445 - 459 Canterbury Rd - Campsie

Acoustics Report

Development Application

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	05/02/2021	Draft Issue	James Ashpole	Olivier Gaussen
002	26/08/2021	Revised Massing	James Ashpole	Olivier Gaussen

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1. Introduction

As part of the Development Application (DA) documentation process, Stantec has been engaged by Hailiang Property Group Australia Pty Ltd to provide an acoustic assessment for the proposed health facility development located at 445-459 Canterbury Road, Campsie NSW 2194.

This assessment discusses the likely noise impact of the development upon the potentially nearest most-affected noise-sensitive receivers and also the potential impacts of external noise sources within the proposed development.

This assessment has been prepared considering the following documents:

- Canterbury Development Control Plan 2012.
- NSW Environment Protection Authority (EPA) Noise Policy for Industry, 2016 (NPI 2016)
- Department of Planning (DoP) – Development near Rail Corridors and Busy Roads – Interim Guideline.
- NSW Road Noise Policy, 2011 (RNP 2011)
- AS/NZS 2107:2016: “Acoustics – Recommended design sound levels and reverberation times for building interiors”
- Bureau of Meteorology, Daily rainfall report.
- NSW Environment Protection Authority (EPA) Interim Construction Noise Guideline (ICNG July 2009).
- Assessing Vibration – A Technical Guideline (NSW AV-TG), issued February 2006 by the Department of Environment and Conservation NSW, now part of the NSW EPA.
- British Standard BS5228: Part 1:1997 “Noise and Vibration Control on Construction and Open Sites.”
- British Standard BS7358:1993 “Evaluation and Measurement for Vibration in Buildings” – Part 2: “Guide to Damage Levels from Groundborne Vibration”
- German Standard DIN4150-Part 3 “Structural vibration in buildings – Effects on structures
- Engineering Services Guideline (NSW HI ESG) issued by NSW Health Infrastructure, dated July 2017.

This report provides:

- A noise impact assessment of the proposed new health facility development and its potential effect on the surrounding communities.
- A statement of compliance with the Canterbury Development Control Plan 2012 acoustic requirements for the reference design
- Indicative recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria

This noise assessment is based on noise data collected by unattended noise measurements at representative locations around the site over 8 days from the 24th of September to the 2nd of October 2020.

This report is based on our understanding of the proposed project, application of the relevant state guidelines and professional experience within the acoustic field. Therefore, this report shall not be relied upon as providing any warranties or guarantees.

2. Background

The following documentation has been used for the preparation of this report:

- Site drawings presenting the location of the proposed development in relation to the nearest receivers.
- Noise data collected on site through the use of noise monitors and a handheld spectrum analyser.
- Architectural drawings issued by Team 2 Architects Pty. Ltd:
  - Architectural Concept Design Report
  - Updated Massing Form

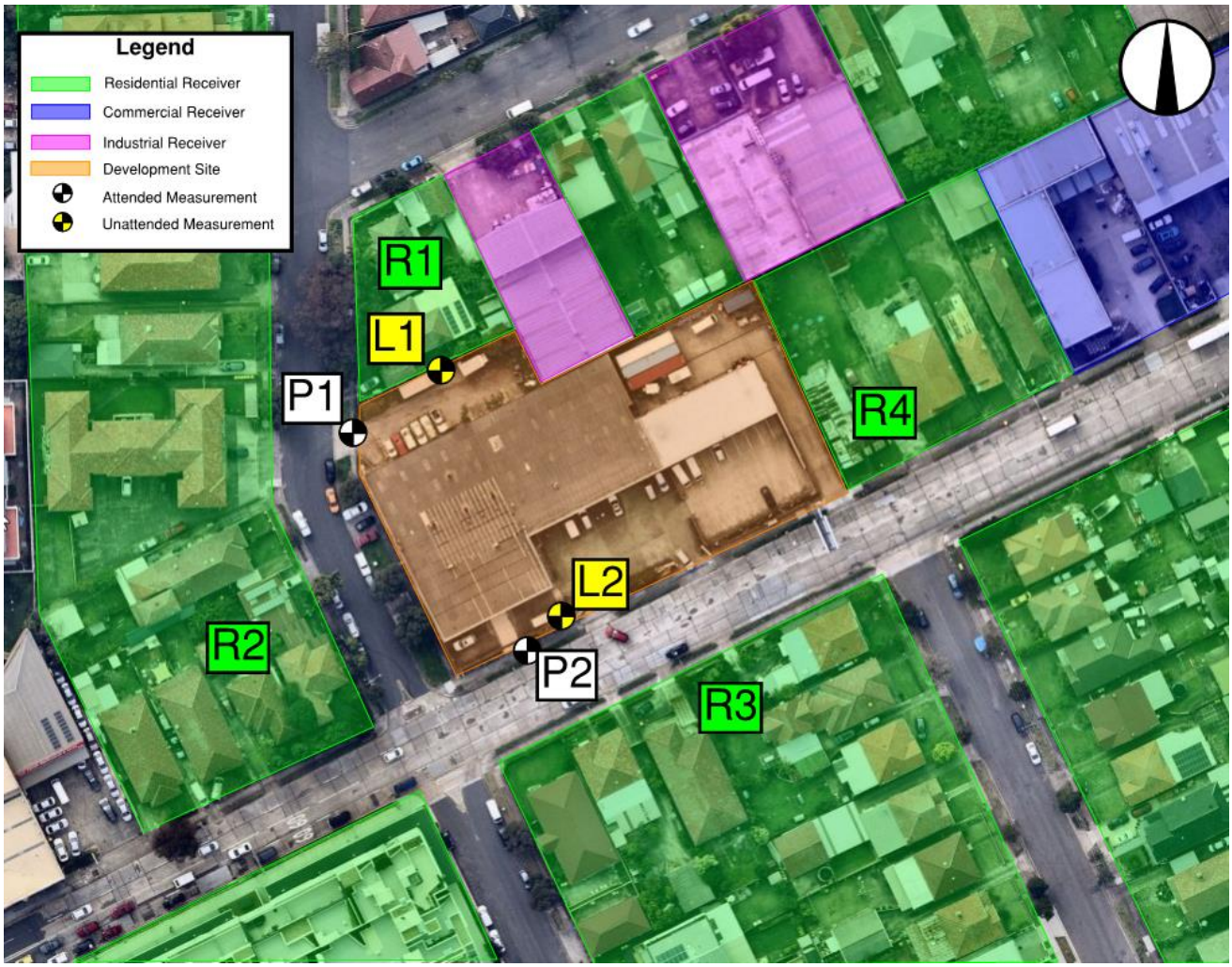
3. Project Overview

3.1 Site Description

The proposed health facility development is located at 445 – 459 Canterbury Rd, Campsie. The proposed development is bound by residential and industrial warehouse properties to the North and East, Canterbury Road to the South and Stanley St to the West. There are residential properties located across Stanley St and Canterbury Rd.

The proposed development site, the unattended noise monitoring locations, the attended noise monitoring locations, and the nearest sensitive receivers are shown in in Figure 1 below.

Figure 1: Aerial Photo of the Area Showing an Overview of the Site and Measurement Locations



Source: nearmap.com

3.1.1 Acoustic Issues

The proposed development will generate noise to the surrounding environment such as residential, industrial and commercial receivers. In addition to this the site-specific acoustic environment (noise) will have an impact on the development itself including acoustic requirements associated with the building envelope in general. This aspect of the project will aim at providing acoustic amenity to the building occupants once the project is completed.

The acoustic issues relating to the development are as follows:

- Noise from vehicle movements on Canterbury Road intruding into the habitable spaces within the proposed development.
- Noise emissions from mechanical plant servicing the proposed development to the surrounding noise-sensitive receivers.
- Noise emissions from the operation of the loading dock to the surrounding noise-sensitive receivers.
- Noise emissions from vehicle movements along the proposed lane way and drop off zone on the northern side of the proposed development.
- Increased traffic noise generated by the proposed development affecting the surrounding residential receivers.

4. Noise Survey

4.1 Instrumentation

The equipment used for the noise survey was the following:

- Hand-held sound spectrum analyser NTI Audio NTI XL2, S/N: A2A-11555-E0
- SVAN Acoustic Calibrator SV30A, S/N: 17556
- ARL Environmental Noise Logger, NL-42X, S/N 1173759
- ARL Environmental Noise Logger, NL-42X, S/N 1173756

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

4.2 COVID-19

It should be noted that the background noise measurements were conducted during the COVID-19 isolation period and are perhaps not representative of 'normal or typical' conditions for the site surrounding areas. However, the background and ambient noise results obtained at logger locations L1 and L2 were benchmarked against Australian Standard – 'AS 1005 *Acoustics – Description and measurements of environmental noise*' and other measurements conducted by Stantec and other acoustic consultancies in the area in 2019 pre-COVID isolation period. The measurements were compared and adjusted accordingly to the site's typical environment.

Whilst on site during the attended measurements periods it was noted that traffic was consistent in volume, surrounding premises were operating and is therefore relevant for the purposes of the assessments. It is worth noting that the attended measurements are used as validation data of the unattended noise survey.

4.3 Attended Noise Measurements

Attended noise measurements of 15-minute duration were conducted on site to characterise the noise intruding into the development and to validate the results of the unattended noise monitoring. A summary of the attended noise measurements taken in the vicinity of the proposed development site are shown in Table 1. Refer to Figure 1 for measurement locations.

Table 1 - Attended Noise Survey Results

Measurement Location	Measurement Time	L_{Aeq} dB(A)	L_{A90} dB(A)	L_{Amax} dB(A)	Comments
P1	24/09/2020 1:26pm	53.1	47.3	71.8	Noise dominated by intermittent traffic movements along Stanley St and low pedestrian foot traffic movement. Operation of nearby warehouses and workshops could be heard. Noise from wildlife in the area.
P2	24/09/2020 1:45pm	75.1	63.8	101.0	Noise dominated by high consistent traffic along Canterbury Rd. Both light and heavy vehicles.

4.4 Unattended Noise Survey Results

4.4.1 Background and Ambient Noise Monitoring

Noise monitors were placed at position L1 and L2 as shown in Figure 1 to measure the background and ambient noise that is representative of the surrounding noise-sensitive residential receivers. The noise monitor at L1 was installed from the 24th of September to the 2nd of October 2020, whilst the monitor L2 was installed from the 25th of September to the 2nd of October 2020. The results of the unattended background and ambient noise survey is shown in Table 2 below (for the day, evening and night time periods).

The noise monitoring results of logger locations L1 and L2 are respectively representative of the residential ambient noise level for R1 and R2, R3, R4. The logger at L2 has also been used to characterise the noise associated with traffic movements along Canterbury Road to assist with assessing the expected impact on the proposed development.

Table 2 - Unattended Noise Monitoring Results – L1 and L2

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	54	49	47	45	43	38
L2	71	70	68	60	56	43

The local ambient noise environment at L2 is dominated by traffic noise from Canterbury Road throughout the majority of the day, evening and night-time periods. The noise environment at L1 is dominated by local environment noise such as intermittent vehicle movements, foot traffic and operation noise associated with the surrounding premises during the day as well as traffic noise from Canterbury Road during day, evening and night-time periods. Note that any rain affected data during the period of logging has been excluded from the calculations.

Refer to Figure 2 and Figure 3 for the noise data.

Figure 2: Unattended background and ambient noise monitoring data – L1

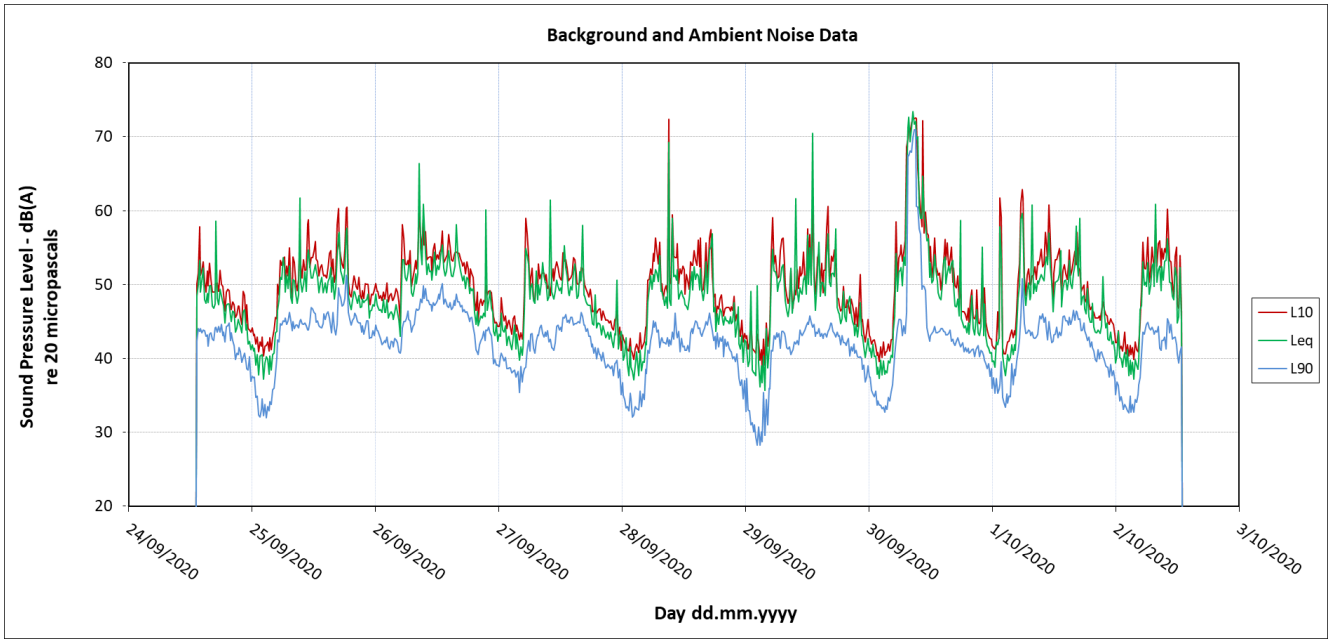
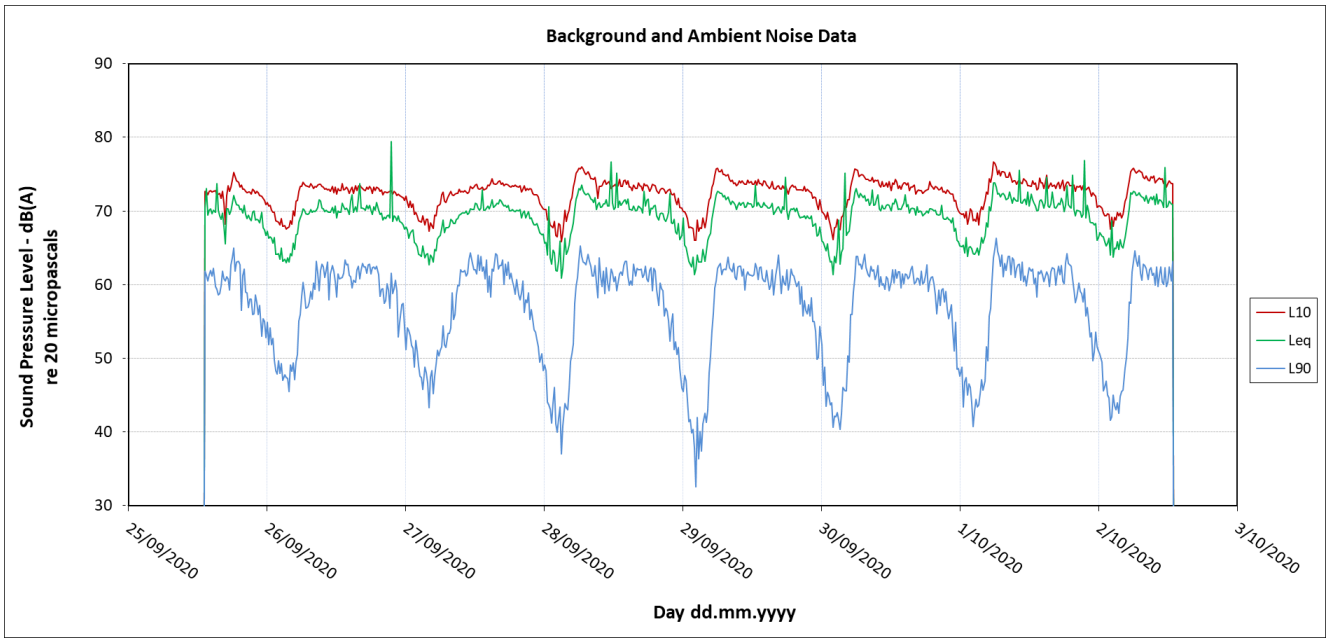


Figure 3: Unattended background and ambient noise monitoring data – L2



5. Noise and Vibration Criteria

5.1 Internal Noise Levels

5.1.1 Canterbury Development Control Plan 2012

The Canterbury Development Control Plan 2012 does not state any specifics with regard to internal noise levels for spaces within the proposed development. Therefore, suitable and relevant Australian standards and guidelines have been used to determine the criteria associated with internal noise levels throughout the development.

5.1.2 Department of Planning: Development near Rail Corridors and Busy Roads – Interim Guideline

The DoP's Development near Rail Corridors and Busy Roads – Interim Guideline governs the required maximum internal noise levels within wards and other noise sensitive areas within the development. The guideline details the application of clause 87/clause 102 of the State Environmental Planning Policy (SEPP) Infrastructure

Table 3 provides a summary of the criteria established in the DoP's Interim Guideline below.

Table 3: Summary of DoP's Interim Guideline criteria for developments adjacent to roads

Type of habitable space		Applicable Time Period	Assessment Noise Metric	Criteria – dB(A)
Hospitals	Wards	At any time	L_{Amax}	35
	Other noise sensitive areas	At any time	L_{Amax}	45

5.1.3 AS/NZS 2107:2016

Australian Standard AS/NZS 2107:2016 – *'Acoustics- Recommended design sound levels and reverberation times for building interiors'* will be used to specifies target noise levels for internal spaces to the development for noise sources and particular spaces that are not covered in the other standards. Traffic noise intrusion AS 3671 refers to internal noise compliance with AS/NZS2107:2016. Refer to Table 4 for the values corresponding to health buildings.

Table 4: Recommended internal noise levels extracted from AS/NZS 2107:2016

Type of occupancy / activity	Design sound level L_{Aeq}, dB(A) range
Health Buildings	
Emergency areas	40 – 45
Control Rooms	40 – 50
Corridors and lobby spaces	< 50
Consulting rooms	40 – 45
Delivery suites	45 – 50
Dental clinics	40 – 45
Dining areas	40 – 45

Geriatric rehabilitation	40 – 45
Intensive care wards	40 – 45
Kitchens, sterilizing and service areas	< 55
Laboratories	40 – 50
Maintenance workshops	< 60
MRI/CT Scan/X=Ray areas/Ultra sound	45 – 50
Nurseries	35 – 45
Nurses' stations	40 – 45
Office areas	35 – 45
Operating theatres	40 – 50
Patient lounge	40 – 45
Post-Op, Pre-Op, Recovery rooms	40 – 45
Pharmacies	45 – 50
Staff rooms	40 – 45
Sterilizing areas in operating theatres	40 – 45
Surgeries/treatment/procedure rooms	40 – 45
Utility rooms	50 – 60
Ward bedrooms	
Single bed	35 – 40
Multiple beds	35 – 40
Waiting rooms, reception areas	40 – 50

5.1.4 NSW HI ESG

NSW HI ESG Table 12a is reproduced in Table 5 below. Column A outlines the 'satisfactory' and 'maximum' internal background noise levels which are required for various types of spaces. This level will be controlled by façade considerations which will regulate external noise intrusion, and selection of appropriate internal mechanical services. Design of partitions is influenced only by sources that are continuous and associated with standard operation of the site; intermittent noises or those associated with emergency operation are neglected.

Table 5: Recommended internal noise levels extracted from AS/NZS 2107:2016

Acoustic Requirements for Areas Affective Patient Care Hospitals and Outpatient Facilities							
	A		**B**	**C**	**D**	**E**	**F**
Area Designation	**Continuous Internal Noise Levels, L_{Aeq} dB**		**Intermittent Internal Noise Level L_{Amax} dB [9]**	**Internal Noise Levels Helicopter $L_{Amax,slow}$ dB [7]**	**Impact Sound Isolation L_{nw} dB**	**Reverberation Time (s) (Fully finished)**	**Emergency Generator Noise Limit L_{Amax}, dB [11]**
	Satisfactory	**Maximum**					
Clinical							
Operating Theatre	40	45	55	65	50	0.4-0.7[8]	+5
Birthing Room or Delivery Suite	45	50	65	75	60	0.4-0.6	+5
Intensive Care	40	45	60	65	50	0.4-0.7	+5
Patient Room / Single Bed Ward	35	40	55[10]	68	50	0.4-0.7	+5
Multi Bed Ward	35	40	55[10]	68	55	0.4-0.7	+5
Toilet / Ensuite	50	55	-	75	60	-	+10
Patient Corridor	40	50	-	80	60	0.4-0.6	+10
Counselling/ Bereavement / Interview Room	40	45	60	65	55	0.4-0.6	+5
Consult Room	40	45	60	65	55	0.4-0.6	+5
Speech and Language Therapy	35	40	60[6]	65	55	0.4-0.6	+5
Treatment / Medication/ Examination Room	40	45	60[6]	65	60	0.4-0.6	+5
Public Areas							
Corridors and Lobby Space	40	50	-	80	60	0.4-0.6[8]	+10

Cafeterias / Dinning	45	50	-	80	60	Practicable reduction	+10
Toilets	45	55		70	-	-	+10
Waiting Rooms, Reception Areas	40	50	-	80	60	0.4-0.6	+10
Multi Faith / Chapel	30	35	-	65	50	0.4-0.6	+5
Staff / Back of House Areas							
Meeting Room	35	40	-	70	55	0.6-0.8	+5
Board / Conference Room (Large)	30	35	-	70	55	0.6-0.8	+5
Open Plan Offices	40	45	-	75	60	0.4-0.6	+5
Private Offices	35	40	-	70	55	0.6-0.8	+5
Multi Person Offices	40	45	-	75	55	0.6-0.8	+5
Locker Room	50	55	-	-	-	-	+10
Rest Room	40	45	-	75	-	0.4-0.6[8]	+5
Classrooms, Training Rooms	35	40	-	75	55	0.5-0.6	+5
Lecture Theatre	30	35	-	75	55	Curve 1 of AS/NZS2107 :2000	+5
Library	40	45	-	80	55	0.4-0.6	+5
Workshops	45	50	-	-	-	Practicable reduction	+10
Plant Rooms	N/A	<85	-	-	-	Practicable reduction	-
Laboratory	45	50	-	75	60	0.4-0.7	+10

Notes:

1. All sound pressure levels referenced to 20 micro-Pascals (dB re 20 µPa).

2. For Column A, L_{eq} noise levels should be measured over a repeatable, worst-case one hour period. A one hour averaging period has been selected to best represent impacts from continuous noise sources, and any frequently occurring intermittent noise sources.

3. The repeatable maximum noise level generated by lift operations should not exceed the maximum L_{eq} noise level specified for that space (excluding lift lobbies).

4. Reverberation times are the spatial average in fully furnished rooms, generally for full octave bands with centre frequencies of 500 Hz and 1 kHz.

5. Ambient noise levels to be in the range between “Satisfactory” and “Maximum” in Column A where the rooms have a “Confidential” or “Private” Speech Privacy Requirement (Refer to Table 12 (b) for Speech Privacy Requirements). In other words, the “Satisfactory” criterion should be interpreted as a “minimum” value for rooms that require a degree of acoustic privacy, unless partition ratings have been otherwise determined using lower background noise levels. In this case the design basis should be nominated.

6. Speech and Language Therapy excludes audiometric rooms and specialist test and measurement rooms that require more controlled ambient noise conditions.

7. Noise levels apply to Westmead and Royal North Shore Hospitals. Also, for new buildings with a rooftop helipad, specific consideration should be given to controlling helicopter noise levels, in agreement with NSW HI on a case-by-case basis. In addition, direction should be sought from NSW HI on a project-by-project basis as to whether consideration should be given to “future-proofing” the building against future increases to helicopter movements.

8. Where practical.

9. The acceptability of any intrusive noise depends on the frequency of occurrence, the intrusive noise level and character, plus the sensitivity of the space. The intermittent internal noise levels shown are intended to apply to any frequently occurring intermittent noise sources including rail, internal and external driveways, loading docks, nearby industry, etc. and where the frequency of occurrence of the noise source is sufficiently high or low that adequate control of the intrusive noise level is not achieved via the Column A, Leq noise levels. The project acoustic engineer is required

to apply professional judgement in assessing the frequency of occurrence of the intrusive noise, the intrusive noise level and character, plus the sensitivity of the space in order to apply the intrusive noise limits in Column B. Justification of the basis of the design needs to be reported for HI review. The intrusive noise limits in Column B do not apply to noise from commercial aircraft (which is to be assessed in accordance

with AS2021).

10. Where a significant, intermittent and intrusive noise source is prevalent, a sleep disturbance assessment is required. The outcome of this assessment shall be included with the acoustic design.

11. Noise levels are set relative to the ‘Maximum’ continuous internal noise levels from Column A.

5.2 External Noise Emissions

In the absence of noise emission criteria in the Canterbury DCP,

the NSW Noise Policy for Industry (NPI) has been applied to the address the noise emissions from proposed development. The NPI sets out noise criteria to control the noise emission from industrial noise sources from activities listed in Schedule 1 of the POEO Act and regulated by the EPA. The external noise due to mechanical services from the proposed development is also addressed following the guideline in the NSW EPA's NPI.

The criteria outlined in the NSW EPA Noise Policy for Industry 2017 presented in Section 5.2.1 addresses this DCP requirement.

5.2.1 NSW EPA Noise Policy for Industry (NPI)

The calculation is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

Once both criteria are established, the most stringent for each considered assessment period (day, evening, night) is adopted as the project noise trigger level (PSNL).

Intrusiveness Criteria

The NSW NPI states the following:

> *"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the LAeq descriptor), measured over a 15minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."*

The intrusiveness criterion can be summarised as L_{Aeq}, 15 minute ≤ RBL background noise level plus 5 dB(A).

Table 6 - NSW NPI Rating background noise levels (RBLs)

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Residential – R1		
Daytime 7am – 6pm	$L_{Aeq,15min}$ ≤ RBL + 5	47
Evening 6pm – 10pm	$L_{Aeq,15min}$ ≤ RBL + 5	46
Night 10pm – 7am	$L_{Aeq,15min}$ ≤ RBL + 5	38
Residential – R2, R3 and R4		
Daytime 7am – 6pm	$L_{Aeq,15min}$ ≤ RBL + 5	65
Evening 6pm – 10pm	$L_{Aeq,15min}$ ≤ RBL + 5	61
Night 10pm – 7am	$L_{Aeq,15min}$ ≤ RBL + 5	48

Amenity Criteria

The NSW NPI states the following:

> *"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The recommended amenity noise levels have been selected on the basis of studies that relate industrial noise to annoyance in communities (Miedema and Voss, 2004).*

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows "Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5, +3 dB(A) to convert from a period level to a 15 minute level".

The applicable parts of Table 2.2: Amenity noise levels from Industrial Noise Sources – L_{Aeq}, dB(A) which are relevant to the project are reproduced below:

Table 7- NSW NPI amenity criteria for external noise levels

Type of Receiver	Noise amenity area	Time of Day	L_{Aeq}, dB(A) Recommended amenity noise level	Project amenity noise level $L_{Aeq, period}$
Residential	Suburban	Day	60	58
		Evening	50	48
		Night	45	43
Commercial premises	All	When in use	65	63
Industrial Premises	All	When in use	70	68

*Suburban area as defined in EPA NPI Table 2.2.

Note that where the resultant project amenity noise level is 10dB or more lower than the existing industrial noise level the project amenity noise levels can be set at 10dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

'Modifying Factor' Adjustments

The NSW NPI also states:

> *"Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level."*

In order to take into account the potential annoying character of the noise an adjustment of 5 dB(A) for each annoying character aspect and cumulative of up to a total of 10 dB(A), is to be added to the measured value to penalise the noise for its potentially greater annoyance aspect.

Table C1 of Fact Sheet C of the NSW NPI (see Table 8 below) provides procedures for determining whether an adjustment should be applied for greater annoyance aspect.

Table 8 - Table C1 from the NSW NPI – Modifying factor corrections

Factor	Assessment / Measurement	When to Apply	Correction[1]	Comments
Tonal Noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method *(ISO1996.2-2007 – Annex D)*.	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB[2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note**: Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low Frequency Noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2dB(A) positive adjustment applies for the daytime period.	2 or 5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.
Intermittent Noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level.	The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible.	5 dB	Adjustment to be applied for **night-time only.**
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	One event in any assessment period.	0 to 20 dB(A)	The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).
Maximum Adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10dB(A)[2] (excluding duration correction)	

Notes: 1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.

2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

For the purpose of the proposed development the above modifying factor are not anticipated to be applicable, these factors have been provided for information.

Sleep Disturbance

The NPI establishes sleep disturbance criteria for residential receivers in close proximity to industrial noise sources during the night-time period, such as vehicle movements and car door slams on private roads. The criteria for protecting the amenity of surrounding residential receivers in regards to sleep disturbance is:

- $L_{Aeq,15min}$ 40 dB(A) or prevailing RBL plus 5dB, whichever is greater, and/or
- L_{AFmax} 52 dB(A) or prevailing RBL plus 15dB, whichever is greater

Table 9 summarises the sleep disturbance criteria for the proposed development.

Table 9 - Sleep Disturbance Criteria

Period	Sleep Disturbance Criteria	
	L_{AFmax} – dB(A)	$L_{Aeq,15min}$ – dB(A)
Residential – R1		
Night (10:00pm to 7:00am)	52	40
Residential – R2, R3, R4		
Night (10:00pm to 7:00am)	58	48

5.2.2 Project Noise Trigger Level

Refer to Table 10 for the NSW NPI project specific criteria applicable to the noise emissions associated with the mechanical plant including external plant and plant rooms. The criteria presented in Table 10 are the project specific noise target which the operation of the site must comply and shall be assessed at the boundary of the nearest affected the residential receivers.

Table 10 – Project Noise Trigger Levels

Receiver	Period	Descriptor	PSNL dB(A)
R1	Day	$L_{Aeq,period}$	47
	Evening	$L_{Aeq,period}$	46
	Night	$L_{Aeq,period}$	38
R2, R3, R4	Day	$L_{Aeq,period}$	58
	Evening	$L_{Aeq,period}$	51[1]
	Night	$L_{Aeq,period}$	43
Industrial Premises	All	When in use	68
Commercial Premises	All	When in use	63

Note: 1. The Project amenity noise level is more than 10dB lower than the existing industrial noise level. Therefore, the project specific criteria have been adjusted to 10dB below the existing industrial noise levels as this is not expected to reduce overtime due to the association with traffic movements along Canterbury Rd during peak times.

5.2.3 Emergency Generator

The NSW Environmental Noise Control Manual (ENCM) sets out the noise control guideline for these emergency diesel generators. The criteria are summarized as below.

Emergency electricity generators which are used in the event of power shortages should not exceed the following maximum noise levels, in order to minimize disturbance to the community.

For residential receiving areas during day and evening time:

- From 7 am to 10 pm any day of the week, the L_{A10} sound pressure level should not exceed the L_{A90} background level by more than 10 dB(A) at the boundary of any nearby affected residence, and in any case
- The L_{A10} level at the residential boundary should not exceed 55 dB(A).

For residential receiving areas during nighttime:

- From 10 pm to 7 am the L_{A10} level should not exceed the L_{A90} background level by more than 5 dB(A) at the boundary of any nearby affected residence, and in any case
- The L_{A10} level at the residential boundary should not exceed 45 dB(A).

For industrial/commercial receivers at any time

- At no time should the L_{A10} level exceed the L_{A90} background level by more than 15 dB(A) at the boundary of any nearby affected industrial or commercial premises; and
- The L_{A10} level at the receiving boundary should not exceed 65 dB(A)

In summary, the noise emissions from the generators must not exceed the values provided in Table 11 corresponding to the noise-sensitive receivers shown in Table 11.

Table 11: Noise emission limits from emergency generators

Receiver	Period	Descriptor	Noise Emission Limit dB(A)
R1	Day	L_{A10}	55
	Evening	L_{A10}	53
	Night	L_{A10}	43
R2, R3 & R4	Day	L_{A10}	55
	Evening	L_{A10}	55
	Night	L_{A10}	45
Industrial Premises	Day	L_{A10}	60
	Evening	L_{A10}	58
	Night	L_{A10}	53

5.3 Traffic Noise Generation

The L_{Aeq} noise level or the "equivalent continuous noise level" correlates best with the human perception of annoyance associated with traffic noise.

Road traffic noise impact is assessed in accordance with the introduced NSW Road Noise Policy (Office of Environment and Heritage July 2011) which supersedes the *NSW Environmental Criteria for Road Traffic Noise* (ECRTN, Department of Environment Climate Change and Water 1999). The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use developments into different categories and lists the respective criteria for each case. The category that is relevant to the proposed use of the site is shown below in Table 12.

Table 12: NSW Road Noise Policy – Traffic noise assessment criteria

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1\ hour}$ 55 (external)	$L_{Aeq,1\ hour}$ 50 (external)
Sub-arterial	Existing residences affected by additional traffic on existing sub-arterial roads generated by land use developments	$L_{Aeq,1\ hour}$ 60 (external)	$L_{Aeq,1\ hour}$ 55 (external)

In the event that the traffic noise at the site is already in excess of the criteria noted above, the NSW RNP states that the primary objective is to reduce the existing level through feasible and reasonable measures to meet the criteria above.

If this is not achievable, Section 3.4.1 Process for applying the criteria – Step 4 states that for existing residences affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise should be limited to 2 dB above that of the corresponding 'no build option'.

5.4 Construction Noise

Noise criteria for construction sites are established in accordance with the Interim Construction Noise Guideline (ICNG July 2009) by the NSW Environment Protection Authority (EPA). It is important to note that the recommended criteria are for planning purposes only. Numerous other factors need to be considered when assessing potential noise impacts from construction works.

However, in undertaking the assessment of potential noise intrusion associated with the proposed construction activities, Chapter 4 of the NSW EPA ICNG (July 2009) were specifically referenced. The limits presented in Table 13 apply.

Table 13: NSW EPA ICNG Construction Noise Criteria

Time of Day	Management Level $L_{Aeq,15min}$ *	How to Apply
Recommended Standard Hours: Mon – Fri (7am – 6pm) Sat (8am – 1pm) No work on Sunday & Public Holidays	Noise Affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB(A)	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

Note: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Source: Chapter 4 (Table 2 Sec 4.1.1) of NSW DECCW ICNG

5.5 Construction Vibration

The NSW Environment Protection Authority (EPA) developed a document, "Assessing vibration: A technical Guideline" in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. The guideline does not however address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent.

5.5.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day.

Maximum allowable magnitudes of building vibration with respect to human response are shown in Table 14. It should be noted that the human comfort for vibration are more stringent than the building damage criteria.

Table 14: RMS values for continuous and impulsive vibration acceleration (m/s2) 1-80Hz

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Critical Areas[1]	Day or night time	0.0050	0.0036	0.10	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and place of worship	Day or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
Critical areas[1]	Day or night-time	0.0050	0.036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and place of worship	Day or night time	0.64	0.46	1.28	0.92

Note:

1. Examples include hospital operating theatres and prevision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort cirtiera specified above, Stipulation of such criteria is outside the scope of this policy. And other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472-1992

5.5.2 Human Comfort – Intermittent Vibration Criteria

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. Various studies support the fact that VDV assessment methods are far more accurate in assessing the level of disturbance than methods which is only based on the vibration magnitude.

Table 15: Acceptable Vibration Dose Values for Intermittent Vibration (m/s1.75)

Location	Daytime (7:00am to 10:00pm)		Night-time (10:00pm to 7:00am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical Areas[1]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and place of worship	0.40	0.80	0.40	0.80

Note:

1. Examples include hospital operating theatres and prevision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas.

5.5.3 Structural Damage – Vibration Criteria

Ground vibration criteria is defined in terms of the levels of vibration emission from the construction activities which will avoid the risk of damaging surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity.

Most commonly specified structural vibration levels are defined to minimize the risk of cosmetic surface cracks and are set below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in German Standard DIN4150-Part 3 “Structural vibration in buildings – Effects on structures” and British Standard BS7385-Part 2: 1993 “Evaluation and Measurement for Vibration in Buildings”. Table 16 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn’t occur.

Table 16: Guideline value of vibration velocity, vi, for evaluating the effects of short-term vibration

Line	Type of Structure	Vibration velocity, vi, in mm/s			
		Foundation			Plane of floor of uppermost full storey
		At a frequency of			
		Less than 10Hz	10 to 50Hz	50 to 100*Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2	3	3 to 8	8 to 10	8

Line	Type of Structure	Vibration velocity, vi, in mm/s Foundation At a frequency of Less than 10Hz	10 to 50Hz	50 to 100*Hz	Plane of floor of uppermost full storey All Frequencies
	and are of great intrinsic value (e.g. buildings that are under a preservation order)				
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

Table 17 presents guide values for building vibration, based on the lowest vibration levels above which cosmetic damage has been demonstrated as per BS7385-Part 2:1993.

Table 17: Transient vibration guide values for cosmetic damage

Type of Building	Peak Particle Velocity in frequency range of predominant pulse (PPV)	
Residential or light commercial type buildings	4 Hz to 15 Hz	15 Hz and above
	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

5.5.4 Construction Vibration Objectives

Table 18 indicates the construction vibration criteria applicable to the residential properties located adjacent to the development site and the train vibration criteria applicable to the habitable spaces within the proposed development.

Table 18: Construction vibration criteria summary

Location	Period	Human Comfort Vibration Objectives Continuous mm/s^2 (RMS) z-axis	x- and y-axis	Intermittent $mm/s^{1.75}$ (VDV)	Building damage Objectives – Velocity (mm/s)
Residential	Day time	10 - 20	7 - 14	0.20 - 0.40	5
	Night time	7 - 14	5 - 10	0.13 - 0.26	5
Commercial	Any time	20 - 40	14 - 28	0.40 – 0.80	20

6. Noise and Vibration Impact Assessment

The following sections detail the acoustic requirements for the proposed building glazing, and the noise impact assessment from external noise emissions to internal receivers.

6.1 External Glazing

In order to provide acoustic amenity to occupants of the proposed development and comply with the project specific internal noise levels, the acoustic performance of the building facades was assessed. Note that this is a preliminary assessment, and further analysis should be conducted when detailed elevations outlining the extent of glazing to the external facade and specific spaces throughout the proposed development are provided.

The general limiting factor of the performance of a building façade in terms of noise attenuation is typically the glazing. In this particular case of the proposed development, the noise generated by traffic movements along Canterbury Rd adjacent to the proposed development provides the greatest acoustic demand on all facades. Refer to Appendix B for the noise modelling results.

In order to achieve the internal noise levels established in AS2107:2016, the DoP's Interim Guideline, and the NSW HI ESG. the minimum recommended glazing types for the facades of the proposed development are presented in Table 19 below. The glazing types presented below should be considered as the minimum to achieve the required internal noise levels. Greater glazing thicknesses may be required for structural loading, wind loading, thermal requirements etc.

Table 19: Required acoustic performance of glazing systems

Facade	Level	Types of Spaces	Glazed System	Required Acoustic Rating of Glazing Assesmbly, R_w
All	Ground	All	8.38mm laminated glass / 12mm air gap / 10.38mm laminated glass	42
All	Level 1	ICU, Multi-Bed Wards, Theatres.	8.38mm laminated glass / 12mm air gap / 10.5mm VLam acoustic glass	44
All	Level 2	Staff Room & Offices	6.38mm laminated glass / 12mm air gap / 8.38mm laminated glass	40
All	Level 3 – Level 8	Bed Ward	10.5mm VLam acoustic glass / 12mm air gap / 10.5mm VLam acoustic glass	47
All	Level 9 – Level 11	Consult / EDU Suite	6.38mm laminated glass / 12mm air gap / 8.38mm laminated glass	40
Note: The required acoustic rating of glazing assembly, refers to the acoustic performance of the glazing once installed on site (including the frame)				

The glazing system proposed above has been provided as a high-level analysis only. The acoustic performance of the glazing facade may be reduced at certain locations within the development during the detailed design phase of the project.

6.2 Mechanical Noise Emissions

The following noise sources are associated with the site operation, and details about expected noise levels from these sources are given in the ensuing sub-sections. Noise sources from general operations at the site typically include mechanical services noise from air-conditioning equipment and exhaust and supply fans servicing the carpark. These noise sources have been used to predict the worst-case scenario noise impact of the proposed use of the site to nearby residential receivers.

The proposed development is expected to include the following mechanical noise sources:

- Cooling Tower units located on the rooftop
- Rooftop Air Handling Units to supply fresh air-conditioned air to spaces withing the development
- Carpark supply fan (CPSF) with intake louvre at ground level
- Carpark exhaust (CPEF) with weatherproof discharge cowl at roof level

In order to assess the worst-case scenario, it was assumed that the air conditioning units associated with the proposed residential development are running at any time throughout a 24hr period. With all, night-time is the most stringent period for the noise generated by the operation of the mechanical plant, therefore this criterion was used as the noise target at the boundary of the nearest sensitive receivers for the project.

6.2.1 Proposed Maximum Noise Levels

Table 20 presents the proposed maximum sound power levels for individual mechanical units to achieve the noise criteria shown at the nearest sensitive receiver of the site. Typical mechanical plant spectra have been implemented in the calculations and will need to be amended once specific units have been selected later in the design stage.

Table 20: Proposed acoustic power for individual mechanical units

Item	SWL re 10^{-12} W, dB(A)								
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Overall dB(A)
Cooling Tower	102	103	98	91	87	83	76	71	94
Air Handling Units	86	74	66	67	63	56	50	45	68
Carpark supply fan at intake louvre	54	55	48	58	57	53	47	42	61
Carpark exhaust fan at discharge cowl	68	65	58	59	58	59	56	50	65

6.2.2 Noise Mitigation Measures

Mitigation measures for the mechanical plant should be considered during the design development phase so as to comply with the outlined criteria established with the NSW NPI at the nearest sensitive receivers. These amelioration measures could include but not limited to the following:

- Positioning mechanical plant away from nearby receivers
- Acoustic attenuators fitted to duct work
- Screening around mechanical plant
- Acoustic insulation within duct work

Note that this is a preliminary solution as the design is yet to be finalized. A detailed acoustic assessment will be conducted during the design stage as more information becomes available regarding performance data of specific mechanical equipment or any further mechanical design information. Acoustic treatment will be proposed to ensure compliance with the project noise trigger levels established in Section 5.2.2.

6.3 Traffic Noise Generation Assessment

At the time of this report, no traffic report was available. More detail will be provided upon receipt of the traffic report in regard to potential increases in traffic noise predicted in association with the development. However, it is unlikely that the increase in traffic noise associated with the proposed development will adversely impact the surrounding noise environment. It is expected that the proposed development will comply with the requirements of the NSW RNP in regards to the maximum 2dB increase. As an indication, a 3dB increase would result from a total doubling of traffic in the area.

6.4 Loading Dock/Services Vehicles Noise Assessment

An acoustic assessment for the garbage and other service vehicles has been conducted to determine the noise levels to the nearest noise-sensitive receivers. The service vehicles are assumed to be either medium rigid trucks and garbage trucks with no more than 1 vehicle in any 15 minute period. The noise levels used within the assessment are shown below in Table 21.

Table 21: Typical sound power levels of service vehicles

Noise Source	Typical SWL dB(A)
Garbage truck unloading bins	99
Medium rigid truck	94

The noise emissions have been calculated to the facades of the surrounding noise-sensitive receivers. Using the assessment methods outlined above, the predicted noise levels at the nearest noise-affected premises are summarized below in Table 22. The following assumptions have been made:

- Any one service vehicle within a 15-minute period
- All service trucks including waste collection will be restricted to entering and exiting and operating during the daytime period (7:00am – 6:00pm)

Table 22: Predicted noise levels (with mitigation measures)

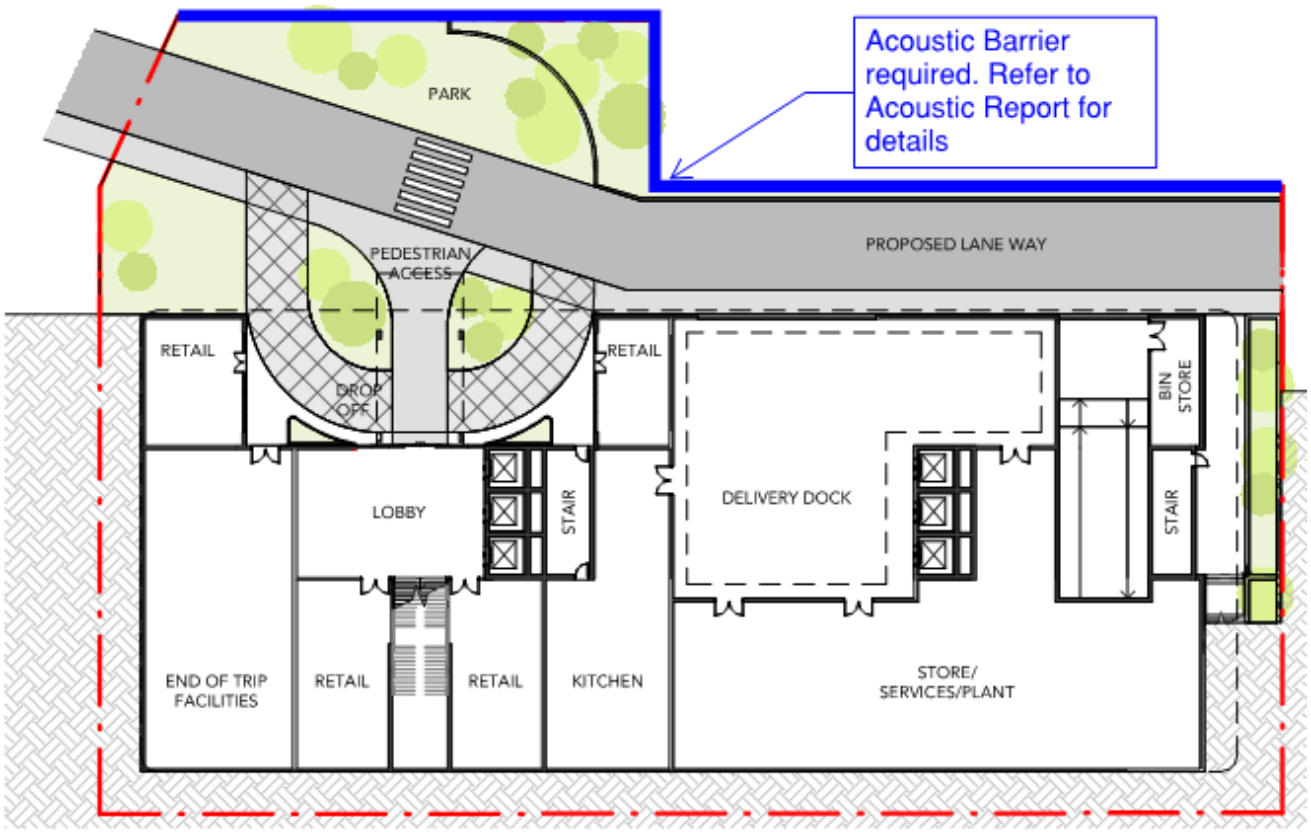
Receiver Location	Predicted Noise Level $L_{Aeq,15min}$ - dB(A)	Day time criteria $L_{Aeq,15min}$ - dB(A)	Compliance (Yes/No)
Nearest noise-affected premises	45	47	Yes

6.4.1 Noise Mitigation Measures

The following acoustic mitigation measures are required to achieve compliance with the NSW NPI for noise associated with service vehicle related noise:

- Install an acoustic barrier where indicated in Figure 4. The Barrier shall be at least 3m high and be constructed from a material with a surface density no less than 17kg/m^2 such as a lapped and capped timber fence and be free from any air gaps.

Figure 4: Acoustic Barrier for vehicle movement along proposed lane way



7. Conclusion

An acoustic assessment for the proposed Health facility development located at 445 – 459 Canterbury Rd, Campsie NSW, 2194 has been conducted. This document forms part of the documentation package to be submitted to local authorities as part of the Development Application process.

This report has provided criteria, in-principle treatment and design requirements which aim to achieve the statutory criteria discussed in Section 5. In terms of noise and vibration criteria, we have provided the following:

- Noise criteria for internal noise levels according to DoP's Development near Rail Corridors and Busy Roads – Interim Guideline, AS/NZS 2107:2016 and NSW HI ESG, provided in Section 5.1.
- Noise criteria for noise emissions from the development to noise-sensitive receivers in accordance with the Canterbury DCP and NSW EPA NPI provided in Section 5.2
- Traffic noise criteria for additional vehicle movements on public roads generated by the proposed development presented in Section 5.3.
- Construction noise criteria provided in Section 5.4.
- Construction vibration criteria for human comfort and structural damage, provided in Section 5.5.

Glazing for the habitable spaces within the proposed development has been designed to achieve internal noise levels in accordance with the requirements of the DoP Interim Guideline, AS 2107:2016 and the NSW HI ESG. The glazing recommendations are presented in Section 6.1.

The maximum sound power levels for mechanical plant equipment presented in this report show that the day, evening and night criteria are based on the project noise trigger levels established in Section 5.2.2. Should the plant sound power levels exceed levels presented in this report, additional noise mitigation measures will be required. These measures will be developed and implemented in the detailed design phase of the project.

Even though no assessment can be considered as being thorough enough to preclude all potential environmental impacts, having given regard to the above listed conclusions, it is the finding of this assessment that the development application should not be refused on the grounds of excessive noise generation, as it is expected to comply with all applicable regulations with regards to noise.

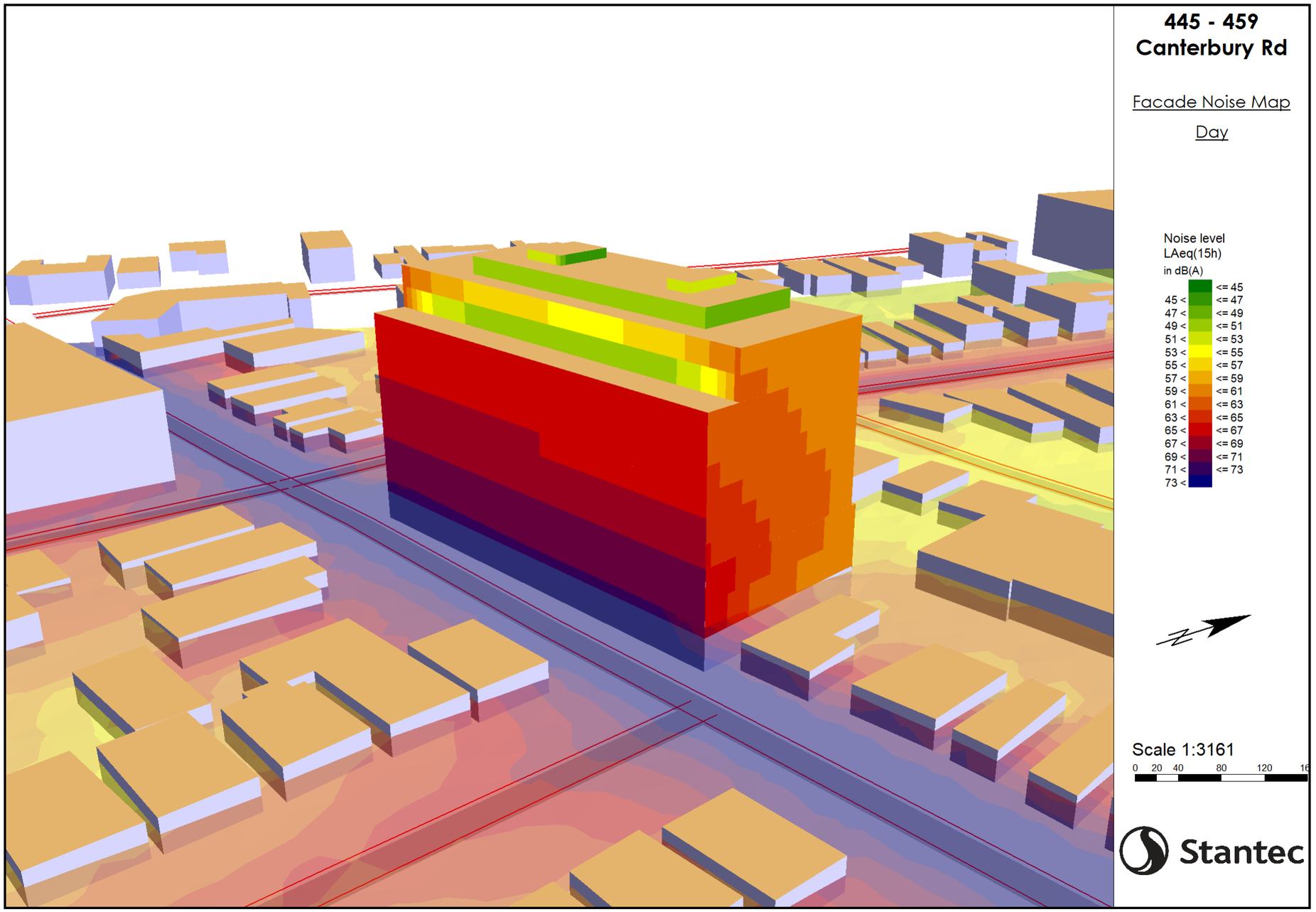
The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of air-conditioning units, layout of equipment, modifications to the building and introduction of any additional noise sources.

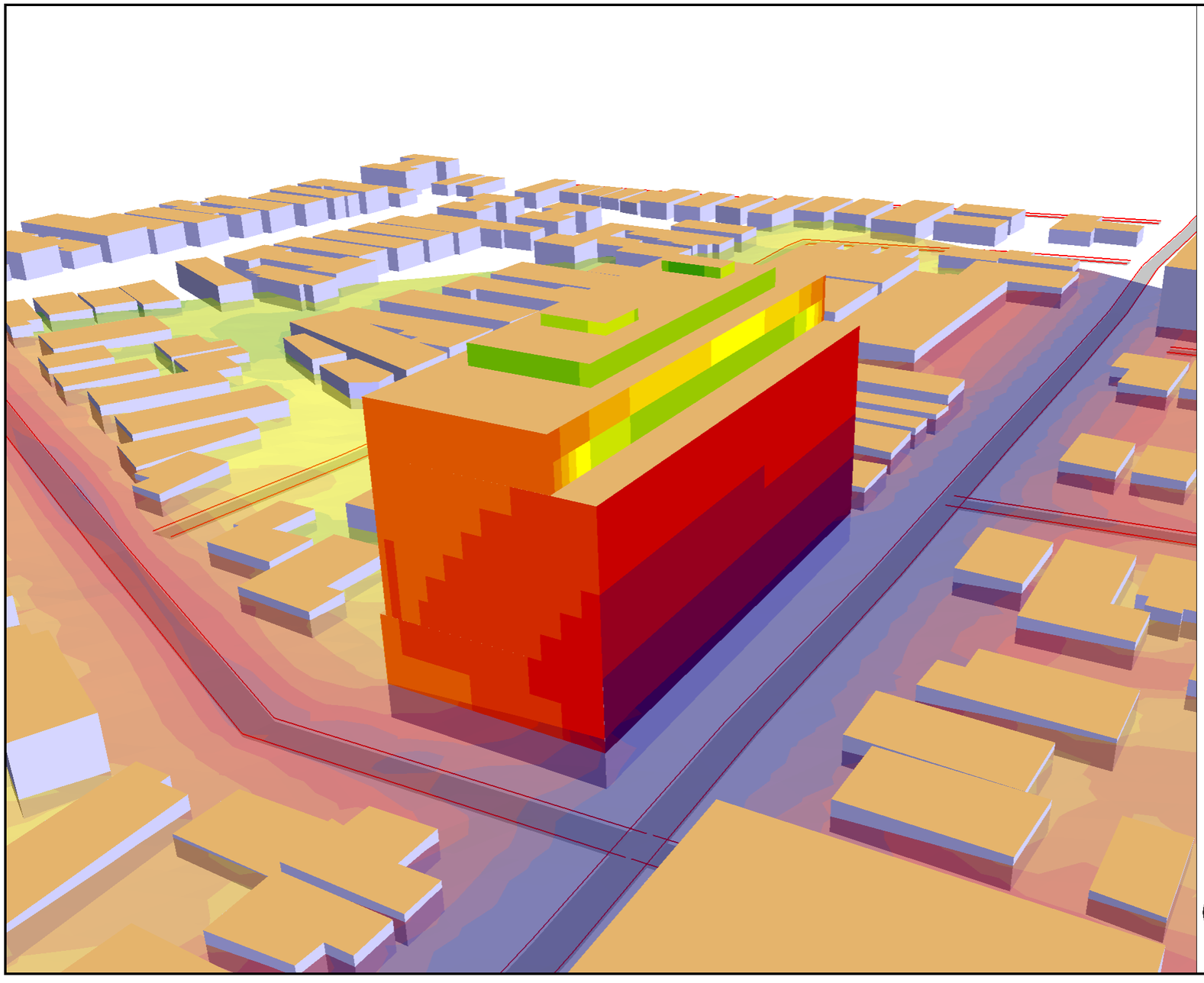
Appendix A Glossary of Acoustic Terms

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 Façade Noise Map Assessment





445 - 459 Canterbury Rd

Facade Noise Map

Day

Noise level
LAeq(15h)
in dB(A)

	<= 45
45 <	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

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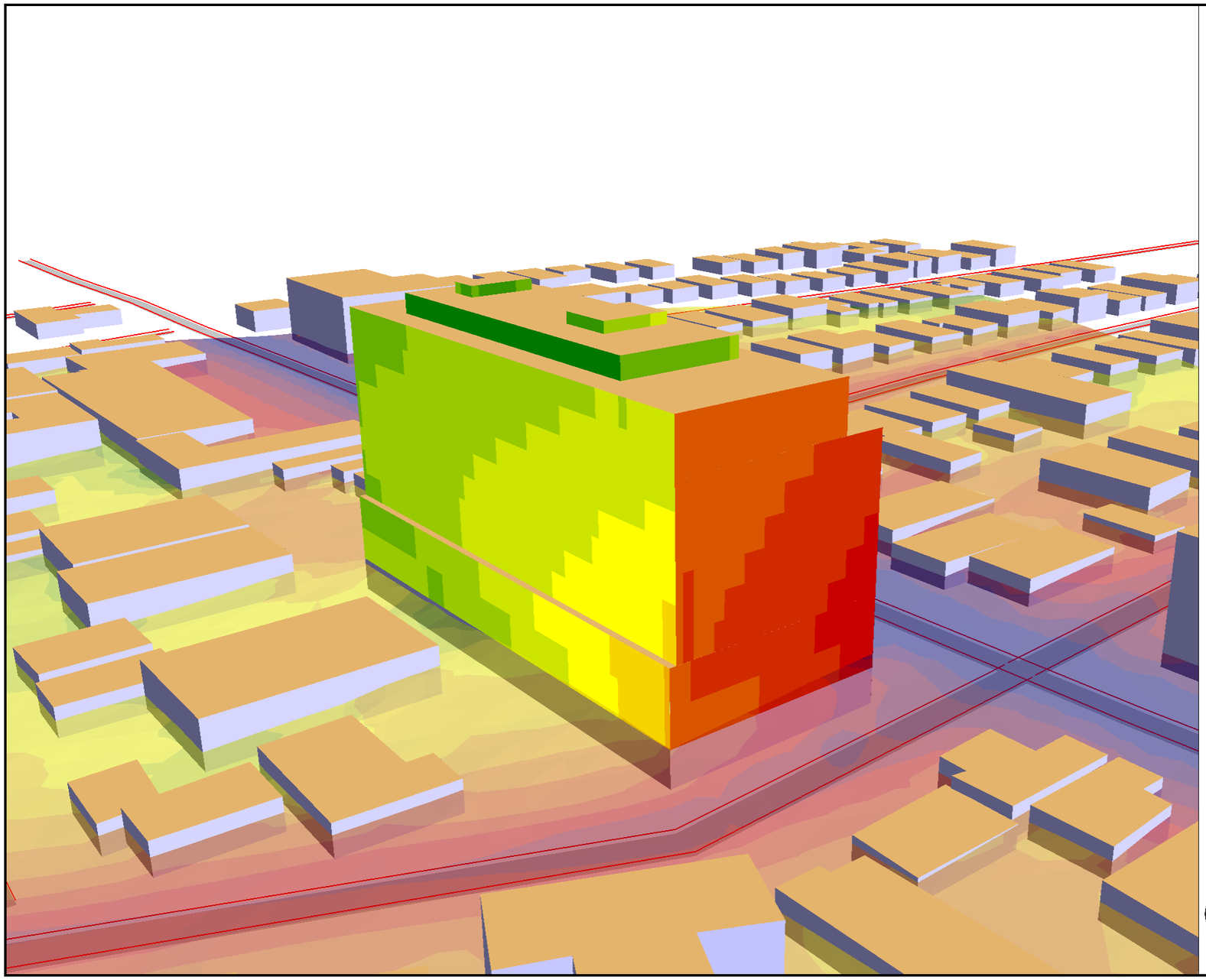

445 - 459 Canterbury Rd

Facade Noise Map

Day

Noise level
LAeq(15h)
in dB(A)

	<= 45
45 <	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

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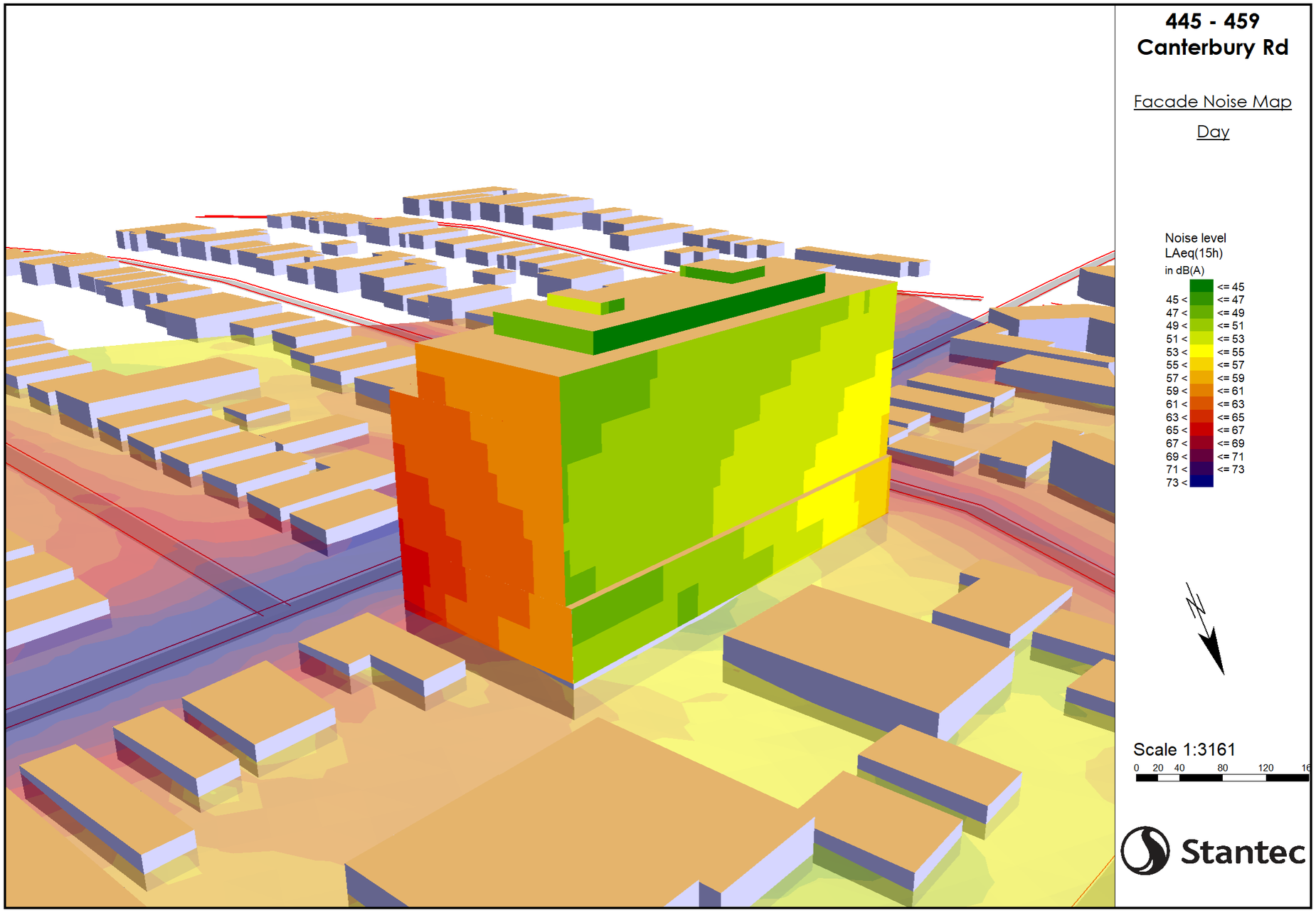
445 - 459
Canterbury Rd
Facade Noise Map
Day
Noise level
LAeq(15h)
in dB(A)
<= 45
45 < <= 47
47 < <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
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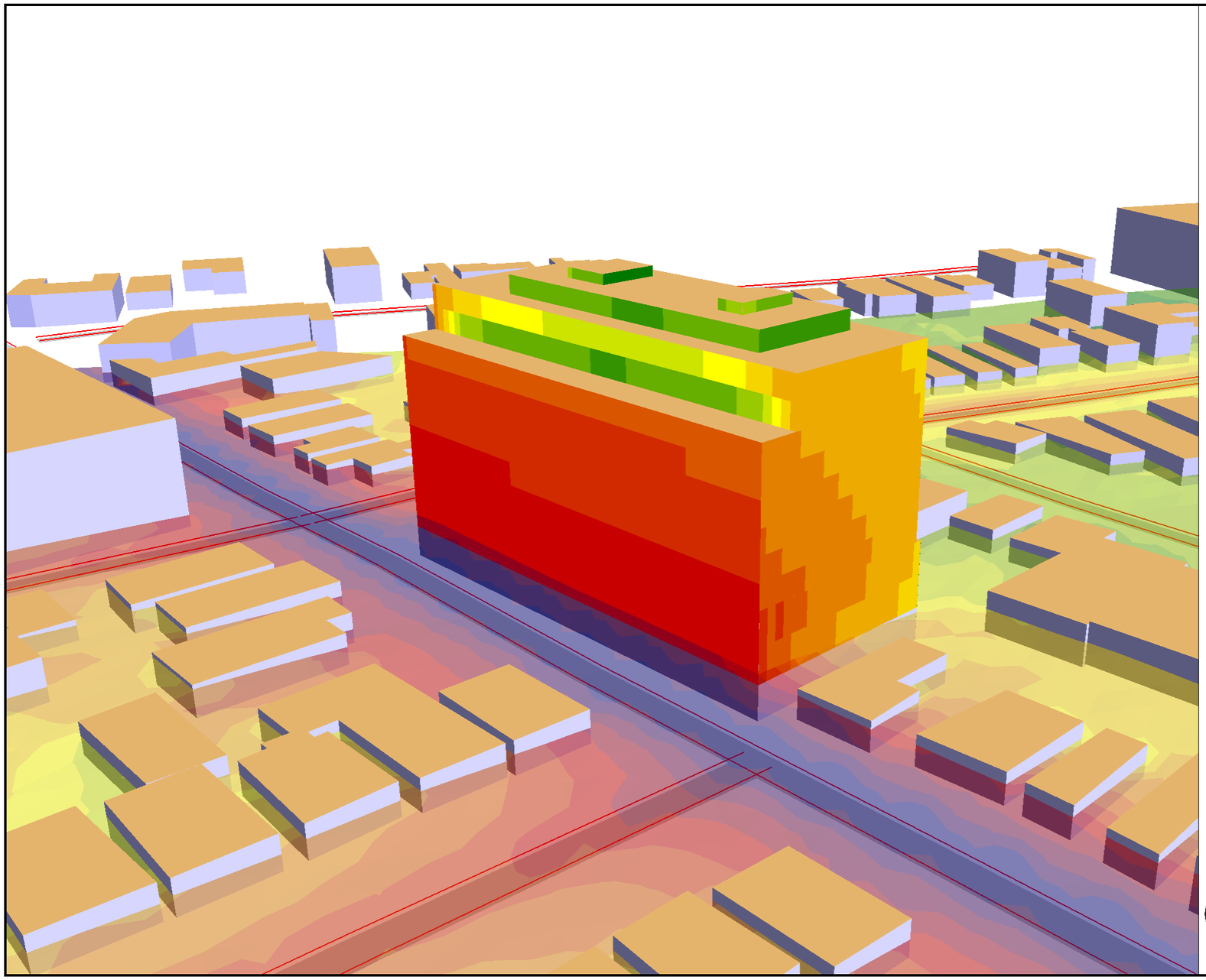

445 - 459 Canterbury Rd

Facade Noise Map

Night

Noise level
LAeq(15h)
in dB(A)

	<= 45
45 <	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

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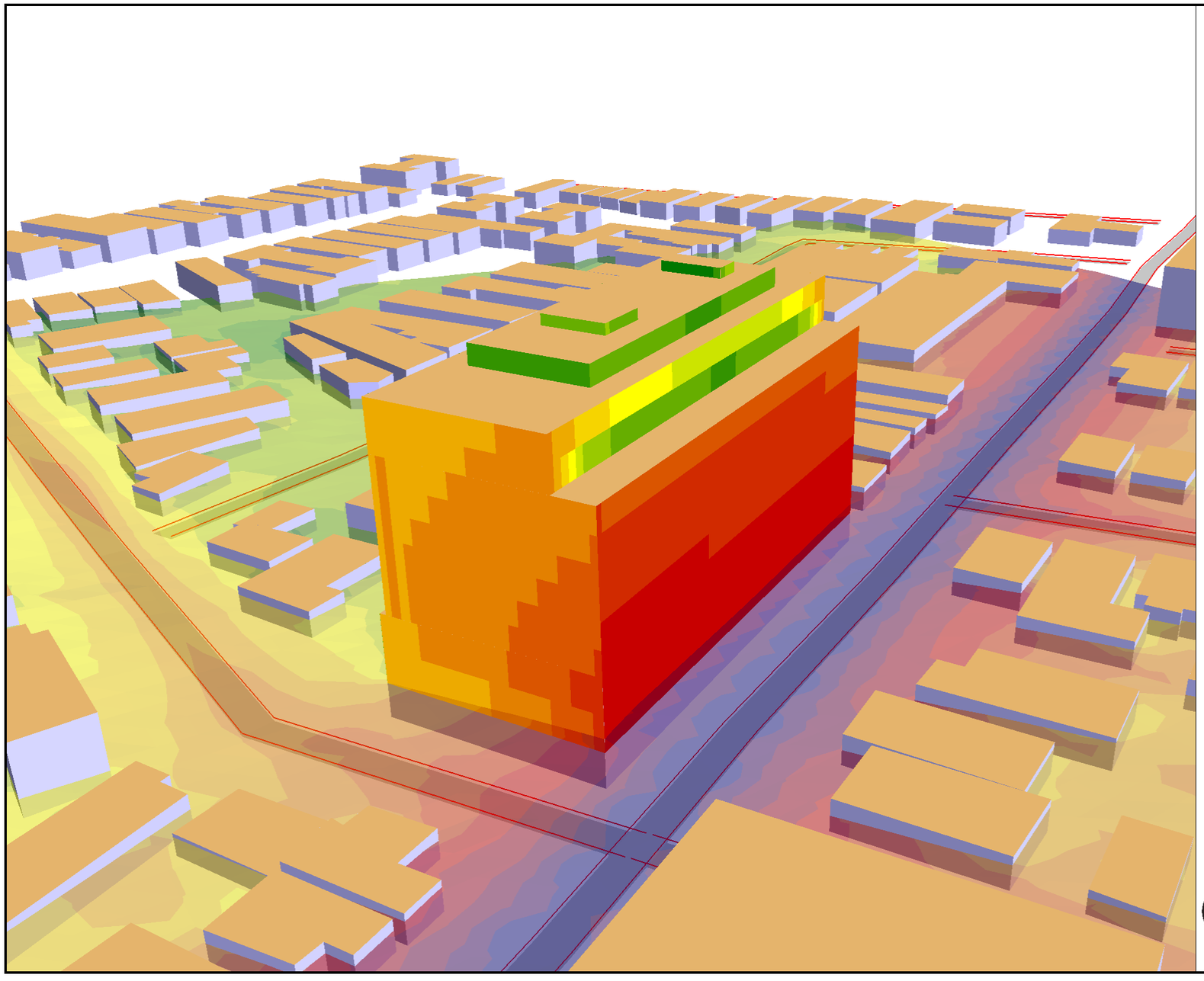


445 - 459 Canterbury Rd

Facade Noise Map

Night

Noise level
LAeq(15h)
in dB(A)

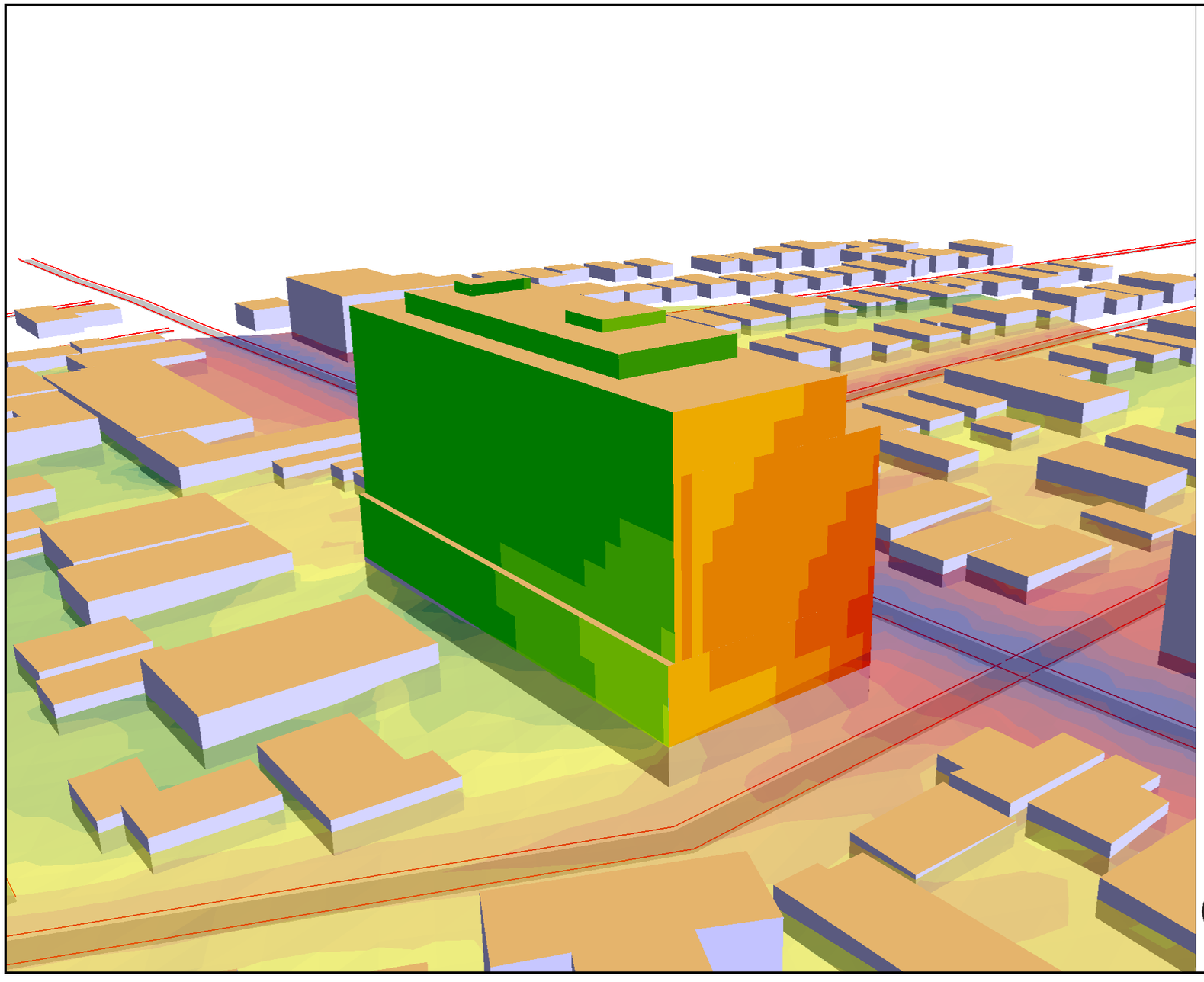
	<= 45
45 <	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

N

Scale 1:3161

0 20 40 80 120 16

Stantec



445 - 459 Canterbury Rd

Facade Noise Map

Night

Noise level
LAeq(15h)
in dB(A)

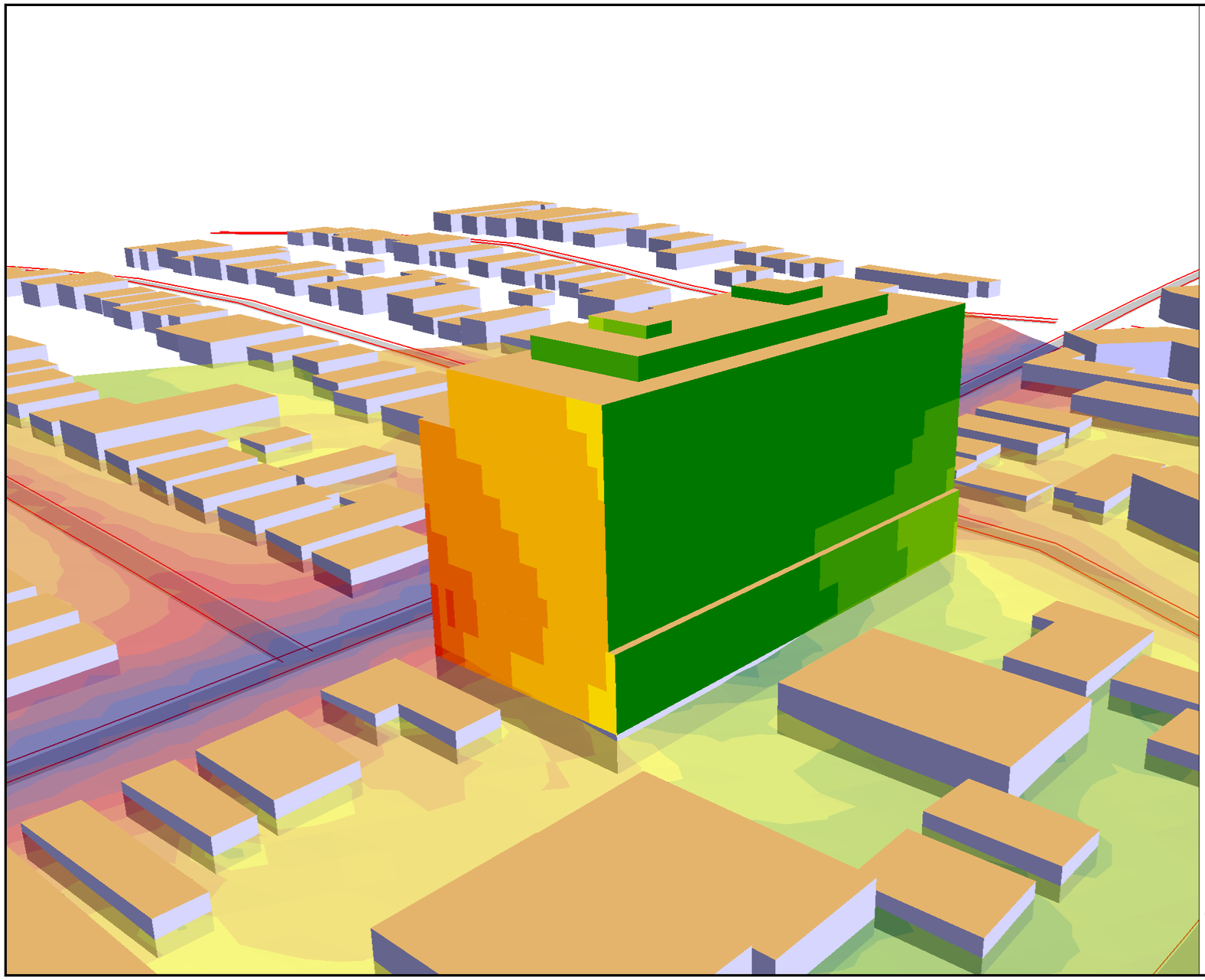
	<= 45
45 <	<= 47
47 <	<= 49
49 <	<= 51
51 <	<= 53
53 <	<= 55
55 <	<= 57
57 <	<= 59
59 <	<= 61
61 <	<= 63
63 <	<= 65
65 <	<= 67
67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

N

Scale 1:3161

0 20 40 80 120 16

Stantec



445 - 459 Canterbury Rd

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67 <	<= 69
69 <	<= 71
71 <	<= 73
73 <	

Scale 1:3161

0 20 40 80 120 16

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Design with
community in mind

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