



Lloyd George Acoustics

PO Box 717

Hillarys WA 6923

T: 9401 7770

www.lgacoustics.com.au

Environmental Noise Assessment

Lots 3 and 301 Anstey Road, Forrestdale

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Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717
Hillarys WA 6923

www.lgacoustics.com.au

T: 9401 7770

Contacts	Daniel Lloyd	Terry George	Matt Moyle	Olivier Mallié	Ben Hillion	Rob Connolly
E:	daniel@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au	olivier@lgacoustics.com.au	ben@lgacoustics.com.au	rob@lgacoustics.com.au
M:	0439 032 844	0400 414 197	0412 611 330	0439 987 455	0457 095 555	0410 107 440

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Date:	Rev	Description	Prepared By	Verified
04-Feb-20	0	Issued to Client	Olivier Mallié	Terry George

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1 INTRODUCTION

It is proposed to develop Lots 3 and 301 Anstey Road in Forrestdale (refer *Figure 1-1*) into a service station and fast food restaurant. The development includes:

- One Service Station building with loading bay and bin store on the south side,
- Four fuel bowsers, and
- Three Fast Food tenancies in one building, with one dedicated drive-thru and loading bay on the north side.



Figure 1-1 Project Locality

This report presents the assessment of the noise emissions associated with the site: mechanical plant, fuel bowsers, vehicle noise in drive thru, etc. based on the plans provided in *Appendix A*.

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

2 CRITERIA

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
Industrial	All hours	65	80	90

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.

The overall influencing factor, applicable at the noise sensitive premises has been calculated as 6 dB, as shown in *Table 2-3*, due to Armadale Road being considered a major road (> 15,000 vehicles per day, 2017/18 Mainroads WA count at site 0774 east of Nicholson Road) within 100 metres of the residences. At this stage, the development and the land surrounding the development is zoned 'urban development' and was considered as residential use for the purpose of this assessment. However, if the land is developed, the influencing factor will increase by 1 dB from the proposed commercial development.

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 %	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}
Noise sensitive premises: 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 and within 15 metres from a noise-sensitive building i.e. a house not a shed or garage/car port.

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.

2.1 Refrigerated Deliveries and Drive-thru

With regards to noise from vehicles, regulation 3(1)(a) states:

- (1) *Nothing in these regulations applies to the following noise emissions —*
 - (a) *noise emissions from the propulsion and braking systems of motor vehicles on a road;*

Since the development is open to the public, the car park is considered to be a road and therefore vehicle noise (propulsion and braking) is not strictly assessed. However, any equipment fixed to a delivery truck, such as the refrigeration unit, is not exempt.

In addition, vehicle propulsion noise in the drive-through area has been considered assessable due to the 24-hour nature of the restaurant and the lanes being solely for food ordering purposes and not road access.

Vehicle door closing noise is also assessable in any parts of the car park, as this does not form part of the 'propulsion or braking' systems.

2.2 Waste Collection and Site Cleaning (Specified Works)

Regulation 14A provides requirements for such activities as the collection of waste, landscaped area maintenance and car park cleaning. Such activities can also be exempt from having to comply with regulation 7, provided they are undertaken in accordance with regulation 14A(2) as follows:

- during daytime hours, defined as:
 - 07:00 to 19:00 Monday to Saturday (excluding public holiday), or
 - 09:00 to 19:00 on a Sunday or public holiday
- in the quietest reasonable and practicable manner and using the quietest equipment reasonably available.

In the case where specified works are to be carried outside daytime hours and their noise emissions are likely not to comply with regulation 7, the works also need to be carried out according to a Noise Management Plan which has been approved by the local government authority CEO. While not specifically assessed in this report, recommendations are provided to achieve 'quietest reasonable' noise impacts.

2.3 Reversing Alarms

With regard to reversing alarms fitted to commercial vehicles, under regulation 3, nothing in the Regulations applies to the following noise emissions –

- (h) *noise emissions from –*
- (i). *a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment; or*
 - (ii). *a startup or movement alarm fitted to plant,*
if
 - (iii). *it is a requirement under another written law that such an alarm be fitted; and*
 - (iv). *it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these Regulations;*

From the above, it is considered that reversing alarms fitted to private and commercial vehicles e.g. goods delivery or garbage trucks, are not exempt under the Regulations since they are not specifically required under another written law. The commonly used tonal reversing alarms (reversing beeper), emit, by their very nature, tonal and modulating noise at high levels. As such,

this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Therefore, where reversing alarms are deemed necessary, alarms emitting broadband noise should be considered, as these can more readily comply with the Regulations.

3 METHODOLOGY

Computer modelling has been used to predict noise levels at each nearby receiver. The software used was *SoundPLAN 8.2* with the ISO 9613 (ISO 17534-3 improved method) algorithms selected. These algorithms have been selected as they include the influence of wind. Input data required in the model are:

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

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	Up to 5
Wind Direction*	All	All

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

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

3.2 Topographical Data

Topographical data was based on that publicly available from *Google* in the form of spot heights and the development plans. It is noted the topography is flat between sources and receivers, with no significant differences in elevations with adjacent lots.

Buildings have been included as they provide barrier attenuation when located between a source and receiver. The proposed buildings were modelled based on the plans and elevations provided. Adjacent residential buildings were modelled as 3.5 metres high with a receiver at 1.4 metres above ground level. Existing boundary fences were modelled at 1.6 metres high.

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value of 0.0 has been used for the bitumen areas and 0.7 has been used for the remaining areas.

3.4 Source Sound Levels

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

Table 3-2 Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
<i>Service Station</i>									
4x Fuel Bowser, each, L ₁₀	-	65	68	65	67	65	59	50	71
Air Service Alarm, L _{max}	-	-	-	-	-	91	96	92	99
2x Exhaust Fans, each, L ₁₀	78	77	68	65	60	58	56	52	68
Kitchen Exhaust Fan, L _{A10}	80	78	74	71	62	64	63	53	73
3x AC Condenser, each, L ₁₀	-	77	74	72	70	67	62	56	75
Refrigeration Condenser, L _{A10}	82	81	79	75	70	64	58	53	76
Truck Mounted Refrigeration Unit, L ₁	107	97	90	95	94	89	86	-	98
Car Door Closing, L _{max}	71	74	77	81	80	78	72	61	84
<i>Fast Food Restaurants</i>									
Customer Ordering Device, L _{A1}	62	64	66	77	80	73	57	42	82
3x 30-35 kW capacity ACs, each, low/high, L _{A10}	-	75	74	73	71	67	65	60	76
	-	78	78	77	75	71	69	64	80
3x Kitchen Exhaust Fan, each, L _{A10}	80	78	74	71	62	64	63	53	73
3x Exhaust Fans, each, L _{A10}	78	77	68	65	60	58	56	52	68
Car Idling/moving slowly, L _{A10}	81	78	74	72	74	74	67	64	79

With regards to *Table 3-2*, please note the following:

- The Service Station and Fast Food mechanical plant (ACs, fans, etc.) sound levels have been sourced from file data for previous similar projects and may therefore not reflect the final plant selection and design.
- Exhaust fans were assumed to be roof mounted and were modelled at 0.5 m above roof level.
- Air conditioning and refrigeration plant are assumed installed on the roof and were modelled as point sources located 1.0 metre above roof level.
- The Service Station mechanical plant is noted to be screened by architectural louvres, however these louvres were considered to have no acoustic properties;
- All mechanical plant are assumed to operate at all times, due to the 24-hour nature of the development.
- Parapets at least 1.5 metre high are assumed to be surrounding the rooftop area of the Fast Food building, therefore providing some barrier effects to neighbouring receivers.
- The truck mounted refrigeration unit is assumed 2.5 metres above ground level, being above the truck cab.
- The Customer Order Device (COD) was modelled as a point source located 1.2 metres above ground level.
- Car engine sources were modelled at 0.5 metres above ground;
- All other sources were modelled at 1.0 metre above ground level unless stated otherwise;
- For night-time scenarios, mechanical plant is modelled with low speed noise levels where available.

4 RESULTS

Various operational scenarios were considered as follows:

1. Night-time Mechanical Plant, L_{A10} – All mechanical plant are running. Plant with a 'low noise' mode are assumed to operate in this mode. All bowsers are used simultaneously. No cars in the drive through.
2. Night-time Operations, L_{A10} – All mechanical plant running as per Scenario 1. Drive-thru lane with up to 6 cars idling between the customer ordering device (COD) and pick-up point.
3. Night-time Operations, L_{A1} – As per Scenario 1 and with the customer ordering device (COD) in use and up to 12 cars in the drive-thru lane. For this scenario any noise mitigation required for the drive-thru lane from scenario 2 are assumed to be implemented.
4. Night-time Delivery, L_{A1} – All plant from Scenario 1 and with a refrigerated truck delivery to the Service Station or Fast Food. For this scenario any noise mitigation required for the drive-thru lane are assumed to be implemented. The delivery truck is assumed to have reversed in the loading bay so that the truck mounted refrigeration unit is facing away from the sensitive receivers.
5. Night-time Max Events, L_{Amax} – This scenario includes car doors closing in any parking bay or at the bowsers and the air service beeper.
6. Sunday Daytime Operations, L_{A10} – All mechanical plant running at full capacity. Drive-thru lane with up to 12 cars idling/queuing. For this scenario any noise mitigation required for the drive-thru lane from scenario 2 are assumed to be implemented.

4.1 Scenario 1 – Night-time Mechanical Plant, L_{A10}

Table 4-1 provides the results for this scenario. It should be noted that the assessment has assumed all fuel bowsers will be used simultaneously, which is conservative as in reality, they will be used more intermittently. In addition, at night-time, noise from mechanical plant was considered to be tonal, therefore a +5 dB adjustment was made – refer *Table 2-1*. *Figure 4-1* provides the noise contour plot.

From *Table 4-1* it can be seen that exceedences up to 7 dB (including the tonal adjustment) are predicted at #801 Armadale Road (Patio and Backyard). For all the receivers, the main source of noise is generally the AC units located on the roof of either the service station or fast food buildings.

Table 4-1 Predicted Noise Levels, Scenario 1 Night-time Mechanical Plant, L_{A10} dB

Location	Predicted Noise Levels			Assigned Noise Level	Calculated Exceedence
	Mechanical Plant	Fuel Bowers	Combined		
#16 Back Patio	38	16	$38 + 5 = 43$	41	2
#16 Driveway	36	27	$37 + 5 = 42$	41	1
#16 West	32	17	$32 + 5 = 37$	41	Complies
#801 Backyard	43	28	$43 + 5 = 48$	41	7
#801 Front Yard	40	16	$40 + 5 = 45$	41	4
#801 Patio	43	17	$43 + 5 = 48$	41	7
#803 Pool	39	22	$39 + 5 = 44$	41	3

However, it must be noted that at this stage, mechanical plant has not been designed in detail, but rather the assessment uses typical plant from similar projects. To achieve compliance at all times, a minimum 8 dB overall noise reduction is required. This level of reduction could be achieved with the following combination of noise controls:

- All plant to be the quietest available, and
- Provide a solid barrier on the plant side of the architectural louvres of the service station building and localised acoustic screens around the fast food restaurants AC plant. As a minimum, all acoustic barriers are to be at least 0.5 metres higher than any part of the plant, made from solid material with surface density 8 kg/m^2 minimum and include acoustic absorption on the plant side. Examples of proprietary systems include acoustic screens from Con-formgroup.com.au or monkeytoe.com.au, and
- Exhaust fans should be located within the ceiling space and ducted to the roof, with the roof cowl then to be located furthest away from sensitive receivers, and
- Allow for silencers or acoustic flexible ducts on the outside air side of all exhaust fans, and
- All plant to be mounted on suitable anti-vibration mounts.

The above is to be reviewed during detailed design/building permit stage when mechanical plant selection and layout is known.

4.2 Scenario 2 – Night-time Operations, LA10

Table 4-2 provides the results for this scenario and Figure 4-2 the noise contour plot.

The night-time period includes Sundays and public holidays between 7am to 9am, however it is considered that at even those times the drive-thru lane will not be at full capacity e.g. up to 6 vehicles idling simultaneously. In addition, given the noise sources include various car types/models, the overall noise emissions were not considered to contain annoying characteristics. At times when there is little or no traffic in the drive-thru lane, mechanical plant noise is dominant and Scenario 1 applies.

From Table 4-2 it can be seen that exceedences up to 7 dB are predicted at #801 Armadale Road (Backyard), with the vehicles idling being the dominant source.

Table 4-2 Predicted Noise Levels, Scenario 2 Night-time Operations, LA10 dB

Location	Predicted Noise Levels				Assigned Noise Level	Calculated Exceedence
	Drive-Thru	Mechanical Plant	Fuel Bowsers	Combined		
#16 Back Patio	36	38	16	40	41	Complies
#16 Driveway	41	36	27	42	41	1
#16 West	31	32	17	34	41	Complies
#801 Backyard	46	43	28	48	41	7
#801 Front Yard	36	40	16	42	41	1
#801 Patio	43	43	17	46	41	5
#803 Pool	37	39	22	41	41	Complies

Since mechanical plant noise requires attenuation, the noise emissions from the vehicles idling in the drive-thru lane were considered in isolation. From *Table 4-2* it can be seen the drive-thru noise contribution complies with the night-time assigned noise level of 41 dB LA10 at all receivers, with the exception of #801 Armadale Road (Backyard and Patio). Therefore, the following noise wall is required:

- A 2.4 metres high wall with a 1.0 metre long overhang on top angled 60 degrees from vertical, resulting in the top edge of the overhang to be 2.9 metres over the drive-thru lane. This wall is to connect with the service station building and extend approximately 15 metres to the north – refer *Figure 4-3* and *Figure 4-4*.
- Noise wall and overhang to be made from solid material with surface density 8 kg/m² minimum and include acoustic absorption on the drive-thru side e.g. Stratocell *Whisper* 25 mm thick.

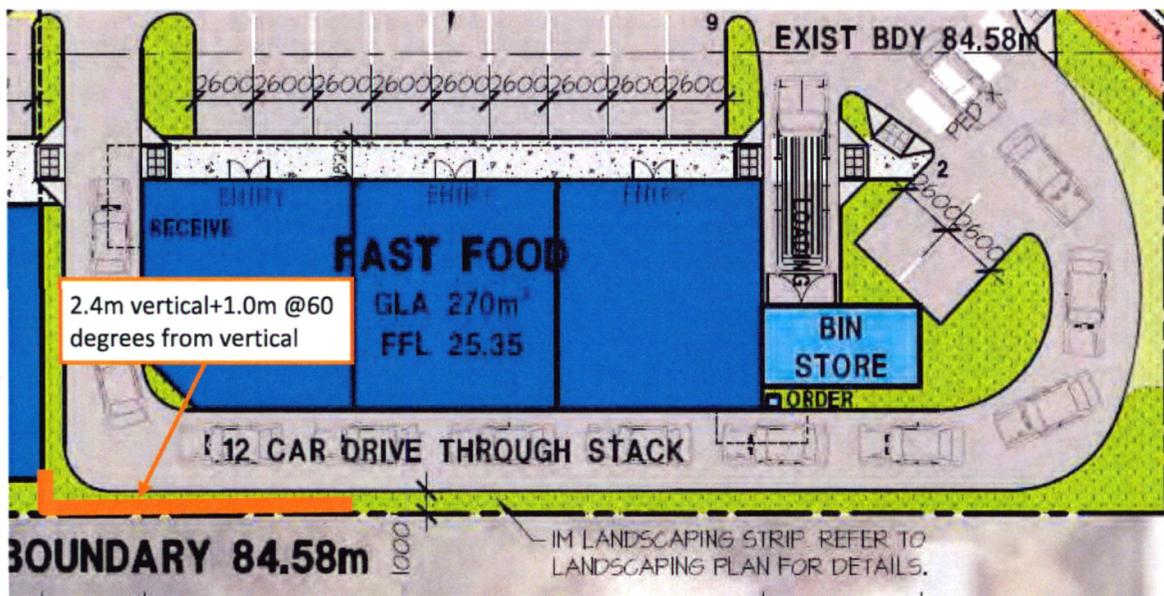


Figure 4-3 Scenario 2 – Noise Wall Minimum Extents

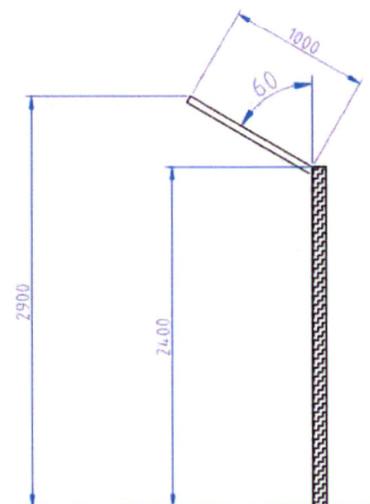


Figure 4-4 Scenario 2 – Noise Wall Cross-section

During other time periods e.g. the Sunday daytime or Monday-Saturday, more cars may be idling in the drive-thru lanes, however the assigned noise levels are also higher such that compliance is still expected at nearby receivers.

4.3 Scenario 3 – Night-time Operations, L_{A1}

Table 4-3 provides the results for this scenario and Figure 4-5 the noise contour plot.

For this scenario any noise mitigation required for the drive-thru lane are assumed to be implemented. The noise from the customer ordering unit was not considered to contain annoying characteristics.

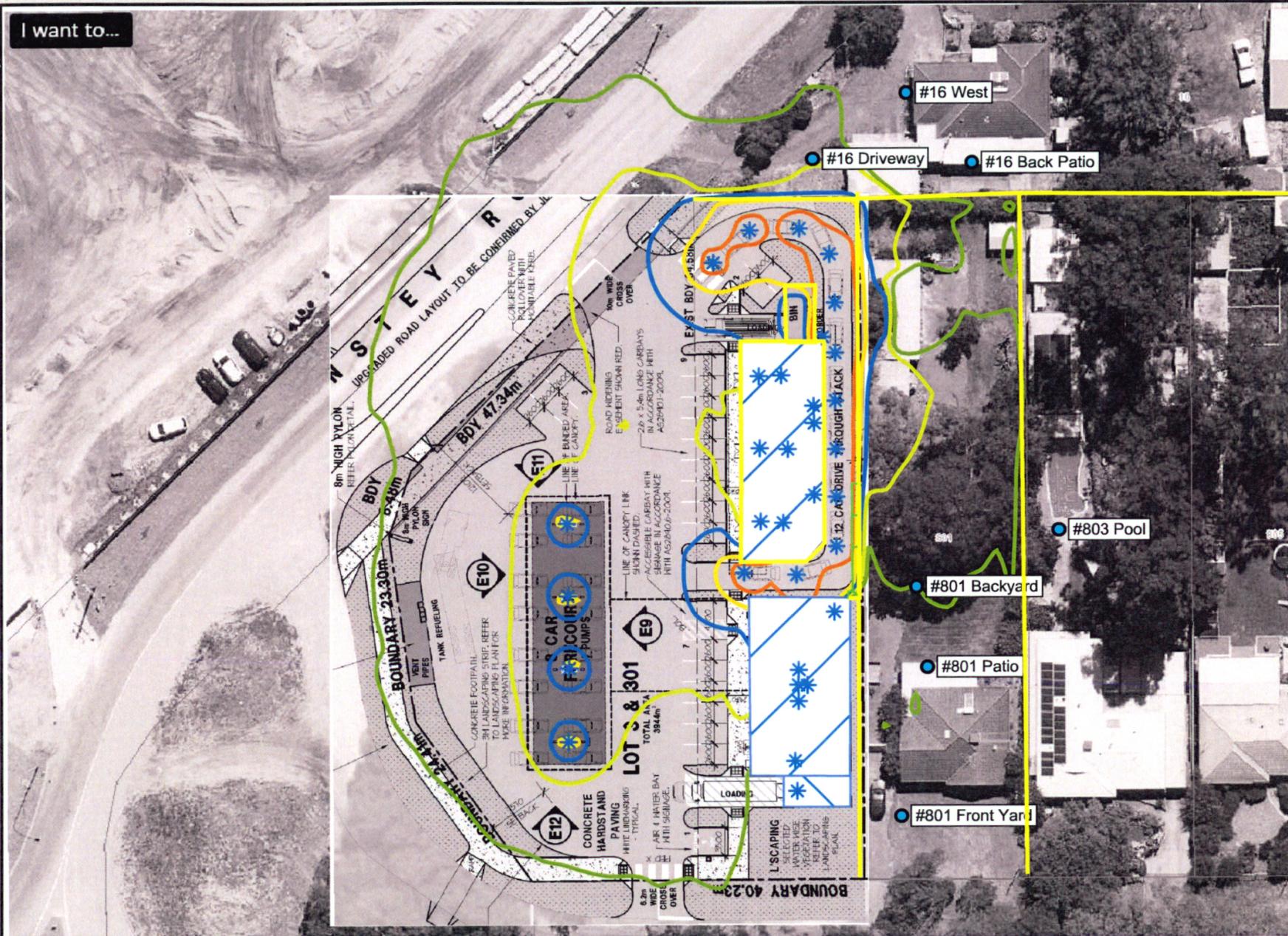
Table 4-3 Predicted Noise Levels, Scenario 3 Night-time Operations, L_{A1} dB

Location	Predicted Noise Levels				Assigned Noise Level	Calculated Exceedence
	COD	Drive-thru	Mechanical Plant+Bowsers	Combined		
#16 Back Patio	38	39	38	43	51	Complies
#16 Driveway	46	49	37	50	51	Complies
#16 West	35	36	32	39	51	Complies
#801 Backyard	26	43	42	46	51	Complies
#801 Front Yard	17	35	40	41	51	Complies
#801 Patio	24	42	43	45	51	Complies
#803 Pool	37	38	39	43	51	Complies

From Table 4-3, it can be seen that Scenario 3 achieves compliance with the night-time L_{A1} assigned noise level at all receivers.

I want to...

Figure 4-5



**Predicted Noise level
LA1 dB**

	= 46
	= 51
	= 56
	= 61
	= 66



Signs and symbols

- Proposed building
- Point source
- Receiver
- Fence/Parapet

Lots 3 & 301 Armadale Rd - Night-time Operations Noise Levels (All Plant and Drive-thru)

LA1 Ground Level Noise Contours



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

4.4 Scenario 4 – Night-time Delivery, L_{A1}

Table 4-4 provides the results for this scenario and Figure 4-6 the noise contour plot for deliveries. The results assume that refrigerated deliveries occur simultaneously in both delivery bays. While this is conservative, Table 4-4 shows that receivers are mostly impacted by one or the other delivery bay in any case. For this scenario any noise mitigation required for the drive-thru lane is assumed to be implemented. At night-time, noise from the truck mounted refrigerated unit was considered to be tonal based on the 8 dB rule, therefore a +5 dB adjustment was made – refer Table 2-1.

From Table 4-4 it can be seen an exceedence up to 13 dB (including the tonal adjustment) is predicted at #16 Driveway. However, although this receiver is technically within 15 metres of the residential building at #16 Anstey Road, the driveway itself could be considered as not requiring the same level of protection as say, the back patio area (#16 Back Patio) or the west façade of the building (#16 West), at which exceedences up to 6 dB are predicted.

Table 4-4 Predicted Noise Levels, Scenario 4 Night-time Delivery, L_{A1} dB

Location	Predicted Noise Levels				Assigned Noise Level	Calculated Exceedence
	Refrigerated Delivery @ Service Station	Refrigerated Delivery @ Fast Food	Others*	Overall +5		
#16 Back Patio	38	51	43	57	51	6
#16 Driveway	39	59	51	64	51	13
#16 West	33	46	40	52	51	1
#801 Backyard	42	41	46	53	51	2
#801 Front Yard	50	37	41	56	51	5
#801 Patio	44	41	45	53	51	2
#803 Pool	38	40	43	51	51	Complies

* Includes mechanical plant, fuel bowsers, cars in drive-thru and COD

To achieve compliance at all receivers except #16 Driveway, a minimum 6 dB overall noise reduction is required. This level of reduction could be achieved with the following combination of noise controls on the basis that the mechanical plant noise is also mitigated:

- Restrict refrigerated deliveries to daytime only i.e. Monday to Saturday 7am-10pm and Sunday and public holidays 9am to 10pm, and
- Ensure the refrigeration unit does not run for more than 24 minutes. If operating for longer than this, exceedences of the L_{A10} assigned noise level are then predicted even without the tonal adjustment applied.

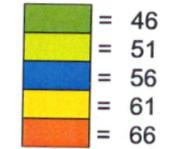
For refrigerated deliveries to occur outside of the hours nominated above, or achieve compliance at #16 Driveway, the refrigeration unit will need to be turned off as soon as the truck is parked and for the duration of the delivery. Alternatively, the loading bay for the Fast Food restaurants could be

designed so as to provide acoustic fencing and car port style structure over-head, the design of which can be determined during detailed design.

I want to...

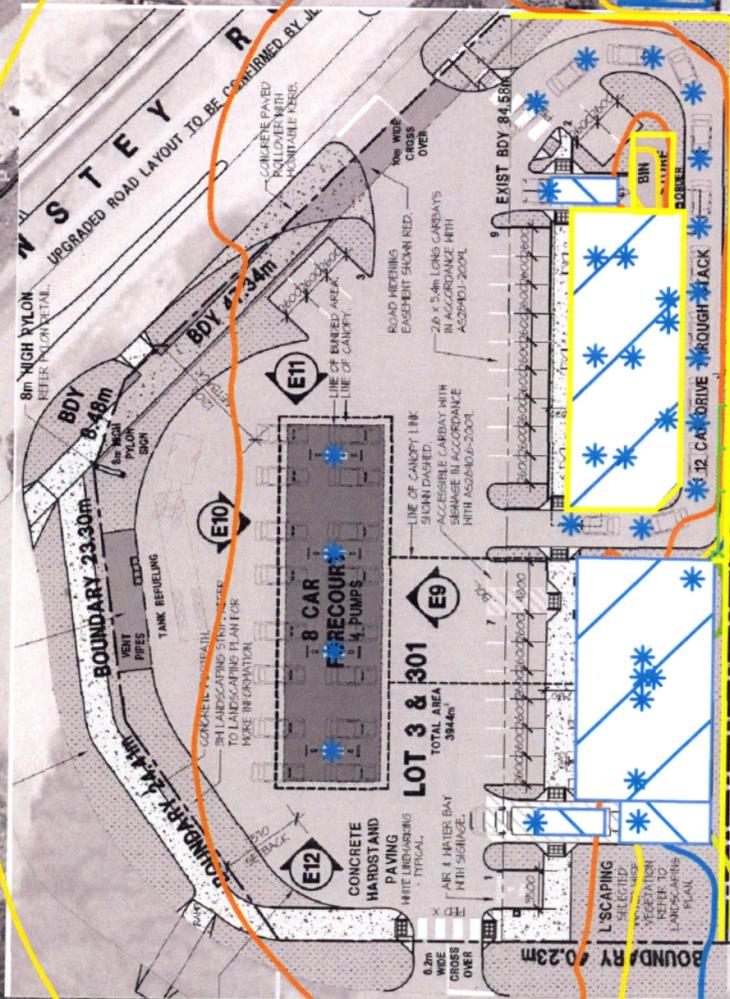
Figure 4-6

Predicted Noise level
L_{A1} dB



Signs and symbols

-  Proposed building
-  Point source
-  Receiver
-  Fence/Parapet



Lots 3 & 301 Armadale Rd - Night-time Delivery Noise Levels (Both Bays Used)
L_{A1} Ground Level Noise Contours



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4.5 Scenario 5 – Night-time Max Events, L_{Amax}

Table 4-5 provides the results for this scenario and Figure 4-7 provides the noise contour plot.

At night-time, noise from a car door closing was considered to be impulsive, therefore a +10 dB adjustment was made to this source. The air service beeper was also considered to be tonal, therefore a +5 dB adjustment for tonality was applied (refer Table 2-1).

From Table 4-5 it can be seen that a marginal exceedance is predicted at #801 Armadale Road (Front Yard), while compliance is predicted to be achieved at all other receivers. The marginal exceedance is a result of the air service alarm, which can be readily adjusted to emit a compliant noise level.

Table 4-5 Predicted Noise Levels, Scenario 5 Night-time Max Events, L_{Amax} dB

Location	Predicted Noise Levels			Assigned Noise Level	Calculated Exceedance
	Car Doors Closing	Air Service Beeper	Highest Adjusted Level		
#16 Back Patio	39	31	49	61	Complies
#16 Driveway	47	29	57	61	Complies
#16 West	34	25	44	61	Complies
#801 Backyard	32	37	42	61	Complies
#801 Front Yard	41	57	62	61	1
#801 Patio	27	37	42	61	Complies
#803 Pool	31	31	41	61	Complies

4.6 Scenario 6 – Sunday Daytime Operations, LA10

Table 4-6 provides the results for this scenario and Figure 4-8 the noise contour plot.

Given the noise sources include various car types/models, the overall noise emissions were not considered to contain annoying characteristics. At times when there is little or no traffic in the drive-thru lane, mechanical plant noise is dominant, which could be considered tonal.

From Table 4-6 it can be seen that an exceedence of 3 dB is predicted at #16 Driveway. However, as previously mentioned, although this receiver is technically within 15 metres of the residential building at #16 Anstey Road, the driveway itself could be considered as not requiring the same level of protection as, say, the back patio area (#16 Back Patio) or the west façade of the building (#16 West), at which compliance is achieved.

If considering the mechanical plant in isolation, an exceedence of 3 dB is possible at receivers #801 Armadale Road (Backyard and Patio). However, as previously noted, at this stage mechanical plant has not been designed in detail, but rather the assessment uses typical plant from similar projects and noise controls are already required to comply at night-time.

Table 4-6 Predicted Noise Levels, Scenario 6 Sunday Daytime Operations, LA10 dB

Location	Predicted Noise Levels				Assigned Noise Level	Calculated Exceedence
	Drive-Thru	Mechanical Plant	Fuel Bowsers	Combined		
#16 Back Patio	39	40	16	43	46	Complies
#16 Driveway	49	39	27	49	46	3
#16 West	36	34	17	38	46	Complies
#801 Backyard	43	44	28	46	46	Complies
#801 Front Yard	35	40	16	42	46	Complies
#801 Patio	42	44	17	46	46	Complies
#803 Pool	38	40	22	43	46	Complies

5 CONCLUSIONS

The potential noise impacts from the proposed Service Station and Fast Food restaurants at Lots 3 and 301 Anstey Road, Forrestdale, have been assessed against the *Environmental Protection (Noise) Regulations 1997* by way of modelling.

Compliance with the assigned noise levels can be achieved provided the noise controls investigated are implemented, as summarised below:

With regard to mechanical plant noise emissions

- All plant to be the quietest available, and
- Provide a solid barrier on the plant side of the architectural louvres of the service station building and localised acoustic screens around the fast food restaurants AC plant. As a minimum, all acoustic barriers are to be at least 0.5 metres higher than any part of the plant, made from solid material with surface density 8 kg/m² minimum and include acoustic absorption on the plant side. Examples of proprietary systems include acoustic screens from *Con-formgroup.com.au* or *monkeytoe.com.au*, and
- Exhaust fans should be located within the ceiling space and ducted to the roof, with the roof cowl then to be located furthest away from sensitive receivers, and
- Allow for silencers or acoustic flexible ducts on the outside air side of all exhaust fans, and
- All plant to be mounted on suitable anti-vibration mounts, and
- The above is to be reviewed in details during detailed design, when part selection is layout is available.

With regard to the drive-thru lane

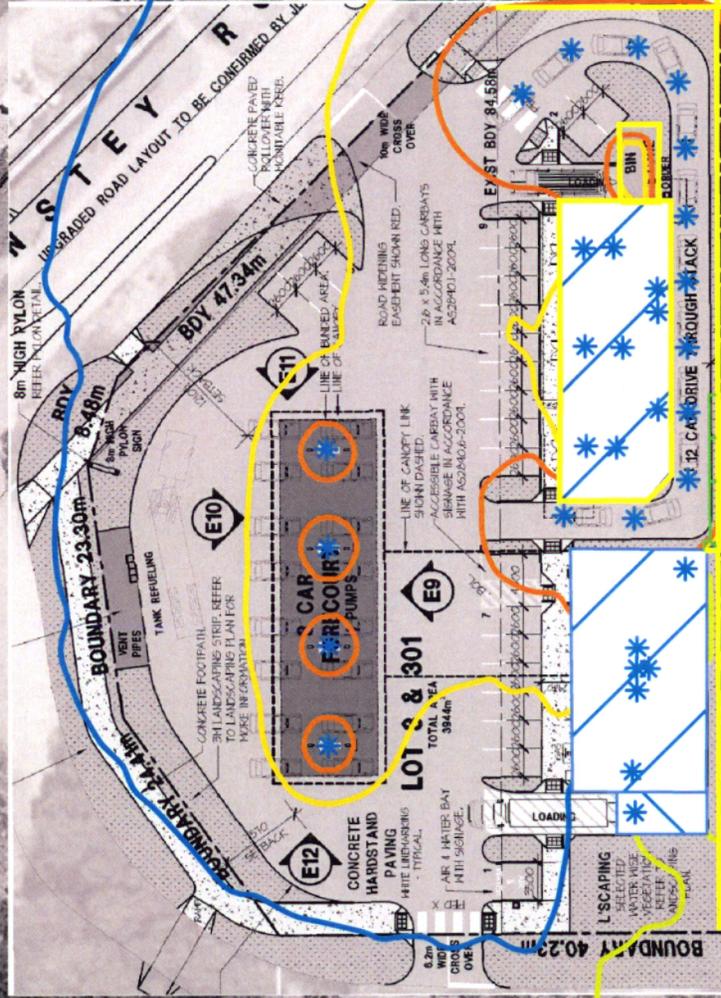
- Provide a 2.4 metres high wall with a 1.0 metre long overhang on top angled 60 degrees from vertical, resulting in the top edge of the overhang to be 2.9 metres over the drive-thru lane. This wall is to connect with the service station building and extend approximately 15 metres to the north – refer *Figure 4-3* and *Figure 4-4*.
- Noise wall and overhang to be made from solid material with surface density 8 kg/m² minimum and include acoustic absorption on the drive-thru side e.g. Stratocell *Whisper* 25 mm thick.

With regard to refrigerated deliveries

- Restrict refrigerated to daytime only i.e. Monday to Saturday 7am-10pm and Sunday and public holidays 9am to 10pm.
- Ensure the refrigeration unit does not run for more than 24 minutes. If operating for longer than this, exceedences of the L_{A10} assigned noise level are then predicted even without the tonal adjustment applied.
- For refrigerated deliveries to occur outside of the daytime hours nominated above, the refrigeration unit will need to be turned off as soon as the truck is parked and for the duration of the delivery. Alternatively, the loading bay for the Fast Food restaurants could be designed so as to provide acoustic fencing and car port style structure over head, the design of which can be determined during detailed design.

I want to...

Figure 4-8



Predicted Noise level
L_{A10} dB

	= 36
	= 41
	= 46
	= 51
	= 56



Signs and symbols

- Proposed building
- * Point source
- Receiver
- Fence/Parapet

Lots 3 & 301 Armadale Rd - Daytime Operations Noise Levels (All Plant and Drive-thru)
L_{A10} Ground Level Noise Contours



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In addition to the above, the following best practices are to be implemented in the design and operation of the premises:

- All delivery vehicles to have broadband reversing alarms fitted rather than tonal alarms.
- Mechanical plant to be maintained to ensure noise levels do not increase over time;
- Any external music or the like shall be low level and inaudible at residences;
- Any PA system installed on the premises is to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*;
- Schedule waste collections to occur during daytime hours:
 - 7am to 7pm Monday to Saturday (excluding public holiday), or
 - 9am to 7pm on a Sunday or public holiday, and
 - Use the quietest practicably and reasonably available equipment, and
 - Provide impact matting under large steel bins to minimise steel/ground impact noise.
- Access grates shall be firmly seated in position and fitted with rubber gaskets to avoid excess banging.

Appendix A

Development Plans

ARMADALE ROAD

LANDSCAPING
 NOTE: AREAS BELOW EXCLUDE LANDSCAPING WITHIN ROAD WIDENING.
 TOTAL SITE AREA 3944m²
 TOTAL PROVIDED 600m² = 15.21%

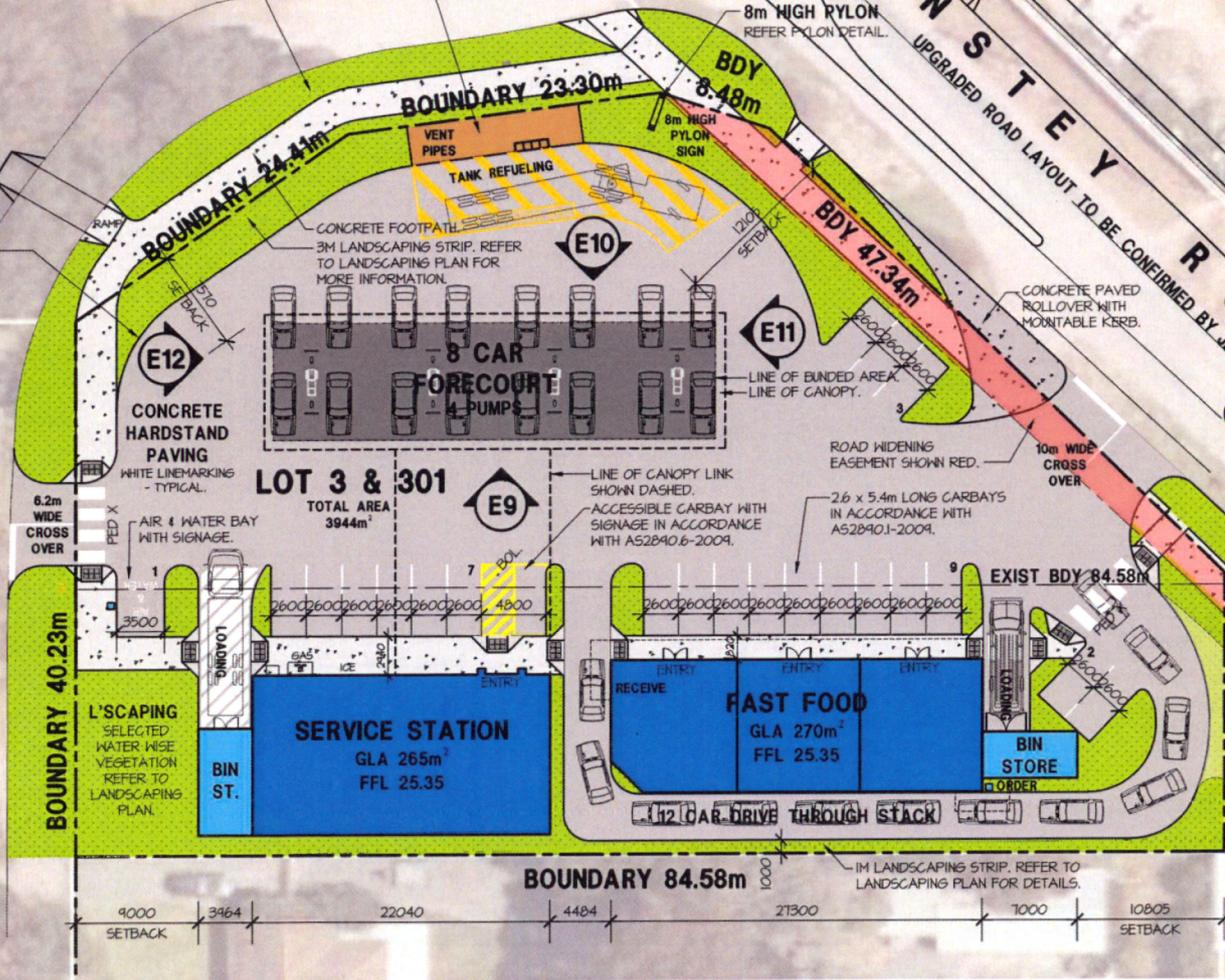
LEGEND

- BUILDING FOOTPRINT AREA
- CONCRETE PAVED CAR PARK WITH WHITE LINEMARKING TYP.
- CONCRETE BUNDED AREA.
- NEW CONCRETE PAVED FOOTPATH
- SOFT LANDSCAPING. REFER TO LANDSCAPING PLAN FOR MORE INFORMATION.
- BLUE METAL TO VENT PIPE CLEARANCE ZONE.
- KERB RAMP WITH T.6.5J. IN ACCORDANCE WITH A.S. 1428.1

FILL POINT CONTAINMENT AREA SHOWN DASHED. CLEARANCE ZONE TO BE IN ACCORDANCE WITH AS 6007.10.1-2004
 VERGE LANDSCAPING STRIP IN ACCORDANCE WITH LOCAL COUNCIL GUIDELINES. REFER TO LANDSCAPING PLAN FOR MORE INFORMATION.

NEW 150W CONCRETE SEMI MOUNTABLE KERBING. TYPICAL.

10150 CANOPY FORECOURT
 8650 DRIVEWAY
 5400
 2934
 12040 CONVENIENCE STORE
 1500 SETBACK



ANSTEY ROAD
 UPGRADED ROAD LAYOUT TO BE CONFIRMED BY JDSI

IWA
 HINDLEY & ASSOCIATES
 PTY LTD
 BUILDING DESIGNERS
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 WEDLANDS WA 6103
 PO BOX 196
 WEDLANDS WA 6103
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A3 SHEET

PROPOSED SITE PLAN

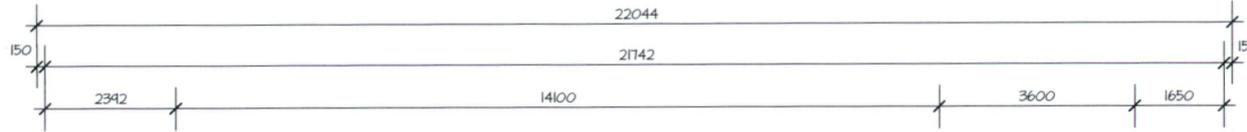
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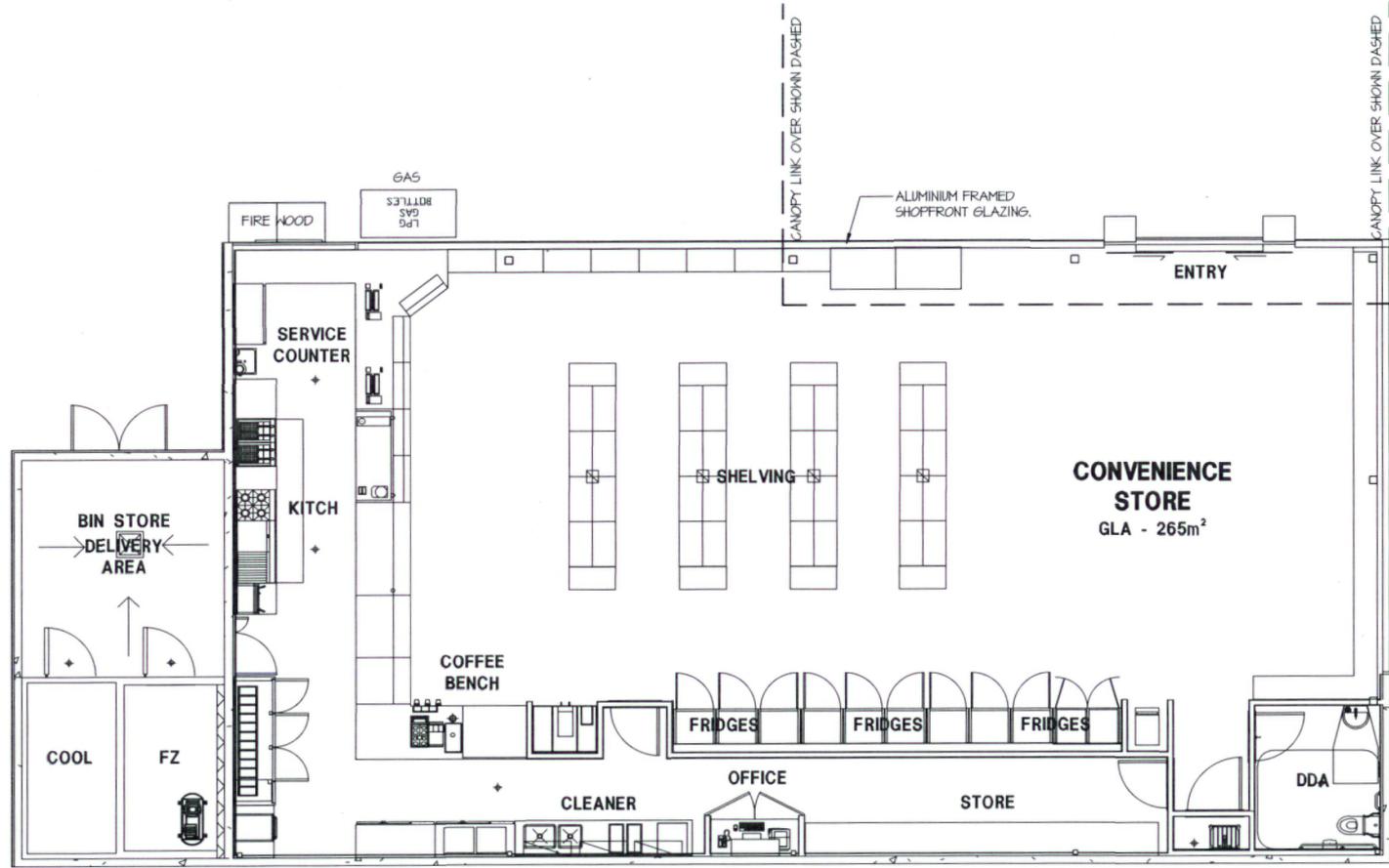
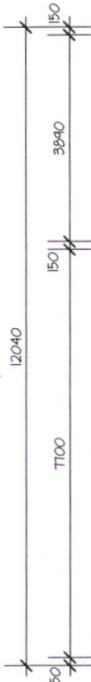
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 LOTS 3 & 301 ANSTEY RD, FORRESTDAL
 REALCOM Pty Ltd

Date - 14.01.21
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 Checked - CPH
 Scale - 1:400
 Job No - 3028
 Dwg - DA03
 Rev - A

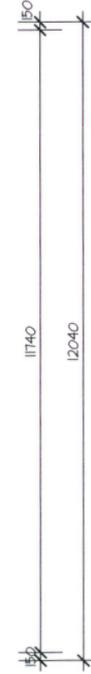
E1



E2



E3



E4

26048



SERVICE STATION FLOOR PLAN

SCALE 1:100



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 Dwg No. **DA06**
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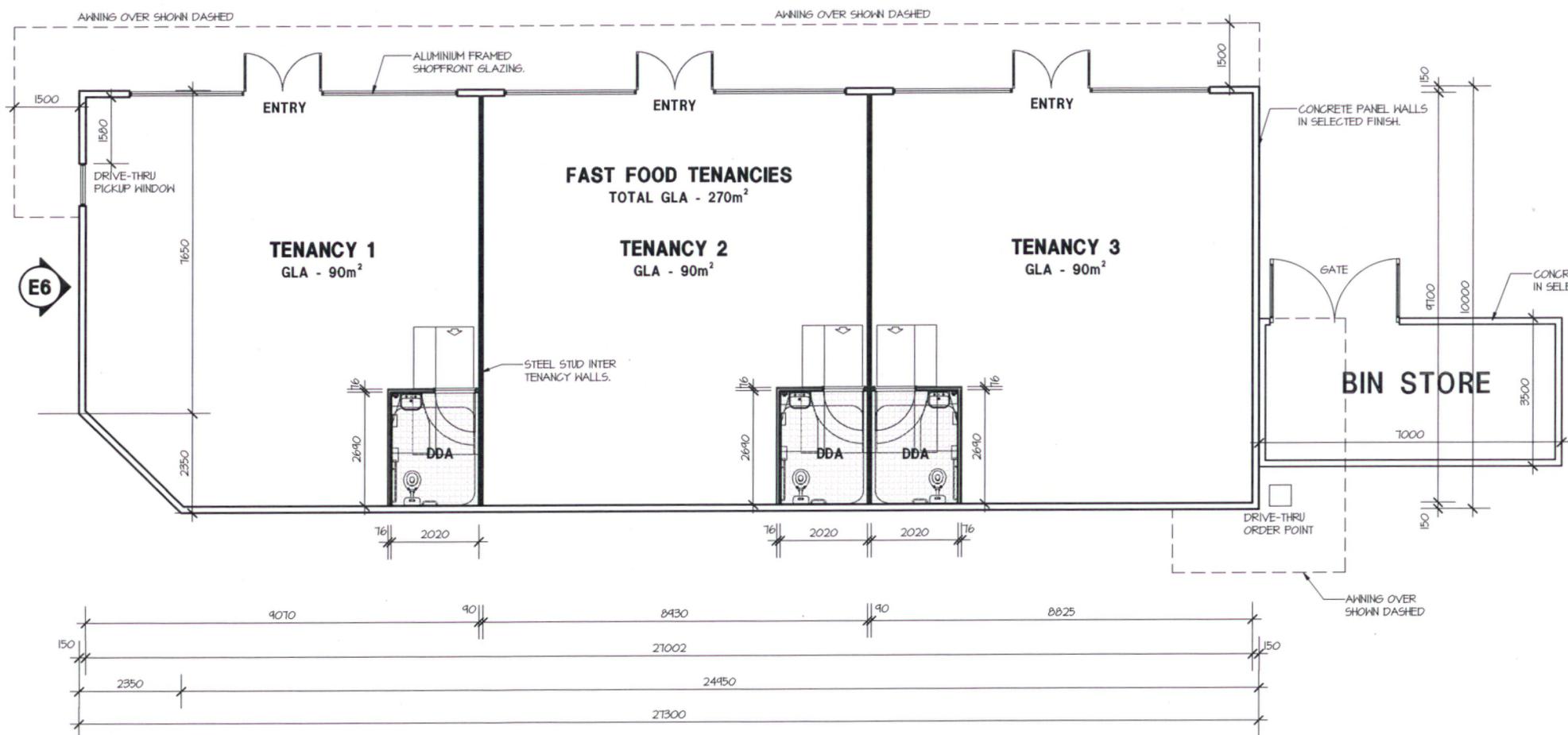
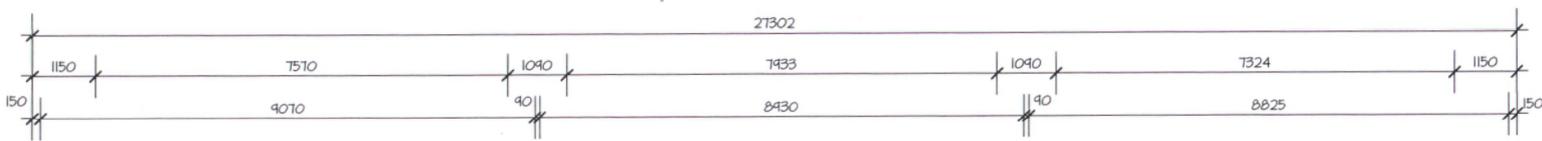
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E5



E6

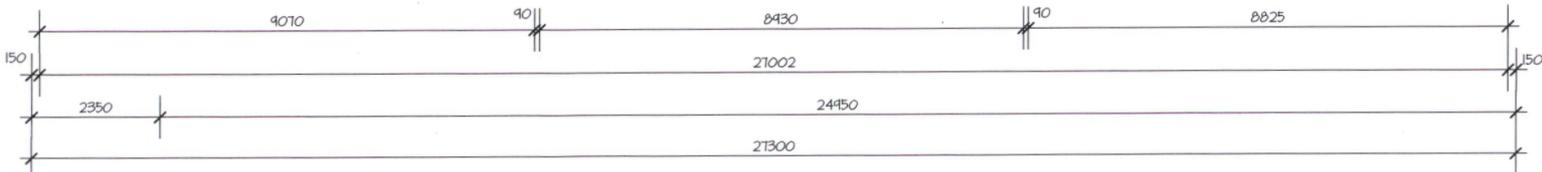
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E8



FAST FOOD FLOOR PLAN

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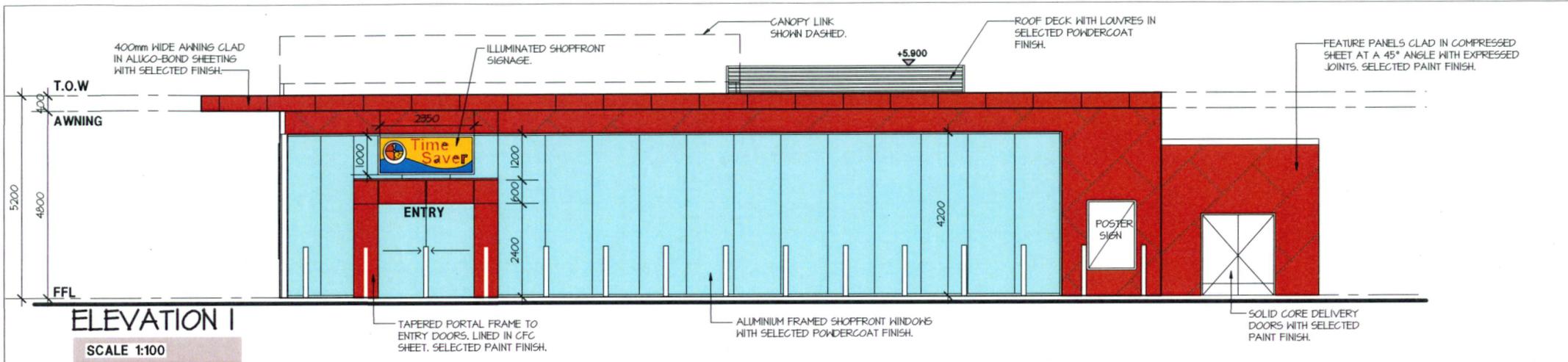
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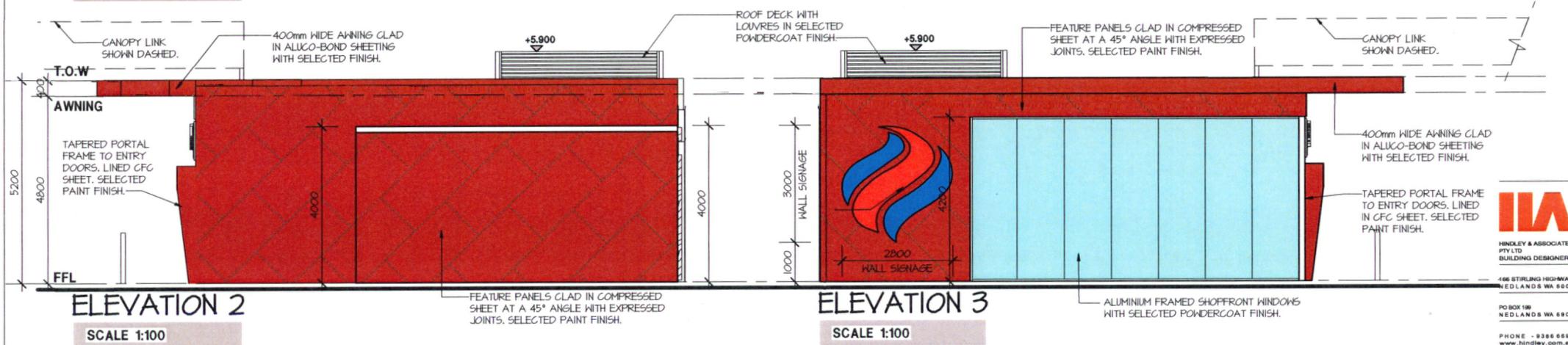
A3 SHEET

PROPOSED SERVICE STATION &
FAST FOOD OUTLET
LOTS 3 & 301 ANSTEY RD, FORRESTDALE
REALCOM Pty Ltd

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Scale - 1:100
Job No. - 0754
DWG **DA07**
Rev - **A**

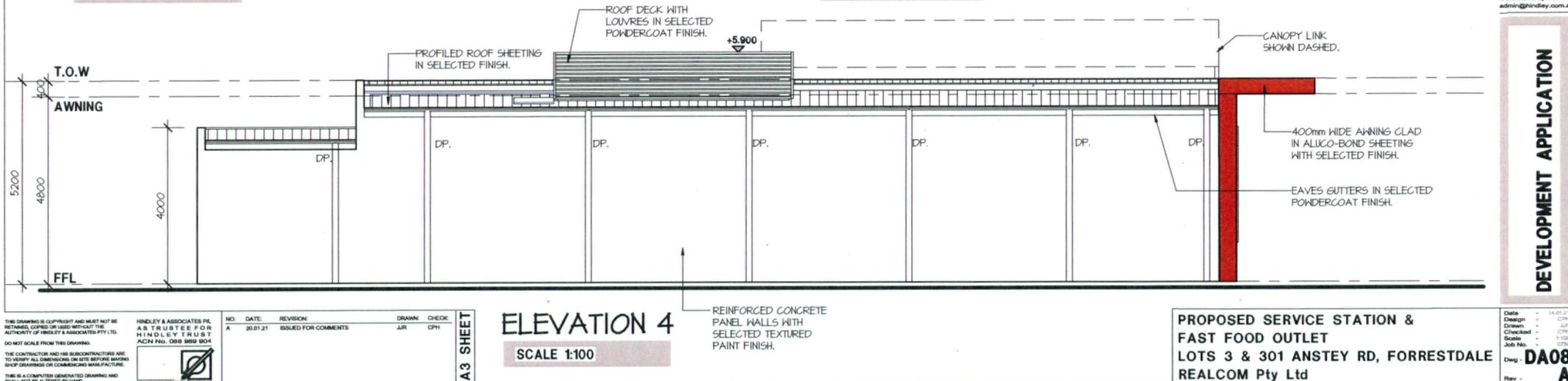


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ELEVATION 2
SCALE 1:100

ELEVATION 3
SCALE 1:100



ELEVATION 4
SCALE 1:100

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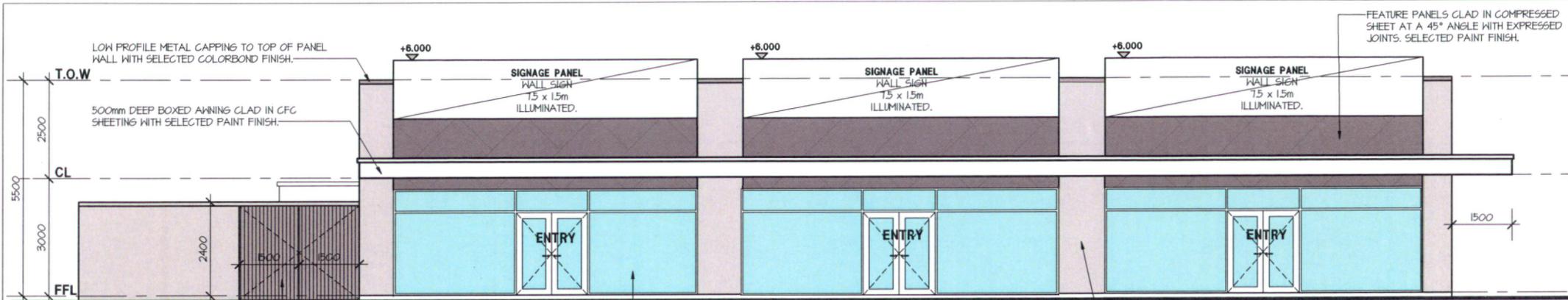
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PROPOSED SERVICE STATION & FAST FOOD OUTLET
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REALCOM Pty Ltd

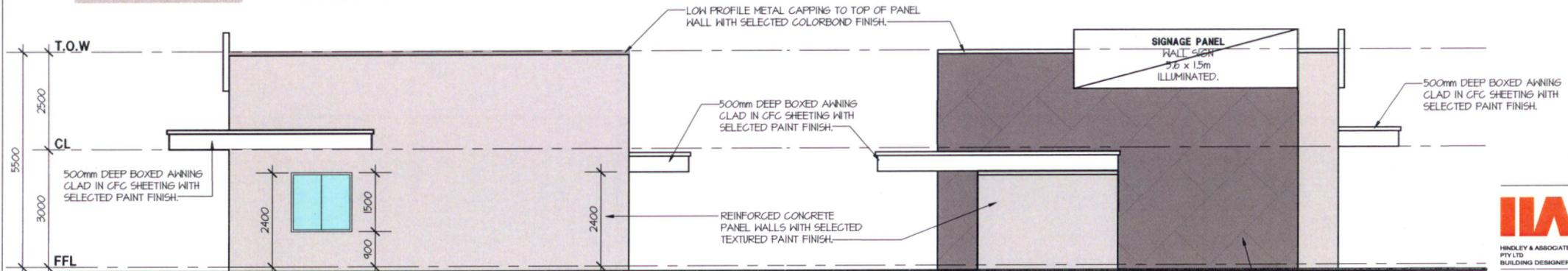
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Dwg	DA08
Rev	A

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BUILDING DESIGNERS
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NEDLANDS WA 6009
PO BOX 188
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PHONE - 9386 6599
www.hindley.com.au
admin@hindley.com.au

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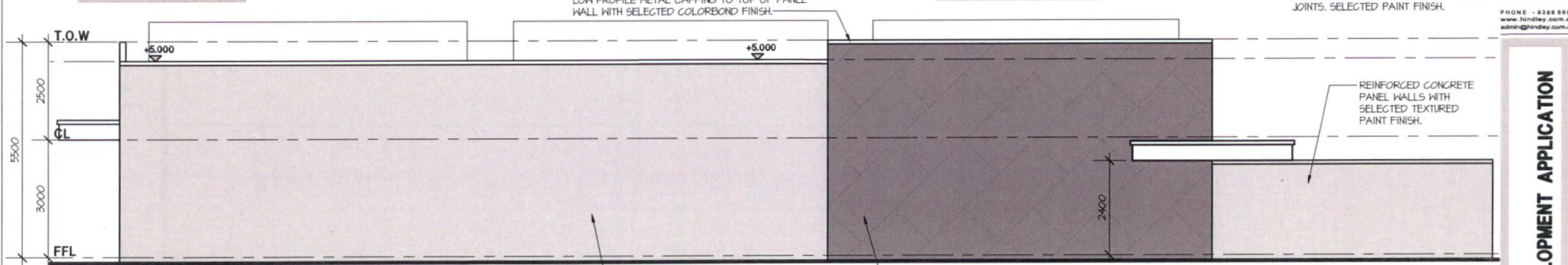


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ELEVATION 6
SCALE 1:100

ELEVATION 7
SCALE 1:100



ELEVATION 8
SCALE 1:100

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Job No.	0258

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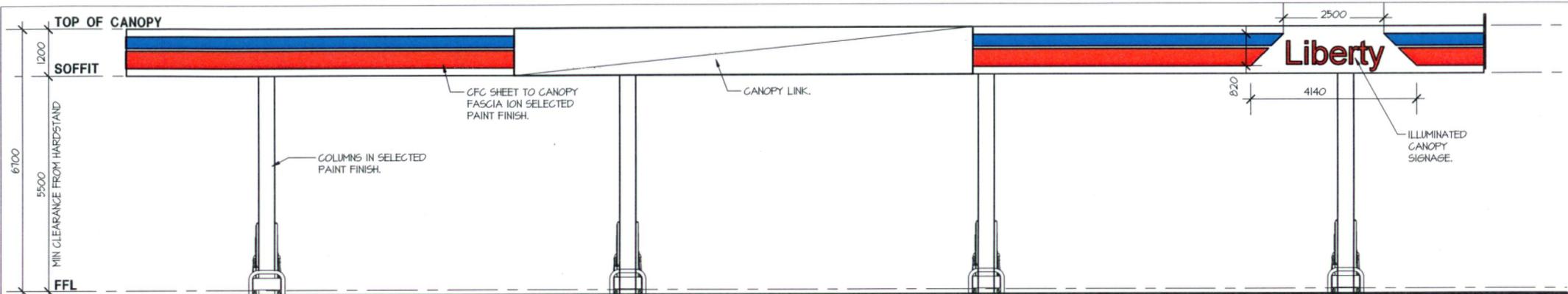
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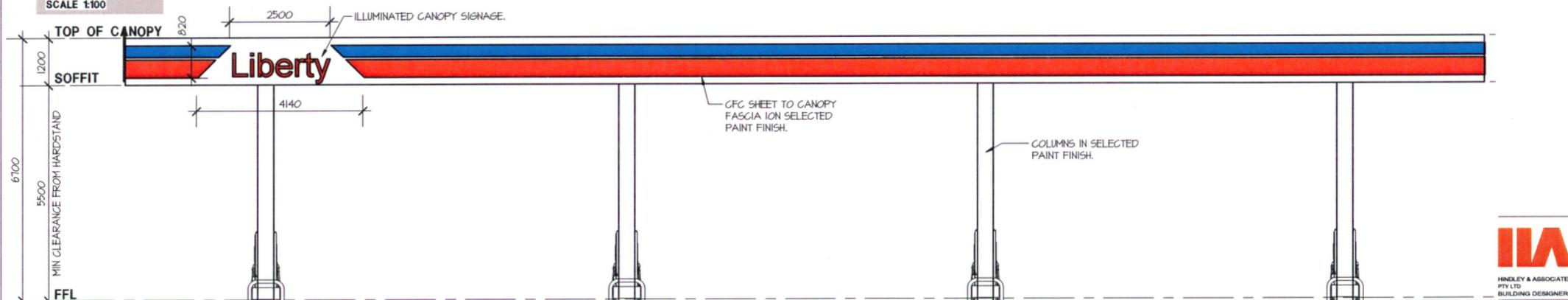
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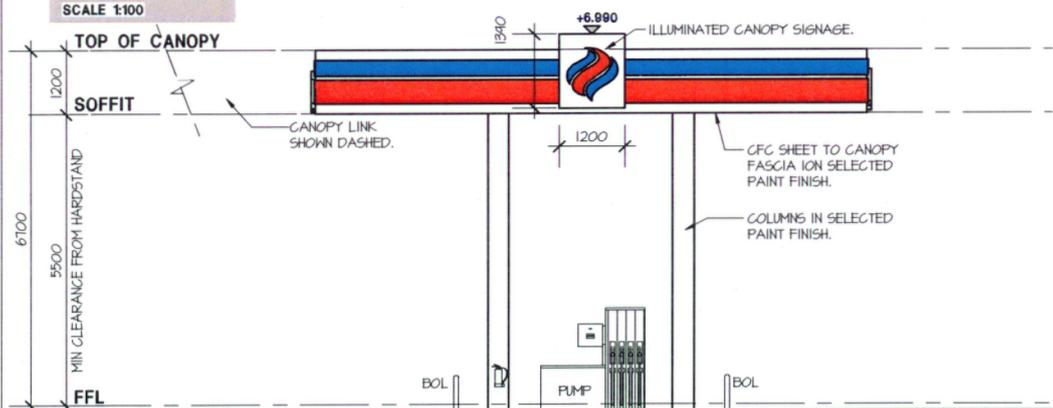
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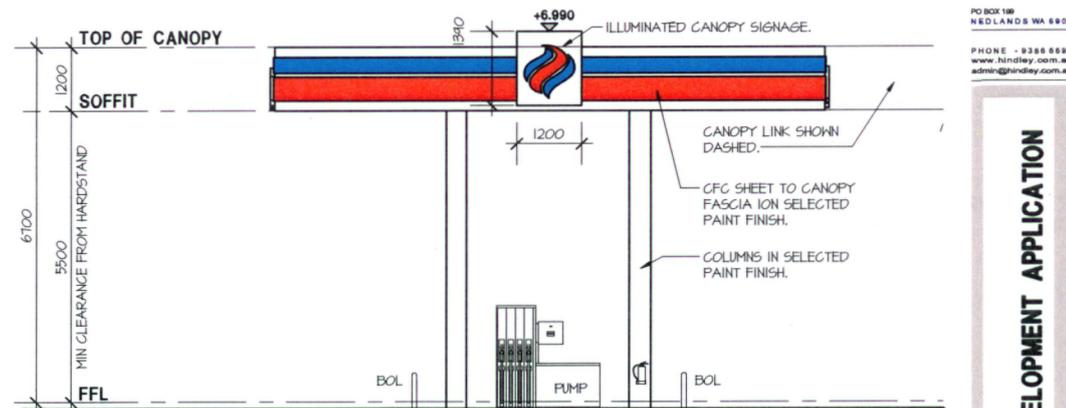
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ELEVATION 11

SCALE 1:100



ELEVATION 12

SCALE 1:100



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Checked	CPH
Scale	1:100
Job No.	0754
Dwg	DA10
Rev	A

Appendix B

Terminology

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

Decibel (dB)

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

A-Weighting

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

Sound Power Level (L_w)

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

Sound Pressure Level (L_p)

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

L_{ASlow}

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

L_{AFast}

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

L_{APeak}

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

L_{Amax}

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

L_{A1}

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

L_{A10}

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

L_{Aeq}

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

L_{A90}

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

One-Third-Octave Band

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

L_{Amax} assigned level

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

L_{A1} assigned level

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

L_{A10} assigned level

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

Tonal Noise

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

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

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

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

This is relatively common in most noise sources.

Modulating Noise

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

a variation in the emission of noise that —

- (a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;
- (b) is present for at least 10% of the representative.

Impulsive Noise

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

a variation in the emission of a noise where the difference between $L_{A \text{ peak}}$ and $L_{A \text{ Max slow}}$ 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.

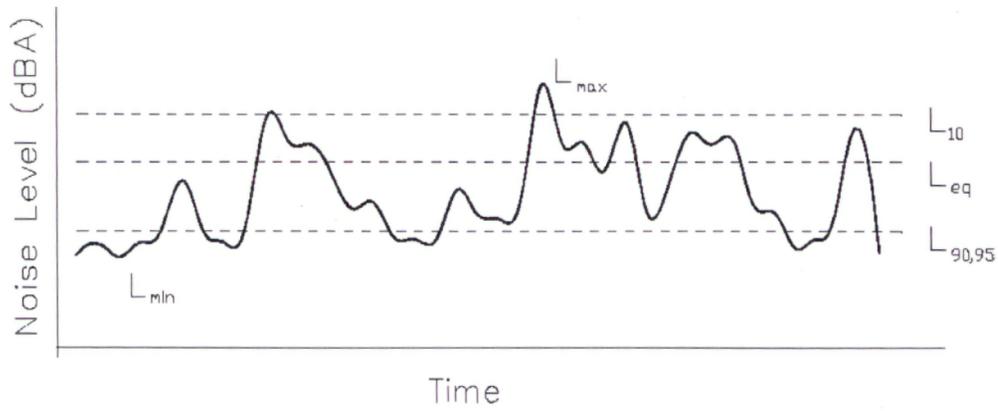
Ambient Noise

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.

Chart of Noise Level Descriptors



Typical Noise Levels

