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**Harbord Diggers Redevelopment, 80 Evans Street
Freshwater NSW 2096**

Extended Working Hours Acoustic Report

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1 EXECUTIVE SUMMARY

A noise and vibration management plan has been developed that will be used to manage impacts from construction activities associated with the Harbord Diggers Redevelopment, 80 Evans Street Freshwater NSW 2096 development during the proposed extended working hours to comply with the broad objectives of the Australian Standard 2436-2010" Guide to Noise Control on Construction, Maintenance and Demolition Sites".

The principal objective is to undertake detailed evaluation of all work to be performed during the construction period and to forecast the potential impact. The noise forecasts will be used to formulate and streamline effective regulation and mitigation measures during the proposed extended hours of work.

The principal issues that will be addressed in this document are:

1. Identification of the specific activities that will be conducted and the associated noise sources,
2. Identification of all potentially noise sensitive receivers, including residence, churches, commercial premises, schools and properties containing noise sensitive equipment.
3. The proposed hours of work,
4. The construction noise objectives,
5. The construction vibration criteria during the proposed period,
6. Determination of appropriate noise and vibration objectives for each identified sensitive receivers,
7. Noise and vibration monitoring, reporting and response procedures,
8. Assessment of potential noise and vibration from the proposed construction activities,
9. Procedure for notifying residence of construction activities that are likely to affect their amenity through noise and vibration.
10. Contingency plans to be implemented in the event of non-compliances and/or noise complaints.
11. Compliance with Australian Standard 2436-2010" Guide to Noise Control on Construction, Maintenance and Demolition Sites" and NSW EPA "*Interim Construction Noise Guideline*".

2 INTRODUCTION

This document presents the construction noise and vibration plan that will be used to manage noise and vibration from the construction of residential development at Harbord Diggers Redevelopment, 80 Evans Street Freshwater NSW 2096 during the proposed extended hours working period. The objectives of this management plan are the minimisation of noise and vibration emissions from construction works and to assist in maintaining a satisfactory environment around the site during the proposed extended hour's period.

In recognition of the requirement to minimise noise emissions from the site to surrounding residential premises this study has been commissioned. The principal objective of this study is to undertake advance evaluation of all work to be performed during the proposed extended hours of work for the construction phase of the project and forecast the potential impact of noise. The noise forecasts will be used to formulate and streamline effective regulation and mitigation measures. As a part of this process on going testing may be used to evaluate the noise regulation strategies and ensure that they are effective.

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

- Identification of the noise and vibration standards which will be applicable to this project.
- Formulation of a strategy for construction to comply with the standards identified in the above point.
- Development of a monitoring programme to measure and regulate noise and vibration at all potentially affected locations.
- Establishment of direct communication networks between affected groups including surrounding receivers, site contacts and Acoustic Logic Consultancy.

The currently approved working hours include the following, based on the projects DA Conditions of Consent:

6. General Requirements

- a) Unless authorised by Council:
Building construction and delivery of material hours are restricted to:
 - a. 7.00 am to 5.00 pm inclusive Monday to Friday,
 - b. 8.00 am to 1.00 pm inclusive on Saturday,
 - c. No work on Sundays and Public Holidays.
- b) Demolition and excavation works are restricted to:
 - a. 8.00 am to 5.00 pm Monday to Friday only.

It is proposed to extend these hours to include:

- Monday – Friday Extend Working Time from 5.00pm to 8.00pm For internal finishing works once facade is installed
- Saturday Extend working hours from 1.00pm to 4.00pm internal finishing once façade works complete.

It is noted that there is no change to the currently approved hours for excavation activities being conducted on the site

3 SITE DESCRIPTION




The site is located within the Harbord Diggers site within the block bound by Carrington Parade, Evans Street and Lumsdaine Drive. Receivers in the vicinity of the site including the residential receivers to the north and west of the site as detailed in the figure below.



Figure 1 - Aerial Picture Showing Site and Receivers

Please see the legend on the following page for colour markings and descriptions.

Table 1 – Legend for site plan

Location	Marking
Subject Site	
Approximate Location of Nearest affected Residential Receivers	
Attended Noise Measurements	

4 PROJECT DESCRIPTION

It is proposed to extend these hours to include:

- Monday – Friday Extend Working Time from 5.00pm to 8.00pm For internal finishing works once facade is installed
- Saturday Extend working hours from 1.00pm to 4.00pm internal finishing once façade works complete.

It is noted that there is no change to the currently approved hours for excavation activities being conducted on the site

4.1 PROPOSED WORKS

The proposed works on the site includes the construction of the proposed mixed use residential and club development on the site including the associated construction period only for the proposed extended hours.

The proposed internal fitout works will be within the sealed building facade only. Detailed internal works are as per below:

- Installation of plasterboard ceilings
- Painting
- Tiling and Joining
- Laying carpet
- Installation of internal services
- No deliveries are permitted after 5pm week days

5 SOUND POWER LEVELS

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

- Many of the noise sources are present over a small period of the day or may be present for a few days with a significant intervening period before the activity occurs again.
- The distance between the noise source and the receiver.

The A-weighted sound power levels for all the component parts of the above-described activities are outlined in the table below.

Table 2 - Sound Power Levels of the Proposed Equipment

CONSTRUCTION ACTIVITY	EQUIPMENT /PROCESS	SOUND POWER LEVEL - dB(A)
Construction	Angle Grinders	105
	Electric Saw	102
	Drilling	95
	Hammering	110
	Concrete Vibrator	100
	Cement Mixing Truck	105
	Concrete Pumps	105

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

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

6 ASSESSMENT CRITERIA

The assessment of noise and vibration impact associated with the proposed internal works within the Harbord Diggers Redevelopment, 80 Evans Street Freshwater NSW 2096 development during the proposed extended hour's period will be conducted in compliance with the requirements of the EPA's Interim Construction Noise Guideline and the Australian Standard AS2436- Guide to Noise Control on Construction Maintenance and Demolition Site.

6.1.1 EPA –Construction Noise Guideline

The Interim Construction Noise Guideline outlines that the transmission of noise generated by various construction/demolition activities will primarily occur via two paths:

- Airborne Noise
- Ground-borne Noise

6.1.1.1 Airborne Noise Transmission Criteria for Residential Receivers

Table 2 of the Interim Construction Noise Guideline outlines the management levels for noise at residences depending on the hours of construction. The management levels are outlined in the table below.

Table 3 – Noise Management Levels for Residential Receivers

Time of Day	Management Level dB(A)$L_{eq}(15mins)$
Recommended standard hours: Monday to Friday(7am – 6pm); Saturdays (8am – 1am) and no works on Sunday or public holidays	Noise affected RBL* + 10dB
Outside recommended standard hours	Noise affected RBL* + 5dB

6.3 ADDITIONAL ATTENDED NOISE LEVEL MEASUREMENTS

In addition to the noise monitoring previously undertaken at the site Acoustic Logic Consultancy has undertaken attended background noise level measurement at the site during the evening and night time periods of 6am to 7am on Tuesday 17th November 2015 to assess existing background noise levels.

Attended background noise level measurements were undertaken using a Norsonics type SA110 Sound Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was noted.

6.4 EXISTING BACKGROUND NOISE LEVELS

The results of the background noise levels are presented in the below.

Table 5 – Measured Background Noise levels

Location	Background Noise Level db(A) L ₉₀ (15min)
Carrington Parade	46
Evans Street	43

6.4.1 Construction Noise Criteria

The resulting noise levels criteria for construction noise during the proposed extended hours period is detailed in the table below based on the logging background noise level of 53 dB(A) L₉₀.

Table 6 – Resulting Extended Hours Period Noise Criteria

Location	Time Period	Background Noise Level db(A) L ₉₀ (15min)
Worst affected residential receiver Carrington Parade	Monday to Friday 6am to 7am	51
	Monday to Friday 5pm to 6pm	56
	Monday to Friday 6pm to 8pm	51
	Saturday 1pm to 4pm	56
Worst affected residential receiver on Evans Street	Monday to Friday 6am to 7am	48
	Monday to Friday 5pm to 6pm	53
	Monday to Friday 6pm to 8pm	48
	Saturday 1pm to 4pm	48

6.5 AUSTRALIAN STANDARD 2436-2010 “GUIDE TO NOISE CONTROL ON CONSTRUCTION MAINTENANCE AND DEMOLITION SITE”

Where compliance with EPA requirements cannot be achieved, noise emissions must be managed in accordance with the principles outlined in AS 2436:

- A reasonable suitable noise criterion is established;
- All practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

6.5.1 Summary of Applicable Guidelines

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

- For residential receivers surrounding the subject site, a noise level of 10 dB(A) above background level at these receiver is allowed during recommended standard hours.
- For residential receivers surrounding the subject site, a noise level of 5 dB(A) above background level at these receiver is allowed during the proposed working hours outside of normal working hours.
- If noise levels exceed the project specific noise goal at sensitive receiver locations, investigate and implement all practical and cost effective techniques to limit noise emissions.
- If the noise goals are still exceeded after applying all practical engineering controls to limit noise emissions investigate management controls and other techniques to mitigate noise emissions.

6.6 VIBRATION CRITERIA

It is proposed to adopt the following vibration guidelines:

- German Standard DIN 4150-3 (1999-02): “*Structural Vibration – Effects of Vibration on Structures*” – which will be used to assess and limit building damage risk.
- EPA Interim Construction Noise Guideline – which contains guidelines to assess and limit impacts on building occupant’s amenity based on the “Assessing Vibration: A Technical Guide”.

The criteria and the application of this standard are discussed below.

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 1.

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 7 – 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

Based on the surrounding receiver types and building constructions the proposed vibration criteria ensuring no structural or architectural damage is 10mm/s.

6.7 ASSESSING AMENITY

On occupied levels of the building, for the type of vibration producing activities proposed, vibration induced within the adjacent buildings is likely to impact amenity well before the damage limits are reached.

The EPA Interim Construction Noise Guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings. The recommendations of this guideline should be adopted to assess and manage vibration from proposed activities.

6.8 VIBRATION DISCUSSION

Based on the proximity of the propose works to the surrounding residential receivers there is no expected vibration impact on any surrounding receivers.

7 CONSTRUCTION NOISE ASSESSMENT

Construction noise emissions associated with internal activities have been predicted based on the proposed extended hours period, which will be conducted once the building external façade is installed and can be closed.

7.1 NOISE PREDICTION

Prediction was conducted to investigate the potential for noise impact from the proposed construction works during the extended hours' period to the surrounding receivers.

The predictions are based on the following assumptions:

- The prediction is based on the worst case scenario that the loudest typical activity was being conducted within the area nearest to the receiver. This assumes that one angle grinder or power tools being used within the building which is closest to the potentially worst affected receiver to the northern side of the site.
- The sound power levels detailed in Table 1 have been used to calculate internal sound pressure levels impacting on the façade based on:
 - The size and room characteristic.
 - The calculated sound pressure level was assumed to occur consistently across the entire façade of the work area.

The predicted noise levels at the nearby receivers are presented below. The predicted levels are based on the assumption that the loudest typical piece of equipment (angle grinder/small jackhammer) is in use (and hence represents a worst case scenario prediction).

Table 8 – Predicted Construction Noise Levels

Activity	Receiver Location	Predicted Noise Level dB(A) L_{av max} 15min	Construction Noise Criteria dB(A) L_{av max} 15min	Complies	Acoustic Treatments / Comments
Construction Activities	Potentially worst affected residential receiver Carrington Parade	<46	51	Yes	See Comments in Section 7.2
Construction Activities	Potentially worst affected residential receiver Evans Street	<46	48	Yes	See Comments in Section 7.2

7.2 SITE REQUIRED MANAGEMENT CONTROLS

The required site required management controls to mitigate noise during the proposed extended hours construction periods include the following;

1. All proposed construction activities during the extended hours period can only be conducted once the building façade is installed and closed.
2. No external construction works to be conducted during the proposed extended hours periods.
3. No deliveries or material removal is to be undertaken during the proposed extended hours period.
4. No external materials movement is to be undertaken during the proposed extended hours period.
5. In addition to the above site required management controls:
 - No hoist operation is allowed during the proposed extended hours.
 - Electrical hand tools such as electrical saw, electrical drill can only be used within rooms with closed facades with all internal doors close
 - Windows and doors on facades of the project building shall be fully closed during the proposed extended hours. The site foreman will check and ensure that all windows and sliding doors are closed 30 minutes before the commencement of the proposed out of hours work. The closed doors and windows shall be constantly checked during the proposed after hours period.
 - No deliveries are permitted after 5pm week days
 - Jackhammers and other noise generating machinery shall be prohibited from being used after 5pm
 - All site supervisors and workers involved in the proposed out of hours works will be specifically site inducted on noise controls through daily pre-starts and Tool Box meetings.

7.3 NOISE AND VIBRATION CONTROL METHODS

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.

7.4 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

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

7.5 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 achieved. 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.

7.6 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).

7.7 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.

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

7.8 ESTABLISHMENT OF SITE PRACTICES

This involves the formulation of work practices to reduce noise generation. A noise plan will be developed for this project outlining work procedures and methods for minimising noise.

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. Where practical, loading of these vehicles should occur as far as possible from any sensitive receiver.

7.9 REGULAR NOISE CHECKS OF EQUIPMENT

To determine the requirement for silencing devices on machinery it is proposed to undertake fortnightly noise check. Noise levels of all machines on site will be measured and if they are found to be higher than nominated for that equipment type, items such as mufflers and engine shrouds will be examined to ensure they are in good working order.

7.10 NOISE MONITORING

Noise monitoring can be undertaken to determine the effectiveness of measures which are been implemented. The results of monitoring can be used to devise further control measures in the event noise complaints can not be managed in other ways.

7.11 TIME MANAGEMENT

All construction activities will be conducted with the working hours as detailed within this report.

7.12 COMBINATION OF METHODS

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

7.13 DISCUSSION

Based on the detailed noise assessment conducted the mitigation methodologies are not required to be implemented and are detailed in this report as options in the event that future treatments are deemed as required once works commence.

8 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

This section details steps which are to be taken to establish communication with the affected receivers and procedures to follow in the event of a complaint.

8.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continual communication is required between all parties which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation processes is to:

- Inform and educate the groups about the project and the noise controls being implemented.
- Increase understanding of all acoustic issues related to the project and options available.
- Identify group concerns generated by the project, so that they can be addressed.
- Ensure that concerned individuals or groups are aware of and have access to the Complaints Register which will be used to address any construction noise related problems should they arise.

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

An additional step in this process is to produce a newsletter informing the groups of the progress of the works and the upcoming construction activities.

8.2 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 exceedences and identify the required changes to work practices. In the case of an exceedence of the vibration limits all work potentially producing vibration shall cease until the exceedence 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 exceedences are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form which is to be maintained and managed by Hutchinson Builders. 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.
- 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 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 at 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.

The results of any corrective actions arising from a complaint shall be validated by measurement or other method where applicable.

9 STAFF TRAINING

Responsibilities and reporting requirements of all members of management and staff responsible for the implementation of each element of the plan shall be defined.

Training to introduce the Noise Management Plan and explain details of noise sources, noise level targets, personnel roles and responsibilities, communication and complaint handling procedures shall be undertaken for all relevant employees upon commencement.

10 NOISE AND VIBRATION MONITORING, REPORTING AND RESPONSE PROCEDURES

Noise and vibration monitoring may either consist of manned and/or unmanned measurements.

Monitoring can be conducted by Acoustic Logic if necessary during the excavation and construction phase of the project. In the event complaints are received and a noise investigation is required from neighbours the following process will be followed:

1. Determine the validity of the complaint
2. Determining the offending plant/equipment/process
3. Locating the plant/equipment/process further away from the affected receiver(s) if possible.
4. Implementing additional acoustic treatment in the form of localised barriers, silencers etc
5. Selecting alternative equipment/processes

In the event that monitoring indicates exceedences of the noise/vibration limits immediate action in accordance with chart 1 should be taken to identify any further controls as required to reduce noise emissions so that the noise limits are complied with.

10.1 REPORTING REQUIREMENTS

The following shall be kept on site by the contractor.

1. A register of complaints received/communication with the local community shall be maintained and kept on site with information as detailed in section 9.2.
2. Where noise/vibration complaints require noise/vibration monitoring, results from monitoring shall be retained on site at all times.
3. Any noise exceedences occurring including, the actions taken and results of follow up monitoring with the outcomes recorded.

11 DISCUSSION

As a result of the proposed extended hour's period and the works which will be able to be conducted during these times, the required overall period for the construction phase will be reduced. The result of this reduce construction period will hence reduce the impact on the surrounding receivers and minimise any potential impacts resulting from construction activities.

12 CONCLUSION

An assessment noise and vibration impact during the proposed extended hour's period has been undertaken for the Harbord Diggers Redevelopment, 80 Evans Street Freshwater NSW 2096 development.

Based on the assessment noise emissions from the worst case operation of the construction works will comply with the EPA's Interim Construction Noise Guideline during the proposed extended hours period including

- Monday – Friday Extend Working Time from 5.00pm to 8.00pm For internal finishing works once facade is installed
- Saturday Extend working hours from 1.00pm to 4.00pm internal finishing once façade works complete.

Providing the detailed site management controls included in this report are included in the operation of the site compliance with the relevant EPA construction noise requirements for extended hours periods will be achieved and the proposed extended hours are acoustically acceptable.

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