DAY DESIGN PTY LTD
CONSULTING ACOUSTICAL ENGINEERS

SUITE 17, 808 FOREST ROAD, PEAKHURST ABN 73 107 291 494
ACOUSTICS@DAYDESIGN.COM.AU WWW.DAYDESIGN.COM.AU P. 02 9046 3800

Environmental Noise Impact Assessment

Proposed Child Care Centre

16 Terry Road, Eastwood, NSW

REPORT No
7875-1.1R Rev A

DATE ISSUED
16 January 2024

Prepared For:
The Trustee for Y&Z TRD Trust
C/- Whitestone Group
404/4 Francis Road
Artarmon NSW 2064

Attn: Mr Julian Carlo-Stella

Revision History

Report	Date	Prepared	Checked	Comment
Final	11/01/2024	Alexander Mendoza	Stephen Gauld	
Rev A	16/01/2024	Alexander Mendoza	Stephen Gauld	

Document 7875-1.1R Rev A, 38 pages plus attachments

Disclaimer

The work presented in this document was carried out in accordance with the Day Design Pty Ltd Quality Management System. Day Design is certified to ISO9001.

This report has been prepared for the client identified and cannot be relied or used by any third party. Any representation, statement, opinion or advice, expressed or implied in this report is made in good faith but on the basis that Day Design is not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in any respect of any representation, statement, or advice referred to above.

Recommendations made in this report are intended to resolve acoustical problems only. No claims of expertise in other areas are made and no liability is accepted in respect of design or construction for issues falling outside the specialist field of acoustical engineering including but not limited to structural, fire, thermal, architectural buildability, fit for purpose, waterproofing or other aspects of building construction. Supplementary professional advice should be sought in respect of these issues.

The information in this document should not be reproduced, presented or reviewed except in full. Prior to passing onto a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission. The only exception to this is for the Regulatory Authority in its use of this report to make a Determination.

CONTENTS

TABLES

1.0 EXECUTIVE SUMMARY

A new child care centre (The Centre) is proposed to be constructed at 16 Terry Road, Eastwood, NSW (the Site). The Site is located on land zoned R2 – *Low Density Residential* under Ryde Local Environmental Plan (LEP) 2014.

The Site is bounded by single storey residential buildings to the west and east. Two storey residential dwellings are also located to the east, south and to the north on the opposite side of Terry Road. The Site and nearby receptors are shown in Figure 1.

The Site currently includes a partially constructed two storey dwelling. The proposal will involve the demolition of this partially constructed structure and the construction of a new two storey Child Care Centre with a basement level carpark.

The Centre will include an outdoor play area on the ground floor level and another at first floor level. Within the ground and first floor levels of the building are six indoor play areas, office, lobby, kitchen, cot room, lift and amenities. The basement carpark will have capacity for 24 vehicles.

The architectural drawings relied on for this assessment have been prepared by Janssen Designs and are attached as Appendix C.

The Centre will have a total capacity for 126 children, comprising of:

- 0-2 years old – 16 children;
- 2-3 years old – 20 children; and
- 3-5 years old – 90 children.

The proposed hours of operation for the Centre are:

- Monday to Friday: 7.00 am – 7.00 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.

City of Ryde 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 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 Whitestone Group on behalf of The Trustee for Y&Z TRD Trust to assess the environmental noise impact from a proposed Child Care Centre to be constructed at 16 Terry Road, Eastwood, 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

A new child care centre (The Centre) is proposed to be constructed at 16 Terry Road, Eastwood, NSW (the Site). The Site is located on land zoned R2 – *Low Density Residential* under Ryde Local Environmental Plan (LEP) 2014.

The Site is bounded by single storey residential buildings to the west and east. Two storey residential dwellings are located to the east, south and to the north on the opposite side of Terry Road. 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 2 and Figure 1.

Noise assessment RL heights for receptors and the surrounding area have been derived from survey drawings and topographical LiDAR data obtained from ELVIS Elevation and Depth service.

Table 1 Noise Sensitive Receptors ('R1A' – 'R5C')

Receiver, Type & Location	Address	Direction from site
R1A – Residence – *RL 77.30* *1.5 m above ground level – 3 m from boundary*	2 Tarrants Ave (two storey)	East
R1B – Residence – *RL 81.05* *Outside nearest first floor window*		
R2 – Residence – *RL 77.91* *1.5 m above ground level – 3 m from boundary*	4 Tarrants Ave (single storey)	East
R3 – Residence – *RL 78.40* *1.5 m above ground level – 3 m from boundary*	6 Tarrants Ave (single storey)	East
R4 – Residence – *RL 79.19* *1.5 m above ground level – 3 m from boundary*	8 Tarrants Ave (single storey)	East
R5A – Residence – *RL 81.14* *1.5 m above ground level – 3 m from boundary*	32 Wallace Street (two storey)	South
R5B – Residence – *RL 80.37* *1.5 m above ground level – 3 m from boundary*		
R5C – Residence – *RL 84.57* *Outside nearest first floor window*		

Table 2 Noise Sensitive Receptors ('R6A' – 'R7')

Receiver, Type & Location	Address	Direction from site
R6A – Residence – *RL 80.44* *1.5 m above ground level – at east facade*	18-20 Terry Road (single storey)	West
R6B – Residence – *RL 80.44* *1.5 m above ground level – at east facade*		
R6C – Residence – *RL 79.40* *1.5 m above ground level – at east facade*		
R6D – Residence – *RL 79.30* *1.5 m above ground level – at east facade*		
R6E – Residence – *RL 78.83* *1.5 m above ground level – at east facade*		
R6F – Residence – *RL 78.86* *1.5 m above ground level – at east facade*		
R7 – Residence – *RL 77.50* *Outside nearest ground floor window*	29 Terry Road (two storey)	North
R7 – Residence – *RL 80.00* *Outside nearest first floor window*		

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.

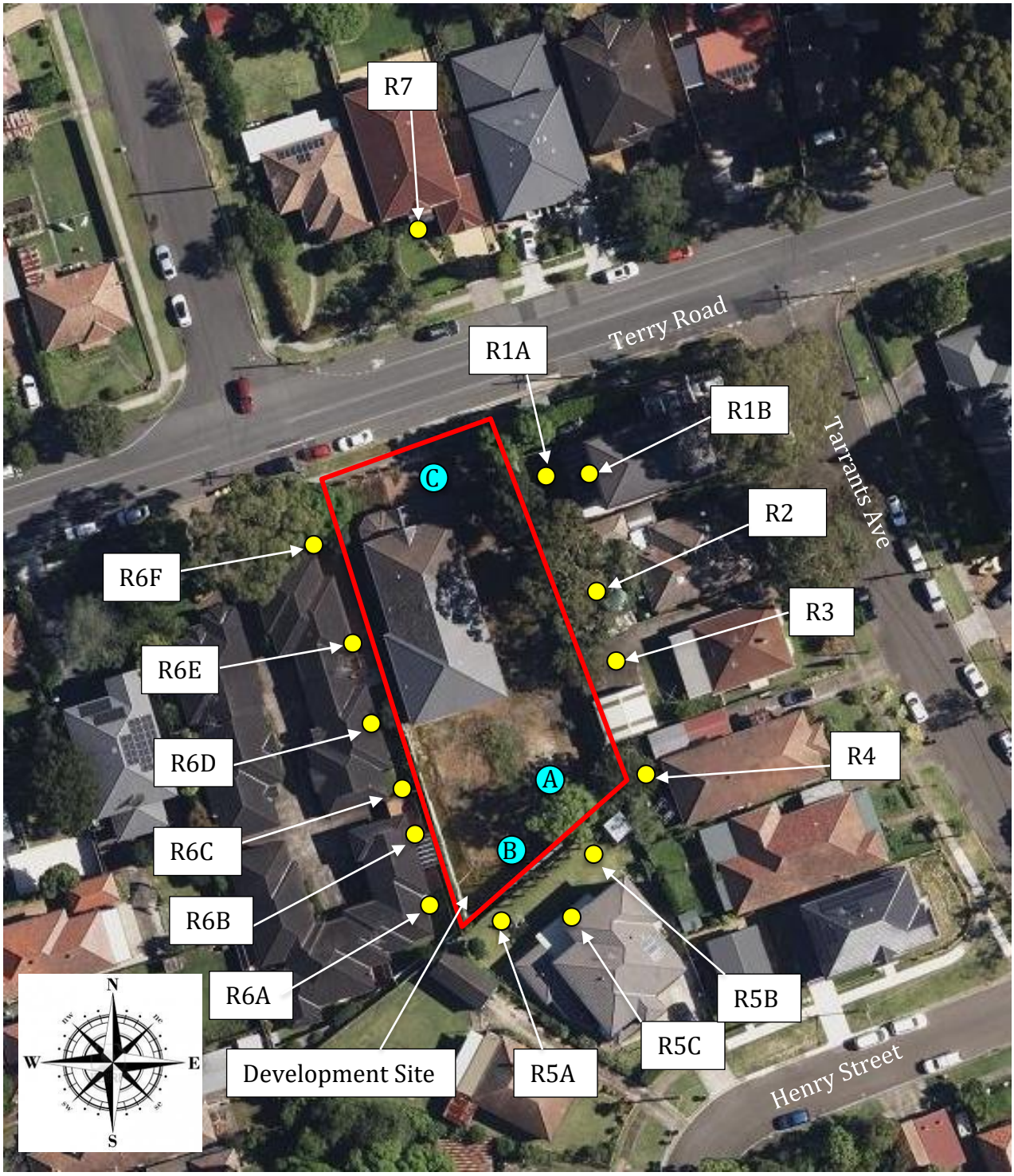


Figure 1 – Location Plan – 16 Terry Road, Eastwood, NSW

3.2 Development Description

The proposal will involve the demolition of the current two storey residential dwelling and other structures and the construction of a new two storey Child Care Centre with a basement level carpark.

The Centre will include outdoor play areas on the ground floor level and another at first floor level. Within the ground and first floor levels of the building are six indoor play areas, office, lobby, kitchen, cot room, lift and amenities. The basement carpark will have capacity for 24 vehicles.

The architectural drawings relied on for this assessment have been prepared by Janssen Design and are attached as Appendix C.

The Centre will have a total capacity for 126 children, comprising of:

- 0-2 years old – 16 children;
- 2-3 years old – 20 children; and
- 3-5 years old – 90 children.

The proposed hours of operation for the Centre are:

- Monday to Friday: 7.00 am – 7.00 pm.

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

4.1.1 Short Term, Attended Ambient Noise Measurement

It was observed that the topography of the site slopes down from the rear of the site to Terry Road. The ground level of the site has been cut below natural ground level with large retaining walls constructed around the west, south and east boundaries at the rear of the site. Boundary fences are constructed at natural ground level and are significantly higher than the cut-in ground level in the rear yard of the site.

Due to the topography of the site and surrounding area, ground level and first floor building facades overlook the ground floor and first floor outdoor play areas, particularly for dwellings to the south of the site, i.e., 'R3', 'R4', 'R5' and 'R6A'- 'R6C'. These locations are likely to be affected by noise emission from the Centre, particularly from activities occurring within the outdoor play areas. However, as these floors are elevated and less shielded from buildings, fences and other structures, compared to receptors at ground level, they are also more exposed to existing general ambient noise within the environment.

Additionally, dwellings facing Terry Road are directly exposed to road traffic noise. It was also observed that two storey dwellings are located to the east ('R1') and north of the site ('R7') with direct line of sight to the road from elevated positions.

Therefore, to ascertain any differences in ambient noise level between ground level (at the logger location) and elevated positions for other receiver locations, short term ambient noise levels measurements were conducted simultaneously at ground and first floor at Locations 'A', 'B' and 'C'.

Where applicable, the measured difference is then applied to the long-term RBL's at first floor level of receptor 'R5C' and for ground and first floor levels of receptors 'R1', 'R6F' and 'R7'.

Short term noise measurements were conducted on 24 October 2023 between 11:15 am and 11:30 am. The $L_{90,\,15\,min}$ noise level at Location 'A' was 40.5 dBA.

The differences in the $L_{90,\,15\,min}$ noise level between the noise logger at Location 'A' and ground and first floor levels at Location 'B' (at the rear of the site), are shown in Table 3.

Table 3 Ambient Noise Levels – Location B

Date & Time	Noise Level at Location 'B' – $L_{90,\,15\,min}$	Difference - dB
24 October 2023 11:15 – 11:30 pm	Ground Floor – 40.9 dBA	+0.4 dB
	First Floor – 43.3 dBA	+2.8 dB

The differences in the $L_{90,\ 15\ min}$ noise level between the noise logger at Location 'A' and ground and first floor levels at Location 'C' (at the front of the site), are shown in Table 4.

Table 4 Ambient Noise Levels – Location C

Date & Time	Noise Level at Location 'C' – $L_{90,\ 15\ min}$	Difference - dB
24 October 2023 11:15 – 11:30 pm	Ground Floor – 46.1 dBA	+5.6 dB
	First Floor – 50.5 dBA	+10.0 dB

Based on the measured level difference at Location 'C', the noise criteria at elevated ground level locations ('R1H', 'R2' and 'R3') and upper floors ('R1A'- 'R3') will be adjusted to account for higher ambient noise levels where applicable.

Project specific noise criteria for each receptor location are presented in Table 8.

4.1.2 Long Term, Unattended Ambient Noise Measurement

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 noted that the potentially *most affected sensitive receiver locations* were 'R1A' – 'R7', as detailed in Section 3. Therefore, suitable and equivalent noise monitoring locations, Locations 'A'-'C' (see Figure 1) were selected to represent these *most affected sensitive receivers*.

An unattended environmental noise monitor was placed in the rear yard (Location 'A') of 16 Terry Road, Eastwood, NSW, from Monday 9 October to Tuesday 24 October 2023, to determine the Rating Background Level in this representative location. The microphone height was approximately 1.5 metres above natural ground level at this location, equivalent to ground level of nearby residential dwellings.

The noise logger was placed at natural ground level above the south retaining wall, with road traffic noise from Terry Road partially shielded by the existing dwelling, and is considered to be representative of noise levels at ground floor level for residential lots at the rear of the site. This noise logger, in conjunction with short term noise measurements at Locations 'B' and 'C', has been used to establish the relevant criteria for all other sensitive receivers.

Day Design notes that the background noise in the area is mainly influenced by road traffic noise from Terry Road, the surrounding road network and general neighbourhood noise.

As the Centre is not proposed to operate on weekends, ambient noise levels measured on weekends, have been excluded from the assessment period.

The results of the background noise survey at Location 'A', during times when the Centre is proposed to be operating, are shown in the attached Appendix B, and below in Table 5.

Table 5 Ambient Background Levels – 16 Terry Road, Eastwood, NSW

Noise Measurement Location	Time Period	L_{90} Rating Background Level	L_{eq} Noise Level
Location 'A' Rear Yard, Ground Level	Early Morning (6:30 am – 7 am)	46	52
	Day (7 am to 6 pm)	41	51
	Evening (6 pm to 7 pm)	43	50

Meteorological conditions during the measurement surveys typically consisted of clear skies with temperatures ranging from 9°C to 33°C. Periods of rainfall and/or wind speeds above 5 m/sec were recorded during the day during the measurement session. Noise level measurements adversely affected by weather conditions have been removed from calculations, where required[1]. Noise level measurements are considered reliable, and representative of the background noise levels at all nearby receptor locations.

The RBL's at Location 'A' are considered to be representative of all residential receptors in the general area surrounding the subject site at ground floor level.

[1] *Section B1.3 of the EPA's NSW Noise Policy for Industry, under 'Exception' states, 're-monitoring may not be required, where monitoring contains weather-affected data, if it can be ascertained that the affected samples are not within the expected 'quieter' times of an assessment period (day/evening/night); that is, those time periods where the lowest 10th percentile background noise level might occur.'*

4.2 Measured Road Traffic Noise Levels

The site is exposed to road traffic noise from vehicles passing by the site on Terry Road. However, the outdoor play areas, located on the ground and first floor, are well shielded from road traffic noise by the Centre building and other structures. Additionally, the indoor playrooms on the ground and first floor are generally well shielded by the Centre building with the exception of Indoor Playroom 5 on the first floor, with a north facing window overlooking Terry Road.

The weekday $L_{Aeq,\ 1\ hour}$ noise levels measured at Locations 'A' are also shown below in Table 6.

Table 6 Measured $L_{Aeq,\ 1\ hour}$ Road Traffic Sound Pressure Levels – Location 'A'

Time	$L_{Aeq,\ 1\ hour}$ Road Traffic Noise (dBA)					
	Tue 3/5	Wed 4/5	Thu 5/5	Fri 8/5	Mon 9/5	Tue 10/5
7 – 8 am	52	51	52	50	51	51
8 – 9 am	52	53	52	50	50	51
9 – 10 am	50	51	49	48	49	50
10 – 11 am	49	51	50	48	49	52
11 – 12 pm	54	49	49	48	52	49
12 – 1 pm	52	49	50	48	52	50
1 – 2 pm	48	49	49	49	54	49
2 – 3 pm	55	47	49	48	55	50
3 – 4 pm	49	49	49	51	53	50
4 – 5 pm	53	52	53	49	51	52
5 – 6 pm	49	50	50	50	48	52

Based on the long-term measurements at Location 'A', 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 day time noise level is 52 dBA at Location 'A'.

L_{eq} noise levels measured within the rear yard at Location 'A' are considered representative of the outdoor play areas on the ground and first floor. External noise levels are below the AAAC criteria for external noise within outdoor play areas at all times.

It should be noted that the $L_{Aeq,\ 1\ hour}$ noise levels include all ambient noise in the acoustic environment, with a proportion comprising road traffic noise. The contribution from road traffic noise exclusively is likely to be lower than measured. Based on short term noise measurements taken at Location 'C', road traffic noise intrusion has been calculated across the site, refer Section 7 for details.

5.0 ACOUSTIC CRITERIA

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

5.1 The Ryde City Council DCP

Ryde City Council, in its Development Control Plan (DCP), Part 3.4 – Child Care Centres, Section 4: *Privacy,* provides guidance for planning child care centres. Relevant sections from this document are reproduced as follows:

'4.0 Privacy

4.1 Acoustic Privacy – for children in the centre

Objectives

ii. To ensure children's play and sleep areas are not subjected to excessive traffic noise, or other external noises.

Development Controls - Acoustic Privacy

a) Sites affected by heavy traffic or other external noises are to be designed so as to locate sleep rooms and play areas away from the noise source. The impact of noise should also be reduced by design measures including barriers such as solid fencing and laminated or double glazing where relevant.

b) b. Design measures to minimize internal noise levels should be designed to meet recommended design sound levels equivalent to Australian Standards AS/NZS2107 (eg sleep areas 30 dBA, internal activity areas 40 dBA).

4.2 Acoustic Privacy – for adjoining residents

1. To ensure that the site layout and building design, including internal layout, minimises the noise emitted from the centre and does not have an adverse impact on the amenity of surrounding residences.

Controls

a) Noise impacts on neighbouring properties are to be minimised by design measures including:

   i. Orientating the facility having regard to neighbouring property layout, including locating playroom windows and doorways away from neighbouring bedrooms and living areas;

   ii. Orientating playgrounds/outdoor play areas away from private open space areas, bedrooms and living areas on neighbouring residential properties (refer diagram below);

   iii. Using laminated or double glazing where necessary; and

   iv. Designing fencing which minimises noise transmission and loss of privacy (eg lapped and capped timber fencing, brick).

b) For freestanding child care centres in residential areas with a side boundary set back of less than 3 m, noise buffering measures should be considered such as allocating the internal rooms closest to the boundaries to be used for low noise generating uses, for example administration, storage, staff rooms, kitchen, to reduce potential noise impacts on adjoining property owners.

c) Applicants may be required to submit an acoustic report prepared by a suitably qualified practitioner which includes recommendations for noise attenuation measures. The report must specify pre and post development noise levels and abatement measures.

d) Roof and walls of the child care centre should be sound insulated.

e) Elevated play and transition areas are to be avoided.

f) Information about practical design measures incorporated in the design to minimise potential noise impact, including insulation and other acoustic elements, are to be identified in the Development Application.

g) Location details of noise sources (such as air conditioning condenser units) are to be included in the Development Application.

h) Information regarding how groups are proposed to be managed in the outdoor play spaces and where time will be spent, group sizes and how rotated may be required to be submitted with the Development Application.

5.2 NSW Department of Planning and Environment

5.2.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW Department of Planning and Environment (DoPE) 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 DoPE – 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 eg, 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:

5.1 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).

It should be noted that the L_{eq} noise levels measured at Location 'A' are representative of the outdoor play areas and complies with the AAAC noise criterion for outdoor play areas.

No further consideration is given to road traffic noise intrusion for outdoor play areas in this report.

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.'

A standard building façade will typically provide 20-25 dB reduction of external noise with external windows/doors closed.

Based on the average measured external $L_{eq,\ 1\ hour}$ noise level at Location 'C' (61 dBA during the day at the front of the site), the internal noise level is calculated to be 35 dBA, as a worst case, within the indoor playrooms. Therefore, the building is capable of achieving the internal noise criteria as recommended by the AAAC Guideline. No specific noise controls are required to be implemented into the design of the Centre building.

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 7.

Table 7 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 Specific Criteria

Based on the measured long term and short term background noise levels and the relevant planning instruments and legislation, the project specific noise criteria at each receptor location are as shown in Table 8.

The noise criteria applicable at each receptor location for outdoor play areas, cumulative noise emission from the car park, indoor play areas and mechanical plant, sleep disturbance and on-road traffic are based on long and short term ambient noise measurements at Location 'A', 'B' and 'C', rounded to the nearest whole decibel.

It is noted that the Centre is proposed to operate until 7 pm weekdays. It can be seen from Table 5 that the evening RBL is higher than during the day time. As a conservative approach, the day time RBL will be used to set noise criteria for the 1 hour evening period.

Table 8 Noise Criteria for Residential Receptor Locations (R1A – R7)

Receptor	Noise Criteria for Centre Activities			
	Outdoor Play – dBA $L_{eq,\ 15\ min}$	Car Park, Indoor Play & Mechanical Plant – dBA $L_{eq,\ 15\ min}$	Sleep Disturbance dBA L_{max}	On-Road Traffic Noise dBA– $L_{eq,\ 1\ hr}$
	Up to 4 Hours Per Day			
R1A – GF	57	52	62	55
R1B – FF	61	56	66	
R2 – FF	51	46	56	
R3 – GF	51	46	56	
R4 – GF	51	46	56	
R5A – GF	51	46	56	
R5B – GF	51	46	56	
R5C – GF	54	49	59	
R6A – FF	51	46	56	
R6B – GF	51	46	56	
R6C – GF	51	46	56	
R6D – GF	51	46	56	
R6E – GF	51	46	56	
R6F – GF	51	46	56	
R7 – GF	61	56	66	
R7 – FF	61	56	66	

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.

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 architectural drawings prepared by Janssen Designs shown 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 9 and have been adopted to assess noise emissions from children in this assessment.

The sound power levels for each group are presented in Table 9 and used in this assessment.

Table 9 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 101 trips in 1 hour arriving or leaving the Centre in the morning peak. This is equivalent to 25 vehicle trips in a 15-minute period.

For the assessment of sleep disturbance and staff arriving during the early morning shoulder period between 6:30 am and 7 am, we have assessed the maximum noise impact of staff arriving and parking in the ground 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 moving in and out of the basement car park driveway. 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[2] (SEL) and $L_{AF,\,max}$ sound power level and spectra of vehicle noise is shown below in Table 10 and is based on previous measurements by Day Design.

Table 10 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 level of a car driving on an inclined road (downhill) at 10 km/h	**83**	91	89	83	81	77	72	70	64
SEL level of a car driving on an inclined road (uphill) at 10 km/h	**88**	96	94	86	85	83	79	76	70
SEL of car drive-by at approximately 50 km/h	**97**	99	97	94	93	95	87	77	70
L_{Amax} of car entering car park	**92**	98	92	90	88	88	83	80	76

[2] *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 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.

External air conditioning condensers are assumed to be located at ground level within the alcoves located outside the office and waiting area.

We have assumed that the kitchen and toilet exhaust fans will be ducted through the façades of the building, terminating in a wall grille mounted at high level.

Sound power levels used in the calculation of the noise contribution from the mechanical plant are shown in Table 11.

Table 11 L_{eq} 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[3]	**60**	61	67	62	54	54	50	45	39
Small exhaust fan (toilet)[4]	**60**	51	47	50	53	59	43	36	31
Medium (double fan) Outdoor condenser unit[5] 1 of 3	**70**	69	67	67	69	64	59	54	48

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.

[3] *Spectral sound power level based on Fantech CPD01254FSC.*
[4] *Spectral sound power level based on Fantech TD-500/150 SIL.*
[5] *Spectral sound power level based on Daikin RZQ140LV1 outdoor condenser unit.*

6.4 Calculated Noise Levels

Knowing the sound power level of a noise source (See Table 9 to Table 11), 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.

Calculations include reductions for the acoustic screening provided by fences, assumed to have been constructed in accordance with recommendations specified in Section 8 and the proposed Centre building itself.

Calculations of noise emission from the indoor play area include reductions for glazing and external doors within the façade. For the purposes of our calculations, we have assumed all glazing to be of a standard construction (5 mm glass) and external doors are closed whilst indoor play areas are in use.

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 metre above ground level for all children.

All noise modelling calculations for noise generating components of the proposed Centre were performed within DGMR iNoise 2024 noise modelling software using noise propagation equations of ISO 9613-1 – '*Acoustics – Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere',* and ISO 9613-1 – '*Acoustics – Attenuation of sound during propagation outdoors. Part 2: Attenuation of sound during propagation outdoors. Part 2: General method of calculation'*.

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

Table 12 shows the calculated $L_{eq,\ 15\ min}$ noise levels at the residential receptors from outdoor play activities discussed previously, during the day time period. Noise levels are shown for noise emission from the use of the outdoor play area, inclusive of noise controls.

The distribution of children's age groups within the outdoor play area assumed for noise modelling purposes is shown in Appendix D.

Table 13 - Table 15 show the calculated $L_{eq,\ 15\ min}$ noise levels at the residential receptors from vehicle movements in the car park and driveway, indoor play activities and the operation of mechanical plant, during the day time period.

Table 16 shows the calculated L_{max} noise levels at the residential receivers from staff vehicles arriving at the site during the early morning shoulder period between 6:30 am and 7 am.

Table 17 shows the calculated $L_{eq,\ 1\ hour}$ noise levels at the residential receptors from additional on-road traffic generated by vehicle movements on Terry Road during the day time period.

6.4.1 Outdoor Play Area Noise Levels

The calculated $L_{eq,\ 15\ min}$ noise levels from activity within the outdoor play areas at each receptor location at ground floor (GF) and first floor windows (FF) are shown in Table 12.

Using AAAC sound power levels for children in active play, as established in Table 9, the calculated noise levels at each receptor location were determined by evenly distributing children into groups at separate locations across the various outdoor play areas, as can be seen in Appendix D.

Calculations also assume that the noise control recommendations specified in Section 8 have been implemented into the design and management of the Centre, including boundary fences and management of child numbers in the outdoor play areas (Refer Section 8.2).

Table 12 Calculated L_{eq} Noise Levels - Outdoor Play Group A (R1A – R7)

Receptor Location	Outdoor Play Group	Calculated Noise Level - $L_{eq,\ 15\ min}$	Noise Criterion - $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R1A – GF	126 Children	44 dBA	57 dBA	Yes
R1B – FF		45 dBA	61 dBA	Yes
R2 – GF		50 dBA	51 dBA	Yes
R3 – GF		51 dBA	51 dBA	Yes
R4 – GF		50 dBA	51 dBA	Yes
R5A – GF (East)		50 dBA	51 dBA	Yes
R5B – GF (West)		49 dBA	51 dBA	Yes
R5C – FF		54 dBA	54 dBA	Yes
R6A – GF		44 dBA	51 dBA	Yes
R6B – GF		47 dBA	51 dBA	Yes
R6C – GF		44 dBA	51 dBA	Yes
R6D – GF		40 dBA	51 dBA	Yes
R6E – GF		43 dBA	51 dBA	Yes
R6F – GF		36 dBA	51 dBA	Yes
R7 – GF		38 dBA	61 dBA	Yes
R7 – FF		42 dBA	61 dBA	Yes

The calculated $L_{eq,\ 15\ minute}$ levels of noise from children playing outdoors in Outdoor Play Group 'A' are summarised in Table 12 for each receptor location. With the aforementioned assumptions, the calculated levels of noise from the use of the outdoor play areas indicate that the noise criterion is met at all receptor locations.

Noise contours for the use of the outdoor play areas are shown in Appendix D for Outdoor Play activities.

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

Calculations assume all 126 children are playing inside are distributed evenly throughout the indoor play areas and that noise controls specified in Section 8 have been implemented into the management of each indoor play area.

Calculations assume that fences and barriers have been constructed in accordance with the recommendations specified in Section 8.3.

As specific items of mechanical plant have not yet been selected, noise level calculations for mechanical plant assume the sound power levels shown in Table 11.

Cumulative noise levels have been calculated at the assessment points for each of the receptor locations. The highest noise levels for indoor play, car park use and mechanical plant are summarised in Table 13 - Table 15 at the nearest affected point at ground (GF) and first floor windows (FF) where applicable. Specific noise levels at each location can be seen in Appendix E.

Table 13 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R1A-R3)

Receptor Location	Calculated Noise Level $L_{eq,\ 15\ min}$	Noise Criterion $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R1A – Residence			
– Car park	GF - 24 dBA		
– Indoor Playrooms	GF - 31 dBA		
– Mechanical plant	GF - 44 dBA		
	GF - 44 dBA	52 dBA	Yes
R1B – Residence			
– Car park	FF - 32 dBA		
– Indoor Playrooms	FF - 36 dBA		
– Mechanical plant	FF - 40 dBA		
	FF - 42 dBA	56 dBA	Yes
R2 – Residence			
– Car park	GF - 22 dBA		
– Indoor Playrooms	GF - 37 dBA		
– Mechanical plant	GF - 44 dBA		
	GF - 45 dBA	46 dBA	Yes
R3 – Residence			
– Car park	GF - 19 dBA		
– Indoor Playrooms	GF - 43 dBA		
– Mechanical plant	GF - 36 dBA		
	GF - 44 dBA	46 dBA	Yes

Table 14 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R4-R6D)

Receptor Location	Calculated Noise Level $L_{eq,\ 15\ min}$	Noise Criterion $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R4 – Residence			
– Car park	GF - 14 dBA		
– Indoor Playrooms	GF - 39 dBA		
– Mechanical plant	GF - 24 dBA		
	GF - 39 dBA	46 dBA	Yes
R5A – Residence			
– Car park	FF - 10 dBA		
– Indoor Playrooms	FF - 40 dBA		
– Mechanical plant	FF - 17 dBA		
	FF - 40 dBA	46 dBA	Yes
R5B – Residence			
– Car park	GF - 12 dBA		
– Indoor Playrooms	GF - 39 dBA		
– Mechanical plant	GF - 18 dBA		
	FFB - 39 dBA	46 dBA	Yes
R5C – Residence			
– Car park	GF - 14 dBA		
– Indoor Playrooms	GF - 44 dBA		
– Mechanical plant	GF - 23 dBA		
	GF - 44 dBA	49 dBA	Yes
R6A – Residence			
– Car park	GF - 11 dBA		
– Indoor Playrooms	GF - 31 dBA		
– Mechanical plant	GF - 16 dBA		
	GF - 31 dBA	43 dBA	Yes
R6B – Residence			
– Car park	GF - 14 dBA		
– Indoor Playrooms	GF - 40 dBA		
– Mechanical plant	GF - 19 dBA		
	GF - 40 dBA	46 dBA	Yes
R6C – Residence			
– Car park	GF - 19 dBA		
– Indoor Playrooms	GF - 33 dBA		
– Mechanical plant	GF - 22 dBA		
	GF - 33 dBA	46 dBA	Yes
R6D – Residence			
– Car park	GF - 22 dBA		
– Indoor Playrooms	GF - 33 dBA		
– Mechanical plant	GF - 26 dBA		
	GF - 34 dBA	46 dBA	Yes

Table 15 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R6E-R7)

Receptor Location	Calculated Noise Level $L_{eq,\ 15\ min}$	Noise Criterion $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R6E – Residence			
– Car park	GF - 26 dBA		
– Indoor Playrooms	GF - 20 dBA		
– Mechanical plant	GF - 22 dBA		
	GF - 28 dBA	46 dBA	Yes
R6F – Residence			
– Car park	GF - 40 dBA		
– Indoor Playrooms	GF - 36 dBA		
– Mechanical plant	GF - 23 dBA		
	GF - 42 dBA	46 dBA	Yes
R7 – Residence			
– Car park	GF - 32 dBA		
– Indoor Playrooms	GF - 30 dBA		
– Mechanical plant	GF - 29 dBA		
	GF - 35 dBA	56 dBA	Yes
R7 – Residence			
– Car park	FF - 33 dBA		
– Indoor Playrooms	FF - 33 dBA		
– Mechanical plant	FF - 30 dBA		
	FF - 37 dBA	56 dBA	Yes

The calculated cumulative $L_{eq,\ 15\ min}$ levels of noise from the operation of the Centre are summarised in Table 13 - Table 15 at each receptor location. With the aforementioned assumptions, the calculated cumulative levels of noise from the Centre indicate that the noise criterion is met at all receptor locations. Compliance at these receptor locations ensures compliance at all other locations which are further away and/or shielded by buildings and other structures.

Noise contours and additional noise level calculations for cumulative noise emissions from the Centre (indoor play, mechanical plant and vehicle movements) are shown in Appendix E.

6.4.3 Sleep Disturbance

It is proposed that the Centre will accept children from 7 am. Six 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 considered noise emission from staff vehicles arriving between 6.30 am and 7 am.

As shown in the architectural drawings, the driveway for the basement level car park is located on the north side of the Site, accessed from Terry Road. To assess potential sleep disturbance on the nearest, most affected residential receptors at 'R1A', 'R1B', 'R6F' and 'R7'. The calculated L_{max} noise levels at the nearest affected residential receptor locations to the car park and driveway are shown in Table 16 below.

Table 16 Calculated L_{max} Noise Levels – Sleep Disturbance

Receptor and Description	Calculated Noise Level - L_{max}	Noise Criterion - L_{max}	Compliance (Yes/No)
R1A – Residence (West Façade)			
– Car Pulling into Driveway	GF - 47 dBA	67	Yes
R1B – Residence (West Façade)			
– Car Pulling into Driveway	FF - 51 dBA	71	Yes
R6F – Car Pulling into Driveway			
– Car Pulling into Driveway	GF - 56 dBA	67	Yes
R7 – Residence			
– Car Pulling into Driveway	GF - 48 dBA	71	Yes
– Car Pulling into Driveway	FF - 48 dBA	71	Yes

As can be seen in Table 16, the calculated level of noise emission from staff arriving prior to 7 am will comply with the sleep disturbance criteria established in Section 5.5 at receptor locations 'R1A', 'R1B', 'R6F' and 'R7', and is therefore considered acceptable. Compliance at these receptor locations ensures compliance at all other locations which are further away and/or shielded by buildings and other structures.

Noise contours and additional noise level calculations for L_{max} noise emissions from staff vehicle movements in the early morning are shown in Appendix F.

6.4.4 On-Road Traffic

The external $L_{eq,\ 1\ hour}$ noise levels at the most affected residential receptor locations 'R1A', 'R1B', 'R6F' and 'R7', from noise associated with on–road traffic throughout the day is calculated to be as shown below in Table 17.

Table 17 Calculated $L_{eq,\ 1\ hour}$ Noise Levels – On Road Traffic Generation

Receiver Location	Calculated Noise Level – $L_{eq,\ 1\ Hour}$	Noise Criterion - $L_{eq,\ 1\ Hour}$	Compliance (Yes/No)
R1A – Residence	GF[6] - 52 dBA	55	Yes
R1B – Residence	FF[6] - 52 dBA	55	Yes
R6F – Residence	GF - 50 dBA	55	Yes
R7 – Residence	GF - 49 dBA	55	Yes
	FF - 49 dBA	55	Yes

The calculated external noise levels from on–road traffic generated by the Centre is below the noise criteria established in Section 5.5 and are therefore acceptable.

Noise contours and additional noise level calculations for $L_{eq,\ 1\ hour}$ noise emissions from vehicle movements are shown in Appendix G.

[6] *At north facade*

7.0 CHILD CARE CENTRE NOISE INTRUSION

7.1 Indoor Playrooms and Sleeping Areas

Based on the external road $L_{eq,\ 15\ min}$ noise levels measured at Location 'C' from Terry Road, the external $L_{eq,\ 1\ hour}$ road noise levels have been calculated at the facades of Indoor Playrooms 1-3 at ground level and Playrooms 4-6 on the first floor.

A standard building façade will provide up to 10 dB reduction of external noise with windows open and 20-25 dB reduction with external windows and doors closed. The internal noise levels within Indoor Playrooms 1-6 with windows open (WO) and windows closed (WC) have been calculated to be as shown in Table 18.

Table 18 Calculated $L_{eq,\ 1\ hour}$ Road Noise Levels – Indoor Playrooms

Indoor Playroom Location	Calculated External Noise Level $L_{eq,\ 1\ Hr}$	Calculated Internal Noise Level $L_{eq,\ 1\ Hr}$		Noise Criterion $L_{eq,\ 1\ Hr}$	Compliance (Yes/No)	
		WO	WC		WO	WC
Cot Room (GF)	47 dBA	37 dBA	22 - 27 dBA	35 dBA	**No**	Yes
Playroom 1 (GF)	Up to 48 dBA[7]	44 dBA	29 - 34 dBA	40 dBA	**No**	Yes
Playroom 2 (GF)	53 dBA	43 dBA	28 - 33 dBA	40 dBA	**No**	Yes
Playroom 3 (GF)	34 dBA	24 dBA	9 - 14 dBA	40 dBA	Yes	Yes
Playroom 4 (FF)	54 dBA	44 dBA	29 - 34 dBA	40 dBA	**No**	Yes
Playroom 5 (FF)	62 dBA[8]	52 dBA	35 - 42[9] dBA	40 dBA	**No**	Yes
Playroom 6 (FF)	49 dBA	38 dBA	23 - 28 dBA	40 dBA	Yes	Yes

It can be seen from Table 18 that the internal noise level within the Cot Room and Indoor Playrooms 1, 2, 4 and 5 may exceed the internal noise criterion with windows/glazed doors open. As such, external windows and doors should be closed when these areas are in use.

Internal noise levels within all other Indoor Playrooms are below the internal noise criterion with windows open.

No specific noise controls are required for Indoor Playrooms 3 and 6. Noise contours for the entire OPA area on the ground and first floor, including noise levels at each facade of the indoor playrooms, are shown in Appendix H1 and H2.

[7] *At the east façade as a worst case.*
[8] *At the north façade as a worst case.*
[9] *An exceedance of 2 dB or less is considered negligible. Recommendations for glazing in are specified in Section 8.4.*

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.
- Use of the Outdoor Play Areas are to be restricted to a maximum of 4 hours per day.
- Ensuring a sufficient number of educators are provided to supervise children within the outdoor play areas 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 basement car park should move directly in to the basement car park and avoid idling vehicles for extended periods in the driveway.
- West facing windows to the 2-3 year old indoor playroom on the ground floor should be closed when these rooms are in use.
- East facing windows to Indoor Playroom 1 (3-5's) on the ground floor should be closed when this room is in use.
- West facing windows to Indoor Playroom 2 (2-3's) on the ground floor should be closed when this room is in use.
- All windows to Indoor Playroom 3 (0-2's) on the ground floor may remain open when this room is in use.
- East facing windows to the 3-5 year old Indoor Playroom 4 (3-5's) on the first floor should be closed when this room is in use.
- West facing windows to the 3-5 year old Indoor Playroom 5 (3-5's) on the first floor should be closed when this room is in use.
- West facing windows to Indoor Playroom 6 (3-5's) on the first floor should be closed when this room is in use.
- All other windows and glazed doors to all Indoor Playrooms may be left open when playrooms are in use.

8.2 Permissible Outdoor Play Scenarios

To be implemented in conjunction with the recommendations in Sections 8.1 and 8.3.

In order for the outdoor play areas (OPA's) at ground OPA-1 and at first floor OPA-2, to be used all day, the maximum number of children in these OPA's at any one time must be limited to either of the following groups:

Up to 126 children for a maximum of 4 hours per day:

- Up to 16 children, 0-2 years old within OPA-1; *and*
- Up to 20 children, 2-3 years old within OPA-1; *and*
- Up to 30 children, 3-5 years old within OPA-1; *and*
- Up to 60 children, 3-5 years old within OPA-2.

Staff to child ratios shall be maintained in accordance with the requirements stipulated in the National Quality Framework (NQF).

8.3 Sound Barrier Fences

The sound barrier fences, as shown in Appendix C, should be constructed from an impervious material such as sheet metal, masonry, lapped-and-capped timber, clear polycarbonate, toughened glass, a proprietary modular system or a combination, free from holes or gaps.

Should sheet metal or Colorbond fencing be used for outdoor play area fencing, we recommend that screen planting is used in front of this fencing where the fence may be impacted with balls and other items during outdoor play activities.

8.3.1 Site Boundary Fences

- Min 1 metre fences along the east and west boundaries within the front setback extending from the north boundary of the Site to the north building line.
- Min 1.8 metre fences along the east and west boundaries of the Site from the north building line to the south boundary of the Site.
- Min 2.1 metre section of fence along the east boundary of the Site adjacent to 'R3'.
- Min 1.8 metre fence along the south boundary of the Site.

8.3.2 Outdoor Play Areas

We recommend the following barrier heights and locations:

- Construct an acoustic barrier on the eastern boundary of OPA-1, in the section adjacent to 'R3', and along the southern boundary to a minimum height of 2.1 metres above ground level. This fence should comprise of a minimum 1.8 metre straight section with a cantilever extension fixed above to meet the required overall height. The top of the cantilevered extension should extend at least 400 mm into the site.
- Construct an acoustic barrier along the south perimeter of OPA-2 to a minimum height of 1.8 metres above the FFL of OPA-2.
- Construct acoustic barriers along the east and west perimeter of OPA-2 to a minimum height of 1.39 metres above the FFL of OPA-2.

A diagram of example acoustic fence configurations is shown in Appendix I.

8.4 Indoor Playrooms

We recommend that the north facing window of Indoor Playroom 5, facing Terry Road, achieves a minimum weighted sound reduction index of R_w 30. This can be achieved with 6.38 mm laminated glass in a fixed frame or an operable frame with acoustic seals installed.

Glazing to all other Indoor Playrooms may be of standard construction.

8.5 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 11, 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 F6D6 of the Building Code of Australia and Australian Standards AS1668.

8.6 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 CONCLUSION

Day Design Pty Ltd was engaged by White Stone Group on behalf of The Trustee for Y&Z TRD Trust to assess the environmental noise impact from a proposed Child Care Centre to be constructed at 16 Terry Road, Eastwood, NSW.

Calculations show that 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 of this report are implemented, the level of noise emitted by the proposed Child Care Centre at 16 Terry Road, Eastwood, 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.

Alexander Mendoza, MDesSc (Audio & Acoustics), MAAS
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 & Barrier Heights
Appendix D – $L_{eq,\ 15\ min}$ Noise contours: Outdoor Play Areas
Appendix E – $L_{eq,\ 15\ min}$ Noise contours: Carpark, Mechanical Plant & Indoor Play
Appendix F – L_{max} Noise contours: Sleep Disturbance
Appendix G – $L_{eq,\ 1\ hour}$ Noise contours: On Road Traffic
Appendix H – $L_{eq,\ 1\ hour}$ Noise contours: Road Traffic Noise Intrusion – Terry Road
Appendix I – Acoustic Fence Detail
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

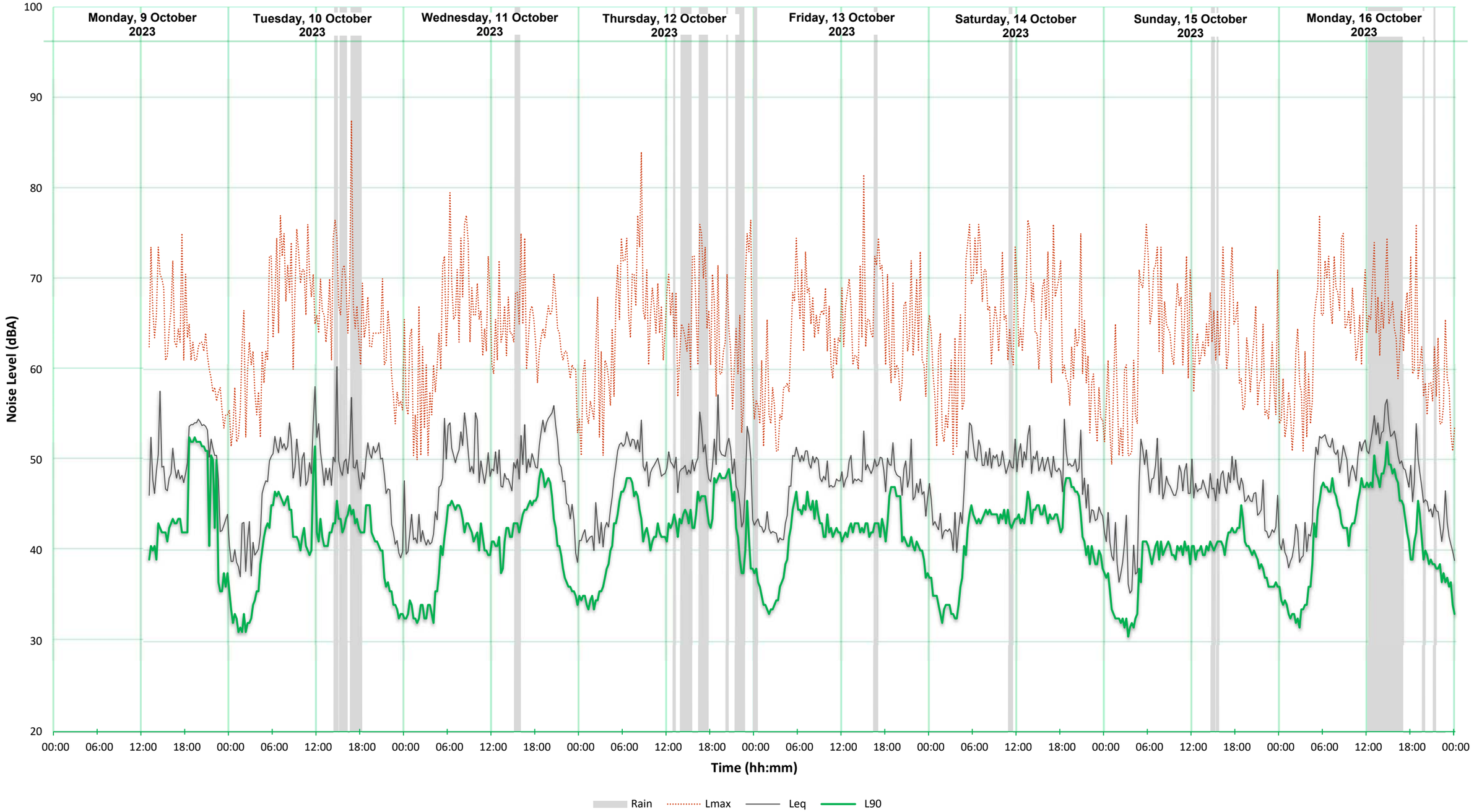
Description	Model No	Serial No
Infobyte Noise Logger (Type 1)	iM4	122
Condenser Microphone 0.5" diameter	MK 250	5219
Acoustical Calibrator	B&K 4231	2095415
Modular Precision Sound Analyser	B&K 2250	2690243
Condenser Microphone 0.5" diameter	B&K 4189	3022960
Modular Precision Sound Analyser	B&K 2270	3010781
Condenser Microphone 0.5" diameter	B&K 4189	3044649
Condenser Microphone 0.5" diameter	B&K 4189	2791662

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 Monitor iM4 (#122) is a Type 1 precision environmental noise monitors meeting all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

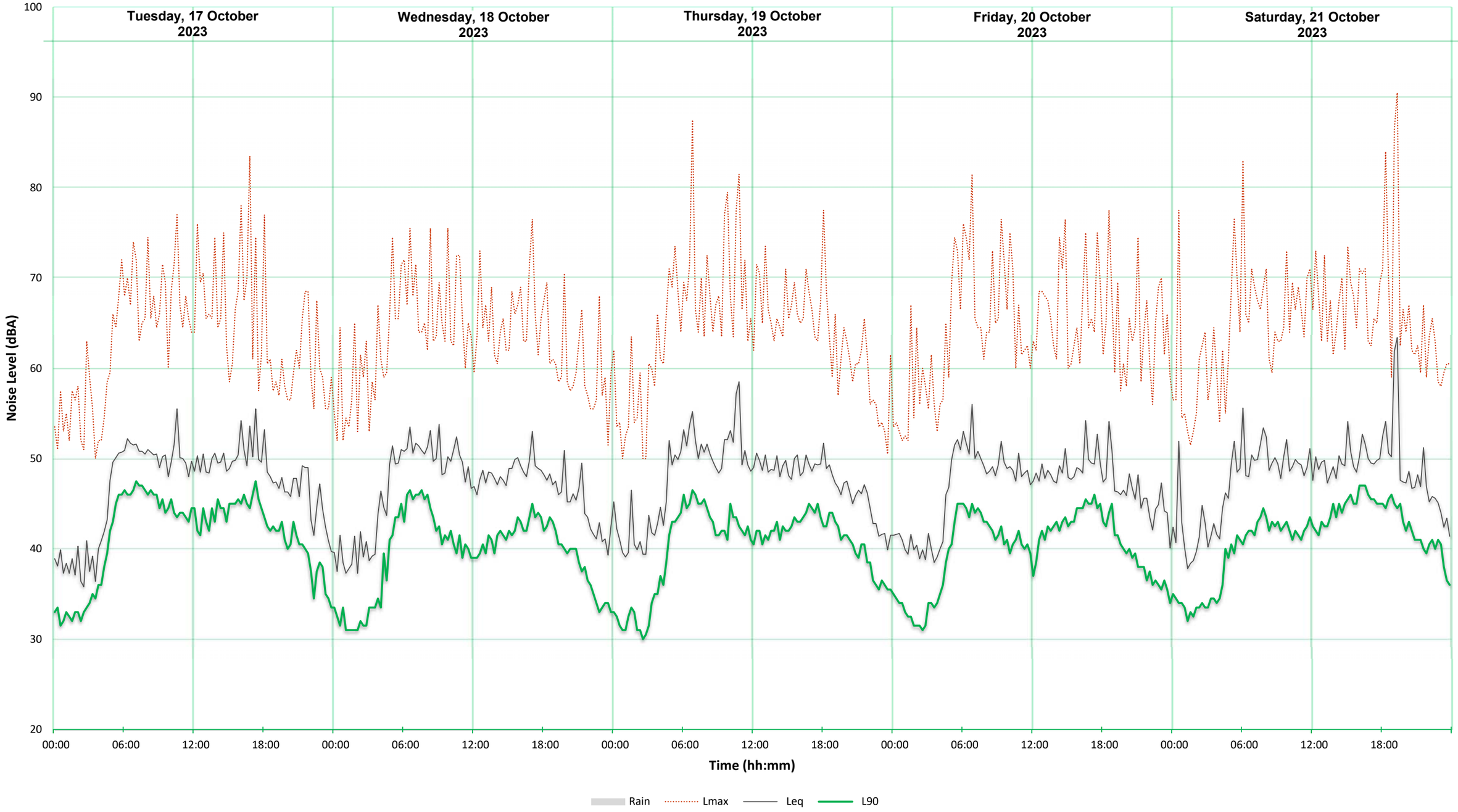
The B&K 2270 and 2250 are real-time precision integrating sound level meters with octave and third octave filters, that sample noise at a rate of 8 samples per second and provides L_{eq}, L_{10} and L_{90} noise levels using both Fast and Slow response and L_{peak} noise levels on Impulse response time settings. The meter is frequency weighted to provide dBA, dBC or Linear sound pressure level readings as required.

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 0.5dB for attended measurements and less than 1 dB during unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

Located at Rear Yard, 16 Terry Road, Eastwood, NSW



Located at Rear Yard, 16 Terry Road, Eastwood, NSW



Acoustic Barrier Heights

- 1 metre above ground level
- 1.8 metres above ground level
- 2.1 metres above ground level
- 2.1 metres above ground level with cantilever extending min. 450mm into site

NOTE: ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH BCA, SAA & COUNCILS CONDITIONS **COPYRIGHT:** DO NOT SCALE OFF ARCHITECTURAL DRAWINGS. THESE NOTES MUST BE READ IN CONJUNCTION WITH COLOURS SELECTION FOR ADDITIONAL DETAILS ON APPLIANCES, PC ITEMS & SHOWER SIZES SHOWN ON PLAN ARE INSIDE HOB DIMENSIONS, SHOWER SCREENS TO BE LIMITED ONLY INSIDE OF HOB BULKHEADS MAY BE REQUIRED TO ACCOMMODATE DRAINAGE UNDER & STEEL BEAMS POSITION TO BE DETERMINED ON SITE. **USE FIGURED DIMENSIONS ONLY, DO NOT SCALE.** FINISHED GROUND LEVELS ON PLANS ARE SUBJECT TO SITE CONDITIONS. ALL CALCULATED DIMENSIONS ARE SUBJECT TO SITE MEASURE DURING CONSTRUCTION & NO ALLOWANCE HAS BEEN MADE FOR SHRINKAGE OR MILLING POSITION OF ELECTRICAL METER TO BE DETERMINED ON SITE IN ACCORDANCE TO THE TURRET POSITION FRONT GARDEN TAP ON METER **ENERGY SMART DESIGN:** AAA RATED WATER CONSERVATION DEVICES INCLUDE RAINWATER TANK, SHOWER HEADS, WATER TAP FLOW REGULATORS, DUAL FLUSH TOILETS CERTIFIED AS COMPLIANT HOT WATER SYSTEMS WITH MINIMUM GREEN HOUSE SCORE OF 3 STARS ARE TO BE USED IN THIS DEVELOPMENT, OCCUPANTS ARE ENCOURAGED TO USE AAA RATED DISH WASHING MACHINES WITH FRONT LOADING WHERE POSSIBLE. OWNNOR/BUILDER MUST READ ALL PLANS IN CONJUNCTION WITH THE ASPECT & BASIX REPORT

DO NOT SCALE OFF ARCHITECTURAL DRAWINGS

LOT 12 DP 14296 | LOT 13 DP 14296 | LOT 1 DP 511311 | LOT 2 DP 511311 | LOT 9 DP 15420 | SP 70688

ROOM 1
3-5 YEAR ROOM
30 PLACES
AREA: 99.3m2
3 STAFF
FFL 76.700
17870X6500

ROOM 2
0-2 YEAR ROOM
16 PLACES
AREA: 65.5m2
4 STAFF
FFL 76.700
9000X8100

ROOM 3
2-3 YEAR ROOM
20 PLACES
AREA: 65.6m2
5 STAFF
FFL 76.700
10800X6000

DIRECTORS OFFICE 2900X4550 | RECEPTION 2600X2900 | ENTRY / FOYER | LIFT | STORE | SIGN IN BENCH | CLNR CPBD | ACCESS WC | CORRIDOR | CRAFT | NAPPY CHANGE 4200X2800 | NAPPY CHANGE 8400X2100 | COT ROOM 2900X2700 | COT ROOM 8400X3200 | BIN STORE 5200X2750 | STORAGE VOL 6.6m3 | STORAGE VOL 5.13m3 | STORAGE VOL 5.55m3 | STORAGE VOL 4.5m3 | STORAGE VOL 3.6m3 | STORAGE VOL 12m3 | BOTTLE PREP | LOCKER | SERVICE

PROPOSED OUTDOOR PLAY AREA: 545.3M2

BASEMENT BELOW SHOWN DOTTED

DRIVEWAY TO BASEMENT BELOW | SHARED ZONE SIGN AT DRIVEWAY ENTRANCE | STOP SIGN LOCATION | PROPOSED SIGHT TRIANGLE TO BE CLEAR OF OBSTRUCTIONS. ENSURE LANDSCAPE IS LOWER THAN 1.15M IN HEIGHT

GARAGE | SHED | FENCE | TIMBER | INACCESSIBLE | AWNING | ONE STOREY BRICK RESIDENCE TILE ROAD No. 18-20

GRASS AREA | CONCRETE | FOOTPATH | KERB | BUS STOP SHELTER | DRAINAGE PIT | APPROX. SEWER (SOURCE DBYD) | ROAD

150°00'20" | 62°34'20" | 333°29'20" | 221°22'20"

GROUND FLOOR PLAN -
1:100 @ A1

JANSSEN DESIGNS
info@ijanssendesigns.com.au | PO Box 41, Kenthurst 2156 | m: 0423 216 636
Nominated Architect: Jake Janssen NSW ARB 11575

AMENDMENTS

ISSUE:	DESCRIPTION	DATE:

Project Title:
Proposed Child Care Centre

DRAWING TITLE: Ground Floor Plan

ADDRESS: 16 Terry Road, Eastwood

CLIENT DETAILS: Zhong

LOCAL GOVERNMENT AREA: Ryde Council

Issue For:	Issue:		
DA	A		
Date: 1.9.2023	Scale: 1:100	Drawing #: A007	Project #: 10258

Acoustic Barrier Heights
1.39 metres above ground level
1.8 metres above ground level

7875-1 Appendix C

NOTE: ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH BCA, SAA & COUNCILS CONDITIONS **COPYRIGHT:** DO NOT SCALE OFF ARCHITECTURAL DRAWINGS. THESE NOTES MUST BE READ IN CONJUNCTION WITH COLOURS SELECTION FOR ADDITIONAL DETAILS ON APPLIANCES, PC ITEMS & SHOWER SIZES SHOWN ON PLAN ARE INSIDE HOB DIMENSIONS, SHOWER SCREENS TO BE FITTED OUT INSIDE OF HOB BULKHEADS MAY BE REQUIRED TO ACCOMMODATE DRAINAGE UNEH & STEEL BEAMS POSITION TO BE DETERMINED ON SITE. **USE FIGURED DIMENSIONS ONLY, DO NOT SCALE.** FINISHED GROUND LEVELS ON PLANS ARE SUBJECT TO SITE CONDITIONS. ALL CALCULATED DIMENSIONS ARE SUBJECT TO SITE MEASURE DURING CONSTRUCTION & NO ALLOWANCE HAS BEEN MADE FOR SHRINKAGE OR MILLING POSITION OF ELECTRICAL METER TO BE DETERMINED ON SITE IN ACCORDANCE TO THE TURRET POSITION FRONT GARDEN TAP ON METER **ENERGY SMART DESIGN:** AAA RATED WATER CONSERVATION DEVICES INCLUDE RAINWATER TANK, SHOWER HEADS, WATER TAP FLOW REGULATORS, DUAL FLUSH TOILETS, CETERIN & AC COMPLIANT HOT WATER SYSTEMS WITH MINIMUM GREEN HOUSE SCORE OF 3.5 STARS ARE TO BE USED IN THIS DEVELOPMENT, OCCUPANTS ARE ENCOURAGED TO USE AAA RATED DISH WASHING MACHINES WITH FRONT LOADING WHERE POSSIBLE. OWNNER/BUILDER MUST READ ALL PLANS IN CONJUNCTION WITH THE ASPIA & BASIX REPORT

DO NOT SCALE OFF ARCHITECTURAL DRAWINGS

ROOM 4
3-5 YEAR ROOM
20 PLACES
AREA: 65.3m2
2 STAFF
11000X6800

ROOM 5
3-5 YEAR ROOM
20 PLACES
AREA: 65.7m2
2 STAFF
14300X4500

ROOM 6
3-5 YEAR ROOM
20 PLACES
AREA: 65.4m2
2 STAFF
16000X3850

PROPOSED OUTDOOR PLAY AREA: 344M2

ONE STOREY
BRICK RESIDENCE
TILE ROOF
No. 18–20

SP 70688

LOT 12 DP 14296
LOT 13 DP 14296
LOT 1 DP 511311
LOT 2 DP 511311
LOT 9 DP 15420

FIRST 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 11575

AMENDMENTS

ISSUE:	DESCRIPTION	DATE:

Project Title:
Proposed Child Care Centre

DRAWING TITLE:
First Floor Plan

ADDRESS:
16 Terry Road, Eastwood

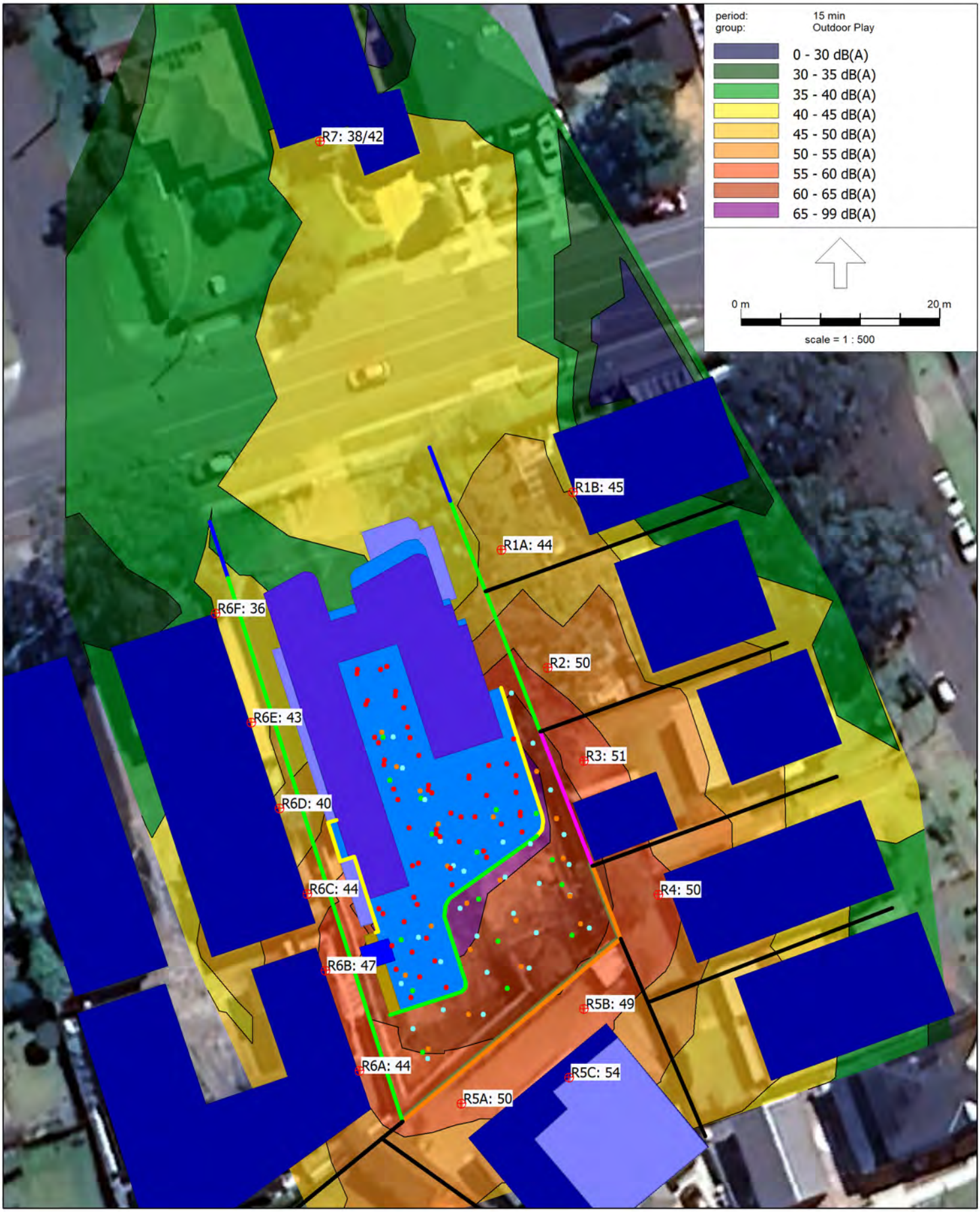
CLIENT DETAILS:
Zhong

LOCAL GOVERNMENT AREA:
Ryde Council

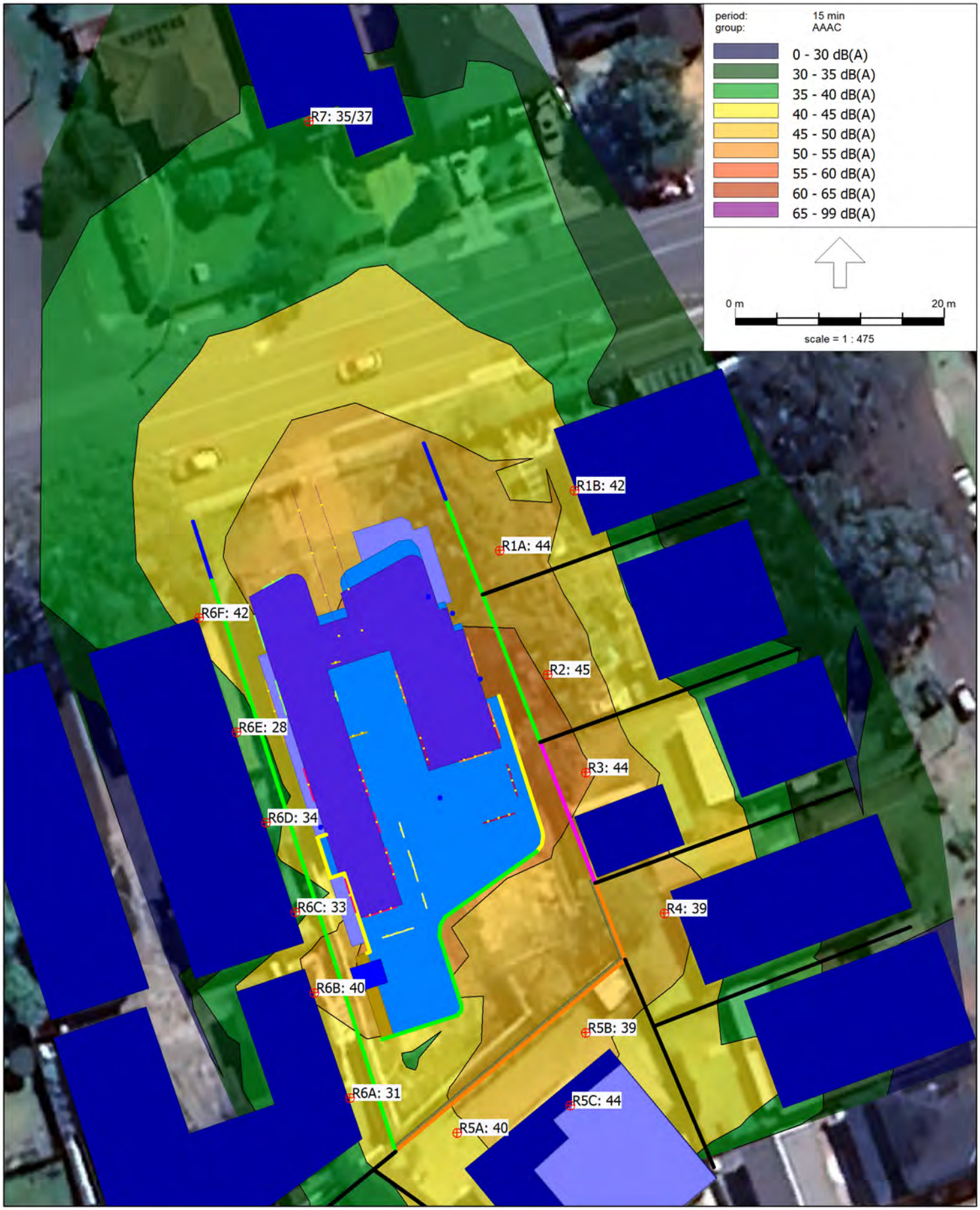
Issue For:	Issue:
DA	A

Date:	Scale:	Drawing #:	Project #:
1.9.2023	1:100	A009	10298

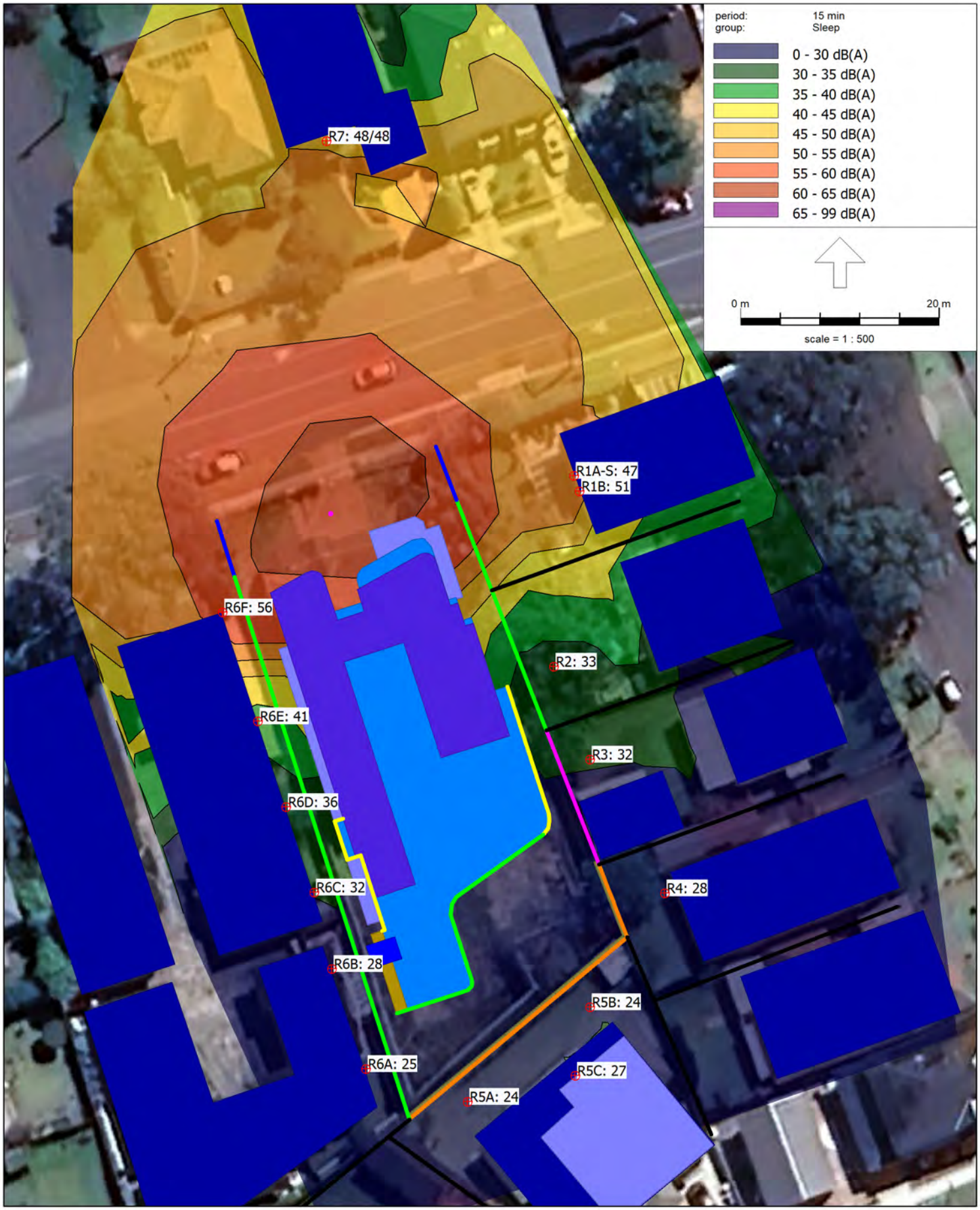
Leq, 15 min - Outdoor Play Areas. Up to 126 Children.



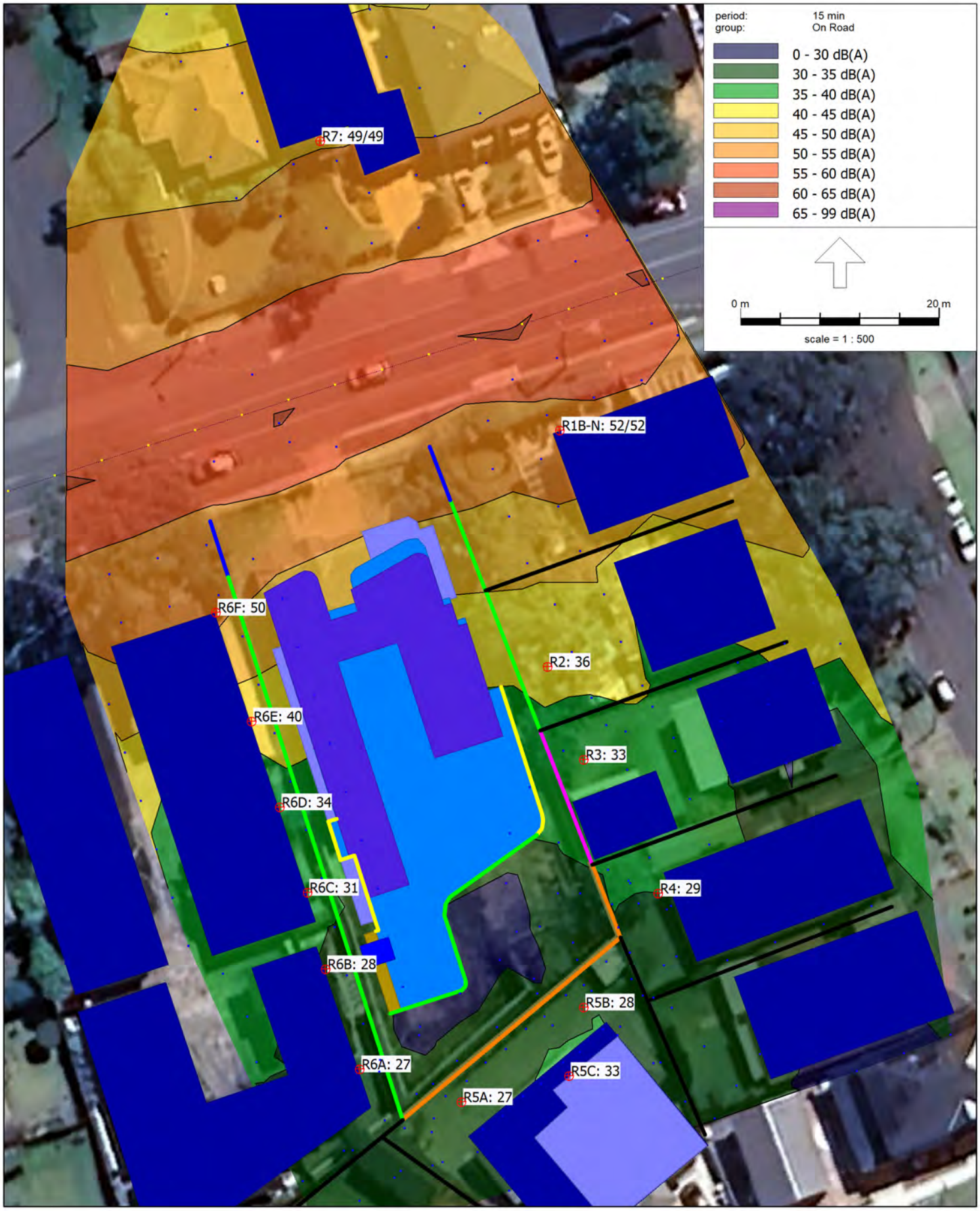
Leq, 15 min - Carpark, Indoor Play & Mechanical Plant



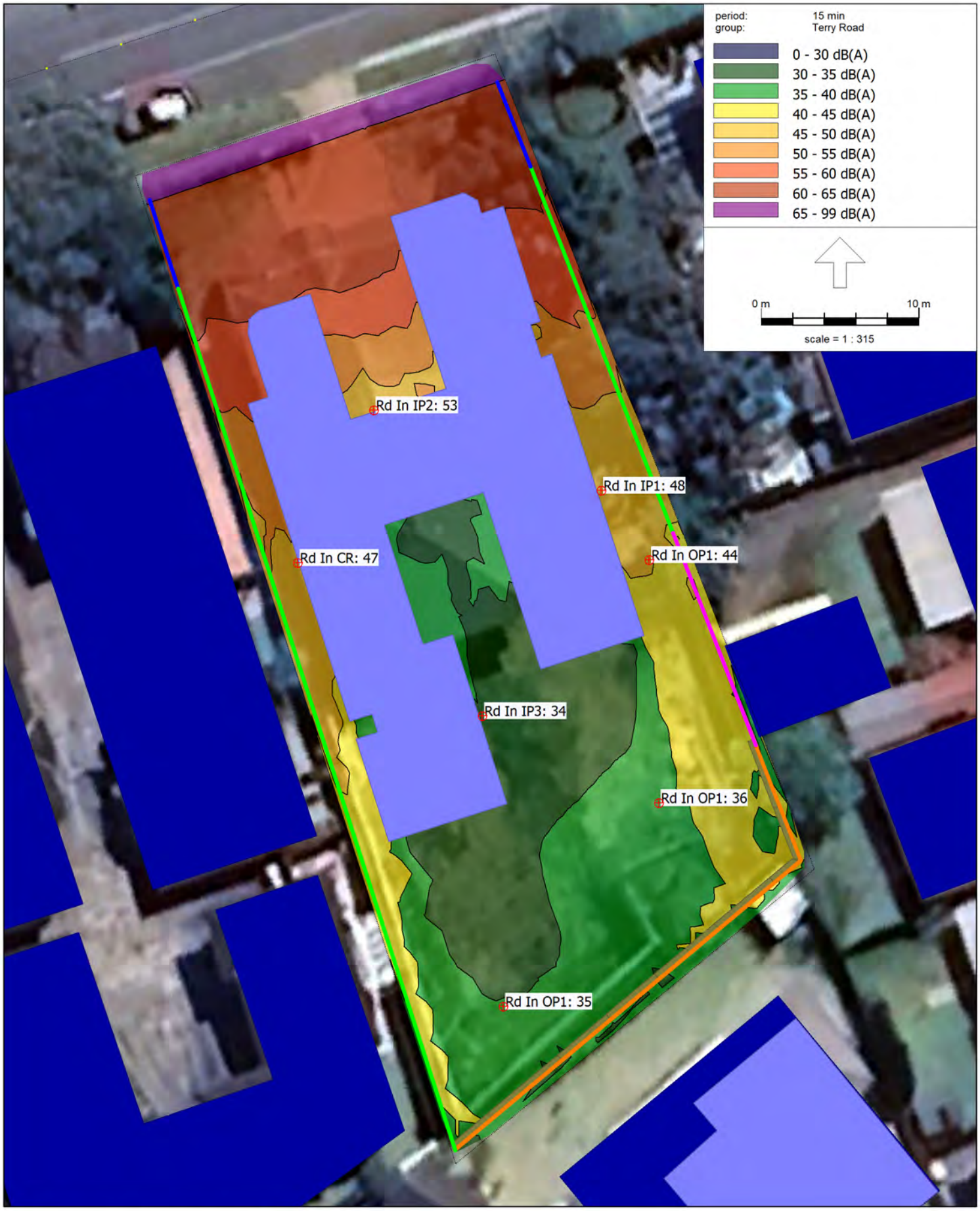
Lmax - Sleep Disturbance. Staff Vehicles.



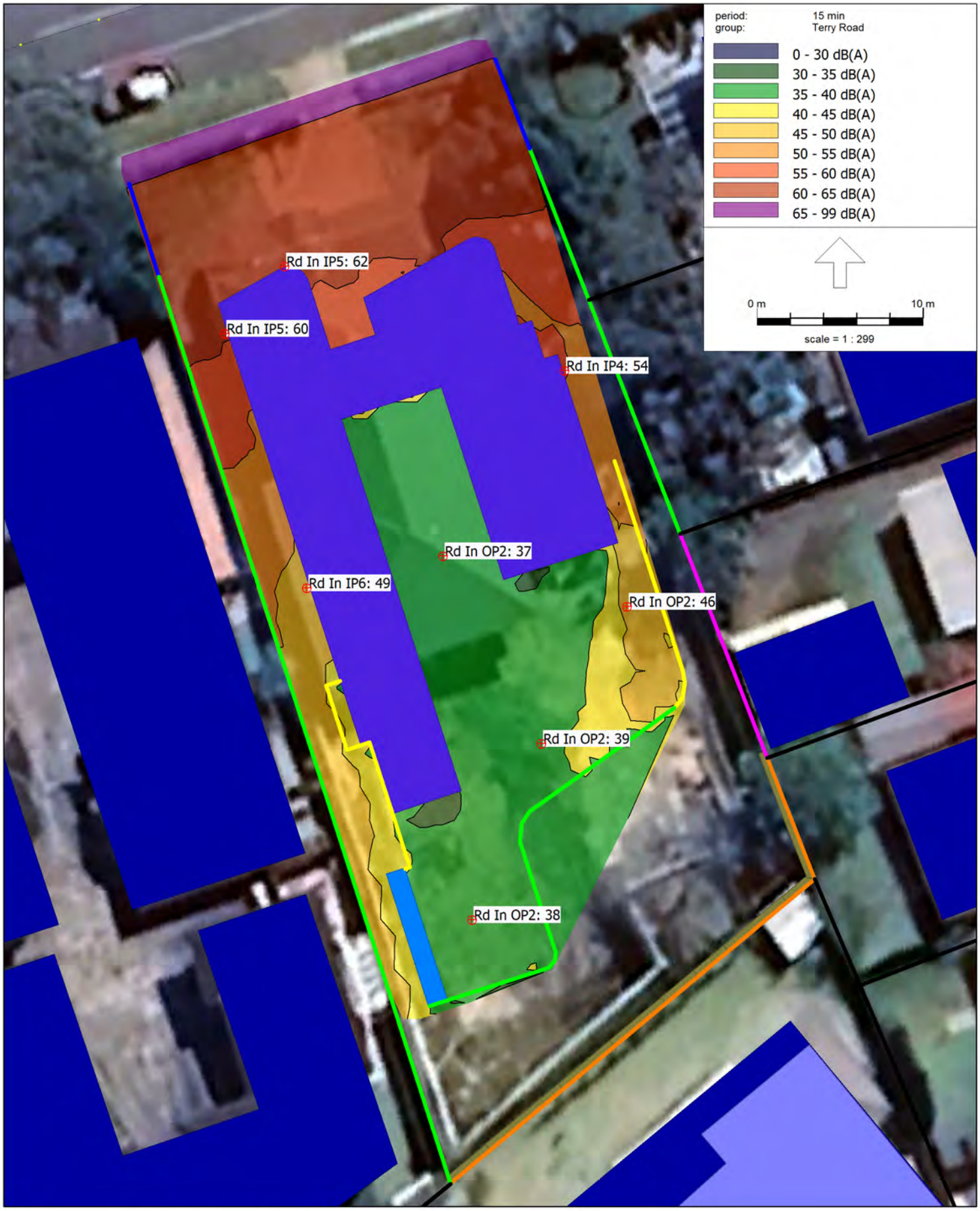
Leq, 1 hour - On Road Traffic



Leq, 1 hour - Road Traffic Noise Intrusion. Ground Floor (OPA-1)



Leq, 1 hour - Road Noise Intrusion. First Floor Level (OPA-2)



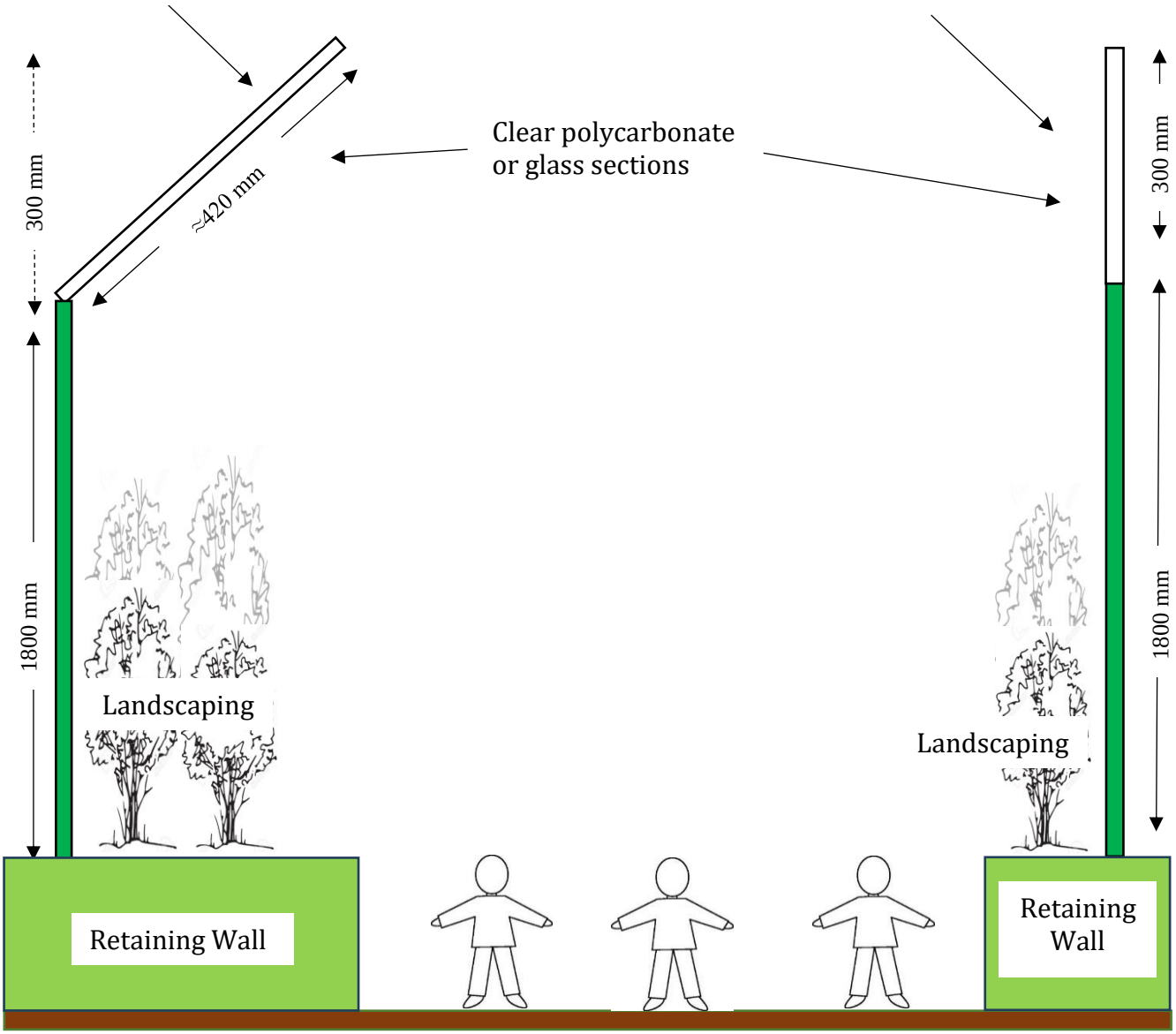
OUTDOOR PLAY AREA
Acoustic Fence Detail

Cantilever attachment at 45° inset from a standard 1.8 metre boundary fence.

Total height; 2.1 metres.

Standard boundary fence with extension.

Total height 2.1 metres



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, α – α 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, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α 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.