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North Kellyville New Primary School

Construction Noise and Vibration Management Plan

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged to prepare a Noise and Vibration Management Plan for Main Works at the North Kellyville New Primary School at Kellyville to satisfy conditions of consent B23-25.

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 site is located on Hezlett Road, Kellyville.

The proposed development consists of:

- Construction of a two storey school building at the eastern end of the site.
- Sports fields (soccer and two netball courts) centrally and at the western end of the site.

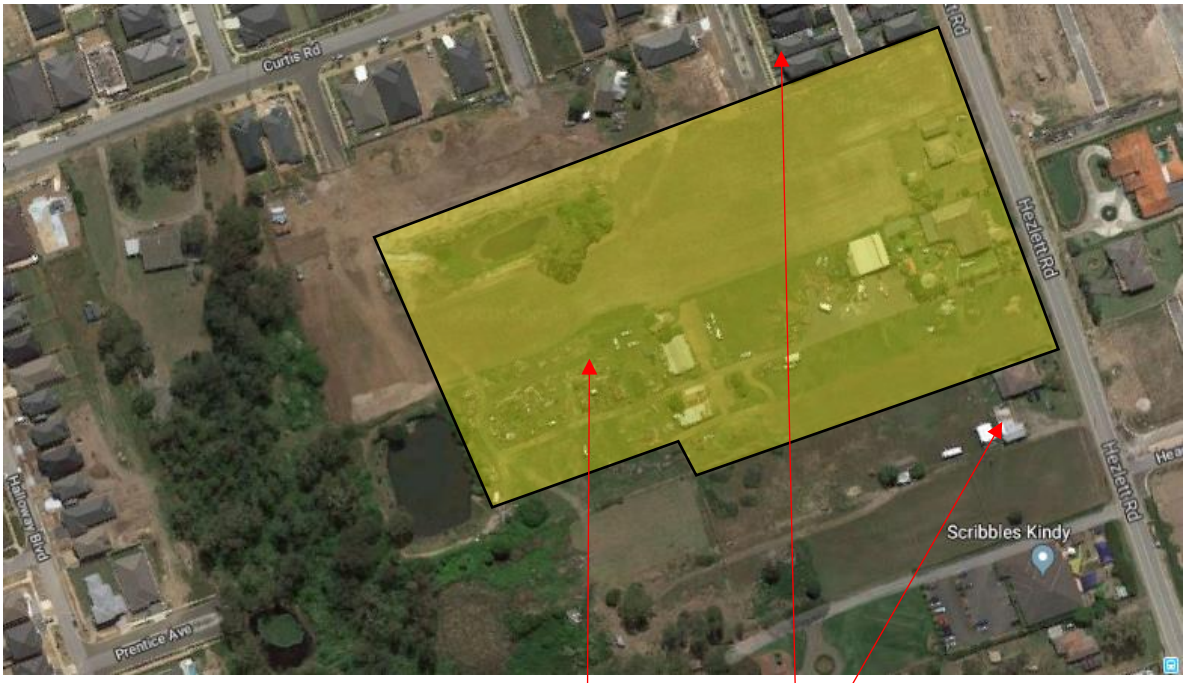
Primary noise producing activities associated with the works will be:

- Civil works associated with the sports fields and school building.
- Use of mobile cranes as required.
- Erection of building structure (powered hand tools for formwork, concrete pump, vibrators).
- Façade Installation (powered hand tools).
- Internal works (powered hand tools).
- Landscaping (front end loaders etc).

The site is adjoined to the north, west and south by residential development (the residences to the north and south being the closest).

The site is adjoined to the east by Hezlett Road (with residential development further to the east on the opposite side of Hezlett Road).

See aerial photo, below.



Site

Nearest noise sensitive development

3 BACKGROUND NOISE MEASUREMENT

Attended were undertaken at the site (Hezlett Road boundary) to determine the daytime background level at the site. Measurements were made using a Norsonic 140 Type 1 sound meter, with the results presented below:

Table 1 – Measured Background Noise Levels

LOCATION	PERIOD/TIME	BACKGROUND NOISE LEVEL dB(A) L_{90}
Hezlett Road	Day (7am to 6pm)	45

4 CONSENT CONDITIONS

4.1 CONDITION B23, 24 AND 25

Construction Noise and Vibration Management Plan

B23.

a. Prior to the commencement of building works on the Subject Site, a **Construction Noise and Vibration Management Plan** (CNVMP) must be prepared for the development and must address, but not be limited to, the following matters where relevant:

i) be prepared by a suitably qualified expert;

ii) be prepared in consultation with Council and all noise sensitive receivers where noise levels exceed the construction noise management level, in accordance with EPA guidelines;

iii) describe the measures that would be implemented to ensure:

a. best management practice is being employed;

b. compliance with the relevant conditions of this consent;

iv) describe the proposed noise and vibration management measures in detail;

v) include strategies that have been developed to address impacts to noise sensitive receivers where noise levels exceed the construction noise management level, for managing high noise generating works;

vi) describe the consultation undertaken to develop the strategies in v) above;

vii) evaluates and reports on the effectiveness of the noise and vibration management measures; and

viii) include a complaints management system that would be implemented for the duration of the project.

B24. The Applicant must submit a copy of the **CNVMP** to the Department and Council, prior to commencement of work.

B25. The **CNVMP** (as revised from time to time) must be implemented by the Applicant for the duration of the construction works.

Condition B23 requires preparation of a Construction Noise and Vibration Management Plan (CNVMP) in accordance with EPA guidelines. The applicable guidelines are:

- The NSW EPA Interim Construction Noise Guideline (ICNG),
- DIN 4150-3 (with respect to building damage from construction vibration).
- The NSW EPA document Assessing Vibration: A Technical Guideline 2006.

5 NOISE AND VIBRATION CRITERIA

5.1 EPA INTERIM CONSTRUCTION NOISE GUIDELINE

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

- Determination of noise generation goals (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 goals 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 is presented below.

Table 2 – Noise Management Levels

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Development	45	55

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

5.2 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 the EPA document Assessing Vibration, A Technical Guideline.

5.2.1 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

The surrounding residential buildings would be considered a Type 2 structure.

5.2.2 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

6 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation, civil works (compaction, asphalting) and piling.

We note that demolition work and majority of earthworks were completed as part of an early works package and is not part of this assessment.

Table 5 - Sound Power Levels of the Proposed Equipment

EQUIPMENT /PROCESS	SOUND POWER LEVEL dB(A)*
Excavator (in soil)	105
Asphalting	110
Compactor (Vibratory)	110
Compactor (Roller)	105
Bobcat	100
Crane (mobile)	100
Concrete Pump	110
Powered Hand Tools	95-100

*As required by the nominated Sound Power Levels take into account modifying factors as applicable under the NSW Industrial Noise Policy.

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).

7 NOISE AND VIBRATION ASSESSMENT AND RECOMMENDATIONS

7.1 NOISE IMPACT ASSESMENT

Predictions of construction noise impacts on nearby development are shown below.

Given the size of the site, the noise generated by any given activity will vary significantly depending on where on the site the activity is undertaken. For this reason, a noise range is presented (being the noise level when working at the property boundary closest to the residence, and when working at the far boundary of the site).

Table 6 – Predicted Noise Generation to Nearest Residences (North and South of Site)

Activity	Predicted Level – dB(A)$L_{eq(15min)}$ (Internal Areas)	Comment
Excavator (Detailed excavation of building services/footings)	55-75dB(A)	Intermittent exceedance of 55dB(A) goal (table 2).
Compactor - Vibratory	60-80dB(A)	Exceeds 55dB(A) goal (table 2).
Compactor - Roller	55-75dB(A)	Intermittent exceedance of 55dB(A) goal (table 2).).
Asphalting	60-80dB(A)	Exceeds 55dB(A) goal (table 2).
Bobcat	45-70dB(A)	Intermittent exceedance of 55dB(A) goal (table 2).
Crane	65dB(A)	Exceeds 55dB(A) goal (table 2).
Pump	65dB(A)	Exceeds 55dB(A) goal (table 2).
Hand tools - externally	50-65dB(A)	Intermittent exceedance of 55dB(A) goal (table 2).
Hand tools - internally	35-50dB(A)	Compliant with 55dB(A) goal (table 2).

Noise impacts on the residences to the east and west of the site are significantly lower, given the additional distance. The noise mitigation treatments to address impacts on the residences to the north and south will also be suitable to mitigate the impacts on the residences to the east and west of the site.

7.2 DISCUSSION – NOISE

Given the low ambient noise levels and the close proximity of the neighbours to the north and t in particular, exceedances the “Background+10dB(A)” Noise Management Level are inevitable when working close to property boundaries.

Use of vibratory rollers and asphalting equipment also have a risk of intermittently exceeding that 75dB(A) "Highly Noise Effected" noise level when working close to the northern and southern property boundaries.

Noise mitigation measures are detailed in section 7.4.

7.3 DISCUSSION - VIBRATION

Typically, excavation and compaction are the activities with the greatest potential for generation of vibration.

The primary potential vibration source will be from use of vibratory compactors or if localised excavation in rock is required. Excavation in soil is not likely to produce significant levels of vibration.

In the event that extensive use of thee equipment items is required, there is a potential exceedance of the EPA Amenity/Human comfort criteria, however it is unlikely that the DIN4150-3 building damage threshold levels will be reached.

In the event that extensive use of percussive excavation equipment and vibratory compaction are required, some degree of vibration monitoring should be considered (see section 7.4).

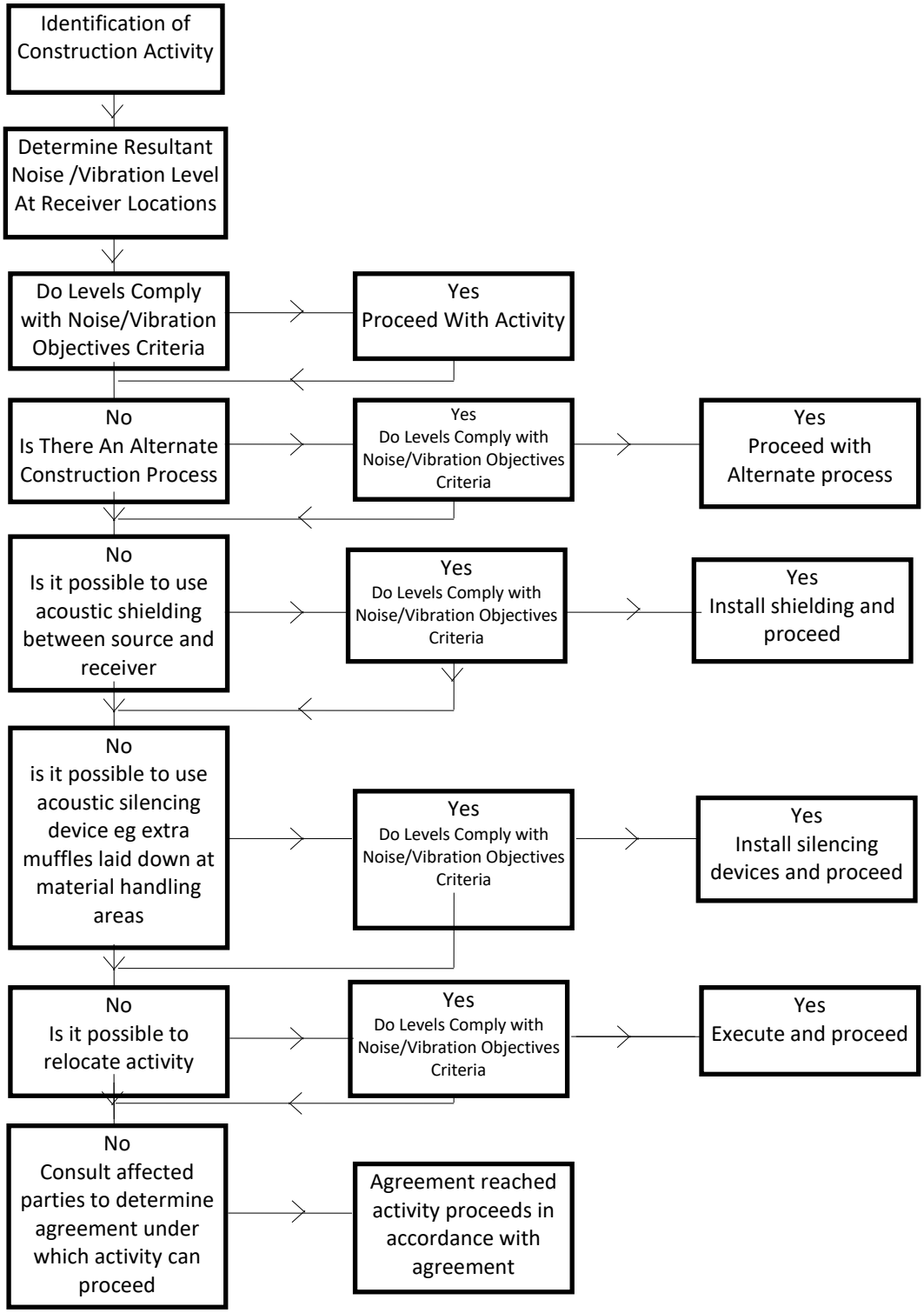
7.4 RECOMMENDATIONS

In light of the above, we recommend:

- Community consultation/notification - Notification (leaflet or similar) of all residential development sharing a boundary with the site is recommended prior to commencement of demolition and civil works.
- Concrete pump truck – ideally, this is located as far as practically possible from property boundaries. Recommend that adjoining development be notified prior to days of concrete pours if it is anticipated that concrete finishing works may extend past 6pm.
- Use of percussive demolition/excavation equipment, vibratory rollers and asphalting equipment within 20m of residential development is no recommended prior to 7.30am.
- Materials handling/vehicles:
    - Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
    - Avoid careless dropping of construction materials into empty trucks.
    - Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).
- Complaints handling - In the event of complaint, the procedures outlined in Section 8 and 10 should be adopted.
- As envisaged by condition B25, in the event of excessive complaint from neighbours, further development of noise management treatments may be required. These will be determined on an as required basis.

8 CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS

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



9 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.

9.1 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.

9.2 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.

9.3 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).

9.4 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.

9.5 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.

9.6 COMBINATION OF METHODS

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

10 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria 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.

11 CONCLUSION

A noise and vibration assessment has been undertaken of the proposed construction works to be undertaken at the North Kellyville New Primary School development.

Potential noise and vibration impacts on nearby development have been assessed.

Provided that the mitigation techniques and the vibration monitoring as recommended in sections 7.4, 8, 9 and 10 of this report are adopted, noise and vibration impacts on the adjacent buildings are expected to be acceptable.

This report has been prepared in order to address conditions of consent B23-25.

Yours faithfully,

Thomas Taylor
Acoustic Logic Consultancy Pty Ltd