

Environmental Noise Assessment

**Proposed Childcare Centre
Lot 212 (#4) Gungurru Avenue, Hocking**

Reference: 19034886-01 R1.docx

Prepared for:
RA Del Borrello

Report: 19034886-01 R1.docx

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

T: 9300 4188

F: 9300 4199

Contacts	Daniel Lloyd	Terry George	Matt Moyle	Olivier Mallié	Ben Hillion
E:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au	olivier@lgacoustics.com.au	ben@lgacoustics.com.au
M:	0439 032 844	0400 414 197	0412 611 330	0439 987 455	0457 095 555

This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd George Acoustics Pty Ltd and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd George Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Date:	Rev	Description	Prepared By	Verified
05-Apr-19	-	Issued to Client	Olivier Mallié	Terry George
09-Apr-19	1	Editorial changes following Client comments	Olivier Mallié	-

Table of Contents

1	INTRODUCTION	1
2	CRITERIA	3
2.1	Environmental Protection (Noise) Regulations 1997	3
2.2	City of Wanneroo Child Care Premises	5
2.3	State Planning Policy 5.4	5
3	METHODOLOGY	7
3.1	Meteorological Information	7
3.2	Topographical Data	7
3.3	Buildings and Receivers	7
3.4	Walls and Fences	8
3.5	Ground Absorption	8
3.6	Source Sound Levels	8
3.7	Traffic Modelling	10
3.7.1	Traffic Data	10
3.7.2	Parameter Conversion	10
4	RESULTS	11
4.1	Outdoor Child Play	11
4.2	Mechanical Plant	16
4.3	Car Door Closing	19
4.4	Traffic Noise	21
5	ASSESSMENT	23
5.1	Outdoor Child Play	23
5.1.1	L_{A10} Compliance	23
5.1.2	L_{A1} Compliance	25
5.2	Mechanical Plant	25
5.3	Car Doors	26
5.4	Traffic Noise Intrusion	26
6	CONCLUSIONS	27

List of Tables

Table 2-1 Adjustments Where Characteristics Cannot Be Removed	3
Table 2-2 Baseline Assigned Noise Levels	4
Table 2-3 Influencing Factor Calculation	4
Table 2-4 Assigned Noise Levels	5
Table 2-5 Outdoor Noise Criteria	6
Table 3-1 Modelling Meteorological Conditions	7
Table 3-2 Source Sound Power Levels, dB	9
Table 3-3 Traffic Information – Wanneroo Road	10
Table 3-4 Summary of Logged Data – February 2018 (Wanneroo Road)	11
Table 4-1 Predicted Noise Levels of Child Play	12
Table 4-2 Predicted Noise Levels of Mechanical Plant, dB L_{A10}	16
Table 4-3 Predicted Car Doors Closing Noise Levels, dB L_{Amax}	19
Table 4-4 Predicted Future $L_{Aeq(Day)}$ Noise Levels	21
Table 5-1 Assessment of Scenario 2 Noise Levels, dB L_{A10}	24

List of Figures

Figure 1-1 Project Locality (Courtesy City of Wanneroo IntraMaps)	2
Figure 3-1 North East Elevation of 3D Noise Model	8
Figure 4-1 Scenario 1A (60 Kindy + 55 Pre-Kindy on North Side) Noise Contours	13
Figure 4-2 Scenario 1B (60 Kindy + 55 Pre-Kindy on South Side) Noise Contours	14
Figure 4-3 Scenario 2 (25 Kindy + 25 Pre-Kindy North and South) Noise Contours	15
Figure 4-4 Daytime Mechanical Plant Noise Contours	17
Figure 4-5 Night-time Mechanical Plant Noise Contours	18
Figure 4-6 Car Doors Closing Noise Contours	20
Figure 4-7 Year 2037 Daytime Predicted Traffic Noise, dB $L_{Aeq(Day)}$	22

Appendices

A	Development Plans
B	Land Use Map
C	Terminology

1 INTRODUCTION

It is proposed to redevelop the existing residential premises located at Lot 212 (#4) Gungurru Avenue, Hocking (refer *Figure 1-1*), into a childcare centre. The redevelopment is understood to include:

- Lot will be cleared and incorporate a new childcare building,
- Outdoor play area wrapping around the childcare building, and
- A 37 bay car park on the north side, with entry from Gungurru Avenue, and an additional 4 bays for staff to the south of the building with entry via Wayford Circle.

The proposed development is located within a predominantly residential area. The site is bound by single storey houses to the east, across Gungurru Avenue to the north, and across Wanneroo Road to the west. The adjacent lots to the south (lot 20 and 22) are currently a drainage site.

The proposed childcare centre will accommodate up to 135 children and for the purpose of this assessment, the following age group distribution was assumed:

- Babies (0-24 months), 20 children,
- Pre-Kindy (2 - 3 years), 55 children overall; and,
- Kindy (3 years and over), 60 children overall.

The proposed hours of operation are 6.30am to 6.30pm Monday to Friday. As such, it is noted that staff and parents can arrive before 7.00am.

This report assesses noise emissions from child play, mechanical plant (AC plant and extraction fans) and car doors closing at the proposed site, against the *Environmental Protection (Noise) Regulations 1997*.

In addition to the above, it is noted the childcare centre is located close to Wanneroo Road, which carries significant amount of traffic. Therefore, noise intrusion from the road was also assessed against *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*.

The development plans are provided in *Appendix A*.

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

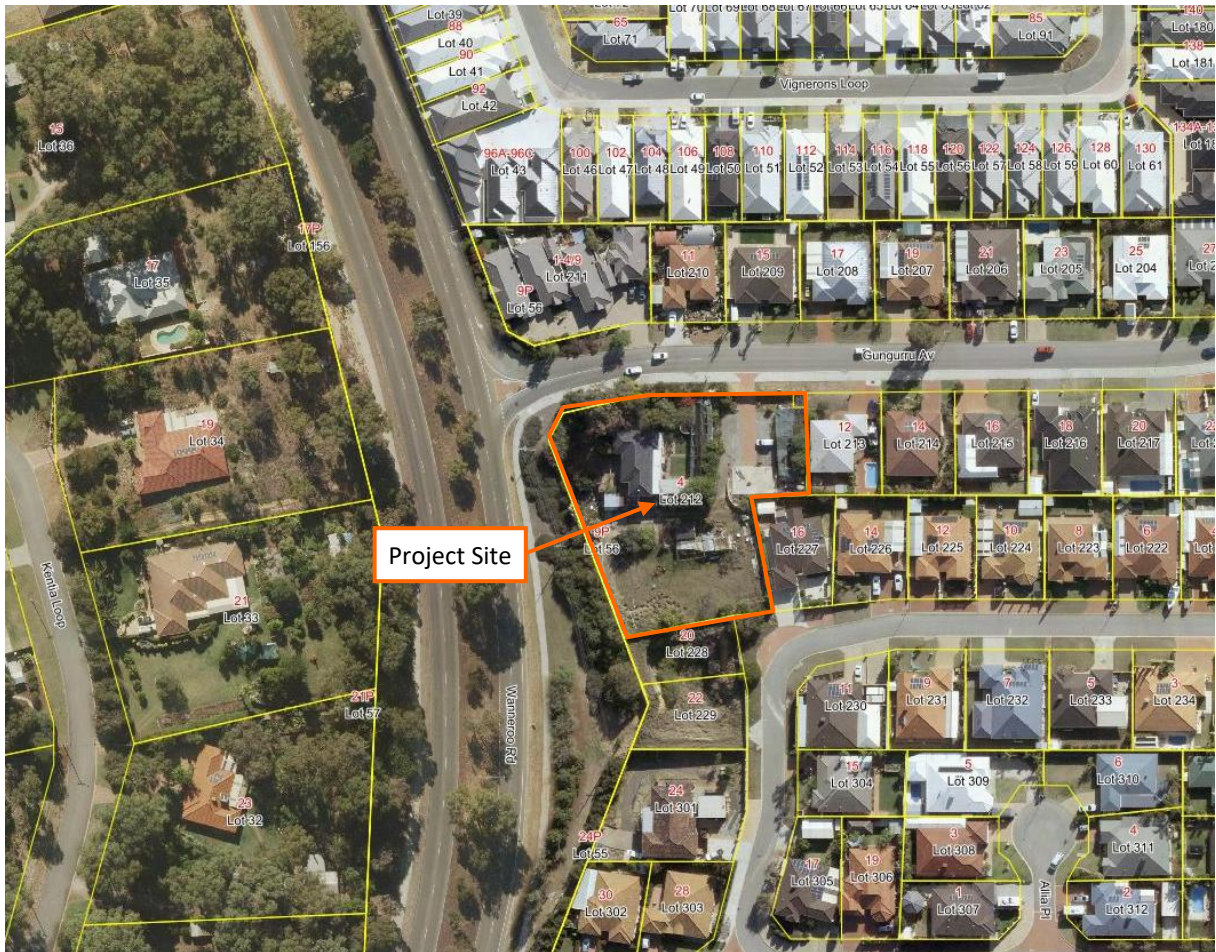


Figure 1-1 Project Locality (Courtesy City of Wanneroo IntraMaps)

2 CRITERIA

2.1 Environmental Protection (Noise) Regulations 1997

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 building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - any other part of the premises within 15 metres of that building or that part of the building.

It is noted the project and surrounding land is located within a residential area with no industrial land uses within 450 metres. The only commercial use within 450 metres is the small complex on the corner of Jacaranda Drive and Wanneroo Road. Wanneroo Road was considered a major road as it carries around 27,500 vehicles per day (Mainroads WA, 2015/16 count at site 6392, south of Dundobar Road).

Based on the above and the land use map shown in *Appendix B*, the influencing factor, applicable at the noise sensitive premises, has been calculated as either 6 dB for houses within 100 metres of Wanneroo Road. This is summarised in *Table 2-3*.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0 dB
Commercial Land	0 %	1 %	0.0 dB
Transport Factor			6 dB
Total			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}
#9-17 Gungurru Ave #12-14 Gungurru Ave #14-16 Wayford Cir #24 Wayford Cir #9-#15 Wayford Cir #19-#21 Kentia Loop Highly sensitive area 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 could not be achieved due to the close proximity of existing buildings and/or fences, the noise emissions were assessed at a point within 1 metre of the building facade and a -2 dB adjustment was made to the predicted noise levels to account for reflected noise.

Furthermore, 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 City of Wanneroo Child Care Premises

The City of Wanneroo Policy LPP2.3 is acknowledged, in particular clauses 9.3 Acoustic Report. This environmental noise assessment report was prepared to satisfy this clause.

2.3 State Planning Policy 5.4

Childcare developments are considered sensitive premises under *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the

Policy) produced by the Western Australian Planning Commission (WAPC). The objectives in the Policy are to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best practice design and construction standards for new development proposals and new or redevelopment transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

The Policy's outdoor noise criteria are shown below in *Table 2-1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2-5 Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(Day)}$	60 dB $L_{Aeq(Day)}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

Note: The 5 dB difference between the target and limit is referred to as the margin.

In areas where the *target* is exceeded, customised noise mitigation measures should be implemented with a view to achieving the *target* in at least one outdoor area, or if this is not practicable, within the *margin*.

In the case of this development, only the daytime criteria are considered applicable given the operating hours of the proposed childcare. As stated in the Policy, for non-residential noise-sensitive developments e.g. schools and child care centres, consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.

The development being a childcare centre, “acceptable indoor noise levels” are taken to be 40 dB $L_{Aeq(Day)}$ in both the group activity and sleeping areas. These are based on AS NZS 2107-2016 *Recommended design sound levels and reverberation times* for primary schools. With regard to the outdoor play areas, noise levels should not exceed the *limit*.

3 METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development at all nearby receivers, as well as traffic noise levels from Wanneroo Road. The software used was *SoundPLAN 8.1* with the ISO 9613 algorithms selected for the environmental noise predictions, and the CoRTN algorithms for the road traffic noise.

3.1 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	Night (1900-0700)	Day (0700-1900)
Temperature (°C)	15	20
Humidity (%)	50	50
Wind Speed (m/s)	Up to 5 m/s	Up to 5 m/s
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.

3.2 Topographical Data

Topographical data was based on the survey data provided on the drawings, as well as that publicly available from *Google Earth* in the form of spot heights.

It is noted the topography is relatively flat but sloping up in an eastward direction from Wanneroo Road. The finished floor levels of the childcare building and outdoor play area was taken to be at RL 63.0, while the finished floor level of the southern section was taken to be at RL 61.5.

3.3 Buildings and Receivers

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

Houses were modelled as single storey buildings at 3.5 metres high and with receivers located 1.5 metres above local ground level.

3.4 Walls and Fences

A new limestone wall will be built along the north-west, west and southern boundaries. The wall is 1500 mm high and topped with 300 mm high open slats fencing.

All other existing boundary fences are solid fences minimum 1.8 metres high, and were also included in the model.

Figure 3-1 shows a view of the 3D model based on the information above in relation to topography and building and fences height.

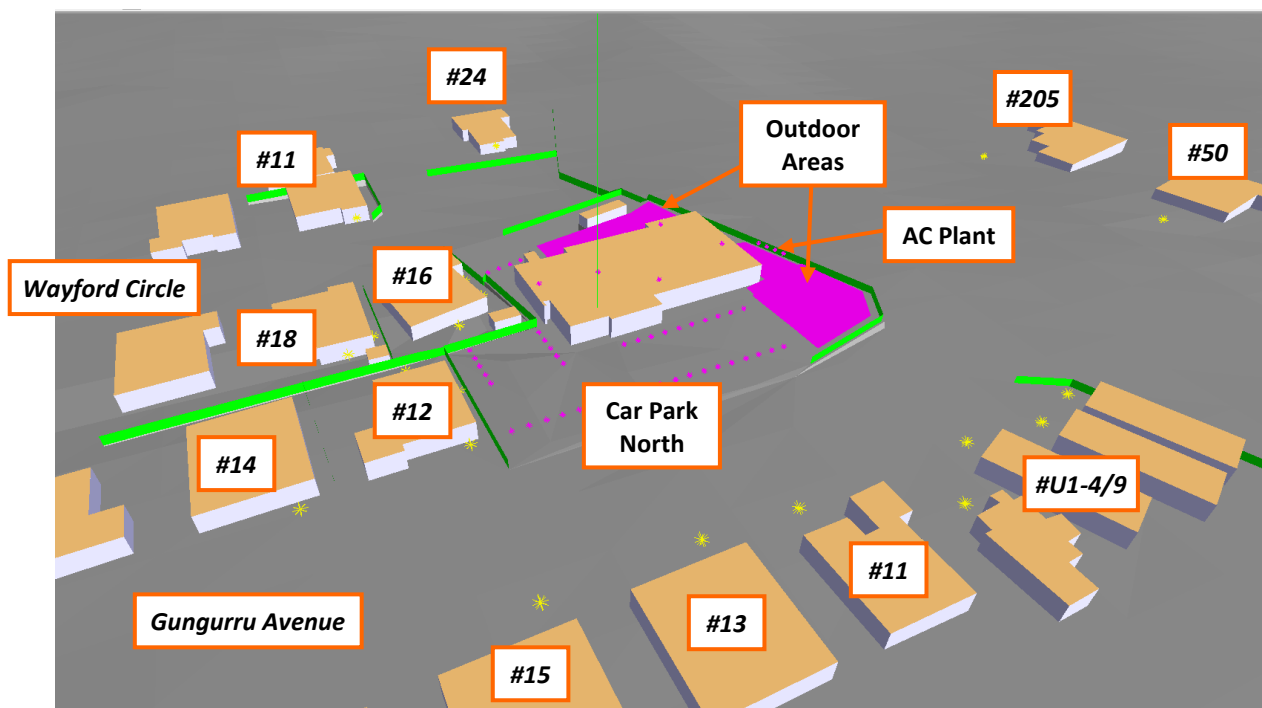


Figure 3-1 North East Elevation of 3D Noise Model

3.5 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 outdoor grassed areas and 0 for the surroundings.

3.6 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	
Child Play Pre-Kindy (25 kids), L ₁₀	51	60	70	77	83	82	75	67	87
Child Play Kindy (25 kids), L ₁₀	55	64	74	81	87	86	79	71	91
Child Play Pre-Kindy (55 kids), L ₁₀	55	64	74	81	87	86	79	71	91
Child Play Kindy (60 kids), L ₁₀	59	68	78	85	91	90	83	75	95
Outdoor Condensing Unit, (18 kW)	77	79	75	73	67	66	58	49	74
Toilet exhaust fans (Fantech TD-800/200 SIL)	71	64	61	64	62	60	57	51	67
Kitchen exhaust fan (Fantech CEEC45D)	70	76	77	69	71	66	64	51	75
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 represent the group of children playing outside at the same time. It is noted that based on observations and measurements, the noise levels tend to increase with the children's age and therefore Kindy children (3 years and above) were considered noisier than Pre-Kindy children (2-3 years). Noise from infant play was considered negligible. Outdoor child play was modelled as area sources at various heights to account for the slight difference in height between age groups as follows:
 - Kindy - 1.0 metre above ground plane; and
 - Pre-Kindy - 0.9 metre above ground plane.
- Whilst the premises is open prior to 7.00am, it is assumed there will be no outdoor play until after 7.00am.
- Based on similar projects, two outdoor AC units were assumed to be required for the building. Each was modelled as a point source located 1.2 metres above ground. The AC units are assumed to be operating at night-time (prior to 7.00am);
- Other mechanical plant include three toilet exhaust fans and one kitchen exhaust fan. All were modelled as point sources approximately 0.5 metre above roof level, and above the area serviced. The kitchen exhaust fan is assumed to only operate after 7.00am; and,
- 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 but can occur prior to 7.00am.

3.7 Traffic Modelling

A noise model developed for the section of Wanneroo Road between Ocean Reef Road and Pinjar Road was used in the modelling. The model was setup and calibrated in 2018, and is therefore considered adequate for the purpose of this assessment.

3.7.1 Traffic Data

Traffic data for Wanneroo Road includes:

- The road surface along Wanneroo Road appears to be dense graded asphalt and assumed to remain unchanged for future conditions.
- Vehicle Speed – The existing posted speed is 60 km/h, and assumed to remain the same.
- Traffic Volumes – Information used in the modelling is provided in *Table 3-3*. Traffic information is based on Link Volume Plots provided by Mainroads WA (provided by Clare Yu, March 2018, Job no. 40846).

Table 3-3 Traffic Information – Wanneroo Road

Parameter	Scenario			
	Existing – 2016 ¹		Future - 2037 ²	
	Northbound	Southbound	Northbound	Southbound
24 Hour Volume	14,800	17,300	17,400	23,000
Percentage Heavies	11%	9%	11%	11%

Notes:

1. Based on calibrated 2016 LVP ROM data provided by MRWA.
2. Based on calibrated 2031 LVP ROM data provided by MRWA extrapolated to 2037.

3.7.2 Parameter Conversion

The *Calculation of Road Traffic Noise* (CoRTN) algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18\text{hour}}$ noise level. The Policy however uses $L_{Aeq(\text{Day})}$ and $L_{Aeq(\text{Night})}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles).

Noise monitoring was undertaken in February 2018 for another project along Wanneroo Road, where the logger was approximately 15 metres from the kerb. The logged data was processed to determine the $L_{A10,18\text{hour}}$ and $L_{Aeq(\text{Day})}$ parameters, which are shown in *Table 3-4*. Based on this data, the difference between the two parameters ($L_{A10,18\text{hour}}$ and $L_{Aeq(\text{Day})}$) is -1.9 dB and is assumed to remain the same for future traffic volumes.

Table 3-4 Summary of Logged Data – February 2018 (Wanneroo Road)

Date	Average Weekday Noise Level, dB			
	$L_{A10,18hour}$	$L_{Aeq,24hour}$	$L_{Aeq (Day)}$	$L_{Aeq (Night)}$
Thursday 8 February 2018	67.3	64.0	65.3	58.7
Friday 9 February 2018	68.1	64.6	65.8	59.9
Monday 12 February 2018	66.8	63.8	65.0	59.4
Tuesday 13 February 2018	67.1	64.1	65.4	58.4
Wednesday 14 February 2018	67.4	63.9	65.2	58.9
Weekday Average	67.3	64.1	65.4	59.1

4 RESULTS

4.1 Outdoor Child Play

The childcare development will host up to 135 children with only 115 above the age of two and considered to make noise during child play i.e. babies are not considered to make significant noise during play. Children will be organised in six groups (i.e. play 1 to 6) with babies being all in one play group. Based on the proposed numbers one play group will be a split of pre-kindy and kindy children together.

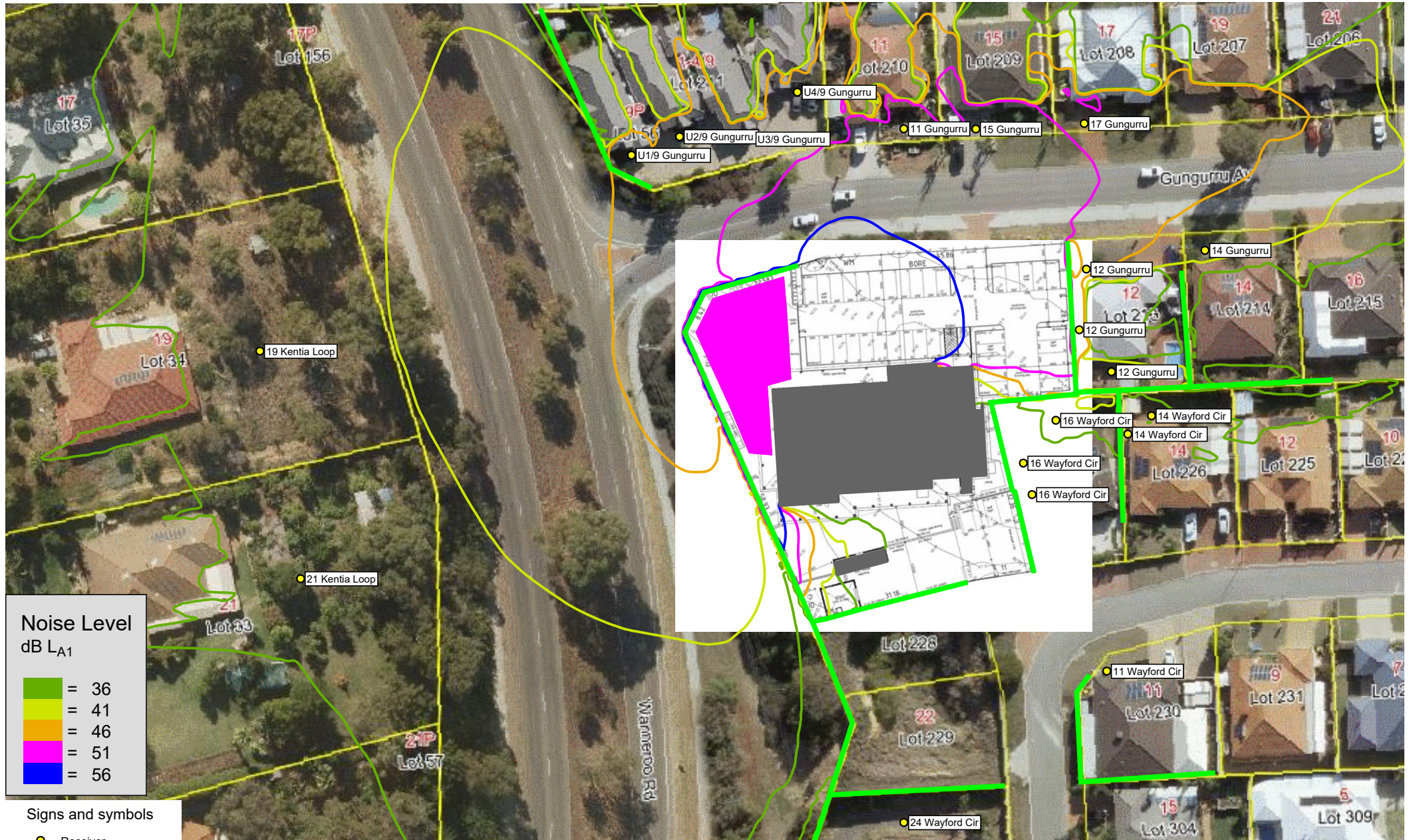
For the purpose of this assessment, noise levels were predicted for the following child play scenarios:

- Scenario 1A (L_{A1}) – all kindy and pre-kindy children are outside. For this scenario it was assumed all 60 kindy children and all 55 pre-kindy children play on the north side. This scenario is considered conservative as it is unlikely all 115 children would be within this area at once. This scenario therefore represents a worst-case ‘north area change over period’.
- Scenario 1B (L_{A1}) – as with scenario 1A, however all children play on the south side. Again, this scenario is considered conservative as it is unlikely all 115 children would be within this area at once. This scenario therefore represents a worst-case ‘south area change over period’.
- Scenario 2 (L_{A10}) – 25 kindy and 25 pre-kindy playing on the north side, and 25 kindy and 25 pre-kindy playing in the south side. This scenario was developed to represent noise levels from typical staggered play i.e. limited number of children outside for extended period of time, and therefore assessed against the L_{A10} assigned noise level.

For all scenarios above, the predicted noise levels are from child play only i.e. mechanical plant noise not included. *Table 4-1* presents the predicted noise levels at each receiver. *Figures 4-1 to 4-4* also show the predicted noise levels as noise contour maps at ground level (1.5 metres AGL).

Table 4-1 Predicted Noise Levels of Child Play

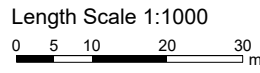
Receiver	Scenario 1A dB L_{A1}	Scenario 1B dB L_{A1}	Scenario 2 dB L_{A10}
11 Gungurru Ave	53	32	49
11 Wayford Cir	28	50	46
12 Gungurru Ave	47	34	45
12 Gungurru Ave	44	37	42
12 Gungurru Ave	43	31	40
14 Gungurru Ave	43	32	40
14 Wayford Cir	33	32	32
14 Wayford Cir	34	36	35
15 Gungurru Ave	52	32	49
16 Wayford Cir	31	42	38
16 Wayford Cir	32	52	48
16 Wayford Cir	39	39	38
17 Gungurru Ave	49	29	46
19 Kentia Loop	38	34	35
21 Kentia Loop	37	35	35
24 Wayford Cir	33	44	41
U1/9 Gungurru Ave	48	32	44
U2/9 Gungurru Ave	49	30	45
U3/9 Gungurru Ave	50	32	47
U4/9 Gungurru Ave	49	32	46

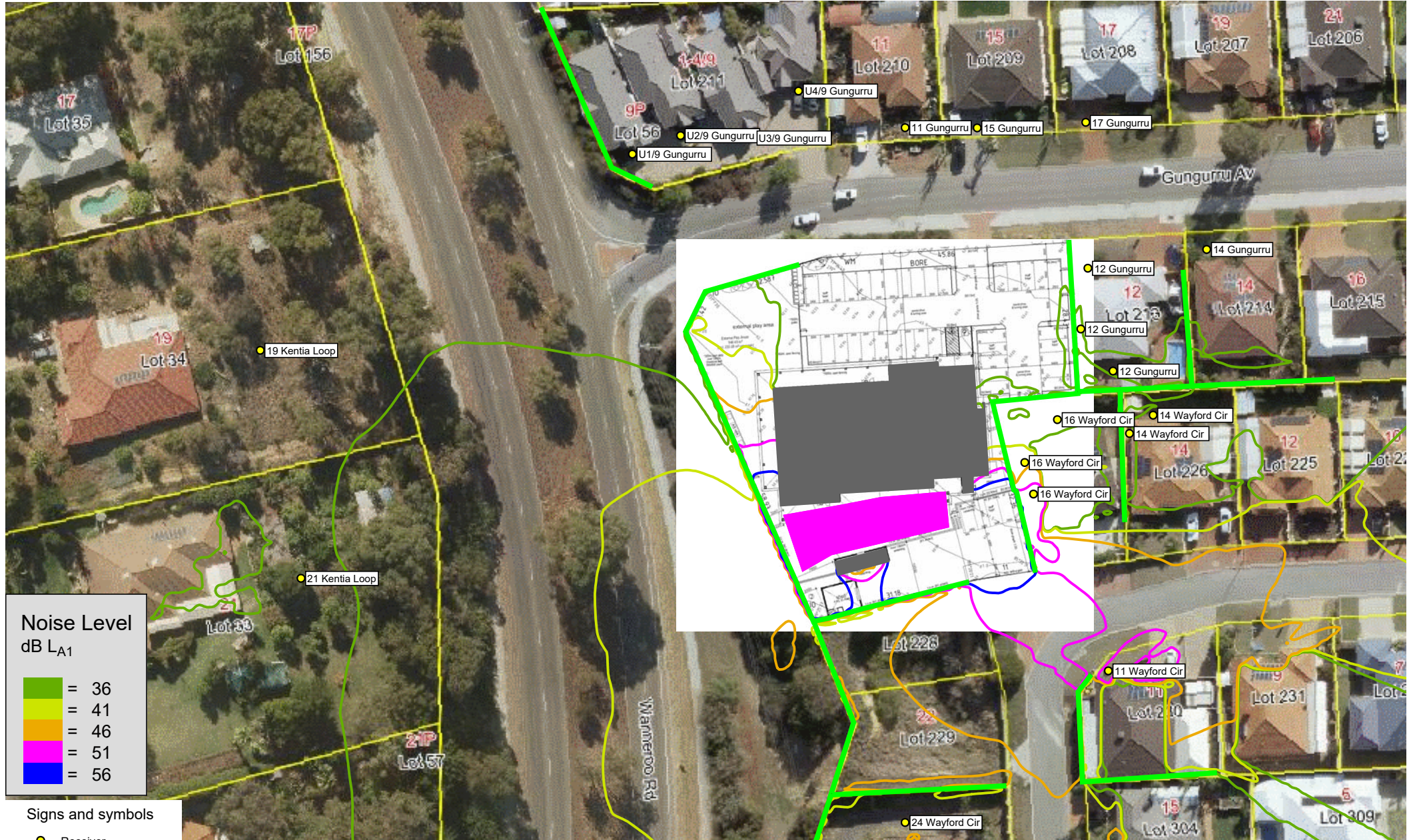


**Noise Level
dB LA1**

█	= 36
█	= 41
█	= 46
█	= 51
█	= 56

- Signs and symbols**
- Receiver
 - █ Child Play
 - █ Fences and Walls

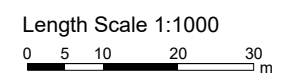


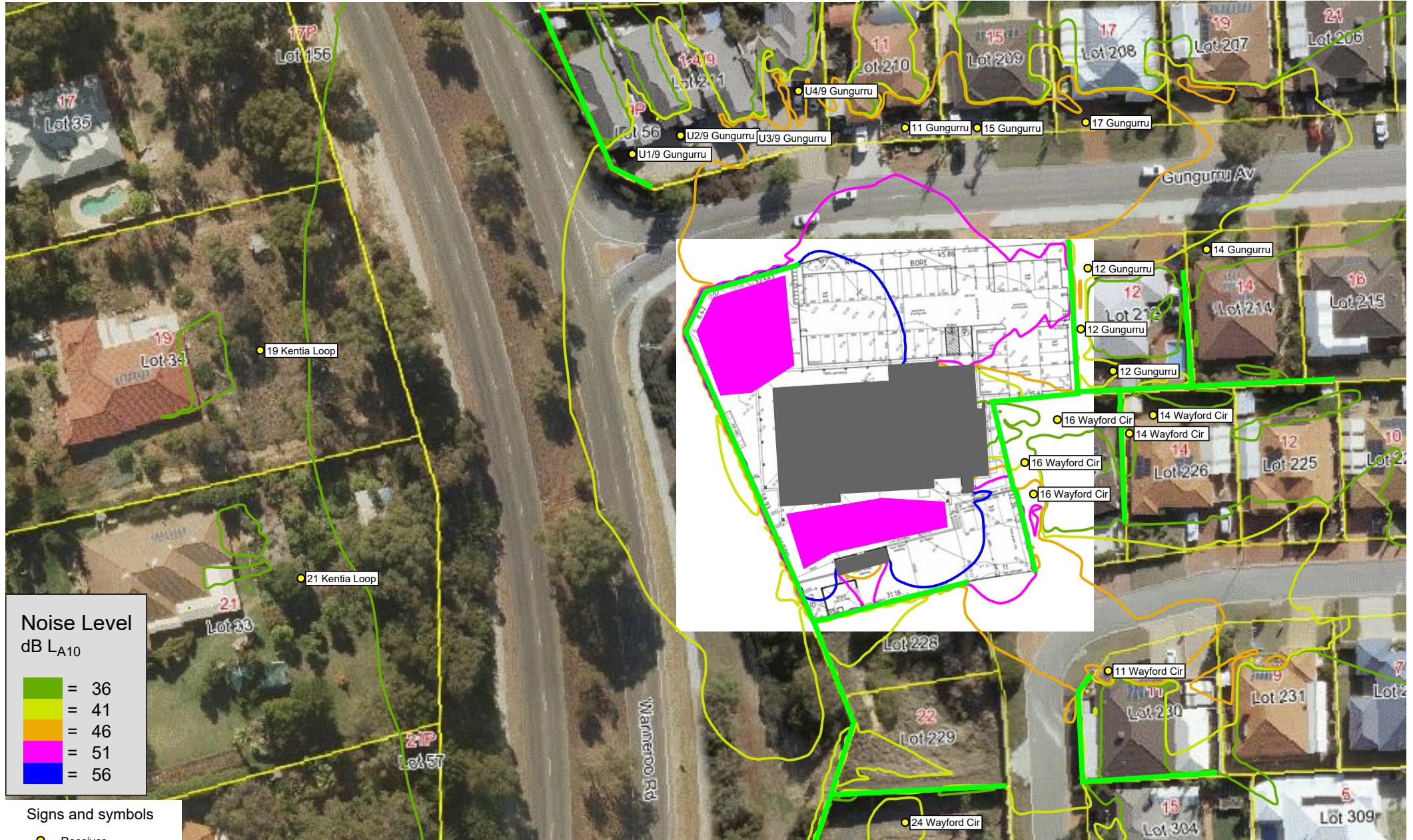


Noise Level
dB LA1

█	= 36
█	= 41
█	= 46
█	= 51
█	= 56

- Signs and symbols**
- Receiver
 - █ Child Play
 - █ Fences and Walls

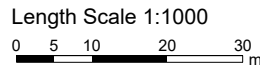




Noise Level
dB L_{A10}

█	= 36
█	= 41
█	= 46
█	= 51
█	= 56

- Signs and symbols**
- Receiver
 - █ Child Play
 - █ Fences and Walls



4.2 Mechanical Plant

Mechanical plant consists of AC plant and extraction fans for the kitchen and toilets. The AC plant is located on the eastern side of the outdoor play area against the boundary wall and behind a screen. The AC plant screen was assumed to be open style fencing as worst-case e.g. steel tube or slats. The exhaust fans were assumed to be located on the roof and above the room being serviced. Noise emission data for all plant was taken from similar projects.

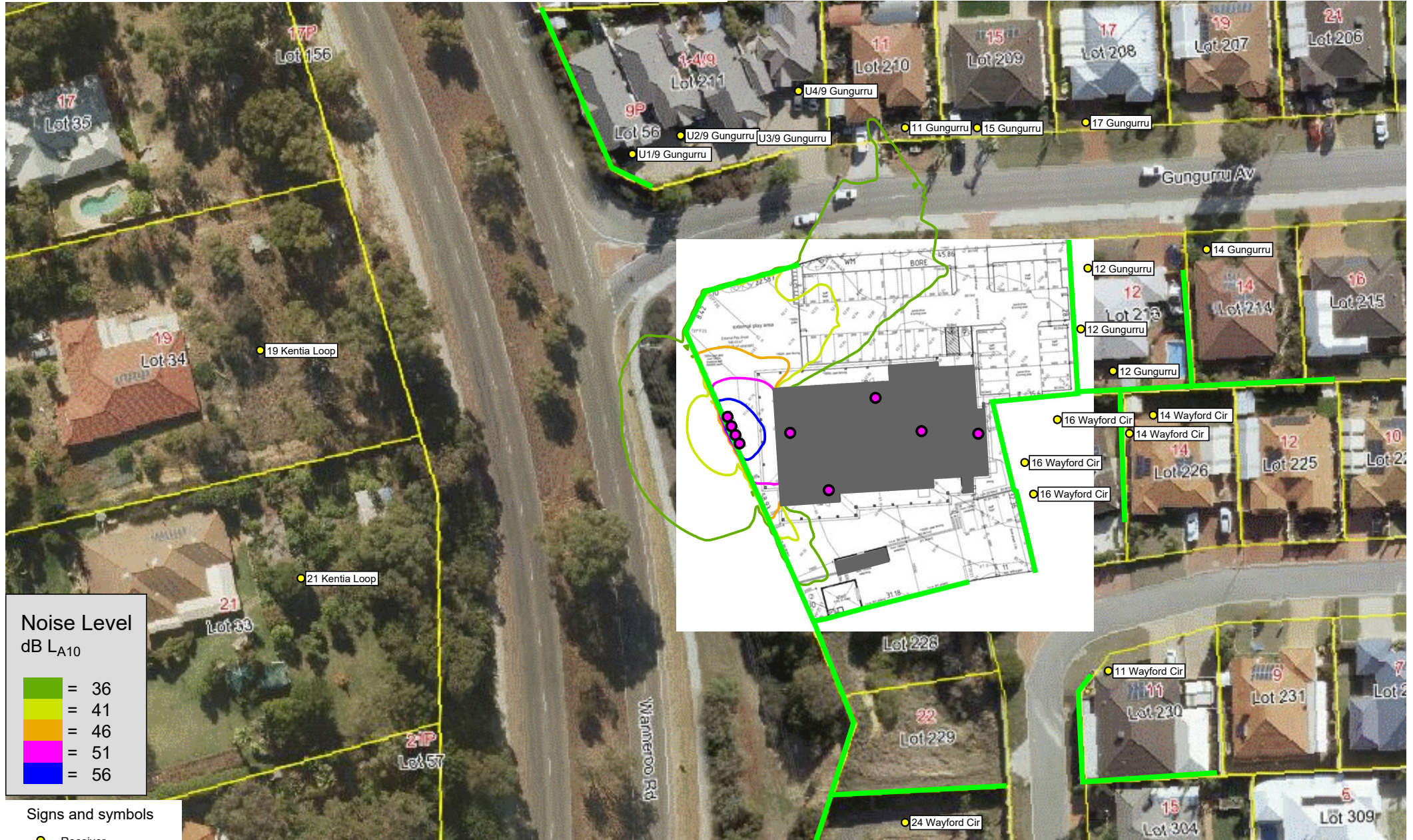
During the daytime, it is assumed that all plant could be operating simultaneously and at full capacity e.g. hot summer day. As the childcare centre would open from 6.30am, the AC plant and toilet exhaust fans were assumed to operate at night-time (i.e. 6.30am-7.00am). The predicted daytime and night-time mechanical plant noise levels are presented in *Table 4-2*.

It can be seen that at most receivers, mechanical plant noise is predicted to be approximately 35 dB(A). Compared to the predicted child play noise levels in *Table 4-1*, it is noted that child play would dominate the noise levels at all the receivers.

The daytime and night-time predicted noise levels are also shown on *Figures 4-4* and *4-5* respectively.

Table 4-2 Predicted Noise Levels of Mechanical Plant, dB LA10

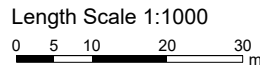
Receiver	Daytime (all plant)	Night-time (AC + TEF)	Receiver	Daytime (all plant)	Night-time (AC + TEF)
11 Gungurru Ave	36	35	16 Wayford Cir	31	31
11 Wayford Cir	25	22	16 Wayford Cir	33	32
12 Gungurru Ave	30	28	17 Gungurru Ave	29	28
12 Gungurru Ave	30	29	19 Kentia Loop	26	25
12 Gungurru Ave	27	24	21 Kentia Loop	26	24
14 Gungurru Ave	24	21	24 Wayford Cir	26	25
14 Wayford Cir	24	22	U1/9 Gungurru Ave	32	31
14 Wayford Cir	25	23	U2/9 Gungurru Ave	33	32
15 Gungurru Ave	35	34	U3/9 Gungurru Ave	34	33
16 Wayford Cir	31	31	U4/9 Gungurru Ave	33	32

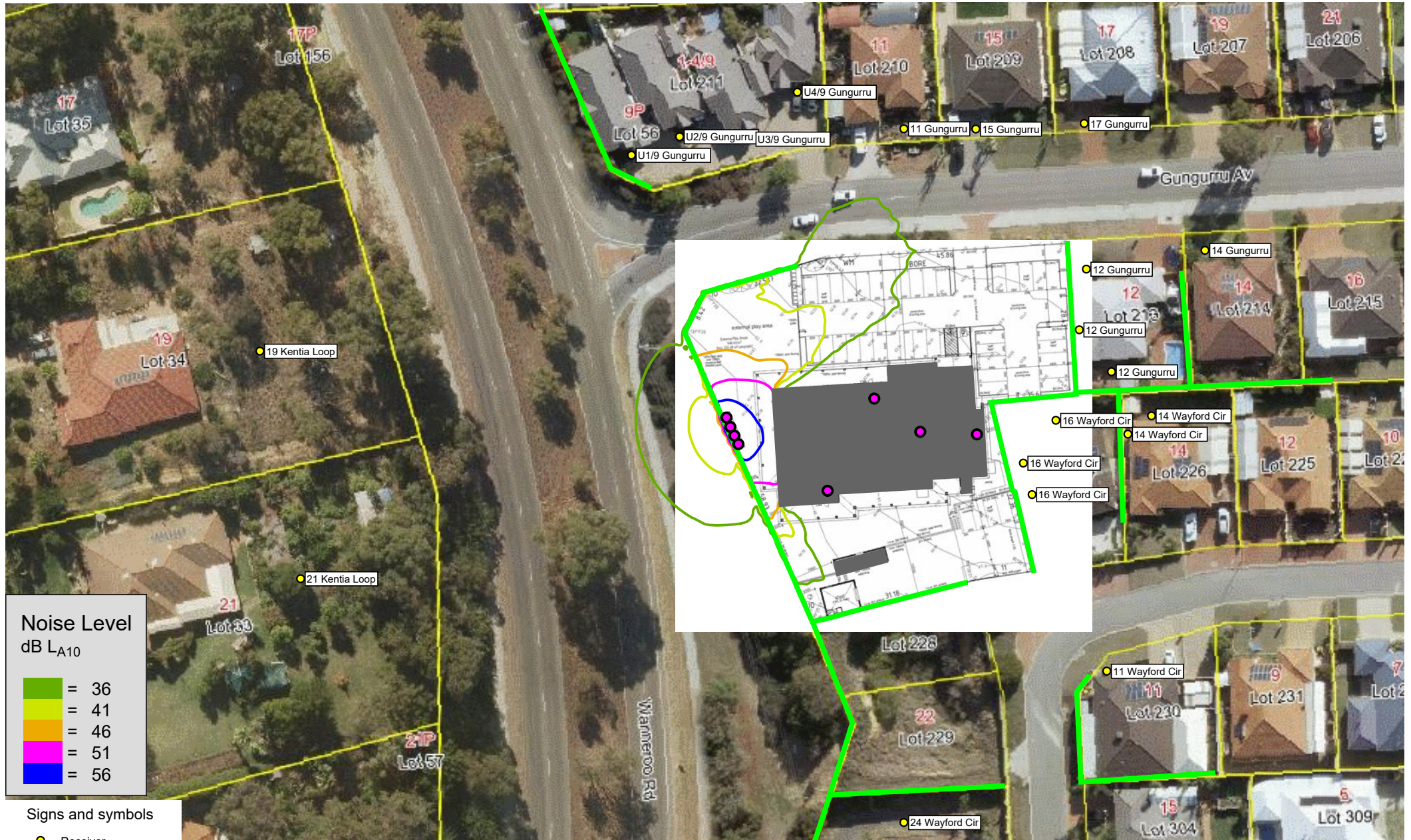


Noise Level
dB LA10

█	= 36
█	= 41
█	= 46
█	= 51
█	= 56

- Signs and symbols**
- Receiver
 - Point Source
 - Fences and Walls

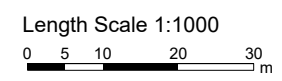




Noise Level
dB LA10

█	= 36
█	= 41
█	= 46
█	= 51
█	= 56

- Signs and symbols**
- Receiver
 - Point Source
 - Fences and Walls



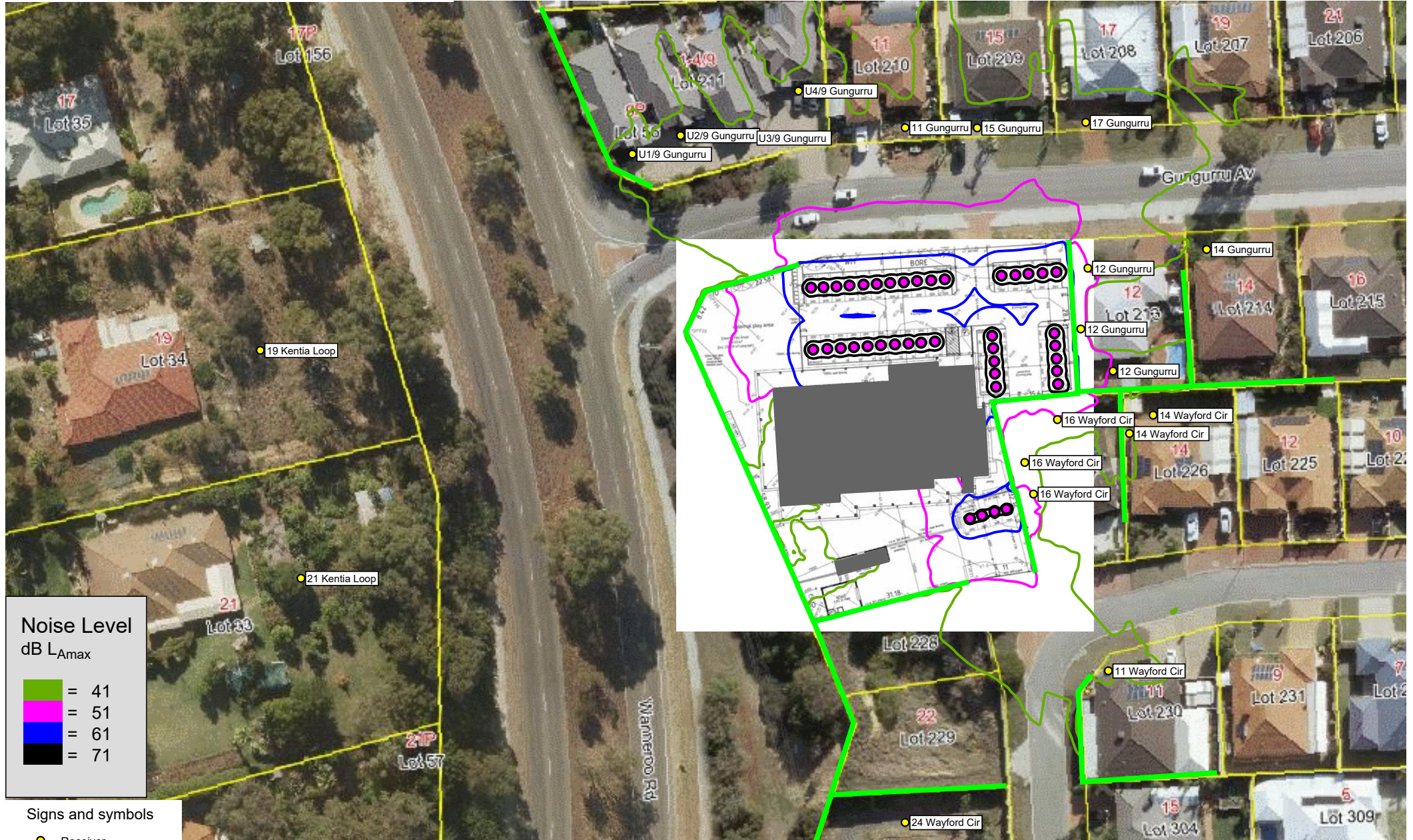
4.3 Car Door Closing

The model includes noise from car doors closing in the proposed parking bays on site. *Table 4-3* presents the predicted noise levels from car doors closing. *Figure 4-6* also shows the predicted noise levels as a noise contour map at ground level (1.5 metres AGL).

As the main car park is located north of the building, the receivers to the north and east are most affected by car doors closing.

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

Receiver	Predicted Noise Levels
11 Gungurru Ave	46
11 Wayford Cir	42
12 Gungurru Ave	55
12 Gungurru Ave	49
12 Gungurru Ave	48
14 Gungurru Ave	40
14 Wayford Cir	38
14 Wayford Cir	40
15 Gungurru Ave	47
16 Wayford Cir	44
16 Wayford Cir	49
16 Wayford Cir	51
17 Gungurru Ave	46
19 Kentia Loop	26
21 Kentia Loop	24
24 Wayford Cir	35
U1/9 Gungurru Ave	43
U2/9 Gungurru Ave	45
U3/9 Gungurru Ave	47
U4/9 Gungurru Ave	46

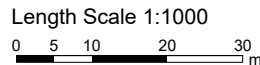


Noise Level
 dB L_{Amax}

	= 41
	= 51
	= 61
	= 71

Signs and symbols

- Receiver
- Point Source
- Fences and Walls



4.4 Traffic Noise

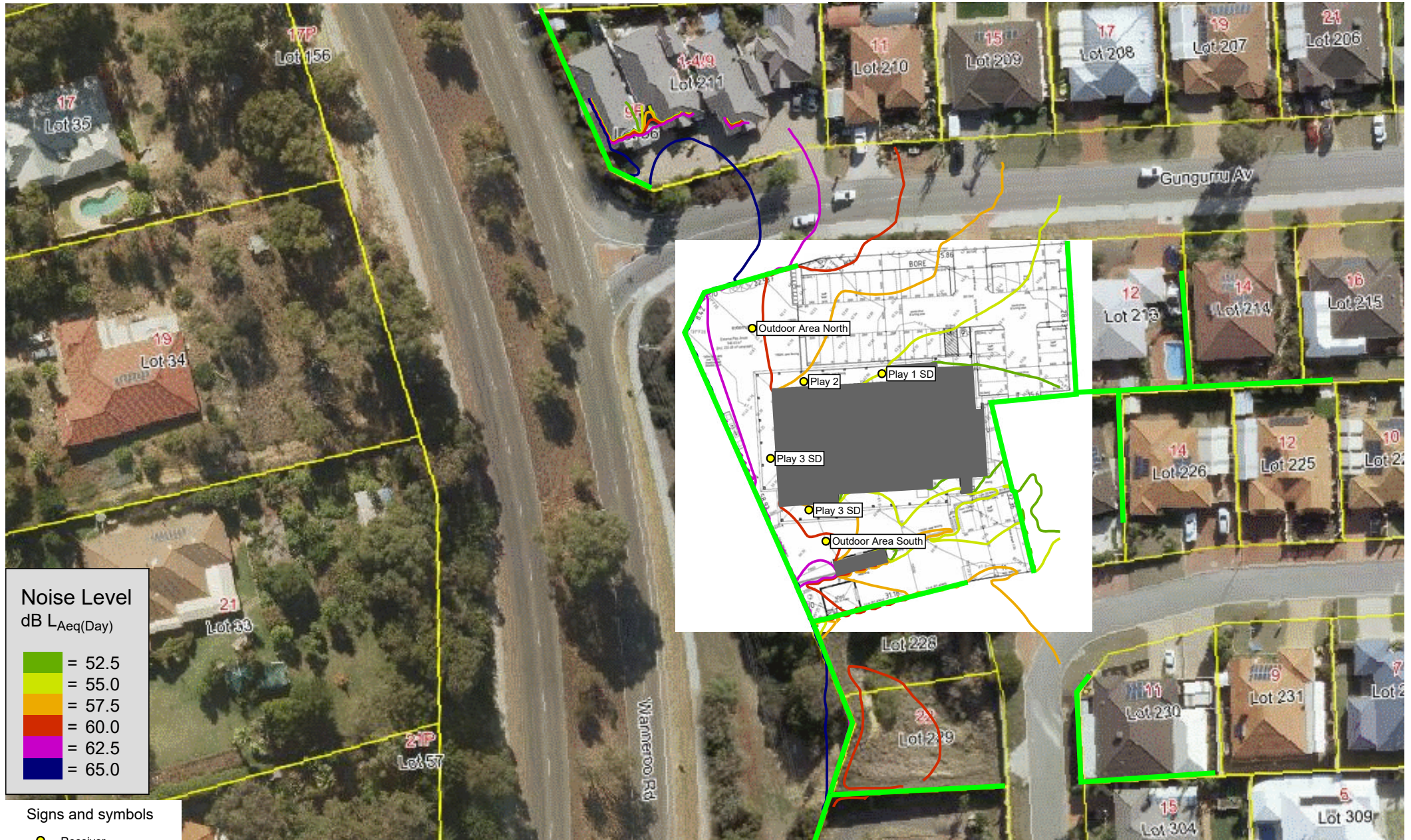
Table 4-4 provides the tabulated daytime noise level, $L_{Aeq(Day)}$, for the future (year 2037) traffic conditions at the receivers within the childcare development.

From the results it can be seen that the Play 03 room west façade is the most exposed.

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

Receiver	Facade Orientation	2037 Traffic $L_{Aeq(Day)}$, dB
Outdoor Play Area North	-	58
Outdoor Play Area South	-	58
Play 01 (Sliding Door)	W	56
Play 02 (West Window)	N	58
Play 03 (Sliding Door)	S	59
Play 03 (Sliding Door)	W	62

The noise levels for future traffic conditions are also presented as contours on Figure 4-7.



Noise Level
 dB L_{Aeq}(Day)

- = 52.5
- = 55.0
- = 57.5
- = 60.0
- = 62.5
- = 65.0

Signs and symbols

- Receiver
- Point Source
- Fences and Walls



Length Scale 1:1000



5 ASSESSMENT

5.1 Outdoor Child Play

Child play will only occur during the daytime, when the assigned noise levels are either 51 dB L_{A10} , and 61 dB L_{A1} depending on the receiver location. Noise from child play is not considered to contain annoying characteristics within the definition of the Regulations. Therefore no adjustments are made to the predicted noise levels.

5.1.1 L_{A10} Compliance

As mentioned previously, play time is generally staggered, resulting in smaller groups of children playing outside simultaneously for extended periods of time, as represented by scenario 2.

Table 5-1 presents the assessment of the predicted noise levels from this scenario against the L_{A10} assigned noise level. It is further noted that at the receivers shown in *Table 5-1*, the daytime mechanical plant noise levels are not significantly contributing to the overall noise levels, and therefore noise from child play can be considered in isolation. Mechanical plant noise is specifically addressed in *Section 5-2*.

From the assessment in *Table 5-1* it can be seen that compliance can be achieved at all receivers by a margin of at least 2 dB e.g. receiver at #11 Gungurru Avenue. Therefore, and based on the modelling results, it is noted that compliance would still be achieved under the following alternative scenarios:

- Scenario 2A - 40 kindy and 30 pre-kindy children play in the north area. Or,
- Scenario 2B - 50 kindy and 55 pre-kindy children play in the south area.

It is noted the above is provided for reference as it may not be physically possible to accommodate the nominated number of children in either play area.

Table 5-1 Assessment of Scenario 2 Noise Levels, dB LA10

Receiver	Assigned Noise Level¹	Predicted Level²	Exceedence
11 Gungurru Ave	51	49	<i>Complies</i>
11 Wayford Cir	51	46	<i>Complies</i>
12 Gungurru Ave	51	45	<i>Complies</i>
12 Gungurru Ave	51	42	<i>Complies</i>
12 Gungurru Ave	51	40	<i>Complies</i>
14 Gungurru Ave	51	40	<i>Complies</i>
14 Wayford Cir	51	32	<i>Complies</i>
14 Wayford Cir	51	35	<i>Complies</i>
15 Gungurru Ave	51	49	<i>Complies</i>
16 Wayford Cir	51	38	<i>Complies</i>
16 Wayford Cir	51	48	<i>Complies</i>
16 Wayford Cir	51	38	<i>Complies</i>
17 Gungurru Ave	51	46	<i>Complies</i>
19 Kentia Loop	51	35	<i>Complies</i>
21 Kentia Loop	51	35	<i>Complies</i>
24 Wayford Cir	51	41	<i>Complies</i>
U1/9 Gungurru Ave	51	44	<i>Complies</i>
U2/9 Gungurru Ave	51	45	<i>Complies</i>
U3/9 Gungurru Ave	51	47	<i>Complies</i>
U4/9 Gungurru Ave	51	46	<i>Complies</i>

Notes:

1. The assigned noise level is as defined in *Table 2-4*.
2. From *Table 4-1*.

5.1.2 LA1 Compliance

During the 'change over' period, all 115 children above the age of 2 may be outside at once. However, this would occur for short periods of time and therefore the LA1 assigned noise level is considered applicable.

This is represented by scenarios 1A and 1B and from *Table 4-1*, it can be seen the highest predicted noise levels are 52-53 dB(A) at the closest receivers at #11 and #15 Gungurru Avenue, and #16 Wayford Circle.

Therefore compliance with the daytime LA1 assigned noise level of 61 dB is achieved.

5.2 Mechanical Plant

Given the proposed hours of operation, the night-time period (i.e. 6.30am to 7.00am) is the most critical. AC plant would be considered tonal prior to 7.00am and therefore a +5 dB adjustment is to be made to the predicted night-time noise levels (refer *Table 2-1*).

Based on the predicted noise levels in *Table 4-2*, the highest predicted noise levels are 39-40 dB(A), including the tonality adjustment, at receivers #11 and #15 Gungurru Avenue. As such, compliance with the night-time LA10 assigned noise level of 41 dB is achieved.

During the daytime, only the kitchen exhaust fan is also considered to operate. Tonality may still be present in the noise emissions given the relatively short source-receiver distances. Based on the predicted noise levels in *Table 4-1*, the highest predicted noise levels are 40-41 dB(A) at receivers at #11 and #15 Gungurru Avenue. As such, compliance with the daytime LA10 assigned noise level of 51 dB is also achieved.

Although compliance is predicted to be achieved at all times, it must be noted this assessment is based on assumptions in relation to the size and type of the AC plant and exhaust fans. Therefore, mechanical plant noise should be reviewed by a qualified acoustical consultant during detailed design, when plant selection and location becomes known. Based on the modelling carried out, the following is recommended in relation to mechanical plant:

- All plant to be the quietest available, and
- Select AC units which can operate on a 'low noise mode' prior to 7am, or potentially not operate before 7am, and
- Exhaust fans to be located within the ceiling space and ducted to the roof. Roof cowls are then to be located furthest away from sensitive receivers, and
- Allow for silencers in the duct design of exhaust fans, and
- All plant to be mounted on suitable anti-vibration mounts.

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 members or parents can arrive before 7.00am, and therefore the night-time L_{Amax} assigned noise level of 61 dB is applicable.

Given the relative short source to receiver distances, car doors closing noise is considered to be impulsive within the definition of the Regulations. Therefore an adjustment of +10 dB is to be applied to the predicted noise levels (refer *Table 2-1*).

The highest predicted noise level is 55 dB L_{Amax} at the receiver at #12 Gungurru Avenue, resulting in an assessable level of 65 dB L_{Amax} . This results in an exceedence of 4 dB of the night-time assigned noise level. Based on discussions with the Client, compliance with the regulations at night-time at the receiver at #12 Gungurru Avenue will be achieved by implementing the following:

- Car bays 12 to 16, and 33 to 37 not to be used before 7am.

At all other receivers, the assessable noise levels are at, or below, 61 dB L_{Amax} and therefore compliant.

5.4 Traffic Noise Intrusion

Traffic noise was assessed by means of noise modelling and based on logged data for Wanneroo Road obtained in February 2018.

From *Table 4-4*, the predicted daytime noise levels $L_{Aeq(Day)}$ for future traffic conditions are above the $L_{Aeq(Day)}$ *limit* of 60 dB at only the west façade of Play 03, while the *limit* is predicted to be achieved at all other façades. It is understood that all external glazing for the childcare centre will be 6.38 mm laminated grey glass. Based on typical manufacturer's data (e.g. CAPRAL Aluminium), this type of glazing can achieve the following acoustic performance:

- $R_w (C_{tr})$ 32 (-3) for sliding door with 6.38 mm laminated glass in commercial frame with finseals and silicone sub sill, and
- $R_w (C_{tr})$ 30 (-1) for sliding window with 6.38 mm laminated glass in commercial frame with finseals, gasket and silicone sub sill.

Based on the predicted outdoor levels, glazing size, room size and acoustic performance of the glazed system above, the internal noise levels within the Play 03 room was predicted to be below 35 dB $L_{Aeq(Day)}$. As other areas are exposed to lower external noise levels, the requirements of State Planning Policy 5.4 are satisfied for all other spaces.

In addition, it is also noted that the noise levels within the outdoor areas are below the *limit*. Therefore, no specific acoustic treatments are considered to be required to mitigate noise levels within the outdoor play areas.

However, as the lot is predicted to be exposed to noise levels over the *target*, some form of notification on the certificate of title would be required to inform future land developers that the lot is, or maybe, impacted by transportation noise. A typical notice is provided below:

Notice: This lot is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise.

6 CONCLUSIONS

The noise impact from the proposed childcare centre to be located at Lot 212 (#4) Gungurru Avenue in Hocking have been assessed against the relevant criteria of the *Environmental Protection (Noise) Regulations 1997*. Based on the modelling and assessments above in relation to the noise emissions from child play, mechanical plant and car doors closing, it is concluded that compliance can be achieved provided the following is implemented:

With regard to noise from outdoor child play:

- Restrict the number of children playing outside for more than 24 minutes as follows:
 - 40 kindy and 30 pre-kindy children in the north area, or
 - 50 kindy and 55 pre-kindy children in the south area.

With regard to mechanical plant noise:

- All plant to be the quietest available, and
- Select AC units which can operate on a 'low noise mode' prior to 7am, and
- Consider locating exhaust fans within the ceiling space and ducted to the roof and allow for silencers in the duct design. Roof cowls are then to be located furthest away from sensitive receivers, and
- All plant to be mounted on suitable anti-vibration mounts, and
- Once plant is selected, a detailed assessment is to be undertaken by a suitably qualified acoustical consultant.

With regard to car doors closing noise:

- Car bays 12 to 16, and 33 to 37 not to be used before 7am.

Finally in addition to the above, the following best practices should be implemented:

- 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,
- External doors and windows to be closed during indoor activity / play, and
- Any music played within the internal activity areas to be 'light' music with no significant bass content and played at a relatively low level.

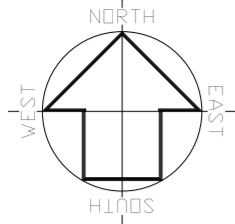
With regard to *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*, noise intrusion from traffic along Wanneroo Road was predicted to exceed the *target* at some façades. While the proposed external glazing can achieve satisfactory internal noise levels in all spaces, the following is required to satisfy the Policy:

- Sliding doors construction to achieve $R_w (C_{tr})$ 32 (-3) minimum,
- Sliding windows construction to achieve $R_w (C_{tr})$ 30 (-1), and
- Notification on the certificate of title. A typical notice is provided below:

Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise.

Appendix A

Development Plans



LOT 212

3576sqm

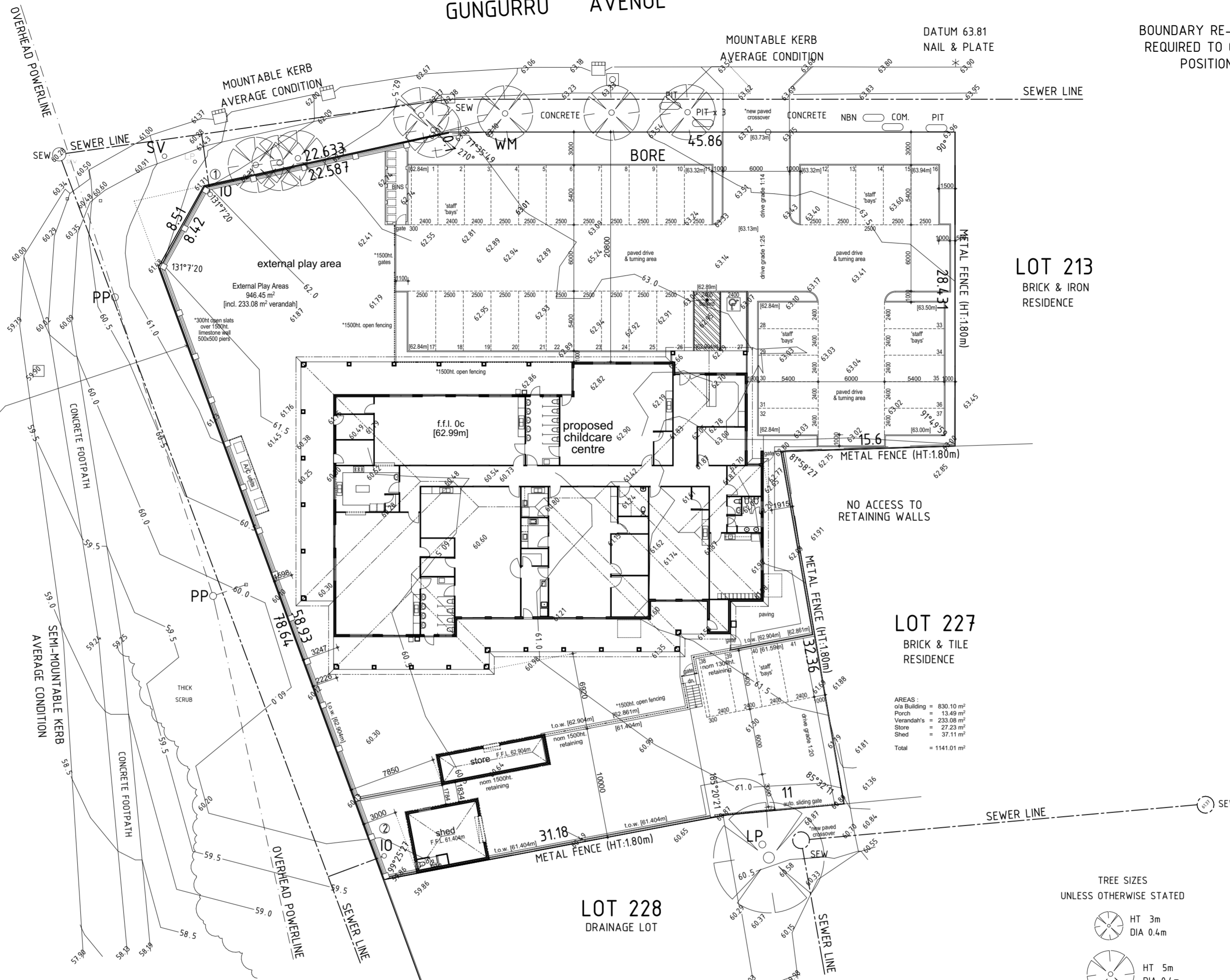
SANDY
GRASS COVER

NOTE: A.H.D. VALUE DERIVED FROM
MANHOLE AA1496.
THIS VALUE DERIVED FROM WATER CORP.
AS CONSTRUCTED RECORDS & MAY NOT BE
EXACT. AN A.H.D. SURVEY IS REQUIRED
TO OBTAIN AN ACCURATE VALUE.

LOT 56
P.A.W.
0.1m WIDE

WANNEROO ROAD

GUNGURRU AVENUE



WARNING!
BOUNDARY RE-ESTABLISHMENT SURVEY
REQUIRED TO CONFIRM LOT BOUNDARY
POSITION AND DIMENSIONS.

SERVICE INFORMATION	
SCALE BAR - 1:300 @ A2	
AREA	ESTABLISHED
SEWERAGE	YES DEPTH SEE BELOW
WATER	YES PRELAD L
ELECTRICAL	YES OH
TELECOM	YES
GAS	YES
DRAFTED TS SURVEYOR TS	

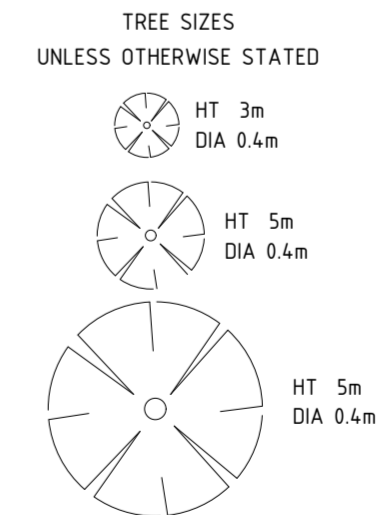
SERVICE LEGEND	
WATER	
SV	STOP VALVE
HY	HYDRANT
FP	FLUSH POINT
WM	WATER METER
SEWERAGE	
○ SEW	SEWER MANHOLE
IS	INSPECTION OPENING
IQ	INSPECTION SHAFT
GAS	
GM	GAS METER
SV	SERVICE VALVE
ELECTRICAL	
PD	POWER DOME
PP	POWER POLE
LP	LAMP POST
CP	CONSUMER POLE
SWA	STAY WIRE ANCHOR
STORMWATER	
○	STORMWATER MANHOLE
□	GRATE
□	SIDE ENTRY PIT
TELECOM	
PIT	TELECOM PIT
SURVEY	
○ PF	PEG FOUND
○ PG	PEG GONE
*	DATUM

LOT 213
BRICK & IRON
RESIDENCE

LOT 227
BRICK & TILE
RESIDENCE

LOT 228
DRAINAGE LOT

AREAS:
o/a Building = 830.10 m²
Porch = 13.49 m²
Verandah's = 233.08 m²
Store = 27.23 m²
Shed = 37.11 m²
Total = 1141.01 m²



① SEW CONN POSITION APPROXIMATE ONLY
SEW INV. 59.08
UP. 2.00
DEPTH. 0.63m

② SEW CONN POSITION APPROXIMATE ONLY
SEW INV. 57.15
UP. 1.50
DEPTH. 1.21m

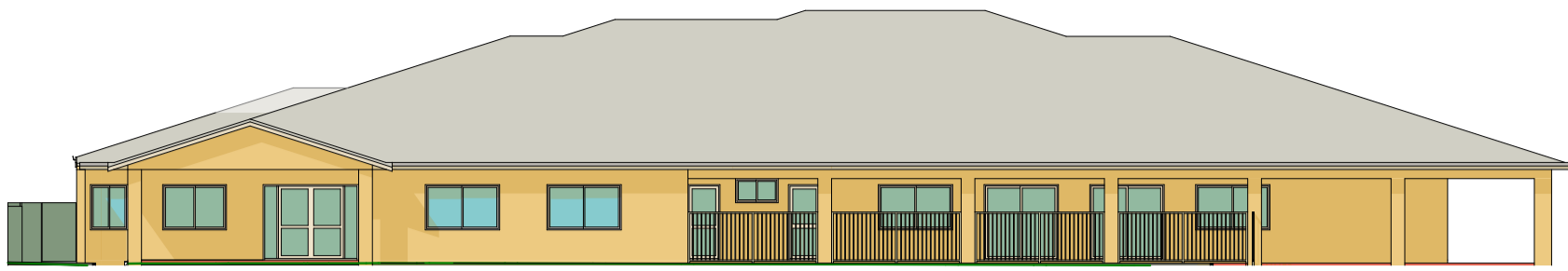
IMPORTANT EXPLANATORY NOTES

- The information on this drawing is current at the date of survey and is prepared for the client names in the title block.
- All services are to be confirmed with relevant authorities. This include without limitation; Sewerage / Water Supply / Drainage / Power Supply / Gas Supply & Communications
- Further Limitations / Interests / Encumbrances / Notifications may be listed on the Certificate of Title.
- Original lot dimensions taken from Landgate Survey Plans.
- Boundary Re-establishment Survey required to confirm lot boundary position and dimension before any design works. Location of boundary in relation to fences or boundary markers is not guaranteed and is placed as per 'best fit'.
- TSA Surveys does not accept liability for loss or damage to any person or corporation who may rely on this plan for any purpose.
- Permission is required from TSA Surveys for the reproduction or copying of this plan.

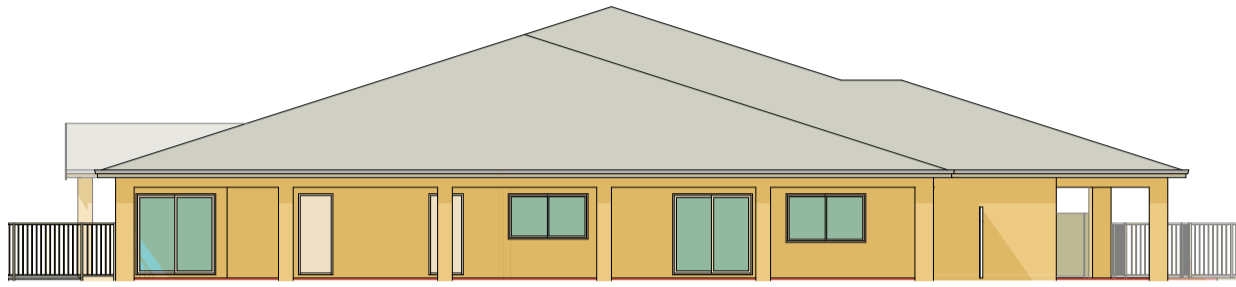
SITE PLAN
scale 1:300

CLIENT	DEL BORRELLO		
ADDRESS	LOT 212 (#4) GUNGURRU AVENUE, HOCKING		
AUTHORITY	WANNEROO	PLAN P23992	C/T Vol.Fol. 2198/589
DATE OF SURVEY	16/2/2019	JOB REFERENCE	TSA172 - FS
	TYSON SEGARAM LICENSED SURVEYOR M 0433 304 648 E tyson@tsasurveys.com.au W www.tsasurveys.com.au A.B.N. 57 295 169 896		

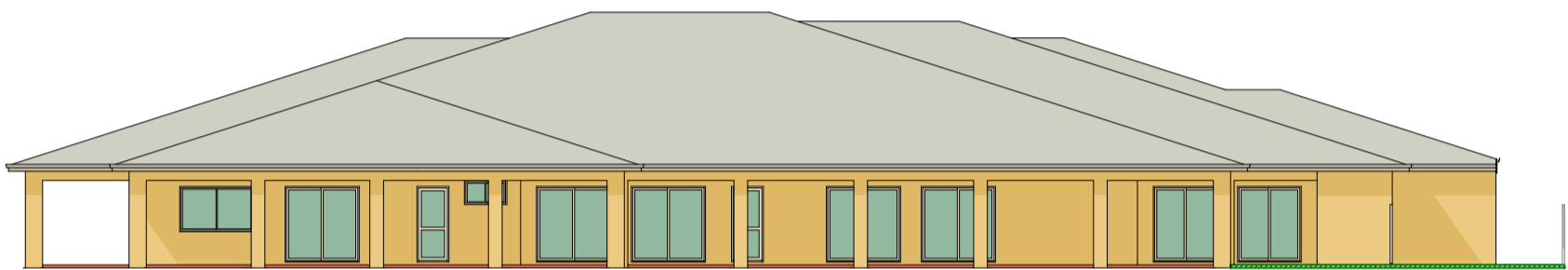
date:	revision:	PROPOSED CHILDCARE CENTRE TO BE ERCTED ON LOT 212 (hse: 4) GUNGURRU AVENUE - HOCKING: FOR CF TOWN PLANNING & DEVELOPMENT	alan king architectural drafting DIPLOMA OF ARCHITECTURAL DRAFTING No 3503 1/11 Riverview Street South Perth WA 6151 Phone/Fax :- 9367 2814	drawn: a.c.k. date: MARCH 19 scale: 1:300	drwg no: 2 of 9 SITE



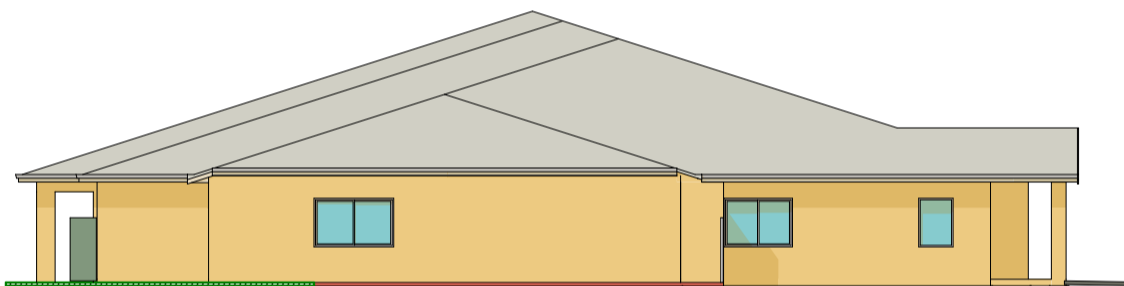
NORTH ELEVATION (to gungurru avenue)



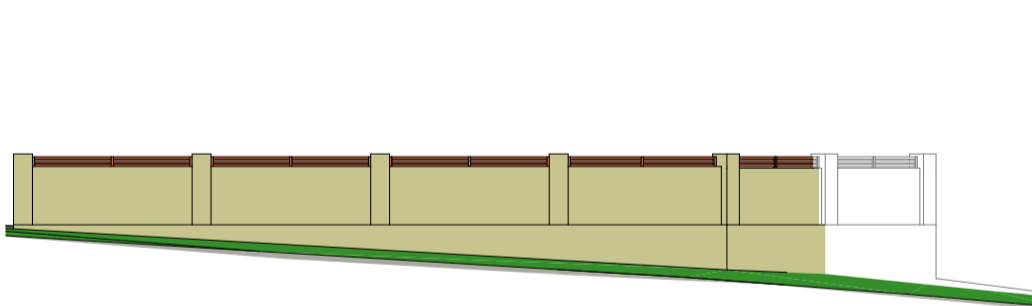
WEST ELEVATION (to wanneroo road)



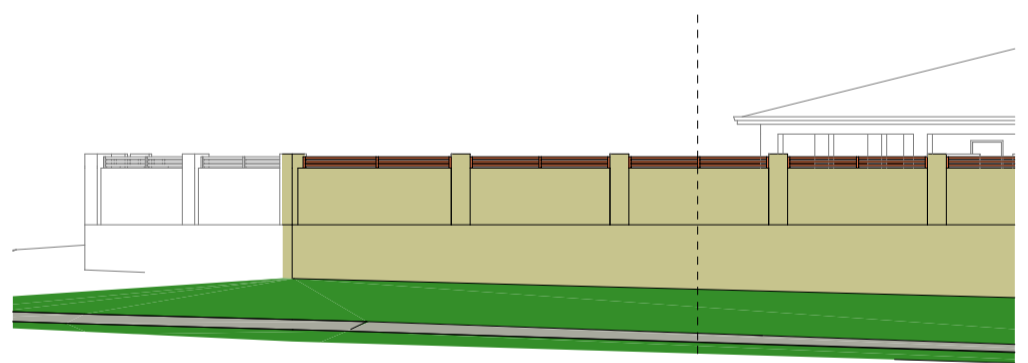
SOUTH ELEVATION



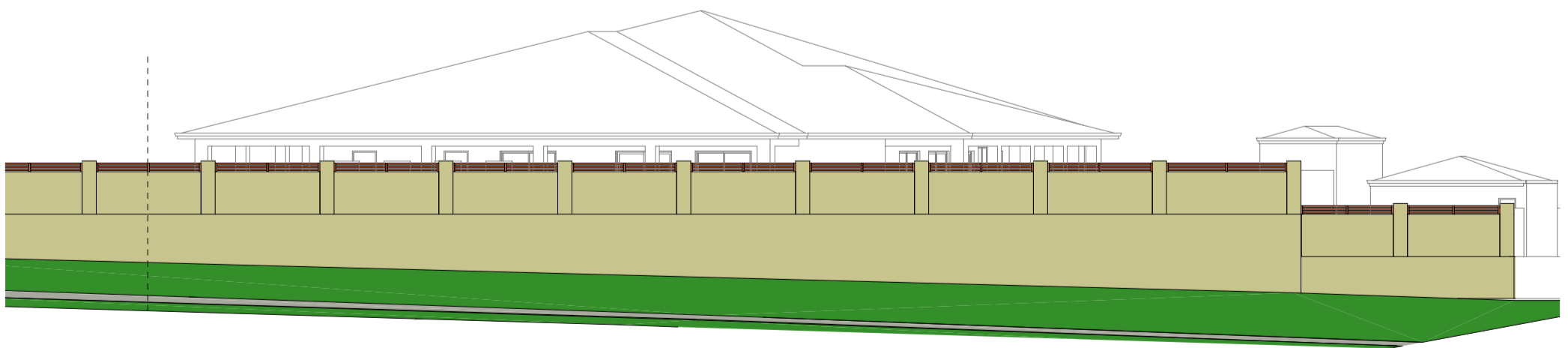
EAST ELEVATION




FENCE ELEVATION (to gungurru avenue)

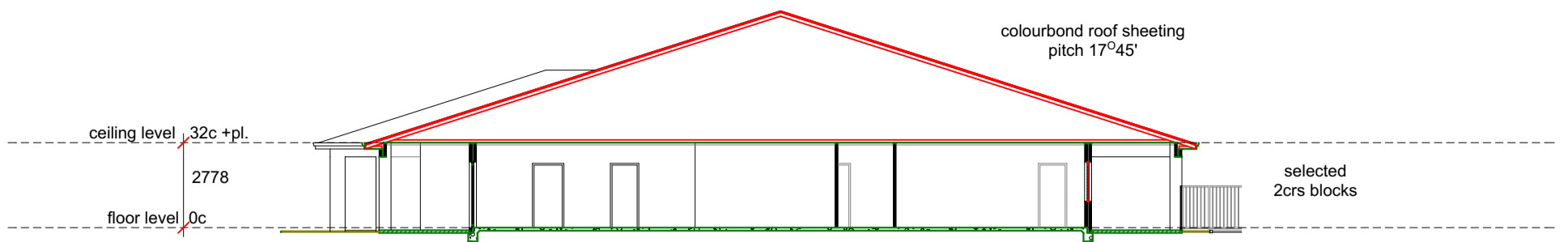


FENCE ELEVATION (to wanneroo road)

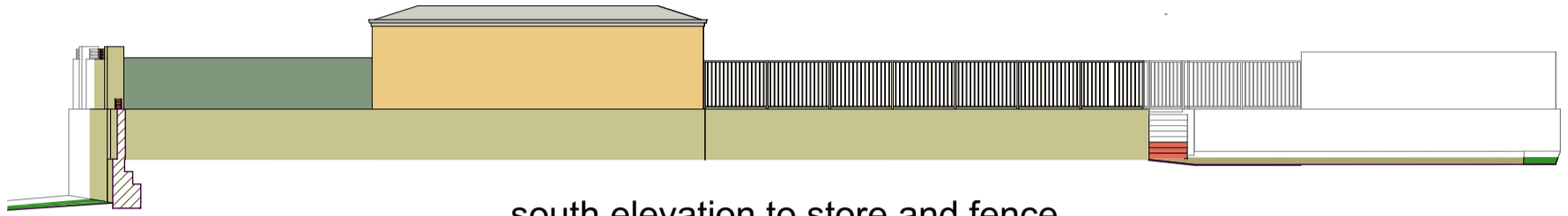


FENCE ELEVATION (to wanneroo road)

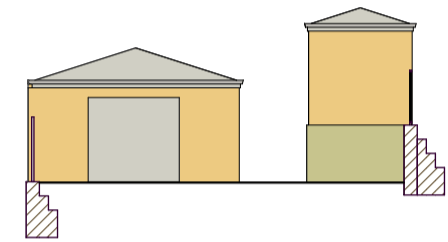
date:	revision	<p>PROPOSED CHILDCARE CENTRE TO BE ERECTED ON LOT 212 (hse: 4) GUNGURRU AVENUE - HOCKING: FOR CF TOWN PLANNING & DEVELOPMENT</p>	<p> alan king architectural drafting DIPLOMA OF ARCHITECTURAL DRAFTING No 3503 1/11 Riverview Street Phone/Fax :- South Perth WA 6151 9367 2814</p>	<p>drawn: a.c.k. date: MARCH 19</p>	<p>drwg no: 7 of 9</p>
				<p>scale: 1:200</p>	<p>ELEV 1</p>



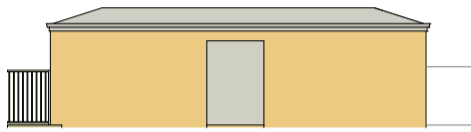
SECTION 1:200



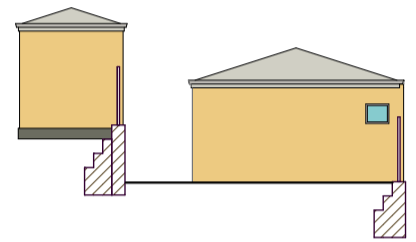
south elevation to store and fence



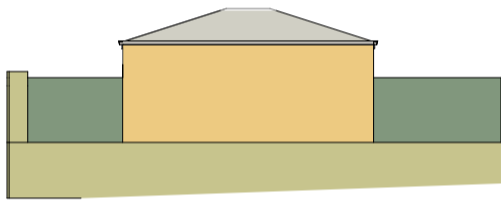
east elevation to shed & store



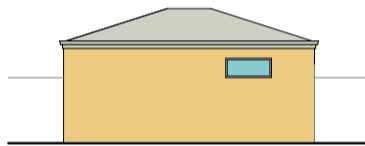
north elevation to store



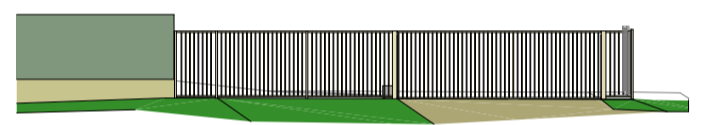
west elevation to store & shed



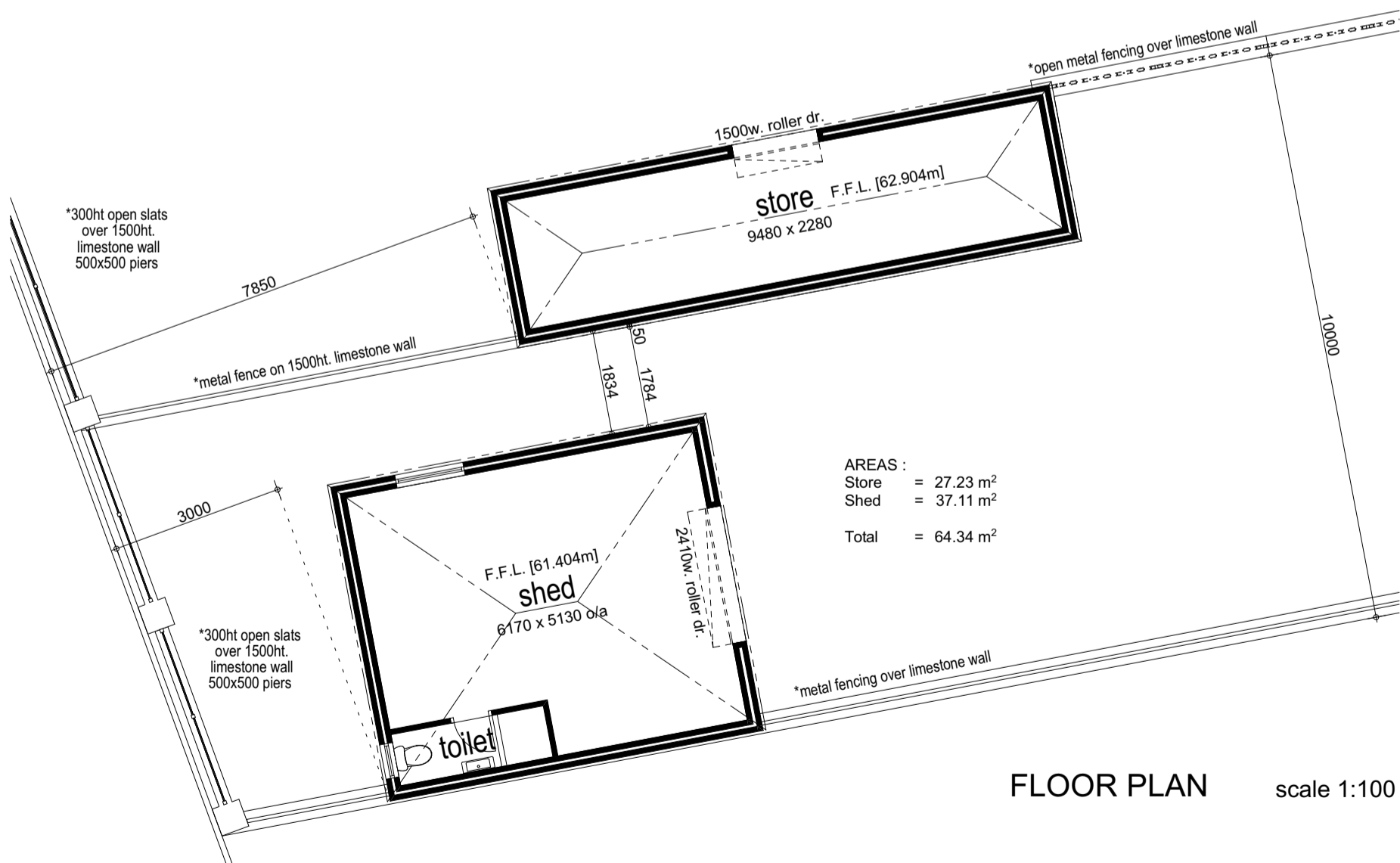
south elevation to shed



north elevation to shed




fence elevation to wayford circle



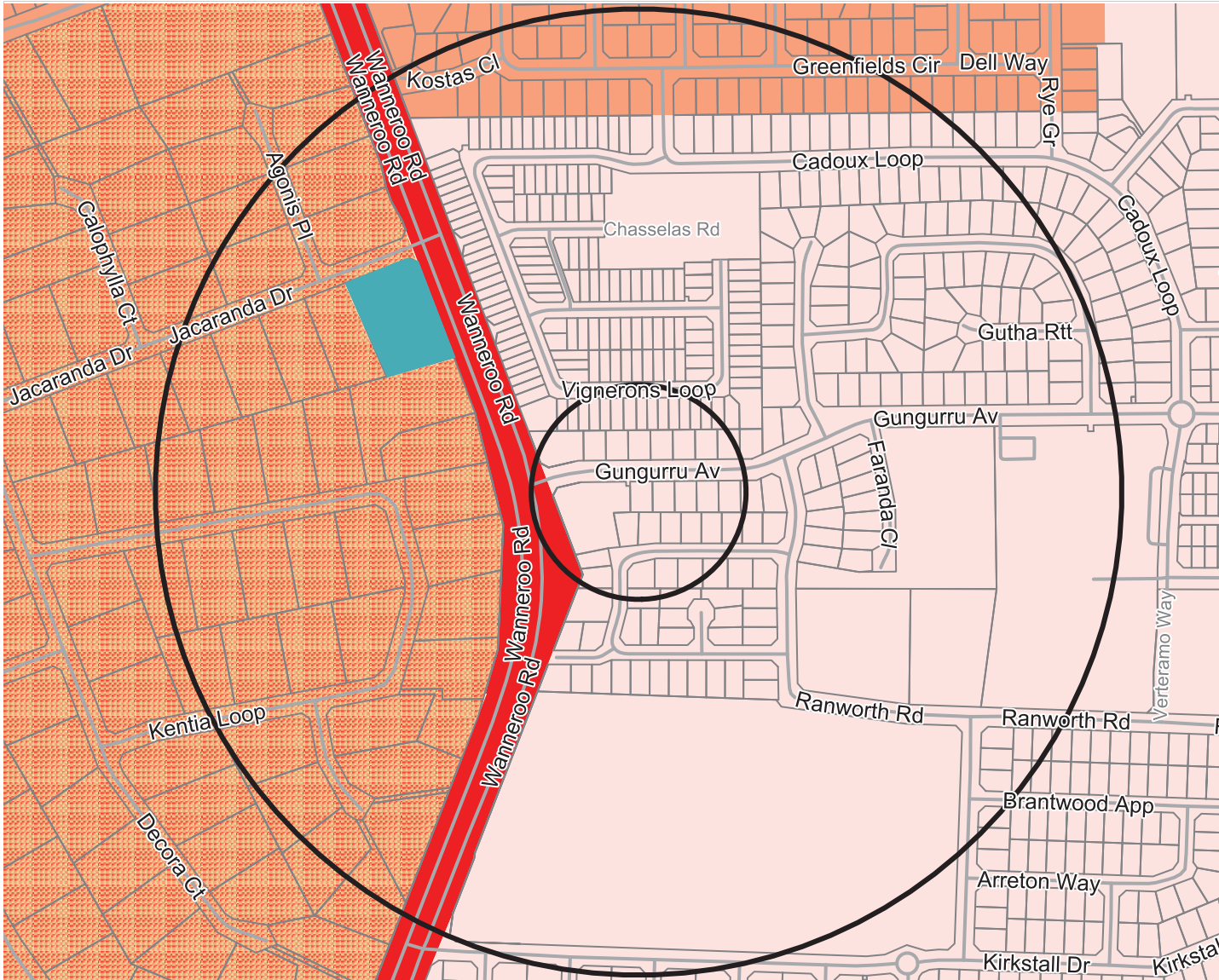
AREAS :
 Store = 27.23 m²
 Shed = 37.11 m²
 Total = 64.34 m²

FLOOR PLAN scale 1:100

date:	revision	PROPOSED CHILDCARE CENTRE TO BE ERECTED ON LOT 212 (hse: 4) GUNGURRU AVENUE - HOCKING: FOR CF TOWN PLANNING & DEVELOPMENT	 alan king architectural drafting DIPLOMA OF ARCHITECTURAL DRAFTING No 3503 1/11 Riverview Street South Perth WA 6151 Phone/Fax :- 9367 2814	drawn: a.c.k.	drwg no: 8 of 9
				date: MARCH 19	scale: 1:200, 1:100
					ELEV 2

Appendix B

Land Use Map



- District Planning Scheme 2**
- DPS2
 - BUSINESS
 - CENTRE
 - CIVIC & CULTURAL
 - COMMERCIAL
 - GENERAL INDUSTRIAL
 - GENERAL RURAL
 - INDUSTRIAL DEVELOPMENT
 - LANDSCAPE ENHANCEMENT
 - MARINA
 - MIXED USE
 - NO ZONE
 - OTHER REGIONAL ROADS
 - PARKS & RECREATION
 - PRIMARY REGIONAL ROADS
 - PRIVATE CLUBS & RECREATION
 - PUBLIC PURPOSES - MRS
 - PUBLIC USE
 - RAILWAYS
 - REGIONAL PARKS & RECREATION
 - RESIDENTIAL
 - RURAL COMMUNITY
 - RURAL RESOURCE
 - SERVICE INDUSTRIAL
 - SMART GROWTH COMMUNITY
 - SPECIAL
 - SPECIAL RESIDENTIAL
 - SPECIAL RURAL
 - STATE FOREST
 - URBAN DEVELOPMENT
 - WATERWAYS



City of Wanneroo does not warrant the accuracy of information in this publication and any person using or relying upon such information does so on the basis that City of Wanneroo shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in this information. Based on information provided by and with the permission of the Western Australian Land Authority trading as LANDGATE

Scale: 1: 6000
 Projection: GDA94 / MGA zone 50
 Date: 27/03/2019



Appendix C

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)

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

where :

% Type A₁₀₀ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

% Type A₄₅₀ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

% Type B₁₀₀ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

% Type B₄₅₀ = 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.

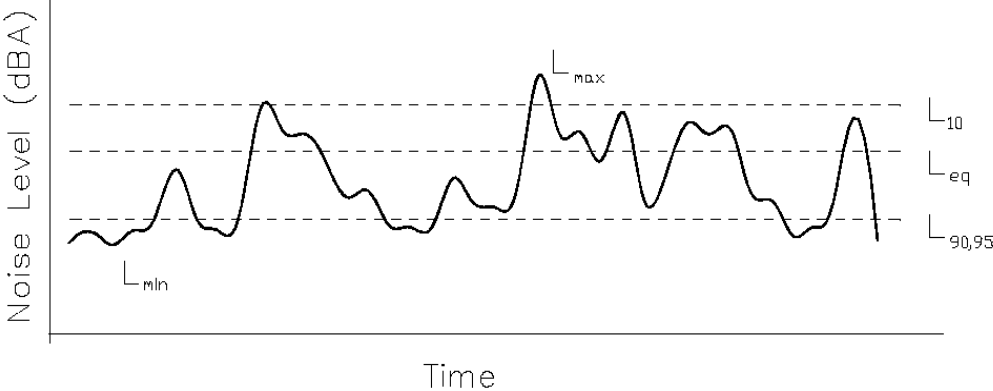
Ambient Noise

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

