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Environmental Noise Assessment - Industrial Development

Lot 8 (#37) Stirling Cres / Lot 16 (#14) Hatch Ct, High Wycombe

Reference: 24089337-01A

Prepared for:
Sarich

Reference: 24089337-01A

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Date	Rev	Description	Author	Verified
20-Dec-24	0	Issued to Client	Dave Perry	Rob Connolly
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1. INTRODUCTION

Lloyd George Acoustics was engaged by Sarich to undertake an environmental noise assessment for proposed industrial development of Lot 8 (#37) Stirling Cres / Lot 16 (#14) Hatch Ct, High Wycombe - refer *Figure* 1-1.



Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

The proposed development includes four (4) tenancies within the Lot 8 warehouse (Building 1) and 14 smaller tenancies within the Lot 16 building (Building 2) - refer to *Figure 1-2* below. Nearest noise sensitive premises are also shown below in *Figure 1-2*.

With regard to noise emissions, consideration is given to rooftop mechanical services, forklifts, truck movements and closing car doors at neighbouring properties, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*. Consideration is also given to internal noise breakout from the larger warehouse units (Building 1) noting zoning is light industry in the area.

The report is based on all warehouse tenancies only being operational between 7.00am and 7.00pm, Monday to Saturday.

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

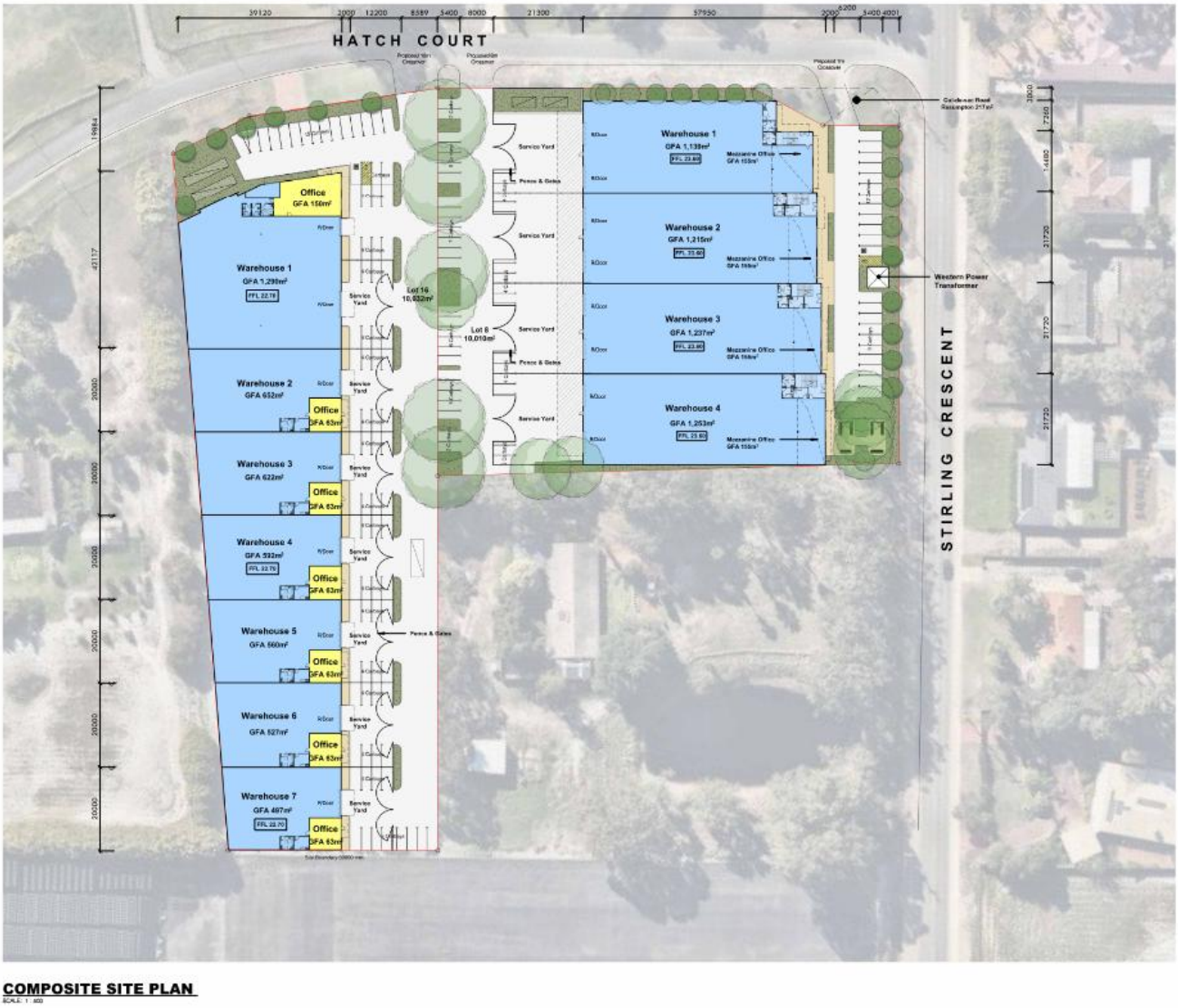


Figure 1-2: Site Plan



Figure 1-3: Surrounding Noise Sensitive Premises (Source: DPLH PlanWA)

2. CRITERIA

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

2.1. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

"7. Prescribed standard for noise emissions

(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; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), 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 at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation 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(1)(a) after the adjustments in the table [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

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2: Baseline Assigned 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 Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

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 (IF), in relation to noise received at noise sensitive premises, has been calculated as 7-12 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor and transport factor at the receiving locations.

Table 2-3: Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+12 dB IF Noise sensitive premises: highly sensitive area[1] **R1, R2**	0700 to 1900 hours Monday to Saturday (Day)	57	67	77
	0900 to 1900 hours Sunday and public holidays (Sunday)	52	62	77
	1900 to 2200 hours all days (Evening)	52	62	67
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	47	57	67
+7 dB IF Noise sensitive premises: highly sensitive area[1] **R3**	0700 to 1900 hours Monday to Saturday (Day)	52	62	72
	0900 to 1900 hours Sunday and public holidays (Sunday)	47	57	72
	1900 to 2200 hours all days (Evening)	47	57	62
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	42	52	62
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned 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*, *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 Water Environmental 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. Regulation 3

"3. Regulations do not apply to certain noise emissions

(1) Nothing in these regulations applies to the following noise emissions –

(a) Noise emissions from the propulsion and braking systems of motor vehicles operating on a road;"

The car park is considered a road and therefore vehicle noise (propulsion and braking) is not assessed. Noise from vehicle car doors however are assessed, since these are not part of the propulsion or braking system.

2.3. Regulation 14A

"14A. Waste Collection and Other Works

(2) Regulation 7 does not apply to noise emitted in the course of carrying out class 1 works if –

(a) The works are carried out in the quietest reasonable and practicable manner; and

(b) The equipment used to carry out the works is the quietest reasonably available;

class 1 works means specified works carried out between -

(a) 0700 hours and 1900 hours on any day that is not a Sunday or a public holiday; or

(b) 0900 hours and 1900 hours on a Sunday or public holiday.

specified works means -

(a) The collection of waste; or

(b) The cleaning of a road or the drains for a road; or

(c) The cleaning of public places, including footpaths, cycle paths, car parks and beaches;"

In the case where specified works are to be carried out outside of class 1, a noise management plan is to be prepared and approved by the CEO.

3. METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the ISO 9613 algorithms (ISO 17534-3 improved method) selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.1.1* to *Section 3.1.4*:

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

3.1.1. Meteorological Conditions

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 (7.00am to 7.00pm)
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	Up to 5
Wind Direction*	All

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.1.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights and combined with the site plan.

Surrounding existing buildings were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. Single storey buildings are modelled with a height of 3.5 metres and any double storey buildings identified assumed to be 7.0 metres in height with receivers 1.4 metres above ground.

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



Figure 3-1: Overview of Noise Model

3.1.3. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads and 0.5 (50%) elsewhere, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.1.4. Source Sound Levels

The source 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	
Internal Activity (Building 1)									
Light Industry Workshop, L_{10}	87	83	87	80	75	67	68	64	**82**
Service Yard (Building 1)									
Forklift Use, L_{10}	84	80	83	82	76	74	67	60	**83**
General Unloading/Loading Works, L_{10}	73	75	76	82	80	77	76	73	**85**
Truck (Class 3) movements, L_{10}	108	98	94	95	90	88	86	82	**97**
Reversing Beeper, L_{max}	-	-	-	-	98	-	-	-	**98**
Rooftop Mech Plant (Building 1)									
Daikin - RXYQ6AYM Outdoor CU, $L_{10\ (2\ off)}$	82	78	78	75	72	67	61	54	**77**
Pacific Ventilation - RCD 355-6E EF, $L_{10\ (4\ off)}$	59	64	62	59	52	49	46	40	**60**
Rooftop Mech Plant (Building 2)									
Daikin - RXYQ6AYM Outdoor CU, $L_{10\ (1\ off)}$	82	78	78	75	72	67	61	54	**77**
Pacific Ventilation - RCD 355-6E EF, $L_{10\ (2\ off)}$	59	64	62	59	52	49	46	40	**60**
Car Park (all)									
Car Door Closing, L_{max}	71	74	77	81	80	78	72	61	**84**

The following is noted in relation to *Table 3-2*:

- Light industry workshop noise level is based on field measurements and representative of typical warehouse tenancies operations;
- Mechanical plant data is obtained from previous similar projects;
- Condenser units are modelled as 1m above the roof, exhaust fans 0.5m above the roof;
- The truck is modelled at 2.5m above ground level;
- Trucks are modelled as a line source travelling at a maximum of 15 km/hr whilst in the yard;
- The forklift is modelled at 1.5m above ground level;
- Loading/Unloading and car door closing are all modelled as 1.0m above ground.

4. RESULTS & ASSESSMENT

4.1. Scenario 1 – Normal Daytime Operations, L_{A10}

Table 4-1 provides the predicted noise levels for operations Monday to Saturday 7.00am to 10.00pm, with all Building 1 warehouse roller doors open. A noise contour plot is provided in *Figure 4-1*.

Table 4-1: Scenario 1 Predicted Levels, dB L_{A10}

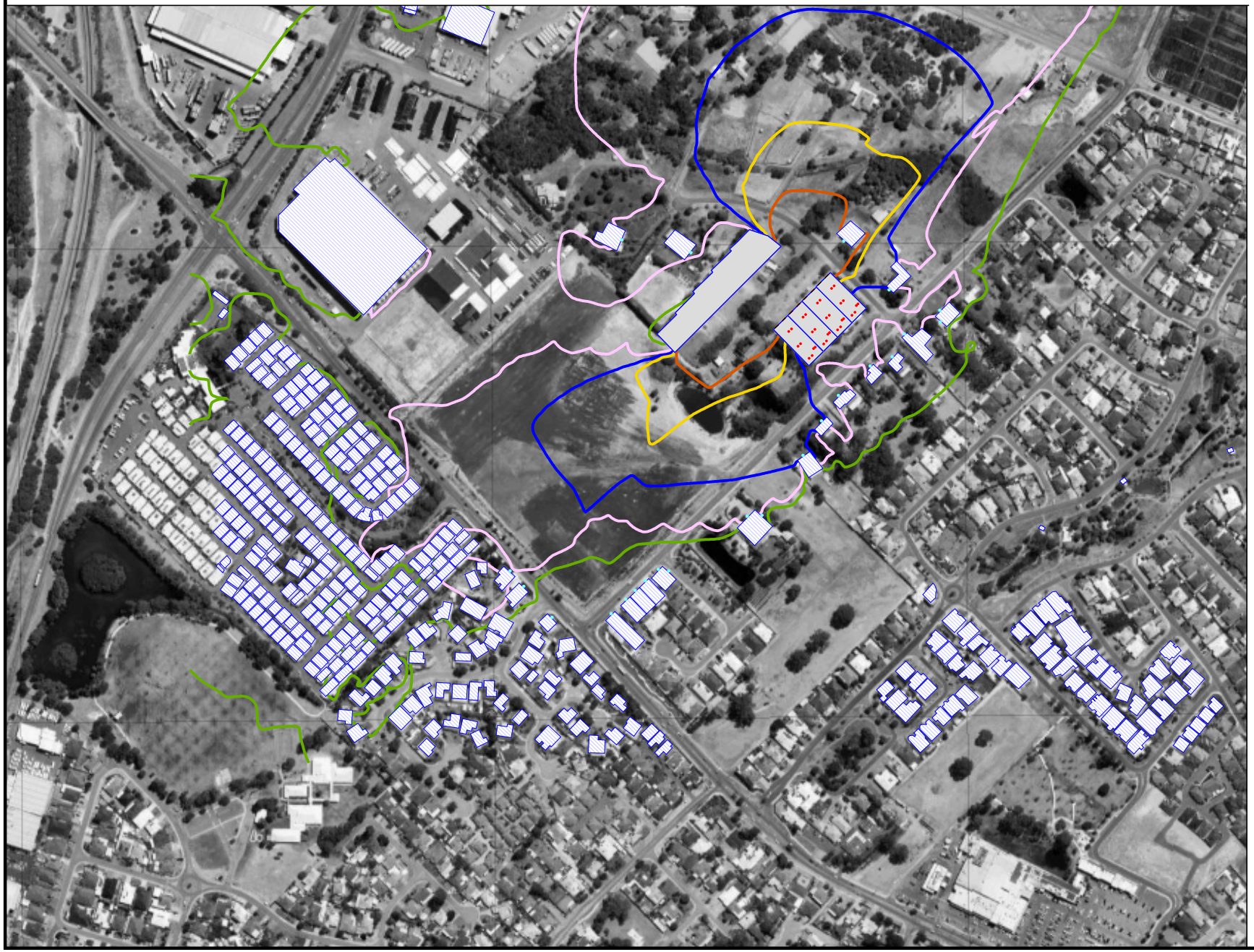
Receiver	Noise Breakout	Mechanical Plant	Service Yard	Total Noise Level	Assigned Level	Assessment
R1 - Hatch Court receivers	55	30	49	55	**57**	*Complies*
R2 - Stirling Cresent receivers	40	28	35	40	**57**	*Complies*
R3 - Kalamunda Road receivers	38	20	30	39	**52**	*Complies*

Based on typical noise from yard related activities, warehouse/workshop (doors open), and assumed mechanical plant active, compliance is calculated to be achieved and the noise is not considered to significantly contribute during the daytime (Monday to Saturday 7.00am to 10.00pm) period

The dominant noise is breakout from internal warehouse activities with roller doors open.

Figure 4-1 Scenario 1: Ground Floor (1.4m AGL), dB L_{A10}

Industrial Development High Wycombe



PREDICTED NOISE LEVEL

= 30
= 35
= 40
= 45
= 50

Scale 1:6000

0 35 70 140 210 m

Project No: 24089337
Consultant: DP
Date: 2/04/2025
Algorithm: ISO 9613
SoundPLAN Version: 9.1

N

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4.2. Scenario 2 – Car Door Closing and Reverse Alarms L_{max}

Table 4-2 provides the predicted noise levels from the worst-case closing car doors in any marked bays and alarms (beepers) for trucks reversing in the site yard. To be conservative, an adjustment of + 10 dB has been applied in case the noise is found to be impulsive. A noise contour plot is provided in *Figure 4-2*.

Table 4-2: Scenario 2 Car Doors & Reverse Alarms Predicted Levels, dB L_{A10}

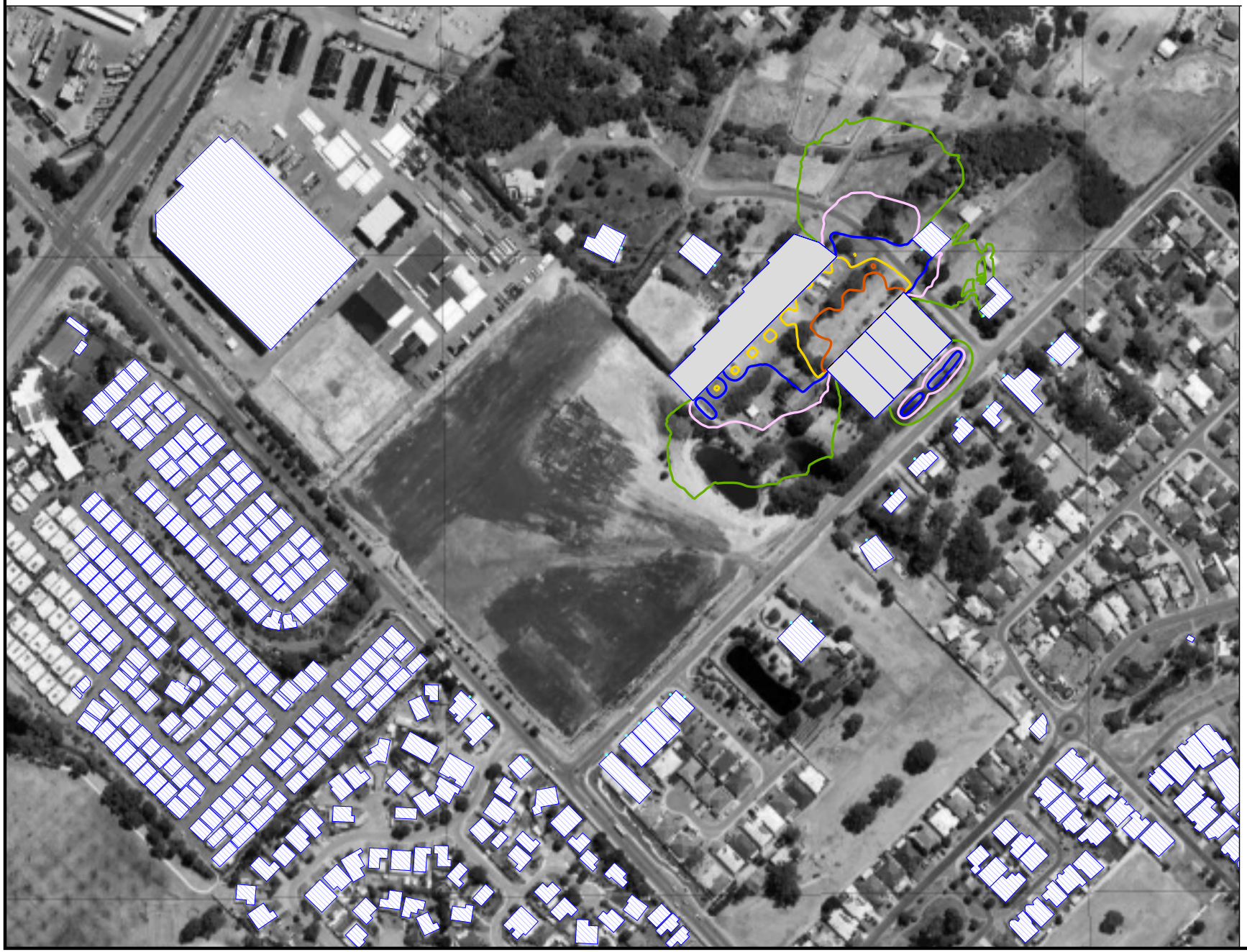
Receiver	Predicted Noise Level	Adjusted Noise Level*	Assigned Level	Assessment
R1 - Hatch Court receivers	51	61	**77**	*Complies*
R2 - Stirling Cresent receivers	32	42	**77**	*Complies*
R3 - Kalamunda Road receivers	31	41	**72**	*Complies*

* Adjusted by + 10 dB for possible impulsiveness.

The results show that compliance is calculated to be achieved during the daytime and noise is not considered to significantly contribute.

Figure 4-2 Scenario 2: Ground Floor (1.4m AGL), dB L_{Amax}

Industrial Development High Wycombe



Predicted Noise level

= 50
= 55
= 60
= 65
= 70

N

Scale 1:4403

0 25 50 100 150 m

Project No: 24089337
Consultant: DP
Date: 20/12/2024
Algorithm: ISO 9613
SoundPLAN Version: 9.1

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5. RECOMMENDATIONS

Compliance is demonstrated to be achieved; however, the following 'good practice' recommendations are provided for information purposes only:

- Delivery management plan is to advise drivers that leaving trucks to idle is not preferred and engines should be turned off during loading activities;
- No truck start-ups in yard area before 7am;
- Noise is to generally be minimised during unloading as far as practicable.

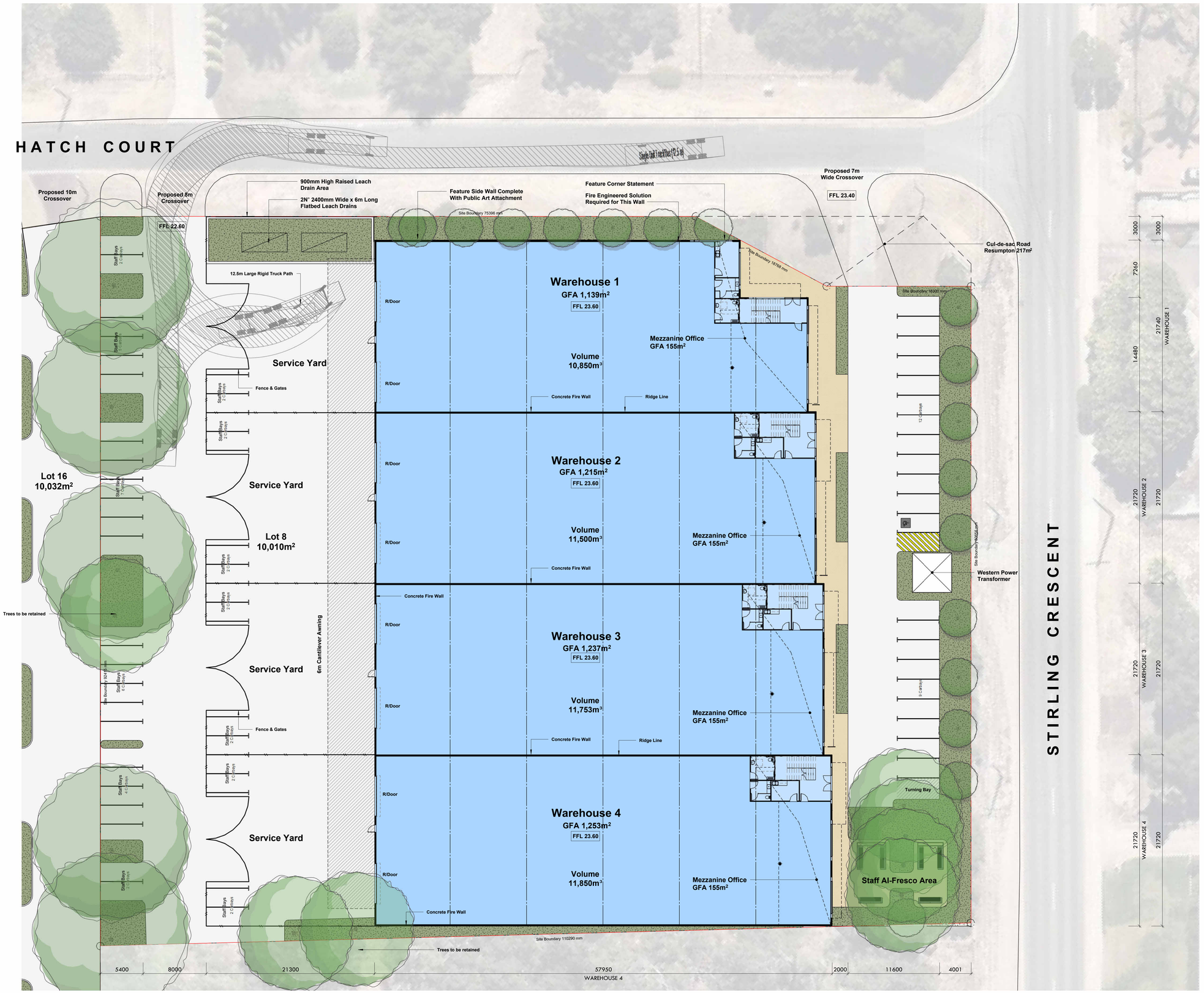
At this stage, mechanical plant has not been designed such that the assessment has been based on nominal sound levels and assumed locations. As such, the following is recommended:

- All exhaust fans shall be located inside the ceiling void and shall be axial fan type, allowing the incorporation of an attenuator if required;
- All fans shall be variable speed drive so that maximum speed is only occurring when necessary with demand;
- Air-conditioning shall have a 'night' / 'quiet' mode option, in case required for prior to 7.00am operation, subject to final detailed analysis;
- All plant shall be selected for quiet operation;
- All plant is to be appropriately vibration isolated to 95% isolation efficiency.

Further to the above, the following are to also be noted:

- Warehouse roller doors near the northern boundary (Warehouses 1 and 2) must be closed prior to 7.00am;
- All plant and equipment are to be maintained in good working order in order to minimise noise emissions. Any manufacturer's noise suppression parts are to be replaced following any maintenance;
- Waste collection shall occur 7.00am to 7.00pm Mondays to Saturdays (excluding public holidays) and 9.00am to 7.00pm Sundays and public holidays;
- Forklifts and delivery vehicles are to be encouraged to install broadband type reversing alarms rather than tonal, beepers, whilst still maintaining a safe workplace;
- External loading areas are not to have music or announcements systems, other than for emergencies;
- Owner shall have a buy quiet policy. That is, when purchasing new plant/equipment and comparing multiple models, sound levels shall be taken into consideration;
- External contractors are to be made aware that they also have a responsibility to minimise noise.

Appendix A – Development Plans



SITE PLAN
SCALE: 1 : 200

SITE CRITERIA

1. Site Area
a. Cul-de-sac Road Resumption 217m²
b. Site Balance 9,793m²
Total 10,010m²

2. Landscaping
a. Provided **1,032m²**
Soft

3. Floor Area
a. External Walls 59m²
b. Dividing Walls 47m²
c. Stairs + Foyer 119m²
d. Toilets & Lunch 102m²
e. Warehouse NLA 4,517m²
Total GF GFA 4,844m²

f. Mezzanine Toilets & Lunch Room 95m²
g. Mezzanine Office NLA 487m²
h. External Walls 38m²
Total MEZZ GFA 620m²

Total GFA 5,464m²

4. Carparking (GFA)
i. Cars Required 45 Cars
a. Warehouse 4,517m² @ 1/100 19 Cars
b. Mezzanine Office 487m² @ 4/100 **64 Cars**
Total Car required

ii. Cars Required 61 Cars
a. Cars Provided **61 Cars**
Total

5. Plot Ratio **5,005m²**
i. Required Plot Ratio of 0.5

ii. Provided 487m²
a. First Floor Office NLA 4,517m²
b. Ground Floor Warehouse NLA **5,004m²**
Total Plot Ratio

Landscaping
A. Soft Landscaping
Defined as vegetative landscaping.

Gross Floor Area : GFA
A. All Floor Areas on this plan are shown as GROSS FLOOR AREA. Unless otherwise noted as Nett Floor Area
B. Definition of Gross Floor Area is defined as:
i/ GROSS FLOOR AREA OF TENANCY:
Gross Floor Area of an individual Tenancy is defined as the area contained between the centre line of common tenancy walls and the outside edge of external walls.
ii/ GROSS FLOOR AREA OF A BUILDING:
Gross Floor Area of a Building is defined as the total area contained between the outside edge of external walls

Nett Floor Area : NFA
A. Nett Floor Area of a Tenancy on this plan is defined as the area between external or tenancy dividing walls.
B. This area is inclusive of toilets if the toilets are exclusive to the Tenancy.

SITE DESIGN CHECKLIST

- ☐ 1. SEWER MAINS LOCATION TO BE DETERMINED
- ☐ 2. FIRE MAINS PRESSURE TEST REQUIRED
- ☐ 3. FIRE TANKS OR PUMPS TO BE DETERMINED
- ☐ 4. WESTERN POWER TRANSFORMER LOCATION TO BE DETERMINED
- ☐ 5. CROSSOVER & ACCESS TO STREET TO BE DETERMINED BY LOCAL AUTHORITY
- ☐ 6. FULL FEATURE SITE SURVEY REQUIRED
- ☐ 7. DIAL BEFORE YOU DIG REQUIRED
- ☐ 8. BUSHFIRE ATTACK LEVEL (BAL) TO BE DETERMINED
- ☐ 9. STREET POWER POLES TO BE DETERMINED
- ☐ 10. SITE ZONING & USE TO BE DETERMINED

NOTE: Any of the following items that do not have an 'X' in the provided square require determination.

LEGEND

- BUILDING FOOTPRINT - SHOWROOM / WAREHOUSE / FACTORY
- BUILDING FOOTPRINT - OFFICE
- EXTENT OF CONCRETE HARDSTAND
- EXTENT OF ROADBASE HARDSTAND
- EXTENT OF BITUMEN PAVING
- EXTENT OF BRICK PAVING / CONCRETE PAVING
- EXTENT OF LANDSCAPING

EXISTING TREES TO BE RETAINED

PROPOSED TREES

meyer shircore architects

PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION : LOT 8 CNR HATCH COURT & STIRLING CRESCENT, HIGH WYCOMBE
BY : SARICH

SARICH BUILDING INDUSTRY

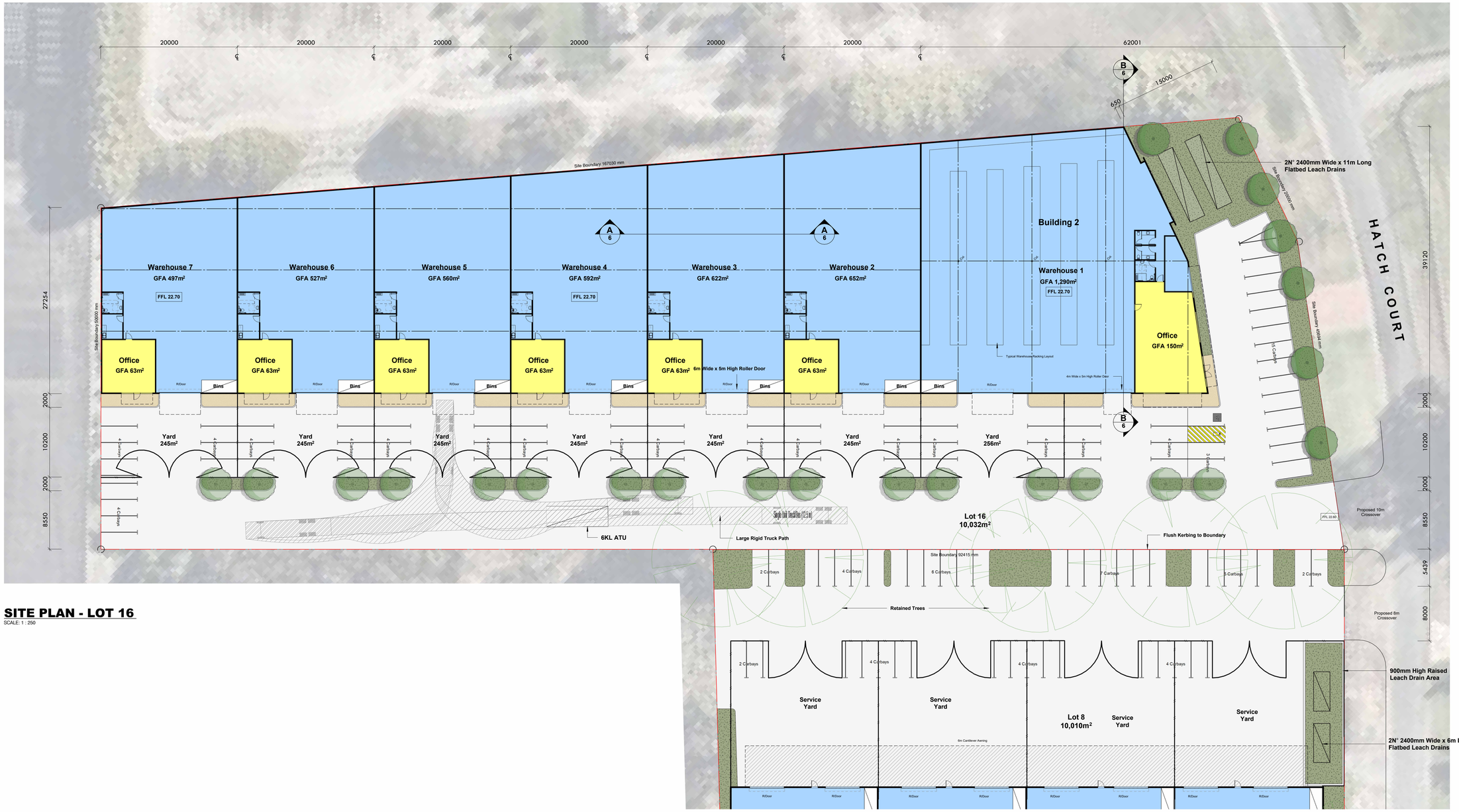
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0 2 4 6 8 10 20

DATE: MAR 2025
REVISION: SK027
SHEET: 3
SCALE: As indicated @B1

PROJECT NUMBER **24-9352**

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SITE PLAN - LOT 16

SCALE: 1 : 250

SITE CRITERIA

Lot 16

1. Site Area		
a. Site Area		**10,032m²**
2. Landscaping		
a. Provided		
Soft		**530m²**
3. Floor Area		
a. External Walls		62m²
b. Dividing Walls		15m²
c. Lunch		100m²
d. Toilets		85m²
e. Warehouse NLA		4,478m²
Total W/H GFA		**4,740m²**
f. Office NLA		504m²
G. Dividing Walls		24m²
Total Office GFA		**528m²**
Total GFA		**5,250m²**
4. Carparking (GFA)		
i. Cars Required		
a. Warehouse	3,000m² @ 1/100	30 Cars
c. Industrial	1,740m² @ 2/100	35 Cars
d. Office	504m² @ 4/100	20 Cars
Total Car required		**85 Cars**
ii. Cars Required		
a. Cars Provided		86 Cars
Total		**86 Cars**
5. Plot Ratio		
i. Required Plot Ratio of 0.5		**5,016m²**
ii. Provided		
a. Warehouse NLA		4,478m²
b. Office NLA		504m²
Total Plot Ratio		**4,982m²**

Landscaping
A. Soft Landscaping
Defined as vegetative landscaping.

Gross Floor Area : GFA
A. All Floor Areas on this plan are shown as GROSS FLOOR AREA.
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B. Definition of Gross Floor Area is defined as:
i/ GROSS FLOOR AREA OF TENANCY:
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ii/ GROSS FLOOR AREA OF A BUILDING:
Gross Floor Area of a Building is defined as the total area contained between the outside edge of external walls

Nett Floor Area : NFA
A. Nett Floor Area of a Tenancy on this plan is defined as the area between external or tenancy dividing walls.
B. This area is inclusive of toilets if the toilets are exclusive to the Tenancy.

SITE DESIGN CHECKLIST

- ☐ 1. SEWER MAINS LOCATION TO BE DETERMINED
- ☐ 2. FIRE MAINS PRESSURE TEST REQUIRED
- ☐ 3. FIRE TANKS OR PUMPS TO BE DETERMINED
- ☐ 4. WESTERN POWER TRANSFORMER LOCATION TO BE DETERMINED
- ☐ 5. CROSSOVER & ACCESS TO STREET TO BE DETERMINED BY LOCAL AUTHORITY
- ☐ 6. FULL FEATURE SITE SURVEY REQUIRED
- ☐ 7. DIAL BEFORE YOU DIG REQUIRED
- ☐ 8. BUSHFIRE ATTACK LEVEL (BAL) TO BE DETERMINED
- ☐ 9. STREET POWER POLES TO BE DETERMINED
- ☐ 10. SITE ZONING & USE TO BE DETERMINED

NOTE: Any of the following items that do not have an 'X' in the provided square require determination.

LEGEND

- BUILDING FOOTPRINT - SHOWROOM / WAREHOUSE / FACTORY
- BUILDING FOOTPRINT - OFFICE
- EXTENT OF CONCRETE HARDSTAND
- EXTENT OF ROADBASE HARDSTAND
- EXTENT OF BITUMEN PAVING
- EXTENT OF BRICK PAVING / CONCRETE PAVING
- EXTENT OF LANDSCAPING

meyer shircore architects

PROPOSED INDUSTRIAL DEVELOPMENT

LOCATION : LOT 16 CNR HATCH COURT & STIRLING CRESCENT, HIGH WYCOMBE

BY : SARICH

SARICH BUILDING INDUSTRY

Member Australian Institute of Architects

0 2 4 6 8 10 20

DATE: MARCH 2025 PROJECT NUMBER

REVISION: SK010 **9512**

SHEET: 3

SCALE: As indicated @B1

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Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

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

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

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for a major road (>15,000 vpd) within 450m

= 6 for a major road within 100m

The nearest noise sensitive premises are identified as:

- R1 - Hatch Court receivers (9 – 14 Hatch Court, High Wycombe)
- R2 - Stirling Cresent receivers (4 – 51 Stirling Cresent, High Wycombe)
- R3 - Kalamunda Road receivers (2 – 4 Bodney Court / 597 Kalamunda Road, High Wycombe)

Table B-1 shows the percentage of industrial and commercial land within the inner (100 metre radius) and outer (450 metre radius) circles of the noise sensitive premises, with this also shown on *Figure B-1* for Receiver R1.

Table B-1: Percentage of Land Types within 100m and 450m Radii

Receiver	Land Type	Within 100m	Within 450m
R1	Type A - Industrial and Utility	56	45
	Type B – Commercial	-	-
R2	Type A - Industrial and Utility	54	48
	Type B – Commercial	-	-
R3	Type A - Industrial and Utility	23	25
	Type B – Commercial	-	-



Figure B-1: Land Types within 100m and 450m Radii of R1

From the Main Roads WA Traffic Map (refer *Figure B-2*), *Table B-2* shows the relevant roads and their traffic counts within the inner (100 metre radius) and outer (450 metre radius) circles.

Table B-2: Relevant Roads within 100m and 450m Radii

Receiver	Within 100m		Within 450m
	Major Road (+ 6 dB)	Secondary Road (+ 2 dB)	Major Road Not Within 100m (+ 2 dB)
R1, R2	-	Stirling Cr (6,050 2023/24 #6304)	-
R3	-	Kalamunda Rd (12,382 2023/24 #1390)	-

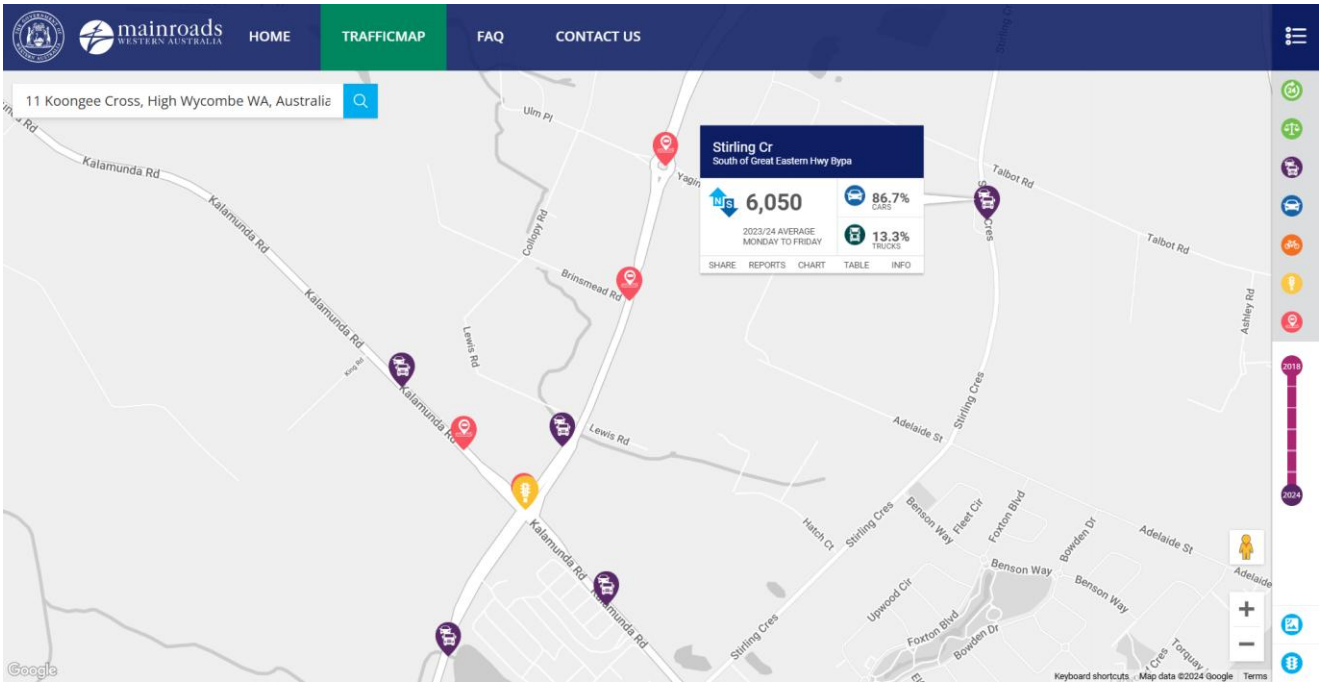


Figure B-2: MRWA Published Traffic Data

Table B-3 combines the percentage land types and Transport Factor to calculate the influencing factor.

Table B-3: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
R1	10.2	0.0	2.0	**12**
R2	10.2	0.0	2.0	**12**
R3	4.8	0.0	2.0	**7**

The influencing factor calculated in *Table B-3* is combined with those baseline assigned levels of *Table 2-2*, resulting in the project assigned levels provided in *Table 2-3*.

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 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 level 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. 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. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

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

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

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

- **L_{A90}**

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

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **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.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent 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; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

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

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

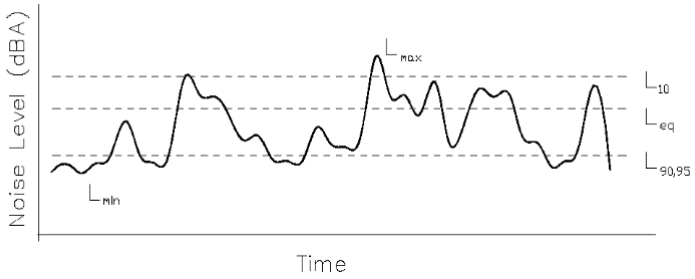
- **Major Road**

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

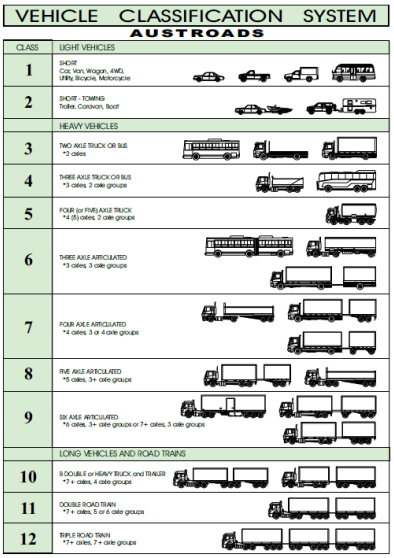
- **Secondary / Minor Road**

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

- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**

