Appendix D – Acoustic Report

Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9300 4188 F:9300 4199
www.lgacoustics.com.au

Environmental Noise Assessment

Lot 201 Pollino Gardens, Landsdale

Mixed Commercial Development and Child Care Centre

Reference: 18054433-01

Prepared for:
V V Nominees Pty Ltd C/- Urbis Planning

Report: 18054433-01

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

T: 9300 4188 / 9401 7770
F: 9300 4199

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

Date:	Rev	Description	Prepared By	Verified
24-Aug-18	-	Issued to Client	Matt Moyle	Terry George

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1 INTRODUCTION

A mixed commercial and childcare centre (CCC) development is proposed at Lot 201 Pollino Gardens, in Wanneroo - refer *Figure 1-1*. The site is located within an established residential area with the closest noise sensitive premises being located to the south, east and west.

The proposed mixed commercial development will be comprised of the following components:

- Underground car parking for up to 41 bays;
- Cafe Restaurant;
- Medical centre;
- Pharmacy; and
- Childcare Centre.

The proposed CCC will accommodate up to 80 children distributed across three main age groups approximately as follows:

- Babies (0-2 years), 20 children;
- Toddlers (2-3 years), 30 children;
- Pre-Kindy and Kindy (3+ years), 30 children;

The proposed hours of operation are likely to be within 7am to 7pm Monday to Friday. However, it is considered that the carpark will be in use prior to 7am. Car parking spaces are provided for staff and parents to the south of the proposed building with entry from Pollino Gardens.

It is noted that noise emissions from new mechanical plant are only generally assessed as this is Development Approval stage only and details of the plant (i.e. type, noise levels and location) are not known. A detailed review of the noise emissions from mechanical plant will be conducted during Building Permit stage to ensure compliance with the Regulations.

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

Appendix A shows the site layout and plans this assessment is based on.

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

Figure 1-1 Project Locality (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
Commercial	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 influencing factor, applicable at the noise sensitive premises has been calculated 8 dB, as shown in *Table 2-3*. The transport factor has been calculated as 6 dB, due to Gnangara Rd being considered a major road (>30,000 vehicles per day – 2015/2016 Site 6735) within 100 metres of the most affected residences.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Industrial Land	0 %	0 %	0 dB
Commercial Land	15 %	1 %	0.6 dB
Industrial Land	0 %	15%	1.5 dB
Transport Factor (Gnangara Road)			**6 dB**
Total			**8 dB**

Table 2-4 shows the assigned noise levels including the influencing factor and transport factor at the receiving locations. Refer to *Figure 2-1* for the noise model overview and aerial map of each receiver as identified throughout this report. *Appendix B* contains a screenshot zoning map of the subject area. It is noted that surrounding land use is primarily residential with industrial to the west and north west (Wangara) of the subject site.

Table 2-4 Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
All Residences	0700 to 1900 hours Monday to Saturday (Day)	53	63	73
	0900 to 1900 hours Sunday and public holidays (Sunday)	48	58	73
	1900 to 2200 hours all days (Evening)	48	58	63
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	43	53	63
Commercial	All hours	60	75	80

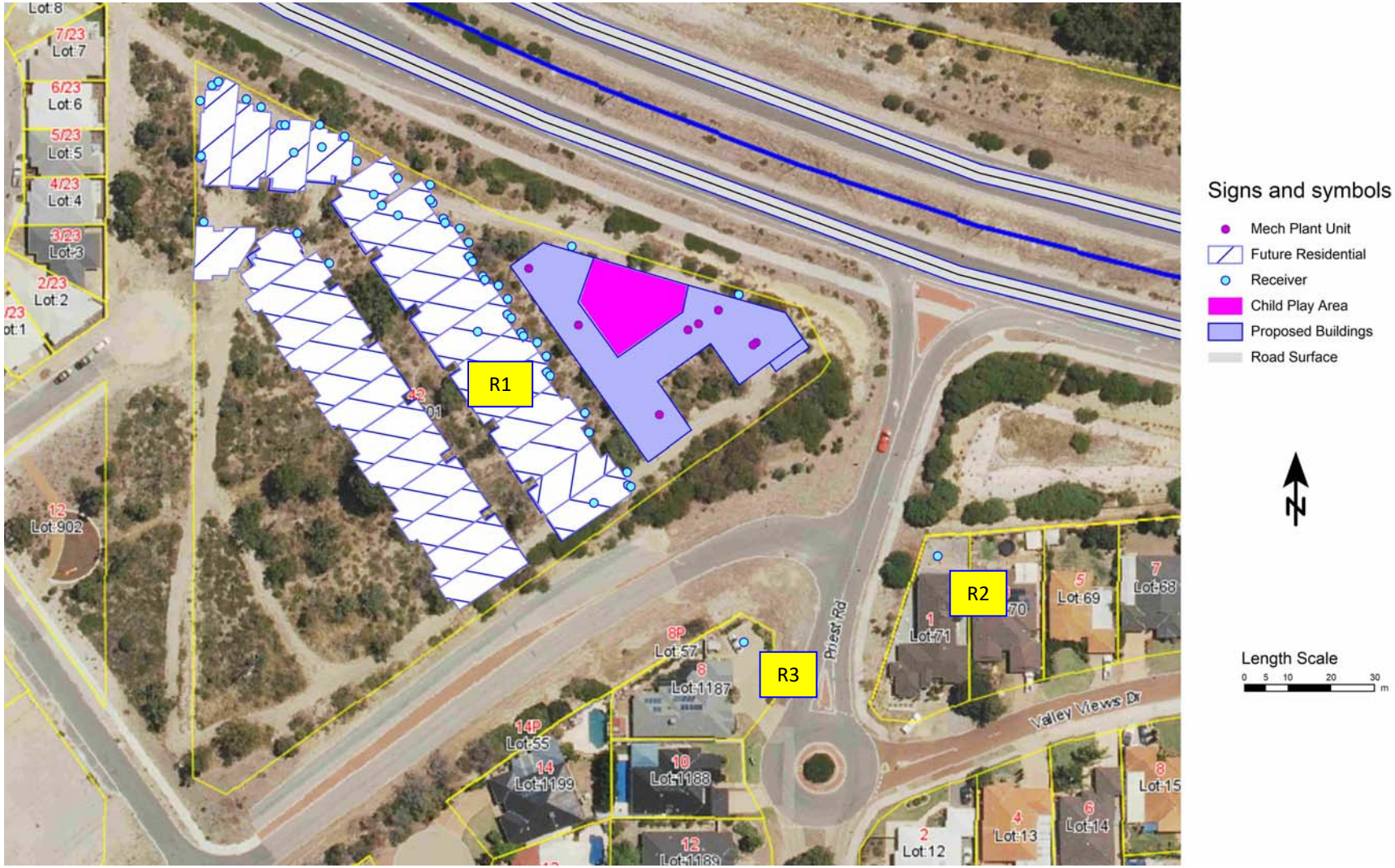


Figure 2-1 2D Image of Noise Model

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. Given the close proximity of existing buildings and fences, where the noise emissions were assessed at a point 1 metre away 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 City of Wanneroo - Child Care Centres LPP 2.3

The City of Wanneroo LPP 2.3 is acknowledged, in particular provision 9.2 in relation to windows to activity rooms and provision 9.3 in relation to childcare nuisance noise (noise impact onto neighbours), which will be satisfied in accordance with the Regulations.

3 METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development at all nearby receivers. The software used was *SoundPLAN 8.0* with the ISO 9613 algorithms selected. These algorithms have been selected as they include the influence of wind.

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

Based on the site plan provided and civil concept drawings for the adjacent residential lot, combined with *Google Earth* publicly available elevation data, a 3-dimensional model of the surroundings was developed. This included ground elevations, the existing residences and the proposed buildings. It is noted that the site is situated on a slope and the design of the new buildings will incorporate this into the underground car park.

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.

It is noted that all residential buildings to the east and south are single storey houses while those to the west are soon to be developed double storey residences. Single storey dwellings were modelled as 3.5 metres high with the receiver at 1.5 metres above local ground. Double storey dwellings were modelled at 7 metres high with an upper floor receiver at 4.4m above local ground.

3.4 Walls and Fences

Solid 1.8 metre high fencing atop a 2 metre high retaining wall on the western boundary is assumed in the model. Neighbourhood fencing is also included where verified by site photographs.

On the open side of the outdoor play area, a 1.5m high wall/balustrade is modelled as a solidstyle fence e.g. clear *Plexiglass* fencing which provides some acoustic benefits.

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 the outdoor grassed area and 0.1 for the surroundings (including the carpark).

3.6 Childcare 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 Care Centre									
Closing Car Door, L_{max}	71	74	77	81	80	78	72	61	**84**
Child Play Toddlers (30 kids), L_{10}	49	58	68	75	81	80	73	65	**85**
Child Play 4 years (30 kids), L_{10}	52	61	75	82	88	87	80	72	**88**
Typical A/C Condenser unit, L_{10}	-	75	74	73	71	67	65	60	**76**
Pharmacy, Medical Centre, Cafe									
Typical A/C Condenser unit, L_{10}	-	75	74	73	71	67	65	60	**76**
Exhaust Fan General, L_{10}	68	73	67	65	59	55	59	47	**67**
Exhaust Fan Kitchen, L_{10}	71	77	77	79	77	74	69	61	**81**

With regard to the above, the following is noted:

- Car doors closing were modelled as a point source 1.0 metre above ground level. These were placed both underground and in the open-air carparks. Since noise from a car door closing is a short term event, only the L_{Amax} level is applicable;
- Child Play source levels represent the full 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 and Pre-Kindy children (3 years and above) were considered noisier than Toddlers children (2-3 years). Noise from babies 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 3+ yrs: 1.0 metre above ground plane;
  - Toddlers: 0.8 metre above ground plane.

It is noted that noise emissions from mechanical plant is assessed in general in this early stage, being Development Approval. However, a full review of the noise emissions from mechanical plant will be conducted during Building Permit stage when details of plant type, noise levels and location are known. Typical sound power levels and approximate roof mounted locations have been utilised at this stage.

4 RESULTS

4.1 Child Play and Mechanical Plant

The predicted noise levels from Child Play and the roof mounted mechanical plant are presented in *Table 4-1*. Note that mechanical plant results are an indication only, as this information will need further assessment when more details of location and specification are available at building permit stage.

Table 4-1 Predicted Noise Levels of Child Play and AC Plant

Location	Child Play, dB L_{A10}	AC Plant, dB L_{A10}	Overall, dB L_{A10}
R1*	41	39	**43**
R2	17	28	**28**
R3	20	31	**31**

*Represents the worst case level of a group of dwellings

In regard to the Child Play, the results assume that all age groups are playing outside at the same time and at a location that results in the highest noise levels for any receiver. The results above are therefore conservative, as each age group will generally be split at playtime resulting in smaller number of children playing outside simultaneously.

In regard to the roof mounted AC plant, the results assume all units making up the plant run simultaneously and at full capacity. In reality, the plant will cycle on and off as necessary so that again, the calculations are a worst-case scenario.

4.2 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:

- External doors will be closed during indoor activity / play;
- Internal noise levels within activity rooms would not exceed those from outdoor play for each age group;
- Any music played within the internal activity areas would be 'light' music with no significant bass content and played at a relatively low level; and,
- External glazing is assumed to be minimum 6mm thick for child play rooms.

4.3 Carpark Bays

The proposed carpark includes 41 car bays located to the south of the main building and in the underground level. The assessable noise emissions are from car doors closing which are short events and therefore only assessed against the L_{Amax} criteria. The resulting predicted levels to each receiver are displayed in *Table 4-2*.

Table 4-2 Predicted Noise Levels of Car Doors

Location	Car Doors, dB L_{Amax}
R1*	33
R2	33
R3	37

*Represents the worst case level of a group of dwellings

5 ASSESSMENT

5.1 Child Play and AC plant

Table 5-1 presents an assessment of the predicted noise levels from the overall emissions from the proposed Child Care Centre that is, child play and roof mounted AC plant combined, against the daytime assigned noise level of 53 dB L_{A10}. Plant noise is assumed negligible in the night period due to the commercial enterprises being closed at these times.

Noise from child play is not considered to contain intrusive characteristics within the definition of the Regulations. In addition, AC plant noise is generally considered to be tonal and a penalty should be applied however, this would only be the case when the AC plant noise is considered in isolation (i.e. without child play noise). Therefore no penalties were added to the overall predicted L_{A10} levels. Note that if a tonality adjustment were applied to the mechanical plant noise only, noise levels would still be compliant during the day.

Table 5-1 Assessment of Noise Levels Against L_{A10}

Location	Assigned Noise Level[1] dB L_{A10}	Assessable Noise Level[2] dB L_{A10}	Calculated Exceedance
R1	53	**43**	*Complies*
R2	53	**28**	*Complies*
R3	53	**31**	*Complies*

Notes:
1. The assigned noise level is as defined in *Table 2-4*.
2. Overall levels from *Table 4-1*.

It can be seen from the above, the daytime L_{A10} assigned level is complied with at all receivers by at least 10 dB. As such, the mechanical plant and child play noise would also comply with the more stringent night time assigned level (which is 10dB lower). The predicted level is dominated by mechanical plant noise and can be minimised by using solid screening on the rooftop and where possible, collocating of plant.

5.2 Car park

Table 5-2 presents an assessment of the predicted noise levels from car park use (doors closing).

Car door closing noise is a short-term event and is therefore assessed against the L_{Amax} night time assigned noise level of 63 dB in the event some vehicles park prior to 7am (such as staff). An adjustment for impulsiveness may be applicable for car door closing noise, which is a +10 dB adjustment.

Table 5-2 Assessment of Car Door Closing Against L_{Amax}

Location	Assigned Noise Level dB L_{Amax}	Assessable Noise Level dB L_{Amax}	Calculated Exceedance
R1	63	33 + 10 = 43	*Complies*
R2	63	33 + 10 =43	*Complies*
R3	63	37 + 10 = 47	*Complies*

It can be seen from the above tables that the L_{Amax} assigned levels will be complied with at all receivers, even at night-time when the carpark is used before 7am. After 7am the assigned noise level is higher and therefore compliance will also be achieved. Note that the design of the carpark has been assumed open on the east and north sides (following the sloping terrain) and enclosed on the western side (nearest to houses).

5.3 Noise Intrusion

Due to the nature and location of the development, traffic noise intrusion from Gnangara Road is considered likely. Noise is predicted to be 63 to 65 dB $L_{Aeq,day}$ based on noise modelling completed for the adjacent residential subdivision.

Therefore the 6mm thick glass specified in *Section 4.2*, will assist in minimising external noise intrusion to commercial spaces. It is recommended that this glazing be increased to 10mm minimum or equivalent to all sleeping areas of the CCC. A more detailed assessment should also be carried out when architectural drawings are available at building permit stage.

6 RECOMMENDATIONS

Based on the noise modelling and the assessment carried out, it can be seen the predicted overall noise levels from the proposed Commercial Development, including Child Care Centre can comply with the Regulations at all receivers.

It is expected that noise levels from the development will be lower where the following common 'good practices' are implemented:

- Plan duration of play and stagger play times where practicable so that:
  - all age groups do not play simultaneously for long periods of time; and,
  - not all children within one age group congregate within one area for long periods of time.
- 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;
- Crying children should be taken inside to be comforted;
- No amplified music should be played outside; and
- Consider signage in the drop-off/pick-up area advising parents to keep noise to a minimum and behave in a courteous manner, given the close proximity of neighbouring dwellings.
- Property fencing on shared boundaries is to be selected to be free of gaps and minimum *colorbond* type material.

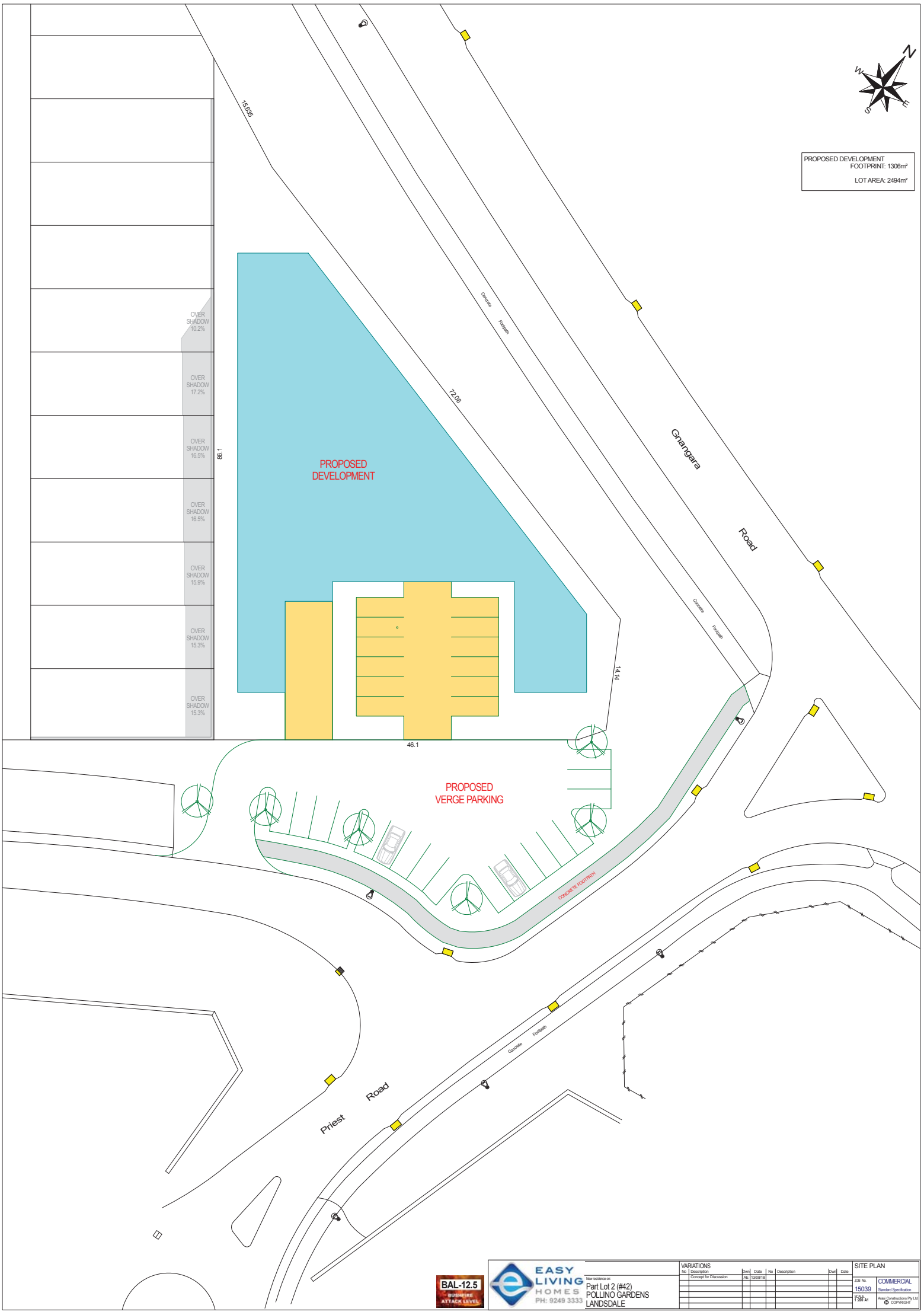
Should any speed humps be implemented, these shall be designed to have a gradual slope so that they are sufficient to slow vehicles but will not result in unnecessary noise generation as vehicles drive over.

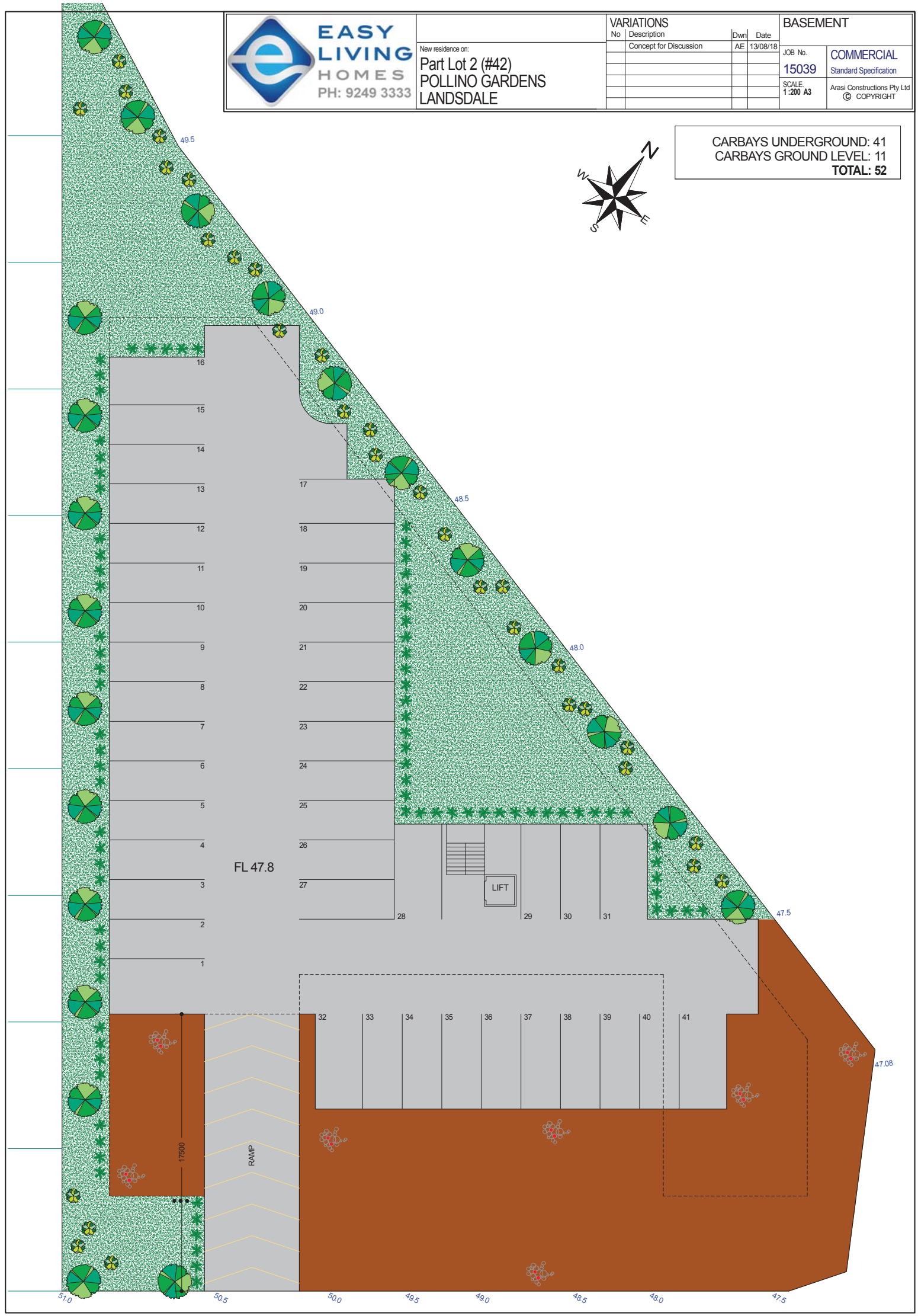
With regards to mechanical plant, we note the following:

- Installed plant shall have sound power levels no greater than those in *Table 3-2*.
- Air-conditioning mechanical plant are to be located on the rooftop, where this is not the case, a follow up assessment of selected plant should be undertaken by a qualified acoustic consultant;
- All mechanical plant shall be vibration isolated sufficient to achieve 97% isolation efficiency. Appropriate isolation mounts shall be selected by a mount supplier such as Embelton's taking into account the structure, weight of the equipment and operating frequency.

Appendix A

Site Plans


N
W
E
S
PROPOSED DEVELOPMENT
FOOTPRINT: 1306m²
LOT AREA: 2494m²
15.635
72.09
14.14
46.1
86.1
OVER SHADOW 10.2%
OVER SHADOW 17.2%
OVER SHADOW 16.5%
OVER SHADOW 16.5%
OVER SHADOW 15.9%
OVER SHADOW 15.3%
OVER SHADOW 15.3%
PROPOSED DEVELOPMENT
PROPOSED VERGE PARKING
Concrete Footpath
Concrete Footpath
Concrete Footpath
CONCRETE FOOTPATH
Ghangara Road
Priest Road
BAL-12.5
BUSHFIRE ATTACK LEVEL
EASY LIVING HOMES
PH: 9249 3333
New residence on:
Part Lot 2 (#42)
POLLINO GARDENS
LANDSDALE
VARIATIONS
No Description Dwn Date
Concept for Discussion AE 13/08/18
SITE PLAN
JOB No. 15039
COMMERCIAL
Standard Specification
SCALE 1:200 A1
Arasi Constructions Pty Ltd
© COPYRIGHT


EASY LIVING HOMES
PH: 9249 3333
New residence on:
Part Lot 2 (#42)
POLLINO GARDENS
LANDSDALE
VARIATIONS
No | Description | Dwn | Date
Concept for Discussion | AE | 13/08/18
BASEMENT
JOB No. 15039
COMMERCIAL
Standard Specification
SCALE. 1 :200 A3
Arasi Constructions Pty Ltd
© COPYRIGHT
CARBAYS UNDERGROUND: 41
CARBAYS GROUND LEVEL: 11
TOTAL: 52
N
W
E
S
49.5
49.0
48.5
48.0
47.5
47.08
FL 47.8
LIFT
RAMP
17500
1
2
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41
51.0
50.5
50.0
49.5
49.0
48.5
48.0
47.5

EASY LIVING HOMES
PH: 9249 3333

New residence on:
Part Lot 2 (#42)
POLLINO GARDENS
LANDSDALE

VARIATIONS

No	Description	Dwn	Date
	Concept for Discussion	AE	13/08/18

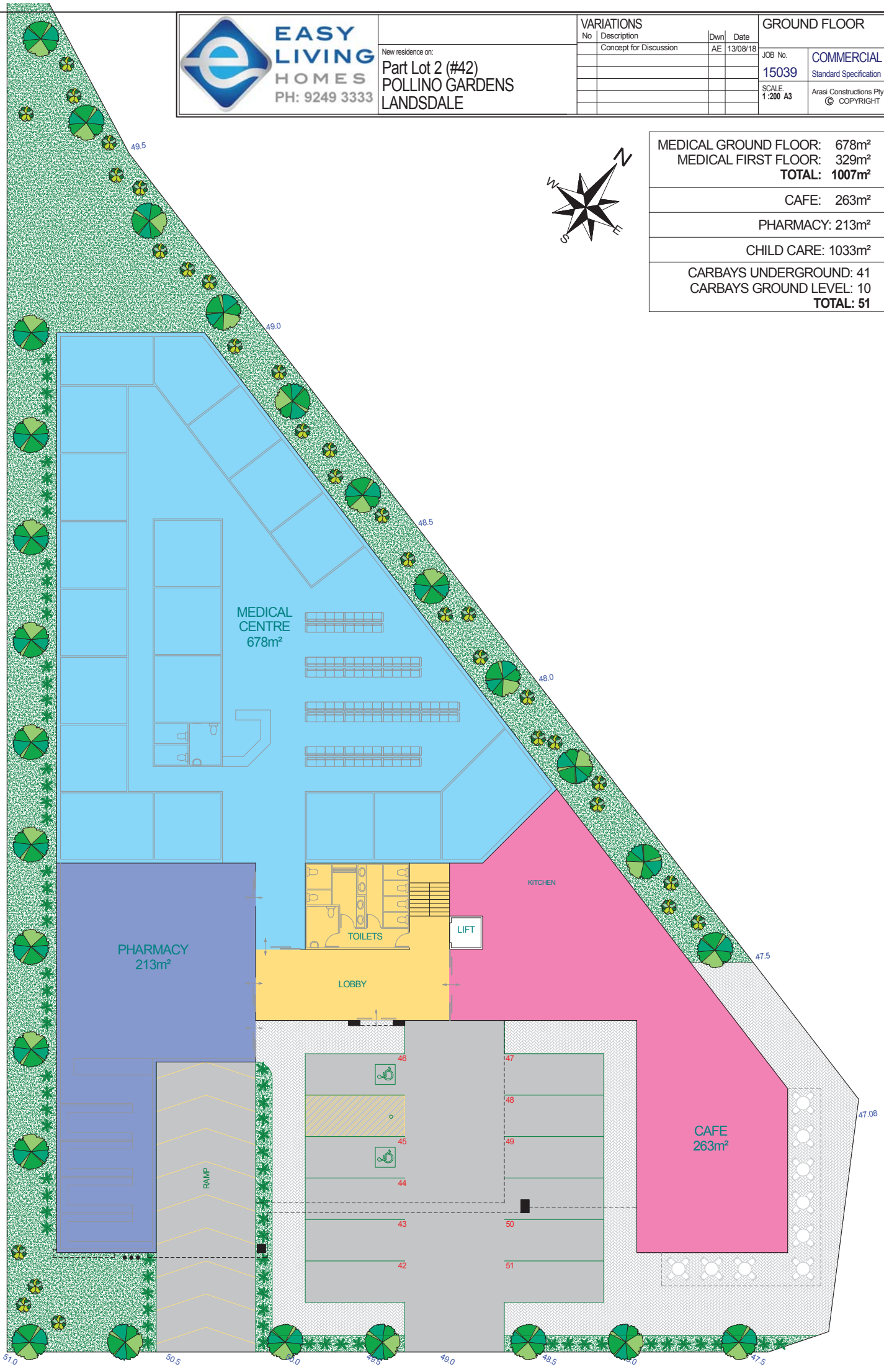
GROUND FLOOR

JOB No. 15039

COMMERCIAL
Standard Specification

SCALE. 1 :200 A3

MEDICAL GROUND FLOOR:	678m²
MEDICAL FIRST FLOOR:	329m²
TOTAL:	**1007m²**
CAFE:	263m²
PHARMACY:	213m²
CHILD CARE:	1033m²
CARBAYS UNDERGROUND:	41
CARBAYS GROUND LEVEL:	10
TOTAL:	**51**



EASY LIVING HOMES
PH: 9249 3333

New residence on:
Part Lot 2 (#42)
POLLINO GARDENS
LANDSDALE

VARIATIONS			
No	Description	Dwn	Date
	Concept for Discussion	AE	13/08/18

FIRST FLOOR

JOB No. 15039

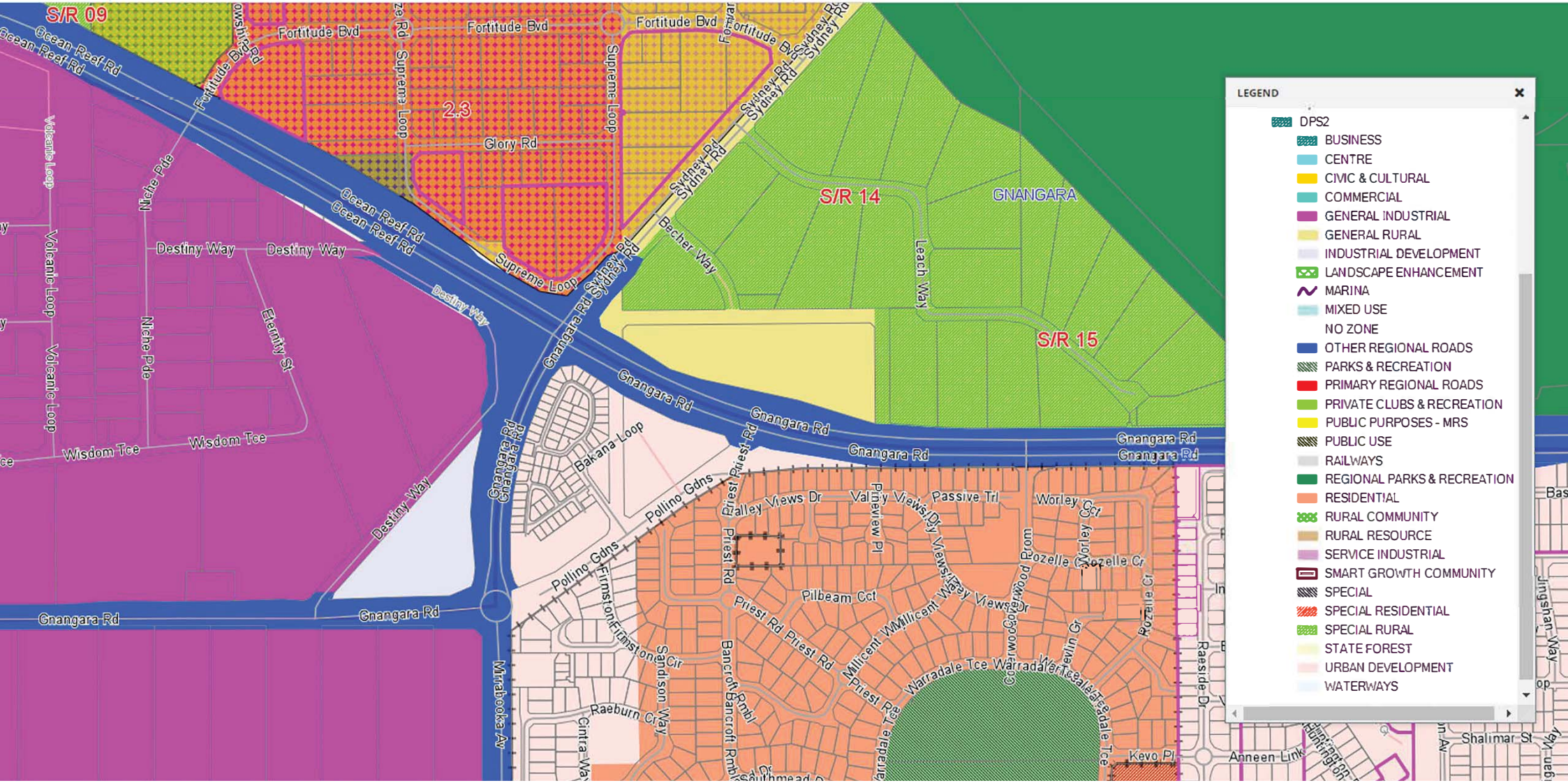
COMMERCIAL
Standard Specification

SCALE. 1 :200 A3

MEDICAL GROUND FLOOR:	678m²
MEDICAL FIRST FLOOR:	329m²
TOTAL:	**1007m²**
CAFE:	263m²
PHARMACY:	213m²
CHILD CARE:	1033m²
CARBAYS UNDERGROUND:	41
CARBAYS GROUND LEVEL:	10
TOTAL:	**51**

Appendix B

Zoning Map


S/R 09
Ocean Reef Rd
Fortitude Bvd
Supreme Loop
2.3
Glory Rd
S/R 14
GNANGARA
Sydney Rd
Bacher Way
Leach Way
S/R 15
Destiny Way
Volcanic Loop
Niche Pde
Eternity St
Wisdom Tce
Gnangara Rd
Bakana Loop
Pollino Gdns
Priest Rd
Valley Views Dr
Passive Trl
Worley Cct
Pineview Pl
Rozelle Cr
Pilbeam Cct
Millicent Way
Warradale Tce
Firmston Cir
Sandison Cir
Bancroft Rmbl
Raeburn Cry
Mirabooka Av
Raeside Dr
Kevo Pl
Anneen Link
Shalimar St
LEGEND
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

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:

$\%\ \text{Type}\ A_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise

$\%\ \text{Type}\ A_{450}$ = 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 a 100m radius of the premises receiving the noise

$\%\ \text{Type}\ B_{450}$ = 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.

Peak Component Particle Velocity (PCPV)
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

Peak Particle Velocity (PPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

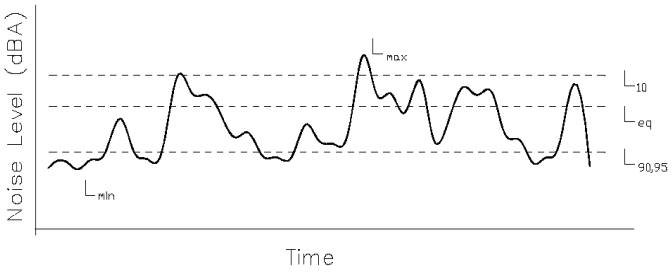
RMS Component Particle Velocity (PCPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Peak Particle Velocity (PPV)

The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

Chart of Noise Level Descriptors



Typical Noise Levels