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# Environmental Noise Impact Assessment

## Proposed Child Care Centre

## 5 Mary Street, Northmead, NSW

REPORT No
**7805-1.1R**

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# CONTENTS

1.0 EXECUTIVE SUMMARY ..... 5
2.0 CONSULTING BRIEF ..... 6
3.0 SITE AND DEVELOPMENT DESCRIPTION ..... 7
3.1 Site Description ..... 7
3.2 Development Description ..... 9
4.0 MEASURED NOISE LEVELS ..... 10
4.1 Measured Ambient Noise Levels ..... 10
4.2 Measured Road Traffic Noise Levels ..... 12
5.0 ACOUSTIC CRITERIA ..... 14
5.1 Parramatta Development Control Plan 2011 ..... 14
5.2 NSW Department of Planning, Industry and Environment ..... 18
5.2.1 State Environmental Planning Policy (Transport and Infrastructure) 2021 ..... 18
5.2.2 NSW DoPIE – Child Care Planning Guideline ..... 19
5.3 AAAC – Guideline for Child Care Centres Acoustic Assessment ..... 21
5.4 NSW Environment Protection Authority – NSW Road Noise Policy ..... 23
5.5 Project Noise Trigger Levels ..... 24
5.5.1.1 Residential Receptors ..... 24
5.5.2 Sleep Disturbance ..... 25
5.5.3 On-Road Traffic Noise Criterion ..... 25
5.5.4 Noise Intrusion Criteria ..... 25
6.0 CHILD CARE CENTRE NOISE EMISSION ..... 26
6.1 Indoor and Outdoor Play Areas ..... 26
6.2 Car Park Noise Emission ..... 27
6.3 Mechanical Plant ..... 28
6.4 Predicted Noise Levels ..... 29
6.4.1 Outdoor Play Area Noise Levels ..... 30
6.4.2 Cumulative Noise Level - Indoor Play Area, Car Park and Mechanical Plant ..... 32
6.4.3 Sleep Disturbance ..... 34
6.4.4 On-Road Traffic ..... 34
7.0 NOISE INTRUSION – ROAD TRAFFIC NOISE ..... 35
7.1 External Road Traffic Noise Levels – Outdoor Play Areas ..... 35
7.2 Road Traffic Noise Intrusion Assessment – Indoor Playrooms ..... 35
8.0 NOISE CONTROL RECOMMENDATIONS ..... 36

8.1 Management Plan....36
8.1.1 Indoor Activity Area Window/Door Closure....36
8.2 Sound Barrier Fences....37
8.3 Mechanical Plant & Equipment – Construction Certificate....38
8.4 Construction Disclaimer....38
9.0 PREDICTED NOISE LEVELS – AFTER NOISE CONTROLS....39
9.1 Outdoor Play Areas....39
9.2 Indoor Play Areas....39
9.3 Traffic Noise Intrusion....40
10.0 CONCLUSION....41

# TABLES

Table 1 Noise Sensitive Receptors....7
Table 2 Ambient Background Levels – 5 Mary Street, Northmead, NSW....11
Table 3 Measured $L_{Aeq,\ 1\ hour}$ Road Traffic Sound Pressure Levels – Location 'A'....12
Table 4 Measured $L_{Aeq,\ 1\ hour}$ Road Traffic Sound Pressure Levels – Location 'B'....13
Table 5 Road Traffic Noise Assessment Criterion - Residential....23
Table 6 $L_{eq}$ Sound Power Levels - Children Engaging in Active Play....26
Table 7 SEL & $L_{Amax}$ Sound Power Levels – Car Park Noise....27
Table 8 $L_{eq,\ 15\ minute}$ Sound Power Levels – Mechanical Plant....28
Table 9 Predicted $L_{eq,\ 15\ minute}$ Noise Levels – Outdoor Play....31
Table 10 Predicted Cumulative $L_{eq,\ 15\ minute}$ Noise Levels – Indoor Play, Mechanical Plant & Car Park32
Table 11 Predicted $L_{AF,\ max}$ Noise Levels – Sleep Disturbance....34
Table 12 Predicted $L_{eq,\ 1\ hour}$ Noise Levels – On – Road Traffic....34
Table 13 Predicted $L_{eq,\ 1\ hour}$ Noise Levels – Noise within Outdoor Play Areas....35
Table 14 Calculated $L_{eq,\ 1\ hour}$ Road Traffic Noise Levels – Indoor Rooms....35
Table 15 Predicted $L_{eq,\ 15\ minute}$ Noise Levels – After Noise Controls....39
Table 16 Predicted Cumulative $L_{eq,\ 15\ minute}$ Noise Levels – Indoor Play, Mechanical Plant & Car Park – After Noise Controls....39
Table 17 Calculated $L_{eq,\ 1\ hour}$ Road Traffic Noise Levels – Indoor Rooms – After Noise Controls....40

## 1.0 EXECUTIVE SUMMARY

A new child care centre (the Centre) is proposed to be constructed at 5 Mary Street, Northmead, NSW (the Site). The Site is located on land zoned R2 – *Low Density Residential* under the Parramatta Local Environmental Plan (LEP) 2023.

The Site is bound by an empty property zoned for residential use to the north, residential premises to the east and west, and by Mary Street to the south. Residential properties are also located on the opposite side of Mary Street to the south. The Site and nearby receptors are shown in Figure 1.

The proposal will involve the demolition of the current residence located at the Site and the construction of a new two-storey child care centre building with a basement parking level. The Centre will comprise of four indoor play areas, two outdoor play areas, two cot rooms, staff room, kitchen and amenities, along with a lower-ground floor level car park. The car park has capacity for 24 vehicles.

The architectural drawings relied on for this assessment are prepared by Janssen Designs dated 5 October 2022, and attached in Appendix C.

The Centre will have a total capacity for 90 children, comprising of:

- 0-2 years old – 20 children;
- 2-3 years old – 20 children; and
- 3-5 years old – 50 children.

The proposed hours of operation for the Centre are:

- Monday to Friday: 7.00 am – 6.00 pm.

Nearby premises may be affected by the following noise sources at the Centre:

- Children playing both outside and inside;
- Car park and on-road traffic; and
- Mechanical plant.

Parramatta City Council requires an acoustic assessment to demonstrate that the noise impact from the Centre will not adversely affect the acoustic amenity of nearby residential premises.

Acceptable noise limits have been derived from the Association of Australasian Acoustical Consultants' (AAAC) '*Guideline for Child Care Centres Acoustic Assessment*' and the Environmental Protection Authority's (EPA) *Road Noise Policy* (RNP).

Calculations show that, provided the recommendations in Section 8.0 are implemented, the levels of noise emission from the Centre and of intrusive noise at the Centre will meet the acoustic requirements established in Section 5.5, and will therefore be acceptable.

## 2.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Janssen Designs on behalf of Kirribilli Capital Pty Ltd to assess the potential environmental noise impact from a proposed Child Care Centre to be constructed at 5 Mary Street, Northmead, NSW. This commission involves the following:

**Scope of Work:**

- Inspect the site and environs
- Measure the background noise levels at critical locations and times
- Establish acceptable noise level criterion
- Prepare a site plan identifying the development and nearby noise sensitive locations
- Quantify noise emissions from the proposed Child Care Centre
- Quantify traffic noise intrusion to the site
- Calculate the level of noise emission, taking into account building envelope transmission loss, screen walls and distance attenuation
- Provide recommendations for noise control
- Prepare an Environmental Noise Impact Assessment Report.

# 3.0 SITE AND DEVELOPMENT DESCRIPTION

## 3.1 Site Description

The Centre is proposed to be constructed at 5 Mary Street, Northmead, NSW. The Site is located on land zoned R2 – *Low Density Residential* under the Parramatta Local Environmental Plan (LEP) 2023.

The Site currently consists of a two-storey residential dwelling with access via Mary Street.

The Site is bound by a vacant site zoned for residential use to the north, residential premises to the east and west, and by Mary Street to the south. Residential properties are also located on the opposite side of Mary Street to the south. The Site and nearby receptors are shown in Figure 1.

The nearest noise sensitive receptors to the site are also shown in Figure 1, and are presented below in Table 1.

**Table 1 Noise Sensitive Receptors**

| Receiver, Type & Location | Address | Direction from site |
|---|---|---|
| R1 – Residence – *RL 66.5*<br>*3 m from boundary – 1.5 m above ground level* | 189 Windsor Road (future development) | North |
| R2a – Residence – *RL 63.6*<br>*3 m from boundary – 1.5 m above ground level* | 7 Mary Street (two storeys) | East |
| R2b – Residence – *RL 63.24*<br>*outside western first-floor window* | | East |
| R2c – Residence – *RL 60.2*<br>*outside western ground-floor window* | | East |
| R3 – Residence – *RL 60*<br>*front façade – 1.5 m above ground level* | 8 Mary Street (single storey) | South |
| R4a – Residence – *RL 62.9*<br>*front façade – 1.5 m above ground level* | 3A Mary Street (two storeys) | West |
| R4b – Residence – *RL 65.9*<br>*outside eastern first floor window* | | West |
| R4c – Residence – *RL 65*<br>*3 m from boundary – 1.5 m above ground level* | | West |

As the noise sources on the Site are at varying distances from the receptors, specific distances between each noise source and receptor are used in all calculations. All distances are based upon the architectural drawings attached as Appendix C.

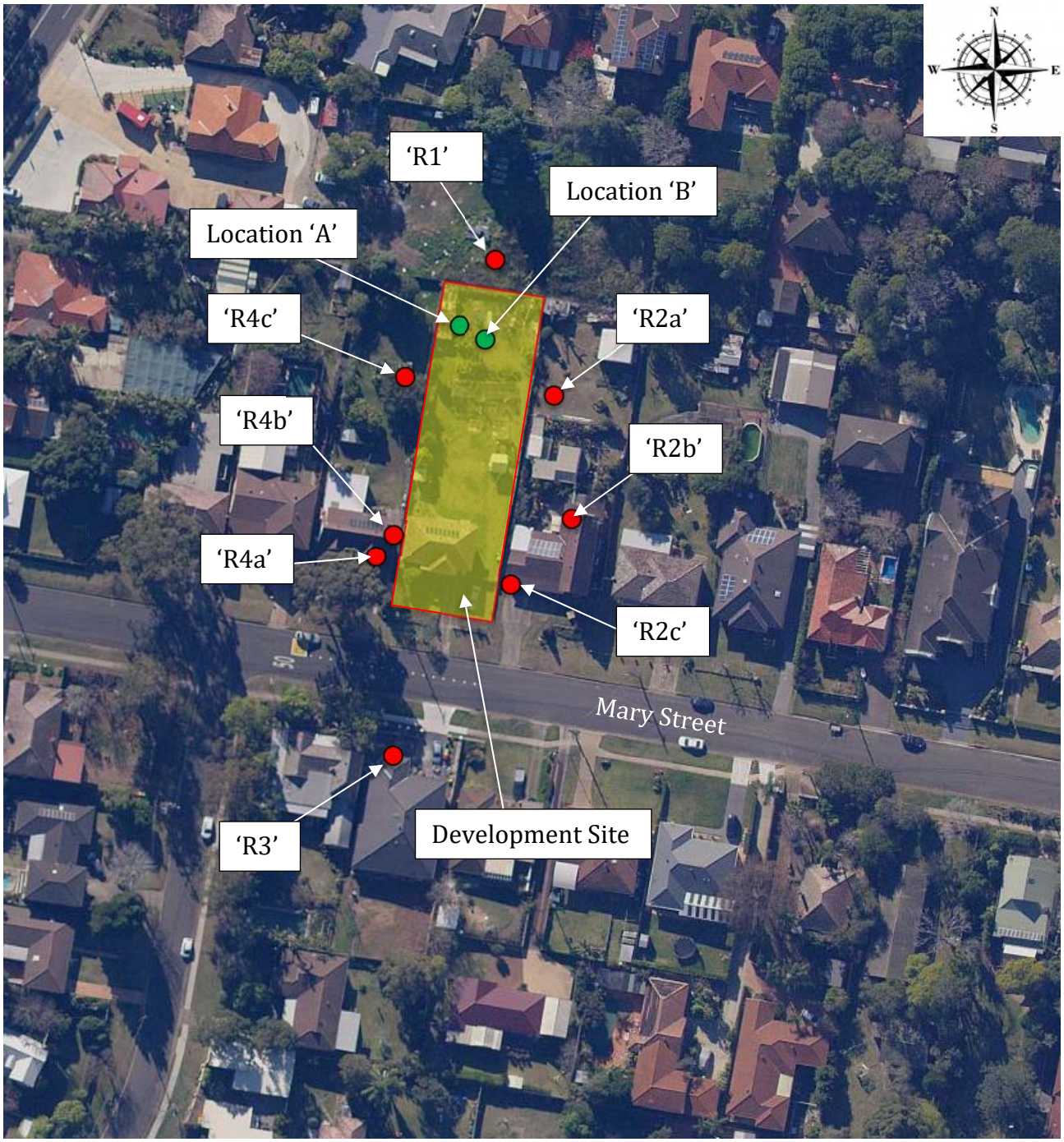



***Figure 1 – Location Plan – 5 Mary Street, Northmead, NSW***

## 3.2 Development Description

The proposal will involve the demolition of the current residence and the construction of a new two-storey child care centre building with lower-ground floor level parking. The Centre will comprise of four indoor play areas, two outdoor play areas, two cot rooms, staff room, kitchen and amenities, along with a lower-ground floor level car park. The car park has capacity for 24 vehicles.

The proposed layout of the Centre can be seen in the architectural drawings prepared by Janssen Designs, attached as Appendix C.

The proposed hours of operation for the Centre are:

- Monday to Friday: 7.00 am – 6.00 pm.

The Centre will have a total capacity for 90 children, comprising of:

- 0-2 years old – 20 children;
- 2-3 years old – 20 children; and
- 3-5 years old – 50 children.

## 4.0 MEASURED NOISE LEVELS

Noise survey instrumentation used in this assessment is listed in Appendix A. A Glossary of Acoustical Terms is included as Datasheet AC108.

### 4.1 Measured Ambient Noise Levels

In order to assess the severity of a possible environmental noise problem in a residential area it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying.

The background noise level should be measured at a location most representative of the potentially affected receptors, in the absence of any noise sources that may be associated with the proposed development.

As specified in Section 3.1 "Background Noise Monitoring" of the AAAC's *'Guideline for Child Care Centre Acoustic Assessment'*, where a consultant is unable to measure the background noise level at the most affected residential receiver location, the consultant *'shall select another suitable and equivalent location. This measured representative noise environment should be used to establish relevant criteria for all sensitive receivers.'*

During our site inspection it was determined that the potentially *most affected sensitive receiver locations* are 'R2' to the east and 'R4' to the west of the proposed Centre. Therefore, suitable and equivalent locations - Location 'A' and 'B' (see below) were selected to represent *the most affected sensitive receivers*. This measured representative noise environment has been used to establish the relevant criteria for all other sensitive receivers.

Consideration is also given the possible future residential receiver 'R1' to the north and the residential receiver 'R3' to the south.

Day Design notes that the background noise in the area is mainly influenced by local fauna and some neighbourhood noises (pets, people talking and occasional yard work), as well as occasional aircraft noise.

Two environmental noise monitors, one at ground floor level and one at first floor level, were placed at Location 'A' and Location 'B' respectively, in the rear yard of 5 Mary Street, Northmead, NSW. These noise monitors collected data from Tuesday 6 June to Monday 19 June, 2023 to determine the Rating Background Level.

As the Centre is not proposed to operate on weekends, ambient noise levels measured on Saturday 10, Sunday 11, Saturday 17 and Sunday 18 June 2023, have been excluded from the assessment period.

The results of the background noise surveys at Location 'A' and Location 'B' are shown in the attached Appendix B, and below in Table 2.

**Table 2 Ambient Background Levels – 5 Mary Street, Northmead, NSW**

| Noise Measurement Location | Time Period | $L_{90}$ Rating Background Level |
|---|---|---|
| Location 'A' – Ground Floor | Early Morning (6:30 am – 7 am) | **47** |
| | Day (7 am to 6 pm) | **40** |
| Location 'B' – First Floor | Early Morning (6:30 am – 7 am) | **48** |
| | Day (7 am to 6 pm) | **43** |

Meteorological conditions during the measurement surveys typically consisted of clear or overcast skies with temperatures ranging from 2°C to 22°C. Noise level measurements are considered reliable and representative of the background noise levels at all nearby receptor locations.

## 4.2 Measured Road Traffic Noise Levels

The proposed development is affected by road traffic noise from Mary Street which carries low traffic volumes.

The weekday $L_{Aeq,\ 1\ hour}$ traffic noise levels measured at Location 'A' and Location 'B' are shown below in Table 3 and Table 4.

**Table 3 Measured $L_{Aeq,\ 1\ hour}$ Road Traffic Sound Pressure Levels – Location 'A'**

| Time | $L_{Aeq,\ 1\ hour}$ Road Traffic Noise (dBA) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weds 07/06 | Thurs 08/06 | Fri 09/06 | Mon 12/06 | Tue 13/06 | Weds 14/06 | Thurs 15/06 | Fri 16/06 |
| 7 – 8 am | 48 | 47 | 49 | 45 | 49 | 49 | 50 | 50 |
| 8 – 9 am | 50 | 50 | 50 | 49 | 51 | 51 | 50 | 52 |
| 9 – 10 am | 52 | 50 | 49 | 50 | 47 | 50 | 51 | 52 |
| 10 – 11 am | 50 | 54 | 53 | 50 | 54 | 53 | 54 | 54 |
| 11 – 12 pm | 53 | 55 | 51 | 51 | 50 | 51 | 50 | 52 |
| 12 – 1 pm | 52 | 53 | 52 | 50 | 53 | 51 | 49 | 53 |
| 1 – 2 pm | 53 | 52 | 50 | 52 | 49 | 50 | 49 | 48 |
| 2 – 3 pm | 51 | 52 | 51 | 48 | 50 | 50 | 49 | 53 |
| 3 – 4 pm | 48 | 52 | 50 | 51 | 49 | 51 | 52 | 51 |
| 4 – 5 pm | 51 | 52 | 74 | 50 | 51 | 54 | 53 | 50 |
| 5 – 6 pm | 51 | 48 | 53 | 53 | 54 | 48 | 50 | 54 |

**Table 4 Measured $L_{Aeq,\ 1\ hour}$ Road Traffic Sound Pressure Levels – Location 'B'**

| Time | $L_{Aeq,\ 1\ hour}$ Road Traffic Noise (dBA) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Weds 07/06 | Thurs 08/06 | Fri 09/06 | Mon 12/06 | Tue 13/06 | Weds 14/06 | Thurs 15/06 | Fri 16/06 |
| 7 – 8 am | 48 | 50 | 50 | 44 | 52 | 50 | 53 | 51 |
| 8 – 9 am | 51 | 51 | 50 | 48 | 51 | 52 | 51 | 52 |
| 9 – 10 am | 51 | 51 | 50 | 49 | 49 | 49 | 51 | 52 |
| 10 – 11 am | 50 | 52 | 54 | 50 | 54 | 54 | 54 | 54 |
| 11 – 12 pm | 54 | 55 | 53 | 51 | 52 | 53 | 51 | 52 |
| 12 – 1 pm | 53 | 54 | 53 | 50 | 54 | 52 | 51 | 53 |
| 1 – 2 pm | 54 | 54 | 53 | 52 | 52 | 52 | 51 | 48 |
| 2 – 3 pm | 51 | 53 | 54 | 50 | 52 | 54 | 50 | 54 |
| 3 – 4 pm | 49 | 52 | 52 | 52 | 51 | 53 | 53 | 51 |
| 4 – 5 pm | 52 | 52 | 70 | 49 | 51 | 56 | 54 | 50 |
| 5 – 6 pm | 52 | 49 | 54 | 53 | 55 | 49 | 51 | 55 |

Based on the long-term measurements at Location 'A', and the calculation method show in Appendix B, Section B3 of the NSW Road Noise Policy for the 'overall $L_{Aeq,\ (1\ hour)}$', the calculated day time traffic noise level is 53 dBA at Location 'A' and 54 dBA at Location 'B'. These levels are used in the calculation of traffic noise intrusion for the existing site within Section 7.0 of this report.

## 5.0 ACOUSTIC CRITERIA

This Section presents the noise guidelines applicable to this proposal and establishes the project noise trigger levels.

### 5.1 Parramatta Development Control Plan 2011

Parramatta City Council in its Parramatta Development Control Plan (DCP) 2011 – Part 5.2, Child Care Centres, Subsection 5.2.3.5 outlines objectives and development controls specific for child care centres for visual and acoustic privacy.

***5.2.3.5 Acoustic and Visual Privacy***

***Design Principles and Controls***

***Acoustic privacy***

*The design of the child care centre should aim to locate sleep rooms and play areas away from external noise sources.*

*Centres must be designed in a manner that minimises noise transmission to neighbouring residential premises. The following design and operational matters are to be adopted for the management of noise generated by the centre:*

- *Where feasible, designs should be based on a 'U' shaped or 'L' shaped layout for the buildings, with external activity areas positioned such that the building structures act as a noise barrier (refer to Figures A10.2 and A10.3 in Appendix A10). If one of these layouts is not adopted, the applicant must provide a valid justification to Council as to why an alternative approach is more suitable or necessary.*
- *Orienting the building and outdoor play spaces having regard to impacts on neighbours (for example, locating play areas away from neighbouring bedrooms).*
- *Maximising the separation between the active outdoor play area (as opposed to passive activities such as sand pits, painting, storytelling etc) and the façade of any neighbouring premises.*
- *Ensuring openable windows at the child care centre and external play areas do not have a direct line of sight to neighbouring sensitive uses.*
- *Locate pedestrian access ways and ramps away from neighbouring sensitive premises where practicable.*
- *Adopt low noise features such as self closing gates with soft closure (ie low noise) hinges, selection of low noise air conditioning equipment, minimising the use of speed humps and ensuring car park surfaces and access ways are smooth.*

*The applicant should note that use of acoustic controls and management measures will not be accepted in cases where the design has not adequately addressed the above objectives.*

### *Acceptable Acoustic Management Measures*

*Where optimal design and layout of the child care centre results in noise levels that do not comply with the acoustic criteria specified in Table A10.1 in Appendix A10, acoustic management measures must also be incorporated in the design. The preferred approach to acoustic management is through provision of physical measures such as barriers, enclosures, changes to glazing and provision of air conditioning. Management measures that must be implemented and monitored by staff and parents are not considered appropriate for a well designed child care centre.*

*Acceptable acoustic mitigation solutions include, but are not necessarily restricted to, the following:*

- *Erection of noise barriers, which may include fencing types and other barriers that minimize noise transmission, to a maximum height of 2 m for a flat site. Noise barriers in excess of 2 m in height will be considered for sloping sites (eg where a barrier is positioned on a retaining wall due to changes in levels). Figure A10.4 in Appendix A10 presents examples of situations where barrier heights in excess of 2 m are acceptable. The at the base. The use of composite barrier constructions utilising clear barrier panels should be considered where there is potential for the barrier to restrict the vision of vehicles entering and/or leaving the premises.*
- *The majority of internal surfaces are to utilise absorptive materials as opposed to reflective to reduce the potential for reverberant fields to increase noise emissions and reduce speech intelligibility.*
- *Provision of mechanical ventilation and fixed windows (at the child care centre or adjacent receptors) where windows and doors must remain closed to achieve the appropriate noise criteria.*

*The following approaches are not considered appropriate for management of noise emissions from child care centre activities:*

- *Restricting the number of children utilising external play areas at any one time.*
- *Restricting the time periods and/or times of day that children are allowed to use external play areas.*
- *Staging of outdoor activities to reduce the number of children playing outdoors at any one time.*

*All child care centre development applications are to be supported by an acoustic assessment report. The acoustic assessment must be completed by an appropriately qualified and experienced person or organisation The assessment is to address the following:*

- *Noise and acoustics matters included in Quality Area 3 - 'Physical Environment' of the National Quality Standard in association with the Regulation.*
- *Identification of sensitive noise receivers to be potentially impacted.*

- *Quantification of the existing acoustic environment at the receiver locations. Measurement techniques and assessment period should be fully justified and in accordance with relevant Australian Standards and NSW Office of Environment and Heritage requirements. The following specific requirements are to be followed as a minimum:*

  *- Type 1 or Type 2 noise instrumentation in current NATA or manufacturers calibration, field calibrated before and after the measurements.*

  *- Monitoring of LAeq, LAmax, LA1, LA10, LA50 and LA90 noise levels continuously, with results presented as 15 minute averages.*

  *- Details of the prevailing meteorological conditions during the monitoring. Monitoring data for periods with wind speeds at ground level in excess of 5 m/s or when more than 1 mm of rain per hour must be deleted from the monitoring dataset to prevent a weather related bias.*

  *- Details of the noise monitoring positions, including microphone height (1.5 m above ground level is the preferred height to represent receiver noise levels), whether a wind shield was fitted, potential effects of reflecting surfaces, trees or structures, confirmation of either a free-field or façade monitoring position (including distance from the building façade), whether the monitoring position was located on hard or soft ground and information about the most significant noise sources at the measurement position.*

  *- Confirmation that the noise monitoring was completed during representative conditions and that no unusual circumstances or activities are likely to have affected the noise monitoring results.*

  *- A five (5) day measuring period is required in order to cover proposed operating hours for weekdays. If Saturday operations are proposed, monitoring data must also be collected for a representative Saturday.*

  *- The acoustic report is to present in full, the results of the noise monitoring for each position along with a summary of these data for the proposed operating hours of the child care centre. The summary must present the data as hourly average noise levels for each of the noise indices and statistical parameters measured.*

- *Identification of all noise that is likely to emanate from the child care centre and the subsequent prediction of resultant noise at the identified sensitive receiver locations from the operation of the premises. The predictions are to be completed in accordance with the recommendations of the NSW Office of Environment and Heritage and specifically address the following:*

  *- Provide predicted noise levels at all receptors on adjacent properties of noise levels from all relevant activities at the child care centre.*

*- Consider the influence of topography, relative heights and actual floor levels for the activities for the activities at the child care centre.*

*- All predictions must represent the receiver position. This should be taken as 1.5 m above floor level for noise impacts at centre and neighbouring receptors.*

*- The noise modelling of external play areas must assume that all external play areas could be utilised simultaneously.*

*- This source noise level must be adopted for each area and room where children's activities can occur, and the modelling must assume that noise can be emitted from each play area or room simultaneously.*

*- The acoustic report is to provide details of all modelling assumptions including source noise data, modelled noise positions, receiver heights and locations, confirmation of the methodology adopted along with a copy of the model input and output data.*

*- Details of any acoustic control measures that will be incorporated into the proposal.*

*- Proposed fencing height, materials and acoustic performance of barriers where barrier structures are to be used to ameliorate noise impacts.*

*- A statement from a certified acoustic consultant certifying that the development is capable of operating without causing a nuisance and able to operate without undue noise disturbance from external noise sources.*

## 5.2 NSW Department of Planning, Industry and Environment

### *5.2.1 State Environmental Planning Policy (Transport and Infrastructure) 2021*

The NSW Department of Planning, Industry and Environment (DoPIE) published the State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021 on 1 March 2022. The SEPP (Transport and Infrastructure) 2021 consolidates the previous SEPP (Educational Establishments and Child Care Facilities) 2017, along with other related SEPPs.

Chapter 3 of the SEPP, 'Educational establishments and child care facilities', aims to establish consistent State-wide assessment requirements and design considerations for educational establishments and early education and care facilities to improve the quality of infrastructure delivered and to minimise impacts on surrounding areas. Section 3.27 of Chapter 3 of the SEPP states the following with regard to Local Council Development Control Plans that contain specific requirements, standards or controls related to Child Care Centres:

> *'3.27: Centre-based child care facility—development control plans*
>
> *(1) A provision of a development control plan that specifies a requirement, standard or control in relation to any of the following matters (including by reference to ages, age ratios, groupings, numbers or the like, of children) does not apply to development for the purpose of a centre-based child care facility—*
>
> *(a) operational or management plans or arrangements (including hours of operation),*
>
> *(b) demonstrated need or demand for child care services,*
>
> *(c) proximity of facility to other early childhood education and care facilities,*
>
> *(d) any matter relating to development for the purpose of a centre-based child care facility contained in:*
>
> *(i) the design principles set out in Part 2 of the Child Care Planning Guideline, or*
>
> *(ii) the matters for consideration set out in Part 3 or the regulatory requirements set out in Part 4 of that Guideline (other than those concerning building height, side and rear setbacks or car parking rates).*
>
> *(2) This section applies regardless of when the development control plan was made."*

### *5.2.2 NSW DoPIE – Child Care Planning Guideline*

The NSW DoPE published the Child Care Planning Guideline (CCPG) in August 2017 as a supplement to the SEPP (Educational Establishments and Child Care Facilities) 2017. The CCPG was then updated in September 2021.

The SEPP states that "*a consent authority must take into consideration this Guideline* (CCPG) *when assessing a development application (DA) for a centre-based child care facility.*" The SEPP also determines the Guideline "*will take precedence over a Development Control Plan (DCP), with some exceptions, where the two overlap in relation to a child care facility."*

The Guideline was introduced to *'assist industry to deliver early childhood education facilities that are of the highest standards'* and *'to align NSW planning controls with the National Quality Framework for early education and care, creating more certainty for developers and operators seeking service approval'.*

Section 3, *Matters for Consideration*, Subsection 3.5 Visual and acoustic Privacy, contains the following for consideration:

***Objective: To minimise the impact of child care facilities on the acoustic privacy of neighbouring residential developments.***

***C22***

*A new development, or development that includes alterations to more than 50 percent of the existing floor area, and is located adjacent to residential accommodation should:*

- *provide an acoustic fence along any boundary where the adjoining property contains a residential use. An acoustic fence is one that is a solid, gap free fence*
- *ensure that mechanical plant or equipment is screened by solid, gap free material and constructed to reduce noise levels e.g. acoustic fence, building or enclosure.*

***C23***

*A suitably qualified acoustic professional should prepare an acoustic report which will cover the following matters:*

- *Identify an appropriate noise level for a child care facility located in residential and other zones*
- *Determine an appropriate background noise level for outdoor play area during times they are proposed to be in use*
- *Determine the appropriate height of any acoustic fence to enable the noise criteria to be met.*

Subsection 3.6 Noise and air pollution, contains the following for consideration:

***'Considerations***

***Objective: To ensure that outside levels on the facility are minimized to acceptable levels.***

***C24***

*Adopt design solutions to minimise the impacts of noise, such as:*

- *creating physical separation between buildings and the noise source*
- *orienting the facility perpendicular to the noise source and where possible buffered by other uses*
- *using landscaping to reduce the perception of noise*
- *limiting the number and size of openings facing noise sources*
- *using double or acoustic glazing, acoustic louvres or enclosed balconies (wintergardens)*
- *using materials with mass and/or sound insulation or absorption properties, such as solid balcony balustrades, external screens and soffits*
- *locating cot rooms, sleeping areas and play areas away from external noise sources.'*

***C25***

*An acoustic report should identify appropriate noise levels for sleeping areas and other non play areas and examine impacts and noise attenuation measures where a child care facility is proposed in any of the following locations:*

- *on industrial zoned land*
- *where the ANEF contour is between 20 and 25, consistent with AS2021:2000*
- *along a railway or mass transit corridor, as defined by State Environmental Planning Policy (Infrastructure) 2007*
- *on a major road or busy road*
- *other land that is impacted by substantial external noise.*

## 5.3 AAAC – Guideline for Child Care Centres Acoustic Assessment

The Association of Australasian Acoustical Consultants (AAAC) published the *Guideline for Child Care Centre Acoustic Assessment* (Guideline), in September 2020 to assist both AAAC members and local Councils to assess the noise impact from proposed child care centres both accurately and fairly (see www.aaac.org.au).

Section 3 of the AAAC Guideline states the following in relation to noise generation from child care centres, while Section 5.0 states the following in relation to noise impact on children:

***'3.2 Criteria - Residential Receptors***

***3.2.1 Outdoor Play Area***

*The noise impact from children at play in a child care 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 child care centres have considerable social and community benefit.*

***Base Criteria*** *– With the development of child care 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 (ie 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* $L_{eq,15min}$ *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* $L_{eq,\ 15min}$ *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.*

### *3.2.2 Indoor Play Area, Mechanical Plant, Pick up and Drop off*

*The cumulative $L_{eq,\ 15\ minute}$ noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:*

- *Indoor play;*
- *Mechanical plant;*
- *Drop off and pick up;*
- *Other activities/operations (not including outdoor play).*

### *3.2.3 Sleep Disturbance*

*The noise impact of staff arrivals, setup, cleaning or other on-site activities prior to 7 am or during night-time hours should be assessed at nearby residential premises. The $L_{Amax}$ noise level emitted from vehicles arriving and parking, depending on the requirements of the state or territory where the centre is located shall not exceed the background noise level by more than 15 dB outside the nearest habitable room window.*

Section 5 of the AAAC Guideline states the following in relation to external noise impacts on children within Child Care Centres:

### *'5.0 External Noise Impact on Children*

*For proposals that are located within 60 metres of an arterial road, railway line, industry or within close proximity to an airport, a noise intrusion assessment should be submitted with the development application.*

### *5.1 Road, Rail Traffic and Industry*

*The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).*

*The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (ie with doors and/or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas.'*

## 5.4 NSW Environment Protection Authority – NSW Road Noise Policy

The NSW Road Noise Policy (RNP), in Section 2.3.1, sets out road traffic noise assessment criteria for residential land uses in Table 3. The information in that table is extracted below in Table 5.

**Table 5 Road Traffic Noise Assessment Criterion - Residential**

| Road Category | Type of project/land use | Assessment Criteria – dB(A) Day (7 am – 10 pm) |
|---|---|---|
| Local roads | 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments | $L_{Aeq,\ (1\ hour)}$ 55 (external) |

## 5.5 Project Noise Trigger Levels

Based on the measured background noise levels and the relevant planning instruments and legislation, the Project Noise Trigger Levels at each receptor location are as follows:

#### *5.5.1.1 Residential Receptors*

*For ground floor Residential Receptors 'R1', 'R2a', 'R2c', 'R3', 'R4a' and 'R4c' – based on the measured background noise levels at Location 'A':*

- (40 + 5 =) **45 dBA** $L_{eq,\ 15\ minute}$ for outdoor play all day; **or**
- (40 + 10 =) **50 dBA** $L_{eq,\ 15\ minute}$ for outdoor play of up to 4 hours (total) per day;
- (40 + 5 =) **45 dBA** $L_{eq,\ 15\ minute}$ for all other noise sources including car park, mechanical plant and indoor play areas.

*For first floor Residential Receptors 'R2b' and 'R4b' – based on the measured background noise levels at Location 'B':*

- (43 + 5 =) **48 dBA** $L_{eq,\ 15\ minute}$ for outdoor play all day; **or**
- (43 + 10 =) **53 dBA** $L_{eq,\ 15\ minute}$ for outdoor play of up to 4 hours (total) per day;
- (43 + 5 =) **48 dBA** $L_{eq,\ 15\ minute}$ for all other noise sources including car park, mechanical plant and indoor play areas.

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.

### *5.5.2 Sleep Disturbance*

Consideration has been given to sleep disturbance caused by noise generated from staff arriving prior to 7 am, and parking within the lower-ground floor level car park.

The following criteria is applied at the residential receptors closest to the entry to the car park, 'R2c' and 'R4a', during the early morning period of 6.30 am to 7 am. Compliance at the most affected receptors will ensure compliance at all other potentially affected receptor locations:

*For residential facades 'R2c' and 'R4a'– based on the measured background noise levels at Location 'B':*

- (47 + 15 =) **62 dBA** $L_{Amax}$ at the closest affected habitable room window of the residential premises between 6.30 am and 7 am.

### *5.5.3 On-Road Traffic Noise Criterion*

The following criterion will be applied at 1 metre from the most affected residential façades 'R2c', 'R3' and 'R4a', for on – road traffic noise. Compliance at the most affected receptors will ensure compliance at all other potentially affected receptor locations further away from Mary Street:

- **55 dBA** (external) $L_{Aeq,\ 1\ hour}$ between 7 am and 6 pm.

### *5.5.4 Noise Intrusion Criteria*

*Road Traffic Noise Intrusion - in accordance with the AAAC Guideline:*

- Internal traffic levels within sleeping areas (Cot Rooms) of the Centre should not exceed $L_{Aeq,\ 1\ hour}$ 35 dBA during operating hours.
- Internal traffic noise levels within indoor activity areas of the Centre should not exceed $L_{Aeq,\ 1\ hour}$ 40 dBA during operating hours.
- External traffic noise levels in any outdoor play or activity area of the Centre should not exceed $L_{Aeq,\ 1\ hour}$ 55 dBA during operating hours.

## 6.0 CHILD CARE CENTRE NOISE EMISSION

The main sources of noise from the Centre will be as follows:

- Children playing both outside and inside;
- Cars entering and exiting the car park; and
- Mechanical plant serving the Centre.

Noise modelling is based on the architectural drawings prepared by Janssen Designs attached as Appendix C.

### 6.1 Indoor and Outdoor Play Areas

The AAAC has presented a range of A-weighted sound power levels per child in Table 1 of its *'Guideline for Child Care Centre Acoustic Assessment'.* The sound power levels of each group are presented in Table 6 and have been adopted to assess noise emissions from children in this assessment.

The sound power levels for each group are presented in Table 6 and used in this assessment.

**Table 6 $L_{eq}$ Sound Power Levels - Children Engaging in Active Play**

| Number and Age of Children | Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **dBA** | **63** | **125** | **250** | **500** | **1k** | **2k** | **4k** | **8k** |
| 10 children, 0 to 2 years | **78** | 54 | 60 | 66 | 72 | 74 | 71 | 67 | 64 |
| 10 children, 2 to 3 years | **85** | 61 | 67 | 73 | 79 | 81 | 78 | 74 | 70 |
| 10 children, 3 to 5 years | **87** | 64 | 70 | 75 | 81 | 83 | 80 | 76 | 72 |

In the notes to Table 1 of the AAAC's *Guideline*, where passive/quiet activities are engaged in by children, the noise generated by children is generally 6 dB lower than active play.

## 6.2 Car Park Noise Emission

Based on the RTA's 'Guide to Traffic Generating Developments' prediction of 0.8 peak (morning 7 am-9 am) vehicle trips per child for Child Care Centres (Long-day care), we have assumed, as a worst-case scenario, a flow of cars equivalent to 72 trips in 1 hour arriving or leaving the Centre in the morning peak. This is equivalent to 18 vehicle trips in a 15-minute period.

For the assessment of sleep disturbance and staff arriving during the early morning shoulder period, we have assessed the maximum noise impact of staff arriving and parking in the lower-ground floor level car park.

For the assessment of vehicular activity associated with the car park area, we have assumed vehicles will travel at a speed of 10 km/h on the site. For noise generated by on-road traffic, we have assumed vehicles will travel at a speed of 50 km/h as they approach or leave the site.

The Sound Exposure Level[1] (SEL) and $L_{AF,\,max}$ sound power level and spectra of vehicle noise is shown below in Table 7 and is based on previous measurements by Day Design.

**Table 7 SEL & $L_{Amax}$ Sound Power Levels – Car Park Noise**

| Description | Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **dBA** | **63** | **125** | **250** | **500** | **1k** | **2k** | **4k** | **8k** |
| SEL of car drive by at approximately 10 km/h | **88** | 92 | 88 | 84 | 83 | 84 | 79 | 76 | 70 |
| SEL of car drive-by at approximately 50 km/h | **97** | 99 | 97 | 94 | 93 | 95 | 87 | 77 | 70 |
| SEL of car door slam, ignition and drive away | **91** | 104 | 98 | 89 | 87 | 86 | 83 | 81 | 75 |
| $L_{Amax}$ of car entering car park | **92** | 98 | 92 | 90 | 88 | 88 | 83 | 80 | 76 |

[1] *SEL is the total sound energy of a single noise event condensed into a one second duration.*

## 6.3 Mechanical Plant

The mechanical plant, including air conditioning condensers, kitchen and bathroom exhaust fans and lift motor have not been selected at this stage. Therefore, a preliminary noise assessment will be based on typical units for the size of the development, with sound power levels from typical units being used.

The air conditioning condensers are assumed to be located in the lower-ground floor service room. The lift motor for the development is assumed to be located within a pit at the bottom of the proposed lift shaft. We have assumed that the kitchen and toilet exhaust fans will be ducted through the façades of the development.

The assumed locations of these items of mechanical plant can be seen within the marked up architectural drawings attached as Appendix D.

Sound power levels used in the calculation of the noise contribution from the mechanical plant are shown in Table 8.

**Table 8 $L_{eq,\ 15\ minute}$ Sound Power Levels – Mechanical Plant**

| Description | Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **dBA** | **63** | **125** | **250** | **500** | **1k** | **2k** | **4k** | **8k** |
| Small kitchen exhaust fan[2] | **60** | 61 | 67 | 62 | 54 | 54 | 50 | 45 | 39 |
| Small exhaust fan (toilet)[3] | **60** | 51 | 47 | 50 | 53 | 59 | 43 | 36 | 31 |
| Hydraulic lift motor[4] | **63** | 59 | 61 | 55 | 59 | 58 | 56 | 52 | 48 |
| Medium (double fan) outdoor condenser unit[5] | **69** | 55 | 55 | 61 | 67 | 64 | 62 | 59 | 45 |

We recommend a detailed analysis be carried out once the mechanical plant is selected and locations are finalised, prior to the issue of a Construction Certificate.

[2] *Spectral sound power level based on Fantech CPD01254FSC.*
[3] *Spectral sound power level based on Fantech TD-500/150 SIL.*
[4] *Spectral sound power level based on a residential lift system previously measured by Day Design.*
[5] *Spectral sound power level based on Daikin RZQ140LV1 outdoor condenser unit.*

## 6.4 Predicted Noise Levels

Knowing the sound power level of a noise source (See Table 6 to Table 8), the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, sound barriers, etc.

Where applicable, calculations include reductions for the acoustic screening provided by fences and the proposed Centre itself. Based upon the architectural drawings attached as Appendix C, the following solid boundary heights are assumed for the Centre:

- 1.8-metre-high fence along the northern, eastern and western boundaries of the Site; and
- 1.39-metre-high fence around the perimeter of the first-floor outdoor play area.

Noise emission calculations also include reductions provided by the following time period correction, where relevant:

- Time period correction of (*10 x log [1/900] =* ) – 29.5 dB for SEL noise levels associated with the use of car parks in a 15 minute period - $L_{eq,\ 15\ minute}$ calculations only; and
- Time period correction of (*10 x log [1/3600] =* ) – 35.6 dB for SEL noise levels associated with the use of car parks in a 1 hour period - $L_{eq,\ 1\ hour}$ calculations only.

Calculations of noise emission from the indoor play area include reductions for operable glazing in the façade. For the purposes of our calculations, we have assumed all operable glazing to be of a standard construction (5 mm glass) and to be open (50% of the window area).

Based upon a review of World Health Organization (WHO) data for average children heights, the notes to Table 1 of the *AAAC's Guideline* recommends a source height of 1.0 metre above ground level for all children.

As a worst-case scenario, noise emission has been modelled with all children engaged in simultaneous outdoor play, as discussed in Section 6.4.1.

Noise levels are calculated to all receptor locations outlined in Table 1.

Table 9 and Table 10 show the predicted noise levels at the residential receptors from the activities discussed previously, during the day periods.

### *6.4.1 Outdoor Play Area Noise Levels*

The following formula, which is well known to acoustic professionals, was used to calculate noise levels at the receptor locations:

$$L_p = L_w + 10\log(n/10) - 20\log(d) - 8 - B$$

Where: $L_p$ = Sound Pressure Level at receptor

$L_w$ = Sound Power Level for group of 10 children

n = number of children

d = distance from children playing to receptor

B = acoustic reduction due to barrier

The noise prediction was therefore determined by spacing the 90 children across the Centre's outdoor play areas as follows:

- Ground Floor Outdoor Play Area = 2 groups of 10 x 0-2 year olds and 4 groups of 5 x 2-3 year olds and 4 groups of 5 x 3-5 year olds.
- First Floor Outdoor Play Area = 3 groups of 10 x 3-5 year olds.

The approximate locations of the noise sources (children) used for the assessment of the outdoor play area are shown in the attached Appendix D. All noise sources in each outdoor play area shown in Appendix D are assessed as being outside at the same time to achieve the overall worst case predicted noise levels at each of the receiver locations.

The $L_{eq,\ 15\ minute}$ noise levels at all receptor locations for children engaged in outdoor play are calculated to be as shown in Table 9.

**Table 9 Predicted $L_{eq,\ 15\ minute}$ Noise Levels – Outdoor Play**

| Receptor Location – Ground Floor (GF), First Floor (FF) | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R1a – 189 Windsor Road (GF) | 50 | 45 | **No (+5 dB)** |
| R2a – 7 Mary Street (GF) | 52 | 45 | **No (+7 dB)** |
| R2b – 7 Mary Street (FF) | 44 | 48 | Yes |
| R2c – 7 Mary Street (GF) | 35 | 45 | Yes |
| R3 – 8 Mary Street (GF) | 30 | 45 | Yes |
| R4a – 3A Mary Street (GF) | 35 | 45 | Yes |
| R4b – 3A Mary Street (FF) | 38 | 48 | Yes |
| R4c – 3A Mary Street (GF) | 53 | 45 | **No (+8 dB)** |

As summarised in Table 9, the predicted levels of noise at the nearby receptors will comply with the criteria established in Section 5.5 of this report for receptor locations 'R2b', 'R2c', 'R3', 'R4a' and 'R4b', but will exceed the criteria at receptor locations 'R1a', 'R2a' and 'R4c'. As such, noise controls will be required, as recommended in Section 8.0.

### *6.4.2 Cumulative Noise Level - Indoor Play Area, Car Park and Mechanical Plant*

The predicted worst case cumulative $L_{eq,\ 15minute}$ noise levels at all receptor locations are calculated to be as shown in Table 10.

**Table 10 Predicted Cumulative $L_{eq,\ 15\ minute}$ Noise Levels – Indoor Play, Mechanical Plant & Car Park**

| Receptor Location and Description | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R1a – 189 Windsor Road (GF) | | | |
| - Indoor play areas | 42 | | |
| - Car park | 32 | | |
| - Mechanical | <20 | | |
| Cumulative Noise Level | 42 | 45 | Yes |
| R2a – 7 Mary Street (GF) | | | |
| - Indoor play areas | 47 | | |
| - Car park | 35 | | |
| - Mechanical | 24 | | |
| Cumulative Noise Level | 47 | 45 | **No (+2 dB)** |
| R2b – 7 Mary Street (FF) | | | |
| - Indoor play areas | 43 | | |
| - Car park | 38 | | |
| - Mechanical | <20 | | |
| Cumulative Noise Level | 44 | 48 | Yes |
| R2c – 7 Mary Street (GF) | | | |
| - Indoor play areas | 35 | | |
| - Car park | 43 | | |
| - Mechanical | <20 | | |
| Cumulative Noise Level | 44 | 45 | Yes |
| R3 – 8 Mary Street (GF) | | | |
| - Indoor play areas | 23 | | |
| - Car park | 36 | | |
| - Mechanical | <20 | | |
| Cumulative Noise Level | 36 | 45 | Yes |

**Table 10 Predicted Cumulative $L_{eq,\ 15\ minute}$ Noise Levels – Indoor Play, Mechanical Plant & Car Park - Continued**

| Receptor Location and Description | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R4a – 3A Mary Street (GF) | | | |
| - Indoor play area | 28 | | |
| - Car park | 43 | | |
| - Mechanical | 20 | | |
| Cumulative Noise Level | 43 | 45 | Yes |
| R4b – 3A Mary Street (FF) | | | |
| - Indoor play areas | 30 | | |
| - Car park | 45 | | |
| - Mechanical | 28 | | |
| Cumulative Noise Level | 45 | 48 | Yes |
| R4c – 3A Mary Street (GF) | | | |
| - Indoor play areas | 45 | | |
| - Car park | 34 | | |
| - Mechanical | 22 | | |
| Cumulative Noise Level | 45 | 45 | Yes |

As summarised in Table 10, the predicted levels of noise at the nearby receptors will comply with the criteria established in Section 5.5 of this report for the majority of receptor locations, with the exception of 'R2a'. As such, noise controls will be required, as recommended in Section 8.0.

### *6.4.3 Sleep Disturbance*

It is proposed that the Centre will accept children from 7 am. Four staff members are assumed to arrive prior to 7 am, to prepare for the arrival of the children, with more staff and parents arriving after 7 am. In order to assess the potential for sleep disturbance from staff vehicle activity, we have assumed that four staff vehicles will arrive between 6.30 am and 7 am.

As shown in the architectural drawings, the staff parking spaces are located on the northern and eastern sides of the car park. As such, we have assumed that the staff vehicles will park in the closest staff spaces to the lift, shown as spaces CS21 to CS24.

The calculated $L_{AFmax}$ noise levels at the nearest affected residential receptor locations to the car park are shown in Table 11 below.

**Table 11 Predicted $L_{AF,\,max}$ Noise Levels – Sleep Disturbance**

| Receptor Location and Description | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R2c – 7 Mary Street (GF) | | | |
| - Car Pulling into Driveway | 58 | 62 | Yes |
| R3 – 8 Mary Street (GF) | | | |
| - Car Pulling into Driveway | 51 | 62 | Yes |
| R4a – 3A Mary Street (GF) | | | |
| - Car Pulling into Driveway | 58 | 62 | Yes |

### *6.4.4 On-Road Traffic*

The external $L_{eq,\,1\,hour}$ noise levels at the most affected residential receiver locations 'R1a' and 'R4' from noise associated with on–road traffic throughout the day are calculated to be as shown below in Table 12.

**Table 12 Predicted $L_{eq,\,1\,hour}$ Noise Levels – On – Road Traffic**

| Receiver Location | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R2c – 7 Mary Street (GF) | 45 | 55 | Yes |
| R3 – 8 Mary Street (GF) | 48 | 55 | Yes |
| R4a – 3A Mary Street (GF) | 46 | 55 | Yes |

The predicted external noise levels from on–road traffic are within the noise criteria in Section 5.0, and are therefore acceptable.

## 7.0 NOISE INTRUSION – ROAD TRAFFIC NOISE

### 7.1 External Road Traffic Noise Levels – Outdoor Play Areas

Based on the long-term measurements at Location 'A' and Location 'B', and the calculation method shown in Appendix B, Section B3 of the NSW Road Noise Policy for the 'overall $L_{Aeq, (1\ hour)}$', the calculated equivalent $L_{Aeq, 1\ hour\ (traffic)}$ level is shown below in Table 13.

**Table 13 Predicted $L_{eq, 1\ hour}$ Noise Levels – Noise within Outdoor Play Areas**

| Outdoor Location | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| Outdoor Play Area – Ground Floor | 47 | 55 | Yes |
| Outdoor Play Area – First Floor | 49 | 55 | Yes |

The calculated levels for the outdoor play area comply with the noise criteria in Section 5.5.4 and are therefore acceptable.

### 7.2 Road Traffic Noise Intrusion Assessment – Indoor Playrooms

The internal $L_{eq, 1\ hour}$ road traffic noise level within the proposed Cot Room and indoor play rooms has been calculated to be as shown in Table 14.

Calculations assume that standard construction has been used throughout and the recommended glazing thicknesses (as detailed in Section 6.4) has been used for windows and glazed doors. Results are shown in Table 14 for situations with the windows and doors open, and with windows and doors closed.

**Table 14 Calculated $L_{eq, 1\ hour}$ Road Traffic Noise Levels – Indoor Rooms**

| Receptor Location | Calculated Noise Level $L_{eq, 1\ hour}$ (dBA) | | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|---|
| ***Windows & Doors*** | **Open** | **Closed** | | |
| Cot Room 2 | 50 | 40 | 35 | **No/No** |
| Indoor Play Room 1 (0-2 Years) | 35 | 25 | 40 | Yes/Yes |
| Indoor Play Room 2 (2-3 Years) | 36 | 26 | 40 | Yes/Yes |
| Indoor Play Room 3 (3-5 Years) | 36 | 26 | 40 | Yes/Yes |
| Indoor Play Room 4 (3-5 Years) | 38 | 28 | 40 | Yes/Yes |

It can be seen that the calculated internal levels of road traffic noise within the indoor play rooms are below the noise criteria established in Section 5.5.4, and will therefore be acceptable. The internal levels of road traffic noise within Cot Room 2 will exceed the noise criteria established in Section 5.5.4 with the southern windows open or closed. As such, noise controls will be required, as recommended in Section 8.0.

# 8.0 NOISE CONTROL RECOMMENDATIONS

## 8.1 Management Plan

We recommend the Centre's management implement a Noise Management Plan that should include, but not be limited to, the following:

- Ensuring all staff and parents are provided with a copy of the Centre's Noise Management Plan and its implications for them during their time at the Centre.
- The name and contact details of the Centre's Manager should be clearly displayed at the front of the building to ensure neighbours can contact that person at any time the Centre is operating.
- Ensuring a sufficient number of educators are provided to supervise children's outside play to discourage unnecessarily loud activities.
- Carers/staff should be educated to control the level of their voice while outdoors.
- Facilitating children's small group play when outside, and encouraging educators to engage in children's play and facilitate friendships between children.
- Crying children should be comforted as quickly as possible and moved indoors.
- Staff arriving prior to 7 am and parking in the 'Staff' area should ensure they do not create unnecessary noise.
- Outdoor play should be limited to a maximum of 4 hours per day.

### *8.1.1 Indoor Activity Area Window/Door Closure*

- Windows in the southern façade of "Cot Room 2" should remain closed when the room is in use, to limit the level of traffic noise intrusion into the space. Windows for Cot Room 2 should be constructed from 6.38 mm laminated glass, with a minimum $R_w$ 31 rating.

As these windows are required to be closed, alternative ventilation may need to be provided. Rooms are to be ventilated to the standards set out in clause F4.5 of the Building Code of Australia and Australian Standard AS1688.2:1991. An air conditioning system with fresh air supply or SilenceAir vents (see www.silenceair.com), see Appendix F will satisfy this requirement.

## 8.2 Sound Barrier Fences

The proposed sound barrier walls specified within this report may be constructed from 3 rail 'solid capped and lapped' timber, 10 mm thick solid polycarbonate (not hollow), 6.38 mm thick laminated glass or masonry. The construction shall be free of visible air gaps to provide an impervious sound barrier.

If required, where an existing boundary fence is to be maintained (and is of sound construction), and to achieve the required vertical heights recommended in the following sections, a new upper portion of fence should be constructed on top of the existing fence. A transparent material such as 10 mm thick UV resistant solid polycarbonate (not hollow) may be used, cantilevered inwards at 45 degrees, as shown in Appendix E1. The construction shall be free of visible air gaps to provide an impervious sound barrier.

Alternatively, steel posts may be placed 0.5 to 1 metre stepped in from the existing fences and have 10 mm thick polycarbonate sheeting installed vertically on the outside of the steel posts and then angled inwards to the required vertical height. The vertical section is required to start a minimum of 0.5 or 1 metre (relative to distance from the boundary fence) below the maximum height of the existing fence line, as shown in Appendix E2.

We recommend the following barrier heights and locations:

- 2.1 metre high fence along the northern boundary of the GF OPA;
- 2.1 metre high fence along the eastern boundary of the GF OPA;
- 2.3 metre high fence along the western boundary of the GF OPA; and
- 1.39 metre high fence around the perimeter of the FF OPA.

## 8.3 Mechanical Plant & Equipment – Construction Certificate

The specifications for the mechanical plant have not yet been selected for this development. For typical mechanical plant and equipment with sound power levels not exceeding those listed in Table 8, it is reasonable and feasible to acoustically treat the associated plant area (absorptive lining, etc) or equipment itself so that noise will not impact the neighbouring properties.

Once mechanical plant has been selected, a detailed acoustic assessment should be made, prior to the issue of a Construction Certificate. We recommend that the mechanical services engineers select mechanical plant equipment with the lowest sound power levels to reduce the amount of acoustic treatment necessary to achieve the noise criteria at nearby residential receivers.

The cumulative noise emissions from the mechanical plant system, and use of the indoor play areas and car park is not to exceed the project noise trigger levels specified in Section 5.5.

We offer to provide detailed noise controls when specifications of the mechanical plant equipment have been finalised.

Rooms are to be ventilated to the standards set out in clause F4.5 of the Building Code of Australia and Australian Standards AS1668.2:1991.

## 8.4 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claims of expertise in other areas of building construction and therefore the recommended noise controls should be implemented into the building design in consultation with other specialists to ensure they meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. Therefore, the use of contractors that are experienced in acoustic construction is encouraged.

# 9.0 PREDICTED NOISE LEVELS – AFTER NOISE CONTROLS

## 9.1 Outdoor Play Areas

Once the noise control recommendations in Section 8.0 are incorporated into the operation of the Centre, the calculated sound pressure level at the nearby residential receptors from the outdoor play areas will be as shown in Table 15.

**Table 15 Predicted $L_{eq,\ 15\ minute}$ Noise Levels – After Noise Controls**

| Receptor Location | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R1a – 189 Windsor Road (GF) | 49 | 50 | Yes |
| R2a – 7 Mary Street (GF) | 50 | 50 | Yes |
| R2b – 7 Mary Street (FF) | 44 | 53 | Yes |
| R2c – 7 Mary Street (GF) | 35 | 50 | Yes |
| R3 – 8 Mary Street (GF) | 30 | 50 | Yes |
| R4a – 3A Mary Street (GF) | 35 | 50 | Yes |
| R4b – 3A Mary Street (FF) | 38 | 53 | Yes |
| R4c – 3A Mary Street (GF) | 50 | 50 | Yes |

## 9.2 Indoor Play Areas

Once the noise control recommendations in Section 8.0 are incorporated into the operation of the Centre, the calculated cumulative sound pressure level from indoor play, car park and mechanical plant at the nearby residential receptors will be as shown in Table 16.

**Table 16 Predicted Cumulative $L_{eq,\ 15\ minute}$ Noise Levels – Indoor Play, Mechanical Plant & Car Park – After Noise Controls**

| Receptor Location and Description | Predicted Noise Level (dBA) | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|
| R2a – 7 Mary Street (GF) | | | |
| - Indoor play areas | 45 | | |
| - Car park | 35 | | |
| - Mechanical | 24 | | |
| Cumulative Noise Level | 45 | 45 | Yes |

## 9.3 Traffic Noise Intrusion

Once the noise control recommendations in Section 8.0 are incorporated into the operation of the Centre, the calculated sound pressure level from road traffic inside Cot Room 2 will be as shown in Table 17.

**Table 17 Calculated $L_{eq,\ 1\ hour}$ Road Traffic Noise Levels – Indoor Rooms – After Noise Controls**

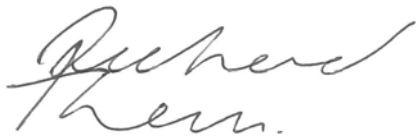
| Receptor Location | Calculated Noise Level $L_{eq,\ 1\ hour}$ (dBA) | | Noise Criterion (dBA) | Compliance (Yes/No) |
|---|---|---|---|---|
| ***Windows & Doors*** | **Open** | **Closed** | | |
| Cot Room 2 | 50 | 35 | 35 | **No**/Yes |

## 10.0 CONCLUSION

Day Design Pty Ltd was engaged by Janssen Designs on behalf of Kirribilli Capital Pty Ltd to assess the potential environmental noise impact from a proposed Child Care Centre to be constructed at 10 Mary Street, Northmead, NSW.

Calculations show that, provided the noise control recommendations made in Section 8.0 of this report are implemented, the intrusive noise levels will meet the noise level requirements of the NSW Department of Planning and Environment's *Child Care Planning Guideline* and the Association of Australasian Acoustical Consultants' *Guideline for Child Care Centres Acoustic Assessment*, and be considered acceptable.

Calculations also show that, provided the noise control recommendations made in Section 8.0 of this report are implemented, the level of noise emitted by the proposed Child Care Centre at 10 Mary Street, Northmead, NSW, will meet the acceptable noise level requirements of the Association of Australasian Acoustical Consultants' *Guideline for Child Care Centres Acoustic Assessmen*t and the Environmental Protection Authority's *NSW Road Noise Policy,* as detailed in Section 5.5 of this report, and is considered acceptable.



**Ricky Thom**, BA, BE(Mech)Hons, GradIEAust
Acoustical Engineer
for and on behalf of Day Design Pty Ltd

**AAAC MEMBERSHIP**

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

**APPENDICES**

**Appendix A** – Instrumentation
**Appendix B** – Ambient Noise Survey
**Appendix C** – Architectural Drawings
**Appendix D** – Approximate Nosie Source Locations and Noise Control Recommendations Mark-up
**Appendix E** – Sound Barrier Wall Construction
**AC108-1 to 4** – Glossary of Acoustical Terms

## NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis in this report were made with instrumentation as follows:

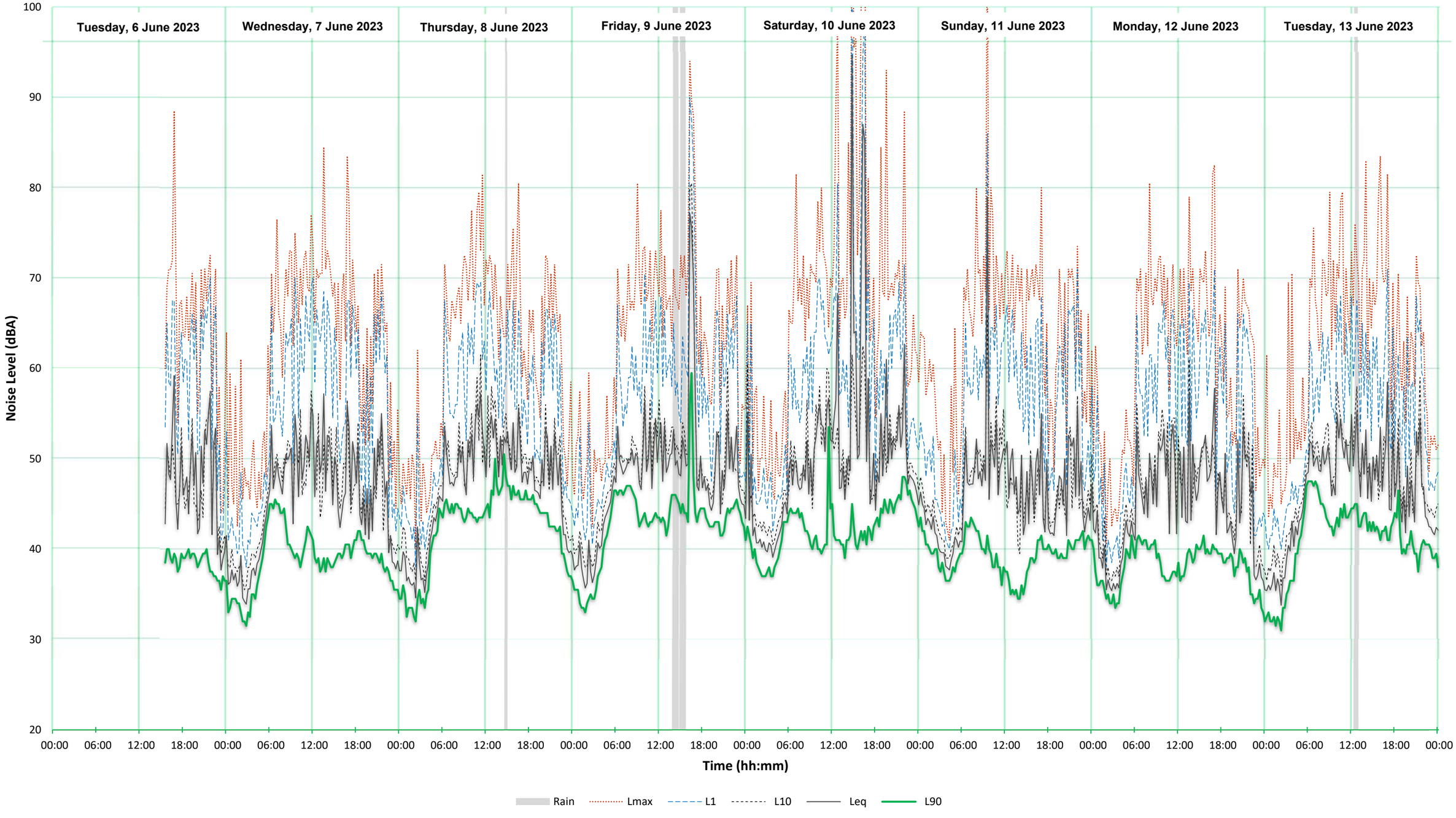
**Table A1 Noise Survey Instrumentation**

| Description | Model No | Serial No |
|---|---|---|
| Infobyte Noise Logger (Type 1)<br>Condenser Microphone 0.5" diameter | iM4<br>MK 250 | 115<br>3778 |
| Infobyte Noise Logger (Type 2)<br>Condenser Microphone 0.5" diameter | iM4<br>MK 250 | 124<br>124 |
| Acoustical Calibrator | B&K 4231 | 2095415 |

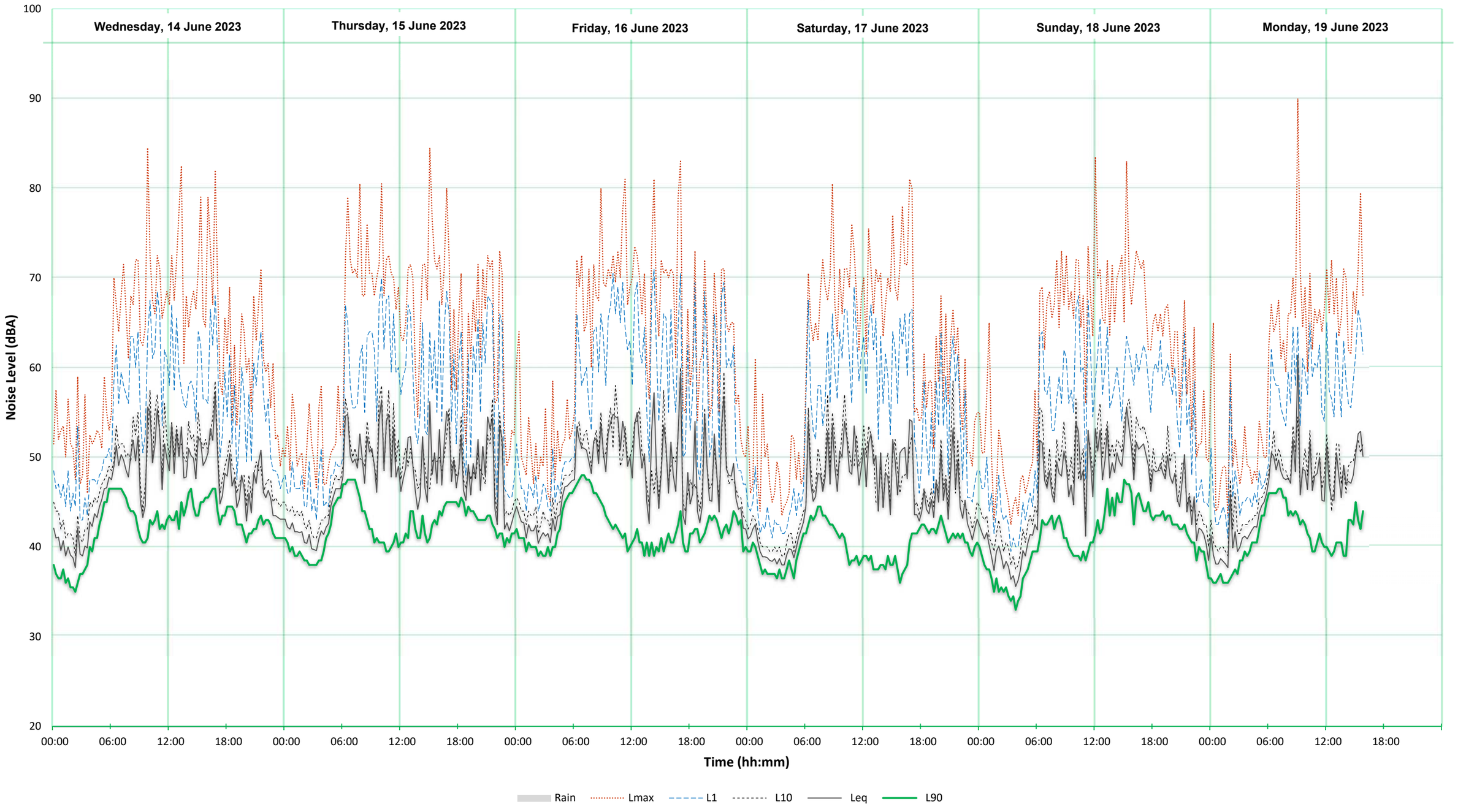
An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitors are Type 1 and Type 2 precision environmental noise monitors meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 1 dB during unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

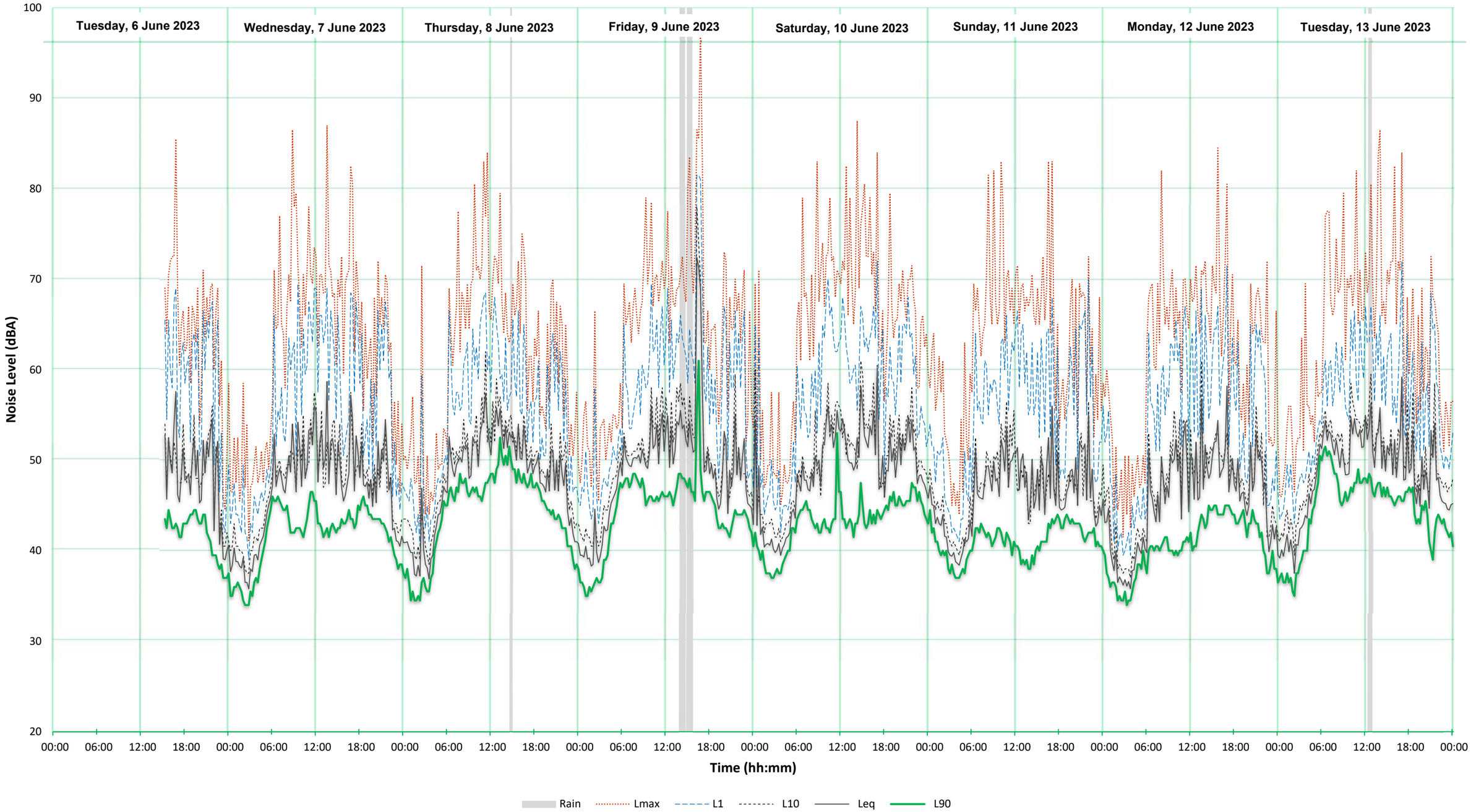
## Located at Rear Yard, Ground Floor, 5 Mary Street, Northmead, NSW



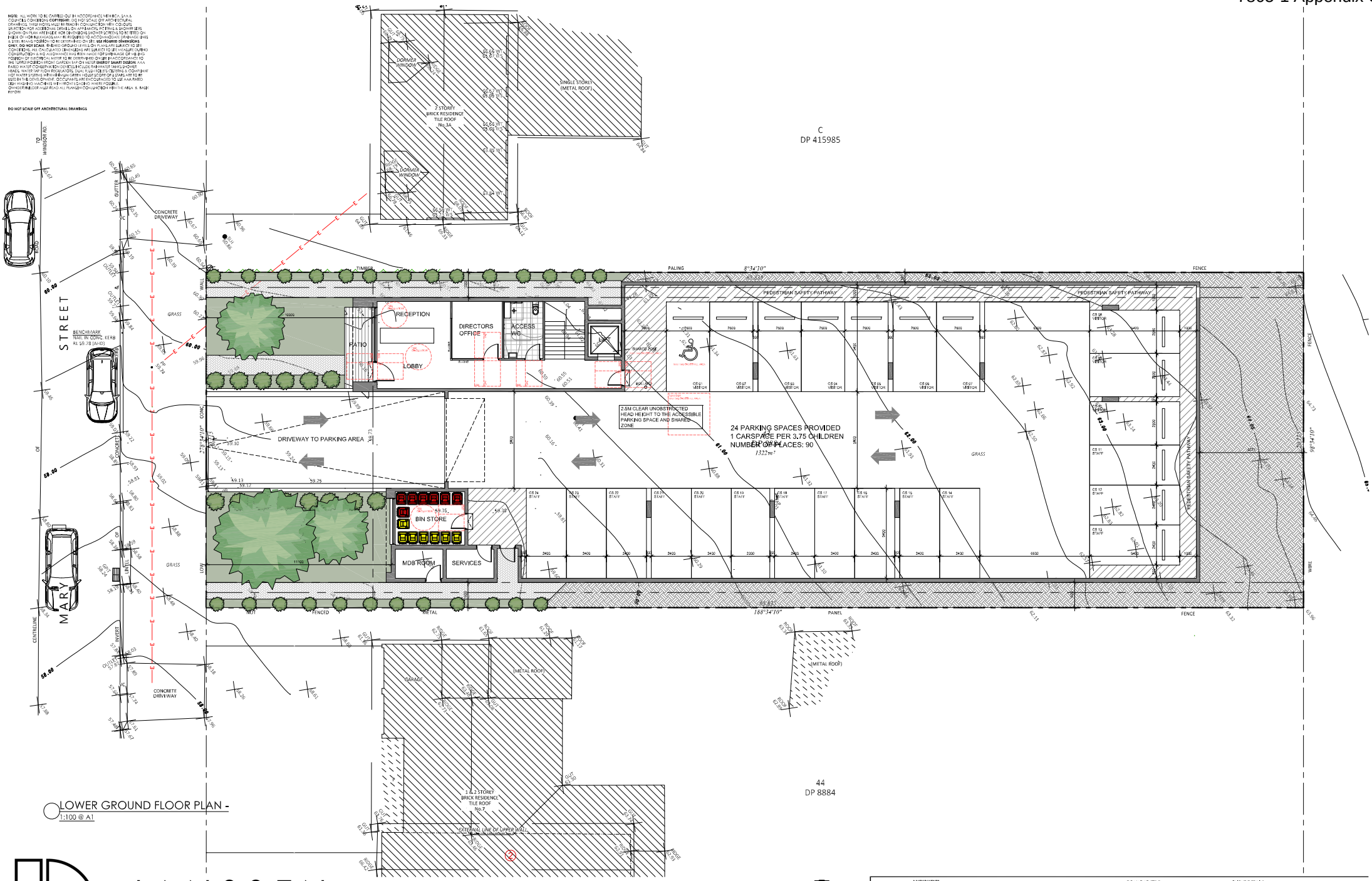
## Located at Rear Yard, Ground Floor, 5 Mary Street, Northmead, NSW



## Located at Rear Yard, First Floor, 5 Mary Street, Northmead, NSW



## Located at Rear Yard, First Floor, 5 Mary Street, Northmead, NSW




LOWER GROUND FLOOR PLAN -
1:100 @ A1

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**DO NOT SCALE OFF ARCHITECTURAL DRAWINGS**

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Nominated Architect: Jake Janssen NSW ARB 11573

AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

DRAWING TITLE:
Lower Ground Floor Plan

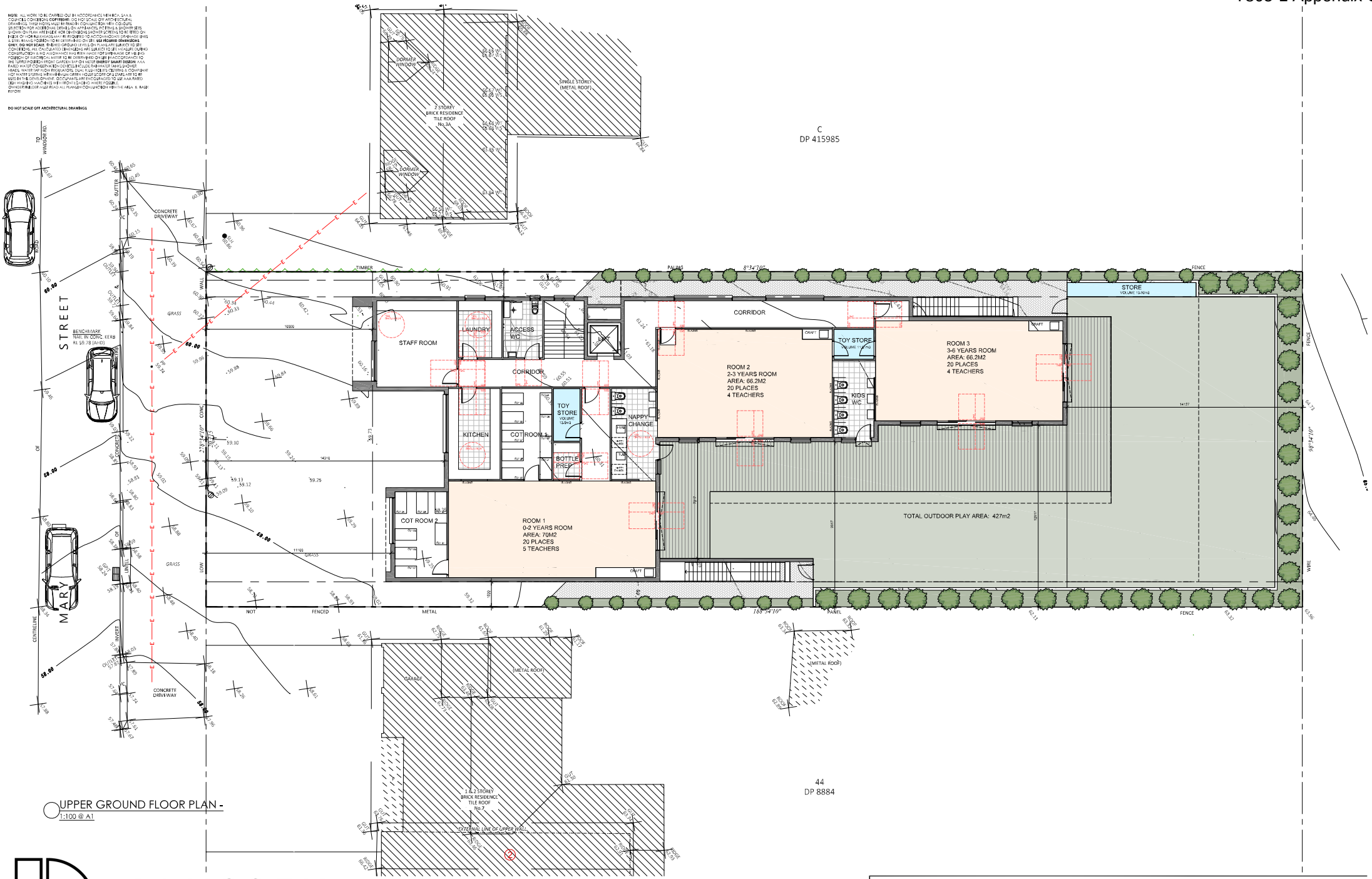
ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

Issue For: DA | Issue: A

Date: 9.10.2022 | Scale: 1:100 | Drawing #: A000 | Project #: 10793

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AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

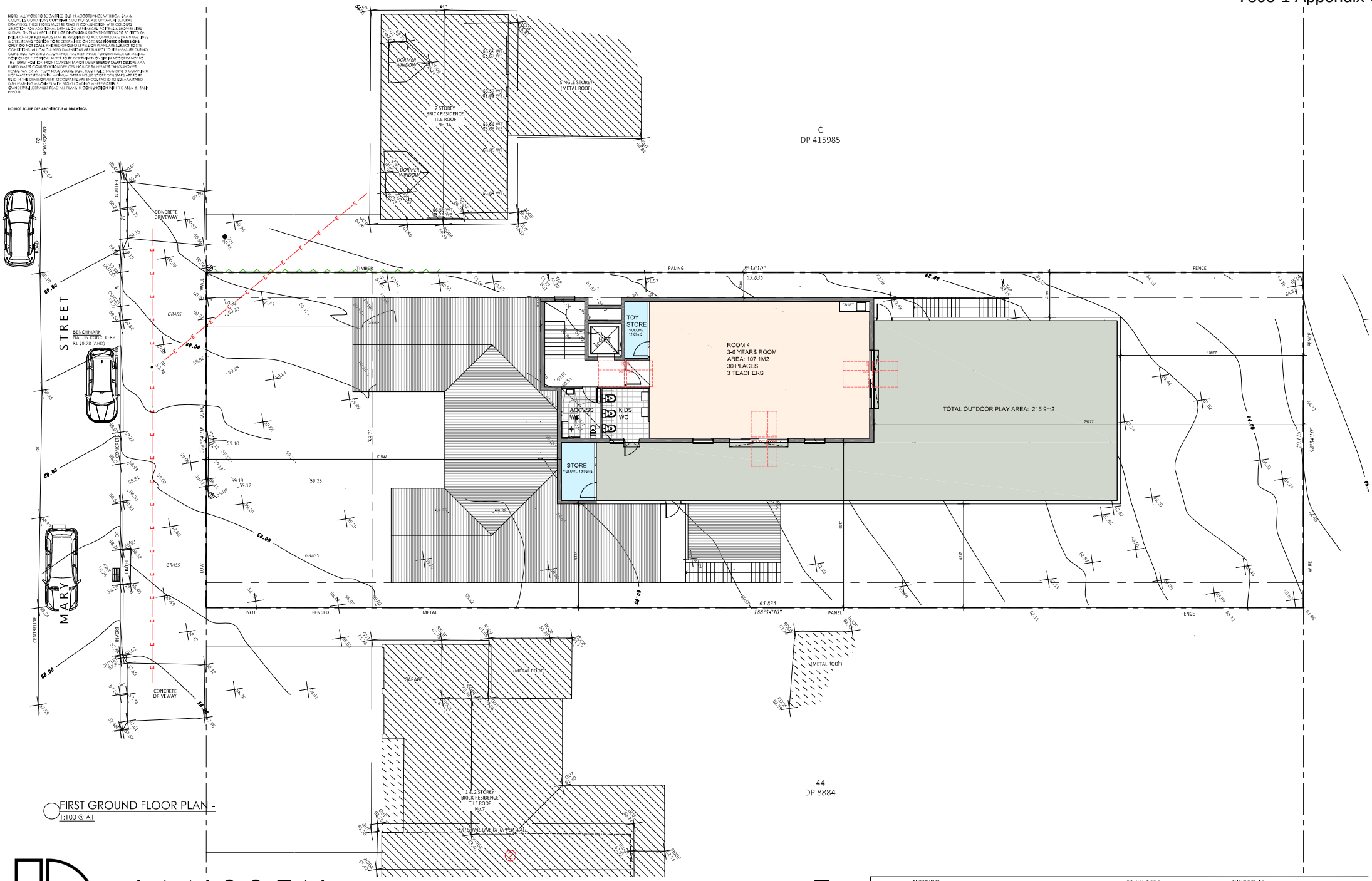
DRAWING TITLE:
Upper Ground Floor Plan

ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

| Issue For: | Issue: | Date: | Scale: | Drawing #: | Project #: |
|---|---|---|---|---|---|
| DA | A | 9.10.2022 | 1:100@A1 | A000 | 10193 |




FIRST GROUND FLOOR PLAN -
1:100 @ A1

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AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

DRAWING TITLE:
First Floor Plan

ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

| Issue For: | Issue: | | |
|---|---|---|---|
| DA | A | | |
| Date: 9.10.2022 | Scale: 1:100 @ A1 | Drawing #: A000 | Project #: 10190 |

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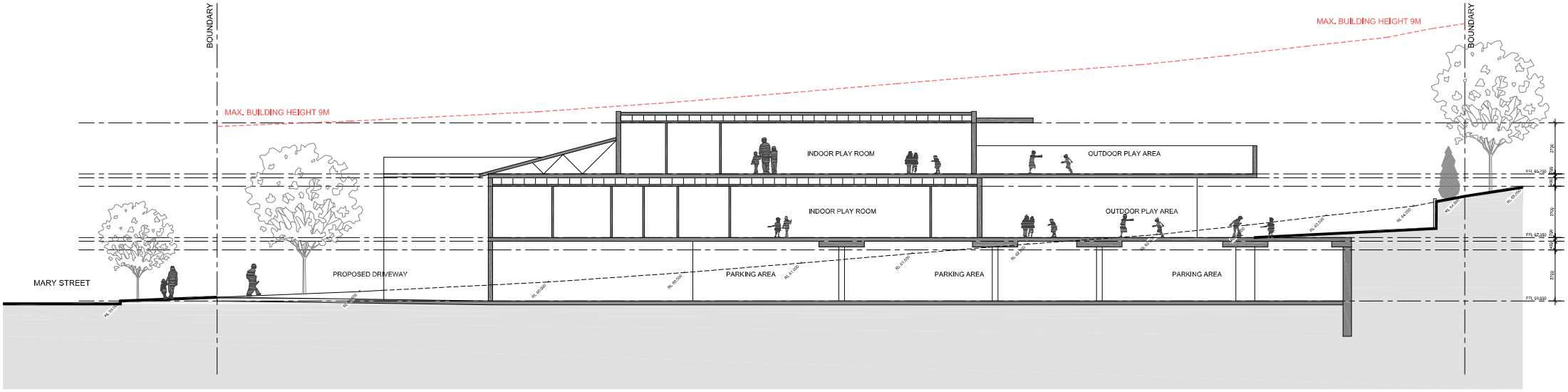


SECTION A -
1:100 @ A1

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AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

DRAWING TITLE:
First Floor Plan

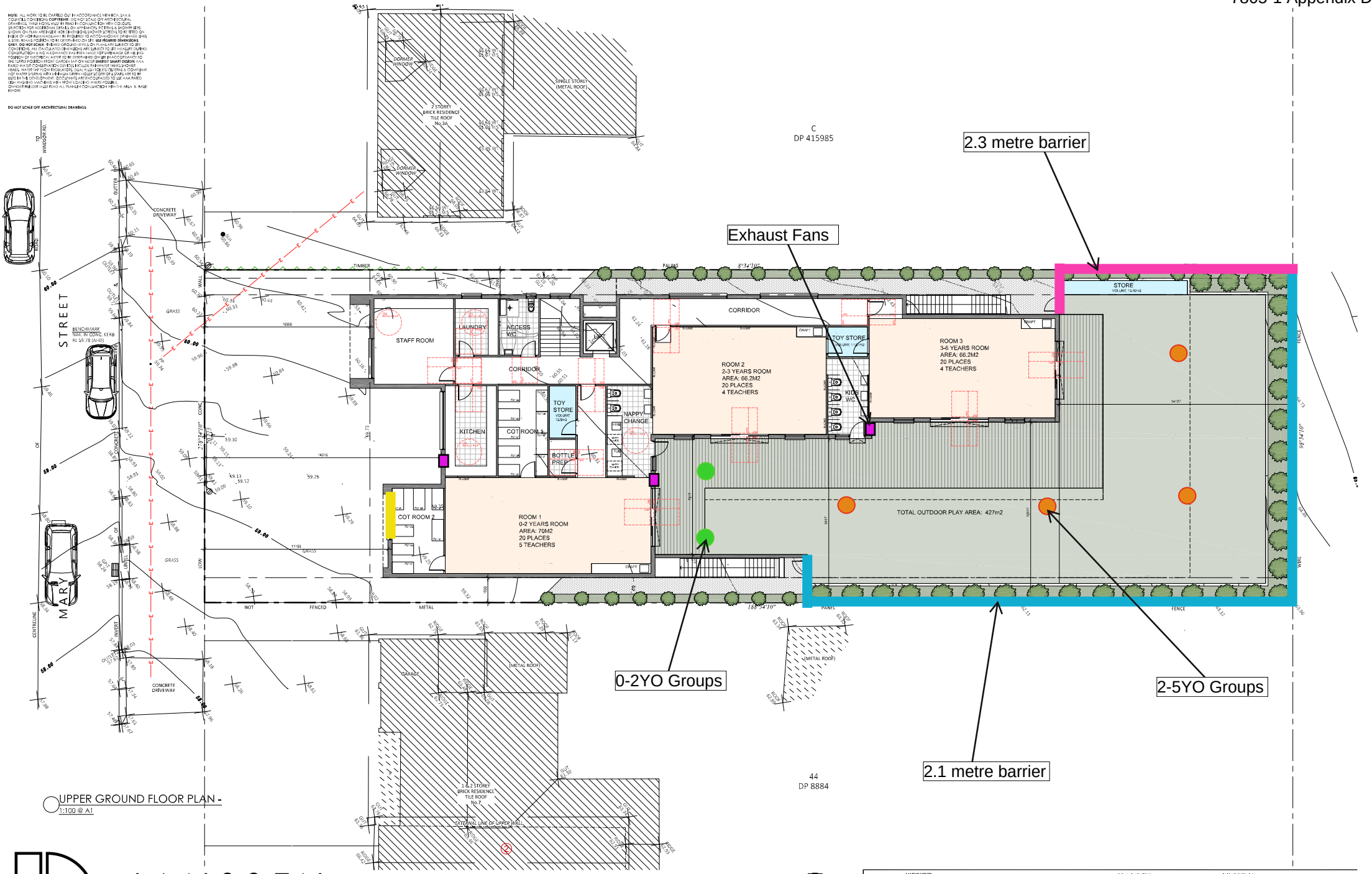
ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

| Issue For: | Issue: | |
|---|---|---|
| DA | A | |

| Date: | Scale: | Drawing #: | Project #: |
|---|---|---|---|
| 9.10.2022 | 1:100 | A000 | 10193 |




UPPER GROUND FLOOR PLAN -
1:100 @ A1

JANSSEN DESIGNS
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Nominated Architect: Jake Janssen NSW ARB 11573

AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

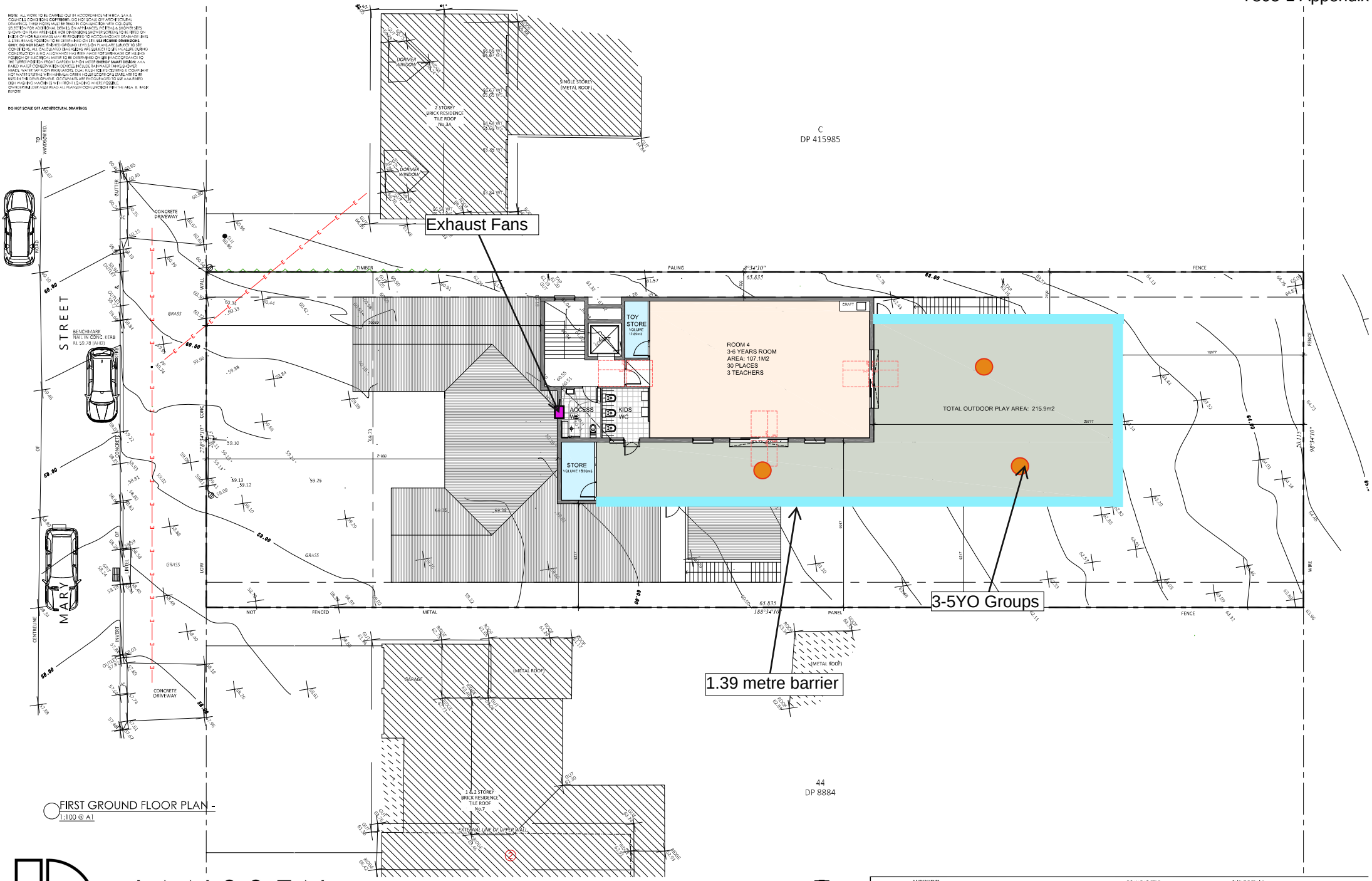
DRAWING TITLE:
Upper Ground Floor Plan

ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

Issue For: DA | Issue: A | Date: 9.10.2022 | Scale: 1:100 | Drawing #: A000 | Project #: 10193




FIRST GROUND FLOOR PLAN -
1:100 @ A1

JANSSEN DESIGNS
info@janssendesigns.com.au | PO Box 41, Kenthurst 2156 | m: 0423 216 636
Nominated Architect: Jake Janssen NSW ARB 11573

AMENDMENTS

| ISSUE | DESCRIPTION | DATE |
|---|---|---|

Project Title:
Proposed Child Care Centre

DRAWING TITLE:
First Floor Plan

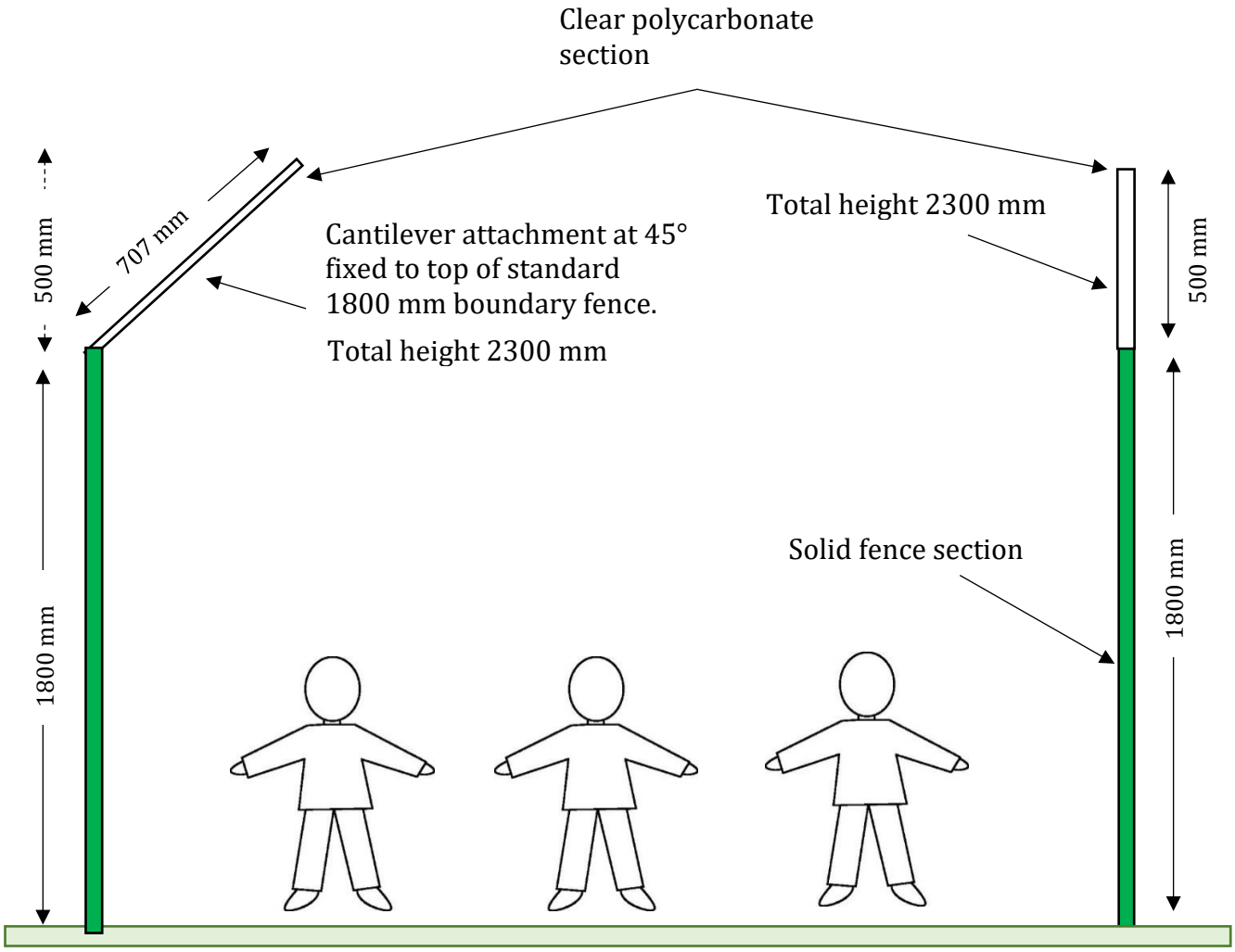
ADDRESS:
5 Mary Street, Northmead

CLIENT DETAILS:
Kirribilli Capital

LOCAL GOVERNMENT AREA:
Parramatta Council

| Issue For: | Issue: | Date: | Scale: | Drawing #: | Project #: |
|---|---|---|---|---|---|
| DA | A | 9.10.2022 | 1:100 | A000 | 10193 |

## OUTDOOR PLAY AREA

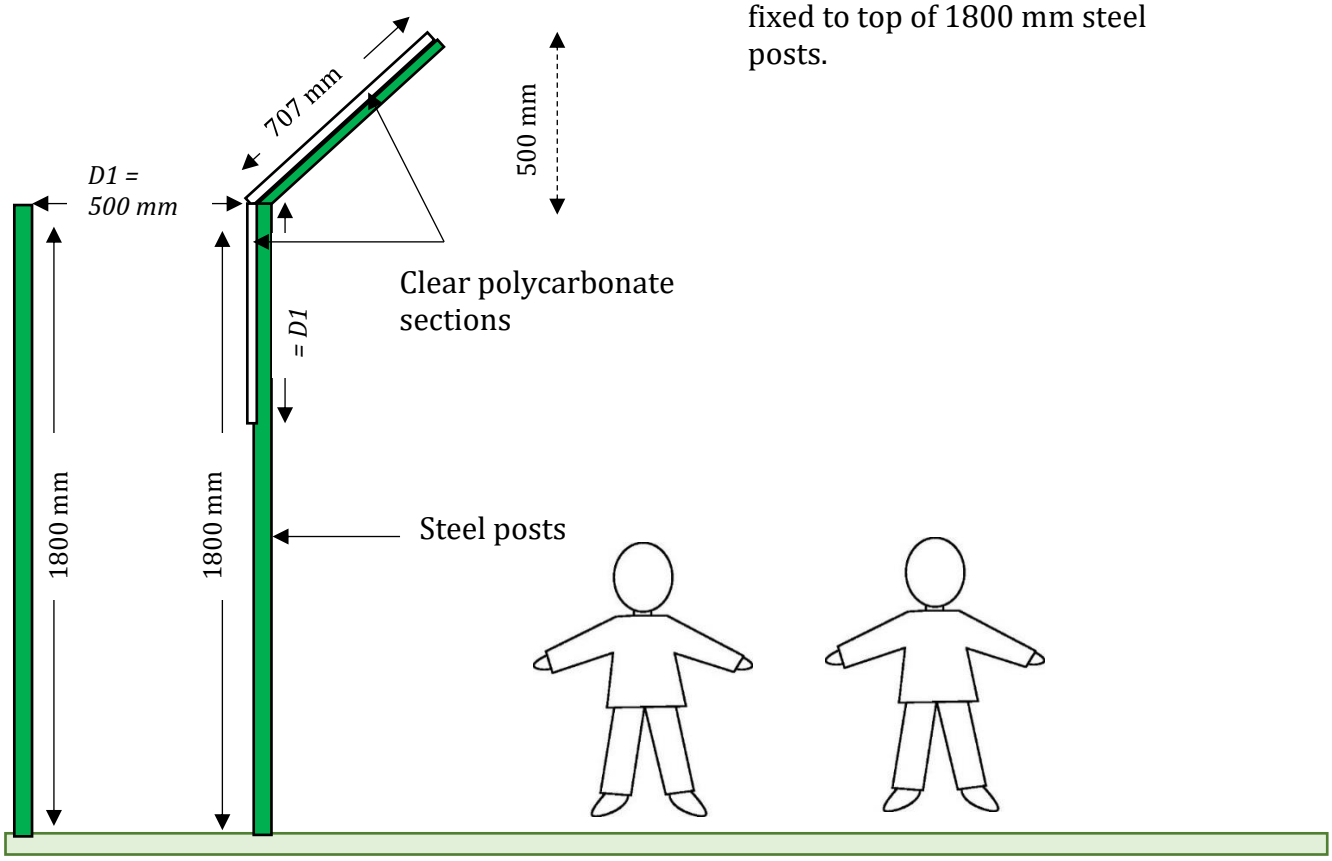



Not To Scale

# OUTDOOR PLAY AREA

Total height 2300 mm

Cantilever attachment at 45° fixed to top of 1800 mm steel posts.




Not To Scale

**ACOUSTICAL** – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

**AMBIENT NOISE** – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

**AUDIBLE** – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
*"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".*

It follows that the word "audible" in an environmental noise context means "clearly audible".

**BACKGROUND NOISE LEVEL** – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the $L_{A90}$ or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels ($L_{A90}$) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure ($L_{A90}$) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of $L_{90}$ background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

**DECIBEL** – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

**dBA** – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

**dBC** – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

**EQUIVALENT CONTINUOUS NOISE LEVEL, $L_{Aeq}$** – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or $L_{Aeq}$ sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the $L_{Aeq}$ level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the $L_{Aeq}$ noise level.

**FREE FIELD** – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

**FREQUENCY** – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

**IMPACT ISOLATION CLASS (IIC)** – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

**IMPACT SOUND INSULATION ($L_{nT,w}$ )** – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$ ) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

**IMPULSE NOISE** – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

**INTRUSIVE NOISE LEVEL, $L_{Aeq}$** – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

**LOUDNESS** – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

**MAXIMUM NOISE LEVEL, $L_{Amax}$** – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the $L_{Amax}$ noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

**NOISE RATING NUMBERS** – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

**NOISE** – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

**NOISE REDUCTION COEFFICIENT** – See: "Sound Absorption Coefficient".

**OFFENSIVE NOISE -** (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

*(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:*

*(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or*

*(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*

*(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."*

**PINK NOISE** – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

**REVERBERATION TIME, $T_{60}$** – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the $T_{60}$. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

**SOUND ABSORPTION COEFFICIENT, $\alpha$** – $\alpha$ Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, $\alpha$. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average $\alpha$ from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

**SOUND ATTENUATION** – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

**SOUND EXPOSURE LEVEL (SEL)** – The total sound energy of a single noise event condensed into a one second duration or in other words it is an $L_{eq}$ (1 sec).

**SOUND PRESSURE LEVEL, $L_p$** – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and $P_o$ is a reference sound pressure of 20 µPa. $L_p$ varies with distance from a noise source.

**SOUND POWER LEVEL, $L_w$** – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

**SOUND TRANSMISSION CLASS (STC)** – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

**SOUND TRANSMISSION LOSS** – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

**STATISTICAL EXCEEDENCE SOUND LEVELS, $L_{A90}$, $L_{A10}$, $L_{A1}$, etc** – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The $L_{A90}$ is the dBA level exceeded for 90 % of the time. In NSW the $L_{A90}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The $L_{A10}$ is the dBA level that is exceeded for 10 % of the time. In NSW the $L_{A10}$ measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the $L_{Aeq}$ for describing level-varying noise.

The $L_{A1}$ is the dBA level that is exceeded for 1 % of the time. In NSW the $L_{A1}$ may be used for describing short-term noise levels such as could cause sleep arousal during the night.

**STEADY NOISE** – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

**WEIGHTED SOUND REDUCTION INDEX, $R_w$** – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

**WHITE NOISE** – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.