DAY DESIGN PTY LTD
CONSULTING ACOUSTICAL ENGINEERS

[redacted]

Environmental Noise Impact Assessment

Proposed Child Care Centre

15-17 Garswood Road, Glenmore Park, NSW

REPORT No
7041-1.1R

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Attn: Mr Ram Baskaran

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1.0 EXECUTIVE SUMMARY

A new child care centre (the Centre) is proposed to be constructed at 15-17 Garswood Road, Glenmore Park, NSW. The proposal involves the demolition of an existing single storey residential dwelling and construction of a new single storey building with a ground level car park.

The proposal includes 4 outdoor play areas, 6 indoor play rooms, one after school care room for children over 5 years old and associated offices, kitchen and laundry facilities.

The ground level car park will have capacity for 45 vehicles.

The Centre will have a total capacity for 200 children comprising:

- 0-2 years old – 20 children; and
- 2-3 years old – 30 children; and
- 3-5 years old – 120 children; and
- 5+ years old (After School Care) – 30 Children

The proposed hours of operation for the Centre are:

- Monday to Friday: 7:00 am – 6:00 pm.

The subject site is bounded on the west, north and east boundaries by residential premises on large lots. An active recreation area, the Penrith Golf Club, is located on the opposite side of Garswood Road to the south.

The various receptor locations nearby that may be affected by noise generating facets of the Centre are as follows:

- Children playing both outside and inside;
- Traffic generated by the development; and
- Mechanical plant serving the Centre.

Penrith City Council requires an acoustic assessment to accompany the development application to demonstrate that the noise impact from the Centre will not adversely affect the acoustic amenity of residential premises and active recreation areas nearby.

Acceptable noise limits have been derived from the Association of Australasian Acoustical Consultants *Guideline for Child Care Centres Acoustic Assessmen*t (the Guideline) and the Environmental Protection Authority's (EPA) *Noise Policy for Industry* (NPI) and *Road Noise Policy* (RNP).

Noise levels from the Centre's activities have been modelled to the nearest existing residential premises and active recreation areas. Recommendations are made in Section 8 of this report to reduce the noise emission to within the acceptable limits as established in Section 5.

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2.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Rammy Associates Pty Ltd on behalf of Wiggles and Giggles Pty Ltd to assess the potential environmental noise impact from a proposed Child Care Centre to be constructed at 15-17 Garswood Road, Glenmore Park, 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
- Calculate the level of noise emission, taking into account building envelope transmission loss, screen walls and distance attenuation
- Provide recommendations for noise control (if necessary)
- Prepare an Environmental Noise Impact Report.

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3.0 SITE AND DEVELOPMENT DESCRIPTION

3.1 Site Description

The site is located on the north side of Garswood Road, on land zoned *E4; Environmental Living* under the Penrith Local Environment Plan 2010.

The subject site is bounded on the west, north and east boundaries by residential premises on large lots. An active recreation area, the Penrith Golf Club, is located on the opposite side of Garswood Road to the south.

Approximately 150 metres to the north is the M4/Western Motorway and approximately 150 metres to the east is the Northern Road. Both roads carry high volumes of road traffic including trucks and other heavy vehicles. Road traffic noise from these two roads is the dominant noise source within the existing acoustic environment.

The nearest noise sensitive receptors are shown in Figure 1 and in Table 1.

Table 1 Noise Sensitive Receptors

Receptor	Address	Direction From Site	Building type
R1	19-27 Garswood Road	West	Residential
R2	1921 The Northern Road	North	Residential
R3	13 Garswood Road	East	Residential
R4	Penrith Golf Club	South	Active Recreation

3.2 Development Description

The proposal includes 4 outdoor play areas, 6 indoor play rooms, one after school care room for children over 5 years old and associated offices, kitchen and laundry facilities.

The car park will have capacity for 45 vehicles.

The Centre will have a total capacity for 200 children comprising:

- 0-2 years old – 20 children; and
- 2-3 years old – 30 children; and
- 3-5 years old – 120 children; and
- 5+ years old (After School Care) – 30 Children

The proposed hours of operation for the Centre are:

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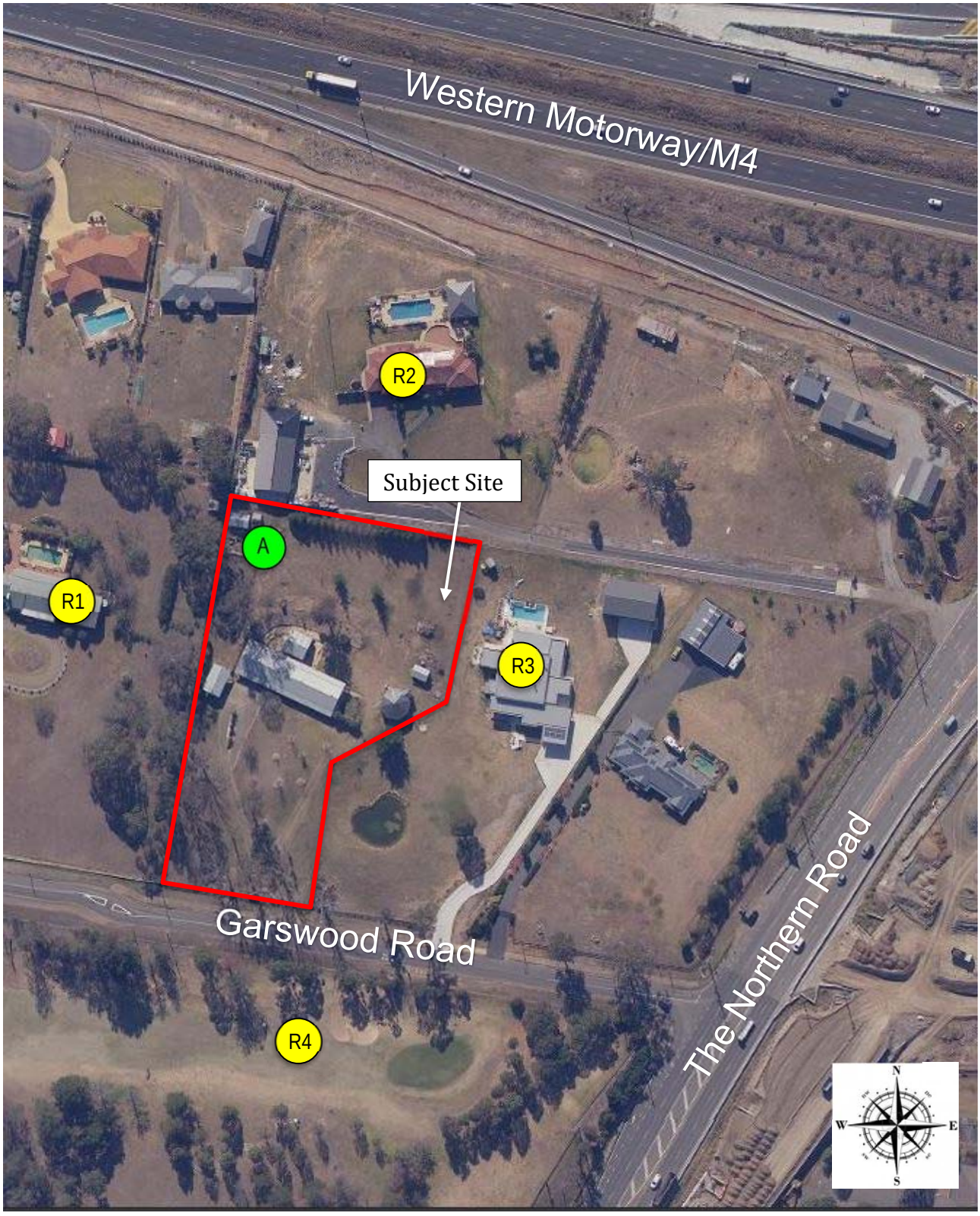

Figure 1 Location Plan, 15-17 Garswood Road, Glenmore Park, NSW.

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4.0 MEASURED NOISE LEVELS

4.1 Long Term Noise Monitoring

The L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measurement period (typically 15 minutes).

The Rating Background Level (RBL) is defined by the NSW EPA as the median value of the (lower) tenth percentile of L_{90} ambient background noise levels for day, evening or night periods, measured over a number of days during the proposed days and times of operation.

An environmental noise logger was placed on site in the rear yard of 15-17 Garswood Road, Glenmore Park to measure the existing background noise levels in the area. The logger was placed approximately 1.5 metres above ground level at Location 'A', as shown in Figure 1.

The logger gathered noise data between Tuesday 25 August and Tuesday 1 September 2020. Details of instrumentation used during the noise surveys can be seen in the attached Appendix A.

The results of the background noise survey at the logger position is shown in the attached Appendix B and Table 2. While the Centre is not proposed to operate during the evening and night time periods, noise levels during these times are shown to provide a complete overview of the current acoustic environment.

Table 2 Ambient Background Levels – 15-17 Garswood Road, Glenmore Park

Location	Time Period	L_{90} Rating Background Level - dBA	Existing L_{eq} Noise Levels - dBA
Location 'A'- Ground Floor Level	**Shoulder Period (6:30 am – 7 am)**	**58**	**N/A**
	Day (7 am to 6 pm)	**46**	**60**
	Evening (6 pm to 10 pm)	*46*	*50*
	Night (10 pm to 7 am)	*38*	*55*

Meteorological conditions during the measurement surveys typically consisted of clear skies with temperatures ranging from 2°C to 27°C. Atmospheric conditions were considered ideal for noise monitoring. Therefore, noise level measurements were considered reliable and considered to be representative of the background noise levels at all nearby receptor locations.

It is noted that the early morning shoulder period is significantly higher than the day time RBL. This is likely due to local wildlife, such as birds, sheltering in the nearby trees and peak hour road traffic on the nearby M4 and The Northern Road.

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5.0 NOISE CRITERIA

5.1 NSW DoPE –Child Care Planning Guide

The NSW Department of Planning and Environment (DoPE) published the Child Care Planning Guideline (CCPG) in August 2017 as a supplement to the State Environmental Planning Policy (SEPP) (Educational Establishments and Child Care Facilities) 2017.

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 that 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 neighboring residential developments.

C23

A new development, or development that includes alterations to more than 50 percent of the existing floor area, and is 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.*

C24

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.'*

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

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

C25

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.*

5.2 AAAC – Guideline for Child Care Centres Acoustic Assessment

5.2.1 AAAC Noise Criteria for Outdoor Play Areas

In May 2008, the Association of Australasian Acoustical Consultants (AAAC) first published the *Guideline for Child Care Centre Acoustic Assessment*. The guideline was updated in 2010 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).

It is common practice for councils to follow the recommendations of the EPA and require a noise criterion of background +5 dB at residential receptor locations for noise impact from sources such as mechanical plant, which may operate over a prolonged period of time.

However, children do not generally play outdoors for long periods of time, and as the duration of time for children playing outside is reduced, the overall noise annoyance reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration. The AAAC document states that a total time limit of 2 hours of outdoor play per day (e.g. 1 hour in the morning and 1 hour in the afternoon) should allow an additional 5 dB noise impact.

Up to 2 hours (total) per day – The $L_{eq,\ 15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.

More than 2 hours per day – The $L_{eq,\ 15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

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5.2.2 AAAC Noise Criteria for Indoor Play Areas, Mechanical Plant and Car Park

The $L_{eq,\ 15min}$ noise level emitted from the cumulative noise impact of children playing indoors, mechanical plant and traffic on the site shall not exceed the background noise level by more than 5 dB at the residential assessment location.

5.2.3 AAAC Noise Criteria for External Noise Impact on Children

For noise emission from road traffic, train lines and industry the noise level within any location within an outdoor play area during the hours when the Centre is operating shall not exceed 55 dBA $L_{eq,\ 1\ hour}$.

The $L_{eq,\ 1\ hour}$ noise level from road, rail traffic or industry at any location within the indoor play or sleeping areas of the Centre during the hours then the Centre is operating, shall not exceed 40 dBA $L_{eq,\ 1\ hour}$.

5.3 NSW Environment Protection Authority

5.3.1 Sleep Disturbance

Given the proposed operating hours of the Centre (7 am to 6 pm), it follows that a number of staff will arrive prior to 7 am. As such, the potential for sleep disturbance, from maximum noise level events from vehicles arriving during the shoulder period of 6:30 am and 7 am, has been considered.

The Noise Policy for Industry provides the following guidance (NPI, Section 2.5) for setting appropriate trigger levels for sleep disturbance:

> *'Sleep disturbance is considered to be both awakenings and disturbance to sleep stages. Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.'*

Additionally, Section 5.4 of the NSW Road Noise Policy provides the following advice with regard to sleep disturbance:

> *'From the research on sleep disturbance to date it can be concluded that:*
>
> - *Maximum internal noise levels below 50 – 55 dBA are unlikely to awaken people from sleep*
> - *One or two noise events per night, with maximum internal levels of 65 – 70 dBA are not likely to affect health and wellbeing significantly.*

It is noted that the early morning shoulder period is significantly higher than the day time RBL. This is likely due to local wildlife, such as birds, sheltering in the nearby trees and peak hour road traffic on the nearby M4 and The Northern Road.

As a conservative approach, we have use the day time RBL to set the sleep disturbance criterion.

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5.4 Road Traffic Noise Criteria

The NSW Road Noise Policy (RNP), in Section 2.3.1, sets out road traffic noise assessment criteria for residential and non-residential land uses in Tables 3 and 4 of the policy. The relevant information in those tables is extracted and reproduced in Table 3 below.

Table 3 Road Traffic Noise Assessment Criteria - Residential

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7 am – 10 pm)	Night (10 pm – 7 am)
Local roads	1. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55dB (external)	$L_{Aeq, (1\ hour)}$ 50dB (external)

The noise criterion in Table 3 above is to be assessed at 1 metre from the nearest affected façade, as outlined in Table 7 of the RNP.

5.5 NSW Noise Policy for Industry

The Environmental Protection Authority published its Noise Policy for Industry (NPI) in 2017. For setting appropriate noise limits for the active recreation area, the Penrith Golf Club, we refer to the Table 2.2 of the NPI, which specifies recommended amenity noise levels for these areas as follows:

- $L_{eq, 15\ min}$ 55dBA – When in use

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5.6 Project Specific Noise Criteria

Based on measurements of the existing acoustic environment and the relevant planning instruments and legislation, the noise criteria at each receptor applicable at each location is as shown in the following sections.

5.6.1 Residential Receptors

For residential premises:

- (46 + 5 =) **51 dBA** $L_{eq,\ 15\ minute}$ for outdoor play and the cumulative impact of all other noise sources including car park, mechanical plant and indoor play areas.

Compliance with the residential noise criteria is assessed at 1 metre from the façade of the receptor or outside the most affected first floor window.

5.6.2 Sleep Disturbance

Consideration has been given to sleep disturbance caused by noise generated by vehicles of staff arriving prior to 7 am.

Residential facades at ground floor level:

- (46 + 15 =) **61 dBA** L_{Amax} at ground floor level between 6.30 am and 7 am.

For all residential premises:

- **50 – 55 dBA** L_{Amax} internal level between 6.30 am and 7 am (staff arriving).

5.6.3 Active Recreation Areas

For all active recreation areas:

- **55 dBA** when in use

5.6.4 On-Road Traffic Noise Criterion

The following criterion will be applied for residential and non-residential receptors for additional on – road traffic noise generated by the use of the Centre:

- **55 dBA** (external) $L_{eq,\ 1\ hour}$ 1 metre from the nearest residential façade between 7 am and 10 pm.

5.6.5 External Noise Within Indoor Play and Sleeping Areas

The following criterion will be applied within any point of any indoor area within the Centre for external noise intrusion:

- **40 dBA** (internal) $L_{eq,\ 1\ hour}$ within any other room, when in use.

5.6.6 External Noise Within Outdoor Play Areas

The following criterion will be applied within any point of any outdoor play area within the Centre for external noise intrusion:

- **55 dBA** $L_{eq,\ 1\ hour}$ when in use.

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6.0 CHILD CARE CENTRE NOISE EMISSION

The noise impacts to the nearby noise sensitive areas have been assessed from noise generated by the Centre as follows:

- Up to 200 children playing both outside and inside;
- Traffic generated by the use of the Centre; and
- Mechanical plant.

For a residence, the project noise trigger level and maximum noise levels are assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level.

In assessing amenity noise levels within an active recreation area, the noise level is to be assessed at the reasonably most-affected point on or within the property boundary.

We have considered the noise impact at each of the residential receptor locations and active recreation areas, as outlined in Table 1. Noise modeling is based on preliminary architectural drawings provided by Design M Studio, as shown in Appendix D.

All distances used in noise calculations are approximate and are based on individual noise generating facets within the Centre, as shown in Appendix C, to the assessment location at each receptor. All residential receptor locations listed in Table 1, at which noise levels have been assessed, are representative of all adjacent residential receptors in the immediate area. Compliance at these nearest representative locations will ensure compliance at every other adjacent receptor.

6.1 Indoor and Outdoor Play Areas

Day Design Pty Ltd has previously measured and quantified the $L_{eq\ (15\ min)}$ sound level of children at a number of different child care centres. From this data we have been able to determine an L_{eq} sound power level (SWL) per child.

The AAAC has presented a range of A-weighted SWL's per child in its '*Guideline for Child Care Centre Acoustic Assessment*'. The logarithmic average of the full range of A-weighted SWL's for children has been used to represent the noise emission from a typical group of mixed aged children engaged in free play. It should also be noted that from previous experience, where passive/quiet activities are engaged in by children, the noise generated by children is generally 10 dB lower than active play.

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The sound power levels for each group are presented in Table 4 and used in this assessment.

Table 4 Children at Play Indoor and Outdoor $L_{eq,\ 15\ min}$ Sound Power Levels

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	**79**	55	61	67	72	75	72	68	64
10 children, 2 to 3 years	**85**	61	67	73	79	81	78	74	70
10 children, 3 to 5 years	**88**	65	71	76	82	85	81	77	73
10 children, 5+ years	**90**	67	73	78	84	87	83	79	75

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 160 trips in 1 hour arriving or leaving the car park in the morning peak. This is equivalent to 40 vehicle trips in a 15 minute period.

The SEL and L_{Amax} sound power level and spectra of vehicle noise is shown in Table 5. These levels are based on previous measurements by Day Design.

For the assessment of sleep disturbance we have assumed that staff vehicles will arrive at the Child Care Centre between 6:30 am and 7:00 am, enter the car park from the driveway on the north side of the subject site and park in the designated staff parking spaces at ground level.

For the assessment of vehicular activity from within the car park area we have assumed vehicles will travel at a rate of 10km/h. For additional noise generated by on-road traffic, we have assumed vehicles will travel at a rate of 30km/h as they approach or leave the Centre.

Table 5 Sound Power Levels of Car Park Noise

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
SEL sound power level of car drive-by at approximately 10 km/h	**82**	86	82	78	77	78	73	70	64
SEL sound power level of car drive-by at approximately 30 km/h	**87**	93	86	84	82	83	76	69	63
L_{Amax} of car turning into driveway	**92**	98	92	90	88	88	83	80	76

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6.3 Mechanical Plant

At the time of preparing this noise impact assessment report it is anticipated that three Actron SRA260C air conditioning units will serve the various areas of the Centre. It is also anticipated that exhaust fans may also be installed to ventilate bathrooms, kitchen and laundry areas however, specific models of ventilation fans had not yet been selected.

To determine the levels of noise at each residential receptor, sound power levels from an Actron SRA260C condenser unit (previously measured by Day Design) and typical exhaust fans for toilets, laundry and kitchen areas and have been used.

It is anticipated that two outdoor air conditioning condenser units will be installed at ground level on the south side of the building outside the Administration and Office areas and another unit will be installed at ground level outside the Cot Room, as shown in the architectural drawings attached as Appendix C. It is anticipated that toilet, laundry and kitchen exhaust fans will discharge at rooftop level.

Sound power levels used in the calculation of the noise contribution from the mechanical plant are shown in Table 6.

Table 6 $L_{eq,\ 15\ min}$ Sound Power Level – Mechanical Plant

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Typical Toilet/Laundry Exhaust Fan[1] - 2 off	**59**	51	47	50	53	58	43	36	31
Typical Kitchen Exhaust Fan[2] - 1 off	**65**	53	57	57	65	58	52	45	34
Typical Outdoor Condenser Unit[3] - 3 off	**75**	80	75	75	74	68	64	58	50

[1] *Spectral sound power level based on Fantech TD-500/150 SIL*
[2] *Spectral sound power level based on Fantech RSS0316AA10/10*
[3] *Spectral sound power level based on Actron SRC260C outdoor condenser unit.*

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7.0 CALCULATED NOISE LEVELS AT RECEPTOR LOCATIONS

Knowing the sound power level of a noise source (See Tables 4 to 6), 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.

The following noise level calculations are shown for the ground and first floor levels of the nearest residential dwellings and for ground floor levels of active recreation areas. The calculated noise level at the receptor locations from the various noise producing facets of the Centre are shown in Tables 7 to 11.

7.1 Cumulative Noise Level –Indoor Play, Car Park and Mechanical Plant

Calculations assume all 200 children are playing inside and are distributed evenly throughout the indoor play areas with windows and doors partially open when the Centre is in use.

Calculations also assume that 1.8 metre high boundary fences are in place along the north, south east and west boundaries of the outdoor play areas only.

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 7.

Cumulative noise levels at levels for indoor play, car park use and mechanical plant are shown in Tables 7 and 8.

Table 7 Cumulative $L_{eq,\ 15\ minute}$ Noise Levels - Indoor Play, Car Park and Mechanical Plant (R1, R2)

Receptor Location	Calculated Noise Level - $L_{eq,\ 15\ min}$	Noise Criterion - $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R1 – Residence (West)			
- Indoor play areas	GF - 36 dBA		
- Car park	GF - 35 dBA		
- Mechanical plant	GF - 9 dBA		
Cumulative Noise Level	GF - 39 dBA	51 dBA	Yes
R2 – Residence (North)			
- Indoor play areas	GF - 43 dBA		
- Car park	GF - 17 dBA		
- Mechanical plant	GF - 9 dBA		
Cumulative Noise Level	GF - 43 dBA	51 dBA	Yes

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Table 8 Cumulative $L_{eq,\ 15\ minute}$ Noise Levels - Indoor Play, Car Park and Mechanical Plant (R3-R4)

Receptor Location	Calculated Noise Level - $L_{eq,\ 15\ min}$	Noise Criterion - $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R3 – Residence (East)			
- Indoor play areas	GF - 46 dBA		
- Car park	GF - 45 dBA		
- Mechanical plant	GF - 30 dBA		
Cumulative Noise Level	GF - 48 dBA	51 dBA	Yes
R4 – Active Recreation (South)			
- Indoor play areas	GF - 27 dBA		
- Car park	GF - 28 dBA		
- Mechanical plant	GF - 13 dBA		
Cumulative Noise Level	GF - 31 dBA	55 dBA When in use	Yes

The calculated cumulative $L_{eq,\ 15\ minute}$ levels of noise from the general operation of the Centre is summarised in Tables 7 and 8 at each receptor location. With the aforementioned assumptions, the calculated cumulative levels of noise from the Centre indicate that the noise criteria is met at all receptor locations.

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7.2 Outdoor Play Areas

The calculated $L_{eq,\ 15\ min}$ noise levels from activity in the outdoor play area for each receptor, are shown in Table 9. Using AAAC sound power levels for children, as established in Table 4, the calculated noise levels at each receptor location was determined by evenly distributing all 200 children into groups at separate locations across the outdoor play areas, as can be seen in Appendix C.

Calculations also assume that 1.8 metre high boundary fences are in place along the north, south east and west boundaries of the outdoor play areas only.

Table 9 Calculated L_{eq} Noise Levels - Outdoor Play

Receptor Location	Calculated Noise Level - $L_{eq,\ 15\ min}$	Noise Criterion - $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R1 – Residence (West)	51 dBA	51 dBA	Yes
R2 – Residence (North)	51 dBA	51 dBA	Yes
R3 – Residence (East)	51 dBA	51 dBA	Yes
R4 – Active Recreation (South)	37 dBA	55 dBA When in use	Yes

The calculated $L_{eq,\ 15\ minute}$ levels of noise from children playing outdoors are summarised in Table 9 at the receptor locations. It can be seen that the level of noise emission from the use of the outdoor play areas is below the noise criterion established in Section 5 of this report for all receptor locations.

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7.3 Sleep Disturbance

It is proposed that the Centre will accept children from 7 am. A number of staff will arrive and park within the basement car park, prior to 7 am to prepare for the arrival of the children, with more staff and parents arriving after 7 am.

The calculated L_{Amax} noise levels at the nearest façade of the most affected residential receptor locations 'R1', 'R2' and 'R3' are shown in Table 10.

Calculations also assume that 1.8 metre high boundary fences are in place along the north, south east and west boundaries of the outdoor play areas only.

Given that these receptors are the closest and most exposed to L_{max} noise events from the Centre, compliance at these receptor locations ensures compliance at all other receptors which are further away.

Table 10 Calculated L_{max} Noise Levels - (R1 – R3)

Receptor Location	Calculated Noise Level - L_{max}	Noise Criterion - L_{max}	Compliance (Yes/No)
R1 – Residence (West)	49 dBA	61 dBA	Yes
R2 – Residence (North)	26 dBA	61 dBA	Yes
R3 – Residence (East)	57 dBA	61 dBA	Yes

It can be seen from Table 10 that the L_{Amax} noise level at all residential receptor locations is below the sleep disturbance noise criterion established in Section 5 and is therefore acceptable.

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7.4 On – Road Traffic

The external $L_{eq,\ 1\ hour}$ traffic noise levels at the residential receptor locations associated with additional on – road traffic throughout the day have been calculated. Calculations assume additional traffic will be travelling on Garswood Road. $L_{eq,\ 1\ hour}$ noise levels at receptor locations 'R1' - 'R4' are shown in Table 11.

Receptors 'R1', 'R3' and 'R4' are the closest and most exposed to additional traffic generated from the Centre. It is reasonable to assume that compliance at these locations will ensure compliance at all other receptor locations which are further away and shielded from the road by buildings and other structures.

Calculations consider distance attenuation only and assume a worst case scenario with all traffic from the Centre moving past each receptor exclusively. However, vehicles are more likely use the additional surrounding roads, therefore it is reasonable to assume noise levels will be lower in practice.

Table 11 Calculated $L_{eq,\ 1\ hour}$ Noise Levels - Additional On – Road Traffic

Receptor Location	Calculated Noise Level $L_{eq,\ 1\ hour}$	Noise Criterion $L_{eq,\ 1\ hour}$	Compliance (Yes/No)
R1 – At nearest façade	29 dBA	55 dBA	Yes
R3 – At nearest façade	30 dBA	55 dBA	Yes
R4 – At nearest affected point	39 dBA	55 dBA	Yes

The calculated external $L_{eq,\ 1\ hour}$ noise levels of noise from additional on-road traffic at the nearest residential locations are well below the noise criteria established in Section 5 and is therefore acceptable.

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7.5 External Traffic Noise Within Outdoor Play Areas

The site is exposed to road traffic noise from the M4/Western Motorway to the north and The Northern Road to the east. Road traffic noise constitutes the dominant noise source within the existing acoustic environment, which is constant throughout the day when the Centre is to be in operation. Based on long term noise measurements conducted on site, as described in Section 4.1, we have calculated that the $L_{eq,\ 1hour}$ level of external road traffic noise within the play area is 60 dBA. No boundary fences were in place while the environmental noise logger gathered ambient noise data.

$L_{eq,\ 1hour}$ noise levels within the outdoor play area are shown in Table 12. Calculations assume attenuation due to new 1.8 metre high fences constructed along the east, north, west and south boundaries of the outdoor play areas.

Table 12 Calculated $L_{eq,\ 1\ hour}$ Road Traffic Noise Levels – Outdoor Play Areas

Receptor Location	Calculated Noise Level $L_{eq,\ 1\ hour}$	Noise Criterion $L_{eq,\ 1\ hour}$	Compliance (Yes/No)
Outdoor Play Area	53 dBA	55 dBA	Yes

The calculated external level of road traffic noise is below the noise criteria in Section 5 and is therefore acceptable.

7.6 External Noise Within Indoor Play and Sleeping Areas

Based on long term noise measurements conducted on site, as described in Section 4.1, we have calculated that the $L_{eq,\ 1hour}$ level of external road traffic noise at the facades of indoor play areas will be 53 dBA within for the outdoor play areas in Table 12 above.

We have assumed that windows and glazed doors comprise standard thickness glazing throughout the building. Standard façade construction with partially open windows/doors typically reduce external noise by up to 10 dB.

Table 13 Calculated $L_{eq,\ 1\ hour}$ Road Traffic Noise Levels – Indoor Play Areas

Receptor Location	Calculated Noise Level - $L_{eq,\ 1\ hour}$	Noise Criterion - $L_{eq,\ 1\ hour}$	Compliance (Yes/No)
Indoor Playrooms – Windows/Doors Open	**43 dBA**	40 dBA	**No +3 dB**
Indoor Playrooms – Windows/Doors Closed	35 dBA	40 dBA	Yes

It can be seen that the calculated internal levels of road traffic noise may exceed the noise criteria established in Section 5 when windows and/or glazed doors are open. The internal noise criterion is met when windows and/or glazed doors of indoor play areas are closed.

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8.0 NOISE CONTROL RECOMMENDATIONS

8.1 Management Plan

We recommend the Child Care 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
- Neighbours should be provided with the name and contact details of the Centre Director, and the invitation to contact that person at any time the Centre is operating.
- Staff arriving prior to 7 am should park in the dedicated Staff parking spaces.
- All external windows and sliding doors to all indoor play areas shall be kept closed except when in use.
- 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.

8.1.1 Outdoor Play Areas

Up to 200 children can utilise the outdoor play areas, as follows:

- Up to 20 children, 0-2 years old, within Outdoor Play Area 1 all day; ***and***
- Up to 30 children, 2-3 years old, within Outdoor Play Area 1 all day; ***and***
- Up to 60 children, 3-5 years old, within Outdoor Play Area 2 all day; ***and***
- Up to 60 children, 3-5 years old, within Outdoor Play Area 3 all day; ***and***
- Up to 30 children, 5+ years old, within Outdoor Play Area 4 all day.

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

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8.2 Sound Barrier Fences

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

We recommend that the use of Colorbond or sheet metal fencing be avoided in areas where the fence may be impacted with balls and other items during outdoor play activities.

8.2.1 Outdoor Play Areas – Up to 200 children

In order to meet the established noise criteria for all receptor locations with up to 200 children engaged in active play within each of the Outdoor Play Areas, we recommend the following fence heights are constructed:

- Construct a sound barrier fences along the west, north and east boundaries of the outdoor play area to a minimum height of 1.8 metres above finished ground level of the outdoor play area.

Acoustic fences and their required heights are shown in Appendix C.

8.2.2 Site Boundary Fences

Provided acoustic fences are constructed around the outdoor play areas, as specified in Section 8.2.1, additional acoustic fences along the boundaries of the site are not required to meet the established noise criteria.

8.3 Mechanical Plant

Outdoor air conditioning condenser units are proposed for the Centre and our calculations assume that units will be installed at ground level on the east façade. In this location, we recommend that the maximum total sound power level for all external condenser units is 75 dBA or less.

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 Landscaping

Landscaping between the noise source and the receptors, in the form of trees and tall shrubs that provide visual screening of the noise source, will not reduce noise levels appreciably. However, they tend to make intrusive noise psychologically less offensive.

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8.5 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.

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9.0 CONCLUSION

Day Design Pty Ltd was engaged by Rammy Associates Pty Ltd on behalf of Wiggles and Giggles Pty Ltd to assess the potential environmental noise impact from a proposed Child Care Centre to be constructed at 15-17 Garswood Road, Glenmore Park, NSW.

Measurements and calculations 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 15-17 Garswood Road, Glenmore Park, 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 *Noise Policy for Industry* and *Road Noise Policy,* as detailed in Section 5 of this report, and is considered acceptable.

[redacted]

Alexander Mendoza, MDesSc (Audio and Acoustics), MAAS

Acoustical Consultant

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 – Sound Barrier Fence Heights
Appendix D – Architectural Drawings
AC108-1 to 4 – Glossary of Acoustical Terms

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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 2)	iM4	122
Condenser Microphone 0.5" diameter	MK 250	5219

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 monitor 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.

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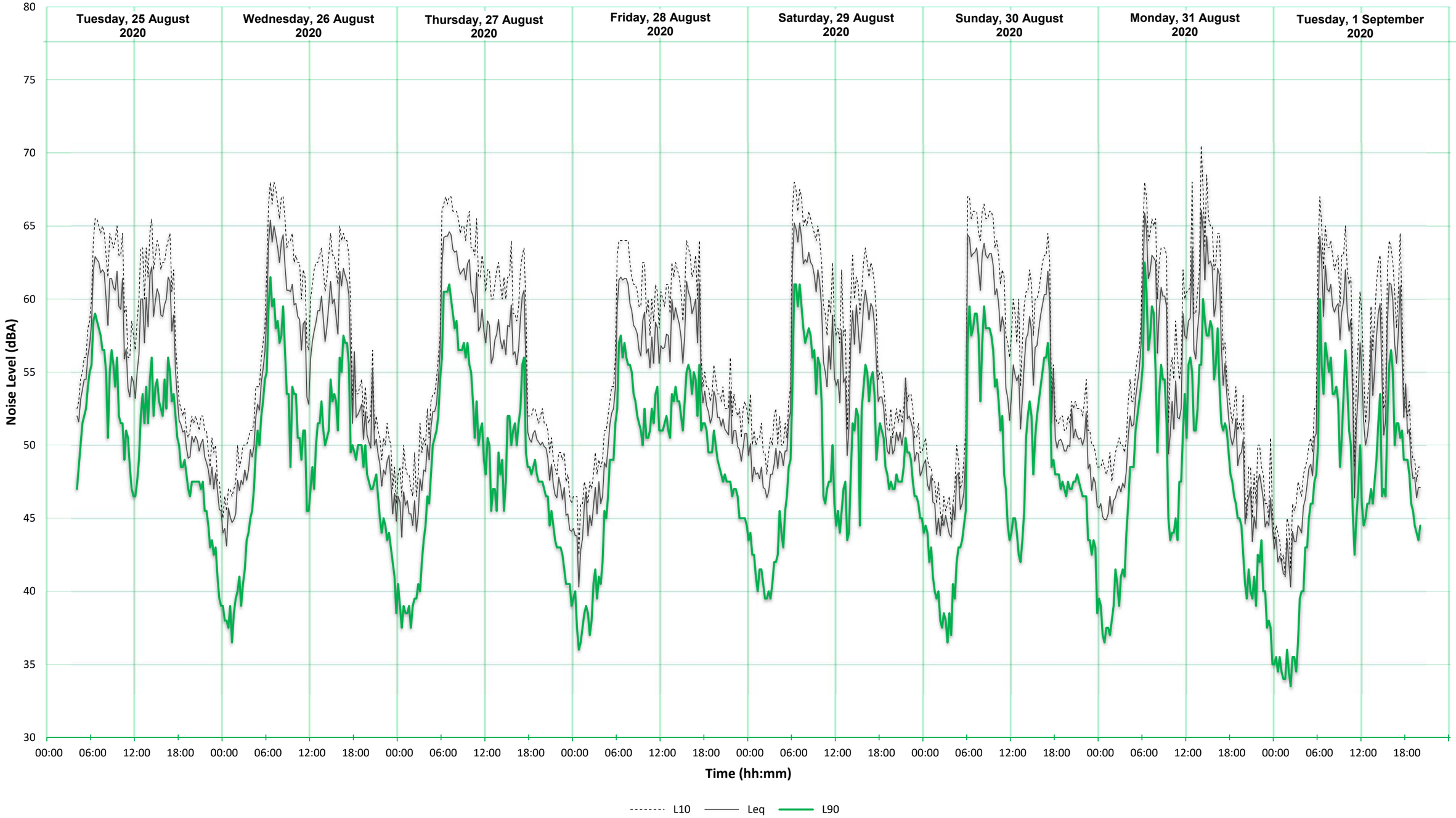
Located at 15-17 Garswood Rd, Glenmore Park, NSW



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GLOSSARY OF ACOUSTICAL TERMS

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).

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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.

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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).

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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.

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