Raymond Terrace Parklands

Proposed Preliminary Work for Future Residential Development

251 Adelaide Street, Raymond Terrace

Construction Noise & Vibration Management Plan

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1 Introduction

The following report has been prepared by Acouras Consultancy on behalf of Raymond Terrace Parklands to assess the potential for construction noise and vibration impact associated with proposed preliminary work for future residential development located at 251 Adelaide Street, Raymond Terrace.

The vacant site is surrounded by existing residential buildings to the north and west. To the south is a vacant mine that is to be redeveloped. The site location is shown in Figure 1.

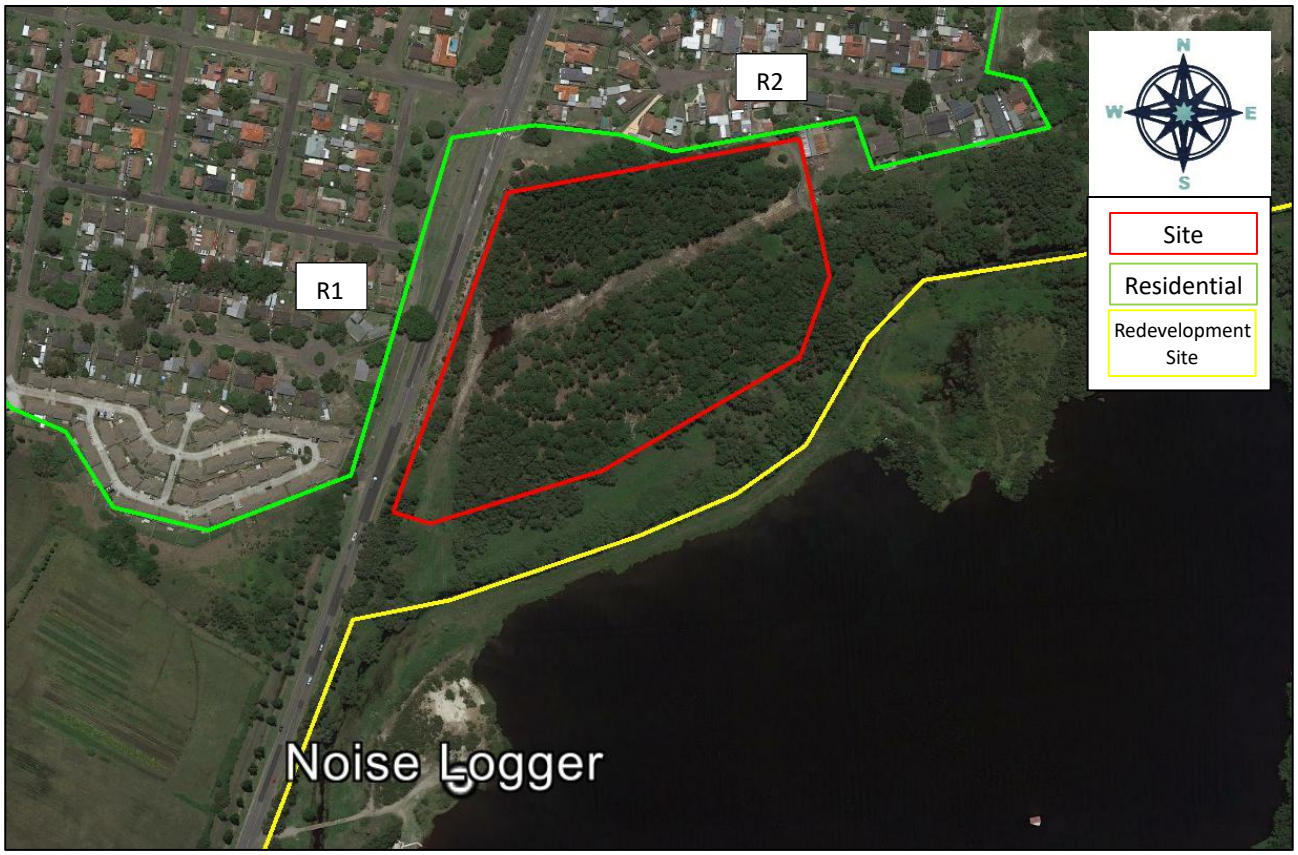


Figure 1 – Site Location, Nearest Residents and Noise Logger Position

The nearest residents are located at (refer to Figure 1):

- R1 – Residents located to the west on the opposite side of Adelaide Street. The receivers are more than 60m from the western site boundary.
- R2 – Residential properties to the north along Meredith Crescent, along the northern site boundary.

2 Noise Criteria

The following standards and guidelines are applicable to this project:

- Planning Secretary's Environmental Assessment Requirements (SEAR) 1571 (ref: EF21/6032, dated 11th May 2021)
- NSW EPA "Interim Construction Noise Guideline" (ICNG).
- DEC/EPA "Assessing vibration: a technical guideline".
- Australian Standard 2436:2010: "Guide to noise and vibration control on construction, demolition and maintenance sites".
- Australian standard AS 1055.1-1997: Acoustics – Description and measurement of environmental noise - General procedures.

2.1 Construction Noise Criteria

The NSW EPA "Interim Construction Noise Guideline" (ICNG) provides guidance on noise limits from construction sites. Table 1 is an extract from the EPA guideline.

When assessing short-term construction works, best management practices should be implemented to reduce any impact as far as practically possible.

Table 1 – Noise at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq\ (15min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ 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 75 dB(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: 1. 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 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

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

2.2 Noise Survey

An unattended noise survey was carried out at the site to measure the background and ambient noise levels. Nose monitoring was conducted between Tuesday 7th to Tuesday 14th August 2018. The monitor was positioned as shown in Figure 1. Measurements were conducted using the following equipment:

- SVAN 977 Type 1 Real time Analyser/Noise Logger. Serial No. 34135.
- SVAN SV30A Type 1 Sound Level Calibrator. Serial No. 31830.

Noise monitoring was conducted in general accordance with Australian standard AS 1055.1-1997: Acoustics-Description and measurement of environmental noise-General procedures. The noise analyser was calibrated immediately before and after measurements were taken with no discernible differences between these two recorded levels. The sound analyser is Type 1 and complies with Australian standard AS1259.2: 1990.

During the monitoring period any adverse weather condition have been excluded. The noise logger results are presented in Appendix C.

2.3 Construction Noise Limits

Table 2presents a summary of the measured background noise level and the noise management level for this project in accordance with EPA's ICNG.

Table 2 — EPA Construction Noise Management Level, dBA

Receiver	Time Period	Existing Noise Levels		Management Level
		$L_{eq\ (period)}$	RBL	$L_{Aeq\ (15min)}$*
Residential	Mon-Fri: 07.00-18.00	50	45	55 (Highly noise affected 75 dBA)
	Sat: 08.00-13.00	47	44	54
Neighbouring industrial premises	When in use	n/a	n/a	75
Offices, retail outlets.	When in use	n/a	n/a	70

During the monitoring period any adverse weather condition have been excluded.

2.4 Construction Vibration Criteria

The DEC/EPA's guideline "Assessing vibration: a technical guideline" is based on the "BS 6472–1992: Evaluation of human exposure to vibration in buildings (1–80 Hz)" which presents preferred and maximum vibration values for use in assessing human responses to vibration. Vibration and its associated effects are usually classified as follows:

- **Continuous** vibration continues uninterrupted for a defined period (usually throughout daytime and/or night-time).
- **Impulsive** vibration is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds.
- **Intermittent** vibration can be defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous vibration that varies significantly in magnitude.

Higher levels of vibration are generated during excavation and piling operations, which are intermittent and are assessed using the Vibration Dose Value (VDV). The VDV criteria for a range of receiver types are stated in Table 3.

Table 3—Acceptable Vibration Dose Values for Intermittent Vibration (m/s $^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas	0.10	0.20	0.10	0.20
Residence	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

[1] Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.

Guidance for acceptable vibration at the foundation of buildings to limit cosmetic damage or nearby buildings is given in the British Standard "BS 7385 (1993): Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration". It is recommended that vibration from construction activities should be limited to the values given in Table 4 below.

Table 4—BS 7385 Construction vibration criteria for buildings, PPV mm/s

Construction	Limits for Transient Vibration	
	4 – 15 Hz	>15 Hz
Heavy or reinforced	50 mm/s	
Light (e.g. normal dwellings)	15 mm/s at 4 Hz rising to 20 mm/s at 15 Hz	20 mm/s at 15 Hz rising to 50 mm/s for 40 Hz and above

Typically, it would be expected that no cosmetic damage would occur provided intermittent vibration levels do not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above.

3 Construction Noise Assessment

This is an assessment for the proposed preliminary work for future residential development of the vacant site located at 251 Adelaide Street Raymond Terrace. The construction work on the site would include:

Activity 1: Earthworks to fill/raise existing site:

- Bulldozer and excavator (30 Ton) with bucket.
- Tippers and dogs entering the site and existing the site for backfilling.

Activity 2: Compacting of driveways with some minor earthworks:

- Profile Compactor.
- Track Loader.

Activity 3: Site levelling:

- Track Type Tactor, such as Caterpillar D9.
- 30 T Excavator.

Table B-1 in Appendix B presents typical sound pressure levels at various distances from construction equipment noise sources.

3.1 Construction Noise

The predicted noise levels (based on ISO9613) in Table 5 to Table 7 are a "worst case" scenario and do not allow for acoustic mitigation measure (such mufflers/shrouds), barriers (buildings, hoarding, etc) or operating time correction.

Also, each equipment would be dependent on the phase of the earthworks, compacting and site levelling, and not all equipment is expected operate simultaneously.

Table 5 – Activity 1: Typical Noise Level of Construction Equipment (no mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Excavator (30T)	1	85	**79**	**73**	**67**	**61**
Bulldozer	1	86	**80**	**74**	**68**	**62**

[2] Table A1 in Australian Standard 2436:2010 and Department for Environment, Food and Rural Affairs (DEFRA UK).

Table 6 – Activity 2: Typical Noise Level of Construction Equipment (no mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Loader (wheeled)	1	83	**77**	**71**	**65**	**59**
Compactor	1	91	**85**	**79**	**73**	**67**

Table 7 – Activity 3: Typical Noise Level of Construction Equipment (no mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Front end loader	1	91	**85**	**79**	**73**	**67**
Excavator (30T)	1	85	**79**	**73**	**67**	**61**

Based on the expected construction activity the predicted noise levels, we conclude as follows:

- For the existing residents (R1and R2), most construction noise activities will exceed the noise management levels, but mostly below the “Highly Noise Affected” levels.
- There is no use of radios/stereos onsite due to safety requirements.

To control construction activity noise, Section 3.2 provides managerial and noise control measures to limit the impact of noise to the nearest residents.

3.2 Management of Construction Noise

In order to manage the noise from the construction activities the following work practices and procedures are to be considered:

- Adherence to the recommended preferred hours for construction and deliveries.
- Truck drivers are to be informed of site access routes, acceptable delivery hours and minimising extended periods of engine idling.
- When selecting equipment ensure where feasible and reasonable it has the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.
- Turn off plant that is not being used.
- Table 8 is an excerpt from Appendix E 'Noise Sources, remedies and their effectiveness' Australian Standard 2436:2010, presenting possible noise reductions from various control mechanisms.

Table 8 – Relative Effectiveness of Various forms of Noise Control[3]

Control by	Noise Reduction Possible in Practice, dB(A)
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum 15
Enclosure	Normally 15 to 25, maximum 50
Silencing	Normally 5 to 10, maximum 20

Applying the above mentioned noise reduction techniques from acoustic mitigation measures, distance and time corrections, the following Table 9 to Table 11.

[3] Table A1 in Australian Standard 2436:2010 and Department for Environment, Food and Rural Affairs (DEFRA UK).

Table 9 – Activity 1: Typical Noise Level of Construction Equipment (with mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Excavator (30T)	1	77	**71**	**65**	**59**	53
Bulldozer	1	78	**72**	**66**	**60**	54

Table 10 – Activity 2: Typical Noise Level of Construction Equipment (with mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Compactor	1	83	**77**	**71**	**65**	**59**
Loader (wheeled)	1	75	**69**	**63**	**57**	51

Table 11 – Activity 3: Typical Noise Level of Construction Equipment (with mitigation)

Description of Noise Source[2]	# of Sources	Sound Pressure Level, L_p dBA				
		5m	10m	20m	40m	80m
Front end loader	1	83	**77**	**71**	**65**	**59**
Excavator (30T)	1	77	**71**	**65**	**59**	53

3.3 Management of Construction Vibration

Vibration levels due to construction activities are very difficult to predict due to variations in ground and structural conditions. The expected construction activity associated with this development is unlikely exceed the recommended limits and cause excessive damage or vibration to existing structures. Generally, vibration monitoring should be considered when these construction works are conducted within 10m of an existing structure. Any building located within 40m of the site should be subject to inspection prior to commencement of construction activities in order to identify and rule out any existing damage.

In all cases, where the vibration levels are found to exceed the relevant criteria, alternative construction methods should be considered to reduce the impact. This may include the following strategies:

- Prior to start of construction work and after the construction activities, prepare a dilapidation report on the state of the adjacent existing buildings.
- During the construction, consider conducting vibration monitoring next to the sensitive buildings to determine when exceedances that may take place.
- When exceedances occur/are likely to occur:
    - Use smaller equipment - This will reduce the level of impact, but will need longer duration. The number of smaller equipment can be increased to compensate for the longer duration.
    - Allowance for respites - When human comfort levels are exceeded, breaking up the longer exposure periods to allow for rest will reduce the degree of impact.

3.4 Construction Vehicles

In order to minimise the impact of construction vehicle traffic noise, it is recommended that as part of the construction management plan, following mitigation strategies are implemented:

- Construction vehicles will access (enter/exit) the site on Adelaide Road. Drivers are to be informed of designated vehicle routes, parking locations and other relevant practices such as minimising the use of engine brakes, and no extended periods of engine idling.
- Schedule deliveries during the nominated hours only.
- Nominate an off-site truck parking area, away from residential street, for trucks arriving prior to gates opening. No trucks are to wait outside the site before the gates open.
- Provide on-site truck waiting areas away from residences and other sensitive land uses. Where possible provide only forward truck movements to avoid engaging reversing alarms.
- For more details, refer to Construction Traffic Management Plan (prepared by others).

3.5 Community Consultation

The proponent is to develop within The Construction Management Plan details and strategies to handle disputes and resolution. This may include:

- Strategies to inform the community of the various ways they could contact the project staff if they have queries, concerns or complaints. This may include a 24 hour complaints phone line, project email and website addresses.
- Procedures to notifying residents and occupants of other sensitive land uses of forthcoming works likely to affect their noise amenity (such as letterbox drops).
- The Project Manager to maintain a register of complaints and any corrective actions taken. The register must record, but not necessarily be limited to:

  (a) The date and time of the complaint;

  (b) The means by which the complaint was made;

  (c) (c) Any personal details of the complainants that were provided, or if no details were provided, a note to that affect;

  (d) Nature of the complaints;

  (e) Any action(s) taken by the applicant in relation to the compliant, including any follow up contact with the complainant; and

  (f) If no action was taken by the applicant in relation to the complaint, the reason(s) why no action was taken.

- When complaints are received, implement a long/short term noise monitoring strategy and analysis of the results to improve the management plan, so that best practice noise control measures are continually met for the duration of the project.

4 Conclusion

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of the NSW EPA guidelines.

Noise management level for construction activity noise has been determined based on the on the EPA ICNG. The management level are presented in Table 2 of Section 2.3 . The predicted noise from construction phases are expected to exceed the managerial noise limits. However, the construction noise emission can be managed to meet acceptable levels at the nearest sensitive receivers by implementing the recommended methods given in Section 3.2 can be adopted to provide effective noise control during the construction phases.

The criteria for construction vibration has been established in Section 2.4 based on the DEC/EPA guidelines. Predictions for vibration impact may be difficult to predict, however the expected construction activity is unlikely exceed the recommended limits and cause excessive damage or vibration to existing structures. Section 3.3 details various mitigation measures and management controls to limit the impact of vibration onto nearby structures and minimise disturbance to the nearest sensitive receivers.

Providing the management strategies outlined in this report are adopted, construction activity noise associated with the proposed development can managed to minimise noise and vibration impact to surrounding receivers to comply the NSW EPA guidelines.

Appendix A – Acoustic Terminology

Decibel, dB: A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 micro Pascals.

A-WEIGHTING: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

Sound Pressure Level, L p (dB), of a sound: 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Ambient Noise/Sound: All noise level present in a given environment, usually being a composite of sounds from many sources far and near. Traffic, HVAC, masking sound or even low-level background music can contribute to ambient level of noise or sound.

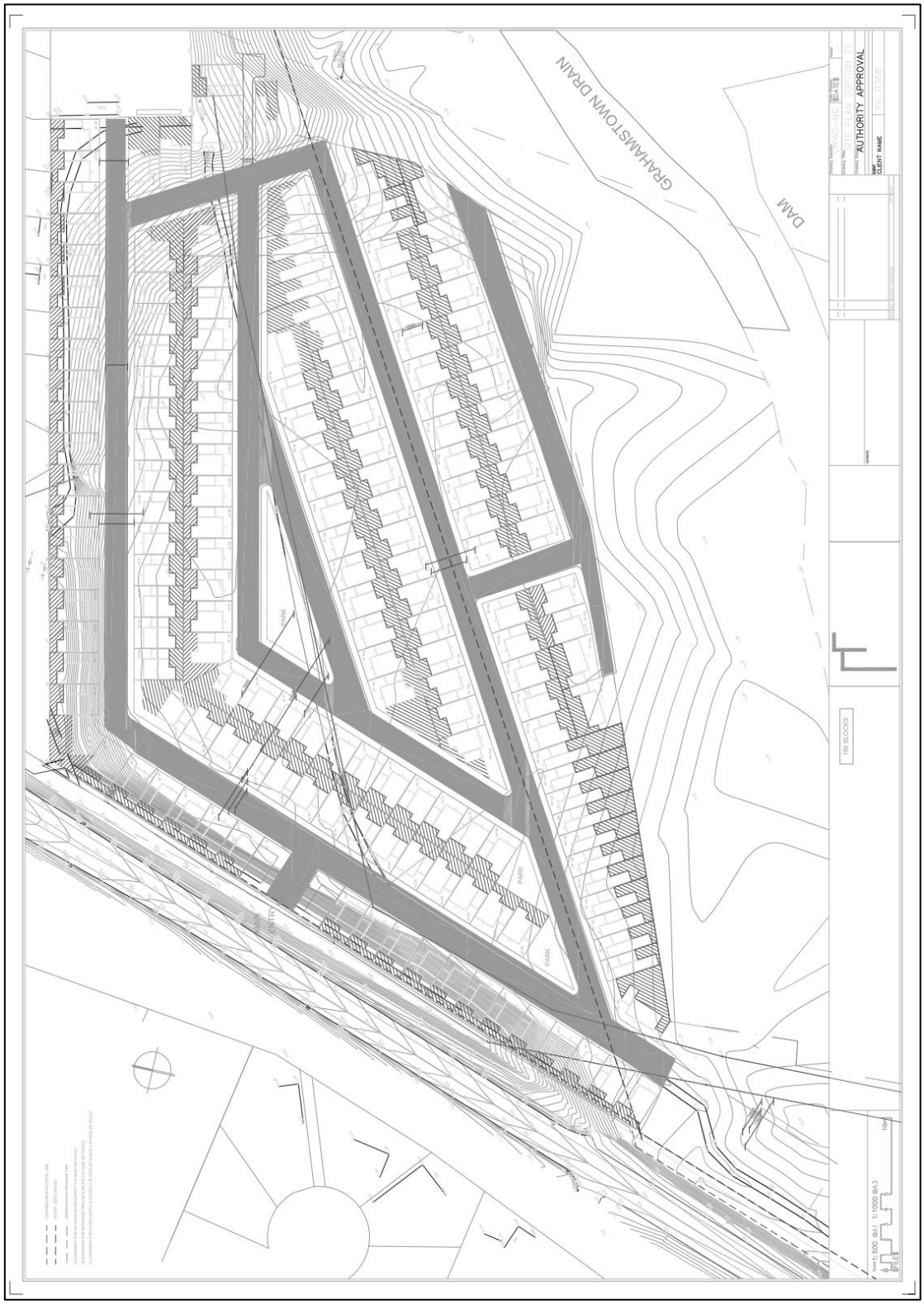
Percentile Level - L 90 , L 10 , etc: A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L 90 is the level which is exceeded for 90% of a measurement period. L 90 is commonly referred to as the "background" sound level.

Background Noise (L 90): The sum total of all unwanted residual noise generated from all direct and reflected sound sources in a space that can represent an interface to, or interfere with good listening and speech intelligibility.

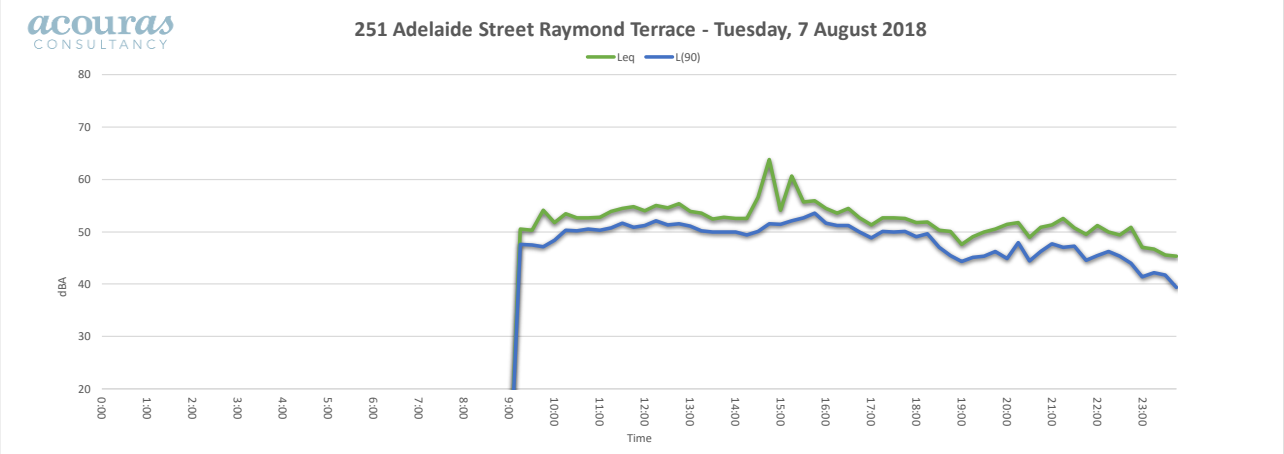
Rating Background Level – RBL: Method for determining the existing background noise level which involves calculating the tenth percentile from the L A90 measurements. This value gives the Assessment Background Noise Level (ABL). Rating Background Level is the median of the overall ABL.

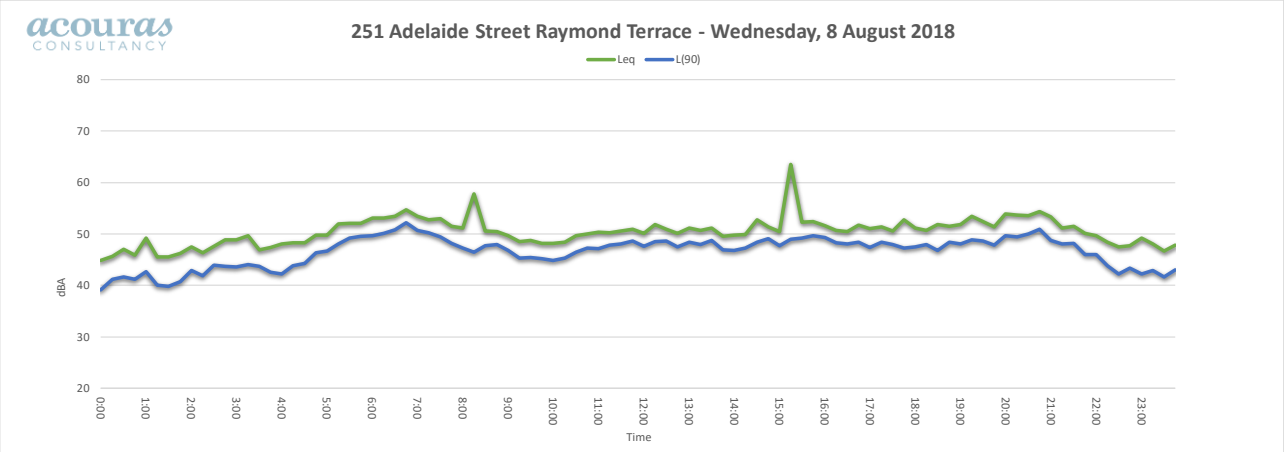
L AEQ,T : Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

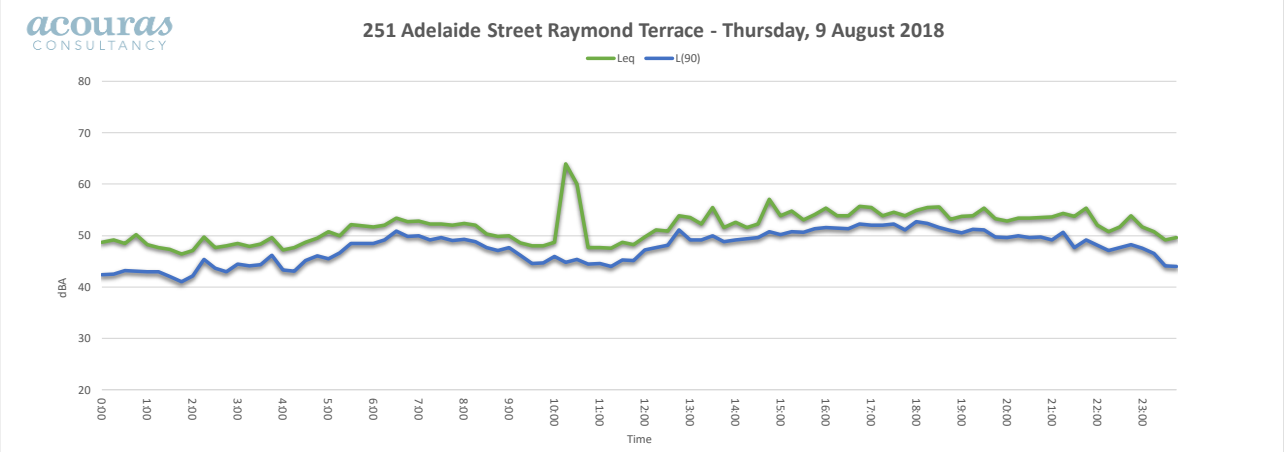
Appendix B – Site Layout

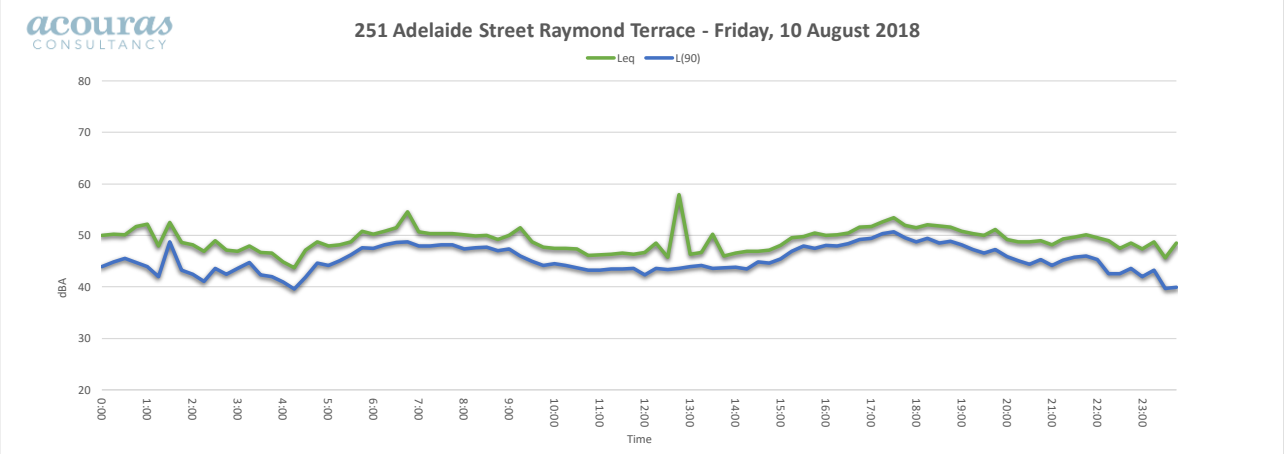


Appendix C – Noise Logger Results





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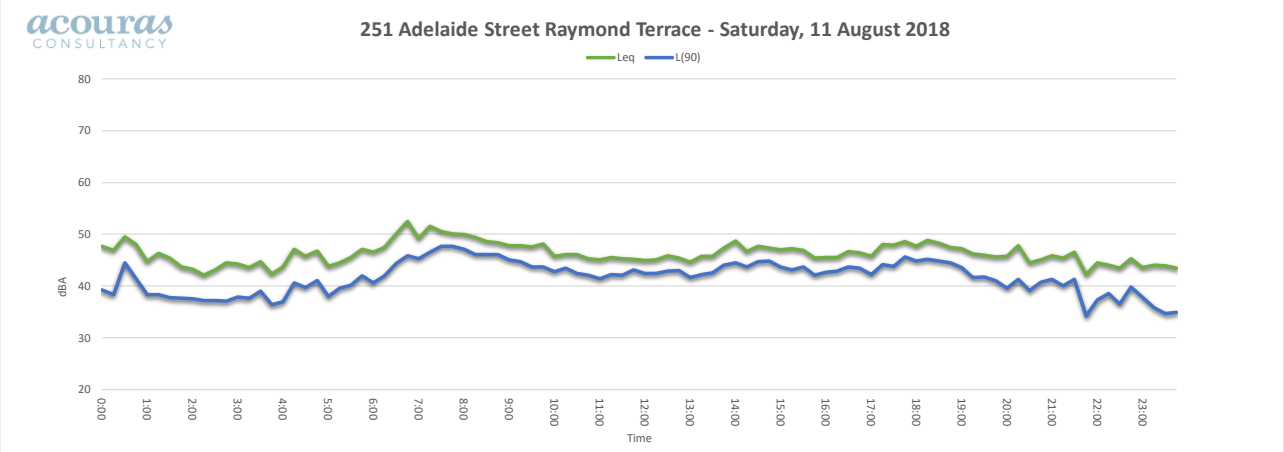
Leq
L(90)
dBA
Time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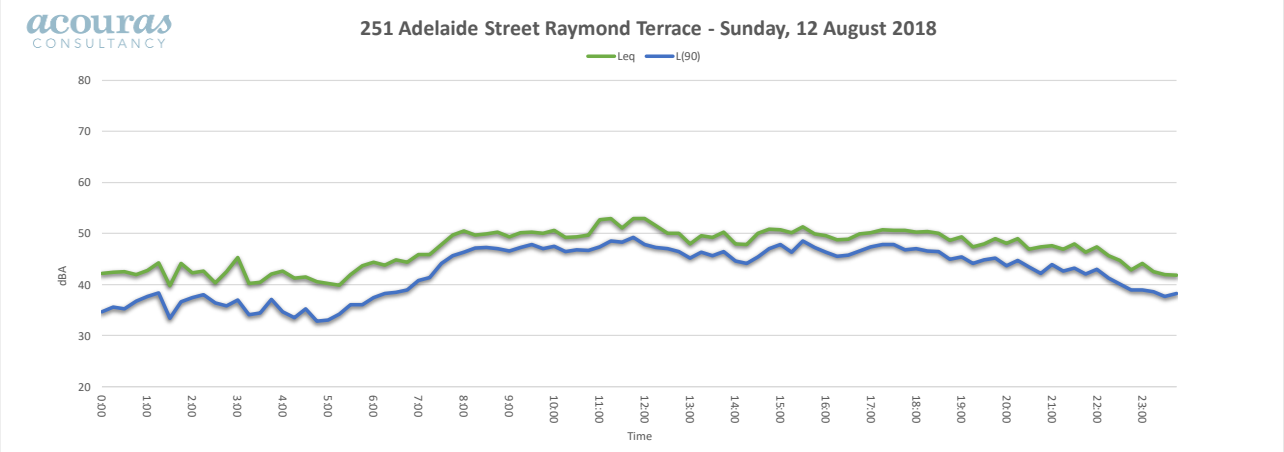
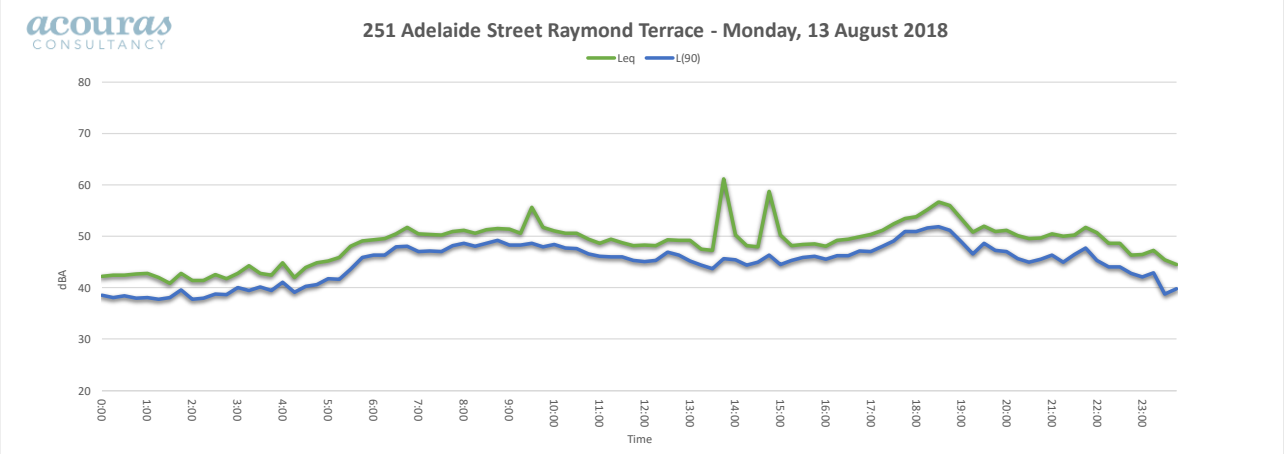
Leq
L(90)
dBA
Time


251 Adelaide Street Raymond Terrace - Sunday, 12 August 2018
Leq
L(90)
dBA
Time


acouras CONSULTANCY
251 Adelaide Street Raymond Terrace - Monday, 13 August 2018
Leq
L(90)
dBA
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70
60
50
40
30
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1:00
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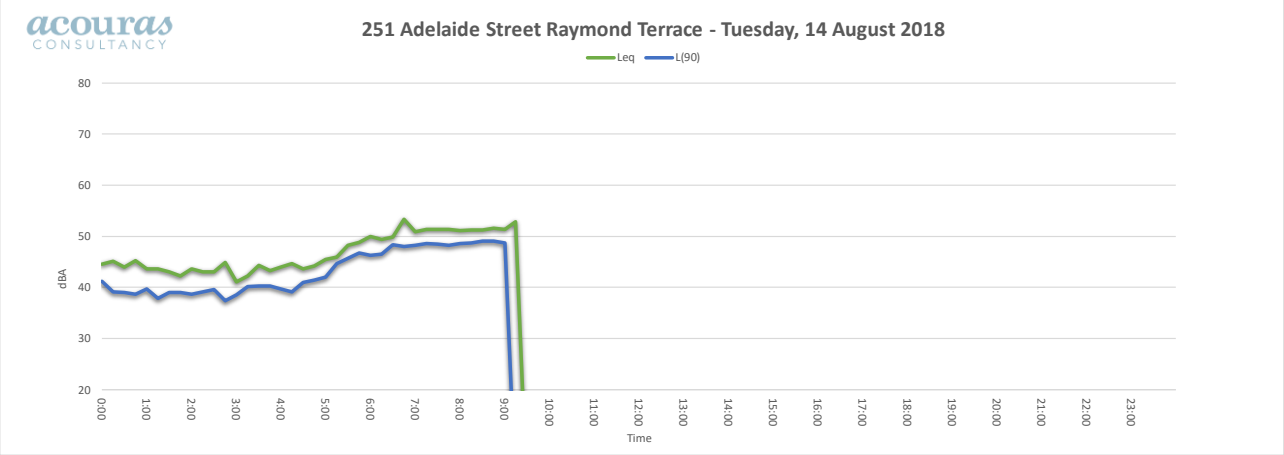
acouras CONSULTANCY
251 Adelaide Street Raymond Terrace - Tuesday, 14 August 2018
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60
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Appendix D – Construction Equipment Noise Levels

Table D-1 — Typical Sound Pressure Level of Construction Equipment

Description	Sound Pressure Level L_{pA} (mid point) at 10m
Backhoe with auger	78
Bulldozer	80
Excavator	79
Forklift	78
Front end loader	85
Hand tools (electric)	74
Hand tools (pneumatic)	88
Loader (wheeled)	77
Compactor	85