



68-80 Banks Avenue, Pagewood

Noise and Vibration Impact Assessment

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E-LAB Consulting

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Document QA and Revisions

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4				

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1 EXECUTIVE SUMMARY

This noise and vibration impact assessment has been prepared by E-LAB Consulting as part of the Environmental Impact Statement (EIS) for a State Significant Development Application (SSDA) for a residential development at 68-80 Banks Avenue, Pagewood (the site).

The site is located at 68-80 Banks Avenue, Pagewood in the Bayside Local Government Area (LGA) and comprises 18 lots with a combined site area of 9,262sqm. It is currently occupied by 5 2-3 storey walk up buildings containing 82 social housing dwellings.

The SSD application seeks approval for demolition of all existing structures and construction of residential flat buildings comprising a total of 84 social housing dwellings and 140 private market dwellings.

The report has been prepared to address the Secretary’s Environmental Assessment Requirements (SEARs) issued for the project (SSD-83256472) on 12 May 2025 as detailed in the table below.

Table 1: Relevant SEARs considered

ISSUE	SEARs REQUIREMENT
10. Noise and Vibration	Provide a noise and vibration impact assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented

This report concludes that the proposed residential development appropriately considers the noise and vibration impacts subject to the implementation of the mitigation measures outlined in Section 9.

Following implementation of the mitigation measures, the remaining noise and vibration impacts are appropriate.



2 INTRODUCTION

2.1 DOCUMENT PURPOSE

This Noise and Vibration Impact Assessment has been prepared by E-LAB Consulting to support a State Significant Development Application (SSD-83256472) for the proposed mixed-use development at 68-80 Banks Avenue, Pagewood.

This Noise and Vibration Impact Assessment specifically responds to the requirements of Item 10 of the SEARS (SSD-83256472) issued for the project by DPHI on 12 May 2025.

In summary, the purpose of this report is to:

- Identify surrounding noise-sensitive receivers;
- Identify relevant standards and guidelines and to establish noise and vibration project requirements for the construction and operation of the site;
- Provide a noise and vibration assessment for the construction of the site, which discusses the expected construction stages, expected machinery / activities involved;
- Provide a noise and vibration assessment for the operation of the site, which discusses both noise emissions from the proposed development (including traffic generation), and noise intruding into the development from road; and
- Outline mitigation measures and recommendations to ensure project noise and vibration requirements are satisfied.

2.2 RELEVANT DOCUMENTS

The following standards, guidelines and drawings have been used to establish the project specific acoustic design requirements for the development.

- Architectural drawings prepared by BVN Architects dated October 2025;
- State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021;
- Development Near Rail Corridors and Busy Roads – Interim Guideline;
- NSW Noise Policy for Industry (NPI) 2017;
- NSW Road Noise Policy (RNP), 2011;
- Interim Construction Noise Guideline (ICNG) 2009;
- Assessing vibration: A Technical Guideline 2006;
- 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”; and
- German Standard DIN4150 – Part 3: “Structural vibration in buildings – Effects on structures”.

3 PROJECT SITE

3.1 SITE DESCRIPTION

The site is located at 68-80 Banks Avenue, Pagewood in the Bayside Local Government Area (LGA) and comprises 18 lots with a combined site area of 9,262sqm. It is currently occupied by 5 buildings containing 82 dwellings within 2-3 storey walk-up buildings.

The site is bound by Banks Road to the west, Park Parade to the north and south, and Jellicoe Park to the east. The Bonnie Doon Golf Course is opposite the site on Banks Avenue to the west.

The site is located within the residential suburb of Pagewood which comprises largely low-rise residential dwellings zoned R2 Low Density Residential and open space.

Further south is higher density development being undertaken as part of the Pagewood Centro development, with buildings up to 20 storeys. Westfield Eastgardens is approximately 600m to the south of the site providing extensive local services and amenities and is subject of a Planning Proposal to facilitate expanded retail as well as office uses.

The location of the proposal, noise monitoring and measurement positions, and the surrounding noise-sensitive receivers are shown in Figure 1. The noise-sensitive receivers have been delineated into receiver catchments (RCs) as noted in Figure 1. Receiver catchments have been identified with a detailed description in Table 2 below.

Table 2: Description of nearby noise sensitive receiver catchments

RECEIVER CATCHMENT	DESCRIPTION
RC1 – Residential	Existing residential housing to the north of the site.
RC2 – Residential	Existing residential housing across Jellicoe Park the east of the site.
RC3 – Residential	Existing residential housing to the south of the site.
RC4 – Active Recreation	Jellicoe Park to adjacent to the eastern boundary of the site, includes sports fields and a playground.
RC5 – Active Recreation	Bonnie Doon golf club across Banks Avenue west of the site.

3.2 DEVELOPMENT PROPOSAL

The SSD application seeks consent for the following:

- Demolition of all existing structures on the site, tree removal, excavation and site preparation works
- Construction of new residential flat buildings comprising:
 - A seven-storey social housing residential flat building with 84 dwellings with a single basement level accessed from Park Avenue to the south
 - Two eight-storey private market housing residential flat buildings with 140 dwellings over a consolidated two-level basement accessed from Park Avenue to the north
- Shared servicing access via a lay-by from Banks Avenue
- Associated landscaping and communal open space
- Infrastructure servicing
- Staged delivery to enable relocation of existing tenants and demolition of existing social housing dwellings.

A detailed description of the project is included in the EIS.



Figure 1: Acoustic site plan identifying the surrounding noise-sensitive receivers and noise monitoring locations



4 METHODOLOGY

To assess the noise and vibration impacts of the proposed development, the following process was carried out:

- Identify and classify the surrounding noise and vibration sensitive receivers surrounding the proposed development;
- Identify and classify the noise and vibration sources generated by the proposed development, together with external noise and vibration sources impacting on the proposed development;
- Carry out site noise investigations to quantify the background noise levels local to the proposed development;
- Determine the project noise and vibration criteria applicable to the proposed development in accordance with relevant standards and guidelines;
- Assess the operational and construction noise and vibration impacts of the noise and vibration sources generated by the proposed development to the surrounding noise-sensitive receivers, together with any impacts on the occupants of the proposed development; and
- Provide details of mitigation measures required to alleviate noise and vibration impacts to achieve the project noise and vibration criteria.

The following operational noise and vibration assessments were conducted as part of this report:

- Road noise intrusion into the development from traffic movement on surrounding local roads;
- Noise and vibration impact of mechanical plant and equipment serving the proposed development on surrounding noise and vibration sensitive receivers; and
- Noise impacts of additional traffic on surrounding local roads generated by the proposed development.

The following construction noise and vibration assessments were conducted as part of this report:

- Noise generated during the construction of the proposed development and associated impacts on the surrounding noise sensitive receivers; and
- Vibration generated during the construction of the proposed development and associated impacts on the surrounding vibration sensitive receivers.

5 NOISE MONITORING

5.1 INSTRUMENTATION

The equipment used for the noise survey was the following:

- Bruel and Kjaer 2250 Integrating Sound Level Meter (S/N: 3031115)
- Bruel and Kjaer type 1 microphone – comprising of:
 - ZC 0032 preamplifier (S/N: 31930)
 - 4189 capsule (S/N: 3334640)
- Bruel and Kjaer Sound calibrator Type 4231 (S/N: 3029638)
- 1 x NSRT mk3 Sentry Noise Loggers

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.

5.2 LONG-TERM NOISE MONITORING

Long term noise monitoring has been undertaken for the project site at locations shown in Figure 1 to measure the background and ambient noise that is representative of the surrounding noise and vibration sensitive receivers. Monitoring was conducted from Tuesday 13th October 2025 to Tuesday 21st September 2025. Detailed graphical noise monitoring data is presented in Appendix C.

5.2.1 Background Noise

Background noise levels and subsequent Rating Background Noise Level (RBL) have been established in accordance with the Noise Policy for Industry 2017 using the results of the noise monitoring at locations LT1 as indicated in Figure 1. The local ambient noise environment is typical of a Suburban residential environment (as described by the NPfI).

Table 3: Unattended noise monitoring results

LOCATION	MEASURED EQUIVALENT CONTINUOUS NOISE LEVEL – L_{EQ} dB(A)			MEASURED RATING BACKGROUND NOISE LEVELS – L_{90} dB(A)		
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT
LT1	58	55	49	42	40	35

General Note: Noise Policy for Industry (NPfI) assessment periods – Daytime: 7:00 am to 6:00 pm Monday to Saturday, 8:00 am to 6:00 pm Sundays and Public Holidays; Evening: 6:00 pm to 10:00 pm; Night: 10:00 pm to 8:00 am Monday to Saturday, 10:00 pm to 8:00 am Sundays and Public Holidays.

5.2.2 Traffic Noise

In addition to background noise, long-term noise monitoring was also conducted at the project site to establish traffic and rail noise levels respectively for the site and have been summarised in Table 4.

Table 4: Long-term traffic noise monitoring results

LOCATION	MEASURED NOISE LEVELS, $L_{Aeq,period}$ dB(A)	
	DAY (7AM – 10PM)	NIGHT (10PM – 7AM)
LT1	57	48

5.3 SHORT-TERM (ATTENDED) NOISE MONITORING

Short-term noise measurements were conducted at the subject site to determine the environmental noise characteristics on 21st October 2025 between the hours of 12:47pm to 1:16pm. The results of the measurements are presented in Table 5.

Table 5: Short-term noise measurement summary

MEASUREMENT LOCATION	MEASUREMENT TIME	L_{Aeq} dB(A)	L_{A90} dB(A)	L_{A10} dB(A)	COMMENTS
ST1 – Banks Avenue	12:47pm-12:57pm	58	50	61	Dominant noise source in the area was from traffic along Banks Avenue, additional noise from nearby Bonnie Doon golf course.
ST2 – Heffron Road	1:06pm-1:16pm	65	54	68	Dominant noise source in the area was continuous traffic along Heffron Road.

6 PROJECT NOISE AND VIBRATION CRITERIA

The project noise and vibration criteria has been established considering the following documents:

- State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021;
- Development Near Rail Corridors and Busy Roads – Interim Guideline;
- NSW Road Noise Policy (RNP), 2011;
- NSW Noise Policy for Industry (NPI) 2017;
- Interim Construction Noise Guideline (ICNG) 2009;
- Assessing vibration: A Technical Guideline 2006;
- 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”; and
- German Standard DIN4150 – Part 3: “Structural vibration in buildings – Effects on structures”.

6.1 PLANNING SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEAR'S)

The SEAR's acoustic requirements for the development are as follows:

10. Noise & Vibration

Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.

6.2 INTERNAL NOISE LEVELS

6.2.1 Australian/New Zealand Standard AS/NZS 2107:2016

AS/NZS 2107:2016 “Acoustics - Recommended design sound levels and reverberation times for building interiors” provides recommended design sound levels within occupied spaces for various building types and usages. Table 6 below provides design sound levels applicable to the development.

Table 6: AS/NZS 2107:2016 design sound levels

TYPE OF OCCUPANCY / ACTIVITY	DESIGN SOUND LEVEL - L_{Aeq} dB(A)
Apartment common areas	45 - 50
Living areas	30 - 40
Sleeping areas	30 - 35
Commercial areas	40 - 45
Retail spaces	< 50
Dining Rooms	40-45

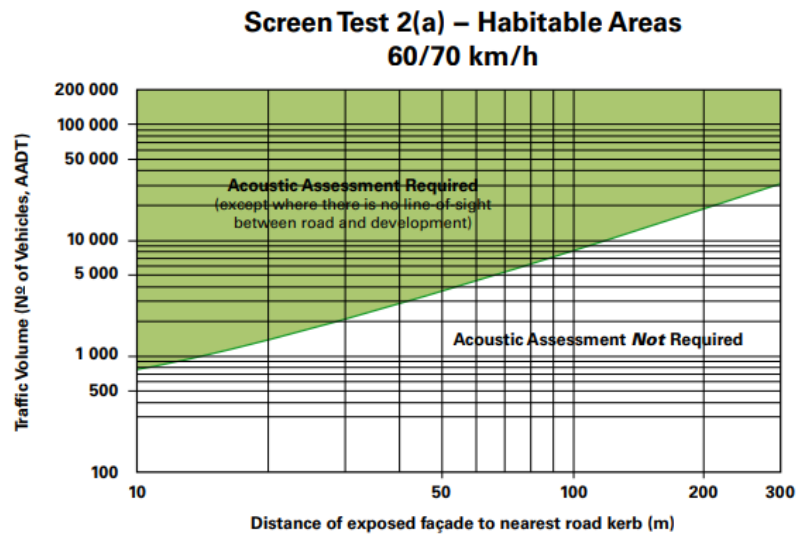
6.2.2 Development Near Rail Corridors and Busy Roads – Interim Guideline

Road Noise Assessment

Figure 2 has been extracted from the Interim Guideline and provides a screening test for noise sensitive developments that takes into account the volume of traffic and the distance between the proposed development and the busy road. Clause 2.120 of the State Environmental Planning Policy (Transport and Infrastructure) 2021, through which the Interim Guideline road noise criteria applies through, only applies for roads with an annual average daily traffic volume (AADT) of more than 20,000 vehicles, or if the road is a freeway, tollway or transitway. The screen test has been conducted to establish whether or not an acoustic assessment is required.

In this case, based on Map 12D and 16B of the Transport for NSW traffic volume maps, there are no roads within 300m of the proposed development carrying more than 20,000 vehicles and as such there is no need for a mandatory road noise assessment under Clause 2.120 of SEPP (Transport and Infrastructure) 2021.

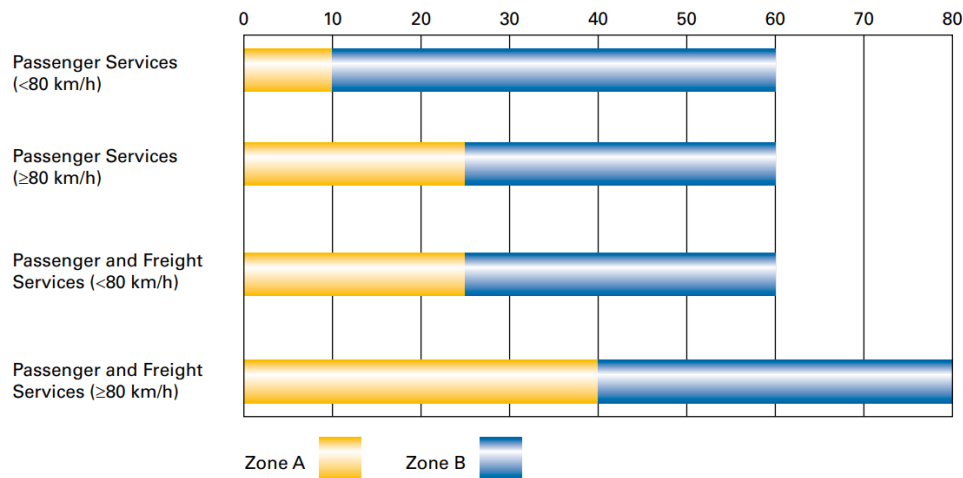
Figure 2: Screen tests for habitable areas of multiple dwellings (noting that any exposed facade is direct line-of-sight)



Rail Noise Assessment

Figure 3 which has been extracted from the Interim Guideline provides guidance as to the level of assessment required when noise sensitive developments are located in the vicinity of existing rail lines. Zones A and B are indicative acoustic assessment zones where sensitive land-uses are likely to be adversely affected.

Figure 3: Acoustic assessment zones based on distance (m) of noise-sensitive development from operation track (not corridor)



Given the proposed development boundary is located over 500m from the nearest the nearest rail corridor, an assessment of rail noise to the facades of the proposed development is not required.

6.3 EXTERNAL NOISE EMISSIONS

6.3.1 NSW EPA Noise Policy for Industry (NPI) 2017 – Industrial Noise (Plant and Equipment)

The NSW EPA's Noise Policy for Industry (NPI) 2017 has been implemented to assess the noise impacts of mechanical plant and equipment, as well as other industrial noise sources on the surrounding receiver catchments.

The NPI sets out a framework for the derivation of project noise trigger levels that are used to assess the potential impacts of noise from industry (and industrial noise sources) and indicate the noise level at which feasible and reasonable noise management measures should be considered.

This policy applies to noise sources from activities listed in Schedule 1 of the POEO Act and those regulated by the EPA. This includes noise sources from mechanical plant and equipment within the proposed redevelopment, for which this policy will be applied.

The project noise trigger level provides a benchmark for assessing a proposal, where if exceeded, indicates a potential noise impact on the community and so triggers a management response such as additional mitigation measures. The project noise trigger level is the lower (the more stringent) value of the project intrusiveness noise level and project amenity noise level determined in Sections 2.3 and 2.4 of the NPI, respectively.

Project Intrusiveness Noise Level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (in terms of L_{Aeq}) measured over a 15-minute period does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. The project intrusiveness noise level is only applicable to surrounding residential receivers.

To account for the temporal variation of background noise levels, the method outlined in Fact Sheet A of the NPI establishes a method in determining the Rating Background Noise Level (RBL) to be used in the assessment.

The intrusiveness noise level is determined as follows:

$$L_{Aeq,15min} \text{ (Intrusiveness Criteria)} = \text{Rating Background Noise Level (RBL)} + 5 \text{ dB(A)}$$

Table 7 provides the project intrusiveness noise levels applicable to each of the surrounding residential noise-sensitive receivers. Receiver catchments are provided in Table 2.

Table 7: Project intrusiveness noise level criteria for each residential receiver catchment

RECEIVER CATCHMENT	TIME OF DAY	MEASURED RBL - dB(A)	PROJECT INTRUSIVENESS NOISE LEVELS - $L_{Aeq,15min}$ dB(A)
RC1 ¹	Day	42	47
	Evening	40	45
	Night	35	40
RC2 ¹	Day	42	47
	Evening	40	45
	Night	35	40
RC3 ¹	Day	42	47
	Evening	40	45
	Night	35	40

Note 1 – Based on the results of long-term unattended noise monitoring at monitoring position LT1.

Project Amenity Noise Level

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

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:

$$\text{Project Amenity Noise Level} = \text{Recommended Amenity Noise Level (see Table 8)} - 5 \text{ dB(A)}$$

The recommended amenity noise level, project amenity noise level, and converted project amenity noise level for comparison with the intrusiveness criteria (from time-of-day period to 15-minute) is provided for each surrounding receiver catchment in Table 8.

Table 8: Project amenity noise level criteria for each receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	RECOMMENDED AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)
RC1	Residential – Suburban ¹	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
RC2	Residential – Suburban ¹	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
RC3	Residential – Suburban ¹	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
RC4	Active Recreation	When in Use	55	55	55
RC5	Active Recreation	When in Use	55	55	55

Note 1: Suburban residential as classified in Table 2.3 of the Noise Policy for Industry (NPI) 2017.

Sleep Disturbance and Maximum Noise Level Assessment

Where the proposed redevelopment night-time noise levels generated at a residential location exceed either:

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

a detailed maximum noise level event assessment should be undertaken.

Corrections for Annoying Noise Characteristics – Noise Policy for Industry Fact Sheet C

Fact Sheet C contained within the Noise Policy for Industry outlines the correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels established within this report, to account for the additional annoyance caused by these modifying factors.

The modifying factor corrections should be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location, and
- The nature of the noise source and its characteristics (as set out in Fact Sheet C)

Table C1 within Fact Sheet C sets out the corrections to be applied for any assessment in-line with the NPI. The corrections specified for tonal, intermittent and low-frequency noise are to be added to the measured or predicted levels at the receiver before comparison with the project noise trigger levels. The adjustments for duration are to be applied to the criterion.

Project Noise Trigger Levels

Table 9 presents the project intrusiveness and project amenity noise levels for each period, and each receiver catchment, as well as the resultant project noise trigger levels (PNTLs) that shall be applied for any assessment of impacts of mechanical plant and equipment noise on the surrounding receiver catchments.

Table 9: Project noise trigger levels (PNTL) to be applied to each surrounding receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	PROJECT INTRUSIVENESS NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	SLEEP DISTURBANCE NOISE LEVEL - dB(A)	PROJECT NOISE TRIGGER LEVEL - $L_{Aeq,15min}$ dB(A)
RC1	Residential – Suburban	Day	47	53	N/A	47
		Evening	45	43	N/A	43
		Night	40	38	40dB(A) L_{eq} and 52dB(A) L_{max}	38dB(A) L_{eq} and 52dB(A) L_{max}
RC2	Residential – Suburban	Day	47	53	N/A	47
		Evening	45	43	N/A	43
		Night	40	38	40dB(A) L_{eq} and 52dB(A) L_{max}	38dB(A) L_{eq} and 52dB(A) L_{max}
RC3	Residential – Suburban	Day	47	53	N/A	47
		Evening	45	43	N/A	43
		Night	40	38	40dB(A) L_{eq} and 52dB(A) L_{max}	38dB(A) L_{eq} and 52dB(A) L_{max}
RC4	Active Recreation	When in use	N/A	55	N/A	55
RC5	Active Recreation	When in use	N/A	55	N/A	55

6.4 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 NSW Road Noise Policy (RNP). 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 10.

Table 10: NSW RNP – Traffic Noise Assessment Criteria

ROAD CATEGORY	TYPE OF PROJECT/LAND USE	ASSESSMENT CRITERIA – dB(A)	
		DAY (7AM – 10PM)	NIGHT (10PM – 7AM)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	L_{Aeq} , (15 hour) 55	L_{Aeq} , (15 hour) 50
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	L_{Aeq} , (15 hour) 60	L_{Aeq} , (15 hour) 55
	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments		
Local Roads	4. Existing residences affected by noise from new local road corridors	L_{Aeq} , (1 hour) 55	L_{Aeq} , (1 hour) 50
	5. Existing residences affected by noise from redevelopment of existing local roads		
	6. Existing residences affected by additional traffic on existing local roads generated by land use developments		

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 of the RNP 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’.

Also, the inherent quality of noise from vehicles on public roads arriving to and departing from the site would be indistinguishable from other traffic noise on public roads.

6.5 CONSTRUCTION NOISE CRITERIA

6.5.1 Interim Construction Noise Guideline (ICNG)

The noise criteria outlined within the ICNG has been adopted for the assessment of noise emissions from the construction of the proposed redevelopment.

Airborne Noise – Residential Receiver Catchments

The airborne noise criteria for surrounding residential receiver catchments (R3 and R4) have been extracted from Table 2 in the ICNG and is presented in Table 11 below.

Table 11: NSW ICNG construction noise criteria for surrounding residential receiver catchments (RC3 and RC4)

TIME OF DAY	MANAGEMENT LEVEL $L_{Aeq,15min}^1$	HOW TO APPLY
Recommended Standard Hours: Monday – Friday 7am – 6pm	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.
Saturday 8am – 1pm No work on Sundays or public holidays	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	- 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 1: 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.

Airborne Noise – Other Sensitive Land Uses

The airborne noise criteria for surrounding land uses have been extracted from Table 3 in the ICNG and is presented in Table 12 below.

Table 12: NSW ICNG construction noise criteria for other sensitive land uses

LAND USE	MANAGEMENT LEVEL (APPLIES WHEN BEING USED)
	$L_{Aeq,15min}$
Classrooms at schools and other educational institutions / Hospital wards and operating theatres / Places of worship	45 dB(A) - Internal
Active Recreation Areas	65 dB(A) - External
Passive Recreation Areas	60 dB(A) - External
Commercial Premises (offices, retail outlets)	70 dB(A) - External

Ground-borne Noise – Residential Receiver Catchments

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, such as an excavator with a hydraulic hammer attachment, or impact/bore piling. The following ground-borne noise levels for residences have been extracted from Section 4.2 of the ICNG and indicate when management actions should be implemented.

- Evening (6pm to 10pm) – Internal Noise Level: $L_{Aeq,15min}$ 40 dB(A); and
- Night-time (10pm to 7am) – Internal Noise Level: $L_{Aeq,15min}$ 35 dB(A).

An assessment of ground-borne noise to these levels is only required when the ground-borne noise levels are higher than airborne noise levels, and for surrounding residential receiver catchments. The ground-borne noise levels are for evening and night-time periods only. The levels shall be assessed at the centre of the most affected habitable room.

6.6 CONSTRUCTION VIBRATION CRITERIA

It is important for vibration emissions from vibration-intensive equipment utilised during the construction works be managed to maintain appropriate levels of human comfort, and to avoid both cosmetic and structural damage. The vibration limits proposed in the ensuing sub-sections aid in achieving this outcome.

6.6.1 Human Comfort

The office of Environment and Heritage (OEH) developed a document, “Assessing Vibration: A Technical Guideline” in February 2006 to assist in preventing people from exposure to excessive vibration levels from construction and operation of a development 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.

Continuous and Impulsive Vibration

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 is more stringent than the building damage criteria.

Table 13: Preferred and maximum weighted RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

LOCATION	ASSESSMENT PERIOD ¹	PREFERRED VALUES		MAXIMUM VALUES	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration					
Critical areas ²	Day- or night time	0.0050	0.0036	0.010	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 places of worship	Day- or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
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 places of worship	Day- or night time	0.64	0.46	1.28	0.92

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

Note 2: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria 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

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 ($m/s^{1.75}$)

LOCATION	DAYTIME ¹		NIGHT-TIME ¹	
	PREFERRED VALUE	MAXIMUM VALUE	PREFERRED VALUE	MAXIMUM VALUE
Critical areas ²	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

Note 2: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria 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

6.6.2 Cosmetic Damage

Structural vibration thresholds are set to minimize the risk of cosmetic surface cracks and lie below the levels that have the potential to cause damage to the main structure. Table 15 presents guide values for building vibration, based on the vibration thresholds above which cosmetic damage has been demonstrated outlined within BS7385-Part 2:1993. These values are evaluated to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as 95% probability of no effect.

Table 15: Transient vibration guide values for cosmetic damage – BS 7385-2:1993

TYPE OF BUILDING	PEAK PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE (PPV)	
	4 HZ TO 15 HZ	15 HZ AND ABOVE
Reinforced or framed structures Industrial or light commercial type buildings	50mm/s	N/A
Unreinforced or light framed structures, Residential or light commercial type buildings	15mm/s	20mm/s (50mm/s at 40Hz and above)

6.6.3 Structural Damage

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 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, v_i , for evaluating the effects of short-term vibration – DIN4150-3

LINE	TYPE OF STRUCTURE	VIBRATION VELOCITY, V_i , IN mm/s			
		FOUNDATION			PLANE OF FLOOR OF UPPERMOST FULL STOREY
		AT A FREQUENCY OF			
		LESS THAN 10HZ	10 TO 50HZ	50 TO 100HZ*	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

7 OPERATIONAL NOISE AND VIBRATION ASSESSMENT

7.1 MECHANICAL SERVICES

At this stage of the proposed development, the design has not progressed enough for mechanical plant and equipment selections are yet to be made. During the design development stage of the project, the mitigation measures outlined below in Section 9.1 should be considered when preparing the mechanical services, to ensure compliance with the external noise emissions criteria established in Section 6.3.

7.2 CARPARK USAGE

It is proposed that all carparking be situated in an enclosed basement car park accessed from Park Parade to the north and south of the site on ground floor and continuing through basement levels B1 and B2. As such, it can be reasonably expected that the use of the carparking will not have noise impact on the nearest noise sensitive receivers and noise level criteria in Section 6.2.1 will be met.

7.3 ROAD NOISE INTRUSION ASSESSMENT

A preliminary façade noise model of the development to predict the road noise incident on the facades of the development.

Appendix A provides façade noise maps to present road noise on each of the facades of the proposal development. The modelling takes into account building shielding, directivity and calculations for road noise.

To simplify the acoustic façade requirements across the entire development, an acoustic facade type (AFT) has been assigned to typical glazing arrangements in Table 17. This AFT shall be read in conjunction with the façade matrix provided in Table 18 and Table 19 which outlines the required acoustic performance for the glazing based on the total façade glass surface area for bedrooms and living areas. Refer to façade noise maps provided in Appendix A for the predicted façade noise range.

The specific acoustic ratings for each façade element shown on the plan shall be reviewed and specified during the development of the design.

Table 17: Acoustic Facade Categories & Glazing Arrangements

ACOUSTIC FAÇADE TYPE	REQUIRED ACOUSTIC RATING (R_w , C_{tr})	TYPICAL EQUIVALENT GLASS LITE
1	32, -3	6.38mm laminated glass

Table 18: Acoustic performance requirements for glass to habitable spaces for various total glazing areas - bedrooms

FAÇADE NOISE RANGE	TOTAL GLAZING SURFACE AREA FOR SPACE			
	4m ²	6m ²	8m ²	10m ²
BEDROOM AREAS				
< 46 dBA	1	1	1	1

Table 19: Acoustic performance requirements for glass to habitable spaces for various total glazing areas – living areas

FAÇADE NOISE RANGE	TOTAL GLAZING SURFACE AREA FOR SPACE			
	0-5m ²	5-10m ²	10-15m ²	15-20m ²
LIVING AREAS				
< 56 dBA	1	1	1	1

7.4 OUTDOOR COMMUNAL SPACES

A communal outdoor lounge area is currently proposed on Ground Level. The noise generated by residents using the communal outdoor areas may cause disturbance to noise-sensitive receivers surrounding the proposed development and in proximity to the outdoors areas.

Specifically, noise generated by patrons during the night-time period (10pm – 7am) on the communal outdoor areas has the potential to be intrusive and offensive. To reduce the risk of intrusive and/or offensive noise emissions to surrounding noise-sensitive receivers, the communal outdoor areas should not be used during these hours. In addition to this, operational noise management techniques should be introduced to reduce the noise generated by patrons.

7.5 TRAFFIC NOISE GENERATION

A traffic noise generation assessment has been undertaken based on existing and expected traffic volumes for the site provided by JMT Consulting.

Traffic noise generation from the development are subject to the NSW Road Noise Policy (RNP) as outlined in Section 6.4. The forecast traffic generation in AM and PM peak hour traffic volumes from the development are presented below in Table 20.

An increase of more than 2dB, in line with the RNP, requires an increase in traffic flows of more than 60% on the existing roads. The predicted traffic generation from the development is anticipated to be less than a 60% increase and as such the development is expected to comply with the RNP.

Table 20: Existing and additional peak hour traffic volumes

ROADWAY	PEAK PERIOD	EXISTING TOTAL TRAFFIC VOLUME (VEHICLES/HOUR)	ADDITIONAL PEAK HOUR TRIPS (PROPOSED DEVELOPMENT) (VEHICLES/HOUR)	PREDICTED TRAFFIC NOISE LEVEL INCREASE FROM DEVELOPMENT
Banks Avenue	AM	690	40	< 2dB
	PM	515	40	< 2dB

8 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

8.1 PROPOSED CONSTRUCTION ACTIVITIES

In this assessment, the noise impact from the construction works are considered, which are expected to comprise of the following indicative major stages of works:

- Early Works - Demolition
- Civil works – Excavation and foundation
- Structural works - Construction

The construction works are expected to occur during the following hours (in line with the NSW ICNG):

- Monday to Friday: 7:00am to 6:00pm;
- Saturday: 8:00am to 1:00pm; and
- Sunday and public holidays: no work.

8.2 EXPECTED CONSTRUCTION EQUIPMENT

The noise sources likely to be associated with the works listed in the previous section of this report are presented in Table 21. The equipment noise levels have been extracted from AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites”.

Table 21: Cumulative impact – construction equipment noise levels

STAGES	EQUIPMENT	SOUND POWER LEVEL – dB(A)	USAGE IN 15-MINUTE PERIOD (MINUTES)	TIME CORRECTED SOUND POWER LEVEL– dB(A) $L_{Aeq,15min}$
Early Works - Demolition	Jackhammer	113	3	106
	Powered hand tool	102	7.5	99
	Excavator 30 tonne	110	6	106
	Excavator breaker	115	6	111
	Bobcat	107	10.5	105
	Cherry picker	102	7.5	99
	General Truck	108	6	104
Civil works – Excavation and foundation	Excavator breaker	115	6	111
	Excavator 30 tonne	110	6	106
	Concrete pump	109	7.5	106
	Concrete Truck	108	7.5	105
	Generator	104	3	97
	Mobile crane	110	2.4	102
	General Truck	108	6	104
Structural works - Construction	Powered hand tool	102	7.5	99
	Mobile crane	110	2.4	102
	Generator	104	3	97
	General Truck	108	6	104

8.3 NOISE MODELLING AND ASSUMPTIONS

In order to assess the noise impact from the site during the various construction stages, a noise model was prepared using commercial software SoundPLAN v9.0, which is a comprehensive software package for conducting three-dimensional complex noise propagation modelling. Using the software, a 3D model of the site and its surroundings was constructed including the nearby buildings, and the construction plant and equipment were positioned as noise sources. Within the model, the effects of the environment (built and natural) on propagation of sound were considered to reliably estimate the resulting noise effects on the surrounding noise sensitive receivers.

The noise model represents the 'reasonable' worst case periods of construction activities, meaning that all the equipment of each stage is operating simultaneously during a 15-minute observation period.

The assumptions that were made within the assessment include the following:

- The predicted noise levels represent the worst-case scenario for each receiver;
- Neutral weather conditions;
- Provision of a 2.1m Class-A hoarding along perimeter of the site adjacent to Jellicoe Park.

8.4 PREDICTED NOISE LEVELS

The predicted noise levels have been presented in Table 22 to

Table 24 have been assessed to the construction noise management levels established in Section 6.6. The noise contour maps produced by the three-dimensional noise propagation modelling are provided in Appendix B.

Table 22: Predicted noise levels – Early Works – Demolition

RECEIVER	PREDICTED NOISE LEVEL RANGE dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL EXCEEDANCE dB	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	65	52	13	No
RC2	49	52	-	No
RC3	65	52	13	No
RC4	71	65	6	No
RC5	67	65	2	No

Table 23: Predicted noise levels – Civil works – Excavation and foundation

RECEIVER	PREDICTED NOISE LEVEL RANGE dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL EXCEEDANCE dB	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	63	52	11	No
RC2	51	52	-	No
RC3	66	52	14	No
RC4	71	65	6	No
RC5	64	65	-	No

Table 24: Predicted noise levels – Structural works – Construction

RECEIVER	PREDICTED NOISE LEVEL RANGE dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL dB(A) $L_{Aeq,15min}$	NOISE MANAGEMENT LEVEL EXCEEDANCE dB	EXCEEDS HIGHLY NOISE AFFECTED LEVEL (YES/NO)
RC1	59	52	7	No
RC2	42	52	-	No
RC3	61	52	9	No
RC4	58	65	-	No
RC5	62	65	-	No

8.5 CONSTRUCTION VIBRATION ASSESSMENT

It is expected that majority of vibration intensive activities will occur during the demolition and excavation works where excavator mounted hammering may be utilised.

Safe working distances for vibration intensive plant and are quoted for both “cosmetic” damage (in accordance with BS 7385) and human comfort (in accordance with Assessing Vibration – a technical guideline), have been provided, based on the Transport for NSW’s “Construction Noise Strategy (2013)”. The recommended safe working distances for each of the plant listed above are provided in Table 25.

Table 25: Recommended safe working distances for vibration intensive plant

ACTIVITY	SAFE WORKING DISTANCE (METRES)	
	COSMETIC DAMAGE (BS 7385)	HUMAN RESPONSE (OH&E VIBRATION GUIDELINE)
Piling	2m (nominal)	N/A
Jackhammering	1m (nominal)	Avoid contact with structure
Rock Breaking	22m	73m
Rock Sawing	22m	73m

Attended vibration monitoring should be considered at the commencement of vibration inducing activities (rock breaking and hammering) in order to verify the safe working distances. If the levels are compliant with the vibration limits as listed in Section 6.6, then work may proceed based on the implementation of the measures detailed in this report. If there are exceedances, reasonable and feasible mitigation measures should be considered to lessen the impact, such as an alternative method of activity or using machinery with less capacity, and additional vibration monitoring should be conducted.

Monitoring strategies have been discussed in Section 9.3.2, which shall be reviewed as part of a future construction noise and vibration management plan once construction methodologies are known.

9 MITIGATION MEASURES

9.1 MECHANICAL PLANT AND EQUIPMENT NOISE MITIGATION

Mitigation measures for the mechanical plant should be considered during the design development stage to ensure compliance with the outlined criteria at the nearest sensitive receiver catchments. These mitigation measures could include but not limited to the following:

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

It should be noted that the noise reduction requirements will likely be refined and reduced once the mechanical plant and equipment selections and designs have been progressed further during the detailed design of the proposed development. The mitigation measures proposed at this stage of the development are conservative in nature.

9.2 OUTDOOR COMMUNAL SPACES

Noise from the use of outdoor communal open spaces shall be mitigated with the following measures:

- Use of the outdoor communal area to be restricted to the day and evening period (7am – 10pm)
- Signage displayed reminding residents to be considerate and minimise noise while the space is in use (i.e. no shouting, restriction on any amplified music, and that the outdoor communal space is not to be used for parties), especially during noise sensitive hours of the day.

9.3 CONSTRUCTION NOISE AND VIBRATION

9.3.1 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.

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 demountable offices can be effective barriers);
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise; and
- Installing purpose-built noise barriers, acoustic sheds and enclosures.

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. A noisy, stationary plant can be placed in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficiency when operating the equipment.

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.



In many cases it is not be practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant or to build-in at the early stages protective features required to screen traffic noise. Where earth noise barriers are not practical due to lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any equivalent material in surface density.

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.

Crane (diesel operated)

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

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:

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal frequency 'beep') are less intrusive when heard in the neighbourhood;
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly;
- Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, providing safety considerations, are not compromised;
- 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; and
- Spotters or observers.

The above methods should be combined, where appropriate.

9.3.2 Noise & Vibration Monitoring Strategy

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 and residents.

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; and
- 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 in order 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.

Both methodologies 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.

10 CONCLUSION

This Noise and Vibration Impact Report has been prepared by E-LAB Consulting to support a State Significant Development Application (SSD-83256472) for the proposed mixed-use development at 68-80 Banks Avenue. This Noise and Vibration Impact Assessment specifically responds to the requirements of Item 10 of the SEARS (SSD-83256472) issued for the project by DPHI on 12 May 2025.

The assessment has considered the following key acoustic elements:

- Noise impacts from local roads on the proposed development;
- Noise impacts from the operation of the development on surrounding noise sensitive receivers; and
- Noise and vibration impacts from construction activities associated with the development on surrounding noise sensitive receivers.

To assess each of the acoustic considerations for the proposed development, noise criteria has been established in Section 6 in accordance with the following documents:

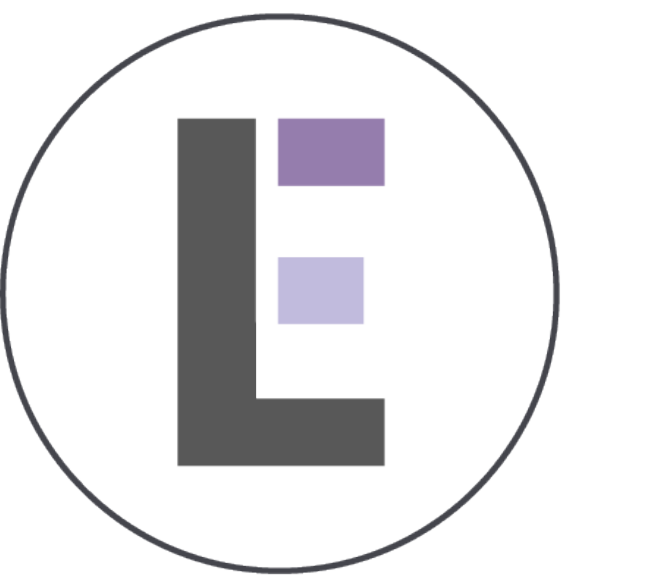
- AS/NZS 2107:2016 “Acoustics - Recommended design sound levels and reverberation times for building interiors”;
- Development Near Rail Corridors and Busy Roads – Interim Guideline;
- NSW Road Noise Policy (RNP), 2011;
- NSW Noise Policy for Industry (NPI) 2017;
- Interim Construction Noise Guideline (ICNG) 2009;
- Assessing vibration: A Technical Guideline 2006;
- 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”; and
- German Standard DIN4150 – Part 3: “Structural vibration in buildings – Effects on structures”.

Having given regard to the analysis conducted within this report, it is the finding of this noise and vibration impact assessment that the proposed redevelopment is compliant with the relevant noise and vibration criteria controls for this type of development, and it is expected to comply with the applicable regulations with regards to noise and vibration, particularly those listed above.

It is recommended the SSDA be approved subject to the implementation of the mitigation measures outlined in this report.

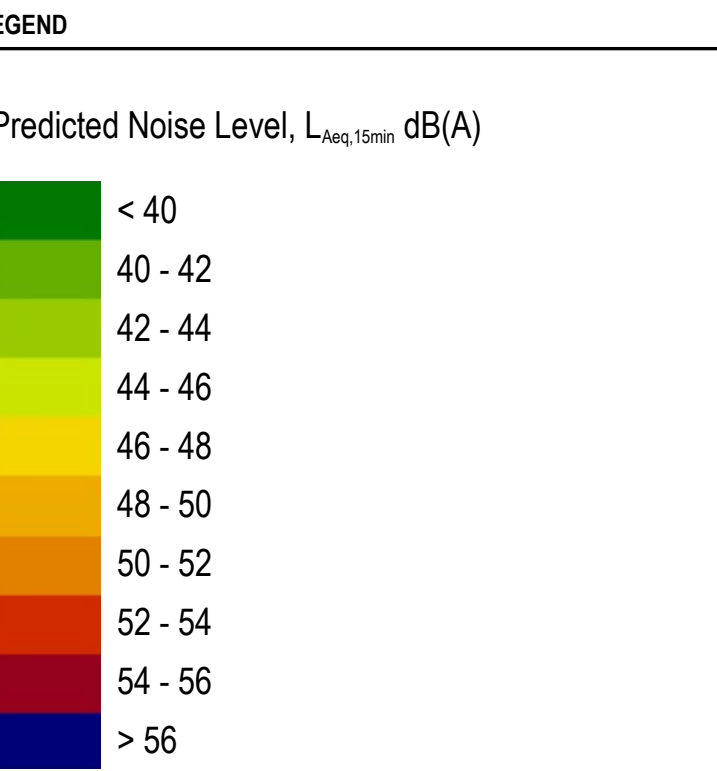
Appendix A **Façade Noise Map**





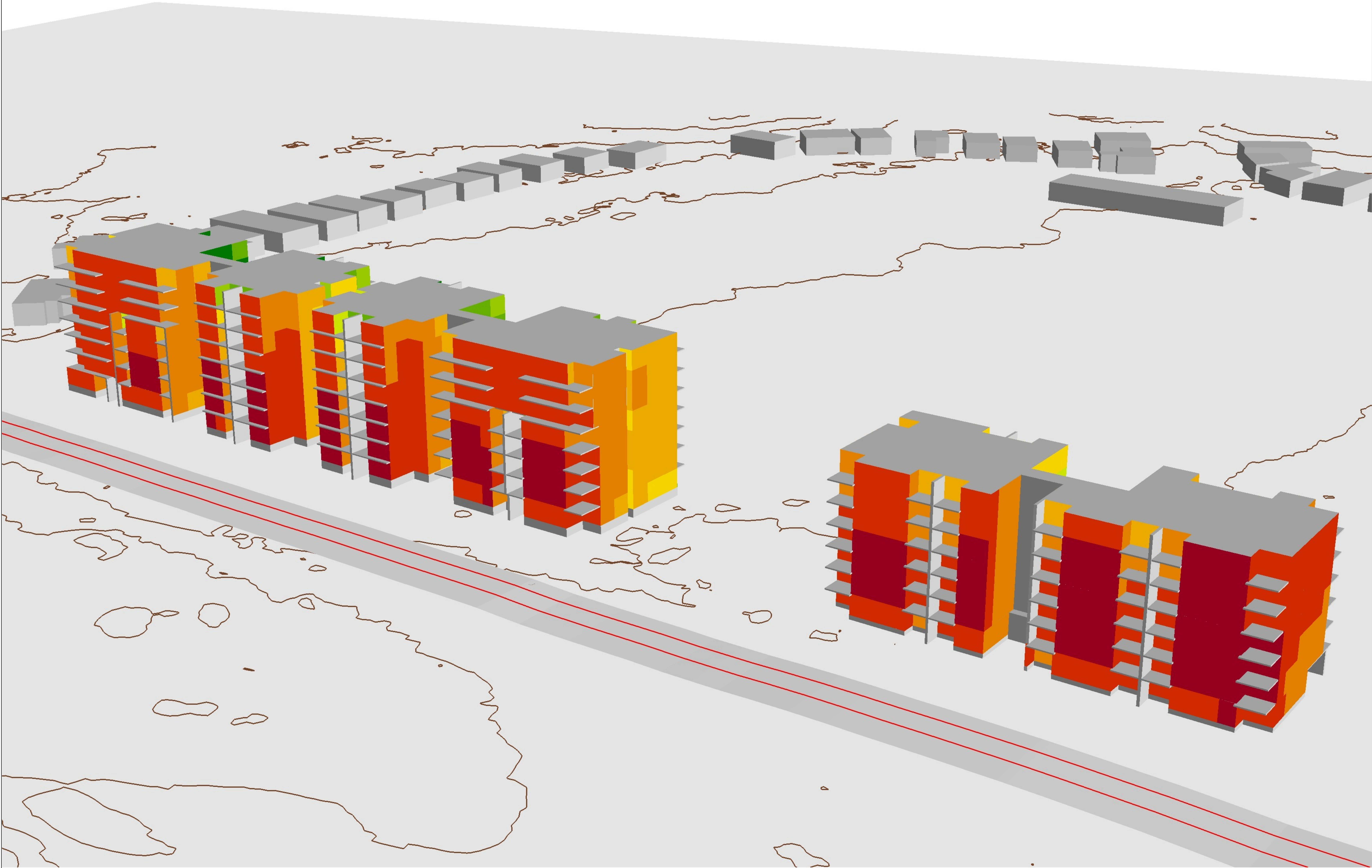
E-LAB CONSULTING

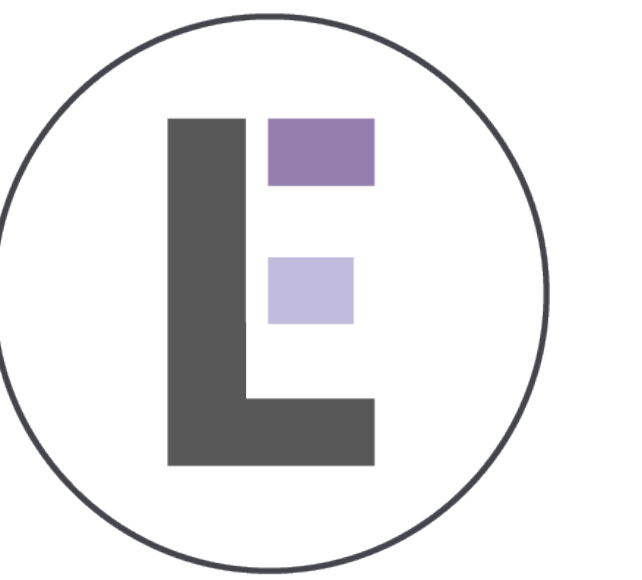
ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA



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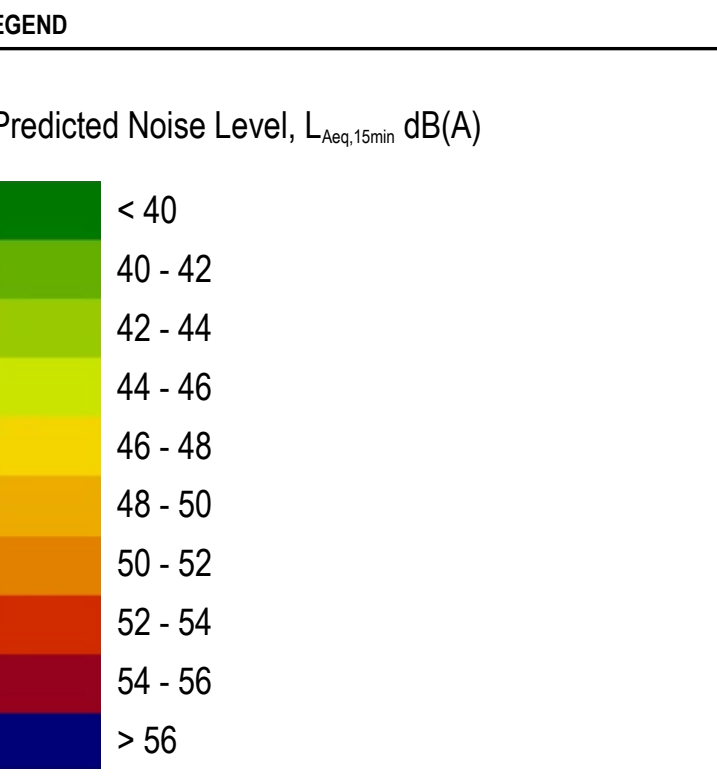
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PROJECT NO.	P02422
ARCHITECT	BN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	FACADE NOISE MAP
DAYTIME - VIEW 1	
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-01-01
REVISION	001



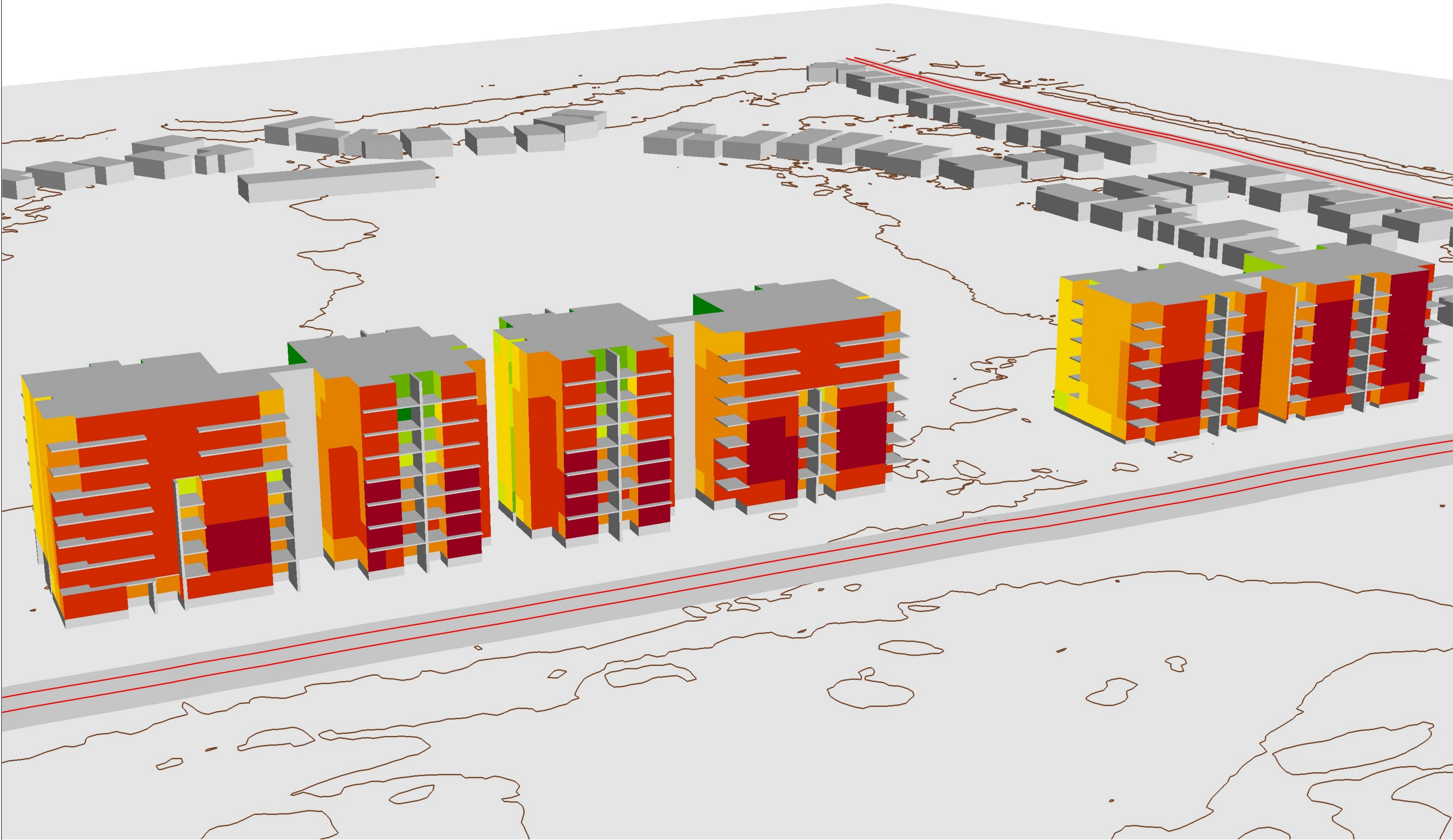


E-LAB CONSULTING

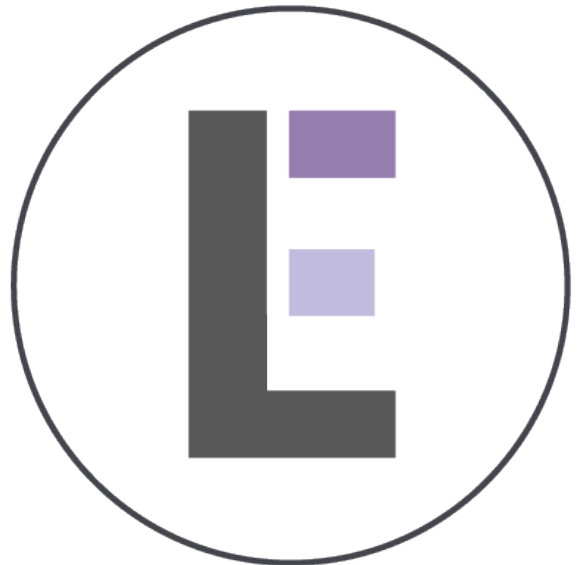
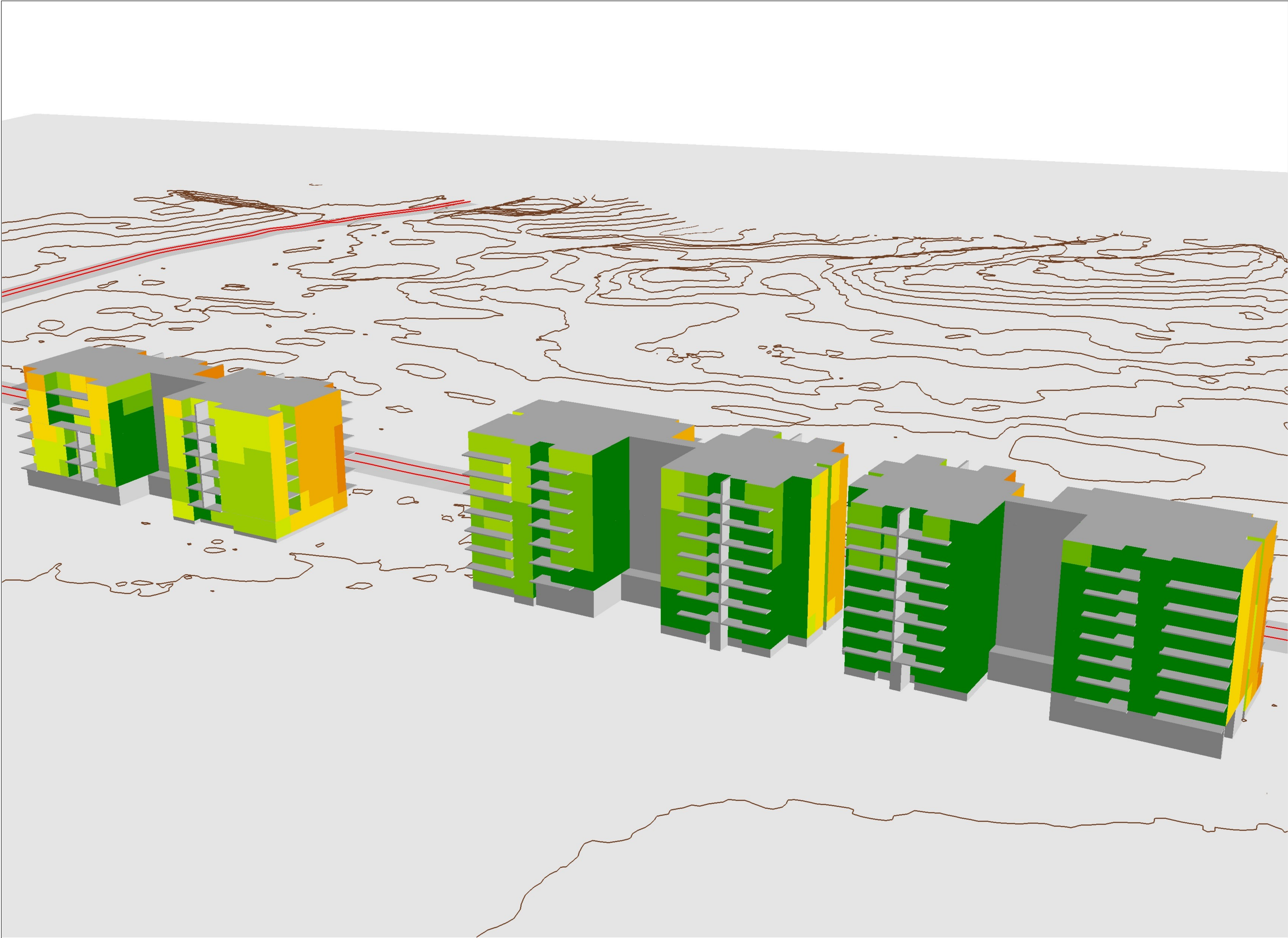
ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA



NOTES

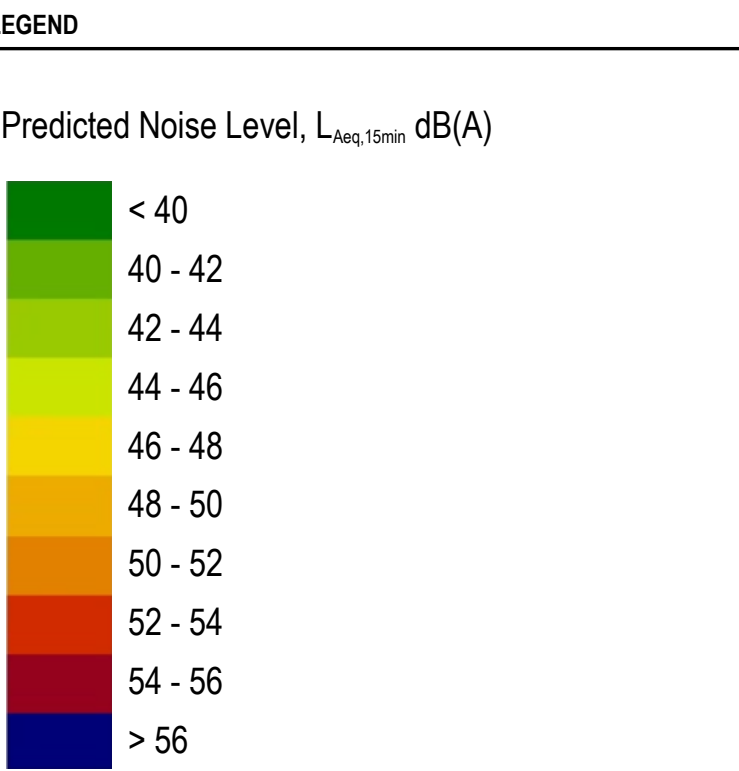


PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	FACADE NOISE MAP
DAY - VIEW 2	
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-02-01
REVISION	001



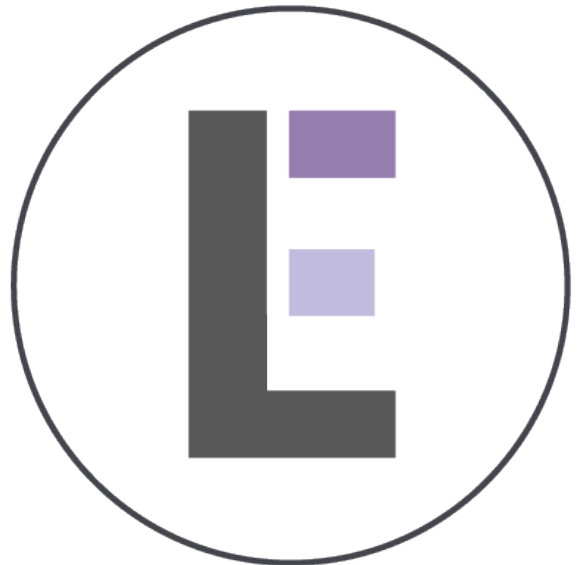
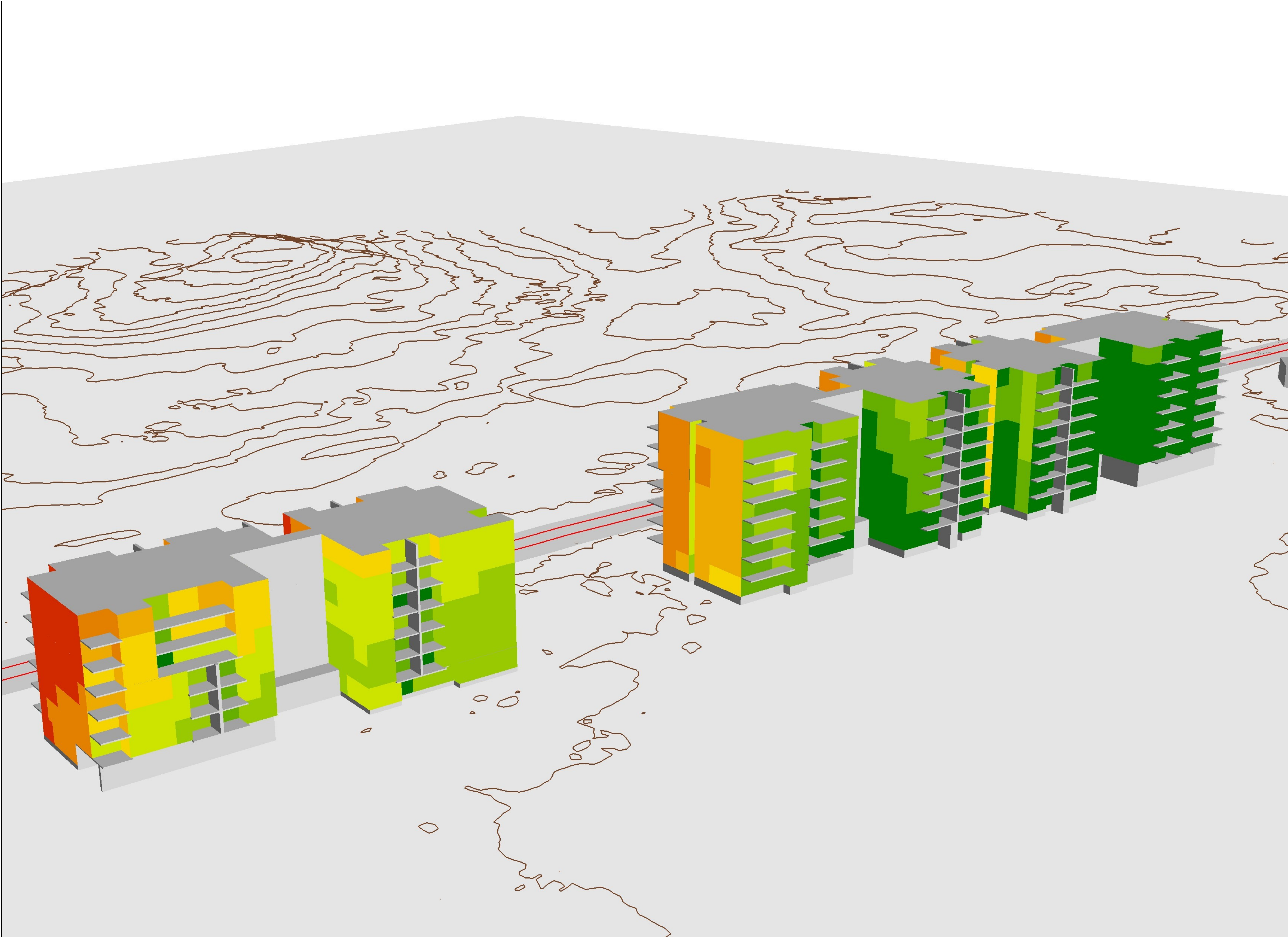
E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA



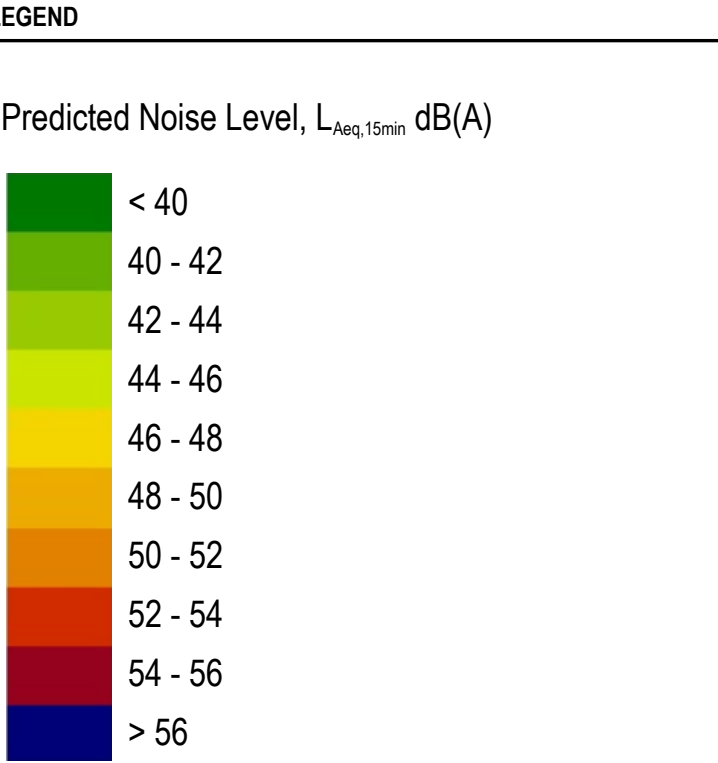
NOTES

PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BVN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	FACADE NOISE MAP
DAY - VIEW	3
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-03-01
REVISION	001



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA



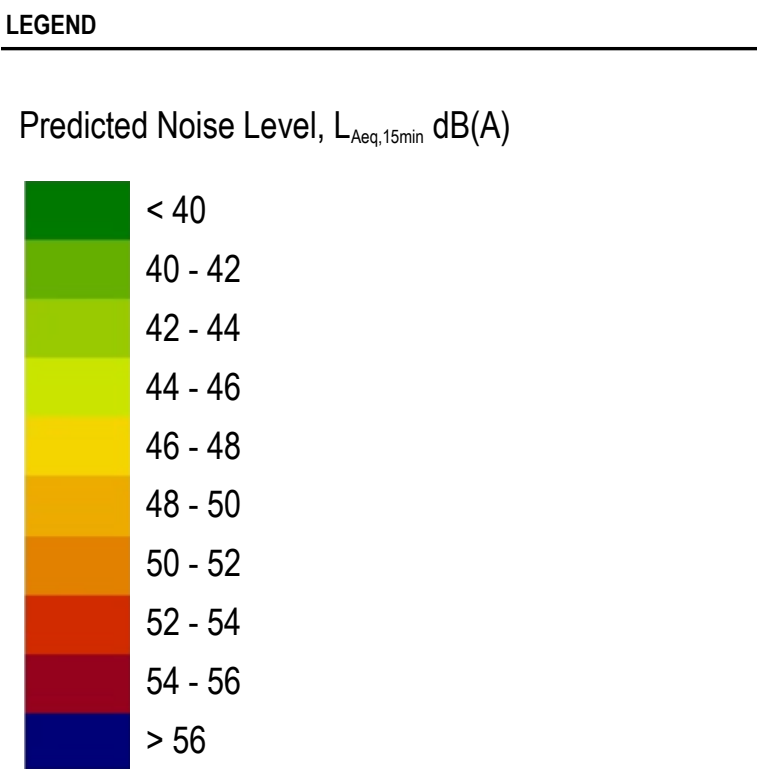
NOTES

PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BVN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	FACADE NOISE MAP
DAY - VIEW 4	
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-04-01
REVISION	001

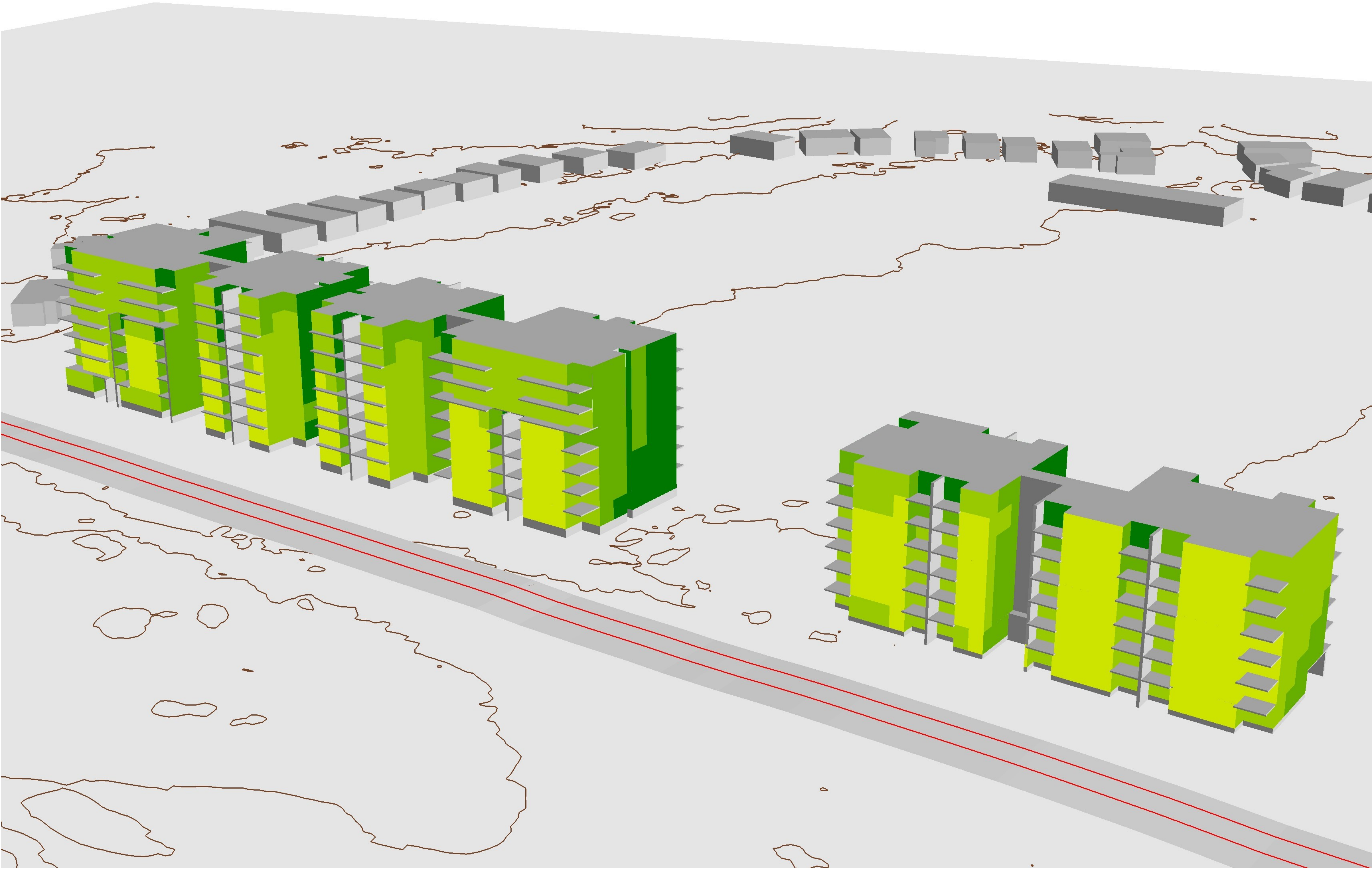


E-LAB CONSULTING

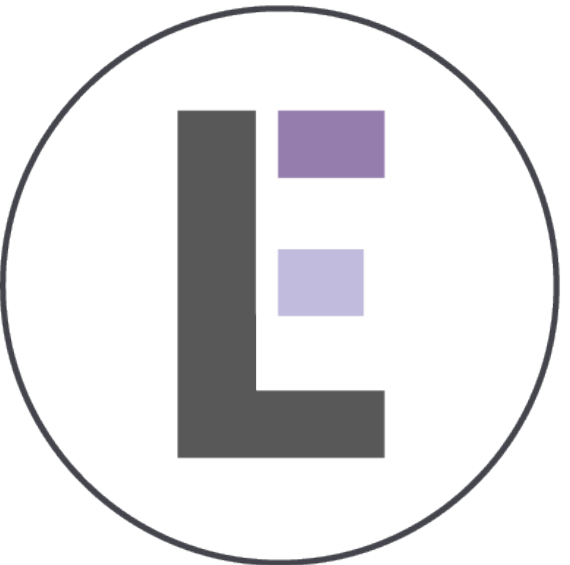
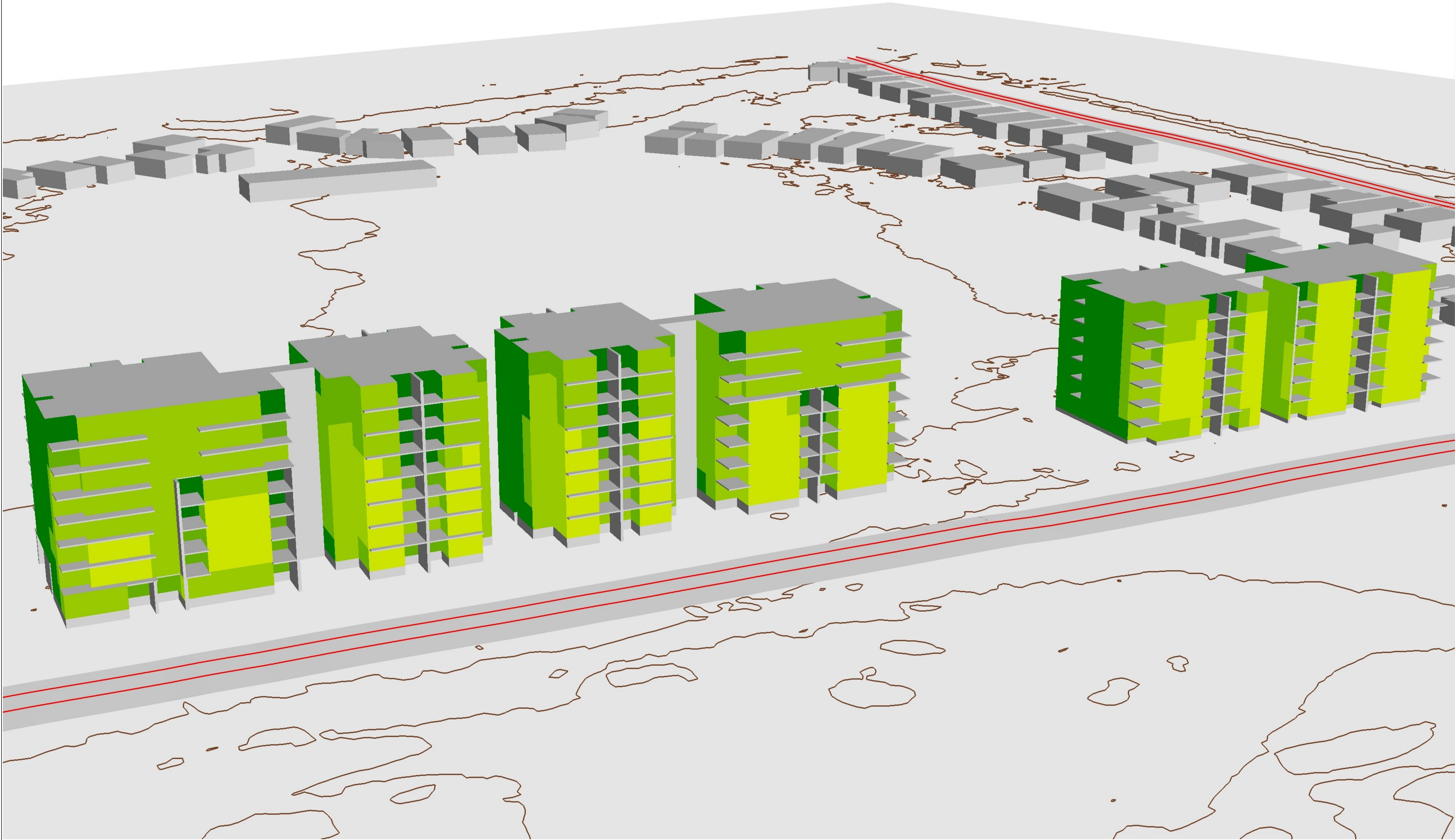
ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA



NOTES

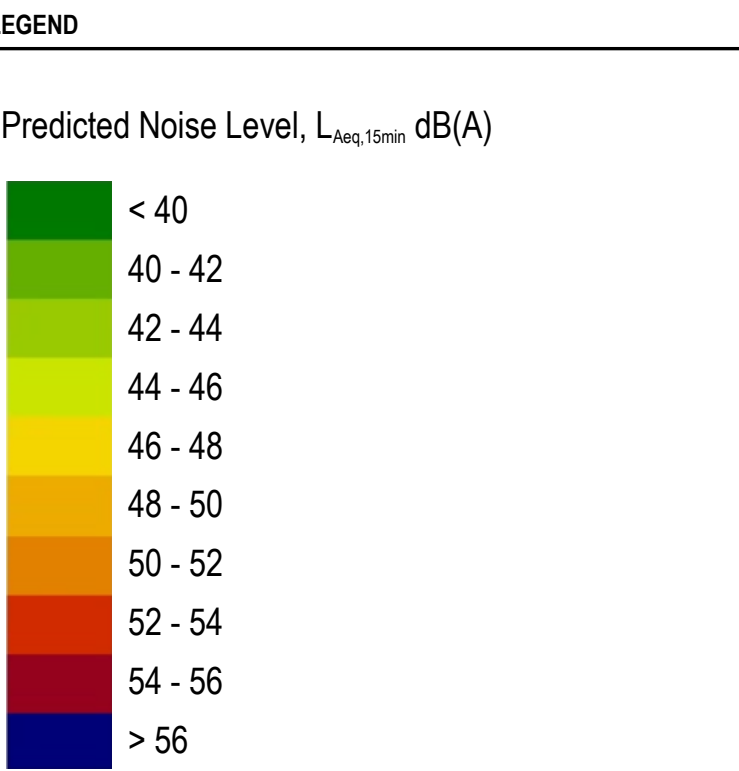


PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	FACADE NOISE MAP
NIGHT - VIEW 1	
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-05-01
REVISION	001



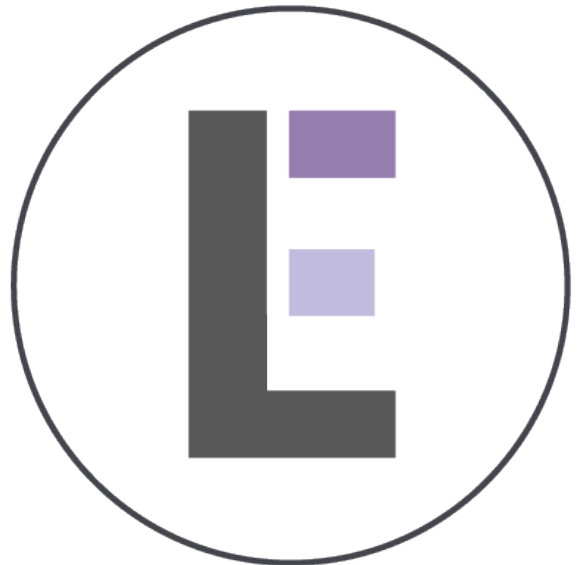
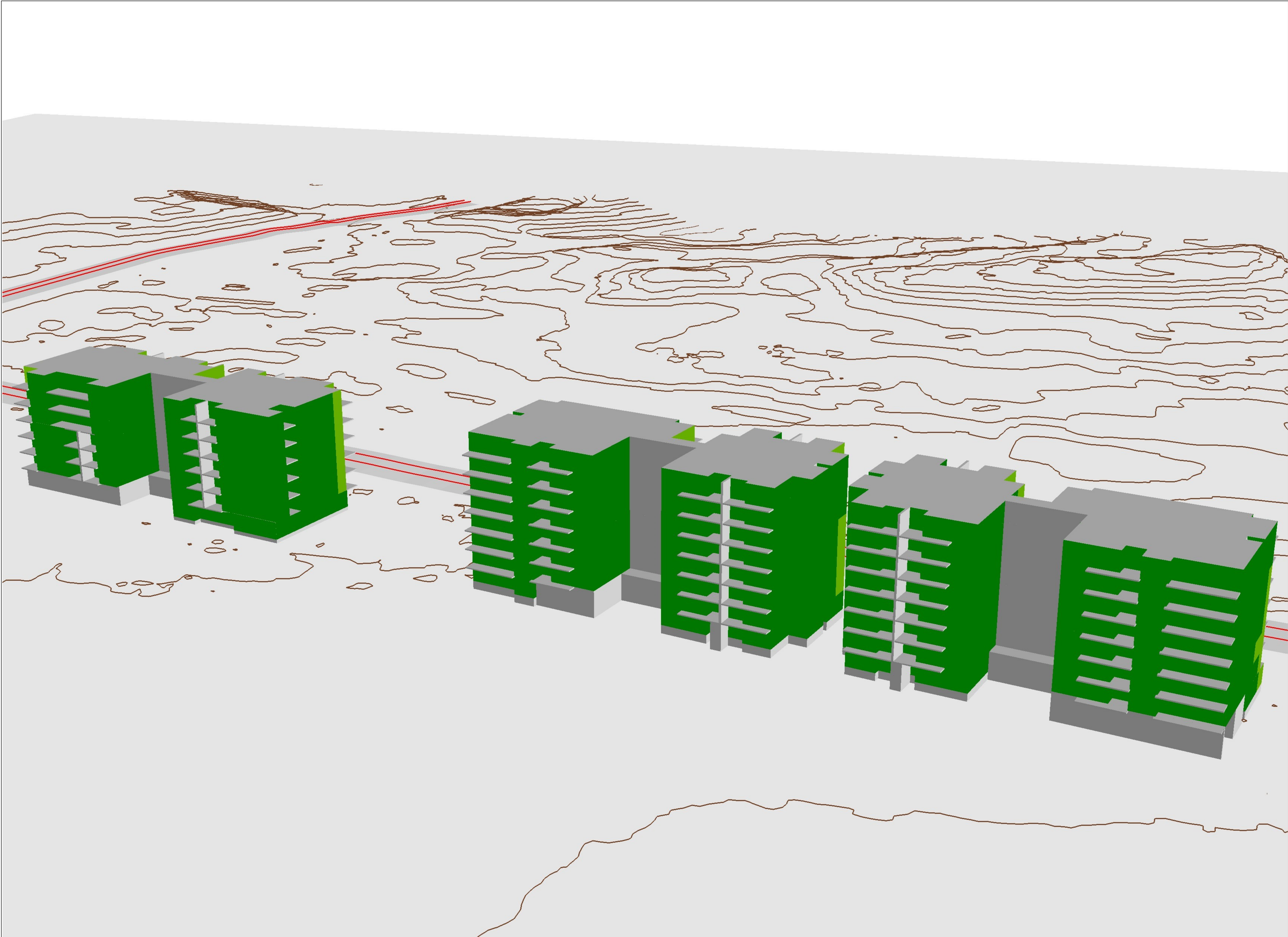
E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSQA



NOTES

PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BVN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSQA
DRAWING	FACADE NOISE MAP
	NIGHT - VIEW 2
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-100-06-01
REVISION	001



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSQA

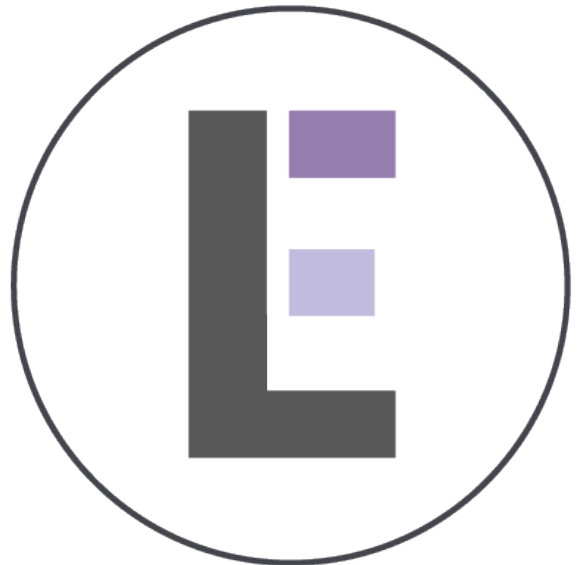
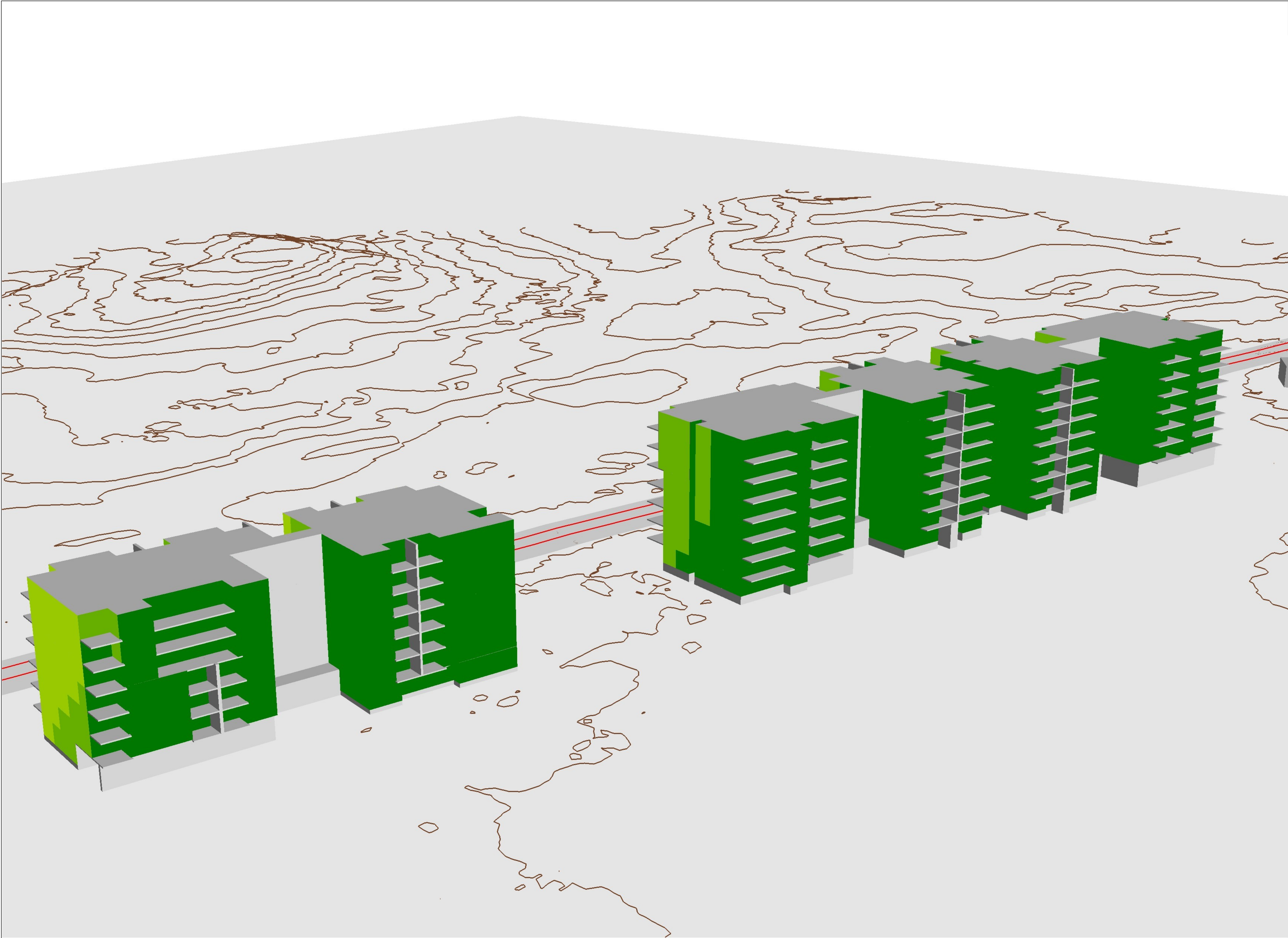
LEGEND

Predicted Noise Level, $L_{Aeq,1hr}$ dB(A)

< 40
40 - 42
42 - 44
44 - 46
46 - 48
48 - 50
50 - 52
52 - 54
54 - 56
> 56

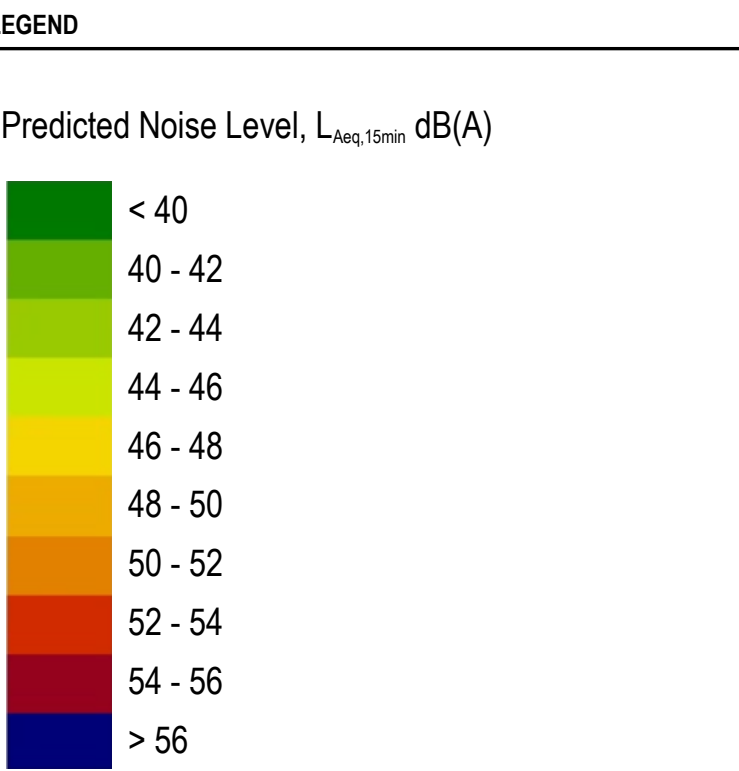
NOTES

PROJECT 8-80 BANKS AVENUE, PAGEWOOD	
PROJECT NO. 102422	
ARCHITECT BVN	
CLIENT HOMES NSW	
SCALE 1:100	
STATUS FOR SSQA	
DRAWING FACADE NOISE MAP NIGHT - VIEW 3	
DISCIPLINE ACOUSTICS AND VIBRATION	
DRAWING NUMBER AC-DWG-100-07-01	REVISION 001



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA

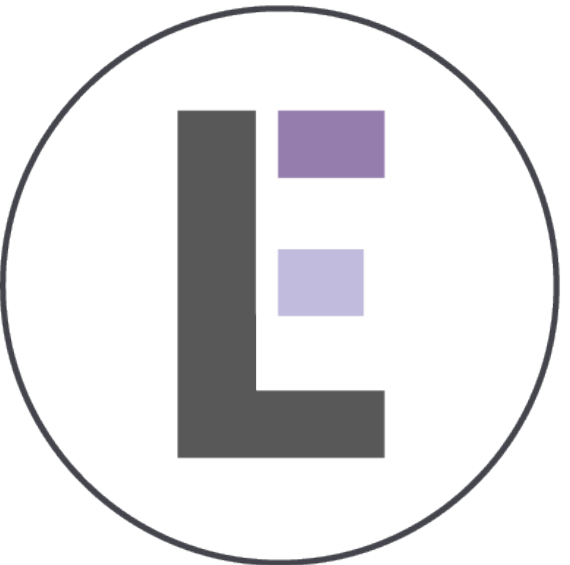
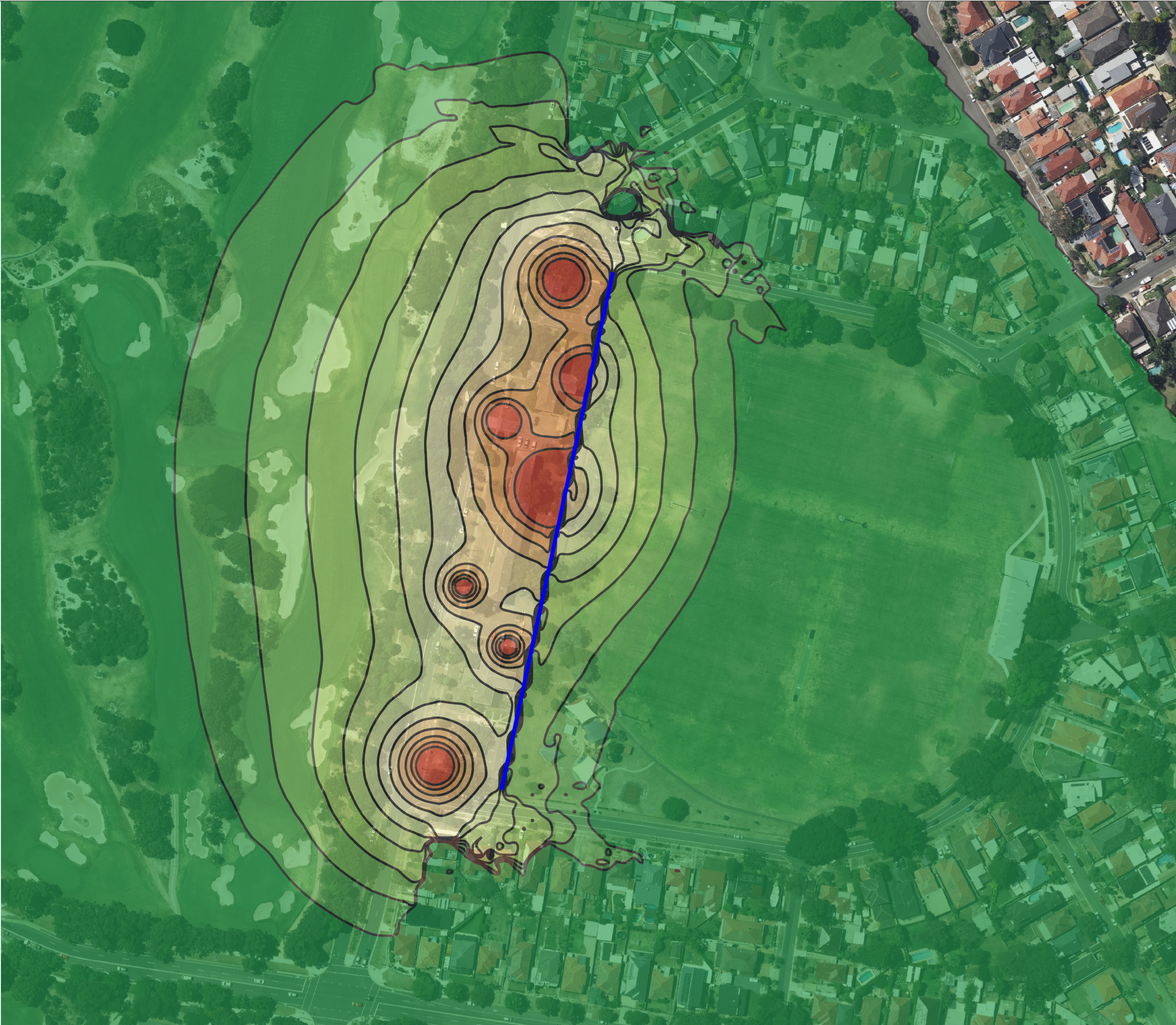


NOTES

PROJECT 8-80 BANKS AVENUE, PAGEWOOD	
PROJECT NO. 102422	
ARCHITECT BVN	
CLIENT HOMES NSW	
SCALE 1:15	
STATUS FOR SSDA	
DRAWING FACADE NOISE MAP NIGHT - VIEW 4	
DISCIPLINE ACOUSTICS AND VIBRATION	
DRAWING NUMBER AC-DWG-100-08-01	REVISION 001

Appendix B **Construction Noise Contour Maps**



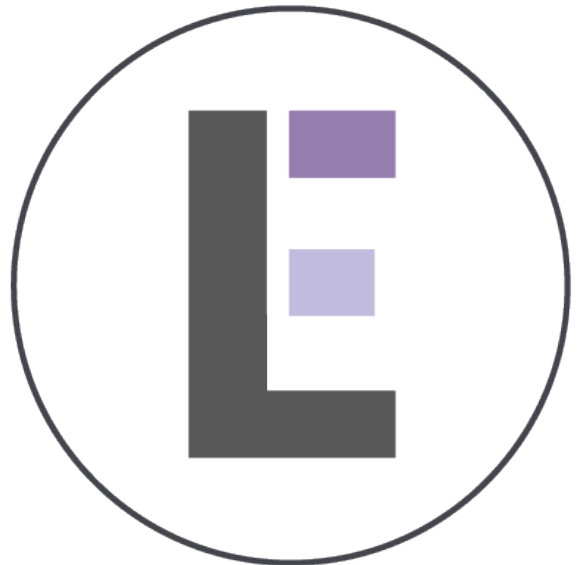
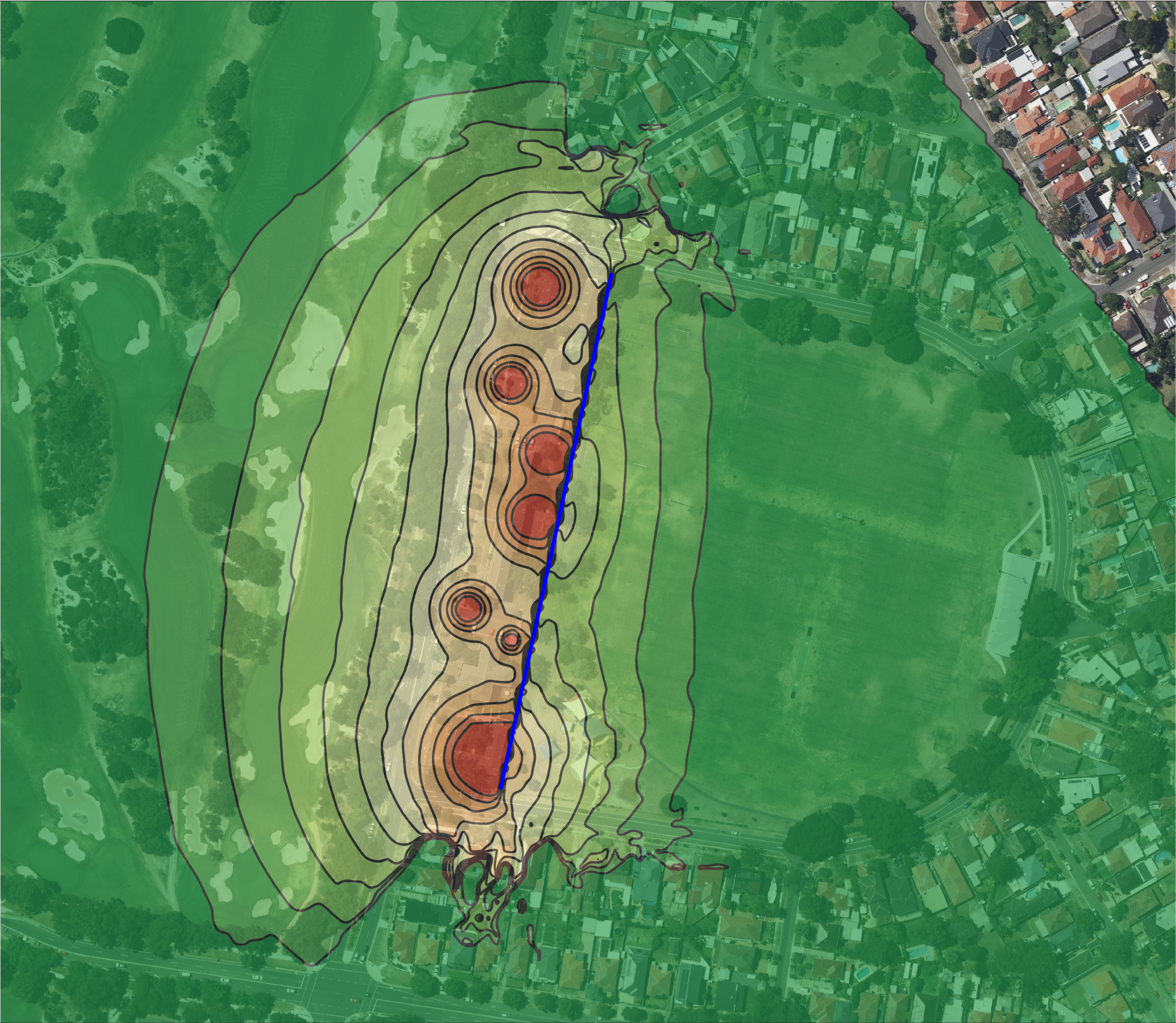


E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA
2	03/11/2025	FOR SSDA

LEGEND	
Predicted Noise Level, $L_{Aeq,1hr}$ dB(A)	
< 55	
55 - 57	
57 - 59	
59 - 61	
61 - 63	
63 - 65	
65 - 67	
67 - 69	
69 - 71	
71 - 73	
73 - 75	
> 75	
NOTES	
2.1m Class-A hoarding	

PROJECT 68-80 BANKS AVENUE, PAGEWOOD	
PROJECT NO. P02422	
ARCHITECT BVN	
CLIENT HOMES NSW	
SCALE NTS	
STATUS FOR SSDA	
DRAWING CONSTRUCTION NOISE CONTOUR MAP EARLY WORKS - DEMOLITION	
DISCIPLINE ACOUSTICS AND VIBRATION	
DRAWING NUMBER AC-DWG-200-01-01	REVISION 002

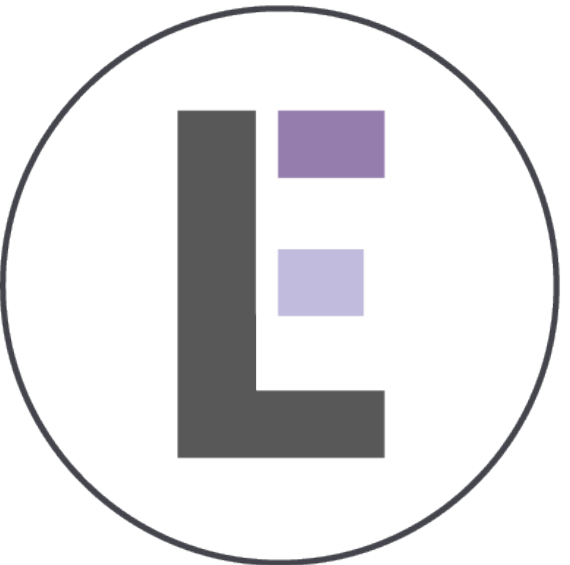


E-LAB CONSULTING

ISSUE	DATE	STATUS
1	25/10/2025	FOR SSDA
2	03/11/2025	FOR SSDA

LEGEND	
Predicted Noise Level, $L_{Aeq,1hr}$ dB(A)	
< 55	
55 - 57	
57 - 59	
59 - 61	
61 - 63	
63 - 65	
65 - 67	
67 - 69	
69 - 71	
71 - 73	
73 - 75	
> 75	
NOTES	
2.1m Class-A hoarding	

PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BVN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	CONSTRUCTION NOISE CONTOUR MAP
	CIVIL WORKS - EXCAVATION AND FOUNDATION
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-200-02-01
REVISION	002



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	29/10/2025	FOR SSDA
2	03/11/2025	FOR SSDA

LEGEND

Predicted Noise Level, $L_{Aeq,1hr}$ dB(A)

< 55
55 - 57
57 - 59
59 - 61
61 - 63
63 - 65
65 - 67
67 - 69
69 - 71
71 - 73
73 - 75
> 75

NOTES

2.1m Class-A hoarding

PROJECT	68-80 BANKS AVENUE, PAGEWOOD
PROJECT NO.	P02422
ARCHITECT	BVN
CLIENT	HOMES NSW
SCALE	NTS
STATUS	FOR SSDA
DRAWING	CONSTRUCTION NOISE CONTOUR MAP
	STRUCTURAL WORKS - CONSTRUCTION
DISCIPLINE	ACOUSTICS AND VIBRATION
DRAWING NUMBER	AC-DWG-200-03-01
REVISION	002

Appendix C Noise Monitoring Data

Figure 4: Long-term noise monitoring data graph (LT1)

