MATTHEW PALAVIDIS
VICTOR FATTORETTO
MATTHEW SHIELDS

Westmead Children's Hospital MSCP

Construction Noise and Vibration Sub-Plan (CNVMSP)

SYDNEY
9 Sarah St
MASCOT NSW 2020
(02) 8339 8000

ABN 98 145 324 714
www.acousticlogic.com.au

Project ID	20220264.1
Document Title	Construction Noise and Vibration Sub-Plan
Attention To	Kane Constructions Pty Ltd

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	18/03/2022	20220264.1/1803C/R0/TH	TH		VF

TABLE OF CONTENTS

B13 Consent Satisfaction Table

Condition	Condition requirements	Document reference
B13	The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:	
	(a) be prepared by a suitably qualified and experienced noise expert;	Appendix A
	(b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);	Section 9
	(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;	Section 9.3
	(d) include strategies that have been developed with the community for managing high noise generating works;	Section 10
	(e) describe the community consultation undertaken to develop the strategies in condition B14;	Section 10
	(f) include a complaints management system that would be implemented for the duration of the construction; and	Section 10.1, 10.2
	(g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B11.	Section 9.7.7 & 9.7.8

1 INTRODUCTION

This report presents our assessment of the processes which will be followed in order to manage noise and vibration from construction activities associated with the development of Westmead Children's Hospital MSCP. This report is pursuant to development consent SSD conditions B13 for the provision of a Construction Noise and Vibration Management Sub-Plan.

The principal objective of this study is to undertake an evaluation of work to be performed during construction phases and forecast potential impacts of noise and vibration. The evaluation will be used to formulate and streamline effective regulation and mitigation measures.

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

- Specific activities that will be conducted and the associated noise/vibration sources.
- Identification of potentially affected noise/ vibration sensitive receivers.
- The development, hours of work and excavation period.
- The construction noise requirements specified in consent condition B13.
- Noise/ vibration response procedures,
- Assessment of potential noise/ vibration from the proposed construction activities; and

Contingency plans to be implemented in the event of non-compliances and/or noise complaints.

2 SITE DESCRIPTION & PROPOSED DEVELOPMENT

The proposed works involves construction of structure and external/landscaping works for a multi-storey carparking facility.

Construction works will provide for 8 levels of car parking to accommodate approximately 1000 car parking spaces. This is to meet current and future growth demands within the hospital precinct.

The work generally involves ground/foundation works, erection of the new multi-story structure as well as associated civil/landscaping works to the site surrounds.

The previously conducted *SSDA Acoustics Report* prepared by Stantec dated 1st April 2021 (ref: 44311-1) indicates that nearest affected receivers are as follows:

- **R1:** Residential receivers north of Redbank Creek, east of Redbank Road.
- **C1:** Industrial uses - north of Redbank Creek, east of Redbank Road.
- **C2:** Industrial uses - north of Redbank Creek, west of Redbank Road.
- **S1:** 'Ronald McDonald House' short-term accommodation, directly adjacent the north-eastern site boundary.
- **H1:** Children's Hospital Westmead (CHW) buildings, to the east and south of the project site.
- **H2:** Westmead Hospital buildings, to the west and south of the project site.

An aerial photo of the site, monitoring locations and surrounding receivers is shown below in Figure 1. This image is taken from the site SSDA Acoustics Report prepared by Stantec (ref: 44311-1).

Figure 1 – Overview of site and surrounds, measurement locations and surrounding developments (obtained from SSDA Acoustics Report prepared by Stantec (ref: 44311-1))

3 ACTIVITIES TO BE CONDUCTED AND ASSOCIATED NOISE SOURCES

The construction period has been divided into the main work phases along with the primary noise producing equipment and activities likely to occur in each phase.

3.1 FOUNDATION WORKS

This stage will include the following noise intensive works:

- Excavator (up to 20 tonnes) – minor earthworks limited to detailing and trimming.
- Piling
- Hand tools – Saw cutters, Impact drills, electric drills and angle grinders.
- Electric powered tower crane.
- Hand tools – Saw cutters, Impact drills, electric drills, hammering (jack hammers) and angle grinders; and
- Materials handling.

3.2 STRUCTURE, ENVELOPE & INTERNAL FIT-OUT

Construction stage will include erection of the building structure, followed by internal fit out works and general landscaping. Typical activities during this stage include:

- Hand tools – Saw cutters, Impact drills, electric drills and angle grinders.
- Concrete pump, concrete truck and associated concrete vibrators.
- Trucks, trailers and forklifts delivering materials and removing spoil from site.
- Electric powered tower crane.
- Operation of mobile plant (i.e. bob cats and scissor lifts).

3.3 EXTERNAL WORKS & LANDSCAPING

- Hand tools – Saw cutters, Impact drills, electric drills and angle grinders.
- Concrete pump, concrete truck and associated concrete vibrators.
- Trucks, trailers and forklifts delivering materials and removing spoil from site.
- Operation of mobile plant (i.e. bob cats and scissor lifts).

4 HOURS OF WORK AND DURATION

4.1 HOURS OF WORK

Consent conditions C4-C8 stipulates that construction hours are limited as follows:

Construction Hours	
C4	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, Mondays to Fridays inclusive; and (b) between 8am and 1pm, Saturdays. No work may be carried out on Sundays or public holidays.
C5	Notwithstanding condition C4, provided noise levels do not exceed the existing background noise level plus 5dB, works may also be undertaken during the following hours: between 1pm and 5pm, Saturdays.
C6	Construction activities may be undertaken outside of the hours in condition C4 and C5 if required: (a) by the Police or a public authority for the delivery of vehicles, plant or materials; or (b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or (c) where the works are inaudible at the nearest sensitive receivers; or (d) for the delivery, set-up and removal of construction cranes, where notice of the crane-related works is provided to the Planning Secretary and affected residents at least seven days prior to the works; or (e) where a variation is approved in advance in writing by the Planning Secretary or his nominee if appropriate justification is provided for the works.
C7	Notification of such construction activities as referenced in condition C6 must be given to affected residents before undertaking the activities or as soon as is practical afterwards
C8	Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours: (a) 9am to 12pm, Monday to Friday; (b) 2pm to 5pm Monday to Friday; and (c) 9am to 12pm, Saturday.

A summary of approved construction hours is provided in Table 1 below:

Table 1 – Summary of Approved Construction Hours

Construction Activity	Development Consent Condition	Day of the Week – Permitted Times		
		Monday - Friday	Saturday	Sunday & Public Holidays
Construction and delivery of materials to and from site	C4	7:00am – 6:00pm	8:00am – 1:00pm	None permitted.
Construction and delivery of materials to and from site	C5 (BG+5 noise limit)	N/A	1:00pm – 5:00pm	None permitted
Rock breaking, rock hammering, sheet piling, pile driving	C8	9:00am – 12:00pm, and 2:00pm – 5:00pm	9:00am – 12:00pm	None permitted

5 EXISTING BACKGROUND NOISE LEVELS

Long term unattended noise logging and attended noise measurements were previously conducted at SSDA stage in order to quantify the existing local acoustic environment. These measurements are detailed in the SSDA Acoustics Report prepared by Stantec (ref: 44311-1) and are summarised below:

Table 2 – Unattended Long-Term Noise Monitoring

Monitor Location	Measured Noise Level – Time of Day		
	Daytime (7am – 6pm)	Evening (6pm -10pm)	Night (10pm – 7am)
L1 (refer Figure 1)	51 dB(A)$L_{eq(Period)}$ 43 dB(A)$L_{90(Period)}$	52 dB(A)$L_{eq(Period)}$ 43* dB(A)$L_{90(Period)}$	48 dB(A)$L_{eq(Period)}$ 42 dB(A)$L_{90(Period)}$

*44dB(A) measured.

6 CONSTRUCTION NOISE AND VIBRATION EMISSION MANAGEMENT LEVELS

6.1 NOISE MANAGEMENT LEVELS

Noise emissions associated with construction activities on the project site to external areas of receivers will be assessed in with reference to the following:

- Development Consent Condition B13
- NSW EPA's I*nterim Construction Noise Guideline (DECC, 2009),*
- Protection of the Environment Operations Act 1997,
- Australian Standard AS2436:2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites.

6.1.1 Development Consent Condition B13

Consent conditions state the following with respect to construction nose limits:

Construction Noise Limits

C13	The development must achieve the construction noise management levels during construction as detailed in the Interim Construction Noise Guideline (DECC, 2009). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures identified in the approved Construction Noise and Vibration Management Plan.

We note that DECC noise management levels as detailed in the Interim construction Noise Guideline (ICNG) are *not* regulatory stop-work limits. This is discussed further in section 6.1.2 below.

6.1.2 2009 NSW Environmental Protection Authority (EPA) document – "Interim Construction Noise Guideline (ICNG) 2009"

The EPA's ICNG assessment requires:

- Review of noise levels at nearby development
- If necessary, recommendation of noise control strategies in the event that compliance with noise emission goals is not possible.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences for construction during the recommended standard hours:

- "*Noise Affected" level* – Where construction noise is predicted to exceed the "noise affected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the noise affected level. For residential properties, the noise affected level occurs when construction noise exceeds the rating background noise level by more than 10dB.
- "*Highly Noise Affected" level* – Where noise emissions are such that nearby properties are "highly noise affected", noise controls such as respite periods should be considered. For residential properties, the highly noise affected level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

The guideline also provides external management levels for land used for commercial or industrial purposes to be assessed at the most affect occupied point of the premises. EPA guidelines recommend a construction noise management level for industrial receivers of 75dB(A)$L_{eq(15\text{-}minute)}$.

Section 4.1.2 of the guideline provides that, for other sensitive land uses such as classrooms at educational institutions, the noise management level should not exceed 45 dB(A) internally.

6.1.3 Protection of the Environment Operations Act 1997,

We note that, in the absence of specific noise limits provided in the Protection of the Environment Operations Act 1997 with respect to construction noise, it is considered that adherence to the requirements of the NSW EPA's ICNG is sufficient in the assessment of 'offensive noise'.

6.1.4 Construction Noise Management Levels Summary

Nosie management levels applicable to the development site and surrounding receivers are summarised in the following tables.

Table 3 – Construction Noise Emission Management Levels – External of Westmead Hospital Precinct

Receiver Type	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Receivers (R1)	Background + 10dB(A) (Standard Construction Hours)	75
Commercial Receivers (C1 & C2)	**Noise Management Level - dB(A)$L_{eq(15min)}$**	
	70	

In determining appropriate noise management levels for areas within the hospital precinct construction noise management levels are provided below:

Table 4 – Construction Noise Emission Management Level (Other)

Receiver Type	Noise Management Level - dB(A)$L_{eq(15min)}$
H1 & H2 – Children's Hospital Westmead	80*
S1 –Short-term Accommodation 'Ronald McDonald House'	80*

*Based on an AS2107+5dB(A) internal noise level and a 30dB(A) reduction across a fixed/closed façade.

6.1.5 Australian Standard AS2436:2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites

Australian Standard AS2436 does not provide specific noise management targets. The guideline focuses on strategies for developing feasible and reasonable mitigation methodologies, management controls and community liaison to reach realistic compromises between the needs of construction activities and potentially affected receivers.

For the control and regulation of noise from construction sites AS2436:2010 *Guide to noise control on construction, maintenance and demolition sites* nominates the following:

- That reasonable suitable noise management objectives are established.
- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating demolition hours, and

6.2 VIBRATION OBJECTIVES

Development consent conditions state the following with respect to vibration:

Vibration Criteria	
C16	Vibration caused by construction at any residence or structure outside the site must be limited to: (a) for structural damage, the latest version of DIN 4150-3 (1992-02) Structural vibration - Effects of vibration on structures (German Institute for Standardisation, 1999); and (b) for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006) (as may be updated or replaced from time to time).
C17	Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C16.
C18	The limits in conditions C16 and C17 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition B13 of this consent.

The criteria and the application of the guidelines mentioned in condition C16-18 are discussed in separate sections below.

6.2.1 German Standard DIN 4150-3 (1999-02) - Ground Borne Vibrations and Damage Limits

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 5.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 5 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in 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 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

6.2.2 Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006) - Managing Assessing Impacts

Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration within the excavation/construction site.

Table 6 – EPA Recommended Vibration Criteria

Place	Time	RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
		Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Critical Working Areas	**Daytime**	0.005	0.01	0.1	0.2	0.14	0.28
Residences		0.01	0.02	0.2	0.4	0.28	0.56
Offices		0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
Impulsive Vibration							
Critical Working Areas	**Daytime**	0.005	0.01	0.1	0.2	0.14	0.28
Residences		0.3	0.6	6.0	12.0	8.6	17.0
Offices		0.64	1.28	13.0	26.0	18.0	36.0
Workshops		0.64	1.28	13.0	26.0	18.0	36.0

7 ASSESSMENT OF NOISE EMISSIONS

7.1 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

We have been advised of the typical equipment/processes anticipated to be used on the project site. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers will be predicted based on the A-weighted sound power levels outlined in the table below.

Table 7 – Equipment Sound Power Levels

EQUIPMENT /PROCESS	SOUND POWER LEVEL dB(A)
Excavator with Bucket (up to 20 tonnes)	100
Concrete Saw	105
Bobcat	100
Heavy Trailers (idling)	95
Piling Plant	103
Concrete Pump	105
Concrete Vibrators	100
Hand Tools (Used Externally)	100
Work Zone (Forklifts, Trucks, etc.)	95
Crane (electric)	95

***Noise levels take into account correction factors (for tonality, intermittency where necessary).**

The noise levels presented in the above table are derived from the following sources:

1. On-site measurements;
2. Table D2 of Australian Standard 2436-1981 & Table A1 of Australian Standard 2436-2010; and
3. Data held by this office from other similar studies.

7.2 NOISE EMISSION PREDICTIONS AND ASSESSMENT

7.2.1 Methodology

Noise generated by plant and equipment will be managed to generally comply with the nominated noise management levels, and where this noise goal may be exceeded, noise will be managed based on principles consistent with Australian Standard 2436.

Predictions of noise levels at the sensitive receivers identified have been made of the construction processes with the potential to produce significant noise.

It is noted that many of the noise sources are present over a small period of the day or may be present for a few days with a significant intervening period before the activity occurs again.

7.2.2 Predicted Noise Levels

An assessment of the principal sources of noise emission has been undertaken to identify the activities that may produce noise and/or vibration impacts so that appropriate ameliorative measures can be formulated.

Noise levels from construction works have been predicted at the surrounding receivers and assessed against the construction noise management levels set out in Section 6. Refer to tables below for predicted noise levels for each receiver.

It is noted that:

- Many of the noise sources are present over a small period of the day or may be present for a few days with a significant intervening period before the activity occurs again. This assessment assumes all items of plant operate continuously over a 15minute period. As such, this is a decidedly conservative assessment.
- The distance between the noise source and the receiver.
- The screening effected provided by any remaining building structure/shell and topography.
- Proposed A class hoarding will provide additional screening benefit.

Table 8 – Predicted Noise Emissions to R1 Residential Receivers

Activity	Predicted Level dB(A)$L_{10(15\text{-minute})}$	Noise Management Level	Comment
Excavator with Bucket (up to 20 tonnes)	47 to 54	**NSW EPA *Interim Construction Noise Guideline*** **Residential Areas** Noise Affected Level: 53 dB(A)$L_{eq(15min)}$ (for condition C4 approved hours) 48 dB(A)$L_{eq(15min)}$ (for condition C5 approved hours) Highly Noise Affected Level: 75dB(A)$L_{eq(15min)}$ (Assessed at property boundary)	See discussion in Section 7.3.
Concrete Saw	47 to 54		
Bobcat	47 to 54		
Heavy Trailers (idling)	42 to 49		
Piling Plant	48 to 55		
Concrete Pump	52 to 59		
Concrete Vibrators	47 to 54		
Hand Tools (Used Externally)	45 to 52		
Work Zone (Forklifts, Trucks, etc.)	45 to 49		
Crane (electric)	43 to 49		

Table 9 – Predicted Noise Emissions to S1 Receivers 'Ronald McDonald House'

Activity	Predicted Level dB(A)$L_{10(15\text{-minute})}$	Noise Management Level	Comment
Excavator with Bucket (up to 20 tonnes)	50 to 67	80 dB(A)$L_{eq(15min)}$ (Assessed at building facade)	See discussion in Section 7.3.
Concrete Saw	51 to 68		
Bobcat	50 to 67		
Heavy Trailers (idling)	45 to 62		
Piling Plant	52 to 69		
Concrete Pump	55 to 72		
Concrete Vibrators	50 to 67		
Hand Tools (Used Externally)	49 to 66		
Work Zone (Forklifts, Trucks, etc.)	45 to 63		
Crane (electric)	47 to 53		

Table 10 – Predicted Noise Emissions to C1 & C2 Commercial Receivers

Activity	Predicted Level dB(A)$L_{10(15\text{-minute})}$	Noise Management Level	Comment
Excavator with Bucket (up to 20 tonnes)	47 to 53	**NSW EPA *Interim Construction Noise Guideline*** **Commercial Areas** Noise Management Level: 70dB(A)$L_{ed(15min)}$ (Assessed at property boundary)	See discussion in Section 7.3.
Concrete Saw	47 to 53		
Bobcat	47 to 53		
Heavy Trailers (idling)	42 to 48		
Piling Plant	48 to 54		
Concrete Pump	52 to 58		
Concrete Vibrators	47 to 53		
Hand Tools (Used Externally)	45 to 51		
Work Zone (Forklifts, Trucks, etc.)	43 to 49		
Crane (electric)	41 to 47		

Table 11 – Predicted Noise Emissions to H1 & H2 Receivers

Activity	Predicted Level dB(A)$L_{10(15\text{-minute})}$ (Internal)	Noise Management Level	Comment
Excavator with Bucket (up to 20 tonnes)	50 to 64	80 dB(A)$L_{eq(15min)}$ (Assessed at building facade)	See discussion in Section 7.3.
Concrete Saw	51 to 64		
Bobcat	50 to 64		
Heavy Trailers (idling)	45 to 59		
Piling Plant	52 to 65		
Concrete Pump	55 to 69		
Concrete Vibrators	50 to 64		
Hand Tools (Used Externally)	49 to 62		
Work Zone (Forklifts, Trucks, etc.)	45 to 59		
Crane (electric)	47 to 53		

7.3 DISCUSSION – NOISE

Predicted construction noise levels to surrounding receivers, as presented in tables above, are summarised and discussed below:

7.3.1 R1 - Residential Receivers

Construction noise impacts to residential receivers to the north of site are expected to intermittently exceed the noise affected level (NAL) when operating the following plant or undertaking the following processes:

- Excavator with bucket attachment
- Concrete saw
- Piling works
- Bobcats
- Concrete Pumps
- Concrete Vibrators

Exceedances from the use of the above are expected when operated/undertaken near to the northern site boundary. Generally, noise levels would be below the NAL.

In is not expected that the 'Highly Noise Affected Level' (HNAL) will be exceeded from any process at surrounding residential locations.

All proposed construction activities have the potential to exceed a BG+5 noise level during C5 hours. The use of mobile plant and powered hand tools is predicted to be below this limit where operated away from the northern site boundary or otherwise screened by the building form or site boundary hoarding.

7.3.2 C1 & C2 – Commercial Receivers

Noise levels from the proposed construction activities are not expected to exceed the 70dB(A) noise management at commercial receiver boundaries.

7.3.3 S1 – Short-term Accommodation 'Ronald McDonald House'

Construction activities are predicted to be below the adopted NML at this location.

7.3.4 H1 & H2 – Hospital Receivers

Construction activities are generally predicted to be below the adopted NML at this location.

7.3.5 Generally

Noise levels predicted to residences occasionally exceed EPA recommended noise management levels however, proposed activities are intermittent and will generally occur over a limited time period.

8 GROUND VIBRATION IMPACTS

Bulk excavation and groundworks is to be undertaken by others prior to use of site by Kane. The most vibration intensive works proposed by Kane will be pilling works for the foundations of structure. If piling is in soil, it is not typically expected to create vibration levels exceeding EPA guidelines.

Given the distance of the development site from residential receivers to the north, vibration levels are unlikely to exceed structural damage or amenity vibration criteria.

It is expected that piling works will be occurring near to adjacent buildings within the Westmead Hospital (H1&H2) site including the Ronald McDonald House (S1).

Due to the proximity of these works, it is recommended that vibration monitoring occur during the initial stage to confirm vibration criteria are not exceeded. Elsewhere, if complaints are received as a result of vibration impacts, the complaints procedure listed in Section 10 should be followed and, where required, vibration monitoring should be implemented.

8.1 SAFEGUARDS TO PROTECT SENSITIVE STRUCTURES

It is impossible to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers. This is because vibration level is principally proportional to the energy impact which is unknown nature of terrain in the area (type of soil), drop weight, height etc.

A suitably qualified acoustic consultant should undertake monitoring of initial excavation process when conducted near potentially affected receivers to ensure that vibration criteria set out in section 5 are not exceeded.

8.2 VIBRATION MONITORING

In the event of complaints or concern for structural damage to nearby buildings, vibration monitors can be installed during the key stages.

The monitors are proposed to be fitted with GSM modem and remotely signal up to five mobile phones indicating any exceedance of the prescribed vibration criteria to enable immediate notification to be sent to the contractor when vibration thresholds are approached.

We note, it is impossible to predict the vibrations induced by the excavation/construction operations on site at potentially affected receivers. However, the total vibration emissions are to be limited with real-time alarm notification given to the plant operators to ensure that the vibration limits are not exceeded. Based on feedback from the real-time monitoring system, the plant operators will be able to modify their operations to ensure the vibrations are kept within acceptable limits.

8.2.1 Vibration Monitoring Download

Downloading of the vibration logger will be conducted on a regular basis. In the event exceedance of vibration criteria or alarms occur, downloading of the logger will be conducted more frequently. Results obtained from the vibration monitor will be presented in a graph format and will be forwarded to the client for review. It is proposed that reports are provided fortnightly with any exceedance in the vibration criteria reported as detailed in this report.

8.2.2 Vibration Monitoring Reports

A fortnightly report will be submitted to the client via email summarising the vibration events. The vibration exceedance of limit is recorded the report shall be submitted within 24 hours. Complete results of the continuous vibration logging will be presented in fortnightly reports including graphs of collected data.

9 SPECIFIC NOISE CONTROLS

9.1 STATIC PLANT

If required, additional noise reduction can be achieved by erecting solid barriers around static plant such as diesel generators and any stationary concrete pumps.

The use of electric powered tower crane means that enclosing of crane motors or fitting of exhaust mufflers is not required. Adopting quieter plant is effective in reducing the noise emitted from its operation.

9.2 CONCRETE PUMPS, PILING PLANT

Noise from concrete pumps and piling rigs have the potential to result in intermittent exceedances of allowable noise levels. Screw piling is recommended above hammer or vibro-piling which pose greater risk of exceeding vibration criteria and noise management levels.

Concrete pumps should not be operated prior to 7:30 am and be placed as close as possible to the middle of the site (where feasible) to reduce proximity to the nearby receivers or otherwise near to site boundary hoardings which will also maximise noise reduction from screening.

We note that operational limits for piling are inherently addressed in consent condition C8.

9.3 VIBRATORY ROLLERS & COMPACTORS

Consent condition 17 stipulates vibratory compactors are not to be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C16.

Given that the nearest residence is approximately 80m from site, the use of compactor plant would be considered acceptable under the requirements of the development consent.

Notwithstanding, we recommend that only non-vibratory rollers be used on site, and that sample vibration measurements be undertaken to confirm compliance with DIN 4150-3 and EPA criteria prior to the use of other compacting plant.

9.4 ACOUSTIC BARRIERS

The placement of barriers at the source is generally only effective for static plant (i.e. diesel generators). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source. Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15 dB(A) can be affected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8 dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

Screens around work areas will provide no material benefit for multi storey receivers as these will overlook screening.

9.5 OTHER ACTIVITIES

In the event of complaint, noise management techniques identified in this report should be employed to minimise the level of noise impact if management levels are found to be exceeded. This may include additional community consultation and re-scheduling of loud construction processes.

Notwithstanding above, general management techniques and acoustic treatments are included in Section 9.6 which may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

9.6 GENERAL RECOMMENDATIONS

Other noise management practices which may be adopted are discussed below. In addition, notification, reporting and complaints handling procedures should be adopted as recommended in this report.

9.6.1 Treatment of Specific Equipment

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

9.6.2 Material Handling

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

9.6.3 Selection of Alternate Appliance or Process

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying out this activity by use of bulldozers ripping and/or milling machines lower levels of noise will result.

9.6.4 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers. Construction vehicles accessing the site should not queue in residential streets and should only use the designated construction vehicle routes. Loading of these vehicles should occur as far as possible from any sensitive receiver.

9.6.5 Management Training

All site managers should be aware of noise and vibration limits, applicable control measures and methods. They should ensure that all agreed noise and vibration measures are carried out by employees and sub-contractors.

A copy of the Noise Management Plan is to be available to contractors, and site inductions should detail the site contact in the event of noise complaints.

9.6.6 Respite Periods

We note that development consent condition C8 provides specific time periods in which plant or activities with the potential to exceed noise management levels are permitted to operate. This inherently provides periods, subsequently reducing the occurrence and severity of noise impacts to surrounding receivers.

The respite periods would apply to very noisy works exceeding the highly noise affected management levels or as stipulated for the activities included in Condition C8. It is noted that the only activities predicted to exceed the HNML's are those described in C8.

It is noted that, although DA hours allow for Saturday works, Kane have proposed a 5-day working week program which will provide further respite from construction activities for patients and families within the hospital precinct on Saturdays.

9.6.7 Noise Monitoring

Noise monitoring can be undertaken to determine the effectiveness of measures which are been implemented, whilst the results of monitoring can be used to devise further control measures.

Attended noise measurements can be undertaken at key stages (i.e; piling, first major concrete pour) when particularly noise generating activities are undertaken or specific items of plant are in operation.

Attended noise measurements are to be conducted in accordance with Australian Standard AS1055: 2018 *'Acoustics- Description and measurement of environmental noise'*, and should include the following:

- Type 1 or 2 sound meter (calibrated)
- Use of appropriate noise descriptor (in this case, $L_{eq(15min)}$).
- Detail of measurement position and proximity to reflecting surface if any (building or similar). Measurement positions will typically be a residential property boundary.

Monitoring not be should be conducted under adverse weather conditions. The conditions applying at the time of the measurements should be indicated in the reporting.

9.6.8 Vibration Monitoring

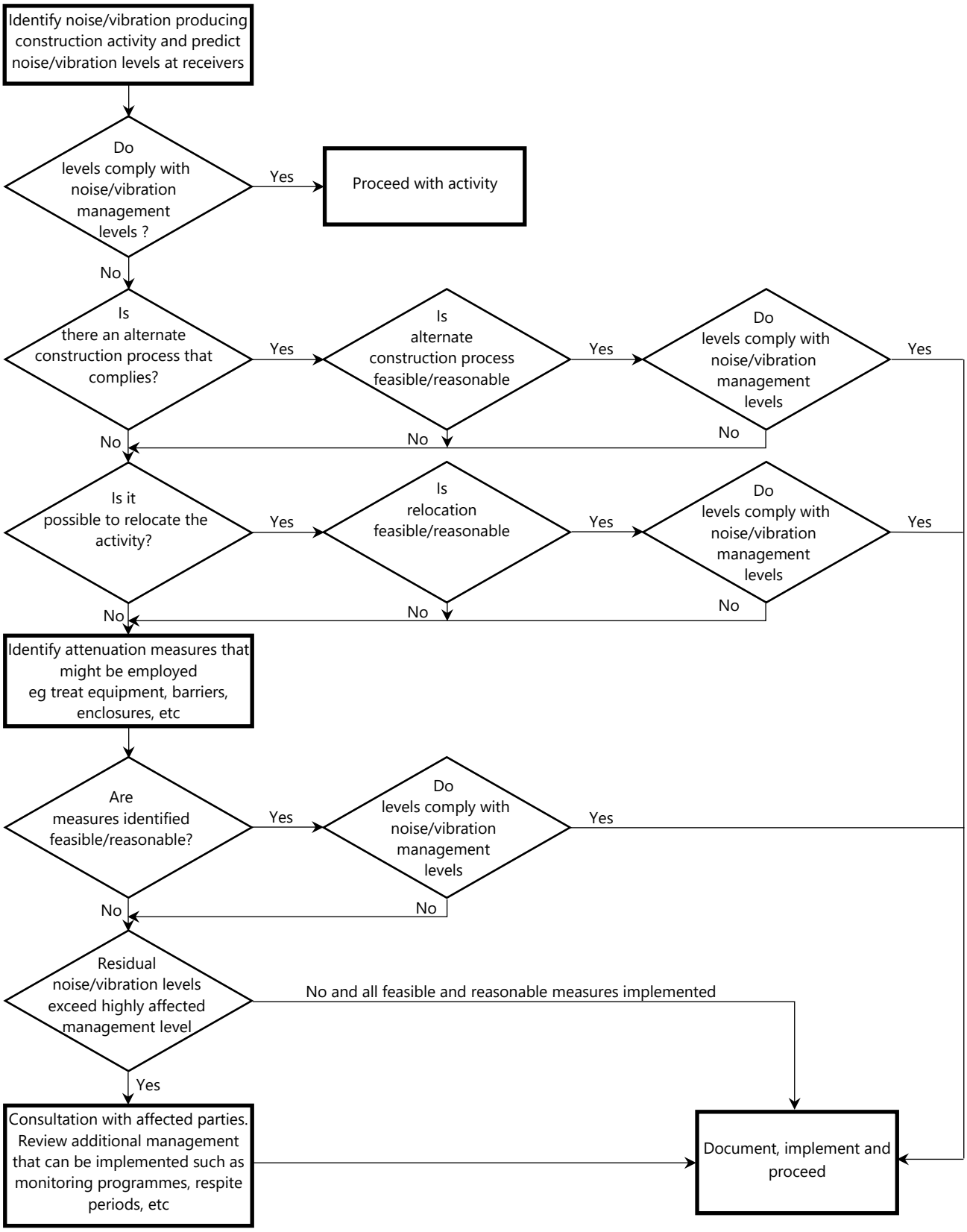
Vibration monitoring should occur at the nearby Ronald McDonald (S1) and Westmead Hospital (H1&H2) buildings during pilling works.

The measurement location should be near the middle of the common boundary between the two properties, or as otherwise determined from time to time to best measure representative vibration levels. The monitor used should log the peak particle velocities and also transmit SMS warnings to the contractor and acoustic expert if a pre-determined threshold is exceeded. Regular reports should be provided (twice monthly) showing the vibration levels recorded and comparing these to the criteria.

Attended or unattended monitoring should also be undertaken at other locations in response to complaints, or as needed to confirm the use of additional plant/processes with the potential to exceed vibration criteria.

9.7 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

The flow chart presented below illustrates the process that should be followed in assessing construction activities.



9.8 DEALING WITH OFFENSIVE NOISE LEVELS

Should ongoing complaints of excessive noise occur, immediate measures shall be undertaken to investigate the complaint, the cause of noise exceedances and identify the required changes to work practices.

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.

All complaints or offensive noise 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 offensive noise shall involve where applicable:

- noise measurements at the affected receiver.
- an investigation of the activities occurring at the time of the incident.
- inspection of the activity to determine whether any undue noise is being emitted by equipment.
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

10 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

10.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

Consent Condition B3 states the following with respect to community interaction:

B13. The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:

(a) be prepared by a suitably qualified and experienced 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 B13(d);

(f) include a complaints management system that would be implemented for the duration of the construction; and

(g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B13.

Consultation Requirements under the SSDA Conditions

MSCP Condition B13 states that the Plan should be prepared in consultation with the relevant government organisations and surrounding stakeholders. These include:

- NSW Health
    - Western Sydney Local Health District (WSLHD) and Westmead Adult's Hospital.
    - Sydney Children's Hospital Network (SCHN) and Children's Hospital Westmead (CHW);
- Kids Research Institute (KRI)
- Ronald McDonald House

Ongoing consultation

Ongoing consultation with key hospital stakeholders, particularly SCHN and WSLHD, containing noise and/or vibration sensitive equipment will continue throughout the construction of the project. This will be in the way of weekly interface and disruption notice meetings.

A complaint procedure will also be implemented where stakeholder complaints are tracked weekly and reported back to the principal during weekly contractor and interface meetings.

These complaints, whether it be from the community members or from hospital stakeholders, will be tracked in KANE's Community Contacts and Complaints Register.

10.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration occur, immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. 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 complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- 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; and
- Setup vibration monitoring system at the location represents the nearest vibration receiver location with alarm device which can inform the project manager on site if the vibration exceedance happened.
- 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;

- noise measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

11 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process.
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc. where practical.
4. Selecting alternative equipment/processes where practical
5. Setup noise monitoring devices at locations represent nearest noise receivers and provide noise data for each complain time period. Analysis is required and determine suitable noise mitigation measures.

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

12 CONCLUSION

This document presents a noise and vibration management plan for construction activities proposed at Westmead Children's Hospital MSCP.

The principal issues which addressed in this report are:

- Specific activities that will be conducted and the associated noise/vibration sources;
- Identification of potentially affected noise/ vibration sensitive receivers;
- The development, hours of work and excavation period;
- The construction noise and vibration requirements specified in development conditions of consent.
- Noise/ vibration response procedures;
- Assessment of potential noise/ vibration from the proposed construction activities; and
- Contingency plans to be implemented in the event of non-compliances and/or noise complaints.

The assessment of noise and vibration indicates that construction actives associated with the project development may generate noise levels that will require some additional management. Adoption of the controls detailed in Section 9 of this report and adherence to the requirements of development consent will ensure that noise impacts will be minimised.

Vibration goals have also been set in this report to minimise structural damage risk for existing structures close to the project site and to protect human comfort in line with the requirements of the consent.

Noting the above, we find the construction noise and vibration management requirements of development consent B13 to be satisfied.

Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Pty Ltd
Thomas Hutchens

APPENDIX A – CURRICULUM VITAE

Qualifications & Experience

2010-2012 Advanced Diploma of Sound Production, NMIT

2017-2019 Master of Architectural Science (Audio and Acoustics), University of Sydney

2019-Current Project Engineer, Acoustic Logic Consultancy

Outline of Experience

Beginning at ALC in 2019, Tom has worked in detailed assessment of acoustic impacts and been involved in the design of noise/vibration attenuation systems to meet relevant statutory codes (BCA, EPA guidelines and Australian Standards).

His work involves the investigation, design and construction supervision of noise and vibration control measures associated with mechanical services and building works.

Whilst being employed with Acoustic Logic, Tom has been responsible for noise and vibration engineering for residential, hospital, commercial and special projects including;

- Building acoustics and building services noise control.
- Environmental noise modelling and assessment.
- Traffic, train and aircraft noise prediction.
- Industrial Noise Control.
- Construction Noise and Vibration.
- NSW Office of Liquor and Gaming acoustic assessment.
- Testing and assessment of walls/floors/glazing/building services.
- Room acoustics modelling and design for critical listening and performance spaces.

Project Experience

A sample of projects Tom has been or is currently involved with as a Project Engineer include the following:

Bangarra Recording Studio (Walsh Bay Arts Precinct) – Commercial recording studio

Crown Resorts Sydney – Hotel, gaming, entertainment and residential development

School at the Meadowbank and Employment Precinct – State significant education development

Upgrades to Chatswood Public and High Schools – Educational development

Darlington Public School – Educational development

Hornsby Ku-ring Gai Hospital – Public hospital expansion

Campbell's Stores, Circular Quay – Entertainment precinct

1 Castlereagh Street, Sydney – Commercial development

Marriot, Auburn – Hotel development