St. Leonards Village

Acoustic Report for Development Application

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Revision

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1. Executive Summary

Stantec have been engaged by Evergreen to conduct an acoustic assessment for the proposed development located at 1-3 Canberra Avenue, 4-8 Marshall Avenue, and 2-8 Holdsworth Avenue, St. Leonards and referred to as St. Leonards Village.

This report outlines several relevant noise criteria, in-principle treatment and design requirements which aim to achieve the statutory criteria discussed in Section 5.

A preliminary noise assessment of the external mechanical plant has been carried out as shown in Section 6.1. Based on the application of good plant selection and standard noise control methods the noise criteria at the most sensitive receivers are expected to be met. A detailed assessment will be completed as part of the design development phase of this project.

Acoustic performance requirements for the façade elements have been provided to achieve internal noise levels in accordance with the recommendations of the Department of Planning (DoP) Development near Rail Corridors and Busy Roads – Interim Guideline. These requirements are based on the noise monitoring conducted on the site installed from 3rd November to the 15th October 2021.

An open windows assessment has been conducted with the requirements of the DoP Interim Guideline. Based on the results of the façade assessment shown in Appendix B, alternate means of ventilation is not required to achieve the recommended open window noise levels

As presented in Section 6.3 of this report, the proposed development the predicted traffic generation noise has been assessed. Based on the assessment the development is not expected to have any adverse impact on the surrounding road network and the traffic generation associated with the proposed development is also expected to comply with the requirements of the NSW Road Noise Policy.

A preliminary construction noise and vibration impact assessment has been carried out. in accordance with the criteria established in Section 5.4 and 5.5 of this report. Based on the results of the assessment, noisy works located in close proximity to the identified receivers may exceed the noise criteria. Further noise controls along with noise monitoring are recommended to be implemented during these works in order to satisfy the noise requirements. Specific mitigation measures are to be investigated prior to construction in a detailed construction noise and vibration management plan when further details are available from the relevant contractor.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

2. Introduction

Stantec Australia have been engaged by Evergreen to undertake the engineering design of St. Leonards Village located at 1-3 Canberra Avenue, 4-8 Marshall Avenue, and 2-8 Holdsworth Avenue, St. Leonards. NSW. 2065.The design criteria presented in this acoustic brief are based upon Stantec previous experiences and relevant Australian Guidelines and Standards.

The summary of our brief presents the two major acoustic considerations that are the basis of the development of the acoustic design for the proposed new residential development.

- Noise emissions from the proposed development construction activities to the surrounding most sensitive (residential) receivers
- Noise emission from mechanical plant from the new and redevelopment buildings to the surrounding residential receivers
- Intrusive noise and vibration from the adjacent train line to the new development
- Intrusive noise from the surrounding road to the development
- Traffic generation noise from increased number of traffic accessing the car-park

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

- Architectural Drawings prepared by Rothelowman
- Noise data collected on site through the use of a noise logger and a hand held spectrum analyser.
- Traffic Impact Assessment prepared by Stantec

This document and related work have been prepared following Stantec's Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015 respectively.

3. Project Overview

3.1 Site Description

The proposed development is located at 1-3 Canberra Avenue, 4-8 Marshall Avenue, and 2-8 Holdsworth Avenue, St. Leonards. NSW. 2065. Figure 1 presents the site boundaries in relations to its nearest receivers. The site location, measurement positions and surrounding residential receivers are shown in Figure 1.

The site is bound by existing and future residential properties to the Northern, Southern and Western sides of the site. The railway corridor located to the Eastern side of the site generates the highest impact regarding noise intrusion on the façade. Beyond the residential and commercial developments located to the North is the Pacific Hwy, which carries >40,000 vehicles AADT. To the North-East of the site is the future St Leonards Plaza & Interchange.

The nearest, most-affected residential receivers have been identified in the Figure below and have been considered the most affected noise-sensitive receivers for the acoustic impact assessment.

Figure 1: Overview of the site and measurement locations (Source: nearmap.com)

3.1.1 Acoustic Considerations

Noise Impact from the Development on the Environment

The proposed development will generate noise which may adversely impact the surrounding environment, such as the nearby residential and commercial receivers.

The main noise sources generated by the development that may impact the local community and environment include:

- Noise emissions from the operation of mechanical plant servicing the proposed development to the surrounding noise-sensitive receivers
- Traffic generated by the development, including, vehicle movements entering and exiting the basement carpark spaces
- Construction Noise and Vibration impacts

Noise Impact from the Environment on the Development

The local acoustic environment may have an adverse impact on the development itself. This aspect of the assessment will aim at providing acoustic amenity to the building occupant once completed from noise sources including:

- Noise from railway movements
- Noise from vehicle movements along Marshall Ave and Canberra

4. Noise Survey

4.1 Overview

Attended and unattended noise surveys were conducted in the locations shown in Figure 1 to establish the ambient and background noise levels of the site and surrounds. Noise surveys have been carried out in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'*.

The noise survey was undertaken on the site between 25th November to 16th December 2021 to understand the local noise environment and to establish the noise criteria to the nearest noise sensitive receivers surrounding the site.

4.1.1 Instrumentation

The following equipment was used for the noise surveys conducted by Stantec:

- Hand-held sound spectrum analyzer B&K 2250, S/N 2709742
- Sound Calibrator Svan SV30A, S/N 17556;
- Bruel and Kjear Noise Logger B&K 2250 S/N 3011814
- Bruel and Kjear Noise Logger B&K 2250 S/N 3011850

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 Unattended Noise Survey Results

Unattended noise surveys were conducted in on-site, refer to Figure 1 for the locations of loggers on-site. Results of the monitoring are presented in the following subsections and graphs of these logged results provided below.

4.2.1 Background and Ambient Noise Monitoring

Three (3) noise loggers were placed at position L1, L2, and L3 as shown in Figure 1 to measure the background and ambient noise that is representative of the surrounding residential receivers which are most affected by noise from the existing rail corridor and traffic noise. L1 was installed from the 25th November to the 28th November 2021, L2 was installed from the 9th December to the 13th December 2021, whilst L3 was installed from the 9th December to the 16th December 2021.

The results of the unattended background noise survey are shown in Table 1 below (for the day, evening and night periods). Note that any extraneous data or rain affected data has been excluded from the calculations.

Table 1: Unattended noise measurements

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ – dB(A)			Rating Background Level RBL – dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	57	55	51	50	45	40
L2	51	50	46	43	41	33
L3	56	52	49	49	44	38

Table 2 below shows the results from the unattended noise measurements across day and night periods for traffic assessment. Note that any extraneous data or rain affected data has been excluded from the calculations.

Table 2: Unattended traffic noise measurements

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)	
	Day ($L_{Aeq, 15\ Hour}$)	Night ($L_{Aeq, 9\ Hour}$)
L1	57	51
L2	51	46
L3	55	49

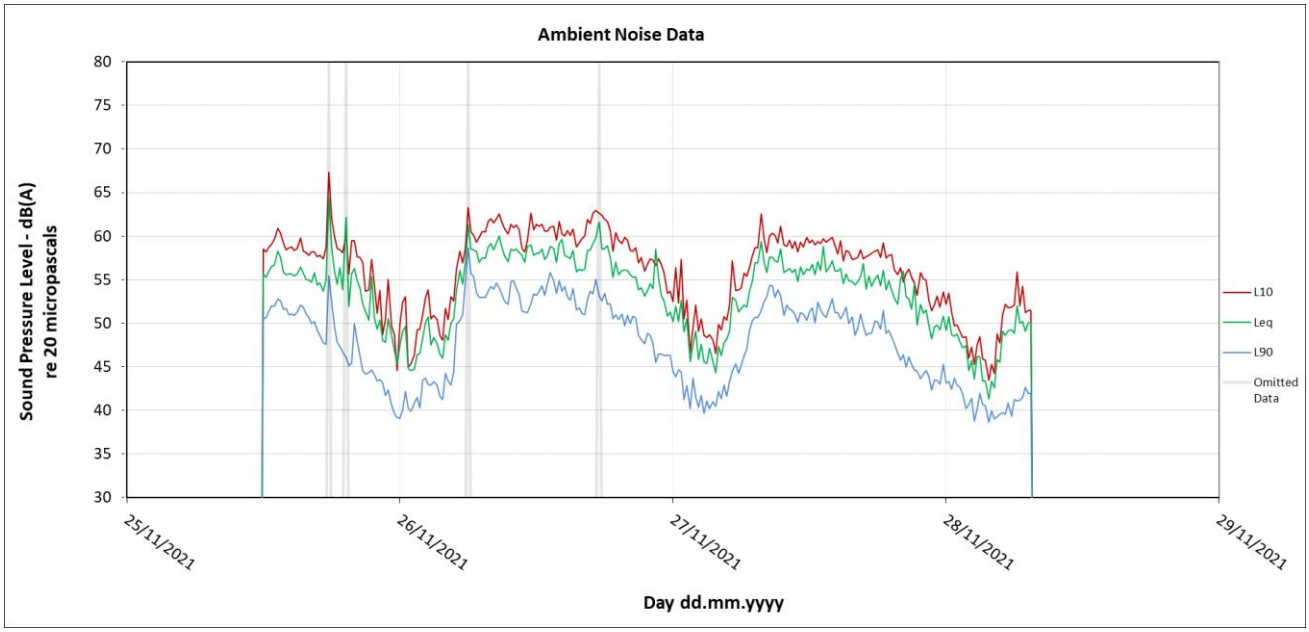


Figure 2: Logger data L1

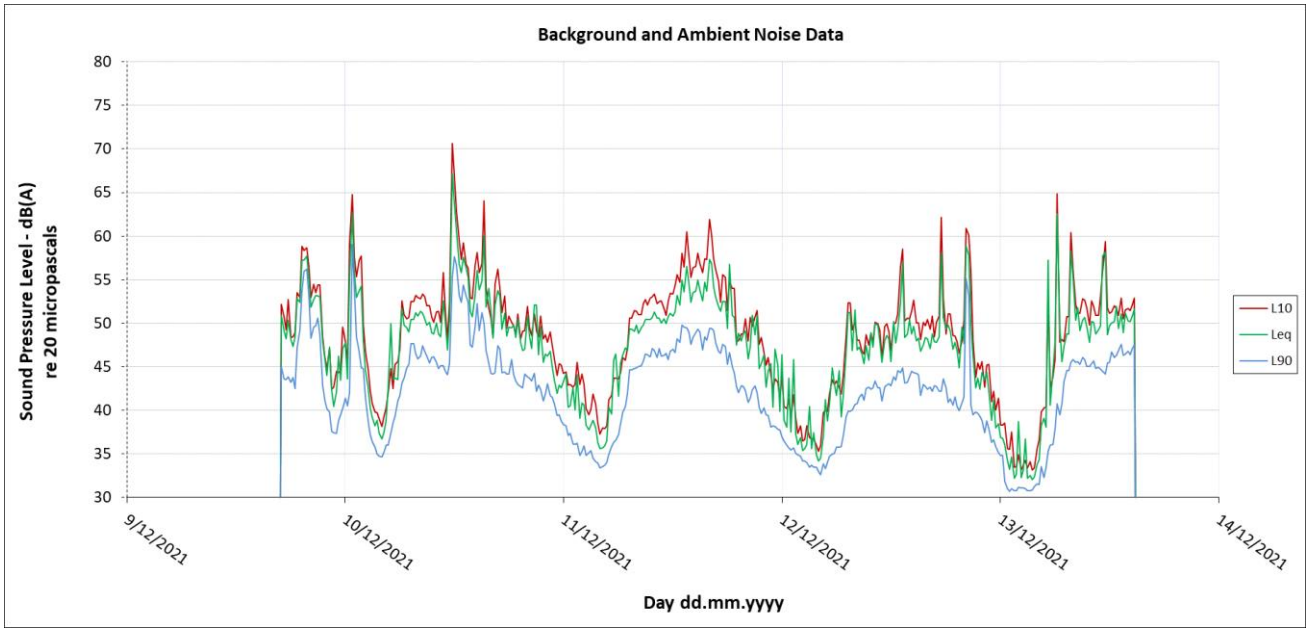


Figure 3: Logger data L2

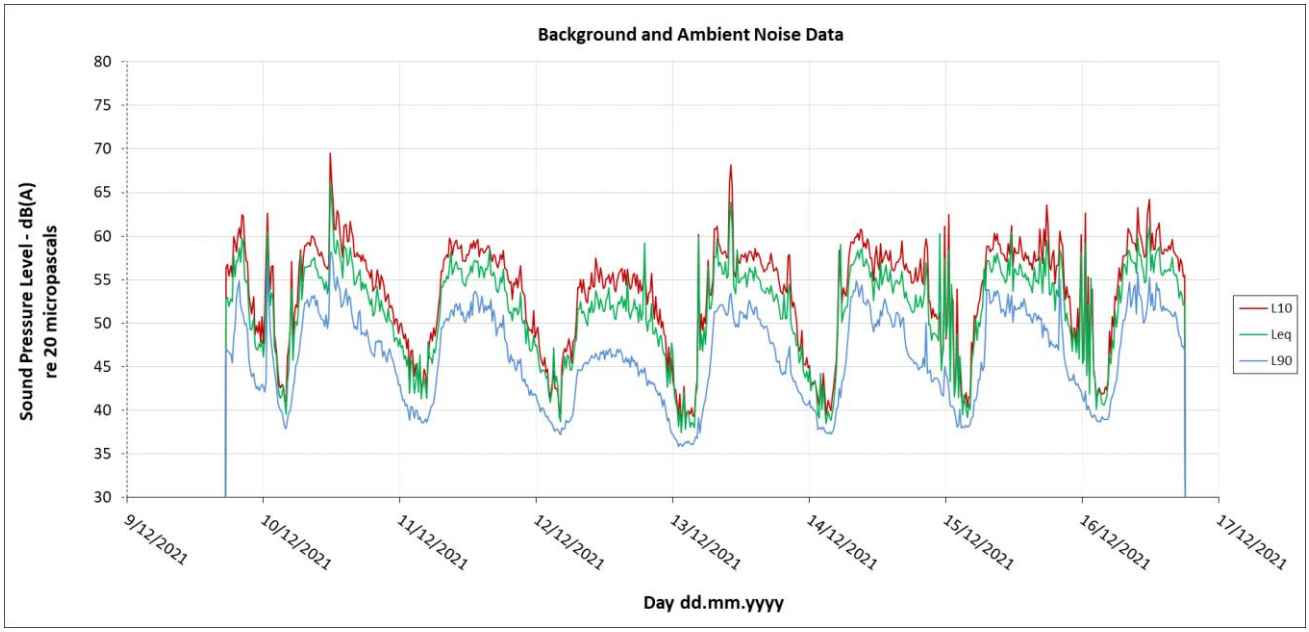


Figure 4: Logger data L3

4.3 Attended Noise Survey Results

Attended noise measurements of 15-minute period were conducted on site in order to characterize the acoustic environment for the noise intrusion into the development and to determine any noise impact on the surrounding receivers.

The sound level metre was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurements were undertaken in the free-field – i.e. more than 3 metres away from any building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring. A summary of the attended noise measurements taken at the site are shown on Table 3. Refer to Figure 1 for the measurement's location.

Table 3: Attended noise measurements

Measurement Location	Measurement Time	L_{Aeq}, dB(A)	L_{A90}, dB(A)	Comments
P1	09/12/2021 16:25	57 $L_{Aeq, 15mins}$	49 $L_{A90, 15mins,}$	Attended noise measurements at the east boundary of 3 Canberra Avenue. Noise environment featured sporadic traffic, with occasional train pass-bys interspersed with periods of relative quiet.
P2	09/12/2021 17:01	76 $L_{Aeq, 15mins}$	64 $L_{A90, 15mins,}$	Attended noise measurements at the south boundary of pacific highway. Noise environment featured constant peak traffic noise, with a combination of trucks and light domestic vehicles. Train speed was slow, as it was coming out of the nearby station
P3	09/12/2021 17:48	67 $L_{Aeq, pass-by}$	50 $L_{A90, pass-by}$	Train pass-by approximately 15m from the center of the nearby railway corridor. Train was south bound and the audible pass-by lasted approximately 41 seconds.
	09/12/2021 17:52	67 $L_{Aeq, pass-by}$	54 $L_{A90, pass-by}$	Train pass-by approximately 15m from the center of the nearby railway corridor. Two train passed by (one north bound, one south bound) and the audible pass-by lasted approximately 31 seconds. Train speeds were slow, as they were entering and exiting the nearby station
	09/12/2021 17:54	67 $L_{Aeq, pass-by}$	54 $L_{A90, pass-by}$	Train pass-by approximately 15m from the center of the nearby railway corridor. Pass-by lasted approximately 28 seconds. Train speed was slow, as it was coming in to the nearby station

4.4 Attended Vibration Survey Results

The proposed development is situated within 45m to existing railway corridor as shown previously on Figure 1. Attended vibration measurements of train pass-by's were conducted at the site boundary to assess the potential impact of rail induced groundborne noise into the development. A summary of the attended vibration measurements taken at the site are shown on Table 4. All measurements were taken on ground level.

Table 4: Attended vibration measurements – train pass-bys (RMS & Peak values)

Measurement Location	Measurement Date & Time	Duration (hh:mm:ss)	$Acc_{rms,z}$, m/s^2	$Acc_{peak,z}$, m/s^2
V1	18/01/2022 14:48:20	00:01:08	0.0002	0.0005
V1	18/01/2022 14:57:05	00:01:06	0.0001	0.0004
V1	18/01/2022 14:59:26	00:00:25	0.0001	0.0003
V1	18/01/2022 15:02:21	00:00:30	0.0002	0.0004
V1	18/01/2022 15:03:06	00:00:30	0.0002	0.0004
V1	18/01/2022 15:05:08	00:00:19	0.0001	0.0004

5. Noise and Vibration Criteria

5.1 Internal Noise Levels

5.1.1 Lane Cove Development Control Plan (DCP) 2016

Lane Cove Development Control Plan (DCP) 2016 – Part C (Residential) does not outline any specific requirements regarding internal noise levels for residential developments. Instead AS2017:2016 and the Department of Planning: Development near Rail Corridors and Busy Roads Interim Guideline will be used for internal noise targets across the development.

5.1.2 AS/NZS 2107:2016

Australian Standard AS/NZS 2107:2016 – *'Acoustics- Recommended design sound levels and reverberation times for building interiors'* specifies target noise levels for internal spaces to the development. Refer to Table 5 for the values corresponding to the internal spaces within the proposed development.

Table 5: Recommended noise levels according to AS/NZS 2107:2016

Type of occupancy/activity	Design Sound Level ($L_{Aeq,t}$) range dB(A)
Houses and apartments near major roads	
Living areas	35 to 45
Sleeping areas (night-time)	35 to 40
Work Areas	35 to 45
Enclosed Car Parks	< 65
Washrooms and Toilets	45 to 55

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

The DoP Interim Guideline details the application of clause 87 (Rail) of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a residential development is in or immediately adjacent to a rail corridor

> *"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:"*
>
> - *in any bedroom in the building : 35dB(A) at any time 10pm–7am*
> - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

The guideline also states the following in regards to an open windows (alternative means of ventilation) assessment:

> *"If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."*

Table 6 provides a summary of the criteria established in the DoP's Interim Guideline below.

Table 6: Development near Rail Corridors and Busy Roads Interim Guideline Internal Noise Criteria

Type of habitable space	Applicable Time Period	Assessment Noise Metric	Windows/Doors Closed Criteria – dB(A)	Windows/Doors Open Criteria – dB(A)
Sleeping areas (bedrooms)	10:00pm – 7:00am	Airborne $L_{Aeq,9h(night)}$	35	45
		Groundborne L_{Amax} (95th Percentile)	35	N/A
Living rooms	At any time	Airborne L_{Aeq}	40	50
		Groundborne $L_{Amax(day)}$ (95th Percentile)	40	N/A

5.1.4 Sleep Disturbance Criteria

The NSW Noise Policy for Industry (NPI) establishes sleep disturbance criteria for residential receivers in proximity to industrial noise sources during the night-time period, such as vehicle movements and the train passing by. The criteria for protecting the amenity of surrounding residential receivers from sleep disturbance are:

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

Table 7 summarises the sleep disturbance criteria for the proposed development.

Table 7: Sleep Disturbance Criteria

Period	Sleep Disturbance Criteria	
	L_{AFmax} – dB(A)	$L_{Aeq,15min}$ – dB(A)
Night (10:00pm to 7:00am)	63	48

5.2 Noise Emission Criteria

5.2.1 The Lane Cove Development Control Plan (DCP) 2012

The Lane Cove DCP is applicable to this development. Part C Section 1.8.2 of the DCP outlines as part of the submission requirements for residential development, a statement of compliance from an acoustical consultant may be required to demonstrate that the noise generated by mechanical equipment of any sort servicing the proposed development must not exceed the background noise level by more than 5dB(A) when measured in or on the lot adjacent to the equipment. Where sound levels are exceeded, sound proofing measures will be required.

5.2.2 The Lane Cove Local Environment Plan (LEP) 2009

Relevant Planning Documents of The Hills Shire Council Legislation have been reviewed for any noise requirement or criteria.

The Lane Cove LEP 2009 sets the Land Zoning as shown in Figure 5 as per information extracted from the maps provided by The Lane Cove LEP 2009 and the NSW Government legislation web service. The proposed site and surrounding developments are categorised as B4 (Mixed use) and R4 (High Density Residential).

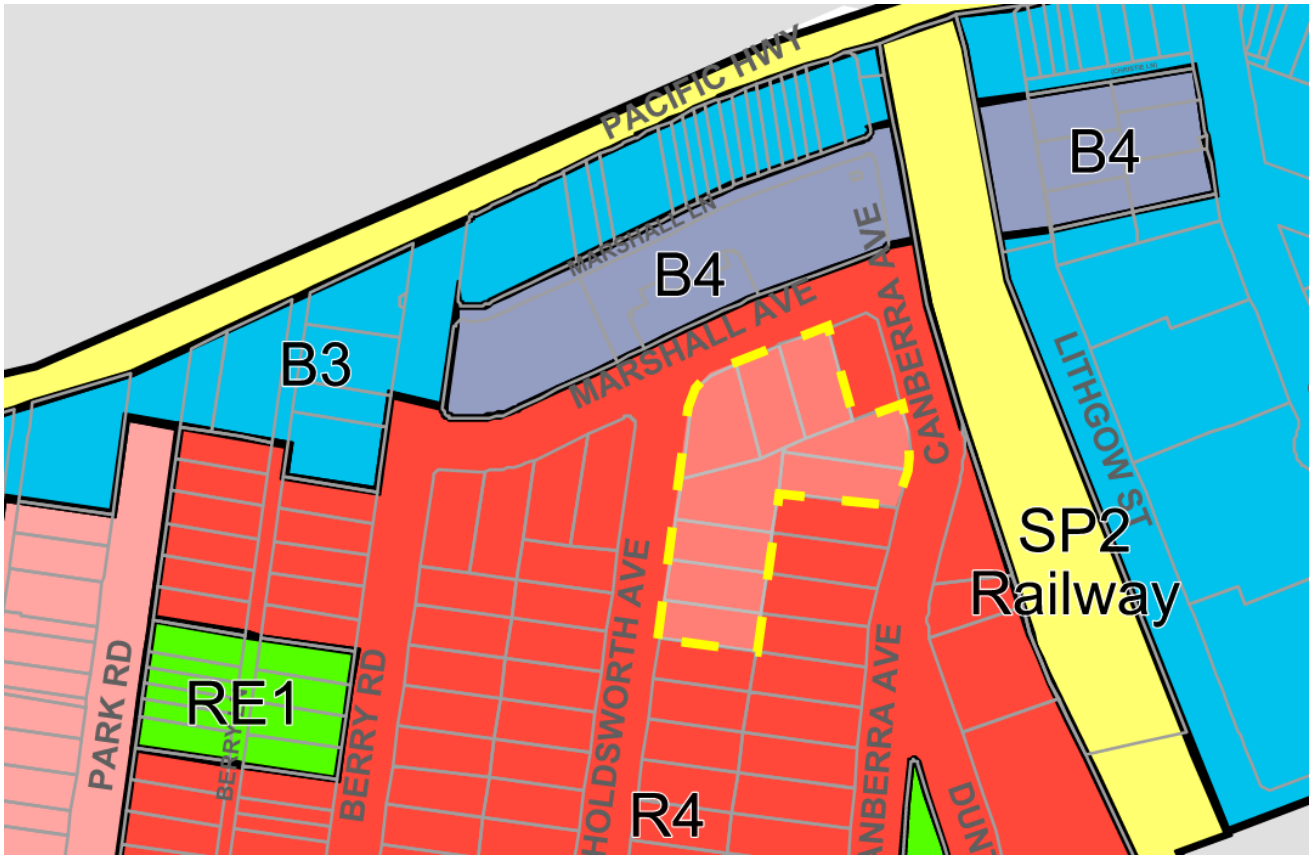


Figure 5: Land Zoning of the site and surroundings.

5.2.3 NSW Noise Policy for Industry (NPI)

The *NSW Noise Policy for Industry* has been applied to address the noise emissions from the development to the surrounding noise-sensitive receivers. The NSW NPI sets out noise criteria to control the noise emission from industrial noise sources generated by the proposed development. Operational noise emissions from the development shall be addressed following the guideline in the NSW NPI.

The calculation is based on the results of the unattended ambient and background noise 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 (PNTL).

Intrusiveness Criteria

The NSW EPA NPI states the following:

> *"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A)."*

The intrusiveness criterion can be summarised as follows:

$L_{Aeq,\ 15\ minute} \leq$ RBL background noise level + 5 dB(A)

The intrusiveness criterion for the closest residential receivers is presented in Table 8 below.

Table 8: NSW NPI intrusiveness criteria

Period	Noise Descriptor – dB(A)	Noise Criteria – dB(A)
Day (7:00am to 6:00pm)	$L_{Aeq,15min} \leq$ RBL + 5	48
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min} \leq$ RBL + 5	46
Night (10:00pm to 7:00am)	$L_{Aeq,15min} \leq$ RBL + 5	38

Amenity Criteria

The NSW NPI states the following:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the Laeq descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A)."

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

The applicable parts of Table 2.2: Amenity noise levels which are relevant to the project are reproduced below:

Table 9: Amenity criteria for external noise levels

Type of Receiver	Noise Amenity Area	Time of Day	Recommended Amenity L_{Aeq} Noise Level, dB(A)	Amenity Criteria $L_{Aeq,15mins}$
Residential (inc. Hotel use)	Urban	Day	60	58
		Evening	50	48
		Night	45	43
Commercial	All	When in use	65	63
Passive recreation area	All	When in use	50	47

*Suburban area as defined in EPA NSW NPI Table 2.3

*Note that as per the NSW NPI the amenity levels are converted from the period to 15 minutes by adding 3dB

5.2.4 Project Noise Trigger Levels

The following criteria is applicable for the external noise emissions from the development, as detailed below in Table 10. These project noise trigger levels are in accordance with the requirements of the NSW NPI, and shall be assessed to the most affected point on or within the residential boundary.

Table 10: Project trigger noise levels

Period	Descriptor	PNTL dB(A)
Residential receivers		
Day (7:00am to 6:00pm)	$L_{Aeq,15min}$	48
Evening (6:00pm to 10:00pm)	$L_{Aeq,15min}$	46
Night (10:00pm to 7:00am)	$L_{Aeq,15min}$	38
Commercial receivers		
When in use	$L_{Aeq,duration}$	63
Park/Passive Recreation Area		
When in use	$L_{Aeq,duration}$	47

Where necessary, noise mitigation measures will be incorporated in the design to ensure that noise levels comply with the recommended noise emission criteria noted above.

5.3 Traffic Generation Noise Criteria

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 11.

Table 11: 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)
Arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,1\ hour}$ 60 (external)	$L_{Aeq,1\ hour}$ 55 (external)
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)

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 2dB above that of the corresponding ‘no build option’.

5.4 Construction Noise Criteria

Noise criteria for construction sites are established in accordance with the Interim Construction Noise Guideline (*ICNG July 2009*) by the NSW Office of Environment & Heritage (NSW OE&H) currently under 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 noise limits are presented in Table 12, and are applicable to the development.

Table 12: NSW 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	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 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. of NSW EPA ICNG (July 2009).

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 EPA ICNG

5.5 Construction Vibration Criteria

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 13. It should be noted that the human comfort for vibration criteria are more stringent than the building damage criteria.

Table 13: Preferred and maximum weighted RMS values for continuous and impulsive vibration

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14

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 14: 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
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

5.5.2 Structural Damage – Vibration Criteria

Ground vibration criteria are defined in terms of levels of vibration emission from 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 15 indicates the vibration limits presented in DIN4150-Part 3 to ensure structural damage doesn’t occur.

Table 15: 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 At a frequency of			Plane of floor of uppermost full storey
		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 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
*For frequencies above 100Hz, at least the values specified in this column shall be applied					

5.5.3 Vibration Objectives

Table 16 indicates the vibration criteria for the nearest residential and commercial properties to the development.

Table 16: Construction vibration criteria summary

Location	Period	Human Comfort Vibration Objectives Continuous mm/s^2 (RMS)		Intermittent $m/s^{1.75}$ (VDV)	Building damage Objectives – Velocity (mm/s)
		z-axis	x- and y-axis		
Residential	Daytime	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 Impact Assessment

6.1 Mechanical Noise Emissions

Noise sources from general operation of the development site typically include mechanical services noise from air-conditioning equipment, car park exhaust fans. These noise sources have been used to predict the noise impact at on-site residential noise sensitive receivers. These noise-sensitive receivers include the following (Refer to Figure 1):

- Residential receivers located at Marshall Avenue St (2 & 9-11 Marshall Avenue)
- Residential receivers located along Holdsworth Avenue (10 Marshall Avenue and 10 Holdsworth Avenue)
- Residential receivers located along Canberra Avenue (5 Canberra Avenue)
- Commercial receivers across the railway corridor (80 Christie St)

The following noise sources are considered the most likely to cause an adverse noise impact to noise sensitive receivers if not treated effectively:

- External Condenser units located on the rooftop to supply fresh air-conditions air to the proposed building
- Cooling Towers located on the rooftop to supply chilled air to the proposed building
- Carpark supply and exhaust fans with intakes and discharges at the rooftop

6.1.1 General Mechanical Equipment – Noise Mitigation Measures

Noise generation by mechanical equipment in association with the proposed development is to be managed to ensure external noise emissions are not intrusive and do not impact the amenity of the nearest sensitive receivers.

In order to meet the external noise emissions requirements for noise generated by the mechanical plant and equipment the following are some typical practices to mitigate noise from operation of mechanical plant and equipment on rooftop plantrooms.

- Where possible, locate plant as far away from possible noise sensitive receivers as practical to minimise the aggregate noise level.
- Select low noise mechanical equipment.
- Acoustic louvres or solid barriers may be required, surrounding plant items on the rooftop. This mitigation will likely be driven by internal noise criteria within the residential spaces of the proposed development.
- Where possible, locate noisy plant within an enclosed plant space.
- Carpark exhaust is to be included in the mechanical assessment. Carpark exhaust fans are typically located in a plant room in a basement allowing for sufficient ductwork to allow for acoustic internal lining or an attenuator for supply and exhaust to meet environmental noise criteria.

A detailed acoustic assessment of the mechanical plant noise is recommended prior to Construction Certificate to ensure no adverse noise impacts from external mechanical plant in accordance with the criteria outlined in Section 5.2.

6.2 Groundborne Noise Assessment

6.2.1 Existing Railway Corridor

The *Development near rail corridors and busy roads – interim guideline* states in relation to the *Infrastructure SEPP 2008* that the guidelines must be taken into account for rail corridors where;

> **Clause 86:** any development that involves the penetration of the ground to a depth of at least 2m below existing ground level on land that is:
>
> a) within or above a rail corridor; or
> b) within 25m (measured horizontally) of a rail corridor; or
> c) within 25m (measured horizontally) of the ground directly above an underground rail corridor

The boundary of the proposed development is approximately 45m away (measured horizontally) from the boundary of the rail corridor. Therefore, by definition the development does not require an assessment in relation to the Infrastructure SEPP for rail corridors.

6.2.2 External Noise Impacts on the Development

6.2.3 External Noise Intrusion

To provide acoustic amenity to occupants of the proposed development and comply with the project specific internal noise limits, the noise impacts of surrounding roads were assessed at the façade of the residential spaces within the proposed development in accordance with the SEPP (Infrastructure) 2007. 3D acoustic modelling for external noise intrusion from the surrounding roads and rail corridor were conducted using the software SoundPlan (Version 8.2)

Noise levels from the road and rail corridor were based on the noise survey carried out on site. A façade analysis was conducted using EN 12354-3:2000: “Building Acoustics – Estimation of Acoustic Performance of Buildings from the Performance of Elements – Part 3: Airborne Sound Insulation against Outdoor Sound”.

3D modelling was implemented in this specific situation because of the complexity of integrating all noise sources and types of noise sources to develop an overall incident façade noise level. Attenuation due to distances, building shielding, air and ground absorption, together with additional noise from reflections off facades of adjacent buildings within the proposed development are taken into account within the 3D model. The results of the 3D modelling are provided in Appendix A showing the incident noise levels on the façade as a result of noise emissions from the external noise sources.

To achieve the internal noise levels outlined by the DoP Interim Guideline, the minimum recommended glazing types for the facades of the proposed development are presented in Table 17. The rating presented are based on the worst-case scenario of external noise obtained from the attended noise measurement and noise data from the unattended logger. 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.

A summary of the acoustic performance requirements to achieve the required internal noise levels is summarized below in Table 17.

Table 17: Typical acoustic performance of glazing system

Minimum acoustic performance	Typical Single Glazed System	Typical Double Glazed System
R_W 32	6.38mm Laminated Glass	6mm/12mm air gap/6mm

When choosing suitable glazing systems, it should be noted that different products perform differently at low, mid and high frequencies. As a result, special attention should be given to the sound reduction across the various frequency ranges, since poor performance especially in the lower end can lead to higher than expected internal noise levels from road traffic.

This report should be read with the understanding that acoustics outcomes are based on the inputs of expected noise and a series of assumptions in regard to the surrounding environment, such as traffic noise and mechanical services noise of buildings located nearby.

6.2.4 Alternate Ventilation Assessments

Based on the results of the façade assessment shown in Appendix B, alternate means of ventilation is not required to achieve the recommended open windows noise level outlined previously in Table 6.

6.3 Traffic Generation Noise Assessment

A Traffic Generation Noise Assessment has been carried out and based on the information provided by the traffic consultant (Stantec) within the Traffic Impact Assessment Report.

In accordance with the traffic report, Lane Cove Council has undertaken modelling of the St Leonards South Precinct using AIMSUN modelling software to understand the traffic impacts of 2,400 dwellings forecasted within the precinct. It is understood that Council is in the process of updating the modelling based on revised lower dwelling forecasts. The proposed 232 dwellings are less than that assumed in the AIMSUN traffic model (approximately 265 dwellings).

On this basis, it is appropriate to conclude that the traffic impacts of the proposal have already been considered as part of the Council's AIMSUN modelling, with no additional impacts expected and therefore complies with the NSW RNP traffic noise generation criteria as provided in Section 5.3.

7. Rail Corridor Vibration Assessment

The purpose of this vibration assessment is to establish compliance with the *Development near rail corridors and busy roads – interim guideline* (Infrastructure SEPP) and whether there is a requirement to isolate any part of the building from an adverse vibration impact in terms of both human comfort and building damage.

As the human comfort recommended vibration criteria are significantly lower than the building damage criteria, it follows that if the human comfort criteria are met at the base of the building, then the building damage criteria will also be satisfied.

Any building amplification as the vibration travels up the building is expected to be compensated for by the distance losses of the vibration.

A vibration assessment has been conducted in accordance with the *NSW Assessing Vibration: A technical guideline*, as the boundary of the proposed development is approximately 45m away (measured horizontally) from the boundary of the nearest rail corridor, the proposed development is close enough to warrant an assessment, as shown by the vibration assessment zone Figure 6 for typical development sites adjacent rail corridors.

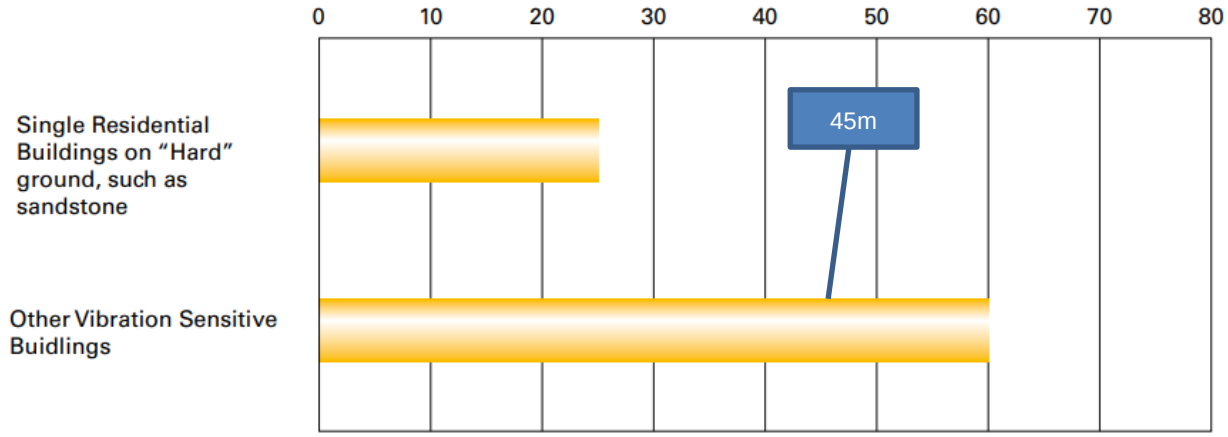


Figure 3.2: Distance from the nearest operational track (m)

Figure 6: Extract from Development near rail corridors and busy roads- interim guideline showing vibration assessment zones

7.1 Human Comfort

Sources of vibration can be classified as Impulsive, continuous or intermittent. Vibration from regular train passbys is considered as intermittent. Where a development falls within the vibration assessment zone (Figure 6), The human comfort criteria for intermittent vibration sources are assessed against the, *NSW Assessing Vibration: A technical guideline*, document, which specifies the Vibration Dose Value (VDV) as the relevant parameter.

The vibration levels of train pass-bys have been measured at the closest part of the development boundary to the nearest rail corridor, which is approximately 45m away from the rail corridor. Vibration levels were measured in x, y, and z axes. The measured values were processed and assessed against the eVDV criteria, which is a short form estimation of the VDV to determine the likelihood of any adverse effect on comfort of occupants of the development.

Table 18 shows the Estimated Vibration Dose Value (**eVDV)** results based on the Z axis of the measurements for human comfort.

Table 18: Estimated Vibration Dose Values from rail corridor

Period	eVDV (m/s$^{1.75}$)	Residential Criterion[1]	Complies (Yes/No)
Day (7am – 10pm)	0.0082	0.40	✓
Night (10pm – 7am)	0.0050	0.13	✓

Based on the vibration measurements at the boundary of the proposed development, and the estimated eVDV levels at the base of the building being significantly under the human comfort criterion. An adverse impact of vibration further up the building is considered highly unlikely.

For continuous vibration sources such as, a long pass-by, road traffic, building services plant from adjacent properties or road traffic, Figure 7 shows how the vibration measurements for the Z axis vibration acceleration compare against the human comfort criteria from BS6472[2] as sourced by the 'Assessing Vibration Guideline'.

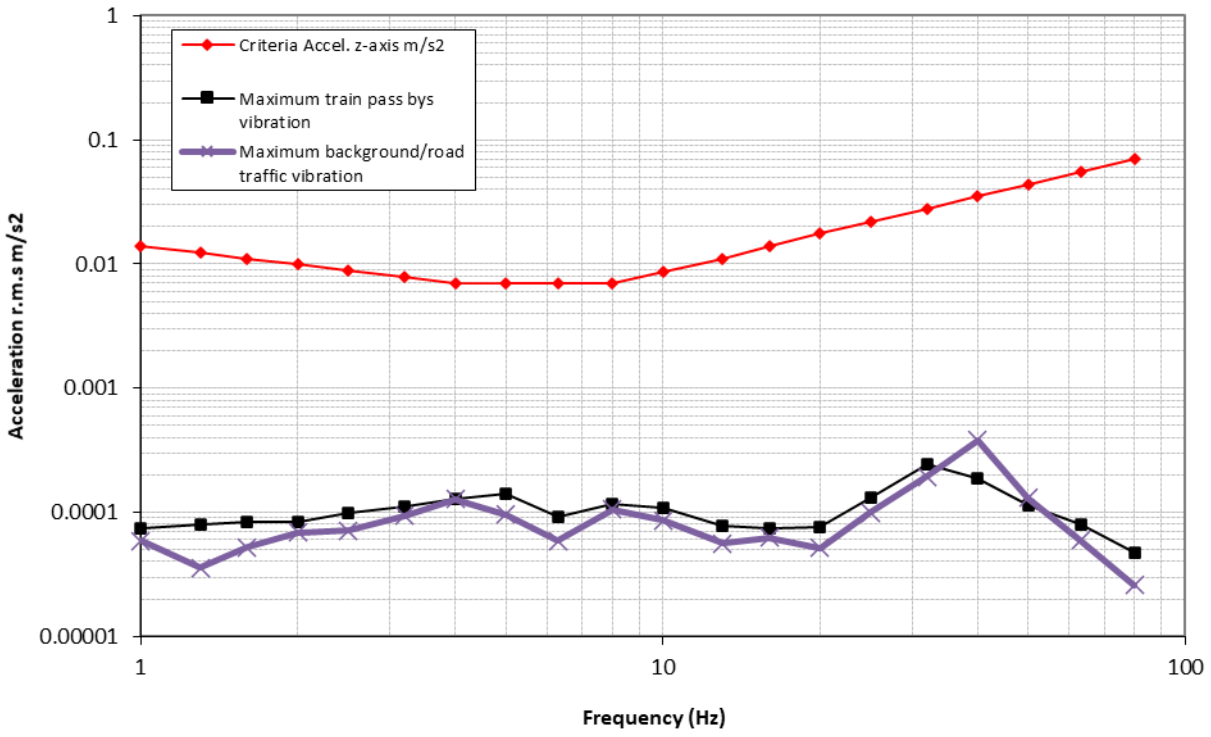


Figure 7: Maximum measured from train pass-bys versus night-time continuous vibration criterion for human comfort (BS 6472)

Figure 7 shows that the average of maximum measured spectrum acceleration (m/s^2 rms) from all pass-bys and existing road traffic, representing a worst-case scenario, is several levels of magnitude below the human comfort criterion for residential buildings at night. Any amplification of vibration up the building is expected to be exceeded by the distance losses. Therefore, compliance with the criterion is achieved and the building does not need to be vibration isolated.

[1] Department of Environment and Conversation NSW 2006 – Assessing Vibration: A technical guideline

2 British Standard BS 6472:1992 – Guide to evaluation of human exposure to vibration in buildings (1 to 80 Hz)

7.2 Building Damage

For comparative purposes, the maximum measured spectrum velocity (mm/s ppv) from all the train pass-bys has also been plotted against the building damage criteria from DIN4150 – 3[3], as shown in Figure 8.

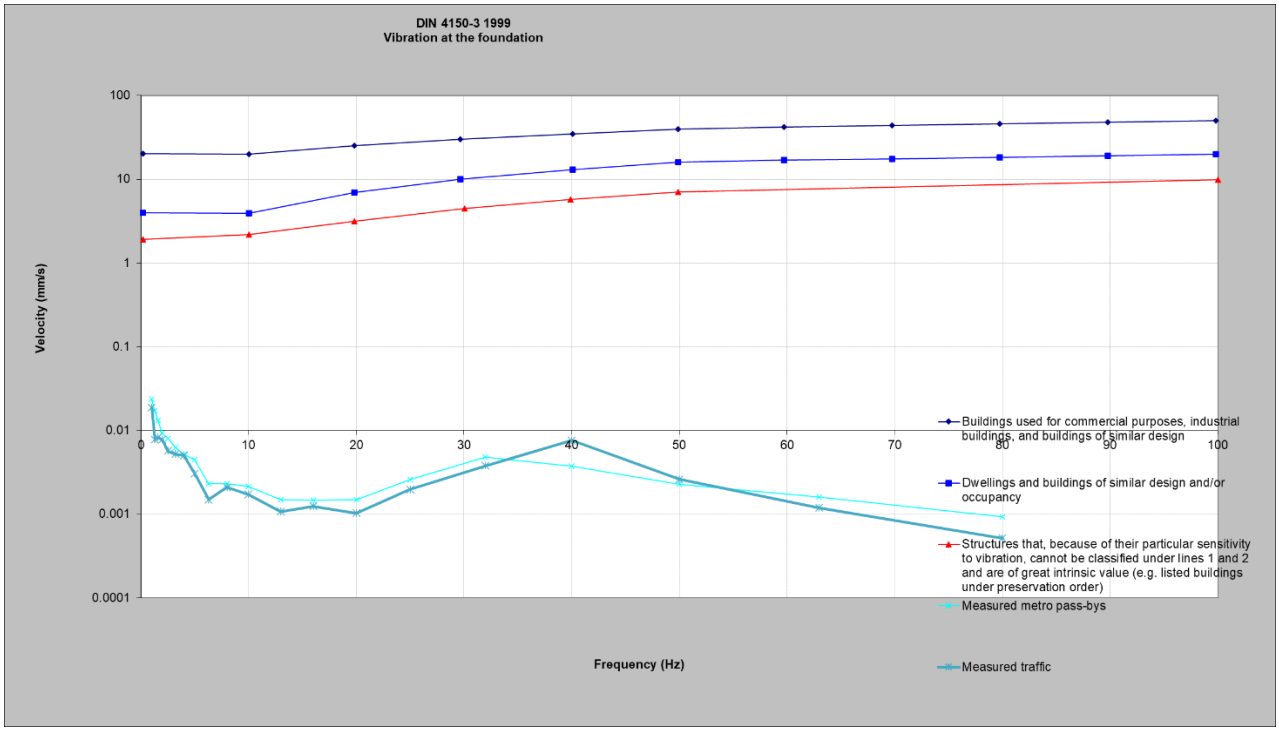


Figure 8: Train vibration for structural damage (DIN 4150)

Figure 8 also shows that the building damage criterion is also comfortably met.

Based on the predicted vibration levels at the boundary of the proposed development from the maximum spectrum of the train pass-bys, both human comfort and building damage vibration criteria are comfortably met at the site boundary. Therefore, based on the results of this assessment the building does not need to be isolated against vibration.

3 German Standard DIN 4150-3:2016 – Vibration in Buildings – Part 3: Effect on structures

8. Construction Noise & Vibration Assessment

8.1 Overview

Currently a detailed construction program is not yet full defined. This section provides general recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice provided within this assessment shall form the basis for the Contractor's detailed Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedances and relevant mitigation measures once construction methods and stages are known.

8.2 Proposed Construction Hours

The proposed construction hours are as follows:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 7:00am to 3:30pm
- Sunday and public holidays: no work
- Safety inspections are permitted from 7:00am

8.3 Preliminary Construction Noise Assessment

A preliminary construction noise assessment has been carried out based on typical plant and machinery expected throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing residential receivers.

8.3.1 Expected Construction Equipment

The noise sources likely to be associated with the works listed in the previous section of this report are presented in . The equipment noise levels have been extracted from *AS 2436:2010* Guide to *Noise and Vibration Control on Construction, Demolition and Maintenance Sites.*

Table 19: Cumulative impact – Construction equipment noise levels

Stages	Equipment	Quantity	Sound Power Level – dB(A)	Acoustical Usage Factor (%)	Usage in 15-minute period (minutes)	Time Corrected Sound Power Level[1] ($L_{aeq,15min}$)
Early Works – Demolition & Dismantle	Jackhammer	1	110	20	3	103
	Electric hand tools	5	99	50	7.5	94
	Bobcat	1	110	50	7.5	107
	Mobile Crane	1	108	20	3	101
	Truck	2	104	40	6	100
Excavation	Excavators	2	116	80	12	115
	Electric hand tools	5	99	50	7.5	94
	Bobcat	2	110	50	7.5	107
	Mobile Crane	1	108	20	3	101

Stages	Equipment	Quantity	Sound Power Level – dB(A)	Acoustical Usage Factor (%)	Usage in 15-minute period (minutes)	Time Corrected Sound Power Level[1] ($L_{aeq,15min}$)
	Truck	2	104	40	6	100
Structural Works	Powered hand tool	5	99	50	7.5	94
	Concrete pump	1	110	50	7.5	96
	Mobile crane	1	108	16	3	101
	Generator	1	110	20	15	110
	Truck	2	104	40	6	104

Note:

1. Time corrected sound power level (SWL) per unit.

8.3.2 Predicted Noise Levels

The predicted noise levels have been presented in to , and have been assessed against the construction noise criteria established in Section 5.4 and a typical 2.1m solid barrier/hoarding around the construction site. Refer to below for the mark-up of Noise Catchment (NC) area.

Figure 9: Noise Catchment Area

Table 20: Predicted noise levels – Scenario 1: Early Works & Demolition

Reference	Receiver	Predicted Noise Level Range $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$ dB	Noise Management Level Exceedance (dB) Without Mitigation	Below Highly Noise Affected Level? (< 75dBA)
NC1	2 Marshall Avenue (Residential)	64 – 82	59	Up to 16	✓*
NC2	1-13 Marshall Avenue (Residential)	54 – 64	59	Up to 5	✓
NC3	10 Marshall Avenue 1-3 Holdsworth Avenue (Residential)	54 – 64	59	Up to 5	✓
NC4	10 Holdsworth Avenue (Residential)	64 – 75	53	Up to 22	✓
NC5	5 Canberra Avenue (Residential)	64 – 75	59	Up to 16	✓
NC6	2 Canberra Avenue (Residential)	49 – 65	59	Up to 6	✓
NC7	80 Christie St (Commercial)	44 – 54	70	-	✓

Note: *May exceed during the high noise intensive works (e.g. rock breaking, hammer, etc). Mittigation measures are to be established in the detail noise construction management plan

Table 21: Predicted noise levels – Scenario 2: Excavation

Reference	Receiver	Predicted Noise Level Range $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$ dB	Noise Management Level Exceedance (dB) With Mitigation	Exceeds Highly Noise Affected Level? (> 75dBA)
NC1	2 Marshall Avenue (Residential)	63 – 82	59	Up to 16	✓*
NC2	9-11 Marshall Avenue (Residential)	54 – 70	59	Up to 11	✓
NC3	10 Marshall Avenue (Residential)	54 – 70	59	Up to 11	✓
NC4	10 Holdsworth Avenue (Residential)	62 – 75	53	Up to 22	✓
NC5	5 Canberra Avenue (Residential)	62 – 75	59	Up to 16	✓
NC6	2 Canberra Avenue (Residential)	52 – 67	59	Up to 8	✓
NC7	80 Christie St (Commercial)	44 – 61	70	-	✓

Note: *May exceed during the high noise intensive works (e.g. rock breaking, hammer, etc). Further mitigation measures are to be established in the detailed noise construction management plan

Table 22: Predicted noise levels – Scenario 3: Structural Works

Reference	Receiver	Predicted Noise Level Range - Without Mitigation $L_{Aeq,15min}$	Noise Management Level $L_{Aeq,15min}$	Noise Management Level Exceedance (dB)	Exceeds Highly Noise Affected Level? (> 75dBA)
NC1	2 Marshall Avenue (Residential)	57 – 71	59	Up to 12	✓
NC2	9-11 Marshall Avenue (Residential)	54 – 66	59	Up to 7	✓
NC3	10 Marshall Avenue (Residential)	54 – 66	59	Up to 7	✓
NC4	10 Holdsworth Avenue (Residential)	64 – 75	53	Up to 22	✓
NC5	5 Canberra Avenue (Residential)	64 – 75	59	Up to 16	✓
NC6	2 Canberra Avenue (Residential)	53 – 63	59	Up to 4	✓
NC7	80 Christie St (Commercial)	42 – 74	70	Up to 4	✓

8.4 General Acoustic Recommendations for Construction

According to AS 2436 – 2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* the following techniques could be applied to minimize the spread of noise and vibrations to the potential receivers.

8.4.1 Noise

If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimized. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportable can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

8.4.2 Screening

On sites where distance is limited, the screening of noise may be beneficial, and this should be taken into account during the planning stages.

If structures such as stores, site offices and other temporary buildings are situated between the noisiest part of the site and the nearest dwellings, some of the noise emission from the site can be reduced. If these buildings are occupied, sound insulation measures may be necessary to protect workers inside the buildings.

A hoarding that includes a site office on an elevated structure offers superior noise reduction when compared with a standard (simple) hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

Storage of building materials or the placement of shipping containers between the noise source and any noise-sensitive area may also provide useful screening and the same is true of partially completed or demolished buildings.

Where such noise barriers are not practical, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen any noise-sensitive areas from the plant. These can often be designed into the construction schedule or site arrangement for future landscaping.

Water pumps, fans and other plant equipment that operate on a 24-hour basis may not be an irritating source of noise during the day but may be problematic at night. They should therefore be effectively screened by either situating them behind a noise barrier or by being positioned in a trench or a hollow in the ground provided this does not generate reverberant noise. In such cases, however, adequate ventilation should also be ensured. Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed if possible, with smaller, quieter excavators. A noise barrier may be a more reliable method of noise control than the imposition of restrictions on throttle settings.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and to the receiver, and the material from which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected to a distance of not less than ten times the shortest measurement from the property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend to a distance beyond the direct line between the noise source and the receiver to a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are predominately within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

8.4.3 Crane (diesel operated)

An appropriate silencer on the muffler and acoustic screen around the engine bay are recommended to attenuate the noise emission.

8.4.4 Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional ‘beeper’, while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate:

(a) Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal frequency ‘beep’) are less intrusive when heard in the neighborhood.

(b) Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.

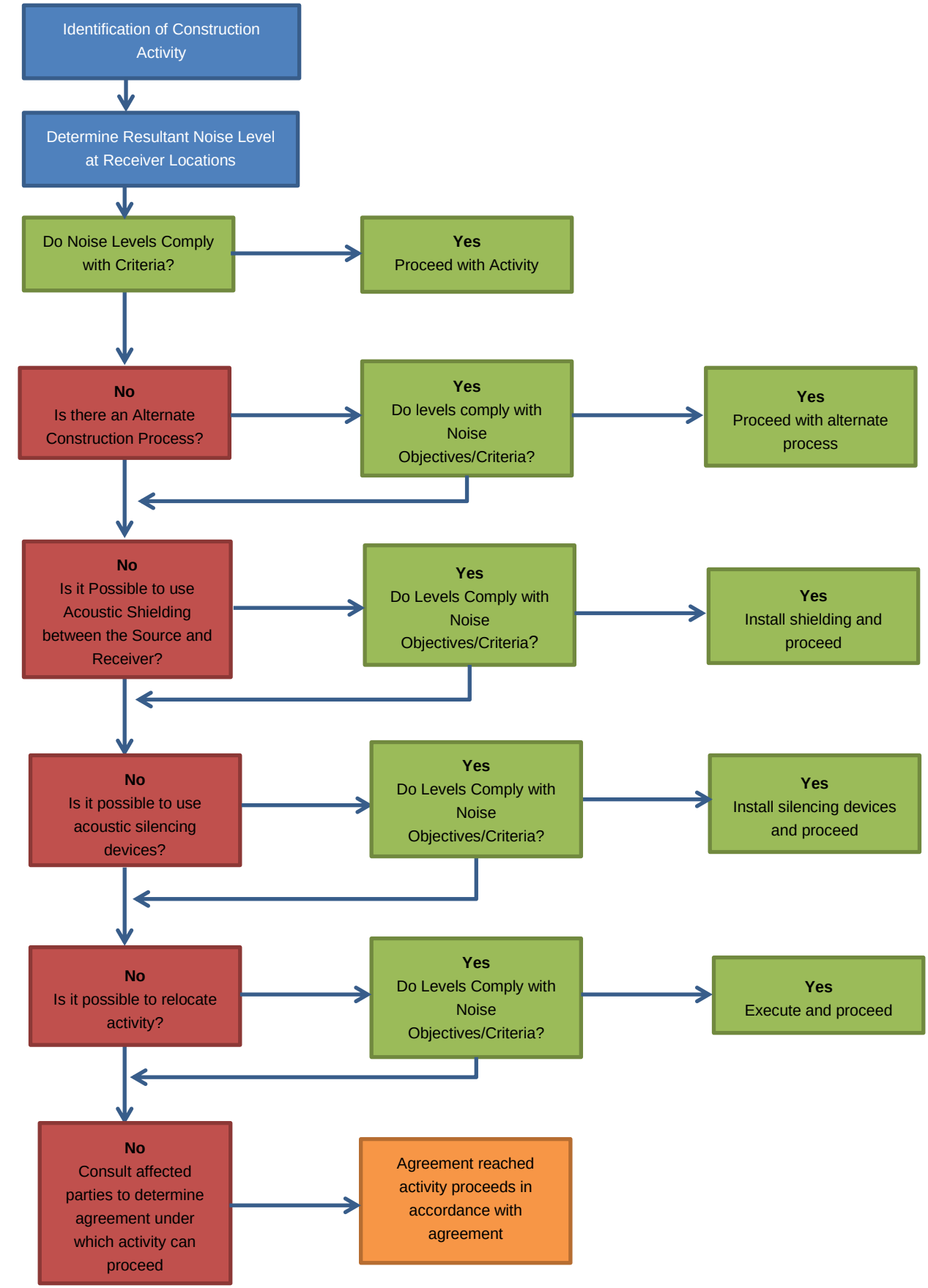
(c) Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, providing safety considerations, are not compromised.

(d) Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.

(e) Spotters or observers.

The above methods should be combined, where appropriate.

Figure 10: Noise mitigation management flow chart



8.5

8.5 Noise & Vibration Monitoring Strategy

8.5.1 General Methodology

Noise and vibration levels should be monitored from time to time to ensure that noise generated as a result of remediation and construction activities does not disturb local businesses.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

- Short term monitoring
- Long-term monitoring

Short-term monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site letting them know when the noise and vibration criteria are exceeded allowing the selection of alternative method on construction or equipment selection to minimise noise and vibration impacts.

Long-term monitoring

Similarly, long-term monitoring uses noise and vibration loggers providing real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded.

Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities through the DA conditions.

Both methods are complementary and normally used simultaneously providing a significant of amount of data via the long-term monitoring but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

8.5.2 Noise & Vibration Monitoring Program

The following monitoring program is proposed for this project:

Table 23 - Proposed noise and vibration monitoring locations details

Sensitive Receiver Details	Proposed Monitoring Type and Phase
9-11 Marshall Avenue (Residential) 10 Marshall Avenue (Residential) 10 Holdsworth Avenue (Residential) 5 Canberra Avenue (Residential)	Noise - All Phases
	Vibration - Civil & Basement Works

The monitoring program as shown above is to be carried out during the likely noisiest stages as agreed with the acoustic engineer and contractor.

9. Conclusion

An acoustic report for the proposed residential development located at 1-3 Canberra Avenue, 4-8 Marshall Avenue, and 2-8 Holdsworth Avenue, St. Leonards. NSW. 2065 has been conducted. This document forms part of the documentation package to be submitted to local authorities as part of the Development Application (DA) process.

This report outlines several relevant noise criteria, in-principle treatment and design requirements which aim to achieve the statutory criteria discussed in Section 5.

A preliminary noise assessment of the external mechanical plant has been carried out as shown in Section 6.1. Based on the application of good plant selection and standard noise control methods the noise criteria at the most sensitive receivers are expected to be met. A detailed assessment will be completed as part of the design development phase of this project.

Acoustic performance requirements for the façade elements have been provided to achieve internal noise levels in accordance with the recommendations of the Department of Planning (DoP) Development near Rail Corridors and Busy Roads – Interim Guideline. These requirements are based on the noise monitoring conducted on the site installed from 3rd November to the 15th October 2021.

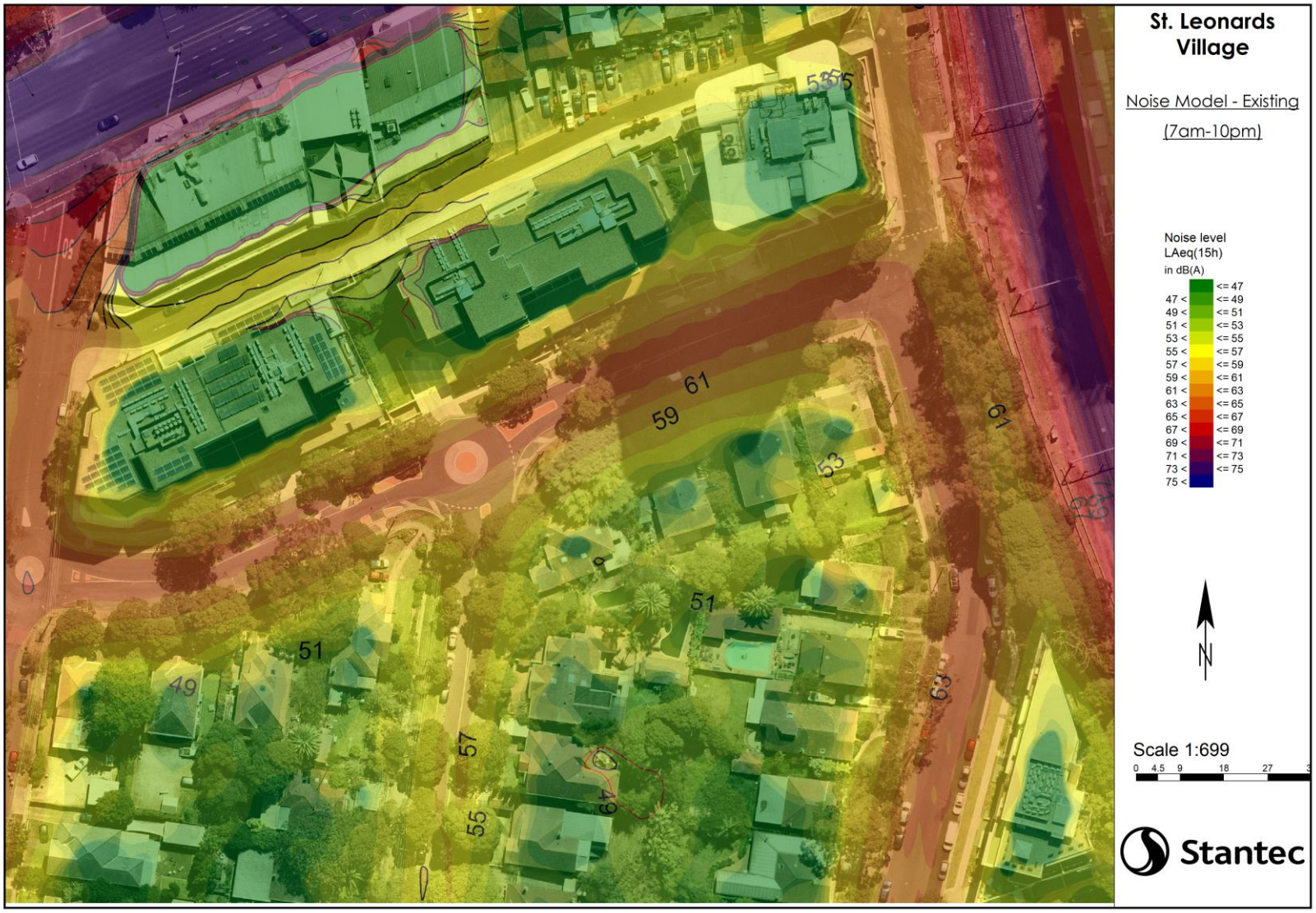
An open windows assessment has been conducted with the requirements of the DoP Interim Guideline. Based on the results of the façade assessment shown in Appendix B, alternate means of ventilation is not required to achieve the recommended open window noise levels

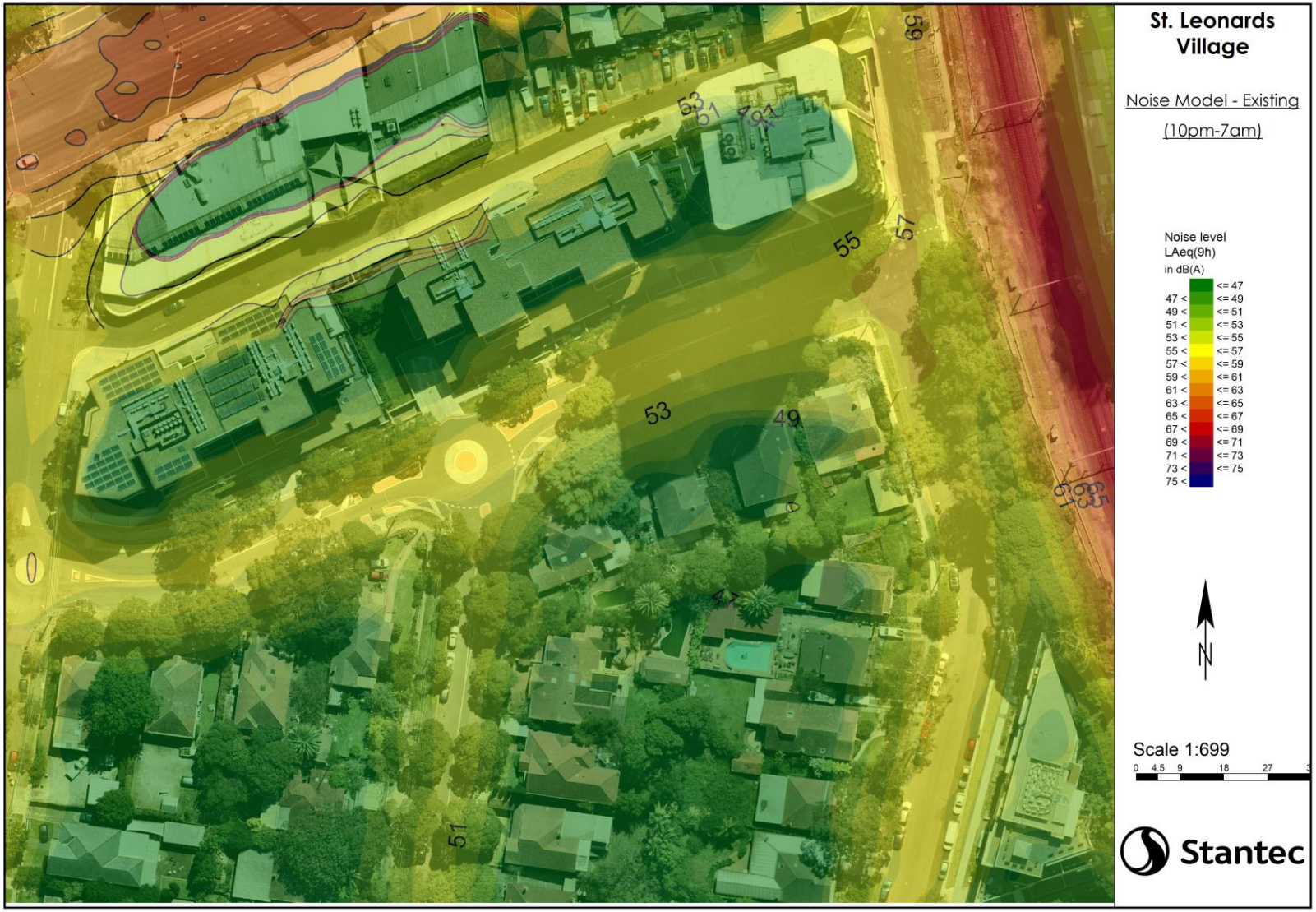
As presented in Section 6.3 of this report, the proposed development the predicted traffic generation noise has been assessed. Based on the assessment the development is not expected to have any adverse impact on the surrounding road network and the traffic generation associated with the proposed development is also expected to comply with the requirements of the NSW Road Noise Policy.

A preliminary construction noise and vibration impact assessment has been carried out. in accordance with the criteria established in Section 5.4 and 5.5 of this report. Based on the results of the assessment, noisy works located in close proximity to the identified receivers may exceed the noise criteria. Further noise controls along with noise monitoring are recommended to be implemented during these works in order to satisfy the noise requirements. Specific mitigation measures are to be investigated prior to construction in a detailed construction noise and vibration management plan when further details are available from the relevant contractor.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

Appendix A Noise Map




St. Leonards Village
Noise Model - Existing
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
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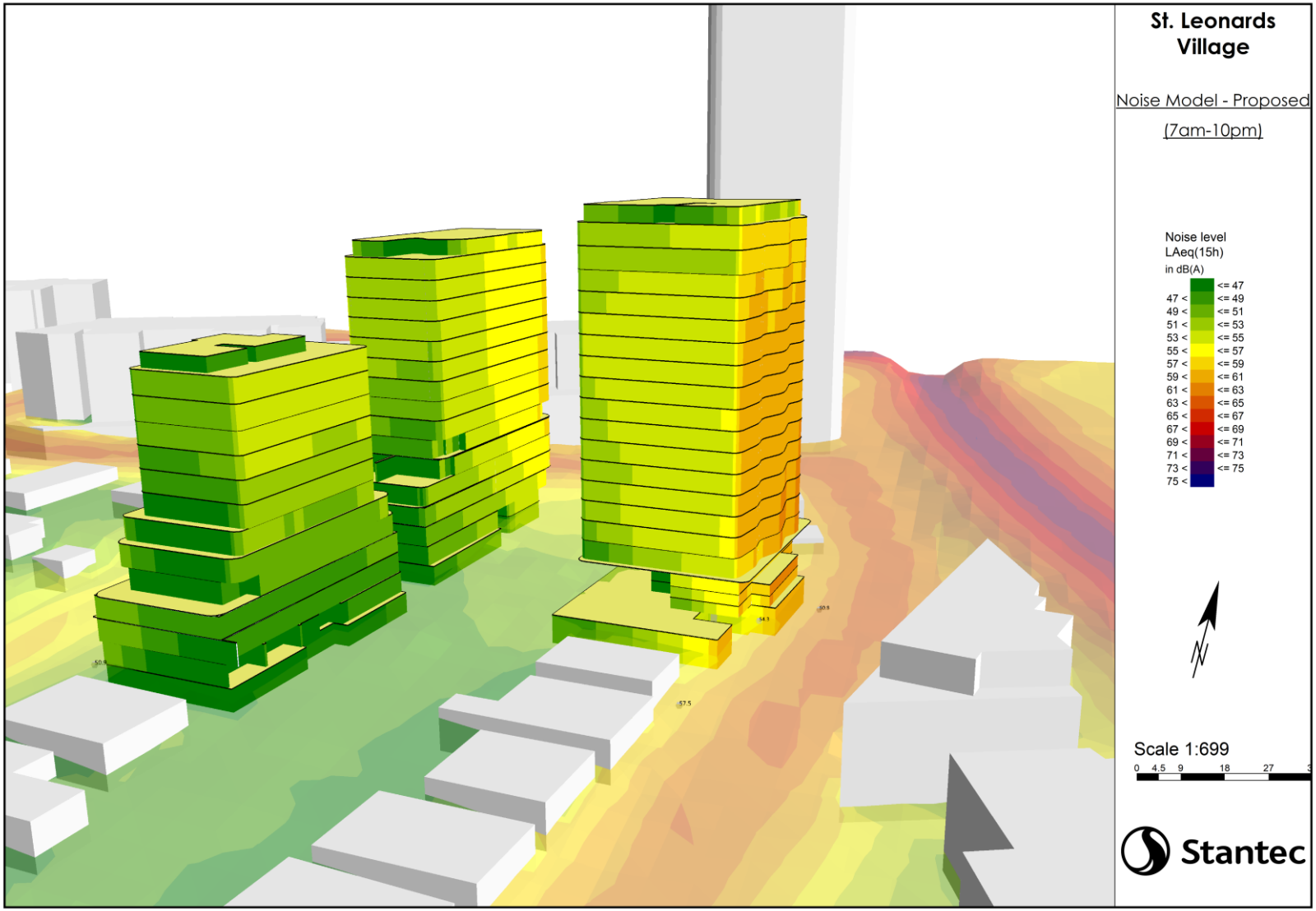
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < <= 71
71 < <= 73
73 < <= 75
N
Scale 1:699
0 4.5 9 18 27
Stantec
53
55
57
59
49
51


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
<= 47
47 < <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
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67 < <= 69
69 < <= 71
71 < <= 73
73 < <= 75
75 <
Scale 1:699
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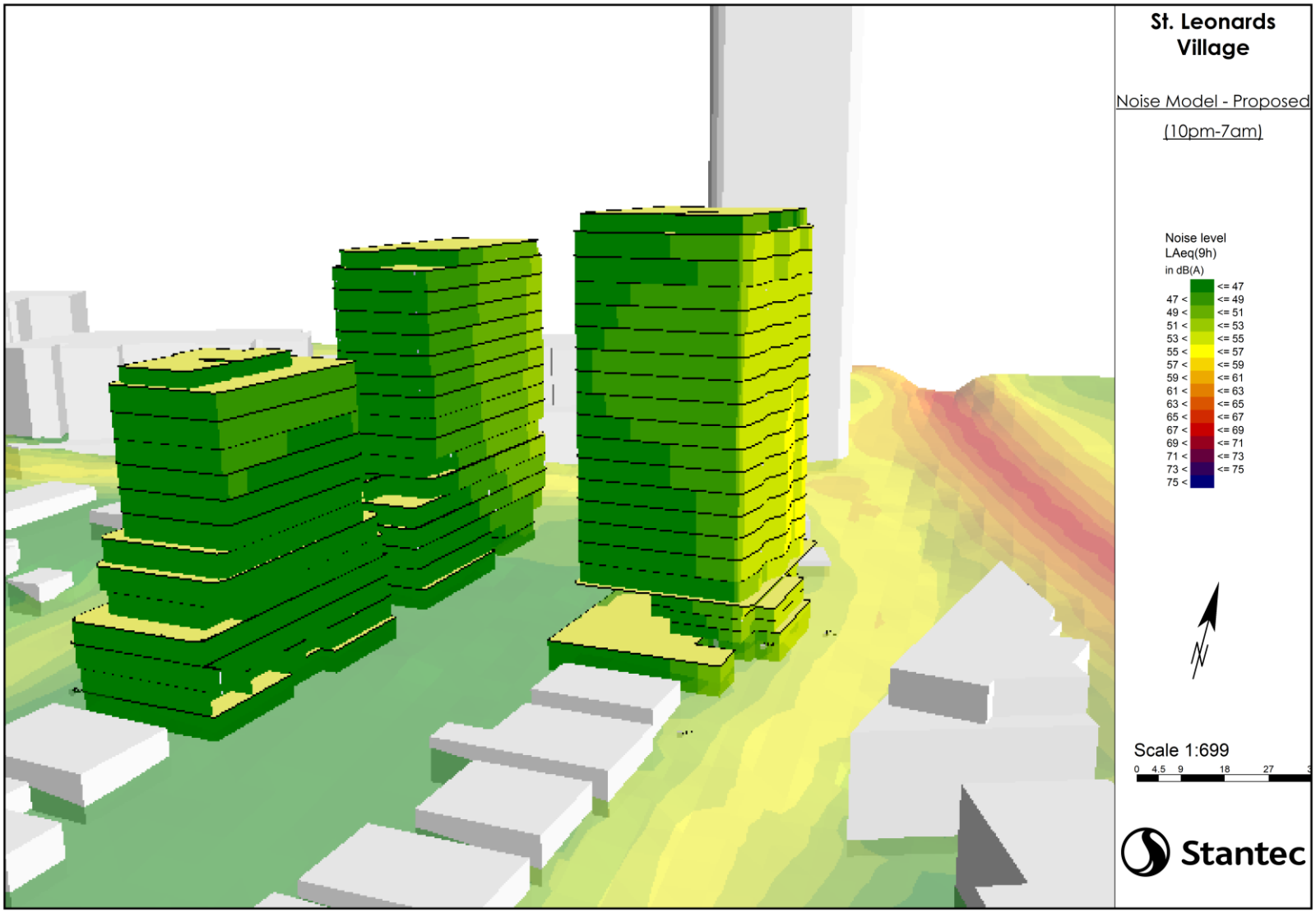
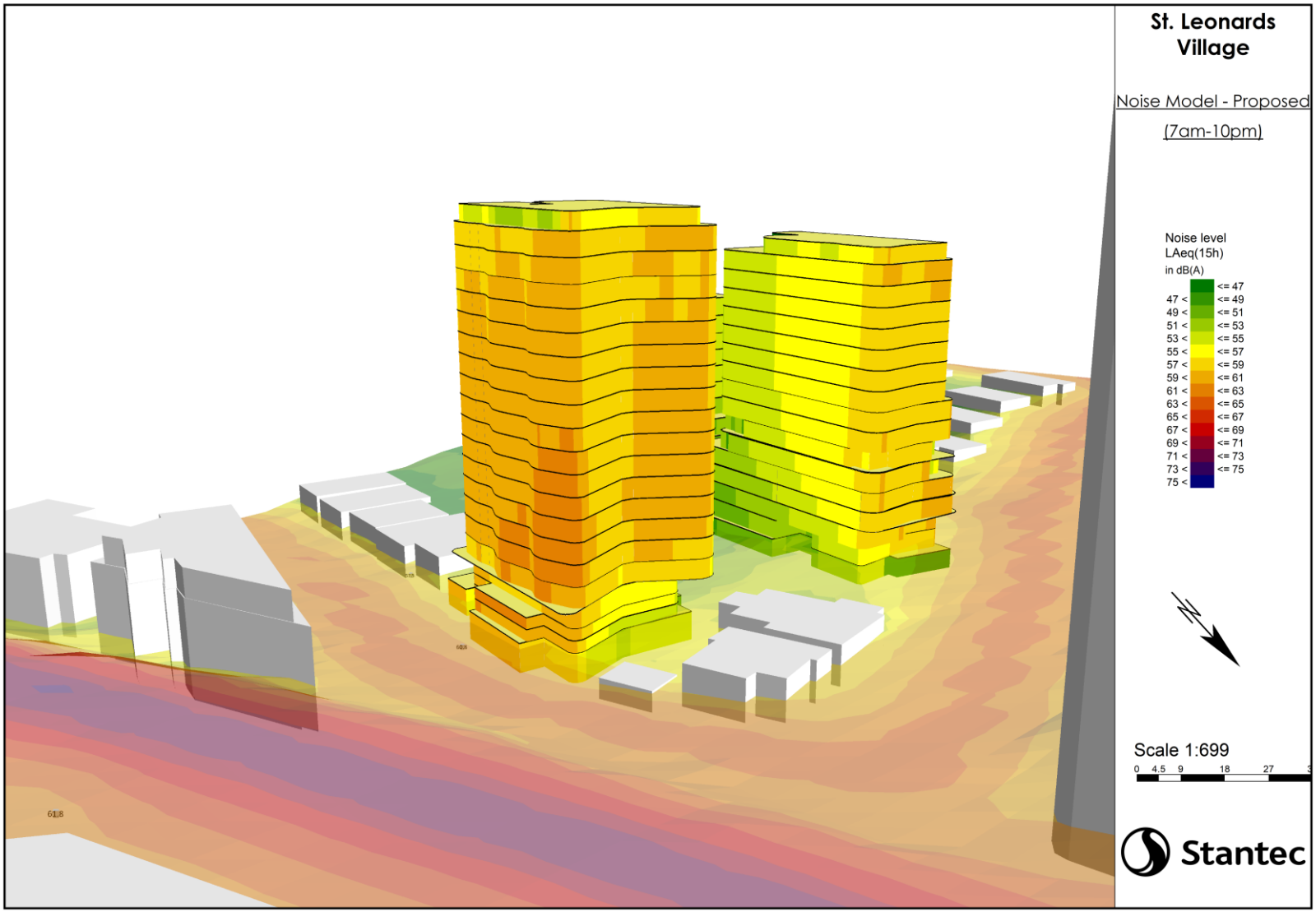
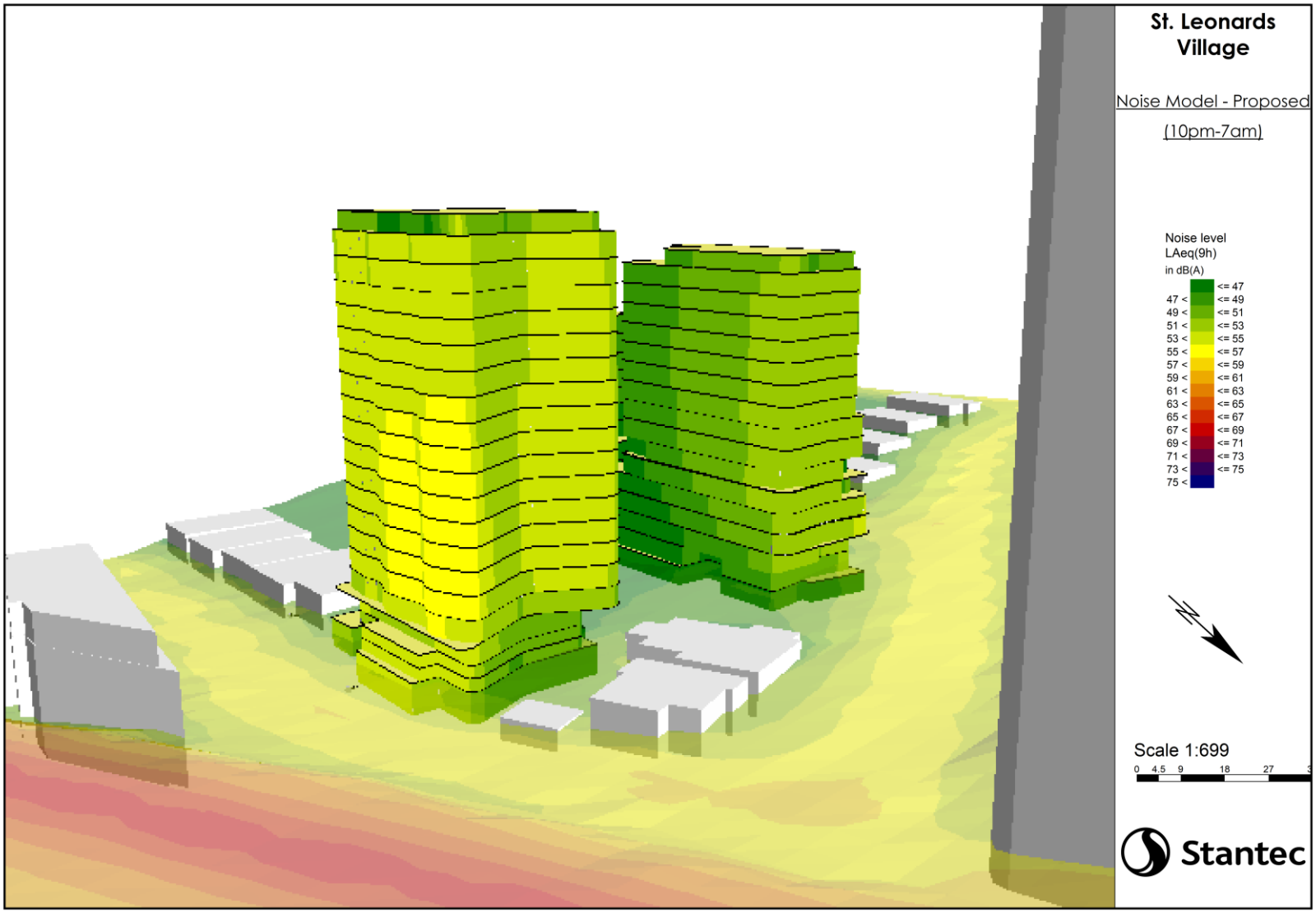
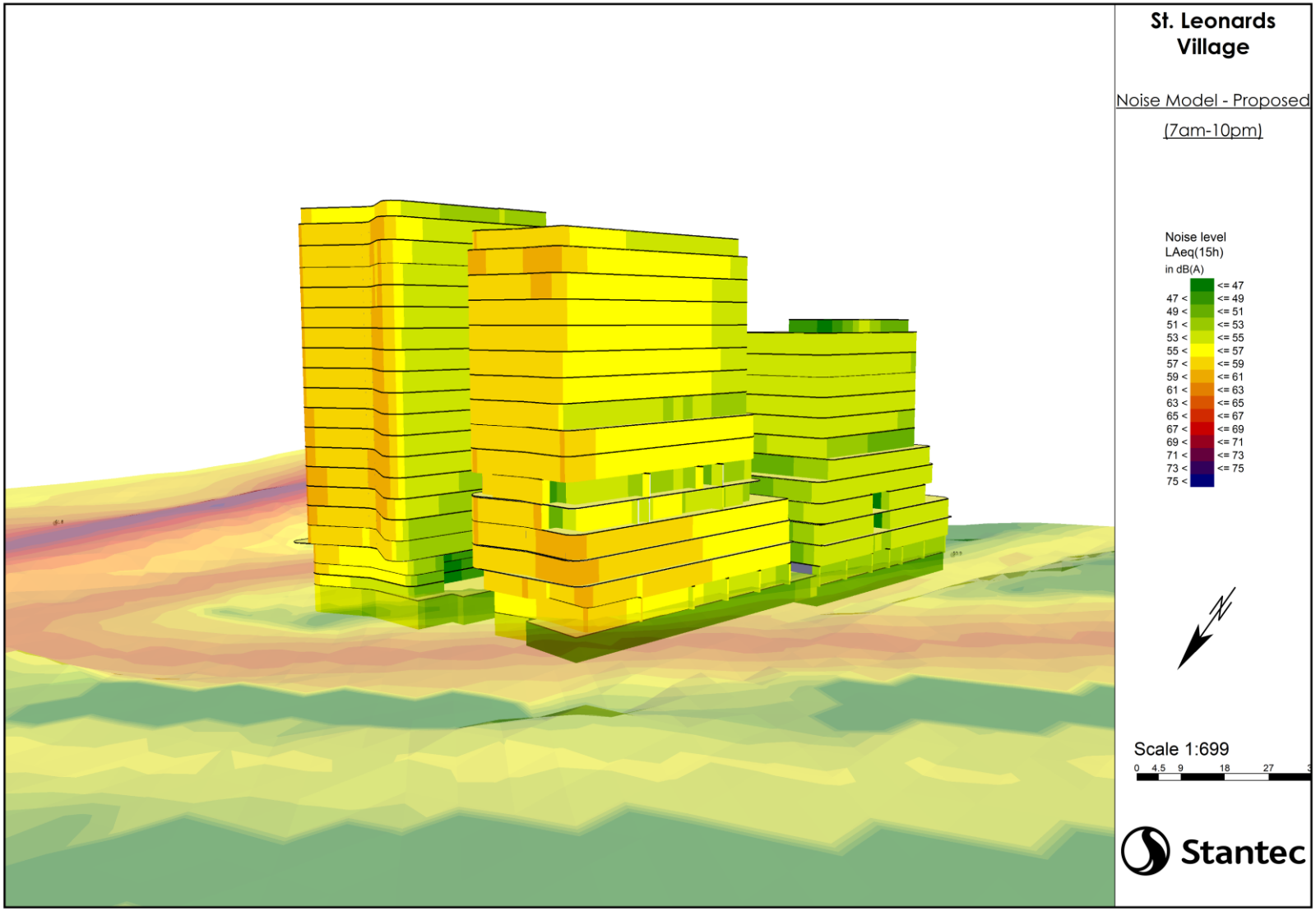
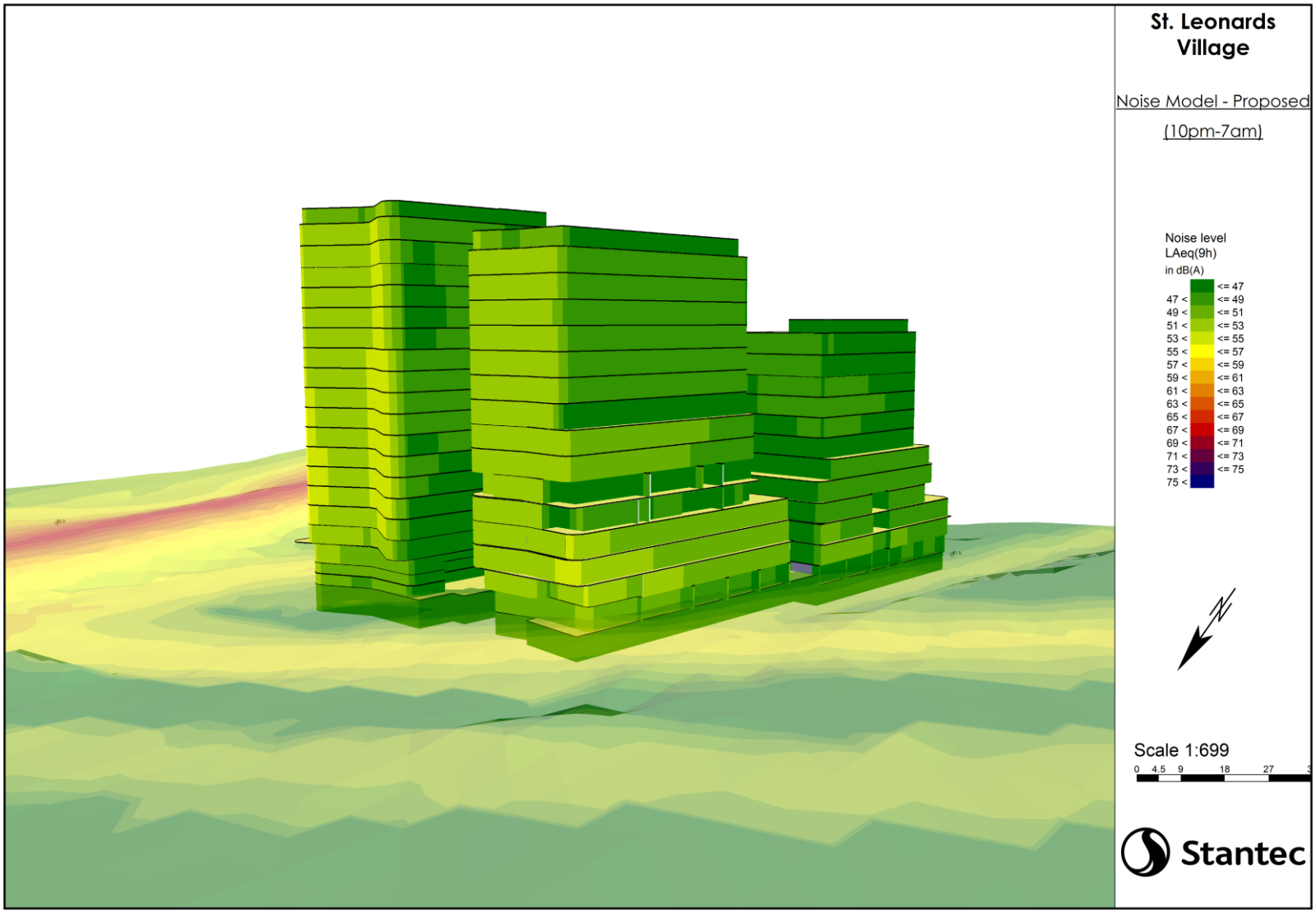
Stantec

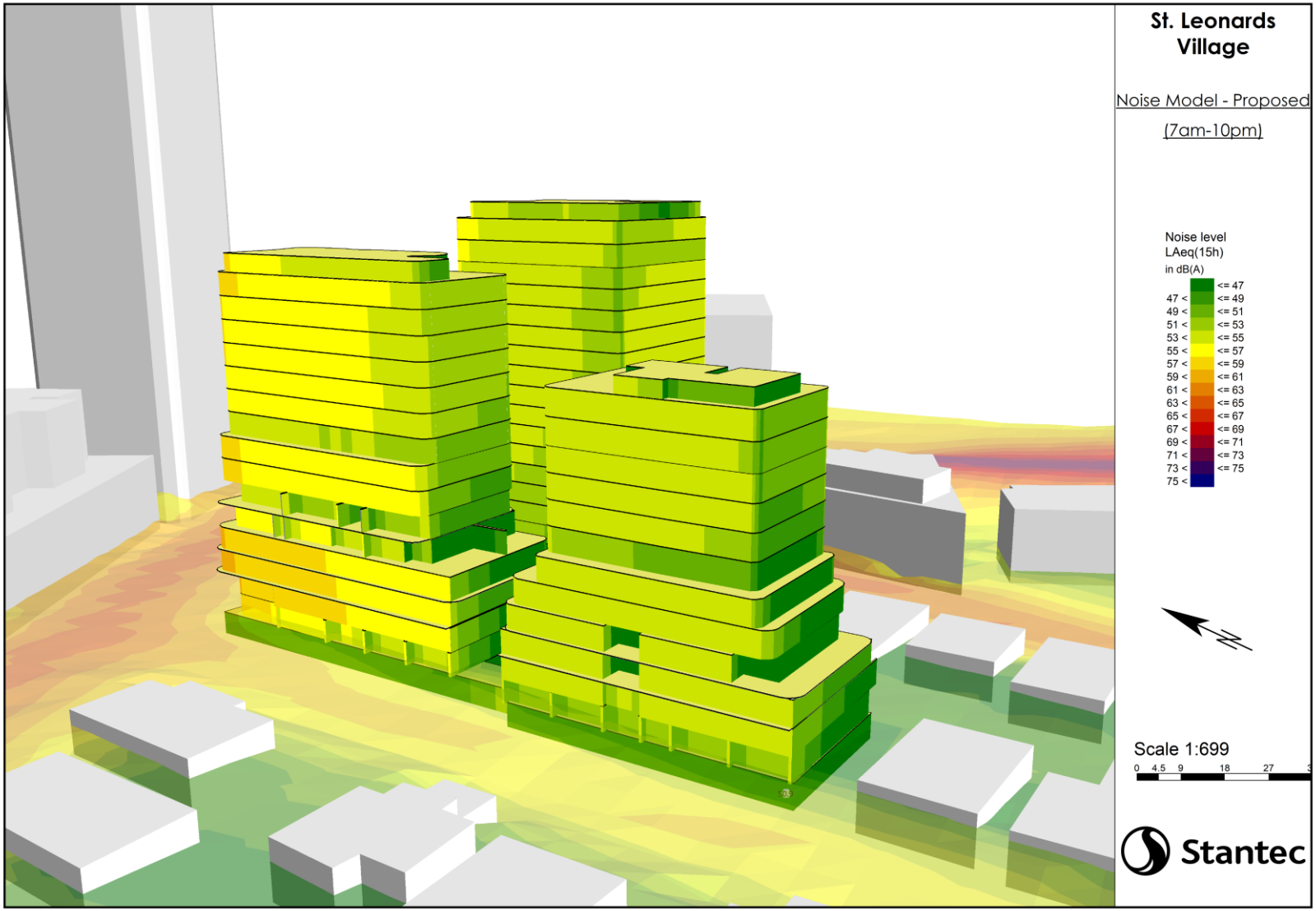

St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
<= 47
47 < <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < <= 71
71 < <= 73
73 < <= 75
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
<= 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 < <= 75
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
<= 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 < <= 75
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
<= 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 < <= 75
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
<= 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 < <= 75
75 <
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
<= 47
47 < <= 49
49 < <= 51
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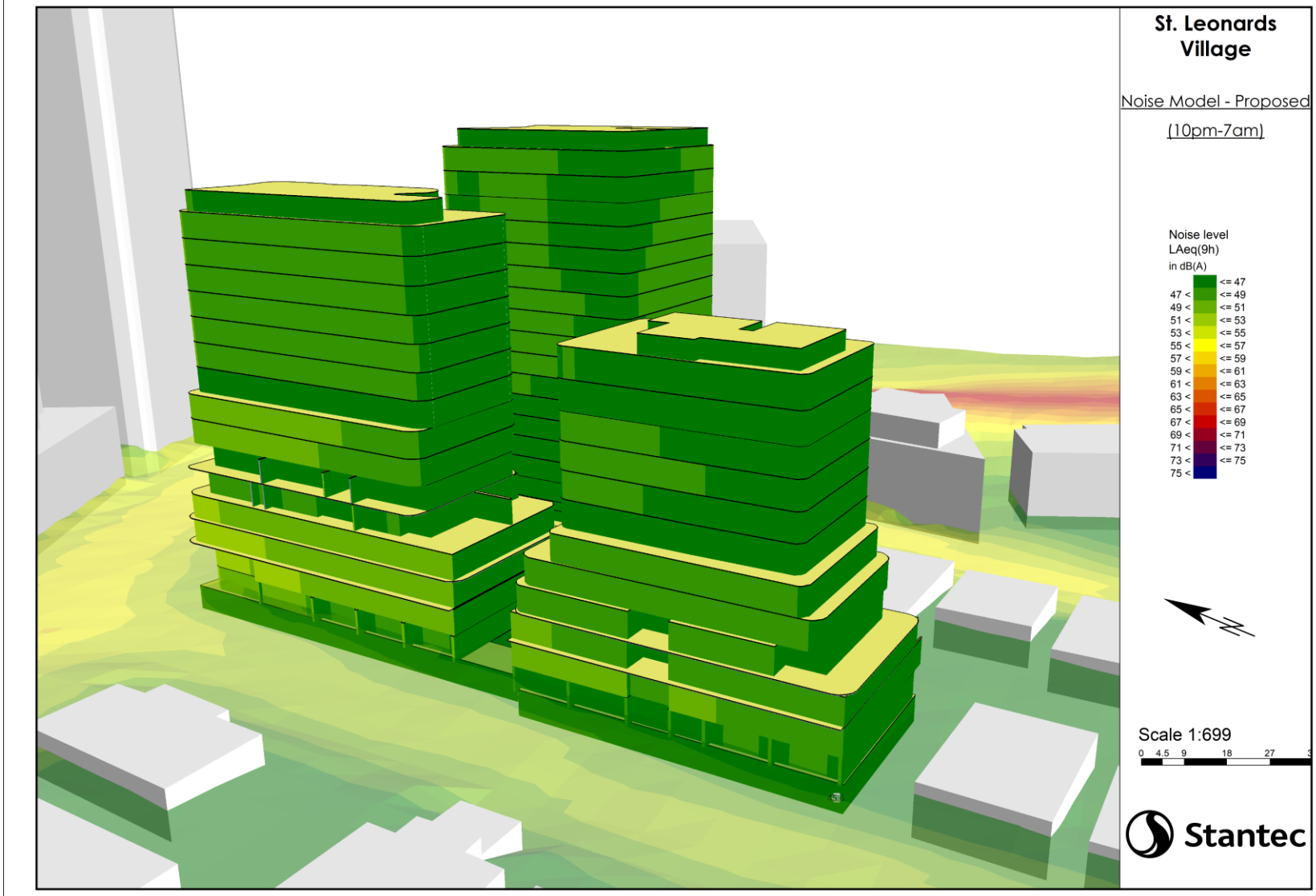
55 < <= 57
57 < <= 59
59 < <= 61
61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < <= 71
71 < <= 73
73 < <= 75
75 <
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
<= 47
47 < <= 49
49 < <= 51
51 < <= 53
53 < <= 55
55 < <= 57
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61 < <= 63
63 < <= 65
65 < <= 67
67 < <= 69
69 < <= 71
71 < <= 73
73 < <= 75
Scale 1:699
0 4.5 9 18 27
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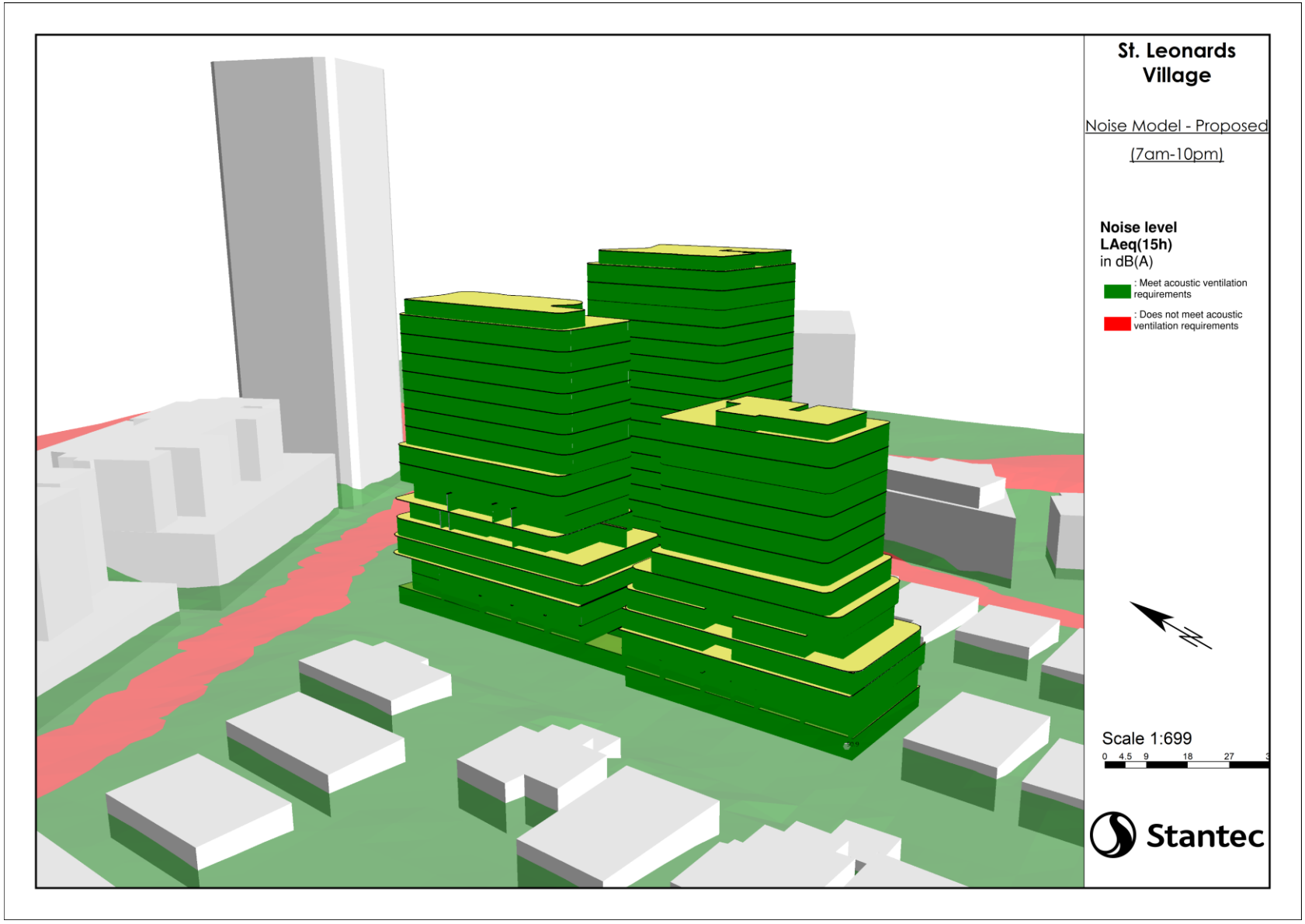
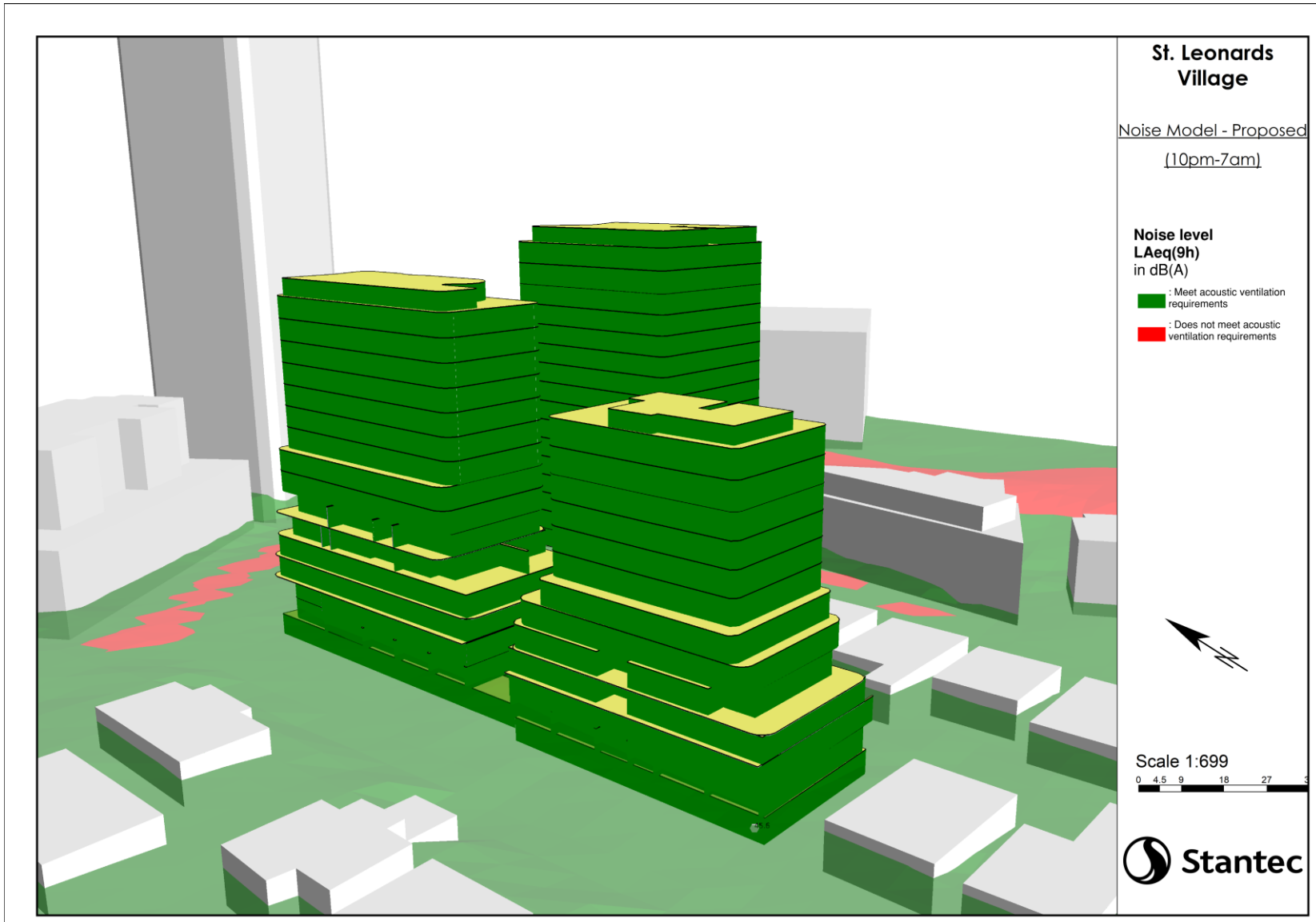
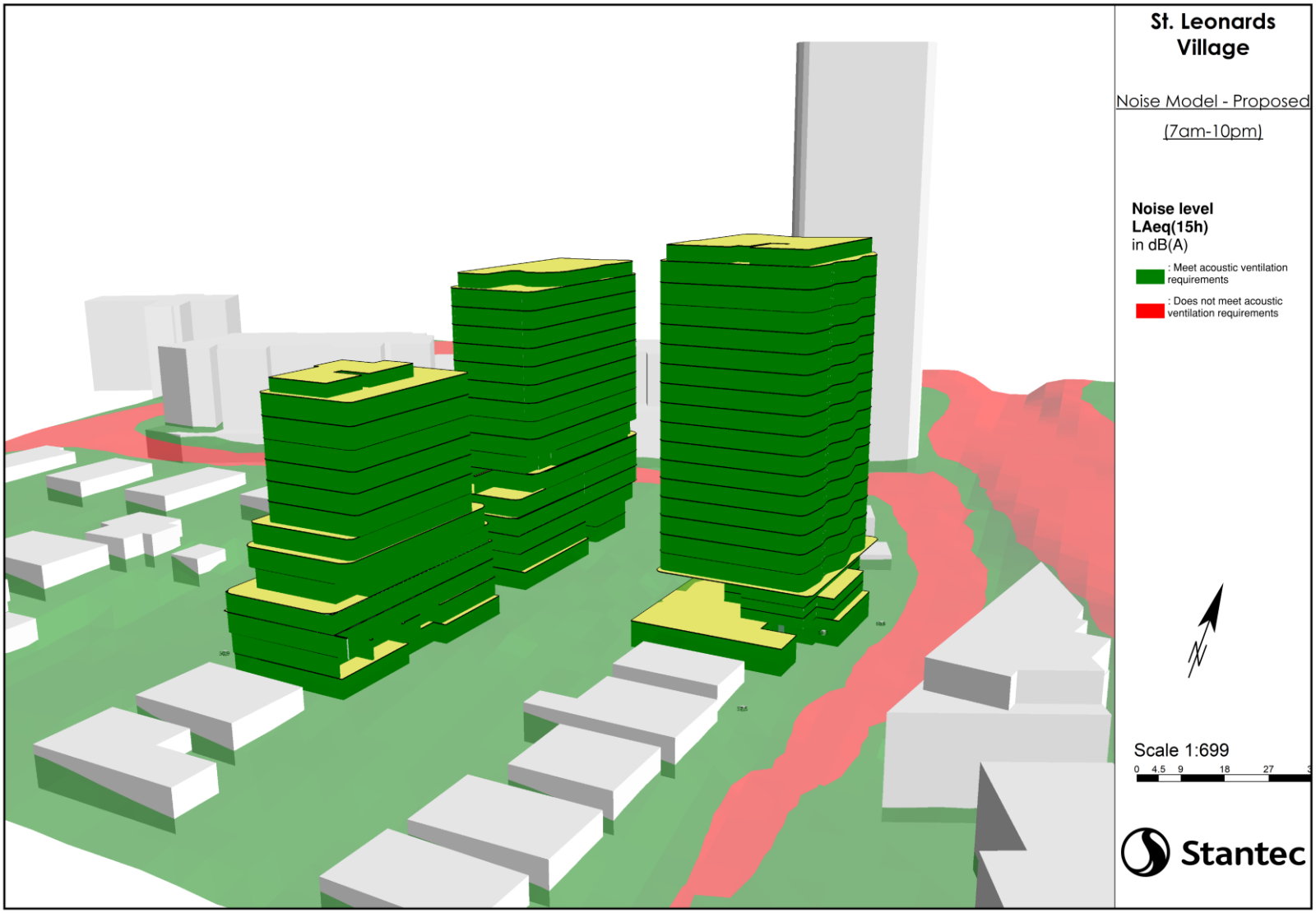
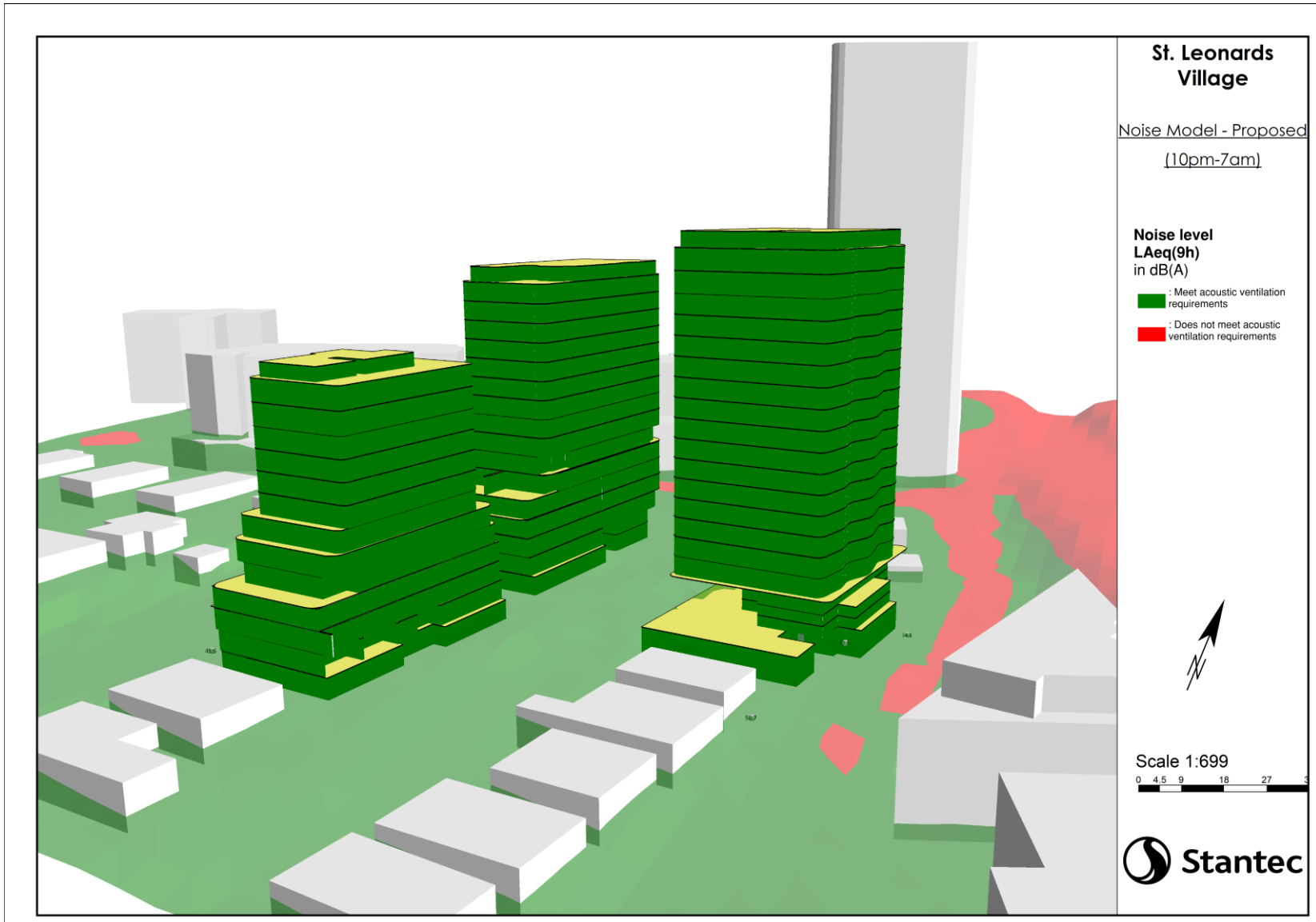
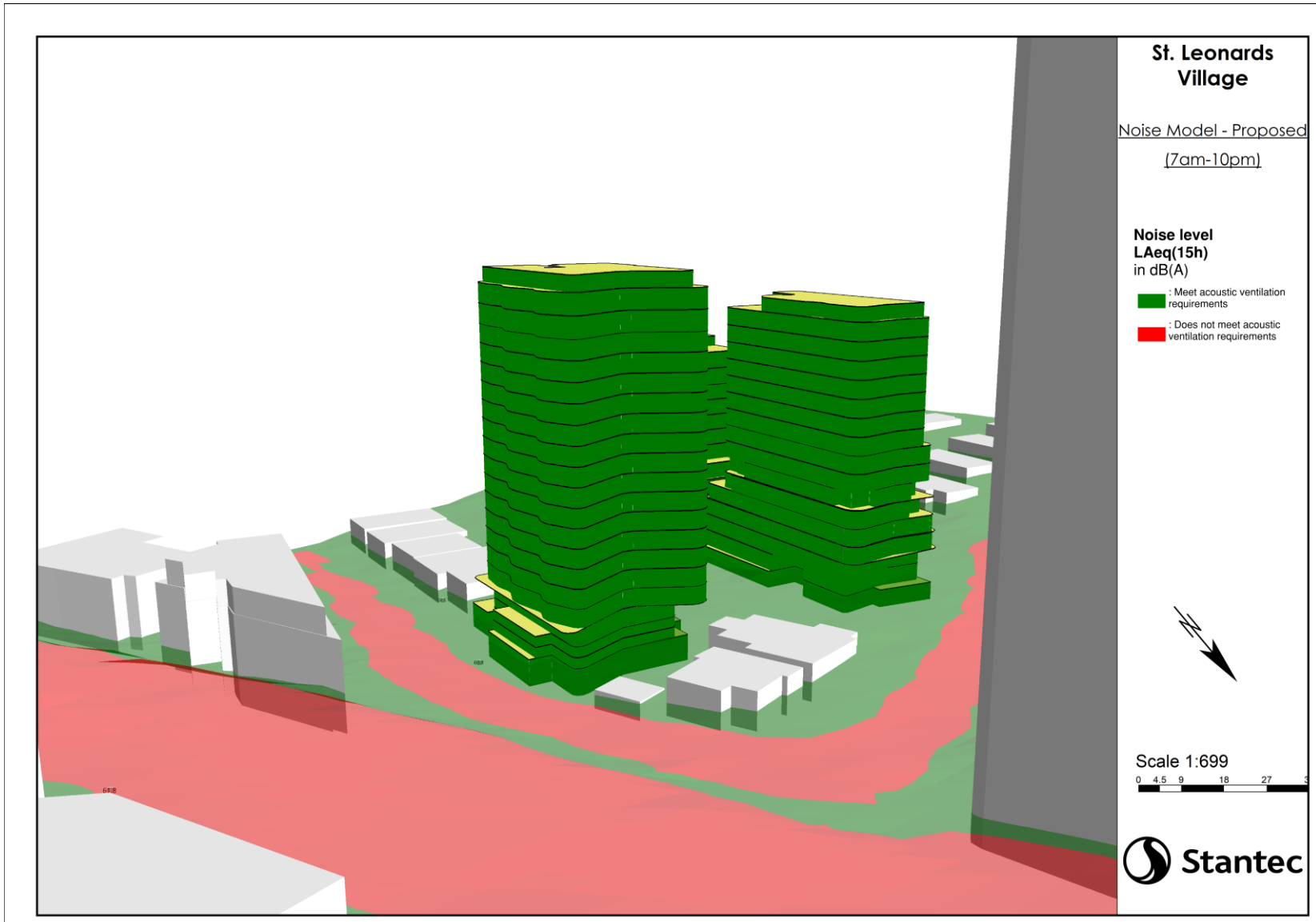
Appendix B Natural Ventilation Requirements




St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
: Meet acoustic ventilation requirements
: Does not meet acoustic ventilation requirements
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
: Meet acoustic ventilation requirements
: Does not meet acoustic ventilation requirements
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
: Meet acoustic ventilation requirements
: Does not meet acoustic ventilation requirements
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(7am-10pm)
Noise level
LAeq(15h)
in dB(A)
: Meet acoustic ventilation requirements
: Does not meet acoustic ventilation requirements
Scale 1:699
0 4.5 9 18 27
Stantec


St. Leonards Village
Noise Model - Proposed
(10pm-7am)
Noise level
LAeq(9h)
in dB(A)
: Meet acoustic ventilation requirements
: Does not meet acoustic ventilation requirements
Scale 1:699
0 4.5 9 18 27
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