Tweed Valley Hospital Health Hub

Construction Noise, Dust and Vibration Management Plan

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1 INTRODUCTION

Acoustic Logic has been engaged to prepare a noise, dust and vibration management plan for the Health Hub to be constructed at Tweed Valley Hospital.

This document presents a discussion of the processes which will be followed in order to manage the noise, dust and vibration from the proposed construction works of the Health Hub and has been undertaken in accordance with the requirements of condition B16 and B20:

B16. The Construction Noise and Vibration Management Sub-Plan (CNVMSP) must address, but not be limited to, the following:

(a) be prepared by a suitably qualified and experienced noise expert;

(b) provide details of construction noise management procedures within the Site, Cudgen Road signalised intersection and the Tweed Coast Road/Cudgen Road intersection upgrade site;

(c) provide detail of all the residential and non-residential receivers in Catchments A, B and C, the Kingscliff TAGE and Kingscliff High School as identified in the Noise and Vibration Impact Assessment for SSDA Tweed Valley Hospital Stage 2' by JHA dated 19 September 2019;

(d) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) and the relevant provisions of Australian Standard 2436-2010 Guide to Noise Control on Construction and Maintenance Sites, at all identified receivers;

(e) incorporate all reasonable and feasible noise mitigation measures and construction methods (where feasible) during the proposed construction works so that the project specific construction noise management levels (NMLs) at all the identified receivers (B16(c)), for standard construction hours (airborne) as identified in Section 6.5.2 of the Noise and Vibration Impact Assessment for SSDA Tweed Valley Hospital Stage' by JHA dated 10 September 2019, be maintained ();

(f) identify the construction activities (including works within the Tweed Coast Road/ Cudgen Road intersection upgrade site) with the associated predicted construction noise levels, that would exceed the NMLs and reach or exceed the Highly Affected Noise Level of 75dB(A) LAeq (15 min), at the identified the residential and non-residential receivers in Catchments A/B/C, Kingscliff TAFE and Kingscliff High School;

(g) describe the management and mitigation measures to be implemented when the predicted construction noise levels for the above construction activities (exceed 75dB(A) LAeq (15 min) at the residential and non-residential receivers in Catchments A/B/C, Kingscliff High School, including (but not limited to):

- *(i) proposing suitable location of the noise generating equipment so that the predicted construction noise levels at the residential and non-residential receivers in Catchments A/B/C can be lowered;*
- *(ii) intra-day respite periods (such as one hour of respite every three hours of exclusion of such works on the Saturdays)*
- *(iii) scheduling of the noisy activities outside the sensitive times of the day and specific periods of the year;*
- *(iv) equipment-specific temporary screening for noisy equipment or use of noise control measures in AS-2436; and*
- *(v) use of noise shields where feasible;*

(h) include detail of noise monitoring procedures and the location of the loggers on the eastern and southern boundaries of the Site, and the Tweed Coast / Cudgen Road intersection, facing the sensitive receiving catchments, to record the noise levels generated by the construction activities, and to ensure that the appropriate notification occurs in the even that the construction noise

level exceeds 75dB(A) LAeq (15 min) at a receiver, so that the mitigation measures can be incorporated on the Site at the time;

(i) provide details of the surveys of each of the key vibration generating activity/equipment and the predicted vibration levels of the equipment;

(j) include details of vibration monitoring techniques to be implemented when vibration levels exceed the prescribed criteria identified in the Noise and Vibration Impact Assessment for SSDA Tweed Valley Hospital Stage 2 by JHA dated 19 September 2019.

(k) include strategies that have been developed with the community (specifically residents in noise and vibration generating works, especially during the Tweed Coast Road / Cudgen Road intersection upgrade works;

(l) describe the community consultation undertaken to develop the strategies in condition B16(g); and

(m) include details of a complaints management system that would be implemented for the duration of the construction.

B20. The Construction Air Quality Management and Dust Management Sub-Plan (CAQDMSP) and the plan must address, but not be limited to the following:

(a) be prepared by a suitably qualified expert, in consultation with Council;

(b) be consistent with the air quality and dust control measures adopted in the Stage 1 CAQDMSP for SSD-9575;

(c) describe the measures that would be implemented on Site to ensure:

(i) the control of air quality and odour impacts of the Development, in particular, during rock crushing and piling activities;

(ii) that these controls remain effective over time;

(iii) that all reasonable and feasible air quality management practice and measures are employed, with specific reference to the rock crushing and piling activities;

(iv) the air quality impacts are minimised during adverse meteorological conditions or extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Planning Secretary; and

(v) compliance with the relevant conditions of this consent.

(d) include performance objectives for monitoring dust and ensuring no off-site air quality impacts to users of Kingscliff TAFE, and nearby residences and other businesses;

(e) includes an air quality monitoring program that:

(i) is capable of evaluating the performance of the construction works;

(ii) includes a protocol for determining any exceedances of the relevant conditions of consent and responding to complaints;

(iii) adequately supports the air quality performance objectives; and

(iv) evaluates and reports on the effectiveness of air quality management for the construction works.

(f) details on monitoring weather conditions and communicating changing conditions to the workforce.

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

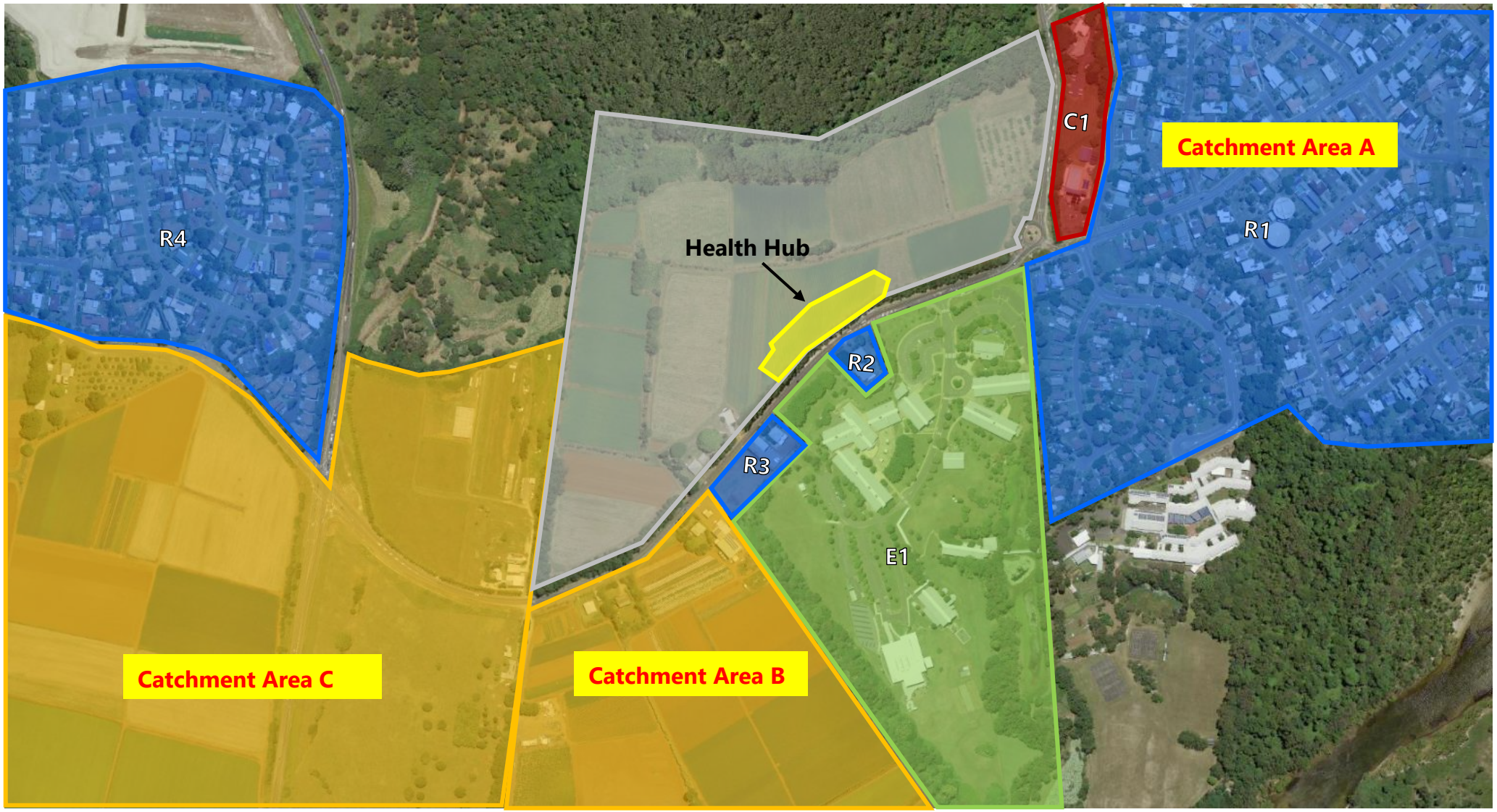
- Identification of sensitive receivers near to the site
- Description of hours of work and what work will be undertaken
- Identification of the noise and vibration standards which will be applicable to this project
- Identify likely sources of noise generation and predicted noise levels at nearby development and sensitive receiving locations, and
- Formulation of a strategy for construction to comply with the standards identified in the above point.

2 SITE DESCRIPTION

The land uses surrounding the proposed Health Hub are the existing commercial, residential, and educational receivers. The nearest potentially most affected receivers are:

- **C1:** Commercial Receiver 1 - Tweed Regional Aquatic Centre – Kingscliff to the east
- **R1:** Residential Receiver 1 - Residential dwellings located on 32-58 Cudgen Road to the east
- **R2:** Residential Receiver 2 - Residential dwelling located at 792 Cudgen Road to the south
- **E1:** Educational Receiver 1 - TAFE NSW – Kingscliff to the south
- **R3:** Residential Receiver 3 - Residential dwelling located at 764 Cudgen Road to the south, and
- **R4:** Residential Receiver 4 - Residential receivers at 6-30 John Robb Way to the west

See Figure 1 below for a site survey and receiver locations.



Industrial/Agricultural

Commercial Receiver

Health Hub

Site

Residential Receiver

Educational/Tafe Receiver

Figure 1 –Site and Sensitive Receiver Locations

3 CONSTRUCTION ACTIVITIES AND HOURS OF WORK

The information provided to this office of the primary noise/dust/vibration producing activities (and estimated duration) associated with the site are as follows below:

3.1 STAGE 1 – EXCAVATION STAGE

- Earthworks using 20T hydraulic excavators, and body trucks, and
- Loading and unloading of trucks.

3.2 STAGE 2 – CONSTRUCTION STAGE

- Erection of the external structure
- Internal works, and
- General hand and power tools will be used on the site.

An electric tower crane will be used on site along with the use of concrete pumps.

3.3 PROPOSED HOURS OF WORK

The above scope of work is proposed to be undertaken during the *'Recommended Standard Hours of Work' period provided by the NSW* 'Interim Construction Noise Guideline':

Monday to Friday: 7:00am to 6:00pm

Saturday: 8:00am to 1:00pm, and

Sunday/Public Holidays: No Works.

See Figure 1 for a detailed location where the construction works are to be undertaken and the nearest surrounding receivers to the project site.

4 CONSTRUCTION NOISE, VIBRATION AND DUST EMISSION CRITERIA

4.1 CONSTRUCTION NOISE MANAGEMENT LEVEL

Establishment of criteria for construction noise requirements will be in accordance with the following documents.

- NSW Environmental Protection Authority - *'Interim Construction Noise Guideline'*
- Australian Standard - *'AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors'*, and
- Australian Standards - *'AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites'*.

4.1.1 NSW EPA Interim Construction Noise Guideline

Given the scale of the proposed works, the "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (ICNG) will be used (as opposed to the simpler "qualitative" assessment method outlined in the guidelines). The quantitative assessment method requires:

- Determination of noise generation management levels (based on background noise levels on site)
- Prediction of operational noise levels at nearby development, and
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

4.1.1.1 At Residential Receivers

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences and the time of day:

Recommended Standard Hours
Monday to Friday (7am – 6pm) & Saturday (8am – 1pm)

- *"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 ambient levels by more than 10dB(A)$L_{eq(15min)}$.
- "*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.

Table 1 – Construction Noise Management Levels to Residential Receivers

Location	Recommended Standard Hours "Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Receivers	BG 45 + 10 = 55	75

4.1.1.2 To Educational Receivers

Table 3 of the ICGN outlines the following management noise levels to internal areas of classrooms at schools and other educational institutions:

Table 2 – Noise Management Level for Educational Buildings (ICGN)

Space	Internal Management Level dB(A)$L_{eq\ (15\ min)}$
Within Classrooms at schools and other educational institutions	45

4.1.1.3 To Commercial Receivers

Section 4.1.3 *"Commercial and industrial premises"* of the ICGN outlines the following external management noise levels to the most-affected occupied point of the premises:

Table 3 – Noise Management Level for Commercial Premises (ICGN)

Space	Management Level dB(A)$L_{eq\ (15\ min)}$
Facade of Offices	70

*"**4.1.3 Commercial and industrial premises***

… The proponent should undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended 'maximum' internal noise levels in AS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors may assist in determining relevant noise levels (Standards Australia 2000)."

4.1.2 Australian Standard AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors

Excavation/Construction noise management levels for noise sensitive spaces in office buildings not covered in the ICGN will be based on the maximum recommended noise levels presented in section AS2107:2016. These are presented in the table below:

Table 4 – Noise Management Level for Commercial Buildings (Internal - AS2107:2016)

Space	Management Level dB(A)$L_{eq\ (15\ min)}$
Office Areas	45

4.1.3 Australian Standard AS2436:2010 Guide to noise control on construction, maintenance and demolition sites

Australian Standard AS2436 provides guidance on noise and vibration control in respect to construction and demolition sites, and the preparation of noise and vibration 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 control, 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. Its guideline promulgates feasible and reasonable mitigation strategies and controls, and stakeholder liaison, in the effort to reach a realistic compromise between site activities and impacts on neighbouring properties.

Based on the above, the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.

- Develop a suitable noise criterion based on the NSW Environmental Protection Authority Interim Construction Noise Guideline.

- Adopt management conditions as per AS 2436 in the event of a non-compliance.

4.1.4 Summarised Noise Management Levels

The summarised noise management levels for the proposed demolition/excavation/construction activities are presented in the table below.

Table 5 – Summarised Noise Management Levels

Location	Management Level dB(A)$L_{eq\ (15\ min)}$
Residential Receivers	**Recommended Standard Hours** "Noise Affected" Level - 55 "Highly Noise Affected" Level – 75
Commercial Receivers	70
Educational Receivers & Office Areas	45 (Internal)

4.2 CONSTRUCTION VIBRATION CRITERIA

Vibration criteria for the nearest receivers will be based on the following documents:

- German Standard DIN 4150 - *'Vibration in Buildings (2016-12)'*
- EPA - *"Assessing Vibration: A technical guideline"*, and
- ASHRAE Handbook 2007.

4.2.1 German Standard DIN 4150

German Standard DIN 4150-3 (2016-12) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (2016-12) are presented in the table below.

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 6 – DIN 4150-3 (2016-12) 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 for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Residential buildings and buildings of similar design and/or occupancy	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. listed buildings)	3	3 to 8	8 to 10	8

4.2.2 EPA Assessing Amenity

Table 2.2 of EPA "Assessing Vibration: A technical guideline" specified the following vibration goal for human comfort:

Table 7 – Preferred and Maximum Weighted RMS Values for Vibration Acceleration (m/s2) 1-80 Hz

Location	Assessment Period	Preferred Values Z-axis	Preferred Values X & Y-axis	Maximum Values Z-axis	Maximum Values X & Y-axis
Continuous Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residences	Day time	0.010	0.0071	0.020	0.014
Office	Day time	0.020	0.014	0.040	0.028
Impulsive Vibration					
Critical Areas	Day time	0.005	0.0036	0.010	0.0072
Residence	Day time	0.3	0.21	0.6	0.42
Office	Day time	0.64	0.46	1.28	0.92

Acceptable values for intermittent vibration shall comply with the requirements in Table 2.4 of EPA "Assessing Vibration: A technical guideline" detailed as below.

Table 8 - Acceptable Vibration Dose Values for Intermittent Vibration (m/s1.75)

Location	Day time preferred value	Day time maximum value
Critical Areas	0.10	0.20
Residences	0.20	0.40
Office	0.40	0.80

4.2.3 Summarised Recommended Vibration Limits

The summarised vibration criteria are presented in the table below.

Table 9 – Recommended Vibration Limit

Vibration Receiver	Recommended Vibration Limits PPV (mm/s)
Residential Buildings	5
Commercial/Other Buildings	20

4.3 CONSTRUCTION DUST EMISSIONS CRITERIA

The NSW EPA air pollutants Impact assessment criterion applicable to the project site with regards to health concerns is shown in Table below.

Table 10 - Dust Impact Criterion

Pollutant	Averaging Period	Concentration
$PM_{2.5}$	24 hours	25 µg/m^3
PM_{10}		50 µg/m^3

The EPA has air quality categories based on particle concentration averaged over one hour as shown in Table below. The dust monitor will be programmed to send an alert via SMS or email when the average hourly concentration reached the 'Poor' category in either particle size concentration. However, the assessment level is the 24-hour average level as outlined in Table 10.

Table 11 – Alert Limits Based on EPA Hourly Air Quality Categories

Pollutant	Averaging Time	Concentration	Air Quality Category
$PM_{2.5}$	1 hour	< 27 µg/m^3	Good
		27-62 µg/m^3	Moderate
		62-97 µg/m^3	Poor
		97-370 µg/m^3	Very Poor
		> 370 µg/m^3	Hazardous
PM_{10}	1 hour	< 40 µg/m^3	Good
		40-80 µg/m^3	Moderate
		80-120 µg/m^3	Poor
		120-240 µg/m^3	Very Poor
		> 240 µg/m^3	Hazardous

5 CONSTRUCTION NOISE EMISSION ASSESSMENT

In this Section, noise emission assessment will be conducted based on the proposed scope of work and standard working hours presented in Section 3.

5.1 CONSTRUCTION EQUIPMENT AND THE ASSOCIATED NOISE SOURCES

Preliminary construction methodology has been discussed with ADCO to determine a typical worst-case scenario for noise emissions from construction activities. The typical worst-case scenario for each stage and associated Sound Power Level noise data is included below.

5.1.1 Excavation Stage Equipment

The following equipment are proposed to be used during the excavation stage:

- 1 x excavators with hydraulic hammers
- 2 x excavators with buckets, and
- 2 x semi-trailers.

5.1.2 Construction Stage Equipment

The following equipment are proposed to be used during the construction stage:

- 2 x excavators with buckets
- 2 x semi-trailers
- 2 x concrete truck
- 2 x concrete pump
- 2 x electric hand tool, and
- 1 x generator.

5.1.3 Equipment Sound Powe Levels

The sound power levels of the proposed equipment are presented in Table 12.

Table 12 – Sound Power Levels of the Proposed Equipment

EQUIPMENT / PROCESS	SOUND POWER LEVEL dB(A)
Cement Mixing Truck	105
Concrete Pump	105
Electric Hand Tool	102
Excavator with Bucket	105
Excavator with Hydraulic Hammer	120
Generator	99
Semi-Trailer	105

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

- On site measurements
- Table A1 of Australian Standard 2436-2010 & Table A1 of Australian Standard 2436-2010, and
- Data held by this office from other similar studies.

5.2 PREDICTED NOISE LEVELS

Noise from the loudest typical construction activities have been predicted to the nearest most affected sensitive receivers. The predicted noise levels are presented in this section and are based on the areas on site in which the plant is likely to be used.

Where the position of the construction activity is variable, a range of predicted noise levels is presented to take into account the change in noise impact depending on where ion the site the work is conducted.

Predictions take into account:

- The distance between the noise source and the receiver, and
- The screening effect provided by barriers or building structures (where relevant).

5.2.1 SoundPlan Modelling

Noise modelling was conducted using SoundPlan™ 8.0 modelling software implementing the ISO 9613-2:1996 "Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation" noise propagation standard.

SoundPLAN noise modelling has been undertaken based on information provided to this office of construction methodology and activities likely to be undertaken simultaneously at the project site and therefore resulting in the *'worst-case'* scenario.

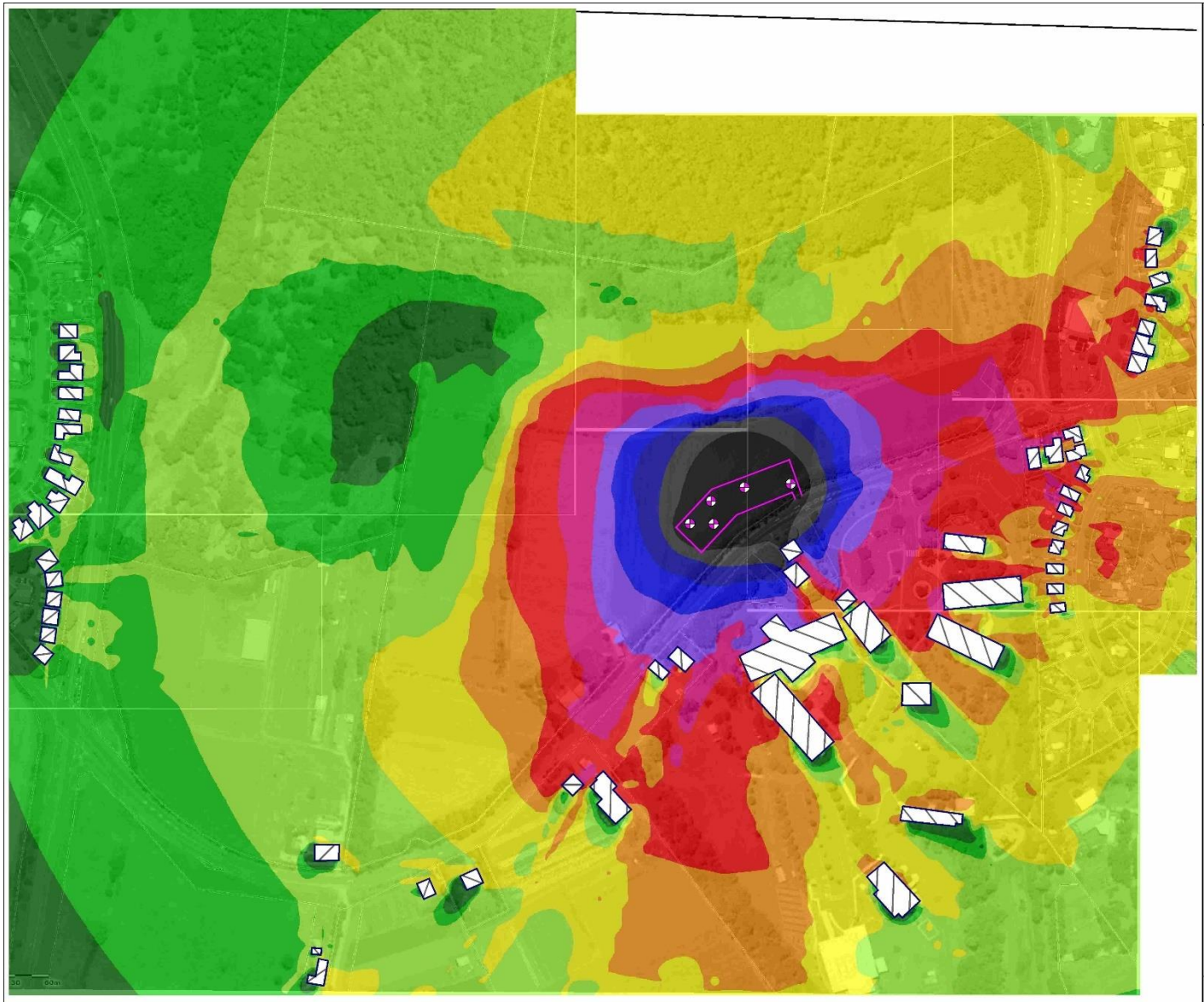
The SoundPLAN noise modelling presents the cumulative predicted external noise levels to the nearest surrounding receivers. In addition, see the tables below for the predicted noise level range. Where the receiver has an internal noise management level, this has been corrected for external to internal transmission loss of approximately R_w30.

Noise enhancing meteorological effects have been adopted as recommended by the NPfI, noting that the ISO 9613 modelling approach assumes that all receivers are 'downwind' (i.e., that noise enhancing wind conditions are in effect at all times).

Ground absorption was conservatively calculated with a ground factor of 0 for all areas surrounding the site exclusive of any localised lawns and greenery, which have been modelled with a ground factor of 0.6, as recommended in *Engineering Noise Control* (Bies & Hanson).

In line with Factsheet C of the NPfI, penalties for annoying noise characteristics should be applied at the receiver, where applicable. Based on the predicted noise levels, no penalty should be applied (either for tonality, intermittency, or otherwise).

5.2.2 Modelling Results - Stage 1 – Excavation



Tweed Valley Hospital Health Hub

Predicted Demolition Noise Levels

1 x Excavators with hydraulic hammers
2 x Excavators with buckets
2 x Semi-trailers
Truck movement

Prepared by: PF
Date: 7/07/2022

Noise Level
L_{eq}
in dB(A)

	< 45
	45 - 48
	48 - 51
	51 - 54
	54 - 57
	57 - 60
	60 - 63
	63 - 66
	66 - 69
	69 - 72
	72 - 75
	>= 75

ACOUSTIC LOGIC

Table 13 – Predicted Excavation Noise at Residential Receivers

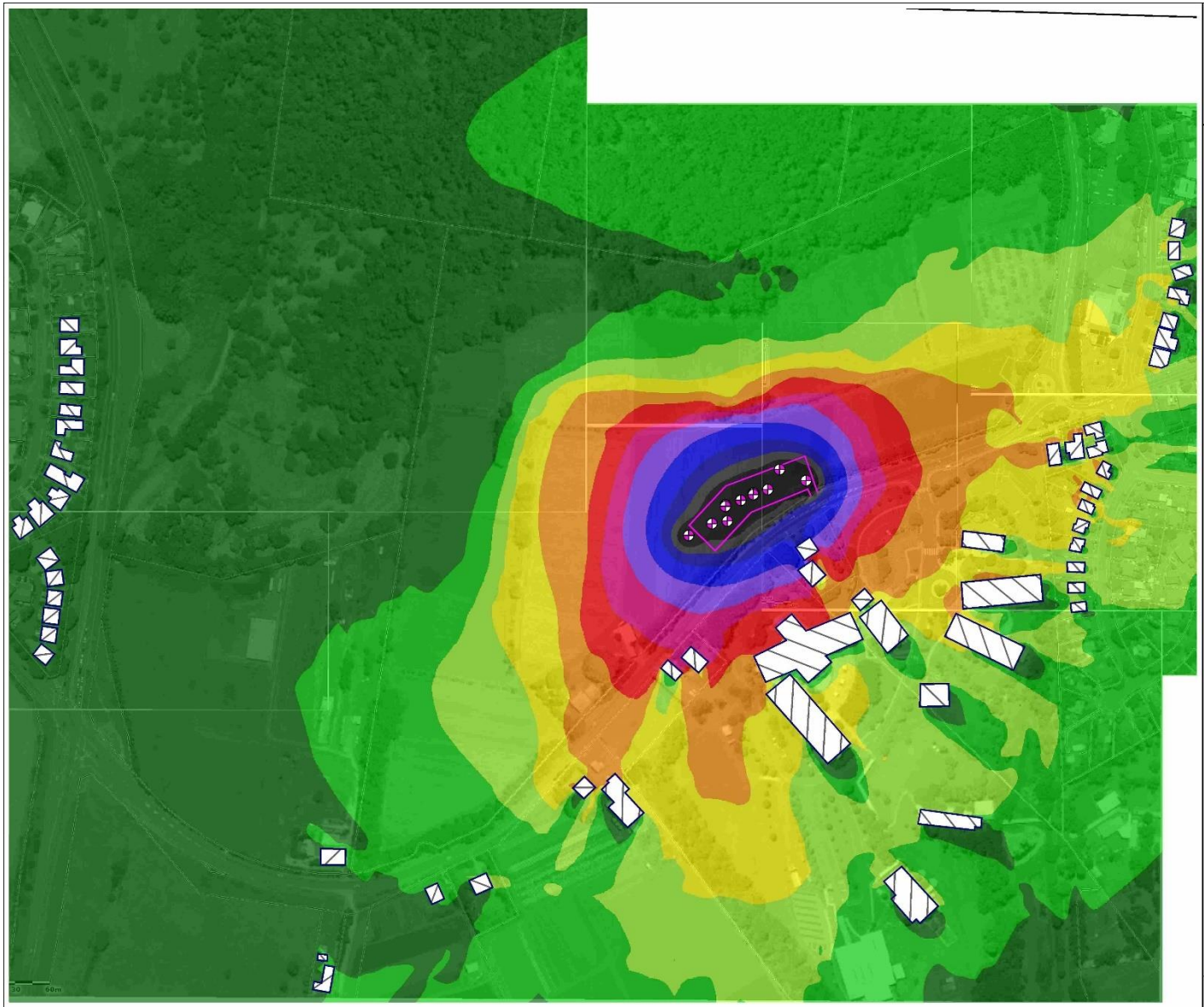
Receiver	Activity	External Noise Management Level dB(A) $L_{eq\ (15min)}$	Predicted Cumulative Noise Level dB(A)$L_{eq(15min)}$	Comments
R1 32-58 Cudgen Road	1 x excavators with hydraulic hammers 2 x excavators with buckets 2 x semi-trailers	Noise Affected Level **55** Highly Noise Affected Level **75**	60	Above Noise Affected Level & below Highly Noise Affected Level
R2 792 Cudgen Road			72	Above Noise Affected Level & below Highly Noise Affected Level
R3 764 Cudgen Road			64	Above Noise Affected Level & below Highly Noise Affected Level
R4 6-30 John Robb Way			48	Below Noise Affected Level

Table 14 – Predicted Excavation Noise at Non-Residential Receivers

Receiver	Activity	Noise Management Level dB(A) $L_{eq\ (15min)}$	Predicted Cumulative Noise Level dB(A)$L_{eq(15min)}$	Below Noise Management Level?
E1 TAFE NSW Kingscliff	1 x excavators with hydraulic hammers 2 x excavators with buckets 2 x semi-trailers	(Internal) Within Classrooms 45dB(A)	*(Internal Areas)* ≤40*	Yes
C1 Tweed Regional Aquatic Centre		(External) 70dB(A)	56	Yes

*windows closed

5.2.3 Modelling Results - Stage 2 – Construction



Tweed Valley Hospital Health Hub

Predicted Construction Noise Levels:

2 x Excavators with buckets
2 x Semi-trailers
2 x Concrete truck
2 x Concrete pump
2 x Electric hand tool
1 x Generator

Prepared by: PF
Date: 7/07/2022

Noise Level
L_{eq}
in dB(A)

	< 45
	45 - 48
	48 - 51
	51 - 54
	54 - 57
	57 - 60
	60 - 63
	63 - 66
	66 - 69
	69 - 72
	72 - 75
	>= 75

ACOUSTIC LOGIC

Table 15 – Predicted Construction Noise at Residential Receivers

Receiver	Activity	External Noise Management Level dB(A) $L_{eq\ (15min)}$	Predicted Cumulative Noise Level dB(A)$L_{eq(15min)}$	Comments?
R1 32-58 Cudgen Road	2 x excavators with buckets 2 x semi-trailers 2 x concrete truck 2 x concrete pump 2 x electric hand tool 1 x generator	Noise Affected Level **55** Highly Noise Affected Level **75**	≤54	Below Noise Affected Level
R2 792 Cudgen Road			67	Above Noise Affected Level & below Highly Noise Affected Level
R3 764 Cudgen Road			60	Above Noise Affected Level & below Highly Noise Affected Level
R4 6-30 John Robb Way			<54	Below Noise Affected Level

Table 16 – Predicted Construction Noise at Non-Residential Receivers

Receiver	Activity	Noise Management Level dB(A) $L_{eq\ (15min)}$	Predicted Cumulative Noise Level dB(A)$L_{eq(15min)}$	Below Noise Management Level?
E1 TAFE NSW Kingscliff	2 x excavators with buckets 2 x semi-trailers	(Internal) Within Classrooms 45dB(A)	*(Internal Areas)* ≤40*	Yes
C1 Tweed Regional Aquatic Centre	2 x concrete truck 2 x concrete pump 2 x electric hand tool 1 x generator	(External) 70dB(A)	52	Yes

*windows closed

5.3 DISCUSSION

Primarily, the use of hydraulic hammer is predicted to be the highest noise generating equipment. Noise predictions have been presented as external noise levels for all residential and commercial receivers, and internal noise levels for educational receivers It is also noted that all high noise generation equipment are only expected to be used during specific portions of the demolition stage and will not be continuous throughout the entire demolition stage.

External noise level predictions to **R1** and **R4** are presented as worst-case scenarios where the closest receivers have direct line of sight to the construction site. Many residents are shielded by other residential development, which would lead to lower noise levels than those predicted in the previous section. The predicted noise levels are to the worst-affected residential receiver in the residential blocks.

Treatment processes are recommended as per Section 8 for concerns with noise levels that are predicted to be over the respective noise management level. Further recommendations in Sections 9, 10 & 11. With the implementation of the aforementioned sections, the client demonstrates that all reasonable and feasible vibration and noise mitigation measures have been taken.

5.4 NOISE MONITORING

5.4.1 Monitoring Locations

It is recommended to install long-term a noise monitor along the site boundary in a location close to the sensitive receivers. The location has been labelled as **Monitoring Location A** in Figure 2.

5.4.2 Downloading of Noise /Dust Monitor Data

Downloading of the noise /dust monitor data will be conducted on a regular basis. In the event of consistent high noise level periods, downloading of the noise monitor data will be conducted more frequently. Results obtained from the noise monitor will be presented in a graph format and will be forwarded to the client for review. It is proposed that reports are provided monthly, presenting the measured noise levels in reference to the noise management levels detailed in this report.

5.4.3 Presentation of Monitor Results

A monthly report will be submitted to the client via email summarising the measured noise/vibration/dust level events. Complete results of the continuous logging will be presented in monthly reports including graphs of the collected data.

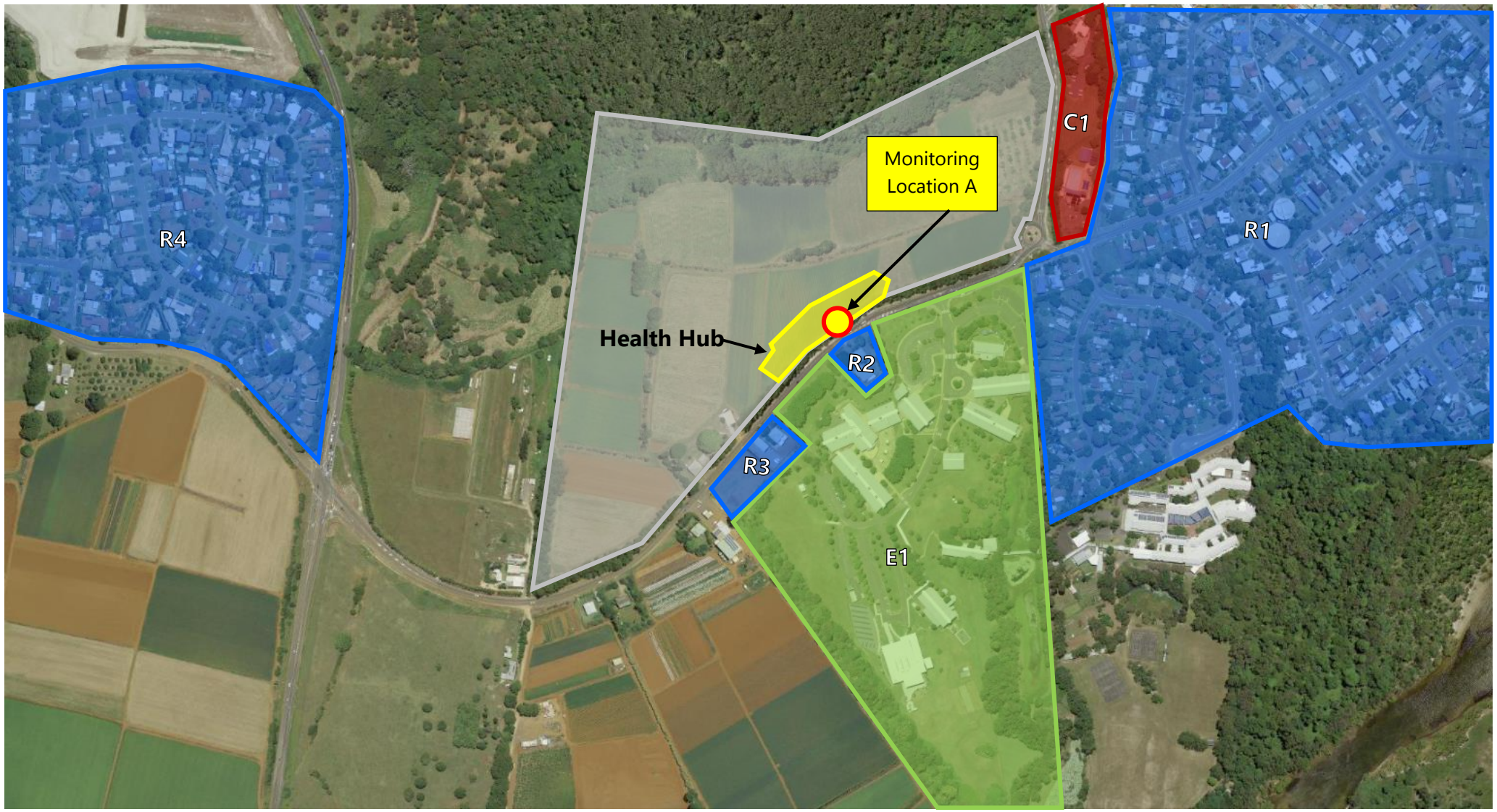


Figure 2 – Noise Monitoring Locations

Site

Noise Monitoring Location

6 CONSTRUCTION VIBRATION ASSESSMENT

Proposed activities that have the potential to produce ground vibration include excavation work.

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

6.1 VIBRATION MONITORING

In the event that complaints are made from neighbouring properties regarding vibration impacts from the subject site, more vibration monitors will be installed at the property boundaries of the neighbouring properties nearest to the subject site to monitor vibration levels.

6.1.1 Downloading of Vibration Monitor Data

Vibration monitor will be with SMS system which can send alarm message if the alarm level is triggered. Noise /Dust monitor will be with remote connection system and access to data is available daily. The vibration limit is recommended as below:

- Alarm Level 4mm/s PPV
- Stop work level 5mm/s PPV

Downloading of the vibration monitor data will be conducted on a regular basis. In the event of exceedance of the vibration criteria, downloading of the vibration monitor data 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 monthly with any exceedances in the vibration criteria reported as detailed in this report.

6.1.2 Presentation of Vibration Monitor Results

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

6.1.3 Period of Onsite Monitoring

The following strategy shall be followed to determine whether the monitoring devices onsite can be removed early:

1. **Existing Conditions Monitoring:** Dust, noise, and vibration monitors shall be installed prior to commencement of work to monitor the existing conditions. This monitoring shall be for conducted for a minimum of 7 days.

2. **Invasive Works Monitoring:** Monitoring shall be conducted for the entire duration of the invasive works. Namely during earthworks, piling, and inground structure works.

3. **Monitoring After the Completion of the Invasive Works:** Following the completion of the invasive works, monitoring shall be conducted for a minimum of 4 weeks.

4. **Comparison of Monitoring Results:** Monitoring After the Completion of the Invasive Works shall be compared against the Existing Conditions Monitoring. In the event that the monitoring results are

consistent no major increase in dust, noise or vibration has been recorded, the monitor equipment can be removed from the site.

7 CONTROL OF DUST

The potentially significant source of dust is associated with the excavation stages of the project. it is recommended to install dust monitor along southern boundary of the project site.

To regulate dust emanating from the excavation processes, the excavation contractors will need to operate particular machinery with hose water spraying on the dirt to dampen the dust.

8 RECOMMENDATIONS

In light of the above, we recommend:

1. **Barrier:** construct/retain a 1.8-meter high solid barrier to the south boundary of the site (facing **R2**, **R3** and **E1**). This barrier will help shield receivers from earth works and other construction activities conducted at ground level. This barrier is to be solid and non-perforate, a maximum 30 mm gap at the bottom is acceptable for water flow if required. This will benefit residents at the same floor level or lower than the barrier.

2. **Community Consultation/Notification:** Notification (leaflet or similar) of all residents within 100m of the development is recommended prior to commencement of works. Notification should advise of anticipate date and duration of excavation.

3. **Respite Periods:** To reduce the impacts on the amenity of the surrounding receivers, it is recommended that respite periods are introduced when works involving hydraulic hammering are to occur, These periods are:

   Monday – Friday: 7 am – 7:30 am

   Monday – Friday: 12 pm – 12:30 pm

   Monday – Friday: 4:30 pm – 5 pm

4. **Quiet Work Methods/Technologies:**

   a. The primary noise generating activity at the site will be the demolition and excavation period. As much as practicable, use of quieter demolition methods is to be adopted.

   b. Excavation is to be done using an excavator as much as possible with a bucket (as opposed to using hydraulic hammering).

   c. Materials handling/vehicles:

      i. Truck movements should not commence prior to 7am.

      ii. Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.

      iii. Avoid careless dropping of construction materials into empty trucks.

      iv. Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).

5. **Hand tools:**

   Hand tools would only be typically used sporadically. Additionally, we recommend the following controls:

   a. In the event of a complaint, the use of hand-held jackhammers, grinders, and electric saws should be screened from surrounding receiver locations with localised acoustic barriers such as an Eco Barrier or plywood hoarding fixed to temporary fencing.

   b. Time Control: Limit hammering, saw cutting and grinding activities to between 9am to 12pm and 2pm to 5pm Monday to Friday and 9am to 12pm Saturday to provide respite to surrounding residents.

6. **Complaints Handling:** In the event of complaint, the procedures outlined in Section **Error! Reference source not found.** should be adopted.

7. **Site Induction:**

   a. A copy of the Construction Noise and Vibration Management Plan is to be available to contractors. The location of the CNVMP should be advised in any site induction.

   b. Site induction should also detail the site contact in the event of noise complaint.

9 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

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

10 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered.

The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

10.1 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. Undertaking this activity using bulldozers, ripping and/or milling machines will result in lower noise levels.

10.2 ACOUSTIC BARRIER

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant. 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.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance which is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10 or 15mm plywood would be acceptable for the barriers.

10.3 SILENCING DEVICES

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.

10.4 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).

10.5 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases, it may be possible to specially treat a piece of equipment to reduce the sound levels emitted. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

10.6 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.

11 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

11.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon, the builder and the regulatory authority. 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 processes 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 Site Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular scheduled meetings will be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

11.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise, vibration or dust 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 and dust limits, all work potentially producing vibration or dust 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

- 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.

11.3 REPORTING REQUIREMENTS

The following shall be kept on site:

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed in this report.
2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.
3. Any noise exceedances occurring including the actions taken and results of follow up monitoring.
4. A report detailing complaints received and actions taken shall be presented to the construction liaison committee.

11.4 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

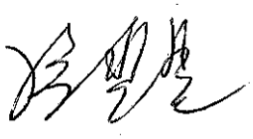
12 CONCLUSION

This report presents a noise/dust and vibration management plan for the excavation and construction activities proposed to be conducted for the Health Hub of the Tweed Valley Hospital.

Provided that the practices and recommendations in this report are implemented, the noise/dust and vibration impact during the excavation and construction stages will be minimised.

Please contact us should you have any further queries.

Yours faithfully,



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