Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Environmental Noise Assessment

54 & 56 Rochester Drive, Mindarie
Proposed Childcare Centre

Reference: 21106780-01A

Prepared for:
UZP Pty Ltd

Association of Australasian Acoustical Consultants

Report: 21106780-01A

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

Contacts	General	Daniel Lloyd	Terry George	Matt Moyle
E:	info@lgacoustics.com.au	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au
P:	9401 7770	0439 032 844	0400 414 197	0412 611 330
Contacts	**Ben Hillion**	**Rob Connolly**	**Daryl Thompson**	**Hao Tran**
E:	ben@lgacoustics.com.au	rob@lgacoustics.com.au	daryl@lgacoustics.com.au	hao@lgacoustics.com.au
P:	0457 095 555	0410 107 440	0420 364 650	0438 481 207

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Date:	Rev	Description	Prepared By	Verified
17-Dec-21	-	Issued to Client	Matt Moyle	Terry George
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1 INTRODUCTION

It is proposed to demolish the two residences at 54 and 56 Rochester Drive, Mindarie (refer *Figure 1-1*) to construct a childcare centre (CCC). The proposed centre will consist of the following:

- Five internal teaching spaces capable of accommodating up to 85 children, grouped as follows:
  - 12 places for children aged 0-1 years,
  - 8 places for children aged 1-2 years,
  - 15 places for children aged for 2-3 years,
  - 50 places for children aged 3-5 years.
- Outdoor play areas located on all sides of the building.
- Amenities and associated mechanical plant such as:
  - One kitchen with rangehood and exhaust fan assumed to be located on the roof above,
  - Various exhaust fans (toilets, laundry, nappy room) assumed to be located on the roof above, and
  - AC plant assumed to be located in drying courtyard as shown on DA plans.
- Car parking on the south east end of the lot.

It is noted that noise sensitive premises are in the vicinity of the subject site. As such an assessment of noise to these receptors is required.

This report presents the assessment of the noise emissions from child play, car doors closing in the car park and mechanical plant associated with the childcare centre against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997* (the Regulations) based on the development drawings shown in *Appendix A*.

The proposed hours of operation are 6.30am to 6.30pm Monday to Friday. Therefore, staff and parents can arrive and park before 7.00am, which is during the night-time period of the Regulations. It is assumed outdoor child play would not occur until after 7.00am.

The site itself is considered a noise sensitive premises under *State Planning Policy No. 5.4: Road and Rail Noise.* An assessment of noise intrusion from Marmion Avenue is therefore required under this Policy, with this report providing recommendations to address these impacts.

Appendix B contains a description of some of the terminology used throughout this report.

Figure 1-1 Project Locality (DPLH Maps)

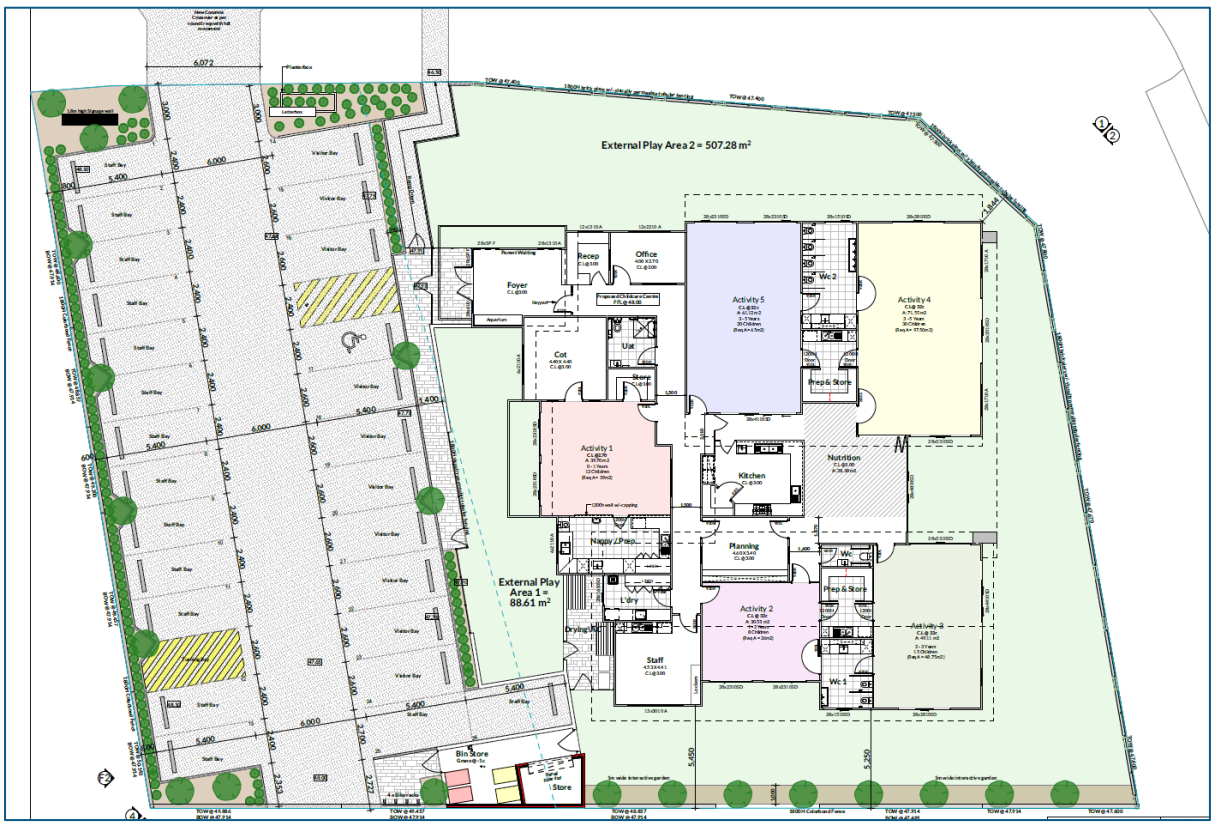


Figure 1-2 Project Site Plan

2 CRITERIA

2.1 Environmental Noise

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

"7. (1) Noise emitted from any premises or public place when received at other premises –

(a) Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) Must be free of –

i. tonality;

ii. impulsiveness; and

iii. modulation,

when assessed under regulation 9"

A "…noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level…"

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

(a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) The noise emission complies with the standard prescribed under regulation 7 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The total influencing factor, applicable at surrounding noise sensitive premises has been calculated as 6 dB. There are no significant commercial or industrial premises within 450m however a transport factor of 6 dB is applicable, as Marmion Avenue is within 100m of the nearest sensitive receivers and is a major road (32,138 vehicles per day 2021/22 MRWA #8617) – refer *Table 2-3*.

Table 2-3 Influencing Factor Calculation

Receiver	Commercial Land		Road Traffic		Total Influencing Factor
	With 100m	Within 450m	Within 100m	Within 450m	
All Nearest Residences	-	-	Marmion Ave (Major Road)	-	**6 dB**

Table 2-4 shows the assigned noise levels including the influencing factor and transport factor at the receiving locations.

Table 2-4 Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
All nearest highly sensitive areas[1]	0700 to 1900 hours Monday to Saturday (Day)	51	61	71
	0900 to 1900 hours Sunday and public holidays (Sunday)	46	56	71
	1900 to 2200 hours all days (Evening)	46	56	61
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	41	51	61
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

It must be noted the assigned noise levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces. Where this was not possible to be achieved due to the close proximity of existing buildings and/or fences, the noise emissions were assessed at a point within 1 metre from building facades and a -2 dB adjustment was made to the predicted noise levels to account for reflected noise.

It is noted the assigned noise levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *a period of time of not less than 15 minutes, and not exceeding 4 hours*, which is determined by an *inspector* or *authorised person* to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission. An *inspector* or *authorised person* is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Environment Regulation. Acoustic consultants or other environmental consultants are not appointed as an *inspector* or *authorised person*. Therefore, whilst this assessment is based on a 4 hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

2.2 Transportation Noise

The criteria relevant to this assessment are provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards

Table 2-5 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-5 Noise Targets for Noise-Sensitive Land-Use

Outdoor Noise Target		Indoor Noise Target	
55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Activity and Work Areas)	35 dB $L_{Aeq(Night)}$ (Cotrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of the noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonable drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment is undertaken.

In the application of the noise targets, the objective is to achieve:

- indoor noise levels specified in *Table 2-5* in noise-sensitive areas (e.g. cot rooms and activity rooms); and
- a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and childcare centres, the design of outdoor areas should take into consideration the noise target.

[1] A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.

3 METHODOLOGY

3.1 Environmental Noise

Computer modelling has been used to predict the noise emissions from the development at all nearby receivers. The software used was *SoundPLAN 8.2* with the ISO 9613 algorithms (ISO 171534-3 improved method) selected, as they include the influence of wind and are considered appropriate given the relatively short source to receiver distances.

Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1.1 Meteorological Information

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1 Modelling Meteorological Conditions

Parameter	Day (0700-1900)	Night (1900-0700)
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5	Up to 5
Wind Direction*	All	All

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.1.2 Topographical Data

Topographical information was based on data publicly available (e.g. *Google*) in the form of spot heights and combined with finished floor levels provided on the development drawings. It is noted that the terrain slopes gently down from south to north across the site.

3.1.3 Buildings and Receivers

Surrounding existing buildings were included in the noise model, as these can provide noise shielding as well as reflection paths.

Adjacent houses are single storey based on *Streetview* images and were modelled as 3.5 metre high buildings, with receivers located 1.4 metres above ground level. The childcare centre building incorporates a car park and play areas as shown in the design drawings of *Appendix A* and this was reproduced within the noise model.

Figure 3-1 shows a 2D overview of the noise model with the location of all relevant receivers identified.

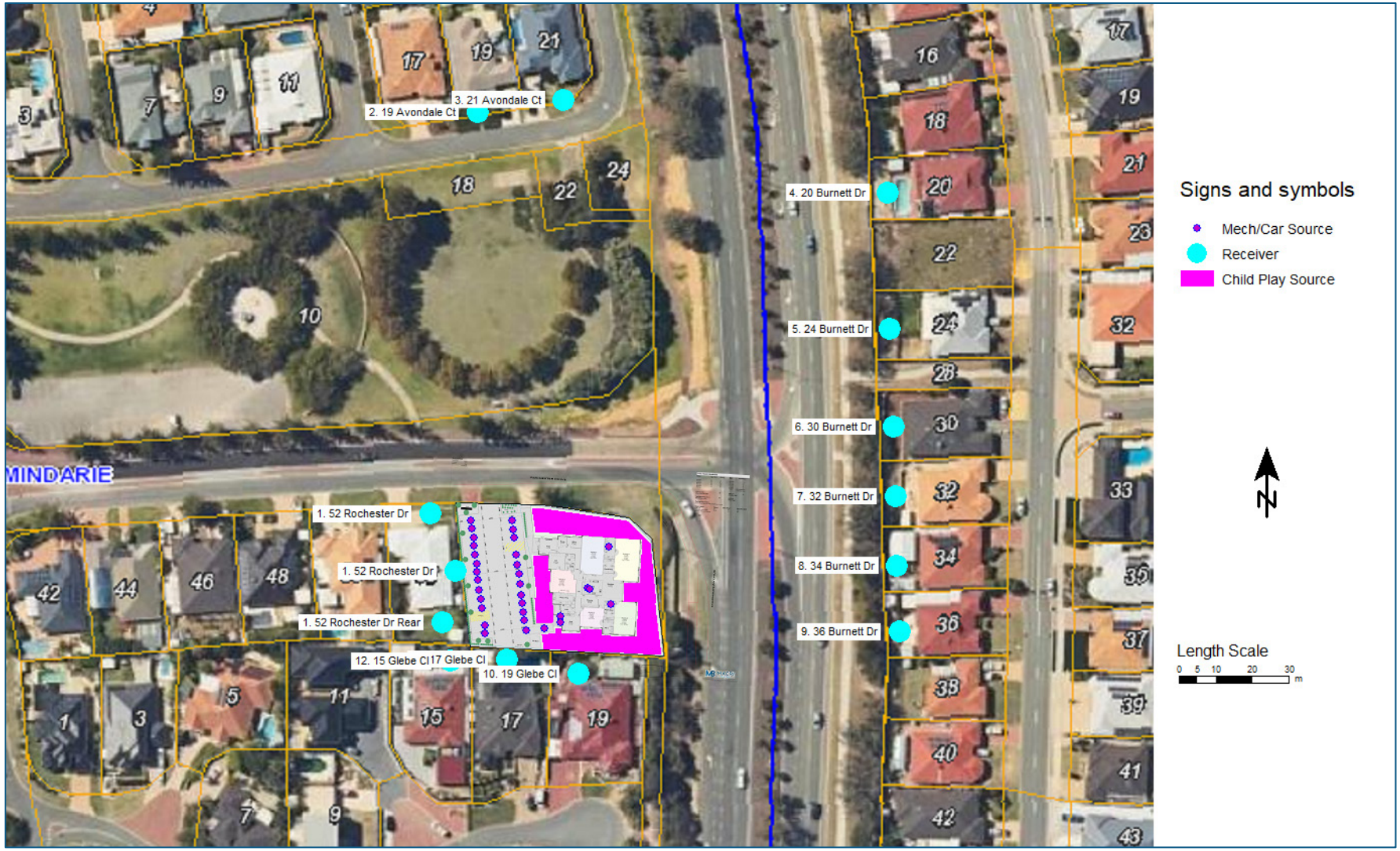


Figure 3-1 2D Overview of Noise Model

3.1.4 Source Sound Levels

The sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2 Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Babies Play Aged 0-2 Years (10 kids), L_{10}	78	54	60	66	72	74	71	67	**78**
Toddler Play Aged 2-3 Years (10 kids), L_{10}	61	67	73	79	81	78	74	70	**85**
Kindy Play Aged 3+ Years (10 kids), L_{10}	64	70	75	81	83	80	76	72	**87**
AC plant, double fan unit (2 off), each, L_{10}	72	74	68	69	63	61	53	47	**70**
Toilet/Laundry Exhausts, each, L_{10}	60	65	62	63	60	61	56	53	**67**
Kitchen Exhaust, L_{10}	50	64	61	70	69	66	62	50	**73**
Closing Car Door, L_{max}	71	74	77	81	80	78	72	61	**84**

The following is noted in relation to the source levels above:

- Child play source levels are based on Guideline 3.0 provided by the Association of Australasian Acoustical Consultants (AAAC) published September 2020. Where the number of children for individual play areas is specified in the plans, these have been adjusted from the reference source levels using appropriate acoustical calculations. Outdoor child play was modelled as area sources at 1-metre heights above ground level. The sound power levels used in the model were scaled as follows:
    - 12 children aged 0-1 years = 78 dB(A)
    - 8 children aged 1-2 years = 78 dB(A)
    - 15 Toddlers aged 2-3 years = 86 dB(A)
    - 50 Kindy aged 3+ years = 94 dB(A)
- Based on the AAAC Guideline 3.0, source sound power levels for AC condensing units were assumed. Medium sized (double fan) outdoor units were deemed appropriate. Each was modelled as a point source located on the ground near the dying courtyard area.
- Other mechanical plant includes three exhaust fans (toilets and laundry) and one kitchen exhaust fan/rangehood fan. All were modelled as point sources approximately 0.5 metres above roof level and above the area serviced.
- Car doors closing were modelled as a point source 1.0 metre above ground level. Since noise from a car door closing is a short term event, only the L_{Amax} level is applicable.

3.1.5 Walls and Fences

The area is mostly suburban residential with typical boundary fencing (*Hardie Fence* and *Colorbond* types) between residences. It is assumed that a 1.8m high solid fence will be installed encompassing the play areas on the south side - refer DA drawings for more detail. It is noted that car park walls are likely to sit atop a retaining wall, again at 1.8m height relative to existing (neighbouring floor level). The modelling has assumed that no gaps are present in these barriers, and this will need to be ensured in the final build.

The material selected for all new child play barriers must have a minimum 8kg/m^2 surface mass to be effective acoustically.

Figure 3-2 shows a view of the 3D model based on the information above in relation to topography and building and fence heights. Also shown are the outdoor play areas (pink polygon) and point sources (e.g. mechanical plant, car doors) as purple dots.

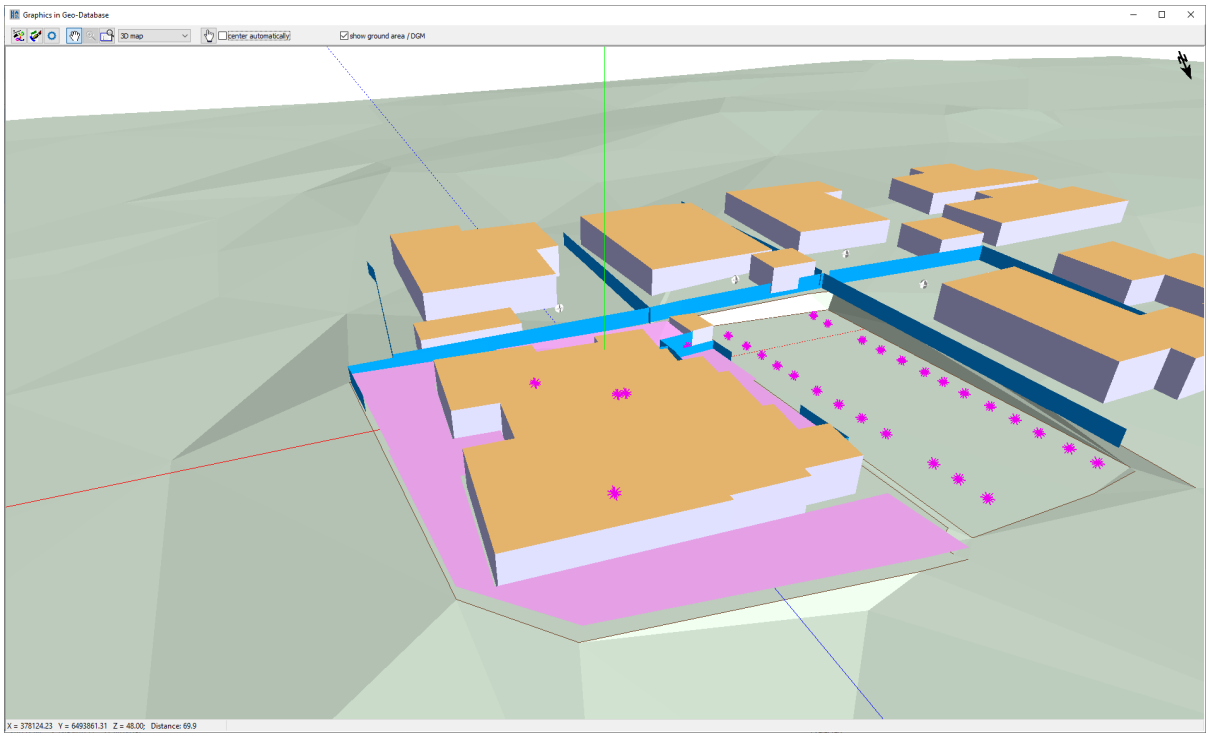


Figure 3-2 North East Elevation View of 3D Noise Model

3.1.6 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. asphalt, concrete) and 1 for acoustically absorbent ground (e.g. grass/sand). In this instance, a value of 1 has been used for the outdoor play areas and 0.0 for the car park and road areas, and 0.7 for all other areas.

3.2 Transportation Noise

To address the noise impact from road traffic noise, a combination of noise measurements and modelling have been undertaken generally in accordance with the requirements of SPP 5.4 and associated Guidelines[2].

3.2.1 Site Measurements

Noise monitoring was undertaken near the site using a Rion Type NA28 sound level meter (refer to *Figure 3-3*). This meter complies with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The meter was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the meter.

The microphone was approximately 1.4 metres above existing ground level and approximately 15 metres from the edge of Marmion Avenue northbound carriageway. The measurements were recorded on 6 December 2021, between 2.00pm and 3.00pm.

Figure 3-3 Sound Level Meter on Site

A relationship between hourly traffic volumes and noise levels can then be derived to determine the existing $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ noise levels at the subject site.

3.2.2 Noise Modelling

The computer programme *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into

[2] Road and Rail Noise Guidelines, September 2019

three, allows for less barrier attenuation for high level sources where barriers are to be considered.

- Note that a -8.0 dB correction is applied to the exhaust and -0.8 dB to the engine (based on Transportation Noise Reference Book, Paul Nelson, 1987), so as to provide consistent results with the CoRTN algorithms for the no barrier scenario;

Predictions are made at heights of 1.4 metres above floor level and at 1-metre from the window of each habitable room, resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed in the following sections.

3.2.3 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown in *Table 3-3*.

Table 3-3 Noise Relationship Between Different Road Surfaces

Road Surfaces							
Chip Seal				Asphalt			
14mm	10mm	5mm	Slurry	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	+1.0 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

The existing road surface is dense graded asphalt and is expected to remain unchanged into the future.

- Vehicle Speed – The existing and future posted speed is 80 km/hr.

- Traffic Volumes – Existing (2021) traffic figures were obtained from the Trafficmap website. These figures are broken down into an hourly format for a typical weekday. Future 2041 traffic was estimated based on a growth rate of 2.5% per annum. *Table 3-4* provides the traffic volume input data in the model.

Table 3-4 Traffic Information Used in the Modelling

Parameter	Scenario			
	Existing – 2021		Future - 2041	
	Northbound	Southbound	Northbound	Southbound
24 Hour Volume	14,283	17,855	+2.5% p/a	+2.5% p/a
% Heavy	8	7	8	7

4 RESULTS

4.1 Outdoor Child Play

The childcare development will host up to 85 children. It is noted play time is generally staggered and therefore not all children would be playing outside at once for extended periods of time. However, noise levels were conservatively predicted for all children playing, as a worst-case scenario.

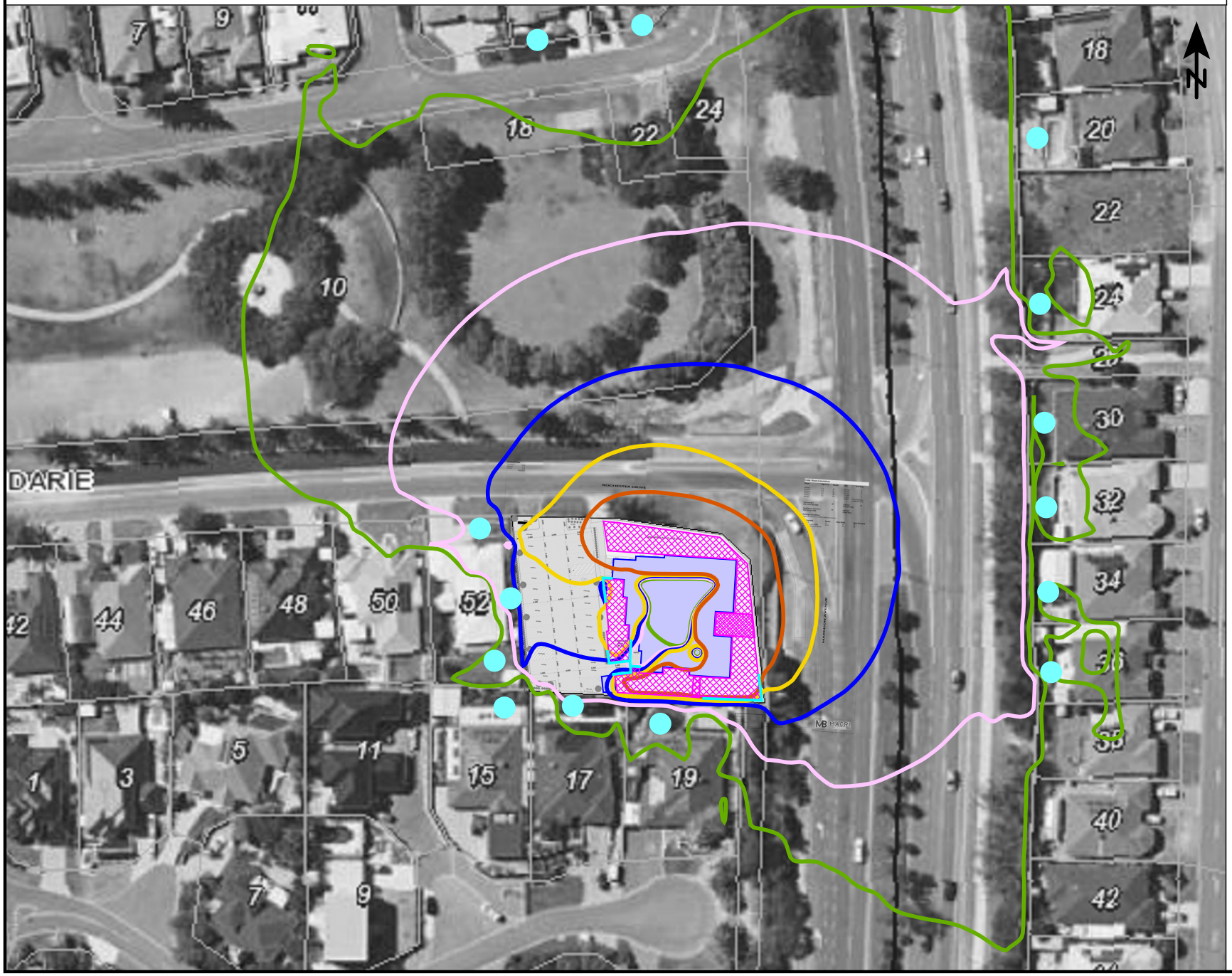
Table 4-1 presents the predicted noise levels at each receiver, noting the predicted noise levels are from child play only i.e. mechanical plant noise is not included. *Figure 4-1* also shows the predicted noise levels as noise contour maps at ground level (1.5 metres AGL).

Table 4-1 Predicted Noise Levels of Child Play, dB L_{A10}

Receiver	50 Kindy (3+)	15 Toddlers (2-3)	20 Babies (0-2)	Total Combined
1. 52 Rochester Dr	44	23	31	**45**
1. 52 Rochester Dr Rear	39	32	33	**41**
2. 19 Avondale Ct	37	15	16	**37**
3. 21 Avondale Ct	36	19	11	**36**
4. 20 Burnett Dr	35	26	9	**35**
5. 24 Burnett Dr	38	27	11	**38**
6. 30 Burnett Dr	39	31	12	**40**
7. 32 Burnett Dr	40	32	13	**40**
8. 34 Burnett Dr	40	32	15	**40**
9. 36 Burnett Dr	38	32	16	**39**
10. 19 Glebe Cl	32	40	39	**43**
11. 17 Glebe Cl	35	36	37	**41**
12. 15 Glebe Cl	35	25	29	**36**

It is evident that the worst case scenario of all children playing in the yard area results in a high level of noise at residences adjoining the site to the south and west. While these levels indicate the conservative potential outcome, in reality noise levels would be lower on average with reduced numbers (staggered play times) and with periods of passive play.

Figure 4-1 Outdoor Child Play Noise, All Children Outside, dB L_{A10}



Predicted Noise level

= 36
= 41
= 46
= 51
= 56

Legend

Receiver
Outdoor Childplay
Childcare Centre
Fence/wall

Scale 1:1200

0 5 10 20 30 m

Project No: 21106780
Consultant: MM
Date: 17/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

4.2 Mechanical Plant

Mechanical plant consists of AC plant and extraction fans for the kitchen, toilets and laundry. The exhaust fans were assumed to be located on the roof and above the room being serviced. The AC plant was modelled as per the designated drying area on the western side.

The predicted mechanical plant noise levels are presented in *Table 4-2*. The overall plant noise levels are also shown on *Figure 4-2*.

Table 4-2 Predicted Noise Levels of Mechanical Plant, dB L_{A10}

Receiver	All Plant Combined
1. 52 Rochester Dr	26
1. 52 Rochester Dr Rear	29
2. 19 Avondale Ct	15
3. 21 Avondale Ct	16
4. 20 Burnett Dr	13
5. 24 Burnett Dr	17
6. 30 Burnett Dr	19
7. 32 Burnett Dr	19
8. 34 Burnett Dr	20
9. 36 Burnett Dr	20
10. 19 Glebe Cl	30
11. 17 Glebe Cl	34
12. 15 Glebe Cl	26

It can be seen that at most receivers, the predicted mechanical plant noise is lower than the child play noise levels (*Table 4-1*). Therefore, child play noise would dominate the noise levels during the day at most receivers, except prior to 7.00am, when child play noise is not present. The above results are based on assumed plant source levels and should therefore be recalculated once mechanical plant specifications are known closer to building permit application.

Figure 4-2 Mechanical Plant Noise, dB L_{A10}

Predicted Noise level

= 31
= 36
= 41
= 46
= 51

Legend

- Receiver
- Outdoor Childplay
- Childcare Centre
- Fence/wall
- Mech Source

Scale 1:1200

0 5 10 20 30 m

Project No: 21106780
Consultant: MM
Date: 17/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

4.3 Car Park

The model includes noise from car doors closing in all parking bays and *Table 4-3* presents the highest predicted noise levels applicable to each receiver. *Figure 4-3* also presents the maximum noise levels at ground level (1.5 m AGL) for car doors as a contour map. Note that this contour is not a cumulative level, but a composite contour of each maximum noise event.

Table 4-3 Predicted Car Doors Closing Noise Levels, dB L_{Amax}

Receiver	Car Doors
1. 52 Rochester Dr	43
1. 52 Rochester Dr Rear	46
1. 52 Rochester Dr Side	48
2. 19 Avondale Ct	27
3. 21 Avondale Ct	28
4. 20 Burnett Dr	26
5. 24 Burnett Dr	27
6. 30 Burnett Dr	29
7. 32 Burnett Dr	29
8. 34 Burnett Dr	28
9. 36 Burnett Dr	20
10. 19 Glebe Cl	38
11. 17 Glebe Cl	45
12. 15 Glebe Cl	42

Figure 4-3 Car Park Noise, dB L_{Amax}

Predicted Noise level

= 41
= 46
= 51
= 56
= 61

Legend

Receiver
Childcare Centre
Fence/wall
Door Source

Scale 1:1200

0 5 10 20 30 m

Project No: 21106780
Consultant: MM
Date: 17/12/2021
Algorithm: ISO 9613
SoundPLAN Version: 8.2

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

4.4 Transportation Noise Monitoring

The results of the hourly noise level measurements, in free-field conditions at 15 metres from the road edge, were:

- 6 December 2021: 2.00pm to 3.00pm – 63.6 dB $L_{Aeq,1hour}$.

Combining the measured noise levels with the hourly traffic volumes as shown in *Figure 4-4*, the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ have been determined to be 62.5 dB $L_{Aeq(Day)}$ and 53.8 dB $L_{Aeq(Night)}$. Based on these results, the $L_{Aeq(Day)}$ is more critical than the $L_{Aeq(Night)}$ since their difference is greater than 5 dB (refer to *Section 2* criteria).

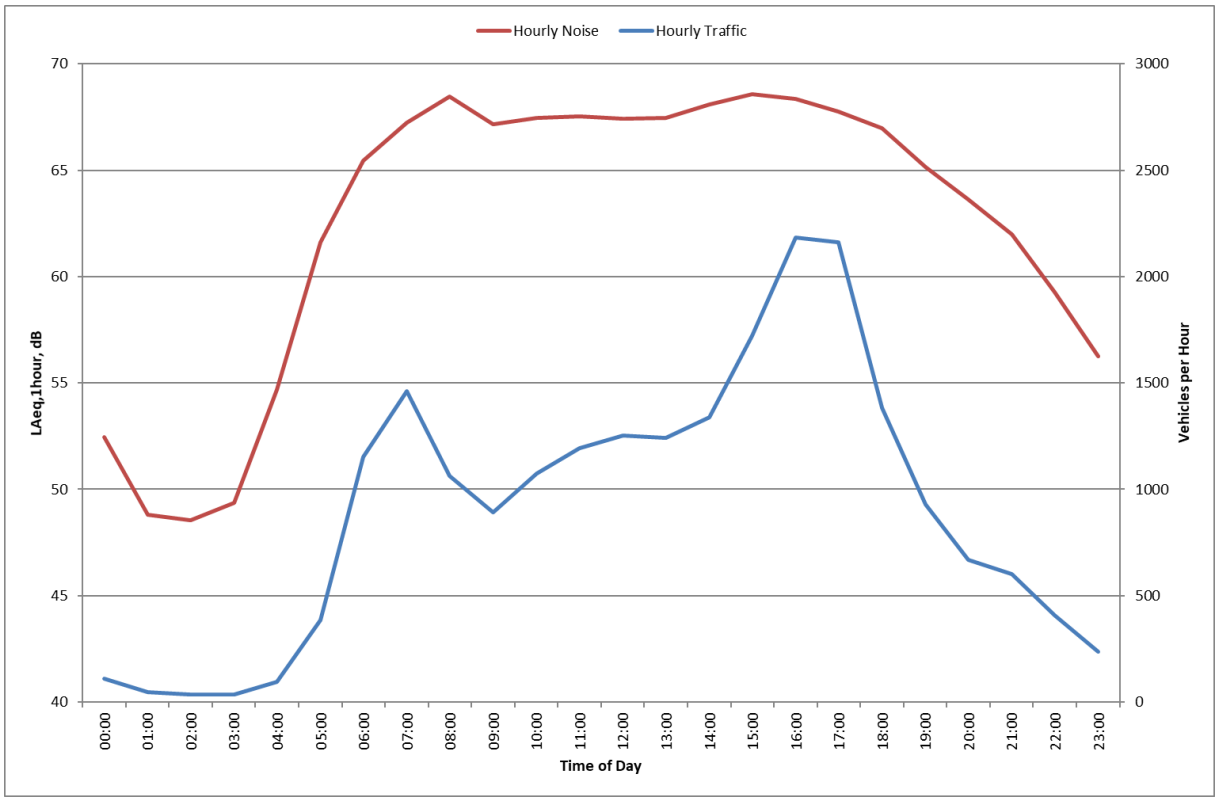


Figure 4-4 Noise Level Relationship to Hourly Traffic Volumes

5 ASSESSMENT

5.1 Outdoor Child Play

Although the childcare centre opens from 6.30am, outdoor child play will only occur after 7.00am, when the assigned noise levels increase by 10 dB compared to prior to 7.00am. Noise from child play is not considered to contain annoying characteristics within the definition of the Regulations and therefore, no adjustments are made to the predicted noise levels.

Table 5-1 presents the assessment of the highest predicted noise levels from all 85 children playing outside against the L_{A10} assigned noise level at each receiver.

Table 5-1 Assessment of Outdoor Child Play Noise Levels, dB L_{A10}

Receiver	Assigned Noise Level	Predicted Level	Exceedance
1. 52 Rochester Dr	**51**	45	*Complies*
1. 52 Rochester Dr Rear	**51**	41	*Complies*
2. 19 Avondale Ct	**51**	37	*Complies*
3. 21 Avondale Ct	**51**	36	*Complies*
4. 20 Burnett Dr	**51**	35	*Complies*
5. 24 Burnett Dr	**51**	38	*Complies*
6. 30 Burnett Dr	**51**	40	*Complies*
7. 32 Burnett Dr	**51**	40	*Complies*
8. 34 Burnett Dr	**51**	40	*Complies*
9. 36 Burnett Dr	**51**	39	*Complies*
10. 19 Glebe Cl	**51**	43	*Complies*
11. 17 Glebe Cl	**51**	41	*Complies*
12. 15 Glebe Cl	**51**	36	*Complies*

Based on a conservative scenario of all 85 children playing simultaneously, the assessment demonstrates compliance at all receivers.

5.2 Mechanical Plant

Given the proposed opening hours of the childcare centre, the night-time period (i.e. before 7.00am) is most critical. The overall noise levels are generally dominated by the kitchen exhaust plant and A/C condenser noise, which may be considered tonal, and a +5 dB adjustment (refer *Table 5-2*) applies to predictions.

Table 5-2 Assessment of Mechanical Plant Noise Levels, dB L_{A10}

Receiver	Night Assigned Noise Level	Predicted Level	Adjusted Level	Exceedance
1. 52 Rochester Dr	**41**	26	**31**	*Complies*
1. 52 Rochester Dr Rear	**41**	29	**34**	*Complies*
2. 19 Avondale Ct	**41**	15	**20**	*Complies*
3. 21 Avondale Ct	**41**	16	**21**	*Complies*
4. 20 Burnett Dr	**41**	13	**18**	*Complies*
5. 24 Burnett Dr	**41**	17	**22**	*Complies*
6. 30 Burnett Dr	**41**	19	**24**	*Complies*
7. 32 Burnett Dr	**41**	19	**24**	*Complies*
8. 34 Burnett Dr	**41**	20	**25**	*Complies*
9. 36 Burnett Dr	**41**	20	**25**	*Complies*
10. 19 Glebe Cl	**41**	30	**35**	*Complies*
11. 17 Glebe Cl	**41**	34	**39**	*Complies*
12. 15 Glebe Cl	**41**	26	**31**	*Complies*

Compliance is demonstrated for all periods. Note that this assessment is based on assumptions in relation to the number, location, size and type of AC plant and exhaust fans. Therefore, mechanical plant noise is to be reviewed by a qualified acoustical consultant during detailed design, when plant selections and locations become known.

5.3 Car Doors

Car doors closing noise are short duration events and were therefore assessed against the L_{Amax} assigned noise level. Given the proposed hours of operation, staff and visitors may arrive before 7.00am when the night-time assigned noise level of 61 dB L_{Amax} is applicable. Car door noise was considered impulsive within the definition of the Regulations. Therefore, an adjustment of +10 dB (refer *Table 5-3*) is to be applied to the predicted noise levels.

Table 5-3 Assessment of Car Doors Closing Noise Levels, dB L_{Amax}

Receiver	Night Assigned Noise Level	Predicted Level	Adjusted Level	Exceedance
1. 52 Rochester Dr	**61**	43	**53**	*Complies*
1. 52 Rochester Dr Rear	**61**	46	**56**	*Complies*
1. 52 Rochester Dr Side	**61**	48	**58**	*Complies*
2. 19 Avondale Ct	**61**	27	**37**	*Complies*
3. 21 Avondale Ct	**61**	28	**38**	*Complies*
4. 20 Burnett Dr	**61**	26	**36**	*Complies*
5. 24 Burnett Dr	**61**	27	**37**	*Complies*
6. 30 Burnett Dr	**61**	29	**39**	*Complies*
7. 32 Burnett Dr	**61**	29	**39**	*Complies*
8. 34 Burnett Dr	**61**	28	**38**	*Complies*
9. 36 Burnett Dr	**61**	20	**30**	*Complies*
10. 19 Glebe Cl	**61**	38	**48**	*Complies*
11. 17 Glebe Cl	**61**	45	**55**	*Complies*
12. 15 Glebe Cl	**61**	42	**52**	*Complies*

The noise from car doors is demonstrated to comply at all nearest noise sensitive locations at night. During the day compliance is readily achieved. It is recommended that compliance be confirmed once detailed retaining walls and top of wall (fence heights) can be verified at detailed design.

5.4 Indoor Child Play

An assessment of noise levels from indoor child play was carried out and the resulting noise levels at all locations were predicted to be well below that of outdoor child play considered in *Section 4.1*. This assessment was carried out based on the following considerations:

- Internal noise levels within activity rooms would not exceed those from outdoor play for each age group; and,
- Any music played within the internal activity areas would be 'light' music with no significant bass content and played at a relatively low level.

5.5 Transportation Noise Modelling Results

The road traffic noise model was initially set-up for existing conditions and calibrated to the noise measurement location. The model is then updated to include the proposed building plans and future traffic volumes, maintaining the same model calibration. *Table 4-4* provides the predicted $L_{Aeq(Day)}$ noise levels to the glazed facade of each habitable room of the centre.

Table 4-4 Predicted Future (2041) $L_{Aeq(Day)}$ Noise Levels

Room/Element	Facade Direction	$L_{Aeq(Day)}$, dB
Activity 1 SD	W	48
Activity 2 SD	S	52
Activity 3 Incl SD East	E	64
Activity 3 SD North	N	62
Activity 3 SD South	S	56
Activity 4 Incl SD East	E	65
Activity 4 SD North	N	62
Activity 4 SD south	S	61
Activity 5 Incl SD	N	60
Cot Room	W	48
Nutrition SD	E	61
Staff	S	52

Based on the future road traffic noise model, some building facade upgrades will be required to achieve compliance with SPP 5.4 criteria. At least one outdoor play area is on the opposite side of the building and therefore is considered compliant with the Policy objectives.

6 RECOMMENDATIONS

6.1 Outdoor Child Play

Noise from child play is demonstrated to comply during the day at all nearest residences provided all proposed play area walls are free of gaps and of a material with minimum surface mass of 8 kg/m^2.

6.2 Mechanical Plant

To minimise noise impact from kitchen exhaust fans, it is recommended that inline type fans, which could be installed with attenuators or diverted ducting, be favoured over externally mounted plant.

The AC condensing units, while potentially compliant at all times at highly sensitive receivers, may be mitigated further with local solid screening and quiet mode programming prior to 7.00am. This should be explored during detailed design and verified by the mechanical services engineer and a qualified acoustical consultant, when plant selections and locations become finalised.

6.3 Car Doors

Noise from the car park to properties to the west should be anticipated. All new fencing barriers should be a minimum 8kg/m^2 surface mass and final height to be confirmed at detailed design.

6.4 Best Practice Measures

Separate to the above, the following 'best practice' measures could be incorporated to further reduce acoustic impact (though not specifically required to achieve compliance):

- The behaviour and 'style of play' of children should be monitored to prevent particularly loud activity e.g. loud banging/crashing of objects, 'group' shouts/yelling,
- Favour soft finishes in the outdoor play area to minimise impact noise (e.g. soft grass, sand pit(s), rubber mats) over timber or plastic,
- Favour soft balls and rubber wheeled toys,
- Crying children should be taken inside to be comforted,
- No amplified music to be played outside,
- Any music played within the internal activity areas to be 'light' music with no significant bass content and played at a relatively low level.
- Car park drainage grates to be plastic or metal with rubber gasket and secured to avoid excess banging.

6.5 Transportation Noise Intrusion

To mitigate noise intrusion from Marmion Avenue in accordance with SPP 5.4, the minimum recommendations for facade upgrades are presented in *Table 6-1.*

Table 6-1 Recommended Construction Upgrades

Element	Room	Construction
Glazing	Activity 3 Incl SD East	Sliding Doors to achieve $R_w + C_{tr} \geq 29$, likely achievable using 6.5mm Vlam Hush glass with acoustic seals. Windows are to achieve $R_w + C_{tr} \geq 29$, likely achievable using 6.5mm Vlam Hush glass in awning style frames with acoustic seals.
	Activity 3 SD North	Sliding Doors to achieve $R_w + C_{tr} \geq 27$, likely achievable using 6mm glass with acoustic seals.
	Activity 3 SD South	Sliding Doors to achieve $R_w + C_{tr} \geq 25$, likely achievable using 5mm glass with acoustic seals.
	Activity 4 Incl SD East	Sliding Doors to achieve $R_w + C_{tr} \geq 29$, likely achievable using 6.5mm Vlam Hush glass with acoustic seals. Windows are to achieve $R_w + C_{tr} \geq 29$, likely achievable using 6.5mm Vlam Hush glass in awning style frames with acoustic seals.
	Activity 4 SD North	Sliding Doors to achieve Rw + Ctr ≥ 27, likely achievable using 6mm glass with acoustic seals.
	Activity 4 SD south	Sliding Doors to achieve $R_w + C_{tr} \geq 25$, likely achievable using 5mm glass with acoustic seals.
	Activity 5 SD	Sliding Doors to achieve $R_w + C_{tr} \geq 25$, likely achievable using 5mm glass with acoustic seals.
	Nutrition SD	Sliding Doors to achieve $R_w + C_{tr} \geq 26$, likely achievable using 5mm glass with acoustic seals.
Roof/Ceiling	Activity 3 and 4	Ceiling to be 13mm thick plasterboard with R4 insulation above.

Note: Install cover mould to weep holes in above window frames where applicable

By implementing the above construction recommendations, noise levels are calculated to comply with the targets of SPP 5.4. Alternative constructions can be accepted provided these are supported by a laboratory calibration certificate and meet the $R_w + C_{tr}$ stipulated in *Table 6-1*.

7 CONCLUSIONS

The noise impacts from the proposed childcare centre to be located at #54 and #56 Rochester Drive, Mindarie have been assessed against the relevant criteria of the *Environmental Protection (Noise) Regulations 1997*. Based on the modelling and assessments in relation to the noise emissions from child play, mechanical plant and car doors closing, it is concluded that compliance can be achieved for all nearest noise sensitive premises.

The impact of road traffic to the childcare centre can be managed by way of building facade upgrades.

Appendix A

Development Plans

Macri Builders

Address:Lot 1 & 383 (#54 & 56) Rochester Drive, Mindarie

Childcare Centre

Job Number: 21104

Drawing No	Description
PD01	Cover Sheet
PD02	3D
PD03	Existing Site Survey & Site Plan
PD04	Floor Plans
PD05	Elevations

MACRI BUILDERS

E: frank@macribuilders.com.au P: 9444 9829 M: 0407 727 766

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ALL FEATURES AND BUILDING POSTIONS ARE APPROXIMATE ONLY, AS THEY HAVE BEEN POSITIONED FROM MEASUREMENTS TAKEN FROM EXISTING PEGS, FENCES AND WALLS.

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A TO B - RESTRICTIVE COVENANT - SEE CERTIFICATE OF TITLE

SCALE 1:200

0 1 2 3 4 5

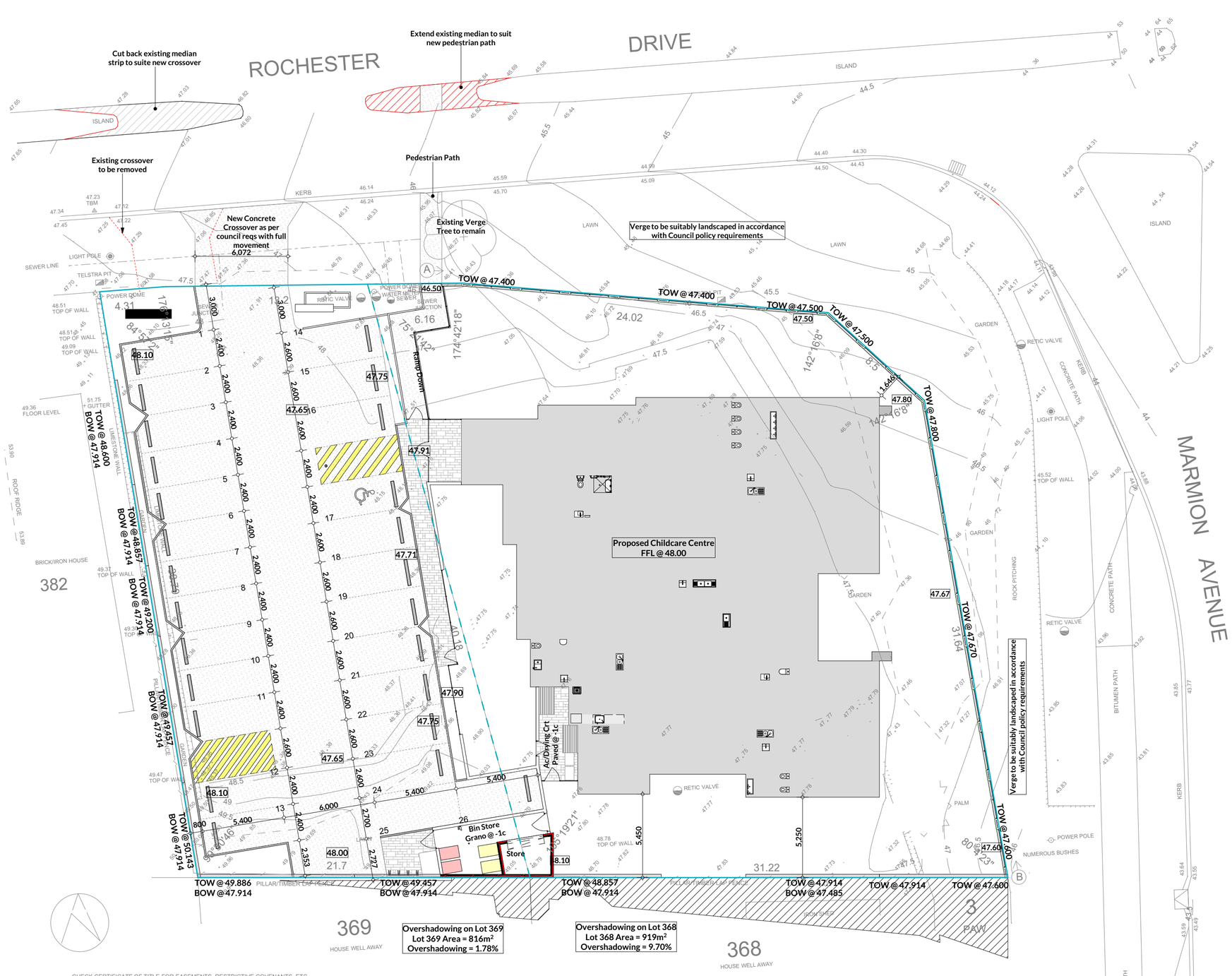
ROSS McLOUGHLIN
CONSULTING SURVEYOR
JOONDALUP: UNIT 1, 9 MERCER LANE
LANCELIN: 4 SALVAIRE CRESCENT
MOBILE 0419 255 999
EMAIL rossmac@iinet.net.au

LOTS 1 AND 383 ROCHESTER DRIVE - MINDARIE

SITE PLAN

SCALE: 1:200 @ A2 SIZE	LOCAL AUTHORITY: CITY OF WANNEROO	SURVEYOR:	RAM
DATE: 22.9.2021	PLAN: LOT 383 ON PLAN 21192, LOT 1 ON DEPOSITED PLAN 42278	DRAWN:	RAM
DATUM: AHD (SEWER M/H LID)	AREA: LOT 1 - 1238m , LOT 383 - 758m 2	SDR FILE:	RC1

Existing Site Survey
1:200



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A TO B - RESTRICTIVE COVENANT - SEE CERTIFICATE OF TITLE

SCALE 1:200

0 1 2 3 4 5

ROSS McLOUGHLIN
CONSULTING SURVEYOR
JOONDALUP: UNIT 1, 9 MERCER LANE
LANCELIN: 4 SALVAIRE CRESCENT
MOBILE 0419 255 999
EMAIL rossmac@iinet.net.au

LOTS 1 AND 383 ROCHESTER DRIVE - MINDARIE

SITE PLAN

SCALE: 1:200 @ A2 SIZE	LOCAL AUTHORITY: CITY OF WANNEROO	SURVEYOR:	RAM
DATE: 22.9.2021	PLAN: LOT 383 ON PLAN 21192, LOT 1 ON DEPOSITED PLAN 42278	DRAWN:	RAM
DATUM: AHD (SEWER M/H LID)	AREA: LOT 1 - 1238m , LOT 383 - 758m 2	SDR FILE:	RC1

Site Plan
1:200

Client: Macri Builders	Drawing Title: Existing Site Survey & Site Plan		Issue: Development Approval	
Project Name: Childcare Centre	Scale: as noted	Sheet Size: A1	Rev: 008 / Description: Planning Drawings	Drawn: CD
Project Address: Lot 1 & 383 (#54 & 56) Rochester Drive, Mindarie	Project No: 21104	Drawing No.: PD03 of 05	Revision Number: 008	Date: 10/01/2022

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Child / Room Calculations

Room	Age (Yrs)	Quant.	Size	Staff Req.
Activity 1	*0-1*	*12*	*39.70m²*	3
Activity 2	*1-2*	*8*	*30.53m²*	2
Activity 3	*2-3*	*15*	*49.11m²*	3
Activity 4	*3-5*	*30*	*71.55m²*	3
Activity 5	*3-5*	*20*	*61.12m²*	2
Nutrition			*28.38m²*	+ 1 Co-Ordinator + 1 Kitchen Hand
Total Internal = **(Min 3.25m² per child)**		**85**	**280.39m²** **(276.25m² Req)**	**15**
Total External Play Area = **(Min 7m² per child)**		**85**	**595.89m²** **(595m² Req)**	

Parking Calculations

as per City of Waneroo LPP2.3 Child Care Centres

Requirement	Quant	Bays Reqd	Bays Provided
1 per staff	15	15	15
9 bays plus 1 per 8 child for every child over 54 places	12.75	13	11

Ground Floor

Ground Floor	569.22
Bin Store	20.24
Drying\AC	15.21
Store	9.18
	613.85 m²

Ground Floor Plan
1:100

Client Macri Builders	Drawing Title: Floor Plans		Issue: Development Approval
Project Name Childcare Centre	Scale: as noted	Sheet Size: A1	Rev: 008 / Description: Planning Drawings / Drawn: CD
Project Address Lot 1 & 383 (#54 & 56) Rochester Drive, Mindarie	Project No: 21104	Drawing No.: PD04 of 05	Revision Number: 008 / Date: 10/01/2022

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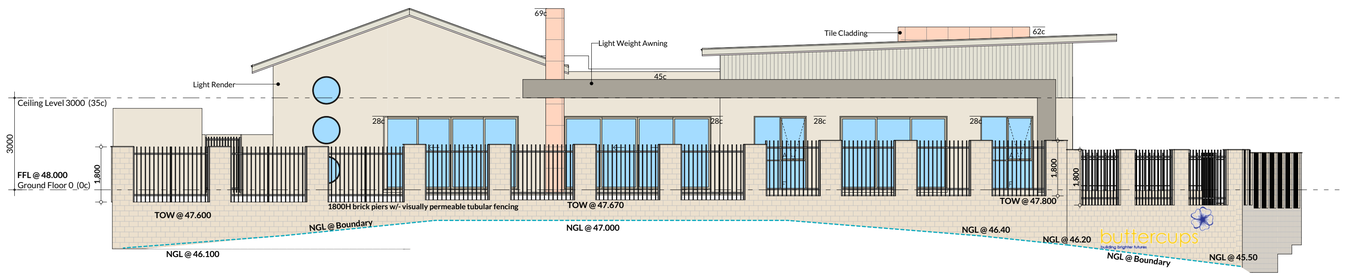
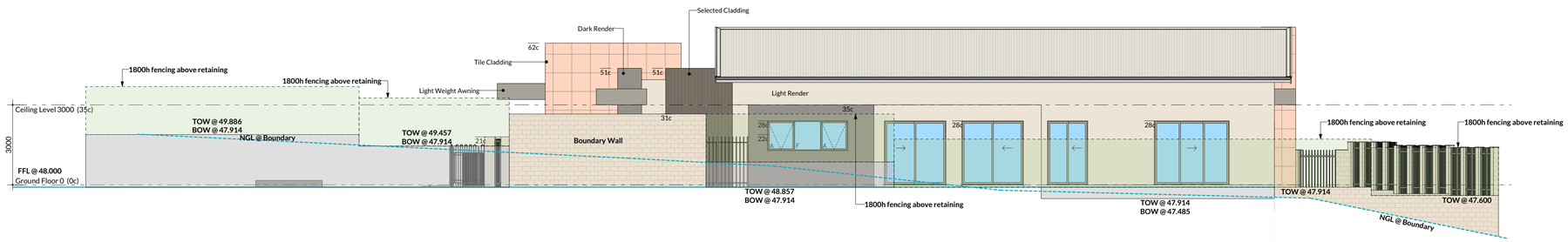
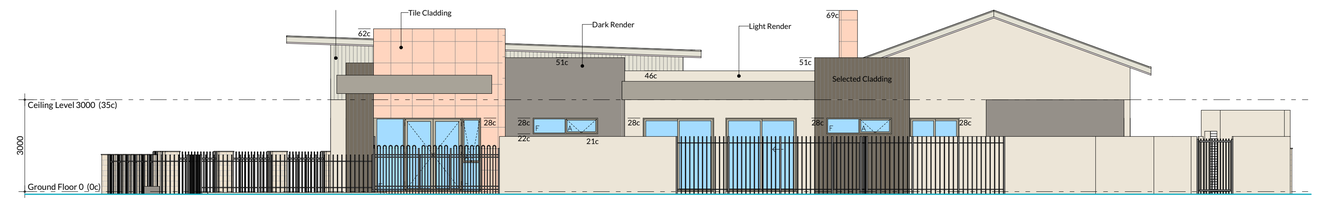
1 North Elevation
1:100



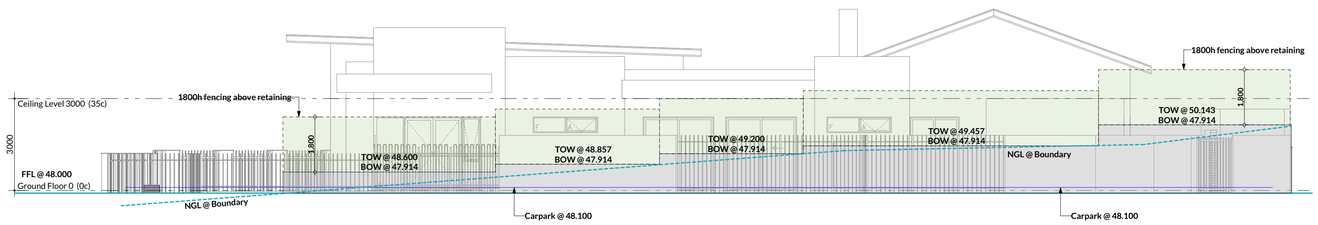
2 East Elevation
1:100



3 South Elevation
1:100



4 West Elevation
1:100



F2 West Elevation
1:100

Material / Colour Finishes Schedule

Location	Description	Example
Roof	Colorbond Sheeting "Surfmist"	
Window & Door Frames	Powdercoat Evening Haze	
Glass- Windows & Doors	6.38mm Laminated Grey Glass or as per acoustic report	
P/Coated Alumin Tubular Fencing	Colorbond "Monument"	
Timber Look Cladding	James Hardi Axon Woodgrain Cladding Paint Finish Dulux "Randall"	
Colorbond Cladding	"Woodland Grey"	
External Render	Acrylic Render Dulux "Hog Bristle Quarter"	
Awning Face	CFC Sheeting w/- Negative Joint Detail Paint Finish Dulux "Paving Stone 50%)	

Client: Macri Builders	Drawing Title: Elevations	Issue: Development Approval	
Project Name: Childcare Centre	Scale: as noted / Sheet Size: A1	Rev: 008 / Description: Planning Drawings / Drawn: CD	
Project Address: Lot 1 & 383 (#54 & 56) Rochester Drive, Mindarie	Project No: 21104 / Drawing No.: PD05 of 05	Revision Number: 008 / Date: 10/01/2022	

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Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Power Level (L_w)
Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)
The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}
This is the noise level in decibels, obtained using the A frequency weighting and the S (Slow) time weighting as specified in IEC 61672-1:2002. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}
This is the noise level in decibels, obtained using the A frequency weighting and the F (Fast) time weighting as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}
This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}
An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}
An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}
An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{Aeq}
The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

L_{A90}
An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the "*background*" noise level.

One-Third-Octave Band
Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level
Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise
A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise
A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;

(b) is present for at least 10% of the representative.

Impulsive Noise
An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between $L_{A\ peak}$ and $L_{A\ Max\ slow}$ is more than 15 dB when determined for a single representative event;

Major Road
Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road
Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10}\left(\%\ \text{Type A}_{100} + \%\ \text{Type A}_{450}\right) + \frac{1}{20}\left(\%\ \text{Type B}_{100} + \%\ \text{Type B}_{450}\right)$$

where:

$\%\ \text{Type A}_{100}$ = the percentage of industrial land within a100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\ \text{Type B}_{100}$ = the percentage of commercial land within a100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

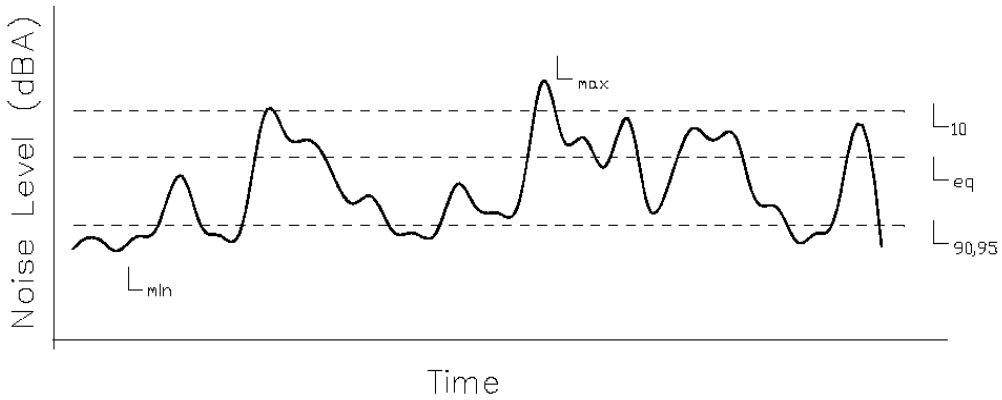
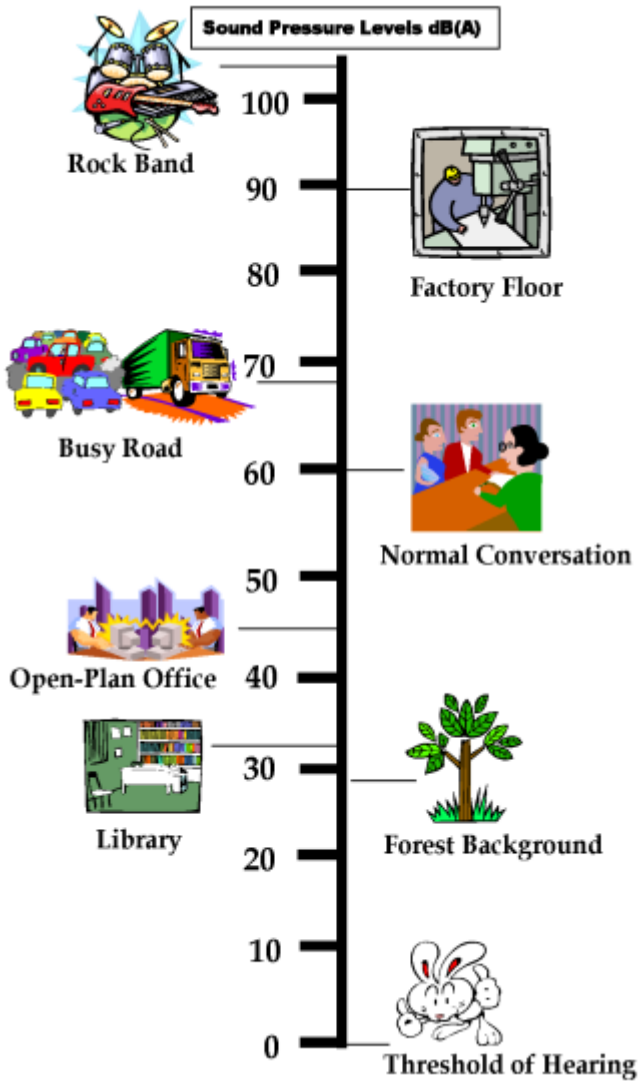
Representative Assessment Period
Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise
Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

Ambient Noise
Means the level of noise from all sources, including background noise from near and far and the source of interest.

Specific Noise
Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Chart of Noise Level Descriptors



Typical Noise Levels