildings A and D (Hall) and buildings B and C on the other side.	Control construction noise to neighbouring buildings	Section 8.2.1
C	• Apply time management to construction noise activities as required to comply with the construction noise limits.	Control construction noise to neighbouring buildings	Section 8.2.1
C	• Install temporary perimeter hoarding during construction of car park.	Control construction noise to neighbouring buildings	Section 8.2.1

10 LOGGERS INFORMATION

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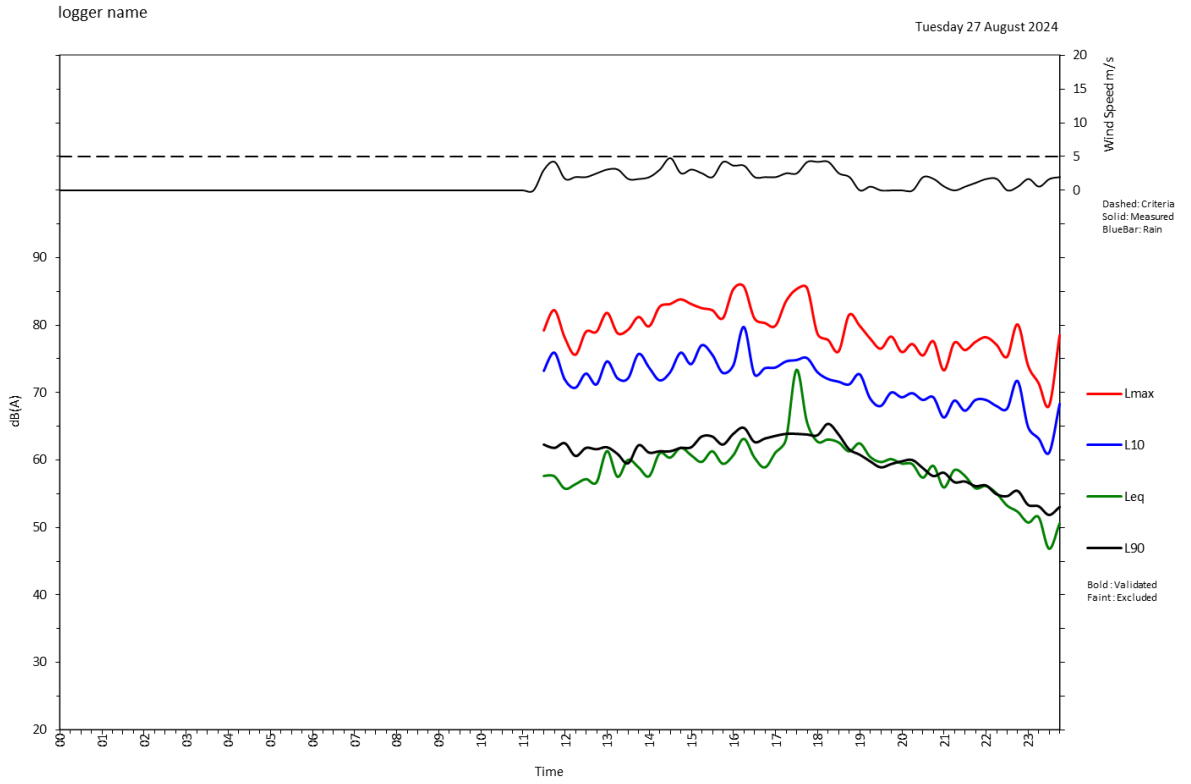

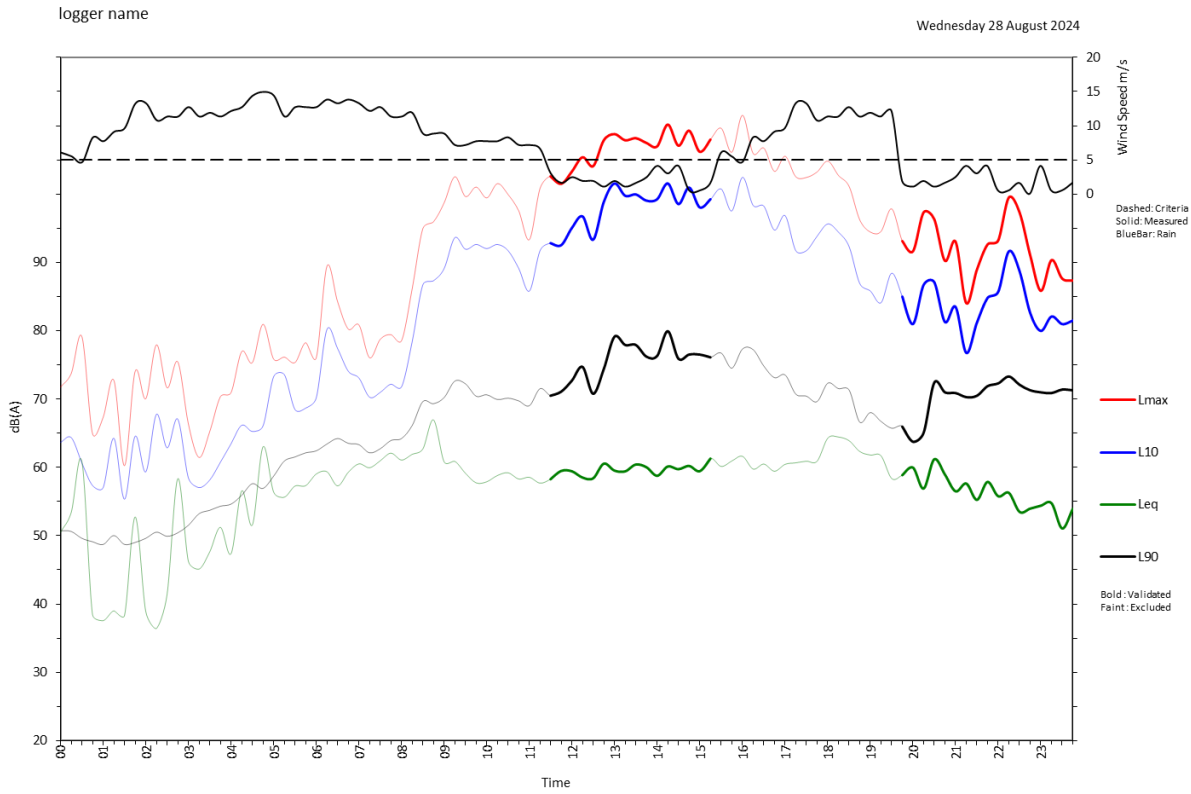

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