# New Primary School in Mulgoa Rise

# MODs – Acoustic Impact Assessment Report

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

Report number: 220300_MODs MRPS_2.0.docx
Date: 29 June 2022
Version: For Issue

**PULSE WHITE NOISE ACOUSTICS** Level 5, 73 Walker Street, North Sydney NSW 2060
**P** 1800 4 PULSE (1800 478 573) **E** info@pwna.com.au **pwna.com.au** ABN 95 642 886 306

## DOCUMENT CONTROL

| | |
|---|---|
| **Project Name** | New Primary School in Mulgoa Rise |
| **Project Number** | 220300 |
| **Report Reference** | 220300_MODs MRPS |
| **Client:** | School Infrastructure NSW Level 8, 259 George Street Sydney NSW 2000 |

| Revision | Description | Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|---|---|
| 1.0 | Draft | 220300_MODs MRPS | 22 June 2022 | Renzo Arango | - | Matthew Harrison |
| 2.0 | For Issue | 220300_MODs MRPS | 29 June 2022 | Renzo Arango | Matthew Harrison | Matthew Harrison |

PREPARED BY:

Pulse White Noise Acoustics Pty Ltd
ABN 95 642 886 306
Level 5, 73 Walker Street, North Sydney, 2060
1800 4 PULSE

## TABLE OF CONTENTS

## TABLES



## FIGURES

# 1 INTRODUCTION

A new primary school is being developed at 1-23 Forestwood Drive, Glenmore Park, NSW. The school is referred herein as the New Primary School in Mulgoa Rise (NPSMR). However, due to significant wet weather earlier this year, the construction works for the new school facilities have been delayed. To meet the delivery of school facilities as initially planned, it is proposed to install temporary facilities.

Therefore, Pulse White Noise Acoustics (PWNA) has been engaged to undertake an acoustic impact assessment, as part of the submission for development application of these temporary facilities.

This report addresses the following for the temporary school premises:

- External acoustic impact from typical operational conditions.
- External acoustic impact from construction activities related to the temporary facilities.

## 1.1 Project Description

The temporary facilities comprise the following premises:

- 9 General Learning Spaces (i.e. homebases).
- 2 Support Unit Learning Spaces.
- 1 administration block.
- 1 staff facilities block.
- 1 library block.
- 2 toilet block facilities.
- 1 accessible toilet block facility.
- Outdoor play area.

These temporary facilities are situated between the southern site boundary of the permanent school premises and Forestwood Drive, towards the Mulgoa Rise Fields. The layout of the temporary facilities is included in Appendix C.

It is also expected that the following permanent facilities will be delivered when the temporary facilities are set up on site:

- Multi-Purpose Hall (Building C).
- COLA located south of Building C.
- Outdoor sports court.
- Waste storage areas
- Staff carpark
- Pick up and drop-off areas along Deerubbin Drive

It is proposed that the school will operate from 8:00 am till 3:00 pm.

It is planned for temporary facilities to be completed in December 2022, and ready for operation in January 2023, with students attending the school on Day 1 of Term 1 2023. The temporary facilities will be removed within 12 months of operation.

The proposed occupancy for the temporary facilities is the following: 230 students and 25 staff. Finally, it is expected that waste collection from the temporary facilities will be conducted on a weekly basis.

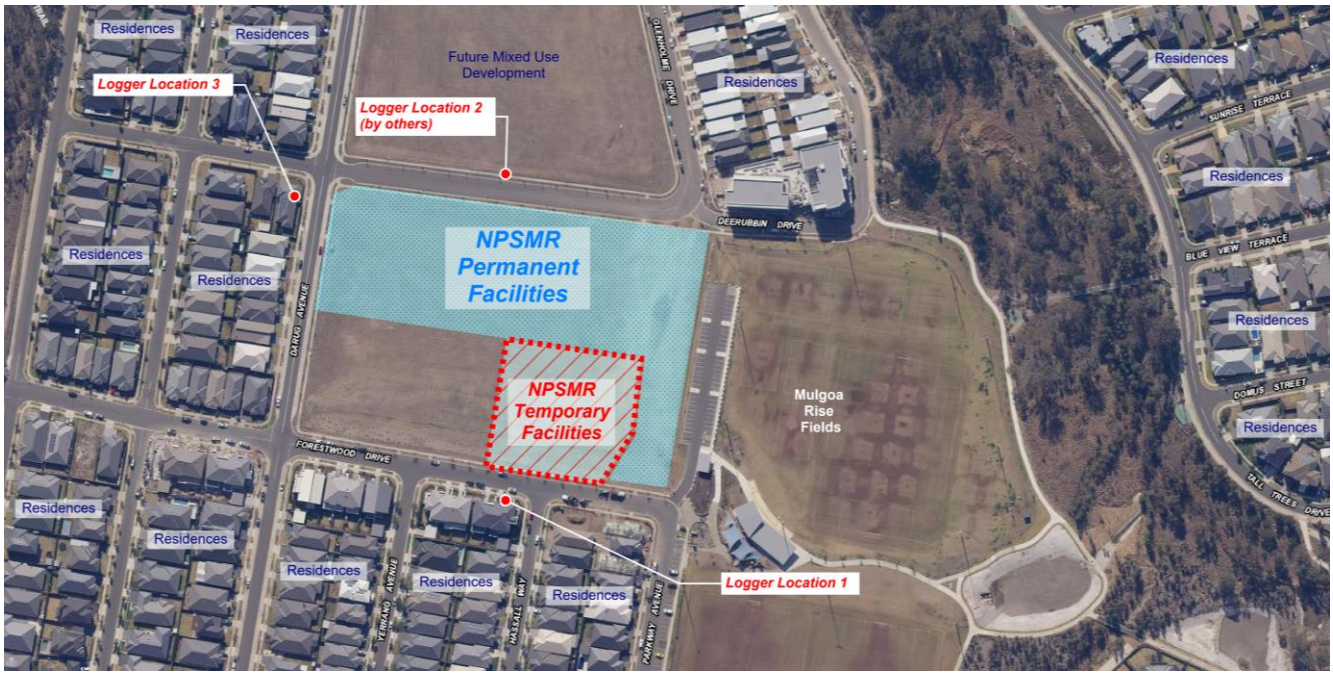
## 1.2 Site Layout

The temporary school facilities are surrounded by the following premises which are also considered the nearest noise affected receivers (refer to Figure 1):

- Residences which are located along the western and southern property boundaries. Residences along the western property boundary are situated across Darug Avenue; and those along the southern property boundary are located across Forestwood Drive.
- A future mixed-use development which will be located across Deerubbin Drive (i.e. 90-98 Glenmore Ridge Drive), along the northern property boundary.
- Residences which are also situated along Deerubbin Drive, to the north-east and north-west from the site.
- A childcare centre located at Ground Level, 71 Deerubbin Drive, Glenmore Park. This only operates from Mondays to Fridays, 6:30 am to 6:00pm.
- Along the eastern property boundary: Active recreation areas (i.e. Mulgoa Rise Fields), and areas dedicated to environmental conservation.

Since the receivers listed above are the nearest affected receivers, the acoustic assessment discussed in this report is undertaken at these receivers.

**Figure 1 Site locality showing survey locations**



# 2 OPERATIONAL ACOUSTIC CRITERIA

The following sub-sections discuss the operational acoustic criteria for the proposed development.

The operational acoustic criteria are derived from the following documentation:

- *"New Primary School in Mulgoa Rise, Review of Environmental Factors – Noise & Vibration Assessment Report"* (dated 16 December 2021, issued by PWNA, referenced herein as the N&VA Report).
- *"New Primary School in Mulgoa Rise, 100% Acoustic Design Report"* (dated 1 December 2021, issued by Marshall Day Acoustics, referenced herein as the Acoustic Design Report).

Therefore, where required, a reference to these previous reports is provided, and a summary is discussed.

## 2.1 External Noise Emission Criteria

### 2.1.1 Operational Criteria

A detailed discussion of the operational criteria for external noise emissions, is included in the N&VA Report. This sub-section provides a summary of this discussion.

To obtain the external noise level criteria, unattended noise measurements were conducted at three locations as summarised in Table 1.

These measured noise levels obtained were analysed and post-processed in accordance with the procedures discussed in the NSW Noise Policy for Industry (NSW NPI). These assessment procedures are also discussed in detail in the N&VA Report.

The criteria defined in accordance with the NSW NPI are summarised in Table 2 below. The criteria are nominated for the purpose of determining the operational noise limits for mechanical plant associated with the development which can potentially affect noise sensitive receivers. For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in Table 2.

**Table 1 Measured ambient noise levels in accordance with the NSW NPI**

| Measurement Location | Daytime 7:00 am to 6:00 pm | | Evening 6:00 pm to 10:00 pm | | Night Time 10:00 pm to 7:00 am | |
|---|---|---|---|---|---|---|
| | $L_{A90}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{Aeq}$ |
| **Logger Location 1:** No. 30 Forestwood Drive Glenmore Park | 34 dBA | 52 dBA | 34 dBA | 50 dBA | 32 dBA | 49 dBA |
| **Logger Location 2** At southern property boundary of future mixed-use development at 90-98 Glenmore Ridge Drive | 43 dBA | 51 dBA | 38 dBA | 47 dBA | 33 dBA | 46 dBA |
| **Logger Location 3:** No. 21 Darug Avenue Glenmore Park | 37 dBA | 57 dBA | 37 dBA | 55 dBA | 32 dBA | 49 dBA |

*Notes:*

1. *For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am*
2. *The $L_{A90}$ noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level*
3. *The $L_{Aeq}$ is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.*

**Table 2 External noise level criteria in accordance with the NSW NPI**

| Location | Time of Day | Project Amenity Noise Level, $L_{Aeq,\ period}$ [1] (dBA) | Measured $L_{A90,\ 15\ min}$ (RBL) [2] (dBA) | Measured $L_{Aeq,\ period}$ Noise Level (dBA) | Intrusive $L_{Aeq,\ 15\ min}$ Criterion for New Sources (dBA) | Amenity $L_{Aeq,\ 15\ min}$ Criterion for New Sources (dBA) [4] |
|---|---|---|---|---|---|---|
| Residences along: Forestwood Drive | Day | 55 | 34 | 52 | **40** [5] | 58 |
| | Evening | 45 | 34 | 50 | **39** | 48 |
| | Night | 40 | 32 | 49 | **37** | 43 |
| | Shoulder period: 6:30 am- 7:00 am | - | 39 | - | **44** | |
| Residences along: Darug Avenue | Day | 55 | 37 | 57 | **42** | 58 |
| | Evening | 45 | 37 | 55 | **42** | 48 |
| | Night | 40 | 32 | 49 | **37** | 43 |
| | Shoulder period: 6:30 am- 7:00 am | - | 41 | - | **46** | - |
| Residences along: Deerubbin Drive | Day | 55 | 43 | 51 | **48** | 58 |
| | Evening | 45 | 38 | 47 | **43** | 48 |
| | Night | 40 | 33 | 46 | **38** | 43 |
| | Shoulder period: 6:30 am- 7:00 am | - | 37 | - | **42** | - |
| Commercial premises at future mixed use development along Deerubbin Drive | When in use | 60 | - | 52 | - | **63** |
| Active Recreation Areas: Mulgoa Rise Fields | When in use | 50 | - | 52 | - | **53** |
| Child Care Centre (external level) [6] | When in use | 55 | - | - | - | **55** |

*Note 1: Project Amenity Noise Levels corresponding to "Urban" areas, equivalent to the Recommended Amenity Noise Levels minus 5 dBA*

*Note 2: $L_{A90}$ Background Noise or Rating Background Level*

*Note 3: Project Noise Trigger Levels are shown in bold*

*Note 4: This is based on the assumption that the existing noise levels are unlikely to decrease in the future*

*Note 5: Minimum project intrusiveness noise level as per Table 2.1 of the NSW NPI*

*Note 6: Based on criteria discussed in Section 2.1.4*

### 2.1.2 Sleep Disturbance

In accordance with the NSW NPI, sleep disturbance is to be assesses in two stages addressing the likelihood of sleep disturbance and sleep awakening.

For the criterion addressing the likelihood of sleep disturbance, the NSW NPI recommends that the maximum noise level event should not exceed the following:

- 40 dB $L_{Aeq,\ 15\ minutes}$ or the prevailing RBL plus 5 dB, whichever is the greater; and / or
- 52 dB $L_{AFmax}$ or the prevailing RBL plus 15 dB, whichever is the greater

As a result, the criterion of 52 dB $L_{AFmax}$ is adopted as the criterion for the likelihood of sleep disturbance at all residences.

Regarding sleep awakening, ongoing research is still being undertaken to quantify an appropriate criterion. The NSW Road Noise Policy (NSW RNP) provides guidelines and a summary of current research being undertaken on this topic. According to the NSW RNP, an accurate representation of sleep disturbance impacts on a community from a noise source is particularly difficult to quantify mainly due to differing responses of individuals to sleep disturbance – this is found even within a single subject monitored at different stages of a single night's sleep or during different periods of sleep.

In addition, the differing grades of sleep state make a definitive definition difficult, and even where sleep disturbance is not noted by the subject, factors such as heart rate, mood and performance can still be negatively affected.

An assessment of sleep disturbance should consider the maximum noise level or $L_{A1(1\ minute)}$, and the extent to which the maximum noise level exceeds the background level and the number of times this may happen during the night-time period. Factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur;
- Time of day (normally between 10.00pm and 7.00am); and
- Whether there are times of day when there is a clear change in the existing noise environment (such as during early morning shoulder periods).

Currently the information relating to sleep disturbance impacts indicates that:

- Maximum internal noise levels below 50–55 dBA are unlikely to cause an awakening from a sleep state.
- One or two noise events per night with maximum internal noise levels of 65–70 dBA are not likely to affect health and wellbeing significantly.

As a result, the adopted sleep awakening criterion for the project is an internal noise level of 50 - 55 dB $L_{AFmax}$. This criterion is applicable for noise emissions generated by short term events occurring during the night time period. Therefore, allowing for a 10 dB noise reduction for open windows, it is proposed that the noise screening criterion for sleep awakening should be 60 - 65 dB $L_{AFmax}$ external noise level at residential properties.

### 2.1.3 Emergency Plant / Infrequent Operational Activities

For emergency plant (such as stand-by generators) or activities which are conducted infrequently, such as waste collection (to be undertaken weekly as discussed in Section 1.1); the NSW NPI allows for modifying factors that can be subtracted from the predicted noise levels. These modifying factors should be applied prior to assessing against the external noise level criteria. These duration modifying factors are summarised in Table 3 below.

Under the assumption that each waste collection event has a duration of between 15 minutes to 1 hour, and there is only one such event in a 24 hour period, then a modifying factor of 5 dB can be applied to the predicted noise levels. Alternatively, the modifying factor can be added to the relevant criterion (as a leniency factor) prior to the assessment.

**Table 3 Modifying factors for duration**

| Allowable Duration of Noise (one event in any 24 hour period) | Allowable Exceedance at Receiver for the Period of Noise Event | |
|---|---|---|
| | Daytime and Evening (7am – 10pm) | Night time (10pm – 7am) |
| 1 to 2.5 hours | 2 | Nil |
| 15 minutes to 1 hour | 5 | Nil |
| 6 minutes to 15 minutes | 7 | 2 |
| 1.5 minutes to 6 minutes | 15 | 5 |
| Less than 1.5 minutes | 20 | 10 |

*Note: Where the duration of the noise event is smaller than the duration of the project trigger noise level (PNTL), that is, less than 15 minutes, the allowable adjusted project noise trigger level (APNTL) is derived as follows:*

$$APNTL = 10\log((10^{\frac{PNTL}{10}}\ x\ (\frac{900 - duration}{900})) + (10^{\frac{PNTL+allowable\ exceedance\ in\ table\ above}{10}}\ x\ duration))$$

### 2.1.4 Child Care Centre

In accordance with the "Guideline for Child Care Centre Acoustic Assessment" (version 3.0, dated September 2020,) issued by the Association of Australian Acoustical Consultants (AAAC), the following is recommended to mitigate the external noise impact on children:

- In outdoor play or activity areas, the $L_{Aeq,\ 1\ hour}$ noise level from road, rail or industry should not exceed 55 dBA during the hours the childcare operates.
- In indoor play or sleeping areas, the $L_{Aeq,\ 1\ hour}$ noise level from road, rail or industry should not exceed the following levels:
    - 40 dBA in activity areas
    - 35 dBA in sleeping areas

It is noted that the childcare centre at 71 Deerubbin Drive is mechanically ventilated, with façade external walls comprising doors and openable windows which can be closed in the event of very loud events. Therefore, assuming a noise reduction of 25 dB for a closed door or window, the following noise levels are recommended as external noise level criteria for indoor areas:

- 65 dB $L_{Aeq,\ 1\ hour}$ for activity areas.
- 55 dB $L_{Aeq,\ 1\ hour}$ for sleeping areas (this concurs with the recommended $L_{Aeq,\ 1\ hour}$ criterion for outdoor play areas).

## 2.2 Outdoor Noise Emissions (Outdoor Play Areas)

No mandatory legislation is available which addresses external noise emission from communal halls, or outdoor gatherings (generally caused by student activities such as talking, playing, etc). However, the *"Guideline for Child Care Centre Acoustic Assessment"* (version 3.0, dated September 2020), issued by the Association of Australasian Acoustical Consultants (AAAC) provides guidance on how to assess similar activities to a primary school.

For outdoor play areas that have the potential to impact on residential receivers the guideline states:

> *The noise impact from children at play in a childcare centre differs from the domestic situation in that it is a business carried out for commercial gain, the number of children can be far greater than in a domestic situation and the age range of the children at the centre does not significantly vary over time as it would in a domestic situation. However, the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times the children play outside. Night-time, weekend or public holiday activity is not typical and childcare centres have considerable social and community benefit.*
>
> ***Base Criteria** – With the development of childcare centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed $L_{eq,15min}$ 45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).*
>
> ***Background Greater Than 40 dB(A)** – The contributed $L_{eq,15min}$ noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (i.e. background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*
>
> ***Up to 4 hours (total) per day** – If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*
>
> ***More than 4 hours (total) per day** – If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed $L_{eq,15\ minute}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.*
>
> - *The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be: 1.5 m above ground level;*
> - *On a balcony at 1.5 m above floor level;*
> - *Outside a window on the ground or higher floors*

Although the guideline is intended for childcare centres, we are of the opinion that assessing noise from children at play based on the NSW NPI criteria is overly restrictive. This type of noise emissions is different in both character and duration to that of industrial, commercial or even machine noise emissions. For example, noise generated by students playing is intermittent in character, as noise from mechanical services is typically constant.

Based on noise measurement results summarised in Table 1; the noise targets listed in Table 4 are adopted for the assessment of noise emissions by children at play in outdoor areas.

**Table 4 Noise targets for assessment of noise emissions by children at play**

| Type of Receiver | Daytime Period 7:00 am – 6:00 pm (dB $L_{Aeq, 15\ minutes}$) | Evening Period 6:00 pm – 10:00 pm (dB $L_{Aeq, 15\ minutes}$) | Night time Period 10:00 pm – 12:00 am (dB $L_{Aeq, 15\ minutes}$) |
|---|---|---|---|
| Residences along: Forestwood Drive | 45 | 45 | 45 |
| Residences along: Darug Avenue | 45 | 45 | 45 |
| Residences along: Deerubbin Drive | 48 | 45 | 45 |

It is noted that a noise target of 45 dB $L_{Aeq, 15\ minutes}$ is also adopted for the night time period. This is consistent with the typically recommended external noise level of 45 dB $L_{Aeq}$ outside a bedroom window. This is obtained by allowing a noise reduction of 10 dB for open windows and a design noise level of 35 dB $L_{Aeq}$ inside the bedroom (as per Table 1 of standard AS/NZS 2107:2016).

## 2.3 Noise Emissions From Carpark

It is likely that all traffic activity related to the school development (i.e. transportation for students and parking within the school premises) will be produced by light vehicles and it is considered feasible to assess car park noise impacts with reference to the NSW NPI as it is forecast that traffic movements in and out of the car park will occur during distinct time periods, i.e. in the morning before school commences and again in the afternoon following the end of school hours. Therefore, the criteria used for the assessment of carpark noise emissions should be as discussed in Section 2.1 (refer to Table 2).

Since the operational times for the temporary school facilities starts at 6:30 am, the criteria for sleep disturbance, as well as the shoulder period criteria, are considered in our carpark noise assessment.

## 2.4 Penrith Development Control Plan 2014

Section E7.4 of the Penrith Development Control Plan 2014 (Penrith DCP 2014), which corresponds to Glenmore Park Stage 2, sub-section 7.4.4.6 includes objective and performance measures for visual and acoustic privacy. However, these conditions do not state specific numeric criteria for educational facilities. Therefore, we refer to other operational acoustic criteria discussed in this report to address acoustic amenity and privacy.

## 2.5 Noise Intrusion From Construction Works

To assess noise intrusion generated by construction activities of the permanent facilities, impacting onto the temporary premises, we adopt the following noise management level (NML): 45 dB $L_{Aeq\ (15\ minutes)}$ internal noise level when temporary school premises are in use.

This criterion is obtained from the *Interim Construction Noise Guideline* (ICNG).

## 2.6 Aircraft Noise Intrusion

In accordance with DG11-Acoustics, general learning areas, music, drama, movement studios and halls are to be assessed where the school site lies within Australian Noise Exposure Forecast (ANEF) 25 (or higher) as shown on airport planning instruments. The procedures discussed in standard AS 2021:2015 *"Acoustics - Aircraft noise intrusion - Building siting and construction"* are to be used in the assessment.

Currently, no ANEF (Australian Noise Exposure Forecast) contours are available for the future Western Sydney Airport, since this is a future development. Instead, ANEC (Australian Noise Exposure Concept) contours are provided. These ANEC contours are provided in the Western Sydney Airport website (https://www.westernsydneyairport.gov.au/about/flight-paths/noise-tool).

Based on these ANEC contours, it is observed that the project site will be exposed to a less than 20 ANEC contour (refer to Figure 2). Therefore, the site is no subject to the aircraft noise intrusion assessment.

**Figure 2 ANEC contours for Western Sydney Airport in relation to the NPSMR**


## 2.7 Noise Impact On Local Roads

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

Also, the NSW RNP recommends the criteria summarised in Table 5 which is applicable to residential land uses.

**Table 5 Road traffic noise assessment criteria for residential land uses according to the NSW RNP**

| Road Category | Type of project/land use | Assessment Criteria | |
|---|---|---|---|
| | | **Day (7:00 am – 10:00 pm)** | **Night (10:00 pm – 7:00 am)** |
| Local roads | Existing residences affected by noise from new local road corridors<br>Existing residences affected by noise from redevelopment of existing local roads<br>Existing residences affected by additional traffic on existing local roads generated by land use developments | 55 dB $L_{Aeq,\ 1\ hour}$ (external) | 50 dB $L_{Aeq,\ 1\ hour}$ (external) |

## 2.8 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"*. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration - from uninterrupted sources (refer to Table 6).
- Impulsive vibration - up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 7).
- Intermittent vibration - such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 8).

**Table 6 Continuous vibration acceleration criteria (m/s$^2$) 1 Hz-80 Hz**

| Location | Assessment period | Preferred Values | | Maximum Values | |
|---|---|---|---|---|---|
| | | z-axis | x- and y-axis | z-axis | x- and y-axis |
| 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 |
| | | 0.04 | 0.029 | 0.080 | 0.058 |
| Workshops | Day or night-time | 0.04 | 0.029 | 0.080 | 0.058 |

**Table 7 Impulsive vibration acceleration criteria (m/s$^2$) 1 Hz-80 Hz**

| Location | Assessment period | Preferred Values | | Maximum Values | |
|---|---|---|---|---|---|
| | | z-axis | x- and y-axis | z-axis | x- and y-axis |
| 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 |

**Table 8 Intermittent vibration impacts criteria (m/s$^{1.75}$) 1 Hz-80 Hz**

| Location | Daytime | | Night-time | |
|---|---|---|---|---|
| | Preferred Values | Maximum Values | Preferred Values | Maximum Values |
| 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 |

# 3 CONSTRUCTION NOISE & VIBRATION CRITERIA

## 3.1 Construction Noise Criteria

### 3.1.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for residential receivers have been reproduced from the guideline and are listed in Table 9 below.

Specific non-residential receivers in the vicinity of the proposed construction site, and their recommended 'management levels', are presented in Table 10.

Based on the measured background noise levels summarised in Section 2.1, the NMLs to be used in this assessment are listed in Table 11.

It is our understanding that construction works will be conducted under standard construction hours (refer to Table 9).

Based on previous project experience, it is noted that the highly noise affected level (HNAL) outside of standard construction hours (i.e. Saturdays between 1:00 pm and 5:00 pm), is defined as 5 dB above the corresponding NML.

**Table 9 NMLs for quantitative assessment at residences (from ICNG)**

| Time of Day | Noise Management Level $L_{Aeq(15minute)}$[1,2] | How to Apply |
|---|---|---|
| Recommended standard hours:<br><br>Monday to Friday<br>7:00 am to 6:00 pm<br><br>Saturday 8:00 am to 1:00 pm<br><br>No work on Sundays or public holidays | Noise affected<br>RBL + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>• Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise 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<br>75 dBA | 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 periods by restricting the 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 | Noise affected<br>RBL + 5 dB | • 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 above the noise affected level, the proponent should negotiate with the community. |

*Note 1* *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.*

*Note 2* *The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).*

**Table 10 NMLs for quantitative assessment at non-residential receivers**

| Land Use | $L_{Aeq(15minute)}$ Construction NML |
|---|---|
| Offices, retail outlets | External noise level<br>70 dBA |
| Active recreation areas<br>(Mulgoa Rise Fields) | External noise level<br>65 dBA |
| Childcare centre<br>(Ground Level, 71 Deerubbin Drive) | External noise level<br>65 dBA [2] |

*Note 1: External noise level criterion estimated from internal noise level criterion assuming a 10 dB noise level difference for open windows.*

*Note 2: Assuming a noise reduction of 25 dB for a closed door or window; and based on an internal noise level of 45 dBA assigned to educational institutions in accordance with Table 3 of the ICNG.*

**Table 11 Construction noise management levels**

| Receiver Types | Construction noise management levels, dB $L_{Aeq(15minute)}$ | |
|---|---|---|
| | **Standard Hours**<br>**Monday to Friday:**<br>**7:00 am to 6:00 pm**<br>**Saturday:**<br>**8:00 am to 1:00 pm** | **Outside Standard Hours** |
| Residences along Forestwood Drive | NML: 44<br>HNAL: 75 | N/A |
| Residences along Darug Avenue | NML: 47<br>HNAL: 75 | N/A |
| Residences along Deerubbin Drive | NML: 53<br>HNAL: 75 | N/A |
| Offices, retail outlets | NML: 70 (external) | N/A |
| Active recreation areas<br>(Mulgoa Rise Fields) | NML: 65 (external) | N/A |
| Childcare centre<br>(Ground Level, 71 Deerubbin Drive) | NML: 65 (external) | N/A |

### 3.1.2 Sleep Disturbance

As discussed in Section 3.1.1, it is noted that construction works will be undertaken outside the night-time period (i.e. 10:00 pm to 7:00 am). Therefore, a sleep disturbance assessment is not required.

## 3.2 Construction Traffic Noise Criteria

For existing residences and other sensitive land uses affected by additional traffic on existing roads, the NSW Road Noise Policy (NSW RNP) states that for noise associated with increased road traffic generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB during both day and night-time periods. An increase of 2 dB represents a minor impact that is considered barely perceptible to the average person.

## 3.3 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 2.8
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 3.3.1
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 3.3.1

### 3.3.1 Vibration Criteria – Building Contents & Structure

The vibration effects on the building itself are assessed against 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).

#### 3.3.1.1 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 12 and illustrated in Figure 3.

**Table 12 Transient vibration criteria as per standard BS 7385 Part 2 - 1993**

| Line in Figure 3 | 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 values in Table 12 relate to transient vibration which does not cause resonant responses in buildings.

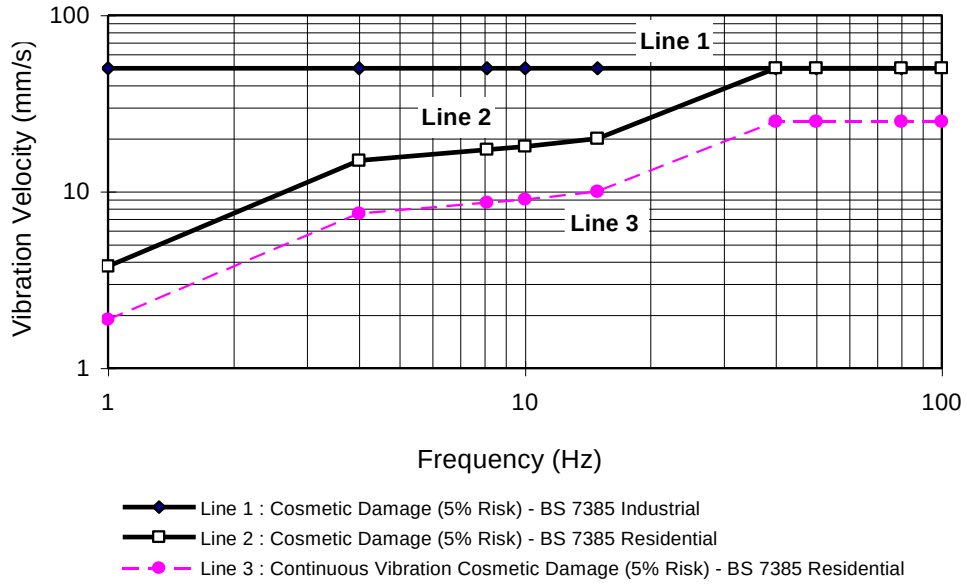
Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 12 may need to be reduced by up to 50% (refer to Line 3 in Figure 3).

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 12, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 12 should not be reduced for fatigue considerations.

**Figure 3 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage**




### 3.3.1.2 Standard DIN 4150 Part 3 – 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 13. The criteria are frequency dependent and specific to particular categories of structures.

**Table 13 Structural damage criteria as per standard DIN 4150 Part 3 - 1999**

| Type of Structure | Peak Component Particle Velocity, mm/s Vibration at the foundation at a frequency of | | | Vibration of horizontal plane of highest floor at all frequencies |
|---|---|---|---|---|
| | 1 Hz to 10 Hz | 10 Hz to 50 Hz | 50 Hz to 100 Hz[1] | |
| Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 15 to 20 | 15 |
| Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order) | 3 | 3 to 8 | 8 to 10 | 8 |

*Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.*

## 3.4 Ground-Borne Noise Criteria

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure. The following ground-borne limits for residences are only applicable when ground-borne noise levels are higher than airborne noise levels. The ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

- Evening (6 pm to 10 pm) - Internal: $L_{Aeq\ (15\ min)}$ 40 dBA
- Night-time (10 pm to 7 am) - Internal: $L_{Aeq\ (15\ min)}$ 35 dBA

Mitigation options to deal with ground-borne noise may include extensive community consultation to determine the acceptable level of disruption and the provision of respite accommodation in some circumstances, not just restriction of work hours.

It is noted that no construction works are currently proposed for the evening and night-time periods, therefore, an assessment of ground-borne is not currently required for this development.

# 4 OPERATIONAL ACOUSTIC ASSESSMENT

## 4.1 External Noise Emissions – Building Services

School Infrastructure NSW (SI NSW) has confirmed that the demountable buildings are served by 7.1 KW ceiling split air conditioning units. Typically, an outdoor unit which is part of this air conditioning system generates noise emissions of 55 dBA at 1m from the unit under free-field conditions.

Therefore, it has been assumed that the following spaces will be served by the air conditioning system described above:

- General learning spaces (i.e. homebases)
- Support unit learning spaces
- Library
- Staff facilities

Based on the information above, Table 14 summarises the predicted external noise levels from mechanical services. From the assessment outcomes listed in this table, it is noted that compliance is achieved with the most stringent applicable noise criteria (i.e. daytime criteria). Therefore, no further acoustic treatment is required for mechanical services.

**Table 14 Predicted noise emissions from mechanical services**

| Receiver | Predicted Noise Levels (dB $L_{Aeq, 15\ minutes}$) | Noise Criteria (dB $L_{Aeq, 15\ minutes}$) | Assessment Outcomes |
|---|---|---|---|
| 34 Forestwood Drive | Less than 35 | Daytime: 40 | Compliance |
| 31 Darug Avenue | Less than 35 | Daytime: 42 | Compliance |
| 27 Darug Avenue | Less than 35 | Daytime: 42 | Compliance |
| 90-98 Glenmore Ridge Drive (future mixed-use development) | Less than 35 | Daytime: 48 | Compliance |
| 71 Deerubbin Drive | Less than 35 | Daytime: 48 | Compliance |
| *Note 1: Exceedances of 1-2 dB are considered to be marginal since these are found to be subjectively imperceivable* | | | |

## 4.2 Outdoor Noise Emissions - Playgrounds

For the prediction of outdoor noise emissions due to students playing in outdoor areas, a typical lunch / recess period has been considered. In this scenario, it is assumed all students are in the designated playground.

To predict the noise impact into nearest affected receivers, a 3D computational model of the site and surrounding area was developed and subsequently analysed using SoundPLAN version 8.0 acoustic modelling software. A summary of the predicted noise levels, as well as assessment outcomes, is presented in Table 15.

From Table 15, it is observed that compliances are achieved at all nearest affected residential receivers.

**Table 15 Predicted noise emissions for a typical lunch / recess period**

| Receiver | Predicted Noise Levels (dB $L_{Aeq, 15\ minutes}$) | Daytime Noise Emission Target (dB $L_{Aeq, 15\ minutes}$) | Assessment Outcomes |
|---|---|---|---|
| 34 Forestwood Drive | 47 | 45 | Compliance (marginal) [1] |
| 31 Darug Avenue | 40 | 45 | Compliance |
| 27 Darug Avenue | 40 | 45 | Compliance |
| 90-98 Glenmore Ridge Drive (future mixed-use development) | 40 | 48 | Compliance |
| 71 Deerubbin Drive | 41 | 48 | Compliance |

*Note 1: Exceedances of 1-2 dB are considered to be marginal since these are found to be subjectively imperceivable*

## 4.3 Outdoor PA System

A detailed design of the outdoor PA system is not available at this stage. Therefore, as a performance requirement, it is recommended the outdoor PA system should be designed so noise emissions from the PA system do not exceed the intrusiveness criteria listed in Table 2. Noise emissions should be obtained under free-field conditions, excluding any noise reflections from walls or vertical structures.

Finally, the following it is recommended to be considered as part of the PA system design:

- Outdoor PA system should not operate outside school opening hours (i.e. between 6:30 pm and 6:30 am), and should not operate within the night time period (i.e. between 10:00 pm and 7:00 am).
- Low-powered horn-type speakers should be located and orientated to provide a good coverage of the school areas whilst being directly away from residences and sensitive receivers. System coverage shall be reviewed during the design phases.
- Speakers should be mounted with a downward angle and as close to the floor as possible. Speakers should be mounted below the height of school buildings and include directional speakers to mitigation noise spill to neighbouring receivers.
- Once appropriate noise levels from the speakers are obtained within school premises and at nearest affected receivers, the system gain should be limited so that staff cannot increase the noise levels.

## 4.4 Carpark Noise Emissions

As discussed in Section 1.1, the staff carpark will be completed by the time the temporary school facilities are operational.

Section 5.7 of the N&VA Report discussed in detail the assessment of carpark noise emissions. In this assessment the carpark noise emissions were found to be compliant with the external noise level criteria.

Since there are no changes to the operational conditions of the carpark while the temporary facilities are on site, then it is expected that compliance will be maintained. Therefore, no further acoustic treatments are required.

## 4.5 Waste Collection

To maintain compliance with the external noise level criteria, it is advised that waste collection should be undertaken between 7:00 am and 10:00 pm.

## 4.6 Noise Impact on Local Roads

Section 5.9 of the N&VA Report discussed in detail the noise impact on local roads. From this report, it was concluded there will be no such impact.

Since it is expected that there will be no operational changes while the temporary facilities are installed on site, then it is likely compliance will be maintained. Therefore, no further acoustic treatments are required.

# 5 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

## 5.1 Construction Noise Assessment

A preliminary construction program for the temporary facilities has been provided by the building contractor (i.e ProGroup). From this program, and based on previous project experience, construction and demolition tasks have been assumed for our assessment. These are summarised in Table 16 below, along with the equipment likely to be used in each task and their sound power levels.

**Table 16 Summary of predicted sound power levels**

| Tasks | Equipment | Sound Power Levels (dBA re 1pW) | Aggregate Sound Power Level per Task (dBA re 1pW) |
|---|---|---|---|
| Site possession and establishment | Elevating platform | 102 | 113 |
| | Mobile crane | 110 | |
| | Power hand tools | 109 | |
| | Franna crane | 102 | |
| | Semi - trailer (idle) | 102 | |
| Footings | Concrete pump | 103 | 115 |
| | Concrete truck | 107 | |
| | Piling rig | 113 | |
| | Welder | 101 | |
| Onsite installation | Mobile crane | 110 | 114 |
| | Franna crane | 102 | |
| | Semi - trailer (idle) | 102 | |
| | Welder | 101 | |
| | Power hand tools | 109 | |
| Internal & external works | Welder | 101 | 114 |
| | Saw cutter | 109 | |
| | Dump truck | 109 | |
| | Power hand tools | 109 | |
| | Handheld nail gun | 101 | |

For this assessment, the nearest affected receivers on which our assessment is conducted, are listed in Table 17 below. Please note that receivers at the future mixed-use development to be located along the northern property boundary, across Deerubbin Drive (i.e. 90-98 Glenmore Ridge Drive), is not considered since it is anticipated that this development will not be finalised before the temporary school facilities are finished.

Based on the equipment sound power levels given in Table 16, noise levels have been predicted at these nearest affected properties for each construction scenario (where each construction scenario comprises two or more construction tasks). These predicted noise levels are summarised in Table 18.

These predicted noise levels have been assessed against the construction noise criteria discussed in Section 3.1. The outcomes of this assessment are summarised in Table 19.

**Table 17 Receiver locations, construction noise management levels**

| Receiver ID | Noise Sensitive Locations | Type | Construction Noise Management Levels, dB $L_{Aeq(15minute)}$<br>Standard Hours<br>Monday to Friday:<br>7:00 am to 6:00 pm<br>Saturday:<br>8:00 am to 1:00 pm |
|---|---|---|---|
| RE01 | 71 Deerubbin Drive, Glenmore Park | Residential | NML: 53<br>HNAL: 75 |
| RE02 | 27 Darug Avenue, Glenmore Park | Residential | NML: 47<br>HNAL: 75 |
| RE03 | 34 Forestwood Drive, Glenmore Park | Residential | NML: 44<br>HNAL: 75 |
| CM01 | 71 Deerubbin Drive, Glenmore Park | Commercial | NML: 70 |
| AR01 | Mulgoa Rise Fields | Active Recreation Area | NML: 65 |
| CC01 | Childcare centre<br>(Ground Level, 71 Deerubbin Drive) | Childcare Centre | NML: 65 |

**Table 18 Predicted $L_{Aeq\ (15\ minutes)}$ noise levels at residential receivers**

| Scenario | Tasks | Aggregate Sound Power Level per Scenario (dBA re 1pW) | Predicted Noise Levels, dBA | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | RE01 | RE02 | RE03 | CM01 | AR01 | CC01 |
| 1 | Site establishment | 110 | 55-60 | 60 | 70-75 | 55-60 | 60-65 | 55-60 |
| 2 | Footings | 111 | 60-65 | 55-60 | 65-75 | 60-65 | 60-70 | 60-65 |
| 3 | Onsite installation | 110 | 55-65 | 55-60 | 65-75 | 55-65 | 60-65 | 55-65 |
| 4 | External works & internal works | 111 | 55-65 | 55-60 | 65-75 | 55-65 | 60-70 | 55-65 |

Consequently, from the assessment summarised in Table 19, it is noted that nearest affected residences will be noise affected. Therefore, the conceptual management procedures discussed in Section 5.4 are recommended. This includes the preparation of a construction noise and vibration management plan (CNVMP).

**Table 19 Construction noise impact assessment**

| Scenario | Parameter | Assessment Outcome | | | | | |
|---|---|---|---|---|---|---|---|
| | | RE01 | RE02 | RE03 | CM01 | AR01 | CC01 |
| 1 | *Predicted Noise Levels, dBA* | *55-60* | *60* | *70-75* | *55-60* | *60-65* | *55-60* |
| | Within standard construction hours | | | | | | |
| | Exceedance over NML, dB | 2--7 | 13 | 26-31 | 0 | 0 | 0 |
| 2 | *Predicted Noise Levels, dBA* | *60-65* | *55-60* | *65-75* | *60-65* | *60-70* | *60-65* |
| | Within standard construction hours | | | | | | |
| | Exceedance over NML, dB | 7-12 | 8-13 | 21-31 | 0 | 0-5 | 0 |
| 3 | *Predicted Noise Levels, dBA* | *55-65* | *55-60* | *65-75* | *55-65* | *60-65* | *55-65* |
| | Within standard construction hours | | | | | | |
| | Exceedance over NML, dB | 2-12 | 8-13 | 21-31 | 0 | 0 | 0 |
| 4 | *Predicted Noise Levels, dBA* | *55-65* | *55-60* | *65-75* | *55-65* | *60-70* | *55-65* |
| | Within standard construction hours | | | | | | |
| | Exceedance over NML, dB | 2-12 | 8-13 | 21-31 | 0 | 0-5 | 0 |

*Note 1: Nil exceedances (i.e. 0 dB shown with **green** font) indicate compliance. Exceedances shown with **orange** font indicate noise affected receivers. Exceedances shown with **red** font indicate highly noise affected receivers*

## 5.2 Construction Traffic Noise Assessment

No information regarding vehicular traffic movements related to construction activities; is available at this stage. Nevertheless, it is noted that vehicle numbers on surrounding roads would need to increase by around 60% from existing traffic flows, for a 2 dB increase in road traffic noise to occur.

Therefore, it is recommended that a traffic consultant confirms the expected traffic volumes generated by the construction activities do not exceed the recommended maximum growth of 60% relative to the existing traffic volumes.

## 5.3 Vibration Assessment

To retain compliance with the human comfort vibration criteria discussed in Section 3.3, it is recommended that the indicative safe distances listed in Table 20 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction and demolition equipment to be used on site.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 3.3. This information should also be included as part of the CNVMP.

**Table 20 Recommended indicative safe working distances for vibration intensive plant**

| Plant | Rating / Description | Safe Working Distances (m) | |
|---|---|---|---|
| | | Cosmetic Damage (BS 7385: Part 2 DIN 4150: Part 3) | Human Comfort (AVTG) |
| Vibratory roller | < 50 kN (Typically 1 – 2 tonnes) | 5 | 15 – 20 |
| | < 100 kN (Typically 2 – 4 tonnes) | 6 | 20 |
| | < 200 kN (Typically 4 – 6 tonnes) | 12 | 40 |
| | < 300 kN (Typically 7 – 13 tonnes) | 15 | 100 |
| | > 300 kN (Typically more than 13 tonnes) | 20 | 100 |
| Small hydraulic hammer | 300 kg, typically 5 – 12 tonnes excavator | 2 | 7 |
| Medium hydraulic hammer | 900 kg, typically 12 – 18 tonnes excavator | 7 | 23 |
| Large hydraulic hammer | 1600 kg, typically 18 – 34 tonnes excavator | 22 | 73 |
| Vibratory pile driver | Sheet piles | 2 – 20 | 20 |
| Jackhammer | Hand held | 1 | Avoid contact with structure and steel reinforcements |

## 5.4 Noise & Vibration Management Procedures

The contractor should develop a construction noise and vibration management plan (CNVMP) in order to implement mitigation measures to manage the noise and vibration impact onto the potentially affected receivers.

The following sub-sections discuss the issues and measures that can be considered as part of this CNVMP.

### 5.4.1 Noise Mitigation Measures

A detailed construction program should be provided which should include the following:

- Schedule of construction activities (classified into scenarios if applicable)
- List of construction equipment per activity
- Location of construction equipment
- Duration of construction activities, as well as proposed construction hours

This construction program should be issued to assist on the prediction of the noise impact and to develop mitigation measures that can ameliorate this impact. The outcomes of this assessment should be discussed in the CNVMP.

The contractor should, where reasonable and feasible, apply best practice noise mitigation measures. These measures include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.

- Carrying out loading and unloading away from noise sensitive areas.

To minimise noise impacts during the works, the contractor should take all reasonable and feasible measures to attenuate the noise impact. Hence it is advised that on-site monitoring be conducted to attest this impact and propose mitigation measures as construction activities develop.

The contractor should also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

A potential approach would be to schedule a respite period after continuous construction activity, or undertaking high noise generating works to less sensitive times.

Procedures addressing community engagement and consultation should be implemented, especially for construction activities to be undertaken outside of standard construction hours.

As part of these procedures, active community consultation and the maintenance of positive relations with residents and businesses, is recommended. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with a hotline number for a community liaison officer available to adequately respond to all project related enquiries.

Ideally the hotline number should provide concerned locals an opportunity to raise any concerns with the project proponent and provide an opportunity to determine the best method to satisfy all requirements

Finally, undertake an assessment of road traffic noise generated by light and heavy vehicle movements which are associated with the development construction. For this purpose, request a traffic study report to determine the relevant traffic flows and assess the predicted road traffic noise levels in accordance with the criteria discussed in Section 3.2.

### 5.4.2 Vibration Mitigation Measures

The following vibration mitigation measures are recommended to be considered as part of a CNVMP:

- Any vibration generating plant and equipment is to be located in areas within the site in order to lower the vibration impacts.

- Investigate the feasibility of rescheduling the hours of operation of major vibration generating plant and equipment.

- Identify of other vibration sensitive structures such as tunnels, gas pipelines, fibre optic cables, Sydney Water retention basins. Specific vibration goals should be determined on a case-by-case basis by an acoustic consultant which is to be engaged by the construction contractor.

- Identify heritage structures as well as vibration sensitive premises (such as those containing scientific and surgery equipment). Safe working distances from vibration generating equipment should be established in order to achieve compliance with the criteria discussed in Section 3.3.

- Hence, it is advised to conduct attended measurements of vibration generating plant at commencement of works to confirm compliance with vibration criteria discussed in Section 3.3. Measurements should be conducted at the nearest affected property boundary. If possible, measurements will also be used to validate the safe working distances advised in Table 20 and to establish safe working distances suitable to the project.

- Use lower vibration generating items of construction plant and equipment, that is, smaller capacity plant.
- Minimise conducting vibration generating works consecutively in the same area (if applicable).
- Schedule a minimum respite period prior to long continuous activities.
- Use only dampened rock breakers and/or "city" rock breakers to minimise the impacts associated with rock breaking works.

### 5.4.3 Miscellaneous Measures

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles on site; and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site.

A complaint response procedure should be implemented. Information to be gathered as part of this process should include location of complainant, time/s of occurrence of alleged noise or vibration impacts (including nature of impact particularly with respect to vibration), perceived source, prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint. All resident complaints will be responded to in the required timeframe and action taken recorded.

# 6 CONCLUSIONS

Pulse White Noise Acoustics (PWNA) has been engaged to undertake an acoustic impact assessment as part of the submission for development application of the temporary school facilities.

From this assessment, the following is found or recommended:

- Operational noise emissions (such as those from building services, playgrounds, and carpark) are found to be compliant. No further acoustic treatments are required.
- Conceptual measures and performance requirements for the PA system are discussed in Section 4.3.
- Waste collection to be undertaken between 7:00 am and 10:00 pm.
- Noise impact on local roads is found to be negligible.
- For installation works of the demountable facilities, a construction noise and vibration management plan will be required to address the acoustic impact of such works onto nearest affected receivers.

Based on the findings from the acoustic assessment, it is our opinion that the proposed development can achieve the conditions required by local authorities provided the conceptual recommendations discussed herein are implemented and further developed.

# APPENDIX A: ACOUSTIC TERMINOLOGY

The following is a brief description of the acoustic terminology used in this report.

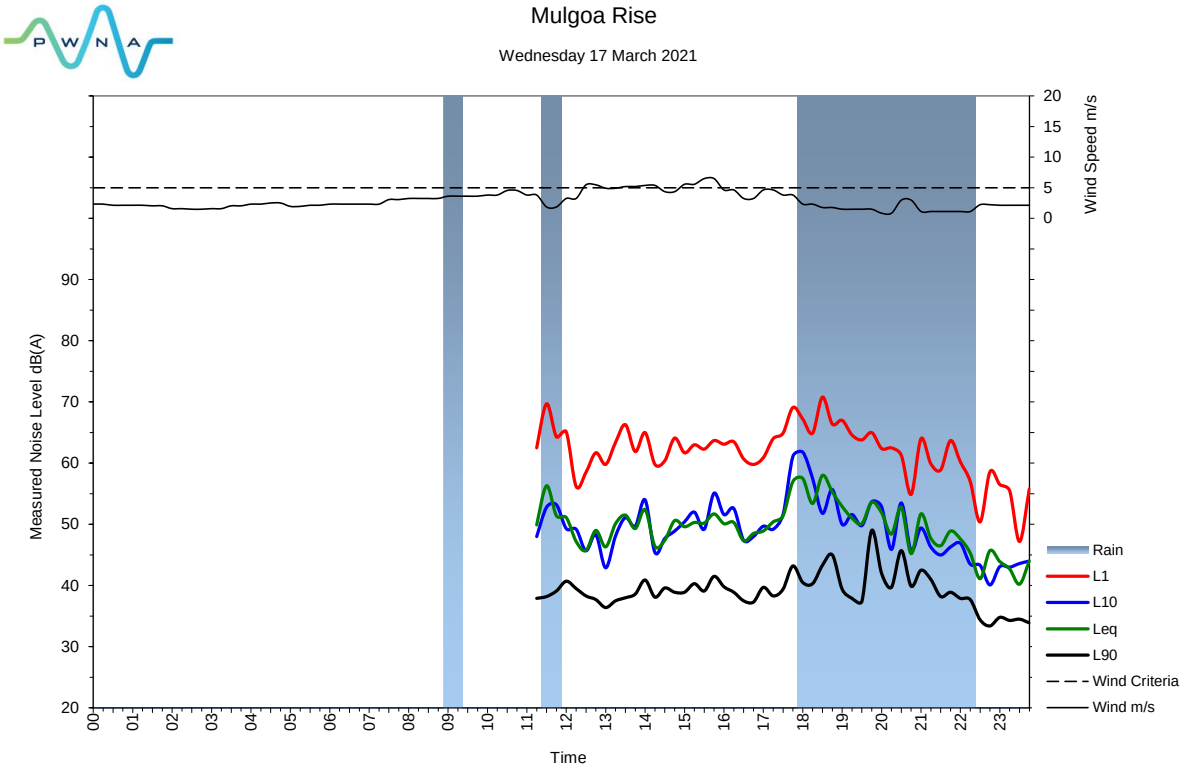
| | |
|---|---|
| *Sound power level* | The total sound emitted by a source |
| *Sound pressure level* | The amount of sound at a specified point |
| *Decibel [dB]* | The measurement unit of sound |
| *A Weighted decibels [dB(A])* | The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A). |
| *Decibel scale* | The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: |
| | 0dB(A) Threshold of human hearing<br>30dB(A) A quiet country park<br>40dB(A) Whisper in a library<br>50dB(A) Open office space<br>70dB(A) Inside a car on a freeway<br>80dB(A) Outboard motor<br>90dB(A) Heavy truck pass-by<br>100dB(A) Jackhammer/Subway train<br>110 dB(A) Rock Concert<br>115dB(A) Limit of sound permitted in industry<br>120dB(A) 747 take off at 250 metres |
| *Frequency [f]* | The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound. |
| *Ambient sound* | The all-encompassing sound at a point composed of sound from all sources near and far. |
| *Equivalent continuous sound level [$L_{eq}$]* | The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy. |
| *Reverberation* | The persistence of sound in a space after the source of that sound has been stopped (the reverberation time is the time taken for a reverberant sound field to decrease by 60 dB) |
| *Air-borne sound* | The sound emitted directly from a source into the surrounding air, such as speech, television or music |
| *Impact sound* | The sound emitted from force of one object hitting another such as footfalls and slamming cupboards. |
| *Air-borne sound isolation* | The reduction of airborne sound between two rooms. |
| *Sound Reduction Index [R] (Sound Transmission Loss)* | The ratio the sound incident on a partition to the sound transmitted by the partition. |
| *Weighted sound reduction index [$R_w$]* | A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment. |
| *Level difference [D]* | The difference in sound pressure level between two rooms. |

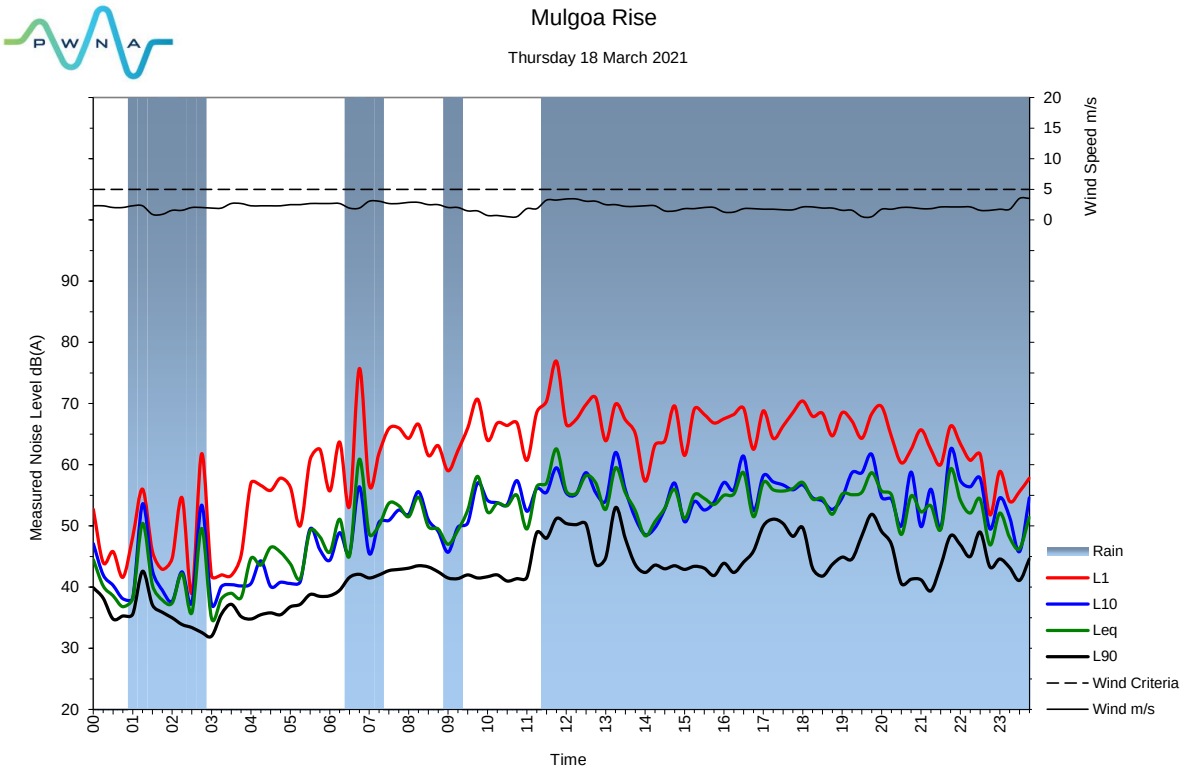
| | |
|---|---|
| *Normalised level difference [$D_n$]* | The difference in sound pressure level between two rooms normalised for the absorption area of the receiving room. |
| *Standardised level difference [$D_{nT}$]* | The difference in sound pressure level between two rooms normalised for the reverberation time of the receiving room. |
| *Weighted standardised level difference [$D_{nT,w}$]* | A single figure representation of the air-borne sound insulation of a partition based upon the level difference. Generally used to present the performance of a partition when measured in situ on site. |
| *$C_{tr}$* | A value added to an $R_w$ or $D_{nT,w}$ value to account for variations in the spectrum. |
| *Impact sound isolation* | The resistance of a floor or wall to transmit impact sound. |
| *Impact sound pressure level [$L_i$]* | The sound pressure level in the receiving room produced by impacts subjected to the adjacent floor or wall by a tapping machine. |
| *Normalised impact sound pressure level [$L_n$]* | The impact sound pressure level normalised for the absorption area of the receiving room. |
| *Weighted normalised impact sound pressure level [$L_{n,w}$]* | A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in a laboratory. |
| *Weighted standardised impact sound pressure level [$L'_{nT,w}$]* | A single figure representation of the impact sound insulation of a floor or wall based upon the impact sound pressure level measured in situ on site. |
| *$C_I$* | A value added to an $L_{nW}$ or $L'_{nT,w}$ value to account for variations in the spectrum. |
| *Energy Equivalent Sound Pressure Level [$L_{A,eq,T}$ ]* | 'A' weighted, energy averaged sound pressure level over the measurement period T. |
| *Percentile Sound Pressure Level [$L_{Ax,T}$ ]* | 'A' weighted, sound pressure that is exceeded for percentile x of the measurement period T. |

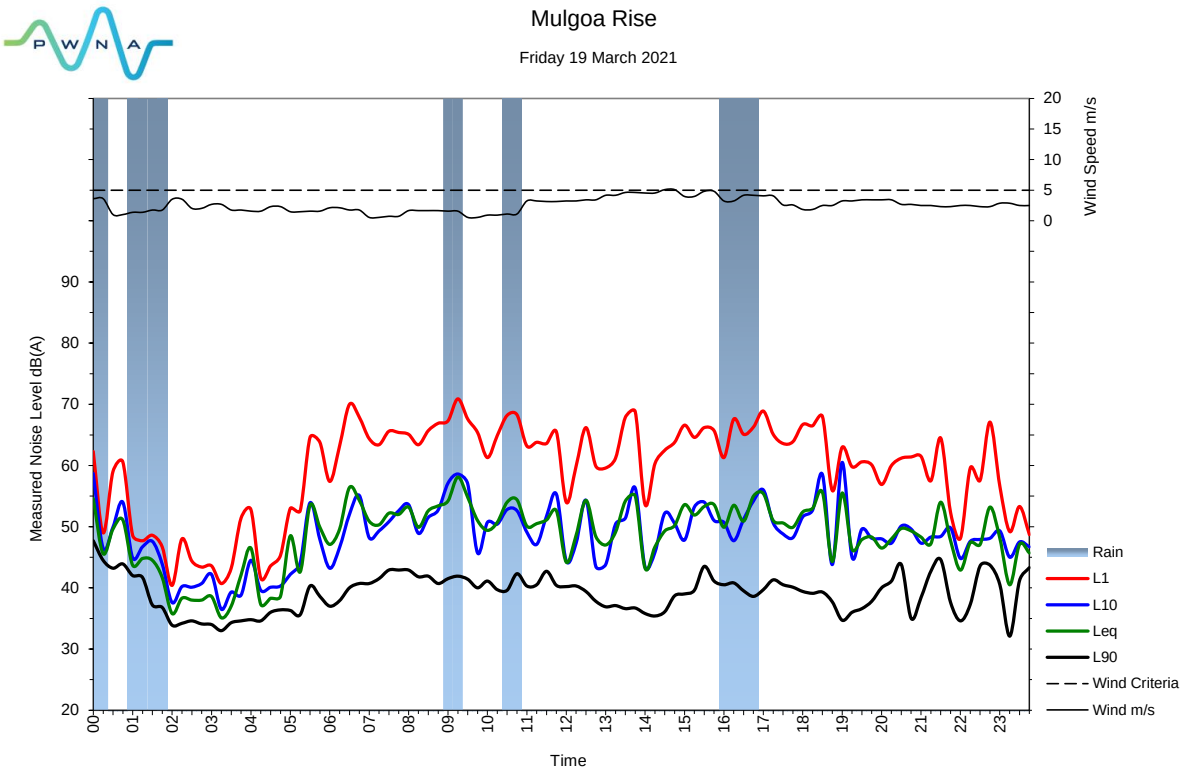
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*

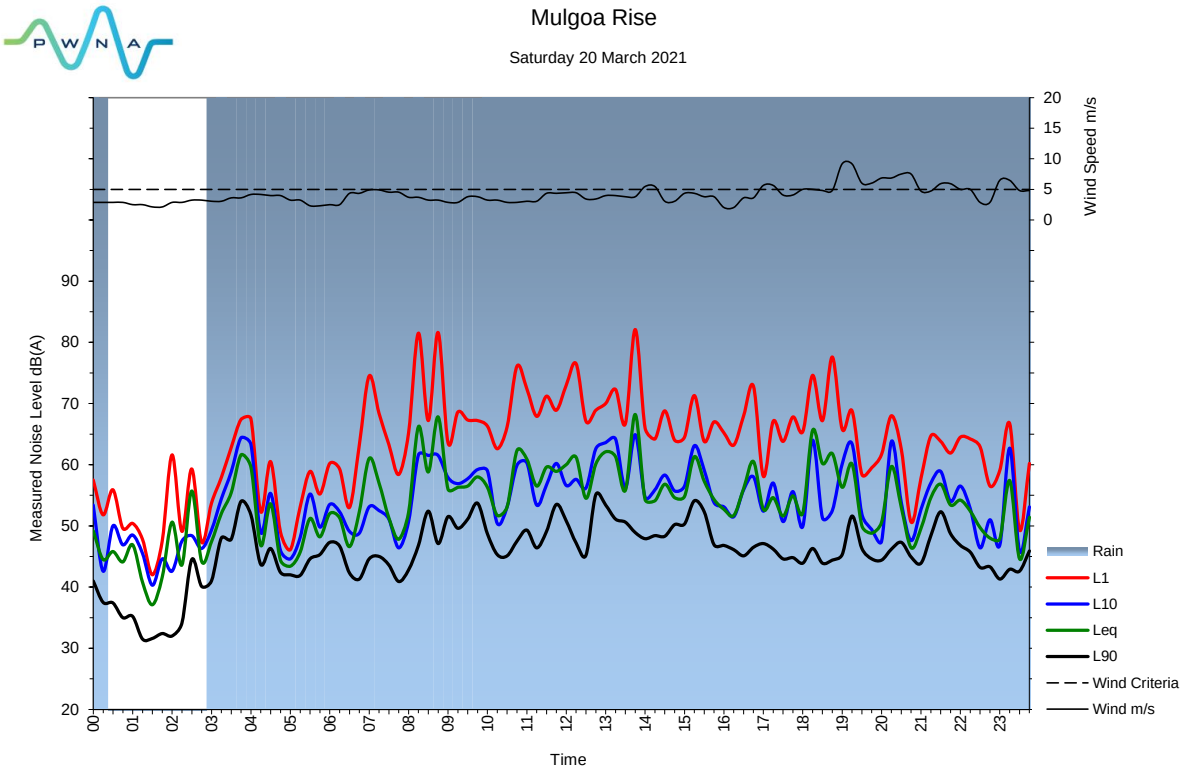
# APPENDIX B: UNATTENDED NOISE MEASUREMENTS

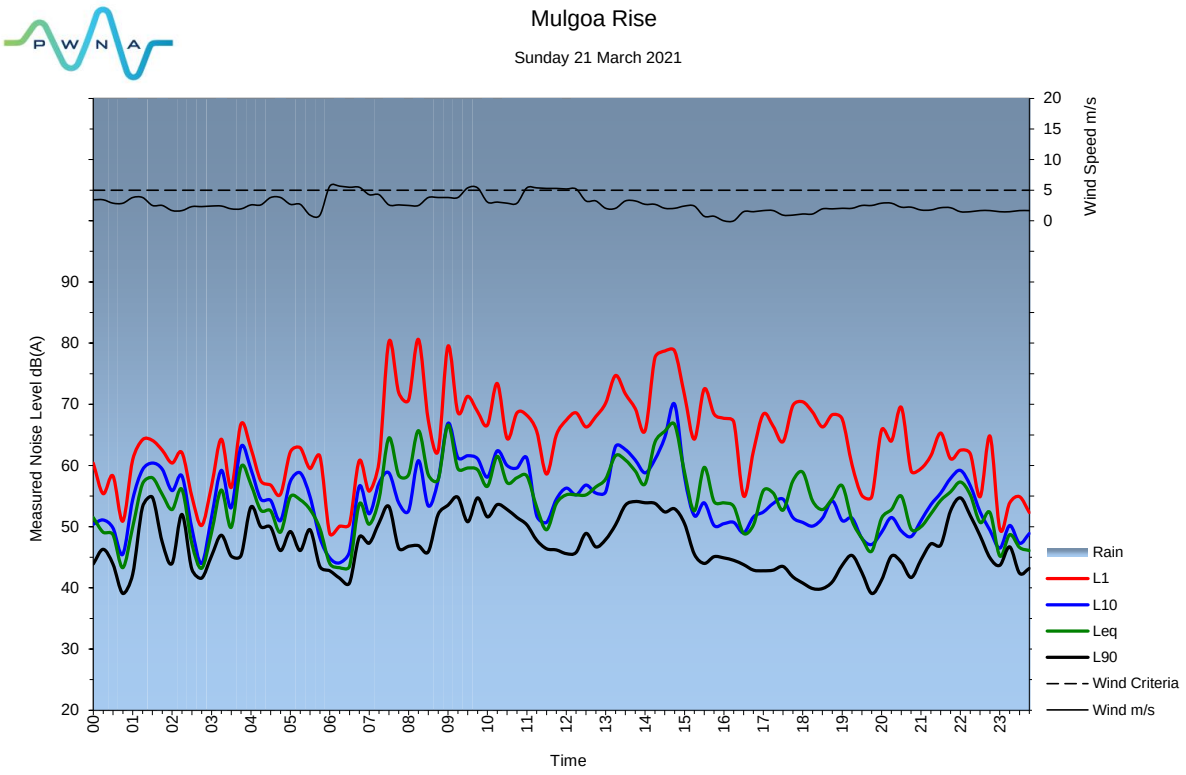
## Logger Location 1: No. 30 Forestwood Drive, Glenmore Park

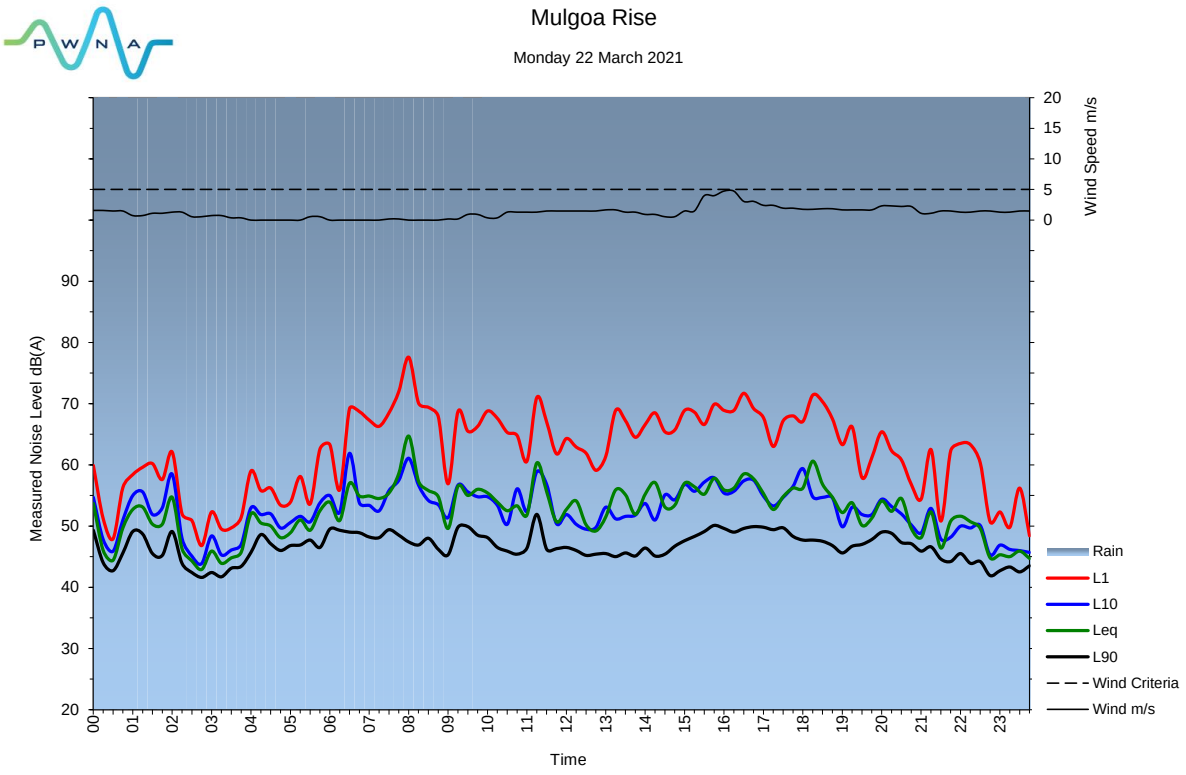


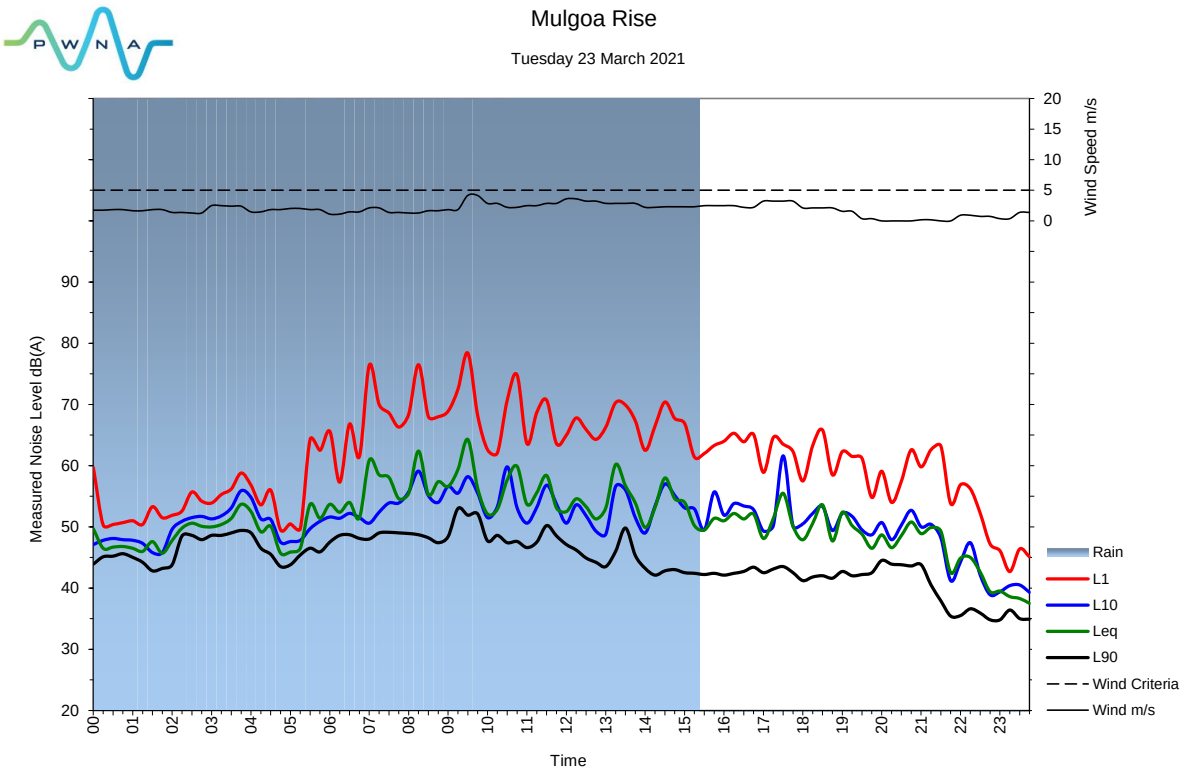



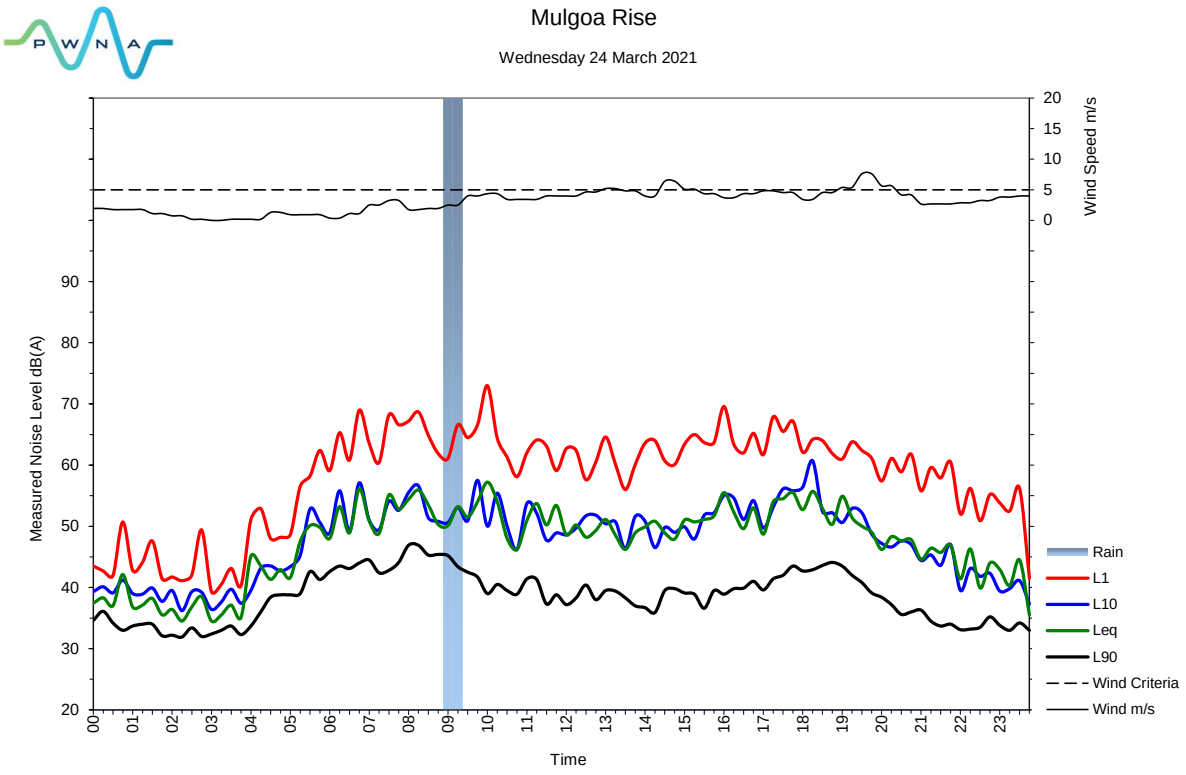

Mulgoa Rise
Friday 19 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

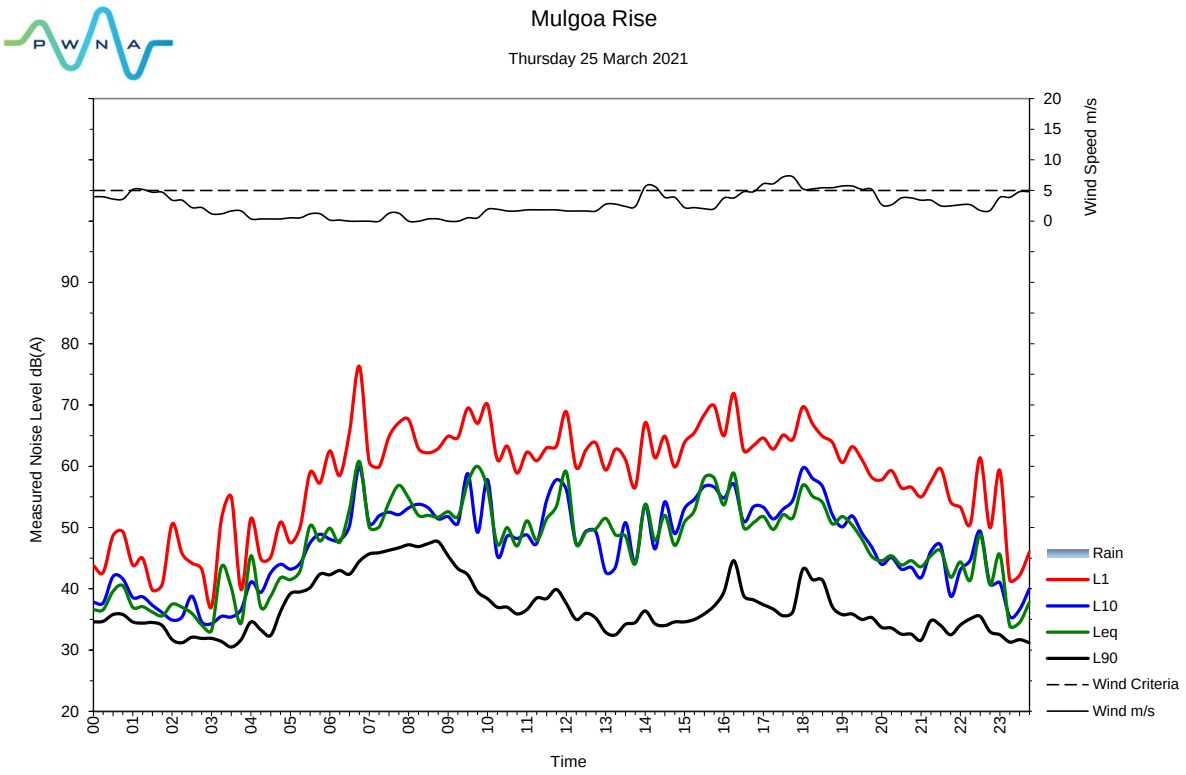

Mulgoa Rise
Saturday 20 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

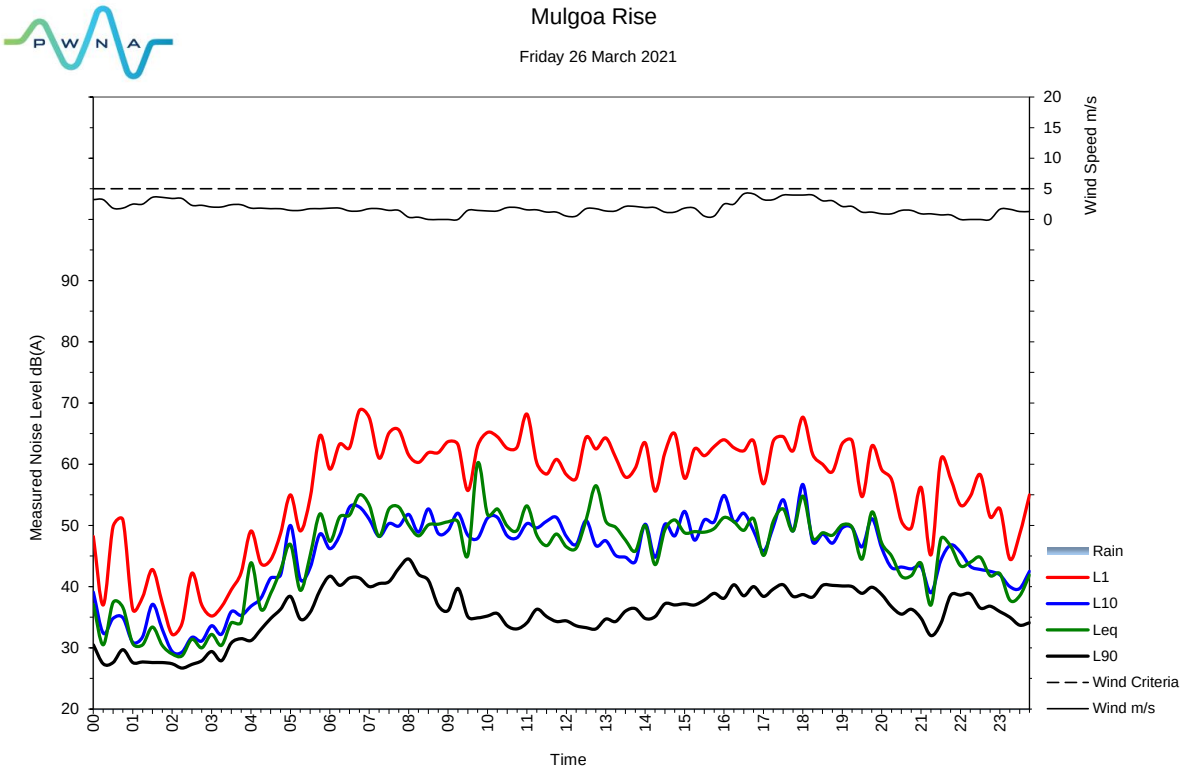

Mulgoa Rise
Sunday 21 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

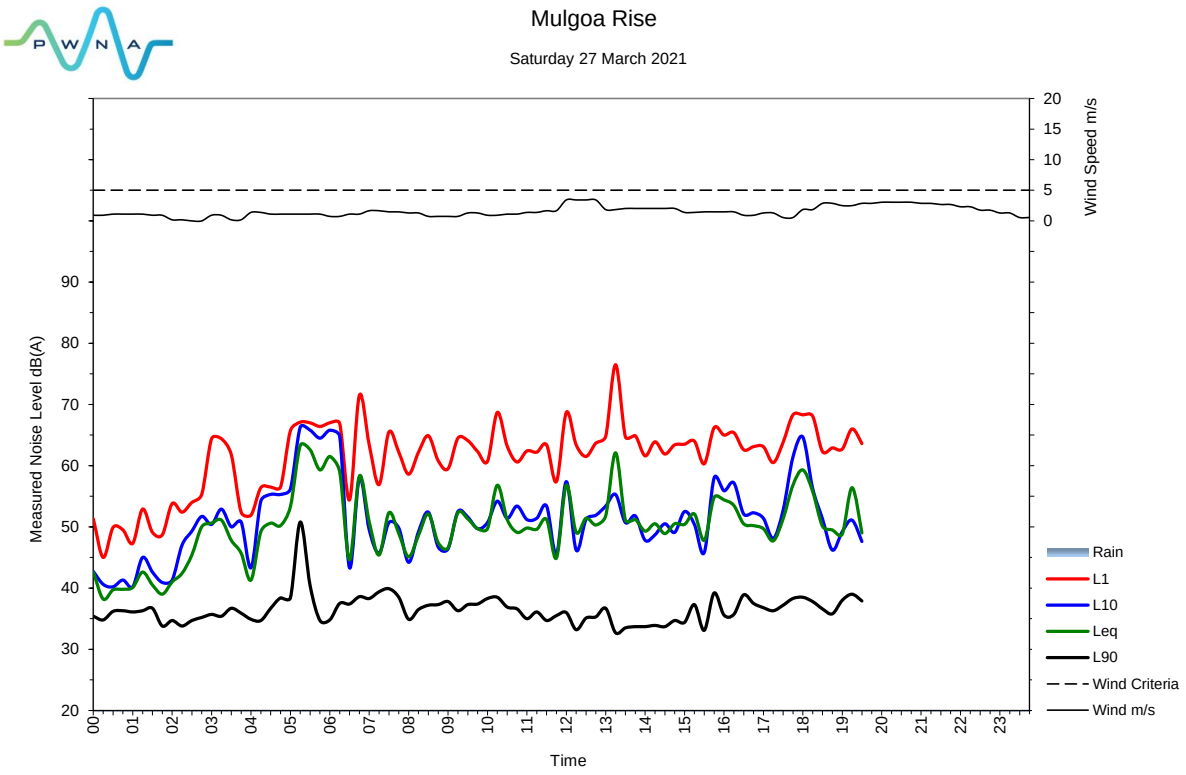

Mulgoa Rise
Monday 22 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

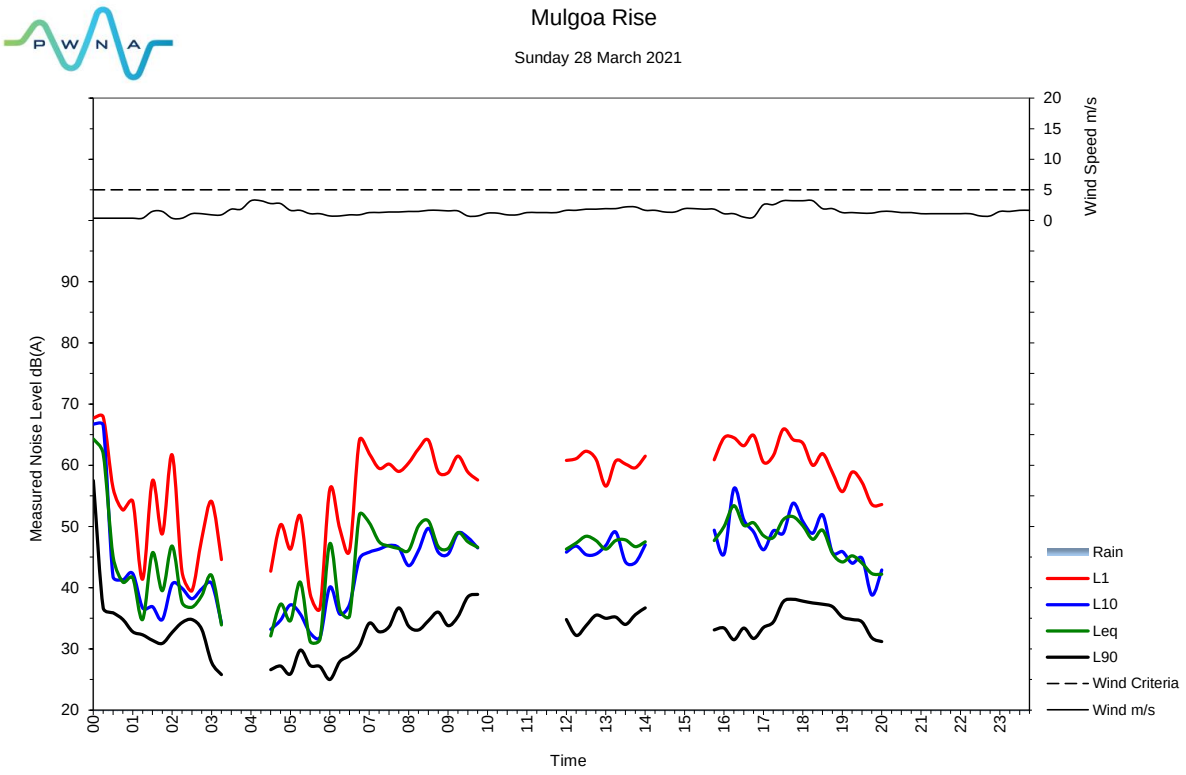

Mulgoa Rise
Tuesday 23 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

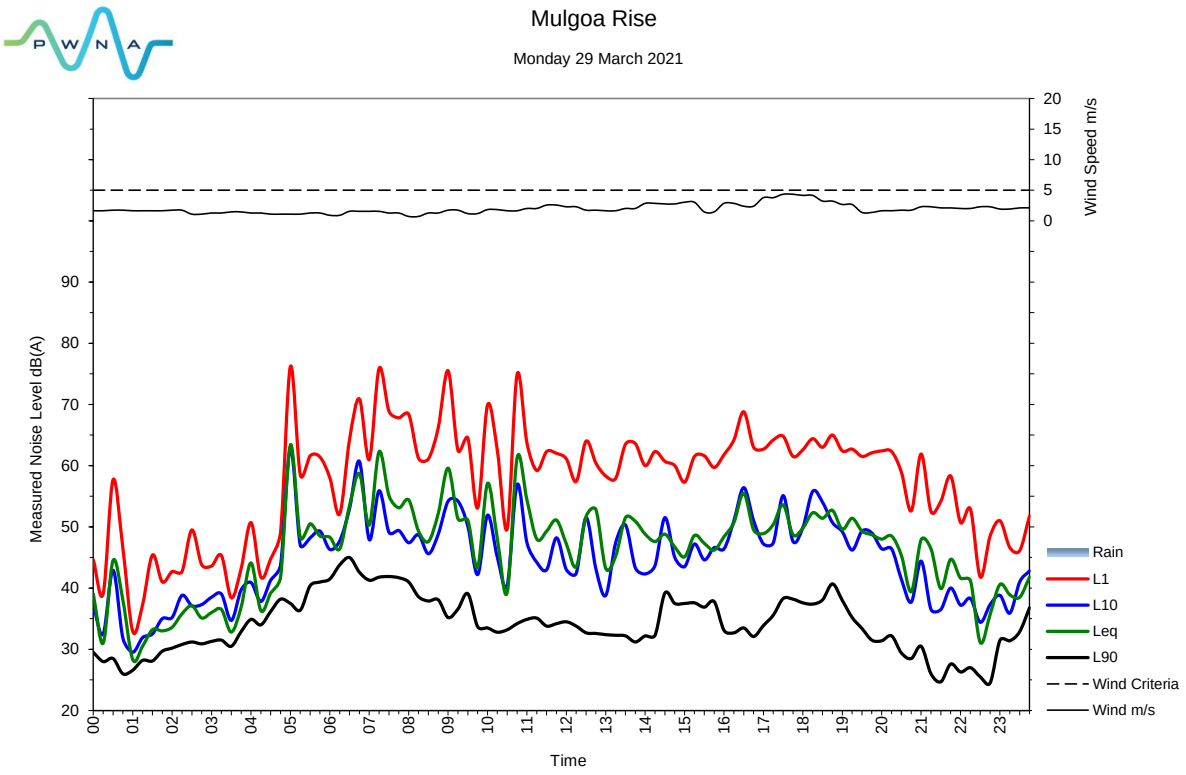

Mulgoa Rise
Wednesday 24 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

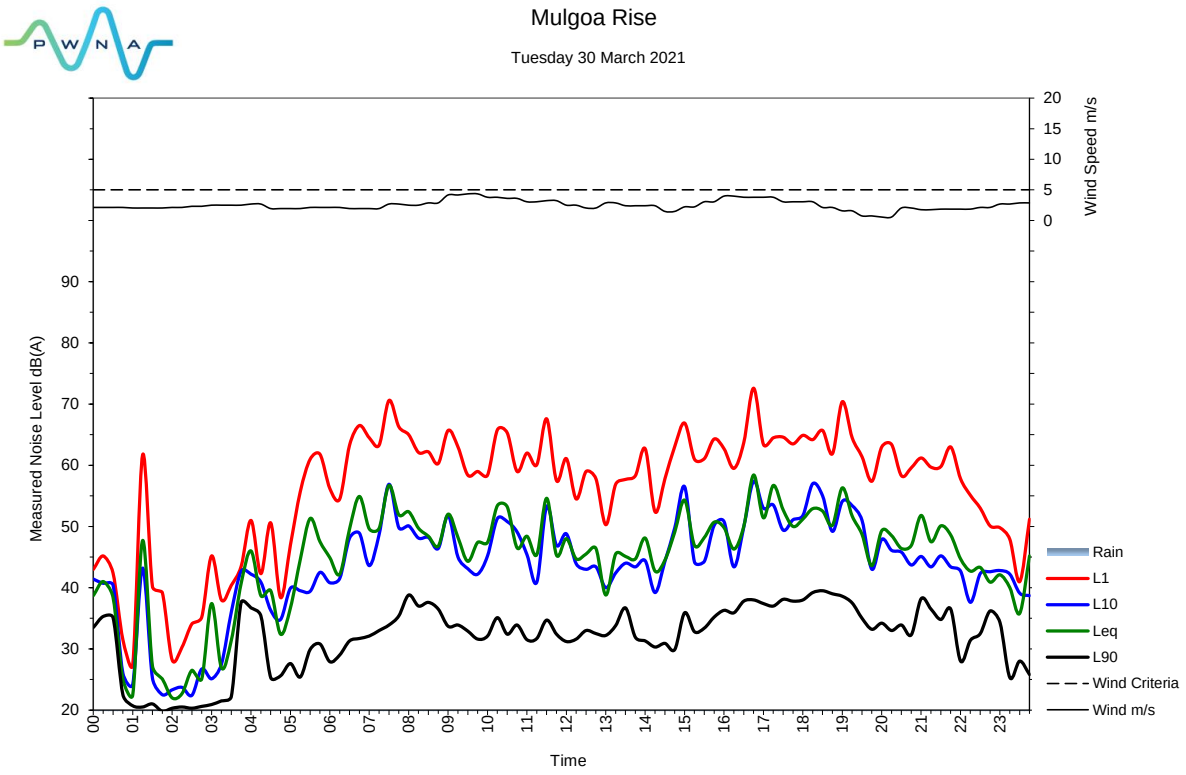

Mulgoa Rise
Thursday 25 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


Mulgoa Rise
Friday 26 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

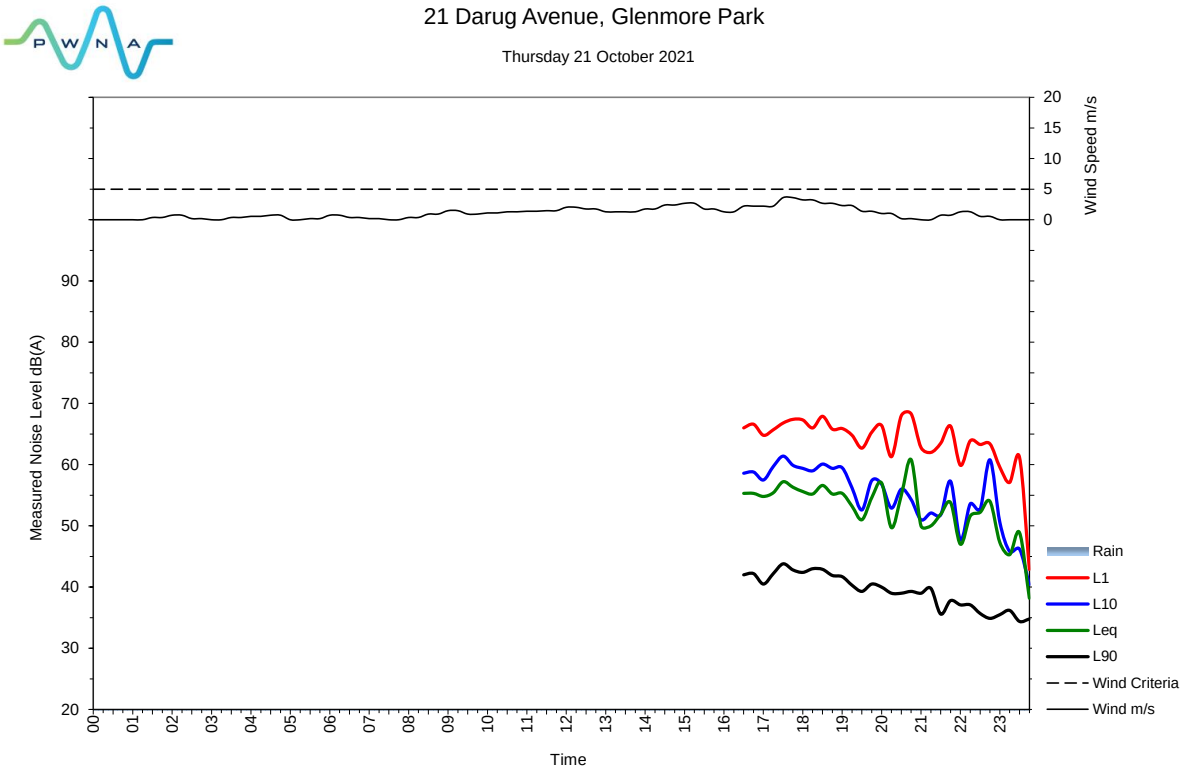

Mulgoa Rise
Saturday 27 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

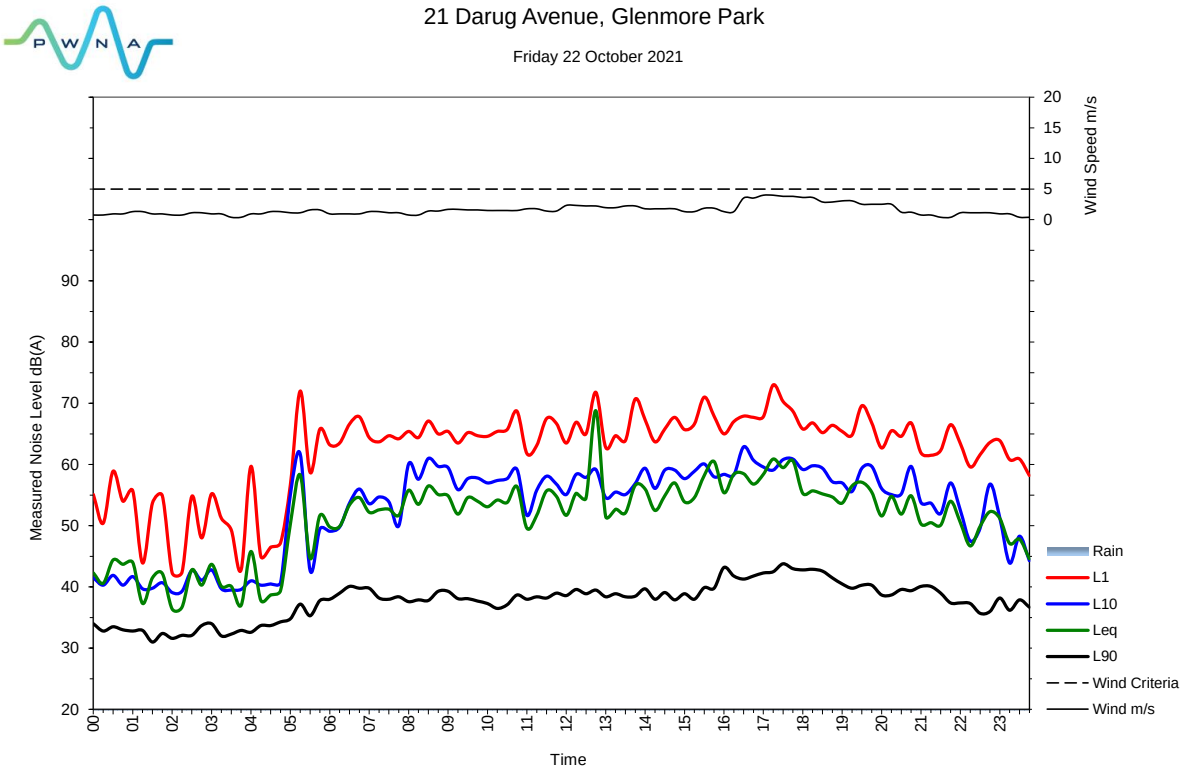

Mulgoa Rise
Sunday 28 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

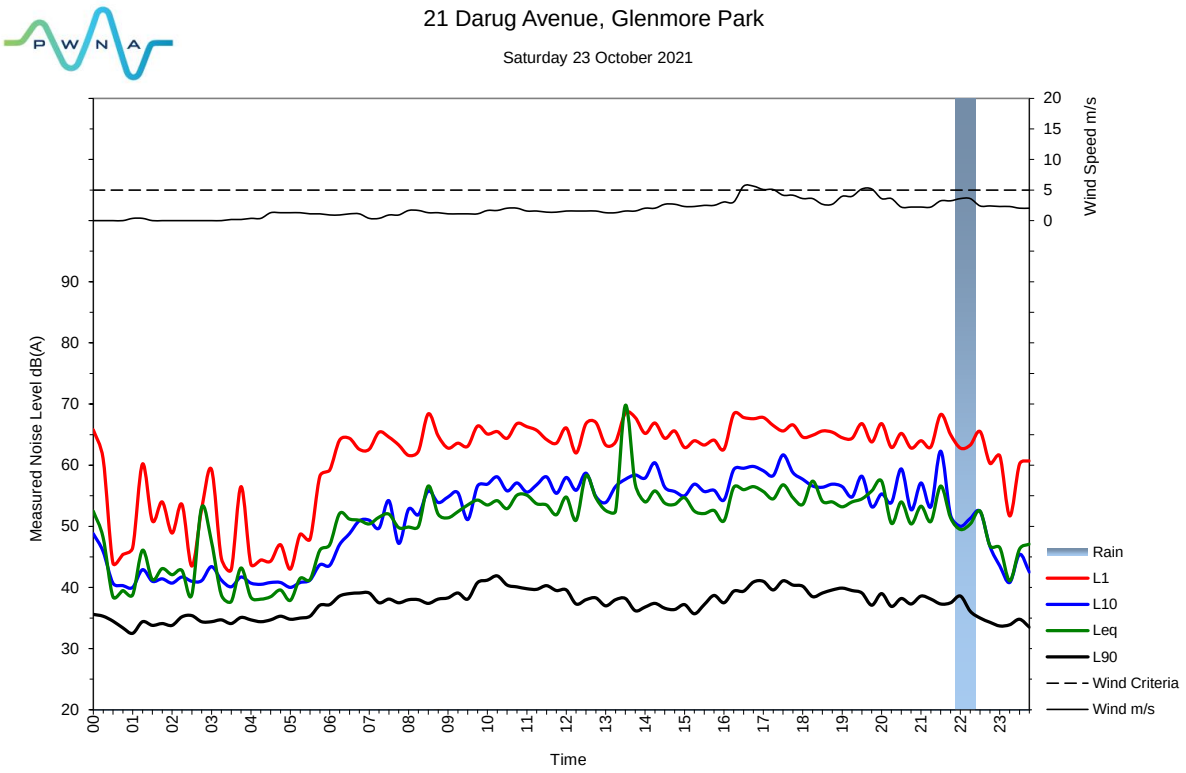

Mulgoa Rise
Monday 29 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

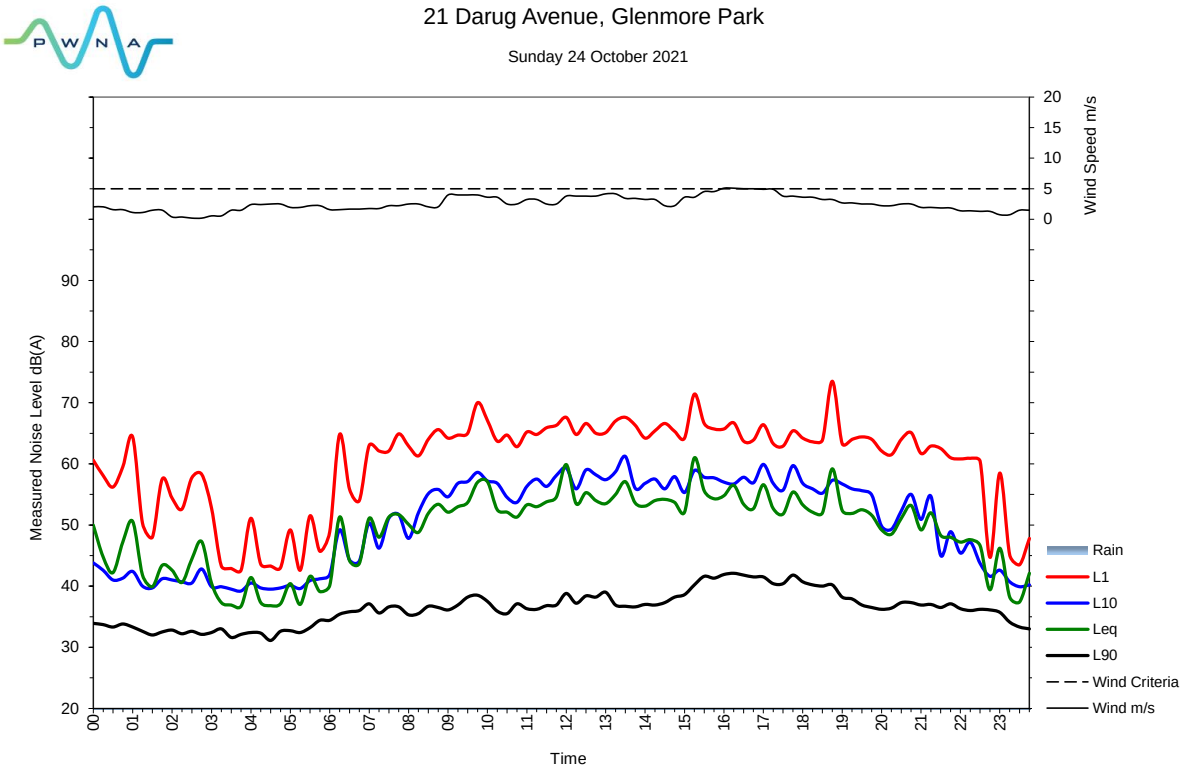

Mulgoa Rise
Tuesday 30 March 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

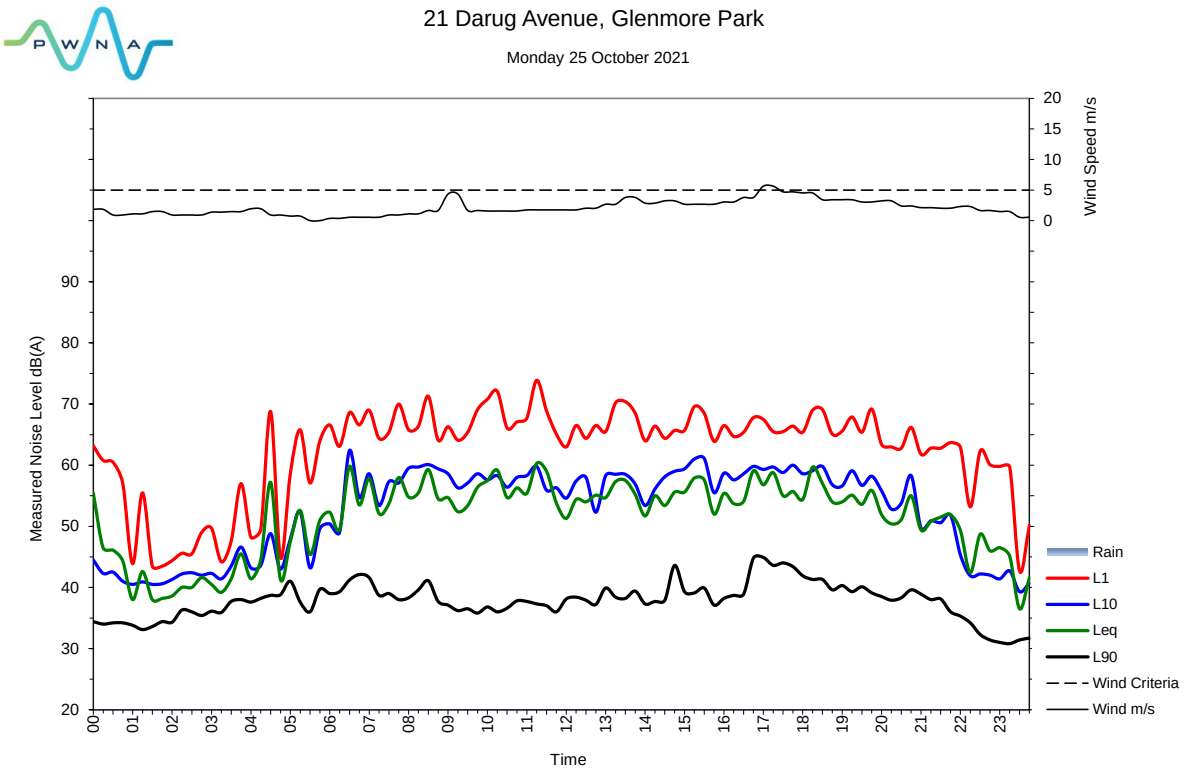
## Logger Location 3: No. 21 Darug Avenue, Glenmore Park

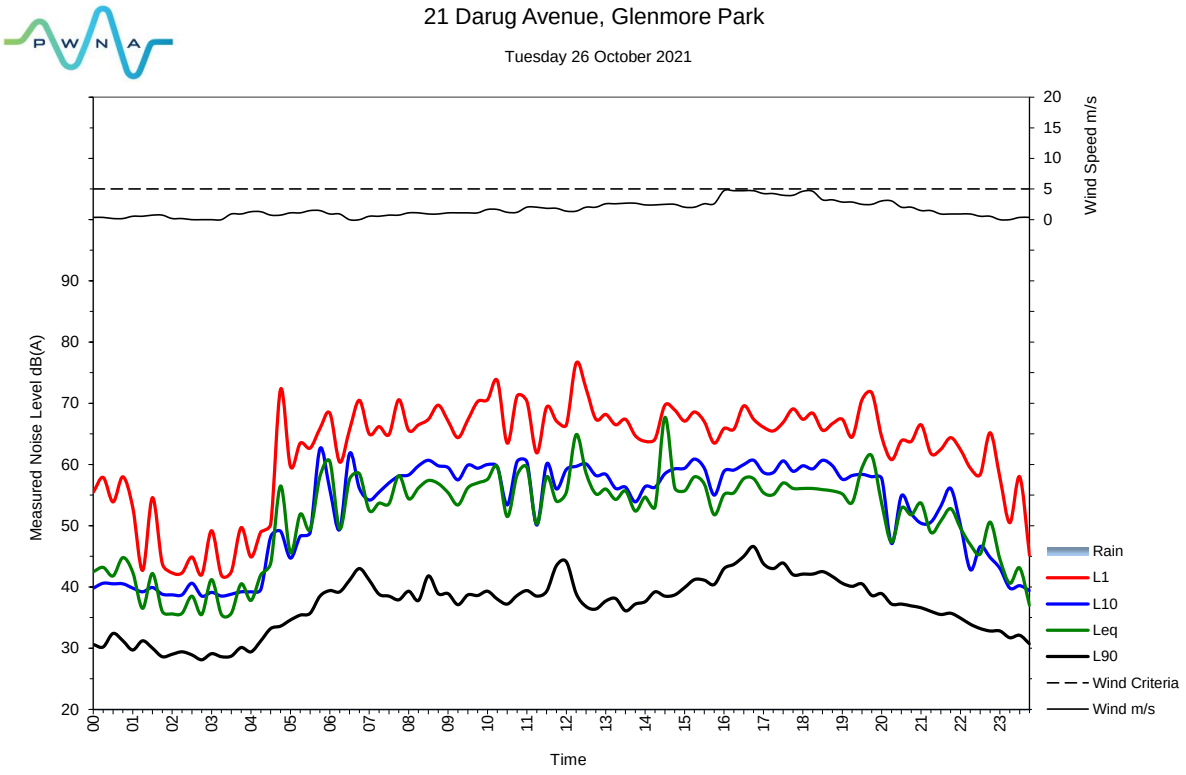


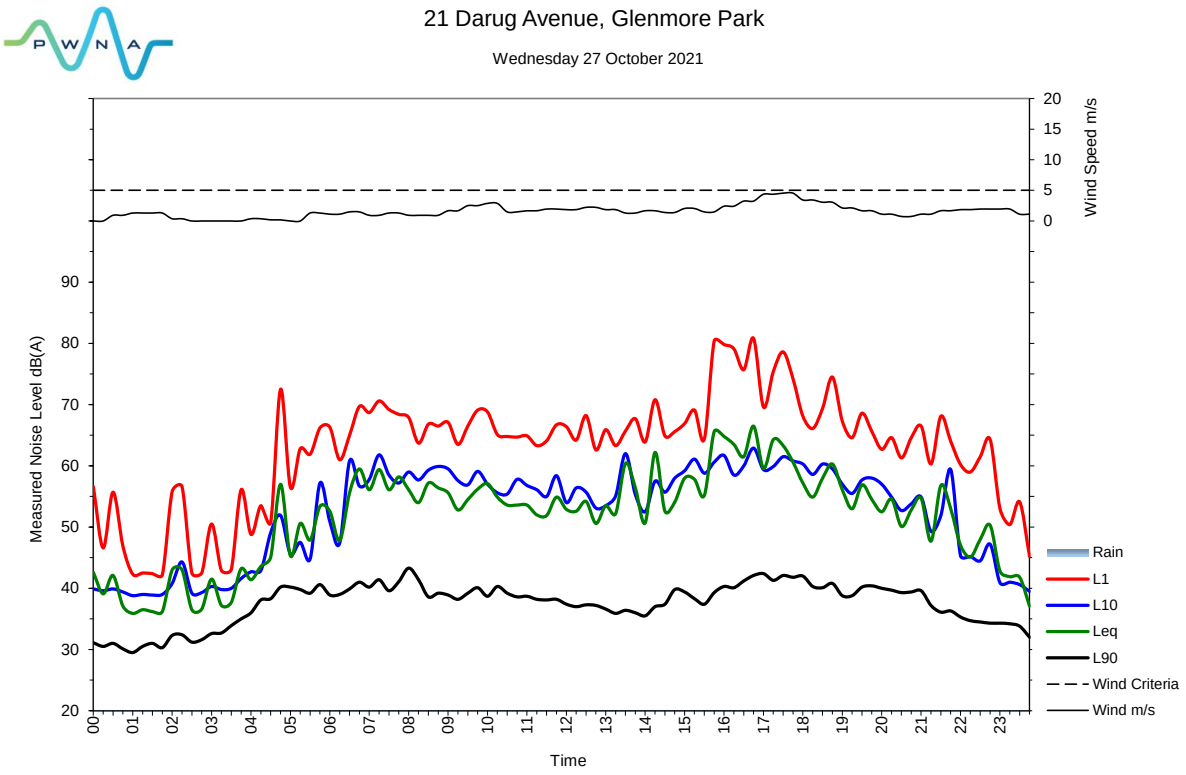



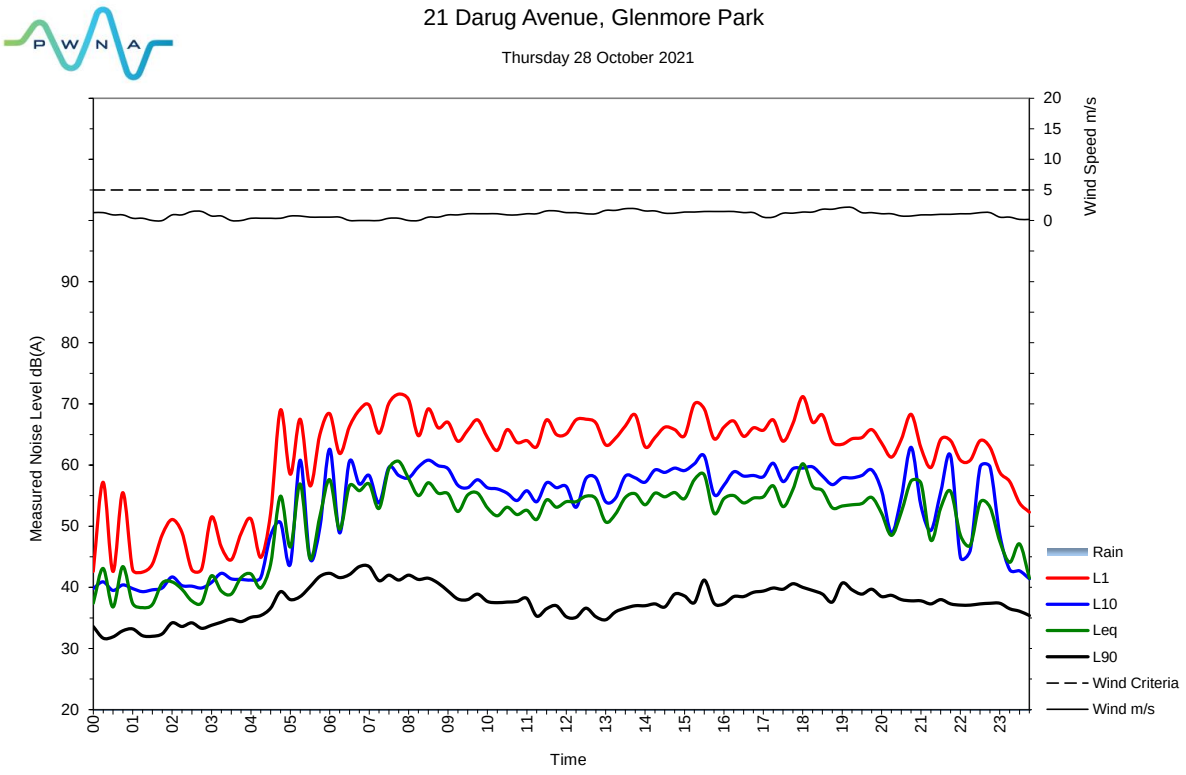

21 Darug Avenue, Glenmore Park
Saturday 23 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

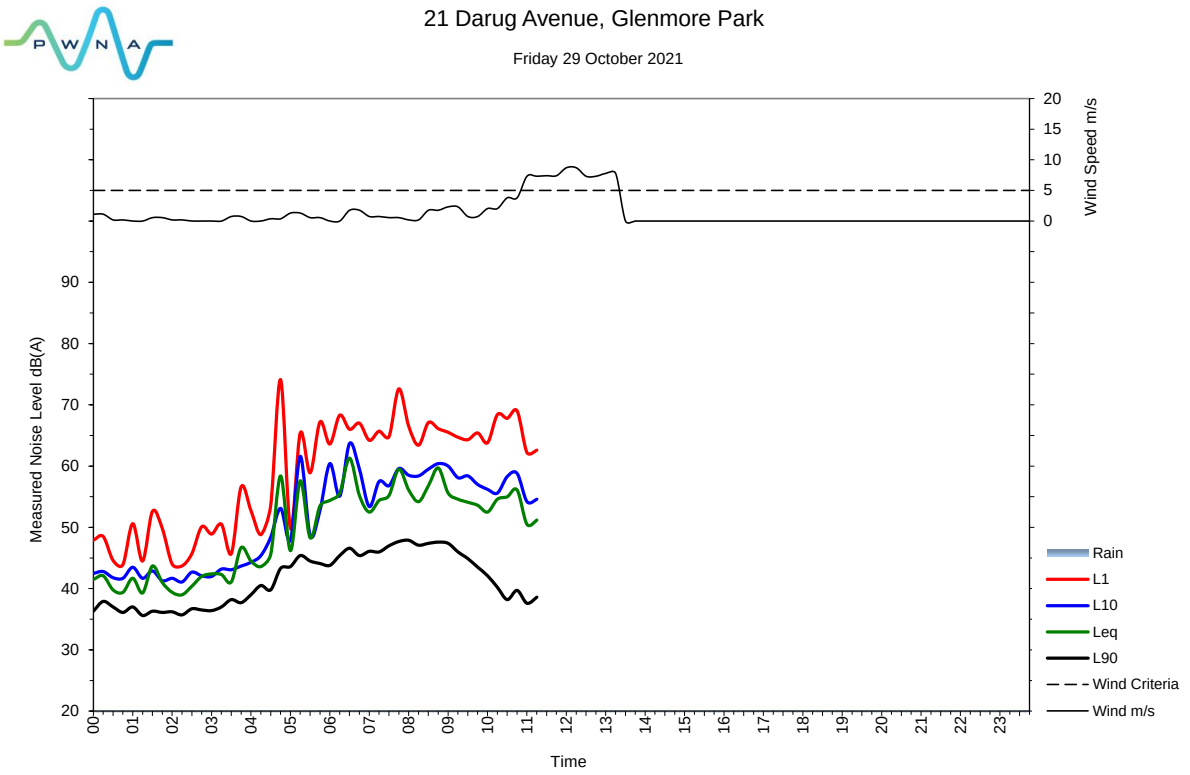

21 Darug Avenue, Glenmore Park
Sunday 24 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


21 Darug Avenue, Glenmore Park
Monday 25 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


21 Darug Avenue, Glenmore Park
Tuesday 26 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


21 Darug Avenue, Glenmore Park
Wednesday 27 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


21 Darug Avenue, Glenmore Park
Thursday 28 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s


21 Darug Avenue, Glenmore Park
Friday 29 October 2021
Measured Noise Level dB(A)
Wind Speed m/s
Time
Rain
L1
L10
Leq
L90
Wind Criteria
Wind m/s

# APPENDIX C: SITE LAYOUT - TEMPORARY FACILITIES

# MULGOA TEMPORARY SCHOOL

# NEW PRIMARY SCHOOL IN MULGOA RISE

1-23 Forestwood Drive, Glenmore Park, NSW 2745

## NBRS DRAWING LIST SSDA

| DRAWING NUMBER | SHEET NAME |
|---|---|
| 20415-NBRS-DR-A-SSDA-0001 | COVER |
| 20415-NBRS-DR-A-SSDA-0003 | SHADOW DIAGRAMS |
| 20415-NBRS-DR-A-SSDA-0101 | SITE SURVEY |
| 20415-NBRS-DR-A-SSDA-0102 | SITE ANALYSIS |
| 20415-NBRS-DR-A-SSDA-0110 | SITE PLAN |
| 20415-NBRS-DR-A-SSDA-0113 | SITE ACCESS AND SECURITY PLAN |
| 20415-NBRS-DR-A-SSDA-0115 | SITE SECTIONS |
| 20415-NBRS-DR-A-SSDA-0120 | PUBLIC DOMAIN SCOPE OF WORKS |
| 20415-NBRS-DR-A-SSDA-0999 | CAR PARK PLAN |
| 20415-NBRS-DR-A-SSDA-1000 | OVERALL GROUND FLOOR PLAN |
| 20415-NBRS-DR-A-SSDA-1001 | OVERALL L1 PLAN |
| 20415-NBRS-DR-A-SSDA-1002 | OVERALL ROOF PLAN |
| 20415-NBRS-DR-A-SSDA-1003 | GROUND FLOOR PLAN TEMPORARY SCHOOL MOD |
| 20415-NBRS-DR-A-SSDA-1004 | ROOF PLAN TEMPORARY SCHOOL MOD |
| 20415-NBRS-DR-A-SSDA-1011 | BLOCK A - GF PLAN |
| 20415-NBRS-DR-A-SSDA-1012 | BLOCK B3 - GF PLAN |
| 20415-NBRS-DR-A-SSDA-1013 | BLOCK B2 - GF PLAN |
| 20415-NBRS-DR-A-SSDA-1014 | BLOCK C - GF PLAN |
| 20415-NBRS-DR-A-SSDA-1021 | BLOCK A - LEVEL 1 PLAN |
| 20415-NBRS-DR-A-SSDA-1022 | BLOCK B3 - LEVEL 1 PLAN |
| 20415-NBRS-DR-A-SSDA-1023 | BLOCK B2 - LEVEL 1 PLAN |
| 20415-NBRS-DR-A-SSDA-3010 | SITE ELEVATIONS |
| 20415-NBRS-DR-A-SSDA-3011 | BUILDING A - ELEVATIONS |
| 20415-NBRS-DR-A-SSDA-3012 | BUILDING B3 - ELEVATIONS |
| 20415-NBRS-DR-A-SSDA-3013 | BUILDING B2 - ELEVATIONS |
| 20415-NBRS-DR-A-SSDA-3014 | BUILDING C - ELEVATIONS |
| 20415-NBRS-DR-A-SSDA-3015 | ELEVATIONS TEMPORARY SCHOOL MOD |
| 20415-NBRS-DR-A-SSDA-4001 | BUILDING A - SECTIONS |
| 20415-NBRS-DR-A-SSDA-4002 | BUILDING - SECTIONS |
| 20415-NBRS-DR-A-SSDA-4003 | BUILDING - DETAIL SECTIONS |
| 20415-NBRS-DR-A-SSDA-4004 | SECTIONS TEMPORARY SCHOOL MOD |
| 20415-NBRS-DR-A-SSDA-7001 | 3D IMAGE 1 |
| 20415-NBRS-DR-A-SSDA-7002 | 3D IMAGE 2 |
| 20415-NBRS-DR-A-SSDA-7003 | 3D IMAGE 3 |
| 20415-NBRS-DR-A-SSDA-7004 | 3D IMAGE 4 |
| 20415-NBRS-DR-A-SSDA-7005 | 3D IMADE 5 MOD |
| 20415-NBRS-DR-A-SSDA-7010 | SIGNAGE |
| 20415-NBRS-DR-A-SSDA-8001 | EXTERNAL FINISHES |

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | 23/04/2021 | ISSUE FOR COORDINATION | |
| 02 | 04/05/2021 | SSDA ISSUE | |
| 03 | 06/08/2021 | SSDA ISSUE | JL |
| 04 | 11/11/2021 | SSDA RIS | CHS |
| 05 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
COVER

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW

Architect
NBRS ARCHITECTURE.

Sydney
61 2 9922 2344 nbrsarchitecture.com



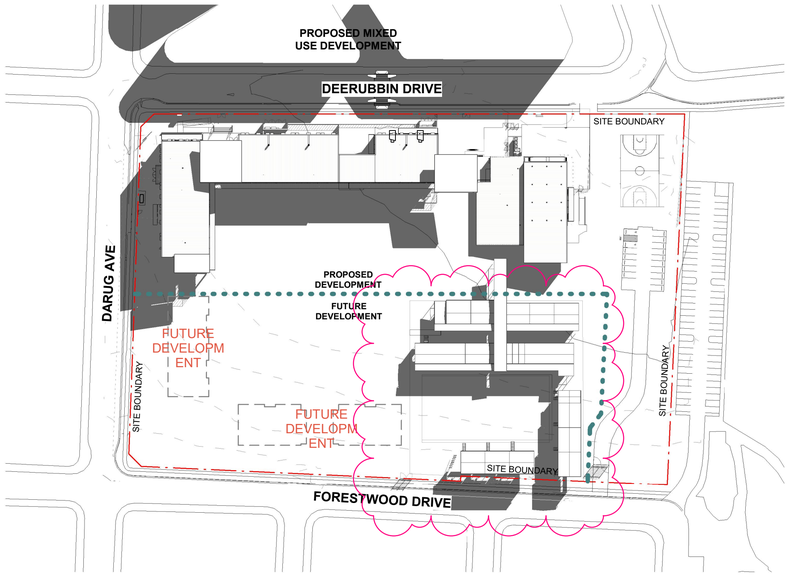
Nominated Architect:
Andrew Duffin NSW 5602



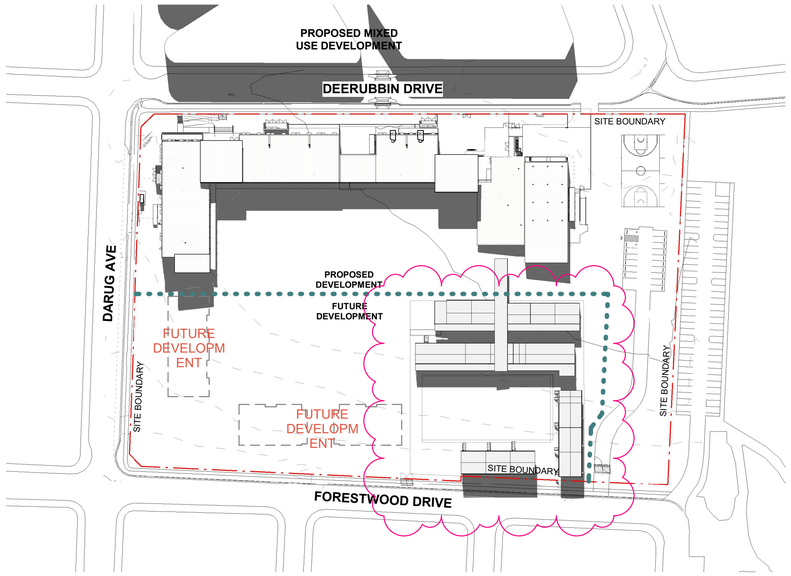
NBRS & Partners Pty Ltd VIC 51197 ABN 16 002 247 565

Date 23/06/2022 4:24:41 pm
Scale NOT TO SCALE

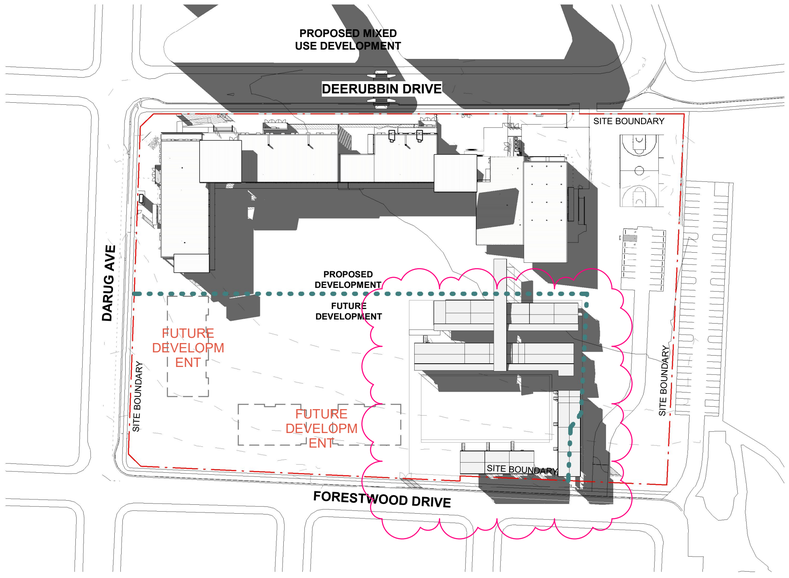
Drawing Reference 20415-NBRS-DW-AR-SSDA-0001
Revision 05



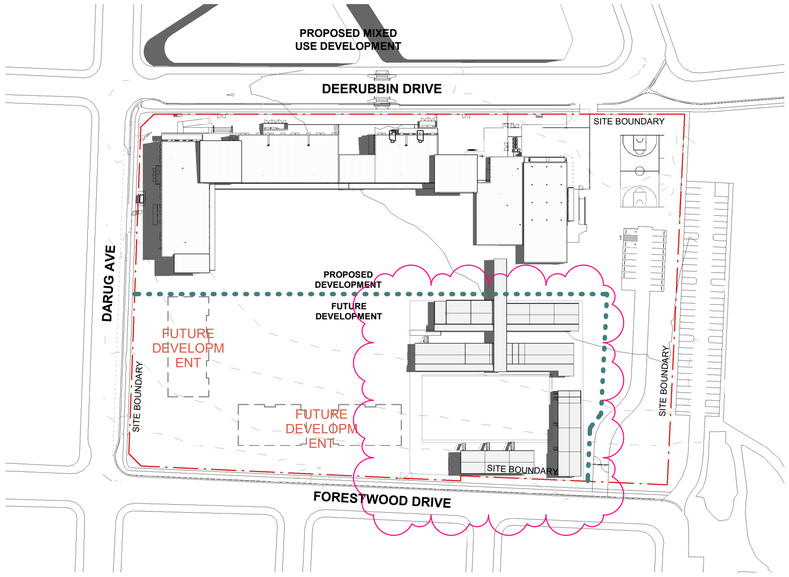

1 SHADOW DIAGRAM JUNE 21 9AM



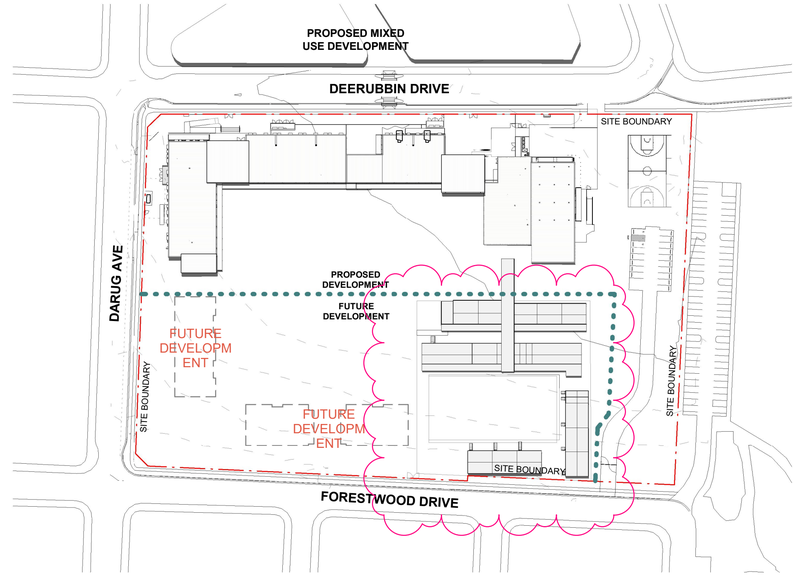

2 SHADOW DIAGRAM JUNE 21 12PM



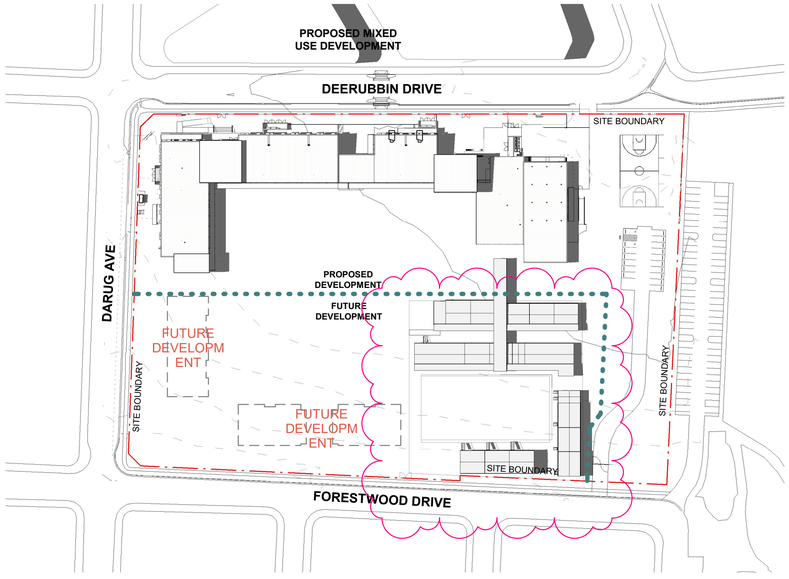

3 SHADOW DIAGRAM JUNE 21 3PM




4 SHADOW DIAGRAM DEC 21 9AM




5 SHADOW DIAGRAM DEC 21 12PM




6 SHADOW DIAGRAM DEC 21 3PM

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | 12/04/2021 | ISSUE FOR COORDINATION | |
| 02 | 23/04/2021 | ISSUE FOR COORDINATION | |
| 03 | 04/05/2021 | SSDA ISSUE | |
| 04 | 06/08/2021 | SSDA ISSUE | JL |
| 05 | 11/11/2021 | SSDA RIS | CHS |
| 06 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
SHADOW DIAGRAMS

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

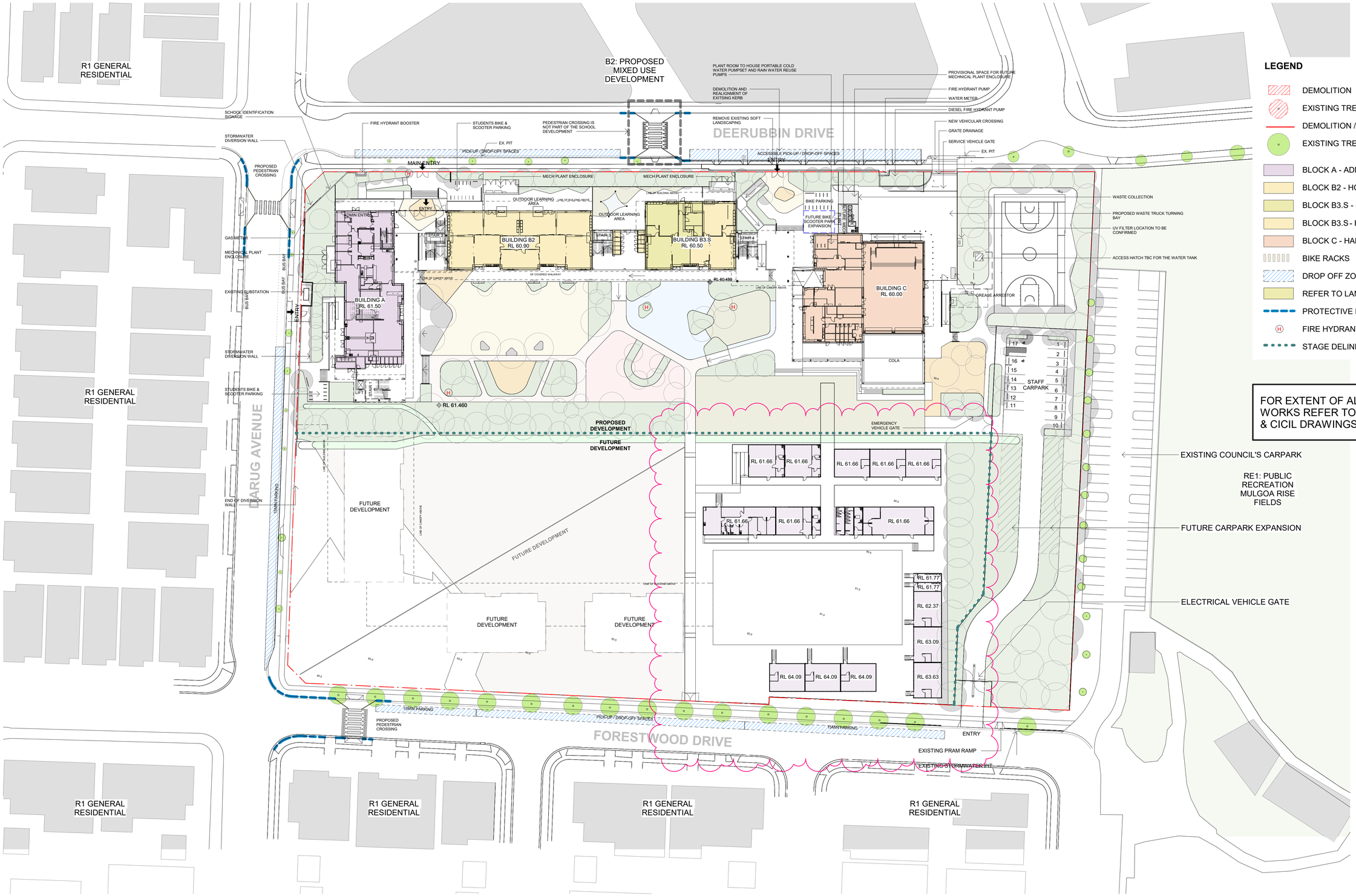
for
SINSW

Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com


Date 23/06/2022 4:27:13 pm
Scale NOT TO SCALE

Drawing Reference 20415-NBRS-DW-AR-SSDA-0003
Revision 06

0 10 20 30 40 50 60 70 80 90 100




## LEGEND

- DEMOLITION
- EXISTING TREES TO BE REMOVED
- DEMOLITION / REMOVAL
- EXISTING TREES
- BLOCK A - ADMIN AND LIBRARY
- BLOCK B2 - HOME BASES LEARNING
- BLOCK B3.S - SUPPORT ED. HUB
- BLOCK B3.S - HOME BASES LEARNING
- BLOCK C - HALL
- BIKE RACKS
- DROP OFF ZONE
- REFER TO LANDSCAPE DRAWINGS
- PROTECTIVE BALUSTRADE
- FIRE HYDRANT
- STAGE DELINIATION LINE

FOR EXTENT OF ALL EXTERNAL WORKS REFER TO LANDSCAPE & CICIL DRAWINGS

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 04 | 04/05/2021 | SSDA ISSUE | |
| 05 | 14/07/2021 | FOR INFORMATION | |
| 06 | 19/07/2021 | COORDINATION ISSUE | JL |
| 07 | 28/07/2021 | ISSUE FOR COORDINATION | |
| 08 | 06/08/2021 | SSDA ISSUE | JL |
| 09 | 11/08/2021 | SSDA ISSUE | JL |
| 010 | 11/11/2021 | SSDA RtS | CHS |
| 011 | 12/11/2021 | SSDA RtS | CHS |
| 012 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS


**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com


Drawing Title
SITE PLAN

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW


Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344
nbrsarchitecture.com



Nominated Architect:
Andrew Duffin NSW 5602
NBRS & Partners Pty Ltd VIC 51197



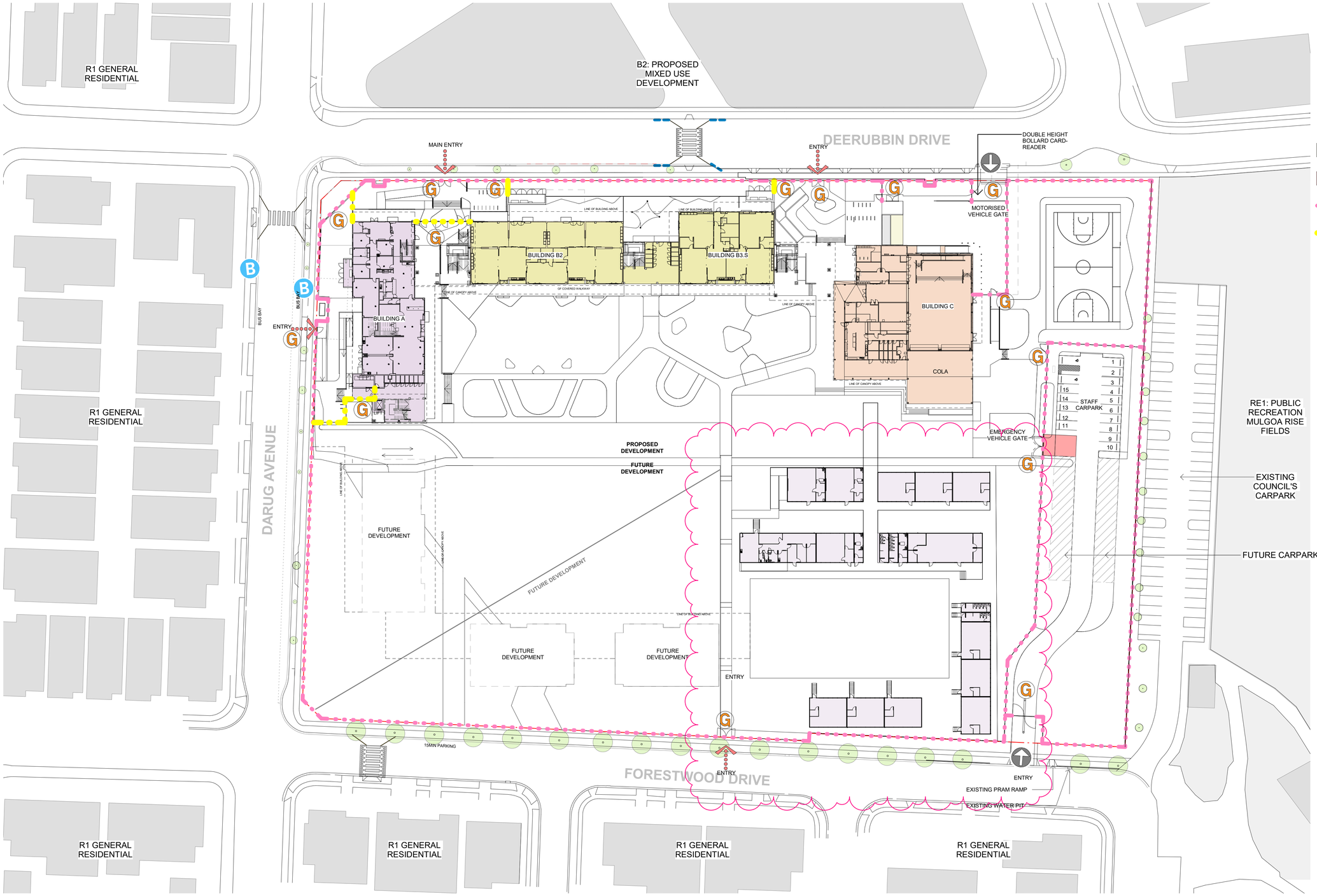
ABN 16 002 247 565


Date 23/06/2022 4:28:03 pm
Scale 1:500 @ A1

Drawing Reference
20415-NBRS-DW-AR-SSDA-0110

Revision
012

0 5m 10m 15m 20m 25m 30m 35m 40m 1:500




PEDESTRIAN ACCESS

VEHICULAR ACCESS

PUBLIC TRANSPORT

WASTE COLLECTION

EMERGENCY VEHICLE

2100 H PERIMETER FENCE

SECONDARY SECURE FENCE (REFER LANDSCAPE FOR FENCING TYPES)

GATE

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | 12/04/2021 | ISSUE FOR COORDINATION | |
| 02 | 16/04/2021 | SD ISSUE | |
| 03 | 23/04/2021 | ISSUE FOR COORDINATION | |
| 04 | 04/05/2021 | SSDA ISSUE | |
| 05 | 06/08/2021 | SSDA ISSUE | JL |
| 06 | 11/08/2021 | SSDA ISSUE | JL |
| 07 | 11/11/2021 | SSDA RIS | CHS |
| 08 | 12/11/2021 | SSDA RIS | CHS |
| 09 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
SITE ACCESS AND SECURITY PLAN

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW

Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com

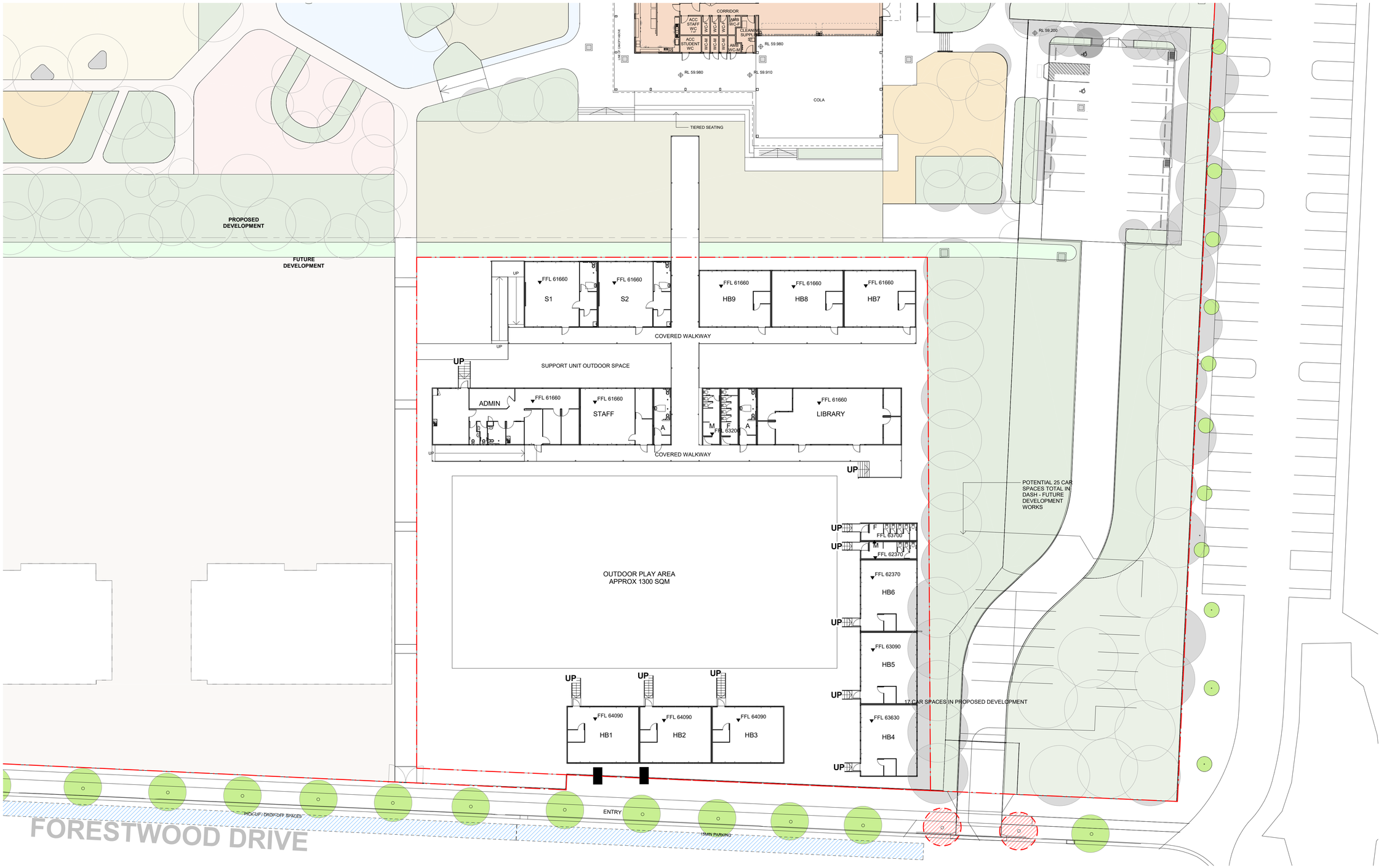
Nominated Architect:
Andrew Duffin NSW 5602

NBRS & Partners Pty Ltd VIC 51197 ABN 16 002 247 565

Date 23/06/2022 4:28:11 pm
Scale 1:500 @ A1

Drawing Reference 20415-NBRS-DW-AR-SSDA-0113
Revision 09

0 5m 10m 15m 20m 25m 30m 35m 40m 1:500




Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
GROUND FLOOR PLAN
TEMPORARY SCHOOL MOD

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia
for
SINSW

Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com

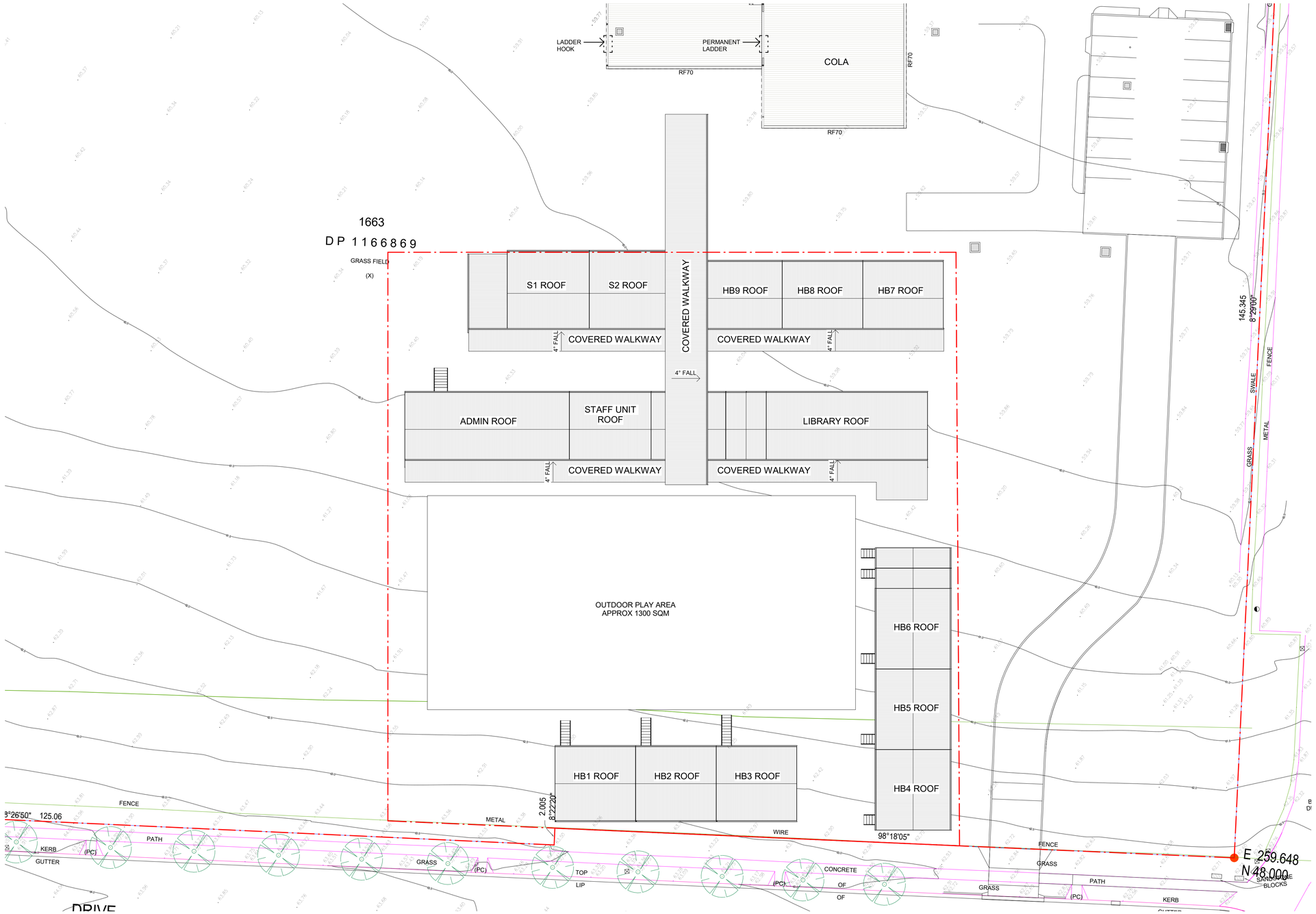
Nominated Architect:
Andrew Duffin NSW 5602
NBRS & Partners Pty Ltd VIC 51197

ABN 16 002 247 565

Date 23/06/2022 4:28:44 pm
Scale 1 : 250 @ A1

Drawing Reference 20415-NBRS-DW-AR-SSDA-1003
Revision 01

0 10 20 30 40 50 60 70 80 90 100




| Issue | | | |
|---|---|---|---|
| No. | Date | Description | Chkd |
| 01 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
ROOF PLAN TEMPORARY SCHOOL MOD

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia
for
SINSW

Architect
NBRS ARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com

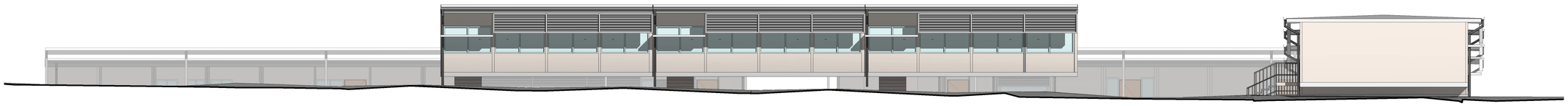
Nominated Architect:
Andrew Duffin NSW 5602

NBRS & Partners Pty Ltd VIC 51197 ABN 16 002 247 565

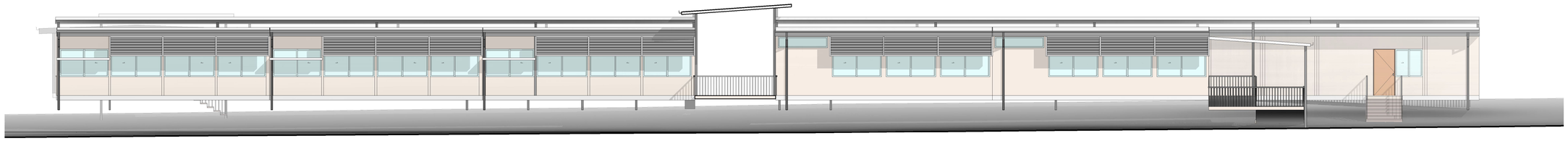
Date 23/06/2022 4:28:51 pm
Scale 1 : 1200 @ A1

Drawing Reference 20415-NBRS-DW-AR-SSDA-1004
Revision 01

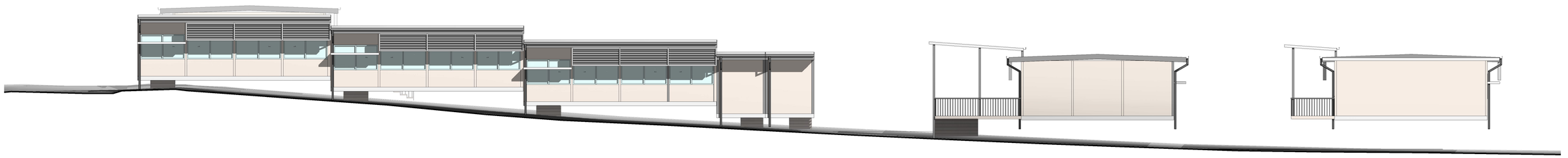
0 10 20 30 40 50 60 70 80 90 100



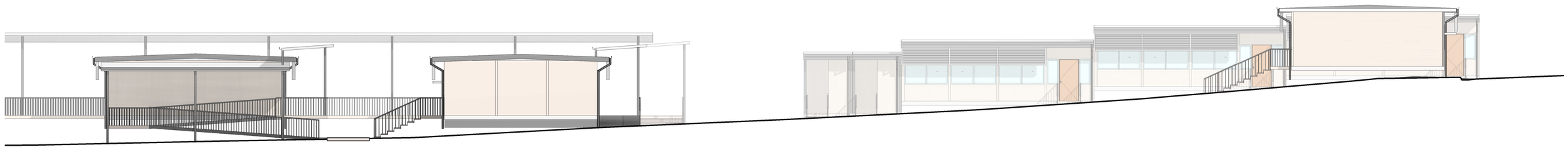
1 MOD SSDA_NORTH
1 : 100



2 MOD SSDA_SOUTH
1 : 100



3 MOD SSDA_RIGHT
1 : 100



4 MOD SSDA_LEFT
1 : 100

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS

**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com

Drawing Title
ELEVATIONS TEMPORARY SCHOOL MOD

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW

Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com

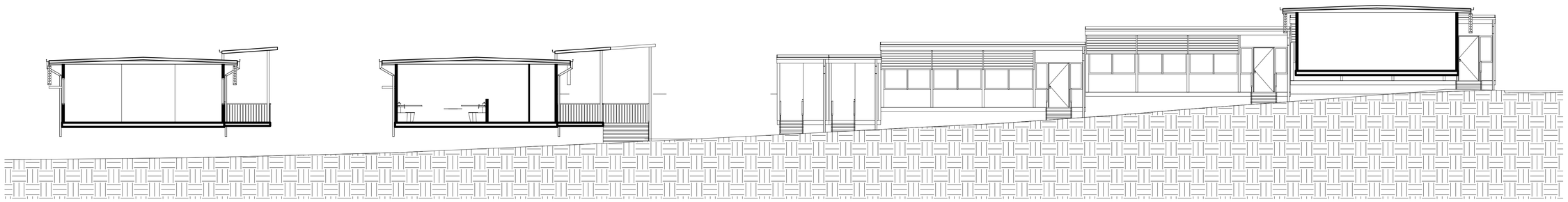
Nominated Architect:
Andrew Duffin NSW 5602
NBRS & Partners Pty Ltd VIC 51197

ABN 16 002 247 565

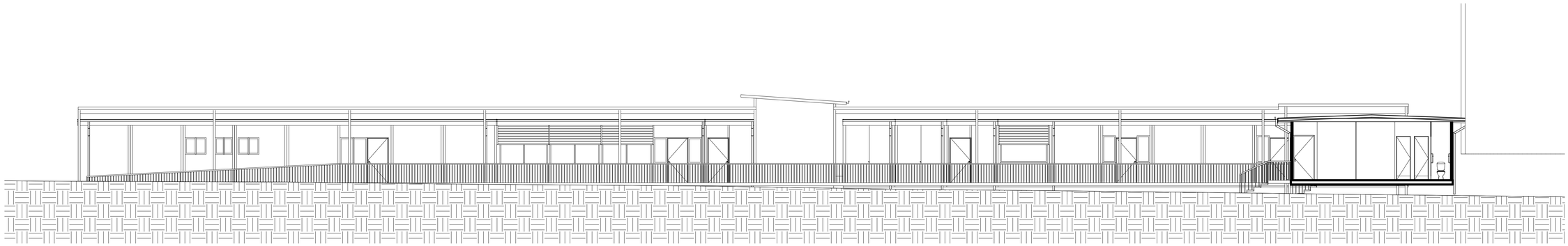
Date 23/06/2022 4:29:21 pm
Scale 1 : 100 @ A1

Drawing Reference 20415-NBRS-DW-AR-SSDA-3015
Revision 01

0 10 20 30 40 50 60 70 80 90 100



1 MOD SSDA_SECTION 1
1 : 100



2 MOD SSDA_SECTION 2
1 : 100

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | Date 45 | MOD SSDA | |

MOD SSDA

RICHARD CROOKES CONSTRUCTIONS


**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com


Drawing Title
SECTIONS TEMPORARY SCHOOL MOD

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW


Architect
NBRSARCHITECTURE.
Sydney
61 2 9922 2344 nbrsarchitecture.com



Nominated Architect:
Andrew Duffin NSW 5602
NBRS & Partners Pty Ltd VIC 51197



ABN 16 002 247 565


Date 23/06/2022 4:29:22 pm
Scale 1 : 100 @ A1

Drawing Reference
20415-NBRS-DW-AR-SSDA-4004

Revision
01

0 10 20 30 40 50 60 70 80 90 100

PERSPECTIVE FROM THE OUTDOOR PLAY AREA LOOKING TOWARD THE LIBRARY AND TOILET

Issue

| No. | Date | Description | Chkd |
|---|---|---|---|
| 01 | Date 45 | MOD SSDA | |

**FOR COORDINATION**

RICHARD CROOKES CONSTRUCTIONS


**TRAFFIC ENGINEER**
**PTC**
KASIA BALSAM
02 8920 0800
kasia.balsam@ptcconsultants.co

**MULTI SERVICES**
**NDY**
RYAN HAHN
0407 236 908
r.hahn@ndy.com

**QUANTITY SURVEYOR**
**MBM**
AUTUMN LU
02 9270 1062
autumn.lu@mbmpl.com.au

**TOWN PLANNER**
**RPS**
ROB DWYER
0425 285 778
rob.dwyer@rpsgroup.com.au

**CIVIL AND STRUCTURAL ENGINEERING**
**WOOLACOTTS**
JUSTIN CHIRILLO
02 8203 1504
jchirillo@woolacotts.com.au

**PROJECT MANAGER**
**COLLIERS**
ANTHONY MAUGHAN-WRIGHT
0424 189 883
anthony.maughan-wright@colliers.com


Drawing Title
3D IMADE 5 MOD

NBRS Internal Project No
20415

Project
NEW PRIMARY SCHOOL IN MULGOA RISE
at
1-23 Forestwood Drive, Glenmore Park, NSW 2745, Australia

for
SINSW


Architect
NBRS ARCHITECTURE.
Sydney
61 2 9922 2344 nbrs.com.au



Nominated Architect:
Andrew Duffin NSW 5602



NBRS & Partners Pty Ltd VIC 51197 ABN 16 002 247 565


Date 23/06/2022 4:29:26 pm
Scale @ A1

Drawing Reference
M-AR-DW-SSDA-7005

Revision
01