APPENDIX F – CONSTRUCTION NOISE MANAGEMENT PLAN

MATTHEW PALAVIDIS
VICTOR FATTORETTO
MATTHEW SHIELDS

Kemps Creek Data Centre

Construction Noise and Vibration Management Plan

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

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

Project ID	20230464.1
Document Title	Construction Noise and Vibration Management
Attention To	A.W. Edwards Pty Ltd

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	4/05/2023	20230464.1/0405A/R0/JW	JW		GW
1	1/06/2023	20230464.1/0106A/R1/JW	JW		GW

TABLE OF CONTENTS

1 INTRODUCTION

Acoustic Logic (AL) has been engaged to prepare a Construction Noise and Vibration Management Plan for the proposed Kemps Creek Data Centre to be located at 707-769 Mamre Road, Kemps Creek.

This Management Plan has been developed based on the requirements of condition B4 of the development consent provided by NSW Government Department of Planning (Ref: SSD-10101987). The development conditions are detailed below:

> ***Construction Noise Management Plan***
>
> *B4. The Applicant must prepare a Construction Noise Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with condition C2 and must*
>
> *(a) be prepared by a suitably qualified and experienced noise expert;*
>
> *(b) be approved by the Planning Secretary prior to the commencement of construction of each stage of the development;*
>
> *(c) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time);*
>
> *(d) describe the measures to be implemented to manage high noise generating works;*
>
> *(e) detail procedures for coordinating construction works with other developments in the immediate vicinity to minimise cumulative noise impacts;*
>
> *(f) describe the community consultation undertaken in relation to construction noise management and outline any strategies development with the community to manage high noise generating works, or to provide respite periods; and*
>
> *(g) include a complaints management system that would be implemented for the duration of the development.*

The key issues addressed within this report are as follows:

- Identification of the noise and vibration standards and statutory requirements which will be applicable to this project.
- Identification of potentially impacted nearby sensitive noise receivers to the development.
- Identify likely sources of noise and vibration generation during construction and predicted noise levels at nearby development.
- Formulation of a strategy to comply with the standards identified and mitigation treatments in the event that compliance is not achievable.

The below table details the components of each condition and where the conditions are addressed in the report.

Table 1 – Addressed Conditions

SSD-10101987 Conditions	CNVMP Section
B4. The Applicant must prepare a Construction Noise Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with condition C2 and must	-
(a) be prepared by a suitably qualified and experienced noise expert	Appendix 1 –
(b) be approved by the Planning Secretary prior to the commencement of construction of each stage of the development;	n/a
(c) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time);	Section 6
(d) describe the measures to be implemented to manage high noise generating works;	Section 6 and 7
(e) detail procedures for coordinating construction works with other developments in the immediate vicinity to minimise cumulative noise impacts;	Section 8.1
(f) describe the community consultation undertaken in relation to construction noise management and outline any strategies development with the community to manage high noise generating works, or to provide respite periods; and	Section 6.1and 8
(g) include a complaints management system that would be implemented for the duration of the development.	Section 8

2 SITE DESCRIPTION

The project site is located at 707-769 Mamre Road, Kemps Creek and is proposing the construction of a Data Centre.

The sites boundaries are surrounded by future industrial premises. Residential receivers are located further east of the site.

The closest affected sensitive receivers within the vicinity of the site are as follows:

- **Residential Receiver 1:** Existing single and two storey residential dwellings to the west of the site at Medinah Avenue.
- **Industrial Receiver 1:** Future industrial receivers north of the site at 705-757 Mamre Road.
- **Industrial Receiver 2:** Future industrial receivers south of the site at 783-797 Mamre Road.

See an aerial photo in Figure 1 below for detailed receiver locations and monitor locations.

Figure 1 – Site Map with Nearest Sensitive Receivers and Measurement Locations (Sourced from Six Maps)

2.1 CONSTRUCTION ACTIVITIES

Construction is expected to last for approximately 14 months with the following stages to overlap.

The primary noise producing activities associated with the site are as follows below:

- **Excavation:**
    - Use of multiple excavators with bucket attachments.
    - Water Pumps
    - Concrete Pumps
    - Graders
    - Vibratory Rollers
    - Trucks and articulated vehicles to move materials and components.
    - Use of three tower cranes located throughout the site, with location presented within Figure 2.
    - Power Hand Tools
- **Piling Works:**
    - 2 x CFA Piling Rigs
    - Impact Pile Testing
    - Use of multiple excavators
    - Water Pumps
    - Concrete pump
    - Concrete Agitator
    - Use of multiple excavators with bucket attachments.
    - Trucks and articulated vehicles to move materials and components.
    - Power Hand Tools
- **Construction Stage:**
    - Trucks and articulated vehicles to move materials and components.
    - Use of three tower cranes located throughout the site, with location presented within Figure 2.
    - Use of concrete boom and associated concrete trucks located within tower crane loading zones.
    - Use of general hand tools (Inclusive of drills, Angle Grinders, jackhammers etc.)

Vehicles will access the site and deliver goods by service corridors via Mamre Road. Vehicles will load and unload within the dedicated tower crane loading zones located through the site.

See Figure 2 below for an aerial view of the staging diagram provided to this office.

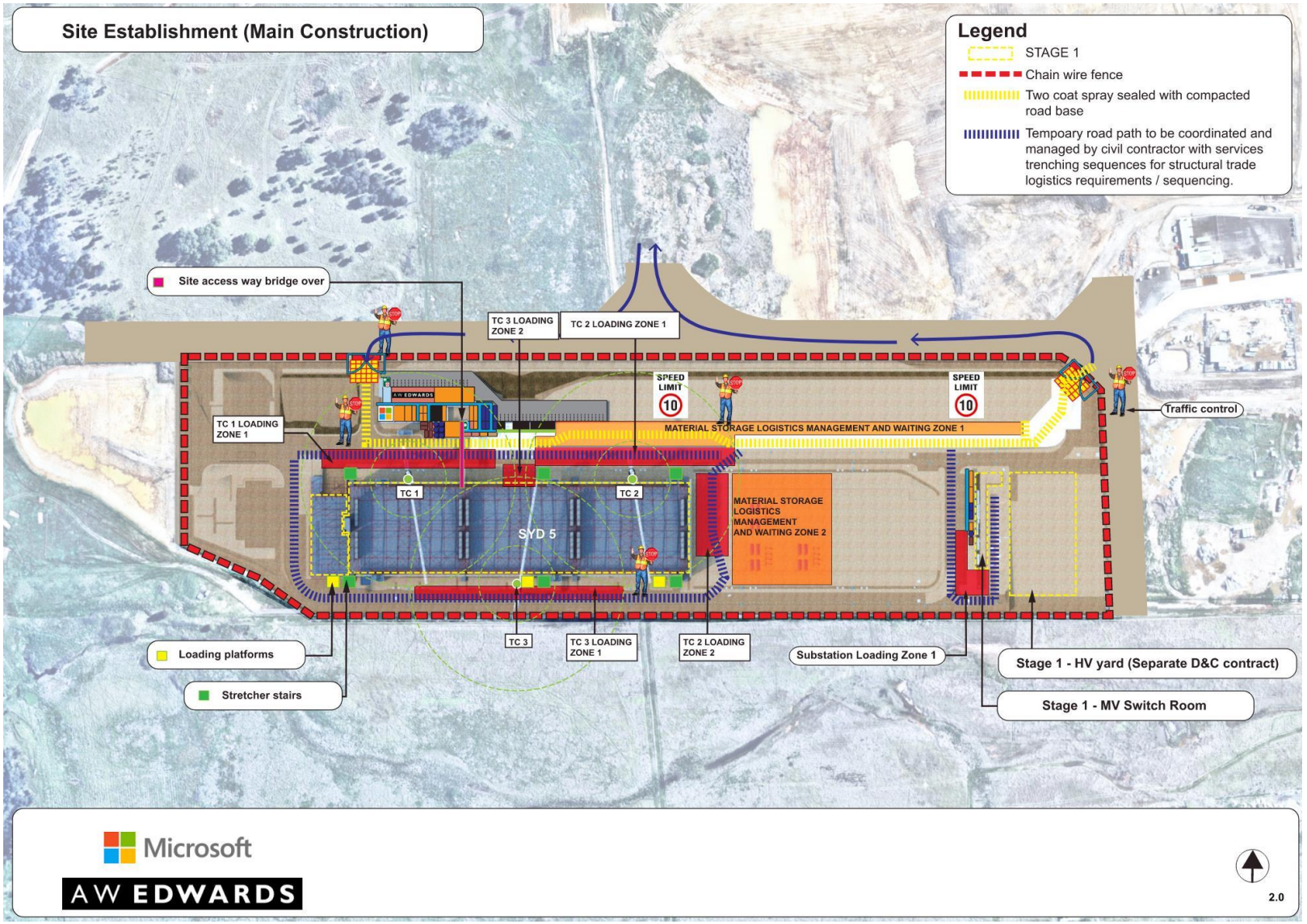


Figure 2: SYD05 Staging Plan

2.2 HOURS OF WORK

Condition B1 of the NSW Government of Planning and the Environment Development Consent nominates the following hours of work for all excavation and construction activity (Ref: SSD-10101987):

- **Monday to Friday – 7:00am – 6:00pm.**
- **Saturday – 8:00am – 1:00pm.**
- **No work on Sunday or Public Holidays.**

3 NOISE AND VIBRATION MANAGEMENT LEVELS

3.1 NSW GOVERNMENT OF PLANNING AND ENVIRONMENT DEVELOPMENT CONSENT (SSD-10101987)

Section B3 of the development consent outlines the below in regards to Construction Noise Limits

> *'B3. The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time). 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 in the Appendix 2.'*

Section B12 of the development outlines the below in regards to vibration criteria;

> *B12. 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).*

3.2 EPA INTERIM CONSUTRCITON NOISE GUIDELINE

The EPA Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise management levels (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

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

- *"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.
- Section 4.1.2 and 4.1.3 of the EPA Interim Construction Noise Guideline also nominates management levels for other sensitive land uses (other than residences). Criteria relevant to this assessment is detailed below.
    - Industrial: 75dB(A)$L_{eq(15min)}$.
    - Commercial: 70dB(A)$L_{eq(15min)}$.

3.2.1 Existing Background Noise Levels

3.2.1.1 Short Term Background Noise Measurements on site

Acoustic Logic attended site on the 9th of May 2023 to confirm if the monitored background noise data collated in 2020 is representative of the current background noise levels. Attended measurements are presented within the table below.

Table 2 – Short Term Background Attended Measurements

Measurement Location	Time of day	Rating Background Noise Level dB(A)$_{L90(Period)}$
Medinah Avenue, Luddenham	9:00am – 10:30am	40
Mamre Road, Kemps Creek		61
Bakers Lane West, Kemps Creek		48

3.2.1.2 Summarised Background Noise Levels

The existing background noise levels for the project site has been collated for the Kemps Creek Data Centre by ARUP (SYD05-06-07_Y-R-0000). This assessment has been provided by AW Edwards and was used as reference for this report (see Appendix 1). The Rating Background Noise Levels have been corrected with the attended noise measurements collated onsite by this office.

The existing background noise levels relevant to construction works are presented within Table 3 below.

Table 3 - Background Noise Level Summary

Measurement Location	Time of day	Rating Background Noise Level $dB(A)_{L90(Period)}$
Medinah Avenue, Luddenham	Day (7am – 6pm)	40

A summary of the recommended noise levels from the ICNG is presented below.

Table 4 – Noise Management Levels

Location	Time of Day	"Noise Affected" Level - $dB(A)L_{eq(15min)}$	"Highly Noise Affected" Level - $dB(A)L_{eq(15min)}$
Residential Receivers (external) (Medinah Avenue – R1)	Daytime (7am-6pm)	50	75
Industrial Receivers (external)	When in use	75	N/A

3.3 VIBRATION

Vibrations caused by any proposed activities on site, at the façade or incident on the structure of any surrounding sensitive receivers, will be assessed against the following provisions:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*.
- For human exposure to vibration, the evaluation criteria presented in NSW Environmental Protection Authority (EPA) "*Assessing Vibration: A Technical Guideline*" guideline.

The criteria and the application of these guidelines are discussed in separate sections below.

3.3.1 Structure Borne Vibrations

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 .

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

= I1, I2

= R1, R2 and R3

3.3.2 Assessing Amenity

The NSW Environment Protection Authority's (EPA) publication "Assessing Vibration: A Technical Guideline" (Feb 2006), outlines vibration criteria to assess the effects on human exposure to vibration from industry, transportation and machinery. This will ensure the amenity of tenants within surrounding residential properties is not adversely impacted.

This document classifies vibrations in buildings into continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Criteria stipulated in this publication is based on the type of vibrations generated by the source.

Criteria relevant to the proposed excavation and construction activities on site are detailed below.

Table 6 – EPA Recommended Human Comfort Vibration Criteria

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	**Time**	**Preferred**	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous Vibration							
Residences	Daytime	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							
Residences	Daytime	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

3.3.3 Recommended Vibration Limits

The recommended vibration limit at the nearest vibration sensitive receivers are summarised below:

Table 7 – Recommended Vibration Limits for Surrounding Sensitive Receivers

Receivers	Recommended Maximum Peak Particle Velocity (mms^{-1})
I1, I2	$\leq$ 20
R1. R2, R3	$\leq$ 5

4 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Noise impacts will be determined from primary processes and equipment. The sound power levels of these activities are presented below.

Table 8 - Sound Power Levels of the Proposed Equipment

Stage	Equipment/Process	Sound Power Level dB(A)
Excavation	Tower Crane	105
	Excavator	107
	Concrete Pump / Boom	108
	Concrete Truck Driving	107
	Graders	110
	Vibratory Rollers	108
	Semi-Trailer Truck	107
	Truck Idling	95
	Power Hand Tools	102
Piling Works	Tower Crane	105
	Piling Rig	111
	Impact Pile Testing	129
	Excavator	107
	Concrete Pump / Boom	108
	Concrete Truck Driving	107
	Semi-Trailer Truck	107
	Truck Idling =	95
	Power Tools	102
Construction Stage	Tower Crane	105
	Concrete Pump / Boom	108
	Concrete Truck Driving	107
	Truck Idling	95
	Power Tools	102

**A tonality correction factor of 5dB(A) has been applied in line with the requirements of EPA documentation.*

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

- Table A1 of Australian Standard 2436-2010.
- Data held by this office from other similar studies.

5 NOISE EMISSION ASSESSMENT

5.1 PREDICTED NOISE EMISSIONS

An assessment of the principal sources of noise emissions has been undertaken to identify the activities that may produce noise and/or vibration impacts so that appropriate ameliorative measures can be formulated. SoundPLAN noise modelling has been conducted based on information provided to this office of construction methodology and activities likely to be undertaken and presents the cumulative predicted external noise levels to the nearest surrounding receivers.

With regard to the noise level generated at the nearest receivers, noise levels will vary depending where on the construction site the work in undertaken. The presented SoundPLAN noise modelling scenarios are of typical construction scenarios representative of the noise impacts generated by works on the surrounding receivers.

Predicted noise levels are presented below. The predicted noise levels are based on the assumption that the recommendations in section 9 have implemented/observed.

5.2 SOUNDPLAN MODELLING

Noise levels have been predicted at the receiver locations 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.

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 except for localised lawns and greenery 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).

The following figures present the results of the SoundPlan Noise modelling, and results are summarised in Table 8 below.

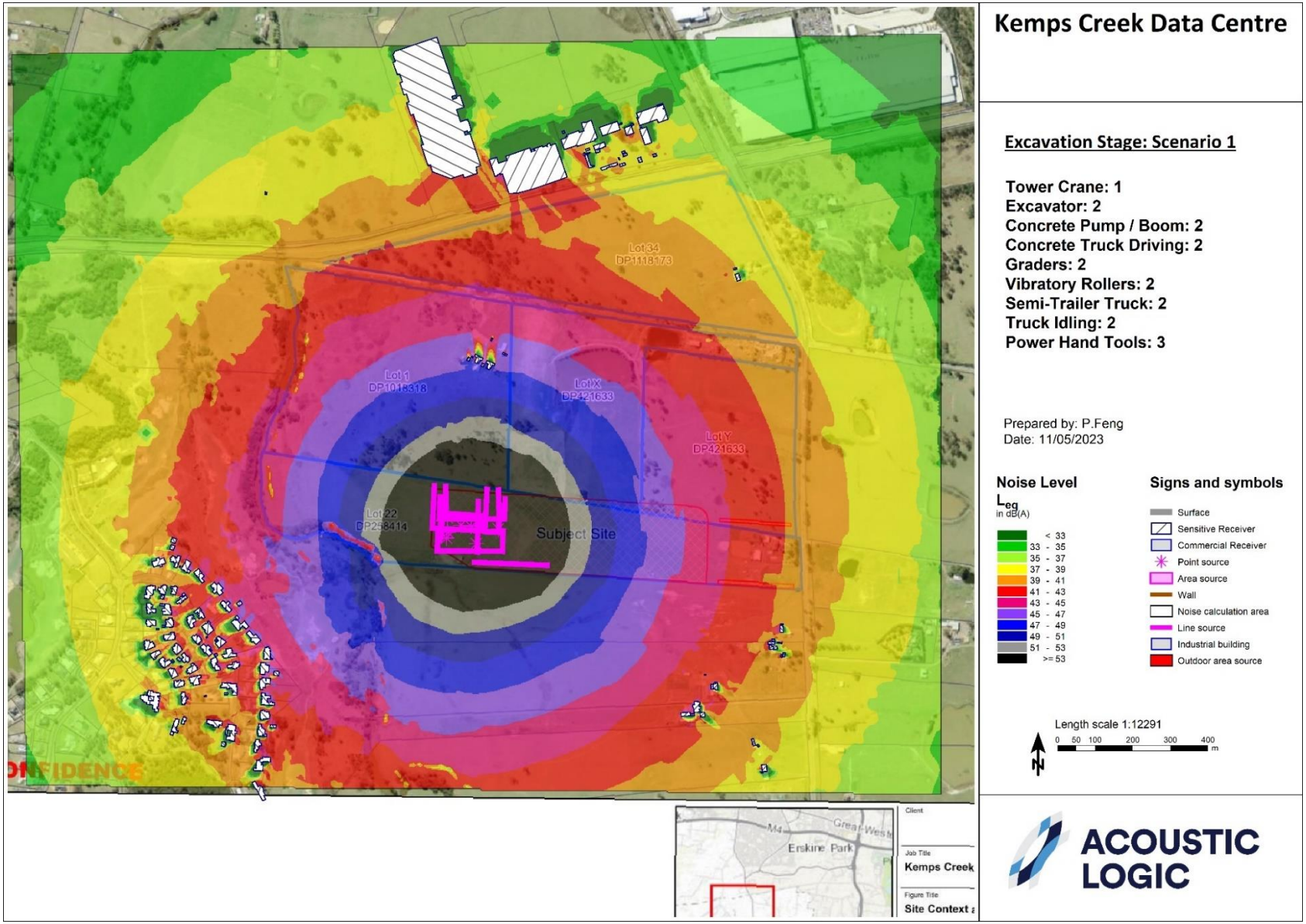


Figure 3: Excavation Stage – Scenario 1

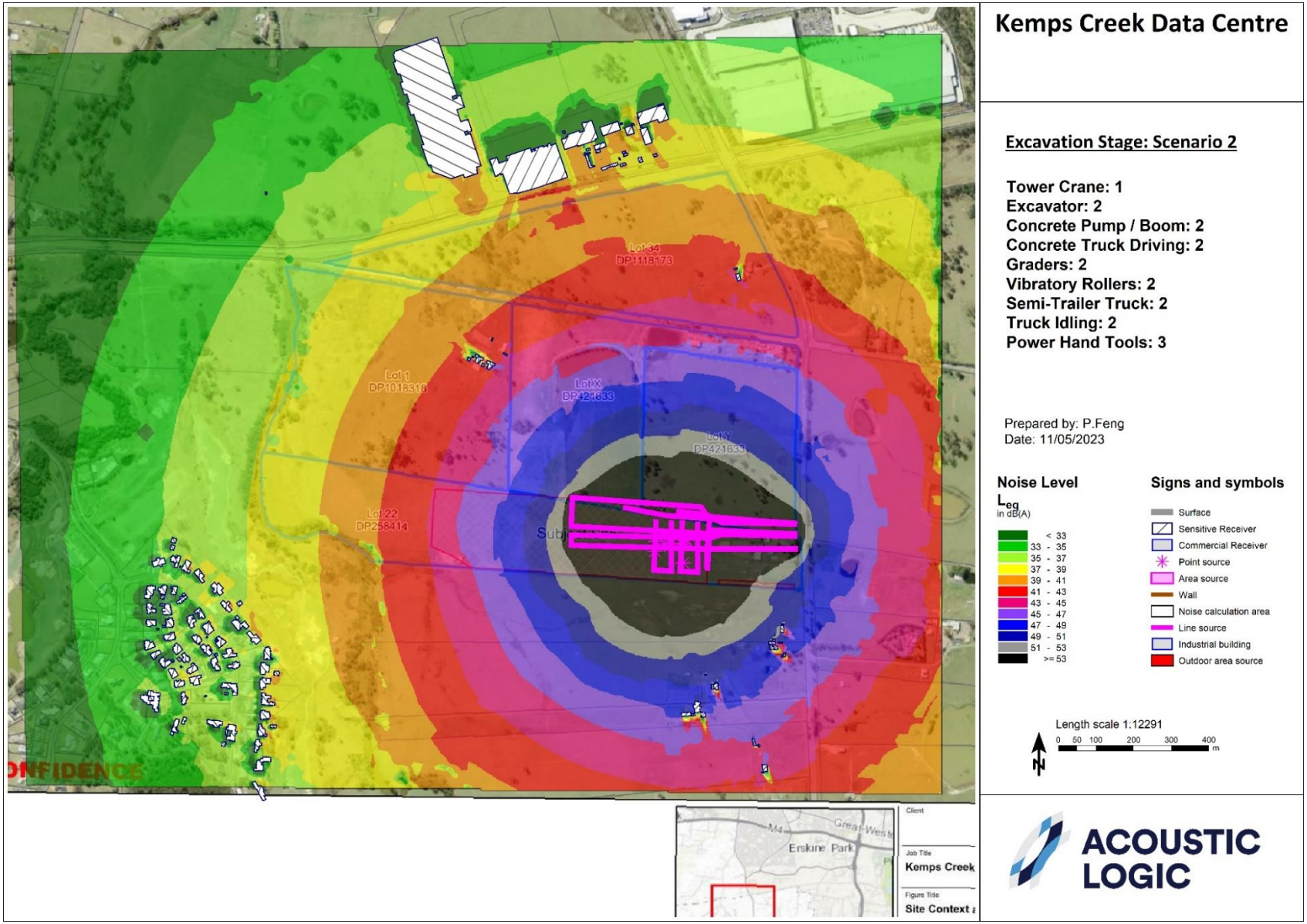


Figure 4: Excavation Stage – Scenario 2

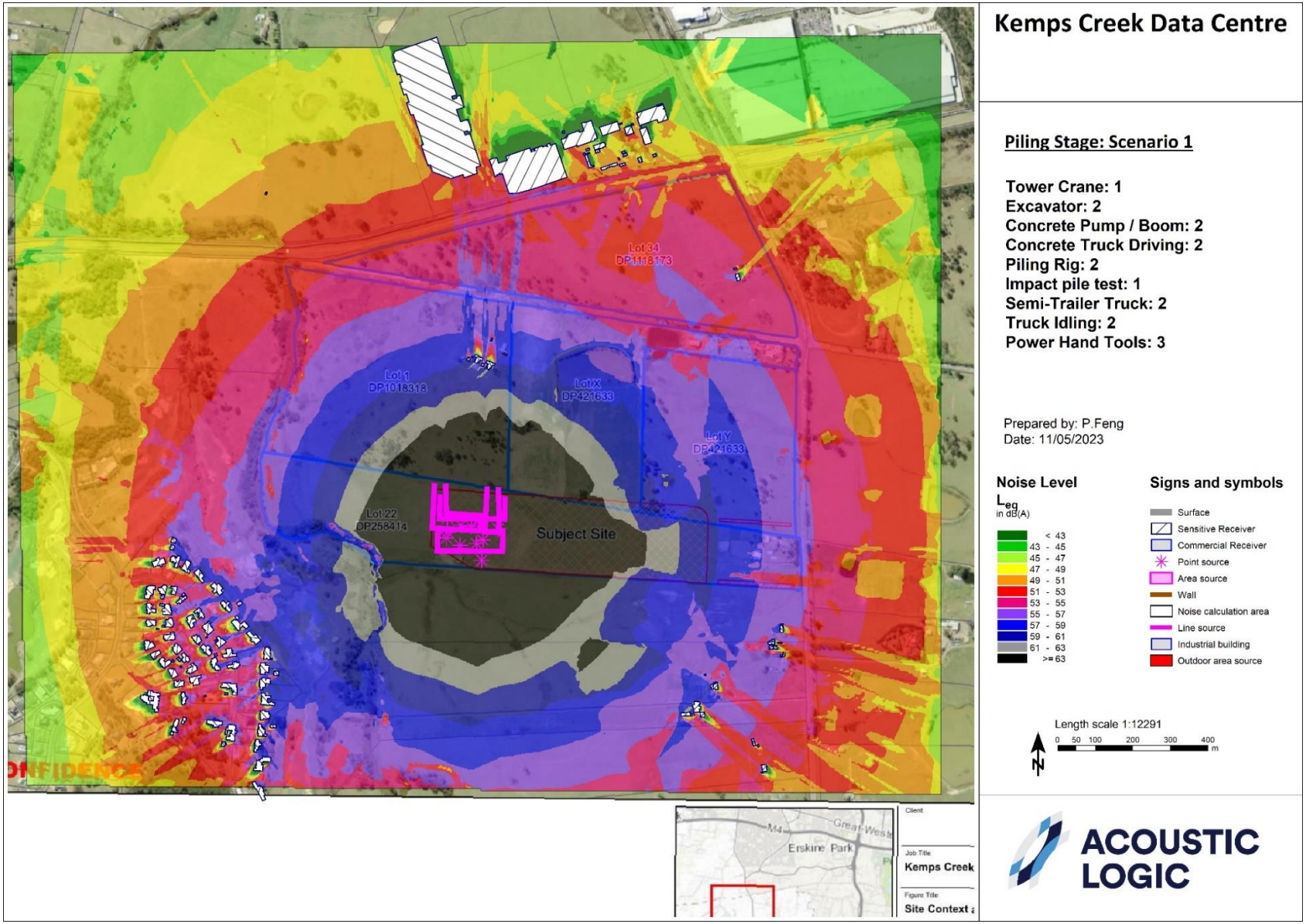


Figure 5: Piling Stage – Scenario 1

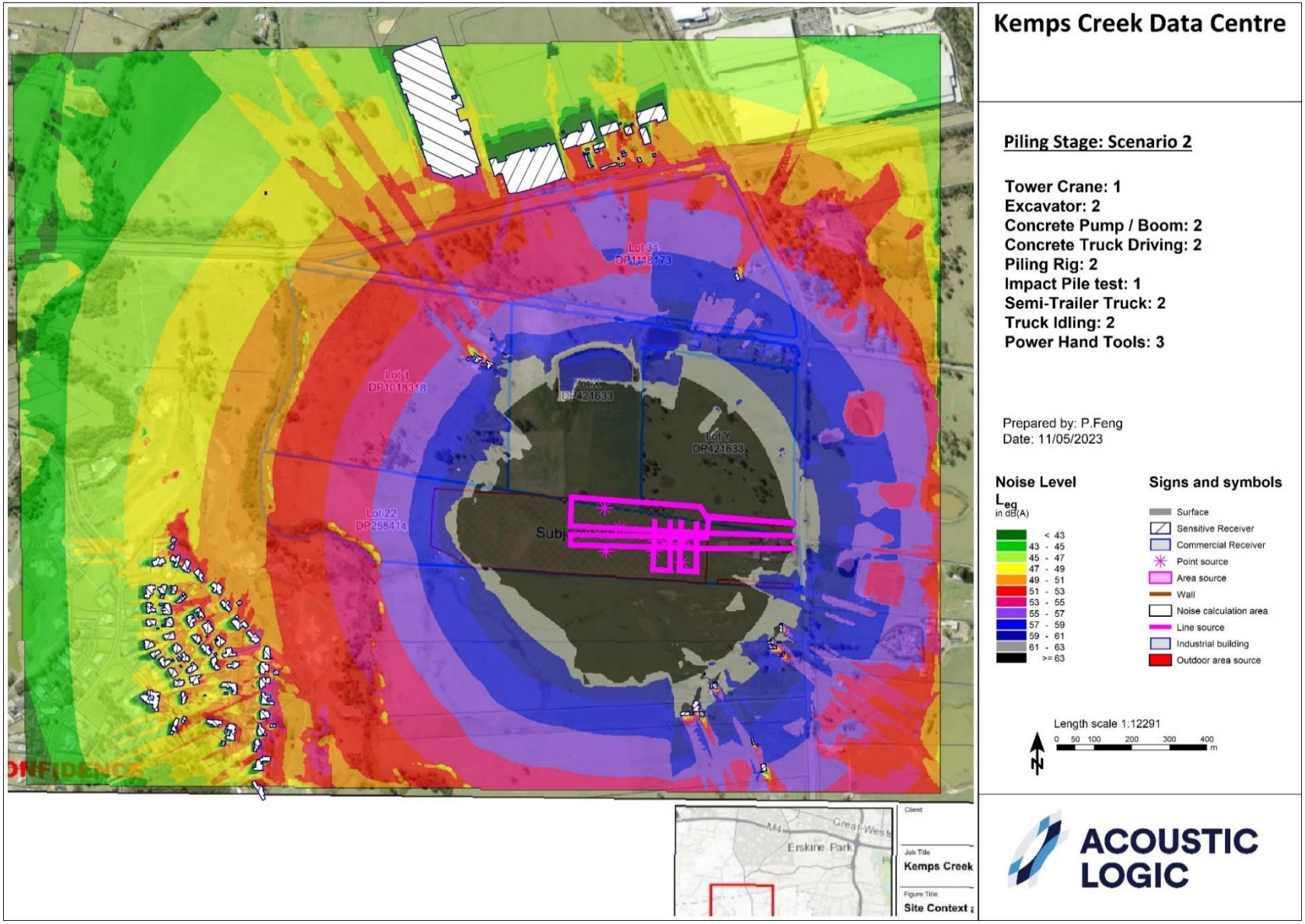


Figure 6: Piling Stage – Scenario 2

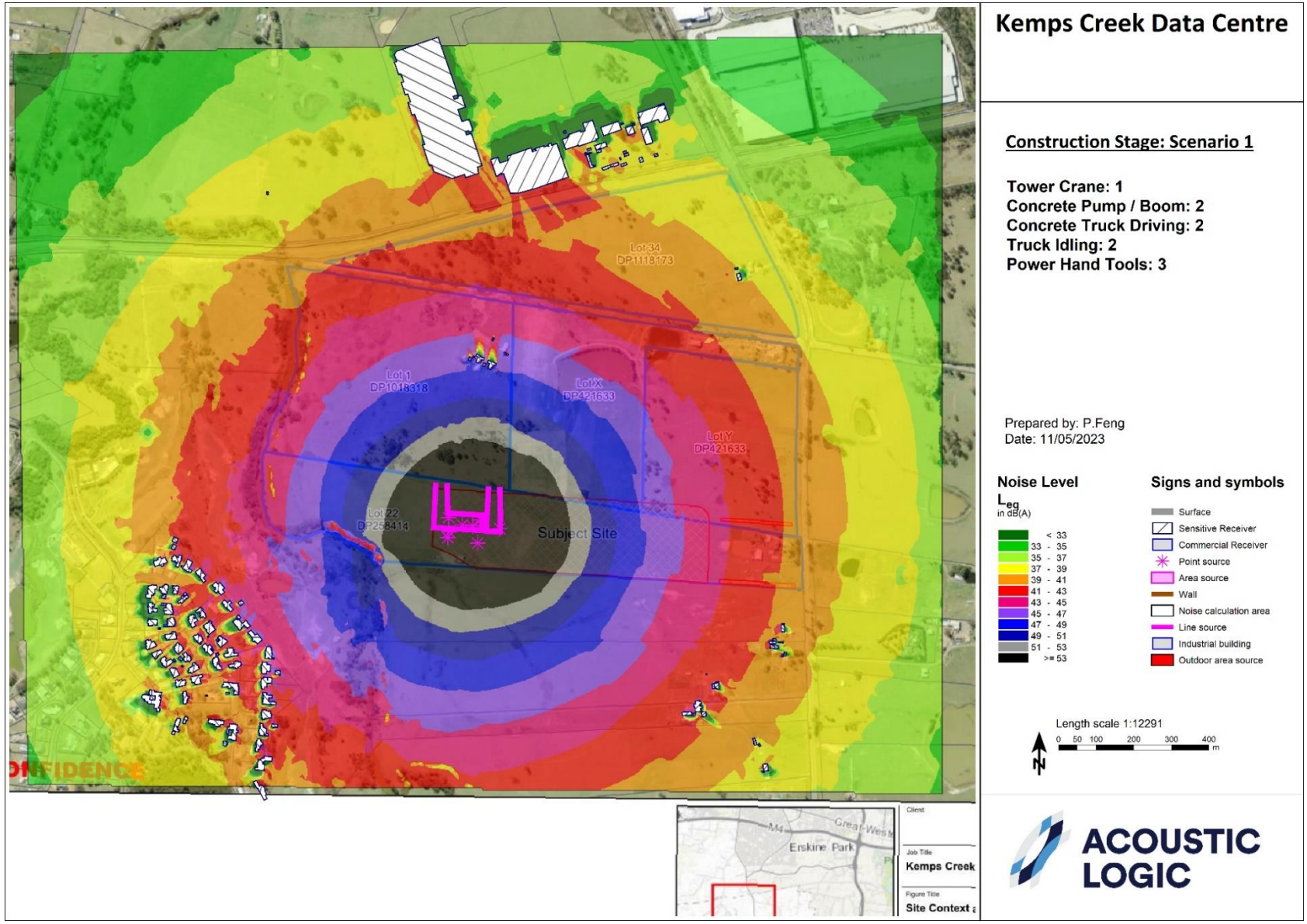


Figure 7: Construction Stage – Scenario 1

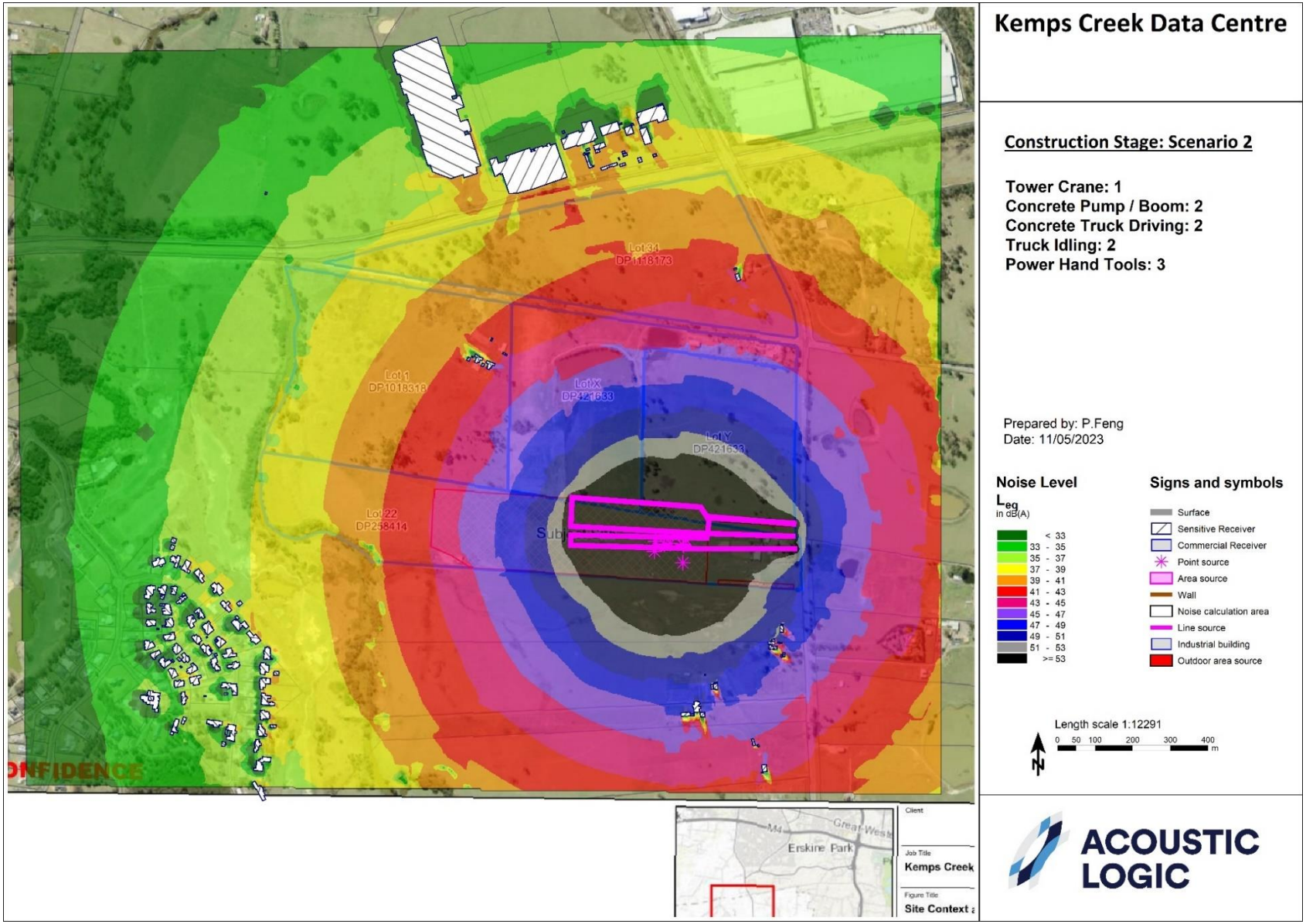


Figure 8: Construction Stage – Scenario 2

5.3 SUMMARISED PREDICTED NOISE LEVELS AT SENSITIVE RECEIVERS

The predicted external noise levels at nearest sensitive receivers are summarised and presented in Table 9 below.

Table 9–Predicted External Noise Levels at Nearest Sensitive Receivers

Receiver	Excavation Stage Predicted External Noise Level dB(A) $L_{eq(15min)}$	Impact Piling Works Predicted External Noise Level dB(A) $L_{eq(15min)}$	Construction Stage Predicted External Noise Level dB(A) $L_{eq(15min)}$	Noise Management Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comments
R1	41-47	53-61	39-45	Noise Affected Management Level(NAML) **50dB(A)$L_{eq(15min)}$** Highly Noise Affected Management Level (HNAML) **75dB(A)$L_{eq(15min)}$**	The Piling Works construction stage has potential to exceed EPA Noise Guidelines, see Section 6 for recommendations
I1	53-60	63-71	49-53	Noise Affected Management Level(NAML) **75dB(A)$L_{eq(15min)}$**	Meets NAML at all times
I2	53-60	63-71	49-53		

6 AMELIORATIVE MEASURES

The following recommendations are made to mitigate the noise impacts of construction activity to surrounding sensitive receivers.

6.1 SITE SPECIFIC RECOMMENDATIONS

- Notification - Prior to commencement of each month, neighbouring receivers should be notified of the anticipated works for that month and the potential noise and vibration generation from the anticipated construction activity.
- High Noise Generating Works:
    - Where high noise generating works are proposed to be undertaken (e.g piling), respite hours are to be implemented to reduce the impact on surrounding receivers. Limit the use of any required piling activities to between 8:00am – 12:00pm and 1:00pm - 5:00pm Monday to Friday and between 9:00am - 1:00pm on Saturdays. This equates to a maximum of four-hour blocks of high generating noise activity, separated by a minimum 1-hour respite period.
- Vehicle Noise - Trucks should consider turning off their engines during idling to reduce noise impacts on nearby receivers (unless truck ignition needs to remain on during concrete pumping). Minimise truck reversing. Plant and equipment should be off when not in use.
- Consideration should be given to the scheduling of deliveries during less sensitive time periods (After 9am) wherever practical.
- When selecting construction equipment to be used on the project, the noise levels of plant and equipment should be considered, whereby equipment selected has an equivalent or lower sound power level than the modelled sound power levels of equipment maintained within this report.
- A conscientious effort should be made to avoid works near the nearest sensitive receivers Compounding various high generating activities simultaneously near receivers should be avoided where possible.
- All employees, contractors and sub-contractors are to undergo an environmental induction which outlines noise management techniques. Additionally, they should be introduced and guided through the 'Microsoft SYD 05 Construction Environmental Plan'.
- Materials should be placed gently and not thrown to avoid excessive noise generation.
- During the construction stage and where practical and safe to do so, handheld construction equipment should be used within the building shell to minimise noise impacts on adjacent receivers.
- In the event of a complaint, noise management procedure identified in Section 8 of this report are to be followed. Notwithstanding above, general management techniques and acoustic treatments are included below which may be implemented on a case-by-case basis to reduce noise emissions to surrounding receivers.

6.2 ASSESSMENT OF VIBRATION

6.2.1 Vibration Producing Activities

Proposed activities that have the potential to produce significant ground vibration include:

- Excavation Work.
- Pile Testing.
- Piling

6.2.2 Safeguards to Protect Sensitive Structures

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.

6.2.3 Vibration Monitoring

AL recommends that vibration monitoring be conducted at the west and south-east site boundaries during the impact piling stages of work to monitor the vibration levels experienced at the nearby vibration-sensitive receivers.

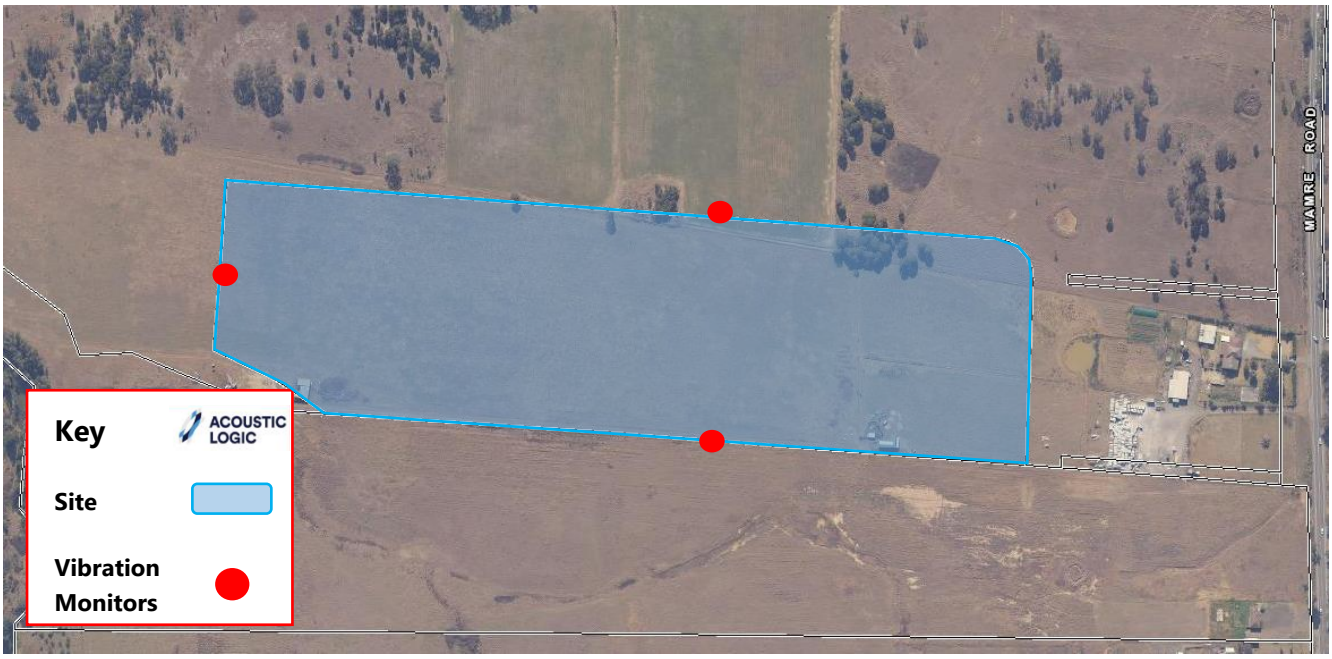


Figure 9 – Proposed Vibration Monitoring Locations

We also recommend that if complaints regarding vibration impacts from construction activity arise at other nearby sensitive receivers, vibration monitoring also be conducted at their development boundary to manage construction vibration levels at said receiver.

Any vibration monitor is to have SMS notification capability to enable contractor to be immediately informed when vibration limits are reached.

6.2.4 Downloading of Vibration Monitor Data

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 fortnightly with any exceedances in the vibration criteria reported as detailed in this report.

6.2.5 Presentation of Vibration Monitor Results

A fortnightly 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 fortnight reports including graphs of the collected data.

6.2.5.1 Equipment

Vibration monitoring at receiver facades or site boundaries are to be conducted using Texcel ETM type monitors with externally mounted tri-axial geophones. The monitors are to be set to send an SMS message when alert levels have been reached/exceeded at the location of the geophone.

6.2.5.2 Vibration Monitoring Alerts

The following personnel will receive alarms in the event that the nominated vibration trigger levels are exceeded at the site:

1. Acoustic consultant/advisor.
2. Project site foreman.
3. Project Manager.

6.3 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 later sections of this report.

6.3.1 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 (tower cranes). 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.

6.3.2 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.

6.3.3 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).

6.3.4 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.

6.3.5 Establishment of Site Practices

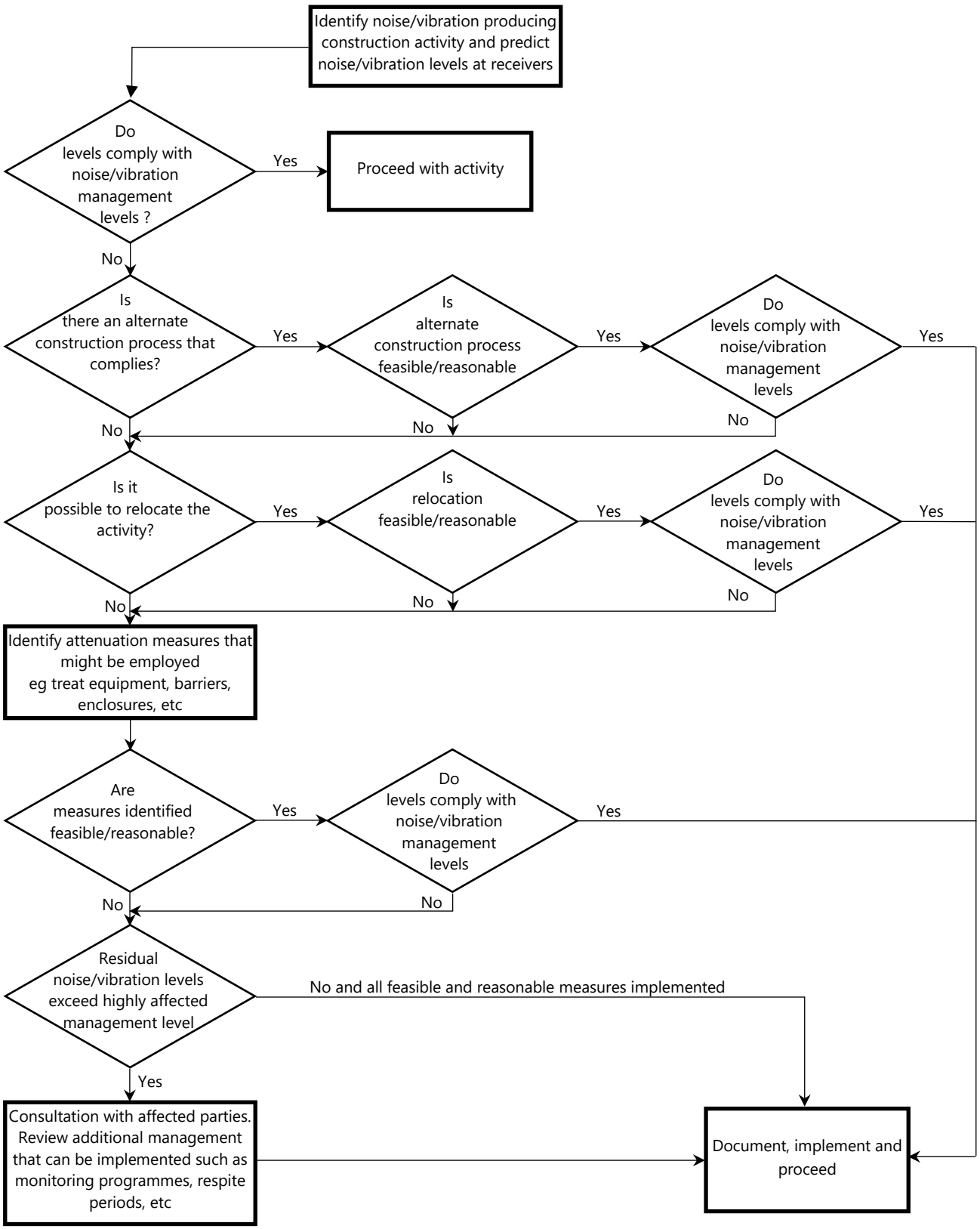
This involves the formulation of work practices to reduce noise generation. This includes locating fixed plant items as far as possible from residents as well as rotating plant and equipment to provide respite to receivers.

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.

7 ASSESSMENT METHODOLOGY AND MITIGATION METHODS

The flow chart that follows illustrates the process to be followed to minimise the impact associated with these activities.

Noise sources with the potential to exceed the criteria set out in Section 3 have been identified and discussed in Section 6.



8 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

8.1 GENERAL 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 process is to:

- Inform and educate the groups about the project and the noise controls being implemented.
- Introduce and guide through the 'Microsoft SYD 05 Construction Environmental Plan'.
- 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.
- 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 may 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.

In relation to condition B4 (e), as a form or coordinating construction works with other developments in the immediate vicinity to reduce cumulative noise, AW Edwards will engage in an initial meeting / 'consultation with respective stakeholders in the immediate vicinity of the project. Furthering this it has been advised that Veyor will issue look ahead programmes of upcoming works, and/or upcoming delivery schedules fortnightly for large delivery/workloads or as practical.

To note - an assigned community consultant (ERM) has been allocated to the project to monitor and address construction related complaints. The consultant will be engaged for the life of the construction to provide project updates and community liaison.

8.2 DEALING WITH COMPLAINTS GENERALLY

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.
- If necessary, setup vibration monitoring at the location representing the nearest affected vibration receiver, 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.

Measurements or other methods shall validate the results of any corrective actions arising from a complaint where applicable. Further both the applicant (MSFT) and general contractor (AWE) will include a community complaints link and designated email address: AWE: jbreakell@awedwards.com.au Microsoft: SydDCcommunities@erm.com

9 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. If necessary, setup noise and vibration monitoring devices at locations representing the nearest noise/vibration and dust affected receivers and provide data for each complain time period. Analysis is required to determine suitable mitigation measures.

Complaints associated with noise and vibration generated by site activities shall be recorded on a 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.

Table 4 of the EPA Interim of Construction Noise Guideline states the following

> *'Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied.'*

It is been advised that a state periodic review will be undertaken every 6 months until the completion of the project or after a particular number/volume of complaints has been received.

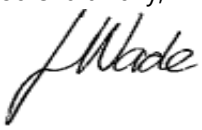
10 CONCLUSION

This report presents a construction noise and vibration management plan for the associated construction activities proposed to be conducted for the commercial development, to be located at 707-769 Mamre Road, Kemps Creek.

Provided that the practices and recommendations in this report are implemented, the noise and vibration impacts during the excavation, structural works, internal fit-out and external works stages will be minimised.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Pty Ltd
Justine Wade

APPENDIX 1 – ARUP ASSESSMENT

Confidential

Kemps Creek Data Centre

Noise and Vibration Impact Assessment

SYD05-06-07_Y-R-0000

Revision 4 | 1 September 2022

Job number 277863-00

Arup Australia Pty Ltd ABN 76 625 912 665

Arup
Level 5
151 Clarence Street
Sydney NSW 2000
Australia
www.arup.com

ARUP

Document verification

ARUP

Job title		Kemps Creek Data Centre		**Job number** 277863-00	
Document title		Noise and Vibration Impact Assessment		**File reference** SYD05-06-07_Y-R-0000	
Document ref		SYD05-06-07_Y-R-0000			
Revision	**Date**	**Filename**	SYD05 AC-RP-001 Acoustic Report_v1.docx		
Draft 1	25 February 2021	**Description**	First Draft		
			Prepared by	Checked by	Approved by
		Name	Mathew Simon	Glenn Wheatley	Mathew Simon
		Signature			
Revision 1	19 March 2021	**Filename**	SYD05-06-07_Y-R-0000 Acoustic Report_v2.docx		
		Description	Revision 1		
			Prepared by	Checked by	Approved by
		Name	Cynthia Nguyen	Mathew Simon	Mathew Simon
		Signature			
Revision 2	16 April 2021	**Filename**	SYD05-06-07_Y-R-0000		
		Description	Final Issue		
			Prepared by	Checked by	Approved by
		Name	Chris Nugroho	Mathew Simon	Mathew Simon
		Signature			

Issue Document verification with document ☑

Document Verification

Job title		Kemps Creek Data Centre			**Job number** 277863-00
Document title		Noise and Vibration Impact Assessment			**File reference**
Document ref		SYD05-06-07_Y-R-0000			
Revision	**Date**	**Filename**	SYD05-06-07_Y-R-0000 v4.docx		
Revision 3	23 Jul 2021	**Description**	Addressed DPIE Comments		
			Prepared by	Checked by	Approved by
		Name	Mathew Simon	Chris Nugroho	Mathew Simon
		Signature			
Revision 4	1 Sep 2022	**Filename**	SYD05-06-07_Y-R-0000 v5.docx		
		Description	Updated amenity criteria to address cumulative noise level		
			Prepared by	Checked by	Approved by
		Name	Mathew Simon	Glenn Wheatley	Mathew Simon
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

Executive summary

An acoustic assessment has been carried out for the proposed data centre in accordance with the requirements of the NSW Department of Planning and Environment (DPE), which has included consideration of the operational and construction phases of the development. Consideration to the Mamre Road Draft DCP [1] has been given.

The operational noise assessment established project noise goals and carried out noise predictions in accordance with the NSW *Noise Policy for Industry* [2]. Both standard operations, including maintenance testing of generators during the daytime period, as well as critical power failure scenario noise emissions have been predicted.

Indicative noise mitigation measures are provided in Section 7. An assessment of all potential mitigation measures has been conducted, and all feasible and reasonable measures are to be implemented. Provided mitigation measures are implemented, operational noise emissions are predicted to comply with established criteria for the day and evening periods. Residual exceedances of prescribed PANLs have been discussed. Detailed acoustic design will be required during the design development phase to confirm the detailed specification of equipment and mitigation measures.

Regarding construction, while specific activities and work schedules are not yet known, criteria has been established in accordance with the NSW ICNG [3] and *Assessing Vibration: a technical guideline* [4]. Exceedances of Noise Management Levels are predicted at nearest residential and non-residential receivers. Recommendations with regard to mitigation and management measures are also outlined and are expected to be developed further in a formal Construction Noise and Vibration Management Plan, to be prepared prior to commencement of works.

No significant acoustic impacts due to the traffic generated by service vehicles are predicted.

Contents

Appendices

Appendix A

Acoustic terminology

Appendix B

Noise monitoring

Appendix C

Cumulative noise level calculation

Appendix D

Noise Contour Maps

1 Introduction

1.1 Purpose of this report

The purpose of this report is to respond to the Secretary's Environmental Assessment Requirements (SEARs) by providing an assessment of the noise and vibration impacts of the proposal and all reasonable and feasible measures that will be implemented to minimise potential impacts. The report provides an assessment of noise and vibration sources and impacts during the construction and operation of the proposal, and outlines how these impacts will be minimised or mitigated.

1.2 Proposal overview

1.2.1 Site context

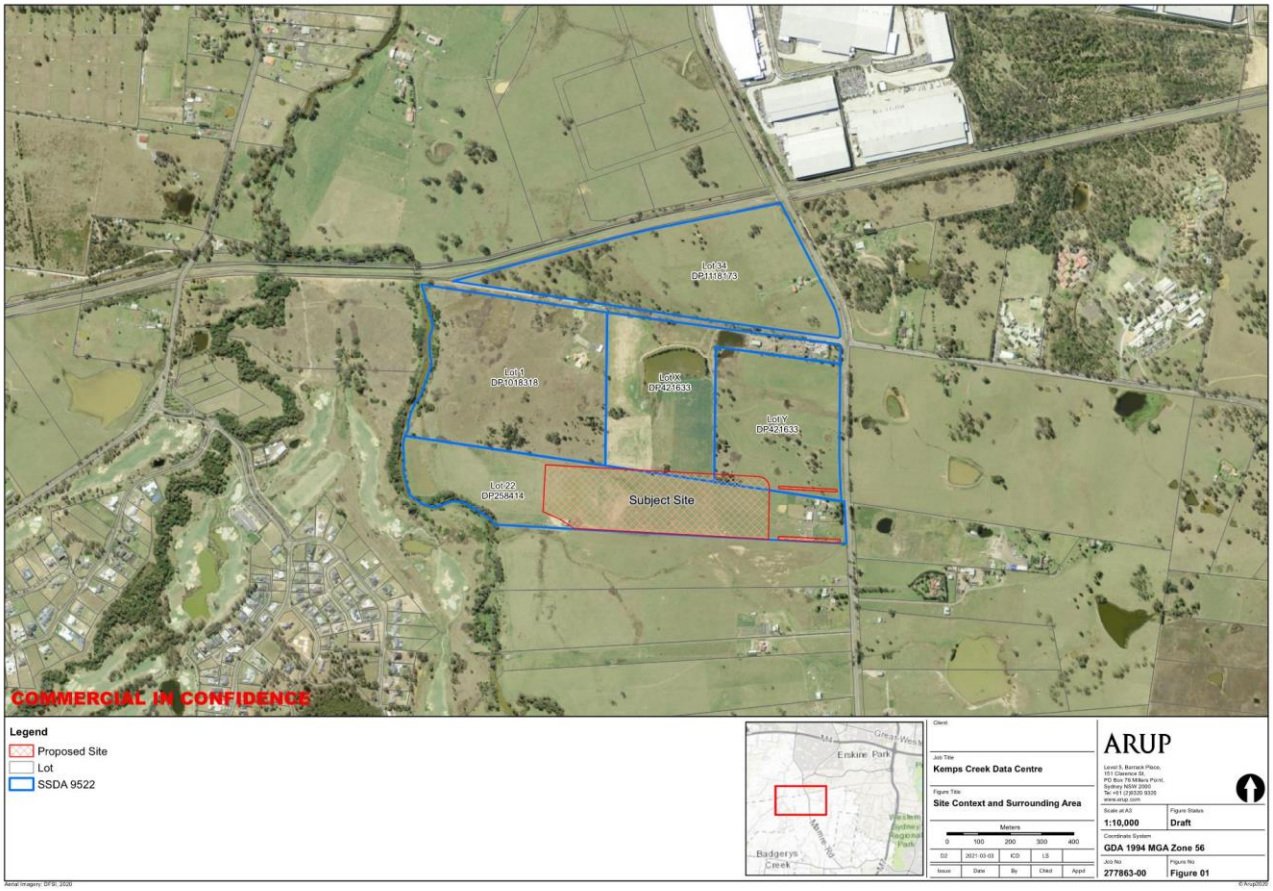
The identified site address that is the subject of this technical report is legally defined as 757-769 Mamre Road, Kemps Creek. The entire Site comprises a total area of approximately 17.38 hectares (ha) and is subject to the applicable provisions outlined within SEPP (WSEA) 2009. Access to the Site is currently obtained via the proposed Estate Access Roads (SSD 9522), which are accessed from Mamre Road. Access into the Site is made possible via Mamre Road, which is subject to future road widening as part of the Mamre Road Widening Project (Transport for NSW).

The Site is situated approximately 40.26 km west of the Sydney CBD, 22.11 km west of Parramatta and 11.97 km southeast of Penrith. It is within close proximity to transport infrastructure routes (predominantly the bus network), as well as sharing direct links with the wider regional road network, including Mamre Road and both the M4 & M7 Motorways. All of which provide enhanced connectivity to the Subject Site and immediate vicinity, as well as the wider locality.

Additionally, the Subject Site is located within close proximity to active transport links, such as bicycle routes, providing an additional mode of accessible transport available to the Subject Site. In its existing state, the Subject Site comprises an undeveloped land portion; however, is subject to bulk earthworks and infrastructure works under a concurrent State Significant Development (SSD) Application - SSD 9522.

The Proponent is proposing to construct and operate a Data Centre on the Subject Site. The Site is located within the Penrith Local Government Area (LGA) and is zoned IN1 General Industrial under the provisions of State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP (WSEA) 2009). Development for the purpose of a Data Centre is permissible with consent within the IN1 General Industrial zone pursuant to the provisions outlined with Part 3, Division 3, Clause 27 of State Environmental Planning Policy (Infrastructure) 2007 (ISEPP).

The site and surrounding context are illustrated below in Figure 1.


Lot34
DP1116373
Lot1
DP1018318
LotX
DP221633
LotY
DP221633
Lot22
DP258414
Subject Site
COMMERCIAL IN CONFIDENCE
Legend
Proposed Site
Lot
SSDA 9522
Erskine Park
Badgerys Creek
Kemps Creek Data Centre
Site Context and Surrounding Area
1:10,000
Draft
GDA 1994 MGA Zone 56
277863-00
Figure 01
ARUP

1.3 Architectural drawings

The acoustic assessment has been based on the following architectural drawings prepared by Greenbox Architecture Pty Ltd, as outlined in Table 1.

Table 1: Architectural drawings

Drawing Number	Revision	Revision Date	Sheet Name
CRD001	2	18/12/2020	GA FLOOR PLANS_1-1000
CRD010	2	18/12/2020	GA FLOOR PLAN - L1 - WEST_1-500
CRD011	2	18/12/2020	GA FLOOR PLAN - L1 - EAST_1-500
CRD020	2	18/12/2020	GA FLOOR PLANS-L2_1-500
CRD050	2	18/12/2020	GA SECTIONS_1-500
CRD051	2	18/12/2020	GA SECTIONS_1-500

1.4 Qualification

This report was prepared by Mathew Simon and reviewed by Glenn Wheatley, both suitably qualified and experienced acousticians from the Arup Acoustics team, who hold good working knowledge of the relevant standards, specifications and conditions applicable to this project.

Mathew and Glenn hold over 10 years' experience as acoustic consultants and are qualified and operating members of the Australian Acoustical Society (AAS). Arup are a member firm of the Association of Australasian Acoustical Consultants (AAAC).

1.5 SEARs and DCP requirements relevant to this report

Table 2 identifies the SEARs and DCP requirements which are relevant to this technical assessment.

Table 2: SEARs and DCP requirements for acoustics

Requirements relevant to this technical report	Where addressed in this technical report
SEARS Key Issue - Noise and Vibration	
The EIS must include an assessment of the potential impacts of the proposal (including cumulative impacts) and develop appropriate measures to avoid, mitigate, manage and/or offset these impacts. The EIS must address the following specific matters:	
a quantitative noise and vibration impact assessment (NVIA) of the development during construction and operation (including testing of the back-up generators). The NVIA is to be undertaken by a suitably qualified person in accordance with the relevant Environment Protection Authority guidelines and include an assessment of nearby sensitive receivers	Construction – Section 5 Operation – Section 6 Nearby sensitive receivers - Section 4

Requirements relevant to this technical report	Where addressed in this technical report
cumulative impacts of other developments	Cumulative noise impacts - Section 6.5
details of proposed mitigation, management and monitoring measures	Environmental management measures - Section 7
Mamre Road Precinct Draft DCP November 2020 **Section 4.3.1 – Noise and Vibration**	
Objectives a) Establish design criteria for noise emissions from industrial or other employment generating development. b) Establish acoustic environmental goals for existing and future adjacent residential areas Establish noise contributions for individual allotments within the employment zones when related to residential boundaries	
Control 1: Any machinery or activity considered to produce noise emissions from a premise shall be adequately sound-proofed so that noise emissions are in accordance with the provisions of the Protection of the Environment Operations Act 1997.	Operation – Section 6
Control 2: The use of mechanical plant and equipment may be restricted in areas close to sensitive receivers, such as adjoining rural residential development. Developers in all areas should ensure through design of their development that no offensive noise is emitted	Operation – Section 6
Control 4: All development shall comply with the requirements of relevant Australian Standards and State Government policies and guidelines relating to noise.	Operation – Section 6
Control 5: An acoustic report shall be required for developments that are likely to generate high noise levels and for development within 500m of residential areas and other sensitive noise receivers, including seniors housing, places of public worship and educational establishments. The acoustic design report should refer to the relevant Australian Standards and State Government policies and guidelines relating to noise	Operation – Section 6
Control 7: It is essential that potential developers investigate noise amelioration features to be included in building design, which will assist in achieving compliance with Council's acoustic criteria. Having regard to the surrounding topography, it is critical that the roof element of all buildings be acoustically capable of controlling potential breakout noise.	Operation – Section 6
An Acoustic Report in accordance with Section 4.3.1 of this DCP must be prepared by a suitably qualified acoustic consultant who possesses the qualifications to render them eligible for membership of the Australian Acoustical Society or employed by an Association of Australasian Acoustical Consultants (AAAC) member firm. The report should refer to the relevant Australian Standards and State Government policies and guidelines relating to noise.	Qualifications – Section 1.3

2 Policy and planning context

The following Acts, Plans, Guidelines and Policies have been considered in accordance with the SEARs:

- NSW DEC *Assessing Vibration: A Technical Guide* [4]
- NSW EPA *Noise Policy for Industry*
- NSW EPA Environmental Criteria for Road Traffic Noise ('ECRTN') [5]

  Note: the ECRTN has been superseded by the NSW Road Noise Policy. Road traffic assessments have been conducted in accordance with this current policy.
- NSW EPA *Noise Guide for Local Government* [6]
- NSW DECC Interim Construction Noise Guideline [3]

In addition, the following documents have been considered as part of this assessment:

- British Standard 7385 Part 2 [7]
- TfNSW Construction Noise Strategy [8]
- NSW Road Noise Policy [9]
- Draft Mamre Road Precinct Development Control Plan 2020 (DCP) [1]
- German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure'* [10]

Regarding aircraft noise, the site location does not require an assessment in accordance with the draft ANEF noise contours for Badgerys Creek Airport. (https://www.westernsydneyairport.gov.au/about/flight-paths/noise-tool)

3 Methodology

This Chapter outlines the methodology used to undertake the environmental assessment of potential acoustic impacts of the proposal, including definition of the study area used as the basis of the assessment.

The scope of work for this project is as follows:

- Review the Master SSD-9522 Acoustic Report (Master SSDA) [11] , site plans and proposed development details.
- Conduct noise monitoring is proposed to ensure the current ambient acoustic environment is captured. Monitoring results are presented in the Master SSDA, however additional monitoring has been conducted to establish current background noise levels.
- Establish construction and operational acoustic criteria based on monitoring data.
- Predict construction noise and vibration impacts based on a preliminary construction equipment selection.
- Predict operational noise emissions based on a preliminary plant equipment selection. Operational scenarios include:
  - Normal operations
  - Power failure operations

  A testing and commissioning period is anticipated following commencement of operations. Noise impacts throughout this period are anticipated to be equal or lower than during operations, therefore are deemed to comply following demonstration of compliance during normal operations
- Assessment of the net change in traffic noise levels on the local road network due to the operation of the development.
- Conduct a preliminary assessment to determine potential (in-principle) noise mitigation treatment for primary operational noise sources, and to inform design that is to be documented for the Development Application.

3.1 Study area

The proposed study area will extend across all nearest receivers to the site, including residences in Luddenham to the west, isolated rural residences to the south and east, and residential and commercial / industrial premises to the north, shown in Figure 2.

Figure 2: Site, surrounding sensitive receivers and NCAs

4 Existing environment

Noise monitoring was undertaken for the purpose of deriving of noise criteria and qualifying the noise environment at nearby receivers.

Long-term unattended and short-term attended monitoring was conducted at locations presented in Table 3 and shown in Figure 3.

Table 3: Monitoring locations

Type	Purpose	ID	Location	Description
Both long-term unattended and short-term attended	Establish criteria	L1	Residential 1 Medinah Avenue, Luddenham	Backyard of 1 Medinah Avenue, near the overhead power line.
		L2	Residential Bakers Lane West, Kemps Creek	Adjacent to Bakers Lane West, a private access road.
Short-term attended only	Quantify and qualify noise levels surrounding site	S1	On Master site	Along northern boundary of site
		S2	Adjacent to Mamre Road	South of intersection of Mamre Road and Bakers Lane

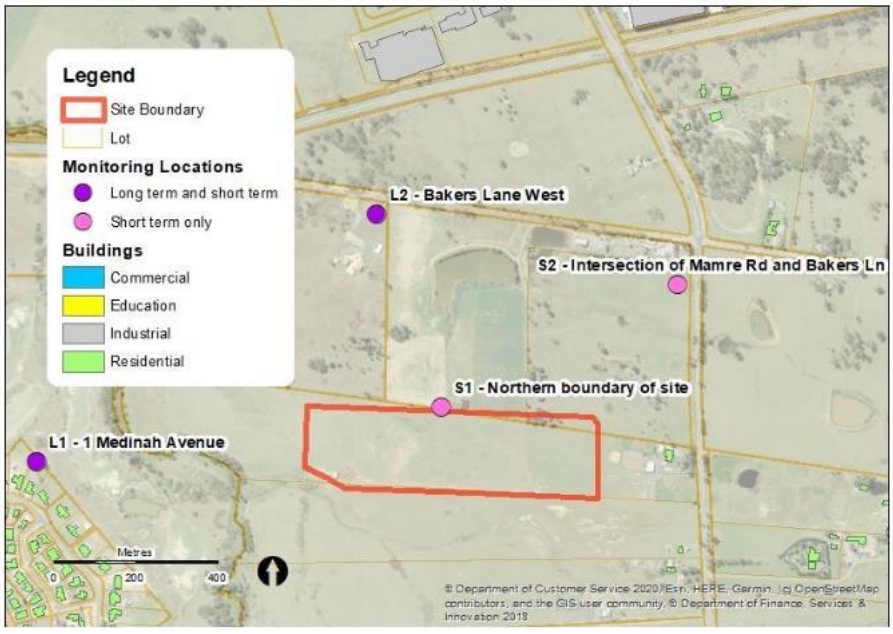


Figure 3: Noise monitoring locations

4.1 Unattended long-term monitoring

Long-term noise monitoring was carried out over two periods from 15 to 23 May 2019 and 25 November to 7 December 2020.

Table 4 summarises the background and ambient noise level results. The long-term noise monitoring methodology and noise level-vs-time graphs of the data are included in Appendix B.

Table 4: Long-term noise monitoring results, dB(A)

Location	NCA	Time period[1]	Rating Background Levels, dBL_{A90}	Ambient dBL_{Aeq} noise levels
L1 - 1 Medinah Avenue, Luddenham	1	Day	37	49
		Evening	36	45
		Night	33	45
L2 – Bakers Lane West, Kemps Creek	2	Day	39	47
		Evening	43	46
		Night	38	46

1 - Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
Evening: 18:00-22:00 Monday to Sunday & Public Holidays
Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
As required by the NPfI, the external ambient noise levels presented are free-field noise levels.

4.2 Attended short-term monitoring

Short-term attended noise measurements were undertaken on Wednesday, 15 May 2019 and Wednesday, 25 November 2020 at four locations shown in Figure 3. The measured noise levels are summarised in Table 5.

Table 5: Short-term noise monitoring results, dB(A)

Location	Date and start time	Measured levels		Noise Sources Contributions
		$dBL_{A90(15min)}$	$dBL_{Aeq(15min)}$	
L1	25/11/20 14:30	39	45	Relatively quiet with limited traffic noise. Insect and bird song fairly present throughout measurements. Occasional helicopter/plane passbys.
L2	15/05/19 13:00	39	48	Traffic noise, light aircraft flyovers, construction noise (jackhammers, reversing alarms), birdsong and insects.
S1	25/11/20 11:14	41	45	Light and heavy traffic from Mamre Road. Insect and bird song fairly present throughout measurement

Location	Date and start time	Measured levels		Noise Sources Contributions
		$dBL_{A90(15min)}$	$dBL_{Aeq(15min)}$	
S2	25/11/20 11:54	55	74	Heavy/light traffic dominated. Some air braking from trucks, Insects audible when traffic noise low.

No industrial noise was noted during measurements.

4.3 Assessment locations

In accordance with the *Noise Policy for Industry* NPfI, the reasonably most-affected residences have been grouped into Noise Catchment Areas (NCAs) based on their acoustic environment as observed on site. NCAs are presented in Figure 2. For clarity, the assessment of residential receivers presented in this report is isolated to the reasonably most-affected receivers listed in Table 6.

Table 6: Reasonably most-affected residential receivers

Receiver ID	Address	No. of floors	NCA
R1	771-781 Mamre Road Kemps Creek	1	1
R2	783-797 Mamre Road Kemps Creek	1	1
R3	799-803 Mamre Road Kemps Creek	2	1
R4	15 Medinah Avenue Luddenham	1	2
R5	9 Medinah Avenue Luddenham	2	2
R6	676-702 Mamre Road Kemps Creek	1	1
R7	676-702 Mamre Road Kemps Creek	1	1

A list of all non-residential noise sensitive receivers within the study area is presented in Table 7.

Table 7: Non-residential receivers

Receiver ID	Name	Address	No. of floors
Education			
E1	Mamre Christian College	45-59 Bakers Lane Kemps Creek	1
Industrial			
I1	Master site boundary East	757-703 Mamre Road Kemps Creek	1
I2	Master site boundary North East	757-703 Mamre Road Kemps Creek	1
I3	Master site boundary North West	757-703 Mamre Road Kemps Creek	1
I4	Master site boundary West	757-703 Mamre Road Kemps Creek	1
I5	DATS	7-9 Distribution Drive Orchard Hills	5

5 Assessment of potential construction impacts

5.1 Construction vibration

Vibration impacts are unlikely to be an issue at the nearest residential premises which lie over 200 m away. Vibration impacts onto the existing site buildings, however, should be managed if vibration intensive works are required near these buildings. Vibration impacts onto existing utilities and buried services also require consideration, and criteria have been provided in Section 5.1.3.

5.1.1 Disturbance to buildings occupants

Concerns regarding impacts on human occupants to buildings would generally be assessed in accordance with the 'intermittent' vibration criteria outlined in the DEC Guideline [4], however reference would typically be made to the Maximum levels. For this project, focus for management purposes is on structural damage, as outlined below.

5.1.2 Structural damage

5.1.2.1 Definition

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard 7385 Part 2 [7] and/or German Standard DIN4150-3 [10]. British Standard 7385 Part 1: 1990, defines different levels of structural damage as:

- *Cosmetic - The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.*
- *Minor - The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.*
- *Major - Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.*

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

> *7.4.2 Guide values for transient vibration relating to cosmetic damage*
>
> *Limits for transient vibration, above which cosmetic damage could occur are given numerically in Table 1 and graphically in Figure 1. In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz, where a*

> *high displacement is associated with a relatively low peak component particle velocity value a maximum displacement of 0.6 mm (zero to peak) should be used.*
>
> *Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 1, and major damage to a building structure may occur at values greater than four times the tabulated values.*

Within DIN4150-3, damage is defined as "*any permanent effect of vibration that reduces the serviceability of a structure or one of its components"* (p.2). The Standard also outlines:

> *"that for structures as in lines 2 and 3 of Table 1, the serviceability is considered to have been reduced if*
>
> - *cracks form in plastered surfaces of walls;*
> - *existing cracks in the building are enlarged;*
> - *partitions become detached from loadbearing walls or floors.*
>
> *These effects are deemed 'minor damage." (DIN4150.3, 1990, p.3)*

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

5.1.2.2 British Standard BS7835-2

BS7385-2 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4–250 Hz, and a maximum displacement value below 4 Hz is recommended. Table 8 sets out the BS7385 criteria for cosmetic, minor and major damage. Regarding heritage buildings, British Standard 7385 Part 2 [7, p. 5] notes that "*a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*".

Table 8: BS 7385-2 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s[1]		
			4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor[2]	100		
		Major[2]	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor[2]	30 to 40	40 to 100	100
		Major[2]	60 to 80	80 to 200	200

1 - Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

2 - Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

5.1.2.3 German Standard

German Standard DIN 4150 - Part 3 '*Structural vibration in buildings - Effects on Structure'* [10] are generally recognised to be conservative and is often referred to for the purpose of assessing structurally sensitive buildings. For the subject site, surrounding buildings are not deemed structurally sensitive and therefore the British Standard is considered appropriate for vibration management.

5.1.3 Buried services

A number of buried services existing on the existing Altis Frasers site and require consideration when conducting vibration intensive construction activities.

DIN 4150-2:1999 sets out guideline values for vibration effects on buried pipework and reproduced in Table 9 below.

Table 9: Guideline values for short-term vibration impacts on buried pipework

	Pipe material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Note: For gas and water supply pipes within 2m of buildings, the levels given in DIN4150-3 [10] should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

In addition, specific limits for vibration affecting high-pressure gas pipelines is provided in the UK National Grid's *Specification for Safe Working in the Vicinity of National Grid High Pressure Gas Pipelines and Associated Installations –*

Requirements for Third Parties (report T/SP/SSW/22, UK National Grid, Rev 10/06, October 2006). This specification states that no piling is allowed within 15 meters of a pipeline without an assessment of the vibration levels at the pipeline. The PPV at the pipeline is limited to a maximum level of 75 mm/s, and where PPV is predicted to exceed 50 mm/sec the ground vibration is required to be monitored.

Other services that maybe encountered include electrical cables and telecommunication services such as fibre optic cables. While these may sustain vibration velocity levels from between 50 mm/s and 100 mm/s, the connected services such as transformers and switchgear, may not. Where encountered, site specific vibration assessment in consultation with the utility provider should be carried out.

5.2 Construction noise criteria

The NSW *Interim Construction Noise Guideline* [3] (ICNG or Guideline) provides recommended noise levels for airborne construction noise at sensitive land uses. The guideline provides construction noise management levels above which all feasible and reasonable work practices should be applied to minimise the construction noise impact. The ICNG works on the principle of a 'screening' criterion – if predicted or measured construction noise exceeds the ICNG levels then the construction activity must implement all 'feasible and reasonable' work practices to reduce noise levels.

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

This development is expected to warrant a quantitative assessment.

The ICNG sets out management levels for noise at noise sensitive receivers, and how they are to be applied. These noise management levels (NMLs) for residential receivers and other sensitive receivers are reproduced in Table 6 and in Table 7 respectively.

Table 10: Construction noise management levels (NMLs) at residential receivers

Time of day	NML[1] $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

1 - Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 11: Construction noise management levels (NMLs) at other noise sensitive land uses

Land use	Where objective applies	Management level $L_{Aeq(15\ min)}$[1]
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)
Industrial premises	External noise level	75 dB(A)

1 - Noise management levels apply when receiver areas are in use only.

Table 12 and Table 13 summarises relevant project construction noise targets for the project for residential and non-residential receivers respectively.

Table 12: Noise Management Levels for residential receivers

Receiver ID	Address	Standard Hours[1] $dBL_{Aeq\ (15\ min)}$
R1	771-781 Mamre road Kemps creek	49
R2	783-797 Mamre road Kemps creek	49
R3	799-803 Mamre road Kemps creek	49
R4	15 Medinah avenue Luddenham	47
R5	9 Medinah avenue Luddenham	47
R6	676-702 Mamre road Kemps creek	49
R7	676-702 Mamre road Kemps creek	49

Notes:

1 - Standard hours are Monday to Friday 7 am to 6 pm and Saturday from 8 am to 1 pm.

Table 13: Noise Management Levels for non-residential receivers

Receiver ID	Address	NML[1] $dBL_{Aeq\ (15\ min)}$
E1	45-59 Bakers lane Kemps creek	55[2]
I1	757-703 Mamre road Kemps creek	75
I2	757-703 Mamre road Kemps creek	75
I3	757-703 Mamre road Kemps creek	75
I4	757-703 Mamre road Kemps creek	75
I5	7-9 Distribution drive Orchard hills	75

Notes:

1 – When in use

2 – Levels which have been adjusted to convert internal NML levels to external, by an addition 10dB. In accordance with the ICNG.

5.3 Construction assessment

5.3.1 Hours of work

Construction would take place between standard working hours:

- Monday to Friday 7 am to 6 pm; and
- Saturday 8 am to 1 pm.

There would be no construction work on Sundays or public holidays.

5.3.2 Assessment methodology

Noise emissions from construction activities have been assessed to criteria outlined in Section 5.2.

Noise emissions have been modelled using SoundPlan 8 in accordance with the CONCAWE algorithm, with a 3 m/s source to receiver wind applied. The model included:

- Construction noise sources listed in Table 15;
- Surrounding buildings;
- Receivers listed in Section 4.3; and
- Ground terrain and absorption.

Noise emissions have been modelled on the following assumptions:

- Equipment, staging, locations and durations are based on information provided by Client.

5.3.3 Activities

Construction details are unavailable at this stage of the project. An assessment of potential construction activities has been conducted on assumed construction activities based on similar datacentre projects, as approved by the Client.

The total construction period is anticipated to take up to 16 months. The construction would involve the stages outlined in Table 14.

Table 14: Construction stages

Stage	Anticipated duration
Stage 1: Site establishment and excavation	1 month
Stage 2: Pavement and road works	3 months
Stage 3: Building construction	10 months
Stage 4: Plant installation and connection	2 months

5.3.4 Plant and equipment sources

Table 15 shows the equipment sound power levels have been determined by reference to AS2436 [12], BS 5228-1:2009 [13] and Arup's measurement database. The equipment below has been assumed to operate concurrently and continuously over a full 15-minute period (a typical worst-case assumption). All construction plant are considered to be 'non-steady sound' sources in accordance with accordance with AS1055:2018 [14] unless specified in Table 15.

Table 15: Equipment and plant sound power levels

Plant item	Plant item SWL, dB(A)	Penalty[1], dB	% of use in worst case 15 mins	Construction Phases			
				Site establishment and excavation	Pavement & road works	Building construction	Plant installation and connection
Backhoe	108	0	100	1			
Compactor	115	5	100	1	1		
Concrete Pump	106	0	100		1	1	
Concrete Pump Truck	113	0	100		1	1	
Crane (Franna)	98	0	100			1	
Crane (Tower)	105	5	100			1	
Excavator (30t) + hydraulic hammer	122	0	100	2	1		
Excavator with breaker	124	0	100	1			
Loader (Front-end) (23t)	112	0	100	1	1		
Generator (Diesel)[2]	113	0	100	1	1	1	
Grader	115	0	100	1	1		
Jack Hammer	121	5	100		1		
Roller (Vibrator)	112	0	100	2			
Roller (Smooth-drum)	107	0	100		1		
Pavement Laying Machine	114	0	100		1		
Piling rig (Impact)	129	5	100			1	
Scraper	116	0	100	1			
Truck (>20 tonne)	107	0	100	1	1		
Truck (Water Cart)	108	0	100	2	2	1	
Vehicle (Light Commercial e.g. 4WD)	111	0	100	2	2	2	1

Notes:

1. Penalty applied for impulsive noise characteristic
2. All plant items are considered 'non-steady sounds' except the generator which is considered to be 'steady sound'.

5.3.5 Noise prediction results

Predicted residential and non- residential construction noise levels at surrounding receivers are presented in Table 16.

Table 16: Predicted construction noise levels for residential and non-residential receivers

Receiver	NML	Construction phase			
		Site Establishment and Excavation	Pavement & Road Works	Building Construction	Plant Installation and Connection
Residential receivers					
R1 - 771-781 Mamre road Kemps creek	49	64	64	69	46
R2 - 783-797 Mamre road Kemps creek	49	64	64	69	46
R3 - 799-803 Mamre road Kemps creek	49	64	64	69	46
R4 - 15 Medinah avenue Luddenham	47	60	60	65	42
R5 - 9 Medinah avenue Luddenham	47	60	60	65	42
R6 - 676-702 Mamre road Kemps creek	49	59	59	64	41
R7 - 676-702 Mamre road Kemps creek	49	60	60	65	42
Non-residential receivers					
E1 - 45-59 Bakers lane Kemps creek	55	50	50	55	32
I1 - Master site boundary - east	75	82	82	87	64
I2 - Master site boundary - north east	75	82	82	87	64
I3 - Master site boundary - north west	75	82	82	87	64
I4 - Master site boundary - west	75	84	84	89	66

Note:
Levels shaded in grey indicate a notional exceedance of NMLs based on the worst-case assumptions noted above.

Results shown in Table 16 indicate that exceedances are predicted at surrounding residential receivers during site establishment and excavation, pavement and road works and building construction phases.

It should also be noted predicted noise levels represent a conservative worst case scenario where all indicated equipment is operating simultaneously and continuously over fifteen minutes. Noise levels experienced by surrounding receivers are likely to be lower than those predicted. In addition, the highest predicted levels are only likely to occur intermittently, as the majority of equipment operate intermittently, and all equipment operating concurrently

The highest predicted noise levels are during the building construction phase, where noise levels of up to 69 dBA are predicted at the nearest residential receivers to the south. This represents an exceedance of NMLs of 20 dB, however is not considered 'highly affected' as noise levels are below 75 dBA.

Noise levels up to 89 dBA are predicted at the adjacent industrial boundary. This represents a significant impact, however the number of building occupants anticipated to be affected by these noise levels are low, due to the industrial nature of the premise. Lower noise levels are predicted during the site establishment and

excavation and pavement and road work phases. Noise levels from the plant installation and construction phase are predicted to comply with established NMLs.

Noise levels at the nearest educational receiver E1 are predicted to comply in all phases.

5.4 Construction noise and vibration management

The contractor will have a key role in managing the noise and vibration levels during the works to reduce noise and vibration as far as is reasonably practicable. Recommended management measures are provided in Section 7.

6 Assessment of potential operational impacts

6.1 Operational noise scenarios

To assess potential noise impacts during operation, two scenarios comprising typical equipment has been developed based on our understanding of the project. These scenarios are considered representative of the noisiest operational activities likely to occur and are described below and in Section 6.3.2:

- **Standard operations:** Assumes all non-emergency equipment operating, and one generator being tested per sub site. Generator testing is included as part of standard (normal) operations as 62 generators need to be tested per month and that the testing duration per generator ranges from one to four hours.
- **Critical power failure**: Assumes all emergency generators (62) operating simultaneously.

6.2 Standard operational noise criteria

The *Protection of the Environment Operations Act 1997* requires that authorities examine and consider matters affecting the environment when making decisions about development and activities. Operational noise emissions from the project have been assessed in accordance with the *Noise Policy for Industry* (NPfI) [2], which is primarily concerned with controlling intrusive noise impacts in the short-term for residences and maintaining long-term noise level amenity for residences and other land uses.

The NPfI sets out the procedure to determine the project noise trigger levels relevant to an industrial development. The project noise trigger level is a level that, if exceeded would indicate a potential noise impact on the community and so 'trigger' a management response.

6.2.1 Intrusive noise trigger level

The intrusiveness noise trigger level is applicable to residential premises only and is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level (RBL) plus 5 dB

  (where $L_{Aeq,15minute}$ represent the equivalent continuous noise level of the source)

6.2.2 Recommended amenity noise level

Residences have been grouped into two NCAs, categorised as either Rural or Suburban Residential in accordance with the NPfI [2].

Residences within NCA 1 have been classified as isolated residences within an industrial zone the industrial zone, in accordance with Table 2.2 of the NPfI for the assessment of operational noise impacts.

NCA 2 has been categorised as Suburban Residential, defined as an area *"an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry"*.

To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from **all** industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 of the NPfI where feasible and reasonable. An extract from the policy is given below in .

Table 17: NPfI Recommended Amenity Noise Levels (RANLs)

Receiver	Noise amenity area	Time of Day[1]	Recommended amenity noise levels (RANLs) dBL_{Aeq}
Residential	Isolated residences within an industrial zone[2]	When in use	70
	Suburban	Day	55
		Evening	45
		Night	40
School classroom - internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Industrial premises	All	When in use	70

Notes:

The recommended amenity noise levels (RANLs) refer only to noise from industrial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

1. The NPfI defines day, evening and night time periods as:
   - Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
   - Evening: the period from 6 pm to 10 pm.
   - Night: the remaining period.
2. Table 2.2 states "*for isolated residences within an industrial zone the industrial amenity level would usually apply*"

6.2.3 Project amenity noise level

The recommended amenity noise levels (RANLs) above represent the objective for **total** industrial noise at a receiver location, whereas the **project amenity noise level (PANL)** represents the noise objective for a **single** industrial development.

To derive the PANL, the NPfI outlines two methods. The first, simplified method of RANL minus 5 dB, is based on a receiver not being impacted by more than three to four individual industrial premises.

For large clusters of industrial premises, Section 2.4.2 of the NPfI states the following equation should be used:

Equation 1: New multiple premises or redevelopment of existing clusters of industry

Individual project amenity noise level = $10\text{Log}\,(10^{(\text{ANL}-5\text{ dB}/10)}/\text{N})$

where:

ANL = relevant recommended amenity noise level from Table 2.2

N = number of proposed additional premises.

> *Where a greenfield development is proposed and it can be demonstrated that existing levels of industrial noise are more than 5 dB lower than the relevant recommended amenity noise level, equation 1 can be modified to reflect 'amenity noise level' in lieu of 'amenity noise level – 5 dB(A)'.*

For the project site, existing industrial noise level are more than 5 dB below the RANL, and therefore the modified approach noted above would apply.

It is noted that the equation is very simplistic, and corrects only for the number of industrial premises, making no allowance for variations in lot size or relative proximity to receiver locations.

For the Mamre Road Precinct, there are over 70 individual new lots are proposed, ranging in lot size (approx. 16,500 to 524,800 m^2) and distance from nearest receivers (approx. 700 m-4 km). Strict application of Equation 1 to the Mamre Road Precinct unfairly assigns the same contribution to smaller, further sites as larger, closer sites. This would allow smaller, further sites being permitted to generate much higher noise levels per unit area than others.

Regarding this matter, DPE have provided a night time PANL of 27 dB $L_{Aeq(15min)}$ for the subject site at the rural-residential areas in Mount Vernon and Luddenham. This equates to a $L_{Aeq(night)}$ limit of 24 dBA, which is a 16 dB adjustment from the night RANL of 40 dB $L_{Aeq(period)}$.

Arup are of the view that this unreasonably constrains the subject site which is one of the closest sites to the nearest sensitive receivers. Arup consider that a more appropriate methodology would be to take account of the lot size and distance to receivers based on an equitable per square meter sound power emission. It is noted that more distant sites would in practice allow for higher sound power emissions when taking account on acoustic losses due to intervening structures, ground topography, ground and air absorption. The omission of these factors would also reasonably offset potential increases from noise-enhancing meteorological effects. The additional accuracy afforded by considering these effects is not considered to justify the additional detail required to assess them.

Based on this approach, a calculated night time PANL is 33 $dBL_{Aeq(15min)}$, which result in predicted noise contributions from all lots in the Mamre Road Precinct and finally allowable contributions to meet RANLs. A calculation of area corrections and propagation losses is presented in Appendix C.

It is understood that the DPE methodology has already been imposed on some sites. If the DPE approach was to be adopted for all other sites, with the revised PANL applied to the subject site (due to its size and proximity to the receiver), the RANL would be exceeded by only 0.3 dB. This is considered inconsequential.

Nothwithstanding, the operational noise predictions have been compared against both the DPE and Arup PANLs, as outlined in .

Table 18: NPfI RANLs and PANLs

Receivers	Indicative Noise Amenity Area	Time of day[1]	Recommended Amenity Noise Level (RANL) $dBL_{Aeq(period)}$	Project Amenity Noise Level (PANL)	
				$dBL_{Aeq(period)}$	$dBL_{Aeq(15min)}$[2]
Residences in NCA 1	Isolated residences within an industrial zone	When in use	70	65	68
Residences in NCA 2	Suburban	Day	55	39-45[3]	42-48[3]
		Evening	45	29-35[3]	32-38[3]
		Night	40	24-30[3]	27-33[3]
School classroom - internal	All	Noisiest 1-hour period when in use	45[4]	40	43
Industrial premises	All	When in use	70	65	68

Notes

1. The NPfI defines day, evening and night time periods as:
   - Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.
   - Evening: the period from 6 pm to 10 pm.
   - Night: the remaining period.
2. 3 dB added to $L_{Aeq(period)}$ to determine $L_{Aeq(15min)}$ as per NPfI.
3. Lower range represents extrapolated DPE PANL from 27dB$L_{Aeq(15min)}$ night time criteria, upper range represents proposed PANL based on distance and area considerations.
4. External noise level based on 10dB reduction through open window

6.2.3.1 Sleep disturbance

The NPfI recommends the following screening criteria for the assessment of potential sleep disturbance, for the period between 10 pm and 7 am:

- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater

As noise sources associated with datacentres, namely mechanical and electrical plant, have constant noise characteristics, sleep disturbance arising from high maximum noise levels is not anticipated to be an issue and has not been assessed further.

6.2.3.2 NPfI Project specific noise levels

Based on the background noise monitoring, Table 19 summarises the derived project specific noise levels based on the NPfI.

Table 19: NPfI Project specific noise levels - Residences

Receiver	Time Period	Project Specific Noise Levels, $dBL_{Aeq(15min)}$		
		Intrusive Noise Trigger Levels	Project Amenity Noise Level (PANL)	Project Noise Trigger Level (PNTL)
NCA 1	All periods	-	68	68
NCA 2	Day	44	42-48	42-44
	Evening	44[1]	32-38	32-38
	Night	43	27-33	27-33

Notes

1. The NPfI states "in determining project noise trigger levels for a particular development, it is generally recommended that the project intrusiveness noise level for evening be set at no greater than the project intrusiveness noise level for daytime. The project intrusiveness noise level for night-time should be no greater than the project intrusiveness noise level for day or evening. Alternative approaches to these recommendations may be adopted if appropriately justified."

6.2.4 Maintenance testing criteria

Maintenance testing of emergency plant is anticipated to occur during daytime period (7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays. between 7am and 6pm). The total testing regime for all 62 generators is summarised in Table 20.

Table 20: Annual testing regime

Month	Test	Duration (min)		Colo gen testing		Admin gen testing		Total Gens Tested	Total Mins
		Run	Cooldown	Number of tests	Gens run per test[1]	Number of tests	Gens run per test[1]		
1	**Bi-monthly, no load**	**10**	**0**	**30**	**2**	**2**	**1**	**62**	**320**
2	No test							62	0
3	Quarterly, 70% load	30	5	60	1	2	1	62	2170
4	**Bi-monthly, no load**	**10**	**0**	**30**	**2**	**2**	**1**	**62**	**320**
5	No test							62	0
6	Quarterly, 70% load	30	5	60	1	2	1	62	2170
7	**Bi-monthly, no load**	**10**	**0**	**30**	**2**	**2**	**1**	**62**	**320**
8	No test							62	0
9	Quarterly, 70% load	30	5	60	1	2	1	62	2170
10	**Bi-monthly, no load**	**10**	**0**	**30**	**2**	**2**	**1**	**62**	**320**
11	No test							62	0
12	Annual, 100% load	60	5	60	1	2	1	62	4030
								Total minutes per year	**11820**
								Total hours per year	**197**

Month	Test	Duration (min)		Colo gen testing		Admin gen testing		Total Gens Tested	Total Mins
		Run	Cooldown	Number of tests	Gens run per test[1]	Number of tests	Gens run per test[1]		

Note:

Rows in **BOLD** indicate a potential worst case scenario regarding noise emissions which have been assessed.

1. Colo generator testing will be conducted separately from admin generator testing.

This equates to 197 hours of testing per year.

Two potential worst case scenarios including generator testing have been identified:

- Bi-monthly no load – two colo generators being tested concurrently with no load applied, i.e. no load bank operating; and
- Annual 100% load – single colo generator being tested with 100% load applied, i.e. load bank operating.

These two scenarios have been included in the assessed scenarios.

Quarterly testing noise emissions are expected to generate noise emissions lower than annual testing, based on the same operating scenario but with the load bank only be operating at 70% load.

Note that generator testing has been included as part of standard operations considering that 62 generators need to be tested per month and that testing duration for all generators annually would be 197 hours per year.

6.2.5 Critical power failure criteria

While design criteria for the development includes scheduled testing of emergency plant, targets are not considered reasonable for critical power failure conditions, and would be considered unreasonable to implement noise treatment due to the low likelihood of this scenario. Furthermore, if power failure was to occur, the duration of an outage would be expected to be hours rather than days.

6.3 Stationary plant assessment

6.3.1 Noise sources

The primary outdoor noise sources on site are outlined in Table 21. Where equipment has yet to be selected, the sound power levels and octave band spectra have been estimated based on expected equipment power ratings and past project experience.

This list represents a preliminary list of primary equipment. Some equipment items may be redundant, may share loads, may operating at no load, or may be

switched off, thereby reducing sound power levels. This assessment therefore represents a conservative assessment scenario.

Noise emissions from all equipment is characterised as steady-state sound in accordance with AS1055:2018 [14], i.e. constant noise emissions.

Note that the emergency generators are proposed to be located within dedicated enclosures.

Table 21: Project equipment, quantities and unmitigated sound power levels (per unit)

Major Equipment and function	Description / function	Number of items on site	Overall sound power level, dBA	Octave band (Hz)							
				63	125	250	500	1k	2	4	8
				Sound power level, dB(Z)							
Generator inlet louvre - Generator used to provide power in critical power failure scenario.	Inlet of acoustic generator enclosure	62	89	101	104	87	60	58	54	61	80
Generator outlet louvre - Generator used to provide power in critical power failure scenario.	Outlet of acoustic generator enclosure	62	89	101	104	87	56	54	51	60	80
Generator exhaust - Generator used to provide power in critical power failure scenario.	Generator diesel engine exhaust.	62	89	59	64	85	81	82	84	82	76
Load Bank - Provides the electrical load representative of the datacentre operational load to allow maintenance testing of generators.	Provides the electrical load representative of the datacentre operational load to allow maintenance testing of generators.	3	111	114	111	109	105	105	104	102	95
Data Hall Transformers - Steps down power for supply to the data centre at the required voltages	3 MVA capacity	480	87	91	88	91	87	78	69	69	64
Site Transformers - Steps down power for supply to the data centre at the required voltages	70 MVA	3 operational, 1 idle.	92	96	93	96	92	83	74	74	69
Data hall – contains server racks and cooling fans. Noise breaking out through data hall exhaust louvres.	Level 1 exhaust louvre outlet based on internal data hall noise level of 90dBA	1 per data hall. 30 data halls	62	72	69	62	56	56	53	49	49
	Level 2 exhaust louvre outlet based on internal data hall noise level of 90dBA	1 per data hall. 30 data halls	66	72	69	64	61	61	59	55	55
Data hall – contains server racks and cooling fans. Noise breaking out through data hall roof.	Roof construction: metal deck, absorption between purlins, two layers of plasterboard	1 per data hall. 30 data halls	76	89	91	76	62	54	51	55	45

Major Equipment and function	Description / function	Number of items on site	Overall sound power level, dBA	Octave band (Hz)							
				63	125	250	500	1k	2	4	8
				Sound power level, dB(Z)							
AHU – supplies ventilation air to data hall	Fresh air inlets open to louvred plantrooms.	8 per data hall level, 480 overall	63	81	75	66	53	46	44	34	40
	Supply air ducted to data hall, anticipated to be mitigated by data hall building and through exhaust paths	8 per data hall level, 480 overall	Not anticipated to generate significant noise levels compared to other equipment on site. If required, mitigation of these minor noise sources will be possible through typical acoustic treatment methods, eg. attenuators, enclosures.								
Admin transformers / isolation transformers (within data halls) - Steps down power for supply to the data centre at the required voltages		3									
Condensing units – facilitates ventilation of admin building	Domestic type	Servicing admin buildings									
Toilet exhaust fans – ventilates toilets		Servicing admin buildings									

Refer to architectural layouts in Table 1 for proposed location of equipment.

6.3.2 Operating Scenarios

Operating scenarios assessed outlined in Table 22. The scenarios are considered representative of the noisiest operational activities likely to occur. In practice, mechanical systems will vary in load dependant on internal and external temperatures, therefore, operation is expected to be typically lower than assessed.

Table 22: Modelling scenarios and corresponding plant and equipment

Project equipment	Model scenarios			
	1A. Standard Operation – Daytime, bi-monthly generator testing[1]	1B. Standard Operation – Daytime, annual generator testing[1]	2. Standard Operation – Evening and night	3. Critical power failure – 24 hours
	Number of equipment modelled in 15-minute assessment period.			
Generator inlet louvre	1	2	-	62
Generator outlet louvre	1	2	-	62
Generator exhaust	1	2	-	62
Load Bank	1	-	-	-
Data Hall Transformers	60	60	60	60
Site Transformers	3	3	3	3
Level 1 data hall exhaust	30	30	30	30
Level 2 data hall exhaust	30	30	30	30
Data hall roof	30	30	30	30
AHU fresh air inlet	480	480	480	480

Notes:
1. See Section 6.2.4

6.3.3 Assessment methodology

Noise emissions have been modelled using SoundPlan 8 using the CONCAWE algorithm with a 3m/s source to receiver wind applied representing worst case meteorological conditions which is considered appropriate for this scenario with nearest receivers located further than 100 metres of the noise sources.

The model included:

- Activity noise sources listed in Section 6.3.1;
- On-site and surrounding buildings;
- Receivers listed in Section 4.3; and
- Ground terrain and absorption.

6.3.4 Results

6.3.4.1 Unmitigated results

Table 23 presents predicted operational noise levels at residential receivers with no acoustic mitigation measures implemented.

Predicted noise levels are presented as ranges, representing levels under neutral weather conditions to worst case conditions under 3m/s source to receiver winds

Table 23: Unmitigated standard operations – residential receivers, $dBL_{eq,15min}$

Receiver	1A. Day			1B. Day			2. Evening			3. Night		
	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies
R1 - 771-781 Mamre Road Kemps Creek	68	45-47	Yes	68	44-46	Yes	68	41-43	Yes	68	41-43	Yes
R2 - 783-797 Mamre Road Kemps Creek	68	43-45	Yes	68	43-45	Yes	68	41-43	Yes	68	41-43	Yes
R3 - 799-803 Mamre Road Kemps Creek	68	44-46	Yes	68	44-46	Yes	68	41-43	Yes	68	41-43	Yes
R4 - 15 Medinah Avenue Luddenham	42-44	33-37	Yes	42-44	34-37	Yes	32-38	31-34	Partial	27-33	31-34	No
R5 - 9 Medinah Avenue Luddenham	42-44	32-36	Yes	42-44	32-36	Yes	32-38	31-34	Partial	27-33	31-34	No
R6 - 676-702 Mamre Road Kemps Creek	68	33-37	Yes	68	32-36	Yes	68	29-33	Yes	68	29-33	Yes
R7 - 676-702 Mamre Road Kemps Creek	68	35-39	Yes	68	34-37	Yes	68	30-34	Yes	68	30-34	Yes

Results show operational noise levels during the day, evening and the night periods are predicted to exceed DPE prescribed PNTLs by up to 7dB, and proposed PNTLs by 1dB. Due to the number of operational noise sources on site, the exceedances are attributed to a range of plant, including contributions from site transformers, data hall exhausts and AHU plantroom inlets.

During the daytime, when maintenance testing of generators would take place, the load bank and generators operating are noted to contribute individually, however due to the high number of other mechanical and electrical plant, the cumulative contributions from other plant largely controls overall noise emissions.

Table 24 presents highest predicted noise levels at non-residential receiver. Noise levels represent impacts during the loudest period of operation, during the day during bi-monthly testing of generators. Compliance during this period is considered to demonstrate compliance during other quieter periods of operation.

Table 24: Unmitigated standard operations – non-residential receivers, $dBL_{eq,15min}$

Receiver	PNTL	Predicted Noise level – 1A. Day	Complies
E1 - Mamre Christian College	43	27-30	Yes
I1 - Master site boundary East	68	56-57	Yes
I2 - Master site boundary North East	68	43	Yes
I3 - Master site boundary North West	68	41	Yes
I4 - Master site boundary West	68	42	Yes
I5 - DATS	68	35-38	Yes

Results show noise levels at non-residential receivers comply with PNTLs.

Table 25 shows predicted noise levels during an critical power failure scenario. No criteria have been established for this scenario, levels are presented for information only.

Table 25: Unmitigated critical power failure scenario – all receivers

Receiver	Predicted Noise level $dBL_{eq,15min}$
Residential receivers	
R1 - 771-781 Mamre Road Kemps Creek	49-51
R2 - 783-797 Mamre Road Kemps Creek	48-50
R3 - 799-803 Mamre Road Kemps Creek	48-50
R4 - 15 Medinah Avenue Luddenham	40-43
R5 - 9 Medinah Avenue Luddenham	39-43
R6 - 676-702 Mamre Road Kemps Creek	34-38
R7 - 676-702 Mamre Road Kemps Creek	37-41
Non-residential receivers (when in use)	
E1 - Mamre Christian College	29-32
I1 - Master site boundary East	60-61
I2 - Master site boundary North East	46
I3 - Master site boundary North West	44
I4 - Master site boundary West	51-52
I5 - DATS	36-40

6.3.4.2 Mitigated results

An investigation into the highest contributors to noise levels at receivers, feasibility and reasonableness of mitigation to noise sources was conducted. Noise mitigation measures have been coordinated with the electrical, mechanical and architectural design teams and are outlined in Section 7.

Table 26 and Table 27 present highest predicted noise levels at non-residential receivers. Noise levels represent impacts during the loudest period of operation, during the day during bi-monthly testing of generators. Compliance during this period is considered to demonstrate compliance during other quieter periods of operation.

A graphical output of results are presented in Appendix D showing predicted operational noise levels following the implementation of mitigation measures outlined in Section 7.

Table 26: Mitigated standard operations – residential receivers, $dBL_{eq,15min}$

Receiver	1A. Day			1B. Day			2. Evening			3. Night		
	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies	PNTL	Predicted Noise level	Complies
R1 - 771-781 Mamre Road Kemps Creek	68	41-43	Yes	68	39-41	Yes	68	37-39	Yes	68	37-39	Yes
R2 - 783-797 Mamre Road Kemps Creek	68	41-43	Yes	68	40-42	Yes	68	38-40	Yes	68	38-40	Yes
R3 - 799-803 Mamre Road Kemps Creek	68	41-43	Yes	68	41-43	Yes	68	39-41	Yes	68	39-41	Yes
R4 - 15 Medinah Avenue Luddenham	42-44	28-32	Yes	42-44	29-32	Yes	32-38	28-31	Yes	27-33	28-31	Partial
R5 - 9 Medinah Avenue Luddenham	42-44	28-32	Yes	42-44	28-32	Yes	32-38	28-31	Yes	27-33	28-31	Partial
R6 - 676-702 Mamre Road Kemps Creek	68	30-33	Yes	68	26-29	Yes	68	26-29	Yes	68	26-29	Yes
R7 - 676-702 Mamre Road Kemps Creek	68	32-35	Yes	68	27-30	Yes	68	27-30	Yes	68	27-30	Yes

Results show daytime and evening predicted noise levels comply with PNTLs, however at night time exceed DPE prescribed PNTLs by up to 4dB, but comply with proposed PNTLs.

An assessment of modifying factor corrections have been conducted in accordance with Fact Sheet C of the NPfI [2]. No tonal or low-frequency penalties are incurred when cumulative site noise emissions and measured ambient noise spectra are assessed, however compliance was determined to be marginal. Should sound power spectra of final plant selections vary significantly from those presented in Table 21, low frequency noise or tonal noise penalties may apply, discussed further in Section 7.

Table 27 presents highest predicted noise levels at non-residential receivers. Noise levels represent impacts during the loudest period of operation, during the day during bi-monthly testing of generators. Compliance during this period is considered to demonstrate compliance during other quieter periods of operation.

Table 27: Mitigated standard operations – non-residential receivers, $dBL_{eq,15min}$

Receiver	PNTL	Predicted Noise level – 1A. Day	Complies
E1 - Mamre Christian College	43	17-20	Yes
I1 - Master site boundary East	68	48-51	Yes
I2 - Master site boundary North East	68	38	Yes
I3 - Master site boundary North West	68	36	Yes
I4 - Master site boundary West	68	37	Yes
I5 - DATS	68	29-32	Yes

Results show predicted mitigated noise levels comply with PNTLs for non-residential receivers.

Table 28 presents the predicted noise levels during an critical power failure scenario when all generators will be operating concurrently.

Table 28: Mitigated critical power failure scenario– all receivers, $dBL_{eq,15min}$

Receiver	Predicted Noise level
Residential receivers	
R1 - 771-781 Mamre Road Kemps Creek	45-47
R2 - 783-797 Mamre Road Kemps Creek	45-47
R3 - 799-803 Mamre Road Kemps Creek	44-46
R4 - 15 Medinah Avenue Luddenham	35-39
R5 - 9 Medinah Avenue Luddenham	34-38
R6 - 676-702 Mamre Road Kemps Creek	29-32
R7 - 676-702 Mamre Road Kemps Creek	31-34
Non-residential receivers (when in use)	
E1 - Mamre Christian College	19-22
I1 - Master site boundary East	54-57
I2 - Master site boundary North East	42

Receiver	Predicted Noise level
I3 - Master site boundary North West	41
I4 - Master site boundary West	50
I5 - DATS	30-33

6.3.5 On site noise impact from noise generated by the development

NSW noise policies do not specifically address noise impacts generated by a development onto the development itself (i.e. Office/FOH). In this instance, selection of appropriate internal noise targets is at the discretion of the applicant. Guidance may be sought from AS/NZS 2107:2016 "Acoustics, Recommended design sound levels and reverberation times for building interiors" for steady-state internal noise targets.

Acoustic input into the design of façade elements would be required to meet typical office noise criteria.

Final mechanical and electrical services equipment have not been selected at this early stage of design such that acoustic specification of façade elements can be determined. During ongoing design of the development, mechanical and electrical services equipment will be selected enabling acoustic specification of architectural elements such as the façade to meet the adopted internal noise targets.

6.4 Service vehicles

A maximum of 10 service vehicles are expected to access the site per day. This is the volume expected during periods of heavy maintenance.

A linear profile has been assumed for the arrival distribution of service vehicles to the site, i.e. the 10 service vehicles will arrive linearly between 8am and 5pm. All servicing vehicles are assumed to exit the site within the hour they arrive. All service vehicles have been conservatively assessed as 19 m B-doubles.

The RNP states:

> *In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.*

Noise increases due to the additional service vehicles over forecast volumes along Mamre Road have been predicted in Table 29. A 15 hour assessment has been conducted as Mamre Road is defined as a sub-arterial road in accordance with the *Road Noise Policy* [9] as it "provides connection between arterial roads and local roads" and "may support arterial roads during peak periods".

Table 29: Traffic assessment – service vehicles on Mamre Road

	Light vehicles	Heavy vehicles	Total
Forecast 2025 Mamre Road volume (15 hour day)	17002	2318	19320
Service vehicles	0	10	10
Increase in traffic noise level due to service vehicles, dBA	**0.00**	**0.02**	**0.02**

Results show noise increases as a result of service vehicle traffic are less than the 2 dB increase criteria, therefore increases in traffic noise are not anticipated to be significant.

On site, the impact of a single vehicle arriving then leaving site is not anticipated to generate significant noise impacts at nearby receivers.

6.5 Cumulative noise impact

Cumulative noise impacts are addressed as part of the establishment of the Project Amenity Noise Levels, discussed in detail in Section 1.1.1.

7 Environmental management measures

A summary of recommended operational and construction mitigation measures are presented in Table 30.

Table 30: Environmental management measures for acoustic impacts

ID	Impacts	Mitigation	Responsi-bility	Timing
Operation				
Operational noise	Exceedance of established noise emission criteria	Implement acoustic treatment measures in Table 32.	Detailed design team	Detailed design stage
Application of low frequency penalty or tonal noise penalty.	If final plant selections generate more significant low frequency noise or tonal noise, up to a 5dB penalty may be applied to predicted noise levels, pushing levels to above PNTLs.	Overall noise characteristics at receivers shall be considered throughout the detailed design process. Should penalties be required, attended noise measurements at night may provide further clarity on the existing ambient noise environment, which is considered when assessing the application of penalties.	Detailed design team	Detailed design stage
Critical power failure noise	High noise impacts during an emergency power failure scenario	Clarity on predicted emergency noise impacts has been provided, shown in Table 25 and Table 28 Further mitigation measures are considered inappropriate for the infrequency and short duration of these events.	-	Post construction
Construction				
Noise and vibration management plan	Adverse noise and vibration impacts	A Construction Noise and Vibration Management Plan shall be prepared prior to the issuing of a Construction Certificate. This will specify the actual plant to be used and will include updated estimates of the likely levels of noise and the scheduling of activities.	Contractor	Construction

ID	Impacts	Mitigation	Responsi-bility	Timing
Staffing	Adverse noise and vibration impacts	Appointing a named member of the site staff who will act as the Responsible Person with respect to noise and vibration; Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise; Ensuring good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable; Avoid the use of radios or stereos outdoors; and Avoid shouting and minimise talking loudly and slamming vehicle doors.	Contractor	Construction
Plant and equipment	Adverse noise impacts	Where possible stationary equipment should be located behind structures such as demountable buildings or stockpiles to maximise shielding to receivers. Minimise use of noisy construction methods where quieter alternatives are feasible. Consider using electric / hydraulic equipment where possible. Using the smallest equipment as is practical. All plant and equipment used on site must be: • maintained in a proper and efficient condition; and • operated in a proper and efficient manner. Turn off all vehicles, plant and equipment when not in use. Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable. Maximise off-site prefabrication.	Contractor	Construction

ID	Impacts	Mitigation	Responsi-bility	Timing
Scheduling	Adverse noise impacts	Ensure that the Responsible Person controls the working hours on site to ensure that work is only done during the acceptable periods (7am to 6pm on weekdays and 8am to 1pm on Saturdays. No work on Sundays or public holidays) High noise activities will be programmed to occur during the standard construction hours wherever possible and will be scheduled with due consideration to the nearest sensitive receivers.	Contractor	Construction
Work site training	Adverse noise impacts	'Toolbox talks' will be held at regular intervals with the contractor workers, including discussion of noise and vibration mitigation, monitoring and assessment. These topics will also be covered under induction processes. Operate two-way radios at the minimum effective volume, and avoid shouting or whistling at the site. Identification of all reasonable and feasible noise mitigation methods will be conducted by the Responsible Person on a daily basis during noisy works. The Responsible Person will have the authority to modify work practices in response to complaints, where this is considered appropriate.	Contractor	Construction

ID	Impacts	Mitigation	Responsi-bility	Timing
Community liaison	Adverse noise and vibration impacts	Ensuring that the Responsible Person keeps the local community advised on expected activities and coordinates scheduling and locations of noisy works around any critical user events where practicable. This shall include face to face meetings with nearby receivers if requested and a letter box drop, and shall include close liaison with neighbours during construction, including the Meriton towers and residences to the north of Parramatta River. Maintaining appropriate records of complaints to include timing, reported issues, actions taken and measures to be included for on-going works. The complaints log will need to be filed with the Responsible Person.	Contractor	Construction
Reversing alarms	Adverse noise impacts	The use of audible movement alarms of a type that would minimise noise impacts on surrounding noise sensitive receivers must be implemented. Where practicable, broadband, non-tonal reversing alarms should be utilised on site equipment. Ensure that the difference in volume between the reversing warning devices and the base machine noise level (at maximum governed speed under no load at any given test location) is minimised (in accordance with International Standard ISO9533:1989), and ensure that warning devices are no more than 5 dB above the Australian Standard level;	Contractor	Construction
Material handling	Adverse noise and vibration impacts	Avoid dropping equipment/materials from a height or into trucks. Where practicable, use sound dampening material to cover the surfaces on to which any materials must be dropped.	Contractor	Construction

ID	Impacts	Mitigation	Responsi-bility	Timing
Equipment Location	Adverse noise impacts	Site noisy equipment away from noise-sensitive areas. Plant known to emit noise strongly in one direction is to be orientated so that the noise is directed away from noise-sensitive areas; Locate site access roads and site compounds as far away as possible from noise sensitive receptors; Plan truck movements to avoid residential streets where possible;	Contractor	Construction

ID	Impacts	Mitigation	Responsi-bility	Timing
Vibration management	Adverse vibration impacts	The safe working distances presented in Table 31 should be maintained between activities and buildings and structures. Distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions. The contractor will be required to manage vibration as well as noise and make use of best practice in the management of vibration using simple and practicable techniques such as avoiding dropping heavy items. Buried services are located on the Altis Frasers site adjacent to the proposed site location, and the contractor shall maintain compliance with buried services vibration criteria outlined in Table 5.1.3. Where vibration intensive works are required within the minimum working distances outlined in Table 31, vibration monitoring at the nearest potential affected building should be considered, where real-time alerts can be generated when measured vibration levels exceed criteria. Less vibration intensive methods of construction would then be required, such as the use of lower capacity equipment over a longer duration. Given the structures immediately adjacent to the site, adverse effects to both human comfort and structural damage are possible if management measures are not adhered to.	Contractor	Construction

Table 31 provides recommended minimum working distances for vibration intensive plant proposed as part of the construction works. These are based on international standards and guidance.

Table 31: Recommended minimum working distances for vibration intensive plant

Plant Item	Rating / Description	Minimum working distance	
		Cosmetic damage[1] (BS 7385)	Human response (OH&E Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure
Piling rig	Diesel impact piling	To be developed as part of the CNVMP[2]	

Note:

1. More stringent conditions may apply to heritage or other sensitive structures. Vibration impacts on buried services require consideration when final construction works are determined.
2. Once piling details such as impact frequency and energy is known.

7.1 Recommended plant acoustic treatment

Preliminary noise mitigation measures have been recommended and incorporated into the current design of the site. Further detailed acoustic design will be required to finalise mitigation specifications during the detailed design phase of the development. The following measures therefore must not be used for construction without certification by an acoustic consultant.

Table 32: Indicative noise mitigation measures

Item	Location	Description
All plant	Throughout site	• To meet indicative sound power levels provided in Table 21.
Loadbank	Enclosure	• Enclosure to achieve 75 dBA at 1 m
Diesel generators (backup power only)	Inlet	• Rectangular attenuator to achieve 75 dBA at 1m
	Discharge	• Rectangular attenuator to achieve 75 dBA at 1m
	Exhaust	• Primary attenuator • Exhaust to achieve 81 dBA at 1 m

Item	Location	Description
Site transformers	Substation yard	To achieve an indicative 9 dB reduction to site transformer contributions to residences to the south, one or more of the following mitigation measures is recommended: • Quieter transformer selection • Noise barrier extending 2 m above top of transformers at a distance of 2 m to the south of the transformer, turning back to the north as indicated in Figure 4. • Grit filling of stiffeners
Building envelope	Exhaust riser walls	• Precast concrete
	Roof	• Kingzip roof system, made of metal deck roofing, insulation layer and two layers of acoustic plasterboard to achieve R_w 40
	Datahall exhaust louvres	• Acoustic louvres for data hall exhaust outlets. An indicative insertion loss of 5 dB is required, provided the pressure drop does not impact the mechanical ventilation requirements. Indicative specifications for the acoustic louvre are: o Minimum overall noise reduction of 5 dB o Maximum pressure drop of 40 Pa o Face velocity of 3 m/s Manufacturers which have indicated a bespoke louvre design can meet these requirements include IAC Acoustics, Kinetics Noise Control and Noise Control Engineering • Junctions between louvres/attenuators or duct work penetrations of the building envelope will need to be fully sealed such that the overall building attenuation is not compromised.
Inlet and exhaust path treatment	AHU plantroom	Internally line with minimum 50mm acoustic absorptive material: • underside of roof / soffit and topside of ceiling in both the Level 1 and Level 2 ceiling plenums • underside of ceiling in AHU plantrooms • internal face of exhaust risers These locations are shown in Figure 5 and Figure 6.
	Level 2 exhaust louvres	A baffle is required to prevent discharge air from Level 2 mixing with AHU plantroom inlet louvres on Level 1. This baffle is required to extend to the top of the discharge louvres to control noise emissions, as indicated in Figure 7.

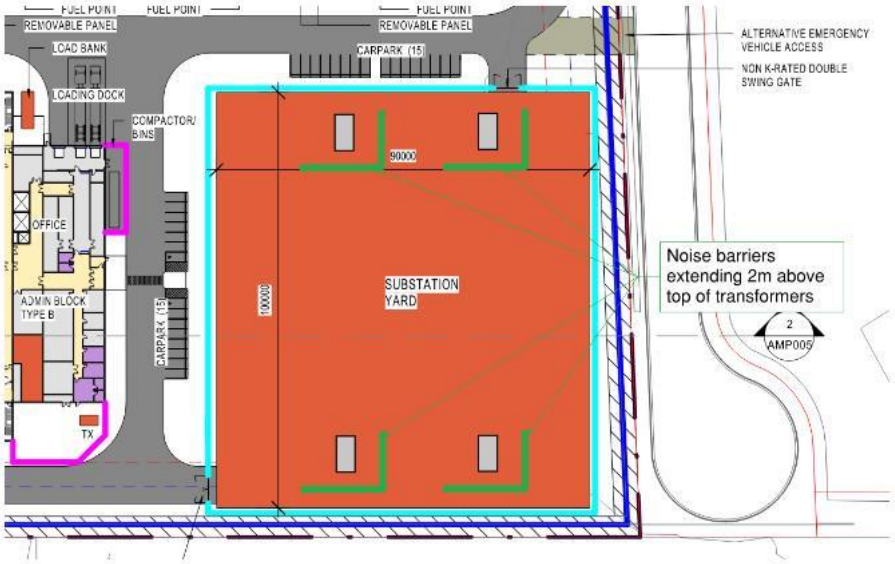


Figure 4: Indicative site transformer noise barrier locations

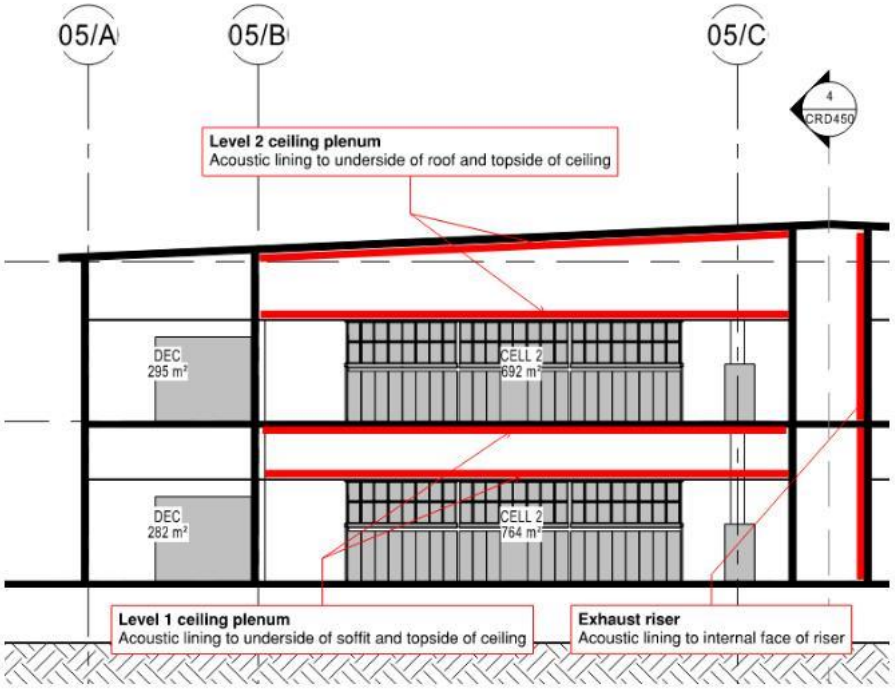


Figure 5: Indicative internal acoustic lining requirements – east-west section

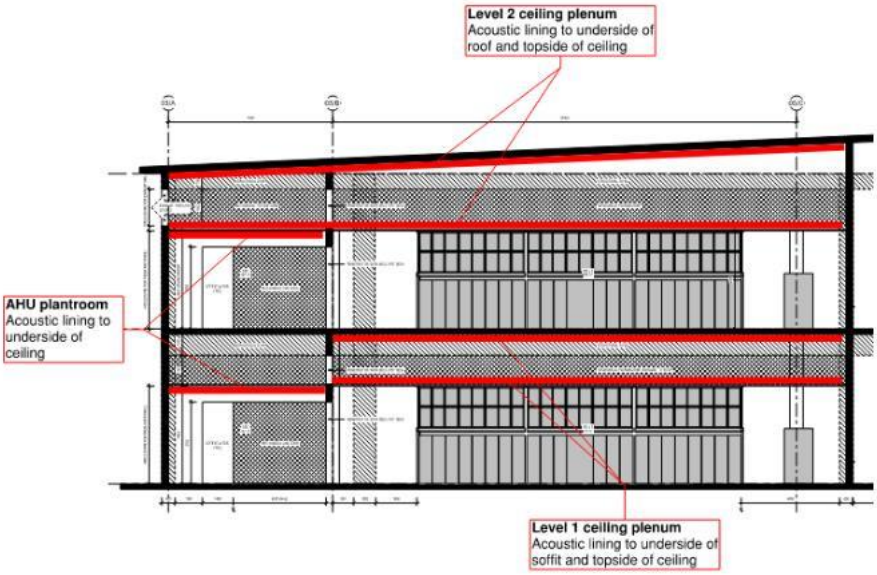

Level 2 ceiling plenum
Acoustic lining to underside of roof and topside of ceiling
AHU plantroom
Acoustic lining to underside of ceiling
Level 1 ceiling plenum
Acoustic lining to underside of soffit and topside of ceiling

Figure 6: Indicative internal acoustic lining requirements – north-south section

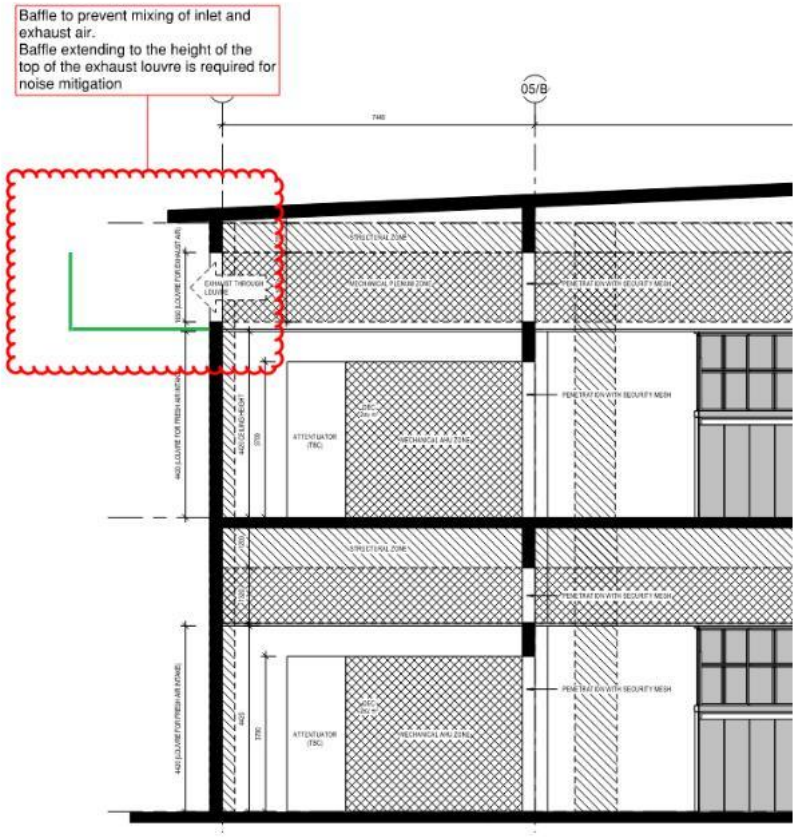


Figure 7: Acoustic requirements for baffle to separate discharge and inlet air

7.2 Feasible and reasonable measures assessment

An investigation into all feasible and reasonable mitigation is presented in Table 33.

Table 33 - Feasible and reasonable mitigation decision matrix

Item	Treatment	Feasible / reasonable	Justification
Adopted mitigation measures			
Loadbank	Enclosure	Feasible and reasonable	Adopted
Diesel generators	Inlet louvre	Feasible and reasonable	Adopted
	Discharge louvre	Feasible and reasonable	Adopted
	Exhaust attenuator	Feasible and reasonable	Adopted

Item	Treatment	Feasible / reasonable	Justification
Maintenance testing times	Restrict testing of generators to less sensitive daytime hours	Feasible and reasonable	Adopted
Building envelope	Wall, roof and door minimum construction	Feasible and reasonable	Adopted
	Louvres/attenuator/duct apertures/ penetrations	Feasible and reasonable	Adopted
Noise wall / reselection of transformers	2m above site transformers / to meet specified sound power level	Feasible and reasonable	Adopted
Datahall exhaust paths	Acoustic louvres	Feasible and reasonable	Adopted
	Absorptive lining to ceiling plenums and risers	Feasible and reasonable	Adopted
	Cowling at exhaust grilles	Feasible and reasonable	Adopted
Not reasonable / feasible			
Datahall Transformers	Enclosures / barriers	Not reasonable	The contribution of overall site noise by transformers is minimal, so treatment to transformers is of limited benefit overall (less than 1dB). Costs and access issues arise due to the introduction of individual enclosures or barriers.
Site transformers	Higher noise barrier / lower required sound power level	Not reasonable	Of limited benefit acoustically with diminishing returns beyond treatment specified due to the contribution of many other noise sources on site.
Noise barrier	At site boundary	Not reasonable	Of limited benefit acoustically due to height of sources and distance from sources, with high cost and structural implications.
Residential treatment	Architectural treatment	Not reasonable	The large number of properties which would be required to be treated renders at-property treatment unreasonable.

8 Summary of residual impacts

This section provides a summary of the construction and operational risks both pre-mitigation and any residual impacts remaining after the implementation of the management measures describe in Section 7. Pre-mitigation and residual impacts are summarised in Table 34.

Table 34: Summary of pre-mitigation and residual impacts

Potential pre-mitigation adverse impact	Relevant management measures	Potential residual impact after implementation of management measures
Construction		
Adverse noise impacts affecting community	Preparation and implementation of a CNVMP.	Some residual noise impacts are likely to exceed noise management levels however receivers are not predicted to be 'highly affected', i.e. experience noise levels of 75 dBA or above. Disturbances to the community will be minimised by the implementation of recommended management measures.
Vibration impacts on human comfort or structural damage	Preparation and implementation of a CNVMP.	Low likelihood of residual vibration impacts if vibration management measures are implemented.

Potential pre-mitigation adverse impact	Relevant management measures	Potential residual impact after implementation of management measures
Operation		
Operational noise adversely impacting community	Implement recommended mitigation measures	Predicted noise levels comply with established criteria during day and evening periods. During the night period, predicted noise levels at the nearest receiver are predicted to be up to 31dB$L_{Aeq(15min)}$ under worst case weather conditions, 28dB$L_{Aeq(15min)}$ under neutral conditions. This represents a worst case noise level 4dB above the DPE prescribed PANL, but compliant with a PANL accounting for size and proximity of lots. Predicted levels are 9dB below the RANL and 2dB under existing RBLs. Assuming all lots within the Mamre Road Precinct cumulatively generate noise levels of 43dB$L_{Aeq(15min)}$ at night at the nearest receivers in Luddenham in line with the RANL, the worst case contribution from the proposed development, which is the nearest lot to these receivers, represents an increase in noise levels of 0.3dB. Under neutral weather conditions this would reduce to 0.1dB. Predicted levels are considered conservative as they assume all plant will be operating at 100% capacity over the entire night time period. In addition, DPE prescribed PANLs assume other sites within the Mamre Road Precinct similarly operate for the 24 hours and will generate noise emissions which reach their noise criteria. In reality, both emissions from the proposed development, as well as from surrounding sites, are likely to be lower than assessed. There therefore exists a low likelihood of residual noise impacts on the community.
Road traffic noise affecting community	None	Low likelihood of residual noise impacts on community.

9 Conclusion

An acoustic assessment has been carried out for the proposed data centre in accordance with the requirements of the NSW Department of Planning and Environment (DPE), which has included consideration of the operational and construction phases of the development.

The operational noise assessment addresses project noise goals prescribed criteria by DPE as well as criteria based on cumulative impacts from industrial premises in the Mamre Road Precinct considering size and proximity of lots to residences. Noise levels are predicted in accordance with the NSW *Noise Policy for Industry* [2]. Indicative noise mitigation measures are provided in Section 7. Detailed acoustic design will be required during the design development phase to confirm the detailed specification of equipment and mitigation measures. An assessment of feasible and reasonable mitigation measures is provided have been recommended. Residual impacts have been discussed.

Regarding construction, while specific activities and work schedules are not yet known, criteria has been established in accordance with the NSW ICNG [3] and *Assessing Vibration: a technical guideline* [4]. Recommendations with regard to mitigation and management measures are also outlined and are expected to be developed further in a formal Construction Noise and Vibration Management Plan, to be prepared prior to commencement of works.

References

[1] Penrith City Council, "Draft Mamre Road Precinct Development Control Plan," Penrith City Council, Penrith, 2020.

[2] NSW Environment Protection Authority, "NSW Noise Policy for Industry," NSW Environment Protection Authority , Sydney, 2017.

[3] Department of Environment and Climate Change NSW, "Interim Construction Noise Guideline," Department of Environment and Climate Change NSW, Sydney, 2009.

[4] Department of Environment and Conservation (NSW), "Assessing Vibration: A technical guideline," Department of Environment and Conservation (NSW), Sydney, 2006.

[5] NSW Environment Protection Authority, "Environmental Criteria for Road Traffic Noise," NSW Environment Protection Authority, Sydney, 1999.

[6] NSW Environment Protection Authority, "Noise Guideline for Local Government," NSW Environment Protection Authority, Sydney, 2013.

[7] Bristish Standard Institution, "BS 7385-2: 1993 Evaluation and measurement for vibration in buildings - Pt 2: Guide to damage levels from groundborne vibration," Bristish Standard Institution, London, 1993.

[8] Transport for NSW, "Construction Noise and Vibration Strategy V4," Transport for NSW, 2018.

[9] Department of Environment, Climate Change and Water NSW, "NSW Road Noise Policy," NSW Environmental Protection Authority, Sydney, 2011.

[10] Deutsches Institut fur Normung, "DIN 4150-3 (1999) Structural vibration - Effects of vibration on structures," Deutsches Institut fur Normung, Berlin, 1999.

[11] Acousticworks, "State Significant Development Application for a proposed Warehouse, Logistics and Facilities Hub Development 657 – 769 Mamre Road Kemps Creek," Acousticworks, Sydney, 2020.

[12] Standards Australia, "AS 2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites," Standards Australia, 2010.

[13] British Standards, "BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites. Noise," British Standards, 2009.

[14] Standards Australia, "AS 1055 Acoustics—Description and measurement of environmental noise," Standards Australia, Sydney, 2018.

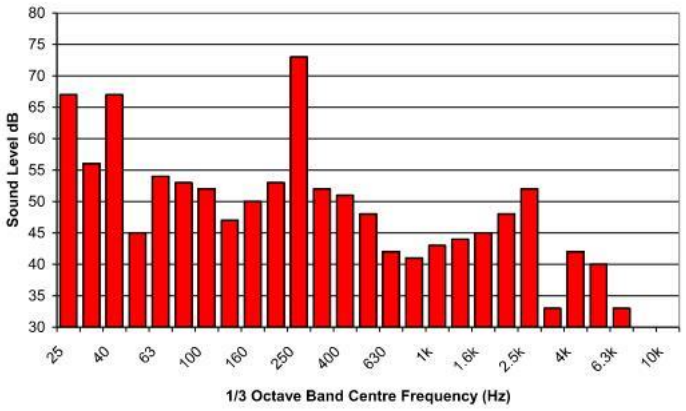
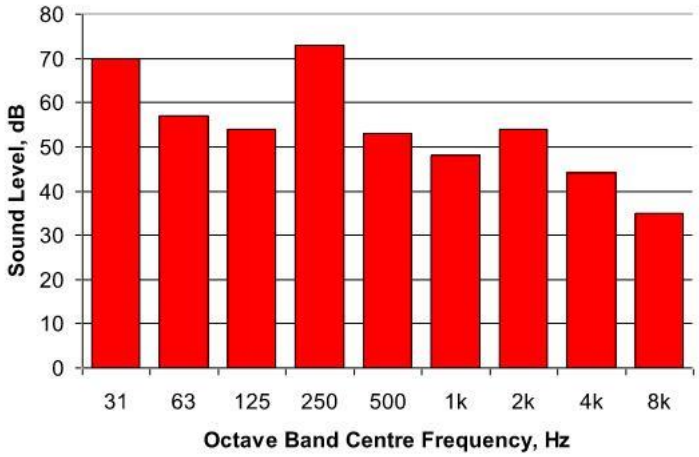
Appendix A

Acoustic terminology

A1 Acoustic terminology

Term	Definition
Ambient Noise Level	The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, birds, people talking and other nearby fans on other buildings.
Background Noise Level	The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects. **Assessment Background Level (ABL)** A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background LA90 noise levels – i.e. the measured background noise is above the ABL 90% of the time. **Rating Background Level (RBL / min $L_{A90,1hour}$)** A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey. This parameter is denoted RBL in NSW, and min $L_{A90,1hour}$ in QLD.
Decibel	The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore, a logarithmic scale, the decibel (dB) scale, is used to describe sound levels. An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.
dBA	dBA denotes a single-number sound pressure level that includes a frequency weighting ("A-weighting") to reflect the subjective loudness of the sound level. The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dBA.

<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td></td><td>Some typical dBA levels are shown below.
<table>
<tr><th>Sound Pressure Level dBA</th><th>Example</th></tr>
<tr><td>130</td><td>Human threshold of pain</td></tr>
<tr><td>120</td><td>Jet aircraft take-off at 100 m</td></tr>
<tr><td>110</td><td>Chain saw at 1 m</td></tr>
<tr><td>100</td><td>Inside nightclub</td></tr>
<tr><td>90</td><td>Heavy trucks at 5 m</td></tr>
<tr><td>80</td><td>Kerbside of busy street</td></tr>
<tr><td>70</td><td>Loud stereo in living room</td></tr>
<tr><td>60</td><td>Office or restaurant with people present</td></tr>
<tr><td>50</td><td>Domestic fan heater at 1m</td></tr>
<tr><td>40</td><td>Living room (without TV, stereo, etc.)</td></tr>
<tr><td>30</td><td>Background noise in a theatre</td></tr>
<tr><td>20</td><td>Remote rural area on still night</td></tr>
<tr><td>10</td><td>Acoustic laboratory test chamber</td></tr>
<tr><td>0</td><td>Threshold of hearing</td></tr>
</table></td></tr>
<tr><td>L_1</td><td>The L_1 statistical level is often used to represent the maximum level of a sound level that varies with time.
Mathematically, the L_1 level is the sound level exceeded for 1% of the measurement duration. As an example, 87 dB $L_{A1,15min}$ is a sound level of 87 dBA or higher for 1% of the 15 minute measurement period.</td></tr>
<tr><td>L_{10}</td><td>The L_{10} statistical level is often used as the “average maximum” level of a sound level that varies with time.
Mathematically, the L_{10} level is the sound level exceeded for 10% of the measurement duration. L_{10} is often used for road traffic noise assessment. As an example, 63 dB $L_{A10,18hr}$ is a sound level of 63 dBA or higher for 10% of the 18 hour measurement period.</td></tr>
<tr><td>L_{90}</td><td>The L_{90} statistical level is often used as the “average minimum” or “background” level of a sound level that varies with time.
Mathematically, L_{90} is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB $L_{A90,15min}$ is a sound level of 45 dBA or higher for 90% of the 15 minute measurement period.</td></tr>
<tr><td>L_{eq}</td><td>The ‘equivalent continuous sound level’, Leq, is used to describe the level of a time-varying sound or vibration measurement.
Leq is often used as the “average” level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dBA weighting is applied, the level is denoted dB LAeq. Often the measurement duration is quoted, thus LAeq,15 min represents the dBA weighted energy-average level of a 15 minute measurement.</td></tr>
</table>

Term	Definition
L_{max}	The Lmax statistical level can be used to describe the "absolute maximum" level of a sound or vibration level that varies with time. Mathematically, Lmax is the highest value recorded during the measurement period. As an example, 94 dB LAmax is a highest value of 94 dBA during the measurement period. Since Lmax is often caused by an instantaneous event, Lmax levels often vary significantly between measurements.
Frequency	Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as "pitch". Sounds towards the lower end of the human hearing frequency range are perceived as "bass" or "low-pitched" and sounds with a higher frequency are perceived as "treble" or "high pitched".  
Peak Particle Velocity (PPV)	Peak Particle Velocity (PPV) is the highest velocity of a particle (such as part of a building structure) as it vibrates. Most sound level meters measure root mean squared (RMS) values; it is common to approximate the PPV based on an RMS measurement. PPV is commonly used as a vibration criterion, and is often interpreted as a PPV based on the Lmax or Lmax,spec index.

Term	Definition
Sound Power and Sound Pressure	The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.
Vibration	Waves in a solid material are called "vibration", as opposed to similar waves in air, which are called "sound" or "noise". If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage. A vibrating structure (eg a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structureborne vibration limits are sometimes set to control the noise level in a space. Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for structureborne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s^2) or else using a decibel scale.

Appendix B

Noise monitoring

B1 Noise monitoring

B1.1 Equipment

Unattended and attended monitoring was carried out using the following equipment:

Table 35: Monitoring equipment details

Measurement location	Equipment/model	Serial No.	SLM Type
Meas. L1	Ngara	878005	Class 1
Meas. L2	Ngara	8780A3	Class 1
Short term measurements	B&K 2250	2449851	Class 1

Notes: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and are designated either Class 1 or Class 2 as per Table 35, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Class 4231 calibrator. No significant drift in calibration was observed.

B1.2 Meteorological conditions

In accordance with the NPfI, any noise monitoring conducted during periods of extraneous weather conditions was excluded from the data set. The NPfI advises that data may be affected where adverse weather, such as wind speeds higher than 5 m/s or rain, occurs. During the measurement period for this assessment, periods of adverse weather occurred during three daytime periods. This was confirmed by using weather data from the Bureau of Meteorology's (BOM) Badgery's Creek weather station.

B1.3 Long-term unattended noise measurements

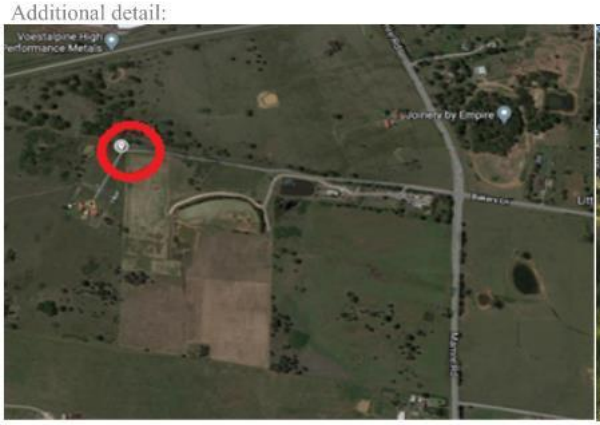
Long-term noise monitoring was carried out by Arup over two rounds from 15 to 23 May 2019 and 25 November 2020 to 7 December 2020. Monitoring was conducted in accordance with Appendix B1 of the NPfI [2]. The NPfI separates the 24-hour day into three different time periods – day, evening and night, as detailed below in Table 36.

Table 36: Standard NPfI time periods

Period	Day of Week	Time period
Day	Monday-Saturday Sunday, Public Holidays	7:00 am-6:00 pm 8:00 am-6:00 pm
Evening	Monday-Sunday	6:00 pm -10:00 pm
Night	Monday-Saturday Sunday, Public Holidays	10:00 pm -7:00 am 10:00 pm -8:00 am

Bakers Lane (West), Kemps Creek (Free Field)

Additional detail:



Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

Date	L_{A90} Background noise levels[4]			L_{Aeq} Ambient noise levels		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
Wednesday-15-May-2019		43	38		47	47
Thursday-16-May-2019	41	44	38	49	48	46
Friday-17-May-2019	40	43	36	48	47	43
Saturday-18-May-2019	34	40	36	47	44	42
Sunday-19-May-2019	32	43	38	43	46	47
Monday-20-May-2019	39	43	40	48	47	47
Tuesday-21-May-2019	40	40	39	48	45	47
Wednesday-22-May-2019	38	40	34	47	45	43
Thursday-23-May-2019						
Representative Weekday[5]	**40**	**43**	**38**	**48**	**46**	**46**
Representative Weekend[5]	**33**	**41**	**37**	**45**	**45**	**45**
Representative Week[5]	**39**	**43**	**38**	**47**	**46**	**46**

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for L_{A90} and logarithmic average for L_{Aeq}

Road / Rail noise monitoring results

Date	L_{Aeq} Noise levels		$L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile)	
	Day[1]	Night[2]	Day	Night
Wednesday-15-May-2019	47	47	48	52
Thursday-16-May-2019	48	46	50	52
Friday-17-May-2019	48	43	50	46
Saturday-18-May-2019	46	42	49	44
Sunday-19-May-2019	44	47	46	52
Monday-20-May-2019	48	47	49	51
Tuesday-21-May-2019	48	47	52	50
Wednesday-22-May-2019	47	43	47	46

Bakers Lane_Logger Data.xlsm

Thursday-23-May-2019	47		49	
Representative Weekday[3]	**47**	**46**	**50**	**50**
Representative Weekend[3]	**45**	**45**	**48**	**49**
Representative Week[3]	**47**	**46**	**49**	**50**

Notes:

1. Day is 7:00am to 10:00pm

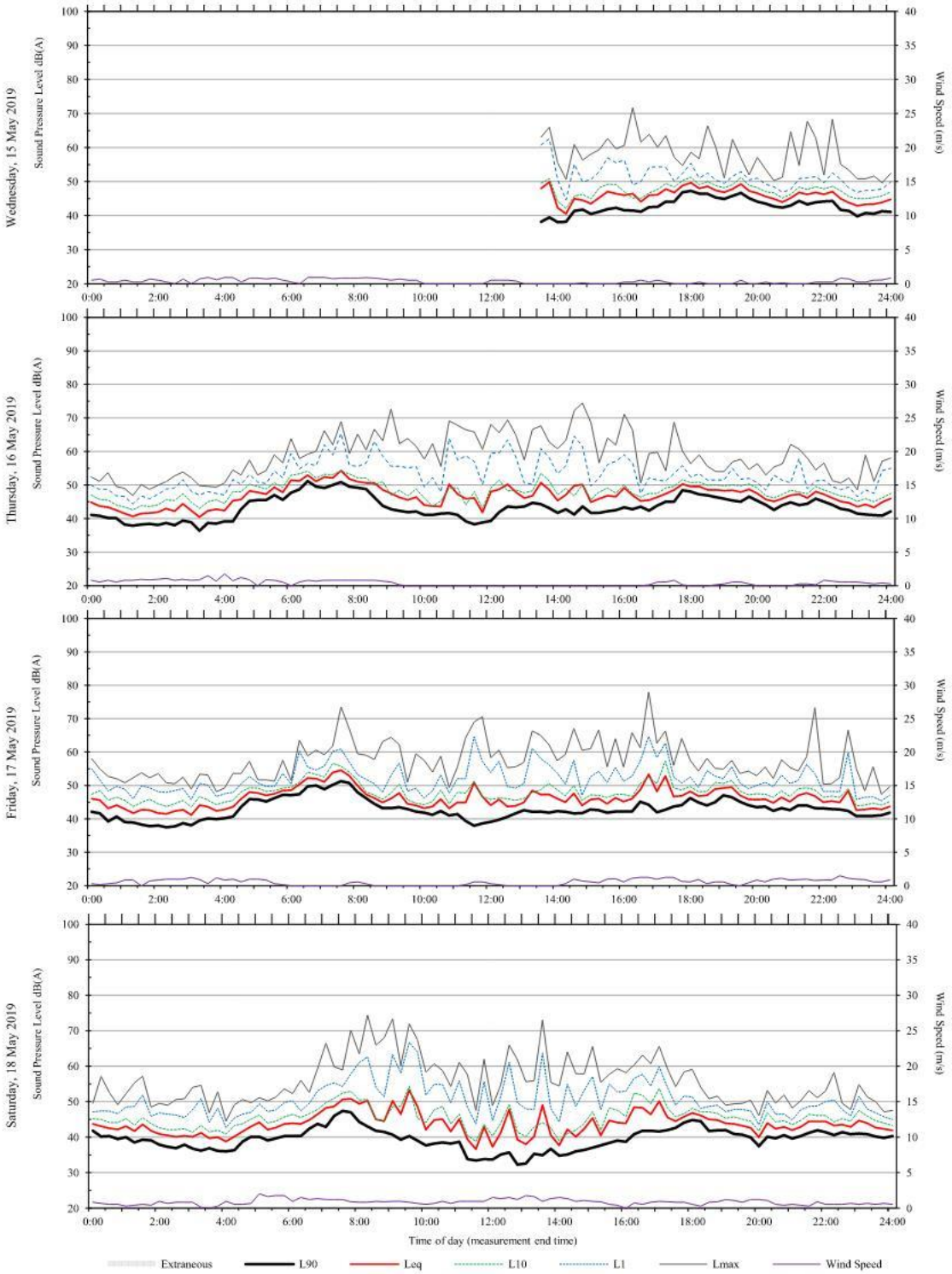
2. Night is 10:00pm to 7:00am

3. Logarithmic average of daily L_{Aeq}

Bakers Lane_Logger Data.xlsm

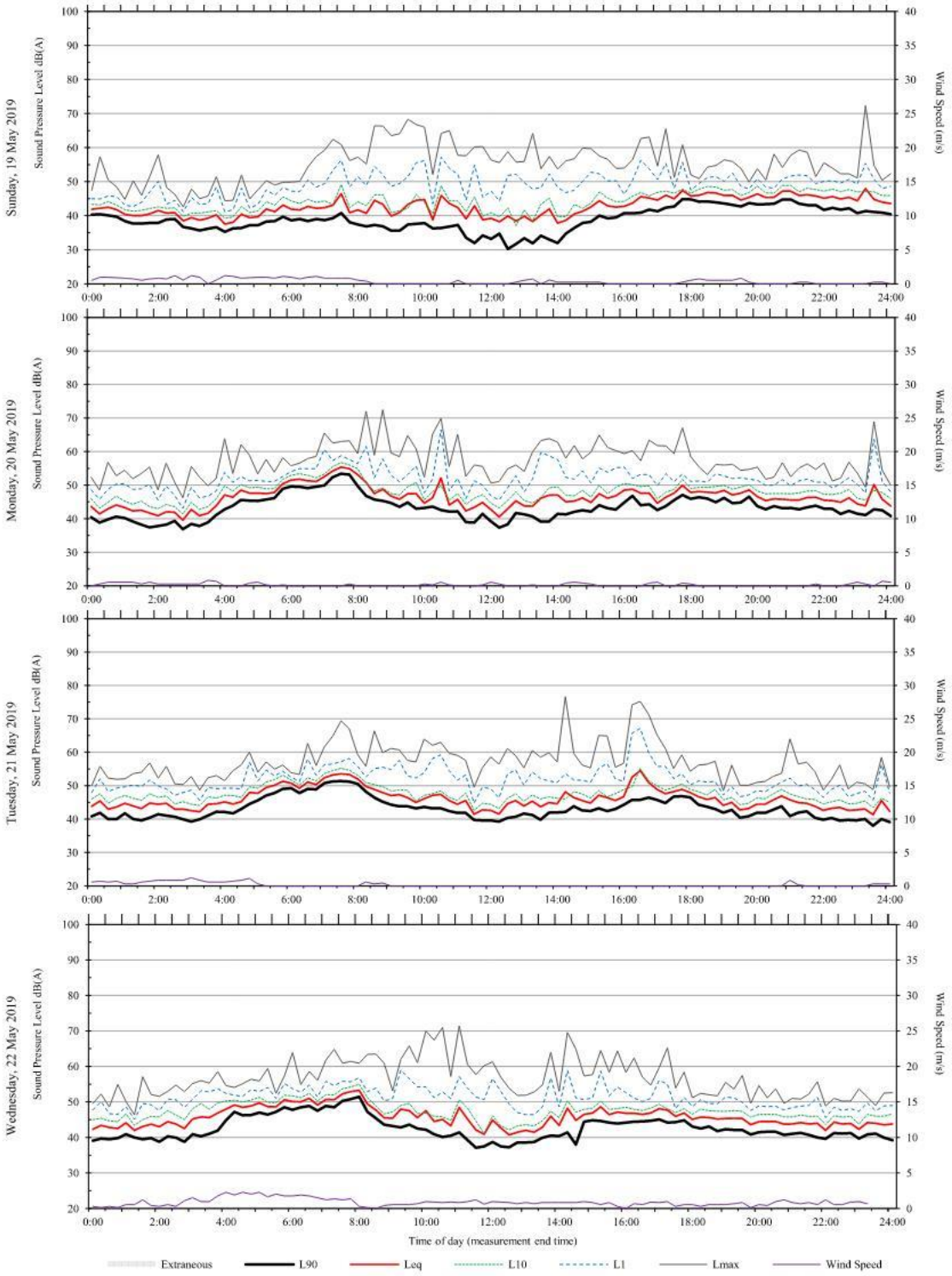
Unattended monitoring: Bakers Lane (West), Kemps Creek (Free Field)

ARUP



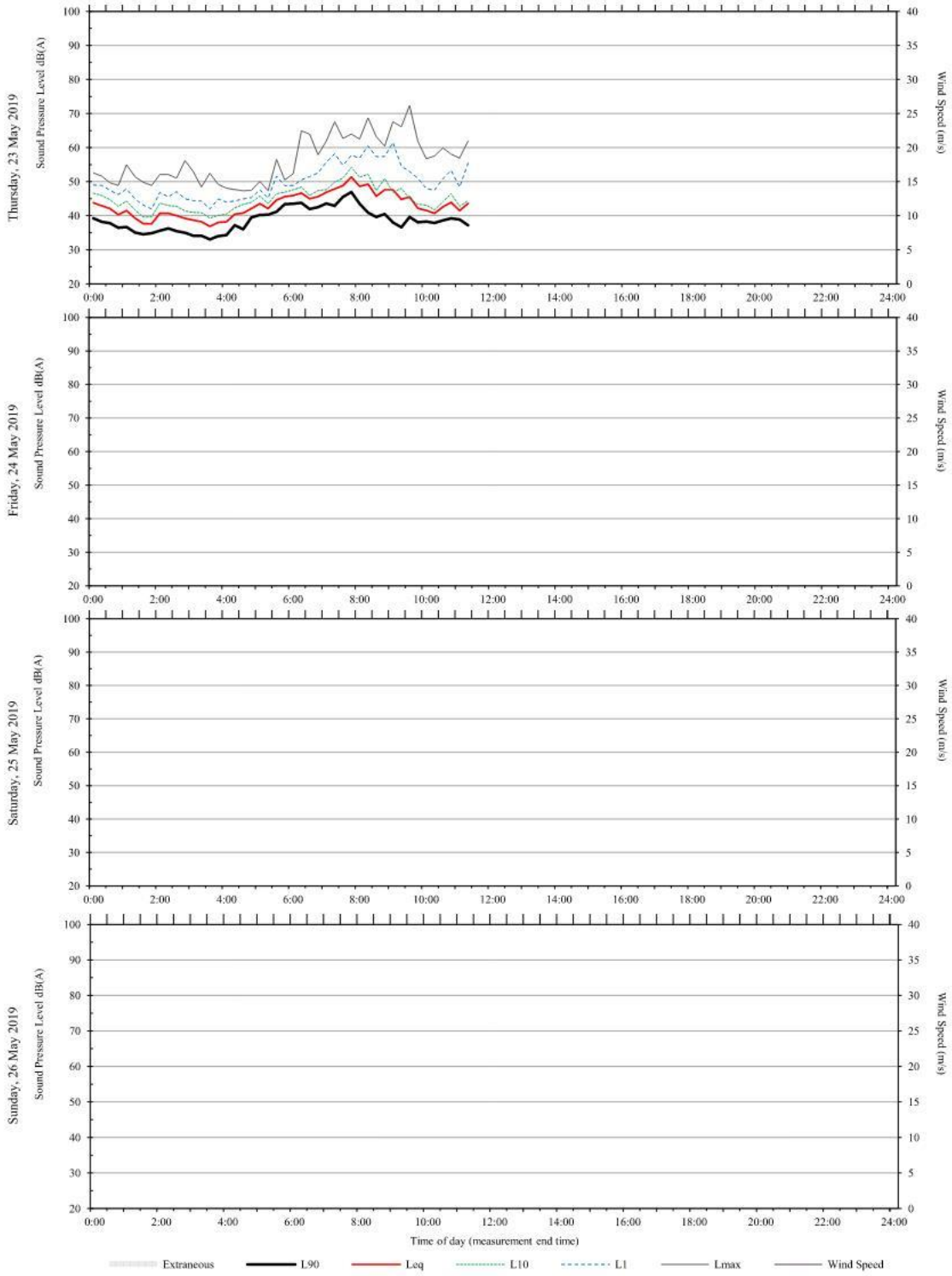
Unattended monitoring: Bakers Lane (West), Kemps Creek (Free Field)

ARUP



Unattended monitoring: Bakers Lane (West), Kemps Creek (Free Field)

ARUP



1 Medinah Avenue, Luddenham (Free Field)

Additional detail:

Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

	L_{A90} Background noise levels[4]			L_{Aeq} Ambient noise levels		
Date	**Day[1]**	**Evening[2]**	**Night[3]**	**Day[1]**	**Evening[2]**	**Night[3]**
Wednesday-25-November-2020			35			42
Thursday-26-November-2020	35		31	47		43
Friday-27-November-2020	37		37	47		49
Saturday-28-November-2020	37			46		
Sunday-29-November-2020						
Monday-30-November-2020	37		34	46		44
Tuesday-01-December-2020						
Wednesday-02-December-2020	38			48		
Thursday-03-December-2020	39			48		
Friday-04-December-2020	35			54		
Saturday-05-December-2020	37		32	47		45
Sunday-06-December-2020	36	36	29	47	45	42
Monday-07-December-2020						
Representative Weekday[5]	**37**	**N/A[6]**	**34**	**49**	**N/A[6]**	**45**
Representative Weekend[5]	**37**	**36**	**30**	**47**	**45**	**43**
Representative Week[5]	**37**	**36 [6]**	**33**	**49**	**45**	**45**

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for L_{A90} and logarithmic average for L_{Aeq}
6. Although all but one evening level has been excluded due to extraneous weather or noise events, this level is in line with anticipated evening RBL, i.e. in line with the daily profile anticipated for a suburban environment, lower than the day and higher than the night, therefore is considered appropriate as the evening RBL. Of note, the evening period is not the critical period of assessment, hence does not change the outcome of the assessment.

Road / Rail noise monitoring results

	L_{Aeq} Noise levels		$L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile)	
Date	**Day[1]**	**Night[2]**	**Day**	**Night**
Wednesday-25-November-2020	53	42	61	47

Luddenham_Logger Data.xlsm

Thursday-26-November-2020	48	43	50	48
Friday-27-November-2020	47	49	49	57
Saturday-28-November-2020	46	46	47	51
Sunday-29-November-2020	49	46	53	49
Monday-30-November-2020	46	44	51	46
Tuesday-01-December-2020	48	44	54	46
Wednesday-02-December-2020	48		51	
Thursday-03-December-2020	48		52	
Friday-04-December-2020	53	44	0	46
Saturday-05-December-2020	47	45	50	50
Sunday-06-December-2020	47	42	48	47
Monday-07-December-2020	47		50	
Representative Weekday[3]	**50**	**45**	**54**	**51**
Representative Weekend[3]	**47**	**45**	**50**	**49**
Representative Week[3]	**49**	**45**	**53**	**50**

Notes:

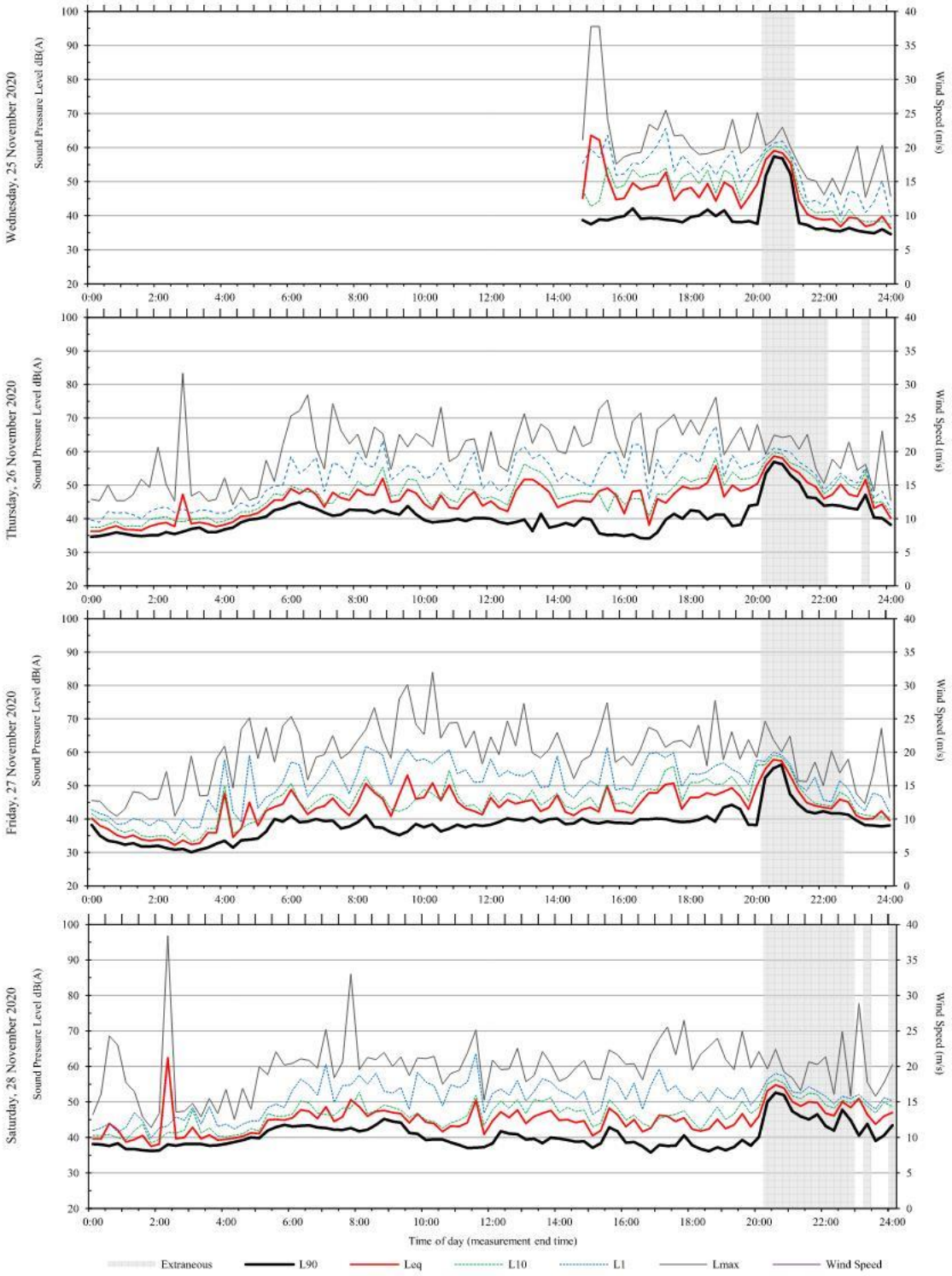
1. Day is 7:00am to 10:00pm

2. Night is 10:00pm to 7:00am

3. Logarithmic average of daily L_{Aeq}

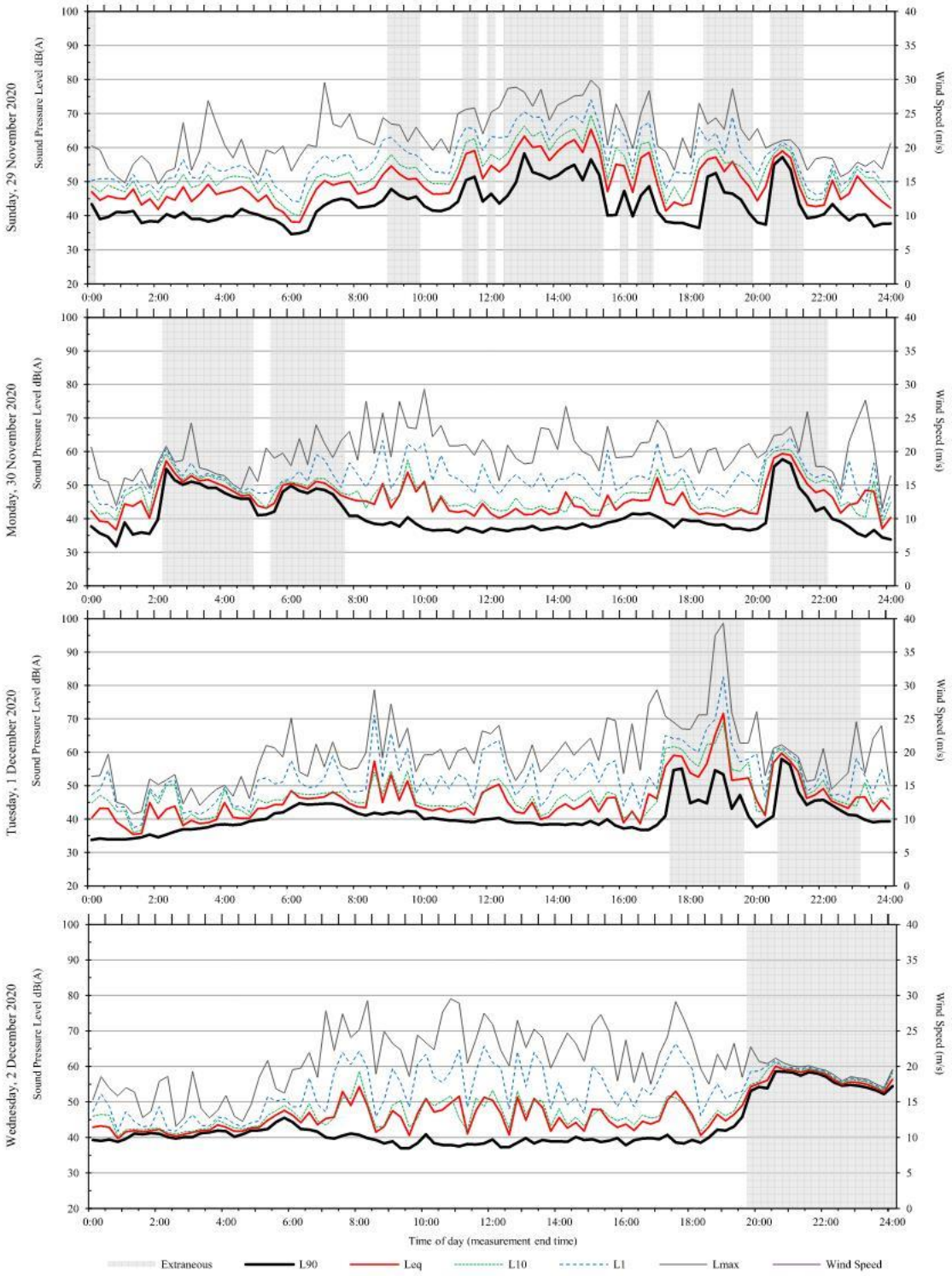
Luddenham_Logger Data.xlsm

Unattended monitoring: 1 Medinah Avenue, Luddenham (Free Field) ARUP

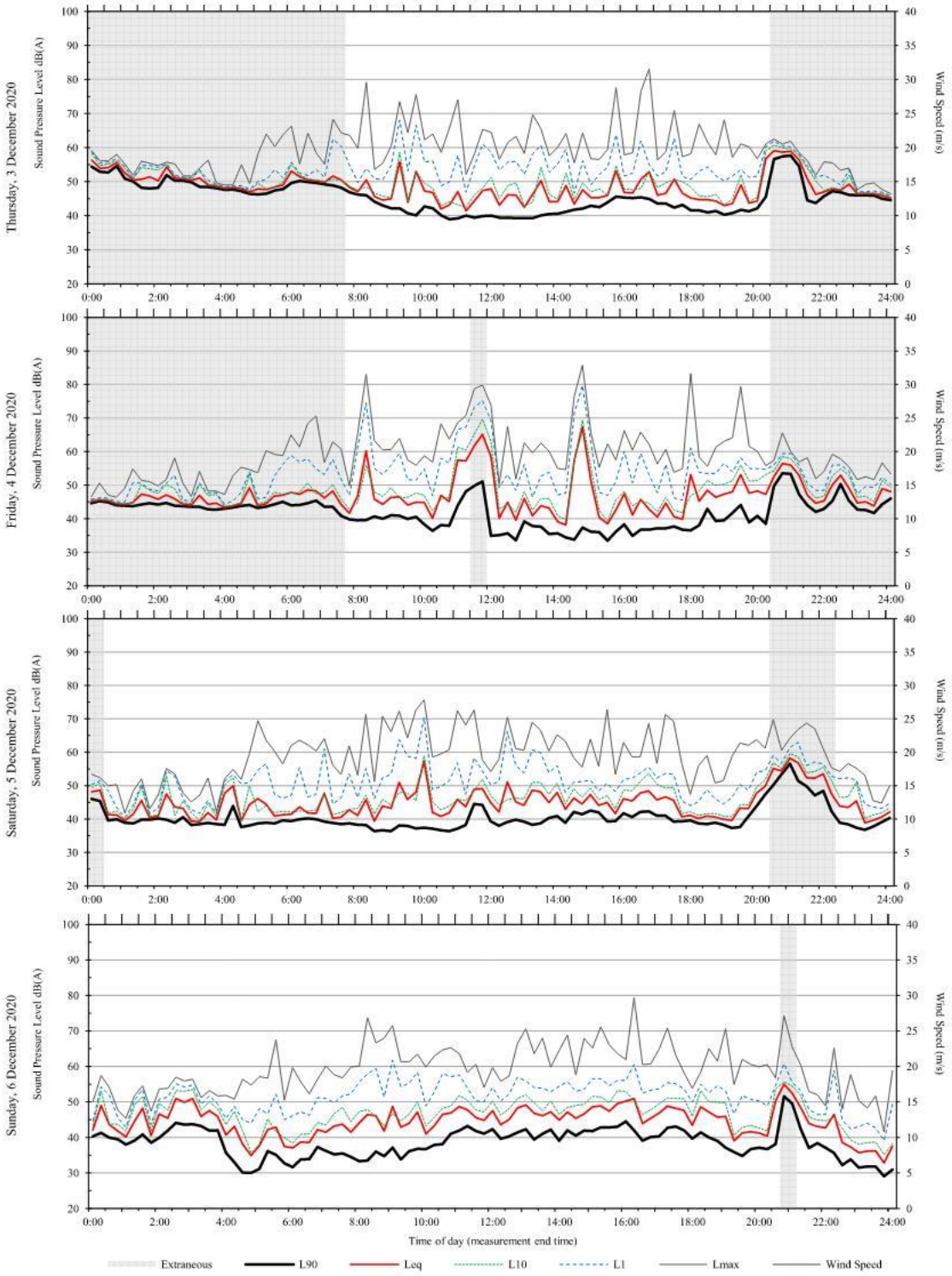


Unattended monitoring: 1 Medinah Avenue, Luddenham (Free Field)

ARUP

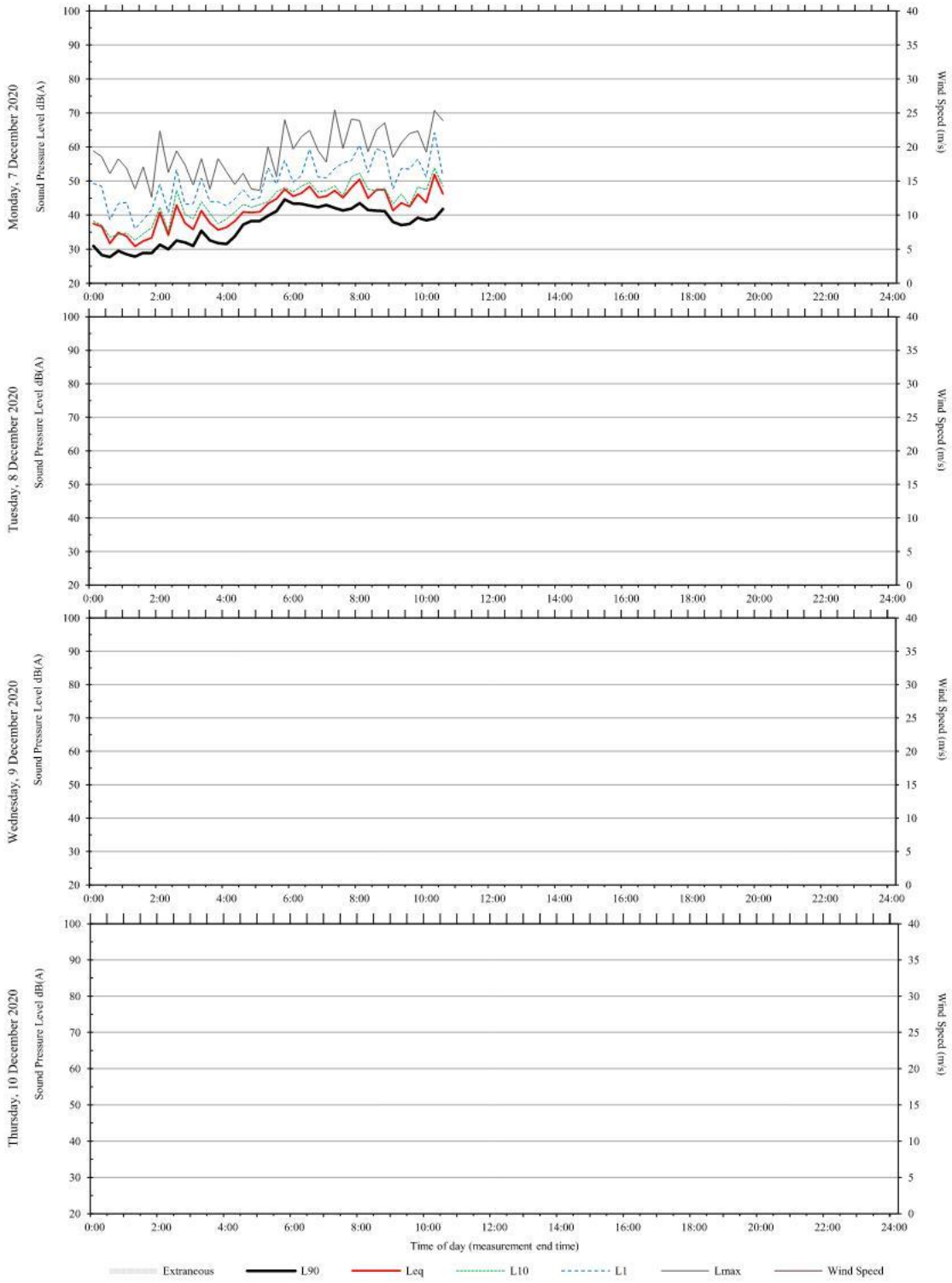


Unattended monitoring: 1 Medinah Avenue, Luddenham (Free Field) ARUP



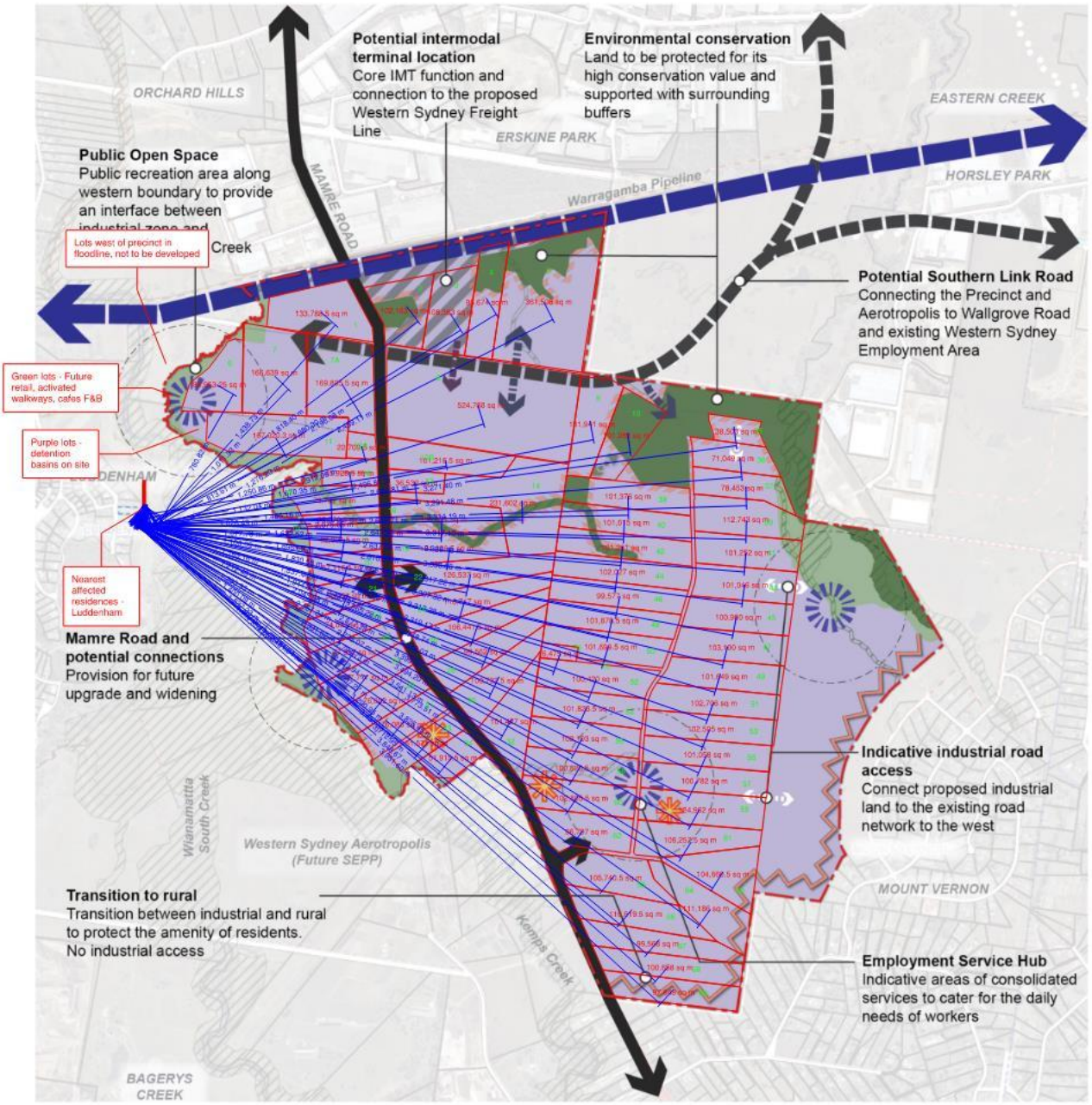
Unattended monitoring: 1 Medinah Avenue, Luddenham (Free Field)

ARUP



Appendix C

Cumulative noise level calculation



Structure Plan

- Precinct boundary
- Cadastral boundaries
- Industrial
- Environmental conservation
- Open space
- Potential intermodal terminal
- Proposed Western Sydney Freight Line
- Mamre Road and potential connections
- Potential Southern Link Road
- Potential road access
- Potential freight connection to precinct
- Indicative road access
- Indicative riparian buffers
- Transition to rural
- Transition to Environmental Conservation
- Local heritage items
- Indicative employment service hub (with 400m catchment)
- Opportunity for ecological corridor

NSW GOVERNMENT

Mamre Road Precinct

Structure Plan - June 2020

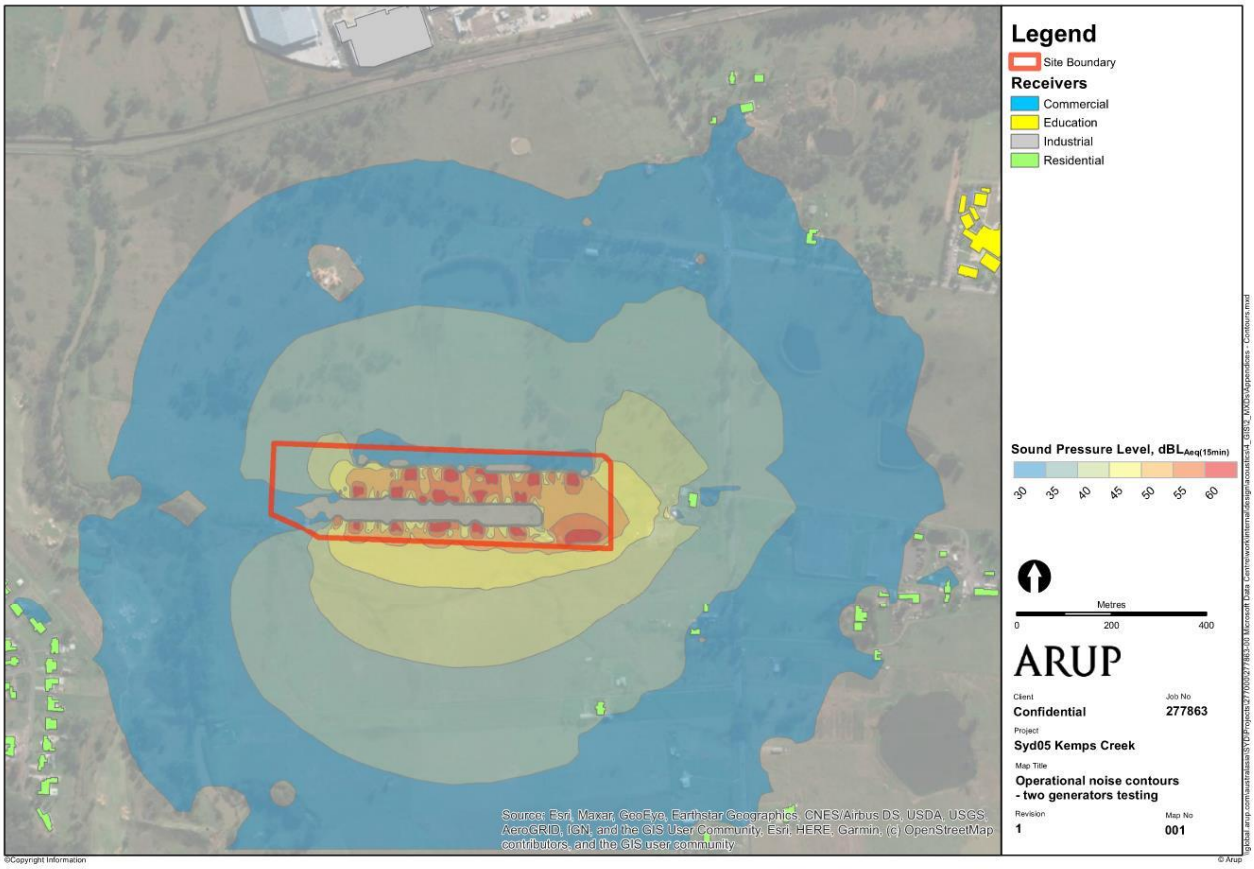
Scale 0 250 500 1000m

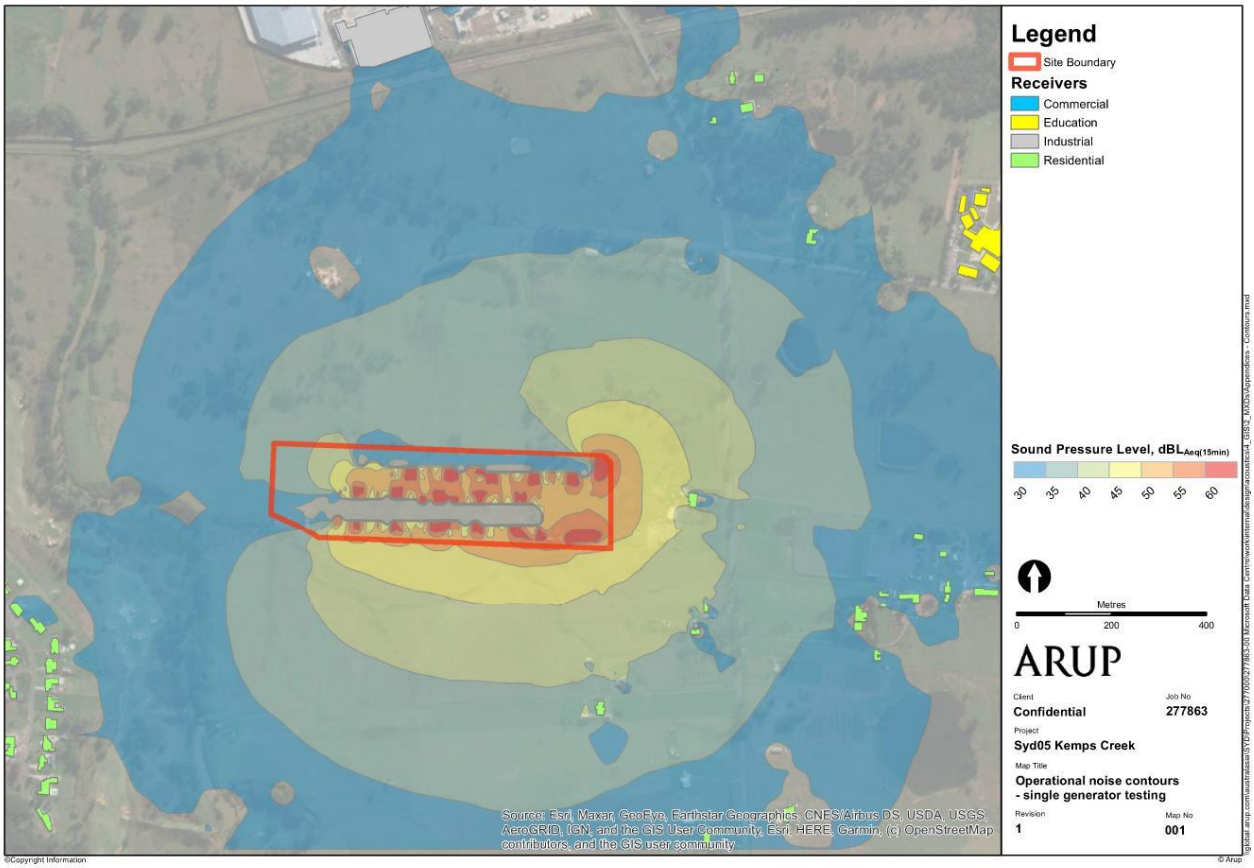
							-55.5		44.5
					Assumed Lw per m2	100			
								NPfI 2.4.2 Amenity noise levels in areas near an existing or proposed cluster of industry: *Where a greenfield development is proposed and it can be demonstrated that existing levels of industrial noise are more than 5 dB lower than the relevant recommended amenity noise level, equation 1 can be modified to reflect 'amenity noise level' in lieu of 'amenity noise level – 5 dB(A)'.*		
min		16475	781		Rural night time amenity level, dBLAeq(night)	40			
max		524788	3951						

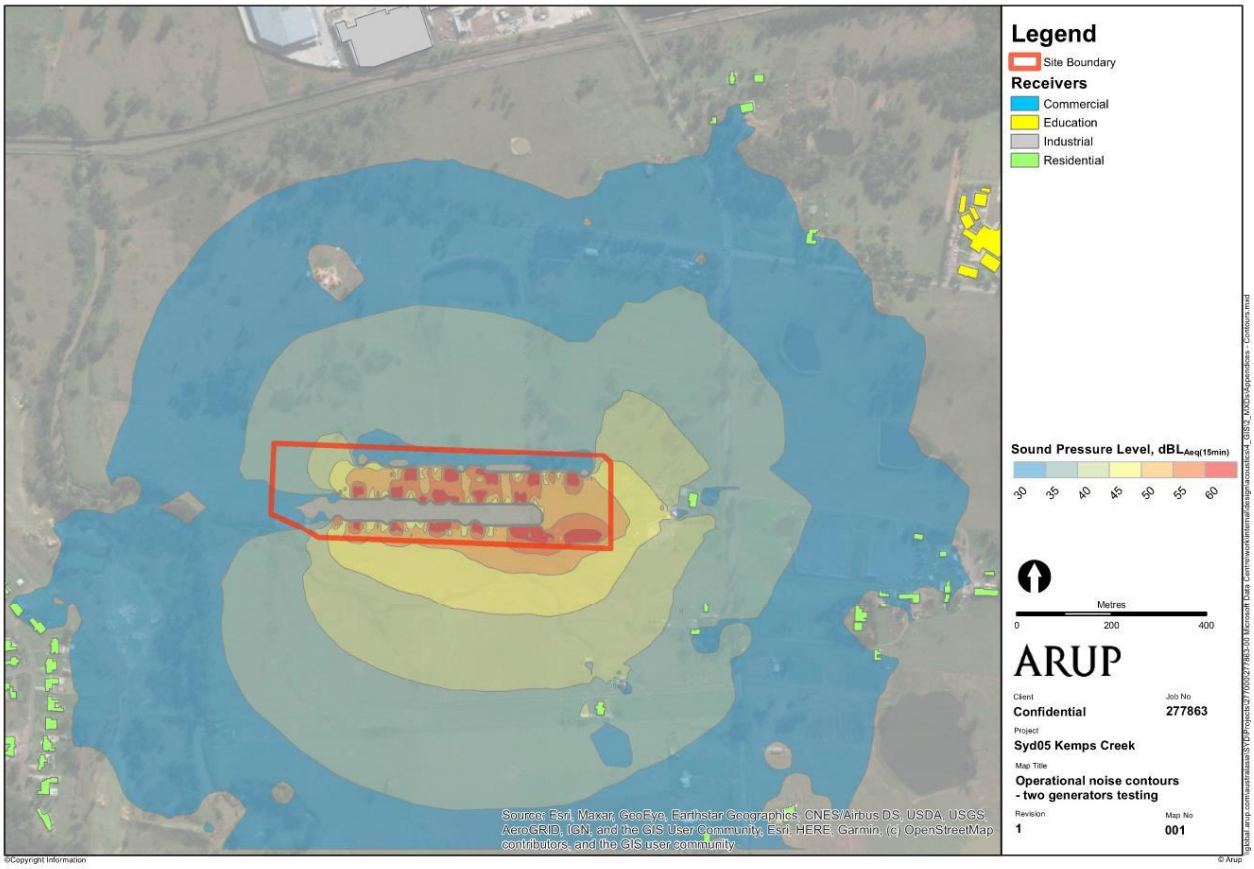
	Source	Area	Distance	Propagation loss	Area correction	Lp contribution at receiver, dBA	Allowable contribution, dBLAeq(period)	Allowable contribution, dBLAeq(15min)
1	1	133785	1439 m	-71	51	80	24.6	
2	2	102163	1818 m	-73	50	77	21.4	
3	3	108383	1980 m	-74	50	76	20.9	
4	4	95374	2196 m	-75	50	75	19.5	
5	5	361508	2459 m	-76	56	80	24.3	
6	6	89953	781 m	-66	50	84	28.1	
7	7	166639	1011 m	-68	52	84	28.5	
8	7A	169806	1276 m	-70	52	82	26.6	
9	8	524788	1912 m	-74	57	83	28.0	
10	9	101941	2496 m	-76	50	74	18.7	
11	10	101283	2690 m	-77	50	73	18.0	
12	11 - Syd05 Development	167020	813 m	-66	52	86	30.3	33.3
13	12	45929	1132 m	-69	47	78	22.1	
14	12A	22710	1251 m	-70	44	74	18.2	
15	12B	101207	1670 m	-72	50	78	22.1	
16	13	36532	1486 m	-71	46	74	18.7	
17	14	231602	2075 m	-74	54	79	23.8	
18	15	73792	1026 m	-68	49	80	24.9	
19	16	25070	1077 m	-69	44	75	19.9	
20	17	62003	1108 m	-69	48	79	23.5	
21	18	101891	1632 m	-72	50	78	22.3	
22	19	101426	1696 m	-73	50	77	22.0	
23	20	57116	1165 m	-69	48	78	22.8	
24	21	59258	1212 m	-70	48	78	22.6	
25	22	126537	1830 m	-73	51	78	22.3	
26	23	74035	1290 m	-70	49	78	23.0	
27	24	116717	1837 m	-73	51	77	21.9	
28	25	77812	1400 m	-71	49	78	22.5	
29	26	106441	1944 m	-74	50	76	21.0	
30	27	77717	1537 m	-72	49	77	21.7	
31	28	99562	2045 m	-74	50	76	20.3	
32	29	76602	1682 m	-73	49	76	20.9	
33	30	100732	2157 m	-75	50	75	19.9	
34	31	76080	1854 m	-73	49	75	20.0	
35	32	101427	2331 m	-75	50	75	19.2	
36	33	51571	2032 m	-74	47	73	17.5	
37	34	51915	2181 m	-75	47	72	16.9	
38	35	38503	3271 m	-78	46	68	12.1	
39	36	71049	3291 m	-78	49	70	14.7	
40	37	78453	3314 m	-78	49	71	15.1	
41	38	101376	2649 m	-76	50	74	18.1	
42	39	112743	3317 m	-78	51	72	16.7	
43	40	101015	2647 m	-76	50	74	18.1	
44	41	101252	3326 m	-78	50	72	16.2	
45	42	101291	2637 m	-76	50	74	18.2	
46	43	101046	3330 m	-78	50	72	16.1	
47	44	102027	2616 m	-76	50	74	18.3	
48	45	100980	3317 m	-78	50	72	16.2	
49	46	99577	2665 m	-77	50	73	18.0	
50	47	103100	3307 m	-78	50	72	16.3	
51	48	101878	2649 m	-76	50	74	18.2	
52	49	101649	3312 m	-78	50	72	16.2	
53	50	101699	2674 m	-77	50	74	18.1	
54	51	102706	3319 m	-78	50	72	16.2	
55	52	100420	2665 m	-77	50	74	18.0	
56	53	102505	3348 m	-78	50	72	16.2	
57	54	101825	2677 m	-77	50	74	18.1	
58	55	101058	3379 m	-79	50	71	16.0	
59	56	102103	2725 m	-77	50	73	17.9	
60	57	100782	3399 m	-79	50	71	16.0	
61	58	100620	2794 m	-77	50	73	17.6	
62	59	124962	3494 m	-79	51	72	16.6	
63	60	102805	2873 m	-77	50	73	17.5	
64	61	106257	3541 m	-79	50	71	15.8	
65	62	96797	3007 m	-78	50	72	16.8	
66	63	104660	3773 m	-80	50	71	15.2	
67	64	111186	3825 m	-80	50	71	15.4	
68	65	105740	3290 m	-78	50	72	16.4	
69	66	116619	3486 m	-79	51	72	16.4	
70	67	99568	3712 m	-79	50	71	15.1	
71	68	100658	3848 m	-80	50	70	14.9	
72	69	97848	3951 m	-80	50	70	14.5	
73	70	16475	2434 m	-76	42	66	11.0	
74	71	101216	1670 m	-72	50	78	22.1	
					dB sum	95.5	40.0	

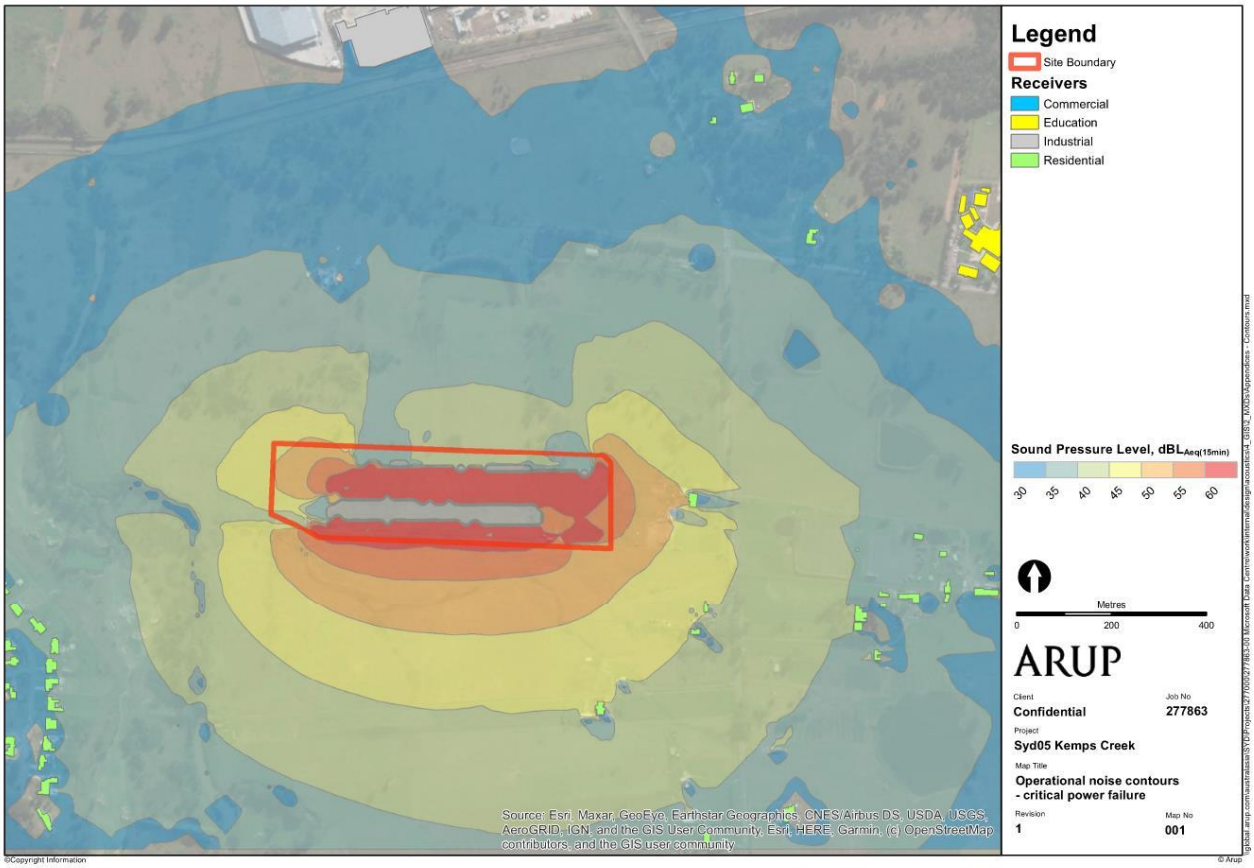
Appendix D

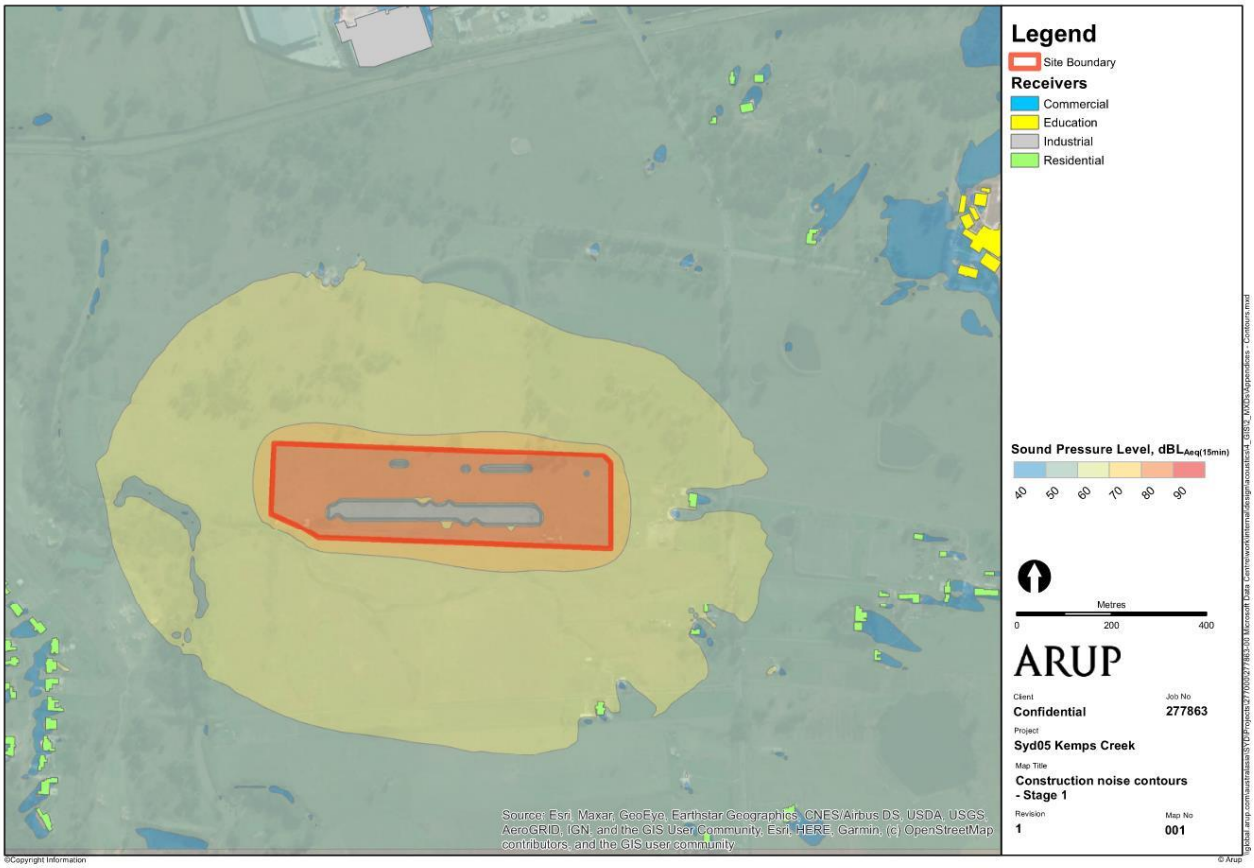
Noise Contour Maps

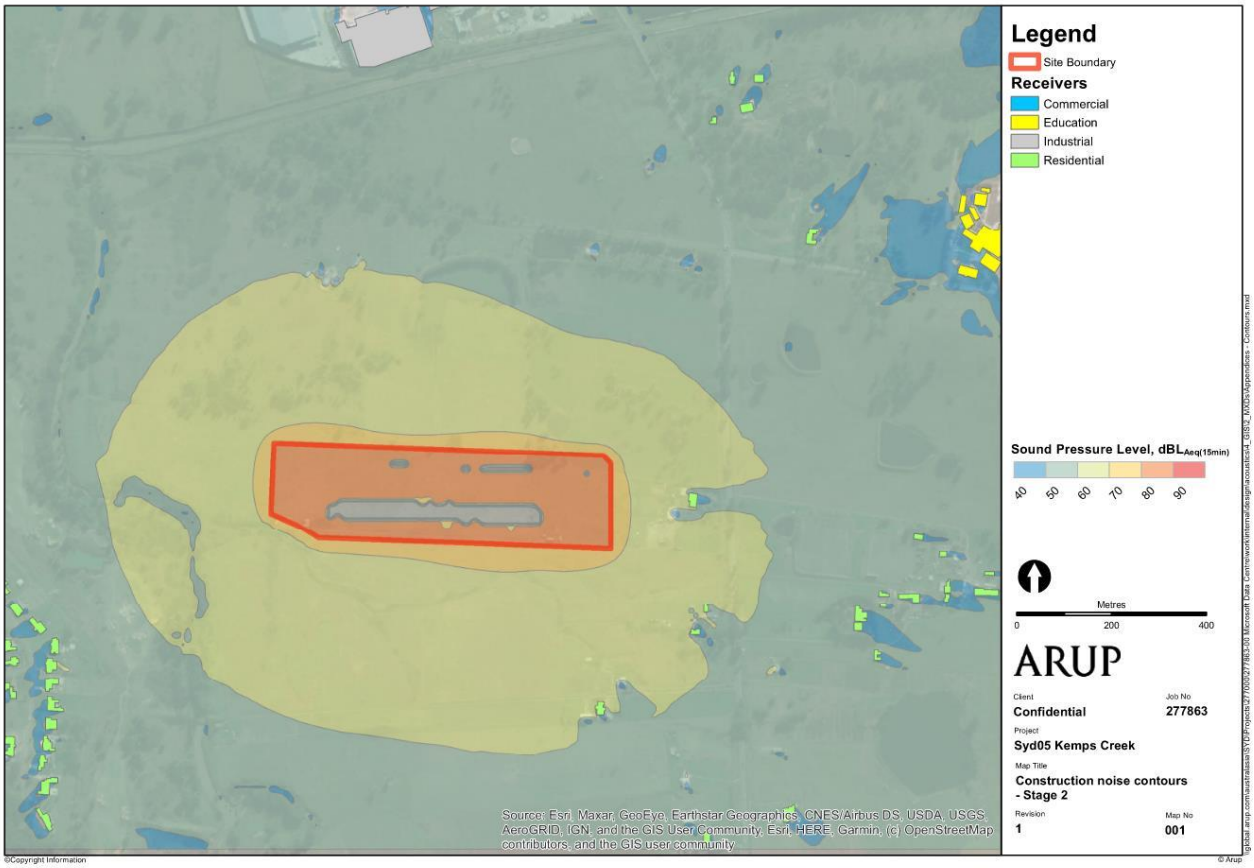

Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
30 35 40 45 50 55 60
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Operational noise contours
- two generators testing
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup

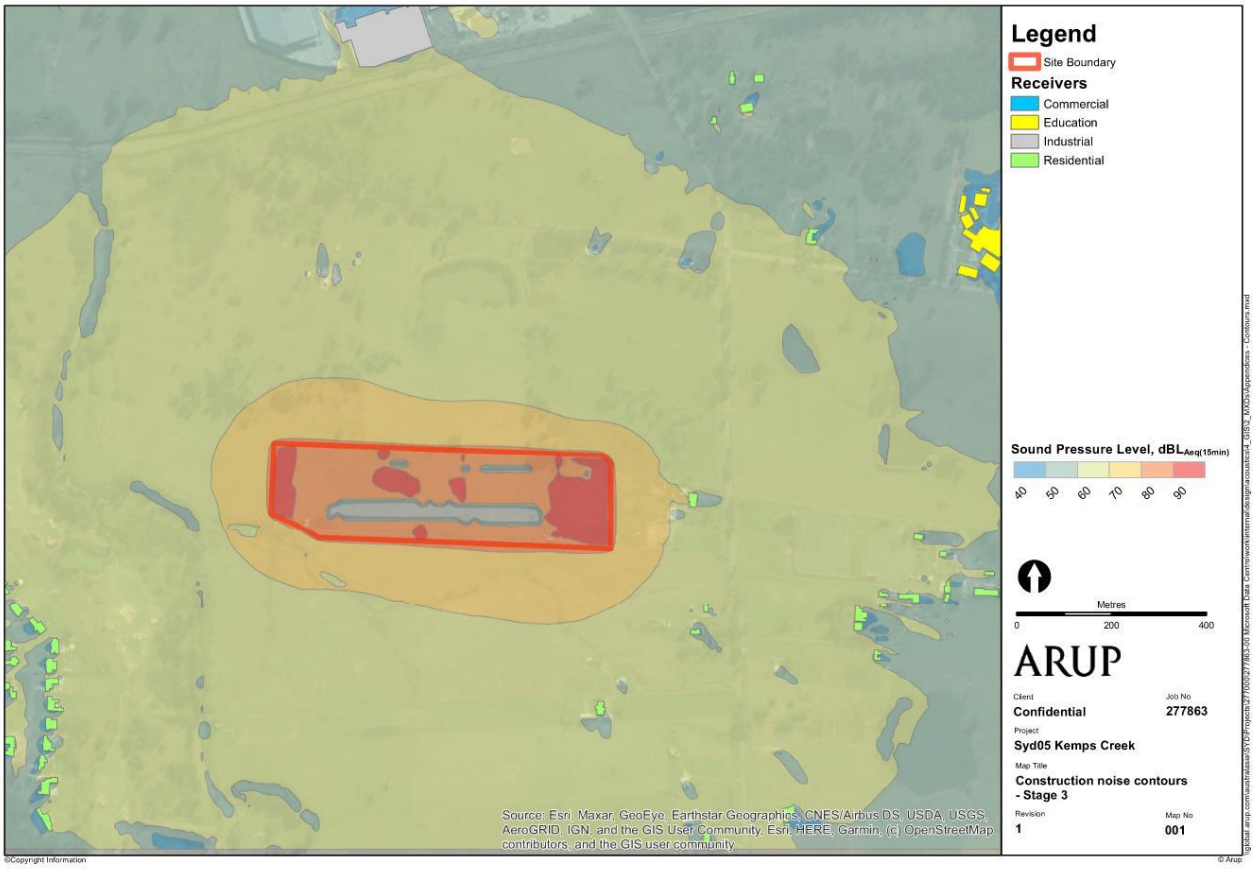

Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
30 35 40 45 50 55 60
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Operational noise contours
- single generator testing
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup

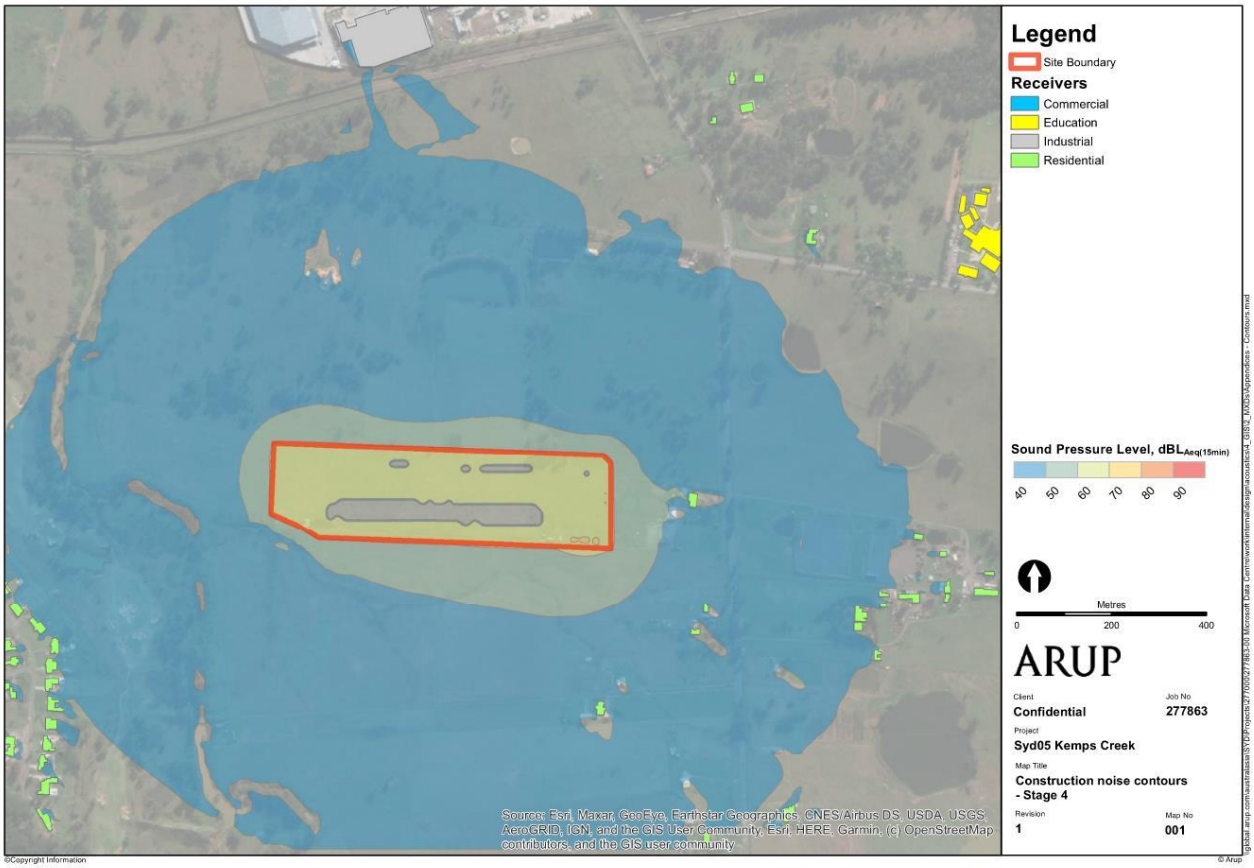

Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
30 35 40 45 50 55 60
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Operational noise contours
- two generators testing
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup


Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
30 35 40 45 50 55 60
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Operational noise contours
- critical power failure
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup


Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBLAeq(15min)
40 50 60 70 80 90
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Construction noise contours - Stage 1
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup


Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBLAeq(15min)
40 50 60 70 80 90
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Construction noise contours - Stage 2
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup


Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
40 50 60 70 80 90
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Construction noise contours - Stage 3
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup


Legend
Site Boundary
Receivers
Commercial
Education
Industrial
Residential
Sound Pressure Level, dBL$_{Aeq(15min)}$
40 50 60 70 80 90
Metres
0 200 400
ARUP
Client
Confidential
Job No
277863
Project
Syd05 Kemps Creek
Map Title
Construction noise contours - Stage 4
Revision
1
Map No
001
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
©Copyright Information
© Arup

APPENDIX 2 – CV / QUALIFICATIONS

CIRICULUM VITAE – GEORGE WEI (DIRECTOR)

Qualifications

NSW Fair Trading Approved Building and Development Certifier – Acoustic (Registration No: BDC04838)
NER EA ID: 2222387
Master Degree of Mechanical Engineering (UNSW)
Bachelor Degree of Mechanical Engineer
Diploma of HVAC Engineering
Member of Australian Acoustical Society

Outline of Experience

George Wei has been employed by Acoustic Logic since January 2004 and has experienced projects in Middle East, Australia, New Zealand, Singapore and United Kingdom. George Wei has built variety experience in the areas of building acoustics, mechanical noise control, environmental noise, traffic noise control, train vibration isolation, hearing protection and real time noise/ vibration monitoring.

Whilst employed with Acoustic Logic, George has been responsible for projects of defence, residential, retail, education, cinema, concert, aged care, sports facility, music function, gymnasium, childcare, etc.

Special Areas- Noise and Vibration

George has gained more than 19 years' experience of acoustic consultancy.

Employment History:

Jan 2004 – March 2009	*Project Engineer Acoustic Logic Consultancy.*
March 2009-August 2017	*Senior Acoustic Engineer Acoustic Logic Consultancy.*
August 2017- November 2021	*Associate Director Acoustic Logic Consultancy.*
November 2021- Current	*Director Acoustic Logic*

Areas of Expertise and Relevant Experience:

- *Building acoustics*
- *MEP noise control*
- *Environmental noise modelling and assessment*
- *Train noise and vibration control*
- *Traffic noise prediction*
- *Concert / Cinema noise isolation.*
- *Helicopter & aircraft noise*
- *Construction noise and vibration*
- *Vibration Isolation*
- *Transmission Loss Testing*
- *Structural Dynamics*
- *Defence Acoustics*

GEORGE WEI
Associate Director

Project Experience

Defence Projects

* *Harman*
* *CEA*
* *Building 918, Richmond RAAF*
* *Building 616, Richmond RAAF*
* *RAAF Williamtown*
* *ACRUX Belbourne*
* *RAAF Richmond*

Residential / Commercial / Mixed Use

* *Loftus Lane*
* *275 George St, Sydney*
* *Balvidia North Sydney*
* *South Bank, Wooli Creek*
* *7D1-7D6, Breakfast Point*
* *710 George St, Sydney.*
* *V- Crown Parramatta*
* *Meriton Group Projects (Victoria Park, Mascot Central, Gordon, Pymble, Epping, Arncliffe, Brisbane, Gold Coast, Parramatta, Pagewood, Olympic Park, etc)*
* *Regents Place, Town Hall*
* *Discovery Point, Wooli Creek*
* *Hyde Park Gardens*
* *Balmain Shores*
* *Bennelong Apartments*
* *Ikon*
* *BP513 & 5F Breakfast Point*
* *Newbury and York Apartments, Breakfast Point*
* *Pinnacle Rhodes*
* *Waterside Rhodes*
* *Kiewa Project, Rhodes*
* *Top Ryde City*
* *Belvedere, North Sydney*
* *Pinnacle Rhodes*
* *Portside Building, Brisbane*

Hospital and Healthcare Projects

* *Randwick Hospital Redevelopment*
* *Liverpool Hospital*
* *Canberra Hospital*
* *Westmead Hospital*
* *Wagga Wagga Hospital*
* *Orange Hospital*
* *Manning Hospital*

GEORGE WEI
Associate Director

* *St George's Hospital*
* *Royal North Shore*
* *Muswell brook Hospital*

Hotel/Serviced Apartments

* *Holiday Inn*
* *Star City*
* *Medina – Kent Street/King Street Wharf*
* *Mercure Hotels - Railway Sq.*
* *Grande Mecure - Darling Harbour*
* *Quest Apartments - Mascot, Cronulla, Rosehill*

Commercial Projects

* *Lend Lease Circular Quay*
* *Star Casino*
* *Wynyard Place*
* *275 George St*
* *46-51 Waterloo Rd, Macquarie Park*
* *60 Martin Place*
* *Penrith Panthers Club*
* *APRA 1 Martin Place*
* *UWS Projects (Bankstown, Penrith, etc)*
* *Manly Wharf*
* *Ibis Hotel*
* *Menzies Hotel*
* *Hydro Majestic Hotel*
* *T2 Piers, Sydney Airport*
* *Justice Precinct*
* *Liverpool Hospital*
* *Auburn Hospital*
* *Westmead Hospital*
* *Norwest precinct*
* *World Square, Sydney*
* *Stockland Merrylands*
* *Sydney Water, Parramatta*
* *Sydney Water, Potts Hill*
* *Atlas, Norwest*

Aged Care Projects

* *ARV Forestville*
* *Woolooware Shores ARV*
* *ARV Glenhaven*
* *ARV Lober Square, Castle Hill*
* *Malabar Aged Care Centre*
* *BUPA Princess Highway Sutherland*
* *St Josephs Coffs Harbour*
* *Pittwater ACF at 14-16 John St, Avalon*

Acoustic Logic Consultancy

GEORGE WEI
Associate Director

* *Aged Care Centre at 75-77 Alexandria Parade, Wahroonga*
* *Mt Wilga Aged Care*
* *Acacia St Kirrawee Village*

Child Care Projects

* *CCC at 203 Darley Road, Randwick*
* *Kids Korner Greenway Supacenta*
* *5 South Ave, Double Nay Childcare Nursery*
* *1-5 Mullane Ave, Baulkham Hills.*
* *88 Newcastle St, Rose Bay.*
* *Childcare centre at 77 King St, Sydney.*
* *20 Gadigal Ave, Zetland, Childcare Centre.*
* *28 Ramsay Rd, Pennant Hills.*
* *262 Hawthorne St, Haberfield*
* *12-14 Pine St, Five Dock.*
* *614 Polding St, Bossley Park.*
* *7 Donnelly Rd, Narrembern*
* *6-8 Waterloo St, Balmain.*
* *Montessori Academy*

Heritage Buildings

* *110 Homebuh Rd, Strathfield. Childcare Centre for Montessori Academy.*
* *14 Garthowen Cre, Castle Hill. Childcare Centre for Revelop Projects.*
* *Cityview Baptist Church, Penrith*
* *St Basils Randwick.*
* *AIN Enabling Projects at Sydney Uni*

Higher Education Projects

* *AIN Enabling Projects at Sydney Uni*
* *Abercrombie Demolition, Sydney Uni.*
* *Function Centre, UTS.*
* *UWS College Teaching Facility, Kingswood campus.*
* *UWS Nirimba*
* *New Teaching Facility at UWS College Bankstown campus*

Gym/ Fitness Projects

* *George Wei has experienced more than 50 Gym projects in recent a few years.*
* *Fitness First Australia: Manly; Bondi Junction, Maroubra, Sydney, etc.*
* *Snap Fitness: Double Bay, Maroubra, Waterloo, Pyrmont, etc.*

University Projects

* *Regiment Redevelopment- Sydney University*
* *Lees Project – Sydney University*
* *Union Court redevelopment - ANU*

Acoustic Logic Consultancy

GEORGE WEI
Associate Director

* *University of Sydney - F07 LEES 1 Building*
* *University of New South Wales – Gate 2 Student Accommodation*
* *University of Sydney - Creative Arts Rozelle – Mechanical Services*
* *Dover Heights High School – New Buildings*
* *Trinity Grammar – Internal acoustics and plant noise for auditorium*
* *Fort Street High School – New Music and Drama workshops and Admin building*
* *UTS Graduate School of Health*
* *University of Sydney – Conservatorium of Music (Refurb)*
* *UWS College Teaching Facility – Kingswood Campus*

School Projects

* *Inner Sydney High School*
* *Knox Grammar*
* *Kent Road Public School*
* *Arthur Phillip High School*
* *Kellyville South Public School*
* *Marsden Park Public School*
* *Central Coast Schools*
* *St Ives North Public School*

JUSTINE WADE
Project Engineer

Qualifications

Bachelor of Natural Science (Environmental Science) WSU
Cert III in Business
Member of the National Association of Women in Construction

Outline of Experience

2022 – Current	Project Engineer, Acoustic Logic
2021 – 2022	Acoustic Consultant, Acoustic Works

Whilst at Acoustic Logic, Justine has been trained in measurement and analysis of noise and vibration. Justine has worked in detailed assessment of acoustic impacts and has been involved in the design of attenuation systems to meet relevant statutory codes (BCA/NCC, EPA Guidelines and Australian Standards).

Her work involves the investigation, design and construction supervision of noise control measures associated with mechanical services and building works. Whilst being employed at Acoustic Logic, Justine has been responsible for noise and vibration engineering for residential, commercial, hospitals and State Significant Developments (SSDs). Justine's area of expertise include:

- Spatial planning of development (room layouts, wall design etc).
- Acoustic control of mechanical systems (ventilation systems, air-conditioning etc).
- Acoustic design of reverberant noise in critical space.
- Environmental noise modelling and assessment as required for consent authorities.
- Review of external noise impacts (traffic, rail).

Project Experience

- Circular Quay Renewal
- Rydges – Sydney International Airport
- Cooma Hospital Key Work Accommodation
- Royal Prince Alfred Hospital
- Woolworths (Regional Store Developments)
- 41 Princes Highway, Kogarah
- 815 George Street, Sydney
- 232-240 Elizabeth Street, Surry Hills