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Stage 2 DA - Construction Noise and Vibration Management Plan

Blakebrook Public School

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1 INTRODUCTION

Acoustic Logic has been engaged to prepare a Noise and Vibration Management Plan for the Stage 2 excavation and construction works associated with the existing Blakebrook Public School located at 417 Rosehill Road, Blakebrook NSW 2480. The issues which will be addressed in this report are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Identification of potentially impacted nearby development.
- Identify likely sources of noise and vibration generation 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.

2 SITE DESCRIPTION

The existing buildings at Blakebrook Public School, 417 Rosehill Road, Blakebrook (Lot 2 Deposited Plan (DP) 859866) were significantly inundated during the February / March 2022 floods and most of the structures are no longer habitable due to the damages caused by the flood waters. As a result, the NSW Department of Education is proposing to demolish most of the existing school buildings and construct a new elevated school building to replace it. The floor level of the new building will be located above the design flood level to increase flood resistance and create useable undercroft spaces.

The works are being undertaken as a Development Application (DA) to Lismore City Council.

The proposed development is to be undertaken in two (2) stages as follows:

- Stage 1: Demolition of the existing buildings and tree removal (separate Early Works DA)
- Stage 2: Construction of a new elevated school building and landscaping and ancillary works and structures (this Main works DA).

The Main Works development comprises:

- Construction of a new elevated school building, with at-grade (undercroft) amenities and storage, including:
    - <u>Ground Level:</u>
        - Open undercroft space for covered outdoor learning and play.
        - Male and female amenities and accessible toilet / change room facility.
        - Cleaners' store.
        - Equipment store.
        - Sport equipment store.
    - <u>Elevated Level:</u>
        - New administration comprising interview room, clerical spaces, Principal's office, staff room, sick bay and male, female and accessible amenities.
        - School library with computer room, store, main communications room and library office.

    - Four (4) General Learning Spaces (GLS) with learning commons and multi-purpose space.
    - Canteen with open servery space.
    - Store.
    - Male, female and accessible amenities.
    - Mechanical plant.
- New and hard soft landscaping including replacement play equipment, vegetable garden, fernery and yarning circle.
- New hydrant pump house with fire tanks.
- Relocation and replacement of existing septic tanks and water tanks.

It is not proposed to increase staff or student numbers as a result of these works.

2.1 RECEIVER LOCATIONS

Sensitive receiver locations as presented in **Figure 1** and detailed below. These locations will be used as a basis for this assessment.

- **R1**: Residential dwelling to the east of the site at 437 Rosehill Road, Blakebrook

An aerial photo of the site, monitoring locations and surrounding receivers is shown in **Figure 1**.

Proposed hours of work are as follows:

Day	Works Period
Monday – Friday	7am – 6pm
Saturday	8am – 1pm
Sunday & Public Holidays	No Work

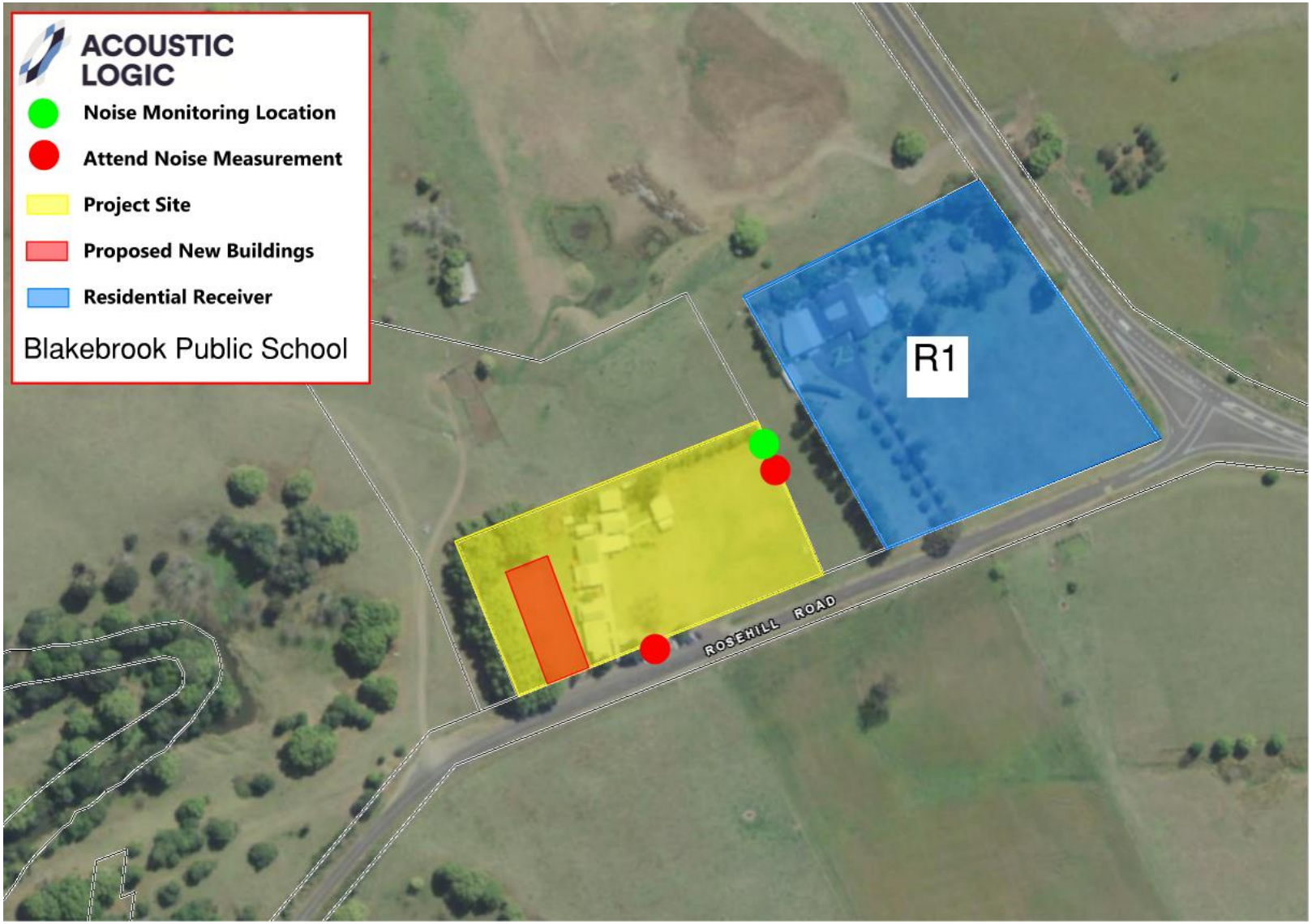


Figure 1 – Site Map (Sourced SIX Maps NSW)

3 NOISE AND VIBRATION MANAGEMENT LEVEL

3.1 ENVIRONMENTAL NOISE SURVEY

3.1.1 Measurement Locations

Unattended noise monitors were placed at the northern boundary of the existing site with line of slight to receiver R1. Refer to **Figure 1** for detailed locations:

3.1.2 Measurement Period

Unattended noise monitoring was conducted from Tuesday 13th of June 2023 to Friday 23rd of June 2023.

3.1.3 Measurement Equipment

Unattended noise monitoring was conducted using Acoustic Research Laboratories Pty Ltd noise loggers. The loggers were set to A-weighted fast response mode and were programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the start and end of the monitoring period using a Rion NC-74 calibrator. No significant drifts were noted.

3.1.4 Measured Rating Background Noise Levels

Measured background noise levels for the project site and immediate surroundings are presented below.

Table 1 – Rating Background Noise Levels

Location	Time of day	Rating Background Noise Level dB(A)L_{90}
Blakebrook Public School	Day (7 am – 6 pm)	35*
	Evening (6 pm – 10 pm)	30*
	Night (10 pm – 7 am)	30*

*Adjustments have been made due to measured noise levels are lower than the recommended minimum noise levels as in NPI.

3.2 EPA INTERIM CONSTRUCTION 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 effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" 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 effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of the recommended noise levels from the ICNG is presented below in Table 2.

Table 2 – Noise Management Levels – Residential

Receivers	**Background Noise Level (Daytime) dB(A) L_{90}**	**"Noise Affected" Level - dB(A)$L_{eq(15min)}$**	**"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$**
Residential Receivers Surrounding Site	35	45	75

If noise levels exceed the management levels identified in the tables above, reasonable and feasible noise management techniques will be reviewed.

3.3 VIBRATION

Vibration caused by construction at any residence or structure outside the subject site must be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*
- For human exposure to vibration, the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

3.3.1 Structure Borne Vibrations (Building Damage Criteria)

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 4.

It is noted that the peak velocity is the 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 3 – 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

Nearby residences would be classified as a type 2 structure.

3.3.2 Assessing Amenity

The NSW EPA document "*Assessing Vibration: A Technical Guideline*" provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings and is used in the assessment of vibration impact on amenity.

Relevant criteria are presented below.

Table 4 – EPA Recommended 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
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0

4 NOISE AND VIBRATION ASSESSMENT AND RECOMMENDATIONS

4.1 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE LEVELS

The most significant sources of noise generated during Stage 2 development will be excavation and civil works. A summary of sound power levels of major construction processes/equipment is detailed in Table 5.

Section 1 outlines the major works to be undertaken. The highest noise levels are likely to be generated during bulk excavation of the sandstone substrate.

With respect to construction noise, the impact on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. The primary construction equipment and sound power levels associated with the works are as follows:

Table 5 – Sound Power Levels of the Proposed Equipment

Construction Stage	Equipment / Process	Sound Power Level – dB(A)*
Excavation	Excavator & Trucks	107
	Powered Hand Tools (Electric)	102
	Materials Handling (Forklifts etc)	85
Construction	Excavator & Trucks	107
	Powered Hand Tools (Electric)	102
	Materials Handling (Forklifts etc)	85

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

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

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

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

4.2 NOISE IMPACT ASSESMENT

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken; and
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

4.2.1 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 the following tables.

To Receiver R1

Table 6 – Predicted Noise Generation to R1 Residential Receivers Northeast of Site

Activity	Predicted Cumulative Level – dB(A) $L_{eq(15min)}$ (External Areas)	Comment
Excavation/ Construction Stage: Excavator & Trucks Materials Handling (Forklifts etc) Powered Hand Tools	<45	Meets noise affected management level at all times.

4.3 DISCUSSION – NOISE

AL note that predicted noise levels presented in the tables above are cumulative noise levels of all the equipment being used. This is conservative and unlikely to occur in real construction sites.

Based on above table, general excavation and construction works are expected to generally be lower than the noise affected management level.

Specific recommendations are detailed in Section 4.5

4.4 DISCUSSION – VIBRATION

Equipment items typically associated with high levels of vibration generated are excavator. Given the distance from the proposed works and the residential properties, the use of above equipment will not produce vibration levels approaching the criteria detailed in Section 3.3.

All other construction items are also not expected to generate vibration exceeding building damage or amenity acoustic criteria.

4.5 RECOMMENDATIONS

In light of the above assessment, and to mitigate any potential noise impacts from the re-development of Blakebrook Public School, we recommend the following management controls be implemented:

- The scheduling of construction activities should be undertaken to reasonably minimise noise impacts to all surrounding residents.

- Community consultation is proposed be undertaken throughout the construction process. In this regard regular letterbox drops detailing site progress and scheduled works is proposed. In particular, these should detail the extent and times of rock hammering which is planned to be undertaken.

- Quiet work methods/technologies:

    - Excavation is conducted initially using excavator with bucket (quietest excavation method), then use of rock rippers (as opposed to hydraulic hammers and rock saws) when rock strength permits. Use of the loudest excavation equipment (hydraulic hammers/rock saws) is used only with other options are not available.

    - Deliver trucks should generally be located away from residential receiver R1.

- Materials handling/vehicles:

    - Trucks and forklifts in general use on site are to use a non-tonal reversing beacon where possible (subject to OH&S requirements) to minimise potential disturbance of surrounding receivers;

    - Avoid careless dropping of construction materials into empty trucks.

    - Trucks, trailers and delivery vehicles are to turn off engines when idling to reduce noise impacts (unless required for concrete pumping or similar).

- Complaints handling:

    - An after hours contact number is displayed outside of the building site, so that in the event that surrounding development believes that a noise breach is occurring, they may contact the site.

    - In the event of complaint, the procedures outlined in Section 5 are adopted.

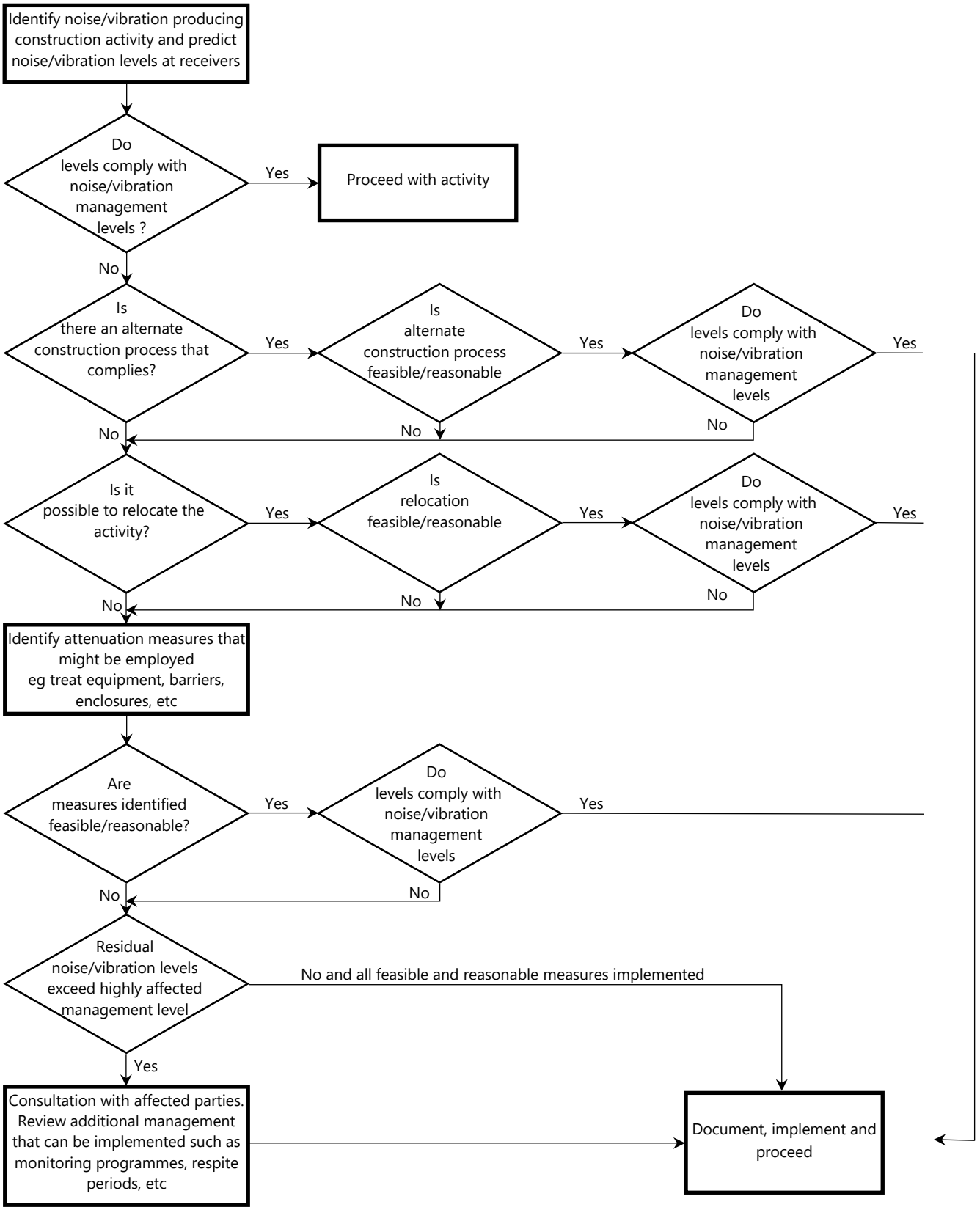
- Site Induction:

    - A copy of the Noise Management Plan is to be available to contractors. The location of the Noise Management Plan should be advised in any site induction.

    - Site induction should also detail the site contact to be notified in the event of noise complaint.

5 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PRECEDURAL STEPS

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



6 ADDITIONAL NOISE AND VIBRATION CONTROL METHODS

In the event of complaints, there are a number of noise mitigation strategies available which can be considered. The determination of appropriate noise control measures will be dependent on the particular activities and construction appliances. This section provides an outline of available methods.

6.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

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

6.2 ACOUSTIC BARRIER

Given the position of adjacent development, it is unlikely that noise screens will provide significant acoustic benefit for commercial or residential receivers, but will provide noticeable improvement for those on ground level.

The placement of barriers at the source is generally only effective for static plant. Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependent on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(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 that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

6.3 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).

6.4 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

6.5 ESTABLISHMENT OF SITE PRACTICES

This involves the formulation of work practices to reduce noise generation. A more detailed management plan will be developed for this project in accordance to the construction methodology outlining work procedures and methods for minimising noise.

6.6 COMBINATION OF METHODS

In some cases it may be necessary that two or more control measures be implemented to minimise noise.

6.7 NOISE MONITORING TECHNIQUES

Where noise monitoring is undertaken (either by attended short term measurements or long term unattended noise monitoring), it should be conducted at a practical location representative of the impact to nearby noise sensitive receivers. Where this is not possible, noise measurements of construction processes should be taken such that noise levels can be accurately predicted to receivers. Any reporting of noise measurement results may include the following information:

- The date and time that the measurements were undertaken;
- The location of measurements, noise receivers and construction processes. A site map should be included for clarity.
- A description of the construction processes being undertaken during the measurement period.
- The measured noise construction noise levels, and the noise level at the façade of nearby receivers (if noise levels are predicted).
- A comparison to the NSW EPA Interim Construction Noise Guideline noise management levels.

7 DEALING WITH COMPLAINTS

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

If a noise complaint is received the complaint should be recorded. Any complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

8 CONCLUSION

An assessment of noise from construction works associated with the Blakebrook Public School Stage 2 DA has been presented within this report.

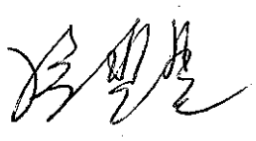
The acoustic assessment of the proposed works has been made with reference to the relevant policies & guidelines for construction noise – namely the *Interim Construction Noise Guideline*.

Based on the assessment, noise emission from excavation and construction activities can generally meet the relevant noise emission levels. Recommendations have been provided to minimise the noise impacts on surrounding receivers.

A Construction Noise and Vibration Plan has been developed that will be used to minimise impacts on the surrounding properties. Provided that the mitigation techniques as recommended in sections 4.5, 5, 6 & 7 of this report are adopted, noise and vibration impacts on the adjacent buildings are expected to be acceptable.

Please contact us should you have any further queries.

Yours faithfully,



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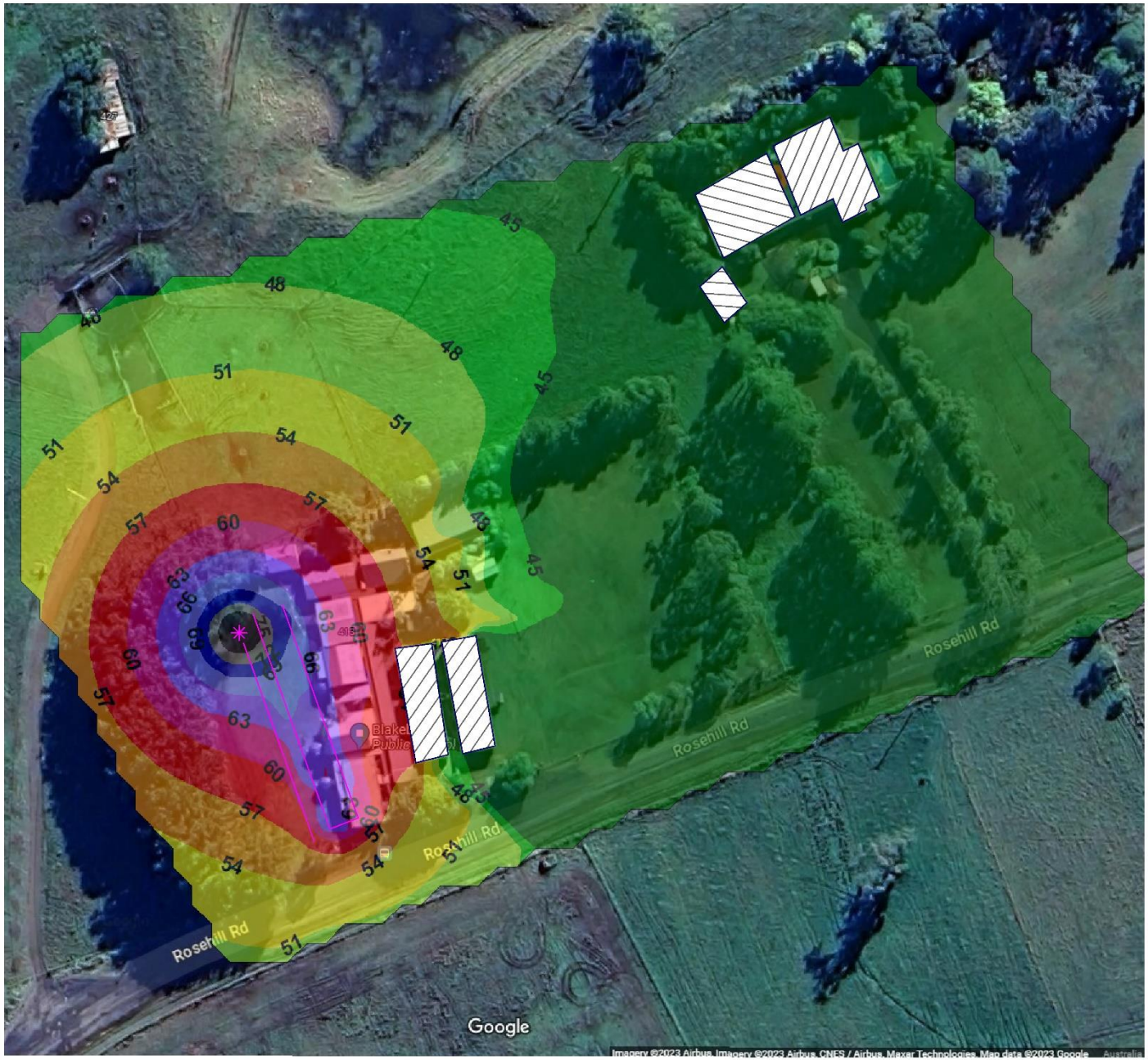
APPENDIX A – SOUNDPLAN MODELLING RESULTS



Blakebrook Public School

Construction Noise Prediction

Excavation & Construction Stage (Scenario 1)

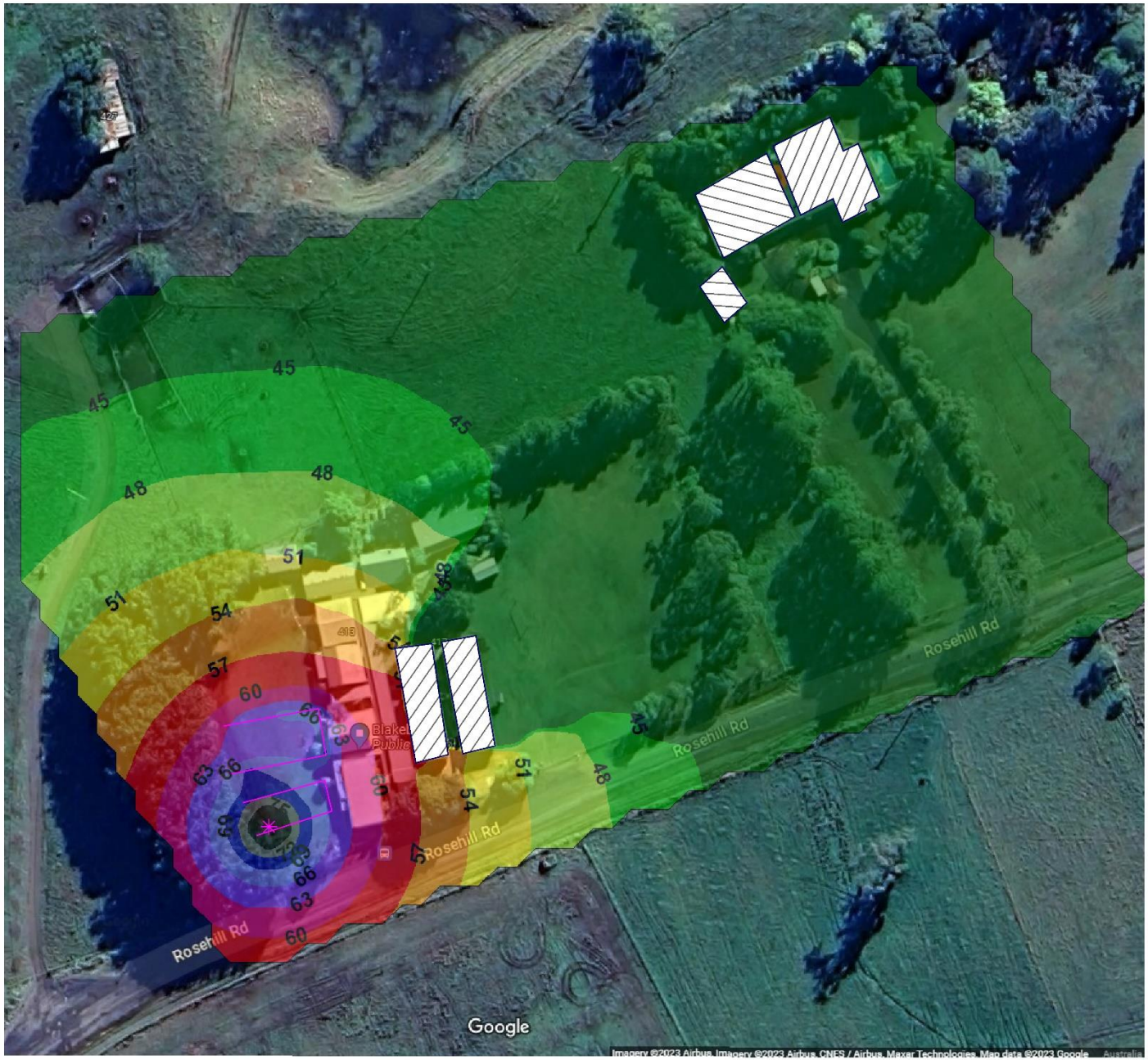
Excavator & Truck
Powered hand tools
Materials handling (Forklifts)

Prepared by: P. Feng
Date: 11/08/2023

Noise Level
L_{eq}
in dB(A)

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

ACOUSTIC LOGIC



Blakebrook Public School

Construction Noise Prediction

Excavation & Construction Stage (Scenario 2)

Excavator & Truck
Powered hand tools
Materials handling (Forklifts)

Prepared by: P. Feng
Date: 11/08/2023

Noise Level
L_{eq}
in dB(A)

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

ACOUSTIC LOGIC