22 St Quentin Ave Claremont

Acoustics Report

Development Application

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	1/04/2021	Draft Schematic Design for DA issue	JLM	IK
002	16/07/2021	Final DA Issue	JLM	IK

Contents

Executive Summary

Stantec has been appointed to undertake acoustic assessment for the proposed Mixed-use development, expected to be located at 22 St Quentin Ave. The project will see the development of a multi-storey mixed-use development to be located at the above street address in Claremont WA.

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);
- 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, Building Code of Australia (NCC 2019); and

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

- 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.

Traffic Noise Intrusion

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. The model was calibrated based on long term on-site measurements conducted.

Mechanical Services Noise Emission

Based on the latest architectural drawings, the following mechanical services are expected:

- Fire Pump Room
- Plant Room Cooling Towers
- Fans serving carpark, commercial and residential tenancies

Preliminary information has been provided regarding the cooling towers. A noise emission assessment has been conducted to determine the noise impact on the surrounding properties in order to achieve compliance to EPNR criteria. The preliminary treatments required have been summarized below:

Current Scenario

Cooling Tower plant room louvres will be required to implement acoustically rated louvres, complying with the minimum static insertion loss as summarized below.

Louvre Location	Model Number	Octave Band Static Insertion Loss (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
North, East and western Louvres	Fantech Acoustic Louvre SBL1	10	13	15	19	20	18	18	14

Future Scenario

Additional acoustic treatment will be required to achieve compliance to EPNR assigned levels at nearest noise sensitive receivers for the future scenario.

Note that the final mechanical equipment selection and layout for the cooling towers has not been confirmed at the time of assessment and is subject to change during the later stages of the project.

As per the advice provided the mechanical engineer, it is expected that the roof plant room containing the cooling towers will have the capacity to allow adequate acoustic treatment to achieve compliance to the relevant noise criteria. Treatment may take the form of selecting quieter units or providing attenuation such as acoustically rated louvres or attenuators.

Once the final cooling tower unit selection and layout has been confirmed, treatments will be provided to achieve compliance to the relevant EPNR assigned noise levels at all closest receivers for the future scenario. This will be finalized prior to the issue of Building Permit.

At this stage no information has been provided regarding the other mechanical service equipment. 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.

Ground Floor Loading Dock

The loading dock on ground floor utilizes Church Lane which is considered a gazetted road as per Mainroads online website.

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

Nearby Entertainment Venue Noise Impact

The nearby entertainment venue The Ave – Club Bay View is a night club venue located to the east of the project site. The venue on level 1 at 20 St Quentin Ave, Claremont. At the time of assessment, it is unclear if this venue is still operational as there is no official website or operating hour details available. If the venue is no longer operating, no further assessment is required.

If the venue is confirmed to be operating, a detailed noise impact assessment will be conducted to determine the noise impact on the façade of the development. The current façade treatments detailed in the report will be reviewed to determine if they are adequate to achieve target internal noise levels.

1. Introduction

1.1 Overview

Stantec has been appointed to undertake acoustic assessment for the proposed Mixed-use development, expected to be located at 22 St Quentin Ave. The project will see the development of a multi-storey mixed-use development to be located at the above street address in Claremont WA.

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;

- Traffic noise impact on the development;
- Noise impact from the nearby entertainment venue; and
- Noise emission from the mechanical equipment servicing the building.

1.2 Project Layout

The project site is located in Claremont with St Quentin Ave situated to the north and Stirling Hwy approximately 20-25m south. The surrounding area is primarily commercially zoned developments with intermittent residential developments with a 450m radius. Note that The Ave – Club Bay View located to the east of the project site is a night club type venue which is currently unconfirmed if it is still operational at the time of assessment.

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);
- 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 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 receiver has been considered as residential development located to the south of the project location at 2 Fresh Water Pde, Claremont.

The Town Planning Scheme 3 (TPS3) was accessed via the Town of Claremont online website.

Traffic data for roads surrounding the nearest noise sensitive receiver were obtained from Main Roads Western Australia (MRWA) on the 26th October 2020. 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					
		2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Stirling Hwy (West of Parry St)	Major Road	-	-	-	42109	-	35392

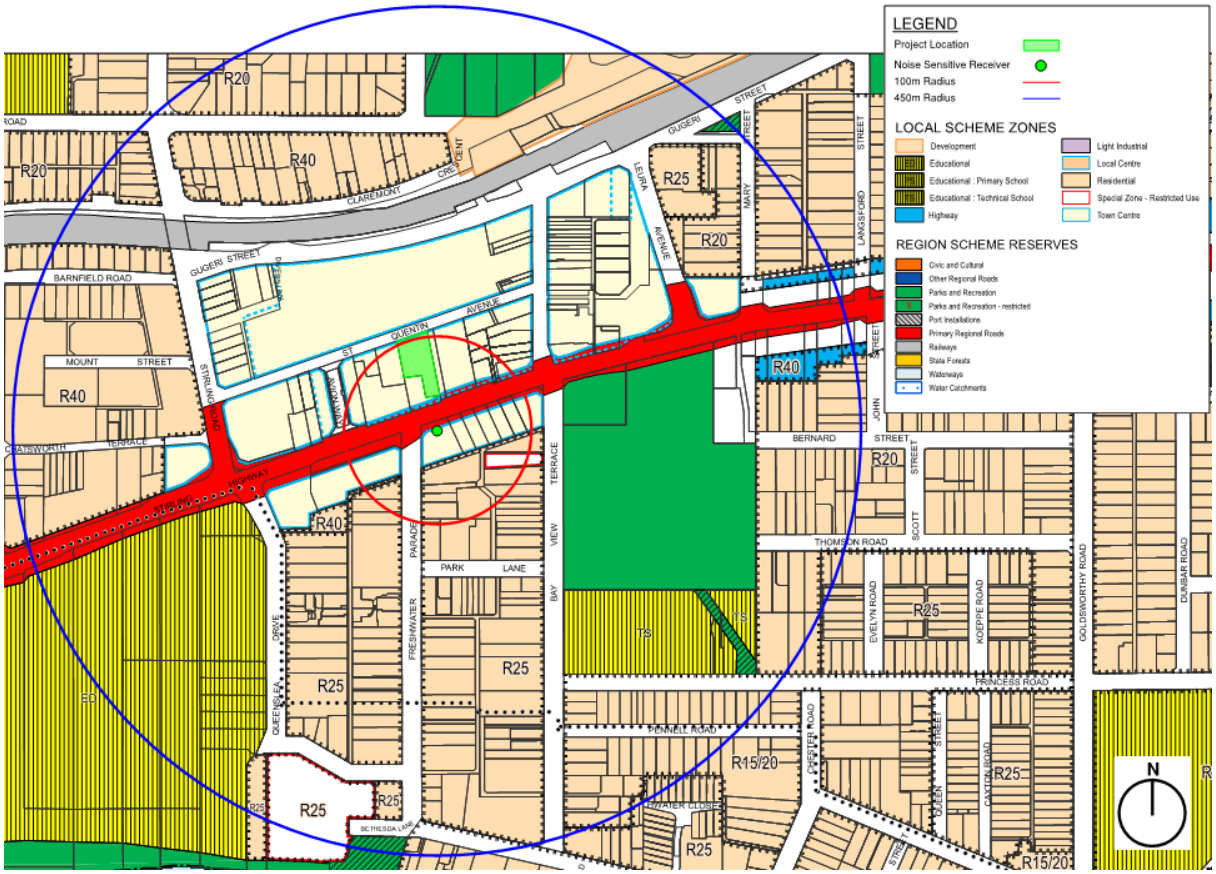
1) As defined by the EPNR. Secondary roads have between 6000-15000 vehicles per day. Major roads have greater than 15000 vehicles per day.

2.1.1 Influencing Factor for 2 Fresh Water Pde

The influencing factor for 2 Fresh Water Pde results from identifying major roads, commercial and industrial areas for all nearest noise sensitive receivers is 9 dB, as summarised in Table 2.

Table 2: Influencing factor (IF) noise sensitive 2 Fresh Water Pde

Noise Sensitive Premises	Commercial Zones	Industrial Zones	Transport Corridors	Influencing Factor
2 Fresh Water Pde	42 % within a 100 m radius 13 % within a 450 m radius	0 % within a 450 m radius	Stirling Hwy (major road) in a 100 m radius	**9 dB**



Source: Town of Claremont online website

Figure 2: Zoning map of areas surrounding 2 Fresh Water Pde

2.1.2 Assigned Noise Levels for Nearest Sensitive Receiver

Table 3 summarizes the assigned levels at the nearest noise sensitive premises. It is required that all noise emissions from the development are below the assigned level for all defined periods of the day and at the lot boundary of the receiver or 15m from any associated building. It is noted that the EPNR assigned levels only apply at the premises receiving the noise only and not to noise within the site.

Table 3: Assigned levels for 2 Fresh Water Pde

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	54	64	74
	0900 to 1900 hours Sunday & public holidays	49	59	74
	1900 to 2200 hours all days	49	59	64
	2200 hours on any day to 0700 hours Monday to Saturday, and 0900 hours Sunday & public holidays	44	54	64
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

2.1.3 Noise Character Adjustments

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

- Tonality, e.g. whining, droning;
- Modulation, e.g. like a siren; and
- 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

2.1.4 Noise Emissions mechanical services

Typically, projects of this type involve noise emissions from mechanical services such as air conditioning units and condensers and exhaust fans.

It is important that noise emissions from the site do not present any form of tonality, modulation or impulsiveness (as defined by the EPNR).

Given that data from mechanical plant 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 correction shall be conservatively assigned when assessing noise emissions from mechanical equipment. Noise emissions from mechanical equipment shall comply with L_{A10} 44 dB at the nearest noise sensitive receiver (2 Fresh Water Pde).

2.2 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.

2.3 Internal Noise Levels

2.3.1 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

Type of occupancy/activity	Recommended design sound level, Leq dB(A)
General Areas	
Enclosed Carpark	< 65
General Retail Tenancies	45 – 50
Washroom and toilets	45 – 55
Gym/Yoga	< 45
Private Dining	40 – 45
Lounges	< 50

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.

AS2107 provides recommended reverberation times for optimising the acoustic amenity in occupied spaces. The relevant reverberation times have been outlined in Table 7.

Table 7: Recommended reverberation times from AS2107

Type of occupancy/activity	Recommended reverberation time (T), s
RESIDENTIAL BUILDINGS - Houses and apartments in inner city areas or entertainment districts or near major roads —	
Sleeping areas (night-time)	-
Living areas	-
Work (study) areas	-
Apartment common areas (e.g. foyer, lift lobby)	See Note 1
General Areas	
Enclosed Carpark	–
General Retail Tenancies	See Note 1
Washroom and toilets	–
Gym/Yoga	0.6 – 0.8
Private Dining	See Note 1
Lounges	0.6 – 1.0

*Note 1: Reverberation to be minimized for noise control

2.4 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 8.

Table 8: 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
	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. Site Survey

As per the requirements of SPP5.4, long term unattended noise measurements were undertaken to establish the surrounding acoustic environment on 21st – 26th 2020. The logger was placed nearby, within the premises of the Claremont Baptist Church. The measurement location is presented in Figure 3.

Figure 3: Noise Logger Location

3.1 Noise Measurements

3.1.1 Test Methodology

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.

All sound level meters were 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 meters were calibrated before and after each 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 9 below. A copy of calibration certificates for the relevant instrumentation may be provided upon request.

Table 9: Equipment and Calibration Details

Manufacturer / Model	Serial Number
Brüel & Kjær 4231 – Calibrator	3005155
NTi XL2 – Sound Level Meter	A2A-14416-E0
Brüel & Kjær 2250 – Sound Level Meter	3010733
Brüel & Kjær 4952 90 – Microphone	3077216

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.

4. Noise Modelling

4.1 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 C.

4.1.1 Noise Source Inputs

Topography

Topographical data for the project site and surrounding areas was based on data imported from Nearmaps within the SoundPLAN software. The surrounding land elevation has been modelled using the data obtained from the Intergovernmental Committee on Surveying and Mapping online database.

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 19th October 2020 (Contact Thomas Ng) and has provided traffic count and projection data for the surrounding Major transport corridors: Stirling 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.

SPP 5.4 requires all noise assessments to consider changes in traffic volumes expected over the next 20 years. The 2041 link volume plot provides data marginally above a 20-year horizon from the current year (2020), therefore the year 2041 will be used for the purposes of this assessment.

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 10. Observed traffic count volumes were used as source inputs to model and assess a worst-case scenario.

Table 10: Major Transport Corridor Growth Rates

Major Transport Corridor	Overall Traffic count growth rate, %/y	Heavy vehicle Percentage growth rate, %/y
Stirling Hwy	1.0	- 1.4

Table 11 summarises the current and future predicted traffic volumes used in the assessment model.

Table 11: 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	Current - 2020	34590	2066	192	6 % - Day	60 km/h
					7 % - Night	
	Future - 2041	42000	2509	233	4 % - Day	
					5 % - 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 3.1 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 12:

Table 12: Average Measured Noise Levels ($L_{eq,T}$)

Time	L_{Aeq} dB(A)
Day 07:00 AM to 22:00 PM	66
Night 22:00 PM to 07:00 AM	59

4.2 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):

- South Façade, Day-time scenario; **65 dB(A)**
- South Façade, Night-time scenario; **55 dB(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.

Note that as per SPP5.4, one outdoor communal area is required to achieve the outdoor noise target as summarised in section 2.2 Table 5. The level 2 Pool Deck area as shown in is compliant to the outdoor noise target. Coloured noise maps are provided in Appendix E

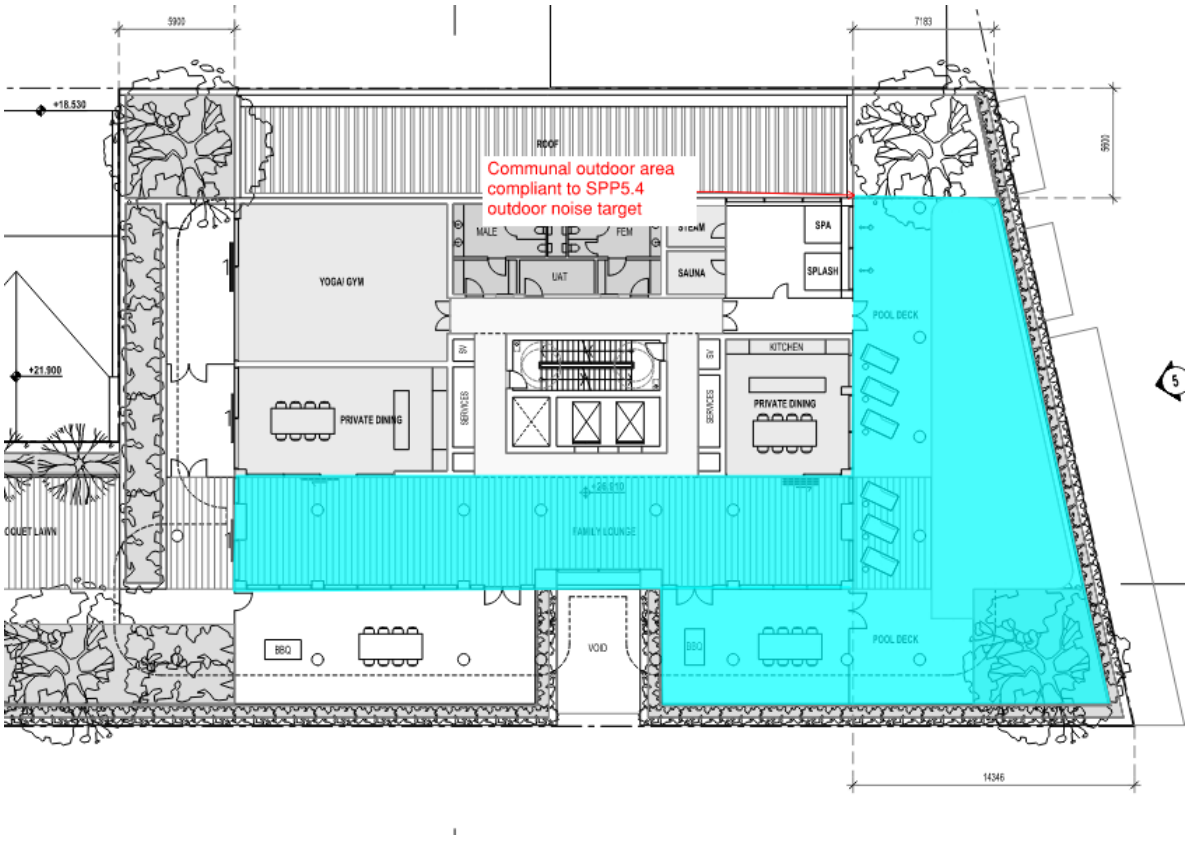


Figure 4: Location of communal area compliant to SPP5.4 outdoor target

A detailed noise intrusion assessment and recommendation for the external envelope are provided to achieve compliance to the internal noise level criteria of SPP5.4. Details of assessment & recommendations are provided in Section 5.

5. Noise Impact Assessment

5.1 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.

5.1.1 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:

- 110mm Concrete Panel; OR
- 110mm brick work + 50mm air gap + 110mm 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 13), to ensure compliance with the recommended internal noise levels for residential units as specified in SPP 5.4.

Table 13: Lightweight External Wall Configurations

Façade Orientation	Airborne Sound Insulation Performance	Configuration
Southern Facade	$R_w + C_{tr}$ 40 - 45	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
All other orientations	R_w 46	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 One layer 13mm thick fire rated plasterboard fixed to the other side of the row of studs

5.1.2 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 14 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 14: Glazing configuration

Glazing Configuration	Rw + Ctr	Spectrum Sound Transmission Loss (dB)						
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
6mm glass + 12mm Air Gap + 6mm Glass	**29(36;-7)**	22	23	19	35	43	42	50

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.

5.1.3 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 2.3.

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

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

- 75 mm thick high-density Anticon insulation hard-fixed to the underside of roof and over steel purlins;
- Min. 50 mm thick glasswool insulation (min. 11kg/m^3) one layer of 13 mm standard plasterboard.

5.2 Entertainment Venue

The nearby entertainment venue The Ave – Club Bay View is a night club venue located to the east of the project site. The venue on level 1 at 20 St Quentin Ave, Claremont. At the time of assessment, it is unclear if this venue is still operational as there is no official website or operating hour details available. If the venue is no longer operating, no further assessment is required.

If the venue is confirmed to be operating, a detailed noise impact assessment will be conducted to determine the noise impact on the façade of the development. The current façade treatments detailed in the report will be reviewed to determine if they are adequate to achieve target internal noise levels.

6. Noise Emission Assessment

Mechanical services will be expected to comply with the respective EPNR criteria at the nearest noise sensitive receivers for all periods of the day.

Based on the latest architectural drawings, the development is expected to contain the following mechanical services:

- Level 1 Mezzanine Fire Pump Room (Figure 5)

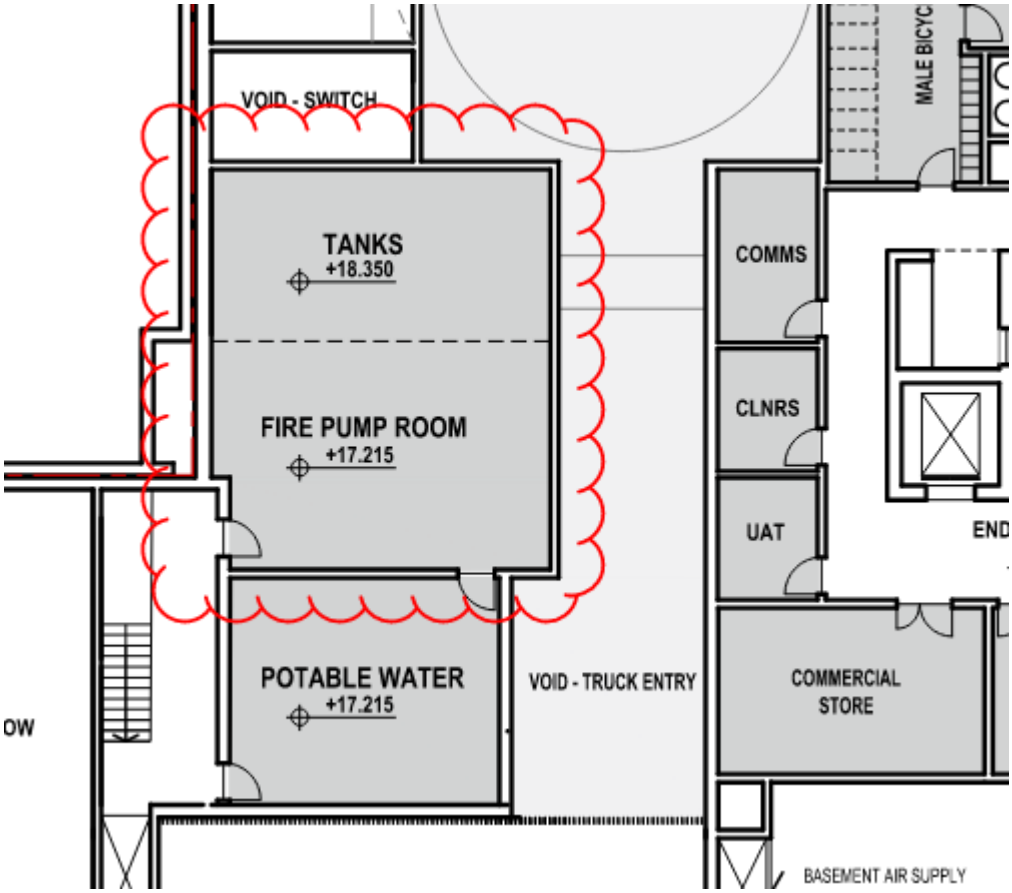


Figure 5: Level 1 Mezzanine Fire Pump Room

- Fans serving carpark, commercial and residential tenancies (Location TBC)

Figure 6: Level 3 Plant decks

Noise emissions from mechanical equipment shall comply with L_{A10} 44 dB at the nearest noise sensitive receivers. This includes the following developments:

- 2 Fresh water Pde
- Claremont Baptist church

Additionally, noise levels at commercial developments shall comply with L_{A10} 60 dB in alignment with the EPNR assigned noise levels.

All noise emissions generated from mechanical equipment shall be assessed 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 the above mechanical services. 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.

6.1 Cooling Towers

Preliminary information has been provided by the mechanical engineer for the proposed cooling towers to be located on the roof as shown in Figure 7. The preliminary location has been illustrated as shown in the latest mechanical layouts. Additionally, the plant room walls are expected to be louvred as per Figure 7. It is assumed that the Cooling towers will be located within the plant room section indicated in Purple as suggested by the mechanical engineer.

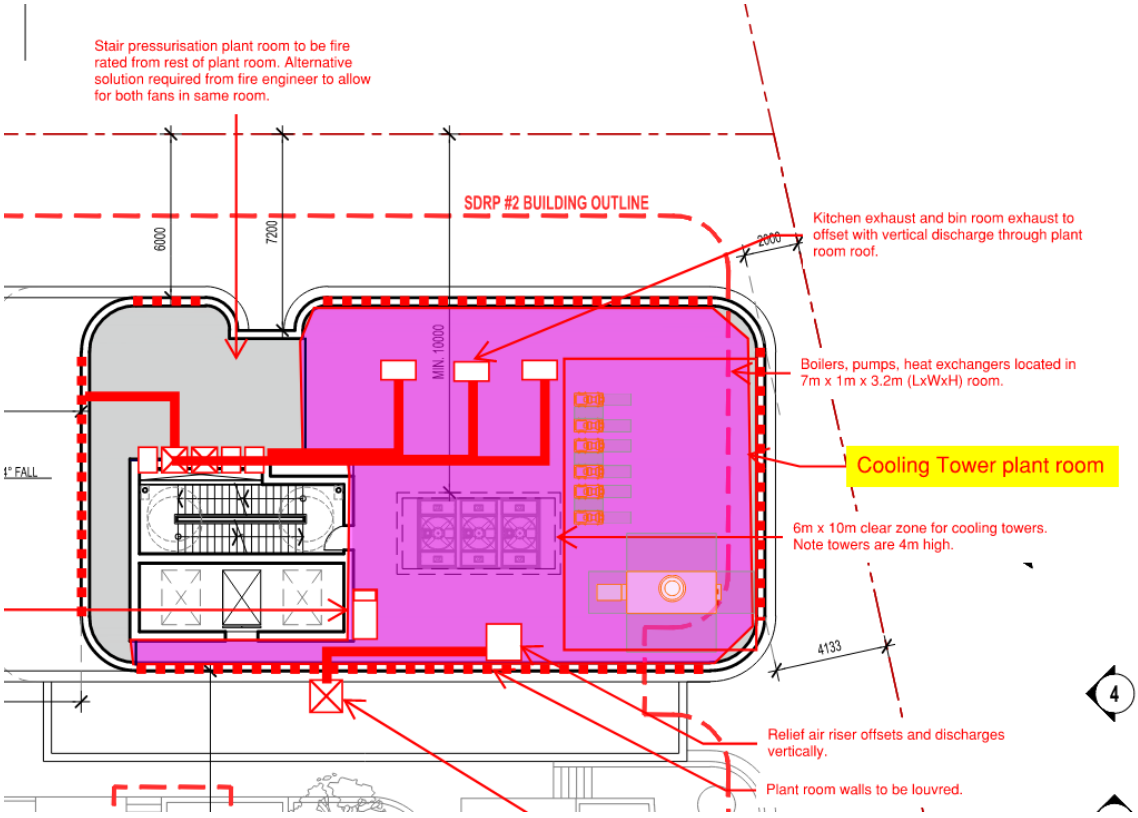


Figure 7: Roof Cooling Towers

A summary of the unit sound data has been provided below in Table 15.

Table 15: Cooling tower sound data

Model	Sound Power Level, dB							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Baltimore Aircoil Company PCT1010-P3-M	105	106	101	94	90	86	79	74

As per the latest mechanical drawings, it is expected that three cooling towers are expected to be located within the development.

6.1.1 Current Scenario

The highest predicted noise levels at the closest commercial and noise sensitive receivers has been shown below in Table 16.

Table 16: Predicted Noise level of cooling towers – Without Treatments (current scenario)

Scenario / Description	Highest Predicted Level[1], dB(A)	Receiver	Relevant EPNR Criteria	Compliance to EPNR
Both cooling towers operating at full load	65	Claremont Quarter Shopping Mall (Commercial)	L_{A10} 60 dB	No
	48	Claremont Baptist Church (Residential)	L_{A10} 44 dB	No

1. +5 dB penalty has been applied to account for the likely presence of sound tonality.

To achieve compliance to EPNR at the closest receivers, the Cooling Tower plant room louvres will be required to implement acoustically rated louvres, complying with the minimum static insertion loss as summarized below in Table 17.

Table 17: Cooling Tower Plant Room Louvre Static Insertion Loss

Louvre Location	Model Number	Octave Band Static Insertion Loss (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
North, East and western Louvres	Fantech Acoustic Louvre SBL1	10	13	15	19	20	18	18	14

6.1.2 Future Scenario

A future noise emission assessment has been conducted to determine if the current architectural layout will provide adequate acoustic attenuation on future developments that may be constructed nearby to a similar height of the proposed development. This has been illustrated in Figure 8.

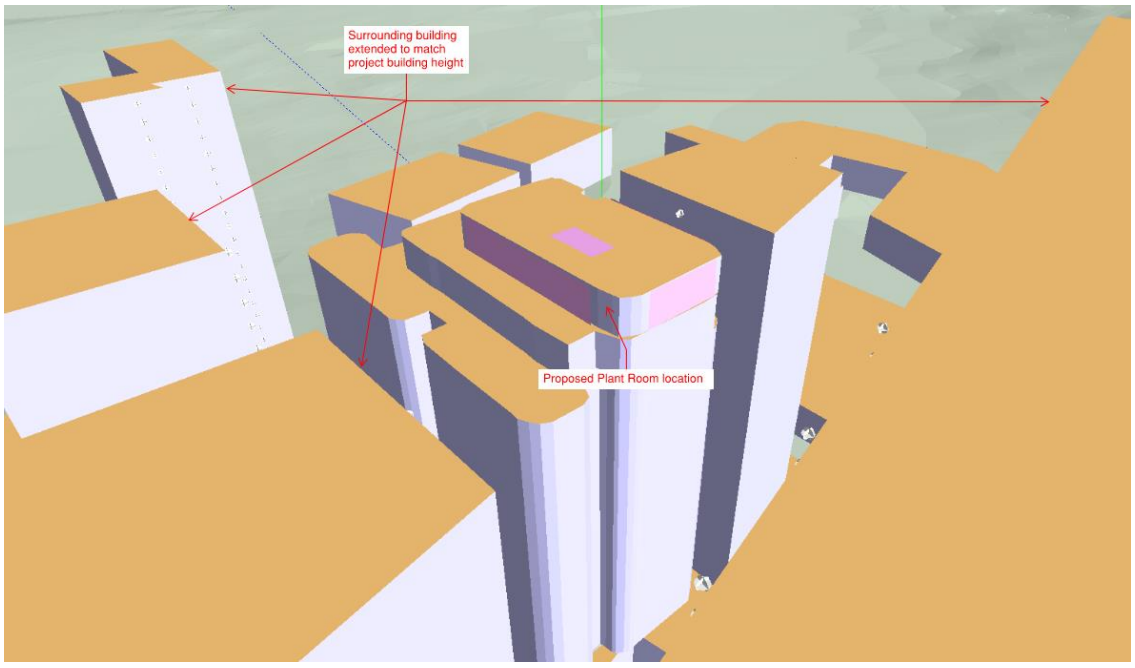


Figure 8: Potential future high-rise developments

The highest predicted noise levels at the closest receivers has been shown below in Table 18.

It has been assumed that all future buildings may be considered residential or mixed-use to assess a worst-case scenario.

Table 18: Predicted Noise level of cooling towers – without treatments (future scenario)

Scenario / Description	Highest Predicted Level[1], dB(A)	Receiver	Relevant EPNR Criteria	Compliance to EPNR
Day (0700 – 2200) Three cooling towers operating at 100% load	69	24 St Quentin Ave (Currently Brinkhaus Jewellers)	L_{A10} 54 dB	Exceeds by 15 dB
Night (2200 – 0700) Three cooling towers operating at 50% load	66		L_{A10} 44 dB	Exceeds by 22 dB

1. +5 dB penalty has been applied to account for the likely presence of sound tonality.

6.1.3 Preliminary Treatment

Based on the results presented in Table 18, Additional acoustic treatment will be required to achieve compliance to EPNR assigned levels at nearest noise sensitive receivers for the future scenario.

Note that the final mechanical equipment selection and layout for the cooling towers has not been confirmed at the time of assessment and is subject to change during the later stages of the project.

As per the advice provided the mechanical engineer, it is expected that the roof plant room containing the cooling towers will have the capacity to allow adequate acoustic treatment to achieve compliance to the relevant noise criteria. Treatment may take the form of selecting quieter units or providing attenuation such as acoustically rated louvres or attenuators.

Once the final cooling tower unit selection and layout has been confirmed, treatments will be provided to achieve compliance to the relevant EPNR assigned noise levels at all closest receivers for the future scenario. This will be finalized prior to the issue of Building Permit.

7. Loading Dock Noise Assessment

A loading dock is proposed on ground floor at the location shown in Figure 9.

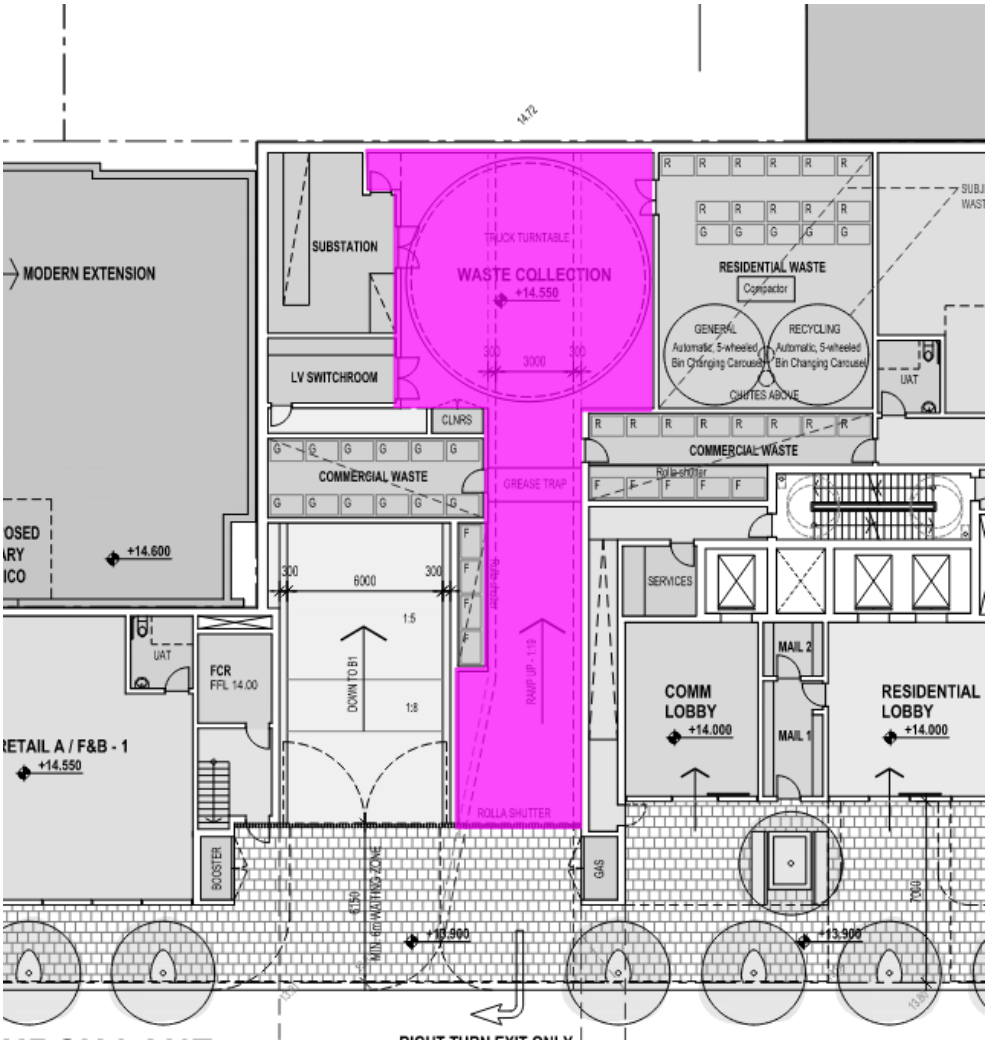


Figure 9: Ground floor loading dock

Church Lane is considered a gazetted road as per Mainroads online website.

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

8. Conclusion

As part of the development approval process for the 22 St Quentin Ave Claremont 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 were conducted in order to calibrate the model.

The nearby entertainment venue The Ave – Club Bay View is a night club venue located to the east of the project site. The venue on level 1 at 20 St Quentin Ave, Claremont. At the time of assessment, it is unclear if this venue is still operational as there is no official website or operating hour details available. If the venue is no longer operating, no further assessment is required.

If the venue is confirmed to be operating, a detailed noise impact assessment will be conducted to determine the noise impact on the façade of the development. The current façade treatments detailed in the report will be reviewed to determine if they are adequate to achieve target internal noise levels.

The loading dock on ground floor utilizes Church Lane which is considered a gazetted road as per Mainroads online website.

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

Preliminary information has been provided regarding the cooling towers. A noise emission assessment has been conducted to determine the noise impact on the surrounding properties in order to achieve compliance to EPNR criteria. The preliminary treatments required have been summarized below:

Current Scenario

Cooling Tower plant room louvres will be required to implement acoustically rated louvres, complying with the minimum static insertion loss as summarized below.

Louvre Location	Model Number	Octave Band Static Insertion Loss (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
North, East and western Louvres	Fantech Acoustic Louvre SBL1	10	13	15	19	20	18	18	14

Future Scenario

Based on the results presented in this report, additional acoustic treatment will be required to achieve compliance to EPNR assigned levels at nearest noise sensitive receivers for the future scenario.

Note that the final mechanical equipment selection and layout for the cooling towers has not been confirmed at the time of assessment and is subject to change during the later stages of the project.

As per the advice provided the mechanical engineer, it is expected that the roof plant room containing the cooling towers will have the capacity to allow adequate acoustic treatment to achieve compliance to the relevant noise criteria. Treatment may take the form of selecting quieter units or providing attenuation such as acoustically rated louvres or attenuators.

Once the final cooling tower unit selection and layout has been confirmed, treatments will be provided to achieve compliance to the relevant EPNR assigned noise levels at all closest receivers for the future scenario. This will be finalized prior to the issue of Building Permit.

At this stage no information has been provided regarding the other mechanical service equipment. 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.

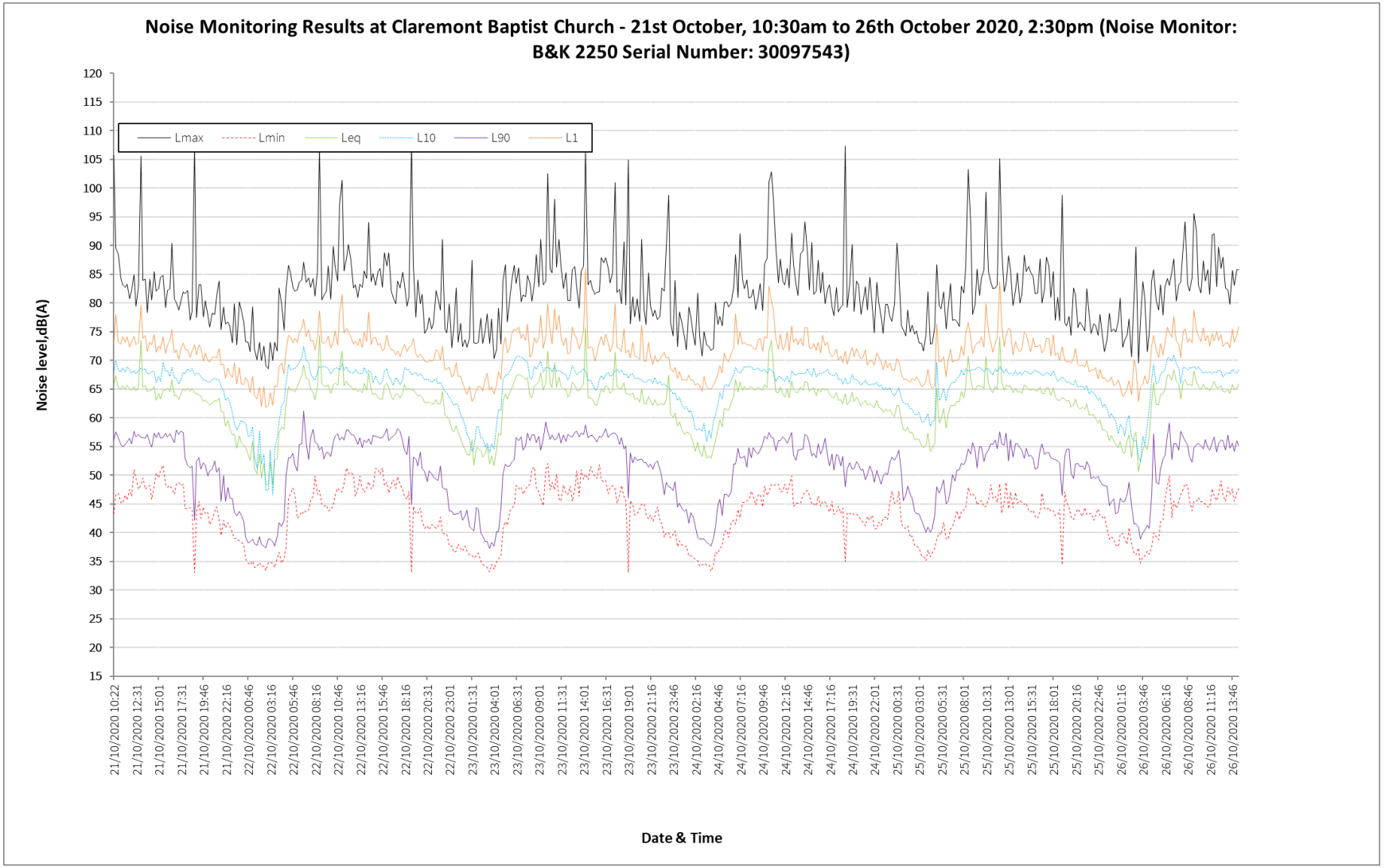
When mechanical services information has been provided a detailed noise assessment will need to be conducted to ascertain the specific acoustic treatments required.

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 Measurements



Appendix C Noise Modelling Checklist

Checklist item			Action
Road traffic input data			
Road name	**Stirling Hwy (West of Parry St) 2019/2020**		
	16-hr daytime road traffic volume		33822
	Percentage of heavy vehicles (daytime)		6
	8-hr night-time road traffic volume		1570
	Percentage of heavy vehicles (night-time)		6
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

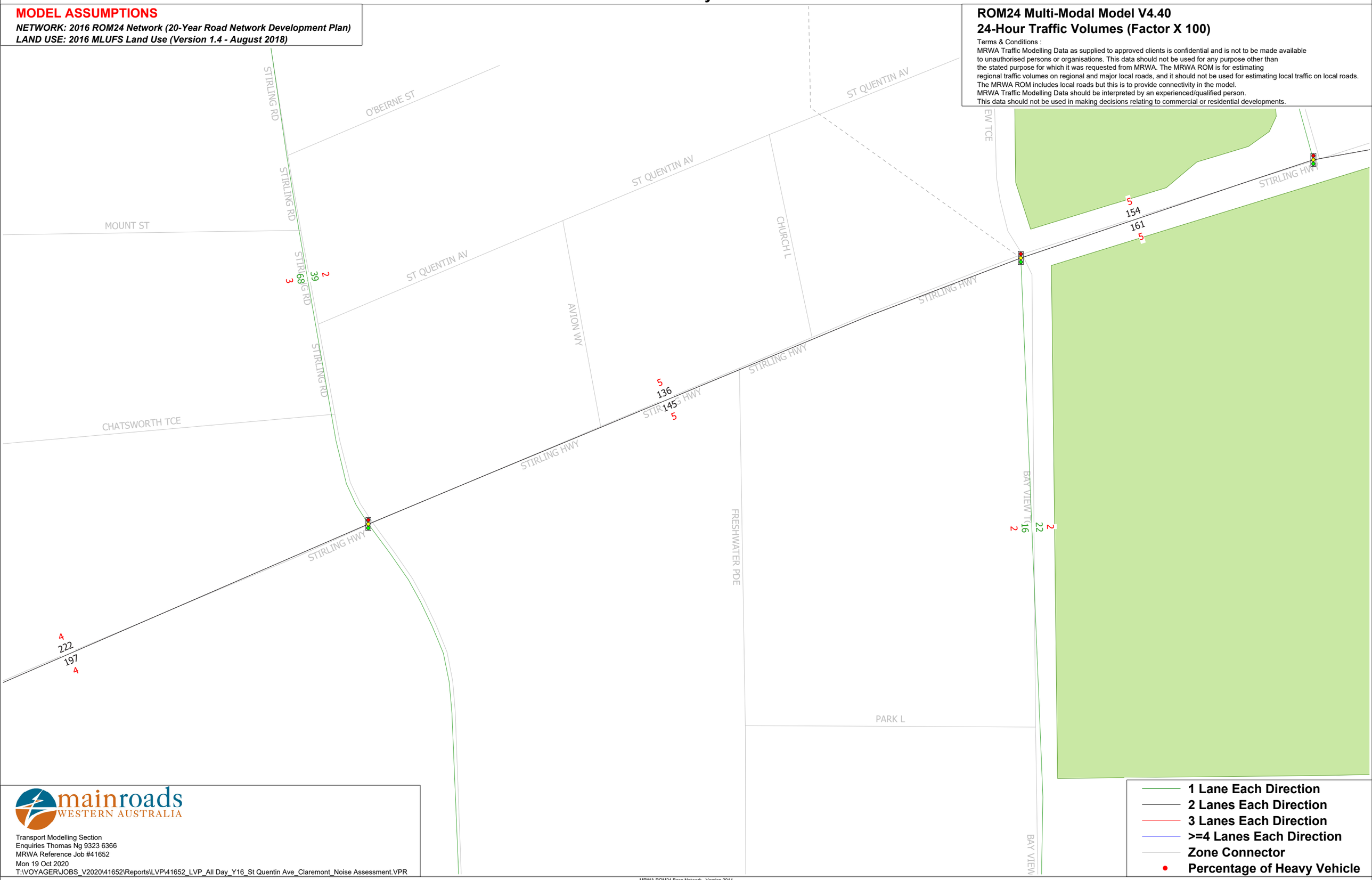
Appendix D Mainroads Validation and Link Volume plots

2016 ROM24 Scenario - Link Volume Plot for St Quentin Ave, Claremont Noise Assessment
LAND USE SCENARIO : MLUFS Version 1.4
All Day

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)



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

mainroads WESTERN AUSTRALIA
Transport Modelling Section
Enquiries Thomas Ng 9323 6366
MRWA Reference Job #41652
Mon 19 Oct 2020
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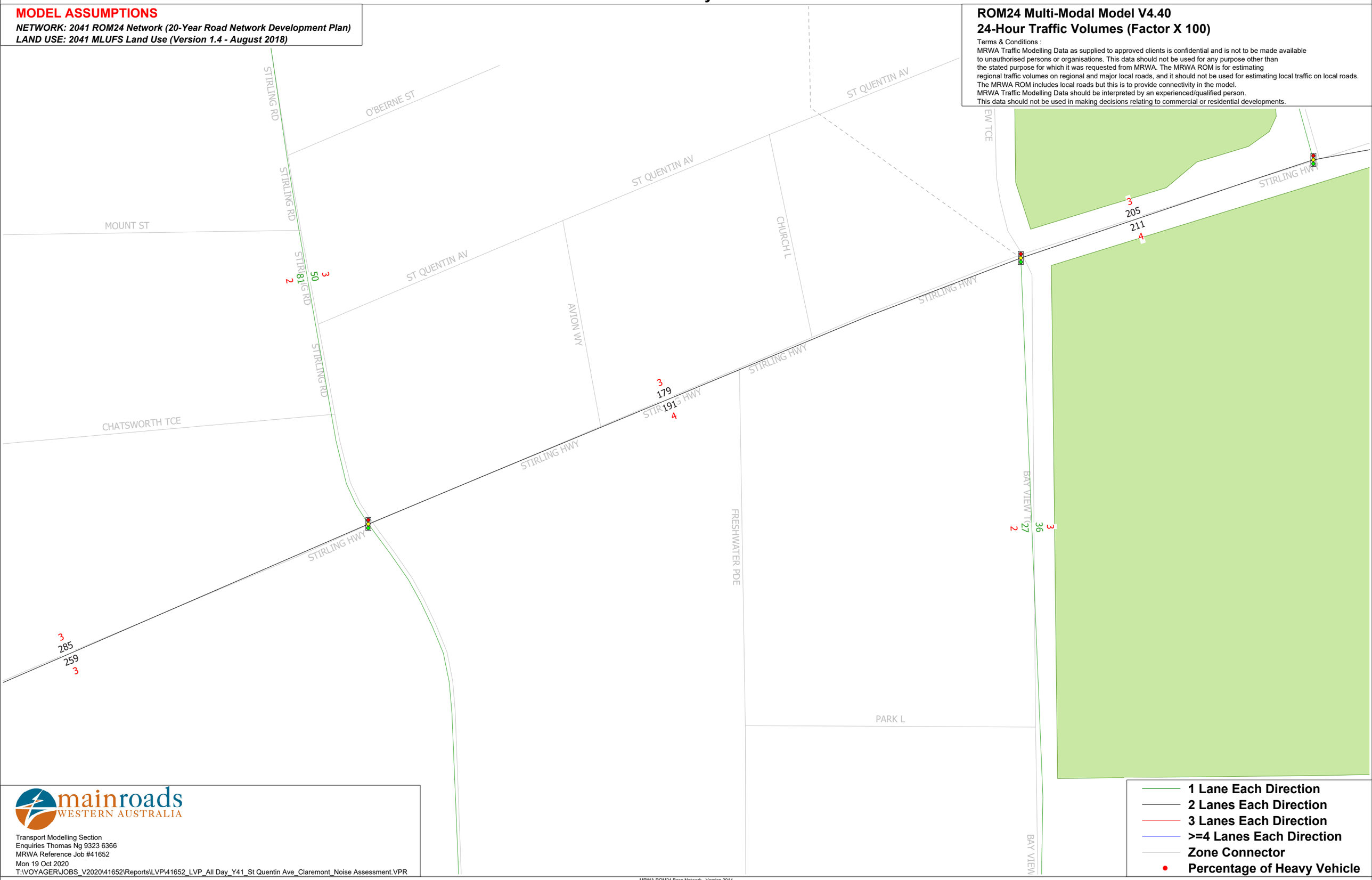
2041 ROM24 Scenario - Link Volume Plot for St Quentin Ave, Claremont Noise Assessment
LAND USE SCENARIO : MLUFS Version 1.4
All Day

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
Percentage of Heavy Vehicle

mainroads WESTERN AUSTRALIA

Transport Modelling Section
Enquiries Thomas Ng 9323 6366

MRWA Reference Job #41652
Mon 19 Oct 2020
T:\VOYAGER\JOBS_V2020\41652\Reports\LVP\41652_LVP_All Day_Y41_St Quentin Ave_Claremont_Noise Assessment.VPR

2016 ROM24 Scenario - Validation Plot for St Quentin Ave, Claremont Noise Assessment
LAND USE SCENARIO : MLUFS Version 1.4
All Day

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 & Observed Counts

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

mainroads WESTERN AUSTRALIA

Transport Modelling Section
Enquiries Thomas Ng 9323 6366
MRWA Reference Job #41652
Mon 19 Oct 2020
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MRWA ROM24 Base Network - Version 2014

cube

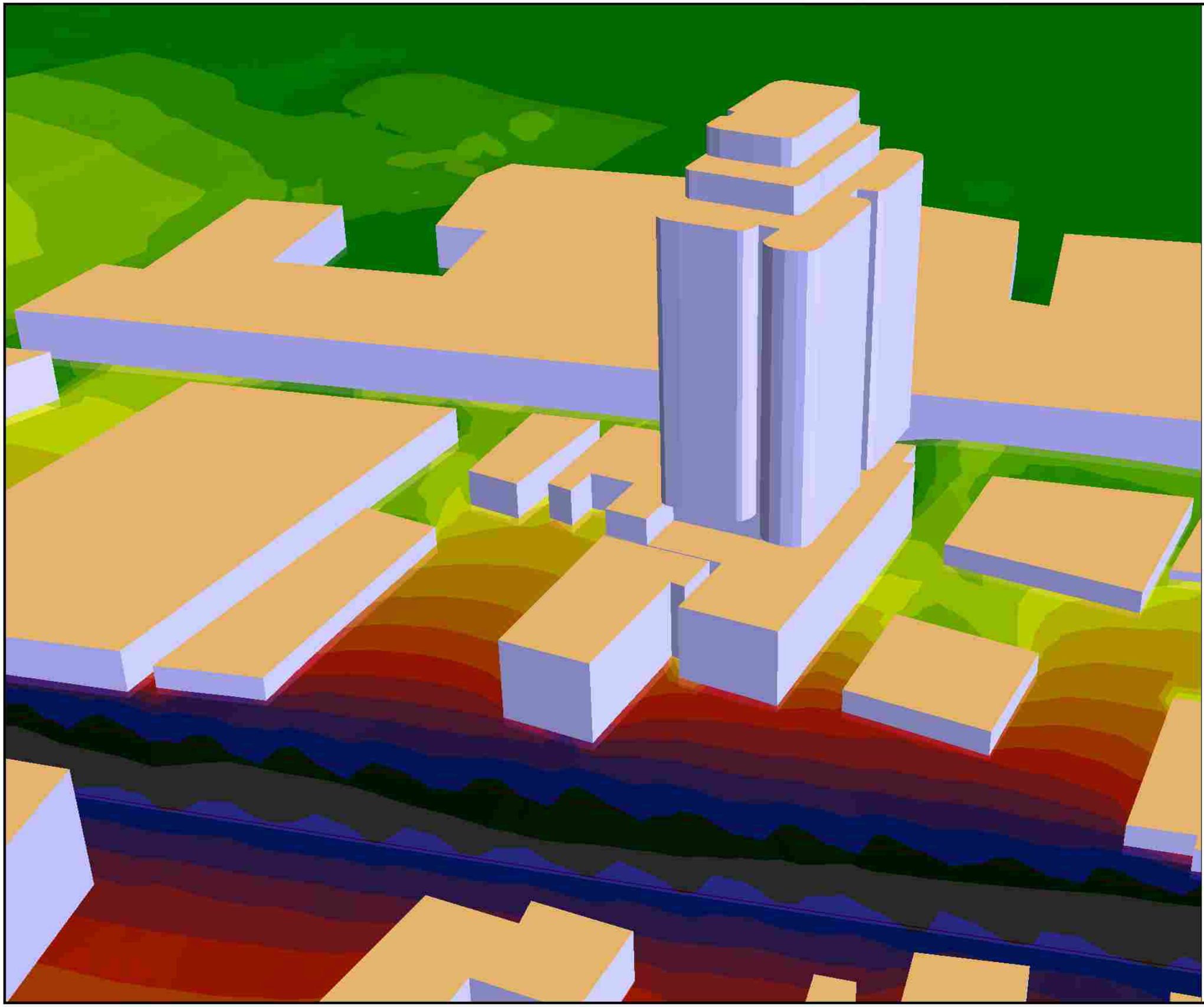
Appendix E Noise Contours

22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

NOISE CONTOUR AT
1.4m RECIEVER HEIGHT



Noise level
in dB(A)

	< 40.0
40.0 <=	< 42.0
42.0 <=	< 44.0
44.0 <=	< 46.0
46.0 <=	< 48.0
48.0 <=	< 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 <=	

0
1m

Stantec

22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

NOISE CONTOUR AT
1.4m RECIEVER HEIGHT

Noise level
in dB(A)

	< 40.0
40.0 <=	< 42.0
42.0 <=	< 44.0
44.0 <=	< 46.0
46.0 <=	< 48.0
48.0 <=	< 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 <=	

0
1m

Stantec

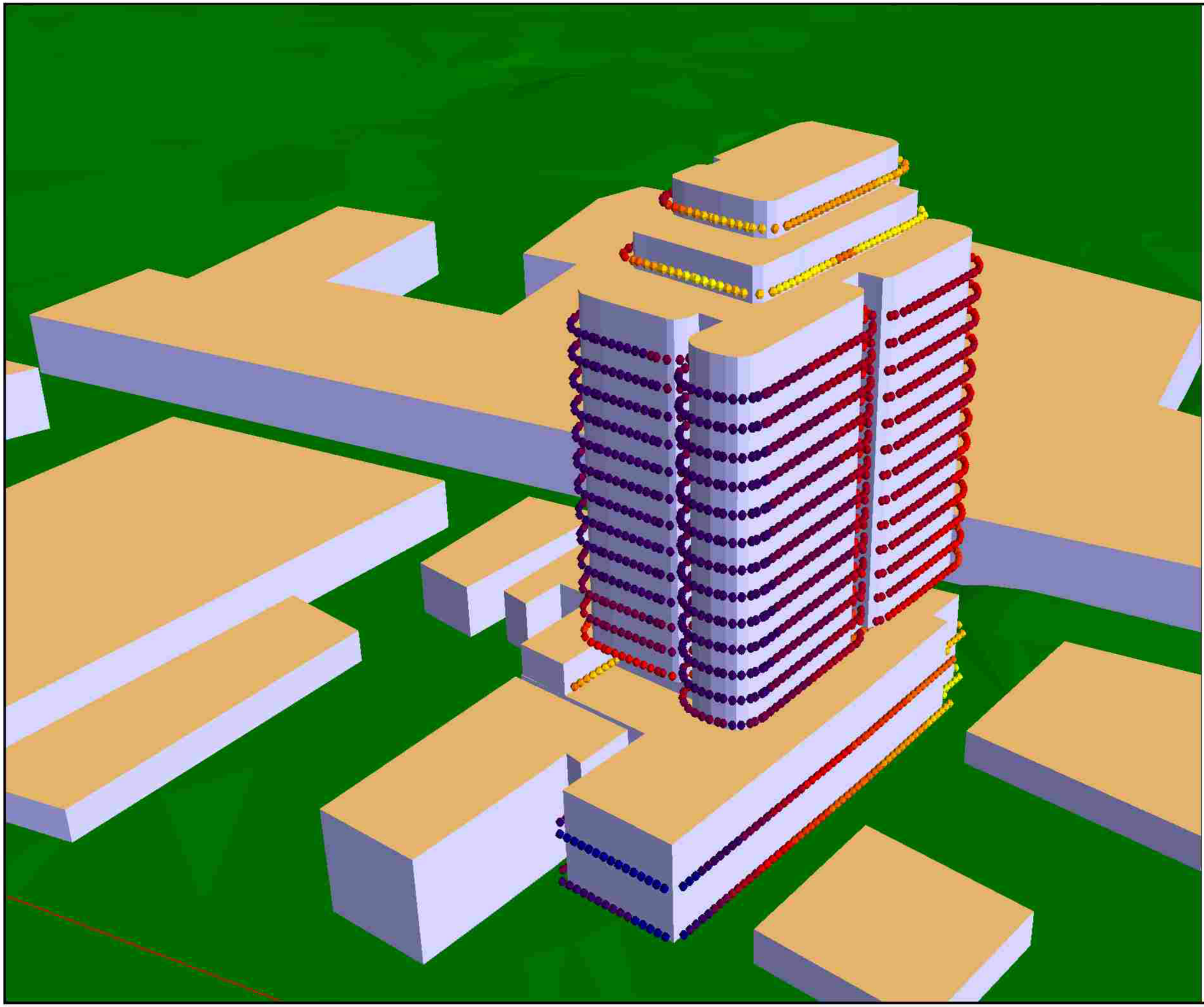
22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

FACADE NOISE
CONTOUR (NORTH-WEST)

Stantec



22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

FACADE NOISE
CONTOUR (SOUTH-EAST)

Noise level
in dB(A)

	< 35.0
35.0 <=	< 37.0
37.0 <=	< 39.0
39.0 <=	< 41.0
41.0 <=	< 43.0
43.0 <=	< 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

0 6 12 18 24 30 m

Stantec

22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

FACADE NOISE
CONTOUR (NORTH-WEST)

Noise level
in dB(A)

	< 35.0
35.0 <=	< 37.0
37.0 <=	< 39.0
39.0 <=	< 41.0
41.0 <=	< 43.0
43.0 <=	< 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 <=	

0 6 12 18 24 30 m

Stantec

22 St Quentin Ave,
Claremont

45527
3/31/2021
JLM

FUTURE NIGHT TIME
SCENARIO (2041)

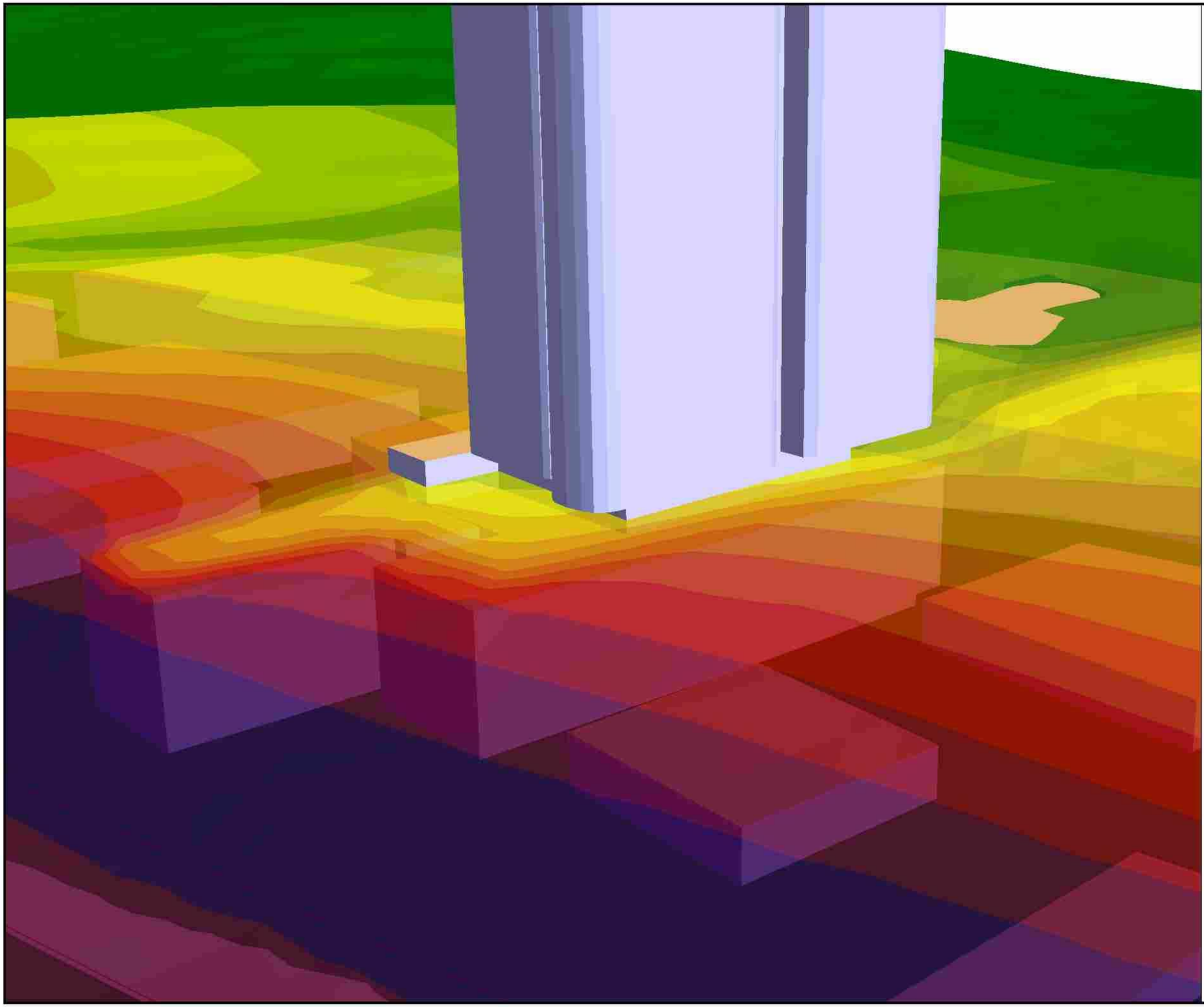
FACADE NOISE
CONTOUR (SOUTH-EAST)

Noise level
in dB(A)

	< 35.0
35.0 <=	< 37.0
37.0 <=	< 39.0
39.0 <=	< 41.0
41.0 <=	< 43.0
43.0 <=	< 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

0 6 12 18 24 30 m

Stantec



22 St Quentin Ave,
Claremont

45527
4/1/2021
JLM

FUTURE DAY TIME
SCENARIO (2041)

NOISE CONTOUR AT
1.4m ABOVE LEVEL 2
RECEIVER HEIGHT

Noise level
in dB(A)

	< 40.0
40.0 <=	< 42.0
42.0 <=	< 44.0
44.0 <=	< 46.0
46.0 <=	< 48.0
48.0 <=	< 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 <=	

0
1m

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