# REPORT

## Noise and Vibration Impact Assessment – Planning Submission

### Milton Public School Upgrade
### NSW Department of Education

NDY
A TETRA TECH COMPANY

CONFIDENTIAL

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## VERIFICATION

| REVISION | DATE ISSUED | PREPARED BY | VERIFIED BY | AUTHORISED BY | COMMENT |
|---|---|---|---|---|---|
| 1.0 | 06.11.2024 | Matthew Adie and Victoria Rastelli | Thomas Warren | Jarrad Underwood | Planning Submission Report |
| 2.0 | 28.01.2025 | Matthew Adie & Victoria Rastelli | Max Cyril | Jarrad Underwood | Planning Submission Report - updated |
| 3.0 | 10.04.2025 | Matthew Adie & Victoria Rastelli | Max Cyril | Jarrad Underwood | Planning Submission Report - updated |

## STAKEHOLDERS

| ROLE | TEAM MEMBER | ORGANISATION |
|---|---|---|
| Client Representative | Jodi Gleeson | SI |
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# 1 INTRODUCTION

This Noise and Vibration Impact Assessment (NVIA) has been prepared to support a Review of Environmental Factors (REF) for the NSW Department of Education (DoE) for Milton Public School upgrade (the activity).

The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

This document has been prepared in accordance with the Guidelines for Division 5.1 assessments (the Guidelines) by the Department of Planning, Housing and Infrastructure (DPHI) as well as the Addendum Division 5.1 guidelines for schools. The purpose of this report is to to assess the potential environmental noise and vibration impacts arising from the Operation and Construction phases of this activity.

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

## 1.1 SITE DESCRIPTION

The site is located at 9 Thomas Street, Milton, NSW, 2538 (the site). The site is legally referred to as Lot 1 in Deposited Plan 861814 and is within the Shoalhaven Local Government Area (LGA) and has an approximate area of 4 hectares. An aerial photograph of the site is provided at Figure 1.

The site is zoned SP2 Educational Establishment and existing development comprises various buildings, sports facilities and play space associated with Milton Public School. Milton Public School currently comprises 24 permanent teaching spaces (PTS) and 10 demountable teaching spaces (DTS). The site contains two locally heritage listed buildings (Building A and Q).

The site is predominantly cleared; however there is existing vegetation interspersed throughout the site and significant trees are present along the northern and western boundary of the site. There is a gradual slope downwards from the south-east to the north-east. of the site.

The site is an irregularly shaped lot with a narrow frontage along Thomas Street. Pedestrian and vehicular access is provided from Thomas Street and from Wason Street. Milton Public School is adjoined by low density residential properties to the south, west and east and Milton Rainforest


FIGURE 1: AERIAL PHOTOGRAPH OF THE SITE. SOURCE URBIS, APRIL 2025.

## 1.2 PROPOSED ACTIVITY DESCRIPTION

The proposed activity relates to upgrades to Milton Public School. Specifically, the proposed activity comprises the following:

- Construction of a new two-storey home base building.
- Installation of solar panels.
- Relocation of existing cricket nets to eastern boundary of site.
- Construction of new stairs and covered walkways linking new building to existing school.
- Construction of new fencing.
- Construction of new hardstand area.
- Minor alterations to the existing staff car park.
- Tree removal.
- External landscape works.

Any works relating to demountables will proceed via a separate planning pathway. Figure 2 provides an extract of the proposed site plan.

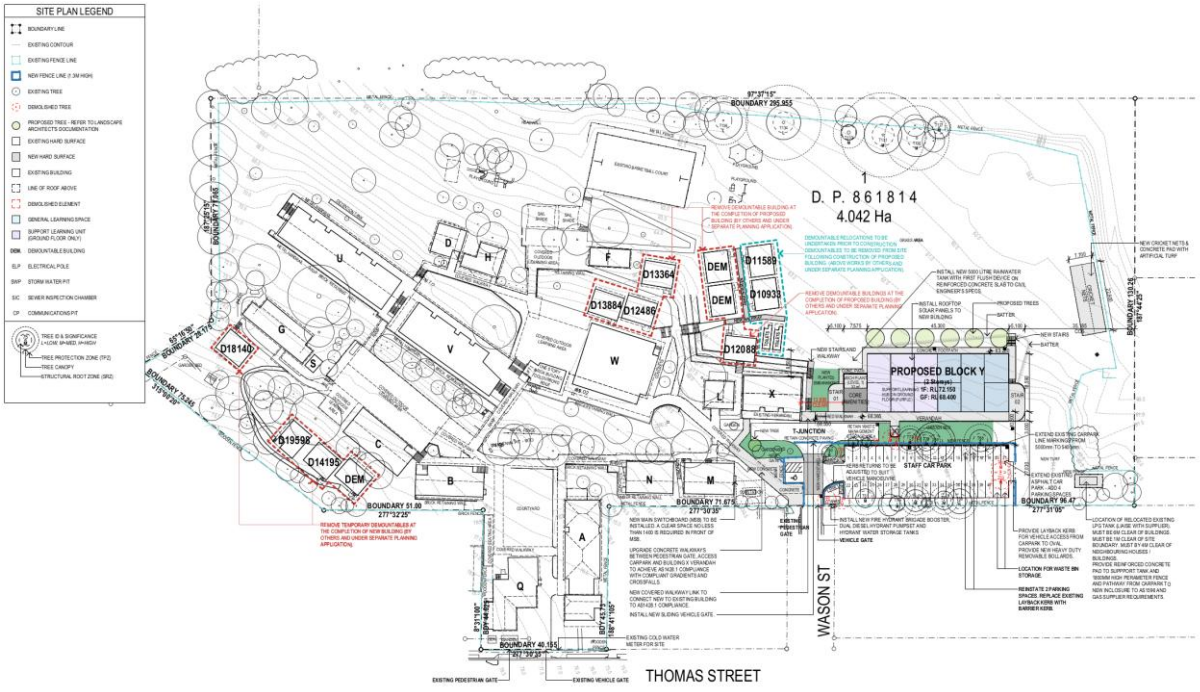


FIGURE 2: SITE PLAN. SOURCE FULTON TROTTER, 2025.

## 1.3 AUTHORS

This report was prepared by Matthew Adie and Victoria Rastelli. Quality assurance was carried out by Thomas Warren. NDY holds a Sydney membership of the Australasian Association of Acoustical Consultants, and Thomas Warren is a Member of the Acoustical Society of New Zealand.

## 1.4 PURPOSE

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

- Baseline noise survey of the area and desktop assessment to obtain amenity noise levels
- Statement of environmental effect such as noise emissions to the boundary from onsite plant equipment

- Construction Noise and vibration assessment to the boundary

## 1.5 AUTHORITY

Authority to undertake this report was provided by Jodi Gleeson of NSW Department of Education.

## 1.6 INFORMATION SOURCES

The report is written with reference to the following information. Where a standard or guideline is listed, this does not necessarily mean that the standard has been adopted in its entirety, as it may not all apply to this site.

- NSW Noise Policy for Industry (NPfI) 2017
- NSW Interim Construction Noise Guideline (ICNG) 2009
- NSW Road Noise Policy (RNP) 2011
- NSW Government Department of Planning Development Near Rail Corridors and Busy Roads – Interim Guidelines (2008)
- NSW EPA Assessing Vibration: A Technical Guideline 2006
- State Environmental Planning Policy (Transport and Infrastructure) 2021
- AS / NZS 2107:2016 Acoustics, Recommended design sound levels and reverberation times for building interiors
- NSW Department of Environment & Climate Change (DECC), Interim Construction Noise Guideline, 2009
- DEFRA 2005 Data base, including the existing construction noise database on BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration control on construction and open sites Part 1 Noise and Part 2 Vibration
- NSW Interim Construction Noise Guideline 2009
- German DIN 4150: Part 3 – 1999 "Effect of Vibration on Structure" (DIN 1999)
- Australian Standard AS 2670.2 1990 – Evaluation of Human Exposure to Whole Body Vibration – Part 2: Continuous and Shock Induced Vibration in Building (1 Hz to 80 Hz)
- British Standard BS 6472 – 2008 – Evaluation of Human Exposure Vibration in Buildings (1 Hz to 80 Hz)
- Fulton Trotter Architects 80% Concept Design Issue dated 18 October 2024
- Shoalhaven Council LEP / DCP Plan 2014
- Urbis Planning Preliminary Due Diligence Advice, Milton Public School upgrade, dated 15.05.24
- Milton Public School Upgrade Study Master Plan Report by NBRS dated 19 Sept 2023
- Detailed Due Diligence Checklist by SINSW for Upgrade Milton Primary School dated 16 May 2023
- Fulton Trotter Architects Appendix A to E, dated 25.09.2024
- Fulton Trotter Architects Validation Report dated 25.09.2024
- Fulton Trotter architects rev 08, 100% schematic design, dated 10.01.2025.
- Geotechnical Report by Stantec dated 30.01.2024
- Rapid Transport Assessment by SCT Consulting dated 07.02.2024
- Milton Public School upgrade Masterplan Validation, Issue E dated 25.09.24
- MPS NDY Electrical Services Schematic Design, Rev 6, dated 17.01.2025.
- MPS NDY Mechanical Services Schematic Design, rev. 4, dated 17.01.2025.
- Urbis standard text dated 28.11.2024.

# 2 SITE INFORMATION

## 2.1 SITE LOCATION AND DESCRIPTION

The site is categorised as an SP2 development (educational establishment), there is a public recreation zone RE1 north of the site boundary and low density residential R2 zones on all other sides. Bus stops are within the locality of the activity.

The objectives of the SP2 zone are:

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

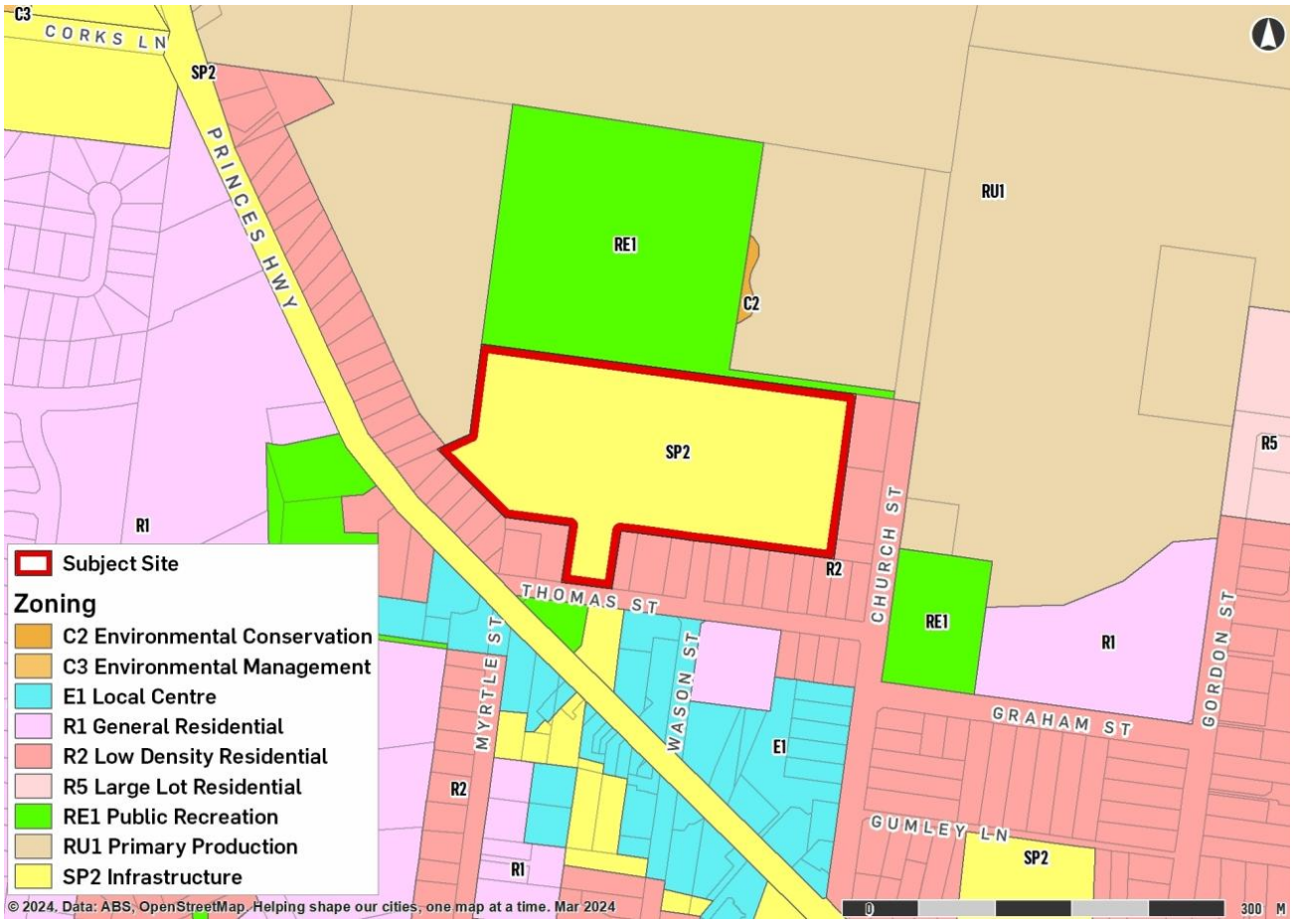


FIGURE 3: SITE LOCATION AS PER NSW PLANNING PORTAL SPATIAL VIEWER

## 2.2 SCHOOL OPERATION HOURS

We understand that the school operating hours will be during daytime (7:00 am – 6:00pm) with limited to no activities during evening time (6:00 pm to 10:00pm) and no activities during the night time (after 10:00 pm).

## 2.3 SENSITIVE RECEIVERS

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

TABLE 1: SENSITIVE RECEIVERS

| RECEIVER | DISTANCE (APPROXIMATE) | TYPE OF RECEIVER / ZONE |
|---|---|---|
| **21 Church Street, Milton (A)** | 50 m | R2 |
| **19 Thomas Street, Milton (B)** | 30 m | |


FIGURE 4: SENSITIVE RECEIVERS LOCATIONS

# 3 METHODOLOGY

This report was prepared using the below methodology:

- Participate at the design team meetings and review provided documentation from the team
- Review of the NSW standards, NPfI regulations and local requirements for noise and vibration (local council DCP / LEP).
- Review of the site location, zoning and most affected receivers for all stages.
- Review of possible busy roads near the site and location of rail corridors.
- Conduct a hand held noise assessment in the area to obtain baseline noise information.
- Depending on the zoning appropriate Amenity noise levels were selected for day, evening and night times according to NSW PNfI tables 2.2 and 2.3.
- Assessment of operating noise and vibration sources, by coordinating with mechanical, electrical, and fire protection designers to establish noise sources and operating times. Other consultants involved were included such as traffic and garbage collection.
- To assess the construction noise and vibration sources, coordination was done with the client, project manager to understand the approximate construction programme and phases.
- Note that for construction noise assessment, the Planning Submission Phase includes a preliminary estimation, using the information existing at the time, if predicted noise levels exceed 75 dBA, then it is necessary a detailed construction noise and vibration management plan.

# 4 ACOUSTIC ASSESSMENT OF THE EXISTING ENVIRONMENT

As the activity is located in a fairly quiet area with low background noise levels and low-density residential receivers, the selected approach for the estimations of the project noise trigger (PNTL) levels was considering the allowed amenity noise levels for a Suburban residential area.

### 4.1.1 SHORT TERM NOISE MEASUREMENTS

To confirm the above approach, during a site visit dated 24.07.24, our team conducted a short-term noise measurement at the corner of Thomas and Wason Street, results are in table below:

TABLE 2: EXISTING NOISE LEVELS (ATTENDED), DBA

| SHORT TERM MONITORING LOCATION | DATE AND TIME | SHORT TERM ATTENDED MEASUREMENT | |
|---|---|---|---|
| | | Overall LAeq | L90 |
| **Cnr. Thomas and Wason St.** | 24.07.24 / Daytime | 50 | 39 |

FIGURE 5: SHORT TERM NOISE MEASUREMENT ON SITE 24.07.24

# 5 NOISE AND VIBRATION CRITERIA

## 5.1 LOCAL CITY COUNCIL RULES

Upon review of the LEP and DCP plans of Shoalhaven City Council, no particular noise or vibration provisions were found to be applicable to this activity.

## 5.2 NSW DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS

We understand that the new school building will be built approx. 50 m away from Thomas Street, with learning spaces potentially being affected by this road traffic. However, this road is not a freeway and it is not expected to meet the min. average daily traffic included in the NSW Developments near rail corridors and busy roads, or the SEPP 2021 (Division 17, 2.120) to justify an acoustic assessment for façade (clause 102 Road).

## 5.3 NSW NOISE POLICY FOR INDUSTRY (NPFI) 2017

The NSW Noise Policy for Industry (NPFI) 2017 provides a methodology to determine the Project specific noise limits. The noise limits determined are categorised into the following time periods:

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

The noise indexes used for this methodology are the measured background ($L_{A90}$) and equivalent continuous ($L_{Aeq}$) noise levels. The $L_{A90}$ noise levels represents the *Rating Background Levels* (RBLs), which is the median of the background $L_{A90}$ (i.e. of the lowest $10^{th}$ percentile of samples) in each daytime, evening and night-time measurement period, for a 24-hour period.

The $L_{Aeq}$ noise levels represents the logarithmic average of all the $L_{Aeq}$ levels during the different time periods (daytime, evening and night-time periods). Using these noise levels, the policy provides a methodology to determine the Intrusiveness Noise Levels and Amenity Noise levels as discussed in below section.

### 5.3.1 AMENITY AND INTRUSIVENESS CRITERIA

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

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

TABLE 3: PROJECT SPECIFIC NSW NPFI AMENITY CRITERIA / TAKEN FROM TABLE 2.2 NPFI

| TYPE OF RECEIVER | INDICATIVE NOISE AMENITY AREA | PERIOD OF TIME | $L_{AEQ}$ DB(A) | AMENITY CRITERIA LAEQ DB(A) – 5 DB + 3 DB |
|---|---|---|---|---|
| **Residential** | Suburban | Day 7:00 to 18:00 | 55 | 53 |
| | | Evening 18:00 to 22:00 | 45 | 43 |
| | | Night 22:00 to 7:00 | 40 | 38 |
| **School classroom** | All | when in use | 35 – 40* | |

Notes:

- *in case where existing schools are affected by noise from existing noise sources, the acceptable LAeq noise level may be increased to 40 dBA.

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

| Receiver category | Typical planning zoning – standard instrument* | Typical existing background noise levels | Description |
|---|---|---|---|
| Suburban residential | RU5 – village<br>RU6 – transition | Daytime RBL<45 dB(A)<br>Evening RBL<40 dB(A) | **Suburban** – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the |
| | R2 – low density residential<br>R3 – medium density residential<br>E2 – environmental conservation<br>E3 – environmental management | Night RBL <35dB(A) | following characteristic: evening ambient noise levels defined by the natural environment and human activity. |

FIGURE 6: NPFI EXTRACT – TABLE 2.3 DETERMINING WHICH OF THE RESIDENTIAL RECEIVER CATEGORIES APPLIES

The 'Suburban residential' area description above is the most suitable for the activity location.

For this activity, the area of assessment is located in a quiet environment. We were not engaged to conduct a background noise assessment using loggers as we believe the existing LA90 levels of the area are low, in fact that would drag the PNTL results to artificially low levels. The proposed methodology in this case was to use the Amenity noise levels for day / evening and night, according to the zoning area and its critical receivers are located. We believe this criterion is conservative and more adequate for the type of area in which our project is located.

### 5.3.2 DETERMINATION OF PROJECT SPECIFIC NOISE TRIGGER LEVEL (PNTL)

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

TABLE 4: EXTERNAL PROJECT NOISE TRIGGER LEVEL (PNTL) FOR OPERATION NOISE

| LOCATION / AFFECTED | TIME | DESCRIPTOR | EXTERNAL PNTL [DBA] |
|---|---|---|---|
| **21 Church Street, Milton** | 0700 to 1800 | $L_{Aeq, Day}$ | 53 dBA (Day) / 43 dBA (Evening) / 38 dBA (Night) |
| | 1800 to 2200 | $L_{Aeq, Evening}$ | |
| | 2200 to 0700 | $L_{Aeq, Night}$ | |
| **19 Thomas Street, Milton** | 0700 to 1800 | $L_{Aeq, Day}$ | |
| | 1800 to 2200 | $L_{Aeq, Evening}$ | |
| | 2200 to 0700 | $L_{Aeq, Night}$ | |

Notes:

- Other school buildings could be affected by these works, however the closest buildings are the H sports hall and a sport court. Other school buildings affected by noise from the activity should meet 45 dBA at façade.

### 5.3.3 MODIFYING FACTOR' ADJUSTMENTS

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

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

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

### 5.3.4 FACT SHEET A NPFL DETERMINING EXISTING NOISE LEVELS

For the assessment of modifications to existing premises, where the premises has been operating for a significant period of time and it is considered a normal part of the acoustic environment, Fact sheet A of NPfI may be included in the background noise assessment.

## 5.4 CONSTRUCTION NOISE AND VIBRATION CRITERIA

### 5.4.1 Interim Construction Noise Guideline

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

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

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

**Table 5** set out the management levels for noise at residence and sensitive land uses, respectively. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected management level' which is >75dBA.

Affected properties above 75 dBA might require community consultation and a Construction Noise & Vibration Management Plan (CNVMP). Based on the RBL of 38 – 39 dBA in the daytime, the recommended noise management level during all aspects of the construction program are summarised in Table 6 below.

TABLE 5: NOISE AT AFFECTED USING QUANTITATIVE ASSESSMENT

| RECOMMENDED HOURS | EXTERNAL NOISE MANAGEMENT LEVEL (NML) $L_{EQ,15MIN}$ [dBA] | HOW TO APPLY |
|---|---|---|
| **Recommended standard hours**<br><br>**Monday – Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays** | Noise Affected 55 dBA | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $L_{Aeq\ (15\ minutes)}$ noise level is greater than the affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details |
| | Highly noise affected 75 dB(A) | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite period by restricting hours that the very noisy activities can occur, taking into account:<br>1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences);<br>2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| **Outside Recommended standard hours** | 40 dBA | A strong justification would typically be required for works outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see section 7.22 |

*Section 6, 'work practices' of the *Interim Construction Noise Guideline*, states: "*there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts. This approach gives construction site managers and construction workers the greatest flexibility to manage noise*".

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

The Interim Construction Noise Guideline recommends the following noise levels for land uses other than residential, as shown in Table 6 below. The external noise levels should be assessed at the most affected occupied point on the premises. A conservative estimate of 10 dB is generally applied as the difference between the external and internal level for noise sensitive uses that require internal noise measurement.

### 5.4.2 NOISE MANAGEMENT LEVELS

Noise Management Levels (NML) associated with the construction works on the project site are presented in Table 6.

TABLE 6: CONSTRUCTION NOISE MANAGEMENT LEVELS, $L_{EQ\ 15MIN}$

| RECEIVERS | RECOMMENDED HOURS | PERIOD | RBL $L_{A90,15MINS}$ [dBA] | EXTERNAL NOISE MANAGEMENT LEVEL [dBA] |
|---|---|---|---|---|
| **21 Church Street, Milton / 19 Thomas Street, Milton** | Day time (standard construction hours) | When in use | 45 | (45 + 10) = 55 dB(A) (Noise affected)<br>75 dB(A)<br>(highly noise affected) |

For other school building users the below NML levels apply:

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

| Land use | Management level, $L_{Aeq\ (15\ min)}$ (applies when properties are being used) |
|---|---|
| Classrooms at schools and other educational institutions | Internal noise level 45 dB(A) |
| Hospital wards and operating theatres | Internal noise level 45 dB(A) |
| Places of worship | Internal noise level 45 dB(A) |
| Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion) | External noise level 65 dB(A) |
| Passive recreation areas (characterised by contemplative activities that generate little noise and where benfefits are compromised by external noise intrusion, for example, reading, meditation) | External noise level 60 dB(A) |

FIGURE 7: EPA CONSTRUCTION NOISE AND VIBRATION GUIDELINE, 2016 / EXTRACT NOISE AT SENSITIVE USERS

## 5.4.3 CONSTRUCTION VIBRATION CRITERIA

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

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

### 5.4.3.1 Human Response to Vibration

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

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

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

#### 5.4.3.2 Continuous and impulsive vibration (1-80 Hz)

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

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

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

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

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

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

The Vibration Guideline notes "*Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community. Situations exist where vibration above the*

*preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short-term duration. An example is a construction or excavation project."*

#### 5.4.3.3 Intermittent vibration (1-80 Hz)

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

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

| Location | Daytime[1] | | Night-time[1] | |
|---|---|---|---|---|
| | Preferred value | Maximum value | Preferred value | Maximum value |
| Critical areas[2] | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences | 0.20 | 0.40 | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | 0.40 | 0.80 | 0.40 | 0.80 |
| Workshops | 0.80 | 1.60 | 0.80 | 1.60 |

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

#### 5.4.3.4 Vibration Criteria – Building Contents and Structure

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

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

#### 5.4.3.5 Standard BS 7385 Part 2 – 1993

For transient vibration, as discussed in standard BS 7385 Part 2- 1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 7 and illustrated in Figure 8.

TABLE 7: TRANSIENT VIBRATION CRITERIA AS PER STANDARD BS 7385 PART 2 – 1993

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

Standard BS 7385 Part 2 – 1993 states that the value in **Table 7** relate to transient vibration which does not cause resonant response in buildings. Where the dynamic loading caused by continuous vibration events is such that it results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in **Table 7** may need to be reduced by up to 50% (refer to Line 3 in Figure 8).

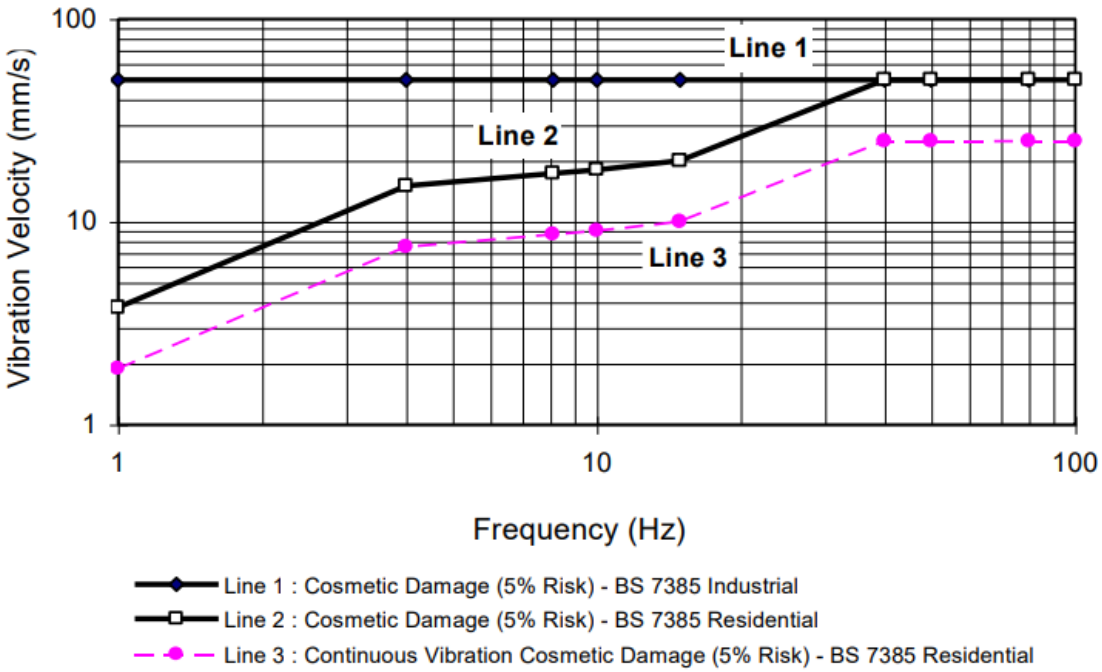


FIGURE 8 – BS 7385 PART 2 – 1993, GRAPH OF TRANSIENT VIBRATION VALUES FOR COSMETIC DAMAGES

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

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 7**, and major damage to a building structure may occur at values greater than four times the tabulate values.

Fatigue considerations are also addressed in the standard and it is concluded that unless the calculation indicated that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in **Table 7** should not be reduced for fatigue considerations.

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

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

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

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

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

The vibration limits of table 1 in DIN 4150-3:1999 (replicated in **Table 8** below) refer to the evaluation of the effects of short-term vibration on structures.

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

TABLE 8: DIN 4150-3 CONSTRUCTION VIBRATION LIMITS – SHORT TERM

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

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

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

The criteria are the peak particle velocities measured on the uppermost full storey of any building not related to the site and are listed in **Table 9**.

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

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

TABLE 9: DIN 4150-3 CONSTRUCTION VIBRATION LIMITS – LONG TERM

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

### 5.4.4 SUMMARY OF CONSTRUCTION NOISE AND VIBRATION CRITERIA

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

- 21 Church Street: 55 / 75 dBA
- 19 Thomas Street: 55 / 75 dBA
- 50 Princess Highway: 55 / 75 dBA
- Other school buildings: 45 dBA (internal) / 55 dBA (external)

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

Based on the NSW DECC Interim Construction Noise Guideline, this REF report will determine if a Construction noise and Vibration Management plan (CNVMP) is required, predicted construction noise and vibration levels are depicted in Section 7.

# 6 OPERATIONAL NOISE & VIBRATION IMPACT ASSESSMENT

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

## 6.1 NOISE EMISSION FROM PA SYSTEMS AND SCHOOL BELLS

There are currently no proposed upgrades/changes to the PA system and school bell schedule, hence it will not increase the current existing impact (see Fact A NPfI). Should this change, an acoustic analysis may need to be performed. We are not aware that the temporary demountable modules will use more PA Systems or school bells other than the existing ones.

## 6.2 NOISE EMISSION FROM OUTDOOR AREAS

There are currently no proposed upgrades/changes to the outdoor areas that would be expected to impact the existing background noise. Should this change, an acoustic analysis may need to be performed.

## 6.3 NOISE EMISSION FROM OPERATIONAL TRAFFIC

Based on the rapid transport assessment by SCT Consulting dated 7 February 2024, the number of students travelling by car and bus is not expected to significantly increase in the future. Hence, it is not expected that noise emissions from operational traffic will likely increase significantly.

## 6.4 NOISE EMISSIONS FROM CARPARK INCLUDING KISS AND DROP

There are currently no proposed upgrades/changes to the car park and kiss and drop area. Should this change, an acoustic analysis may need to be performed.

## 6.5 NOISE EMISSIONS FROM SERVICES

### 6.5.1 MECHANICAL SERVICES

Upon interdisciplinary coordination, we understand that mechanical plant will be located on level one, between grids (A, 1/3). Plant will comprise outdoor condensers and fans (outside air, extraction air and toilet extraction air). Our updated calculations were based on the below:

- The plantroom is located approximately 30 - 50 m of residential Receivers (Table 1).
- The plant would be expected to operate during daytime hours (7:00 am – 6:00 pm) with limited to no activities during evening time (6:00 pm to 10:00pm) and no activities during the nighttime.
- this updated assessment will consider the configuration as included in the NDY Mechanical set.

Mechanical noise sources propagated to critical receivers is shown in table below:

TABLE 10 – NOISE LEVELS FOR MECHANICAL SYSTEMS

| EQUIPMENT | SOUND LEVEL SWL / SPL (dB) PER FREQUENCY BAND (HZ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dBA |
| **Total noise for VRF Outdoor Units (SPL at source)** | 88 | 86 | 85 | 83 | 75 | 73 | 71 | 67 | 84 |

| EQUIPMENT | SOUND LEVEL SWL / SPL (dB) PER FREQUENCY BAND (HZ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dBA |
| **Total noise from fans plant (SWL)** | 75 | 74 | 72 | 72 | 73 | 73 | 69 | 61 | 78 |

Based on the plant configuration above, the noise mitigation measures needed to meet the PNTL and the required noise levels at the critical existing school buildings are listed below:

- ODU unit plant room surrounded by acoustic Louver type IAC SL150 or equivalent / as tall as the units.
- Fans type GEF 001 and OAF will have acoustic internal lining (50 mm thick) for both ends, min. 1m long.
- Fans type GEF 002 and TEF will have acoustic internal lining (50 mm thick) for both ends, min. 1.5m long.
- TEF fan with acoustical flexible duct min. 1.5 m long.
- Any further changes to mechanical plant will require an updated acoustic assessment.

### 6.5.2 MECHANICAL SERVICES ON EXISTING SCHOOL BUILDINGS

Acoustic louvers are required to mitigate the noise impact from the plant on other existing buildings from the school and meet the recommended internal noise levels (building X at 12.8 m).

TABLE 11: PLANTROOM ACOUSTIC LOUVERS FOR MECHANICAL PLANT

| EQUIPMENT | MIN. INSERTION LOSSES (dB) PER FREQUENCY BAND (HZ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| **Min. Insertion Loss from Acoustic Louvre (SL150 or equivalent)** | 6 | 6 | 8 | 10 | 14 | 18 | 16 | 15 |

If there are A/C proposed upgrades to some of the existing learning spaces (Buildings X and U) and if these upgrades require an external ODU unit, the noise of these unit will likely impact the closest existing buildings. An estimation of a medium size ODU propagated into a close existing building (between X and L approximately 2.8m away) shows that the propagated noise will comply with PNTL levels (50 dBA), as seen in the table below.

TABLE 12: NOISE IMPACT OF BUILDINGS WITH NEW A/C UNITS (BUILDING X TO L)

| EQUIPMENT | SOUND LEVEL (dB) PER FREQUENCY BAND (HZ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dBA |
| **Cumulative Sound Power Level from ODUs (1 off)** | 82 | 59 | 58 | 58 | 57 | 46 | 50 | 47 | **62** |
| **Total predicted sound pressure level at Building** | 67 | 44 | 44 | 44 | 44 | 33 | 37 | 36 | **48** |

| EQUIPMENT | SOUND LEVEL (dB) PER FREQUENCY BAND (HZ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **L (from Building X)** | | | | | | | | | |

### 6.5.3 FIRE PROTECTION SERVICES

A new fire booster pump is proposed for this activity, this equipment is not yet selected but the acoustic enclosure will need to be designed in early stages of the design phase, as soon as the approximate model is selected. The minimum characteristics that this acoustic enclosure need to have, are as per below:

- Acoustic walls and ceilings: min. 190 mm blockwork construction for walls and ceiling.
- Exhaust muffler (if required depending on the pump type) type super critical with min. 50 dB attenuation.
- Acoustic solid core access door with acoustic seals, min. Rw 36.
- Internal absorption to mitigate reverberation (min 20 sqm with min. NRC 0.8, on walls / ceilings, where available).
- Equipment must be tested only during day time.
- Acoustic louver for ventilation (if needed) max 3 sqm and high acoustic performance (preferably 300 - 600 mm thick), not oriented towards the existing school buildings or residential neighbours.

## 6.6 OPERATIONAL VIBRATION

For controlling vibration emissions on mechanical plant (VRF, condensers and similar), it would be recommended that all condensers are installed on Embelton, Mason Industries pads or equal. Ensuring compliance with the NSW EPA document Assessing Vibration: A technical guideline. However, as ODU units are small, we do not consider this will be a noticeable impact on school grounds or residential areas.

Noise and vibration control recommendations for internal spaces within the activity is not a REF scope and will need to be assessed by an acoustic consultant during further design stages.

# 7 CONSTRUCTION NOISE & VIBRATION IMPACT ASSESSMENT

At the time of writing, the proposed construction plant and equipment for the activity was still subject to further development. For preliminary assessment purposes and based on previous experience on similar projects, we have assumed that the following plant and equipment will be used in the following phases:

- Excavation and demolition
- Construction / fitout works

We understand the confirmed hours of construction will be standard as per below:

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

## 7.1 CONSTRUCTION PLANT NOISE LEVELS

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

TABLE 13 TYPICAL EXTERNAL NOISE LEVELS OF DEMOLITION AND CONSTRUCTION MACHINERY/ACTIVITY

| ITEM # | ACTIVITY/MACHINERY | SOURCE AND REFERENCE NUMBER (BS 5228 – 1:2009) | $L_{eq}$ SOUND PRESSURE LEVEL AT 10m (dBA) |
|---|---|---|---|
| **Excavation and Demolition** | | | |
| **1** | Tracked excavator 14t / 66kW | Table C2 Ref 25 | 69 |
| **2** | Dumper truck 9T / 75 kW | Table C4 / Ref 4 | 76 |
| **Structural Phase** | | | |
| **3** | Tracked excavator 14t / 66kW | Table C2 Ref 25 | 69 |
| **4** | Dumper truck 9T / 75 kW | Table C4 / Ref 4 | 76 |
| **5** | Mini piling rig (rock bolt) 250mm auger | Table C3 / Ref 18 | 74 |
| **6** | Concrete pump + cement mixer truck (discharging) 8 T / 350 bar | Table C4/ Ref24 | 68 |
| **Construction & Fitout works** | | | |
| **7** | Handheld circular saw 3 Kw | Table C4 / Ref 72 | 79 |
| **8** | Handheld cordless nail gun | Table C4 / Ref 95 | 73 |
| **9** | Diesel generator | Table C4 / Ref 76 | 61 |

**Notes:**

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

## 7.2 PREDICTED CONSTRUCTION NOISE

Based upon the above plant sound power levels, predicted construction noise levels for the various works phases are presented below:

TABLE 14 PREDICTED CONSTRUCTION NOISE $L_{EQ,15MIN}$

| RECEIVERS | RECOMMENDED HOURS | PERIOD | PREDICTED CONSTRUCTION NOISE LEVEL | EXTERNAL NOISE MANAGEMENT LEVEL |
|---|---|---|---|---|
| **Excavation and Demolition Phase** | | | | |
| **21 Church Street** | Monday Friday 7am to 6pm<br>Saturday 8am to 1pm<br>No work on Sundays or Public Holidays | Day | 66 dB(A) | 55 dB(A)(noise affected)<br>75dB(A) (highly noise affected) |
| **Existing Building X (school)** | | | 72 dB(A) | |
| 1**9 Thomas Street** | | | 63 dB(A) | |
| **Structural Phase** | | | | |
| 21 Church Street | Monday Friday 7am to 6pm<br>Saturday 8am to 1pm<br>No work on Sundays or Public Holidays | Day | 68 dB(A) | 55 dB(A)(noise affected)<br>75dB(A) (highly noise affected) |
| 19 Thomas Street | | | 68 dB(A) | |
| **Construction & Fitout Works Phase** | | | | |
| 21 Church Street | Monday Friday 7am to 6pm<br>Saturday 8am to 1pm<br>No work on Sundays or Public Holidays | Day | 70 dB(A) | 55 dB(A)(noise affected)<br>75dB(A) (highly noise affected) |
| 19 Thomas Street | | | 71 dB(A) | |
| NB: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence. | | | | |

Notes:

- For excavation and piling phases, the tracked excavator and dumper truck will need time managed machinery at 70% and 40% respectively.
- Construction hours will only be during day-time.
- Construction site is large and not all machinery is expected to be located at the same distance when assessing to a particular boundary.
- Not all machinery are to be working simultaneously.
- The above estimations are the critical scenario for construction noise.
- Construction fit out noise sources will be kept inside the building and well shielded for other school receivers.
- For excavation and piling phases a perimeter hoarding will be needed to protect existing school buildings (in particular building X) as per figure below:

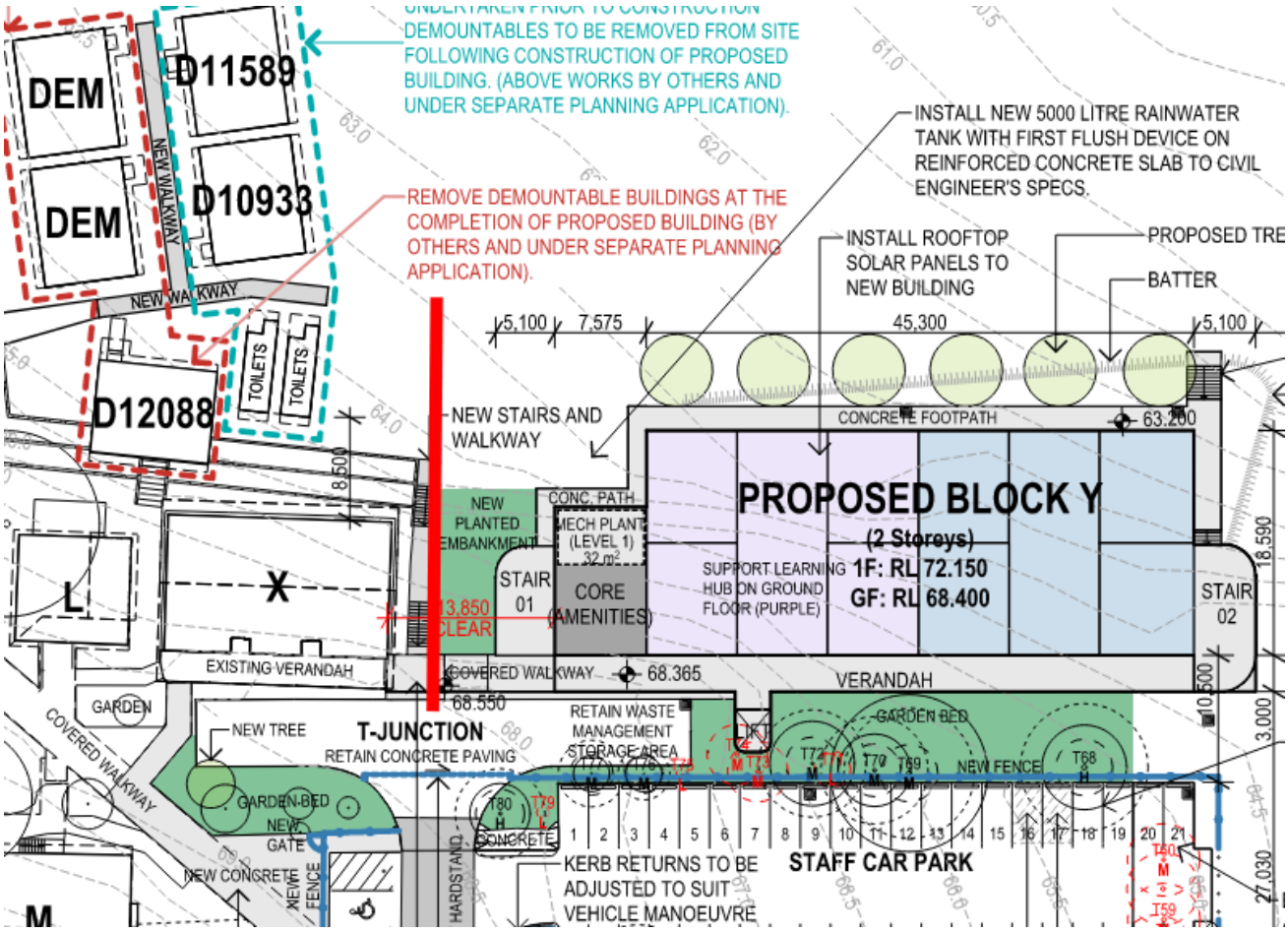


FIGURE 9: INDICATIVE LOCATION OF THE PERIMETER HOARDING DURING EXCAVATION PHASE

The perimeter hoarding construction needs to ensure the noise levels at the existing school building's façade do not exceed the criteria depicted in this report (55 dBA at the existing school building's facade).

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

Any out of hours construction activities will need a construction noise and vibration management plan (CNVMP).

## 7.3 PREDICTED CONSTRUCTION VIBRATION

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

A geotechnical assessment dated 30 January 2024 was conducted by Stantec that reported the subsurface conditions comprise topsoil overlying fill, residual clay/sand.

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

The current RMS Construction Noise and Vibration Guideline sets safe working distances for vibrating plant and equipment. These are summarised below in Table 15. For this size of works, the use of large hydraulic hammers

would not be recommended for these works. Hence it is recommended that the use of smaller rock breakers and handheld jackhammers are used for activity close to the nearest affected residential receivers.

TABLE 15 RMS PLANT VIBRATION SAFE OPERATING DISTANCES - *Construction Noise and Vibration Guideline 2016*

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

Expected vibration levels from percussive piling on critical residential receiver and building X (school) are included below:

TABLE 16 PILING WORKS ESTIMATED VIBRATION LEVELS AS PER TABLE E.1 OF THE BS 5228-2.2009

| EQUIPMENT | VIBRATION LEVEL PPV (MM/S) | SOURCE |
|---|---|---|
| **Percussive piling, piles at 10 m depth with cohesive soils. Distance to Building X at 12m** | 0.38 mm/s | Table E1. BS 5228-2:2009 |

Notes:

- The above vibration levels were calculated based on the below:
  - Piling at 10 m depth with a W factor of 85 kJ for percussive piling. No vibratory piling.

The above levels meet the construction vibration criteria (sensitive structures to vibration, 2.5 mm/s) as per DIN 4150 – 3. These values are not likely going to produce complains on the neighbours and are below all the maximum recommended vibration values as depicted in the criteria section.

## 7.4 GENERAL RECOMMENDATIONS ON CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

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

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

### 7.4.1 GENERAL/SITE MANAGEMENT ISSUES

All employees, contractors and subcontractors are to receive an environmental induction and should instruct all persons at the site with regard to all relevant project specific and standard noise mitigation measures, including but not limited to permissible hours or work, limitation of high noise generating activities, location of nearest affected noise receivers, construction employee parking areas, designated loading/unloading areas and procedures, site opening/closing times (including deliveries) and environmental incident procedures.

A dedicated person will form a point of contact for dissemination of general information regarding site operations. Contact persons will also be defined to receive comment or complaints from the community.

### 7.4.2 CONSTRUCTION ACTIVITIES AND NOISE MITIGATION

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

- Extended construction hours are not recommended, for evening hours, less intrusive works will be scheduled to be carried out and/or works will be carried out away from sensitive receivers;
- Activities that approach the highly noise affected criteria for the residential receivers to be carried out during times where receivers are less sensitive to noise;
- Avoid unnecessary revving of engines and turn off plant that is not being used/required;
- Where possible organise the site so that delivery trucks and haulage trucks only drive forward to avoid the use of reversing alarms;
- Where possible, avoid using tonal reverse alarm outside standard construction hours;
- Organise and schedule the equipment operations to limit the noisiest machines operating simultaneously;
- Site set up/ movement of plant / delivery of material/ waste removal to site should generally be restricted to day period;
- Truck drivers are to be informed of site access routes, acceptable delivery hours and must minimise extended periods of engine idling;
- Ensure there is no unnecessary shouting or loud stereo/radios on site. There must be no dropping of metal from heights, throwing of metal items or slamming of doors;
- Use less noise intensive equipment where reasonable and feasible;
- Where practical fixed plant should be positioned as far as possible from the sensitive receivers;
- Use temporary site buildings and material stockpile as noise barrier;
- Build the perimeter hoarding so it ensures that the noise at the façade of existing school building meet the criteria.
- Any out of hours construction activities will need a CNVMP (Construction noise and vibration management plan).

# 8 CONCLUSIONS

The current noise and vibration assessment considers that the proposed activity is acceptable from a noise / vibration perspective according to the state and local regulations. The following summarises the findings of our assessment:

TABLE 17 MITIGATION MEASURES

| STAGE* | MITIGATION MEASURES | REASON FOR MITIGATION MEASURE | SECTION OF REPORT |
|---|---|---|---|
| **D** | Acoustic louvers installed surrounding mechanical plant and fans to have internally lined ducts with acoustic insulation. | To avoid impacts resulting from the plant room operation. | Section 6.7.1 |
| **O** | Mechanical plant room to have limited operation during evening periods and no operation during night time periods (after 10 pm). | To meet the PNTL levels at night time. | Section 6.7.1 |
| **D / O** | Proposed fire pump will need to be designed with a complete acoustic enclosure to meet project boundary noise levels. | To avoid impacts resulting from the pump operation. | Section 6.7.3 |
| **C** | Construction noise for excavation and piling will require a perimeter hoarding as indicated to meet recommended noise levels inside nearest school building. Additionally, time managed machinery will be required for the tracked excavator (70%) and dumper truck (40%).<br>Any out of hours construction activities will need a CNVMP. | To protect existing school buildings from construction noise. | Section 7 |

*Note: Project stages include:

- (D) Design
- (C) Construction
- (O) Operation

# 9 EVALUATION OF ENVIRONMENTAL IMPACTS

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

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