REPORT

GILLIESTON PUBLIC SCHOOL REDEVELOPMENT AND NEW PUBLIC PRESCHOOL

NOISE & VIBRATION IMPACT ASSESSMENT

RWDI # 2300274

January 15, 2025

SUBMITTED TO

School Infrastructure NSW
Level 8, 259 George Street
Sydney NSW 2000

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ACTIVITY

The Gillieston Public School have been identified by the NSW Department of Education (DoE) as requiring redevelopment. The proposed Gillieston Public School Redevelopment and New Public Preschool is driven by service need including increase in expected student enrolments and the and removing demountable structure and replacement with permanent teaching spaces.

The Gillieston Public School Redevelopment and New Public Preschool comprises the following activity:

- Demolition and removal of existing temporary structures.
- Site preparation activity, including demolition, earthworks, tree removal.
- Construction of new:
  - 32 permanent general learning spaces and 3 support teaching spaces
  - Administration and staff hubs
  - Hall, canteen and library
  - Out of school hours care
  - Public preschool (standalone building for 60 places)
  - Covered Outdoor Learning Areas (COLAs)
  - Outdoor play areas, including games courts and yarning circle
  - New at-grade car parking
  - Extension of the existing drop-off / pick-up area and new bus bay
  - Realignment of the existing fencing
  - Associated stormwater infrastructure upgrades
  - Associated landscaping
  - Associated pedestrian and road upgrade activity

BACKGROUND

1. Introduction

This report presents the results of the noise and vibration impact assessment undertaken for the Gillieston Public School. The REF pertains to the redevelopment of the existing school, which will include demolition of structures, site preparation, tree removals, and the construction of a three-storey school building and a school hall to accommodate up to 736 students, and a preschool accommodating up to 60 children.

The following guidelines and standards have been referenced in this NVIA:

- *Noise Policy for Industry* (NSW EPA, 2017) *(NPfI);*
- *Road Noise Policy* (EPA, 2011) *(RNP);*
- *Interim Construction Noise Guideline* (NSW EPA, 2009) *(ICNG);*
- Transport for NSW *Construction Noise & Vibration Strategy* (TfNSW, 2023);
- British Standard BS 7385:1993;
- German Standard DIN 4150:2016.

Based on the identification of potential impacts and an assessment of the nature and extent of the impacts of the proposed activity, it is determined that all potential impacts can be appropriately managed or mitigated so as to minimise potential adverse impact on the locality, community and/or the environment. A summary of management and mitigation measures can be found in Section 7.1.

2. Site Description

The Site is identified as 100 Ryans Road and 19 Northview Street, Gillieston Heights, legally described as Lot 51 DP 1162489 and Lot 2 DP1308605. The Site is located within the Maitland Local Government Area (LGA) and is zoned RU2 Rural Landscape and R1 General Residential zone under the provisions of the Maitland Local Environmental Plan 2011 (MLEP2011).

Existing attributes of the subject site are noted as follows:

- The subject site exhibits an area of approximately 23,385m² and is located in the suburb of Gillieston Heights;
- The subject site has a frontage to Ryans Road to the east, Gillieston Road to the north, and Northview Street to the south;
- In its existing state, the subject site comprises the existing Gillieston Public School. Existing school buildings are primarily located in the west portion of the subject site with a large area of open space situated in the eastern portion. There are limited permanent structures located on the subject site with thirteen (13) existing demountable classrooms currently occupying the subject site. Permanent buildings consist of the Main Administration Building, Original Brick Cottage, Library and GLS building located in the centre of the subject site; and
- Carparking is provided from Gillieston Road for staff. Pedestrian access is available via this main entrance from Gillieston Road and via a separate pedestrian-only access gates on Northview Street and Ryans Road.

The existing site context is shown in Figure 1 and Figure 2 below.

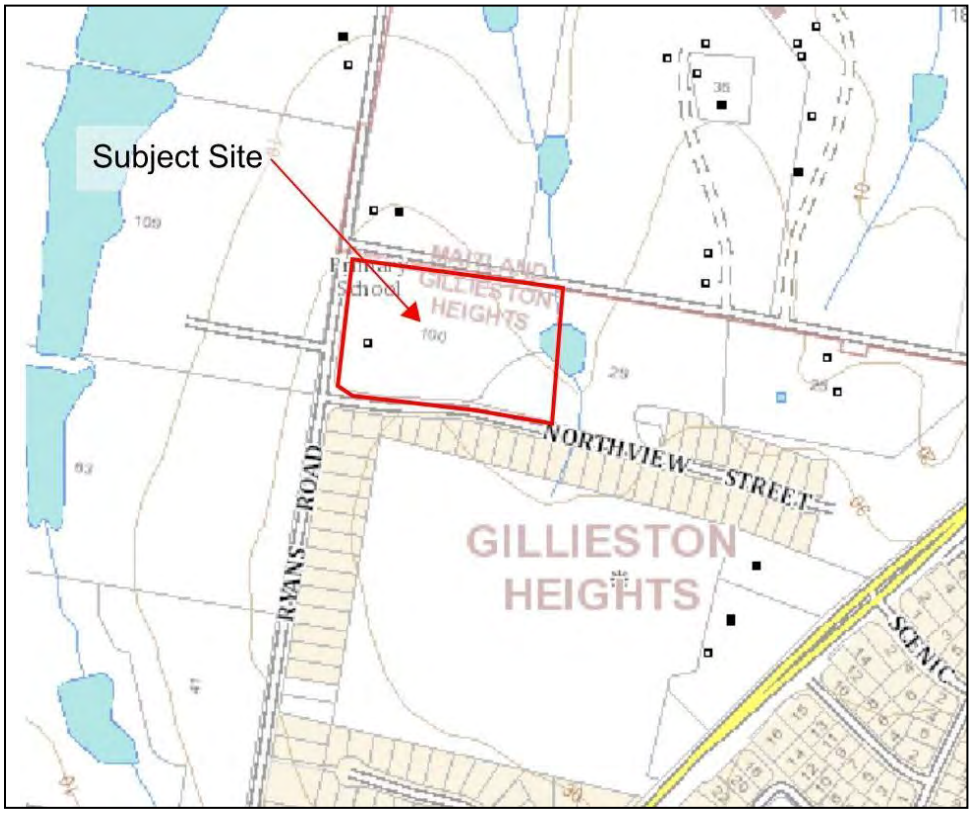

Figure 1 – Cadastral Map (Source: NSW Spatial Viewer, 2024)

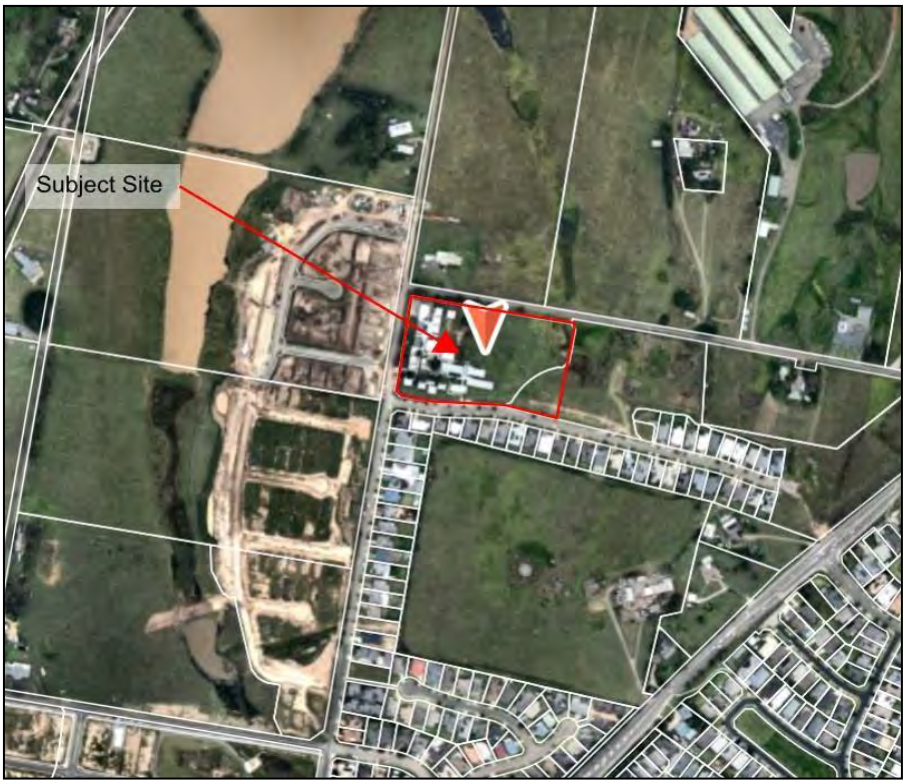

Figure 2 – Site Aerial Map (Source: Near Map, 2024)

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GLOSSARY OF ACOUSTIC TERMS

Acoustical Environment - The acoustical characteristics of a space or room influenced by the amount of acoustical absorption, or lack of it, in the space.

Ambient Noise - All noise level present in a given environment, usually being a composite of sounds from many sources near and far. Traffic, HVAC, masking sound, or even low-level background music can contribute to ambient level of noise or sound.

A-weighting - A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

A-weighted sound level - The sound level measured with a sound level meter using A-weighting, which alters the sensitivity of the sound level meter with respect to frequency so that the sound level meter is less sensitive at frequencies where the ear is less sensitive; usually used in specifying permissible sound levels in buildings.

Baffle - An acoustical sound absorbing unit. Normally suspended vertically in a variety of patterns to introduce absorption into a space to reduce reverberation and noise levels.

Decibel - A logarithmic unit used to express the difference or magnitude of the level or power of sound intensity. It is equal to ten times the common logarithm of the ratio of the two levels. A whisper is about 20 dB, typical conversation is between 60-70 dB, and the threshold of pain for the human ear is around 120 dB. Decibels are not directly related to human ear sensitivity and double dB does not equate to a doubling in perceived loudness since it works as a curve. 10 dB is a typical doubling or halving of perceived volume. Note that being logarithmic values, they cannot be arithmetically added.

Diffusion - The scattering or random reflection of a sound wave from a surface. The direction of reflected sound is changed so that the listeners may have the sensation of sound coming from all directions at equal levels. Most rooms are not diffused, and reverberation times can be different in different parts of the room due to the room's modes. The amount of diffusion can be measured by taking reverb measurements in many different locations in the room and then taking the average of the differences in decay times.

Echo - A reflected sound producing a distinct repetition of the original sound that reaches the listener when the delay is >0.01 seconds after the direct sound. The reflecting object must be at an average of about 15 metres in order for an echo to be heard.

Frequency - The number of cycles per second of a given tone. Acoustical frequency is normally measured in units called Hertz (Hz). One Hz is 1 cycle per second, two Hz is 2 cycles per second, and so on.

Hertz - The unit of frequency, equal to one cycle per second.

Noise Rating (NR) - NR is determined by NR Curves which are a series of curves of octave-band spectra, used to provide a single number rating of the noisiness of an indoor space. The room's octave-band spectrum is compared with this set of curves to determine the NR level of the room and illustrates the extent to which unwanted noise such as mechanical or HVAC noise interferes with speech intelligibility.

Noise Reduction Coefficient (NRC) - An arithmetic average of an acoustic material to the nearest multiple of 0.05 of four sound absorption coefficients at frequencies of 250 Hz, 500 Hz, 1000 Hz, and 2000 Hz. An NRC of 0 = perfect reflection and an NRC of 1 = perfect absorption. NRC is based on human speech frequencies therefore providing a simple scale of how well a surface material will absorb the human voice.

Reverberation - The perpetuation of sound wave energy in an enclosed space after the original sound source has stopped. After this original sound source has stopped, the sound wave energy will continue to be reflected and absorbed until it loses enough energy to die out. More reverberation can be good for music, but poor for speech intelligibility.

Reverberation Time - The time it takes in seconds for a sound to decay 60 dB or one-millionth of its original sound level after the source has stopped in an enclosed space. Commonly referred to as RT60.

Sound Absorption - The property of materials such as air, walls, or acoustic panels that changes sound wave energy into heat energy. When a sound wave hits a surface, that which is not reflected is absorbed.

Speech Privacy - The extent that speech becomes unintelligible between rooms or spaces like offices and conference rooms usually found in an open office plan. The three ratings used are: Confidential (Very Good Privacy), Normal (Fair to Good Privacy), and Minimal (Poor Privacy).

Sound Transmission Class (STC) - A method for a single number ranking of walls, doors, windows, noise barriers, partitions, and other acoustic products measured over 16 frequencies ranging from 125 Hz to 4000 Hz, assuming that the noise source is generally even across the frequency spectrum. STC involves measuring transmission loss (TL) at various frequency bands of a generated sound source from one room to another separated by the median that is being tested.

Weighted Sound Reduction Index (R_w) - This is a single number value in decibels given to an individual element or path through a construction, providing guidance on its sound insulation performance across the spectrum of audible frequencies. Different building elements may have different R_w values, and a single R_w value may be used to represent the overall 'composite' value. Consider for example a brick wall (R_w 45 dB) with a lightweight door inset (R_w 20 dB) and a gap underneath (R_w ~0 dB). The R_w value representing the overall wall, door and gap will depend on the relative size of each component and real examples typically range from 10 dB to 30 dB.

1 INTRODUCTION

This report presents the results of the noise and vibration impact assessment undertaken for Gillieston Public School (the site) located at 100 Ryans Road, Gillieston Heights. Gillieston Public School has been identified by the NSW Department of Education (DoE) as requiring redevelopment. The proposed Gillieston Public School Redevelopment and New Public Preschool is driven by service need including an increase in expected student enrolments and the removal of demountable structures and replacement with permanent teaching spaces.

This report is the Noise and Vibration Impact Assessment (NVIA) prepared for the proposed activity. The report forms part of the Review of Environmental Factors (REF) submission for the proposed activity. The REF pertains to the Redevelopment of the existing school, which will include demolition of structures, site preparation, tree removals, and the construction of a three-storey school building and a school hall to accommodate up to 736 students, and a preschool accommodating up to 60 children.

This assessment has been prepared based on the following documentation:

- Mechanical Services Site Plan prepared by Arcadis dwg GPS -AAP -00 -00 -DR -M-000010 (dated 28 August 2024)
- Architectural Package issued For Information prepared by SHAC (dated 28 August 2024)
- Gillieston Public School Traffic and Transport Impact Assessment prepared by Bitzios, dated 27 September 2024 (hereafter referred to as the "traffic report").

The following guidelines and standards have been referenced in this NVIA:

- *Noise Policy for Industry* (NSW EPA, 2017) *(NPfI);*
- *Road Noise Policy* (EPA, 2011) *(RNP);*
- *Interim Construction Noise Guideline* (NSW EPA, 2009) *(ICNG);*
- Transport for NSW *Construction Noise & Vibration Strategy* (TfNSW, 2023);
- British Standard BS 7385:1993;
- German Standard DIN 4150:2016.

2 PROJECT DESCRIPTION

2.1 Site Location and Surrounding Receivers

The Site is identified as 100 Ryans Road and 19 Northview Street, Gillieston Heights, legally described as Lot 51 DP 1162489 and Part Lot 2 DP1308605.

The Site is located within the Maitland Local Government Area (LGA) and is zoned RU2 Rural Landscape and R1 General Residential zone under the provisions of the Maitland Local Environmental Plan 2011 (MLEP2011).

Existing attributes of the subject site are noted as follows:

- The subject site exhibits an area of approximately 23,385m² and is located in the suburb of Gillieston Heights;
- The subject site has a frontage to Ryans Road to the west, Gillieston Road to the north, and Northview Street to the south;
- In its existing state, the subject site comprises the existing Gillieston Public School. Existing school buildings are primarily located in the west portion of the subject site with a large area of open space situated in the eastern portion. There are limited permanent structures located on the subject site with thirteen (13) existing demountable classrooms currently occupying the subject site. Permanent buildings consist of the Main Administration Building, Original Brick Cottage, Library and GLS building located in the centre of the subject site; and
- Carparking is provided from Gillieston Road for staff. Pedestrian access is available via this main entrance from Gillieston Road and via a separate pedestrian-only access gates on Northview Street and Ryans Road.

The existing site context is shown in Figure 2-1 and Figure 2-2 below.

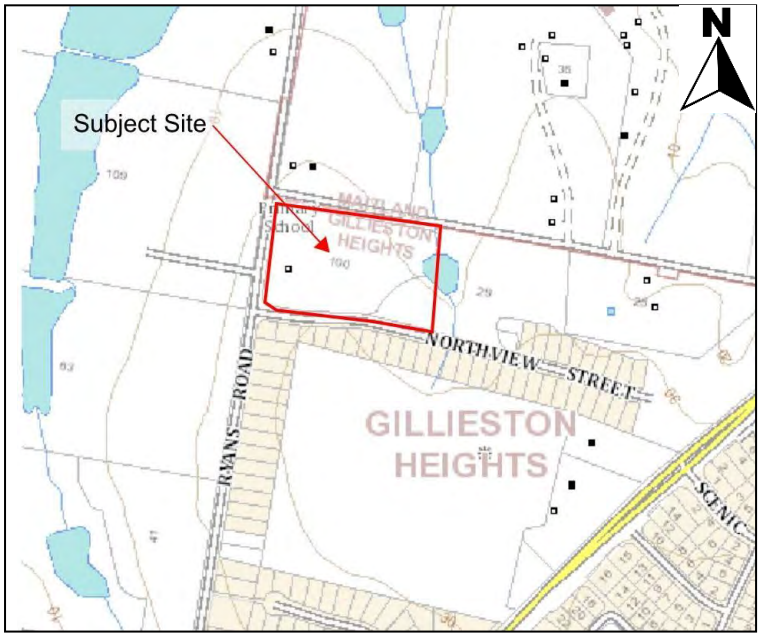

Figure 2-1 Cadastral Map (Source: NSW Spatial Viewer, 2024)

Figure 2-2 Site Aerial Map (Source: Near Map, 2024)

The site is located on land bound to the north by Gillieston Road, to the west by Ryans Road and to the south by Northview Street. The potentially most affected residential receivers from the proposed activity are as follows (indicated in red in Figure 2-3):

- Receiver Area 1 (R1): 98 Ryans Road, and 4 through 34 Northview Street located to the south of the site across Northview Street;
- Receiver 2 (R2): 56 Gillieston Road to the north of the site across Gillieston Road;
- Receiver Area 3 (R3): 31 through 41 Northview Street located further to the east of the site; and
- Receiver Area 4 (R4) Land currently under development for residential use located to the west of the site across Ryans Road.

Figure 2-3 Site Location (Image Courtesy of Nearmap)

2.2 Proposed Activity

The current site has capacity for 339 students, with the intention that enrolments will gradually increase over time as the surrounding area becomes more developed. This acoustic report will assess the redevelopment of the school, which will allow for a capacity of up to 736 students.

The Gillieston Public School Redevelopment and New Public Preschool comprises the following activity:

- Demolition and removal of existing temporary structures.
- Site preparation activity, including demolition, earthworks, tree removal.
- The proposed activity will include:
  - 32 permanent general learning spaces and 3 support teaching spaces
  - Administration and staff hubs
  - Hall, canteen and library
  - Out of school hours care
  - Public preschool (standalone building for 60 places)
  - Covered Outdoor Learning Areas (COLAs)
  - Outdoor play areas, including games courts and yarning circle
  - New at-grade car parking
  - Extension of the existing drop-off / pick-up area and new bus bay
  - Realignment of the existing fencing

- Associated stormwater infrastructure upgrades
- Associated landscaping
- Associated pedestrian and road upgrade activity

The site will operate between the following hours:

- Main school: 8.45am to 3.05pm
- Pre School: 8.45am to 3.05pm
- Before school care: 6.00am-8:35am
- After school care: 3:05pm-6.00pm
- Vacation care (during school holidays): 6.00am-6.00pm

The architectural documentation for the new school has been produced by SHAC and is included separately within the design package. The proposed site ground floor layout is shown for reference in Figure 2-4.

Figure 2-4 Proposed Ground floor Site Layout

3 OPERATIONAL NOISE ASSESSMENT

This section of the report addresses operational noise emissions from the proposed activity.

3.1 Operational Noise Level Criteria

3.1.1 NSW EPA Noise Policy for Industry

The NSW EPA Noise Policy for Industry (NPfI) provides a framework and process for deriving noise criteria for consents and licences that enable the EPA and others to regulate premises that are scheduled under the Protection of the Environment Operations Act 1997. Whilst specifically aimed at assessment and control of noise from industrial premises regulated by the EPA, the policy is also appropriate for use by authorities such as the DP&E when assessing major activity.

The NPfI documents a procedure for assessment and management of industrial noise which involves the following steps:

- Determining the project noise trigger for a activity. The project noise trigger level is a benchmark level above which noise management measures are required to be considered. They are derived by considering shot-term intrusiveness due to changes in the existing environment (applicable to residential receivers only) and maintaining noise level amenity for particular land uses for residents and other sensitive receivers;
- Predicting and measuring noise produced by the activity (having regard to any associated annoying characteristics and prevailing meteorological effects);
- Comparing the predicted or measured noise level with project noise trigger level and assessing impacts and the need for noise mitigation and management measure;
- Considering any residual noise impacts following the application of feasible and reasonable noise mitigation measures;
- Setting statutory compliance levels that reflect the best achievable and agreed noise limits for the activity; and
- Monitoring and reporting environmental noise levels from the activity.

3.1.1.1 Intrusiveness Noise Level

The intrusiveness noise level applies only to residential receivers and is the noise level 5 dB above the background noise level for each time period (daytime, evening or night-time). The Rating Background Level (RBL), representative of the background noise level, is derived from the measured L_{A90} noise levels determined using unattended monitoring. At this stage, no background noise survey has been conducted for this project. Instead, the intrusiveness criteria have been derived based on the minimum RBLs presented in Table 2.1 of the *NPfI*.

Intrusiveness noise criteria levels for the project are summarised in Table 3-1.

Table 3-1 Project Intrusiveness Noise Levels

Assessment Period [1]	Minimum assumed Rating Background Level (RBL) dBA	Project Intrusiveness Noise Level $L_{Aeq,\ 15min}$ dBA
Day	35	40
Evening	30	35
Night	30	35

Note 1: Day = 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am,

3.1.1.2 Amenity Noise Level

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

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

The recommended amenity noise level represents the objective for total industrial noise at a receiver location. The project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To prevent increases in industrial noise due to the cumulative effect of several activities, the project amenity noise level for each new source of industrial noise is set at 5dBA below the recommended amenity noise level.

The following exceptions apply to determining the project amenity noise level:

- For high-traffic areas, the amenity criterion for industrial noise becomes the $L_{Aeq,period(traffic)}$ minus 15dBA.
- In proposed activities in major industrial clusters.
- If the resulting project amenity noise level is 10dB or lower than the existing industrial noise level, the project amenity noise level can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.
- Where cumulative industrial noise is not a consideration because no other industries are present in, or likely to be introduced into the area, the relevant amenity noise level is assigned as the project amenity noise level for the activities.

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

Due to different averaging periods for the $L_{Aeq,15min}$ and $L_{Aeq,period}$ noise descriptors, the values of project intrusiveness and amenity noise levels cannot be compared directly when identifying noise trigger levels i.e. the most stringent values of each category. In order to make a comparison between descriptors, the NPfI assumes that the $L_{Aeq,15min}$ equivalent of an $L_{Aeq,period}$ noise level is equal to the $L_{Aeq,15min}$ level plus 3dB.

The project amenity noise levels for surrounding receivers are shown in Table 3-2. The most potentially affected residential receivers near the site are classified as being in a "suburban" noise amenity area.

Table 3-2 Recommended Amenity Noise Levels

Receiver	Noise Amenity Area	Time of Day [1]	Recommended Amenity Noise Level $L_{Aeq,period}$ dBA	Project Amenity Noise Level $L_{Aeq,period}$ dBA	Project Amenity Noise Level $L_{Aeq,15min}$ dBA
Residential	Suburban	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38

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

3.1.1.3 Project Trigger Criteria

The project noise trigger levels (PNTLs) are defined as the lower of the project intrusiveness and the project amenity noise levels. The PNTLs are summarised in Table 3-3 below.

Table 3-3 *NPfI* Overall Project Trigger Noise Level Criteria

Location	Assessment Period [1]	Intrusiveness Criteria $L_{Aeq,15min}$ dBA	Amenity Criteria $L_{Aeq,15min}$ dBA	Project Noise Trigger Criteria $L_{Aeq,15min}$ dBA
Residential	Day	40	53	40
	Evening	35	43	35
	Night	35	38	35

Note 1: Day = 7am – 6pm; Evening = 6pm – 10pm; Night = 10pm – 7am

3.1.1.4 Sleep Disturbance

Guidance for assessing the potential for sleep disturbance impacts on nearby residences is provided in Section 2.5 of the NPfI, which states:

> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - $L_{Aeq,15min}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
> - L_{Amax} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater,
>
> *a detailed maximum noise level event assessment should be undertaken.*

3.1.2 Speech/Recreational Noise from External Areas

There are no policies in New South Wales governing noise emissions from children within play areas of school facilities. Attempting to assign a level to noise generated by school children involved in outdoor play, predominantly during recess and lunch breaks and then comparing it with a predetermined criterion for the purposes of assessing "offensiveness", is inappropriate. It is difficult to imagine any school from which these emissions could, or would, comply with any 'typical' intrusiveness-based criterion. Being an essential part of every residential community, schools are located to permit ready access to students and, by definition, are generally surrounded by residential premises. An assessment based on a comparison between a measured and/or predicted level with a specific criterion may set an undesirable precedent for both existing and future schools.

Notwithstanding the above, a qualitative assessment of noise impacts from use of the outdoor areas has been undertaken comparing the noise emissions predicted from the current school capacity and playground layout with the proposed future capacity and layout.

Noise emissions from general classroom activities will generally be contained within internal areas of the school and are not expected to result in any adverse noise impacts on surrounding receivers. As a result, no assessment of noise emissions from classroom activities has been undertaken in this assessment.

3.2 Assessment of Operational Noise

Noise emissions from the proposed activities have been predicted using the noise modelling software Cadna v2023, implementing the algorithms outlined in ISO 9613-2: Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.

The primary sources of noise generation identified from the site are as follows:

- Mechanical plant noise.
- Vehicle noise during student drop off and pick-up.
- Passive recreational noise from students occupying the external play areas.

3.2.1 Mechanical Services and Vehicle Noise Assessment

3.2.1.1 Mechanical Services Noise Sources

The latest mechanical services plans indicate mechanical services located in two ground floor plantrooms in Building C housing air-conditioning condenser units, both with ventilation louvres on the northern façade. In addition, two condenser units are proposed on Building B, which are assumed to be located on the roof.

The location of the mechanical services is shown in Figure 3-1.

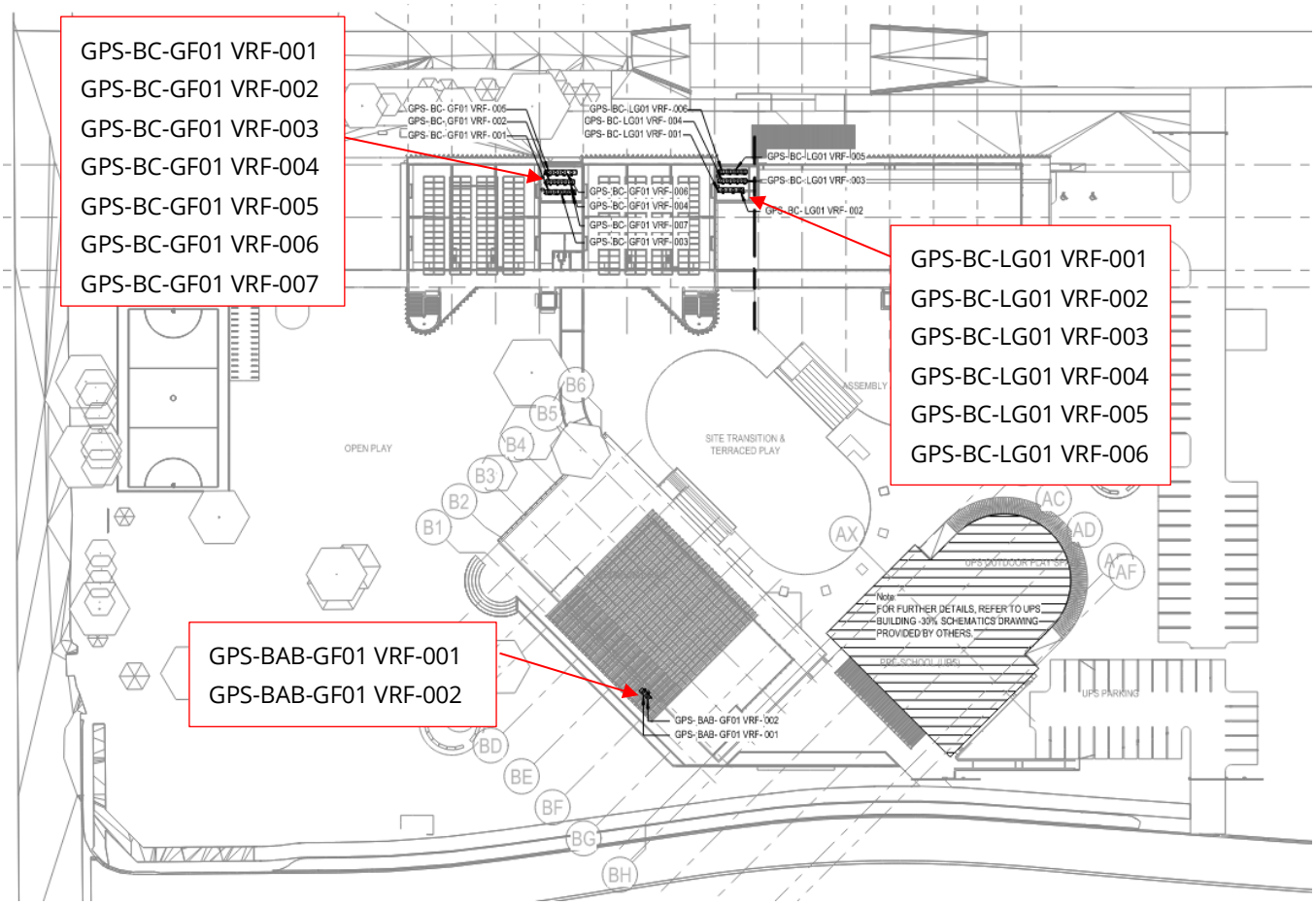

Figure 3-1 Location of Mechanical Services

Preliminary specifications for mechanical services equipment are presented in Table 3-4. The nominated units have been assumed to operate in "Low Noise Mode".

Table 3-4 Preliminary Mechanical Plant Selections

Location	Mark	Nominal Unit	Sound Power Level dBA[1] (Cooling / Heating)
Building C Plantroom	GPS-BC-GF01 VRF-001	PURY-P950YSNW-A1-AU	74 / 76
	GPS-BC-GF01 VRF-002	PURY-P800YSNW-A1-AU	73 / 74
	GPS-BC-GF01 VRF-003	PURY-P600YSNW-A1-AU	69 / 73
	GPS-BC-GF01 VRF-004	PURY-P700YSNW-A1-AU	71 / 74
	GPS-BC-GF01 VRF-005	PURY-P850YSNW-A1-AU	73 / 75
	GPS-BC-GF01 VRF-006	PURY-P950YSNW-A1-AU	74 / 76
	GPS-BC-GF01 VRF-007	PURY-P350YNW-A1-AU	68 / 71
	GPS-BC-LG01 VRF-001	PURY-P1000YSNW-A1-AU	75 / 76

Location	Mark	Nominal Unit	Sound Power Level dBA[1] (Cooling / Heating)
	GPS-BC-LG01 VRF-002	PURY-P300YNW-A1-AU	66 / 70
	GPS-BC-LG01 VRF-003	PURY-P850YSNW-A1-AU	73 / 75
	GPS-BC-LG01 VRF-004	PURY-P800YSNW-A1-AU	73 / 74
	GPS-BC-LG01 VRF-005	PURY-P850YSNW-A1-AU	73 / 75
	GPS-BC-LG01 VRF-006	PURY-P800YSNW-A1-AU	73 / 74
Building B Rooftop	GPS-BAB-GF01 VRF-001	PURY-P450YNW-A1-AU	61 / 63
	GPS-BAB-GF01 VRF-002	PURY-P200YNW-A1-AU	71 / 72

Note 1: Sound power level of units running in low noise mode

3.2.1.2 Vehicle Noise Sources

Base on the predicted peak hour number of trips by staff using the carpark, the following noise modelling assumptions have been made:

- 33 vehicles entering or exiting the primary school carpark during a single 15 minute period
- 10 vehicles entering or exiting the preschool school carpark during a single 15 minute period

An idling car has been assumed to have a sound power level of 85 dBA.

We note that the majority of vehicles dropping off/picking up students will use the drop off zones that are located on the public roads surrounding the site, rather than entering into the school's carpark. However, a temporary turning bay will be included within the school grounds, for use until Northview Street is connected directly to Cessnock Road. This has not been included within the on site operational noise modelling on the assumption that noise from vehicles using the turning bay will be indistinguishable from the noise of the same vehicles as they are idling in the drop off bays on the public road, or returning to Ryans Road after using the bays.

Noise from the vehicles while on public roads are assessed against the EPA's Road Noise Policy (see section 4).

3.2.1.3 Predicted Noise Levels

Based on the noise modelling assumptions presented in sections 3.2.1.1 and 3.2.1.2, the noise emission predictions for mechanical/vehicle noise are shown in Table 3-5. Noise emissions from mechanical plant and vehicles noise manoeuvring on site are predicted to be compliant with the noise criteria at all receivers.

Table 3-5 Predicted Noise Emissions from Mechanical Plant and Vehicle Noise $L_{Aeq(15min)}$ dBA

Receiver	Predicted Worst Case Noise Level $L_{Aeq,15min}$ dBA	Criteria (Daytime) $L_{Aeq,15min}$ dBA	Complies (Y/N)
98 Ryans Road	22	40	Y
4 Northview Street	24	40	Y
6 Northview Street	28	40	Y
6A Northview Street	31	40	Y
8 Northview Street	32	40	Y
10 Northview Street	31	40	Y
12 Northview Street	33	40	Y
14 Northview Street	35	40	Y
16 Northview Street	36	40	Y
18 Northview Street	36	40	Y
20 Northview Street	34	40	Y
22 Northview Street	34	40	Y
56 Gillieston Road	37	40	Y
35 Northview Street	29	40	Y
Opposite to West	21	40	Y

3.2.2 Sleep Disturbance Assessment

As out of hours childcare and vacation day care will open from 6am, a sleep disturbance assessment has also been conducted on the assumption of use of cars in the southern carpark, representing a worst case scenario car park use. An L_{Amax} of 92 dBA has been assumed for a car door slam.

Predicted noise levels for the sleep disturbance assessment are shown in Table 3-5. Noise emissions are predicted to be compliant with the noise criteria at all receivers.

Table 3-6 Predicted Noise Emissions from Mechanical Plant and Vehicle Noise $L_{Aeq(15min)}$ dBA

Receiver	Predicted Worst Case Noise Level $L_{Aeq,15min}$ dBA	Criteria L_{AMax} dBA[1]	Complies (Y/N)
98 Ryans Road	32	52	Y
4 Northview Street	31	52	Y
6 Northview Street	34	52	Y
6A Northview Street	36	52	Y
8 Northview Street	39	52	Y

Receiver	Predicted Worst Case Noise Level $L_{Aeq,15min}$ dBA	Criteria L_{AMax} dBA[1]	Complies (Y/N)
10 Northview Street	40	52	Y
12 Northview Street	44	52	Y
14 Northview Street	50	52	Y
16 Northview Street	50	52	Y
18 Northview Street	52	52	Y
20 Northview Street	49	52	Y
22 Northview Street	47	52	Y
56 Gillieston Road	14	52	Y
35 Northview Street	37	52	Y
Opposite to West	20	52	Y

Note 1: Compliance with LAeq,15min 40dBA sleep disturbance criteria inferred by compliance with LAeq,15min 40 dBA criteria during peak hour

3.2.3 Speech/Recreational Noise from External Areas

3.2.3.1 Noise from Typical Operations

To the best of our knowledge, there have been no social surveys conducted to quantify the levels of noise generated from outdoor play areas of schools of varying size and type or to document the response of the surrounding community to the noise from school children engaged in outdoor play.

Whether this is due to the noise source being of a highly variable nature, making quantification of such emissions extremely difficult, or because this source is considered to be an integral part of any school activities, is a point of some conjecture. Whilst attempts could certainly be made to measure the levels of noise which may be experienced at a nearby receiver, the reliability, statistical replication and relevance of such an assessment would always be open to question. In addition, the purpose of quantifying a noise source is to enable its comparison with a criterion which has been developed in consultation with appropriate parties, for the purpose of assessing the potential impact of the noise upon a receiver.

Outdoor play spaces are anticipated to be loudest during recess and lunch periods, with other activities (such as outdoor PE classes, or other classroom learning activities) to be smaller in scale, quieter, or both, compared to unstructured play. The noise levels generated during recess and lunch periods will vary according to the following factors:

- The number of students in the area.
- The location of the students relevant to the residences – as the distance between the source and the receiver increases, the noise level at the receiver will decrease.
- The level of noise made by each student – this is will vary from individual to individual, and various factors such as age, personality, mood, activity and countless other factors will play a part.

It is also noted that more noise-intensive activities (e.g. children screaming) are generally not capable of being sustained over an extended period of time.

A review was previously conducted of Land and Environment Court cases which may be of relevance to the assessment of these activities. In the judgement of Justice Pain in the case of Meriden School v Pedavoli, noise from children playing outdoors was found to not constitute offensive noise. In the case of Christian Brothers v Waverley Council, no specific criteria were mentioned but Commissioner Murrell commented that,

> *"It is important in our society for uses such as schools and residential areas to coexist".*

The following factors should be noted when considering the impact of noise generated by school children during outdoor play:

- The nature of the noise source is not inconsistent with that experienced within residential communities, and in this case, there is an existing school currently on site, and so there will be no introduction of any noise sources with a considerably different character to what the surrounding community is already exposed to;
- Noise from outdoor play generally occurs during short periods throughout the day within school hours; and
- The wider community benefits through the provision of the facility.

In order to present a comparative assessment of predicted existing noise levels and future noise levels, a sound power level of 95 dBA per 15 children has been conservatively adopted. In reality it is unlikely that all groups of children would be generating this level of noise simultaneously, particularly those engaged in more passive forms of play such as small group conversation. Children have been assumed to be distributed uniformly across the play area in all cases.

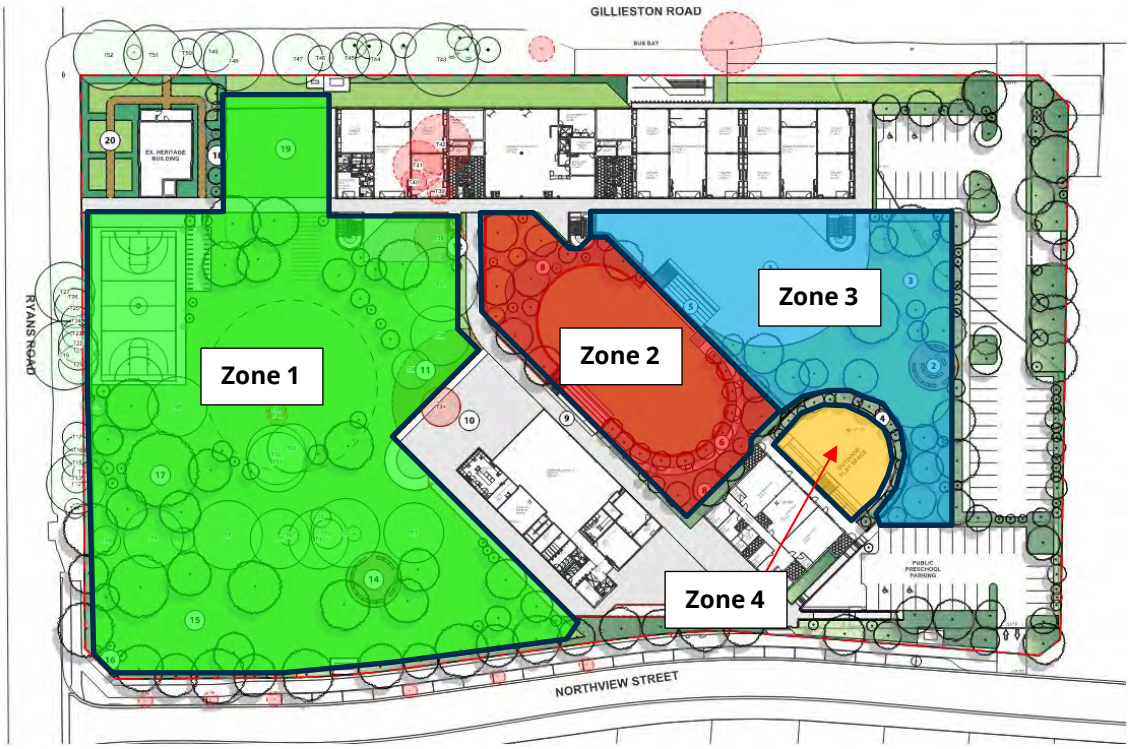

Figure 3-2 Play zones

Compared to the predicted existing noise levels from children playing, the noise levels at residential receivers are predicted to marginally increase at the majority of receivers. However, there is predicted to be a significant increase in noise levels at a small number of residences towards the western end of Northview Street, where existing buildings that provided acoustic shielding will be removed, as well as play areas moving closer to residences. The largest increase (at maximum capacity for Stage 1) is predicted to be in the order of 25 dB, although other than an initial step change following the removal of existing buildings, the increase in noise levels at receivers will be gradual over a period of years as school enrolments increase.

3.2.3.2 Noise from Functions Outside of School Hours

Use of the school for functions outside of school hours is expected to be infrequent. Noise emissions from out of school hours functions should be considered on a case by case basis if these are proposed to occur.

3.2.4 Operational Noise Recommendations

Based on the review of noise emissions from the activities, indicative recommendations are provided in the following sub-sections in order for the activities to comply with the nominated noise emission requirements.

3.2.4.1 Mechanical Services

The predicted noise emissions presented in Table 3-5 reveal that noise emissions from the mechanical plant can be mitigated through considered design and the implementation of standard noise mitigation treatments.

Requirements for mechanical services will be dependent on the final selections of equipment, location and number of plantrooms, and size of mechanical services louvres. Based on the assumptions regarding number of plantrooms and return air louvre size outlined in section 3.2.1.1, plant in the plant room within Building C

would be required to run on low noise mode in order to comply with criteria. However, due to the limited information currently available it is recommended that these assumptions should be reviewed during detailed design stage.

Noise from the mechanical plant should be designed such that noise emissions comply with the project noise trigger levels of the NPfI.

3.2.4.2 Outdoor Areas

The following mitigation and management measures are recommended with regards to noise from children playing outside:

- Recess and lunch breaks should be staggered such that no more than half of the student capacity (~370 students) are in the outdoor play areas at any given time (numbers to be confirmed based on what is feasible for the school operations).
- Children in outdoor play areas are to be supervised by staff to manage any excessive noisy behaviour.
- The school should maintain a complaints register.

3.2.4.3 School Announcements and Bells

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

The following measures should be adopted where new bells and speakers are proposed to ensure that their impact at all surrounding residences is minimised:

- Speakers should be located and orientated to provide good coverage of the school areas whilst being directed away from residences. The coverage of the system should be subject of the detail design of the system.
- The volume of the system should be adjusted on site so that announcements and bells are clearly audible on the school site without being excessive.
- Once the appropriate level has been determined on site, the system should be limited to the acceptable level so that staff cannot increase noise levels.
- The bell system should be set so that it only occurs on school days.

4 ROAD TRAFFIC NOISE GENERATION

This section of the report considers the potential noise impacts from additional traffic generated on the surrounding local road network as a result of the proposed activities.

The site will be accessed primarily via Gillieston Road and Northview Street, via Cessnock Road or Ryans Road. Northview Street is currently a cul-de-sac used as an informal 'Kiss and Drop' site. As part of the ongoing release of land for residential use throughout the area, Northview Street will be connected through to Cessnock Road.

The following facilities are proposed within the future school site and surrounding public roads:

- 'Kiss and Drop' facility for Northview Street;
- Bus stop located on Gillieston Road (relocated from existing on Ryans Road); and
- Access to staff carpark via Gillieston Road and Northview Street.

These facilities are shown in Figure 4-1.

Figure 4-1 Staff Car park, School Bus Stop, and Kiss and Drop Zone

4.1 Traffic Noise Criteria - NSW Road Noise Policy (2011)

Additional guidance for the assessment of traffic noise generated on public roads by new developments is set out in the EPA's Road Noise Policy 2011 (RNP).

The RNP provides base line criteria for noise impacts on residences affected by additional traffic on public roads generated by land use developments. These criteria are found in Table 3 of the RNP and is reproduced in Table 4-1 with the relevant criteria applicable to the site highlighted.

Table 4-1 Road Traffic Noise Assessment Criteria for Residential Land Uses (RNP)

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

For the purposes of this assessment, Gillieston Road, Ryans Road and Northview Street will be classified as sub-arterial roads. This is based on the functional role definition for sub-arterial roads provided in Table 2 of the RNP where it states that sub-arterial roads "*may have been designed as local streets but can serve major traffic-generating developments or support non-local traffic*".

The abovementioned roadways are used to serve the existing Gillieston Public School, which would be considered as a major source of traffic-generation. Moreover, the majority of vehicles using these roadways (e.g. vehicles dropping off/picking up students, staff vehicles) are not expected be local traffic as many staff and students would not live in the immediate vicinity of the school.

Considering these factors, it can be reasonably concluded that these identified roadways (Gillieston Road, Ryans Road and Northview Street) be categorised as sub-arterial roads under the RNP.

Where additional road traffic noise from the activities (i.e. the cumulative noise impact from existing traffic and traffic generated by the activities) exceed the relevant base line criteria stipulated in Table 4-1, additional analysis should be conducted to evaluate whether traffic noise levels at residences would increase by more than 2dB. If the increase in overall traffic noise levels is less than the RNP's 2dB "allowance" criterion, this would typically be considered as a barely perceptible increase in noise level and is unlikely to result in any adverse

impacts on residential receivers. We note that we have assessed traffic noise generation from the proposed activities against the RNP's "allowance" criterion in section 4.2 below.

4.2 Traffic Noise Generation Assessment

Estimates of projected peak hourly traffic volumes have been provided by the traffic consultant advising on the project. As well as the activities of the school site, several land subdivisions will be released for residential use in the coming years. This assessment compares the projected future traffic volumes (including the subdivisions) with and without the increase in school capacity.

There are 3 bus routes which service the school, travelling on Gillieston Road and Ryans Road. The assessment notes that "Student bus demands and bus operations can be reviewed over time in collaboration between TfNSW, bus operators and the school as part of yearly school travel pass application processes". Based on Figure 7-1 of the traffic report, it is assumed that the number of school bus operations will increase proportionally to the increase in enrolments.

Based on these assumptions, the traffic projections used for the purpose of this assessment are presented in Table 4-2.

Table 4-2 Peak Hourly Traffic Volume Projections

Road	Peak Hour Traffic Volumes							
	2026 projected (without activity)				2026 projected (with proposed activity)			
	Volume (1 Hour)		% Heavy Vehicles		Volume (1 Hour)		% Heavy Vehicles	
	AM	PM	AM	PM	AM	PM	AM	PM
Gillieston Road	167	94	0.6%	2.1%	210	137	1.0%	3.1%
Ryans Road	167	94	0.6%	2.1%	210	137	1.0%	3.1%
Northview Street	39	96	0%	0%	98	90	0%	0%

Total traffic volumes on the surrounding roadways during the daytime period (7am-10pm) were not able to be sourced for this assessment, which would be required to assess road traffic noise impacts against the sub-arterial road noise criteria (assessed against a $L_{Aeq,\ 15hr}$ descriptor). In the absence of this traffic volume data, this assessment will assume that the predicted peak hour traffic volumes presented in Table 4-2 will occur every hour during the daytime period. This will provide a conservative assessment of traffic noise impacts from the proposed activities.

4.3 Predicted Noise Levels at External Receivers

Traffic noise impacts at the nearby neighbouring residences have been modelled in Cadna using the Calculation of Road Traffic (CoRTN) algorithms. Predicted traffic noise impacts at the potentially most-affected residential receivers around the site have been presented in Table 4-3 and have been assessed against the RNP criterion for sub-arterial roads (refer to section 4.1). Only results extrapolated from the loudest peak period including school traffic have been presented (AM period for all roads).

Table 4-3 Predicted Traffic Noise Generated from Proposed Activity on Public Roads

Receiver Location	Predicted Traffic Noise Level $L_{Aeq,\ 15hr}$ dBA	Noise Criteria $L_{Aeq,15hr}$ dBA	Complies
Gillieston Road Residences	55.5	60	Yes
Ryans Road Residences	55.8	60	Yes
Northview Street Residences	58.3	60	Yes

Note 1: Predicted noise levels in the absence of the proposed activity are borderline compliant. Proposed activity is compliant with the RNP 2 dB relative increase criteria.

The predicted traffic noise generation from the proposed activity complies with the requirements of the RNP.

5 EXTERNAL NOISE INTRUSION ASSESSMENT

5.1 Acoustic Criteria

Internal noise criteria have been adopted from the Australian Standard • AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors.* The criteria are summarised in Table 5-1.

Table 5-1 External Noise Intrusion Criteria for Educational Institutions

Occupancy Type	Recommended Design Level ($L_{Aeq,cont.}$ dBA)
Assembly Halls up to 250 seats	30 – 40
Assembly halls over 250 seats	30 – 35
Libraries – General Area	40 – 50
Libraries – Reading Area	40 – 45
Office Areas	40 – 45
Professional and Administrative Spaces	35 - 40
Teaching Spaces – Primary Schools	35 – 45
Staff common rooms	40 – 45

5.2 Traffic Noise Levels

Based on the projected traffic volumes (refer to section 4), the traffic noise impacts predicted at the proposed buildings are summarised in Table 5-2. These predictions are conservatively based on the worst case traffic peak hours.

Table 5-2 Predicted Traffic Noise Level at Facade

Location	AM Peak $L_{Aeq,\ 1hr}$ dBA	PM Peak $L_{Aeq,\ 1hr}$ dBA
Building A (Southeast and Southwest Façades Facing Northview Street)	≤62	≤62
Building B (Southeast and Southwest Façades Facing Northview Street)	≤59	≤59
Building B (Northeast façade/school hall space)	≤48	≤48
Building C (Northern Façade Facing Gillieston Road)	≤58	≤56

5.3 Analysis

Based on the traffic noise levels at the future façades (presented in Table 5-2), calculations were performed to determine the internal noise levels within the proposed buildings as a result of noise transmission through the building façade elements (glazing, external walls and roof/ceiling). This analysis considered the transmission loss performance of the façade elements, the surface area of each façade element exposed to external noise, and the expected absorption characteristics of the internal spaces due to room finishes.

5.4 Recommendations

Indicatively, standard constructions for the ceiling and walls, and standard 6mm openable glazing with no rubber acoustic seals (R_w 22) should be satisfactory for the mitigation of external noise ingress. Ventilation of rooms in Building B facing Northview Street and Building C facing Gillieston Road should be provided by other means to maintain this acoustic performance.

Glazing suppliers are to provide acoustic laboratory test reports confirming that the acoustic performance of their window systems (combined performance of the glass and window/door frame) meet the R_w requirements specified below. Glazing requirements should be confirmed at detailed design stage.

These recommendations for the building envelope should be reviewed at detailed design stage.

6 CONSTRUCTION NOISE & VIBRATION IMPACT ASSESSMENT

6.1 Proposed Construction Hours

Where possible, activity should be completed during the standard daytime construction hours of Monday to Friday 7.00am to 6.00pm and Saturday 8.00am to 1.00pm. Where Out-of-Hours Works (OOHWs) are required (for emergency works/delivery, etc) it is likely that they would require separate approval.

6.2 Noise Management Levels – Interim Construction Noise Guideline (EPA, 2009)

The NSW EPA *Interim Construction Noise Guideline (ICNG)* requires project-specific Noise Management Levels (NMLs) to be established for noise affected receivers. In the event construction noise levels are predicted to be above the NMLs, all feasible and reasonable work practices are investigated to minimise noise emissions.

Having investigated all feasible and reasonable work practices, if construction noise levels are still predicted to exceed the NMLs then the potential noise impacts would be managed via site specific construction noise management plans, to be prepared in the detailed design phase. **Table 6-1** detail the *ICNG* noise management levels.

Table 6-1 Interim Construction Noise Guideline Criteria at Residences

Time of Day	NML	How to Apply
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 $L_{Aeq\ (15min)}$ 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 activities to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for activities near schools, or mid-morning or mid-afternoon for activities near residences; 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of Day	NML	How to Apply
Outside Standard Hours	Noise Affected RBL+5 dBA	A strong justification would typically be required for activities outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the *ICNG*.

The ICNG also recommends a NML of 45dBA $L_{Aeq,15min}$ for internal areas of classrooms (refer to Table 3 of the ICNG). This NML will be considered for the purposes of assessing potential construction noise impacts on the classrooms of the Gillieston Public School, which will be in use during construction. A corresponding external NML of 65dBA $L_{Aeq,15min}$ will be adopted for classrooms based on the assumption that classrooms are expected to close their windows when construction activities are being undertaken, and that the outdoor to indoor noise reduction achieved through a closed window is 20dBA.

Based on the above, **Table 6-2** presents the applicable noise management levels for construction activities at surrounding receivers that have been adopted for all applications. We note that these criteria will be conservative, as they use the minimum assumed RBLs as discussed in section 3.1.1.1.

Table 6-2 Site-Specific Construction Noise Management Levels

Receiver Type	Construction Noise Management Level (NMLs) - $L_{Aeq,15min}$				Highly Noise Affected Noise Level – $L_{Aeq,15min}$
	Day Standard Hours	Day OOH	Evening OOH	Night OOH	
Residential[1]	45	40	35	35	75
Classroom Receivers within Gillieston Public School (External)	65				

Note 1: The same RBL will be used for all residential receivers.
Note 2: Applies when in use.

6.3 Vibration Management Levels

When assessing vibration there are two components that require consideration:

- human exposure to vibration; and
- the potential for building or structure damage from vibration

There are currently no Australian Standards or guidelines to provide guidance on assessing the potential for building damage from vibration. It is common practice to derive goal levels from international standards.

British Standard BS 7385:1993 and German Standard DIN 4150:2016 both provide vibration criteria, below which vibration is considered insufficient to cause building damage. Of these, DIN 4150 is the more stringent.

6.3.1 Construction Noise & Vibration Strategy (TfNSW, 2023)

In order to limit the risk of vibration based damage, minimum working distances for typical vibration intensive construction equipment are provided in the Transport for NSW's (TfNSW) *Construction Noise and Vibration Strategy (CNVS)*. The minimum working distances presented in Appendix D of the *CNVS* are based on the vibration criteria for cosmetic damage to structures given in British Standard BS 7358-2-1993 - *Evaluation and measurement for vibration in buildings – Part 2 for typical buildings*, and for effects to human comfort (from the NSW EPA *Assessing Vibration – A Technical Guideline*).

Empirical data has been used to suggest screening distances at which if vibration intensive activities are conducted outside these distances, adverse vibration impacts are unlikely.

The recommended minimum working distances for vibration intensive activities from the CNVS are presented in **Table 6-3**. The empirical data has also been extrapolated to provide screening distances as concerns DIN 4150-3 criteria.

Table 6-3 Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Approx. Size / Weight / Model	Minimum Distance		
		Cosmetic Damage (BS 7385)	Cosmetic Damage (DIN 4150-3)	Human Response (NSW EPA Guideline)
Vibratory Roller	1-2 tonnes	5 m	14 m	15 m to 20 m
	2-4 tonnes	6 m	16 m	20 m
	4-6 tonnes	12 m	33 m	40 m
	7-13 tonnes	15 m	41 m	100 m
	13-18 tonnes	20 m	54 m	100 m
	> 18 tonnes	25 m	68 m	100 m
Small Hydraulic Hammer	300 kg (5t to 12t excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12t to 18t excavator)	7 m	19 m	23 m
Large Hydraulic Hammer	1600 kg (18 to 34t excavator)	22 m	60 m	73 m
Pile Driver – Vibratory	Sheet Piles	2 m to 20 m	50 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Piling Rig – Hammer	12 t down force	15 m	2 m	50 m

Plant Item	Approx. Size / Weight / Model	Minimum Distance		
		Cosmetic Damage (BS 7385)	Cosmetic Damage (DIN 4150-3)	Human Response (NSW EPA Guideline)
Jackhammer	Handheld	1 m (nominal)	14 m	Avoid contact with structure

6.4 Construction Noise Assessment

Noise modelling of the construction noise emissions was undertaken using the CadnaA version 2023 modelling software.

The noise model was constructed from a combination of aerial photography, existing ground topography, design ground topography and proposed design. The local terrain, receiver buildings and structures have been digitised in the noise model to develop a three-dimensional representation of the construction activities and surrounding environment. No predictions have been presented for receivers to the west of the site on Ryans Road as it has been assumed that these will still be under construction during construction activities within the school.

6.4.1 Proposed Activities

At this stage, a detailed list of equipment likely to be used during the construction project was not provided. Indicative construction staging is shown in Figure 6-1 through Figure 6-5.

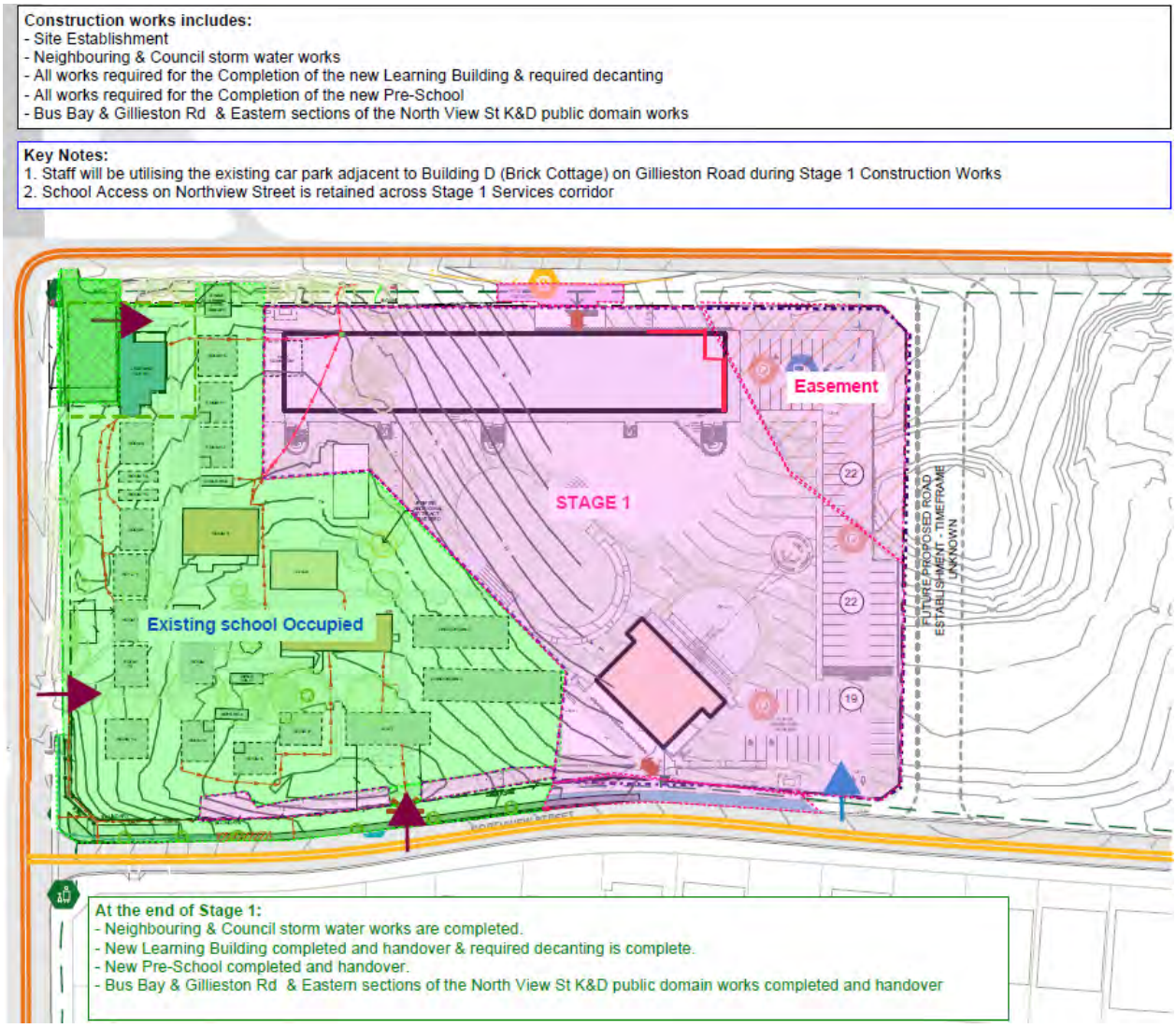

Figure 6-1: Construction Stage 1

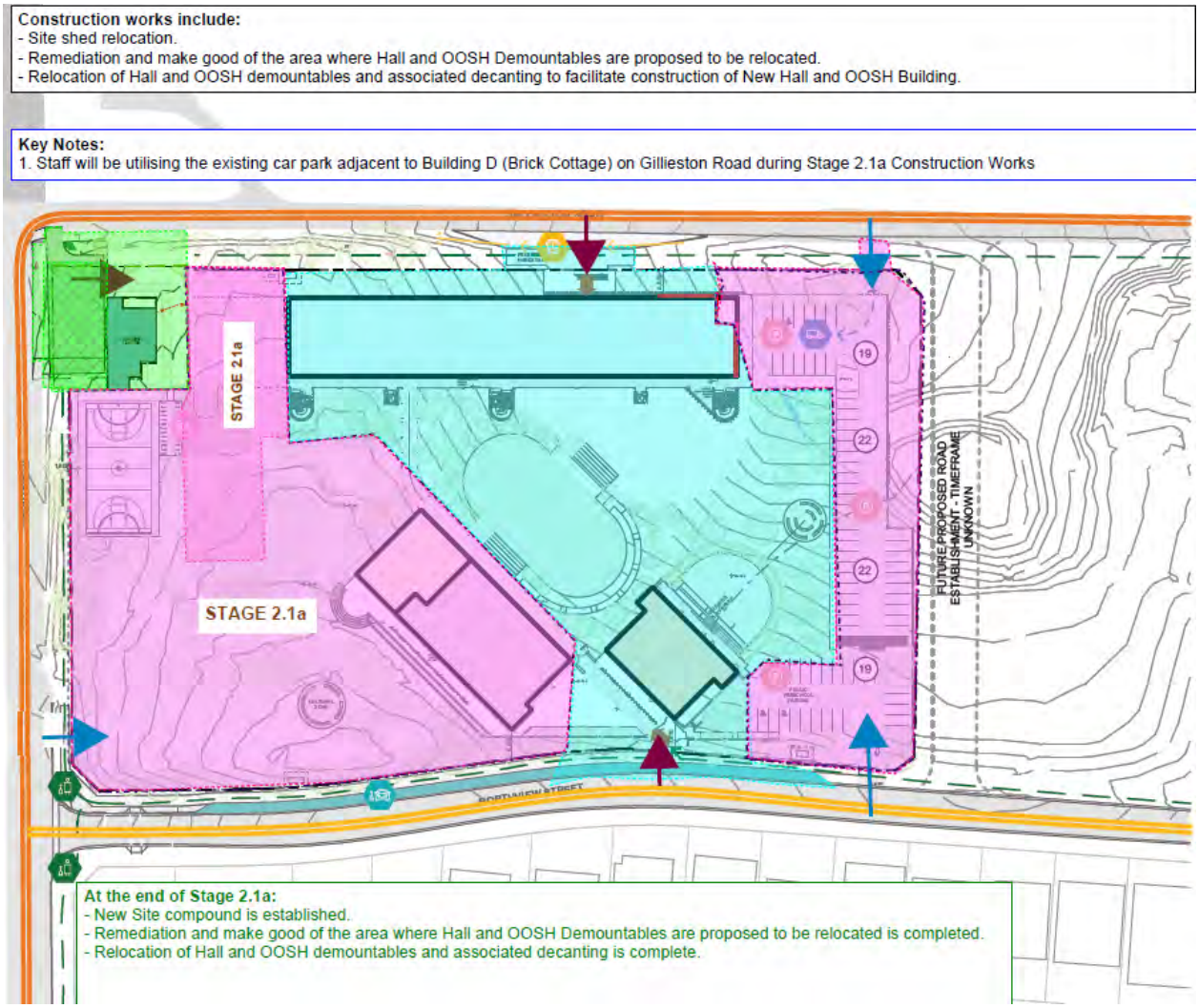

Figure 6-2: Construction Stage 2.1a

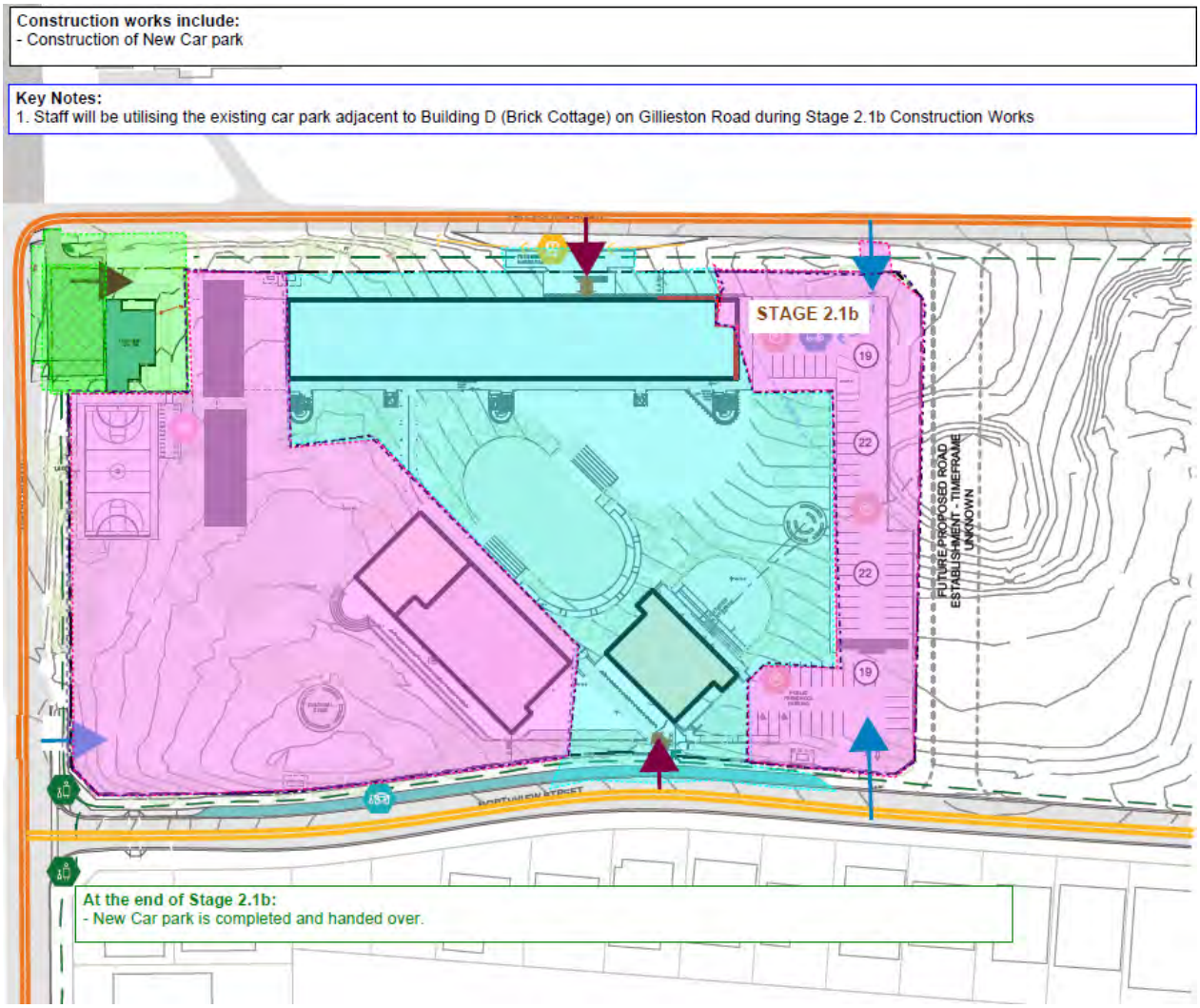

Figure 6-3: Construction Stage 2.1b

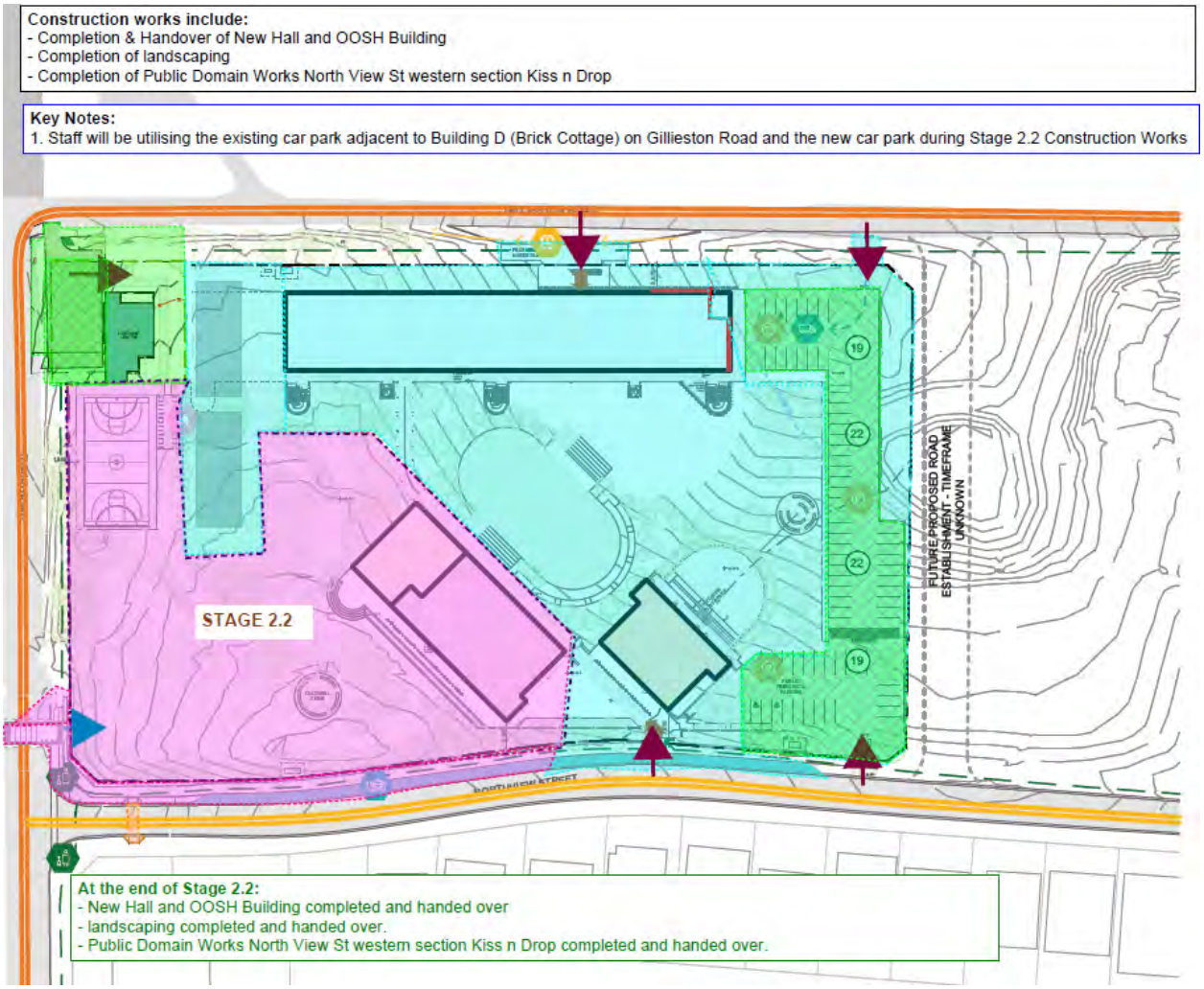

Figure 6-4: Construction Stage 2.2

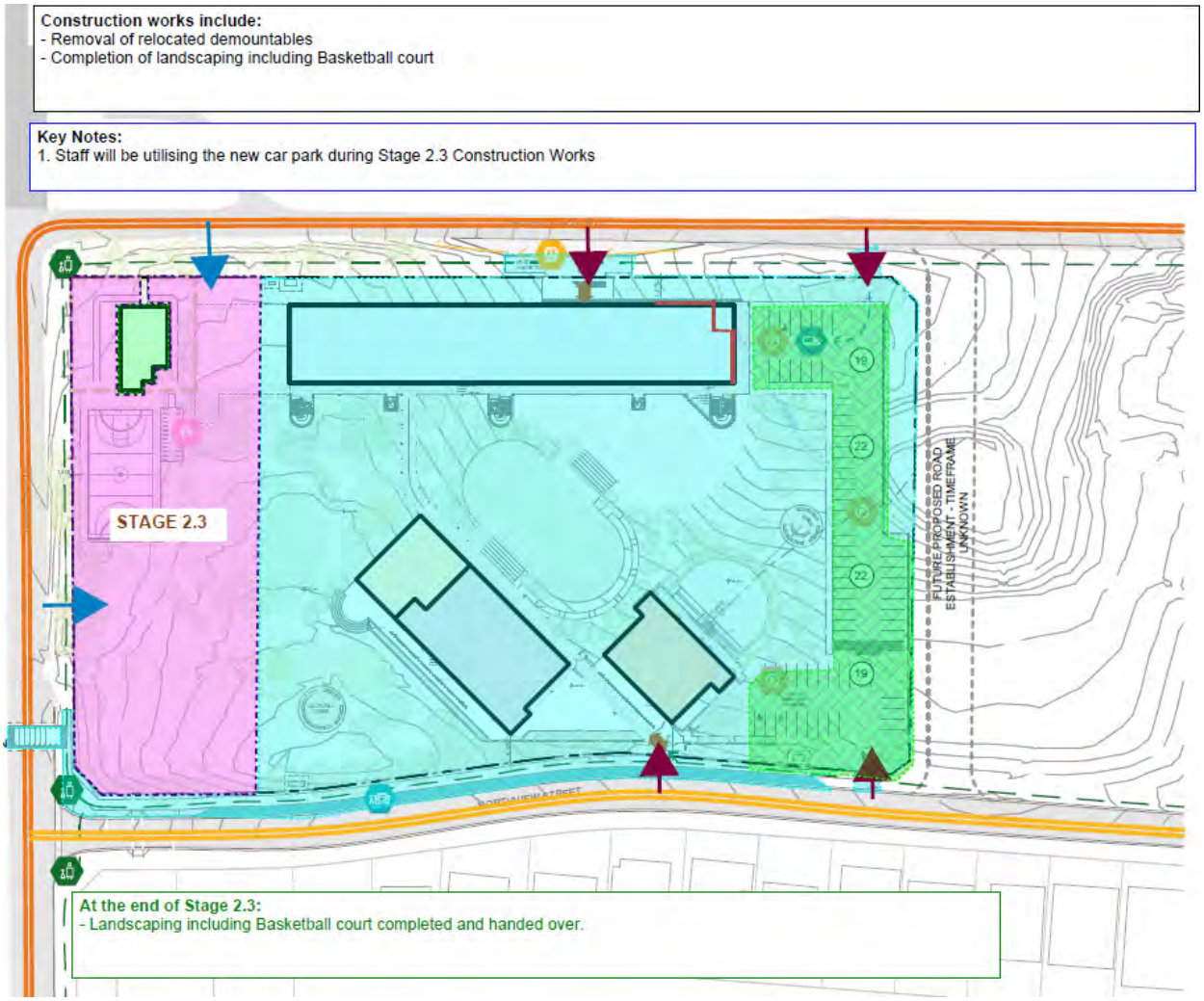

Figure 6-5: Construction Stage 2.3

This construction noise and vibration assessment has broken the construction works into the following three categories in-principle:

- Demolition and clearing activities
- Excavation and piling
- Building construction

Sound power levels (SWLs) for the typical operation of construction equipment applied in the modelling are listed in Table 6-4 and have been based on measurements conducted by RWDI and Appendix C of the CNVS. To assess construction noise levels against the NMLs, the noise levels have been converted to equivalent $L_{Aeq,15min}$ noise emissions based on the expected period of operation of the individual pieces of construction plant.

Table 6-4: Construction Noise Sources

Stage	Activity	Equipment	Operating minutes in 15-min period	Quantity	Sound Power Level (dB)		
					Individual Item (SWL)	$L_{Aeq,15min}$ Activity	Total $L_{Aeq,15min}$ Activity
Stage 1	Excavation and Piling	Dozer (D10)	10	1	116	**114**	119
		Truck & Dog (30 t)	15	2	108	**111**	
		Excavator (30 t)	15	2	110	**113**	
		Piling Rig	5	1	116	**111**	
		Concrete Truck	15	1	109	**109**	
	Construction of Buildings A & C	Concrete Truck / Agitator	15	2	106	**109**	117
		Concrete Pump	15	1	109	**109**	
		Truck (20 t)	15	2	103	**106**	
		Mobile Crane	10	2	113	**114**	
		Hand Tools	7.5	4	105	**108**	
		Elevated Work Platform	10	2	97	**98**	
Stage 2.1a	Demolition and Clearing of Existing School Buildings	Excavator (30 t)	15	2	110	**113**	115
		Truck & Dog (30 t)	15	2	108	**111**	
Stage 2.1b	Car Park Construction (East Boundary of Site)	20t Excavator	15	1	105	**105**	113
		Grader	7.5	1	113	**110**	
		2t Vibratory Roller	7.5	1	109	**106**	
		8-15t Smooth Drum Roller	7.5	1	107	**104**	
		Asphalt Paver	10	1	106	**104**	
Stage 2.2	Excavation and Piling	Dozer (D10)	10	1	116	**114**	119
		Truck & Dog (30 t)	15	2	108	**111**	
		Excavator (30 t)	15	2	110	**113**	
		Piling Rig	5	1	116	**111**	
		Concrete Truck	15	1	109	**109**	
	Building B Construction	Concrete Truck / Agitator	15	1	106	**109**	116
		Concrete Pump	15	1	109	**109**	
		Truck (20 t)	15	1	103	**103**	

Stage	Activity	Equipment	Operating minutes in 15-min period	Quantity	Sound Power Level (dB)		
					Individual Item (SWL)	$L_{Aeq,15min}$ Activity	Total $L_{Aeq,15min}$ Activity
		Mobile Crane	10	1	113	**113**	
		Hand Tools	7.5	3	105	**107**	
		Elevated Work Platform	10	1	97	**95**	
Stage 2.3	Basketball Court Construction & Landscaping	Concrete Truck / Agitator	15	1	106	**109**	115
		Concrete Pump	15	1	109	**109**	
		Truck (20 t)	15	1	103	**103**	
		Excavator (30 t)	15	1	110	**110**	
		Hand Tools	7.5	3	105	**107**	
		Elevated Work Platform	10	1	97	**95**	

Consistent with the requirements of the *ICNG*, and to inform the scheduling of construction activity and management of noise during the detailed design phase, the construction noise impacts are based on an expected typical worst-case scenario. The *ICNG* recommends that the realistic worst-case or conservative noise levels from the source should be predicted for assessment locations representing the most noise exposed residences or other sensitive land uses. For each receiver area the noise levels are predicted at the most noise-exposed location, which would usually be the closest receiver.

For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted at the most-exposed receiver as the noise levels presented in this report are based on an expected worst-case assessment.

6.4.2 Predicted Construction Noise Levels

Preliminary noise levels from construction activities have been quantitatively assessed for the receivers surrounding the Site. The activities considered are described in Section 6.4.1.

The typical expected worst case $L_{Aeq,15min}$ noise levels at the surrounding receivers are provided in **Table 6-5**. Each of the construction activities are representative of the 'noisiest' construction periods where there may be simultaneous operation of several noise intensive construction plant on site. It is anticipated that construction will occur during standard hours only.

Table 6-5 Predicted Construction Noise Impacts

Stage	Activity	Receiver	Noise Level – $L_{Aeq,15min}$ dBA					
			Predicted Noise Level at Nearest Receivers	Noise Affected Noise Management Levels (NMLs)				Highly Noise Affected NML
				Day Standard	Day OOH	Eve OOH	Night OOH	
Stage 1	Excavation and Piling	R1	62 – 73	45	40	35	35	75
		R2	58 – 69					
		R3	57 – 62					
		School Classrooms	62 – 76	65				
	Construction of Buildings A & C	R1	60 – 71	45	40	35	35	75
		R2	56 – 67					
		R3	55 – 60					
		School Classrooms	60 – 74	65				
Stage 2.1a	Demolition and Clearing of Existing School Buildings	R1	58 – 67	45	40	35	35	75
		R2	57 – 69					
		R3	49 – 51					
		School Classrooms	64 – 74	65				
Stage 2.1b	Car Park Construction (East Boundary of Site)	R1	56 – 68	45	40	35	35	75
		R2	52 – 54					
		R3	54 – 56					
		School Classrooms	62 – 75	65				
Stage 2.2	Excavation and Piling	R1	64 – 73	45	40	35	35	75
		R2	60 – 64					
		R3	51 – 58					
		School Classrooms	60 – 76	65				
	Building B Construction	R1	68 – 70	45	40	35	35	75
		R2	60 – 61					
		R3	53 – 55					

Stage	Activity	Receiver	Noise Level – $L_{Aeq,15min}$ dBA					
			Predicted Noise Level at Nearest Receivers	Noise Affected Noise Management Levels (NMLs)				Highly Noise Affected NML
				Day Standard	Day OOH	Eve OOH	Night OOH	
		School Classrooms	69 – 73	65				
Stage 2.3	Basketball Court Construction & Landscaping	R1	60 – 69	45	40	35	35	75
		R2	56 – 60					
		R3	47 – 54					
		School Classrooms	59 – 68	65				

The results of the assessment can be summarised as follows:

- Excavation and piling works are expected to result in exceedances of the daytime noise-affected NMLs at the residential receivers by up to 28 dB both during Stage 1 and Stage 2.
- Excavation and piling works are expected to result in exceedances of the NML for the classrooms within Gillieston Public School by up to 11 dB both Stage 1 and Stage 2.
- Construction activities are expected to result in exceedances of the daytime noise-affected NMLs by up to 26 dB during Stage 1 activities, and 25 dB during Stage 2.
- Construction activities are expected to result in exceedances of the NML for the classrooms within Gillieston Public School by up to 9 dB during Stage 1 activities, and 10 dB during Stage 2.
- No exceedances to the highly noise affected NML are predicted at any of the residential receivers.

The above conclusions apply to an expected worst-case scenario for construction noise generation from the site in which activities occur in the regions of the site in closest proximity to the receivers. Measures to manage construction noise emissions are discussed in Section 6.4.3.

6.4.3 Construction Noise Mitigation

As discussed in Section 6.4.2, noise levels from construction activities during standard hours may exceed the NMLs of the *ICNG* at the nearest receivers in the vicinity of the site. Therefore, in accordance with the *ICNG*, all reasonable and feasible measures should be applied to manage construction noise emissions from the site. In particular, the following is recommended:

A detailed Construction Noise and Vibration Management Plan (CNVMP) should be prepared and should include, but not be limited to the following:

- Identification of nearby residences and other sensitive land uses;
- Description of approved hours of work;
- Description and identification of construction activities, including work areas, equipment and duration;
- Description of what work practices (generic and specific) will be applied to minimise noise;
- Consider the selection of plant and processes with reduced noise emissions;

- A complaints handling process;
- Noise monitoring procedures;
- Overview of community consultation required for identified high impact activities;
- Overview of community consultation process and assessment required for identified additional activities outside of standard construction hours; and
- Induction and training will be provided to relevant staff and sub- contractors outlining their responsibilities regarding to noise.

Examples of typical construction noise mitigation measures are provided in **Table 6-6**, along with the likely reduction in noise levels. Where reasonable and feasible, these measures should be employed during construction.

Table 6-6 Indicative Construction Noise Mitigation Measures

Mitigation Measure	Anticipated Noise Reduction, dBA
Administrative Controls	
Operate during approved hours	N/A
Undertake regular noise monitoring to determine the impact of operating plant on sensitive receivers	N/A
Appropriate training of onsite staff	N/A
Undertake community consultation and respond to complaints in accordance with established project procedures	N/A
Turning off machinery when not in use	0-5
Respite periods for pile drivers and rock breakers (if applicable)	N/A
Conducting regular maintenance of plant to ensure that they are operating as efficiently and quietly as practicable	N/A
Engineering Controls	
Portable temporary screens	5-10
Screen or enclosure for stationary equipment	10-15
Maximising the offset distance between noisy plant items and sensitive receivers	3-6
Avoiding using noisy plant simultaneously and / or close together, adjacent to sensitive receivers	2-3
Orienting equipment away from sensitive receivers	3-5
Carrying out loading and unloading away from sensitive receivers	3-5
Using dampened tips on rock breakers	3-6

Mitigation Measure	Anticipated Noise Reduction, dBA
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Selecting site access points and roads as far as reasonably practicable away from sensitive receivers	3-6
Using spotters, closed circuit television monitors, "smart" reversing alarms, or "squawker" type reversing alarms in place of traditional reversing alarms	2-5
Employ non-noise-generating structures such as site offices, storage sheds, stockpiles, and tanks as noise barriers	5-10

6.5 Construction Vibration Assessment – Building Damage & Human Comfort

Based on the CNVS's recommended minimum working distances for vibration sensitive equipment (refer to **Table 6-3**), no adverse vibration impacts are predicted at any residential receiver provided that vibratory rollers are no larger than 2 tonnes.

There is potential that during the construction of the carpark on the eastern end of the site, vibratory rollers (if used) could be operated within the minimum recommended distance of the CNVS relative to the future Building C.

Should there be use of vibration intensive plant used within the minimum recommended distances of the CNVS of a sensitive receiver, or if there are any other vibration intensive plant items that the Contractor has concerns for causing disruption at a neighbouring receiver, it is recommended that a preliminary vibration survey (typically attended vibration measurements) be undertaken of each vibration generating piece of plant.

This vibration survey will determine whether there will be any exceedances of the relevant construction vibration criteria. If exceedances are observed, vibration mitigation and management strategies can be developed to minimise vibration impacts as far as practicable, and ideally to be compliant with the vibration criteria.

The vibration management strategy may also include the installation of unattended vibration monitors at sensitive receivers to notify the contractor of any exceedances of the vibration criteria. Any such vibration management strategy should be developed as part of a CNVMP.

7 CONCLUSION

This report has presented a noise and vibration impact assessment for the proposed Gillieston Public School Redevelopment and New Public Preschool located at 100 Ryans Road, Gillieston Heights. This report forms part of the Review of Environmental Factors (REF) submission for the proposed activities. No noise logging has been conducted for this Project. Where applicable, noise criteria were conservatively derived from the minimum assumed RBLs set in the *NPfI*.

Noise impacts associated with the mechanical services and carparks have been assessed with reference to the *NPfI*. The results of the noise assessment indicate that noise emissions from the operation of the site are capable of complying with the relevant acoustic requirements through considered design, the implementation of appropriate acoustic treatments, and noise management controls. In addition, discussion of potential impacts of noise from children playing has been included, although there is no formalised regulatory structure governing compliance of this noise source.

Road traffic generation associated with the proposed activity have been assessed in accordance with the NSW EPA's RNP in section 4. Traffic noise generation associated with the site is predicted to comply with the RNP criteria once the local area is fully developed.

Noise and vibration impacts from the construction have been assessed in-principle in section 6 of the report in accordance with the ICNG. Construction NMLs have been established for sensitive receivers based on the established RBL. A computer noise model has been developed to predict $L_{Aeq,15min}$ construction noise levels at sensitive receivers.

Construction noise levels have been predicted for a range of construction activities. The predicted $L_{Aeq,15min}$ construction noise levels are expected to exceed the established noise affected NMLs numerous receivers in the vicinity of the site, however no exceedances of the highly noise affected NML are predicted. It is recommended that a CNVMP be developed for the site and that all reasonable and feasible measures be implemented to minimise construction noise and vibration impacts.

7.1 Summary of Mitigation Measures

Based on the identification of potential impacts and an assessment of the nature and extent of the impacts of the proposed activities, it is determined that all potential impacts can be appropriately mitigated to promote the acoustic amenity of surrounding receivers (see Table 7-1).

Table 7-1 Summary of Mitigation Measures

Project Design Stage *Design (D) Construction (C) Operation (O)*	Mitigation or Management Measures	Relevant Section of Report
O	Mechanical Services • Mechanical services can feasibly comply with the required criteria • Specific measures to be determined after final equipment selection and plantroom design	3.2.1
O	Noise from Children • There are no formally required compliance criteria for this source of noise, the following advice is provided for management of this source of noise: • Recess and lunch breaks should be staggered such that no more than half of the student capacity (~370 students) are in the outdoor play areas at any given time (numbers to be confirmed based on what is feasible for the school operations). • Children in outdoor play areas are to be supervised by staff to manage any excessive noisy behaviour. • The school should maintain a complaints register.	3.2.4.2
O	Noise from School Announcements • There are no formally required compliance criteria for this source of noise, the following advice is provided for management of this source of noise: • Speakers should be located and orientated to provide good coverage of the school areas whilst being directed away from residences. The coverage of the system should be subject of the detail design of the system. • The volume of the system should be adjusted on site so that announcements and bells are clearly audible on the school site without being excessive. • Once the appropriate level has been determined on site, the system should be limited to the acceptable level so that staff cannot increase noise levels. • The bell system should be set so that it only occurs on school days.	3.2.4.3
O	Sleep Disturbance (6am-7am) • Operational noise sources occurring prior to 7am are predicted to comply with sleep disturbance criteria • No mitigation measures required	3.2.2

Project Design Stage *Design (D)* *Construction (C)* *Operation (O)*	Mitigation or Management Measures	Relevant Section of Report
O	Road Traffic Noise • No mitigation measures required for the control of increased traffic noise on public roads, although Northview Street may experience some temporary exceedances to criteria prior to the conversion from cul-de-sac to a through-road	0
O	External Noise Ingress • Standard façade constructions including glazing are predicted to acceptably mitigate traffic noise ingress	5.4
C	Construction Noise and Vibration • Construction noise and vibration management plan should be prepared prior to commencement of construction activities on site to determine all reasonable and feasible measures for minimising construction noise and vibration impacts on surrounding receivers	6

8 STATEMENT OF LIMITATIONS

This report entitled Gillieston Public School Noise and Vibration Assessment was prepared by RWDI Australia Pty Ltd ("RWDI") for Schools Infrastructure ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.