Department of Education

Picton High School Redevelopment
Acoustic Assessment

April 2018

Executive summary

This report assesses the operational and construction noise and vibration impacts from the project. The report has been prepared to meet the Secretary's Environmental Assessment Requirements.

Construction noise and vibration

The predicted noise levels are predicted to exceed the noise management levels during standard construction hours. During the noisiest construction works, 8 sensitive receivers are predicted to experience noise levels above the highly noise level of 75 dBA.

Traffic noise impacts due to construction are not expected as noise levels along the construction traffic routes are not predicted to increase road traffic noise levels by 2 dBA.

Safe working distances for vibration activities have been identified for standard structures. No buildings have been identified within the safe working distances. There is the potential for minor human comfort vibration impacts at residences directly adjacent to the work.

It is typical for construction projects to exceed the construction noise and vibration management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise and vibration levels are generally conservative and would only be experienced for limited periods during construction. Impacts may be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended within this report. However, these mitigation measures are unlikely to reduce noise levels below the construction noise management levels or human comfort criteria.

Construction mitigation measures

To protect the amenity of local residents mitigation measures have been recommended to manage noise and vibration during construction.

For construction activities that are undertaken within the recommended standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday) the work practices in Table 5-1 would be considered feasible and reasonable where noise levels are predicted to exceed the construction noise management levels.

Feasible and reasonable work practices

Construction noise and vibration mitigation measure	
Construction mitigation measures	Noise generating construction activities should be undertaken in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). The standard hours for construction work should be in accordance with the Guideline: • 7:00 am – 6:00 pm Monday to Friday • 8:00 am – 1:00 pm Saturdays • no work on Sundays or Public Holidays. Work outside normal hours should only comprise: • the delivery of materials outside normal hours requested by police or other authorities for safety reasons • emergency work to avoid the loss of lives and/or property
	Residences within 500 m of the site should be notified as to the timing and duration of the construction works and provided with a contact phone number for any complaints or concerns during the construction period.
	Site inductions Inductions for the work crew would include the specific noise issues and mitigation measures required for the site. The induction would include: • all relevant standard noise mitigation measures • relevant licence and approval conditions • permissible hours of work • location of any sensitive receivers that may exceed the construction noise management level • construction employee parking areas • designated loading/ unloading areas and procedures • site opening/closing times (including deliveries) • behavioural practices that minimise noise: • avoiding dropping materials from height and avoiding metal to metal contact on material.
	The distance between plant and equipment and any sensitive receiver should be maximised where practicable.
	Vehicles, plant and equipment would be regularly maintained and kept in good operating condition. Machines found to produce excessive noise should be removed from site or stood down until repairs or modifications can be made.
	Plant should be turned off when not in use. For example, trucks should not be left idling if not operational.
Vibration	Should any buildings be identified that are located within the structural damage vibration buffer distances identified in Section 4.2.2, a property condition report should be prepared for the premises before and after undertaking the work. Compliance vibration monitoring should also be undertaken during high vibration generating activities where buildings are located within the structural damage buffer distances to confirm vibration criteria are not exceeded.

Operational noise

Based on the assumptions in the report, operation of the school is predicted to comply with the *Noise Policy for Industry* (EPA 2017) noise criteria. The proposal should be acceptable from an acoustic perspective assuming the recommended mitigation measures are implemented.

Operational mitigation measures

The following mitigation measures are recommended:

- A 2.0 m high solid barrier (no roof/ceiling) should be constructed around all mechanical plant areas housing air-conditioning units servicing the proposed buildings.
- Events at the school hall should finish prior to 10 pm to negate any sleep disturbance impacts.
- During special concert events in the hall, entry doors should remain closed except for the ingress and egress of students/staff/parents.
- If noisy events in the school are proposed which have the potential to generate internal noise levels in excess of 90 dBA, then additional acoustic treatments to the school hall should be considered.

Road traffic noise

Noise levels are not predicted to increase by 2 dBA due to traffic generation from the Project and would meet the *Road Noise Policy* (DECCW, 2011) criteria when assessed at residences along Argyle Street. However, GHD recommends a traffic survey be conducted for Wonga Road to calculate the existing noise levels received at 500 Argyle Street and determine whether noise mitigation is required at this location (if there is a 2 dBA increase in road traffic noise).

An assessment of road noise intrusion to the internal areas of the school should not be deemed necessary as traffic volumes along Argyle Street do not exceed an AADT of 20,000 vehicles.

The proposal should be acceptable from an acoustic perspective assuming the recommended mitigation measures are implemented.

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Glossary

Term	Definition
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90 per cent of the measurement period.
$L_{Aeq(15hr)}$	The L_{Aeq} noise level for the period 7:00 to 22:00 hours.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 22:00 to 7:00 hours.
L_{Amax}	The maximum A-weighted sound pressure level occurring in a specified time period.
Noise sensitive receiver	A noise modelling term used to describe a map reference point where noise is predicted. They consist of areas or places potentially affected by noise or vibration including: • a residential dwelling • an educational institution, library, childcare centre or kindergarten • a hospital, surgery or other medical institution • an active (for example sports field, golf course) or passive (for example national park) recreational area • commercial or industrial premises • a place of worship.
Peak particle velocity	Peak particle velocity is the maximum vector sum of three orthogonal time-synchronized velocity components regardless of whether these component maxima occurred simultaneously.
Rating background level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
VDV	Vibration dose value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).

1. Introduction

1.1 Overview

GHD has been engaged to prepare a Noise and Vibration Impact Assessment (NVIA) for the proposed redevelopment of Picton High School situated at 480 Argyle Street, Picton (Property Lot 2 in DP 520158).

This NVIA assesses the operational and construction noise and vibration impacts from the project. The NVIA has been prepared to meet the Secretary's Environmental Assessment Requirements (SEARs) in Table 1-1 for preparation of an Environmental Impact Statement (EIS).

Table 1-1 Environmental Assessment Requirements

Environmental Assessment Requirements	Section addressed
Legislation, policies and guidelines	
Relevant legislation • *Protection of the Environment Operations Act 1997* • *Secretary's Environmental Assessment Requirements*	Section 3.1
Relevant Policies and Guidelines • *NSW Industrial Noise Policy* (EPA 2000) – NB: This has been superseded by the NSW Noise Policy for Industry (EPA 2017) • *Interim Construction Noise Guideline* (DECC) • *Assessing Vibration: a Technical Guideline* • *Development Near Rail Corridors and Busy Roads – Interim Guideline* (Department of Planning, 2008)	 Section 3.3.2 Section 3.2.1 Section 3.2.2 Section 3.5.2
Noise and vibration impacts	
10. Noise and Vibration Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction and operation, including consideration of any public address system, school bell and use of any school hall for concerts etc. (both during and outside school hours), and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 4.1 Section 4.2 Section 4.3

1.2 Methodology

The following methodology was used to assess the potential noise and vibration impacts associated with construction and operation of the Project in order to address the SEARs:

- identifying sensitive receivers in the area surrounding the Project
- describing the existing noise environment
- establishing noise and vibration assessment criteria at sensitive receiver locations
- assessing the potential construction and operational noise and vibration impacts from the Project
- assessing potential traffic noise impacts from operation and construction
- assess the potential for noise intrusion into the development
- provide recommendations for reasonable and feasible noise and vibration mitigation measures.

1.3 Report structure

The report is structured as follows:

- **Chapter 1 – Introduction.** This chapter introduces the Project and describes the Project area.
- **Chapter 2 – Existing environment**. This chapter describes the existing environmental values of the study area relevant to the noise and vibration assessment
- **Chapter 3 – Compliance criteria**. This chapter outlines the relevant Commonwealth and State legislation and any guidelines and assessment criteria relevant to construction and operation.
- **Chapter 4 – Assessment of impacts.** This chapter examines the potential environmental impacts associated with the construction and operation of the Project.
- **Chapter 5 – Mitigation measures.** This chapter outlines the proposed mitigation strategies during the construction and operation to manage any identified impacts.
- **Chapter 6 – Conclusion.** This chapter provides a conclusion to the report and presents the next steps in the advancement of the Project.
- **Chapter 7 – References.** This chapter provides the documents references within this report.

1.4 Scope and limitations

This report has been prepared by GHD for Department of Education and may only be used and relied on by Department of Education for the purpose agreed between GHD and Department of Education as set out in Section 1.2 of this report. GHD otherwise disclaims responsibility to any person other than Department of Education arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the methodology set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD accepts no responsibility for the integrity of the software coding of any commercial software used.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report, specifically Section 4. GHD disclaims liability arising from any of the assumptions being incorrect. GHD has prepared this report on the basis of information provided by Department of Education and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

It is not the intention of the assessment to cover every element of the acoustical environment, but rather to conduct the assessment with consideration to the prescribed work scope. The findings of the acoustic assessment represent the findings apparent at the date and time of the monitoring and the conditions of the area at that time. It is the nature of environmental monitoring that not all variations in environmental conditions can be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

2. Existing environment

2.1 Sensitive receivers and land uses

The Picton High School is located within a R2 Low Density Residential planning zone within the Wollondilly Council local government area. The site fronts onto Argyle Street and is surrounded by Residential, Industrial, Public Recreation and Rural Landscape land use. To the south of the site is Wonga Road which is proposed to be utilised for vehicles arriving and exiting the site during construction and operation.

The general topography of the site has a slope down to the north and the west, with a fall of approximately 4 - 10 m from the southern boundary to the northern boundary and approximately 1 - 2 m from the eastern boundary to the western boundary. Bulk earthworks will be required to create level platforms for construction.

Receivers immediately surrounding the site which may be impacted by operational and construction noise are shown in Figure 2-1. Two noise catchment areas have been identified as the residences set back from Argyle Street (Noise Catchment Area 1) and the residences fronting Argyle Street (Noise Catchment Area 2). These areas have significantly different ambient noise environments due to their proximity to Argyle Street, which is the dominant noise source in the study area. Residences within each noise catchment area is shown in Figure 2-1.

Receivers within a 500 m radius may experience noise impacts during construction of the development.

Noise sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Sensitive noise receivers could include residences, educational institutes, hospitals, places of worship, recreational areas and commercial/industrial premises.

These sensitive receivers are tabulated in Table 2-1 and are shown on Figure 2-4.

Table 2-1 Identified noise sensitive receivers

Receiver ID	Receiver Type	Noise Catchment Area
R01	Residential	NCA2
R02	Residential	NCA1
R03	Residential	NCA1
R04	Residential	NCA1
R05	Residential	NCA1
R06	Residential	NCA1
R07	Residential	NCA1
R09	Residential	NCA1
R10	Residential	NCA2
R11	Residential	NCA2
R12	Residential	NCA1
R13	Residential	NCA1
R14	Residential	NCA1
R15	Residential	NCA1
R16	Residential	NCA1
R17	Residential	NCA1
R18	Residential	NCA1
R19	Residential	NCA1
R20	Residential	NCA1
R21	Residential	NCA1
R22	Residential	NCA1

Receiver ID	Receiver Type	Noise Catchment Area
R23	Residential	NCA1
R24	Residential	NCA2
R25	Residential	NCA1
R26	Residential	NCA2
R27	Residential	NCA1
R28	Residential	NCA1
R29	Residential	NCA1
R30	Residential	NCA1
R31	Residential	NCA1
R32	Residential	NCA1
R33	Residential	NCA1
R34	Residential	NCA2
R35	Residential	NCA1
R36	Residential	NCA1
R37	Residential	NCA1
R38	Residential	NCA1
R39	Residential	NCA2
R40	Residential	NCA2
R41	Residential	NCA2
R42	Residential	NCA2
R43	Residential	NCA2
R44	Residential	NCA2
R45	Residential	NCA2
R46	Residential	NCA1
R47	Residential	NCA1
R48	Residential	NCA1
R49	Residential	NCA1
R50	Residential	NCA1
R51	Residential	NCA1
R52	Residential	NCA1
R53	Residential	NCA1
R54	Residential	NCA1
R55	Residential	NCA1
R56	Residential	NCA1
R57	Residential	NCA1
R58	Residential	NCA1
R59	Residential	NCA1
R60	Residential	NCA1
R61	Residential	NCA1
R62	Residential	NCA1
R63	Residential	NCA1
R64	Residential	NCA1
R65	Residential	NCA1
R66	Residential	NCA1
R67	Residential	NCA1
R68	Residential	NCA1
R69	Residential	NCA1
R70	Residential	NCA1
R71	Residential	NCA2
R72	Residential	NCA2
R73	Residential	NCA2

Receiver ID	Receiver Type	Noise Catchment Area
R74	Residential	NCA2
R75	Residential	NCA1
R76	Residential	NCA2
R77	Residential	NCA1
R78	Residential	NCA1
R79	Residential	NCA1
R80	Residential	NCA1
R81	Residential	NCA1
C01	Commercial	
C02	Commercial	
C03	Commercial	
C04	Commercial	
C05	Commercial	
C06	Commercial	
C07	Commercial	
C08	Commercial	
C09	Commercial	
C10	Commercial	
C11	Commercial	
C12	Commercial	
POW1	Place of worship	

Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Noise monitoring location
- Property boundary
- Wollondilly Council Land
- New Site Boundary
- Extent of Proposed Works
- RMS Land
- Proposed school buildings
- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Land zoning

- E2 Environmental Conservation
- IN2 Light Industrial
- R2 Low Density Residential
- RE1 Public Recreation
- RU2 Rural Landscape
- SP2 Infrastructure

Billard Leece Partnership Pty Ltd
Picton High School Redevelopment - Acoustics

Job Number 21-27011
Revision A
Date 05 Apr 2018

Noise monitoring location, noise catchment areas and surrounding sensitive receivers

Figure 2-1

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 1)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice

2.2 Existing noise environment

Background noise monitoring is required to establish the noise criteria for the Project. Background noise monitoring was conducted at the locations presented in Table 2-2 for a period of eight days between Thursday 7 December 2017 and Friday 15 December 2017 in accordance with the *Noise Policy for Industry* (NPI) (EPA 2017) to determine the background and ambient noise levels. The NPI recommends background noise monitoring at the most effected noise sensitive locations. The dominant noise source controlling the background noise level in the vicinity was road traffic noise from Argyle Street. Background monitoring was undertaken in two locations which was considered representative of the background noise environment for the residences fronting Argyle Street and the residences set back from Argyle Street

Noise monitoring location 1 (M1) is considered representative of the residences setback from Argyle Street and is referred to as Noise Catchment Area 1 (NCA1) in this report. Noise monitoring location 2 (M2) is considered representative of the residences that front Argyle Street and is referred to as Noise Catchment Area 2 (NCA2) in this report.

The methodology of the noise monitoring is as follows:

- noise monitoring was undertaken using one Rion NL-52 noise logger and one Svan 977 environmental noise logger. All noise loggers were programmed to accumulate the L_{A90}, L_{A10} and L_{Aeq} noise descriptors continuously over the entire monitoring period
- meteorological data was sourced from the Bureau of Meteorology's Camden Airport AWS
- a calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dBA
- the data collected by the loggers was downloaded and analysed. Data was excluded during periods where average wind speeds were greater than 7 m/s or when rainfall occurred

A summary of the noise monitoring locations and equipment details is provided in Table 2-2. Noise monitoring locations are shown in Figure 2-1.

Table 2-2 Noise monitoring location and equipment details

ID	Location	Equipment details	Equipment photo	Equipment settings
M1	North-eastern corner of Picton High School property boundary	Rion NL-52 Type 1 SN: 131631		A-weighted Fast time response 15 minute intervals Pre to post calibration check: 0.1 dB
M2	Eastern boundary of Picton High School (5 m from road edge)	Svan 977 Type 1 SN: 36873		A-weighted Fast time response 15 minute intervals Pre to post calibration check: 0.4 dB

2.2.1 Noise monitoring results summary

Background noise monitoring data was used to determine the Rating Background Levels (RBL) for the day, evening and night-time periods. The rating background levels are summarised in Table 2 3 and Table 2 4. The road noise levels received at 5 metres from the road edge are presented in Table 2 5. Daily noise level charts for the entire monitoring period are presented in Appendix A and Appendix B. Noise levels in red indicate the noise data is affected by adverse weather and have been excluded from the overall results

Table 2-3 Summary of M1 noise monitoring results (background and ambient), dBA

Date	Rating background level (RBL), 90th percentile $L_{A90(period)}$[1]			Ambient noise levels, $L_{Aeq(period)}$[1]		
	Day	Evening	Night	Day	Evening	Night
Thursday 7/12/17	40	36	29	48	53	46
Friday 8/12/17	40	36	25	49	44	43
Saturday 9/12/17	37	33	26	49	51	48
Sunday 10/12/17	38	31	25	46	50	47
Monday 11/12/17	39	38	24	47	50	46
Tuesday 12/12/17	39	31	26	50	48	44
Wednesday 13/12/17	39	37	28	47	46	46
Thursday 14/12/17	39	35	27	47	45	45
Friday 15/12/17	38			50		
Total	**39**	**35**	**26**	**48**	**49**	**46**

Note: 1) The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday and Public Holidays, Evening 6 pm to 10 pm and Night as the remaining periods

Table 2-4 Summary of M2 noise monitoring results (background and ambient), dBA

Date	Rating background level (RBL), 90th percentile $L_{A90(period)}$[1]			Ambient noise levels, $L_{Aeq(period)}$[1]		
	Day	Evening	Night	Day	Evening	Night
Thursday 7/12/17	49	46	30	68	66	63
Friday 8/12/17	49	41	28	69	66	62
Saturday 9/12/17	44	41	27	68	66	61
Sunday 10/12/17	42	39	28	67	64	62
Monday 11/12/17	47	40	26	67	66	64
Tuesday 12/12/17	48	39	28	67	66	64
Wednesday 13/12/17	48	40	30	67	64	63
Thursday 14/12/17	48	39	29	67	66	63
Friday 15/12/17	50			67		
Total	**48**	**40**	**28**	**67**	**65**	**63**

Note: 1) The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday and Public Holidays, Evening 6 pm to 10 pm and Night as the remaining periods

Table 2-5 Summary of M2 noise monitoring results (road traffic), dBA

Date	Road traffic noise level $L_{Aeq(period)}$		Road traffic noise level $L_{Aeq(1hour)}$	
	Day (15 hour)	Night (9 hour)	Day	Night
Thursday 7/12/17	67	63	68	67
Friday 8/12/17	68	62	69	64
Saturday 9/12/17	67	60	69	62
Sunday 10/12/17	66	62	67	66
Monday 11/12/17	67	64	68	68
Tuesday 12/12/17	67	64	68	67
Wednesday 13/12/17	67	63	68	67
Thursday 14/12/17	67	63	68	67
Friday 15/12/17	67	-	68	-
Total[1]	**67**	**63**	**68**	**67**

Notes: 1) Average of the weekday road traffic noise levels

3. Compliance criteria

3.1 State legislation

3.1.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* is the key piece of environment protection legislation to control noise emission on the environment.

3.1.2 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements includes the following noise requirements:

- an assessment of the construction noise vibration impacts with consideration to the *Interim Construction Noise Guideline* (DECCW, 2009) and *Assessing Vibration: A Technical Guideline* 2006
- an assessment of the operational noise impacts from the school with consideration to the *NSW Noise Policy for Industry* (EPA, 2017)
- *Development Near Rail Corridors and Busy Roads – Interim Guideline* (Department of Planning 2008)

3.2 Construction

3.2.1 Construction noise

The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) guideline recommends standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays. These hours are not mandatory and the ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming that all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant or structures that police or other authorities determine to require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm

- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at sensitive receivers to below the noise management levels outside of the recommended standard construction hours.

Construction noise management levels at sensitive residential receivers are provided in Table 3-1. The construction noise management levels during recommended standard hours represent a noise level that, if exceeded, would require management measures including:

- reasonable and feasible work practices
- contact with the residences to inform them of the nature or works to be carried out, the expected noise levels and durations and contact details.

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The noise affected construction noise management levels during recommended standard hours is not intended as a noise limit but rather a level where noise management is required and as such should not be included as a noise limit in the environmental protection license.

Other sensitive receivers relevant to this Project includes the C3 Church Wollondilly to the north-west of the site which is considered a place of worship and commercial/industrial receivers within the study area (approximately 400 m radius of the subject site). It is unclear whether there are commercial uses within the industrial areas located within the study area. As such, the lower of the commercial land use and industrial land use criteria, being the commercial criteria, has been used to be conservative. The ICNG noise management level for commercial premises is $L_{Aeq(15min)}$ 70 dBA (external).

The ICNG noise management level for places of worship is $L_{Aeq(15min)}$ 45 dBA which applies inside the building. A 10 dBA addition is applied to determine the external noise criteria.

Table 3-1 Residential construction noise management levels, dBA

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	Noise affected: RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • the proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
		• times identified by the community when they are less sensitive to noise (such as before and after school, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected: RBL + 5 dBA	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 measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

A summary of the construction noise management levels are provided in Table 3-2. Note should be made that no construction works are proposed outside of the recommended standard hours.

Table 3-2 Proposal construction noise management levels, dBA

Receiver type	Construction noise management levels, $L_{Aeq(15\ min)}$				
	Standard construction hours		Outside standard construction hours		
	Noise affected	Highly noise affected	Day	Evening	Night
Residential receivers (NCA1)	49	75	44	40	35
Residential receivers (NCA2)	58	75	53	45	35
Commercial	70 (external)				
Place of Worship	55 (external) or 45 (internal)				

3.2.2 Construction vibration

Human comfort

Vibration is assessed based on the criteria in *Assessing Vibration: a technical guideline* (DEC 2006). *British Standard (BS) 6472 – 2008, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* is recognised by the guideline as the preferred standard for assessing the 'human comfort criteria'. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table 3-3 for sensitive receivers.

Whilst the assessment of response to vibration in *BS 6472-1:1992* is based on vibration dose value and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak particle velocity, since this parameter is likely

to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration,* as shown below in Table 3-4.

Table 3-3 Human comfort intermittent vibration dose values (BS 6472-1992)

Receiver type	Period	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day	0.2	0.4
	Night	0.13	0.26

Note 1: Day is between 7 am and 10 pm and night is between 10 pm and 7 am

Table 3-4 Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

Structural damage

BS 7385 is used to assess the effects of transient vibration on structures. The criteria provided in BS 7385 are presented in Table 3-5. The criteria provided in BS 7385 should be applied to all structures as BS 7385 states *'a building of historical value should not (unless it is structurally unsound) to be assumed to be more sensitive'*. Structures of significance should be assessed on a case-by-case basis if a dilapidation report indicates that they are structurally unsound.

Table 3-5 Transient vibration guide values – minimal risk of cosmetic damage (BS 7385-2)

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	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
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.

Summary of vibration criteria

A summary of vibration screening criteria is provided in Table 3-6. The criteria are provided as a guide for determining potential human comfort or structural damage impacted buffer distances

to determine if further detailed investigation is required. The levels provided in Table 3-6 are recommended screening criteria for the impact assessment. During construction of the Project compliance monitoring should be assed against all criteria in Section 3.2.2.

Table 3-6 Recommended screening vibration criteria

Receiver type	Criteria type	Peak particle velocity screening criteria	
		Day	Night
Residential	Human comfort	1 mm/s	0.3 mm/s
	Structural damage	15 mm/s[1]	

Note 1: Higher magnitude of vibration is acceptable at higher frequencies

3.3 Operational noise emission criteria

3.3.1 NSW Department of Education (DG11)

The Department of Education Design Guideline 11 (DG11) provides guidance on the noise emission and noise intrusion guidance for educational developments. The Wollondilly City Council does not provide any specific criteria for the assessment of noise emission from educational establishments, so the NPI criteria will be used.

Emission Criteria

'Generally noise emission to the environment from mechanical services noise sources (such as air conditioners) are the subject of a development consent conditions. In NSW the development consent conditions will refer to the Industrial Noise Policy (INP) or Local Council requirement.

Where no condition regarding noise sources exists for a school development, noise emission from such sources should be designed, in-principle, to satisfy the requirements of the Industrial Noise Policy.

Noise associated with school activity (such as music or sport within a hall) are not a stationary noise source and is not subject to the INP requirements.'

Note should be made that the Industrial Noise Policy (EPA 2000) has been superseded by the Noise Policy for Industry (EPA 2017).

3.3.2 Noise Policy for Industry (EPA, 2017)

The SEARs refers to the Industrial Noise Policy (now superseded by the Noise Policy for Industry) which can be used for guidance on the assessment of operational noise impacts. The guideline includes both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver.

The NPI project noise trigger levels provide an objective for assessing a proposal and are not mandatory limits required by legislation. The project noise trigger levels assist the regulatory authorities to establish licensing conditions. Where project noise trigger levels are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. In circumstances where noise criteria cannot be achieved, residual noise impacts are used to assess noise impacts and manage noise from the site in negotiation between the regulatory authority and community. The regulatory authority then sets statutory compliance levels that reflect the achievable and agreed noise limits from the development.

The intrusiveness noise level controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity noise level limit the total level of extraneous noise for all receiver types. Both levels are calculated and the lower of the two in each time period is set as the project noise trigger level. The intrusiveness noise level is assessed over a 15 minute period however the amenity noise level is assessed over the day, evening or night time period. For the purposes of assessment to standardise the approach the NPI recommends that the $L_{Aeq(15min)} = L_{Aeq(period)} + 3$ dBA unless an alternative approach can be justified.

3.3.3 Intrusiveness noise level

The intrusiveness noise level is determined by a 5 dB addition to the measured or adopted background noise level with a minimum intrusiveness noise level of 35 dBA for the evening and night period and 40 dBA for the day period. The NPI recommends that the intrusiveness noise level for the evening and day period should not exceed the daytime period. The intrusiveness noise levels are only applicable to residential receivers.

3.3.4 Project amenity noise level

The recommended amenity noise level applies to all industrial noise in the area which when combined should remain below the recommended amenity noise level. The recommended amenity noise level represents the total industrial noise at a receiver location and a Project Amenity Noise Level is set at 5 dBA below the recommended amenity noise level.

Residential receiver areas are characterised into ‘urban’, ‘suburban’, ‘rural’ or other categories based on land uses and the existing level of noise from industry and road traffic. With consideration to the NPI ‘noise amenity area’ classification, the residential receivers identified for this assessment should be classified as ‘Rural Residential’ and “Suburban Residential” and all other nearby commercial sites are classified as ‘Commercial premises’.

3.4 Summary of project noise trigger levels

For residential receivers, the project noise trigger levels are provided in Table 3-7. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness and project amenity noise level. Daytime and evening time project noise trigger levels should aim to be achieved since the school will operate during these time periods.

Table 3-7 Project noise trigger levels – residential noise receivers, dBA

Criteria $L_{Aeq(15min)}$	Residential Receivers		
	Day	Evening	Night
Intrusiveness noise level (NCA1)	44	40	35
Intrusiveness noise level (NCA2)	53	45	35
Project amenity noise level (rural residential)	48	43	38
Project amenity noise level (suburban residential)	53	48	43
Project noise trigger levels (NCA1)	44	40	35
Project noise trigger levels (NCA2)	53	45	35

Notes:

- The NPI defines Day as 7 am to 6 pm Monday to Friday and 8 am to 1 pm Sunday and Public Holidays, Evening 6 pm to 10 pm and Night as the remaining periods.

- Where background noise levels are below 30 dBA for the evening and night periods, the minimum assumed rating background noise level is 30 dBA. As such, the minimum project intrusiveness noise level is 35 dBA.
- Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.

For non-residential receivers, the project noise trigger levels are provided in Table 3-8 below. It is unclear whether there are commercial land uses within the industrial areas located within the study area. As such, the lower of the two criteria (commercial) has been used to be conservative.

Table 3-8 Project noise trigger levels – non-residential receivers

Receiver	Non-residential receivers	
	Time of day	L_{Aeq}, dBA
Commercial premises	When in use	65 (external)
Place of worship	When in use	40 (internal) 50 (external)

3.4.1 Meteorological conditions

Noise propagation can be enhanced by particular wind conditions and temperature inversions. The NPI states:

"Where inversion conditions are predicted for at least 30% (or approximately 2 nights per week) of the total night time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment.

Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 per cent of the time or more in any assessment period (day, evening, night) in any season."

Meteorological modelling has not been undertaken, however temperature inversions are not likely to occur during the daytime period as they generally occur during the night-time period. To simulate worst case meteorological conditions for noise propagation during daytime hours, a moderate temperature inversion has been included within the calculations (ISO 9613). For the operations during the evening, to simulate worst-case meteorological conditions, the Concawe F-class algorithm has been included in the calculations to represent worst-case conditions for noise propagation.

Predictions are carried out assuming an average temperature of 10°C and average humidity of 70%.

3.4.2 Modifying factor adjustments

The NPI requires that modifying factor adjustments are applied if the noise sources contain tonal, intermittent or low frequency characteristics, which have the potential to increase annoyance. The modifying factor adjustments are detailed in Table 3-9.

Table 3-9 Modifying factor adjustments

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: •5 dB or more if the centre frequency of the band containing the tone is above 400 Hz •8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive •15 dB or more if the centre frequency of the band containing the tone is below 160 Hz.	5 dBA[2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more.	5 dBA[2]
Impulsive noise	A-weighted fast response and impulse response	If the difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB.	Apply the difference in measured noise levels as the correction up to a maximum of 5 dBA
Intermittent noise	Subjectively assessed	When the night-time noise level drops to that of the background noise level with a noticeable change in noise level of at least 5 dBA.	5 dBA
Duration[3]	If the duration of the noise event in any 24 hour period is as follows: •1.0 to 2.5 hours then increase the noise criteria by 2 dBA day and 0 dBA night •15 minutes to 1 hour then increase the noise criteria by 5 dBA day and 0 dBA night •6 minutes to 15 minutes then increase the noise criteria by 7 dBA day and 2 dBA night •1.5 minutes to 6 minutes then increase the noise criteria by 15 dBA day and 5 dBA night •less than 1.5 minutes then increase the noise criteria by 20 dBA day and 10 dBA night.		

Note 1: Where two or more modifying factors are present the maximum correction is limited to 10 dBA.

Note 2: Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

Note 3: Duration correction is a negative correction which increases the noise criteria

Sleep disturbance

The NPI (EPA 2017) recommends a detailed maximum noise level event assessment be undertaken where night-time noise levels from a development exceed the following levels when assessed externally at the nearest residential location:

- $L_{Aeq(15min)}$ 40 dBA or the prevailing RBL + 5 dBA (whichever is greater); and/or
- L_{AFmax} 52 dBA or the prevailing RBL + 15 dBA (whichever is greater)

Sleep disturbance is not anticipated from the school operations as it is not expected to generate significant noise after 10 pm or before 7 am.

3.4.3 State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

The SEPP (2017) falls under the Environmental Planning and Assessment Act 1979, and outlines criteria for the assessment of noise emission and noise intrusion for various types of educational developments. Schedule 2 presents specific noise emission criteria for the

development of existing schools. This criteria is consistent with the NPI (EPA 2017) intrusive criteria presented above.

Schedule 2 Schools – complying development

6 Noise

A new building or (if the development is an alteration or addition to an existing building for the propose of changing its use) an existing building that is to be used for the propose of a school or school-based child care must be designed so as not to emit noise exceeding an LAeq of 5 dB(A) above the background noise when measured at any lot boundary.

3.4.4 Proposal specific operational noise criteria

The operational noise criteria for sensitive receivers identified in the vicinity of the school are summarised in Table 3-10.

Table 3-10 Operational noise criteria

Receiver	Time period	Project $L_{Aeq(15\ min)}$ specific noise criteria (external), dBA
Residential receiver (NCA1)	Day	44
	Evening	40
	Night	35
Residential receiver (NCA2)	Day	53
	Evening	45
	Night	35
Place of worship	When in use	50
Active recreation	When in use	55
Commercial	When in use	65
Industrial	When in use	70

Note: The INP defines day, evening and night time periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
- Evening: the period from 6 pm to 10 pm.
- Night: the remaining period.

3.5 Noise intrusion criteria

3.5.1 NSW Department of Education DG11

The Department of Education Design Guideline 11 (DG11) provides guidance on the noise emission and noise intrusion guidance for educational developments and is reproduced below.

11.02 Internal Noise Levels

Road Noise for general learning areas, music, drama, movement studios and halls shall be assessed consistent with the requirements of State Environmental Planning Policy (Infrastructure) 2007 – regulation 102. An assessment should be undertaken where directed for any site impacted by traffic noise. Generally it is recommended for all sites impacted by noise from roads with greater than 20,000 vehicles AADT and required for all sites impacted by noise from roads with greater than 40,000 vehicles AADT. The guideline internal noise levels presented in Acoustic Performance Guidelines (section 11.06) is to be used in the assessment.

11.06 Acoustic Performance Guidelines

Room	Internal noise level (dB LAeq)	Reverberation time, s RT60(Av 500 Hz and 1000 Hz)
Libraries – general areas	40	< 0.6
Teaching spaces – secondary schools	35	< 0.5
Open plan teaching areas	40	<0.8
Staff common rooms	40	<0.6
Music practice rooms	35	Note 1
Music studios	30	Note 1
Laboratories – teaching	40	<0.7
Kitchens	50	-
Manual arts workshops	40	Minimise
Toilet/change/showers	50	-

Argyle Street does not have an annual average daily traffic volume of greater than 20,000 vehicles and as such, these performance guidelines do not apply but may be used as a reference.

3.5.2 Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008)

The SEARs refers to the *Development Near Rail Corridors and Busy Roads – Interim Guideline* (Department of Planning, 2008) which states:

"Strategic site selection from the perspective of road and rail corridors for schools and childcare centres is particularly important as young people are generally more sensitive to the effects of noise and adverse air quality than adults.

Where new schools and childcare centres are being considered, the design should ensure that there is sufficient separation from 'busy' roads and rail corridors to avoid adverse noise and air quality impacts."

and

*"**Infrastructure SEPP***

Clauses: Road Corridors

***Clause 102** : development for any of the following purposes that is on land in or adjacent to a road corridor 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 available on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*

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

A "busy road" is specified in Clause 102 Infrastructure SEPP: a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA). "Any other road" is a road with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based

on the traffic volume data published on the website of the RTA). For road corridors with an annual average daily traffic volume of less than 20,000 vehicles, these guidelines do not apply.

The guideline recommends an internal noise level for educational institutions of $L_{Aeq(1hr)}$ 40 dBA. This is consistent with the *Road Noise Policy* (DECCW, 2011) and the State Environmental Planning Policy (Infrastructure) 2007. The *Road Noise Policy* (DECCW, 2011) also referenced the maximum levels shown in AS 2107 for spaces other than classrooms, which is consistent with the Acoustic Performance Guidelines of *DG11* (DET).

The busiest road directly adjacent to Picton High School, being Argyle Road (Old Hume Highway), has an annual average daily traffic volume of less than 12,000 vehicles. As such, the noise intrusion guidelines within the Development Near Rail Corridors and Busy Roads – Interim Guideline do not apply as Argyle Street is not considered a "busy road" or "any other road".

3.5.3 State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

The SEPP (2017) falls under the Environmental Planning and Assessment Act 1979, and outlines criteria for the assessment of noise emission and noise intrusion for various types of educational developments. Schedule 4 of the policy outline noise intrusion recommendations for development of existing schools. In the absence of specific noise intrusion criteria, those outlined in the sections above will be used.

Schedule 4 Schools – design quality principles

Principle 5 – amenity

Schools located near busy roads or near rail corridors should incorporate appropriate noise mitigation measures to ensure a high level of amenity for occupants.

3.6 Road traffic noise

3.6.1 Traffic generation

The *Road Noise Policy* (DECCW 2011) provides traffic noise criteria for sensitive receivers in the vicinity of existing roads (Table 3-11). The criteria are applied to traffic on public roads to identify potential road traffic impacts and the requirement for reasonable and feasible mitigation measures.

The *Road Noise Policy* (DECCW 2011) application notes state that *"for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion."*

If road traffic noise increases during operation and construction work is within 2 dBA of current levels then the objectives of the *Road Noise Policy* (DECCW 2011) are met and no specific mitigation measures are required.

Table 3-11 Road traffic noise criteria, dBA

Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on existing sub-arterial roads generated by land use developments	60 $L_{Aeq(15\ hr)}$	55 $L_{Aeq(9\ hr)}$
Existing residence affected by additional traffic on existing local roads generated by land use developments	55 $L_{Aeq(1\ hr)}$	50 $L_{Aeq(1\ hr)}$

Argyle Street (to the west of Picton High School) can be classified as a sub-arterial road and Wonga Road (to the south of Picton High School) can be classified as a local road.

4. Assessment of impacts

4.1 Construction noise

4.1.1 Construction activities and sources

Noise emission from construction works have been assessed at the surrounding potentially affected receivers during the standard construction hours. A quantitative assessment has been undertaken with consideration to the ICNG.

Construction activities are expected to occur over eighteen (18) months and will include the following activities:

- Demolition of existing buildings/structures – 1 month
- Clearing works – 1 month
- Excavation and bulk earthworks – 6 months
- Construction works – 10 months

4.1.2 Construction hours

It is anticipated that the proposal would typically be completed within the following hours:

- Monday to Friday: 7 am to 6 pm.
- Saturday: 7 am to 1 pm.
- Sunday and Public Holidays: no work.

Construction traffic movements would primarily be associated with the transportation of construction machinery and equipment to the proposal site and the transportation of material.

4.1.3 Construction plant and equipment

Plant and equipment needed for the proposal would be determined during the construction planning phase. The anticipated plant and equipment used for the proposal is shown in Table 4-1 with the corresponding noise emission sound power levels. Noise level data has been obtained from *AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites*. Other equipment may be used however it is anticipated that they would produce similar noise emissions.

The magnitude of off-site noise impact associated with construction will be dependent upon a number of factors:

- The intensity and location of construction activities.
- The type of equipment used.
- Existing background noise levels.
- Intervening terrain and structures.
- The prevailing weather conditions.

Construction machinery would likely move about the study area altering noise impacts with respect to individual receivers. During any given period, the machinery items to be used in the study area would operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time and certain types of construction machinery would be

present in the study area for only brief periods during construction. Therefore noise predictions are considered conservative.

Table 4-1 Construction plant and equipment sound power levels, dBA

Plant and equipment	Sound power level [dBA]
Excavator	108
Jackhammer	121
Air compressor	103
Bulldozer	113
Concrete pump	112
Crane	108
Front end loader	114
Grader	112
Vibrating roller	110
Scraper	114
Truck	110
Concrete truck	107
Hand tools	105
Welder	105

To simulate the worst-case scenario, the two loudest items of mechanical plant have been modelled as a single point source to calculate the activity sound power level for each construction scenario. This is considered conservative as it is likely that there will be greater distances between the items of mechanical plant during construction. A summary of the construction scenarios associated with the Project is presented in Table 4-2 below.

Table 4-2 Construction scenarios and activity sound power level

Construction Scenario	Construction activity	Construction area	Construction hours	Plant and equipment used	Activity sound power level [dBA]
Construction Scenario 1 (CS1)	Demolition of existing buildings	Existing school building areas	Standard construction hours	Excavators, crane, loader, trucks, hand tools	115
Construction Scenario 2 (CS2)	Jackhammer works	Existing school building areas	Standard construction hours	Jackhammer	121
Construction Scenario 3 (CS3)	Clearing works	Existing school building areas	Standard construction hours	Excavators, crane, dozer, loader, trucks,	115
Construction Scenario 4 (CS4)	Excavation and bulk earthworks	Existing school building areas	Standard construction hours	Excavators, loader, dozer, grader, scraper, trucks	117
Construction Scenario 5 (CS5)	Construction works	Existing school building areas	Standard construction hours	Concrete trucks, crane, trucks, hand, roller, tools, generator, compressor, welder	112
Construction Scenario 6 (CS6)	New service roads and carpark	South-eastern corner of school/Wonga Rd	Standard construction hours	Excavator, grader, roller, dozer, trucks, scraper	117

4.1.4 Construction assessment methodology

The noise emissions from construction activities have been assessed at the surrounding sensitive receivers. A quantitative assessment has been undertaken with consideration to the ICNG.

For each construction activity, the potential noise impacts on the surrounding sensitive receivers have been predicted. Noise modelling was undertaken using SoundPLAN version 7.4 which calculates environmental noise propagation according to *ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors.* The following assumptions and calculation parameters were used in the noise model:

- Land was modelled assuming a mixture of hard and soft ground with a ground absorption coefficient of 0.70. This has been considered representative of the grassy, agricultural land surrounding the site
- The noise model was used to predict noise levels during a typical worst case 15 minute period of operation where the modelled equipment is operating at full power
- Meteorological conditions was based on ISO 9613-2 algorithm with moderate temperature inversions for noise propagation (daytime conditions)
- Atmospheric absorption was based on an average temperature of 10 °C and an average humidity of 70%

4.1.5 Assessment of construction noise impacts

Where the predicted $L_{Aeq(15\ minute)}$ noise level is greater than the noise management levels, all feasible and reasonable work practices should be applied, however, it is unlikely that mitigation measures would reduce the predicted noise levels below the management levels. The magnitudes of construction noise levels are dependent on the duration of construction, the type of equipment, location of activities, the surrounding environment's background noise levels and the weather conditions during construction. The predicted noise levels are generally conservative as the construction noise model predicts the worse-case 15 minute scenario and these levels may not represent the actual noise emission experienced by the community throughout the entire construction period.

The residential noise management level of 49 dBA for NCA1 and 58 dBA for NCA2 during standard construction hours is predicted to be exceeded at the majority of residences located within 500 m of the construction works at some stage during construction.

A summary of the exceedances of the relevant noise management levels for each construction scenario (CS) is provided in Table 4-3 below, along with the relevant noise management level (NML). The predicted noise levels is a maximum noise level from the shortest distance from the receiver to the relevant construction activity.

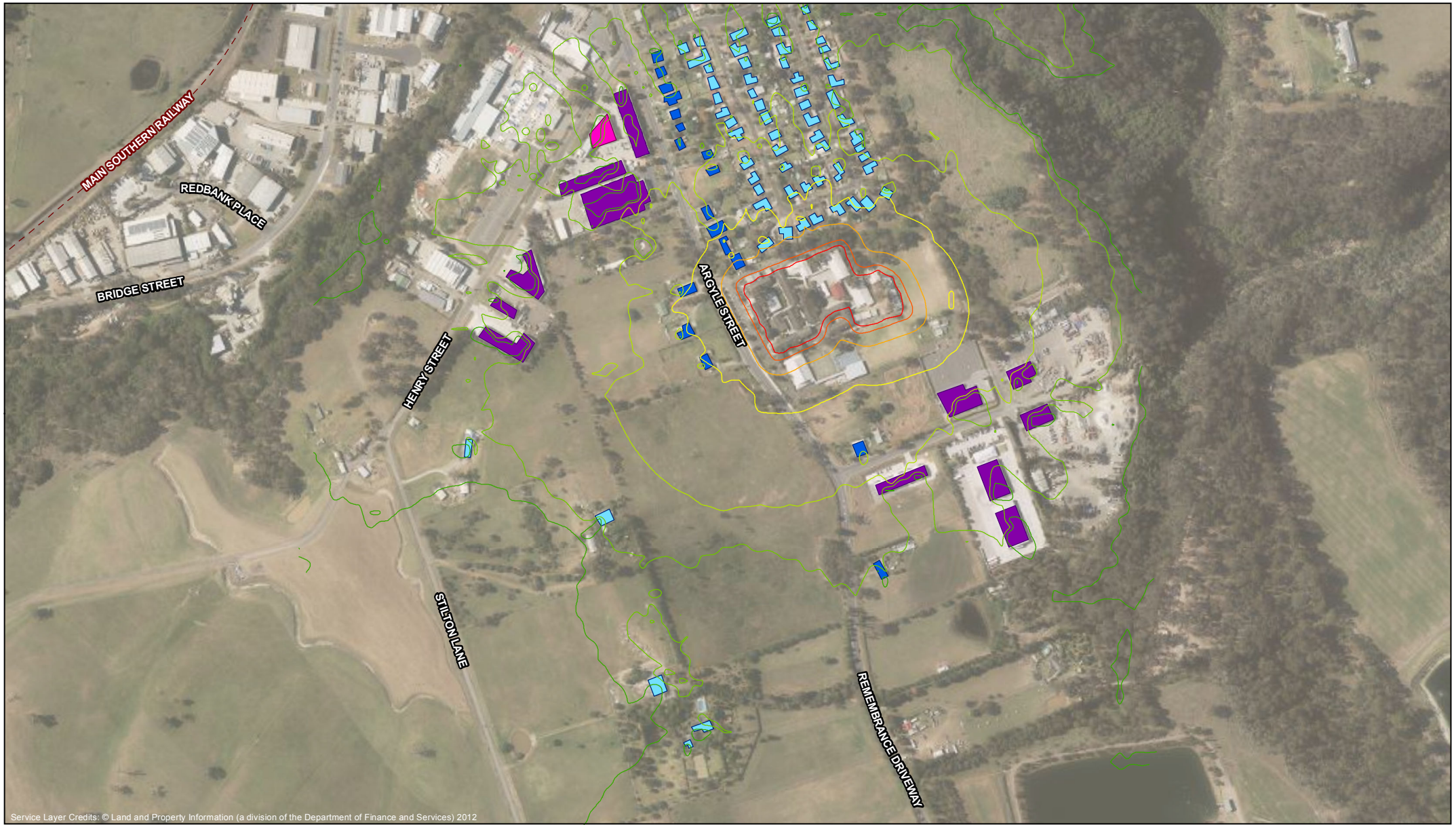
The predicted construction noise levels at all receivers within the study area are presented in Appendix C. All exceedances of the noise management levels at sensitive receivers are presented in Appendix D.

Table 4-3 Number of receivers exceeding the construction noise management levels

Criteria	External Criteria	CS01	CS02	CS03	CS04	CS05	CS06
Noise Management Level at Residences	49 dBA (NCA1) 58 dBA (NCA2)	68	76	60	68	44	56
Highly Noise Affected	75 dBA	4	8	1	6	1	2
Commercial	70 dBA	0	0	0	0	0	3
Places of worship	55 dBA	0	1	1	0	0	0

The worst-affected receivers are the residential receivers directly adjacent to the northern boundary of Picton High School, being the residents located at 468 Argyle Street and 27-41 Coachwood Crescent. Further, the number of exceedances will be greatest during any construction works that include the use of a jackhammer. A noise emission map for noisiest construction works, being Construction Scenario 2 and Construction Scenario CS01/CS04, are presented in Figure 4.1 and Figure 4-2 below. Additionally, a noise emission map for the construction of the new service roads in the south-eastern corner of the school (Construction Scenario 6) is presented in Figure 4-3 below.

Mitigation measures to manage noise impacts have been recommended and are provided in Section 5.1.



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Predicted $L_{Aeq(15min)}$ noise contours

- 40
- 50
- 60
- 70
- 80
- 90
- 100

Billard Leece Partnership Pty Ltd
Picton High School Redevelopment - Acoustics

Job Number 21-27011
Revision A
Date 05 Apr 2018

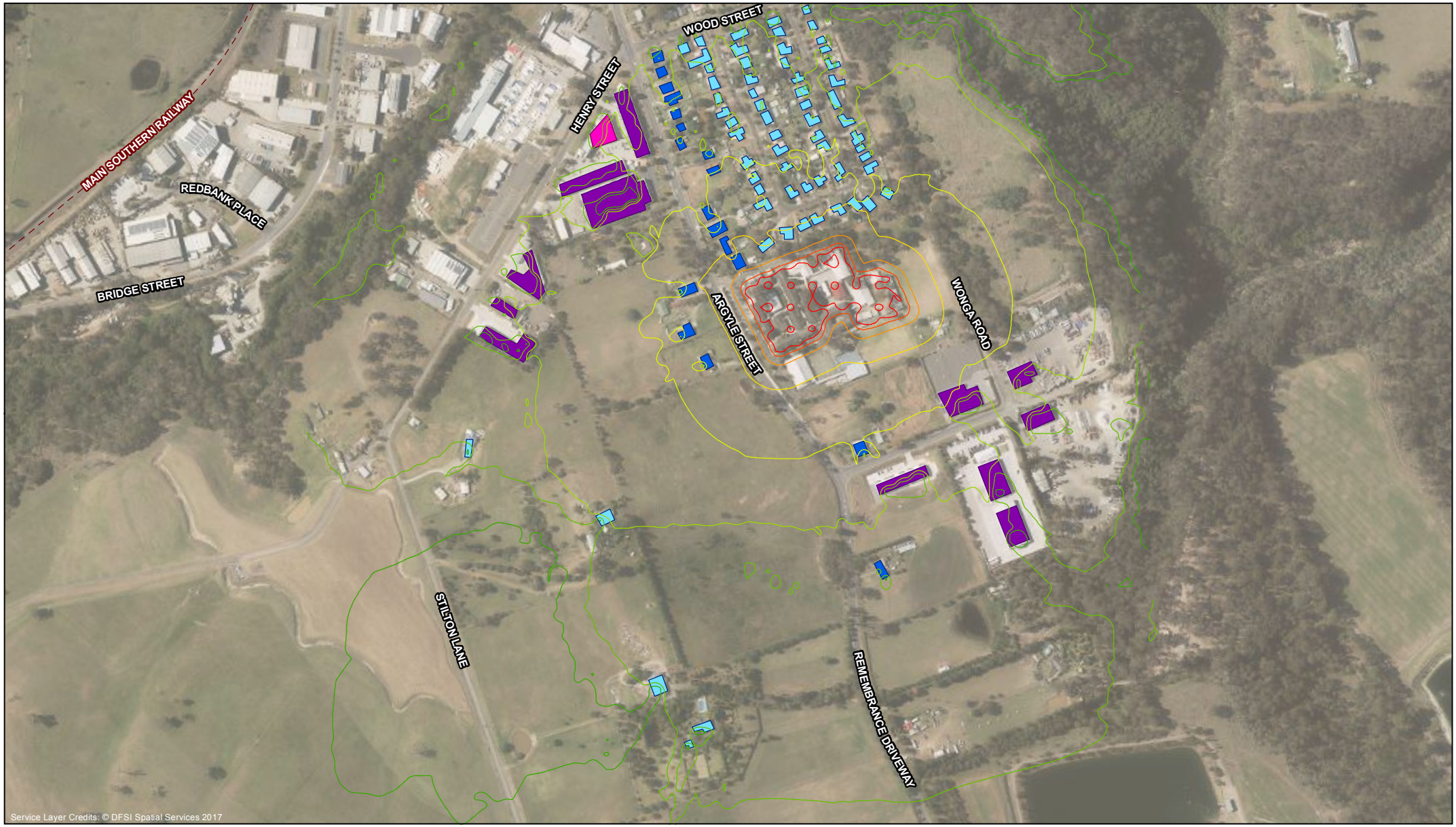
$L_{Aeq(15min)}$ noise emission map - Construction Scenario 2 (jackhammering)

Figure 4-1

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 2)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Predicted $L_{Aeq(15min)}$ noise contours

- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

Billard Leece Partnership Pty Ltd
Picton High School Redevelopment - Acoustics

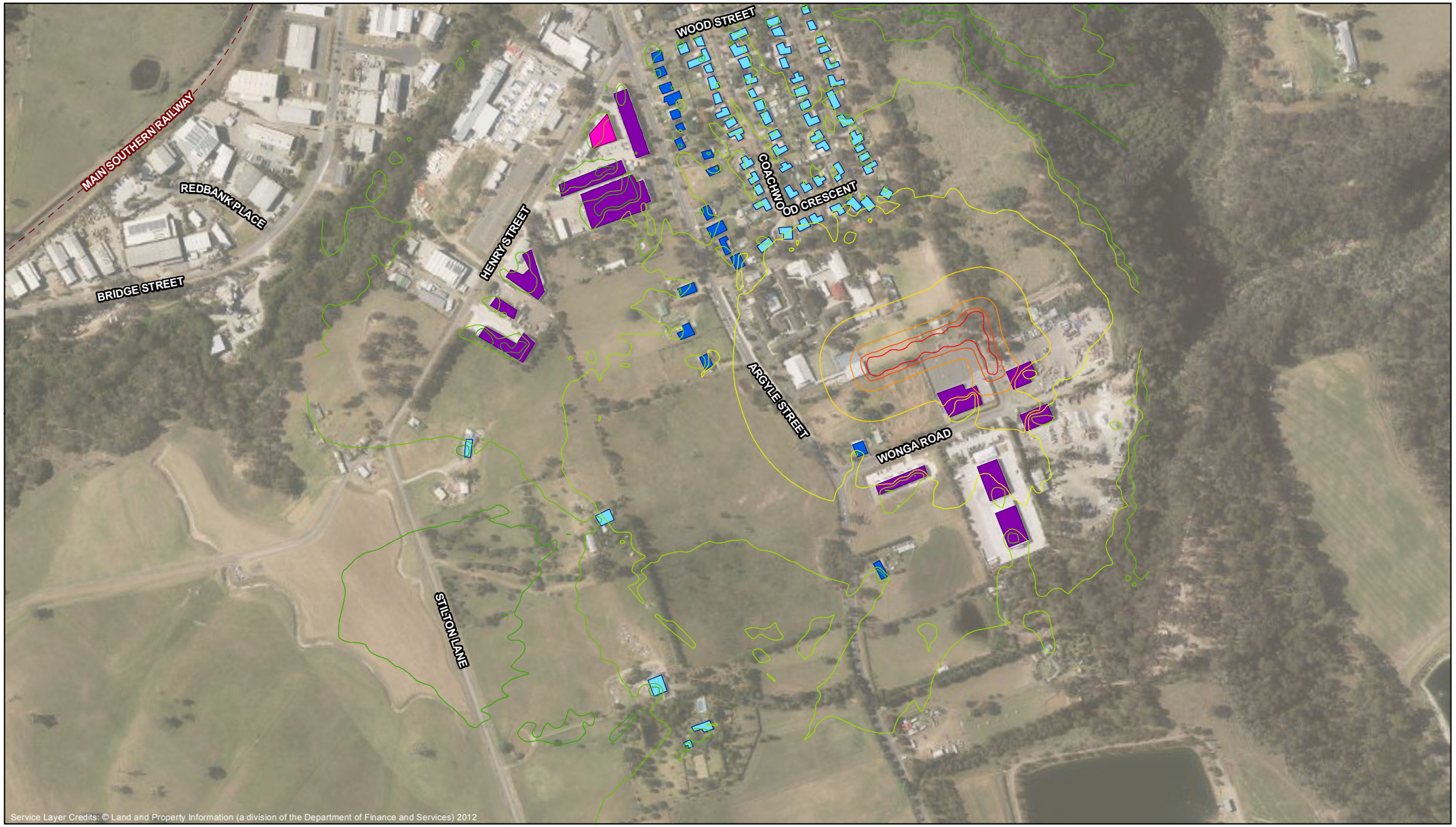
Job Number 21-27011
Revision A
Date 05 Apr 2018

$L_{Aeq(15min)}$ noise emission map - Construction Scenario 1 and 4 (demolition/excavation) Figure 4-2

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 3)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Predicted $L_{Aeq(15min)}$ noise contours

- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

Billard Leece Partnership Pty Ltd
Picton High School Redevelopment - Acoustics

Job Number 21-27011
Revision A
Date 05 Apr 2018

$L_{Aeq(15min)}$ noise emission map - Construction Scenario 6 (new service roads)

Figure 4-3

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 4)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice

4.1.6 Sleep disturbance

All construction activity is expected to occur during recommended standard hours therefore sleep disturbance impacts are not expected.

4.1.7 Construction traffic impacts

The application notes for the *Road Noise Policy* state that *"for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion."* This is also considered to be applicable for construction noise therefore if road traffic noise increases from construction is within 2 dBA of current levels then the objectives on the *Road Noise Policy* are achieved.

A significant increase in traffic volumes would be needed in order to increase road traffic noise by 2 dBA (a doubling in traffic corresponds to an approximate 3 dBA increase).

Construction work would generate light and heavy vehicle movements associated with employees, deliveries, transportation of machinery, materials and equipment to work sites.

The following maximum traffic movements are anticipated during the peak period of construction (utilising Argyle Street and Wonga Road):

- 30 light vehicles per day
- 15 heavy vehicles per day

The increase in vehicle movements would be limited to the period of construction. Noise level increases due to construction traffic would not be significant when compared with the existing vehicle numbers along Argyle Street during the day and as such, the increase in traffic noise levels is predicted to comply with the Road Noise Policy.

The existing traffic volumes along Wonga Road are not currently available. However, based on a maximum of 3 light vehicles and 3 heavy vehicle movements an hour along Wonga Road, the predicted $L_{Aeq(1hour)}$) noise level at 500 Argyle Street (R76) is 49 dBA and is not predicted to exceed the Road Noise Policy criteria of $L_{Aeq(1hour)}$ 55 dBA for a local road.

4.2 Construction vibration impacts

Assessment of vibration has been conducted to determine potential impacts with consideration to structural damage and human comfort criteria. Expected vibration generating activities include vibratory rolling works during the construction of the service roads and the use of excavators, dozers and graders during bulk earthworks.

4.2.1 Vibration source levels

Typical vibration levels for vibration generating equipment are detailed in Table 4-4.

Table 4-4 Vibration generating equipment

Equipment	Peak particle velocity source level (mm/s)	Data reference
Roller	5 to 7 at 10 m	*Environmental Noise Management Manual* (RTA, 2001)
Dozer	2.5 to 4 at 10 m	
Excavator	2.5 at 8 m	Tynan, A.E. *Ground Vibration Damaging Effects to Buildings,* Australian Road Research Board 1973
Grader	2.5 at 8 m	

Energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- the efficiency of the energy transfer mechanism of the equipment (i.e impulsive; reciprocating, rolling or rotating equipment)
- the frequency content
- the impact medium stiffness
- the type of wave (surface or body)
- the ground type and topography.

Due to the above factors, there is inherent variability in ground vibration predictions without site-specific measurement data. Typical rate of vibration attenuation can be calculated from the following regression analysis formula:

$V = kD^{-n}$, *where*

- V = Peak Particle Velocity
- D = Distance
- k = site constant (if k is unknown, the site constant can be calculated from the other known parameters)
- n = site attenuation exponent

The value of the site attenuation exponent, n, depends on the soil and ground type, *Construction noise and vibration impact on sensitive premises, Proceedings of Acoustics* (Roberts, 2009) suggests the following values for *n*:

- 1.4 for weak or soft soils such as loose soils, mud, loose beach sand, dune sand and ploughed ground
- 1.3 for competent soils such as most sands, sandy clays, gravel, silts and weathered rock
- 1.1 for hard soils such as dense compacted sand, dry consolidated clay and some exposed rocks
- 1.0 for hard competent rock such as bedrock and freshly exposed hard rock.

A site attenuation exponent value of 1.3 has been assumed for this assessment.

4.2.2 Assessment of vibration impacts

Vibration levels at various distances from plant and equipment are provided in Table 4-5. Buffer distances to comply with the recommended vibration screening criteria (refer to Table 3-6) are presented in Table 4-6.

Human comfort impacts are dependent on the type of equipment operating and distance to construction works. For continuous vibration, the recommended screening criteria for human comfort are 1.0 mm/s during the day period.

Construction activities on the site have the potential to exceed the human comfort criteria at receivers directly adjacent to the site and within the human comfort buffer distances. Mitigation measures have been recommended in Section 5.1 to manage human comfort vibration impacts.

No structural damage vibration impacts are expected at sensitive receiver locations as construction activities are not expected to occur within the structural damage buffer distances.

Table 4-5 Typical vibration levels at distances

Equipment	Peak particle velocity (mm/s) at distance				
	10 m	20 m	30 m	40 m	50 m
7t Roller	6.0	2.4	1.4	1.0	0.7
Dozer	3.3	1.3	0.8	0.5	0.4
Excavator	1.6	0.7	0.4	0.2	0.1
Grader	2.0	1.0	0.7	0.5	0.4

Table 4-6 Vibration buffer distances to comply with recommended peak particle velocity screening criteria

Equipment	Human comfort buffer distance, m Screening criteria 1 mm/s	Structural damage buffer distance, m Screening criteria 15 mm/s
7t Roller	40	5
Dozer	25	4
Excavator	15	3
Grader	15	3

Vibratory rolling activities are proposed along the southern and south-western boundary of the site (upgrade of Wonga Road and construction of new service roads). No residences are located within 40 metres of these works and as such no human comfort or structural damage impacts are expected. No residences are located within 15 metres of construction works including the use of a grader or excavator and as such no human comfort or structural damage impacts are expected from these works. Excavation works may occur within 40 metres of nearby residents at 27-35 Coachwood Crescent and as such, human comfort impacts may be expected during excavation works. However, vibration impacts during excavation works are likely to be short in duration and no structural damage is expected at nearby residences as no residential structures are located within 5 metres of the proposed excavation works.

4.3 Operational noise

Operational noise has been assessed for the following scenarios:

- mechanical plant
- use of the PA system and period alarm
- community use of the school for special events (outside of school hours, including the evening period).

NSW Department of Education *DG11 Acoustics Section 11.04 Noise Emission (To The Environment)* states *"Noise associated with school activity (such as music or sport within a hall) are not a stationary noise source and is not subject to the Industrial Noise Policy (EPA 2000) requirements".*

The NPI (supersedes the INP) has been used to assess noise from the school hall during special events as it is a requirement of the SEARs. However noise from the school hall and playgrounds associated with general school activities including music, sport or playground noise has not been assessed, as it is not a specific requirement of the SEARs.

4.3.1 Assessment parameters

Noise modelling was undertaken using CadnaA 2017. CadnaA is a computer program for the calculation, assessment and prognosis of noise exposure. Noise modelling was undertaken using CadnaA 2017 which calculates environmental noise propagation according to *ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors.* The following tasks were undertaken as part of the operational noise impact assessment:

- Noise criteria was determined based on the sensitive receiver type and time of day
- Appropriate site specific conditions for the noise model were developed
- The sound power levels of each activity was established
- The impacts on sensitive receivers surrounding the site were assessed

The following noise modelling assumptions were made to establish site specific conditions:

- surrounding land was modelled assuming a mixture of hard and soft ground with a ground absorption coefficient of 0.5
- terrain topography with a 1 metre resolution of the study area was used to generate the site used to predict noise levels.
- A moderate temperature inversion during the day period according to ISO 9613-2 algorithm for noise propagation.
- Worst-case Concawe F- Class meteorological conditions used in the noise model during the evening period to calculate noise propagation between 6 pm and 10 pm.
- atmospheric air absorption was based on an average temperature of 10ºC and an average humidity of 70%.

4.3.2 Noise generating equipment – school hours

Noise sources on-site are provided in Table 4-7 for each activity. The operation of mechanical plant and the PA system/period alarm will occur during the daytime hours, being 7 am to 6 pm.

Table 4-7 Noise source levels, dBA – school hours

Scenario	Assessment Period	Noise level, dBA	Notes and assumptions
Mechanical plant	Daytime	85 dBA SWL	Based on Northrop thermal comfort report (Option 4) and indicative locations of plant. Daikin RXYQ12S units with a 2.0 m high solid barrier surrounding the units (The locations of the units are presented in Appendix F)

Scenario	Assessment Period	Noise level, dBA	Notes and assumptions
PA system and period alarm	Daytime	85 dBA SWL	Impulsive adjustment applied (+5 dBA) Event time 1 minute per 15 minute period Locations estimated based on guidance contained within *NSW Department of Education DG64 – Communications.* Specific locations not yet selected

4.3.1 Noise generating activities – community use (outside of school hours)

The design of the school has considered the opportunity for shared use facilities with the broader community outside school hours. Figure 4-4 below provides a diagram of proposed community use of the school.

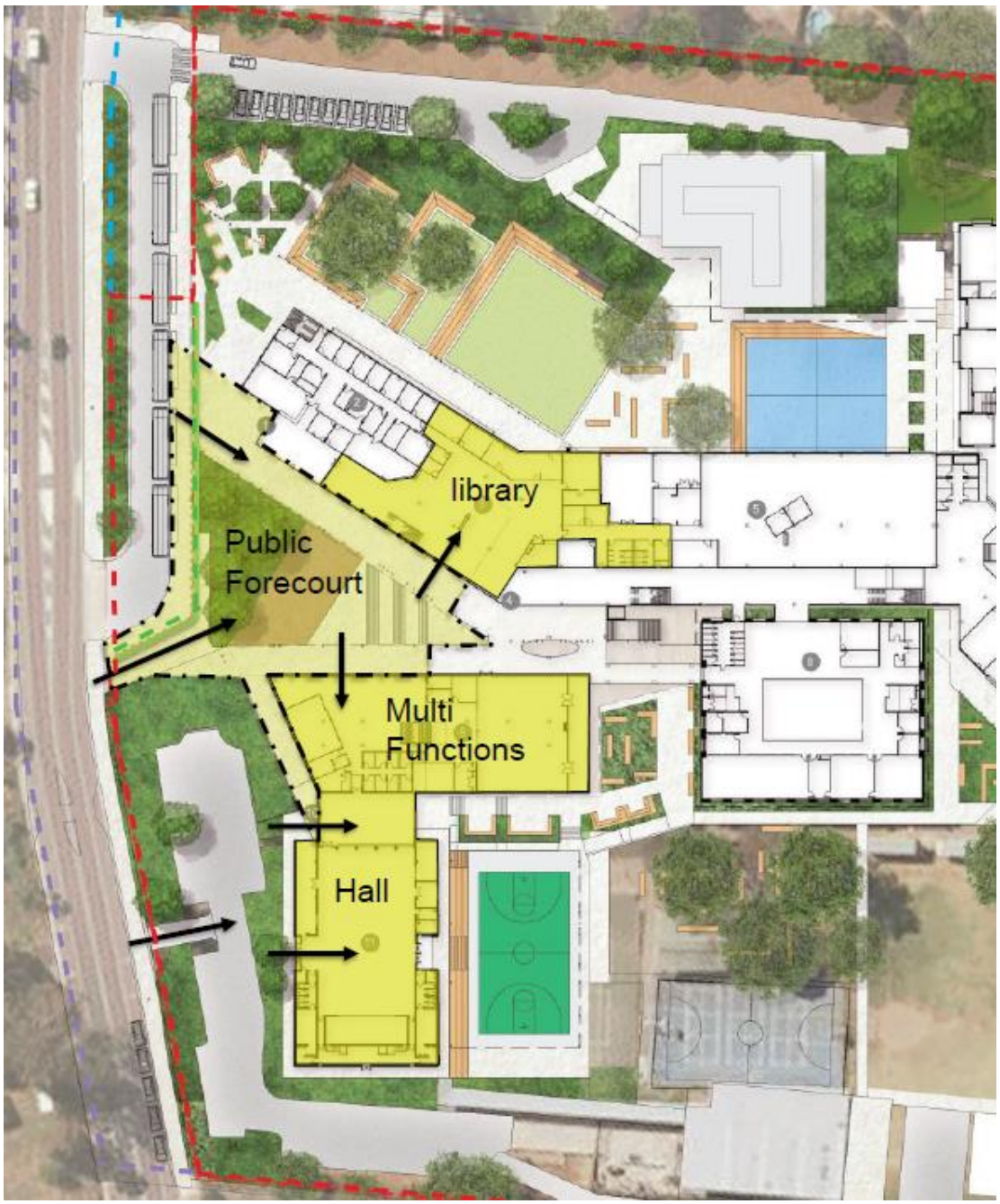


Figure 4-4 Community use diagram

The following table below highlights potential community uses of Picton High School Facilities as guided by the Department of Education regarding Community Use of Schools Implementation Procedures. This table is a guide only and requires consultation with the school regrading which facilities can be used, types of use and hours of operation.

Table 4-8 Potential community use of school facilities

School Facilities	Types of Functions/Activities	Indoor/Outdoor	Occupancy	Hours of Operation
Hall	Community Language Schools Dance, music or drama lessons Community education and training Community productions Community Meetings Sporting events Vacation Care	Indoor	Maximum 200 (approximate)	School Hours: 8:00am – 4pm After School Hours 4-00pm – 10:00pm (Times are indicative only and will have to be confirmed with school)
Performance / Fitness Hub Performance Workshop	Community Language Schools Dance, music or drama lessons Community education and training Community productions Community Meetings	Indoor	Fitness and Performance Hub: Maximum 120 (approximate) Performance Workshop Max: 75 (approximate)	School Hours: 8:00am – 4pm After School Hours 4-00pm – 10:00pm (Times are indicative only and will have to be confirmed with school)
Fitness Lab	Community education and training Sporting events Sports Training	Indoor	Fitness Lab: Maximum 80 (approximate)	School Hours: 8:00am – 4pm After School Hours 4-00pm – 10:00pm (Times are indicative only and will have to be confirmed with school)
Student Hub Library	Community Language Schools Community education and training Community productions Community Meetings	Indoor	Student Hub Maximum: 100 (approximate)	School Hours: 8:00am – 4pm After School Hours 4-00pm – 10:00pm (Times are indicative only and will have to be confirmed with school)

School Facilities	Types of Functions/Activities	Indoor/Outdoor	Occupancy	Hours of Operation
Public Forecourt	Community education and training Community productions Community Meetings	Outdoor	Public Forecourt Maximum: 400 (approximate)	School Hours: 8:00am – 4pm After School Hours 4-00pm – 10:00pm (Times are indicative only and will have to be confirmed with school

Noise sources on-site are provided in Table 4-7 for each activity. The operation of mechanical plant and the PA system/period alarm will occur during the daytime hours, being 7 am to 6 pm.

Table 4-9 Noise source levels, dBA – community use

Scenario	Assessment Period	Noise level, dBA	Notes and assumptions
Mechanical plant	Daytime	85 dBA SWL	Based on Northrop thermal comfort report (Option 4) and indicative locations of plant. Daikin RXYQ12S units with a 2.0 m high solid barrier surrounding the units (The locations of the units are presented in Appendix F)
Small community event – indoor	Evening	80 dBA internal SPL	Internal sound pressure level based on small community gathering of up to 100 people with minimal amplified sound (ie education and training, meetings) Standard brickwork external façade (R_w 39) Standard door (closed) and no acoustic seal (R_w 17)
Large community event – indoor (S1)	Evening	90 dBA internal SPL	Internal sound pressure level based on typical school band concert with up to 200 people(worst case scenario) Standard brickwork external façade (R_w 39) Standard door (closed) and no acoustic seal (R_w 17)
Large community event – outdoor (S2)	Evening	68 dBA SWL (one person)	Sound pressure level based on community event / meeting with up to 400 people Assumed 150 people speaking at once
Large community event – outdoor with PA (S3)	Evening	68 dBA SWL (one person), 95 dBA SWL (one speaker)	Sound pressure level based on community production with up to 400 people including amplified music / speech (2 PA speakers)
Large community event – use of carpark (S4)	Evening	Based on LfU Study 2007	Assuming 1 carpark movement per car space within an hour (approx. 150 movements on site)

4.3.2 Predicted operational noise levels – school hours

The predicted noise levels for each the daytime scenarios are presented in Appendix E. Noise emission maps are provided below in Figure 4-5 and Figure 4-6. The noise levels are predicted to comply with the noise criteria for all assessed scenarios with the receivers directly adjacent to the northern boundary of Picton High School receiving the highest noise levels during the daytime period. During special school events in the hall, the residents are 500 Argyle Street and 475 Argyle Street are predicted to receive the highest noise levels. However, the predicted

noise levels comply with the noise emission requirements of the NPI and should not adversely affect the acoustic amenity of the neighbouring residents.

4.3.3 Predicted operational noise levels – community use (outside of school hours)

Based on the assumptions in Table 4-9 above, the predicted noise levels due to the use of mechanical plant and small community events indoors indicate compliance at all nearby sensitive receiver locations.

The predicted noise levels for the worst-affected receivers during large community events outside of school hours operations are presented below in Table 4-10. Exceedances of the noise criteria are presented in red.

Table 4-10 Predicted noise levels – outside of school hours

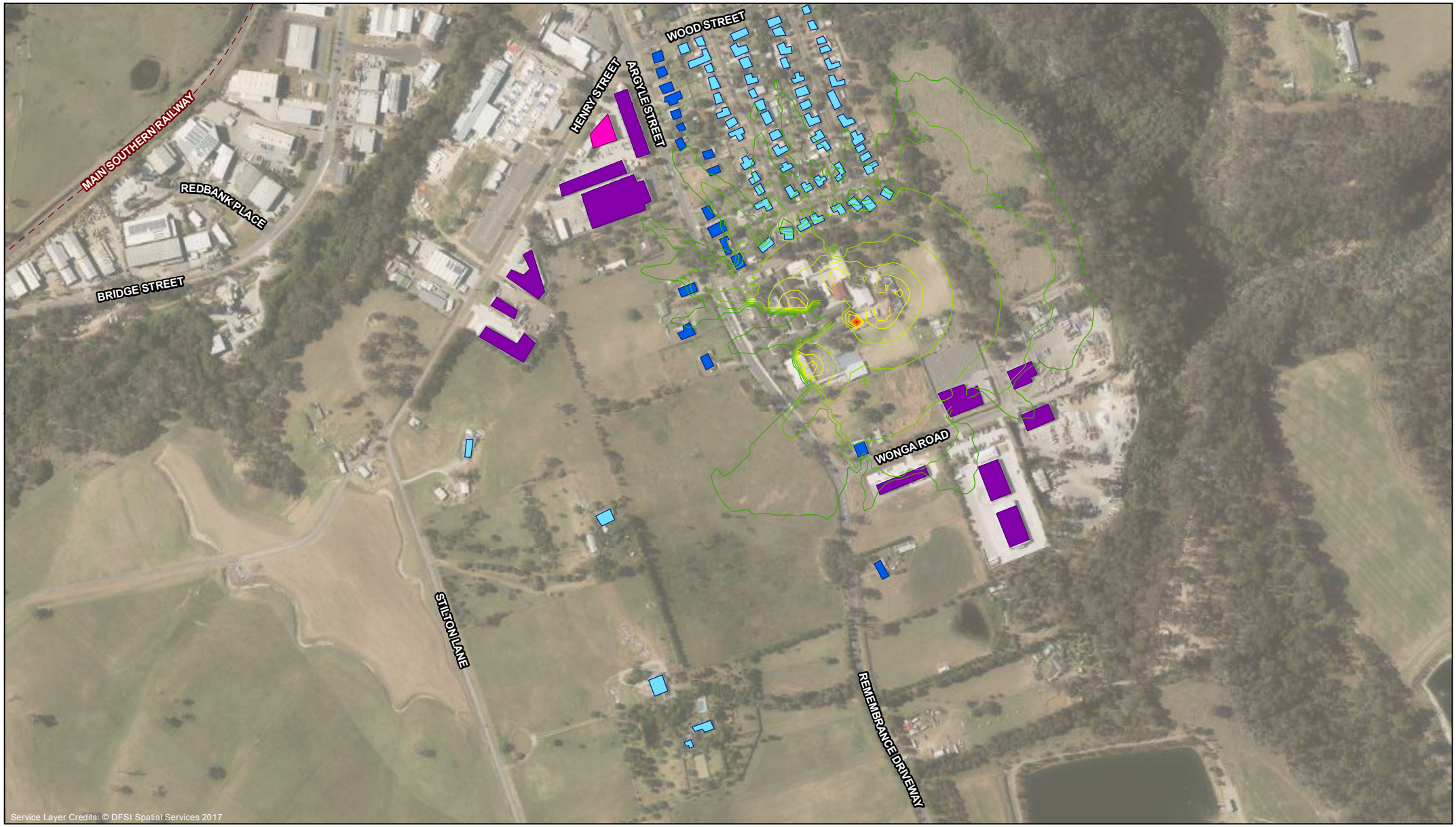
Receiver ID	NCA	Criteria	S1	S2	S3	S4
R01	NCA2	45	15	17	28	**48**
R02	NCA1	40	15	15	27	**46**
R03	NCA1	40	14	14	26	38
R72	NCA2	45	24	33	39	36
R73	NCA2	45	28	38	**49**	37
R74	NCA2	45	33	41	**52**	36
R76	NCA2	45	36	9	23	33
R77	NCA1	40	22	24	36	23

The results presented in the table above indicate that there may be exceedances of the noise criteria during large community events that will use a PA system and also due to the use of the informal car parking spaces to the north of the site. It is recommended that a management plan is created to manage noise impacts during large community events.

Mitigation recommendations have been provided below in Section 5.

4.3.4 Mechanical plant areas

The exact location and selection of the mechanical plant and equipment are still in the preliminary stages of design. The noise emission from these items of mechanical plant should be reviewed to ensure mechanical plant noise does not adversely impacts the acoustic amenity of the nearest sensitive receiver and any occupants within the internal areas of the buildings directly adjacent to mechanical equipment. Subsequent to the selection and design of the mechanical equipment servicing the school, a detailed noise assessment of mechanical noise emission should be undertaken.



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Predicted $L_{Aeq(15min)}$ noise contours

30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85

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Picton High School Redevelopment - Acoustics

Job Number 21-27011
Revision A
Date 05 Apr 2018

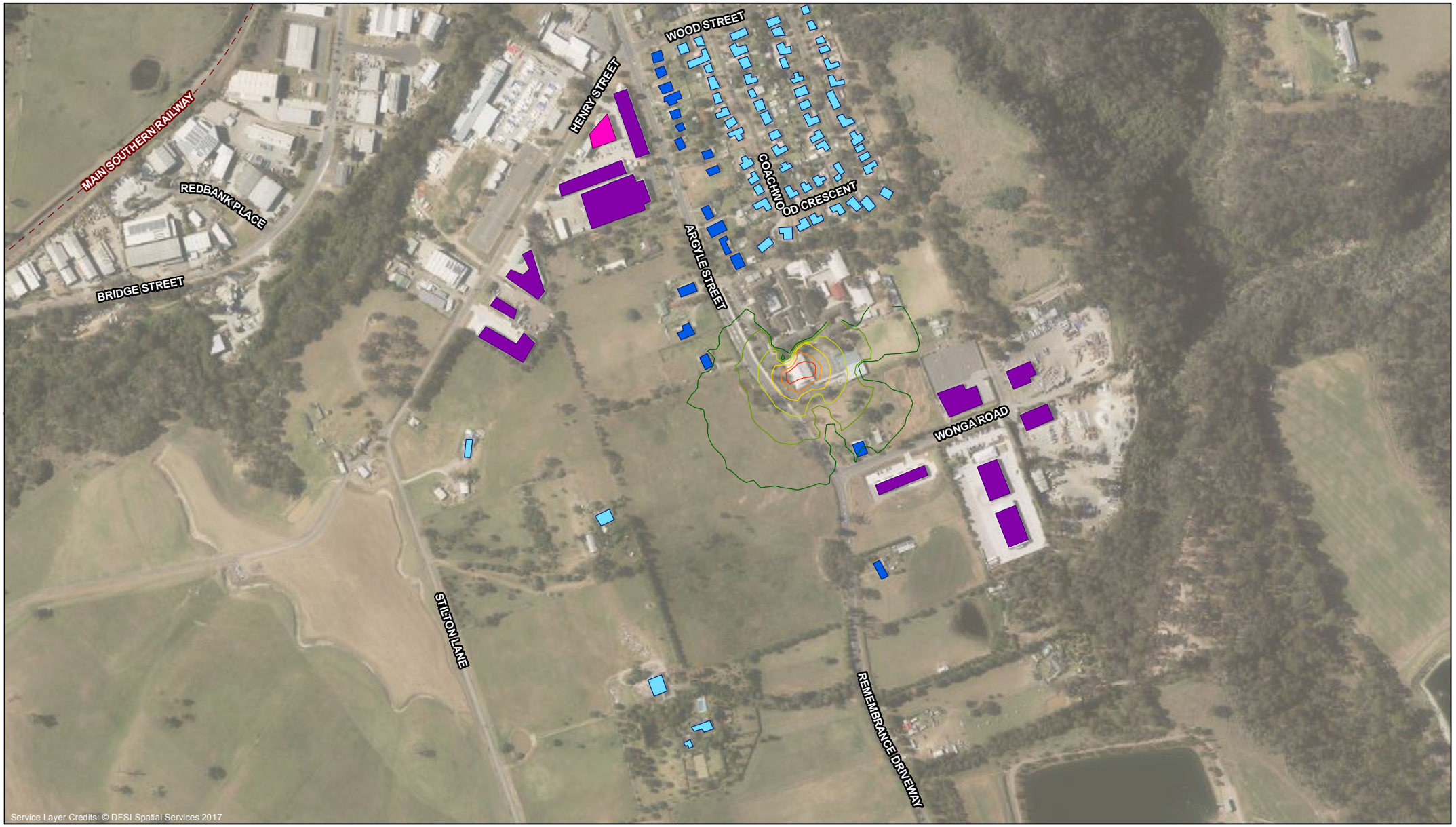
$L_{Aeq(15min)}$ noise emission map - daytime operations

Figure 4-5

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 5)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice



Paper Size A4

0 50 100 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Residential receivers within NCA1
- Residential receivers within NCA2
- Commercial receivers
- Places of Worship receivers

Predicted $L_{Aeq(15min)}$ noise contours

- 30
- 35
- 40
- 45
- 50
- 55

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Job Number 21-27011
Revision A
Date 05 Apr 2018

$L_{Aeq(15min)}$ noise emission map
- evening operations

Figure 4-6

N:\AU\Sydney\Projects\21\27011\GIS\Maps\Deliverables\21_27011_Z001_NoiseSMA.mxd (SMA record: 6)

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: General topo - NSW LPI DTDB 2015 & 2012; Aerial imagery - SIX Maps 2018. Created by:jrprice

4.3.5 Sleep disturbance

All school activity and community use activities are expected to occur during the day or evening period therefore sleep disturbance impacts are not expected.

It is recommended that community use activities should finish prior to 10 pm to avoid associated sleep disturbance noise impacts. Suitable time should be allowed for to ensure everyone has departed the site prior to 10 pm.

4.4 Road traffic noise

4.4.1 Noise intrusion

The Department of Education Design Guideline 11 (DG11) states that an internal noise level assessment should be undertaken for any site impacted by traffic noise from roads with greater than 20,000 vehicles AADT. *Transport and Accessibility Assessment Report* (TDG, 2017) states that Argyle Street has an AADT of approximately 11,000 to 12,000 vehicles. As such, an assessment of road traffic noise intrusion to the internal areas of the educational facility is not necessary.

The proposed external windows are to consist of 6 mm glass / 3 mm air gap / 3 mm glass double glazing and should provide a minimum sound transmission loss performance of R_w 30. The most affected façade is predicted to experience road traffic noise levels of approximately $L_{Aeq(1hour)}$ 60 dBA and as such, the proposed double glazing systems will be sufficient to ensure the internal noise levels targets are achieved. Additionally, mechanical ventilation will be provided if windows are closed.

4.4.2 Noise generation

Existing and predicted traffic volumes for Argyle Street are presented in the draft *Transport and Accessibility Assessment Report* (TDG, 2017), and reproduced in Table 4-11 below. Volumes are presented for the AM and PM peak periods, when the greatest increase to traffic volumes are expected to occur.

The predictions in Table 4-11 show that an increase of approximately 2% traffic volume is expected for 2021 and an increase of approximately 15% total traffic volume is expected for the school running at capacity. A doubling of traffic volume corresponds with an increase of roughly 3 dBA in noise levels and a 60% increase corresponds with a traffic noise increase of roughly 2 dBA. Thus, the presented traffic increases will not exceed the 2 dBA increase criteria specified in the *Road Noise Policy*.

Table 4-11 Existing and predicted traffic volumes – Argyle Street

Time period	Vehicle type	2017 (surveyed)	2021 increase (predicted)	At capacity increase (predicted)
AM Peak 8:20 – 9:20 am	Light	1184	15	150
	Buses	43	3	31
	Total	1227	18	181
PM Peak 3:10 – 4:10 pm	Light	1278	13	121
	Buses	37	3	27
	Total	1312	16	148

Predicted site traffic movements (preliminary forecasts) for school traffic utilising Wonga Road are presented in the draft *Transport and Accessibility Assessment Report* (TDG, 2017), and reproduced in Table 4-12 below. Volumes are presented for the AM and PM peak periods, when the greatest increase to traffic volumes are expected to occur.

Table 4-12 Predicted school site traffic movements – Wonga Road

Time period	Vehicle type	Predicted site movements
AM Peak 8:20 – 9:20 am	Light	114
	Buses	23
	Total	137
PM Peak 3:10 – 4:10 pm	Light	102
	Buses	21
	Total	123

Note:
[1] Based on 83% of total site traffic movements being light vehicles (TDG report surveys/predictions)
[1] Based on 17% of total site traffic movements being buses (TDG report surveys/predictions)

Using the predicted traffic movements presented above, the predicted noise level at R76 was calculated using CadnaA 2017 and the CoRTN algorithm. Based on the busiest one hour period (8:20 am to 9:20 am), the predicted $L_{Aeq(1hour)}$ noise level at 500 Argyle Street (R76) due to the site traffic movements on Wonga Road associated with Picton High School is 59 dBA.. Existing traffic volumes for Wonga Road is not currently available and as such, the increase in traffic noise level cannot be calculated. GHD recommends a traffic survey be conducted on Wonga Road to calculate the existing noise levels received at 500 Argyle Street and determine whether noise mitigation is required at this location.

5. Mitigation measures

5.1 Construction mitigation measures

To protect the amenity of local residents, mitigation measures have been recommended to manage noise and vibration during construction.

For construction activities that are undertaken within the recommended standard construction hours (7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday) the work practices in Table 5-1 would be considered where feasible and reasonable where noise levels are predicted to exceed the construction noise management levels.

Table 5-1 Feasible and reasonable work practices

Construction noise and vibration mitigation measures	
Construction mitigation measures	Noise generating construction activities should be undertaken in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). The standard hours for construction work should be in accordance with the Guideline: • 7:00 am – 6:00 pm Monday to Friday • 8:00 am – 1:00 pm Saturdays • no work on Sundays or Public Holidays. Work outside normal hours should only comprise: • the delivery of materials outside normal hours requested by police or other authorities for safety reasons • emergency work to avoid the loss of lives and/or property
	Residences within 500 m of the site should be notified as to the timing and duration of the construction works and provided with a contact phone number for any complaints or concerns during the construction period.
	Site inductions Inductions for the work crew would include the specific noise issues and mitigation measures required for the site. The induction would include: • all relevant standard noise mitigation measures • relevant licence and approval conditions • permissible hours of work • location of any sensitive receivers that may exceed the construction noise management level • construction employee parking areas • designated loading/ unloading areas and procedures • site opening/closing times (including deliveries) • behavioural practices that minimise noise: • avoiding dropping materials from height and avoiding metal to metal contact on material.
	The distance between plant and equipment and any sensitive receiver should be maximised where practicable.
	Vehicles, plant and equipment would be regularly maintained and kept in good operating condition. Machines found to produce excessive noise should be removed from site or stood down until repairs or modifications can be made.

Construction noise and vibration mitigation measures	
	Plant should be turned off when not in use. For example, trucks should not be left idling if not operational.
Vibration	Should any buildings be identified that are located within the structural damage vibration buffer distances identified in Section 4.2.2, a property condition report should be prepared for the premises before and after undertaking the work. Compliance vibration monitoring should also be undertaken during high vibration generating activities where buildings are located within the structural damage buffer distances to confirm vibration criteria are not exceeded.

5.1.1 Community relations

Consultation and cooperation with the nearest sensitive receivers will assist in minimising uncertainty, misconceptions and adverse reactions to noise. The following community relation measures would be implemented:

- Department of Education would establish contact with residents affected by construction noise and communicate the construction program and progress on a regular basis, particularly when noise generating activities are planned. Communication with the local community would be maintained throughout the construction period.
- Department of Education would provide a community liaison phone number and permanent site contact so that noise complaints can be received and addressed in a timely manner.
- Upon receipt of a noise complaint, monitoring would be undertaken and reported as soon as possible. If exceedances are detected, the situation would be reviewed in order to identify means to attempt to reduce the impact to acceptable levels.

5.2 Operational mitigation measures

5.2.1 School hours

Operational noise levels during school hours are anticipated to comply with the noise criteria assuming the following mitigation measures are considered:

- A 2.0 m high solid barrier should be constructed around all mechanical plant areas housing air-conditioning units servicing the proposed buildings
- Any other additional mechanical plant and equipment is mitigated to ensure that noise emission is compliant with relevant noise criteria.

5.2.2 Out of school hours (community use)

Operational noise levels during out of hours during large community events has the potential to exceed the noise criteria, however the impact will depend on the activity, location and number of people. It is recommended that an operational noise management plan should be developed to manage noise impacts.

Table 5-2 below provides details of the recommended noise mitigation measures to manage noise impacts from large community events.

Table 5-2 Noise management plan noise mitigation measures

Potential Impact	Mitigation measure	Additional information
Noise impact from people egressing on foot	People leaving the school grounds must be directed by staff away from residential dwellings. Signage should be erected to inform the patrons to leave in a quiet and orderly manner and to consider the residential neighbours.	There may be a residual noise impact from patrons exiting the site. Staff members / security and management will be important to ensure this impact is kept to a minimum.
Vehicles exiting car parks	Clear signage should be displayed throughout the car park informing people to return to their vehicles and exit the car park in a quiet manner.	Noise levels from the cars exiting the car parks (particularly the car park at the north of the site) are predicted to exceed the noise criteria when used during large events. As such, this will need to be managed to reduce impact on residents. Management procedures should be included in the noise management plan
Noise management plan	Noise from community use has the potential to exceed the relevant noise criteria. As such, prior to the commencement of noise generating community use events, a noise management plan should be prepared to ensure noise from internal and external events, including ingress and egress, is managed to reduce the impact on the nearest sensitive receivers.	Noise monitoring should be undertaken during the first instance of any noise generating community use activity at the school
Hours of use	Events at the school hall should finish prior to 10 pm to negate any sleep disturbance impacts	
Internal use	During any concert events within the school hall, the external doors to the hall	If noisy events in the school are proposed which have the potential to generate internal

Potential Impact	Mitigation measure	Additional information
	should remain closed except for the ingress and egress of students/staff/parents.	noise levels in excess of the limits presented in Table 4-9 then additional acoustic treatments to the school hall should be considered

5.3 Road traffic recommendations

A traffic survey should be conducted for Wonga Road to determine the existing traffic volumes as construction and operational traffic associated with the Project are proposed along this road. Subsequent to undertaking the traffic survey, a supplementary noise assessment should be undertaken to calculate the increase in traffic noise levels for sensitive receivers adjacent to Wonga Road (specifically at 500 Argyle Street).

6. Conclusion

Noise and vibration impacts for the construction and operational phases of the project has been assessed. Existing noise levels were identified through background noise measurements and used to establish construction and operational noise management levels.

6.1 Construction noise and vibration

The predicted noise levels are predicted to exceed the noise management levels during standard construction hours. 8 sensitive receivers are expected to experience noise levels above the highly affected noise level of 75 dBA.

Traffic noise impacts due to construction traffic are not expected as noise levels along the construction traffic routes are not predicted to significantly increase road traffic noise levels.

Safe working distances for vibration activities have been identified for standard structures. No buildings have been identified within the safe working distances. There is the potential for minor human comfort vibration impacts at residences directly adjacent to construction works.

It is typical for construction projects to exceed the construction noise and vibration management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise and vibration levels are generally conservative and would only be experienced for limited periods during construction. Impacts may be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended. However, these mitigation measures are unlikely to reduce noise levels below the construction noise management levels or human comfort criteria.

6.2 Operational noise

Based on the assumptions in the report, operation of the school is predicted to comply with the *Noise Policy for Industry* (EPA, 2017) noise criteria during school hours. Operational noise levels during out of hours during large community events has the potential to exceed the noise criteria, however the impact will depend on the activity, location and number of people

6.3 Operational road traffic noise

Noise levels are not predicted to increase by 2 dBA due to traffic generation from the operation of the Project and would meet the *Road Noise Policy* (DECCW, 2011) criteria for residents along Argyle Street.

GHD recommends a traffic survey be conducted on Wonga Road to calculate the existing noise levels received at 500 Argyle Street and determine whether noise mitigation is required at this location.

The proposal should be acceptable from an acoustic perspective assuming the recommended mitigation measures are implemented.

7. References

AS 2436 Guide to noise and vibration control on construction, demolition and maintenance sites, Australian Standards, 2010

BS 5228.2 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration, British Standards, 2009.

BS 7385-2 Evaluation and measurement for vibration in buildings (British Standards 1993)

Assessing Vibration: a technical guideline (DEC 2006)

Department of Education Design Guideline 11 – Acoustics (DG11) (NSW DoE)

State Environmental Planning Policy (Educational Establishments and Childcare Facilities) (2017)

Development Near Rail Corridors and Busy Roads – Interim Guideline (DoP 2008)

Industrial Noise Policy, EPA, 2000

Noise Policy for Industry, EPA, 2017

Secretary's Environmental Assessment Requirements (SEARs) SSD 8640 – Picton High School Redevelopment (17 Aug 2017)

Thermal Comfort Review – Picton High School Redevelopment (Northrop, Dec 2017)

Interim Construction Noise Guideline, Department of Environment and Climate Change, July 2009

Construction Noise and Vibration Guideline, RMS, 2016

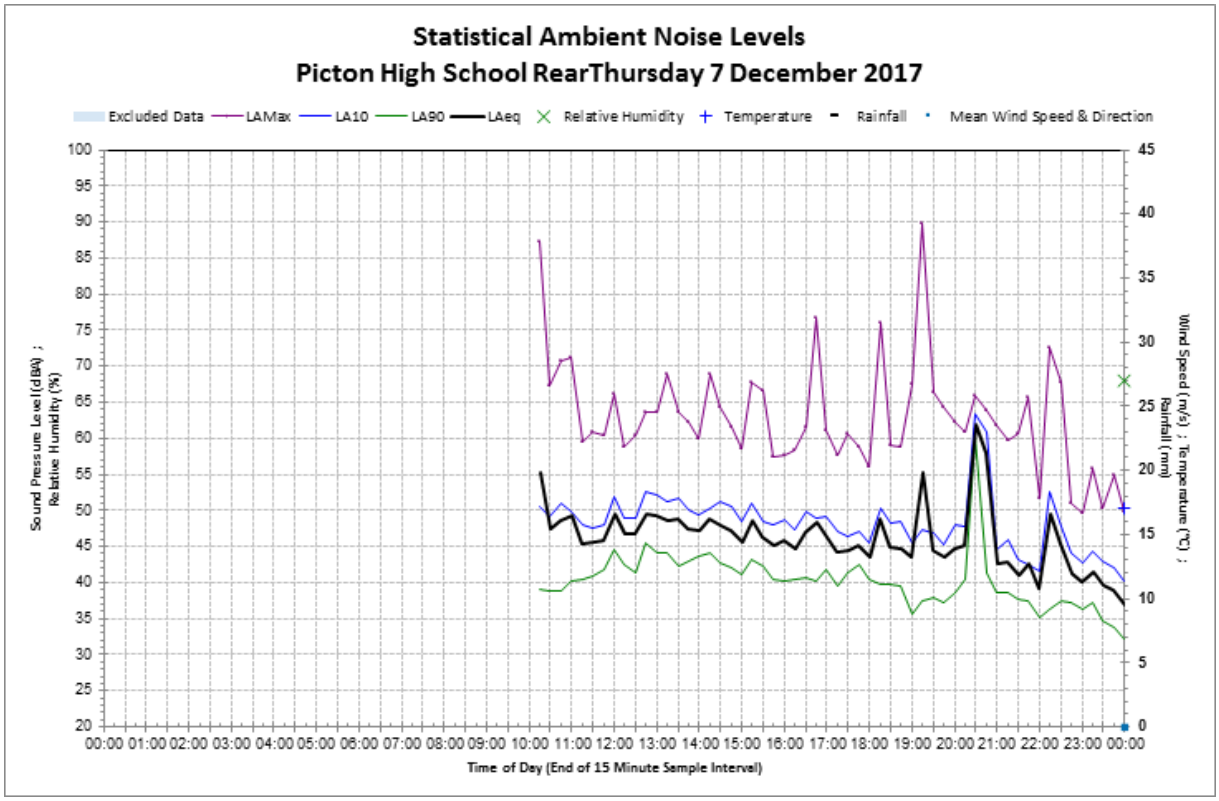
Road Noise Policy, DECCW, 2011

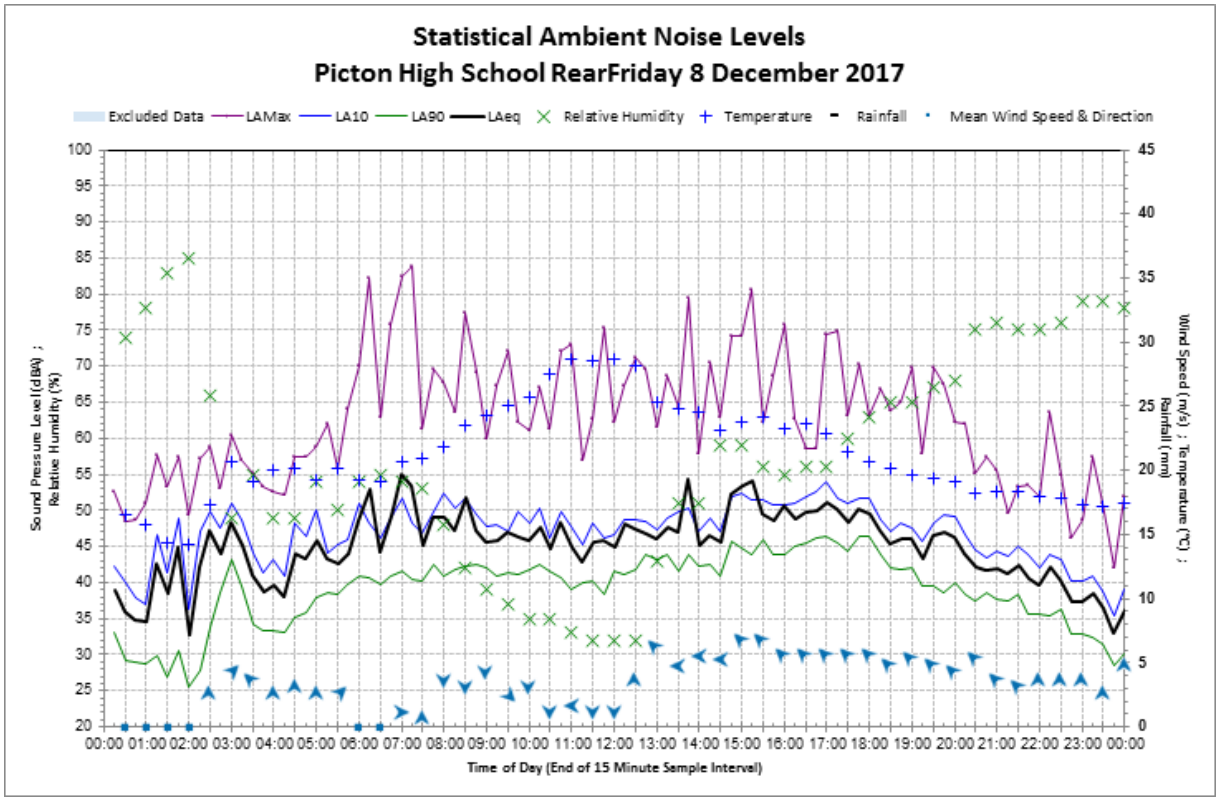
Noise Guide for Local Government, EPA, 2013

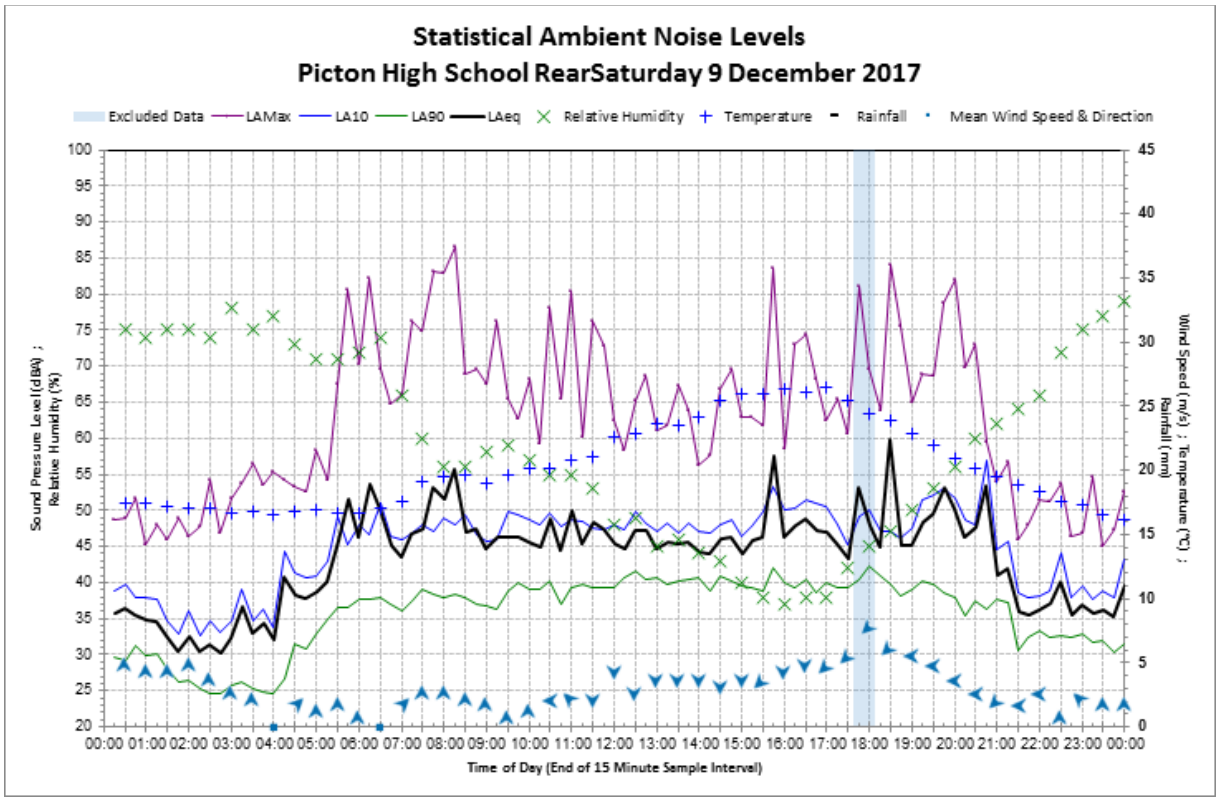
Transport and Accessibility Assessment Report (Draft) (TDG, Nov 2017)

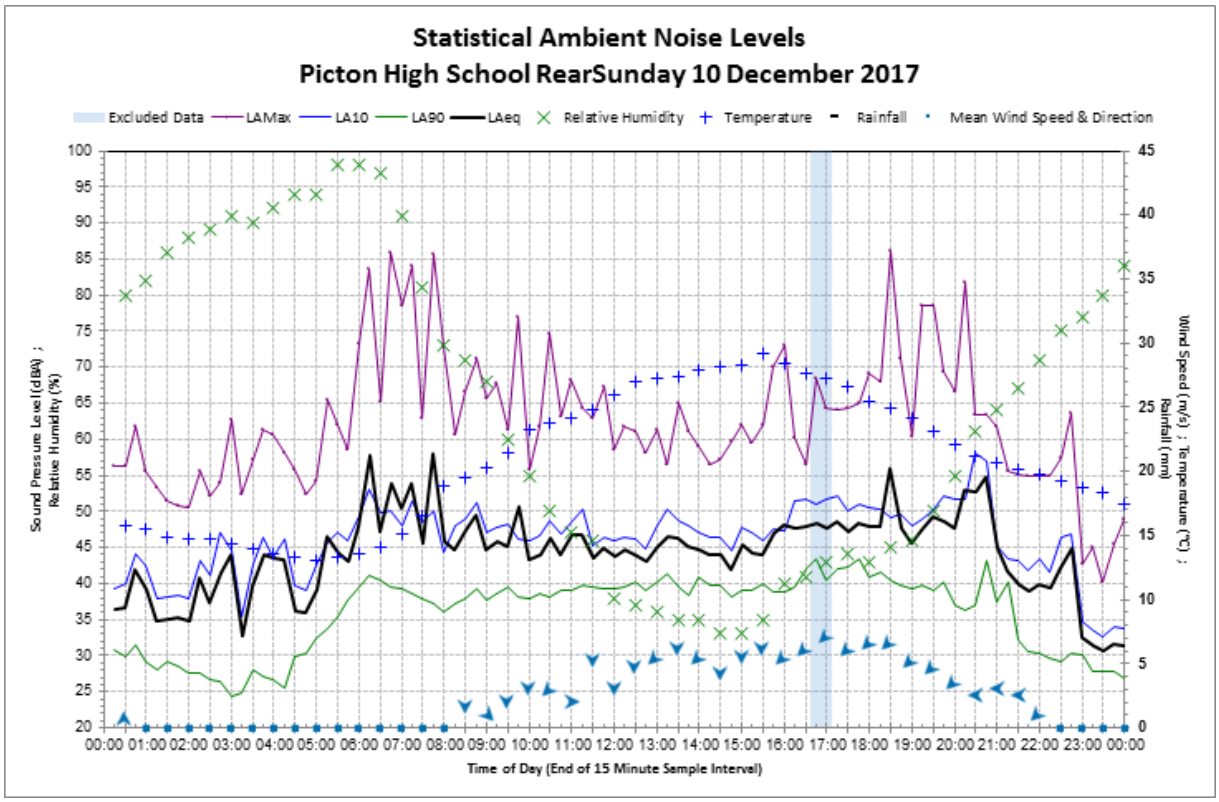
Appendices

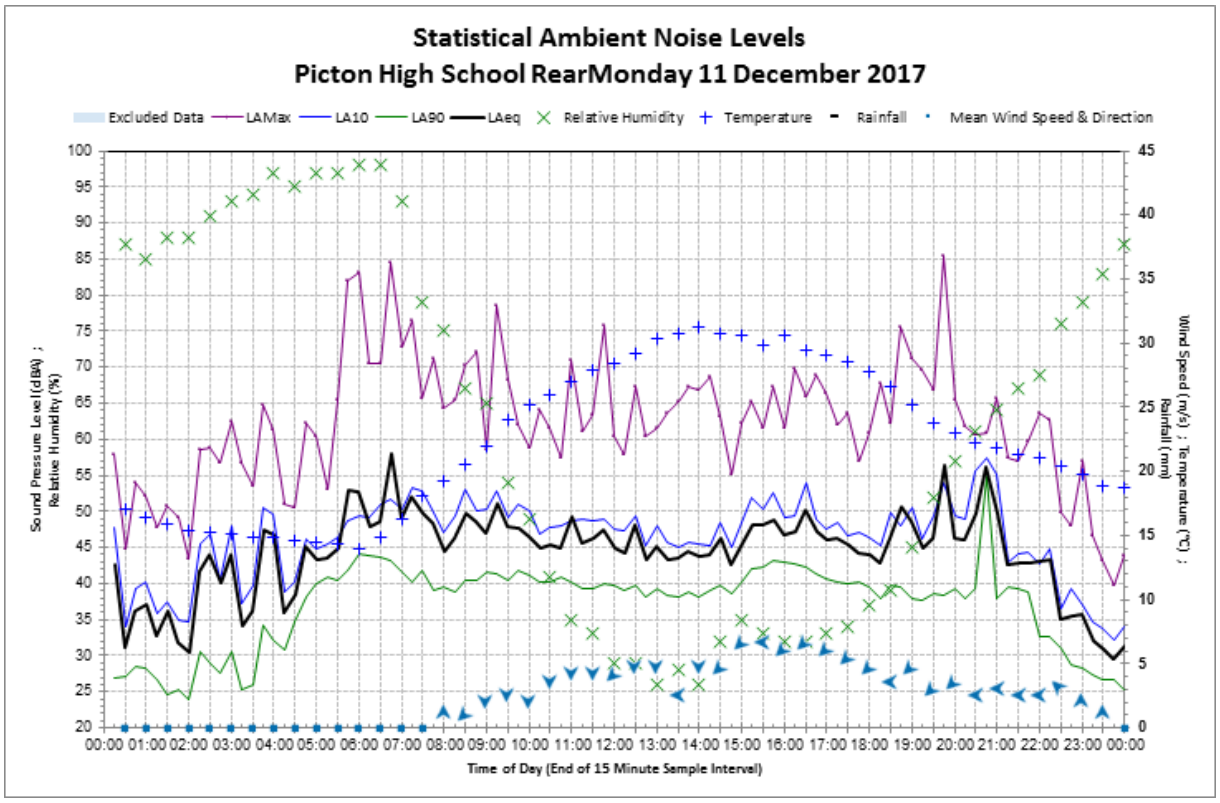
Appendix A – Noise Monitoring Charts (M1)

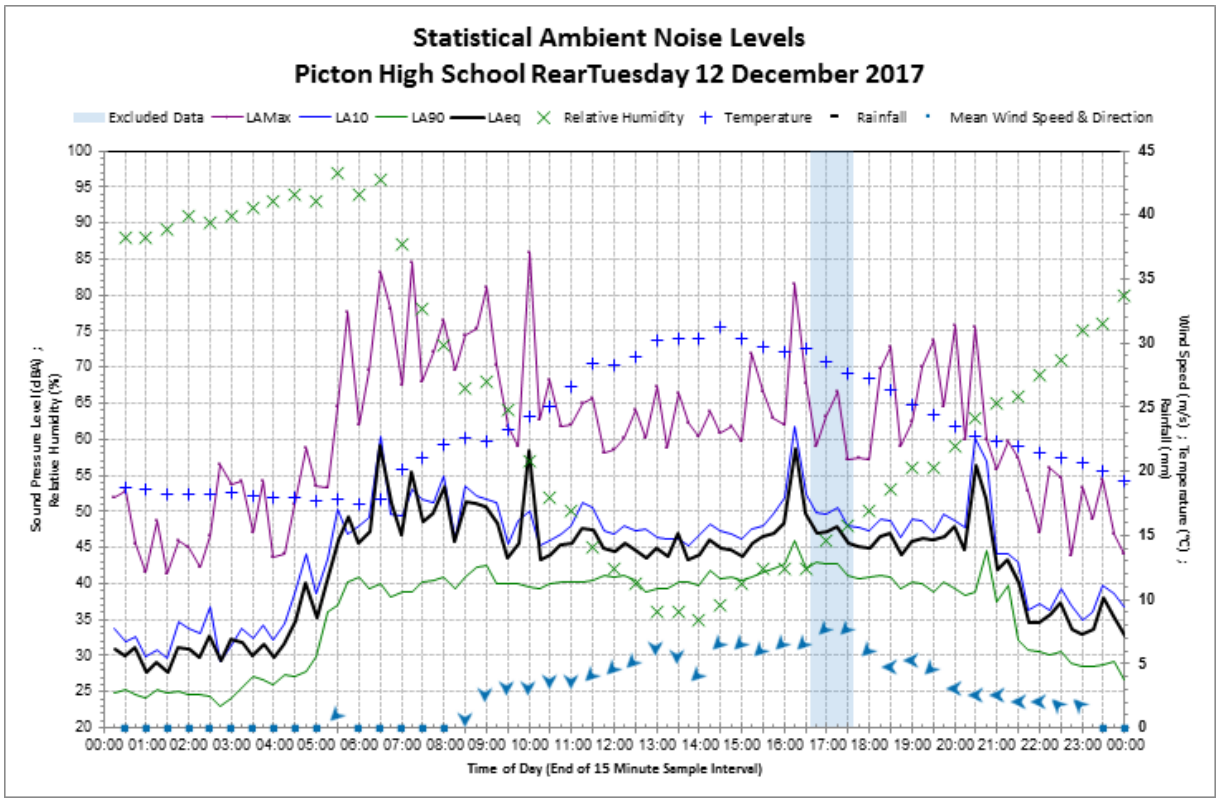


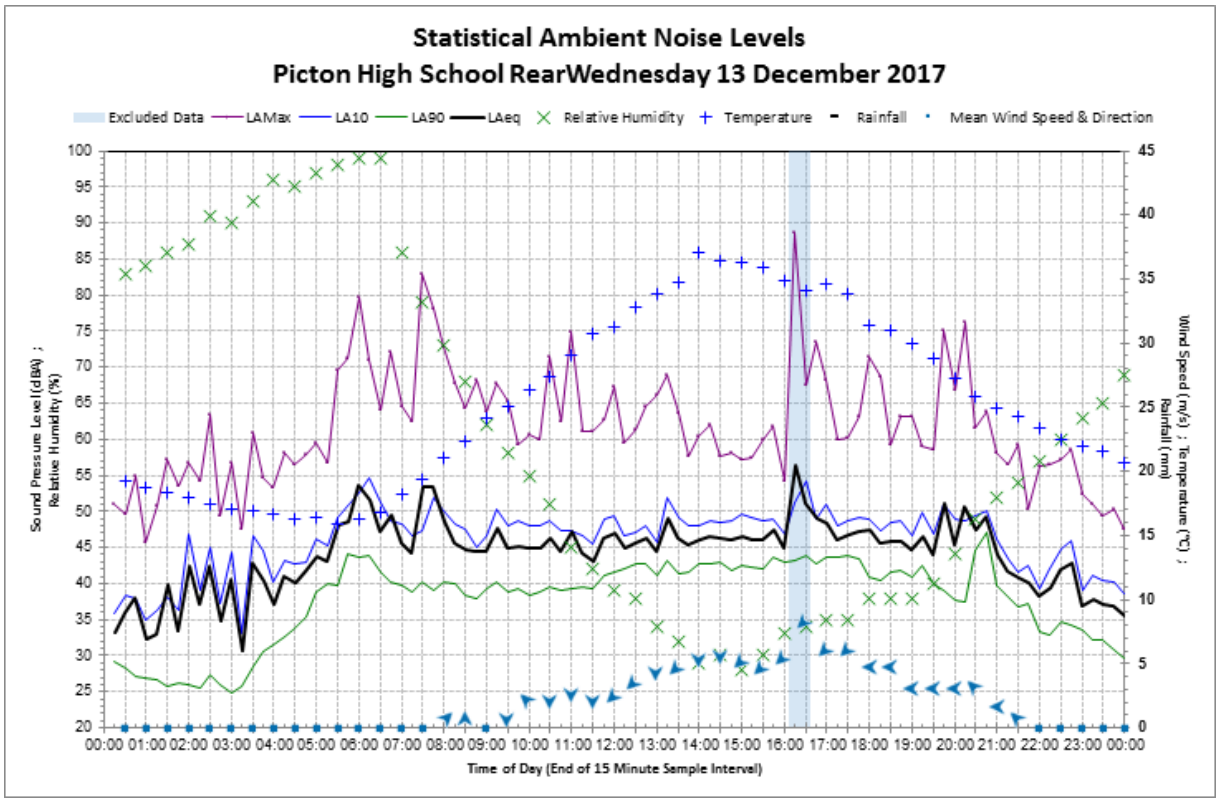


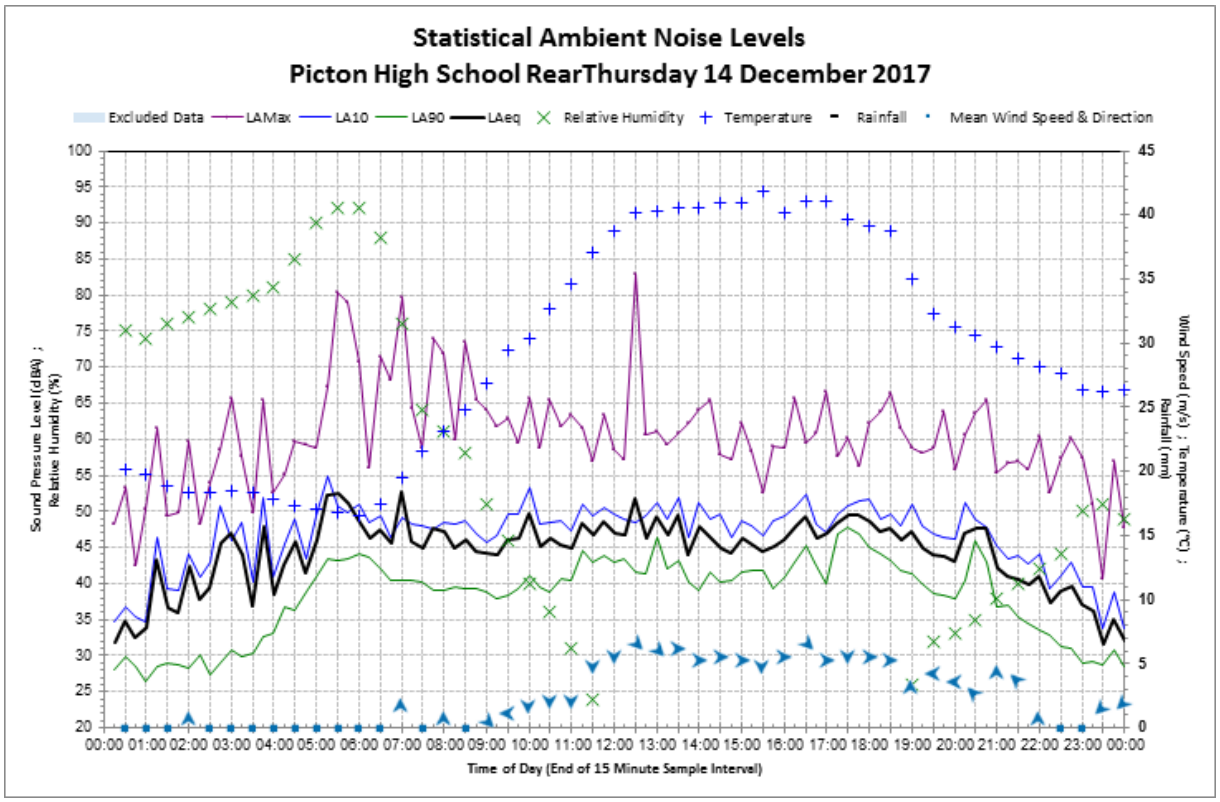

Statistical Ambient Noise Levels
Picton High School RearSaturday 9 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

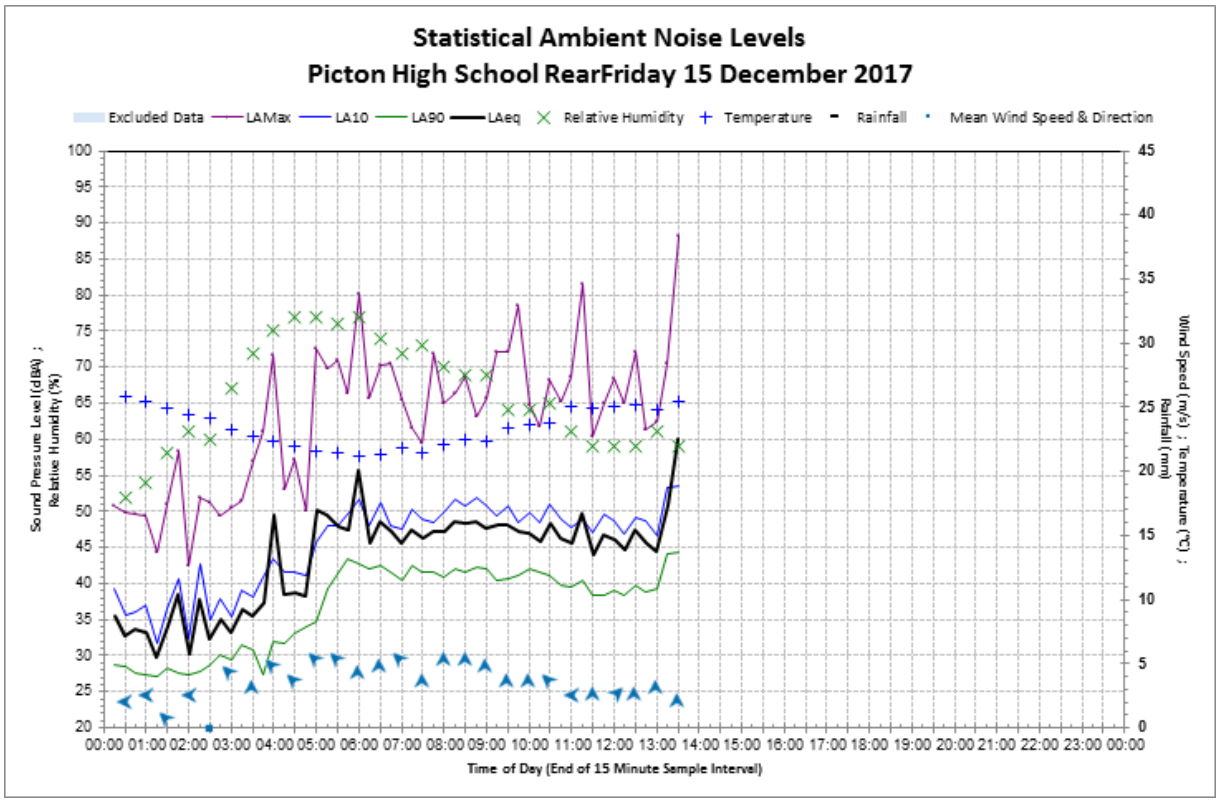

Statistical Ambient Noise Levels
Picton High School RearSunday 10 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School RearMonday 11 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

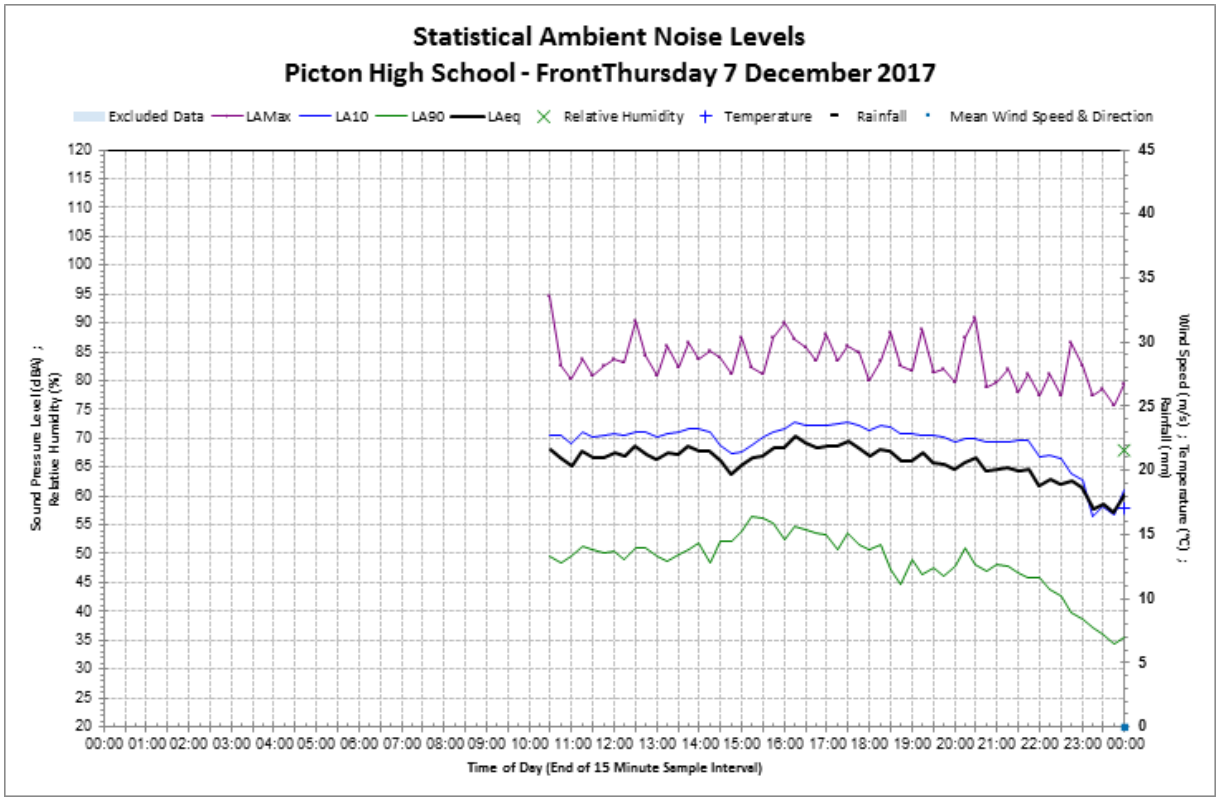

Statistical Ambient Noise Levels
Picton High School RearTuesday 12 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

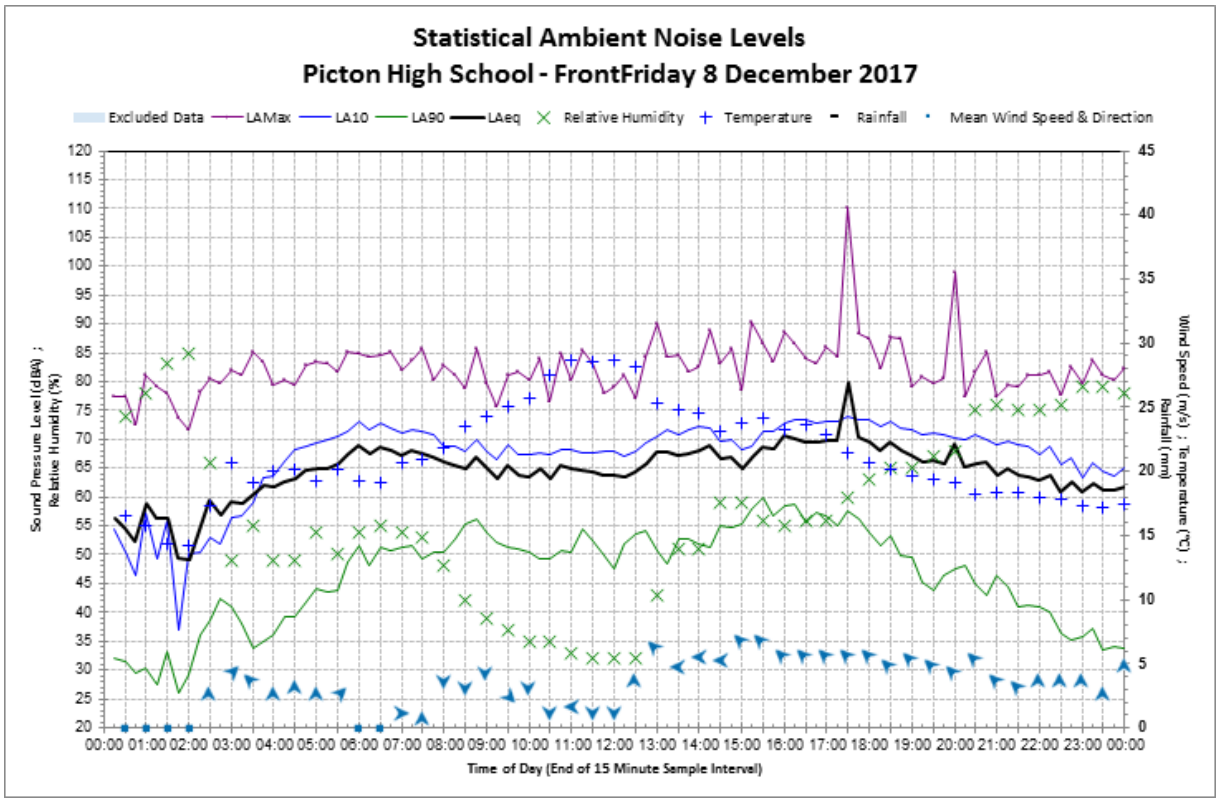

Statistical Ambient Noise Levels
Picton High School RearWednesday 13 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

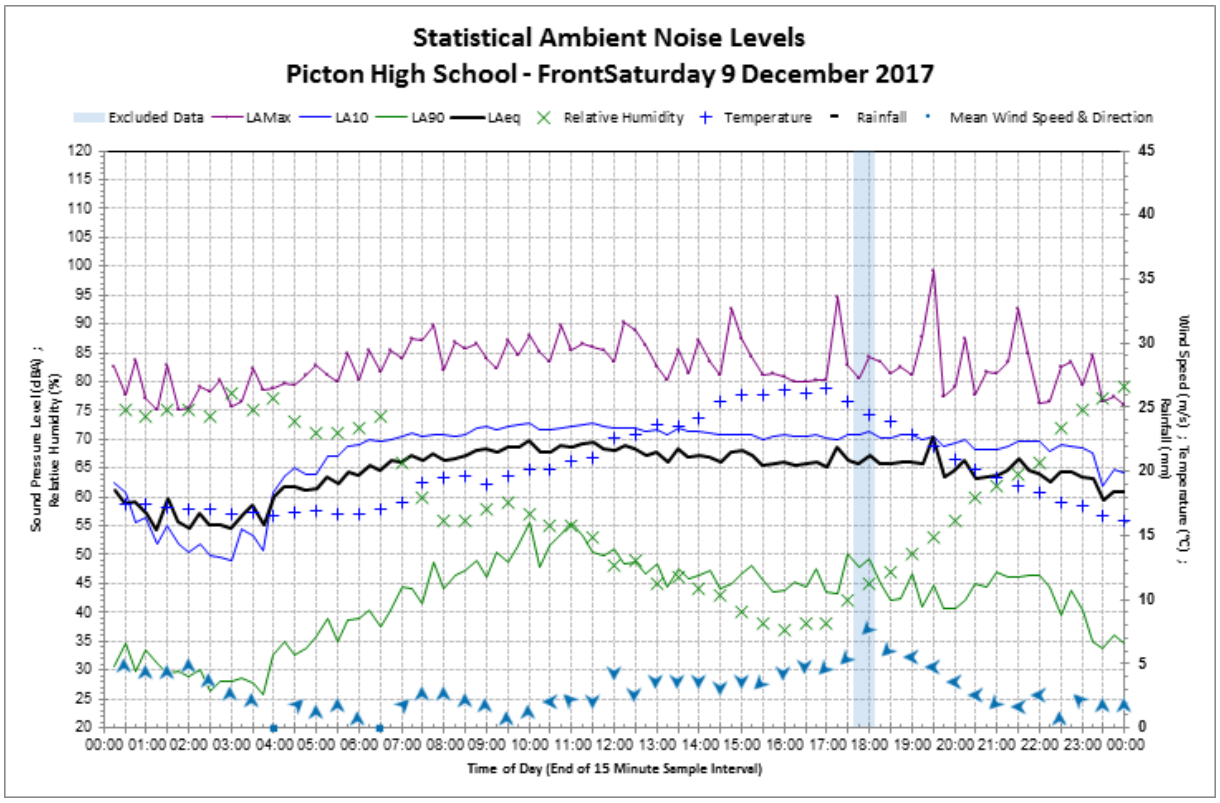

Statistical Ambient Noise Levels
Picton High School RearThursday 14 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

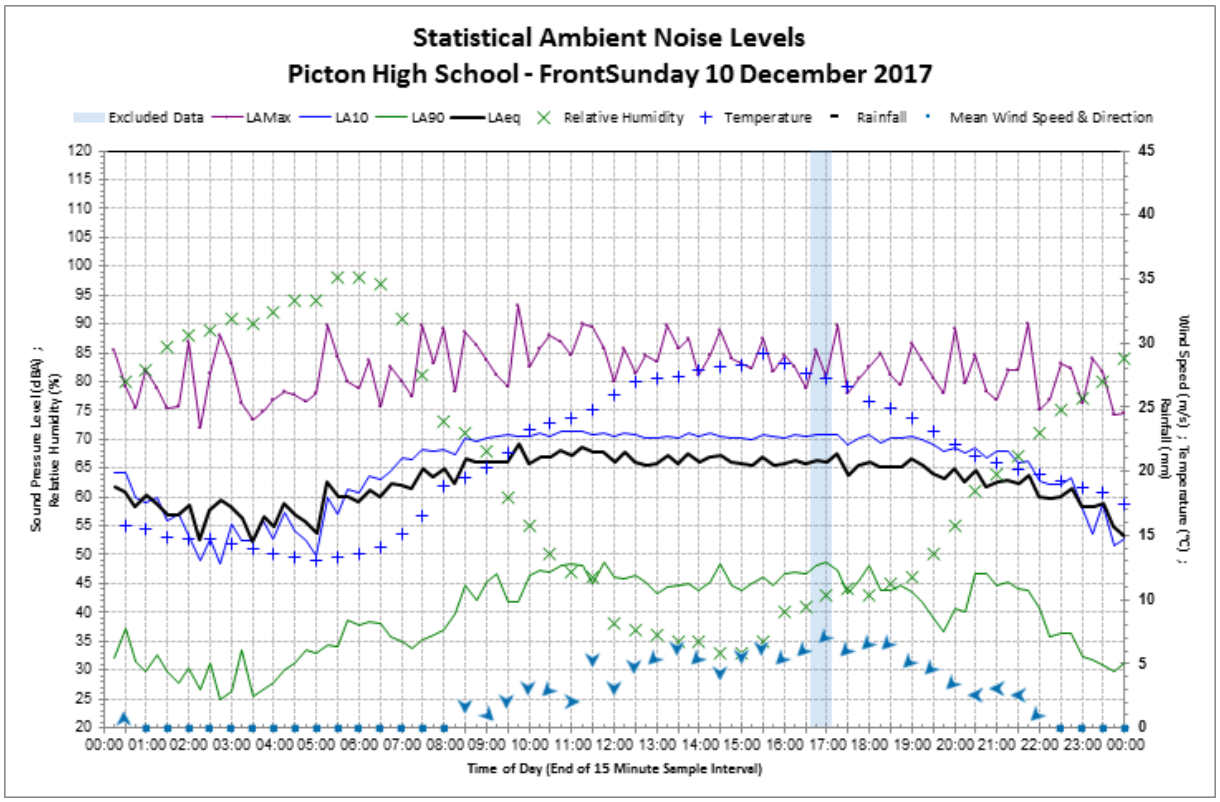

Statistical Ambient Noise Levels
Picton High School RearFriday 15 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

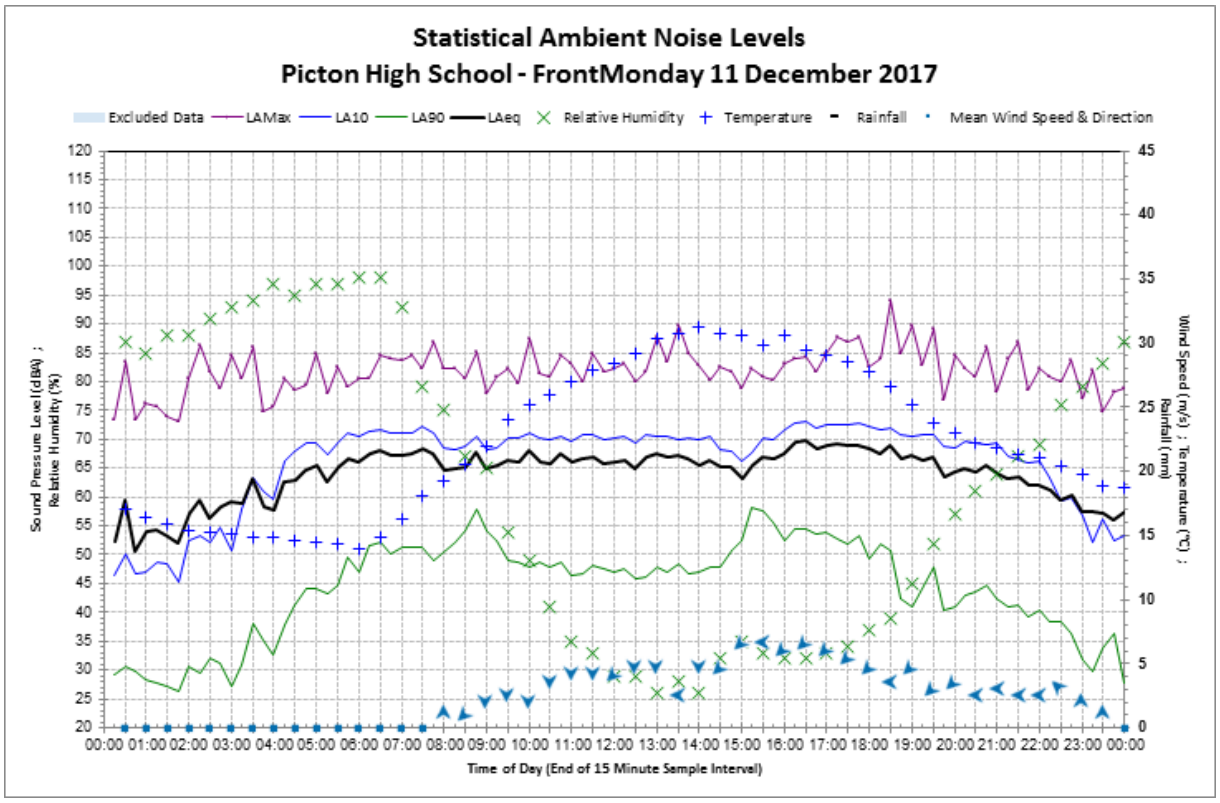
Appendix B – Noise Monitoring Charts (M2)

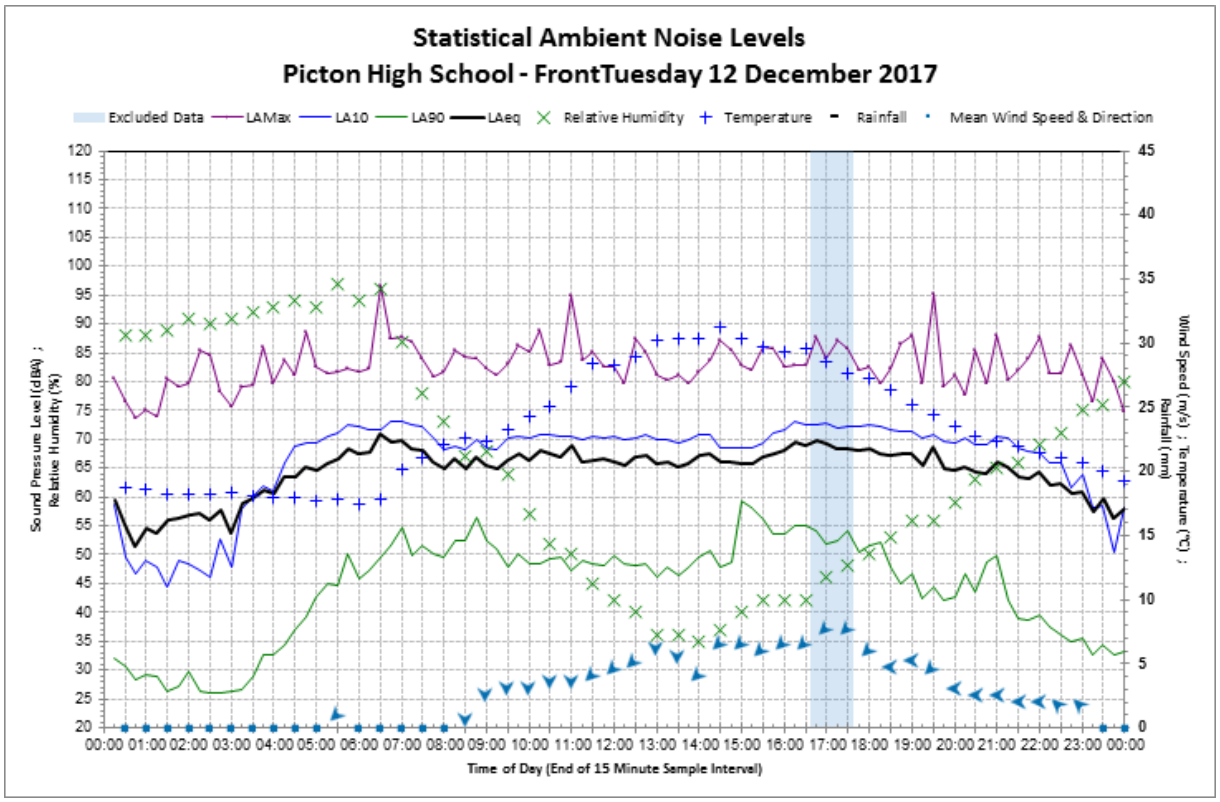


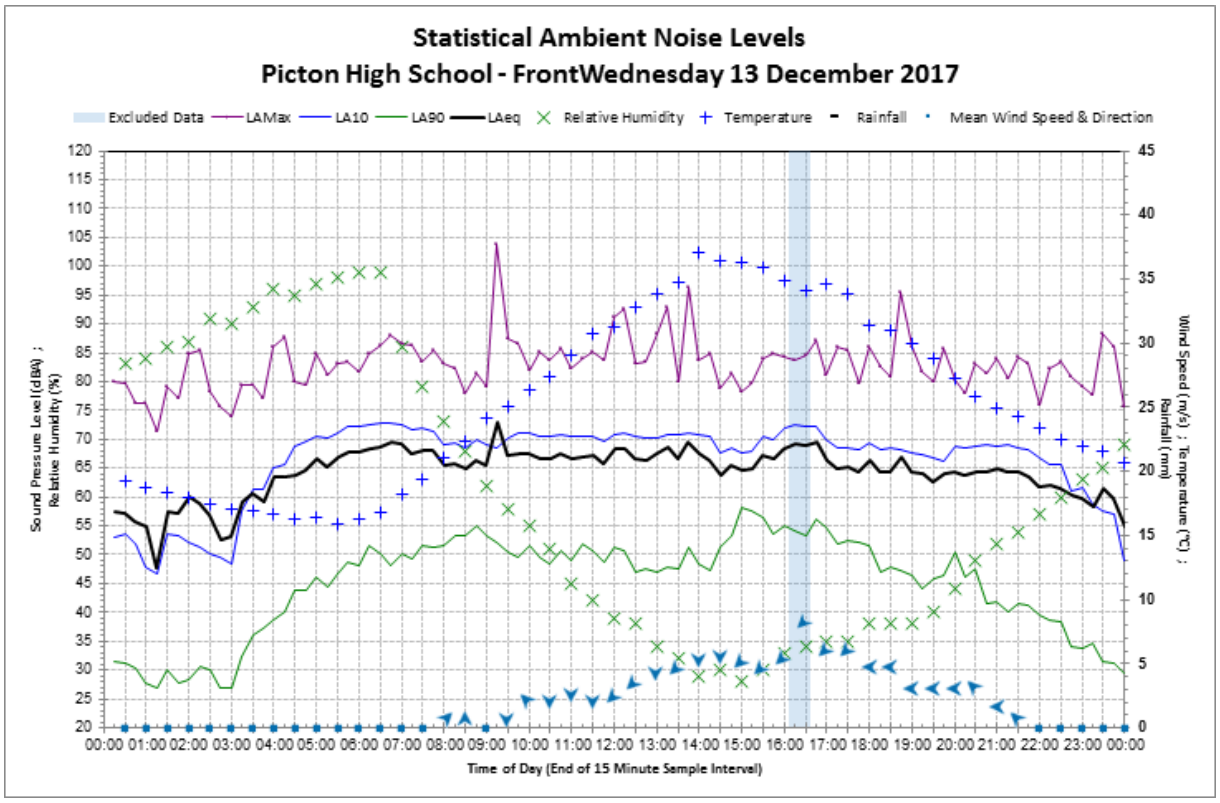


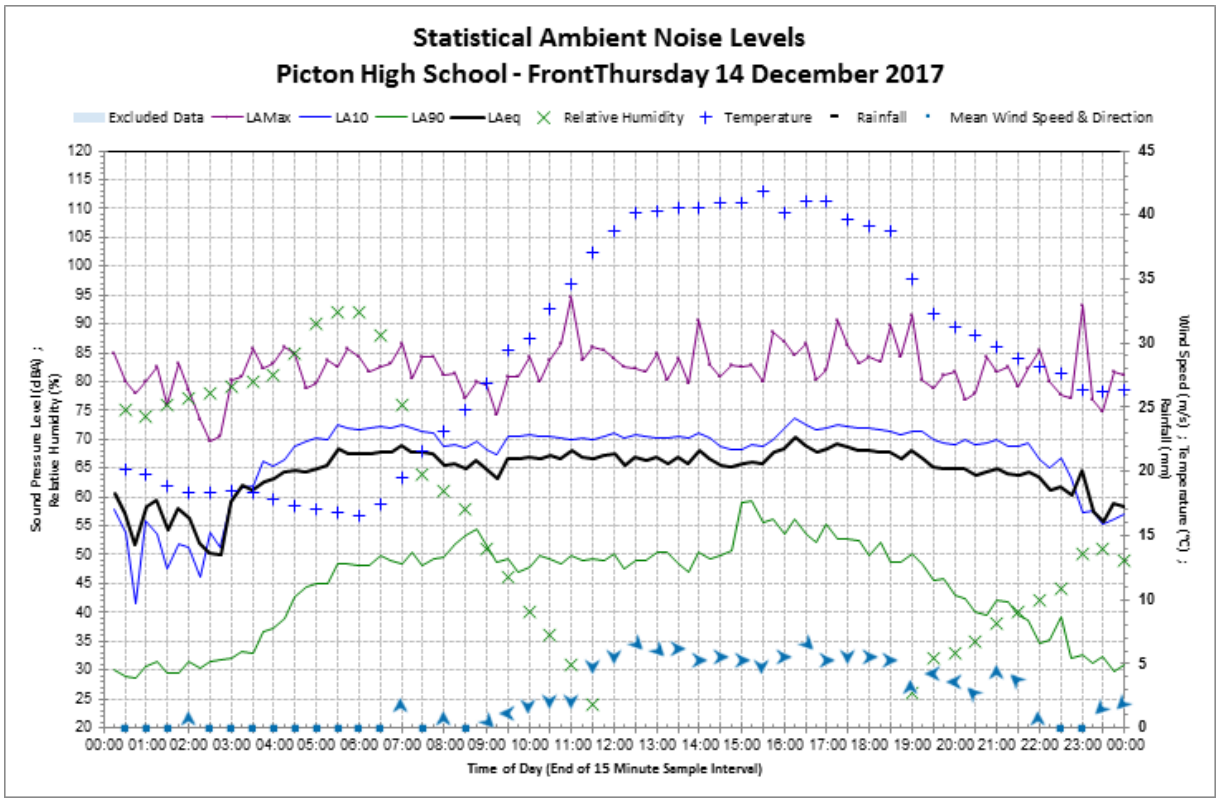

Statistical Ambient Noise Levels
Picton High School - FrontSaturday 9 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

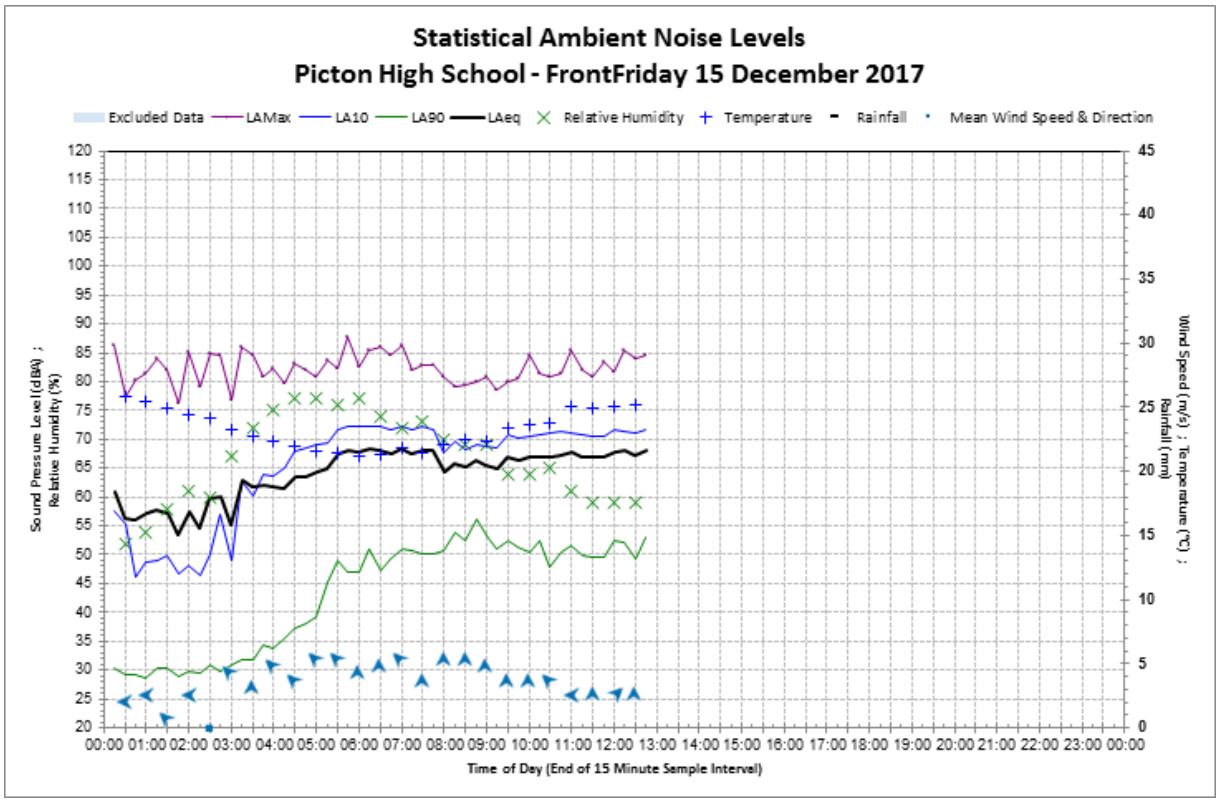

Statistical Ambient Noise Levels
Picton High School - FrontSunday 10 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School - FrontMonday 11 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School - FrontTuesday 12 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School - FrontWednesday 13 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School - FrontThursday 14 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Picton High School - FrontFriday 15 December 2017
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dB(A)) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

Appendix C – Construction noise levels

Receiver ID	Receiver Type		NML	CS01	CS02	CS03	CS04	CS05	CS06
C01	Commercial		70	55	59	53	55	50	49
C02	Commercial		70	51	56	50	52	47	48
C03	Commercial		70	59	64	58	60	55	52
C04	Commercial		70	54	57	51	53	48	48
C05	Commercial		70	51	55	49	51	46	48
C06	Commercial		70	51	56	50	52	47	48
C07	Commercial		70	63	65	59	61	56	82
C08	Commercial		70	57	62	56	58	53	88
C09	Commercial		70	56	61	55	57	52	63
C10	Commercial		70	53	56	50	52	47	67
C11	Commercial		70	54	59	53	55	50	73
C12	Commercial		70	49	53	47	49	44	60
POW1	Place of worship		55	54	57	51	53	48	48
R01	Residential	NCA2	58	79	85	79	81	76	61
R02	Residentia	NCA1	49	76	81	75	77	72	61
R03	Residentia	NCA1	49	76	81	75	77	72	63
R04	Residentia	NCA1	49	76	80	74	76	71	63
R05	Residentia	NCA1	49	74	80	74	76	71	61
R06	Residentia	NCA1	49	75	80	74	76	71	61
R07	Residentia	NCA1	49	73	79	73	75	70	63
R08	Residentia	NCA1	49	72	77	71	73	68	63
R09	Residentia	NCA1	49	67	72	66	68	63	60
R10	Residentia	NCA2	58	71	75	69	71	66	60
R11	Residentia	NCA2	58	70	74	68	70	65	57
R12	Residentia	NCA1	49	68	72	66	68	63	58
R13	Residentia	NCA1	49	69	73	67	69	64	59
R14	Residentia	NCA1	49	67	73	67	69	64	59
R15	Residentia	NCA1	49	67	72	66	68	63	59
R16	Residentia	NCA1	49	65	70	64	66	61	57
R17	Residentia	NCA1	49	61	66	60	62	57	55
R18	Residentia	NCA1	49	60	65	59	61	56	53
R19	Residentia	NCA1	49	59	64	58	60	55	54
R20	Residentia	NCA1	49	58	62	56	58	53	53
R21	Residentia	NCA1	49	62	65	59	61	56	55
R22	Residentia	NCA1	49	64	69	63	65	60	57
R23	Residentia	NCA1	49	64	68	62	64	59	58
R24	Residentia	NCA2	58	62	65	59	61	56	54
R25	Residentia	NCA1	49	64	68	62	64	59	57
R26	Residentia	NCA2	58	62	65	59	61	56	54
R27	Residentia	NCA1	49	64	67	61	63	58	58
R28	Residentia	NCA1	49	61	63	57	59	54	56
R29	Residentia	NCA1	49	56	58	52	54	49	53
R30	Residentia	NCA1	49	60	64	58	60	55	54
R31	Residentia	NCA1	49	56	60	54	56	51	52
R32	Residentia	NCA1	49	59	61	55	57	52	54
R33	Residentia	NCA1	49	61	66	60	62	57	56
R34	Residentia	NCA2	58	57	61	55	57	52	51
R35	Residentia	NCA1	49	59	60	54	56	51	50

Receiver ID	Receiver Type		NML	CS01	CS02	CS03	CS04	CS05	CS06
R36	Residentia	NCA1	49	59	61	55	57	52	53
R37	Residentia	NCA1	49	57	62	56	58	53	52
R38	Residentia	NCA1	49	59	63	57	59	54	52
R39	Residentia	NCA2	58	59	63	57	59	54	51
R40	Residentia	NCA2	58	55	59	53	55	50	50
R41	Residentia	NCA2	58	54	58	52	54	49	51
R42	Residentia	NCA2	58	53	58	52	54	49	52
R43	Residentia	NCA2	58	48	51	45	47	42	47
R44	Residentia	NCA2	58	50	53	47	49	44	49
R45	Residentia	NCA2	58	50	54	48	50	45	48
R46	Residentia	NCA1	49	52	55	49	51	46	44
R47	Residentia	NCA1	49	49	54	48	50	45	49
R48	Residentia	NCA1	49	55	57	51	53	48	49
R49	Residentia	NCA1	49	56	58	52	54	49	50
R50	Residentia	NCA1	49	55	57	51	53	48	52
R51	Residentia	NCA1	49	53	56	50	52	47	51
R52	Residentia	NCA1	49	60	61	55	57	52	50
R53	Residentia	NCA1	49	53	56	50	52	47	50
R54	Residentia	NCA1	49	54	57	51	53	48	51
R55	Residentia	NCA1	49	54	57	51	53	48	52
R56	Residentia	NCA1	49	55	60	54	56	51	54
R57	Residentia	NCA1	49	55	58	52	54	49	53
R58	Residentia	NCA1	49	58	61	55	57	52	55
R59	Residentia	NCA1	49	50	53	47	49	44	48
R60	Residentia	NCA1	49	51	54	48	50	45	49
R61	Residentia	NCA1	49	50	54	48	50	45	49
R62	Residentia	NCA1	49	53	56	50	52	47	50
R63	Residentia	NCA1	49	52	57	51	53	48	50
R64	Residentia	NCA1	49	54	59	53	55	50	51
R65	Residentia	NCA1	49	49	52	46	48	43	47
R66	Residentia	NCA1	49	52	56	50	52	47	49
R67	Residentia	NCA1	49	50	54	48	50	45	48
R68	Residentia	NCA1	49	51	55	49	51	46	47
R69	Residentia	NCA1	49	53	57	51	53	48	50
R70	Residentia	NCA1	49	50	54	48	50	45	51
R71	Residentia	NCA2	58	63	65	59	61	56	52
R72	Residentia	NCA2	58	70	75	69	71	66	56
R73	Residentia	NCA2	58	67	72	66	68	63	58
R74	Residentia	NCA2	58	67	73	67	69	64	61
R75	Residentia	NCA1	49	47	52	46	48	43	42
R76	Residentia	NCA2	58	62	67	61	63	58	69
R77	Residentia	NCA1	49	54	59	53	55	50	54
R78	Residentia	NCA1	49	49	52	46	48	43	55
R79	Residentia	NCA1	49	45	50	44	46	41	47
R80	Residentia	NCA1	49	48	52	46	48	43	50
R81	Residentia	NCA1	49	43	47	41	43	38	40

Appendix D – Exceedances of NML, dBA

Receiver ID	Receiver Type		NML	CS01	CS02	CS03	CS04	CS05	CS06
C01	Commercial		70	0	0	0	0	0	0
C02	Commercial		70	0	0	0	0	0	0
C03	Commercial		70	0	0	0	0	0	0
C04	Commercial		70	0	0	0	0	0	0
C05	Commercial		70	0	0	0	0	0	0
C06	Commercial		70	0	0	0	0	0	0
C07	Commercial		70	0	0	0	0	0	12
C08	Commercial		70	0	0	0	0	0	18
C09	Commercial		70	0	0	0	0	0	0
C10	Commercial		70	0	0	0	0	0	0
C11	Commercial		70	0	0	0	0	0	3
C12	Commercial		70	0	0	0	0	0	0
POW1	Place of worship		55	1	0	0	0	0	0
R01	Residential	NCA2	58	21	27	21	23	18	3
R02	Residential	NCA1	49	27	32	26	28	23	12
R03	Residential	NCA1	49	27	32	26	28	23	14
R04	Residential	NCA1	49	27	31	25	27	22	14
R05	Residential	NCA1	49	25	31	25	27	22	12
R06	Residential	NCA1	49	26	31	25	27	22	12
R07	Residential	NCA1	49	24	30	24	26	21	14
R08	Residential	NCA1	49	23	28	22	24	19	14
R09	Residential	NCA1	49	18	23	17	19	14	11
R10	Residential	NCA2	58	13	17	11	13	8	2
R11	Residential	NCA2	58	12	16	10	12	7	0
R12	Residential	NCA1	49	19	23	17	19	14	9
R13	Residential	NCA1	49	20	24	18	20	15	10
R14	Residential	NCA1	49	18	24	18	20	15	10
R15	Residential	NCA1	49	18	23	17	19	14	10
R16	Residential	NCA1	49	16	21	15	17	12	8
R17	Residential	NCA1	49	12	17	11	13	8	6
R18	Residential	NCA1	49	11	16	10	12	7	4
R19	Residential	NCA1	49	10	15	9	11	6	5
R20	Residential	NCA1	49	9	13	7	9	4	4
R21	Residential	NCA1	49	13	16	10	12	7	6
R22	Residential	NCA1	49	15	20	14	16	11	8
R23	Residential	NCA1	49	15	19	13	15	10	9
R24	Residential	NCA2	58	4	7	1	3	0	0
R25	Residential	NCA1	49	15	19	13	15	10	8
R26	Residential	NCA2	58	4	7	1	3	0	0
R27	Residential	NCA1	49	15	18	12	14	9	9
R28	Residential	NCA1	49	12	14	8	10	5	7
R29	Residential	NCA1	49	7	9	3	5	0	4

Receiver ID	Receiver Type		NML	CS01	CS02	CS03	CS04	CS05	CS06
R30	Residential	NCA1	49	11	15	9	11	6	5
R31	Residential	NCA1	49	7	11	5	7	2	3
R32	Residential	NCA1	49	10	12	6	8	3	5
R33	Residential	NCA1	49	12	17	11	13	8	7
R34	Residential	NCA2	58	0	3	0	0	0	0
R35	Residential	NCA1	49	10	11	5	7	2	1
R36	Residential	NCA1	49	10	12	6	8	3	4
R37	Residential	NCA1	49	8	13	7	9	4	3
R38	Residential	NCA1	49	10	14	8	10	5	3
R39	Residential	NCA2	58	1	5	0	1	0	0
R40	Residential	NCA2	58	0	1	0	0	0	0
R41	Residential	NCA2	58	0	0	0	0	0	0
R42	Residential	NCA2	58	0	0	0	0	0	0
R43	Residential	NCA2	58	0	0	0	0	0	0
R44	Residential	NCA2	58	0	0	0	0	0	0
R45	Residential	NCA2	58	0	0	0	0	0	0
R46	Residential	NCA1	49	3	6	0	2	0	0
R47	Residential	NCA1	49	0	5	0	1	0	0
R48	Residential	NCA1	49	6	8	2	4	0	0
R49	Residential	NCA1	49	7	9	3	5	0	1
R50	Residential	NCA1	49	6	8	2	4	0	3
R51	Residential	NCA1	49	4	7	1	3	0	2
R52	Residential	NCA1	49	11	12	6	8	3	1
R53	Residential	NCA1	49	4	7	1	3	0	1
R54	Residential	NCA1	49	5	8	2	4	0	2
R55	Residential	NCA1	49	5	8	2	4	0	3
R56	Residential	NCA1	49	6	11	5	7	2	5
R57	Residential	NCA1	49	6	9	3	5	0	4
R58	Residential	NCA1	49	9	12	6	8	3	6
R59	Residential	NCA1	49	1	4	0	0	0	0
R60	Residential	NCA1	49	2	5	0	1	0	0
R61	Residential	NCA1	49	1	5	0	1	0	0
R62	Residential	NCA1	49	4	7	1	3	0	1
R63	Residential	NCA1	49	3	8	2	4	0	1
R64	Residential	NCA1	49	5	10	4	6	1	2
R65	Residential	NCA1	49	0	3	0	0	0	0
R66	Residential	NCA1	49	3	7	1	3	0	0
R67	Residential	NCA1	49	1	5	0	1	0	0
R68	Residential	NCA1	49	2	6	0	2	0	0
R69	Residential	NCA1	49	4	8	2	4	0	1
R70	Residential	NCA1	49	1	5	0	1	0	2
R71	Residential	NCA2	58	5	7	1	3	0	0
R72	Residential	NCA2	58	12	17	11	13	8	0
R73	Residential	NCA2	58	9	14	8	10	5	0

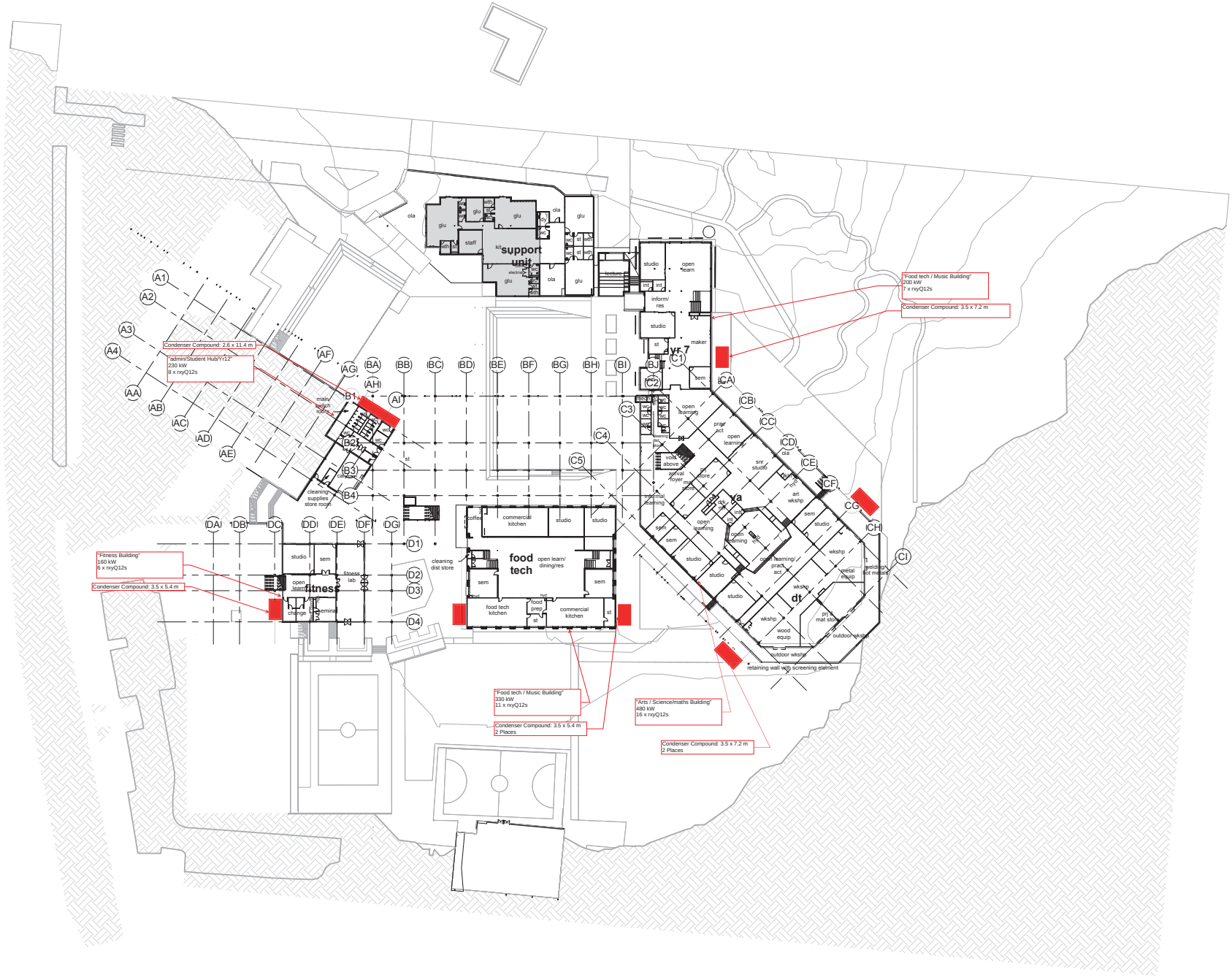
Receiver ID	Receiver Type		NML	CS01	CS02	CS03	CS04	CS05	CS06
R74	Residential	NCA2	58	9	15	9	11	6	3
R75	Residential	NCA1	49	0	3	0	0	0	0
R76	Residential	NCA2	58	4	9	3	5	0	11
R77	Residential	NCA1	49	5	10	4	6	1	5
R78	Residential	NCA1	49	0	3	0	0	0	6
R79	Residential	NCA1	49	0	1	0	0	0	0
R80	Residential	NCA1	49	0	3	0	0	0	1
R81	Residential	NCA1	49	0	0	0	0	0	0

Appendix E – Predicted operational noise levels – day period, dBA

Receiver ID	Receiver Type		Noise Source	NPI Criteria	Predicted noise level	Compliance
C01	Commercial		Mech/Bell/PA	65	28	Yes
C02	Commercial		Mech/Bell/PA	65	26	Yes
C03	Commercial		Mech/Bell/PA	65	29	Yes
C04	Commercial		Mech/Bell/PA	65	27	Yes
C05	Commercial		Mech/Bell/PA	65	23	Yes
C06	Commercial		Mech/Bell/PA	65	24	Yes
C07	Commercial		Mech/Bell/PA	65	38	Yes
C08	Commercial		Mech/Bell/PA	65	34	Yes
C09	Commercial		Mech/Bell/PA	65	34	Yes
C10	Commercial		Mech/Bell/PA	65	30	Yes
C11	Commercial		Mech/Bell/PA	65	30	Yes
C12	Commercial		Mech/Bell/PA	65	27	Yes
POW1	Place of worship		Mech/Bell/PA	55	26	Yes
R01	Residential	NCA2	Mech/Bell/PA	53	41	Yes
R02	Residential	NCA1	Mech/Bell/PA	44	42	Yes
R03	Residential	NCA1	Mech/Bell/PA	44	43	Yes
R04	Residential	NCA1	Mech/Bell/PA	44	43	Yes
R05	Residential	NCA1	Mech/Bell/PA	44	42	Yes
R06	Residential	NCA1	Mech/Bell/PA	44	41	Yes
R07	Residential	NCA1	Mech/Bell/PA	44	41	Yes
R08	Residential	NCA1	Mech/Bell/PA	44	40	Yes
R09	Residential	NCA1	Mech/Bell/PA	44	39	Yes
R10	Residential	NCA2	Mech/Bell/PA	53	37	Yes
R11	Residential	NCA2	Mech/Bell/PA	53	36	Yes
R12	Residential	NCA1	Mech/Bell/PA	44	36	Yes
R13	Residential	NCA1	Mech/Bell/PA	44	39	Yes
R14	Residential	NCA1	Mech/Bell/PA	44	36	Yes
R15	Residential	NCA1	Mech/Bell/PA	44	35	Yes
R16	Residential	NCA1	Mech/Bell/PA	44	34	Yes
R17	Residential	NCA1	Mech/Bell/PA	44	35	Yes
R18	Residential	NCA1	Mech/Bell/PA	44	33	Yes
R19	Residential	NCA1	Mech/Bell/PA	44	32	Yes
R20	Residential	NCA1	Mech/Bell/PA	44	31	Yes
R21	Residential	NCA1	Mech/Bell/PA	44	33	Yes
R22	Residential	NCA1	Mech/Bell/PA	44	33	Yes
R23	Residential	NCA1	Mech/Bell/PA	44	35	Yes
R24	Residential	NCA2	Mech/Bell/PA	53	31	Yes
R25	Residential	NCA1	Mech/Bell/PA	44	34	Yes
R26	Residential	NCA2	Mech/Bell/PA	53	32	Yes
R27	Residential	NCA1	Mech/Bell/PA	44	32	Yes
R28	Residential	NCA1	Mech/Bell/PA	44	31	Yes
R29	Residential	NCA1	Mech/Bell/PA	44	32	Yes
R30	Residential	NCA1	Mech/Bell/PA	44	30	Yes
R31	Residential	NCA1	Mech/Bell/PA	44	29	Yes

Receiver ID	Receiver Type		Noise Source	NPI Criteria	Predicted noise level	Compliance
R32	Residential	NCA1	Mech/Bell/PA	44	29	Yes
R33	Residential	NCA1	Mech/Bell/PA	44	30	Yes
R34	Residential	NCA2	Mech/Bell/PA	53	28	Yes
R35	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R36	Residential	NCA1	Mech/Bell/PA	44	29	Yes
R37	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R38	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R39	Residential	NCA2	Mech/Bell/PA	53	29	Yes
R40	Residential	NCA2	Mech/Bell/PA	53	27	Yes
R41	Residential	NCA2	Mech/Bell/PA	53	27	Yes
R42	Residential	NCA2	Mech/Bell/PA	53	27	Yes
R43	Residential	NCA2	Mech/Bell/PA	53	22	Yes
R44	Residential	NCA2	Mech/Bell/PA	53	25	Yes
R45	Residential	NCA2	Mech/Bell/PA	53	26	Yes
R46	Residential	NCA1	Mech/Bell/PA	44	22	Yes
R47	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R48	Residential	NCA1	Mech/Bell/PA	44	27	Yes
R49	Residential	NCA1	Mech/Bell/PA	44	27	Yes
R50	Residential	NCA1	Mech/Bell/PA	44	27	Yes
R51	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R52	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R53	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R54	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R55	Residential	NCA1	Mech/Bell/PA	44	27	Yes
R56	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R57	Residential	NCA1	Mech/Bell/PA	44	29	Yes
R58	Residential	NCA1	Mech/Bell/PA	44	30	Yes
R59	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R60	Residential	NCA1	Mech/Bell/PA	44	24	Yes
R61	Residential	NCA1	Mech/Bell/PA	44	22	Yes
R62	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R63	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R64	Residential	NCA1	Mech/Bell/PA	44	27	Yes
R65	Residential	NCA1	Mech/Bell/PA	44	25	Yes
R66	Residential	NCA1	Mech/Bell/PA	44	24	Yes
R67	Residential	NCA1	Mech/Bell/PA	44	24	Yes
R68	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R69	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R70	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R71	Residential	NCA2	Mech/Bell/PA	53	32	Yes
R72	Residential	NCA2	Mech/Bell/PA	53	37	Yes
R73	Residential	NCA2	Mech/Bell/PA	53	31	Yes
R74	Residential	NCA2	Mech/Bell/PA	53	29	Yes
R75	Residential	NCA1	Mech/Bell/PA	44	18	Yes
R76	Residential	NCA2	Mech/Bell/PA	53	39	Yes
R77	Residential	NCA1	Mech/Bell/PA	44	28	Yes
R78	Residential	NCA1	Mech/Bell/PA	44	26	Yes
R79	Residential	NCA1	Mech/Bell/PA	44	25	Yes
R80	Residential	NCA1	Mech/Bell/PA	44	25	Yes
R81	Residential	NCA1	Mech/Bell/PA	44	24	Yes

Appendix F – Mechanical equipment locations



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A	66% Schematic Design	5/12/17

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PROJECT
PICTON HIGH SCHOOL REDEVELOPMENT

DESCRIPTION
PLAN - GENERAL ARRANGEMENT - LOWER GROUND FLOOR PLAN

Project No	17003
Scale	Date
1 : 500@A1	05/12/17
Drawn By	Checked By
Author	Checker
Drawing No	Revision
AA10-0100	A

SCHEMATIC DESIGN

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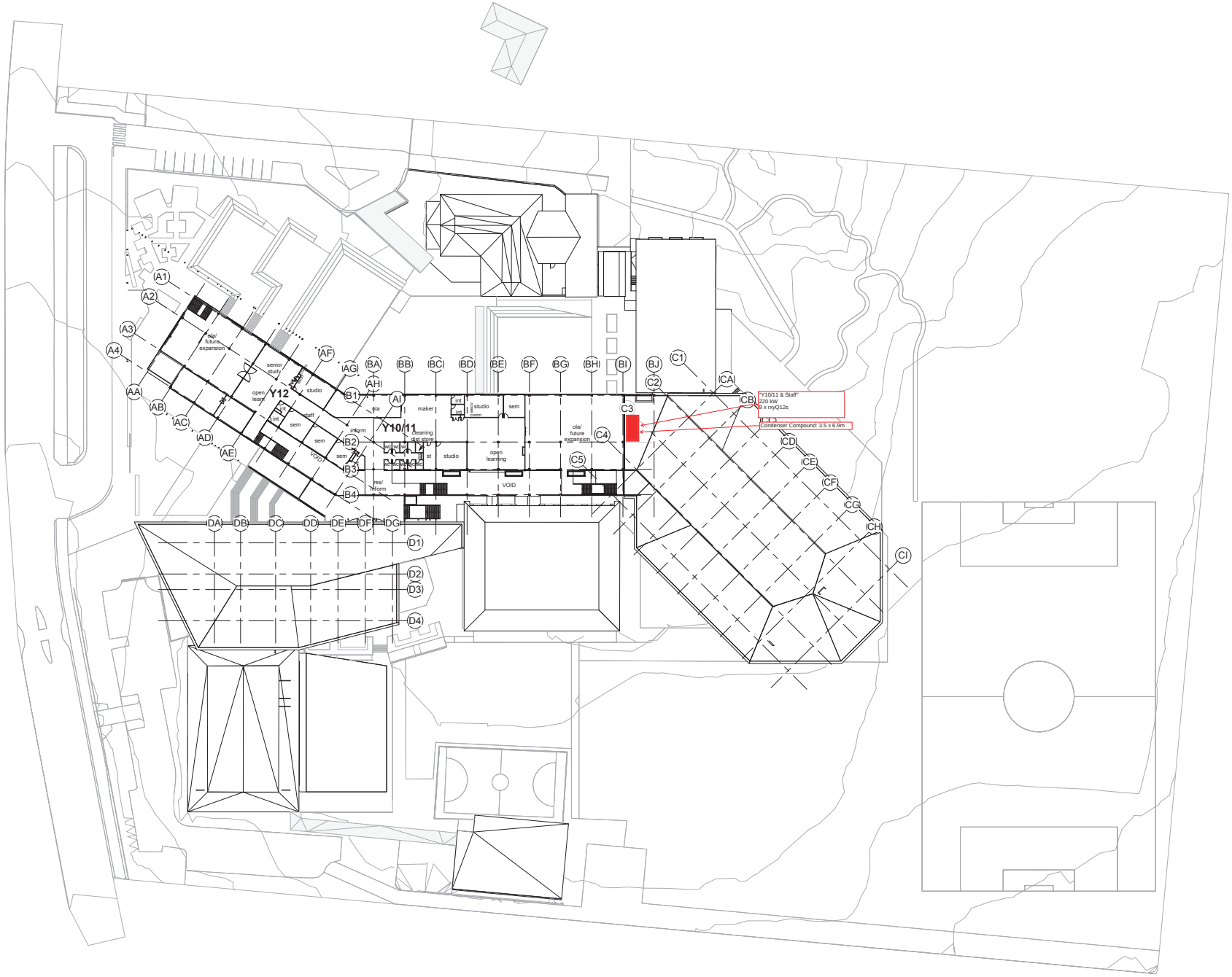

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CLIENT
DEPARTMENT OF EDUCATION

PROJECT
PICTON HIGH SCHOOL REDEVELOPMENT

DESCRIPTION
PLAN - GENERAL ARRANGEMENT - FIRST FLOOR PLAN

Project No	17003
Scale 1 : 500@A1	Date 05/12/17
Drawn By	Checked By
Author	Checker
Drawing No AA10-0300	Revision A

SCHEMATIC DESIGN

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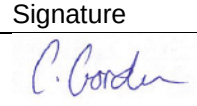
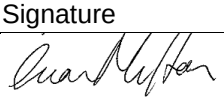
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	M.Velasco	C.Gordon		E.Milton		05/04/2018

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