

CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN

CURL CURL NORTH PUBLIC SCHOOL

**REPORT NO. 17072-A
VERSION B**

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PREPARED FOR

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

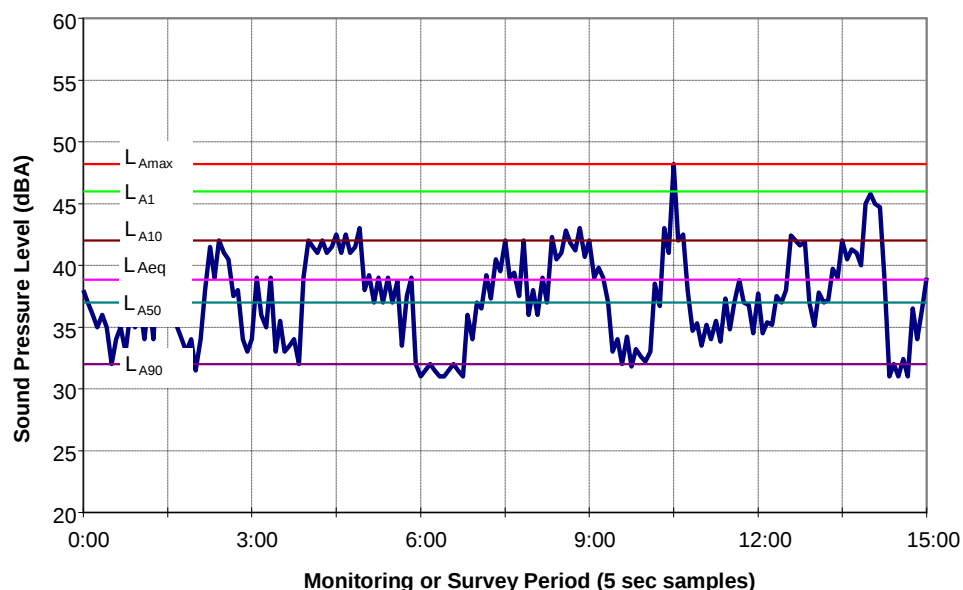
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Wilkinson Murray Pty Limited has been engaged by ADCO Constructions Pty Ltd to provide a Construction Noise & Vibration Management Plan for the redevelopment project at Curl Curl North Public School (the site), located on the corner of Playfair Road and Abbott Road. The site is located within the Northern Beaches Council area.

The proposed construction works consists of demolition, alterations and additions to the existing school. It also includes the construction of multiple new single and two-storey school buildings to accommodate home-base classrooms, library, administrative areas and out of school hours care facilities. The school proposes to increase student enrolments from the current 920 to a maximum of 1,000.

The development application (DA) consent requires a Construction Noise and Vibration Management Sub-Plan plan (SNVMSP) be prepared as per condition B25 of the Application Document: SSD 18310. The conditions outlined in the DA consent documents require the following items:

- a) *(CNVMSP) Be prepared by a suitably qualified and experience noise expert;*
- b) *describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);*
- c) *describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;*
- d) *include strategies that have been developed with the community for managing high noise generating works;*
- e) *describe the community consultation undertaken to develop the strategies in condition B25d); and*
- f) *include a complaints management system that would be implemented for the duration of the construction*

This noise and vibration assessment evaluates potential impacts associated with construction activities associated with the redevelopment works in accordance with the following Environmental Protection Authority (EPA) guideline documents:

- *Interim Construction Noise Guideline (ICNG)*
- *Assessing Vibration: A Technical Guideline (AVTG).*

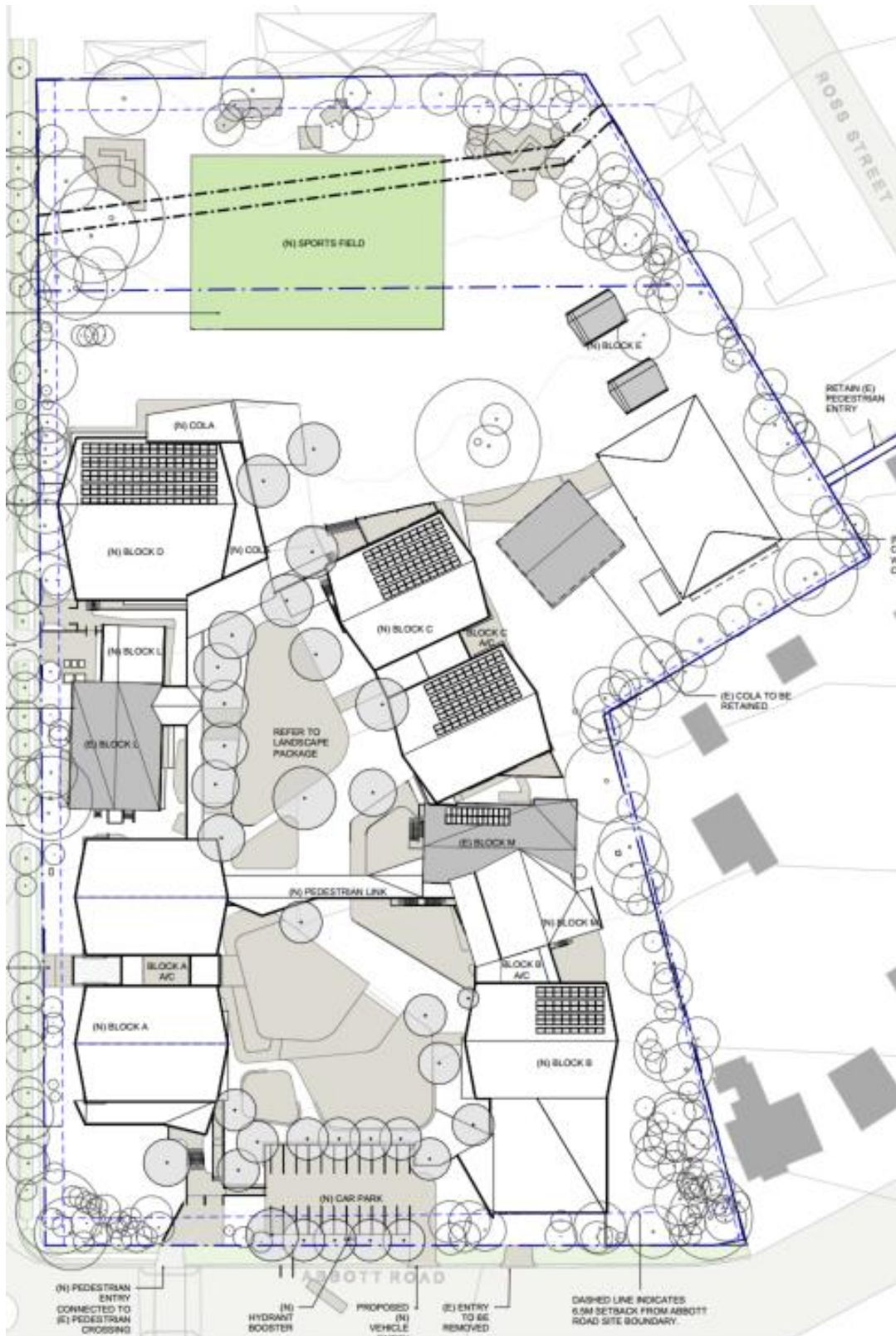
Regarding risk of damage building, the following Standard is most appropriate and forms part of the Consent:

- *DIN 4150-3 (1992-02) Structural vibration – effects of vibration on structures (German Institute for Standardisation 1999).*

Figure 1-1 presents the existing site plan of the Curl Curl North Public School and Figure 1-2 presents the proposed redevelopment layout of the Public School.

[illegible]

Figure 1-2 Proposed Site Plan



2 SITE DESCRIPTION

Residential premises border the east and northern sides of the site. To the west are residences across Playfair Road. To the south are sports fields across Abbott Road. The proposed redevelopment is divided into three work stages. South of the school is categorised as Area 1 and majority of the new school buildings will be constructed in this area. Area 2 is located on the north-east and north-west side of the site, demolition of the existing building will take place after the demolition of buildings within Area 3 which is located in the centre and north of the site. It should be noted, demolition works north of Area 3 will occur during Area 2 demolition works.

Table 2-1 presents the nearby surrounding receivers from the site and Figure 2-1 presents the location of the 3 proposed construction areas of the site and the surrounding receivers.

Table 2-1 Surrounding Receivers

Receiver ID	Address	Receiver Type
S1	Curl Curl North Public School	School
R2	72 Abbott Road, North Curl Curl	Residential
R3	17 Lillie Street, North Curl Curl	Residential
R4	54 Playfair Road, North Curl Curl	Residential
R5	52 Playfair Road, North Curl Curl	Residential
R6	50 Playfair Road, North Curl Curl	Residential
R7	48 Playfair Road, North Curl Curl	Residential
R8	46 Playfair Road, North Curl Curl	Residential
R9	44 Playfair Road, North Curl Curl	Residential
R10	42 Playfair Road, North Curl Curl	Residential
R11	40 Playfair Road, North Curl Curl	Residential
R12	38 Playfair Road, North Curl Curl	Residential
R13	36 Playfair Road, North Curl Curl	Residential
R14	25 Playfair Road, North Curl Curl	Residential
R15	7 Ross Street, North Curl Curl	Residential
R16	9 Ross Street, North Curl Curl	Residential
R17	11 Ross Street, North Curl Curl	Residential
R18	13 Ross Street, North Curl Curl	Residential
R19	15 Ross Street, North Curl Curl	Residential
R20	17 Ross Street, North Curl Curl	Residential
R21	19 Ross Street, North Curl Curl	Residential
R22	60 Abbott Road, North Curl Curl	Residential
R23	58 Abbott Road, North Curl Curl	Residential
R24	56 Abbott Road, North Curl Curl	Residential
R25	54 Abbott Road, North Curl Curl	Residential
R26	52 Abbott Road, North Curl Curl	Residential

Figure 2-1 Site Layout & Surrounding Receivers



3 NOISE MEASUREMENT

A detailed account of the environmental noise survey has been provided within the acoustic assessment report prepared by Wilkinson Murray (Report No. 17072, Version D), undertaken at the Development Application stage. The noise measurement was conducted between 24 February and 8 March 2017 at the eastern boundary of the site.

Table 3-1 presents a summary of the relevant noise measurement that have been considered appropriate to establish the construction noise management levels (NML) for this assessment.

Table 3-1 Ambient Noise Levels

Receivers	Time Period	Noise Level (dBA)	
		RBL	L _{Aeq}
R2 – R25	Day (7.00am-6.00pm)	39	51

4 CONSTRUCTION NOISE & VIBRATION CRITERIA

Noise and vibration criteria have been established based on DA consent requirement. The following sections detail these issues.

4.1 Construction Noise Management Levels

The ICNG provides noise goals that assist in assessing the impact of construction noise.

For residences, the basic daytime construction noise goal is that the noise should not exceed the noise affected Rating Background Level (RBL) by more than 10 dBA. This is for construction during standard hours: Monday to Friday 7.00am-6.00pm, and Saturday 8.00am-1.00pm. Outside the standard hours, the criterion would be RBL + 5 dBA.

According to Section C5 of the DA condition consent, Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:

- a) Between 7am and 6pm, Monday to Fridays inclusive; and
- b) Between 8am and 1pm, Saturdays.

No work may be carried out on Sundays or public holidays.

Table 4-1 Construction Noise Goals at Residences for a Quantitative Assessment

Time of Day	Management Level $L_{Aeq(15min)}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm	Noise affected RBL + 10 dBA	- 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 minimise noise. - 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.
Saturday 8am to 1pm No work on Sundays or Public Holidays	Highly noise affected 75 dBA	- 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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. - If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

In addition to the above noise guideline, the following construction noise management levels $L_{Aeq,15min}$ is recommended for other receivers and areas (relevant to this project) as follows:

- Classrooms at schools and other educational institutions: Internal 45 dBA
- Playgrounds (considered to be active recreational areas): External 65dBA

Based on the above, Table 4-2 presents the applicable site-specific noise management levels for construction activities. It should be noted construction works will only take place during the day.

Table 4-2 Site-Specific Construction Noise Management Levels

Location	Construction Noise Management Level, L_{Aeq} (dBA)	Highly Affected Construction Noise Level, L_{Aeq} (dBA)
	Day	
Residential (R2-R27)	49	75
Classrooms (S1)	55 (outside of classroom assuming windows open)	
	65 (playground area)	

4.2 Construction Vibration Criteria

4.2.1 Criteria for Human Annoyance

The assessment of vibration emissions impact on surrounding receivers should be undertaken using the ATVG. This Guideline covers the appropriate methods and criteria for the assessment of the intrusive vibration on living and working space.

The guideline describes the following:

- The characteristics of vibration and associated effects that can cause community disturbance and concern to people, in particular the occupants of buildings.
- Criteria defining values of vibration to protect amenity.
- Procedures for the measurement and evaluation of vibration values and other associated emissions.

A summary of the Vibration Dose Value (VDV) criteria for human comfort limits are adopted from the ATVG and are presented Table 4-3 in below.

Table 4-3 Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Place	DayTime		Night Time	
	Preferred	Maximum	Preferred	Maximum
Residents	0.20	0.40	0.13	0.26
Offices, Schools, Educational, institutions and place of worship	0.40	0.80	0.40	0.80

4.2.2 Criteria for Structural Damage

DIN 4150--3 should be used to assess vibration levels that may cause structural damage. This Standard specifies methods of measuring and evaluating the effects of vibration on structures designed primarily for static loading.

Short term vibration is classified as vibrations which do not occur often enough to cause structural fatigue. Table 4-4 below gives a guideline value for short term vibration velocity at the foundation and in the plane of the highest floor of various types of building.

Table 4-4 Structural Damage – Short Term Vibration (mm/s)

Type of Building	Peak component particle velocity in frequency range of predominant pulse			Plane of Floor of uppermost storey
	Less than 10Hz	10-50Hz	50-100Hz	All frequencies
Building used for commercial purposes, industrial buildings, and building of similar design	20	20 to 40	40 to 50	40
Dwelling and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

5 CONSTRUCTION NOISE ASSESSMENT

5.1 Construction Work Scenarios

The construction project is divided into 9 separate work stages and a summary of each stage is outlined below:

Stage 1

- 1) Demolition of the demountable classrooms and remediation of the ground located within Area 1.
- 2) Construction Block A, B, C, refurbishment of building Block M and the covered outdoor in Area 1.
- 3) Landscaping and earthmoving works in Area 1.

Stage 2

- 4) Demolition of demountable structures and building Blocks B, H, O, J, K, COLA areas and remediation of the ground within Area 2.
- 5) Construction of Blocks D, E and refurbishment/extension of building Block L. Construction of covered walkways, sports court and play equipment.
- 6) Landscaping and earthmoving works in Area 2.

Stage 3

- 7) Demolition of 3 demountable classrooms and building blocks J, K, N, and remediation of the ground in Area 3.
- 8) Landscaping and earthmoving works in Area 3 and construction of a sports field.

All Stages

- 9) Cutting of trees will take place in Areas 1 and 2 before demolition works.

The timing of the works is likely to be held on the following dates:

- Stage 1: February – November 2019
- Stage 2: November 2019 and July 2020.
- Stage 3: July 2020 - November 2020.

5.2 Construction Equipment Noise Source Levels

At this stage, a detailed list of equipment likely to be used during construction was not provided. Therefore, typical equipment expected to be used is assumed in each construction stage and is presented in

Table 5-1. The table also includes the Sound Power Levels of each piece of equipment. Sound Power Level is the noise level at the source and is independent of measurement position. The level presented below assumes the operation of the piece of equipment to be continuous within a 15-minute assessment period.

Table 5-1 Estimated Plant & Activities

Scenario	Estimated Plant	Quantity	Sound Power Level
Demolition & Remediation of Area 1			
1	Hand tools	2	102
	Generator	1	99
	22t Excavator with bucket	2	106
	Delivery Trucks	4 per hour	106
	Screw Piler	1	108
Construction of buildings in Area 1			
2	Concrete Pump	1	103
	Concrete Truck	4 per hour	108
	22t Excavator with bucket	1	106
	Hand tools	3	102
	Generator	1	99
	Crane	1	104
	Delivery Truck	4 per hour	106
Landscape & External Works of Area 1			
3	Delivery Trucks	1	106
	Front End Loader	1	112
	Generator	1	99
	Hand tools	2	102
Demolition & Remediation of Area 2			
4	Hand tools	4	102
	Generator	1	99
	Excavator with hydraulic hammer (medium) attachment	2	118*
	Delivery Trucks	4 per hour	106
	Screw Piler	1	108
Construction of buildings in Area 2			
5	Concrete Pump	1	103
	Concrete Truck	4 per hour	108
	20t Excavator	2	106
	Hand tools	4	102
	Generator	1	99
	Delivery Truck	4 per hour	106
	Crane	1	104
Landscape & External Works of Area 2			
6	Hand tools	2	102
	Generator	1	99
	Front End Loader	1	106
	Delivery Trucks	4 per hour	106
Demolition & Remediation of Area 3			
7	Hand tools	2	102
	Generator	1	99

Scenario	Estimated Plant	Quantity	Sound Power Level
	22t Excavator with bucket	1	106
	Delivery Trucks	1	106
	Landscape & External Works of Area 3		
	Hand tools	2	102
8	Generator	1	99
	Front End Loader	1	106
	Delivery Trucks	1	106
9	Tree Cutting		
	Chainsaws	1	115

*A 5dB penalty for tonal noise is not added onto the hydraulic hammer because we recommend respite be provided from the use of the hammer.

5.3 Construction Noise Levels at Residences

Site related noise emissions were modeled with the "SoundPLAN 8" acoustic noise prediction software using ISO 9613 noise prediction algorithm. Factors that are addressed in the noise modeling are:

- Equipment sound level emissions and location;
- Receiver locations and ground topography;
- Noise attenuation due to geometric spreading;
- Ground absorption; and
- Atmospheric absorption.

Noise modelling has been conducted for each of the scenarios outlined in Section 5.1. The *ICNG* requires predicted noise levels at receivers to be based on 15-minute periods. The modelling assumes a "typical worst-case" scenario whereby all the plant is running continuously.

As such, the modelling represents likely noise levels that would occur during intensive periods of construction. Therefore, the presented noise levels can be considered in the upper range of noise levels that can be expected at surrounding receivers when the various construction scenarios occur.

It is assumed a 2.5m high barrier between Area 1 and Area 2 and 3 remains throughout the duration of the project. In addition to this a 1.8m high barrier on the east side of the Area 1 is also assumed. These barriers are accounted for within the noise prediction model. The barriers are presented in Figure 5-1. The barriers must be continuous and solid in order for acoustic benefit.

Two noise prediction model for each scenario stage was prepared to provide a minimum and maximum noise impact result. The model for each scenario comprised of majority of the construction machine/tools on either the east or west side of the public school. From the two results a minimum and maximum result was determined.

Based on the above, resultant noise levels at receivers have been predicted and are compared against the Noise Management Level (NML), as shown in tables Table 5-2, and Table 5-3. It should be noted the noise prediction at the worst level of a double storey dwelling is presented in the following tables.

DASHED RED LINE INDICATES EXISTING BUILDINGS TO BE DEMOLISHED

ALL EXISTING DEMOUNTABLE BUILDINGS ON SITE TO BE REMOVED

EXISTING BLOCK L TO BE RETAINED AND EXTENDED

EXISTING TREES TO BE REMOVED SHOWN DASHED CIRCLES

REFER TO DEMOLITION NOTE FOR EXISTING TREES DEMOLITION NOTE

Stage 2/3 area - Not part of the contract

Stage 1 boundary line

demountable building on pad footings

asphalt paving to be demolished

EXISTING BUILDINGS TO BE DEMOLISHED

EXISTING PLAY EQUIPMENT TO BE DEMOLISHED

(E) BLOCK A

(E) BLOCK B

(E) BLOCK C

(E) BLOCK D

(E) BLOCK E

(E) BLOCK F

(E) BLOCK G

(E) BLOCK H

(E) BLOCK I

(E) BLOCK J

(E) BLOCK K

(E) BLOCK L

(E) BLOCK M

(E) BLOCK N

(E) BLOCK O

(E) BLOCK P

(E) BLOCK Q

(E) BLOCK R

(E) BLOCK S

(E) BLOCK T

(E) BLOCK U

(E) BLOCK V

(E) BLOCK W

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(E) BLOCK Y

(E) BLOCK Z

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(E) BLOCK LQ

(E) BLOCK LR

(E) BLOCK LS

(E) BLOCK LT

(E) BLOCK LU

(E) BLOCK LV

(E) BLOCK LW

(E) BLOCK LX

(E) BLOCK LY

(E) BLOCK LZ

(E) BLOCK MA

(E) BLOCK MB

(E) BLOCK MC

(E) BLOCK MD

(E) BLOCK ME

(E) BLOCK MF

(E) BLOCK MG

(E) BLOCK MH

(E) BLOCK MI

(E) BLOCK MJ

(E) BLOCK MK

(E) BLOCK ML

(E) BLOCK MM

(E) BLOCK MN

(E) BLOCK MO

(E) BLOCK MP

(E) BLOCK MQ

(E) BLOCK MR

(E) BLOCK MS

(E) BLOCK MT

(E) BLOCK MU

(E) BLOCK MV

(E) BLOCK MW

(E) BLOCK MX

(E) BLOCK MY

(E) BLOCK MZ

(E) BLOCK NA

(E) BLOCK NB

2 DEMOLITION SITE PLAN
1 : 500

Table 5-2 Predicted Noise Impact – Works within Area 1

Receiver ID	Receivers	Scenario 1		Scenario 2		Scenario 3		NML
		Predicted Level		Predicted Level		Predicted Level		
		Min	Max	Min	Max	Min	Max	
S1	Curl Curl North Public School	52	68	55	70	46	67	55
R2	72 Abbott Road	67	76	68	73	53	63	49
R3	17 Lillie Street	66	77	68	74	56	65	49
R4	54 Playfair Road	63	72	65	71	57	63	49
R5	52 Playfair Road	59	71	61	70	55	61	49
R6	50 Playfair Road	58	69	61	68	50	60	49
R7	48 Playfair Road	59	67	59	64	50	60	49
R8	46 Playfair Road	56	65	58	63	47	58	49
R9	44 Playfair Road	55	62	56	60	44	55	49
R10	42 Playfair Road	56	61	57	61	45	56	49
R11	40 Playfair Road	54	60	57	60	45	55	49
R12	38 Playfair Road	51	60	57	59	43	54	49
R13	36 Playfair Road	49	58	54	59	42	50	49
R14	25 Playfair Road	51	57	53	61	42	54	49
R15	7 Ross Street	53	55	54	65	45	49	49
R16	9 Ross Street	56	61	56	72	45	54	49
R17	11 Ross Street	55	61	57	72	45	54	49
R18	13 Ross Street	50	60	51	69	40	52	49
R19	15 Ross Street	51	56	52	64	41	49	49
R20	17 Ross Street	56	59	56	63	45	51	49
R21	19 Ross Street	56	59	56	61	45	51	49
R22	60 Abbott Road	64	78	65	74	49	65	49
R23	58 Abbott Road	62	68	63	67	50	55	49
R24	56 Abbott Road	62	72	64	70	52	59	49
R25	54 Abbott Road	61	65	61	65	50	54	49
R26	52 Abbott Road	59	65	60	65	50	55	49

Table 5-3 Predicted Noise Impact – Works within Area 2

Receiver ID	Receivers	Scenario 4 Predicted Level		Scenario 5 Predicted Level		Scenario 6 Predicted Level		NML
		Min	Max	Min	Max	Min	Max	
S1	Curl Curl North Public School	67	78	63	72	57	65	55
R2	72 Abbott Road	64	67	59	62	53	58	49
R3	17 Lillie Street	62	67	59	61	53	57	49
R4	54 Playfair Road	71	74	65	66	61	65	49
R5	52 Playfair Road	72	75	66	67	62	66	49
R6	50 Playfair Road	72	76	66	67	62	66	49
R7	48 Playfair Road	74	77	67	68	63	67	49
R8	46 Playfair Road	74	77	68	68	63	67	49
R9	44 Playfair Road	75	78	69	69	65	66	49
R10	42 Playfair Road	75	78	69	70	65	67	49
R11	40 Playfair Road	75	77	69	69	64	68	49
R12	38 Playfair Road	74	76	68	69	63	68	49
R13	36 Playfair Road	71	74	66	66	60	67	49
R14	25 Playfair Road	74	75	71	73	65	72	49
R15	7 Ross Street	71	72	66	66	63	70	49
R16	9 Ross Street	76	79	71	71	64	74	49
R17	11 Ross Street	77	81	72	73	65	73	49
R18	13 Ross Street	77	82	72	73	66	70	49
R19	15 Ross Street	79	83	74	74	65	67	49
R20	17 Ross Street	79	81	74	74	63	68	49
R21	19 Ross Street	77	77	73	73	61	69	49
R22	60 Abbott Road	64	69	63	64	54	58	49
R23	58 Abbott Road	64	68	64	64	55	57	49
R24	56 Abbott Road	68	73	67	67	56	56	49
R25	54 Abbott Road	70	72	66	66	56	61	49
R26	52 Abbott Road	66	79	65	73	55	73	49

Table 5-4 Predicted Noise Impact – Works within Area 3

Receiver ID	Receivers	Scenario 7 Predicted Level		Scenario 8 Predicted Level		NML
		Min	Max	Min	Max	
S1	Curl Curl North Public School	46	72	51	71	55
R2	72 Abbott Road	50	59	53	55	49
R3	17 Lillie Street	50	55	51	54	49
R4	54 Playfair Road	54	57	54	56	49
R5	52 Playfair Road	54	58	54	56	49
R6	50 Playfair Road	54	60	55	58	49
R7	48 Playfair Road	55	60	56	58	49
R8	46 Playfair Road	55	60	56	59	49
R9	44 Playfair Road	58	63	59	63	49
R10	42 Playfair Road	62	65	62	66	49
R11	40 Playfair Road	65	66	64	68	49
R12	38 Playfair Road	66	67	65	68	49
R13	36 Playfair Road	65	67	65	68	49
R14	25 Playfair Road	70	71	71	75	49
R15	7 Ross Street	60	71	64	65	49
R16	9 Ross Street	63	75	68	72	49
R17	11 Ross Street	61	75	66	72	49
R18	13 Ross Street	59	73	64	70	49
R19	15 Ross Street	57	70	61	64	49
R20	17 Ross Street	53	64	59	59	49
R21	19 Ross Street	50	60	56	56	49
R22	60 Abbott Road	48	59	53	57	49
R23	58 Abbott Road	51	58	55	56	49
R24	56 Abbott Road	51	58	56	56	49
R25	54 Abbott Road	49	57	54	56	49
R26	52 Abbott Road	51	62	54	57	49

Table 5-5 Predicted Noise Impact – Cutting Trees

Receiver ID	Receivers	Scenario 9 Predicted		NML
		Level		
		Min	Max	
S1	Curl Curl North Public School	66	71	55
R2	72 Abbott Road	60	77	49
R3	17 Lillie Street	61	72	49
R4	54 Playfair Road	61	66	49
R5	52 Playfair Road	61	65	49
R6	50 Playfair Road	60	64	49
R7	48 Playfair Road	59	63	49
R8	46 Playfair Road	59	63	49
R9	44 Playfair Road	58	63	49
R10	42 Playfair Road	57	64	49
R11	40 Playfair Road	57	65	49
R12	38 Playfair Road	54	64	49
R13	36 Playfair Road	54	62	49
R14	25 Playfair Road	56	65	49
R15	7 Ross Street	55	68	49
R16	9 Ross Street	56	71	49
R17	11 Ross Street	59	76	49
R18	13 Ross Street	57	80	49
R19	15 Ross Street	54	79	49
R20	17 Ross Street	56	79	49
R21	19 Ross Street	56	77	49
R22	60 Abbott Road	62	74	49
R23	58 Abbott Road	60	69	49
R24	56 Abbott Road	61	72	49
R25	54 Abbott Road	59	67	49
R26	52 Abbott Road	58	74	49

6 CONSTRUCTION NOISE & VIBRATION DISCUSSION

6.1 Construction Noise Discussion

It was noted that demolition works (Scenarios 1, 4 and 7 of the project) and the tree cutting (Scenario 9) have the most significant noise impact on nearby receivers. Predicted construction levels at some receiver locations are near or exceed the *ICNG's* 75 dB highly affected noise management level. A summary of the maximum noise impact predictions exceeding 75dB at the receivers' location are presented in Table 6-1.

Table 6-1 Construction Noise Prediction Summary over 75dBA

Receiver ID	Receivers	Scenario 1	Scenario 4	Scenario 7	Scenario 9
R2	72 Abbott Road	76	-	-	-
R3	17 Lillie Street	77	-	-	77
R5	52 Playfair Road	-	75	-	-
R6	50 Playfair Road	-	76	-	-
R7	48 Playfair Road	-	77	-	-
R8	46 Playfair Road	-	77	-	-
R9	44 Playfair Road	-	78	-	-
R10	42 Playfair Road	-	78	-	-
R11	40 Playfair Road	-	77	-	-
R12	38 Playfair Road	-	76	-	-
R14	25 Playfair Road	-	75	-	-
R16	9 Ross Street	-	79	75	-
R17	11 Ross Street	-	81	75	-
R18	13 Ross Street	-	82	-	80
R19	15 Ross Street	-	83	-	79
R20	17 Ross Street	-	81	-	79
R21	19 Ross Street	-	77	-	77
R26	52 Abbott Road	-	79	-	-

The primary contributing noise source in Scenario 4 is the hydraulic hammer attached to the excavator. The primary contributing factors in Scenarios 1 and 7 are from various sources including, excavator and hand tools.

Construction noise impacts on the other surrounding receivers exceed the established NML. Details of the noise management for all construction stages are outlined in Sections 7 and 8.

7 CONSTRUCTION NOISE & VIBRATION MANAGEMENT PROCESSES

7.1 Construction Noise & Vibration Mitigation Measures

Without mitigation, noise levels from construction activities have been predicted to exceed the noise management levels nominated in the guidelines at some surrounding receivers. Therefore, noise control measures are recommended to ensure that noise is reduced where feasible.

The following project specific mitigation measures are recommended:

- *Plant Noise Audit* – Noise emission levels of all critical items of mobile plant and equipment should be checked for compliance with noise limits appropriate to those items prior to the equipment going into regular service. To this end, testing should be established with the contractor.
- *Respite* – Operators of the hydraulic hammer during the demolition of buildings within Area 2 should provide respite throughout the day to minimise the likelihood of complaints.
- *Operator Instruction* – Operators should be trained in order to raise their awareness of potential noise problems and to increase their use of techniques to minimise noise emission.
- *Equipment Selection* – All fixed plant at the work sites should be appropriately selected, and where necessary, fitted with silencers, acoustical enclosures, and other noise attenuation measures in order to ensure that the total noise emission from each work site complies with EPA guidelines.
- *Site Noise Planning* – Where practical, the layout and positioning of noise-producing plant and activities on each work site should be optimised to minimise noise emission levels.

The adoption of the above measures is aimed at working towards achieving the noise management levels established at surrounding receivers.

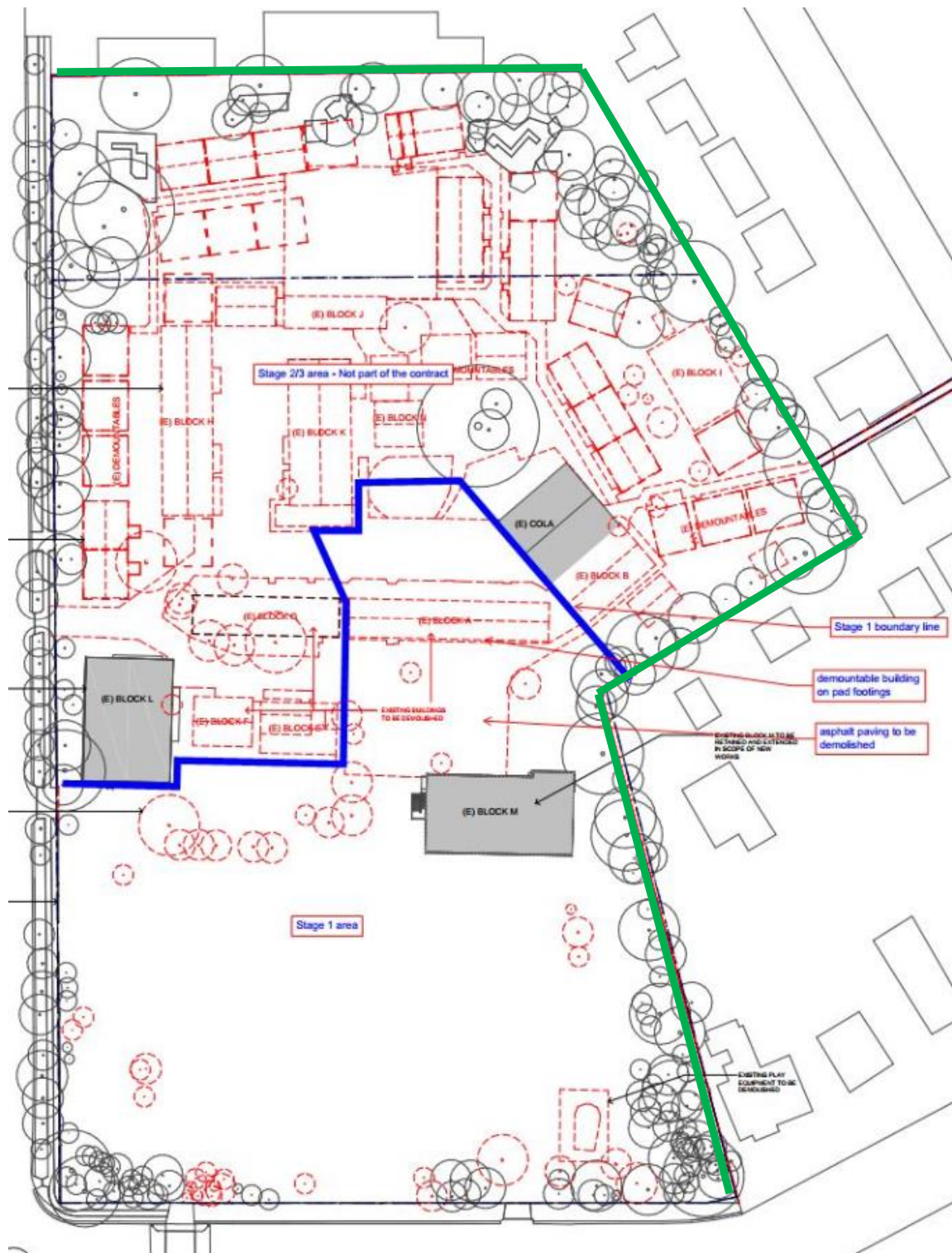
7.2 Additional Noise Barrier

A noise barrier on the north and east boundary should be constructed to attenuate noise emitting from the construction site. The additional barriers should consist of the following properties:

- Layout of the proposed additional barrier (green) is presented in Figure 7-1.
- All joints between noise screen panels should be sealed airtight and should not have an air gap between the screens. If a gap is required underneath the barrier, we recommend that the gap be kept to a minimum so that it is installed close to the ground as much as possible.
- The construction of the proposed noise barrier may be from 9mm thick compressed fibre cement panel or similar material (ie plywood) provided the density is greater than 10kg/m².
- The height of the barrier should be no less than **1.8 metres**.

It should be noted, a barrier on the west side of the public school does not provide much noise attenuation. It is predicted the proposed noise barrier can provide up to 5dB noise reduction during the works within Area 3 and up to 7dB during works within Area 2.

Figure 7-1 Additional Noise Barrier



7.3 Community Consultation

Consultation with and the provision of information to the surrounding community is regarded as a major factor in controlling the negative reaction to the inevitable impacts associated with construction works.

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon including the builder, neighbours and apartment building residents. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation process is to:

- Inform and educate the groups about the project and the noise controls being implemented;
- Increase understanding of all acoustic issues related to the project and options available;
- Identify group concerns generated by the project, so that they can be addressed; and
- Ensure that concerned individuals or groups are aware of and have access to the Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular information regarding the proposed works and period when they will be required to be conducted should be provided to neighbouring receivers.

7.4 Response to Complaints

Should ongoing complaints of excessive noise and vibration impacts occur measures shall be undertaken to investigate the complaint, the cause of the complaint identified and changes to work practices implemented. In the case of exceedances of the vibration limits, all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise and vibration complaint is received the complaint should be recorded. The complaint form should list:

- The name and location of the complainant (if provided);
- The time, date and nature of the complaint was received;
- The name of the employee who received the complaint and actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action by a consultant or as detailed in this report; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held. All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable:

- measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity; and
- whether work practices were being carried out either within established guidelines or outside these guidelines.

7.5 Environmental Inductions

It is important that an induction is provided to all site personnel, contractors and sub-contractors with an emphasis on understanding and managing impacts. This should include the location of sensitive receivers, specific mitigation measures, site hours and complaints procedure.

7.6 Vibration Control Measures

For this project the operation of piling rigs and particularly the use of excavator mounted hydraulic hammers have the potential to transmit vibration likely to cause annoyance to nearby receivers, particularly for receivers located on the east side of the school site. Structural damage vibration criteria are much higher than human comfort criteria, particularly commercial buildings.

Table 7-1 sets out the typical ground vibration levels at various distances for safe working distances (extracted from the TfNSW *Construction Noise Strategy*).

Table 7-1 Recommended Safe Working Distances for Vibration Intensive Plant

Item	Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Small Hydraulic Hammer	(300 kg – 5-12t excavator)	2m	7m
Medium Hydraulic Hammer	(900 kg – 12-18t excavator)	7m	23m
Large Hydraulic Hammer	(1600 kg – 18-34t excavator)	22m	73m
Bored Piling	≤ 800mm	2m (nominal)	N/A

Based on the guideline above, intensive vibration works associated with the use of a hydraulic hammer may potentially cause annoyance to receivers on the east side during construction Scenario 6 – demolition works within Area 2.

Where determined necessary, attended vibration monitoring of typical maximum peak particle velocity levels associated with particular plant items should be measured in all three orthogonal directions. Where possible, extraneous events should be excluded from the results, or highlighted in accompanying notes.

Vibration monitoring of construction activities will be conducted by a qualified acoustic consultant during any stages of construction works where vibration generation is considered by the Contractor to be likely. Monitoring shall be carried out at locations representative of affected receivers over a recommended minimum 15 minutes period during intensive vibration works.

The results of measurements will be documented along with any recommendations for mitigation. Any mitigation will be determined in consultation with the site Project Manager.

Monitoring must be conducted with equipment holding current calibration certification and capable of measuring PPV in all three orthogonal directions. The time of day, duration and weather shall be noted as well as the contribution from construction activities.

8 SUMMARY OF MITIGATION MEASURES

8.1 Noise Control Measures

The noise and vibration mitigation measures to be implemented by the building contractor are summarised in Table 8-1.

Table 8-1 Noise and Vibration Mitigation Measures

Item	Description
Construction Hours	Works will be carried out within the approved construction hours.
Deliveries	Deliveries will be carried out within the approved construction hours.
Site Layout	Where possible, plant and equipment will be located and orientated to direct noise away from sensitive receivers.
Quietest Suitable Equipment	Plant and equipment will be selected to minimise noise emission, where possible, whilst maintaining efficiency of function. Residential grade silencers will be fitted, and all noise control equipment will be maintained in good order.
Respite	Provide respite from intensive construction work (i.e. use of hydraulic hammer). Respite should also be considered for the school and in particular during specific school events/exams etc.
Reversing Alarms	Mobile plant and trucks operating on site for a significant portion of the project will have reversing alarm noise emissions minimised, where possible, recognising the need to maintain occupational safety standards. Alternatives to standard reversing alarms are to be considered.
PA System	No public address system will be used at this site.
Vibration Buffer Zones	General safe working distances for vibration intensive activities are described in Table 7-1 . Monitoring is recommended to confirm these buffer zones at locations where buildings are closest.
Vibration Monitoring	Vibration monitoring will be carried out where any vibration intensive activities are required to be carried out within the established buffer zones, or where there is considered to be a risk that vibration levels may exceed the relevant structural damage criteria.
Truck Noise (off site)	All trucks regularly used for the project are to have mufflers and all noise control equipment will be maintained in good working order. Trucking routes will use main roads, where feasible.
Community Liaison	A programme of community liaison and complaint response will be implemented.
Training	Site induction training will include a noise awareness component.

9 CONCLUSION

A review of potential noise and vibration impacts associated with the redevelopment project located at Curl Curl North Public School, Corner Playfair Road and Abbott Road, has been conducted. Identification of nearby receivers, construction noise impact prediction and noise control measures have been provided in this assessment.

It was noted, significant noise impact was predicted during Stages 1, 4, 7 and 9 of the construction works. The primary contributing noise source in Scenario 4 is the hydraulic hammer attached to the excavator. The primary contributing noise sources in Scenarios 1 and 7 are from various sources including, excavator and hand tools, and from Scenario 9 is the chainsaw.

Following an assessment and predictions (noise and vibration), it is likely that the works will, at times, impact upon the neighbouring residential receivers.

Sections 7 and 8 of this report specifically outline mitigation measures and the management of potentially adverse impacts during potentially high noise – generating construction works.