91-93 Canning Hwy, East Fremantle

Acoustics Report

Development Application

Attention: Saracen Developments Pty Ltd

Date: 14 December 2021

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Ref: 301250644

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	25/10/2021	Draft DA report for Review	JLM	IK
002	14/12/2021	DA Report	JLM	IK

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Executive Summary

Stantec has been appointed by Saracen Developments Pty Ltd to undertake acoustic assessment for the proposed mixed-use development, expected to be located at 91-93 Canning Hwy. The project will see the development of a multi-storey mixed-use development to be located at the above street address in East Fremantle WA 6158.

As part of the development approval process for the mixed-use development, an acoustic assessment has been carried out in order to satisfy the requirements stated in the relevant policies and guidelines applicable to the project. This includes:

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Town of East Fremantle Local Planning Policy 3.1.1
- Town of East Fremantle – Fremantle Port Buffer Development Guidelines
- Australian and New Zealand Standard AS/NZS 2107:2016 - Acoustics – Recommended design sound levels and reverberation times for building interiors (AS2107);
- State Planning Policy 5.4 – Road and Rail Noise 2019 (SPP 5.4); and
- National Construction Code 2019, Building Code of Australia (NCC 2019).

The acoustic criteria derived from the aforementioned documentation forms the basis of acoustic assessment for the project and includes the following acoustic details;

- Applicable criteria for Airborne sound insulation and impact sound isolation between adjoining apartments;
- Internal noise levels resulting from noise intrusion from mechanical services and via the façade due to external sources;
- Noise emissions from the proposed development to the nearest noise sensitive receivers.

Noise Intrusion Assessments

Traffic Corridors

As per the SPP 5.4 requirements, traffic noise assessment has been carried out and the minimum recommended external façade construction has been provided in the form of glazing, roof and wall configurations. The predicted noise levels at the building façades were obtained through the use of the 3D noise modelling software Package, SoundPLAN 8.2.

On-site unattended measurements have been conducted in order to calibrate the sound model.

Tradewinds Bar and Outdoor Courtyard

The nearby venue Tradewinds Hotel Bar and Outdoor courtyard is a restaurant/bar and live music venue located at 59 Canning Hwy East Fremantle. The noise impact from this venue on the project development has been assessed with appropriate façade construction details provided to maintain appropriate internal noise levels.

Fremantle Port

Due to the distance of Fremantle Port to the project site, it was determined that it is unlikely to significantly impact contribute to the noise levels predicted at the façade of the development in comparison to other major noise sources detailed in this report.

It is expected that the facade treatments provided in this report will be more than adequate to mitigate noise from the Port and comply with the built form requirements outlined in the Town of East Fremantle – Fremantle Port Buffer Development Guidelines and consequently the Town of East Fremantle Local Planning Policy 3.1.1.

Façade Glazing

Based on the highest predicted external noise levels, a detailed noise intrusion assessment was carried out. Recommended glazing configurations have been provided as summarized in the table below.

Glazing Reference	Glazing Configuration	$R_w + C_{tr}$
Type – 1	10mm Glass + 12mm air gap + 8.5mm QLam Hush Glass	**40 (44;-4)**
Type – 2	6mm glass + 12mm Air Gap + 12.5mm VLam Hush Glass	**37 (42;-5)**
Type – 3	6mm glass + 12mm air gap + 8.38mm laminated glass	**34 (40;-6)**
Type – 4	6mm glass + 12mm air gap + 6.38mm laminated glass	**32 (38;-6)**
Type – 5	6mm glass + 12mm air gap + 6mm glass	**29 (36;-7)**

SPP5.4 Outdoor Noise Target

SPP5.4 states that developments are to maintain at minimum one outdoor communal area that achieves compliance to the SPP5.4 target outdoor noise levels.

Based on the predicted noise levels from the 3-D sound model, a solid noise wall will be required to be incorporated into the level 12 outdoor lounge area at the location detailed in this report.

Noise walls to be effective are required to be without air gaps or features that would allow sound to be transmitted through the material and is to be at minimum 1.5m high. Typical barrier shall be constructed using materials having a surface density of 15kg/m^2. Example materials include fibre cement sheet or clear Perspex.

Noise Emission Assessments

Ground Floor Cafe

Noise emissions from the ground floor Café tenancy is expected to be compliant to the relevant EPNR assigned noise levels at the closest noise sensitive receivers based on the assumed operating hours and intent of usage of the area.

The tenancy operator is to ensure adequate noise control measures are implemented if noise levels are too loud or considered a nuisance to nearby receivers. The operator should have their own noise management strategy prior to opening of business to the public.

Additionally, noise generated from general conversation is expected to be masked to a degree by ambient noise levels generated from Canning Hwy and Stirling Hwy.

Level 3 Pool

Noise emissions from the pool deck are expected to be compliant to EPNR criteria based on the assumed operating hours and intent of usage of the area. Additionally, the noise generated from general conversation is expected to be masked by ambient noise levels generated from Canning Hwy and Stirling Highway. The pool deck is not to be used during night-time periods (2200 – 0700).

Level 3 Gym

Considering that the gym will be enclosed with mainly glazed elements, it is expected that the noise levels impacting the surrounding noise sensitive receivers will be compliant to the relevant EPNR assigned noise levels.

It is assumed that the Gym will only be used between 0700 – 2200 hours for all days.

Amplified music may be present in the gym. Speakers shall be limited to a sound power level of 80 dB(A) and a sound pressure level of 70-75 dB(A) at the gym façade internally.

Preliminary floor treatments have been provided as provided in this report. Specific details are to be provided once the project develops further into the design stage.

Waste Collection and Service Trucks

Based on the latest architectural layouts, it is expected that service vehicles used for deliveries and waste collection will utilize St Peters Rd which is a Gazetted road.

Therefore, a noise emission assessment from service vehicles operating through this road is not required for the proposed development.

Note that should a loading area for service vehicles be incorporated within the project site, a noise assessment will be required. The acoustic engineer is to be notified should this occur and an acoustic assessment will be conducted with treatments provided where required to achieve compliance to EPNR assigned noise levels at all nearby sensitive receivers.

Mechanical Services and Fire Pump Room

At this stage no information has been provided regarding mechanical service selection. Based on the latest architectural drawings, the following services are expected:

- Mechanical Plant
- Fire Pump Room
- Level 12 and Roof plant decks
- Fans and condensing units serving carpark, commercial and residential tenancies

At this stage no information has been provided regarding mechanical service selection. Typically, this data is not available at the development application phase and review of mechanical equipment is conducted during the design phase prior to the issue of Building Permit.

When mechanical services information has been provided a detailed noise assessment will need to be conducted to ascertain the specific acoustic treatments required.

1. Introduction

1.1 Overview

Stantec has been appointed by Saracen Developments Pty Ltd to undertake acoustic assessment for the proposed mixed-use development, expected to be located at 91-93 Canning Hwy. The project will see the development of a multi-storey mixed-use development to be located at the above street address in East Fremantle WA 6158.

This report presents the key acoustic considerations and criteria pertinent to the project. The criteria will form the basis of the acoustic design for the following areas;

- External noise impacts - Traffic noise impact on the development, Noise from adjoining venues and Fremantle Port noise
- Noise emission from the mechanical equipment servicing the building; and
- Noise emissions from alternative sources such as patrons using the outdoor pool area, waste collection operations and café tenancy.

1.2 Project Layout

The project site is located in East Fremantle with major traffic corridor Stirling Hwy to the East and Canning Hwy to the north. The Tradewinds Hotel is located to the west of the project site, with its associated Restaurant, bar and outdoor courtyard area. The surrounding area is primarily residentially zoned developments with intermittent commercial and mixed-used developments with a 450m radius. Figure 1 below shows the surrounding area of the project location.

Source: Nearmap

Figure 1: Site location and surrounding area

2. Acoustic Criteria

The acoustic criteria presented in this Development Application report are derived from the following documentation;

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Town of East Fremantle Local Planning Policy 3.1.1
- Town of East Fremantle – Fremantle Port Buffer Development Guidelines
- Australian and New Zealand Standard AS/NZS 2107:2016 - Acoustics – Recommended design sound levels and reverberation times for building interiors (AS2107);
- State Planning Policy 5.4 – Road and Rail Noise 2019 (SPP 5.4);
- National Construction Code 2019 Volume 1, Building Code of Australia Class 2, 3 Buildings (NCC 2019);

2.1 Town of East Fremantle Local Planning Policy 3.1.1

The Town of East Fremantle Local Planning Policy 3.1.1 is required to be considered for developments within all applicable Precincts of the Policy Area.

The objectives of the policy are to:

i. To conserve and protect individual residences considered to have significant heritage value;

ii. To provide development and design guidance to landowners wanting to extend or refurbish existing dwellings of heritage significance;

iii. To guide additions to existing dwellings, which do not adversely affect the significance of the dwelling, or of neighbouring heritage places;

iv. To guide new dwellings and additions/alterations to existing dwellings (particularly second storey additions), which are compatible with the character, form and scale of existing residential development in the locality, and harmonise with the existing streetscape; and,

v. To encourage creative design solutions of quality that meet the standards of this Policy, and which enhance the character of the residential precincts and Policy Area.

Fremantle Ports undertook the Fremantle Inner Harbour Definition Study (May 2002), which identified the need for an offsite buffer around the Port. The buffer was determined on a range of potential amenity impacts and risks including noise, odour and public risk.

2.1.1 Town of East Fremantle – Fremantle Port Buffer Development Guidelines

The Town of East Fremantle – Fremantle Port Buffer Development Guidelines has the following objectives:

- To provide clear development guidelines that seek to minimise potential impacts that may arise from the Port.
- Outline clear administrative processes for referral and liaison between the Fremantle Ports and the Town of East Fremantle.

Buffer Areas

The Guidelines identifies Buffer areas surrounding the Harbour which has been determined on the basis of a range of potential amenity impacts and risks including noise, odour and public risk.

Three buffer areas around the Port have been identified: Area 1, Area 2 and Area 3. The policy defines separate land use and built form requirements for each area. The Areas have been illustrated below in Figure 2.

Figure 2: Buffer zone areas within Plympton Precinct

The location of the project site for 91-93 Canning Hwy East Fremantle is located within Area 2. The relevant Risk and Amenity Considerations and built form requirements extracted from the Guidelines are outlined below:

Area 2

Potential Risk and Amenity Considerations

Consideration is given to the following potential impacts:

- Ingress of toxic gases in the event of an incident within the Port,
- Shattering or flying glass as a consequence of explosion within the Port,
- Noise transmission emanating from the Port (attenuation in the order of 30dB(A) is required), and
- Odour.

Built Form Requirements

The following built form requirements shall apply to the following categories of development:

- All residential development other than alterations and additions to existing dwellings.
- All non-residential development other than refurbishment/renovations (not involving a nett increase in floor area) to existing buildings and non-residential change of use proposals.

Within Buffer Area 2, buildings shall be designed to incorporate all of the design and construction features outlined below:

Windows *and Openings*

- Any glass used for windows or other openings shall be laminated safety glass of minimum thickness of 6mm or "double glazed" utilising laminated or toughened safety glass of a minimum thickness of 3mm.
- All safety glass shall be manufactured and installed to an appropriate Australian Standard.

Construction

- Adopt the general principles of quiet house design for residential developments.
- All developments shall incorporate roof insulation.

Note:

Council recognizes that these requirements may not be possible to achieve in the case of the proposals involving some buildings of conservation and heritage significance.

Council may accept alternative built form treatments subject to the applicant satisfactorily demonstrating fulfilment of the potential risk and amenity considerations outlined above. Alternative treatments shall be justified to Council through submission of professionally prepared and certified reports.

Notification and Memorials on Title

- All residential development approvals shall be conditioned in order to require a notification to be placed on title advising of the potential amenity impacts associated with living / working in proximity of the Port.
- In the case of all residential subdivision, Council and Fremantle Ports shall request the Western Australian Planning Commission to support the placing of memorials on new titles advising of the potential amenity impacts associated with living in proximity of the Port.
- Notification and memorial statements shall be as per the standard wording contained in Appendix B.

The proposed development design is to comply with the Built form requirements stated above.

2.2 Environmental Protection (Noise) Regulations 1997

Environmental noise impacts resulting from the noise emissions from the project are addressed through the Environmental Protection Act 1986, with the regulatory requirements detailed in the Environmental Protection (Noise) Regulations 1997 (EPNR).

The EPNR establishes the maximum permissible noise emission levels (assigned levels) to be received at all adjacent noise-sensitive premises during specific periods of the day as a result of the cumulative noise emissions from all sources proposed for the project site. Compliance to relevant noise limits outlined in the EPNR is compulsory.

The EPNR states noise emissions from any premises are considered not to *significantly contribute to* the noise at a receiver if the noise emissions are 5 dB or below the assigned levels.

In brief, the assigned levels are determined by considering of the amount of commercial and industrial zones, as well as main transport corridors and sporting venues surrounding the noise sensitive premises. The assigned levels apply at premises receiving the noise (noise sensitive receiver) and not to areas within the project site or lot. In addition, the Environmental Protection (Noise) Regulations 1997 identify the following in Schedule 3, clause 2A.

"If the land within either of the circles is categorised on the land use map as land in respect of which mixed uses are permitted, the use of that land that results in the highest influencing factor is to be used in the determination of the influencing factor."

The nearest noise sensitive receivers to the project site have been identified as the residential premises located at 8 Sewell St, East Fremantle WA 6158.

Town Planning Scheme No.3 for the Town of East Fremantle and the Town Planning Scheme No.3 for the Town of Fremantle were used to determine the influencing factor.

Traffic data for roads surrounding the nearest noise sensitive receiver were obtained from Main Roads Western Australia (MRWA) on the 10th October 2021. The available traffic data has been presented in Table 1.

Table 1: Traffic count data (MRWA)

Transport Corridors	EPNR Classification [1)]	Average Daily Traffic Volumes					
		2016/17	2017/18	2018/19	2019/20	2020/21	2021/2022
Stirling Hwy (North of Marmion St)	Major Road	27873	30182	29173	-	-	27931
Canning Highway (West of Preston Point Road East Fremantle)	Major Road	28118	26209	24037	-	23318	-

1) As defined by the EPNR. Secondary roads have between 6000-15000 vehicles per day. Major roads have greater than 15000 vehicles per day.

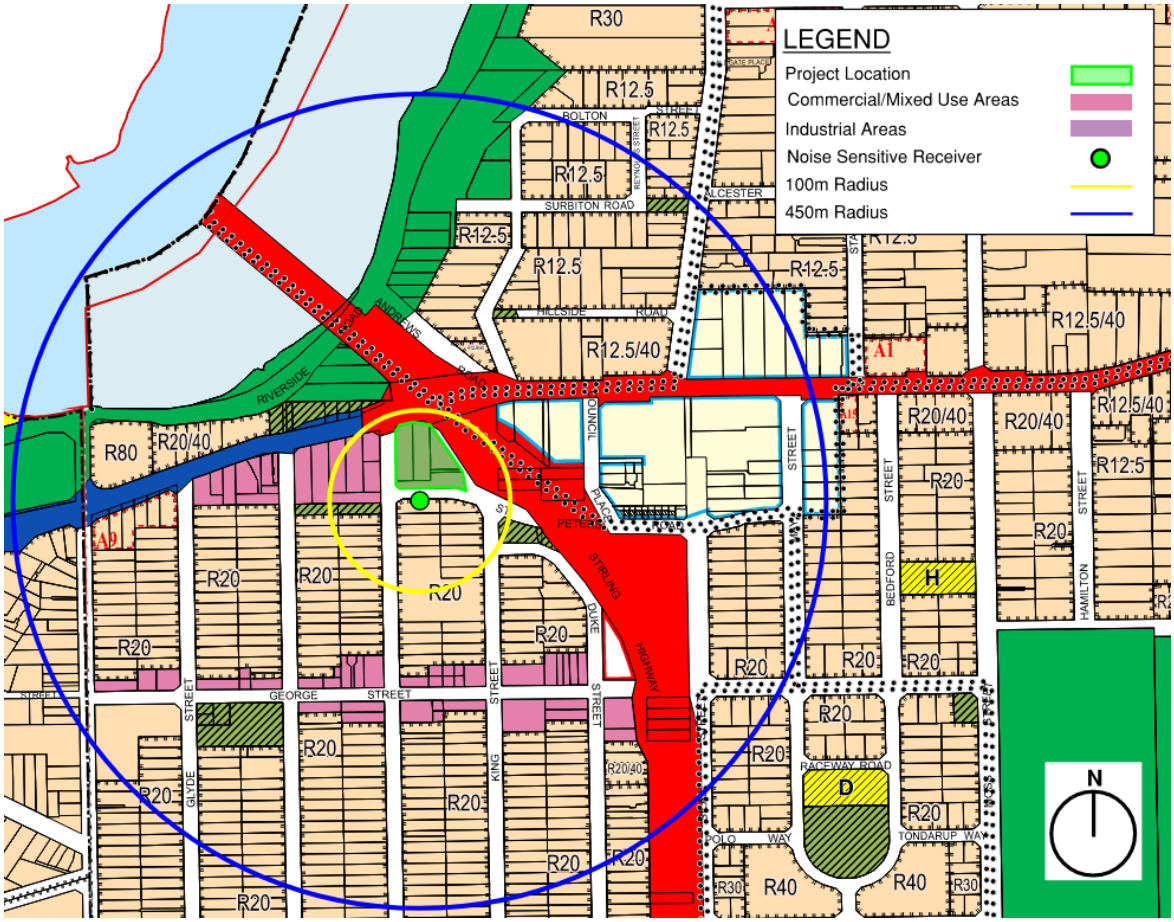
2.2.1 Influencing Factor

The influencing factor for 8 Sewell St, which results from identifying major roads, commercial and industrial areas for nearest noise sensitive receiver is 7 dB, as summarised in Table 2.

Table 2: Influencing factor (IF) noise sensitive receiver

Noise Sensitive Premises	Commercial Zones	Industrial Zones	Transport Corridors	Influencing Factor
8 Sewell St	12 % within a 100 m radius 18 % within a 450 m radius	None	Major road (Canning highway) within 100m radius Major road (Stirling Highway) within a 450m radius	**7 dB**

Figure 3 indicates the land use zones surrounding 8 Sewell St.



Source: Town of Fremantle online mapping system

Figure 3: Zoning map of areas surrounding receiver

2.2.2 Assigned Levels

Table 3 summarises the assigned levels at the nearest noise sensitive premises. It is required that all noise emissions from the development are below the assigned level criteria for all defined periods of the day and at the lot boundary of the receiver or 15m from any associated building.

Table 3: Assigned levels

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: Highly sensitive area	0700 to 1900 hours Monday to Saturday	52	62	72
	0900 to 1900 hours Sunday & public holidays	47	57	72
	1900 to 2200 hours all days	47	57	62
	2200 hours on any day to 0700 hours Monday to Saturday, and 0900 hours Sunday & public holidays	42	52	62

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: any area other than highly sensitive areas	All Hours	60	75	80
Commercial premises	All Hours	60	75	80
Industrial and utility premises	All Hours	65	80	90

2.2.3 Noise Character Adjustments

Regulation 7 states that the noise character must be "free" of annoying characteristics, namely —

1) Tonality, e.g. whining, droning;
2) Modulation, e.g. like a siren; and
3) Impulsiveness, e.g. banging, thumping.

Regulation 9 (1) establishes the methodology for determining noise characteristics. If these characteristics cannot be reasonably and practicably removed, a series of adjustments to the measured levels are required, indicated in Table 4.

Table 4: Noise character adjustment

Adjustment where noise emission is not music these adjustments are cumulative to a maximum of 15 dB			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

The EPNR assigned noise levels only apply at the premises receiving the noise only and not to noise within the project site. It is important that noise emissions from the site do not present any form of tonality, modulation or impulsiveness (defined in the EPNR).

Given the data from mechanical services manufacturers is generally limited to broadband data or in 1/1 octave band value it is not possible to objectively determine tonality, as it is described in the EPNR. 1/3 octave band data is required, yet is typically unavailable. Therefore, a 5 dB penalty shall be conservatively assigned to the noise criteria as indicated in Table 4.

Therefore, a +5 dB correction shall be conservatively assigned when assessing noise emissions from mechanical equipment. In summary, Noise emissions from mechanical equipment shall comply with L_{A10} 42 dB at the nearest noise sensitive receivers.

2.3 State Planning Policy 5.4

The SPP 5.4 establishes the outdoor noise criteria that apply to a noise sensitive land use due to noise emissions from road and rail transport.

The noise criteria provided in Table 5 applies to new noise-sensitive development proposals at 1 m from the most exposed, habitable façade.

Table 5: Noise target criteria for SPP5.4

Proposal	New/Upgrade	Noise Targets		
		Outdoor		Indoor
		Day (L_{Aeq} (Day) dB) (6am - 10 pm)	Night (L_{Aeq} (Night) dB) (10pm - 6am)	L_{Aeq} dB
Noise-Sensitive land-use and/or development	New noise-sensitive land-use and/or development within the trigger distance of an existing/proposed transport corridor	55	50	Day: L_{Aeq} 40 (living and work areas) Night: L_{Aeq} 35 (Bedrooms)

The policy requires outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines.

2.4 Internal Noise Levels

2.4.1 Australian Standard AS2107:2016

The internal noise level criteria detailed in this section are based on the recommendations provided in the Australian / New Zealand Standard AS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (AS 2107:2016).

AS2107 provides recommended internal noise levels (defined as the equivalent continuous A-weighted sound pressure level — $L_{Aeq,t}$) for optimising the acoustic amenity in occupied spaces. The level of noise in an enclosed space typically consists of noise from building services and/or noise intrusion due to external sources (e.g. traffic).

The relevant internal noise level criteria have been outlined in Table 6 below.

Table 6: Recommended internal noise levels from AS2107

Type of occupancy/activity	Recommended design sound level, Leq dB(A)
Residential Buildings – Houses and apartments in inner city areas or entertainment districts or near major roads –	
Sleeping areas (night-time)	35 – 40
Living areas	35 – 45
Common areas (foyer, lift lobby)	45 – 50
General Areas	
Enclosed Carpark	< 65
Washroom and toilets	45 – 55
Cafe	45 – 50
Gym	45 – 50
Commercial tenancy (Office)	40 – 45
Dining Room	40 – 45

The internal noise level criteria in AS2107 recommend continuous equivalent (L_{Aeq}) levels for background noise. This document is a common reference for establishing satisfactory goals for quasi-static mechanical and external traffic noise ingress.

2.5 Sound Transmissions and Insulation — National Construction Code 2019

The acoustic requirements for inter-tenancy walls, floors etc. in residential buildings are outlined in the National Construction Code 2019 Volume 1, Building Code of Australia Class 2, 3 and 9c Buildings (NCC 2019). The acoustic requirements outlined in NCC 2019 are summarised in Table 7.

Table 7: Sound insulation requirements in accordance with NCC 2019

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements
Walls	**Airborne Sound Insulation**		
	Between sole-occupancy units	Minimum $R_w + C_{tr}$ 50	Minimum $D_{nT,w} + C_{tr}$ 45
	Between a sole-occupancy unit and a plant room, lift shaft, stairway corridor, public corridor or the like	Minimum R_w 50	Minimum $D_{nT,w}$ 45
	Impact Sound Insulation		
	Between a laundry, kitchen, bathroom or sanitary compartment in a sole-occupancy unit, and a habitable room in an adjoining unit	Discontinuous construction [1)]	As deemed to satisfy
	Between a sole-occupancy unit and a plant room or lift shaft	Discontinuous construction [1)]	As deemed to satisfy
Floors	**Airborne Sound Insulation**		
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Minimum $R_w + C_{tr}$ 50	Minimum $D_{nT,w} + C_{tr}$ 45
	Impact Sound Insulation		
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Maximum $L_{n,w}$ 62	Maximum $L_{nT,w}$ 62
Services	**Airborne Sound Insulation**		
	Between a habitable room (other than a kitchen) in a sole-occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole-occupancy unit)	Minimum $R_w + C_{tr}$ 40	N/A
	Between a kitchen or non-habitable room in a sole-occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole-occupancy unit	Minimum $R_w + C_{tr}$ 25	N/A
	If a storm water pipe passes through a sole-occupancy unit (habitable room other than kitchen)	Minimum $R_w + C_{tr}$ 40	N/A

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements
	If a storm water pipe passes through a sole-occupancy unit (kitchen or non-habitable room)	Minimum $R_w + C_{tr}$ 25	N/A

1) *For the purposes of this Part, "discontinuous construction" means a wall having a minimum 20 mm cavity between two separate leaves.*

3. Noise Emission Assessment

Noise emissions from the proposed development will be primarily due to the following sources:

- Level 3 Pool and Gym Area;
- Ground Floor Café;
- Service vehicles (Delivery and Waste collection);
- Mechanical services within the development serving the apartment and commercial tenancies; and
- Basement level 1 Fire Pump Room

3.1 Communal Areas

3.1.1 Level 3 Pool and Gym

Based on the latest architectural drawings a pool and gym is proposed to be located on level 3 as shown in Figure 7.

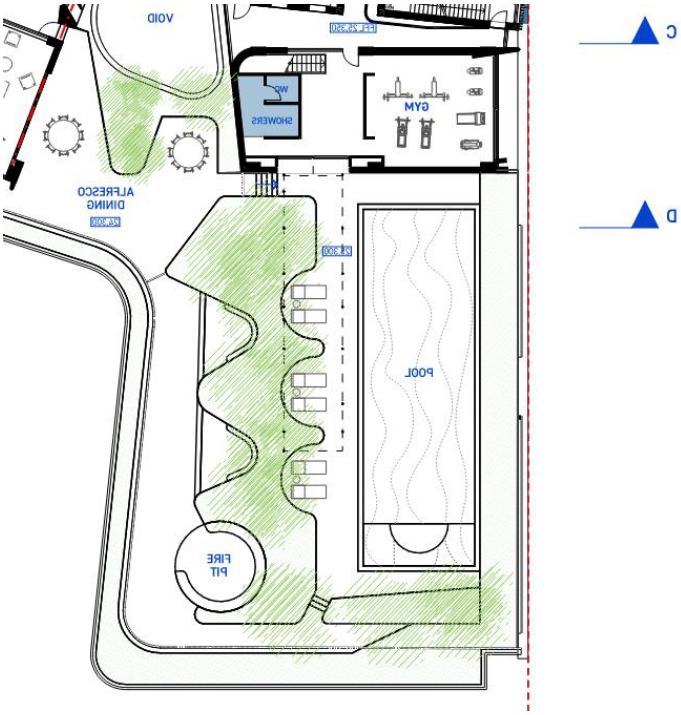


Figure 4: Level 3 Gym and pool areas

3.1.2 Pool

It is assumed that typical operating hours of the pool deck will be between 0700 – 2200 hours for all days.

It is expected that the pool deck will be used by residents and guests only and may typically have 5-10 patrons at any give-time and is not expected to have loud music playing.

Any PA system proposed at the outdoor area to play music will be primarily for background/ambient purposes and must be limited so it is not audible at nearby receivers.

Noise emissions from the pool deck are expected to be compliant to EPNR criteria based on the assumed operating hours and intent of usage of the area. Additionally, the noise generated from general conversation is expected to be masked by

ambient noise levels generated from Canning Hwy and Stirling Highway. The pool deck is not to be used during night-time periods (2200 – 0700).

3.1.3 Gym

At this stage no information has been provided regarding the equipment to be houses within the gym.

It is assumed that the Gymnasium will only be used between 0700 – 2200 hours for all days.

Speakers

Amplified music may be present in the gym. At this stage details regarding the speakers as well as location has not been provided, the noise levels from the speakers shall be limited to a sound power level of 80 dB(A) and a sound pressure level of 70-75 dB(A) at the gym façade internally.

Glazing Recommendation

Considering that the gym will be enclosed with mainly glazed elements, it is expected that the noise levels impacting the surrounding noise sensitive receivers will be compliant to the EPNR regulations criteria as well as the AS2107 with the glazing configurations as per Table 8.

Table 8: Gym External Glazing Requirements

Location	Glazing Configuration	$R_w + C_{tr}$	Spectrum Sound Transmission Loss (dB)						
			63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2kHz	4k Hz
Gym	6mm glass + 12mm Air Gap + 6.38mm laminated glass	**33 (38;-5)**	22	24	24	35	43	44	49

Note: Glazing performance provided for glass only. Overall performance of the glazing system including the frames and seals shall not degrade by more than 3 dB as per the performance requirement stated.

Noise levels transmitted to the apartment above and below shall be designed to meet the internal noise level requirements as per Australian Standard AS2107:2016. It is expected that the gym will incorporate a form of rubberized flooring to mitigate regenerated noise due to vibration generated from usage of gym equipment. Treatment detailed will be provided where necessary to achieve the design internal noise levels for the apartments located above and below.

3.1.4 Ground Floor Café

The latest architectural drawings indicate a café tenancy is proposed to be located on ground floor as shown in Figure 5.

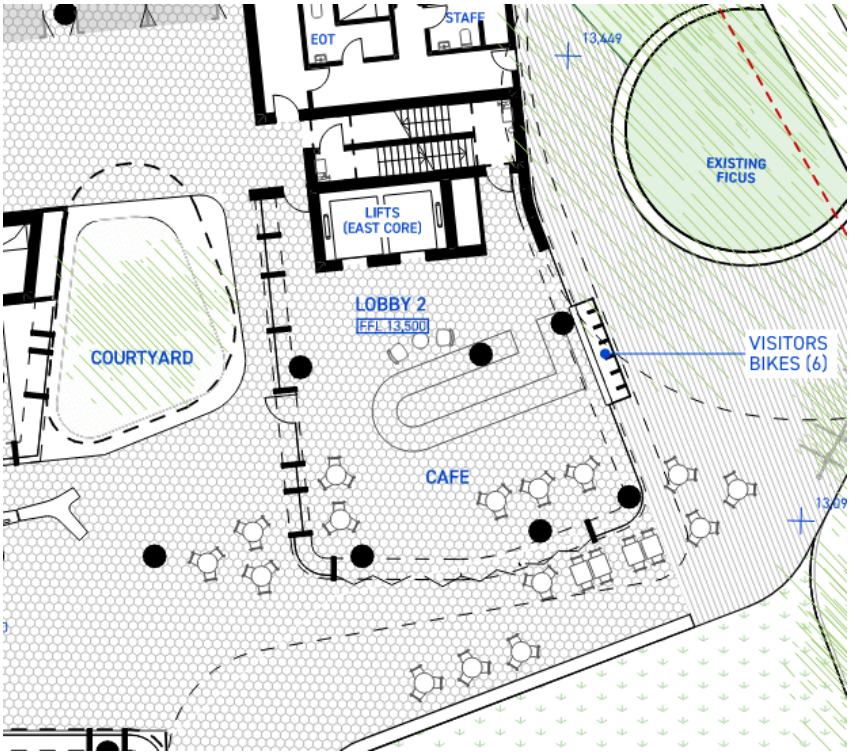


Figure 5: Ground Floor Café

It is assumed that typical operating hours of the Café will be between 0700 – 2200 hours for all days and patronage will primarily be located within the tenancy. It is assumed that the Café will be fully enclosed with operable windows.

It is expected that the Café may typically have 15 – 20 patrons at any given-time and is not expected to have loud music playing.

Any PA system proposed within the Café to play music will be primarily for background/ambient purposes and must be limited so it is not audible at nearby receivers.

Noise emissions from the ground floor Café tenancy is expected to be compliant to the relevant EPNR assigned noise levels at the closest noise sensitive receivers based on the assumed operating hours and intent of usage of the area.

Stantec notes that noise generated from Café type tenancies generally fluctuate depending on the type of ongoing activities, and number of patrons within the tenancy at any given time.

The tenancy operator is to ensure adequate noise control measures are implemented when noise levels are too loud or considered a nuisance to nearby receivers. The operator should have their own noise management strategy prior to opening of business to the public.

Additionally, noise generated from general conversation is expected to be masked to a degree by ambient noise levels generated from Canning Hwy and Stirling Hwy.

3.2 Service Vehicles

Based on the latest architectural layouts, It is assumed that service vehicles will utilize St Peters Rd to make deliveries and for waste collection as shown in Figure 5.

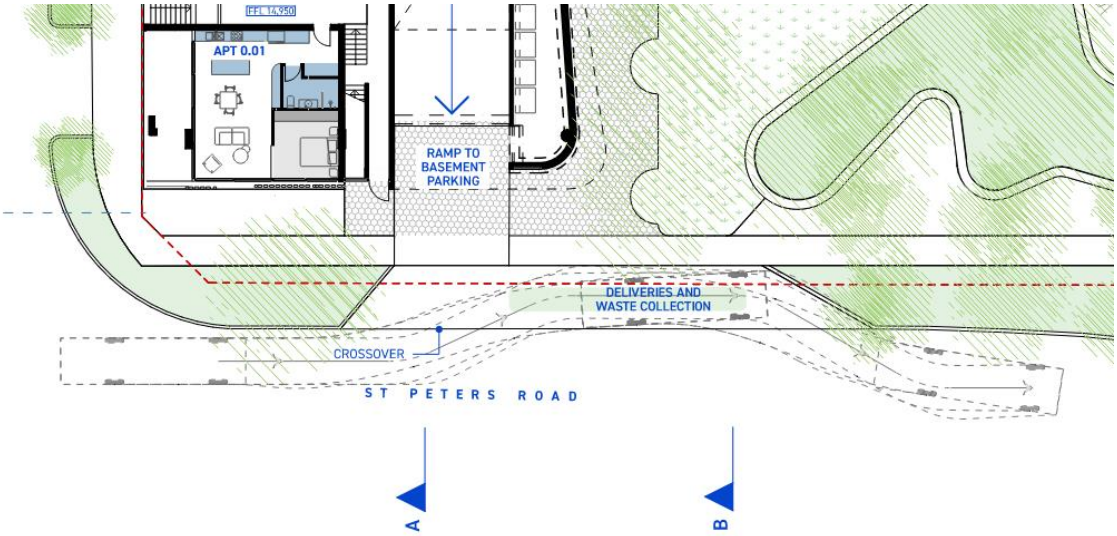


Figure 6: Truck carpark location for delivery and waste collection

St Peters Rd is classified as a Gazetted Road as per the Town of East Fremantle Town Planning Scheme 3 (TPS3).

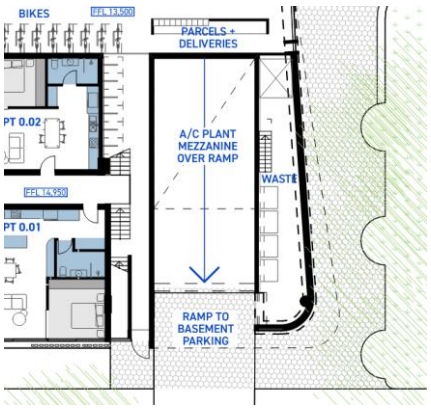
Therefore, a noise emission assessment from service vehicles operating through this road is not required for the proposed development.

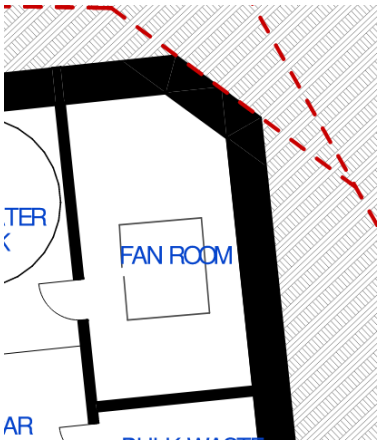
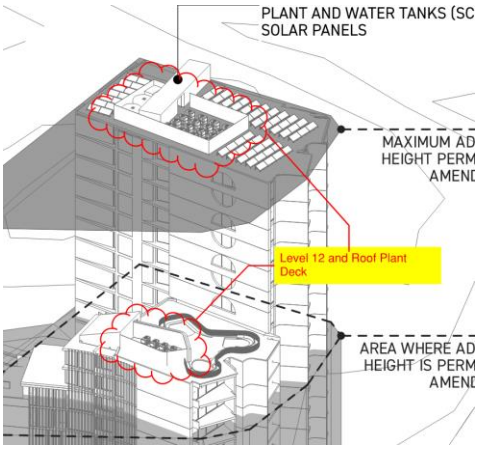
Note that should a loading area for service vehicles be incorporated within the project site, a noise assessment will be required. The acoustic engineer is to be notified should this occur and an acoustic assessment will be conducted with treatments provided where required to achieve compliance to EPNR assigned noise levels at all nearby sensitive receivers.

3.3 Mechanical Services

The following mechanical services are expected based on the latest architectural drawings as summarized below.

Table 9: Expected mechanical services

Mechanical equipment	Location
Mezzanine Mechanical Plant	
FCU's and condensers serving apartments	Location TBC

Mechanical equipment	Location
Basement 1 Fan Room	
Level 12 and Roof plant decks	

Noise emissions from mechanical equipment shall comply with L_{A10} 42 dB at the nearest noise sensitive receiver (8 Sewell St, East Fremantle) with a +5 dB penalty to be conservatively been applied to account for the likely presence of sound tonality.

At this stage no information has been provided regarding mechanical service selection. Typically, this data is not available at the development application phase and review of mechanical equipment is conducted during the design phase prior to the issue of Building Permit.

When mechanical services information has been provided a detailed noise assessment will need to be conducted to ascertain the specific acoustic treatments required.

3.4 Fire Pump room

Based on the latest architectural drawings a fire pump room is proposed to be located in the level 1 Basement as shown in (Figure 7).

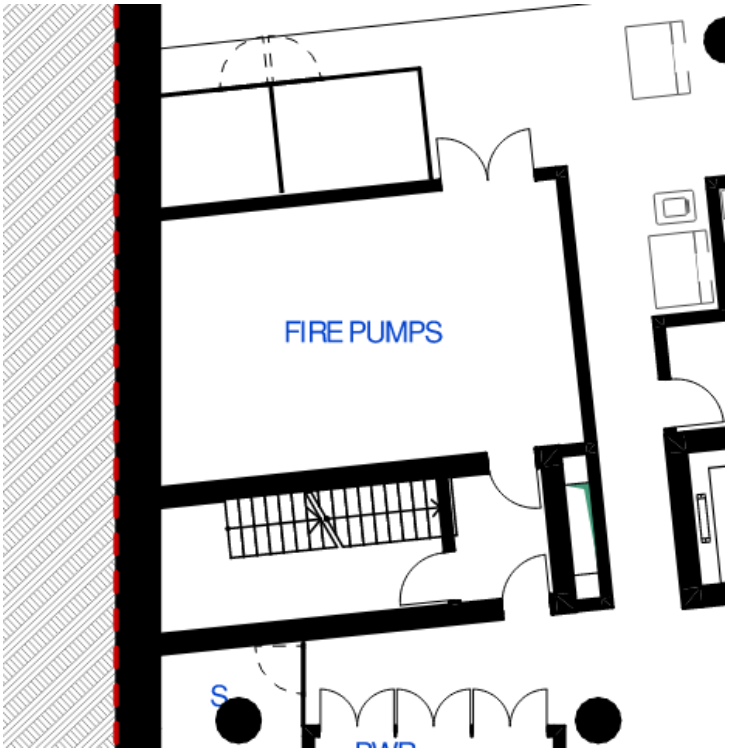


Figure 7: Basement level 1 Fire Pump Room

At this stage no information has been provided regarding fire pump model. When this information becomes available an acoustic assessment will be conducted to ensure compliance to the relevant EPNR assigned noise levels are achieved at all nearest noise sensitive receivers.

4. Site Survey

4.1 Measurement Methodology

4.1.1 Measurement Locations

As per the requirements of SPP5.4, long term unattended noise measurements were undertaken to establish the surrounding acoustic environment and for use in calibrating the sound model.

measurements were conducted between 1st November 2021 to 4th November 2021 at the location shown in Figure 8.

Source: Nearmap

Figure 8: Measurement locations

4.1.2 Equipment Details

Unattended measurements have been conducted using instrumentation equivalent to an integrating sound level meter equipped with one octave and one-third octave band filters, and an omni-directional condenser microphone. All instrumentation meets Type 1 specifications as per ANSI S1.4 and ANSI S1.43.

The sound level meter was calibrated by an authorised NATA (National Association of Testing Authorities) laboratory less than 2 years ago and have successfully passed all AS 1259 and AS/NZS 4476 standards and specifications.

The time constant for the RMS detector were set to a slow response (1 sec) for all measurements on all sound level meters. The sound level meter was calibrated before and after the measurement session using a Type 1 acoustic calibrator. The calibrator was also calibrated less than 2 years ago, and is in compliance with AS IEC 60942-2004.

A complete schedule of all equipment used during for acoustic measurements is provided in Table 10. A copy of calibration certificates for the relevant instrumentation may be provided upon request.

Table 10: Equipment and Calibration Details

Manufacturer / Model	Serial Number
Brüel & Kjær 4231 - Calibrator	3005155
NTi XL2 – Sound Level Meter	A2A-14416-E0

4.2 Noise Measurement Summary

Long term unattended noise measurements were undertaken to establish the surrounding acoustic environment at position shown in Figure 8. Weather data from Bureau of Meteorology from Perth was used and was compared against the conditions defined by Main Roads WA. The data impacted due to adverse meteorological conditions has been excluded in the calculation of any relevant noise parameters used for the purposes of this acoustic assessment.

The noise levels obtained from the unattended noise measurements have been provided in Appendix B.

5. Noise Intrusion Assessment

The main sources of noise considered in the noise intrusion assessment are as follows:

- Road traffic noise from Stirling Highway and Canning Hwy
- Venue noise from
  - Tradewinds Hotel Bar & Courtyard

5.1 Traffic Noise Impact

5.1.1 Assessment Methodology

Noise Modelling was undertaken in accordance with SPP 5.4 to determine road traffic noise impacts affecting the project site.

Detailed methodology and assessment specifications are detailed in the SPP 5.4 *Road and Rail Noise Guidelines September 2019* (referred to as the Guidelines in the remainder of this report). Sound PLAN v8.2 (3D noise modelling software) was used to simulate noise emissions expected from road transport corridors and, subsequently, to determine noise levels 1 metre from the façade as well as external noise sensitive areas.

The noise modelling checklist used in the following assessment as provided by SPP5.4 has been given in Appendix B.

5.1.2 Noise Source Inputs

Topography

Topographical and elevation data for the project site and surrounding areas was based on data imported and modelled from data obtained from the Intergovernmental Committee on Surveying and Mapping online database. The model was calibrated using the latest satellite imagery obtained from Nearmap.

Ground Absorption

To suit the current conditions of the project location, a ground condition of 0.6 has been used in the model, which is in between a soft ground condition (1) and a reflective ground condition (0).

Road Traffic

The road traffic noise assessment has been conducted based on the methodology described by the Calculation of Road Traffic Noise algorithm (CoRTN, UK Transport Agency).

The CoRTN algorithm has been developed to calculate $L_{A10,18hr}$ noise levels. However, SPP5.4 requires road noise assessments to be based upon the energy averaged $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ noise descriptors for the daytime and night-time respectively. Conversions are applied using the method outlined in the DEFRA publication, *"Method for Converting the UK Road Traffic Noise Index $L_{A10,18hour}$ to the EU Noise Indices for Road Noise Mapping."*

This algorithm considers the following parameters;

- Traffic volume during each period of the day, and for current and future scenarios;
- Average traffic speeds;
- Height of each individual noise source (passenger vehicles, heavy vehicles – engine and exhaust);
- Percentage of heavy vehicles; and
- Gradient and surface of road.

Road traffic noise source heights were incorporated into the noise model in accordance to the description detailed by the Guidelines. The modelled heights of vehicle "strings" are provided below;

- Passenger vehicles: + 0.5 m
- Heavy vehicles — Engine noise: + 1.5 m
- Heavy vehicles — Exhaust: + 3.6 m

The Main Roads Traffic Modelling Branch was contacted on the 6th October (Contact Thomas Ng) and has provided traffic count and projection data for the surrounding Major transport corridors: Stirling Hwy and Canning Hwy. These have been provided in the form of a ROM24 2016 validation plot and 2016 and 2041 link volume plots. Validation and link volume plots used have been provided in Appendix D.

Historical hourly traffic volumes provided on the MRWA website were used to determine the proportion of vehicles during the day and night along transit Stirling Hwy and Canning Hwy.

SPP 5.4 requires all noise assessments to consider changes in traffic volumes expected over the next 20 years.

Based on the data provided by Mainroads, the following traffic count and heavy vehicle growth rates have been calculated for each major transport corridor summarised in Table 11. Observed traffic count volumes were used as source inputs to model and assess a worst-case scenario.

Table 11: Major Transport Corridor Growth Rates

Major Transport Corridor	Overall Traffic count growth rate, %/y	Heavy vehicle Percentage growth rate, %/y
Stirling Hwy (North of Marmion St)	3	-1.8
Canning Highway (West of Preston Point Road East Fremantle)	1.7	0
Canning Highway (East of East St)	2.5	-1.8

Table 12 summarises the current and future predicted traffic volumes used in the assessment model.

Table 12: Current and Predicted Future Traffic Volumes

Road	Assessment Year	Predicted Daily Vehicle Volume	Day time 1) vehicle volume per hour	Night-time 1) vehicle volume per hour	Heavy Vehicle Percentage	Mean Speed
Stirling Hwy (North of Marmion St)	Current - 2021	27931	1653	186	13 % - Day	60 km/h
					16 % - Night	
	Future - 2041	46700	2763	311	9 % - Day	
					11 % - Night	
		30601	1837	151	8 % - Day	

Road	Assessment Year	Predicted Daily Vehicle Volume	Day time [1] vehicle volume per hour	Night-time [1] vehicle volume per hour	Heavy Vehicle Percentage	Mean Speed
Canning Highway (West of Preston Point Road East Fremantle)	Current - 2021				9 % - Night	
	Future - 2041	41600	2497	206	8 % - Day	
					9 % - Night	
Canning Highway (East of East St)	Current - 2021	14047	884	67	10 % - Day	
					13 % - Night	
	Future - 2041	27200	1635	130	7 % - Day	
					9 % - Night	

1) Day time period refers to 0600 AM – 2200 PM. Night-time refers to 2200 PM – 0600 AM.

Noise Logging Data Calibration

The noise logging data obtained as per Section 4 was viewed as acceptable with no major disturbances. Based on this, the average L_{Aeq} noise levels during day and night time periods were used to calibrate the traffic noise source within the 3D model. The average noise measured during day and night time has been summarised in Table 13:

Table 13: Average Measured Noise Levels ($L_{eq,T}$)

Reference	Time	L_{Aeq} dB(A)
001	Day 07:00 AM to 22:00 PM	71
	Night 22:00 PM to 07:00 AM	63

The noise model was calibrated based on the on-site noise measurements. An appropriate correction factor was implemented into the sound model to calibrate the model.

5.1.3 Noise Modelling Results

Road traffic noise impact for the future year (2041) predicted the highest external noise levels for the day and night-time periods to be at the following façade location(s):

- North-Eastern Façade, Day-time scenario; **76dB(A)**
- North-Eastern Façade, Night-time scenario; **67dB(A)**

Coloured noise maps are provided in Appendix E. The majority of the predicted noise levels at the façade are above the 'noise target' values in SPP5.4. Therefore, acoustic treatments are required to achieve compliance.

5.1.4 Outdoor Areas

Note that SPP5.4 states that developments are to maintain at minimum one outdoor communal area that achieves compliance to the SPP5.4 target outdoor noise levels.

The latest architectural drawings indicate a communal outdoor area will be located on level 12 as shown in Figure 9.

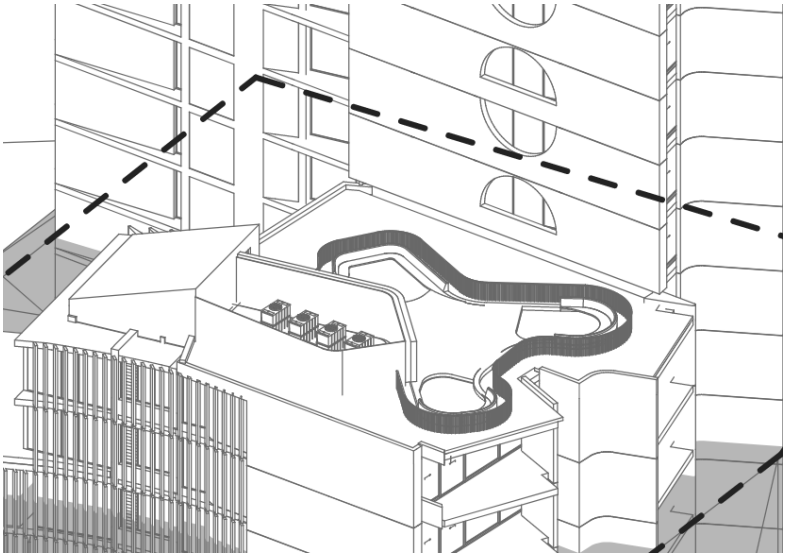


Figure 9: Communal level 12 outdoor lounge terrace

Based on the predicted noise levels from the 3-D sound model, noise levels are exceeding the outdoor noise target within the level 12 outdoor area during day-time and night-time periods for the future scenario (2041).

To achieve compliance to a solid noise wall will be required to be incorporated into the design at the location shown in Figure 10.

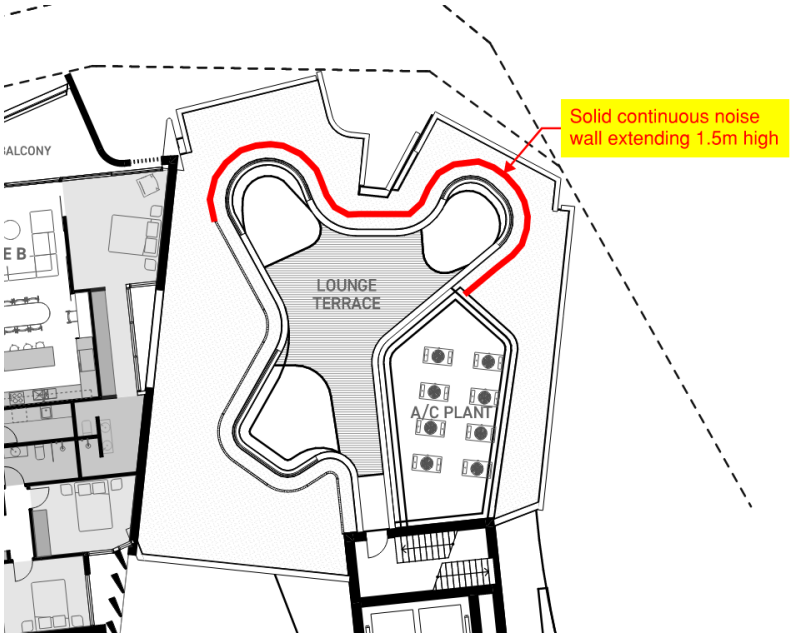


Figure 10: Communal level 12 outdoor lounge terrace noise wall location

Noise walls to be effective are required to be without air gaps or features that would allow sound to be transmitted through the material and is to be at minimum 1.5m high. Typical barrier shall be constructed using materials having a surface density of 15kg/m^2. Example materials include fibre cement sheet or clear Perspex.

A noise contour has been provided in Appendix E.

5.2 Tradewinds Hotel (Bar and Courtyard)

As shown in Figure 1, the Tradewinds Hotel Restaurant, Bar and outdoor courtyard is located west of the project site boundary approximately 40-45m away. The venue includes an enclosed restaurant/bar and an outdoor area expected to have live music.

The sound model established in this report has been used to determine the predicted noise levels at the façade of the project development.

Operating Hours

Based on the Tradewinds Hotel Bar and Courtyard website, the opening hours of the venue are as follows:

- Mon – Sun 0630 – late

Patron Noise Levels

Patron activity in the outdoor courtyard area of the Tradewinds Hotel is expected to have noise impact on the nearest noise sensitive receiver. Expected noise levels from patrons have been determined based on;

- Technical research paper "Prediction of Noise from Small to Medium Sized Crowds", (Hayne et al., Nov 2011, *Proceedings of Acoustics*, Conference Gold Coast Australia, pp. 133-140); and
- Consensus reached by Members of the Australian Acoustical Society (Western Australian Division) in the technical meeting (Mar 2016) on the topic of "Crowd Noise Sound Power Level for Alfresco Areas / Beer Gardens."

Considering that the data contained in the study done by Hayne et. Al has been viewed by many acoustic professionals as an over-prediction of sound power levels, the following equation has been used in order to predict a more reasonable overall noise level of the patrons:

- L_{A10} Sound Power Level = 15 log N + 64 dB(A)

The sound power level of a crowd that may gather at the outdoor area of the venue has been summarised in Table 14. It has been assumed that a maximum of 400 patrons may occupy the outdoor area at any given time based on the size of the area.

Table 14: Crowd noise level (Tradewinds Hotel Bar and Courtyard outdoor area)

Noise Source	Sound Power Level, L_{A10} dB(A)	Octave Band Spectrum Noise Level (dB)					
		250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Crowd of 400 patrons in the outdoor area	**103**	96	93	96	97	97	96

The noise source used for the patrons was the area source parameter in order to replicate an evenly distributed noise source across the outdoor areas. The noise source was positioned at a height of 1.5 m (i.e. assuming midpoint height of standing and seated patrons).

Amplified Music Noise Levels

Amplified music is expected to be present in the Courtyard area of the venue. Typical sound data for speakers used in entertainment venues have been incorporated in the model to replicate what the noise impact of the outdoor courtyard area will be with amplified music being present.

Multiple speaker positions have been modelled in order to determine the most ideal location. Four speakers positioned to within the courtyard area have been assumed.

Speakers have been modelled as point sources a height of 3m above ground and at least 0.5m away from any nearby façade.

It is expected that, the type of music that will be played within the courtyard establishment will mainly be contemporary or pop music. The sound spectrum data used for the speaker generally reflects the type of music that is expected to be played within the outdoor backyard area, and has been summarised in Table 15.

Table 15: Sound Power Levels for Speaker

Noise Source	Sound Power Level, L_{Aeq} dB(A)	Octave Band Spectrum Noise Level (dB)					
		250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
JBL AW 266 Speaker(1)	**80**	67	71	72	73	73	75

1) Sound spectrum obtained from SoundPLAN 8.2 system library (JBL – AW 266, 12" 2 – way rotatable horn all weather loudspeaker).

Results

The highest noise levels predicted at the façade of the project development has been summarised below:

- Western Façade – **55 dB(A)**

5.3 Fremantle Port

The Fremantle Port has also been identified as a potential noise source that may impact the proposed development. Considering the distance between the port and the project site (approximately 750m away) in comparison to the Major traffic corridors and nearby entertainment venue, it is highly unlikely that the noise levels generated from the port will significantly impact the project site.

As per the Town of East Fremantle – Fremantle Port Buffer Development Guidelines, it is expected that the distance between the port and the project site will be adequate to achieve the 30dB(A) noise attenuation required.

It is expected that the treatments provided in Section 6 will comply with the built form requirements outlined LPP3.1.1.

5.4 Results and discussion

Based on the predicted noise levels at the façade generated from major traffic corridors, the Tradewinds Hotel Bar and Outdoor courtyard, noise intrusion calculations have been conducted to assess against the highest noise levels at each façade orientation to determine appropriate external wall, glazing and roof configurations. Recommendations in the following section have been provided to achieve compliance to most stringent internal noise criteria for each respective space.

6. External Envelope

Noise intrusion calculations were undertaken following the methodology described in British Standard BS EN 12354:2000 and by utilizing the worst case (i.e. highest predicted) noise levels predicted at each façade to determine suitable glazing to achieve the required internal noise levels. Appropriate corrections were applied to the linear spectral noise levels to compensate for potential losses due to flanking paths and façade correction.

6.1 External Wall

The noise intrusion has been calculated for all façade elements, which is relative to their surface area.

Stantec recommends solid wall elements have a minimum performance of $R_w + C_{tr}$ 40 - 45. The proposed construction is typical in achieving the required performance:

1) 110mm Concrete Panel; OR

2) 110mm brick work + 50mm air gap + 90mm brickwork

Alternative construction material may be used to achieve the required performance. This will, however, require review and approval of the Acoustic Engineer.

Where lightweight construction is proposed, this will result in reduced acoustic performance specifically in the lower frequencies. As a result, this may have some impact on the recommended glazing types. The following constructions are recommended if lightweight walls are to be used (Table 16), to ensure compliance with the recommended internal noise levels for residential units as specified in SPP 5.4.

Table 16: Lightweight External Wall Configurations

<table>
<tr><th>Façade Orientation</th><th>Floor Level</th><th>Airborne Sound Insulation Performance ($R_w + C_{tr}$)</th><th>Configuration</th></tr>
<tr><td>Northern</td><td>All Floors</td><td rowspan="3">> 55</td><td rowspan="3">Two rows of 64mm studs at 600mm centres with –
• Minimum 20mm air gap between studs;
• Min. 100mm thick glasswool insulation (min. density 14kg/m^3) positioned between row of studs; and
- Two layers 13mm thick sound rated plasterboard fixed to one side of the row of studs; and
- Two layers 9mm thick Compressed fibre cement to the other side</td></tr>
<tr><td>North-West</td><td>All Floors</td></tr>
<tr><td>Eastern façade</td><td>Ground floor – Floor 11</td></tr>
<tr><td colspan="2">All other façade orientations</td><td>40 - 45</td><td>One row of 92mm studs at 600mm centres with –
• Min. 100mm thick glasswool insulation (min. density 14kg/m^3) positioned between row of studs;
• One-layer 9mm fibre cement sheet to outside face; and
• Two layers 13mm thick fire rated plasterboard fixed to the other side of the row of studs</td></tr>
</table>

6.2 Glazing

Glazing systems and entryway elements typically provide lower airborne sound insulation performance than external walls, forming weak acoustic links in the building envelope.

To satisfy internal noise level design targets, glazed elements located at the façades are determined based on the composite sound reduction index (i.e. the combined sound insulation performance of all façade elements relative to their surface area).

Glazing types for each noise sensitive space located at each façade of the proposed development have been comparatively assessed against the noise levels detailed in this report. The table below provides the glazing performance and proposed locations required to satisfy internal noise level design targets.

The performance ratings outlined in Table 17 are required for compliance to internal noise level design targets and apply to the glazing system as a whole (i.e. frame, seals and window hardware), with a maximum allowable deviation of 2-3dB only.

Table 17: Glazing configuration

Glazing Reference	Glazing Configuration	$R_w + C_{tr}$
Type – 1	10mm Glass + 12mm air gap + 8.5mm QLam Hush Glass	**40 (44;-4)**
Type – 2	6mm glass + 12mm Air Gap + 12.5mm VLam Hush Glass	**37 (42;-5)**
Type – 3	6mm glass + 12mm air gap + 8.38mm laminated glass	**34 (40;-6)**
Type – 4	6mm glass + 12mm air gap + 6.38mm laminated glass	**32 (38;-6)**
Type – 5	6mm glass + 12mm air gap + 6mm glass	**29 (36;-7)**

Note: Glazing performance provided for glass only. Overall performance of the glazing system including the frames and seals shall not degrade by more than 3 dB as per the performance requirement stated.

Refer to Appendix G for locations of glazing configurations in Table 17.

6.2.1 Commercial Tenancies

As discussed with the client, it is expected that the commercial tenancies proposed within the development are expected to be office tenancies. To achieve the recommended internal noise levels compliant to AS2107, these areas are recommended to implement the following glazing construction as detailed in Table 18.

Table 18: Commercial tenancies (GF – Level 2) External Glazing Requirements

Location	Glazing Configuration
Commercial Tenancies (Offices)	6mm glass + 12mm Air Gap + 12.5mm VLam Hush Glass

Note: Glazing performance provided for glass only. Overall performance of the glazing system including the frames and seals shall not degrade by more than 3 dB as per the performance requirement stated.

Refer to Appendix G for locations of glazing configurations in Table 18.

6.3 Roof Construction

Roof construction should be adequately designed to control external noise intrusion from noise sources identified in this report to satisfactorily provide internal noise levels which are compliant with the criteria established in Section 2.4.

The following roof configuration is expected to achieve the above objectives:

One layer of Colorbond sheet metal or similar (0.42 mm); and

3) 75 mm thick high-density Anticon insulation hard-fixed to the underside of roof and over steel purlins;

4) Min. 50 mm thick glasswool insulation (min. 11kg/m^3) one layer of 13 mm standard plasterboard.

Where concrete is proposed, a minimum 150-200mm thick slab is typically adequate.

7. Conclusion

As part of the development approval process for the 91-93 Canning Hwy project, an acoustic assessment has been carried out as detailed in this report.

Traffic noise assessment has been carried out as per the SPP 5.4 and the minimum recommended external façade construction has been provided in the form of glazing and wall configurations. The predicted noise levels at the building façades were obtained through the use of the 3D noise modelling software Package, SoundPLAN 8.2. On-site unattended measurements have been conducted in order to calibrate the model.

The nearby Tradewinds Hotel Bar and outdoor courtyard has been identified as an external noise source and façade element recommendations have considered the noise generated from this venue on the project development.

Façade recommendations have been provided to achieve compliance to the most stringent indoor noise criteria stated in AS2107 and SPP 5.4 guidelines.

Due to the distance of Fremantle Port to the project site, it was determined that it is unlikely to significantly impact contribute to the noise levels predicted at the façade of the development in comparison to other major noise sources detailed in this report. It is expected that the facade treatments provided in this report will be more than adequate to mitigate noise from the Port and comply with the built form requirements outlined in Town of East Fremantle Local Planning Policy 3.1.1.

7.1 Future Works

Note that the following items will be required to be assessed as the design progresses further into the design phases of the project:

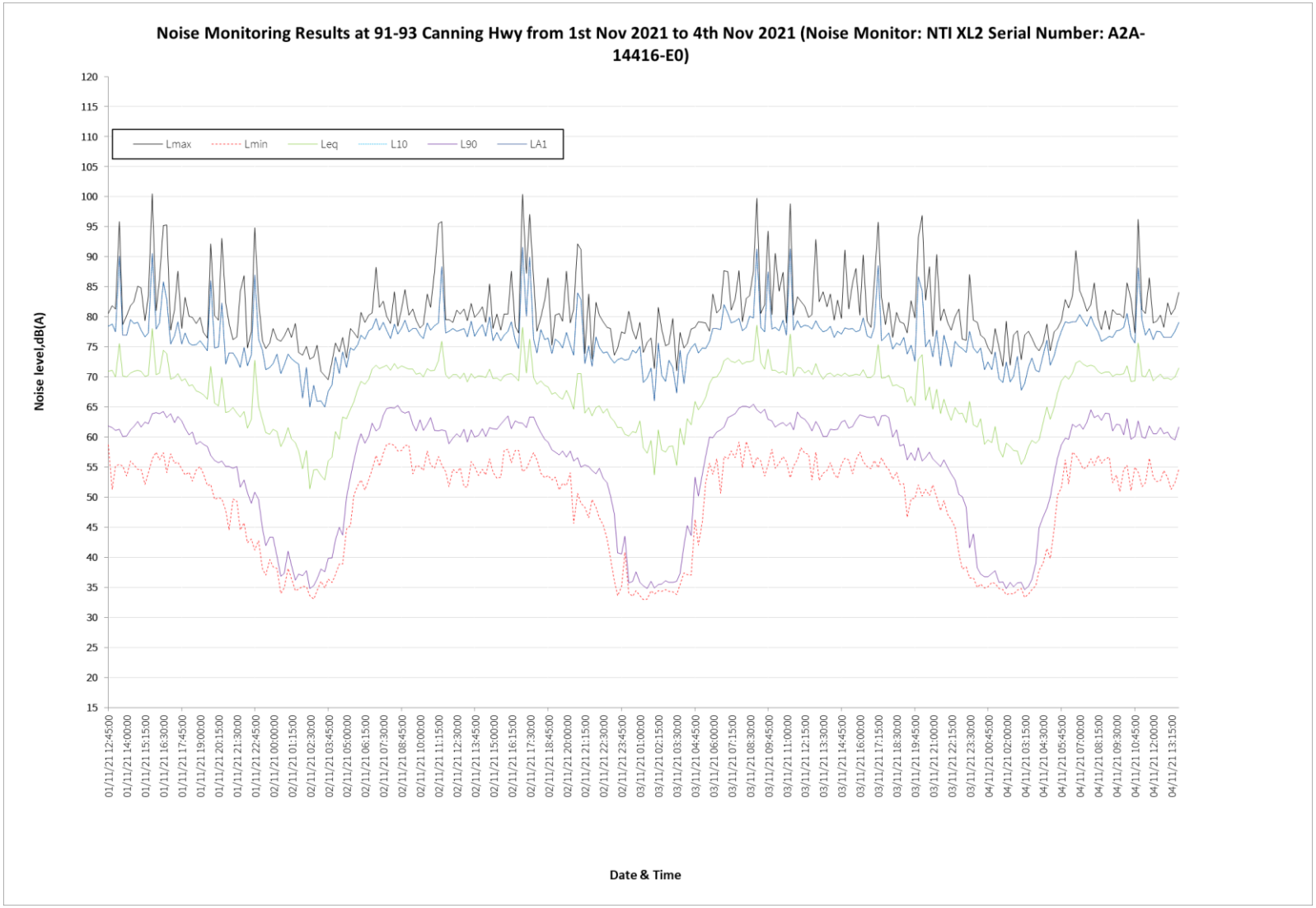
- Level 12 and Roof Mechanical Plant
    - At this stage no information has been provided regarding mechanical service selection. Typically, this data is not available at the development application phase and review of mechanical equipment is conducted during the design phase prior to the issue of Building Permit.
    - When mechanical services information has been provided a detailed noise assessment will need to be conducted to ascertain the specific acoustic treatments required.
- Fire Pump Room
    - At this stage no information has been provided regarding fire pump model. When this information becomes available an acoustic assessment will be conducted to ensure compliance to the relevant EPNR assigned noise levels are achieved at all nearest noise sensitive receivers.
- Internal Architectural Acoustics
    - Intertenancy wall and floor construction between tenancies to achieve compliance to the respective NCC ratings to be provided

Appendix A Glossary of Acoustic Terms

NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

Appendix B Unattended Noise Measurement Data



Appendix C Noise Modelling Checklist

Checklist item		Action
Road traffic input data		
Road name	**Stirling Hwy (North of Marmion St) 2021/22**	
	16-hr daytime road traffic volume	26445
	Percentage of heavy vehicles (daytime)	13
	8-hr night-time road traffic volume	1486
	Percentage of heavy vehicles (night-time)	16
Road pavement	Dense grade Asphalt	
Road traffic heights	Have the road emissions sources been modelled at the following heights?	
	Light and heavy vehicle tyre-road height at +0.5 m	Y
	Heavy vehicle engine height at +1.5 m	Y
	Heavy vehicle exhaust height at +3.6 m	Y
Traffic speed	What is the modelled road posted (signal) traffic speed?	60 km/h

Checklist item		Action
Road traffic input data		
Road name	**Canning Highway (West of Preston Point Road East Fremantle) 20/2021**	
	16-hr daytime road traffic volume	22395
	Percentage of heavy vehicles (daytime)	8
	8-hr night-time road traffic volume	923
	Percentage of heavy vehicles (night-time)	9
Road pavement	Dense grade Asphalt	
Road traffic heights	Have the road emissions sources been modelled at the following heights?	
	Light and heavy vehicle tyre-road height at +0.5 m	Y
	Heavy vehicle engine height at +1.5 m	Y
	Heavy vehicle exhaust height at +3.6 m	Y
Traffic speed	What is the modelled road posted (signal) traffic speed?	60 km/h

Checklist item		Action
Road traffic input data		
Road name	**Canning Highway (East of East St) 2020/21**	
	16-hr daytime road traffic volume	10500
	Percentage of heavy vehicles (daytime)	10
	8-hr night-time road traffic volume	416
	Percentage of heavy vehicles (night-time)	13
Road pavement	Dense grade Asphalt	
Road traffic heights	Have the road emissions sources been modelled at the following heights?	
	Light and heavy vehicle tyre-road height at +0.5 m	Y
	Heavy vehicle engine height at +1.5 m	Y
	Heavy vehicle exhaust height at +3.6 m	Y
Traffic speed	What is the modelled road posted (signal) traffic speed?	60 km/h

Noise prediction corrections			
Traffic emission	If using the Calculation of Road Traffic Noise algorithms, have the following corrections been applied?		
	-0.8 dB correction to heavy vehicle engine emission?		Y
	-8.0 dB correction to the heavy vehicle exhaust emission?		Y
Road pavement	Has one of the following corrections been applied to the tyre/road emission?		Y
	14 mm chip seal	+3.5 dB	
	10 mm chip seal	+2.5 dB	
	5 mm chip seal	+1.5 dB	
	Dense graded asphalt	0.0 dB	Y
	Novachip	-0.2 dB	
	Stone mastic asphalt	-1.5 dB	
	Open graded asphalt	-2.5 dB	
Australian traffic	Has a -1.7 dB Australian Road Research correction or reasonable equivalent applied?		Y
Receptor façade	Has a +2.5 dB building façade correction been applied?		Y

Road noise barriers		
Noise barriers	Have noise barriers been modelled as being fully reflective?	N
	If noise barriers have not been modelled as being fully reflective, have absorptive barrier designs been considered?	N

Appendix D Mainroads Validation and Link Volume plots

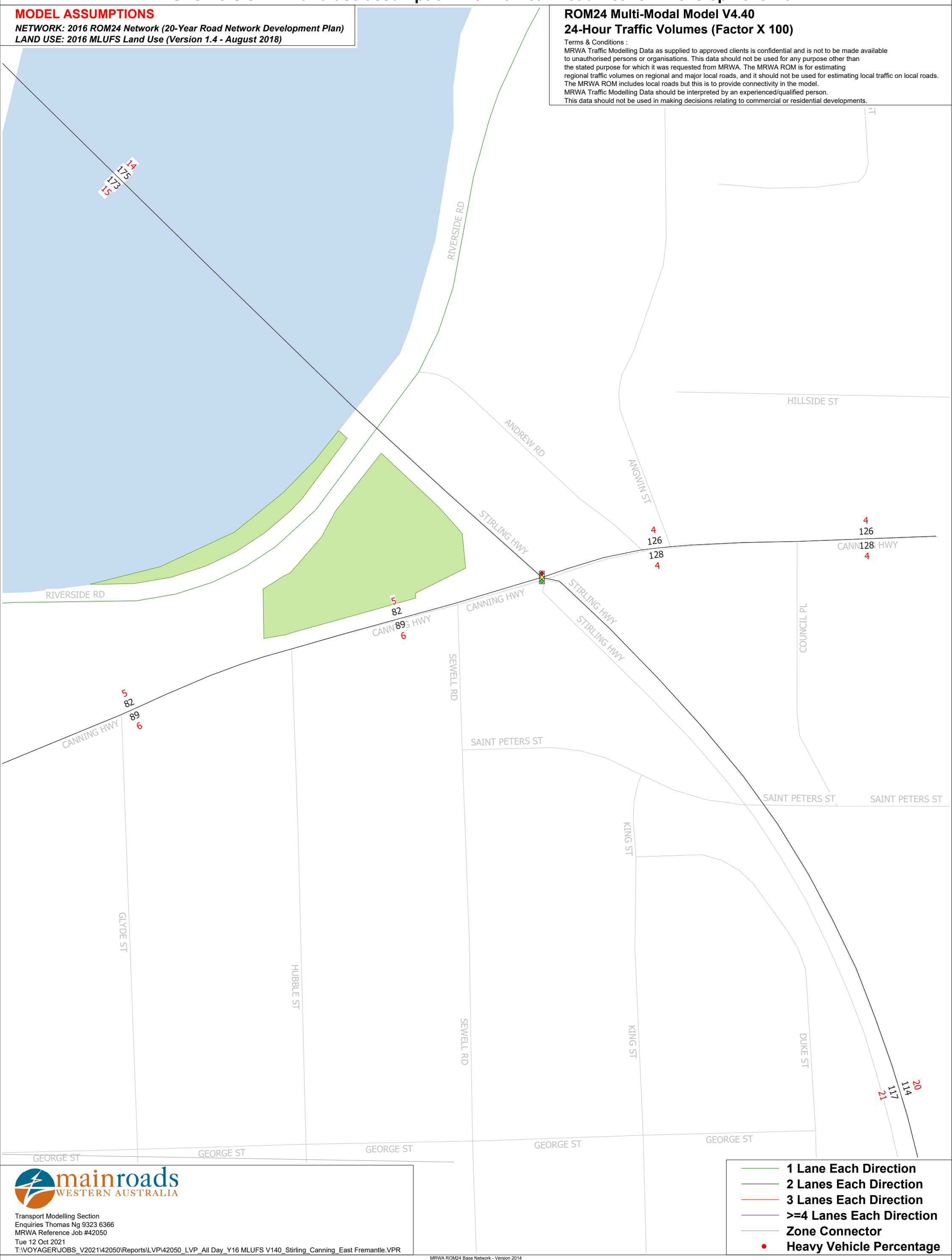
2016 ROM24 Scenario - Link Volume Plot for Stirling Hwy and Canning Hwy, East Fremantle Noise Assessment
All Day
MLUFS Version 1.4 land use assumption with 20-Year Road Network Development Plan

MODEL ASSUMPTIONS

NETWORK: 2016 ROM24 Network (20-Year Road Network Development Plan)
LAND USE: 2016 MLUFS Land Use (Version 1.4 - August 2018)

ROM24 Multi-Modal Model V4.40
24-Hour Traffic Volumes (Factor X 100)

Terms & Conditions :
MRWA Traffic Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations. This data should not be used for any purpose other than the stated purpose for which it was requested from MRWA. The MRWA ROM is for estimating regional traffic volumes on regional and major local roads, and it should not be used for estimating local traffic on local roads. The MRWA ROM includes local roads but this is to provide connectivity in the model.
MRWA Traffic Modelling Data should be interpreted by an experienced/qualified person.
This data should not be used in making decisions relating to commercial or residential developments.



mainroads WESTERN AUSTRALIA

Transport Modelling Section
Enquiries Thomas Ng 9323 6366
MRWA Reference Job #42050
Tue 12 Oct 2021
T:\VOYAGER\JOBS_V2021\42050\Reports\LVP\42050_LVP_All Day_Y16 MLUFS V140_Stirling_Canning_East Fremantle.VPR

- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- >=4 Lanes Each Direction
- Zone Connector
- Heavy Vehicle Percentage

MRWA ROM24 Base Network - Version 2014
MRWA Transport Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations

cube

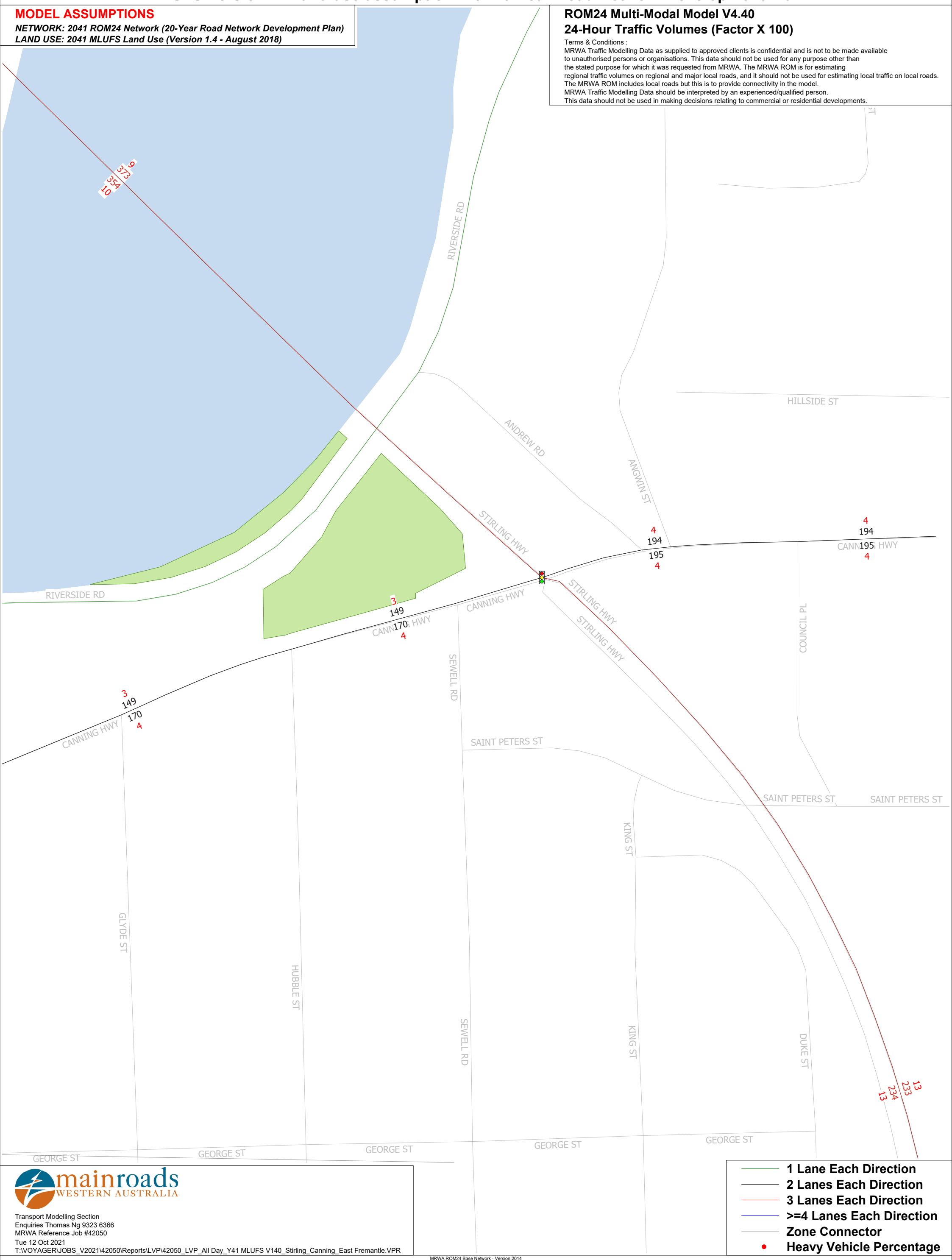
2041 ROM24 Scenario - Link Volume Plot for Stirling Hwy and Canning Hwy, East Fremantle Noise Assessment
All Day
MLUFS Version 1.4 land use assumption with 20-Year Road Network Development Plan

MODEL ASSUMPTIONS

NETWORK: 2041 ROM24 Network (20-Year Road Network Development Plan)
LAND USE: 2041 MLUFS Land Use (Version 1.4 - August 2018)

ROM24 Multi-Modal Model V4.40
24-Hour Traffic Volumes (Factor X 100)

Terms & Conditions :
MRWA Traffic Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations. This data should not be used for any purpose other than the stated purpose for which it was requested from MRWA. The MRWA ROM is for estimating regional traffic volumes on regional and major local roads, and it should not be used for estimating local traffic on local roads. The MRWA ROM includes local roads but this is to provide connectivity in the model.
MRWA Traffic Modelling Data should be interpreted by an experienced/qualified person.
This data should not be used in making decisions relating to commercial or residential developments.



1 Lane Each Direction
2 Lanes Each Direction
3 Lanes Each Direction
>=4 Lanes Each Direction
Zone Connector
Heavy Vehicle Percentage

mainroads WESTERN AUSTRALIA

Transport Modelling Section
Enquiries Thomas Ng 9323 6366
MRWA Reference Job #42050
Tue 12 Oct 2021
T:\VOYAGER\JOBS_V2021\42050\Reports\LVP\42050_LVP_All Day_Y41 MLUFS V140_Stirling_Canning_East Fremantle.VPR

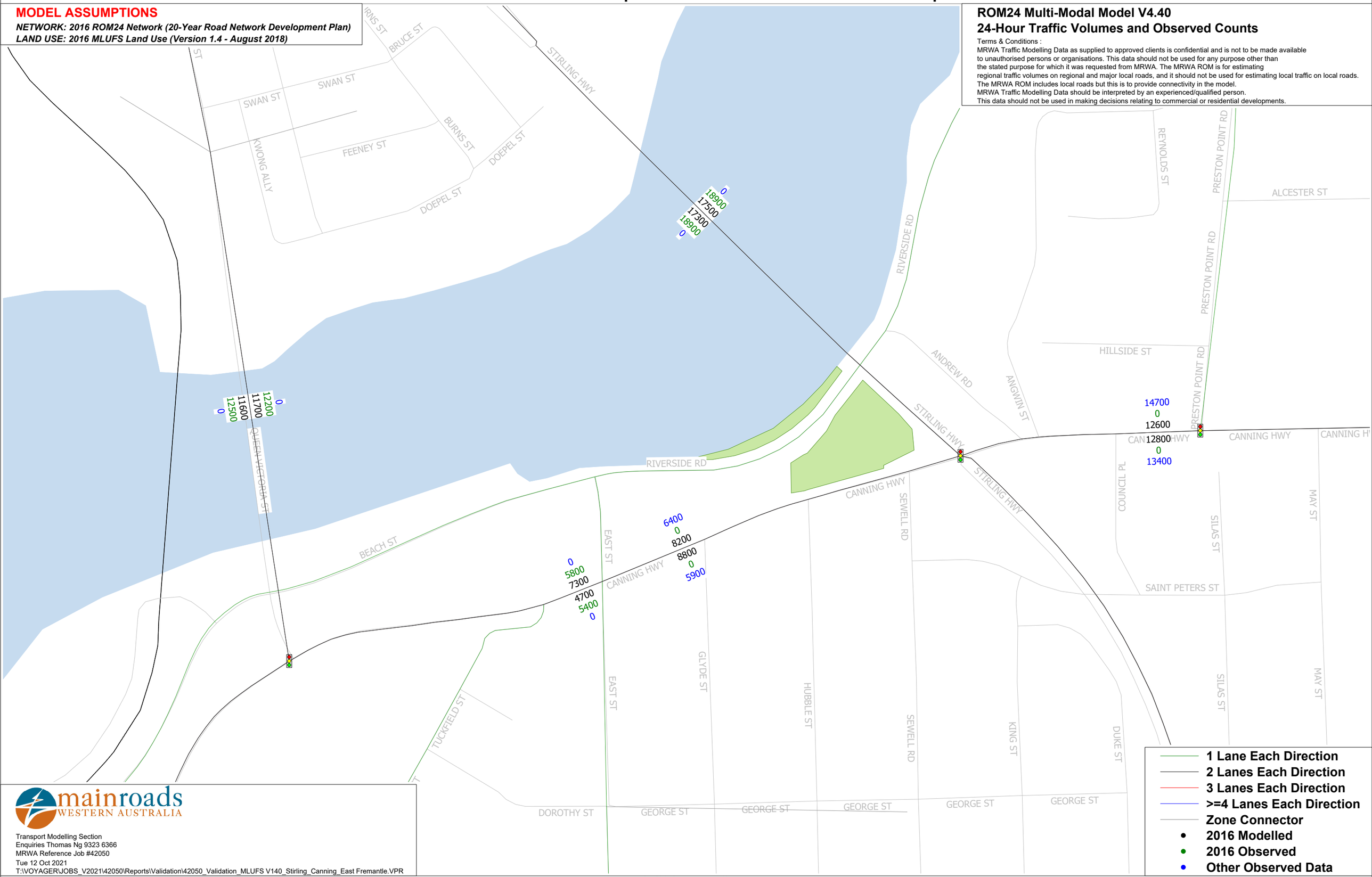
2016 ROM24 Scenario - Validation Plot for Stirling Hwy and Canning Hwy, East Fremantle Noise Assessment
All Day
MLUFS Version 1.4 land use assumption with 20-Year Road Network Development Plan

MODEL ASSUMPTIONS

NETWORK: 2016 ROM24 Network (20-Year Road Network Development Plan)
LAND USE: 2016 MLUFS Land Use (Version 1.4 - August 2018)

ROM24 Multi-Modal Model V4.40
24-Hour Traffic Volumes and Observed Counts

Terms & Conditions :
MRWA Traffic Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations. This data should not be used for any purpose other than the stated purpose for which it was requested from MRWA. The MRWA ROM is for estimating regional traffic volumes on regional and major local roads, and it should not be used for estimating local traffic on local roads. The MRWA ROM includes local roads but this is to provide connectivity in the model. MRWA Traffic Modelling Data should be interpreted by an experienced/qualified person. This data should not be used in making decisions relating to commercial or residential developments.



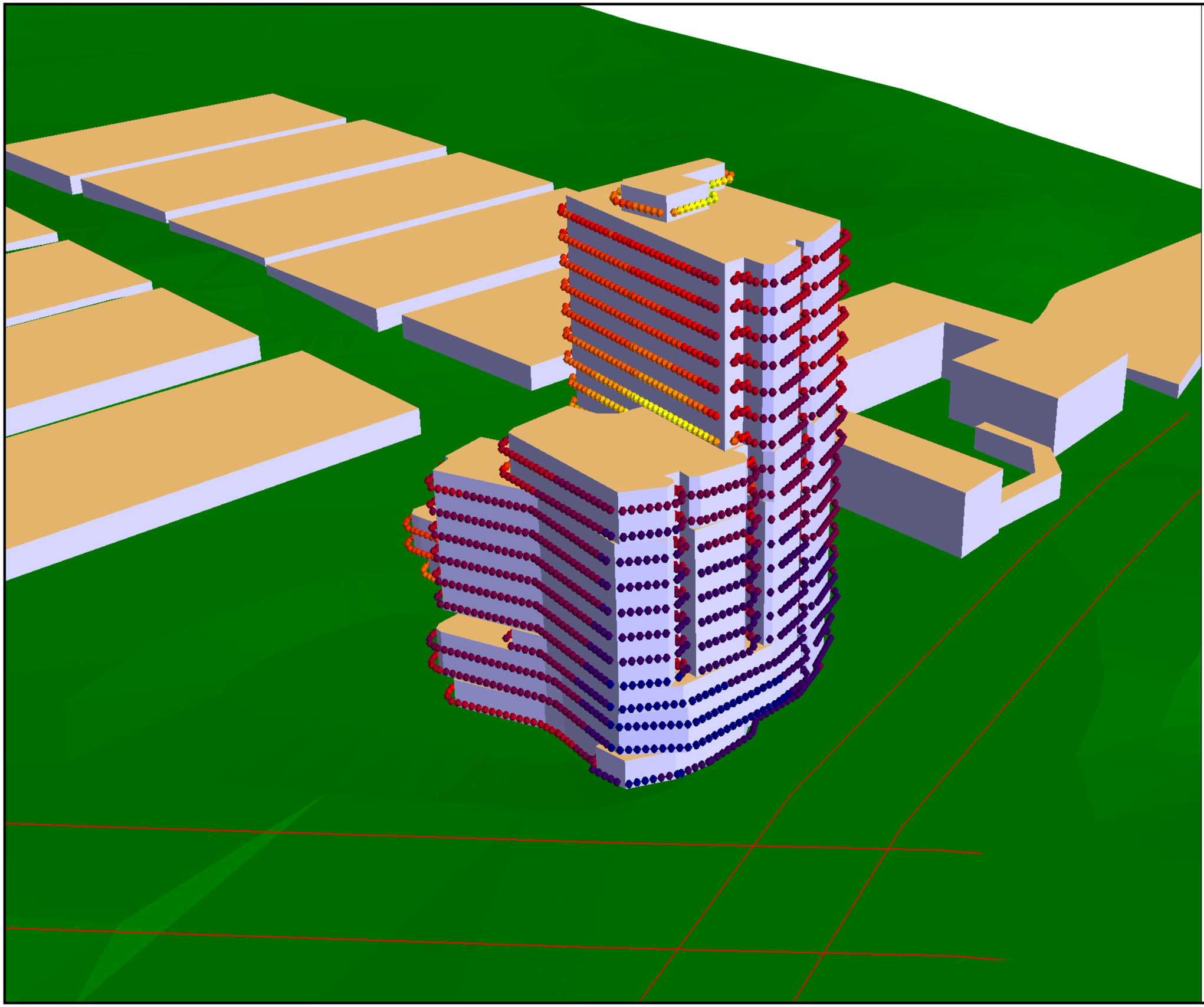
1 Lane Each Direction
2 Lanes Each Direction
3 Lanes Each Direction
>=4 Lanes Each Direction
Zone Connector
2016 Modelled
2016 Observed
Other Observed Data

mainroads WESTERN AUSTRALIA

Transport Modelling Section
Enquiries Thomas Ng 9323 6366

MRWA Reference Job #42050
Tue 12 Oct 2021
T:\VOYAGER\JOBS_V2021\42050\Reports\Validation\42050_Validation_MLUFS V140_Stirling_Canning_East Fremantle.VPR

Appendix E Traffic Noise Contours



91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

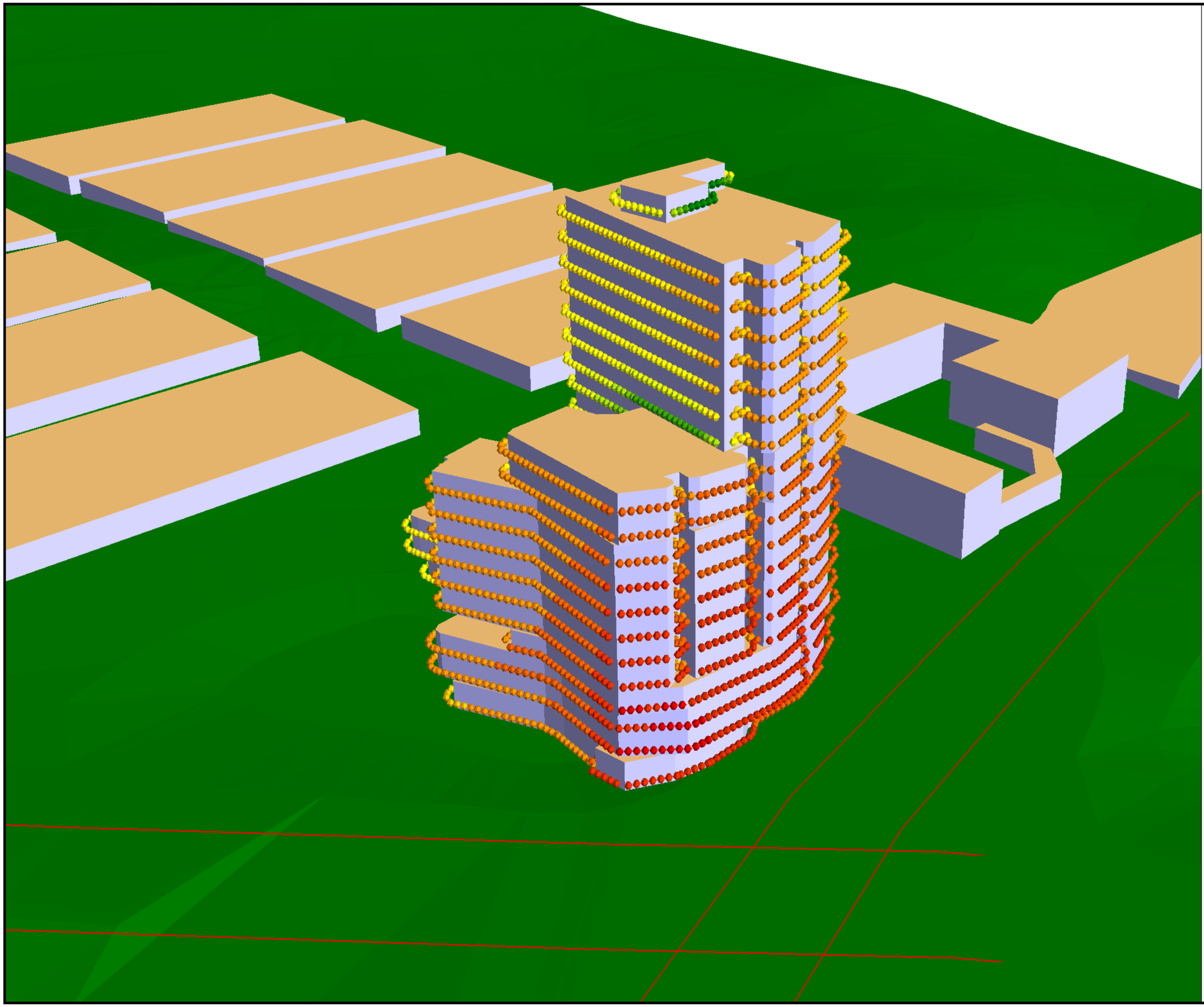
FACADE NOISE
CONTOUR (NORTH - EAST)

Noise level
in dB(A)

	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	

0 3 6 9 12

Stantec



91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

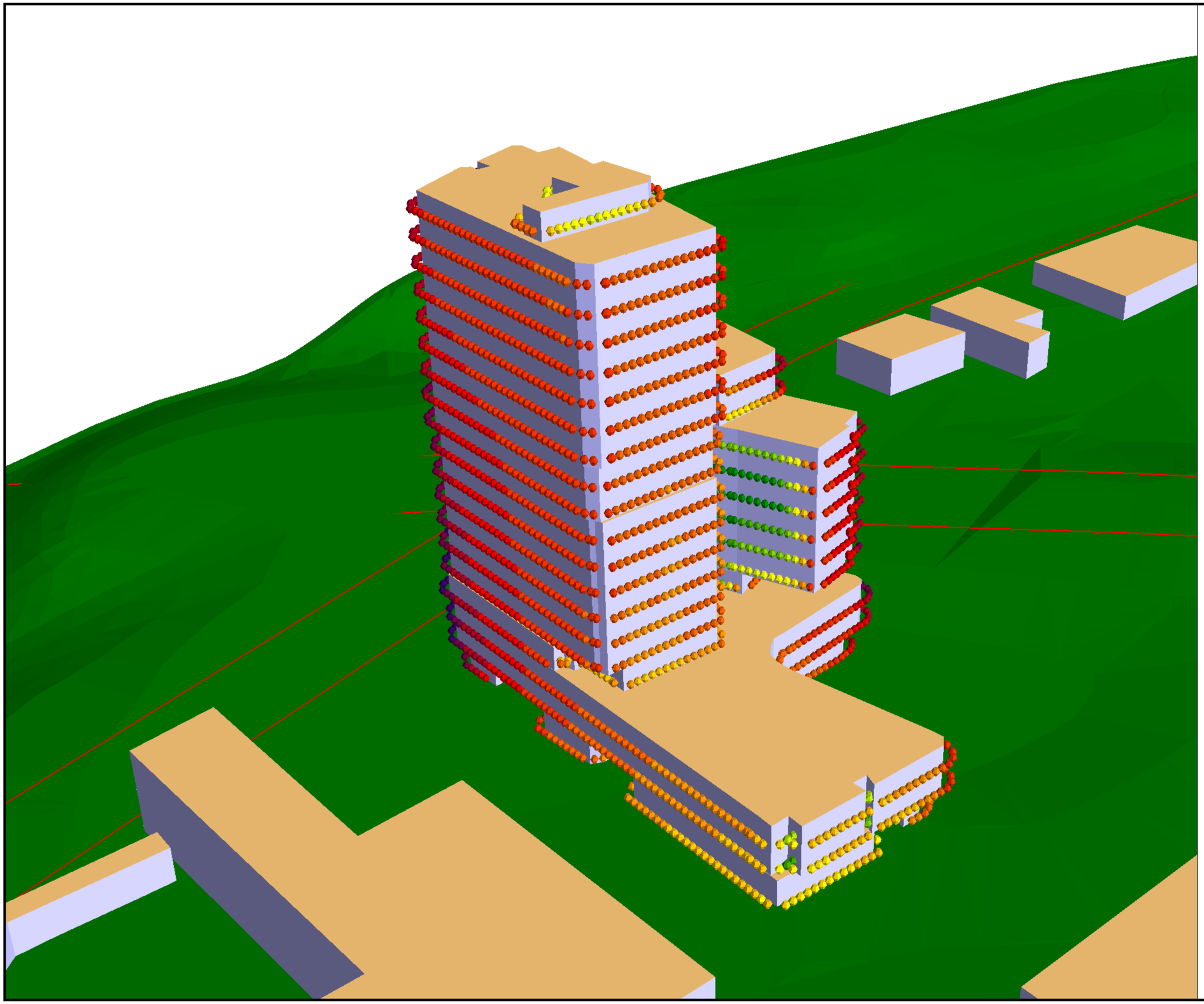
FACADE NOISE
CONTOUR (NORTH - EAST)

Noise level
in dB(A)

	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	

0 3 6 9 12

Stantec



91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

FACADE NOISE
CONTOUR (SOUTH-WEST)

Noise level
in dB(A)

	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	

0 3 6 9 12

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91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

FACADE NOISE
CONTOUR (SOUTH-WEST)

Noise level
in dB(A)

	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	

0 3 6 9 12

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91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
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FUTURE DAY TIME
SCENARIO (2041)

NOISE CONTOUR AT
5.4m RECEIVER HEIGHT
(Worst-case scenario)

Noise level
in dB(A)

	< 50.0
50.0 <=	< 52.0
52.0 <=	< 54.0
54.0 <=	< 56.0
56.0 <=	< 58.0
58.0 <=	< 60.0
60.0 <=	< 62.0
62.0 <=	< 64.0
64.0 <=	< 66.0
66.0 <=	< 68.0
68.0 <=	< 70.0
70.0 <=	< 72.0
72.0 <=	< 74.0
74.0 <=	< 76.0
76.0 <=	< 78.0
78.0 <=	< 80.0
80.0 <=	< 82.0
82.0 <=	< 84.0
84.0 <=	< 86.0
86.0 <=	

0 8 16 24 32 40
m

Stantec

91 - 93 Canning Hwy
East Fremantle

301250644
12/3/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

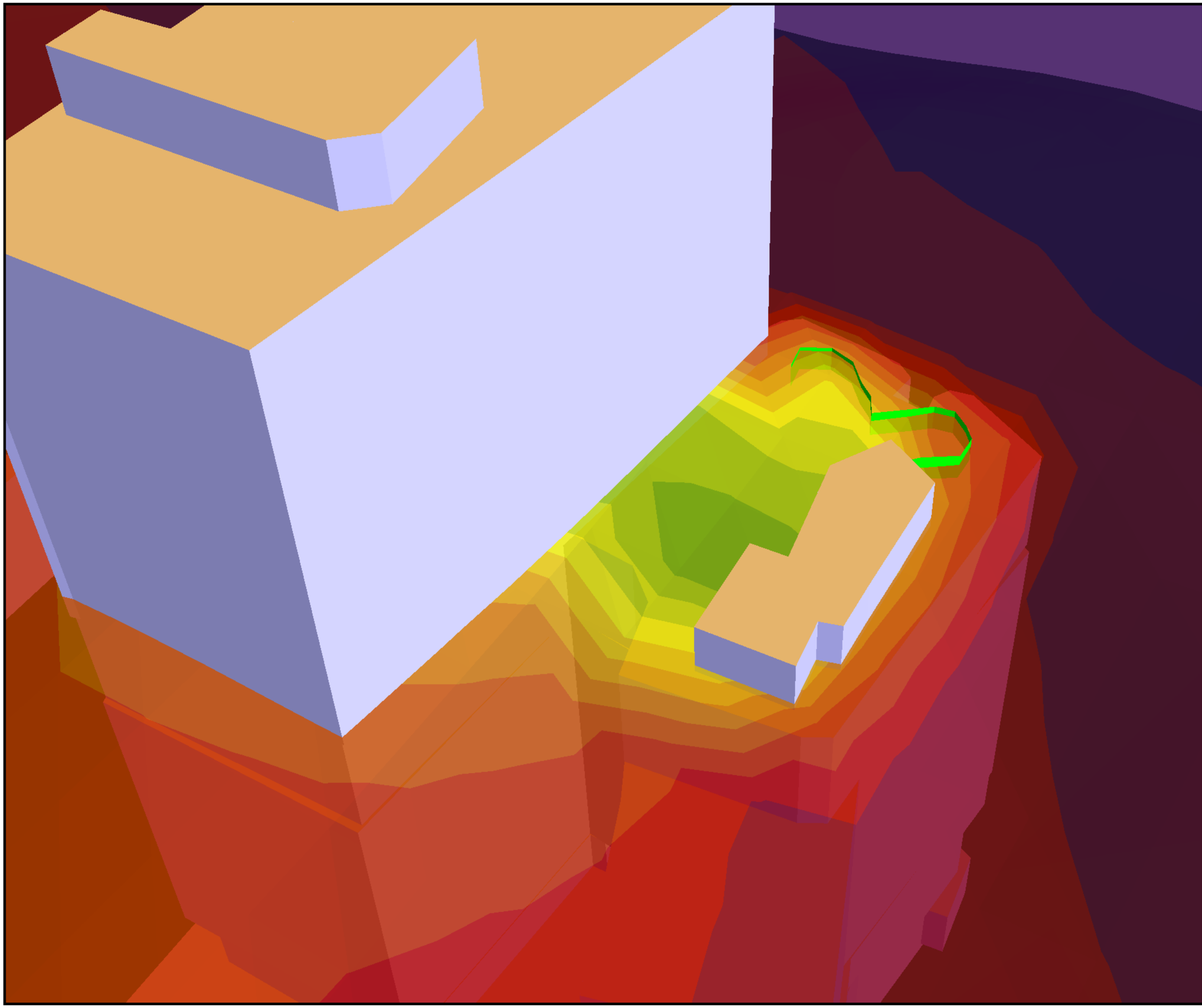
NOISE CONTOUR AT
5.4m RECEIVER HEIGHT
(Worst-case scenario)

Noise level
in dB(A)

	< 50.0
50.0 <=	< 52.0
52.0 <=	< 54.0
54.0 <=	< 56.0
56.0 <=	< 58.0
58.0 <=	< 60.0
60.0 <=	< 62.0
62.0 <=	< 64.0
64.0 <=	< 66.0
66.0 <=	< 68.0
68.0 <=	< 70.0
70.0 <=	< 72.0
72.0 <=	< 74.0
74.0 <=	< 76.0
76.0 <=	< 78.0
78.0 <=	< 80.0
80.0 <=	< 82.0
82.0 <=	< 84.0
84.0 <=	< 86.0

0 8 16 24 32 40 m

Stantec



91 - 93 Canning Hwy
East Fremantle

301250644
12/13/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

NOISE CONTOUR AT
Level 12
1.4m RECEIVER HEIGHT

LEVEL 12 NOISE BARRIER
1.5M HEIGHT

Noise level
in dB(A)

	< 45.0
45.0 <=	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	< 81.0
81.0 <=	

0 8 16 24 32 40 m

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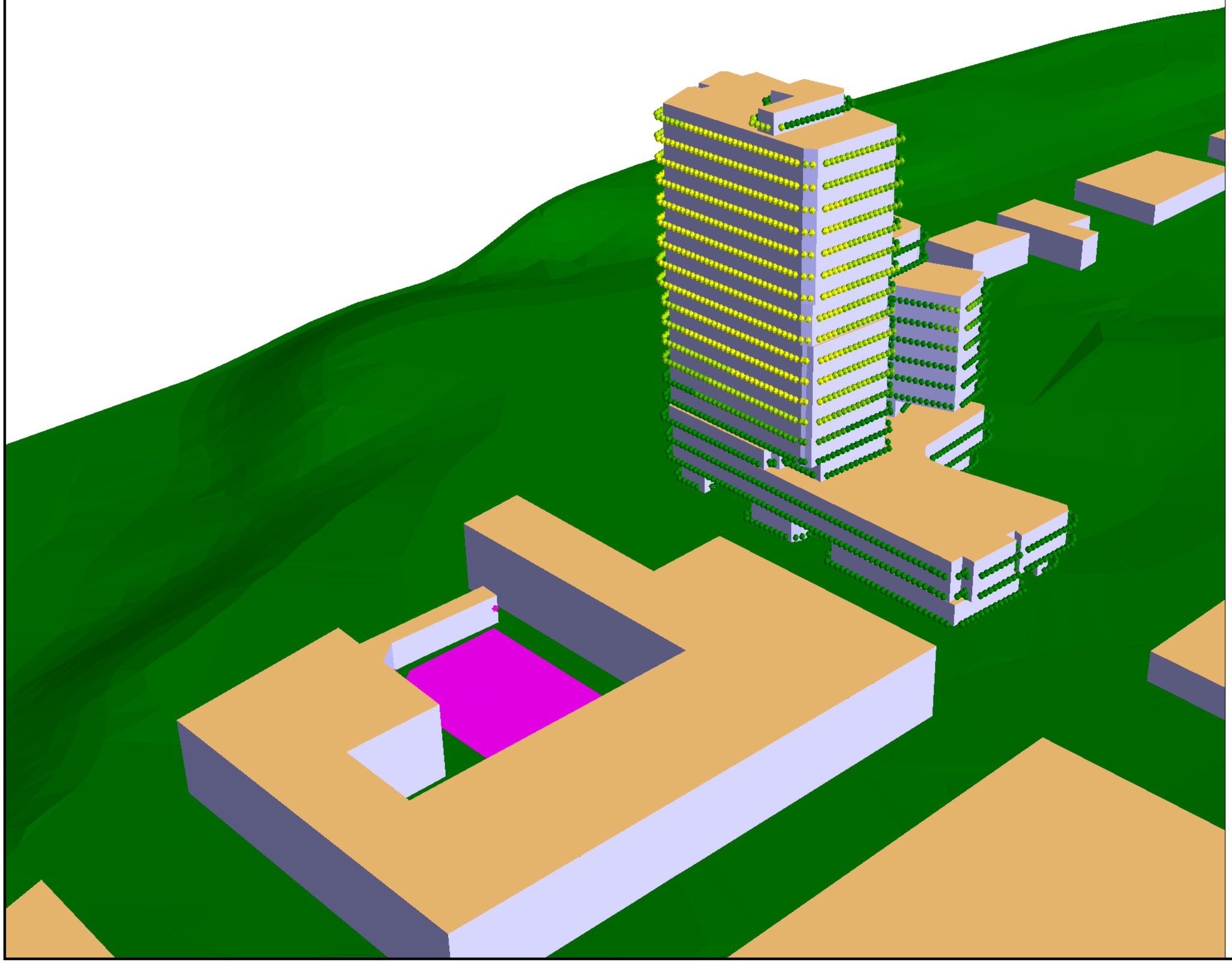
Appendix F Crowd Noise Contours

91 - 95 Canning Hwy
East Fremantle

301250644
10/22/2021
JLM

NOISE IMPACT FROM
TRADEWINDS HOTEL
BAR AND OUTDOOR
COURTYARD

FACADE NOISE
CONTOUR (SOUTH-WEST)



Noise level
in dB(A)

	< 47.0
47.0 <=	< 49.0
49.0 <=	< 51.0
51.0 <=	< 53.0
53.0 <=	< 55.0
55.0 <=	< 57.0
57.0 <=	< 59.0
59.0 <=	< 61.0
61.0 <=	< 63.0
63.0 <=	< 65.0
65.0 <=	< 67.0
67.0 <=	< 69.0
69.0 <=	< 71.0
71.0 <=	< 73.0
73.0 <=	< 75.0
75.0 <=	< 77.0
77.0 <=	< 79.0
79.0 <=	

0 3 6 9 12

Stantec

Appendix G Façade glazing mark up

Stantec

SKETCH TITLE BY: jalim

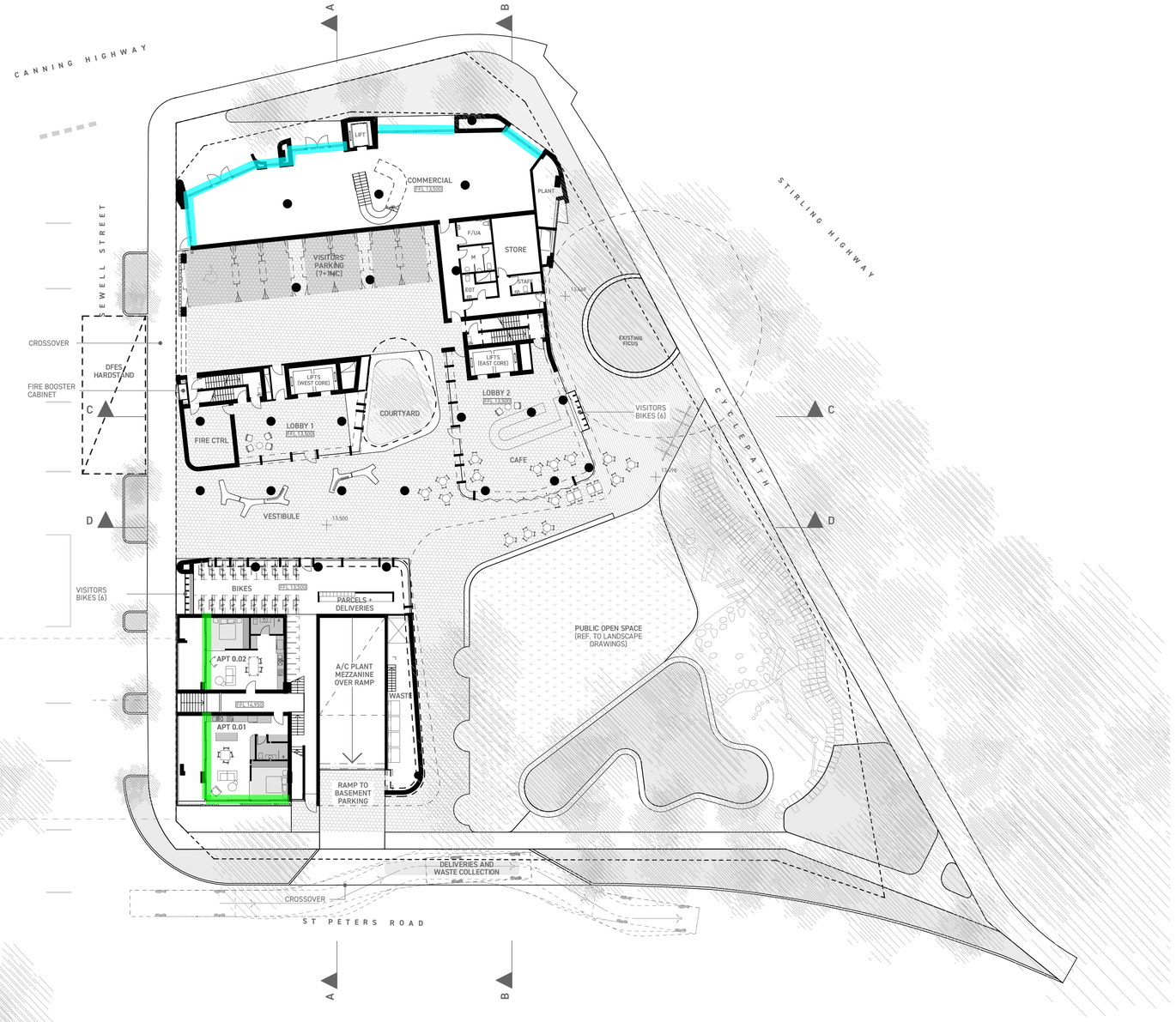
Facade Glazing Mark Up

PROJECT No	SKETCH No	DATE	REV
30125064	AC-SK-001	13/12/2021	002

Legend

- Type - 1
- Type - 2
- Type - 3
- Type - 4
- Type - 5

HALF BASEMENT



GROUND FLOOR

***space**agency:*
architects

PO BOX 48, NORTH FREMANTLE 6159
WESTERN AUSTRALIA
t 08 9430 5450
e STUDIO@SPACEAGENCY.COM.AU

0 | 5 | 10 | 20m

SCALE 1:250 @ A1

CHANGES IN CURRENT REVISIONS

ID	DESCRIPTION

REVISION HISTORY

ID	DESCRIPTION	DATE
P5	FOR REVIEW	26/11/21

PROJECT
ROOFING 2000
91-95 CANNING HWY, EAST FREMANTLE

CLIENT
SARACEN DEVELOPMENTS

PROJECT NUMBER
1402

DRAWING
GROUND FLOOR

DRAWING NUMBER
DA101

DATE **26/11/21**
SCALE **1:250 @A1**
STATUS **FOR APPROVAL**

REVISION
P5

Stantec

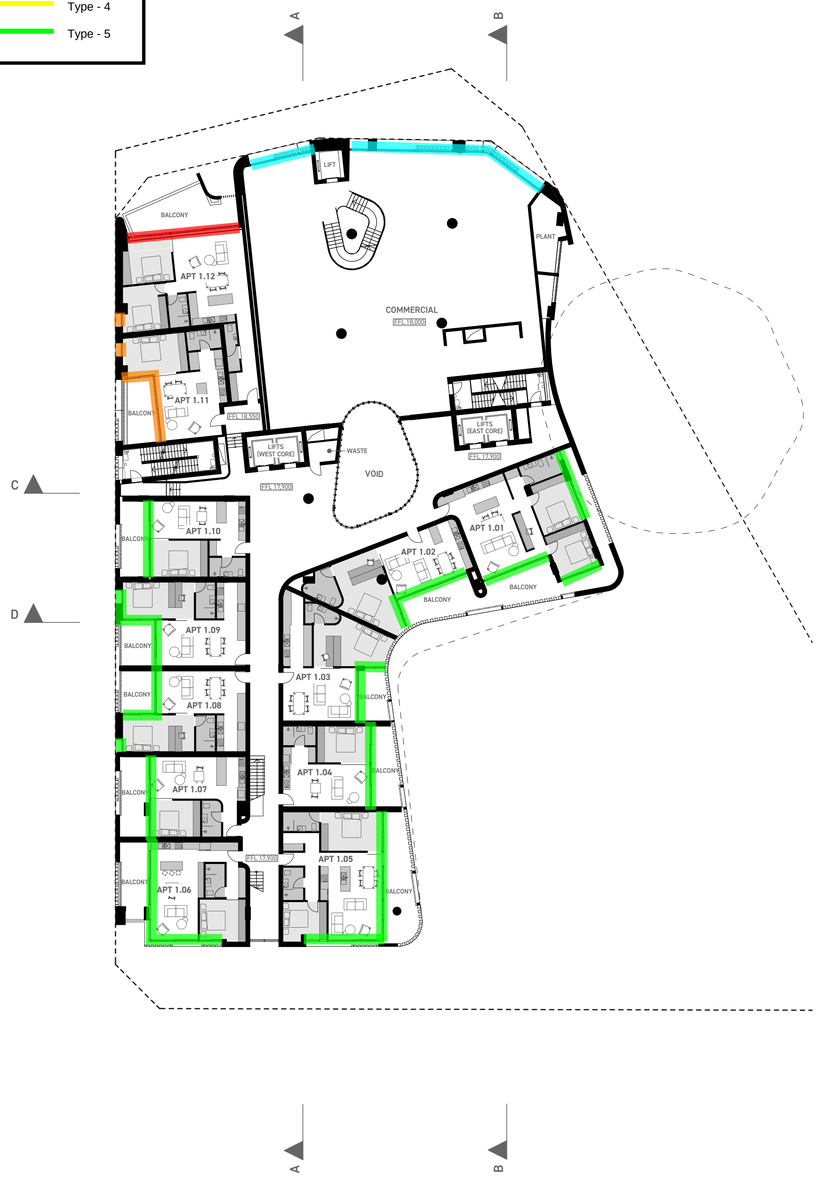
SKETCH TITLE BY: jalim

Facade Glazing Mark Up

PROJECT No	SKETCH No	DATE	REV
30125064	AC-SK-001	13/12/2021	002

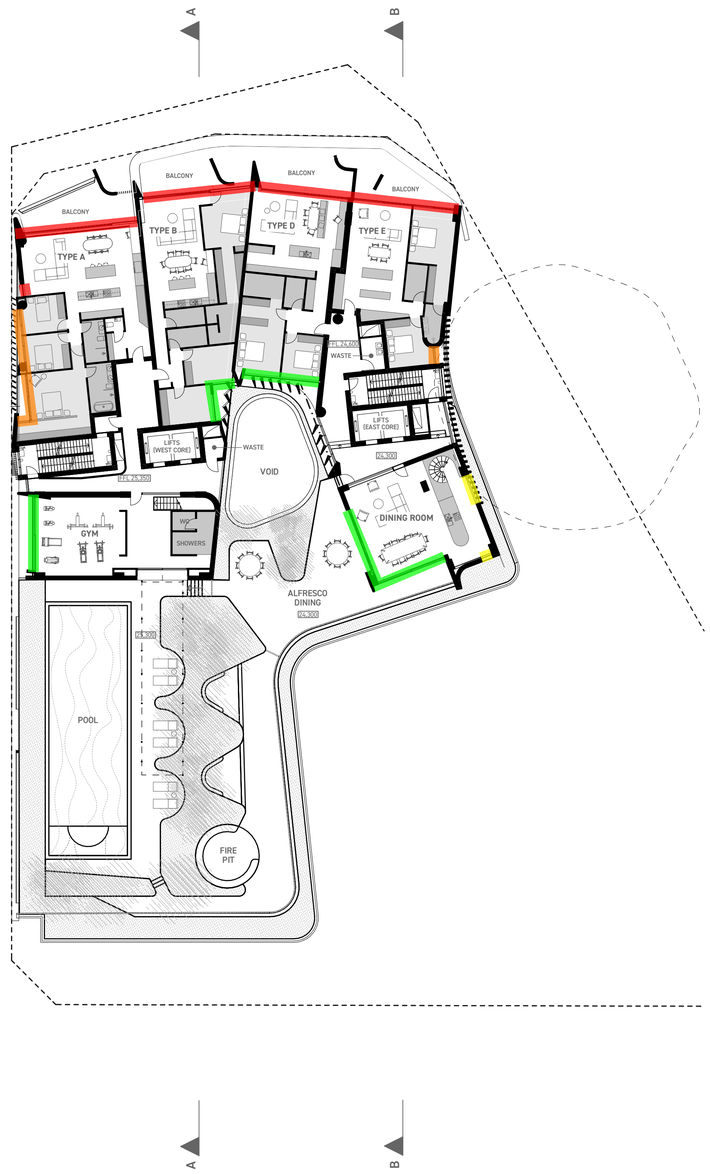
Legend

- Type - 1
- Type - 2
- Type - 3
- Type - 4
- Type - 5



FIRST FLOOR

SECOND FLOOR



THIRD FLOOR

***space**agency:*
architects

PO BOX 48, NORTH FREMANTLE 6159
WESTERN AUSTRALIA
t 08 94285450
e STUDIO@SPACEAGENCY.COM.AU

0 | 5 | 10 | 20m

SCALE 1:250 @ A1

CHANGES IN CURRENT REVISIONS

ID	DESCRIPTION

REVISION HISTORY

ID	DESCRIPTION	DATE
P6	FOR REVIEW	26/11/21

PROJECT
ROOFING 2000
91-95 CANNING HWY, EAST FREMANTLE

CLIENT
SARACEN DEVELOPMENTS

PROJECT NUMBER
1402

DRAWING
LEVELS 1-3

DATE **26/11/21**
SCALE **1:250 @A1**
STATUS **FOR APPROVAL**

DRAWING NUMBER
DA102

REVISION
P6

Stantec

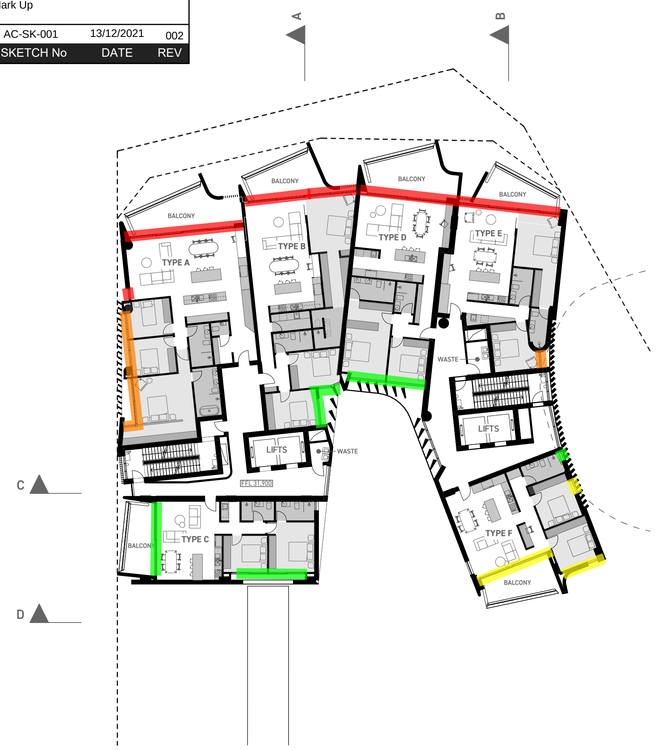
SKETCH TITLE BY: jalim

Facade Glazing Mark Up

PROJECT No	SKETCH No	DATE	REV
30125064	AC-SK-001	13/12/2021	002

Legend

- Type - 1
- Type - 2
- Type - 3
- Type - 4
- Type - 5

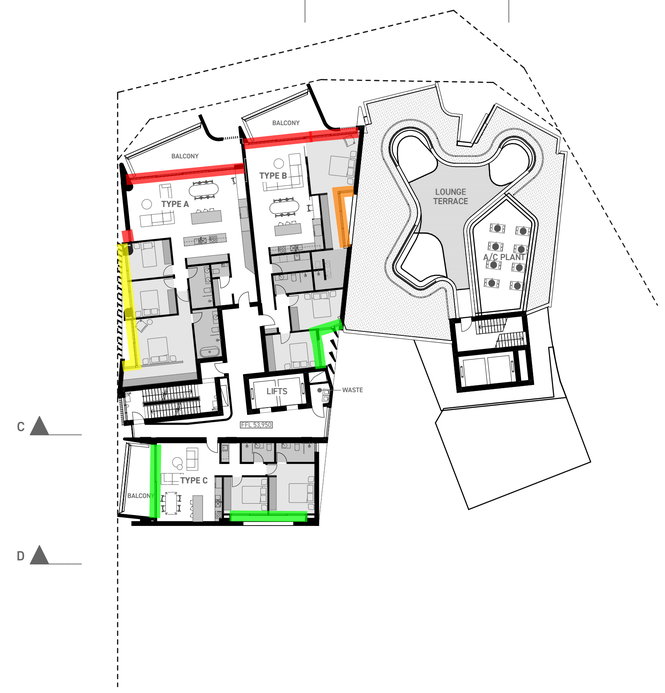


FOURTH TO SEVENTH FLOOR

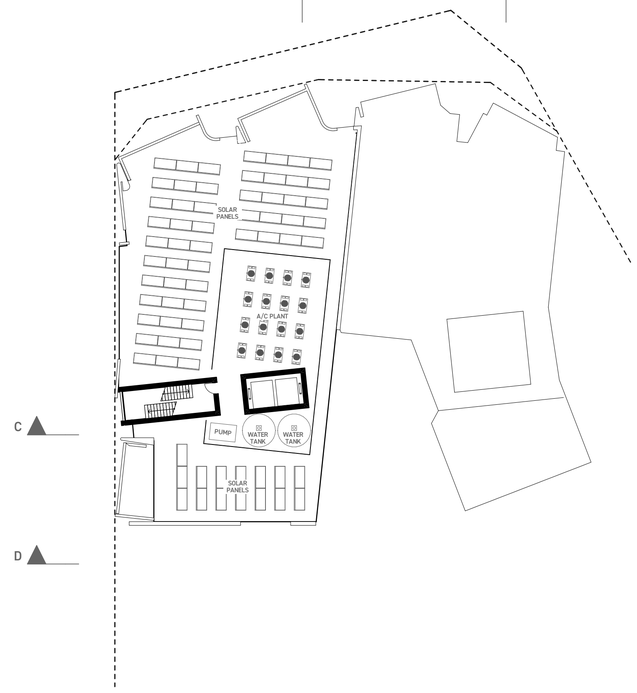
EIGTH FLOOR

NINTH FLOOR

TENTH AND ELEVENTH FLOOR



TWELFTH TO EIGHTEENTH FLOOR



ROOF

***space**agency:*
architects

PO BOX 48, NORTH FREMANTLE 6159
WESTERN AUSTRALIA
t 08 94285450
e STUDIO@SPACEAGENCY.COM.AU

20.0 m
0 5 10 20m

SCALE **1:250 @ A1**

CHANGES IN CURRENT REVISIONS

ID	DESCRIPTION

REVISION HISTORY

ID	DESCRIPTION	DATE
P6	FOR REVIEW	26/11/21

DISCLAIMER
1. Do not scale drawings. Written dimensions govern.
2. All dimensions are in millimeters unless otherwise noted.
3. Check all site levels and existing dimensions prior to proceeding with work.
4. Report any discrepancies to spaceafency in writing.
5. This drawing must be read in conjunction with all relevant contracts, reports, specifications and drawings.

PROJECT
ROOFING 2000
91-95 CANNING HWY, EAST FREMANTLE

PROJECT NUMBER
1402

CLIENT
SARACEN DEVELOPMENTS

DRAWING
LEVELS 4-ROOF

DRAWING NUMBER
DA103

DATE **26/11/21**
SCALE **1:250 @A1**
STATUS **FOR APPROVAL**

REVISION
P6

Design with
community in mind

Ground Floor
226 Adelaide Terrace
Perth WA 6000
Tel +61 8 6222 7000

For more information please visit
www.stantec.com

Stantec