2 SYDENHAM RD, BROOKVALE NSW 2100

CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN

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Project Information

Details	
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1 INTRODUCTION

A construction noise and vibration management plan has been prepared by National Noise & Vibration for the proposed 'Demolition of existing structures and construction of a three (3) storey light industrial building including basement car parking'. It has been prepared in response to the Environmental Health Referral Response from Northern Beaches Council regarding DA2024/1310.

This report presents the recommended approach for managing noise from the proposed activities to be undertaken on site. The principal objective of this study is to forecast the potential impact of noise and vibration emissions to the nearest noise sensitive receivers. The evaluation will be used to formulate and streamline effective regulation and mitigation measures, where deemed feasible and necessary.

The principal issues which will be addressed in this report are:

- Specific activities that will be conducted and the associated noise sources.
- Identification of the worst affected noise sensitive receivers.
- The construction noise objectives specified in the relevant legislative criteria.
- Noise monitoring, reporting and response procedures.
- Contingency plans to be implemented in the event of non-compliances and/or complaints.

2 PROJECT DETAILS

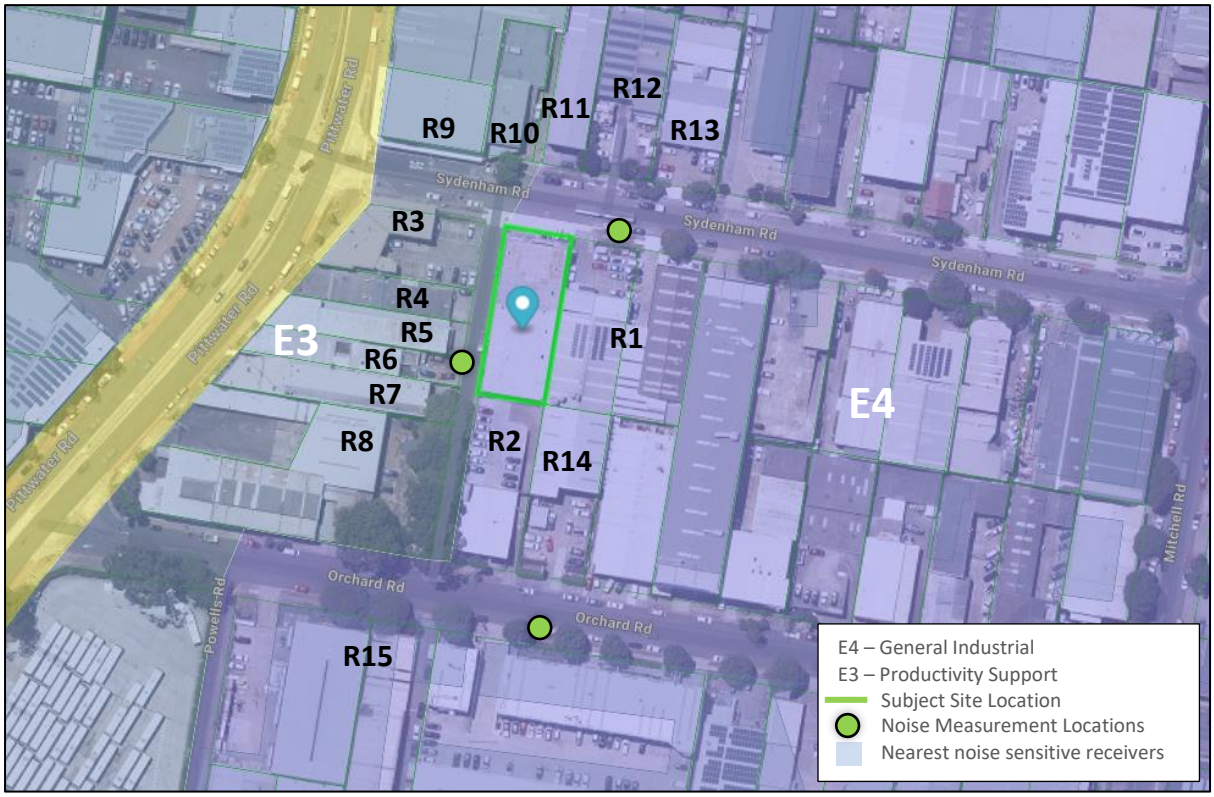
The works will take place in the location shown in Figure 1.

Figure 1 - Area of Works Map

2.1 Project Locality

Land use zones for the work area and surroundings have been presented within the table below. The project site is surrounded by industrial and commercial premises.

Figure 2 - Zoning of Surrounding Areas (Mecone Mosaic)



2.2 Noise Sensitive Receivers

The nearest noise sensitive receivers are detailed below in Table 1 and shown in Figure 3.

Table 1 - Nearest Noise Sensitive Receivers

Type	ID	Description
General Industrial	R1	4 SYDENHAM ROAD BROOKVALE NSW 2100
	R2	7 ORCHARD ROAD BROOKVALE NSW 2100
	R11	1A SYDENHAM ROAD BROOKVALE NSW 2100
	R12	5 SYDENHAM ROAD BROOKVALE NSW 2100
	R13	7 SYDENHAM ROAD BROOKVALE NSW 2100
	R14	9 ORCHARD ROAD BROOKVALE NSW 2100
	R15	4 & 8 ORCHARD ROAD BROOKVALE NSW 2100
Productivity Support	R3	650 PITTWATER ROAD BROOKVALE NSW 2100
	R4	648 PITTWATER ROAD BROOKVALE NSW 2100
	R5	646 PITTWATER ROAD BROOKVALE NSW 2100
	R6	644 PITTWATER ROAD BROOKVALE NSW 2100
	R7	642 PITTWATER ROAD BROOKVALE NSW 2100
	R8	638 PITTWATER ROAD BROOKVALE NSW 2100
	R9	658 PITTWATER ROAD BROOKVALE NSW 2100
	R10	1 SYDENHAM ROAD BROOKVALE NSW 2100

2.3 Work Schedule and Working Hours

The scheduled significant noise emitting activities are outlined in Table 2 below.

Table 2 - Proposed Work Schedule and Activities

Construction Activity	Start Date	Finish Date	Duration	Overall Stage Duration
Demolition & Site Preparation	January 2026	February 2026	1 Month	9 Months
Site Levelling & Shoring Walls	February 2026	March 2026	1 Month	
Excavation	March 2026	May 2026	2 Months	
Structure	May 2026	October 2026	5 Months	

3 BACKGROUND NOISE MEASUREMENTS

3.1 Attended Background Noise Monitoring

Attended measurements were taken on the 19th of September 2024, between 12:45pm and 1:00pm. Noise measurements were recorded with the microphone located 1.5m above the natural surface level and at least 3m from buildings, fences, and other reflective surfaces above the ground. Details of the measurement positioning are as shown in Figure 3.

Attended measurements were conducted with an NTI XL2 Sound Level Meter and a MA220 NTI Microphone. Noise levels were recorded using capture settings including A-weighting, fast response mode and recording in 15-minute intervals.

Instrument calibration was checked before and after measurements, with variation in calibrated levels not exceeding ±0.5dB. The acoustic instrumentation employed was designed to comply with the requirements of AS IEC 61672.1—2004 – Electroacoustics—Sound level meters, Part 1: Specifications and carries current manufacturer calibration certificates.

Short-term measurements were conducted to quantify the existing ambient noise environment during the daytime period. The attended measurement was undertaken in the location shown in Figure 3.

Table 3 – Attended short term background Noise Monitoring

Attended Measurement Location	2210/20/24 Time	Background Noise Levels at Measurement Location, L_{90} dB(A)
		Daytime
Sydenham Road	10:15am	58
Charlotte Lane	10:35am	52
Orchard Road	11:55am	56
Note:	1. Background measurements were taken as unaffected by adverse meteorological conditions including abnormal wind conditions above 5m/s or any precipitation. 2. Extraneous noises sources which are not representative of typical ambient noise of the area have been excluded from the data.	

4 CRITERIA FOR ASSESSING CONSTRUCTION IMPACTS

4.1 Noise

For the purposes of the assessment, the potential for environmental harm associated with construction noise impacts has been considered with reference to both the Queensland Environmental Protection Act 1994 and the Environmental Protection (Noise) Policy (EPP).

However, due to the absence of a specific policy addressing the impacts and management of construction noise in Queensland, the NSW Interim Construction Noise Guideline (ICNG) has been adopted for this assessment.

4.1.1 Environmental protection act (EPA) 1994

Section 440R of the EPA provides the following guidelines relating to building work:

440R Building work

1. *A person must not carry out building work in a way that makes an audible noise—*
    a. *on a business day or Saturday, before 6.30a.m. or after 6.30p.m; or*
    b. *on any other day, at any time.*
2. *The reference in subsection (1) to a person carrying out building work—*
    c. *includes a person carrying out building work under an owner-builder permit; and*
    d. *otherwise does not include a person carrying out building work at premises that are the person's principal place of residence.*

4.1.2 NSW EPA Interim Construction Noise Guideline (ICNG) 2009

The NSW Interim Construction Noise Guideline (ICNG or Guideline) provides recommended noise levels for airborne construction noise at sensitive land uses. The guideline provides construction noise management levels above which all feasible and reasonable work practices should be applied to minimise the construction noise impact. The ICNG works on the principle of a 'screening' criterion – if predicted or measured construction noise exceeds the ICNG levels then the construction activity must implement all 'feasible and reasonable' work practices to reduce noise levels.

The ICNG provides two methods for assessing construction noise, varying typically based on the project duration, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement of background noise levels for determination of noise management levels and prediction of construction noise levels. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

4.1.3 Management Levels for Noise Receivers

Table 2 of the NSW EPA Interim Construction Noise Guideline sets out management levels for noise intrusions to affected residences and provide strategies to determine noise management levels based on the Rating Background Level (RBL) at the nearest noise sensitive receivers, during or outside the recommended standard hours. The NMLs are provided below in Table 4.

Table 4 – ICNG Noise Management Levels

Time of Day	Noise Management Level ($L_{Aeq\ 15\text{-}min}$)	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	**Noise affected RBL + 10 dB**	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) 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 residents 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, taking into account: 1. 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 2. 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 5dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.
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 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.	

4.1.4 Project Construction Noise Targets

Based on the ICNG guideline and the monitoring carried out, Table 5 outlines the project specific targets for the surrounding receivers.

Table 5 – Construction noise emission criteria summary

Period	Location (Receiver)	Measured Background Noise Level dB(A) $L_{90,15min}$	"Noise Affected" Emission Criterion dB(A)		"Highly Noise Affected" Emission Criterion dB(A)
Day (7am-6pm)	Sydenham Road	58	RBL + 10dB	68	75
	Charlotte Lane	52		62	
	Orchard Road	56		66	

4.1.5 Australian Standard 2436:2010

Australian Standard 2436:2010 – *Guide to Noise Control on Construction, Maintenance and Demolition Sites,* provides guidance on noise control in respect to construction and demolition sites, the preparation of noise management plans, work method statements and impact studies. The Standard states that:

> *Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration.*
> *Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since.*
> *(a) they are mainly carried on in the open.*
> *(b) they are often temporary in nature although they may cause considerable disturbance whilst they last.*
> *(c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work; and*
> *(d) the sites cannot be separated by planning controls, from areas that are sensitive to noise and vibration.*

The standard provides advice and guidelines for the prediction of impacts and the methods available to manage impacts. The guideline presents feasible and reasonable mitigation strategies and controls, including stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.

4.2 Vibration

In the absence of specific vibration criteria in Queensland, the criteria presented in the Environmental Noise Management – Assessing Vibration: A Technical Guide (2006) published by the NSW Department of Environment Climate Change and Water (DECCW) have been adopted for the assessment. The technical guide provides vibration criteria associated with amenity impacts (human annoyance) for the three categories of vibration:

- *Continuous vibration (e.g. road traffic, continuous construction activity);*
- *Impulsive vibration includes less than 3 distinct vibration events in an assessment period (e.g. occasional dropping of heavy equipment); and*
- *Intermittent vibration includes interrupted periods of continuous vibration (e.g. drilling), repeated periods of impulsive vibration (e.g. pile driving) or continuous vibration that varies significantly in amplitude.*

Construction vibration criteria have been adopted from the following standards and guidelines:

- *British Standard 7385 Part 2*
- *German Standard DIN 4150-32*

4.2.1 Structural damage

4.2.1.1 Definition

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 Part 2 and/or German Standard DIN4150-3. British Standard 7385 Part 1: 1990, defines different levels of structural damage as:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.*

- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

Table 1 of British Standard 7385 Part 2 (1993) sets limits for the protection against cosmetic damage, however the following guidance on minor and major damage is provided in Section 7.4.2 of the Standard:

> *7.4.2 Guide values for transient vibration relating to cosmetic damage.*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.*

Within DIN4150-3, damage is defined as "*any permanent effect of vibration that reduces the serviceability of a structure or one of its components*".

The Standard also outlines:

> "*That for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if:*
>
> - *cracks form in plastered surfaces of walls.*
> - *existing cracks in the building are enlarged.*
> - *partitions become detached from loadbearing walls or floors.*
>
> *These effects are deemed 'minor damage."*

While the DIN Standard defines the above damage as 'minor', the description aligns with BS7385 cosmetic damage, rather than referring to structural failures.

4.2.1.2 British Standard BS7835-2

BS7385-2 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4–250 Hz, and a maximum displacement value below 4 Hz is recommended. Table 6 sets out the criteria for cosmetic, minor and major damage as established within BS 7385-2.

Table 6 - BS 7385-2 Structural Damage Criteria

Group	Type of Structure	Damage Level	Peak Component Particle Velocity, mm/s[1]		
			4Hz-15Hz	15Hz – 40Hz	40Hz & above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor[2]	100		
		Major[2]	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor[2]	30 -40	40 – 100	100
		Major[2]	60 – 80	80 - 200	200

Notes:	1. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer. 2. Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2 All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

4.2.1.3 German Standard DIN 4150:3

German Standard DIN 4150 - Part 3 'Structural vibration in buildings - Effects on Structure' are generally recognised to be conservative and is often referred to for assessing structurally sensitive buildings. For the subject site, surrounding buildings are not deemed structurally sensitive and therefore the British Standard is considered appropriate for vibration management.

4.2.2 Human Comfort

The NSW EPA's technical guideline titled "Assessing Vibration – A Technical Guideline establishes criteria for assessing vibration and the potential impacts on the human comfort of building occupants. This guideline provides recommendations for both preferred and maximum levels of weighted vibrations, considering both continuous sources like road traffic and construction activity, as well as impulsive vibration sources.

To determine the appropriate weighting curves, the guideline refers to BS 6472-1:2008. For intermittent sources such as construction, the guideline adopts the vibration dose value (VDV) metric to evaluate the impact of vibrations on human comfort. The VDV takes into account the magnitude of vibration events and the frequency at which they occur. If intermittent events happen less than three times within a specified assessment period (either during the day from 7 am to 10 pm or during the night from 10 pm to 7 am), they are classified as "impulsive" sources for assessment purposes.

To maintain human comfort levels in residences and other relevant locations, the guideline provides recommended vibration limits for both continuous/impulsive and intermittent vibrations. These limits can be found in Table 7 for continuous/impulsive vibrations and

Table 8 for intermittent vibration.

Table 7 – Preferred and maximum weighted root-mean-square (rms) values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

Location	Period	Preferred Values		Maximum Values	
		Z axis	X/Y-axes	Z axis	X/Y-axes
Continuous Vibration					
Residences	07:00 – 22:00	0.010	0.0071	0.020	0.014
	22:00-07:00	0.007	0.005	0.014	0.010
Offices/ Educational Institutions / Places of Worship.	Day or Nighttime	0.020	0.014	0.040	0.028
Impulsive Vibration					
Residences	07:00 – 22:00	0.30	0.21	0.60	0.42
	22:00-07:00	0.10	0.071	0.20	0.14
Offices/ Educational Institutions / Places of Worship.	Day or Nighttime	0.64	0.46	1.28	0.92
Notes:	Criteria for sensitive areas are only indicative and have been provided as guidance to acceptable vibration levels for the use of sensitive equipment.				

Table 8 – Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	07:00 – 22:00 hours		22:00 – 7:00 hours	
	Z axis	X/Y-axes	Z axis	X/Y-axes
Residences	0.010	0.0071	0.020	0.014
Offices/ Educational Institutions / Places of Worship.	0.007	0.005	0.014	0.010

5 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

5.1 Noise Emission Predictions

Noise generated by the work activities will be managed to comply with the nominated noise criteria outlined in Section 4. Where the noise goal exceeds the nominated criteria, noise will be managed based on principles consistent with the ICNG.

Noise emission predictions to the nearest noise sensitive receivers are assessed in this section.

5.1.1 ICNG 4.5 Predicting noise levels – Quantitative assessment

Under Section 4.5 of the ICNG it is stated that a 5dB addition to the predicted noise levels needs to be to be factored for the following activities taking place during the night-time (Particularly annoying activities to nearby residents):

- *Use of 'beeper' style reversing or movement alarms, particularly at night-time*
- *Use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work*
- *Grinding metal, concrete or masonry*
- *Rock drilling*
- *Line drilling*
- *Vibratory rolling*
- *Rail tamping and regulating*
- *Bitumen milling or profiling*
- *Jackhammering, rock hammering or rock breaking*
- *Impact piling.*

This correction has been factored in the noise emission assessment for the activities that apply.

5.1.2 Construction Plant and Equipment

Anticipated construction plant and equipment for the project is outlined in Table 9 under each construction stage. The sound power levels for the proposed tools and equipment are also provided in Table 9.

Table 9 - Construction Work Stage, Activities & Sound Power Levels

Stage	Activities	Sound Power Level L_W dB(A)
A. Demolition & Site Preparation	Jackhammers	100
	Bulldozers	102
	Excavators	97
	Dump trucks	106
	Front loaders	98
B. Site Levelling & Shoring Walls	Bulldozers	102
	Excavators	97
	Crane	98
	Drilling	102
	Piling (Bored)	103
	Dump trucks	106
	Concrete Mixer Truck and Concrete Pump	103
C. Excavation	Jackhammers	90
	Bulldozers	102
	Excavators	97
	Dump trucks	106
	Front loaders	98
D. Structure	Crane	98
	Concrete Mixer Truck and Concrete Pump	103
	Concrete Grinders	95
	Concrete Vibrators	101
	Trucks for material delivery	102
	Bench Saw	90
	Power Drill	80
	Nail Gun	91
	Grinder	85
	Hammer	97
	Impact Drill	90

5.1.3 Noise Modelling and Predicted Noise Levels.

Noise emissions levels at the nearest noise sensitive receivers have been calculated using computer-based 3D acoustic noise modelling software iNoise version 2022.1.1. iNoise utilizes ISO 9613 calculation algorithms to determine noise emission levels at the nearest affected noise sensitive receivers. The following assumptions have been included within the noise model:

- Noise source levels.
- Distance attenuation.
- Atmospheric attenuation.
- Directivity.
- Ground absorption (G = 0.5)
- Barrier effects/screening.
- Ground Elevation Contours.

5.1.3.1 Noise Modelling Scenarios

Construction Noise Levels are assessed at the worst affected receivers. The assessment scenarios that have been modelled are presented in Table 10. The scenarios have been created based on the construction schedule and expected work hours as shown in Table 9.

Table 10 – Noise Modelling Scenarios

Stage	Equipment	Assessment Scenario Description	Assessment Time/Criteria
A	Jackhammers	Noisiest activity will be continuously emitting noise for the 15 min assessment period with 1 Truck arrival	Daytime
	Bulldozers		
	Excavators		
	Dump trucks		
	Front loaders		
B	Bulldozers	Noisiest activity will be continuously emitting noise for the 15 min assessment period with 1 Truck arrival	
	Excavators		
	Crane		
	Drilling		
	Piling (Bored)		
	Dump trucks		
	Concrete Mixer Truck and Concrete Pump		
C	Jackhammers	Noisiest activity will be continuously emitting noise for the 15 min assessment period with 1 Truck arrival	
	Bulldozers		
	Excavators		
	Dump trucks		
	Front loaders		
D	Concrete Mixer Truck and Concrete Pump	Continuously emitting noise for the 15 min assessment period	
D.1	Trucks for material delivery	All activities will be continuously emitting noise for the 15 min assessment period with 1 Truck arrival	
	Crane		
	Bench Saw		
	Power Drill		
	Nail Gun		
	Grinder		
	Hammer		
	Impact Drill		

To evaluate the potential adverse outcomes of the proposed activities, noise sources for each assessment have been positioned in section of the work areas closest to the nearest receivers.

5.1.3.2 Predicted Noise Levels

Predicted noise levels at the nearest noise sensitive receivers for the two Scenarios outlined in Table 10 are presented in this section. Table 11 and

Table 12 contain the results of the assessment.

Table 11 - Predicted Noise Emissions to Nearest Receivers (Activity A)

Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**
Stage A. Demolition & Site Preparation	**75**	**75**	**75**	**75**	**74**	**72**	**71**	**59**	**67**
"Noise Affected" Day Time Criterion (Leq: BG + 10Db)	68	66	62	62	62	62	62	62	68
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✗	✗	✗	✗	✗	✓	✓
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R10	**R11**	**R12**	**R13**	**R14**	**R15**	**-**	**-**	**-**
Stage A. Demolition & Site Preparation	**69**	**69**	**65**	**64**	**44**	**54**	-	-	-
"Noise Affected" Day Time Criterion (Leq: BG + 10Db)	68	68	68	68	66	66			
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✓	✓	✓	✓	-	-	-
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	-	-	-

Table 12 - Predicted Noise Emissions to Nearest Receivers (Activity B)

Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**
Activity B. Site Levelling & Shoring Walls	**76**	**76**	**76**	**76**	**75**	**73**	**72**	**60**	**68**
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	66	62	62	62	62	62	62	68
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✗	✗	✗	✗	✗	✓	✓
Complies with Highly Noise Affected Criterion?	✗	✗	✗	✗	✓	✓	✓	✓	✓
Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R10	**R11**	**R12**	**R13**	**R14**	**R15**	**-**	**-**	**-**
Activity B. Site Levelling & Shoring Walls	**70**	**70**	**66**	**65**	**45**	**55**	-	-	-
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	68	68	68	66	66			
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✓	✓	✓	✓	-	-	-
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	-	-	-

Table 13 - Predicted Noise Emissions to Nearest Receivers (Activity C)

Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**
Activity C. Excavation	**75**	**75**	**75**	**75**	**74**	**72**	**71**	**59**	**67**
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	66	62	62	62	62	62	62	68
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✗	✗	✗	✗	✗	✓	✓
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R10	**R11**	**R12**	**R13**	**R14**	**R15**	**-**	**-**	**-**
Activity C. Excavation	**69**	**69**	**65**	**64**	**44**	**54**	-	-	-
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	68	68	68	66	66			
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✓	✓	✓	✓	-	-	-
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	-	-	-

Table 14 - Predicted Noise Emissions to Nearest Receivers (Activity D)

Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**
Activity D. Structure (Concreting)	**76**	**76**	**76**	**76**	**75**	**73**	**72**	**60**	**68**
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	66	62	62	62	62	62	62	68
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✗	✗	✗	✗	✗	✓	✓
Complies with Highly Noise Affected Criterion?	✗	✗	✗	✗	✓	✓	✓	✓	✓
Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R10	**R11**	**R12**	**R13**	**R14**	**R15**	**-**	**-**	**-**
Activity D. Structure (Concreting)	**69**	**69**	**65**	**64**	**44**	**54**	-	-	-
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	68	68	68	66	66			
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✓	✓	✓	✓	-	-	-
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	-	-	-

Table 15 - Predicted Noise Emissions to Nearest Receivers (Activity D.1)

Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**
Activity D.1 Structure	**75**	**75**	**75**	**75**	**74**	**72**	**71**	**59**	**67**
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	66	62	62	62	62	62	62	68
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✗	✗	✗	✗	✗	✓	✓
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction Activity	Predicted External Noise Level dB(A) $L_{Aeq,(15min)}$								
	R10	**R11**	**R12**	**R13**	**R14**	**R15**	**-**	**-**	**-**
Activity D.1 Structure	**69**	**69**	**65**	**64**	**44**	**54**	-	-	-
"Noise Affected" Day Time Criterion (Leq: BG + 10dB)	68	68	68	68	66	66			
"Highly Noise Affected" Criterion	**75**								
Complies with Noise Affected Criterion?	✗	✗	✓	✓	✓	✓	-	-	-
Complies with Highly Noise Affected Criterion?	✓	✓	✓	✓	✓	✓	-	-	-

5.2 Vibration Emission Predictions

Based on the proximity of the surrounding receivers to the subject site, vibration generated by excavators and soil compaction can potentially exceed the human comfort criteria but it is expected to be within the structural damage criteria limits.

In the absence of specific equipment/machinery information to be used on site, it is unreliable to predict vibration impacts at the nearest receivers.

All the feasible and applicable mitigation measures should be implemented to reduce vibration travelling to the adjacent receiver.

Vibration mitigation measures are included in Section 7 of this report. NNV is of the opinion that vibration monitoring should be conducted when excavators and compactors will be used on site, to ensure that vibration values are within the allowable limits.

6 CONSTRUCTION NOISE MITIGATION MEASURES

The result of the assessment is indicative that the noise affected management levels are expected to be exceeded by the works across all stages.

It is suggested to follow mitigation strategies outlined in the ICNG which can be found in Section 6.1.

6.1 ICNG Construction noise mitigation strategies applicable to all construction stages

These mitigation measures are considered to represent 'feasible and reasonable' mitigation measures suitable for implementation during construction of the project for all stages.

ICNG Strategy 1 - Universal Work Practices

Additional Work Practices at Night:

a) Avoid the use of equipment which generates impulsive noise.
b) Minimise the need for reversing or movement alarms as described in Table 7.
c) Avoid dropping materials from a height.
d) Avoid metal-to-metal contact on equipment.
e) Schedule truck movements to avoid residential streets if possible.
f) Avoid mobile plant clustering near residences and other sensitive land uses.
g) Ensure periods of respite are provided in the case of unavoidable maximum noise level events

ICNG Strategy 2 - Consultation and Notification

Notification Before and During Construction:

a) Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement.
b) Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information.
c) Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include afterhours emergency contact details.
d) Maintain good communication between the community and project staff.
e) Appoint a community liaison officer where required.

f) For larger projects consider a regular newsletter with site news, significant project events and timing of different activities.
g) Provide a toll-free contact phone number for enquiries during the works.
h) Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.

Complaints Handling:

a) Provide a readily accessible contact point, for example, through a 24-hour toll-free information and complaints line.
b) Give complaints a fair hearing.
c) Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
d) Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance.
e) Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information.
f) Implement all feasible and reasonable measures to address the source of complaint.
g) Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

ICNG Strategy 3 - Plant and Equipment

Use Quieter Methods:

a) Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis.
b) Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences.
c) Examine and implement, where feasible and reasonable, alternatives to transporting excavated material from underground tunnelling off site at night. For example, stockpile material in an acoustically treated shed at night and load out the following day.

Use Quieter Equipment:

a) Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
b) Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting less noisy plant.
c) Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible.
d) When renting, select quieter items of plant and equipment where feasible and reasonable.
e) When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.

Operate Plant in a Quiet and Efficient Manner:

a) Reduce throttle setting and turn off equipment when not being used.
b) Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

Maintain equipment:

a) Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers.
b) Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified.
c) For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals.
d) Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair.
e) Ensure air lines on pneumatic equipment do not leak.

6.1.1 Applicable Strategies Where Noise is Likely to Exceed the Highly Noise Affected Criterion.

The following mitigation strategies are recommended for construction stages where the highly noise affected criterion is expected to be exceeded.

ICNG Strategy 4 - On Site

Location Of Plant:

a) Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.
b) Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times.
c) Locate site vehicle entrances away from residences and other sensitive land uses.
d) Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site.

Alternatives to reversing alarms:

e) Avoid use of reversing alarms by designing site layout to avoid reversing, such as by including drive-through for parking and deliveries.
f) Install where feasible and reasonable fewer annoying alternatives to the typical ‘beeper’ alarms taking into account the requirements of the Occupational Health and Safety legislation; examples are smart alarms that adjust their volume depending on the ambient level of noise and multifrequency alarms that emit noise over a wide range of frequencies.
g) In all circumstances, the requirements of the relevant Occupational Health and Safety legislation must be complied with. For information on replacing audible warning alarms on mobile plant with less annoying alternatives, see Appendix C.

Maximise Shielding:

a) Reuse existing structures rather than demolish and reconstruct.
b) Use full enclosures, such as large sheds, with good seals fitted to doors to control noise from night-time work.
c) Use temporary site buildings and materials stockpiles as noise barriers.
d) Schedule construction of permanent walls so that they can be used as early as possible as noise barriers.
e) Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms.

f) Note large reflecting surfaces on and off site that might increase noise levels and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.

ICNG Strategy 5 - Work Scheduling

Provide Respite Periods:

a) Where night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residents who will be most affected.
b) Schedule activities to minimise noise impacts:
c) Organise work to be undertaken during the recommended standard hours where possible.
d) Schedule work when neighbours are not present (for example, commercial neighbours, colleges and schools may not be present outside business hours or on weekends).
e) Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background.
f) Consult with affected neighbours about scheduling activities to minimise noise impacts.
g) Care should be taken to minimise noise from any refuelling at night.

Organise Deliveries & Access:

a) Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening.
b) Amalgamated loads can lead to less noise and congestion in nearby streets.
c) Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
d) Designate access routes to the site, through consultation with potentially noise-affected residences and other sensitive land uses and make drivers aware of nominated vehicle routes.
e) Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive land uses. Truck waiting areas may require bunding or walls to minimise noise.
f) Schedule deliveries to nominated hours only.

Strategy 6 - Transmission path

a) Reduce the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers.
b) Temporary noise barriers can be constructed from hoarding (plywood boards, panels of steel sheeting or compressed fibre cement board) with no gaps between the panels at the site boundary. Stockpiles, shipping containers and site office transportable can be effective barriers.
c) Erect temporary noise barriers before work commences to reduce noise from works as soon as possible.
d) Where high-rise dwellings adjoin the construction site, the height of a barrier may not be sufficient to effectively shield the upper levels of the residential building from construction noise. Check whether this is a consideration for the project and examine alternative means of mitigation where needed.
e) Consult with most affected neighbours about how effective the proposed noise mitigation measures will be in addressing their concerns.

Strategy 7 At residences or other sensitive land uses

Temporary relocation:

- Examine and implement, where feasible and reasonable, the option of relocating noise-affected occupants for short periods of time, such as when high noise levels from construction

occur at night and there are no feasible and reasonable ways of reducing noise levels. For example, the proponent could offer alternative accommodation or other respite measures (such as movie tickets) where mitigation is sought and there are no feasible and reasonable work methods available.

Architectural treatments:

- Examine and implement, where feasible and reasonable, the option of acoustical treatment to residences affected by construction noise, such as to windows at the building façade – however, alternative means of ventilation may be needed where windows are closed and airflow into a building does not meet building requirements. Note that the effectiveness of closing existing windows may be limited by the performance of the window seals.

7 CONSTRUCTION VIBRATION MITIGATION MEASURES

7.1 Assessing Vibration – A Technical Guideline (DEC 2006).

Assessing Vibration – A Technical Guideline provides several strategies for managing vibration from construction sites. These are generally applicable as follows:

- Inform neighbours about the nature of the construction stages and the vibration generating activities— (e.g., excavation and rock-breaking).
- Organise demolition, earthmoving and ground impacting operations so as not to occur in the same time period.
- Schedule intensive activities to occur between 6:30pm and 10:00pm where feasible and reasonable.
- Place as much distance as possible between the plant or equipment and the receivers.
- Select demolition methods not involving impact where possible (e.g., hydraulic rock splitters rather than rock breakers).

7.1.1 Monitoring

It is recommended that, if needed, attended noise and vibration monitoring be carried out at the commencement of the first stage to review impacts and also evaluate work practices and mitigation measures.

Vibration monitoring with respect to potential structural damage is considered most critical. Long-term noise and vibration monitoring would generally not be considered unless on-going risks were identified that would otherwise benefit from an on-going monitoring program.

7.1.2 Complaints management

Noise and vibration impacts from activities associated with the construction of the development shall meet the noise and vibration criteria set by the relevant guidelines and regulations.

The contractor is responsible for implementing this Construction Noise and Vibration Management Plan and ensuring that all feasible and reasonable strategies are implemented to minimise noise and vibration impacts at nearby sensitive receivers.

A noise and vibration complaint management procedure are recommended to be set in place to provide owners and occupants of nearby affected properties with means to report complaints related to the operation of the construction activities such as a direct telephone line and contact representative to liaise with complaints.

8 CONCLUSION

A Construction Noise & Vibration Management Plan has been prepared for the proposed demolition, excavation and construction works at 2 SYDENHAM RD, BROOKVALE NSW 2100. The acoustic assessment indicates that, while some construction activities are likely to exceed the noise management levels, the implementation of the recommended mitigation strategies will effectively minimise noise and vibration impacts on nearby sensitive receivers.

The project has been assessed against relevant guidelines and regulations, and compliance with these criteria are not expected. It is recommended that the mitigation measures outlined in Sections 6 and 7 of this report be implemented where necessary to ensure minimal disruption.

Should you have any further questions or require additional information, please do not hesitate to contact us.

Sincerely,

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