MEMO

MARSHALL DAY Acoustics

Project:	Bunyip North Quarry	**Document No.:**	Mm 004 01Draft		
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Attention:	Bryan Chadwick	**Cross Reference:**	N/A		
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From:	Gillian Lee	**No. Pages:**	24	**Attachments:**	No
Subject:	Baseline noise measurements and project criteria				

This memo presents baseline noise monitoring data collected at the subject site and presents the relevant noise criteria for the Bunyip North Quarry EES project (The Project).

The Project Site is located in Bunyip North approximately 80 kilometres southeast of Melbourne Victoria on land owned by Hanson and formally described as:

- Lot 3 on Plan of Subdivision 520625 (195 Tonimbuk Road, Bunyip North, Victoria 3815);
- Lot 8 on Lodged Plan 116228 (240 Sanders Road, Bunyip North, Victoria 3815);
- Lot 2 on Plan of Subdivision 531586 (310 Sanders Road, Bunyip North, Victoria 3815); and
- Lot 1 on Title Plan 251325 (5 Wallaby Court, Bunyip North, Victoria 3815).

The project is bounded by Sanders Road to the north, private agricultural land to the southeast and partially bound by private property and Wallaby Court to the west. In addition, the site boundary extends to the southeast forming the proposed access road that connects with Tonimbuk Road. The Bunyip North Quarry is proposed to be developed on private land owned by Hanson currently utilised for the following land uses.

- Grazing Pasture Land
- Residential Land Use
- Farm Storage (sheds)
- Water capture and storage for farming purposes.

Background noise levels in the area are generally low and are not sufficient to warrant adjustments to the noise criteria determined from the land zoning for the area. However, establishing the existing noise setting via baseline monitoring is a requirement of the draft EES scoping requirements for Bunyip North Quarry.

BASELINE NOISE MEASUREMENTS

Automated noise logging

Automated noise logging was undertaken at seven (7) locations to sample baseline ambient noise levels in the vicinity of the subject site. Noise logging was undertaken at the site between 14 June 2019 and 23 July 2019. Logging locations are denoted as L1 – L7 and are shown in Figure 1.

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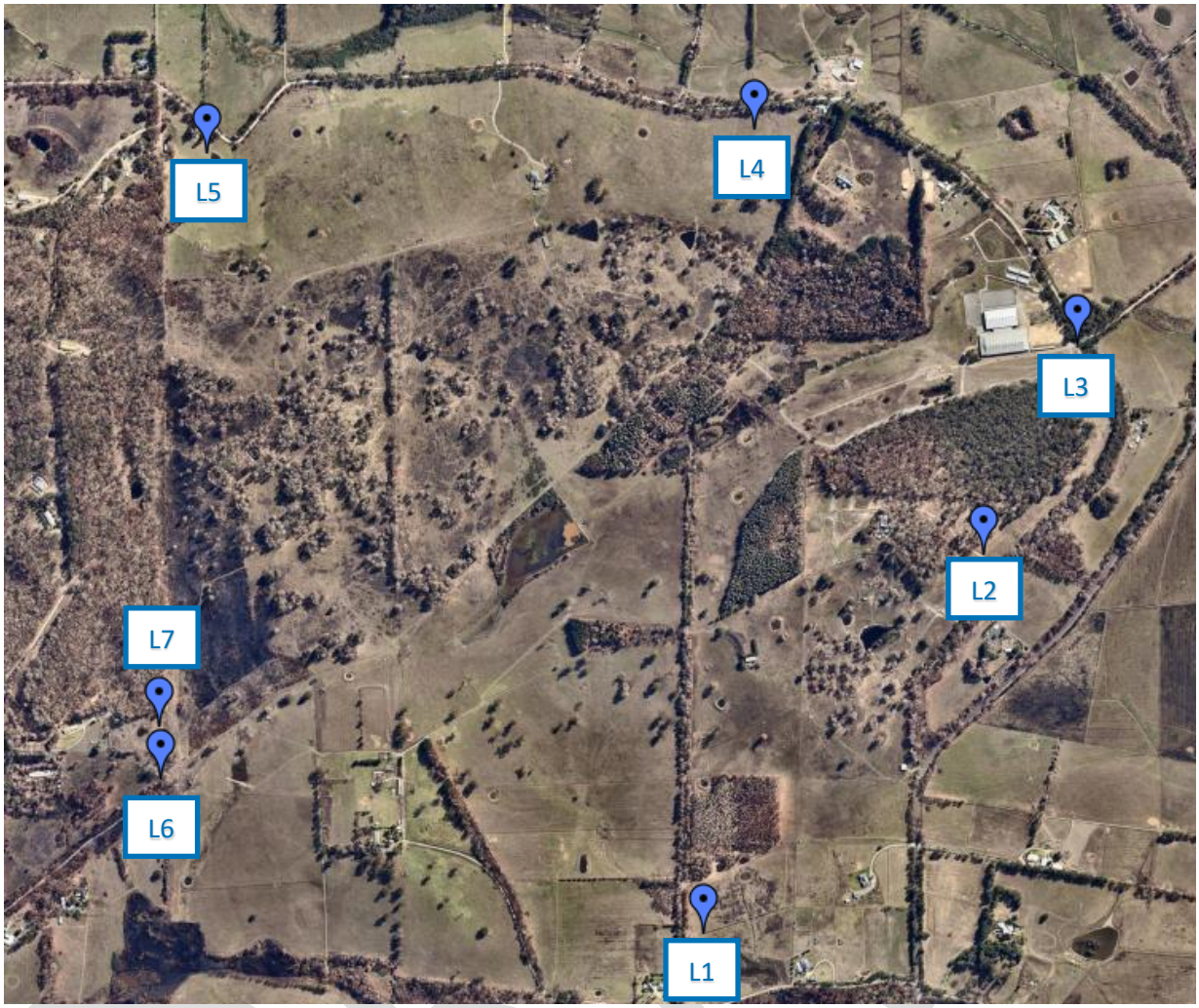
Certified System ISO 9001

Figure 1: Baseline measurement locations (Nearmap.com)



The ranges of ambient and background noise levels measured during the survey are summarised in Table 1.

Table 1: Ambient noise logging results summary

Location	Day	Evening	Night
Range of typical average noise levels $L_{Aeq(1hr)}$[1] dB			
L1	40-52	42-52	37-51
L2	41-50	36-49	29-41
L3	25-51	25-52	25-48
L4	42-58	39-48	33-42
L5	39-50	31-46	26-43
L6	42-52	36-51	33-50
L7	38-48	36-45	30-40
Range of typical background noise levels dB $L_{A90(1hr)}$[2]			
L1	33-47	34-47	32-48
L2	31-43	27-39	25-35
L3	24-40	24-43	22-41
L4	30-41	28-40	28-37
L5	26-40	23-34	19-33
L6	34-49	32-50	27-50
L7	31-43	29-40	25-35

The time periods detailed in Table 1 correspond to the time periods detailed in NIRV and shown below for reference.

Table 2: NIRV time periods

Time period	Hours
Day	0700 – 1800 hrs Monday to Friday
	0700 – 1300 hrs Saturdays
Evening	1800 – 2200 hrs Monday to Friday
	1300 – 2200 hrs Saturdays
	0700 – 2200 hrs Sundays and public holidays
Night	2200 – 0700 hrs

[1] L_{Aeq} refers to the A-weighted average noise level. Refer to Glossary for definition of acoustic terms

[2] L_{A90} refers to the A-weighted background noise level. Refer to Glossary for definition of acoustic terms

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Further details on weather conditions and measurement methodology are provided in Appendix D. The measured noise levels have been analysed to establish existing ambient noise levels and investigate the presence of any trends or patterns as indicated below.

Graphs showing the daily noise levels are provided in Appendix E. Additional charts are provided in Appendix F to demonstrate the relationship between the minimum and maximum ambient noise levels, and the period average to the typical range presented in Table 1.

In general, ambient noise levels appear to be quietest in the night period (specifically around midnight – 0100 hrs) and also during the day (between 1100 hrs and 1500 hrs). This is likely due to noise sources such as birds, insects and traffic movements being more common at other times of the day and night.

Similarly, the loudest ambient noise levels were typically recorded during the early day period (around 0700 hrs) and again in the early evening (around 1700 hrs).

There was some variation in this pattern across the various locations.

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Attended noise measurements

Short-term attended measurements were conducted during the day at each of the noise logging positions during the noise monitor placement. Short-term ambient noise levels are contained in Table 3. Further details regarding the attended noise measurements is provided in Appendix G.

Table 3: Ambient short-term noise measurement results summary – 14 June 2019

Location	Time	Measured noise level		Noise sources contributing to local environment
		Ambient noise level dB L_{Aeq}	Background noise level dB L_{A90}	
L1	1015 – 1025 hrs	50	38	Birds (including crows), distant traffic, wind in trees and some infrequent frogs
L2	1046 – 1056 hrs	49	40	Birds, wind in trees, infrequent passing cars
L3	1119 – 1129 hrs	59	42	Infrequent passing cars on Sanders Road, distant traffic, occasional noise from cows in paddock to north across Sanders Road
L4	1151 – 1201 hrs	55	38	Wind in trees, birds, infrequent passing cars, very short period (<5s) of power tool usage in nearby dwelling
L5	1229 – 1239 hrs	53	36	Wind in trees, some clearing of burned timber at a nearby dwelling, farm work (including an excavator and truck) at a nearby dwelling, passing aircraft.
L6	1248 – 1258 hrs	44	33	Distant mechanical noise from an excavator (different to above) working at a dam at a nearby dwelling, birds, wind in trees.
L7	1324 – 1334 hrs	47	42	Wind in trees, infrequent passing traffic

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LEGISLATIVE CONTEXT AND GUIDELINES

Key noise legislation and guidelines

The following section outlines a review of:

- Key noise legislation and guidelines in Victoria applicable to this project
- Other guidelines typically referenced in Victorian noise assessments.

A range of guidelines and legislation are used in Victoria to assess and control environmental noise. A summary of the relevant legislation and guidelines is provided in Table 4. A planning map is presented in Appendix B and can be used in conjunction with the guidelines.

Table 4: Key noise legislation/guidelines

Document	Overview
Environment Protection Act 1970	Establishes obligations for the control of environmental noise and applies to all types of noise sources except rail operations. The legislation does not specify noise limit values but sets out legal requirements to comply with State Environment Protection Policies and prescribed standards.
EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV)	Prescribes recommended maximum noise levels (recommended levels) for commercial, industrial or trade premises in regional Victoria. The NIRV document is a non-statutory guideline. Accordingly, the recommended levels are only legally binding when applied through statutory instruments, such as a planning permit or notice.

In addition to the key publications noted above, reference is made to guidance used for the assessment of workplace environments in order to provide contextual information about the level of protection afforded by environmental noise policies.

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Supplementary noise guideline documents

The following guidelines in Table 5 are not compulsory for noise from the project but contain useful guidance.

Table 5: Supplementary noise guideline documents

Guideline or Standard	Status	Type of noise covered by document
Offsite amenity impacts guidance sourced from NSW *Road Noise Policy* - Department of Environment, Climate Change and Water NSW [2011]	NSW Policy	Strictly only applies in NSW, however where Victorian policy guidance is not available, reference is often made to related NSW publications. Noise from truck traffic while off-site is not covered by NIRV. There are no regulations, legislation or guidelines in Victoria that address this type of noise impact during the day. Thus, we recommend criteria based on current practice in New South Wales. The NSW *Road Noise Policy* provides criteria for existing residences affected by additional traffic on existing roads generated by land use developments. The criteria in the policy are not mandatory design criteria. They are thresholds above which mitigation measures must be considered with the aim to select the most feasible and reasonable measures.
Australian/New Zealand Standard AS/NZS 2107:2016 *"Acoustics - Recommended design sound levels and reverberation times for building interiors"* (AS2107)	Australian standard	Provides recommendations for acceptable internal noise levels. Table 1 of AS2107 presents the recommended design sound levels for "houses in rural areas with negligible transportation", which is considered to be applicable to the project site.

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Noise from Industry in Regional Victoria (NIRV)

The relevant guidelines for noise from industrial operations such as quarries and mines in regional Victoria are contained in the EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV).

NIRV provides recommended maximum noise levels (recommended levels) for existing and proposed industry. NIRV is a non-statutory guideline.

NIRV adopts procedures for measuring noise outlined in *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1).

SEPP N-1 (and hence NIRV) defines a 'noise sensitive area' as an area of land within 10 m outside the external walls of:

- a dwelling or residential building
- a dormitory, ward or bedroom of a caretaker's house, hospital, hotel, institutional home, motel, reformative institution, tourist establishment or work release hostel.

NIRV prescribes recommended levels depending on either the respective zoning of the sound source and receiver, or type of site in some instances (e.g. Earth Resources sites). Once the recommended levels are established, the noise level (L_{Aeq}) due to the commercial premises is measured or predicted. If necessary, the L_{Aeq} noise level is adjusted for noise character and duration to give the effective noise level (L_{eff}). If the L_{eff} level exceeds the noise limit, then remedial action is required.

The recommended levels are based on the NIRV guidance for earth resources, and the zoning of the receivers. The time periods for NIRV are contained in Table 6.

Table 6: NIRV time periods

Description	Day	Evening	Night
Monday - Friday	0700-1800hrs	1800-2200hrs	2200-0700hrs
Saturday	0700-1300hrs	1300-2200hrs	2200-0700hrs
Sunday	N/A	0700-2200hrs	2200-0700hrs

The recommended levels are presented in Table 7. Derivation of the recommended levels is explained in Appendix C1.3.

Table 7: Derived recommended levels dB L_{eff} for earth resources

Applicable locations	Day	Evening	Night
All nearby residential locations	46	41	36

The NIRV recommended levels for Earth Resources sites presented in Table 7 apply to general mining and quarry operations, including overburden removal and depositing, extraction of material, processing, and the handling or disposal of waste material.

NIRV specifies potential variations to the recommended levels for particular open-air activities as described in in Appendix C1.4 of this memo.

NIRV applies to noise that is generated within the project boundary, and does not cover noise generated off-site, such as from haulage of ore via trucks on public roads.

NIRV has provisions for managing noise from proposals or existing sites that cannot meet the recommended levels.

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Noise from multiple sites

EPA Publication 1413 *Applying NIRV to Proposed and Existing Industries* states the following in relation to noise from multiple sites:

> *In NIRV rural areas, industry should design plant or operations so that their emissions are less than the recommended levels where there are:*

- *Industrial premises in an Industrial 1 or Industrial 2 zone with at least two other allotments in the same zoned piece of land*

  Or;

- *Industrial premises on an allotment greater than 10 ha in any zone where expansion is likely.*

Neither of the two cases above are relevant to this study, therefore operations from the site are to be designed to meet the NIRV recommended levels without adjustment due to other industry sites.

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APPENDIX A GLOSSARY OF ACOUSTIC TERMINOLOGY

Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
dB	Decibel. The unit of sound level.
L_{A90}	The noise level exceeded for 90 % of the measurement period, measured in dB. This is commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous sound level, measured in dB. This is commonly referred to as the average noise level.
L_{eff}	The effective noise level of commercial or industrial noise determined in accordance with *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1). This is the L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise, measured in dB. Adjustments are made for tonality, intermittency and impulsiveness.
L_w (or SWL)	Sound Power Level. The level of total sound power radiated by a sound source.
Octave band	Sound, which can occur over a range of frequencies, may be divided into octave bands for analysis. The audible frequency range is generally divided into 7 octave bands. The octave band frequencies are 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz and 4 kHz.

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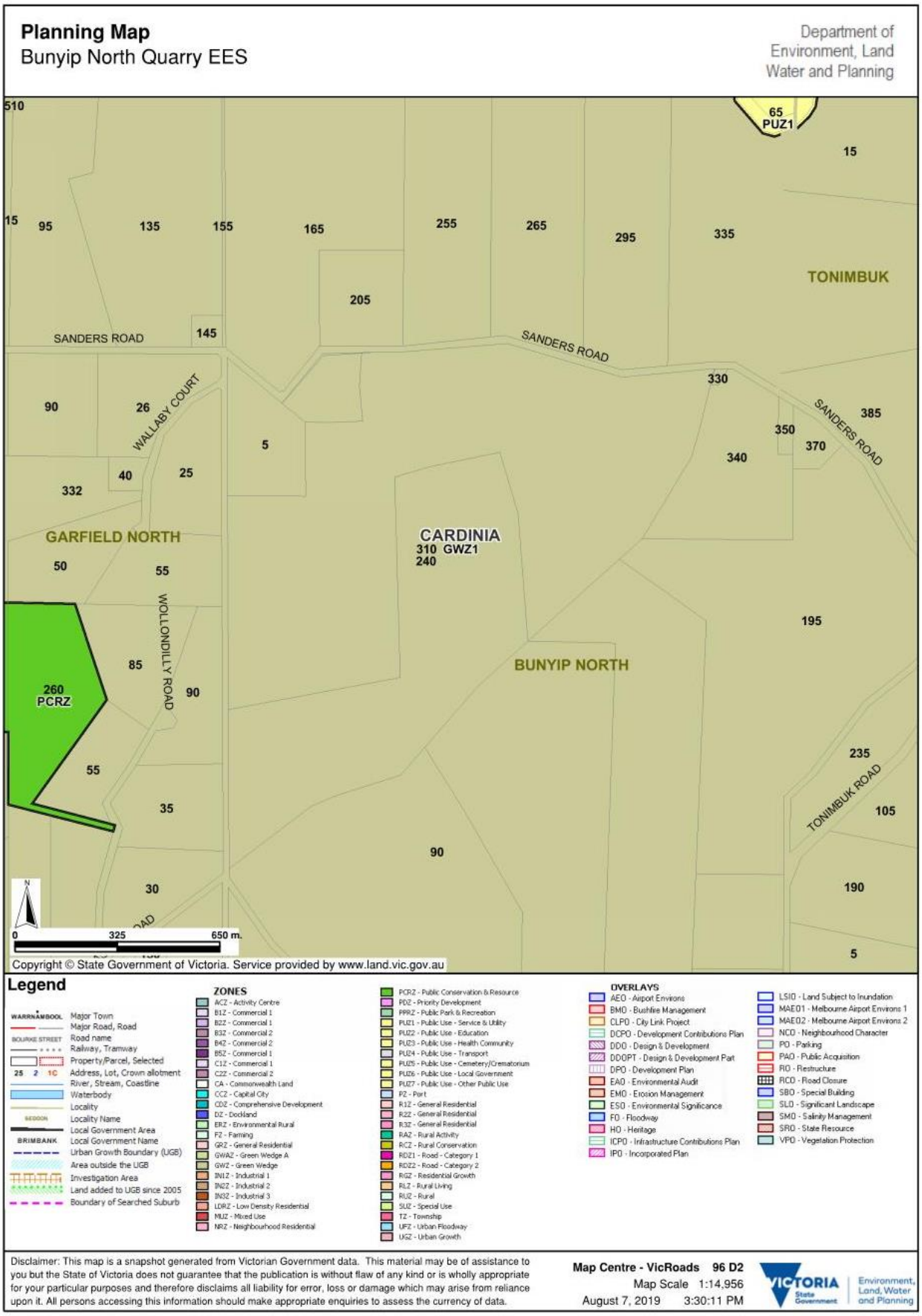
APPENDIX B PLANNING MAP



APPENDIX C NOISE LEGISLATION AND GUIDELINES

C1 Noise from Industry in Regional Victoria (NIRV)

C1.1 Application

The relevant guidelines for noise from industrial operations in regional Victoria are the EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV).

NIRV provides recommended maximum noise levels (recommended levels) for existing and proposed industry in Victoria outside Metropolitan Melbourne. NIRV is a non-statutory guideline. This approach is applied in regional Victoria because the unique characteristics of rural areas, such as generally low ambient noise levels and large location-constrained, resource-based industries, mean that noise limits cannot always be achieved.

NIRV provides a method for the derivation of recommended maximum noise levels for industry, and provides guidance for applying the recommended maximum noise levels for a variety of scenarios.

NIRV recommended levels for extractive industries are based on the zoning classifications of the source and receiver location and background noise levels. A zoning map is included in Appendix B for reference. For this project, distances between the source and receiver, and existing ambient noise levels have been reviewed, and do not alter the recommended levels.

C1.2 Assessment methodology

NIRV adopts the SEPP N-1 procedures for measuring noise, including the definitions of 'noise sensitive areas' which are summarised below.

SEPP N-1 defines a 'noise sensitive area' as an area of land within 10 m outside the external walls of:

> *a dwelling or residential building*
>
> *a dormitory, ward or bedroom of a caretaker's house, hospital, hotel, institutional home, motel, reformative institution, tourist establishment or work release hostel.*

NIRV prescribes recommended levels depending on the respective zoning of the sound source and receiver, and type of site in this instance (e.g. Earth Resources sites). Once the recommended levels are established, the noise level (L_{Aeq}) due to the commercial premises is measured or predicted. If necessary, the L_{Aeq} noise level is adjusted for noise character and duration to give the effective noise level (L_{eff}). If the L_{eff} level exceeds the noise limit, then remedial action is required.

NIRV has provisions for managing noise from proposals or existing sites that cannot meet the recommended levels.

Consistent with the requirements of SEPP N-1, clause 18, the recommended levels apply to the total of all industrial noise affecting a noise-sensitive area.

C1.3 Calculation of recommended levels

NIRV part 3.2 provides recommended maximum noise levels for earth resources, such as mines and quarries, and ancillary infrastructure such as tailings dams. Noise limits are determined by the land-use zoning that the noise-sensitive receiver falls within. A zoning map is provided in Appendix B for reference. The recommended maximum noise levels apply to earth resources sites such as mines and quarries, and ancillary infrastructure (such as evaporation pond facilities, ventilation shafts, tailings dams or pumping stations) located within the site's approved working areas.

The calculation of recommended levels has been performed in accordance with Section 3.2 of NIRV and is presented in Table 8.

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Table 8: Calculation of recommended levels – Earth Resources to Green Wedge Zone

Description	Day	Evening	Night
Applicable time period	Mon-Fri 0700-1800hrs Sat 0700-1300hrs	Mon-Fri 1800-2200hrs Sat 1300-2200hrs Sun 0700-2200hrs	Mon-Sun 2200-0700hrs
Step E1: Earth resources levels	**46 dB L_{eff}**	**41 dB L_{eff}**	**36 dB L_{eff}**
Step E2: Background level check and adjustment	N/A	N/A	N/A
Step E3: High traffic-noise area adjustment	N/A	N/A	N/A

C1.4 Variations to the recommended levels for mines, quarries or landfills

The project criteria presented in Table 8 apply to general quarry operations, including overburden removal and depositing, extraction of material and the handling or disposal of waste material.

NIRV specifies potential variations to the recommended levels for particular open-air activities, as described in NIRV.

Broadly, variations are applicable to the following processes:

- Installation of constructed noise-control works
- Site clearing and preparation
- Final site rehabilitation, short projects and necessary unshielded work.

Table 4 from NIRV is reproduced below and presents definitions and qualifications for the identified processes listed above.

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Table 4 — Mine, quarry and landfill variations

Process	Variations to recommended levels	Limitations to applying variations
Installation of constructed noise-control works 'Constructed noise-control works' are works specifically targeted to a noise-control purpose. They can include walls or fences; or earth mounds or bunds, constructed in particular circumstances (see 'Limitations to applying variations'). They are not mining or quarrying works carried out during the project that have a coincidental, secondary noise-control benefit (e.g. general overburden stockpiling). 'Constructed noise-control works' does not refer to building construction or demolition. SEPP N-1 and this document do not apply to building construction or demolition (e.g. construction of industrial premises, including ore-processing plants). *Noise control guidelines* (EPA publication 1254) apply.	During installation of constructed noise-control works (in the circumstances described under 'Limitations to applying variations') the noise from the activity may be exempted from recommended levels during the Day period.	• The exemption should only be provided for noise-control works that are necessary for the site to meet the recommended levels.[1] • The exemption is primarily intended for structures such as walls that are specifically for a noise-control purpose. • The exemption might also be applied to construction of earth mounds or bund walls (such as from soil or overburden) at the start of the project, where their primary purpose is noise control to meet the recommended levels. • In limited cases, the approved work plan may provide an exemption for noise control works at a later stage in the project. • Later project exemptions should only be applied to noise-control works that are to prevent new/different noise-sensitive areas from being exposed to noise above the recommended levels (e.g. where extraction works take place in a different part of a large site). • Where noise-control works employ soil or overburden, site operations should give priority to the noise-control benefits, above general stockpiling benefits. • The approved work plan should define the exemptions and constrain the periods to which the exemption applies. See Part 4 introductory notes – do not apply variations where recommended levels can be achieved by best practice.
Site clearing and preparation 'Site clearing and preparation' means vegetation removal, topsoil removal, subsoil removal, road construction and civil works such as site drainage.	During site clearing and preparation, the noise from the activity may be exempted from recommended levels during the Day period.	• The exemption can only be applied where the activity will happen before acoustic mounds can feasibly be constructed. • The exemption does not include overburden removal. See Part 4 introductory notes – do not apply variations where recommended levels can be achieved by best practice.

1 Part 1 of this document ('How regulators should apply these guidelines') has provisions for projects in rural areas that cannot meet the recommended levels. For these situations, the Applying NIRV guide sets out a process for assessing proposals and choosing to apply alternative noise outcomes to the recommended levels. If these alternative noise outcomes apply, the exemption for 'Constructed noise-control works' could still be applied in the approval, following the 'Limitations to applying variations' principles.

Table 4 (continued) — Mine, quarry and landfill variations

Process	Variations to recommended levels	Limitations to applying variations
Final site rehabilitation, short projects and necessary unshielded work 'Final site rehabilitation' means any activity related to site closure occurring at the final surface level after normal operations have ceased. It does not include backfilling of a pit. 'Short projects' are sites where the time between first and last earthmoving works of the entire operation is three months or less. 'Necessary unshielded work' includes waste dump extensions (at a mine or quarry), tailings dam construction or final landform construction. It includes work that is necessary but cannot practicably be shielded by barriers, landforms or natural topography.	In these situations, the approval body may allow works during the Day period to be up to 10 decibels greater than the recommended level, to a maximum of 68 dB(A). This allowance should be based on the details provided during project work planning and be documented in the approval.	• This allowance should be approved for a limited period of exposure for each noise-sensitive area. The operator should specify indicative working periods (start and finish dates), which they should communicate to affected neighbours. • Where the project continues over a significant number of years, an allowance for multiple, well separated periods may be given (e.g. initial works and final site rehabilitation). • An allowance period (e.g. three months) is counted as the total period, from start to finish, in which the noisier works are programmed. • Weather conditions that increase noise at sensitive areas to make it above the recommended levels (propagation conditions 'favourable to noise propagation') should be assumed for noise modelling and works programming, regardless of the actual conditions when the works occur. See Part 4 introductory notes – do not apply variations where recommended levels can be achieved by best practice.

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APPENDIX D BASELINE AUTOMATED NOISE LOGGING DETAILS

Ambient noise levels at the site were measured at seven locations over 30 days. Monitoring equipment comprised Rion NL-31 noise loggers fitted with windshields, and 01dB Cube sound level meters fitted with windshields. Microphones were mounted at a height of approximately 1.5 m above local ground level under free-field conditions.

Measurements were obtained using the 'F' response time and A-weighting frequency network. The equipment was checked before and after the survey and no significant calibration drifts were observed.

Consecutive 30-minute measurements were obtained continuously over the survey periods, as per the measurement methodology defined in SEPP N-1, which is adopted by NIRV. The prevailing noise environment when consultants attended site to install and collect the equipment was dominated by breeze, wildlife, and local traffic.

Table 9 provides further details of each of the ambient measurement surveys.

Table 9: Unattended ambient noise logging survey details

Location	Easting	Northing	Duration (days)
L1	386688	5786588	18
L2	387347	5787566	9
L3	387578	5788062	22
L4	386759	5788581	5
L5	385455	5788516	19
L6	385431	5787011	27
L7	385429	5787148	10

Noise monitoring locations were selected on the basis of identifying the closest available locations to key receivers, while aiming to cover a reasonably wide portion of the project area. Noise logging locations were free-field, with no reflecting surfaces nearby, in open spaces. There were no observable fixed noise sources in the vicinity of any of the loggers, except for distant traffic, birds and trees (which contribute to wind noise).

Weather data information has been taken from the BOM weather station at Warrangul. Periods of high winds or significant rainfall have been noted on the survey data. Weather during the survey was mixed, with several days of high wind and rain.

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APPENDIX E DAILY CHARTS - BASELINE AMBIENT NOISE LEVELS

Figure 2 to Figure 8 provide a summary of the measured hourly L_{Aeq} and L_{A90} noise levels at each of the locations.

Figure 2: Baseline ambient noise levels – Location 1

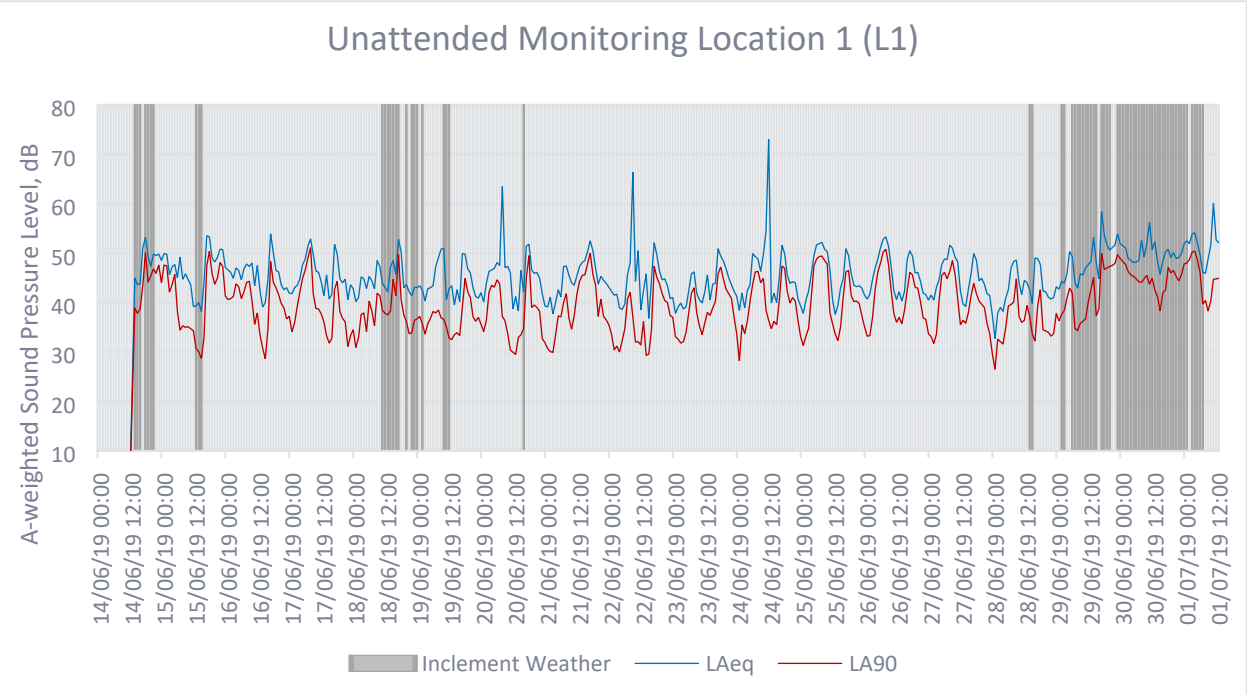


Figure 3: Baseline ambient noise levels – Location 2

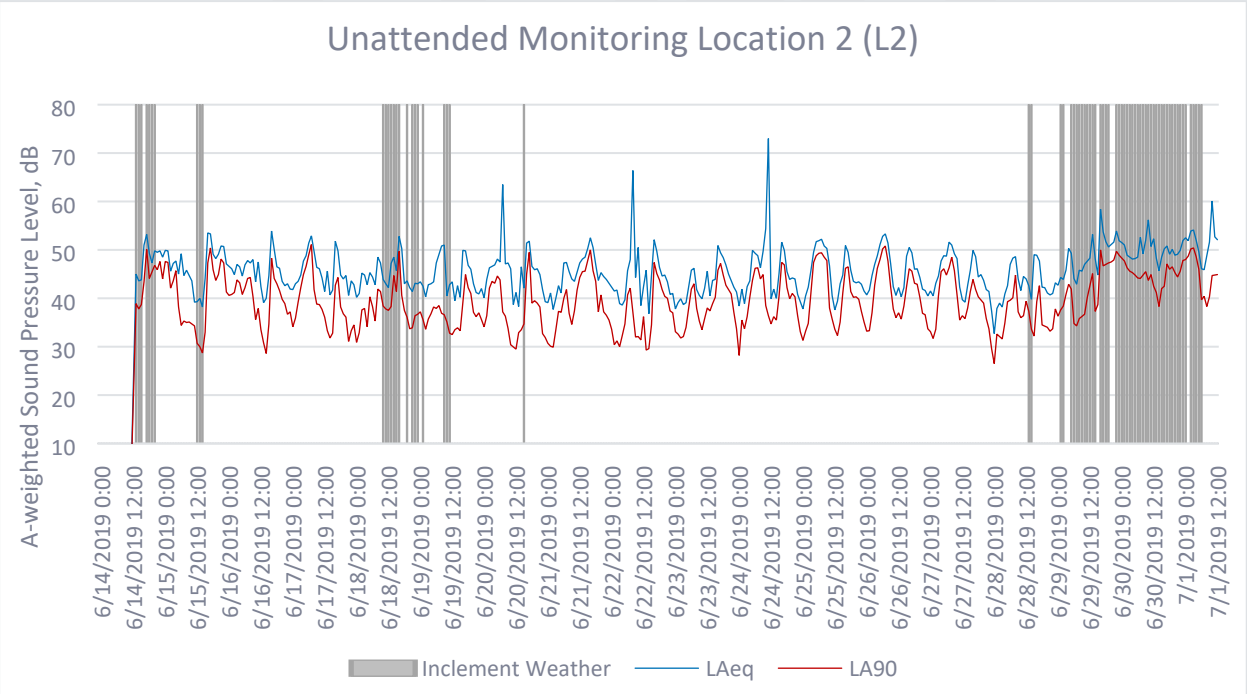


Figure 4: Baseline ambient noise levels – Location 3

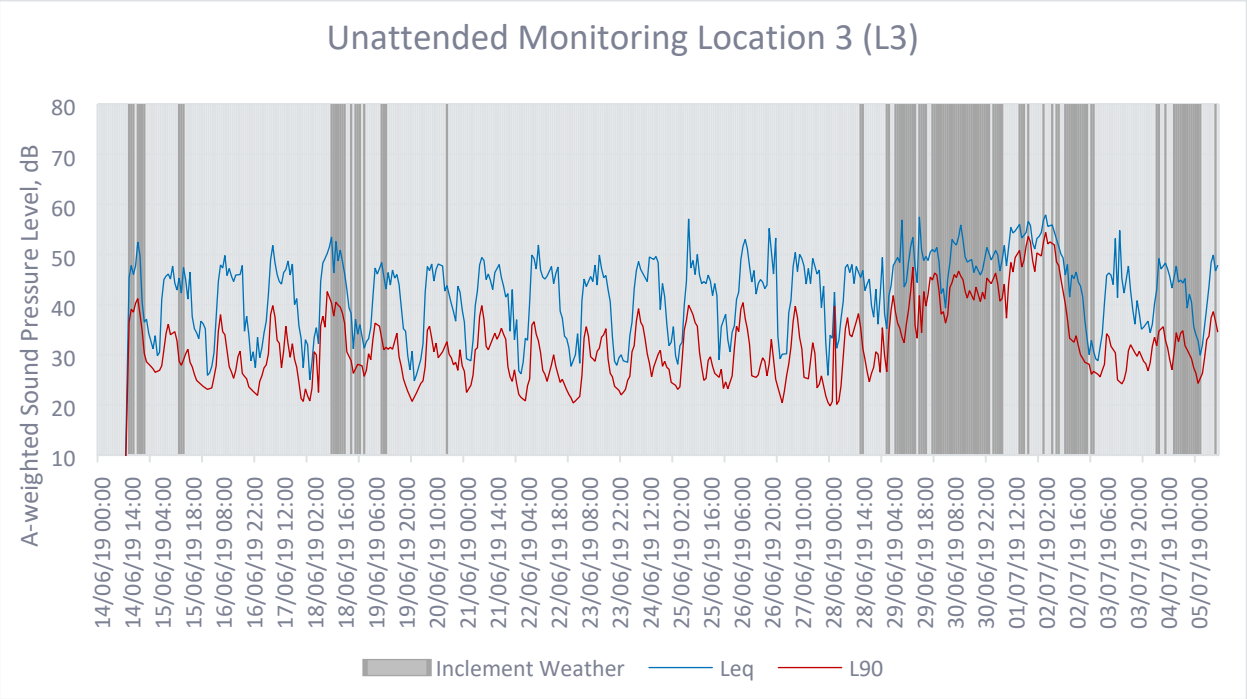


Figure 5: Baseline ambient noise levels – Location 4

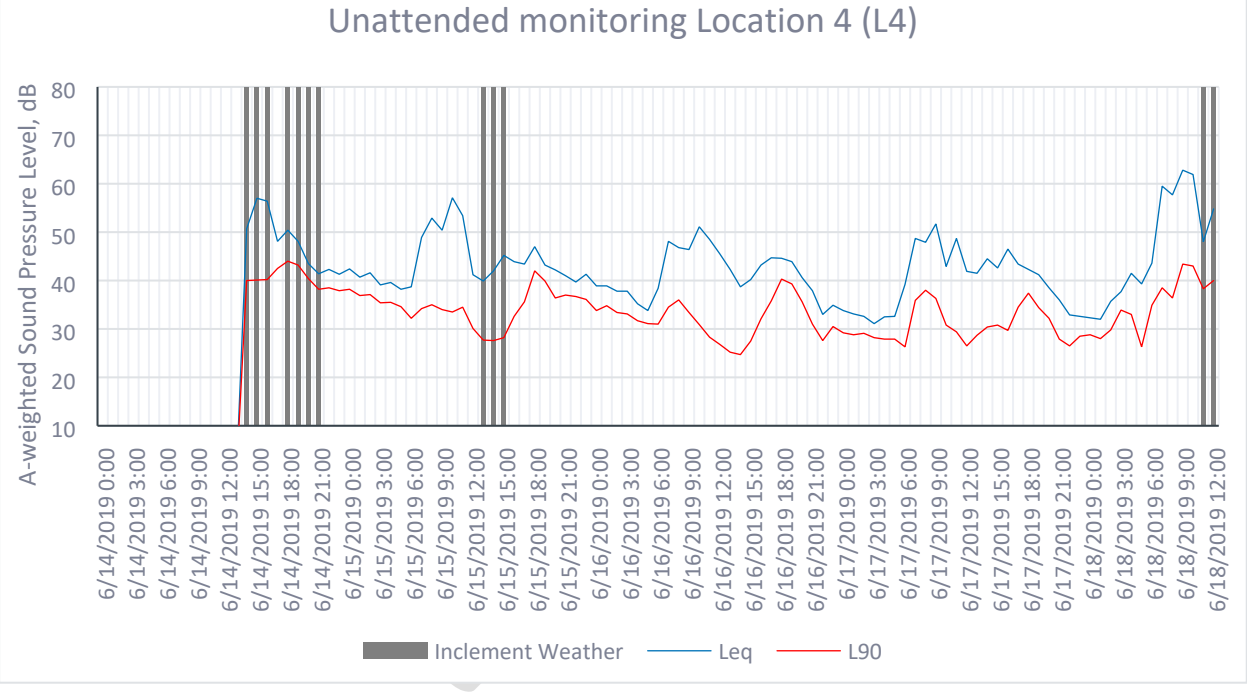


Figure 6: Baseline ambient noise levels – Location 5

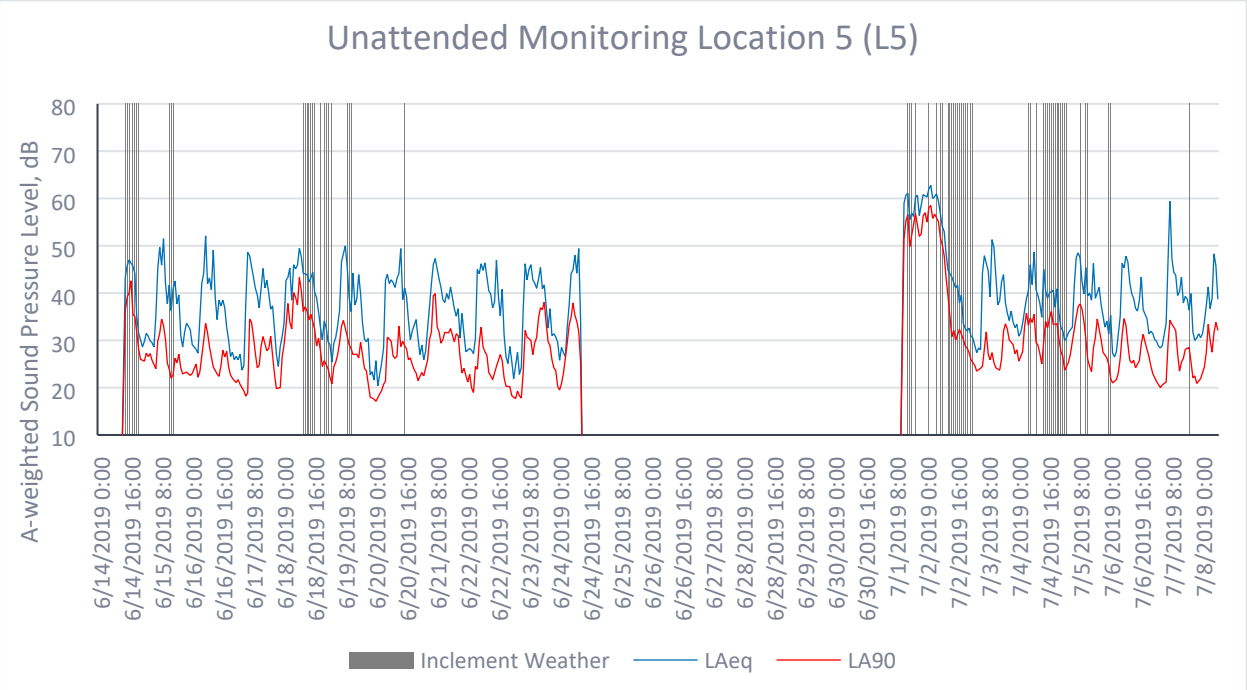


Figure 7: Baseline ambient noise levels – Location 6

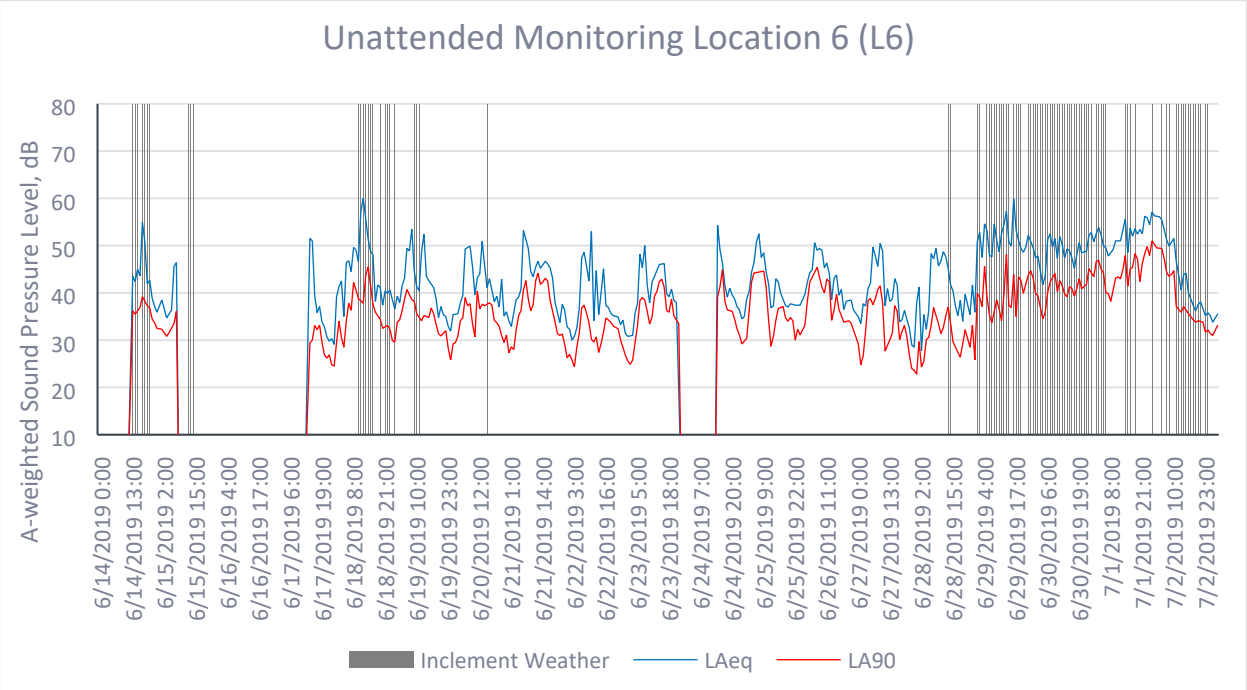
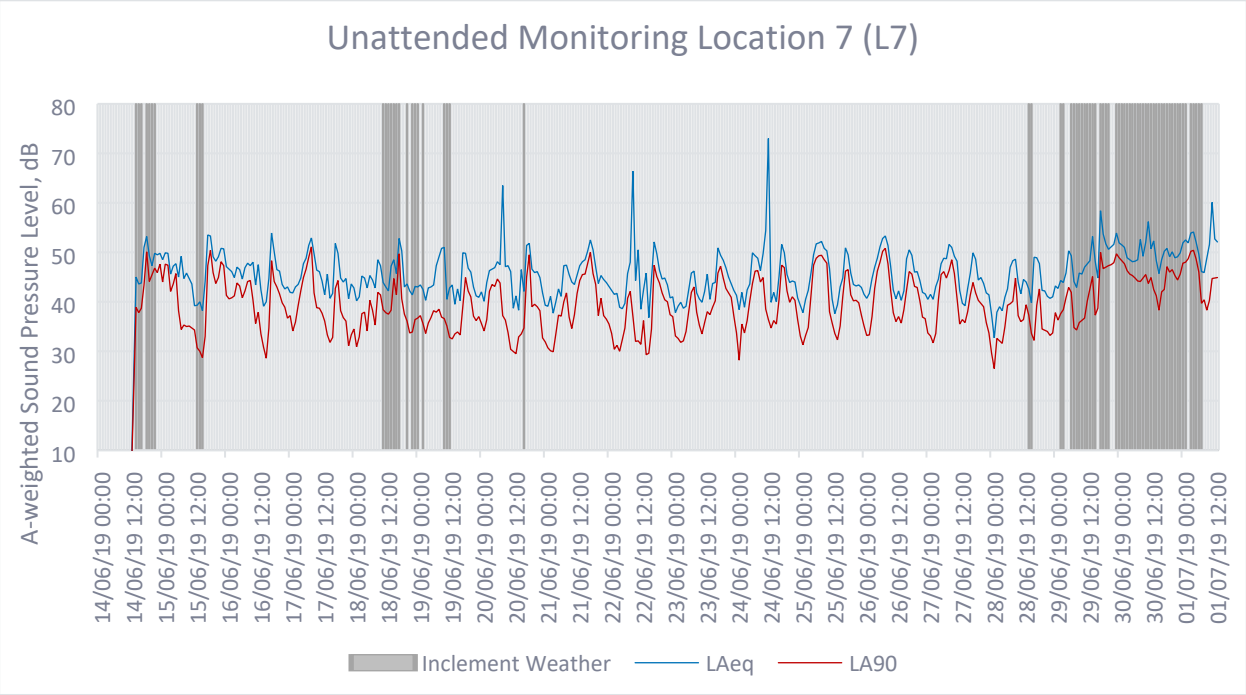


Figure 8: Baseline ambient noise levels – Location 7



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APPENDIX F BOXPLOTS – BASELINE AMBIENT NOISE LEVELS

Table 10: Typical range, maximum, minimum and period average – Average noise levels – Day period

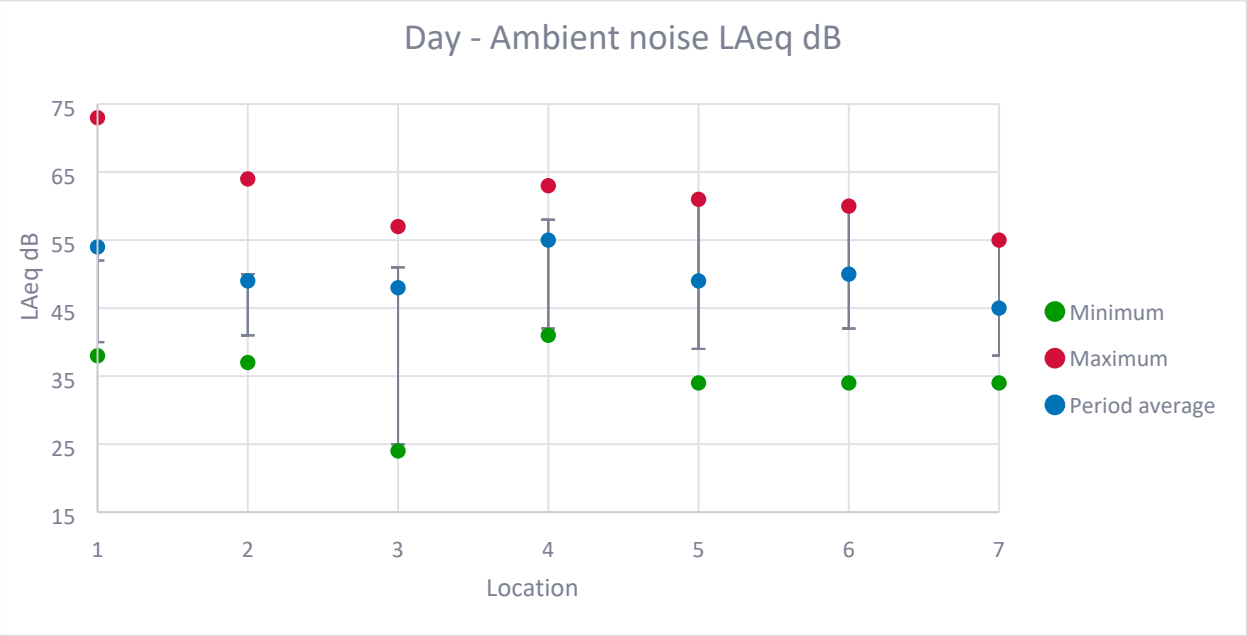


Table 11: Typical range, maximum, minimum and period average – Average noise levels – Evening period

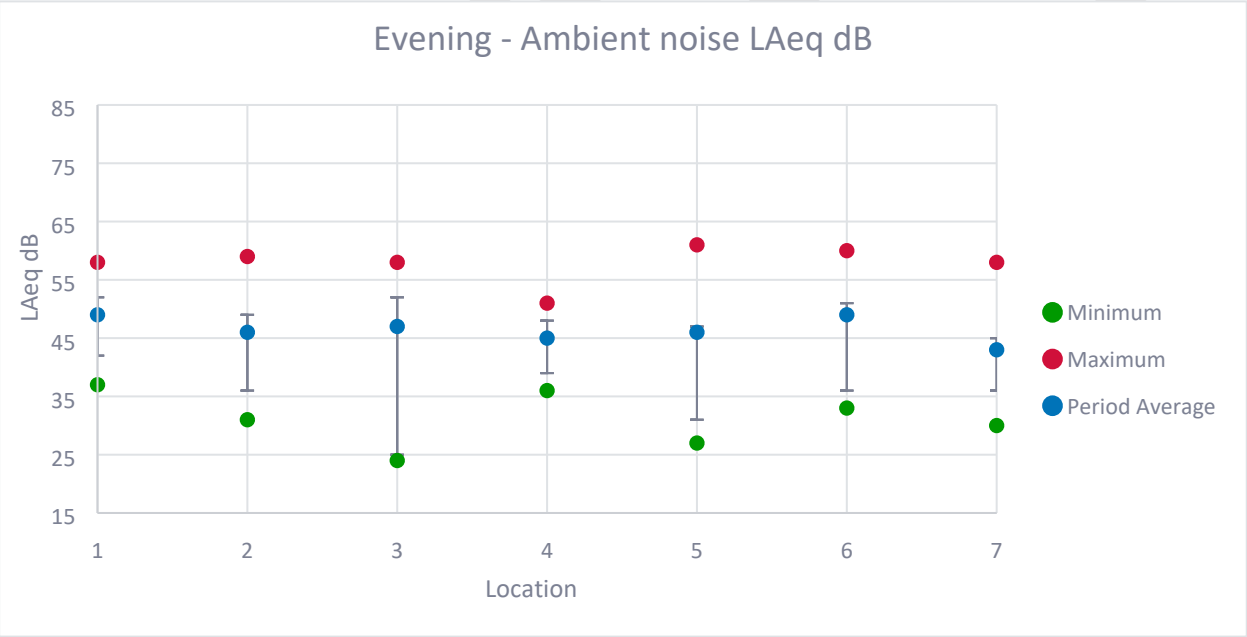


Table 12: Typical range, maximum, minimum and period average – Average noise levels – Night period

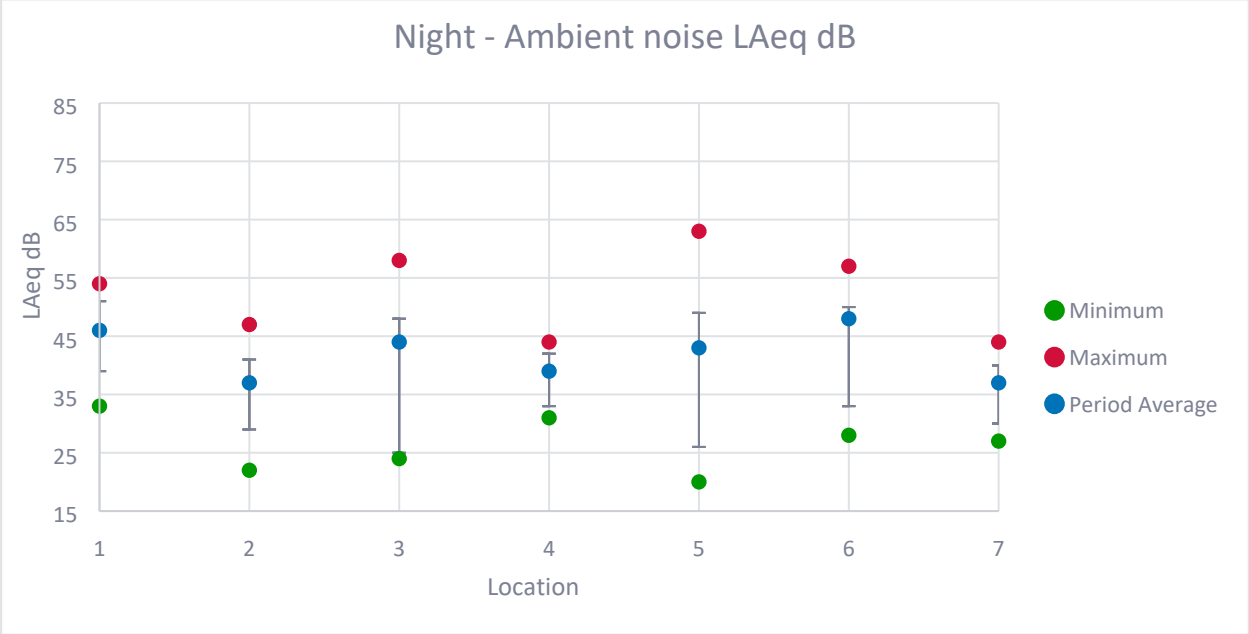


Table 13: Typical range, maximum, minimum and period average – Background noise levels – Day period

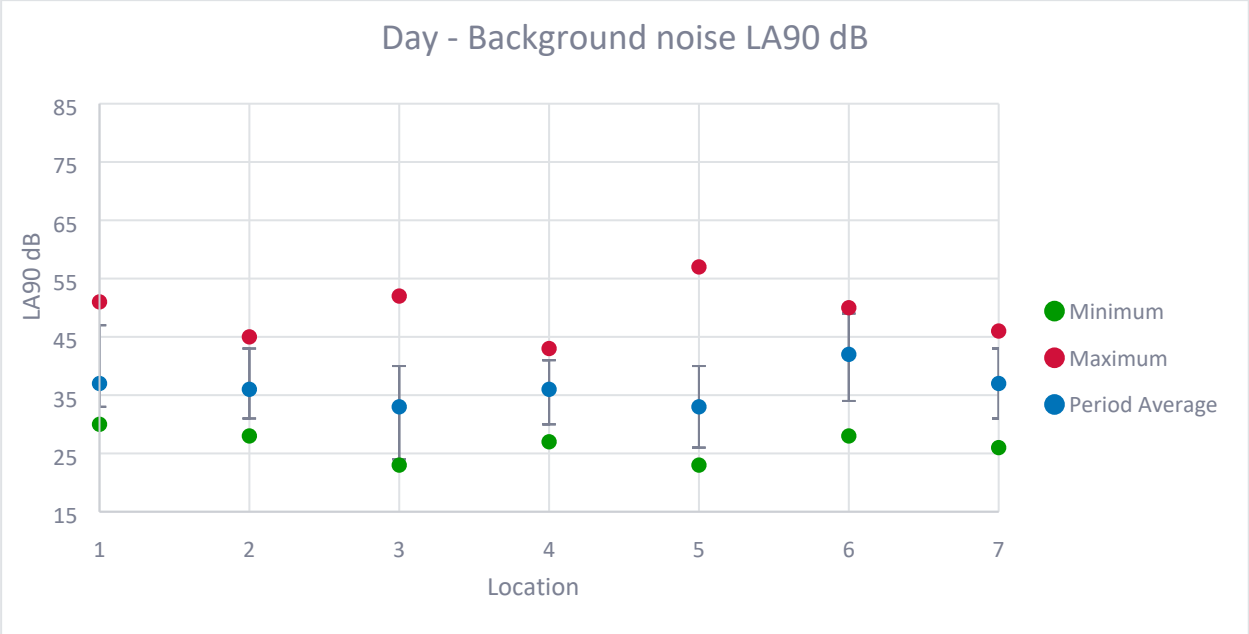


Table 14: Typical range, maximum, minimum and period average – Background noise levels – Evening period

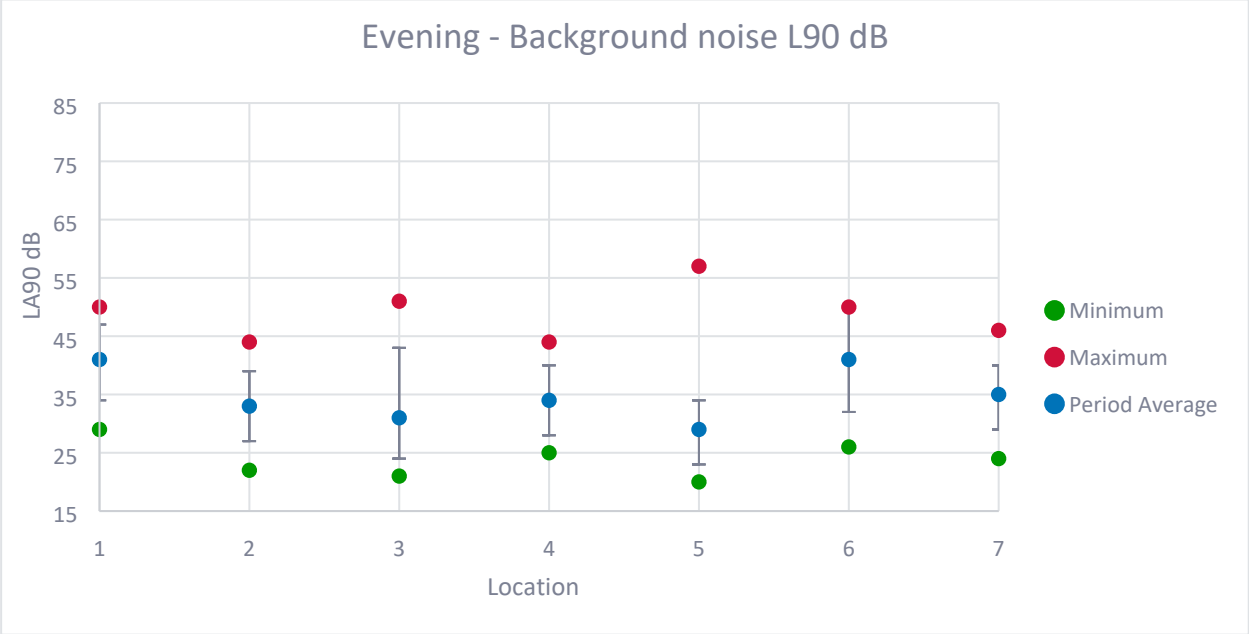
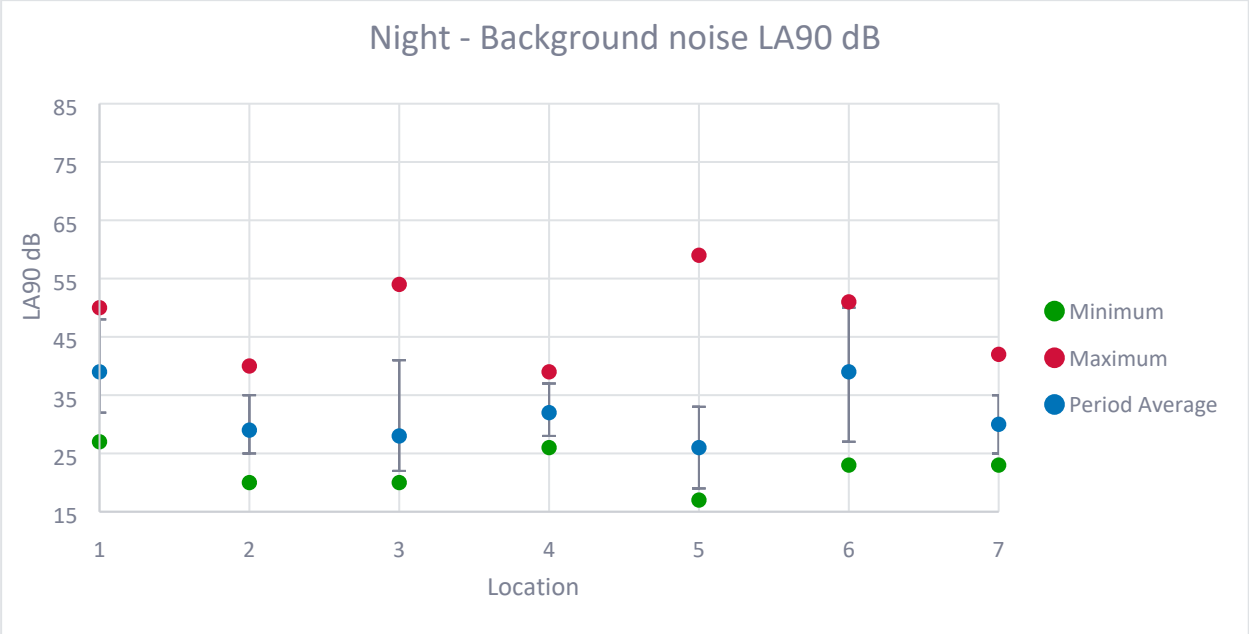


Table 15: Typical range, maximum, minimum and period average – Background noise levels – Night period



APPENDIX G ATTENDED NOISE MEASUREMENT DETAILS

Short-term attended measurements were conducted at each of the noise logging positions during the noise monitor placement. Measurements were undertaken using a Brüel and Kjær Type 2250 precision integrating sound level meter fitted with a windshield.

The microphone was mounted on a tripod at a height of approximately 1.5 m above local ground level under free-field conditions.

Measurements were obtained using the 'F' response time and A-weighting frequency network. The equipment was checked before and after the survey and no significant calibration drifts were observed.

Notes and measurement results are provided in Table 16.

Table 16: Ambient short-term noise measurement results summary,

Location	Time	Measured noise level		Noise sources contributing to local environment
		Ambient noise level L_{Aeq} dB	Background noise level L_{A90} dB	
L1	1015 – 1025 hrs	50	38	Birds (including crows), distant traffic, wind in trees and some infrequent frogs
L2	1046 – 1056 hrs	49	40	Birds, wind in trees, infrequent passing cars
L3	1119 – 1129 hrs	59	42	Infrequent passing cars on Sanders Road, distant traffic, occasional noise from cows in paddock to north across Sanders Road
L4	1151 – 1201 hrs	55	38	Wind in trees, birds, infrequent passing cars, very short period (<5s) of power tool usage in nearby dwelling
L5	1229 – 1239 hrs	53	36	Wind in trees, some clearing of burned timber at a nearby dwelling, farm work (including an excavator and truck) at a nearby dwelling, passing aircraft,
L6	1248 – 1258 hrs	44	33	Distant mechanical noise from an excavator (different to above) working at a dam at a nearby dwelling, birds, wind in trees.
L7	1324 – 1334 hrs	47	42	Wind in trees, infrequent passing traffic

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