

Appendix 5

Noise Impact Assessment

Prepared by Muller Acoustic
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(Total No. of pages including blank pages = 52)

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Noise Impact Assessment

Swan Ponds Quarry, Evans Plains, NSW.

Prepared for: R.W. Corkery & Co. Pty Limited
November 2017



Document Information

Noise Impact Assessment

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by R.W. Corkery & Co Pty Limited (RWC) on behalf of The Yarragrove Family Trust to complete a Noise Impact Assessment (NIA) to quantify potential noise emissions associated with Swan Ponds Quarry, Evans Plains NSW, located 9km southwest of Bathurst, NSW (the “Project”).

The Project is located Lot 241, DP 1185616, Evans Plains as shown in the Locality Plan presented in **Figure 1.1** (RWC, 2017). The Project includes the extraction of an average of 35,000 tonnes per annum (tpa) up to a maximum of 50,000 tonnes of weathered granite per annum.

The NIA was completed to quantify potential acoustic impacts associated with the operation of the project on the surrounding community and will accompany the Environmental Impact Statement (EIS) that is being prepared to assess the proposed development. The NIA has been prepared taking into consideration requirements outlined in the Secretary’s Environmental Noise Assessment Requirements (SEARs) (ref: EAR1053) issued by the NSW Department of Planning and Environment (2017) and in accordance with the following policies and guidelines:

- Environment Protection Authority (EPA) 2000, NSW Industrial Noise Policy (INP); and
- Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**. **Figure 1.2** (RWC, 2017) provides a Project Site layout and land zoning relevant to the Project.

1.1 SEARS Summary

Key conditions pertaining to noise raised by the NSW Environment Protection Authority and listed in the Requirements for the Proposed continuation and expansion of an existing quarry, Evans Plains, NSW are presented in **Table 1** along with the relevant section of the Noise Impact Assessment where they are addressed.

Table 1 Secretary's Environmental Assessment Requirements – 1053		
Noise - including a quantitative assessment potential:	Section addressed	Comment
Construction and operational noise and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW	Section 7	Note: No construction proposed for the project
Reasonable and feasible mitigation measures to minimise noise emissions: and	N/A	Compliance achieved without implementation of amelioration measures.
Monitoring and management measures	N/A	

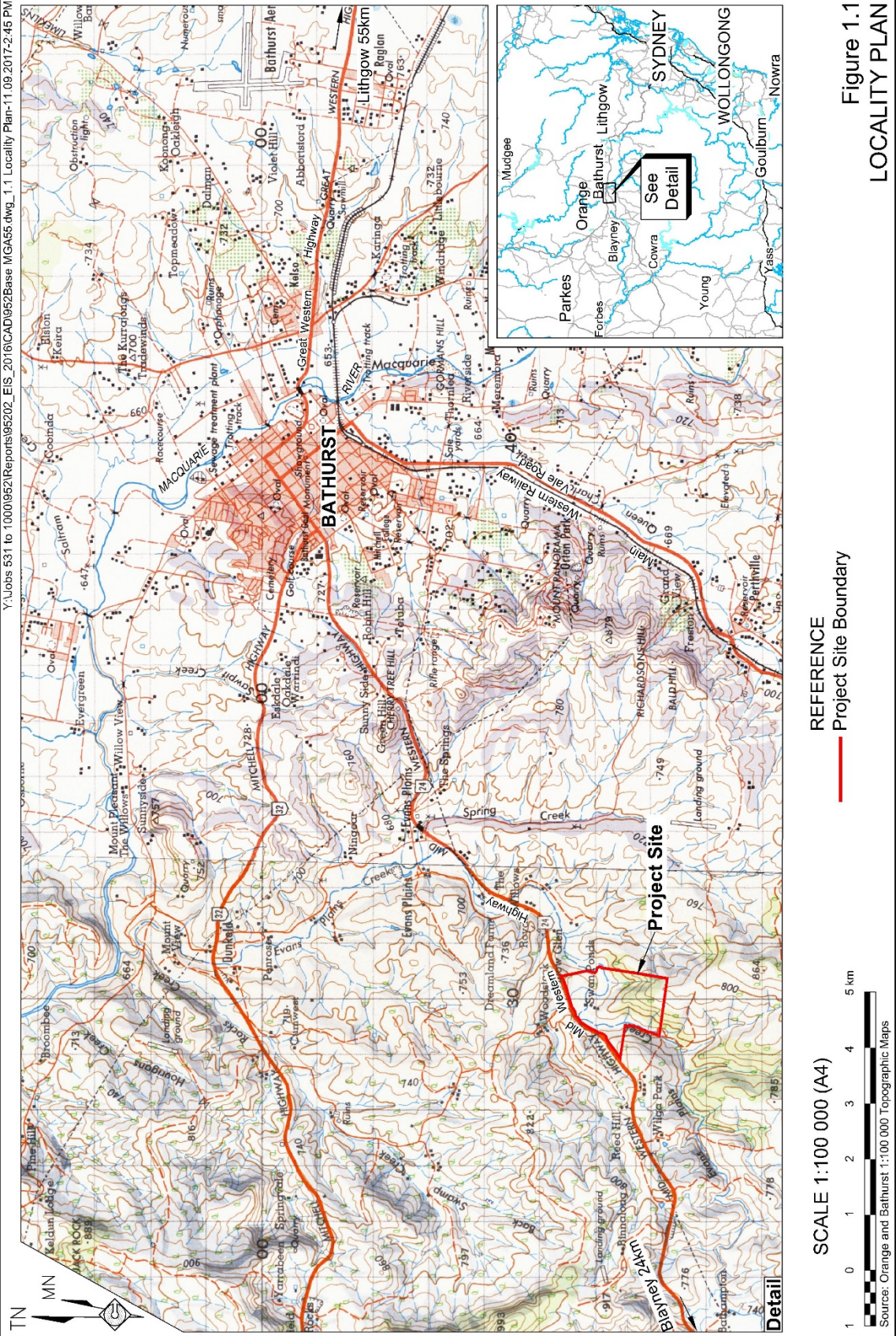


Figure 1.1
LOCALITY PLAN

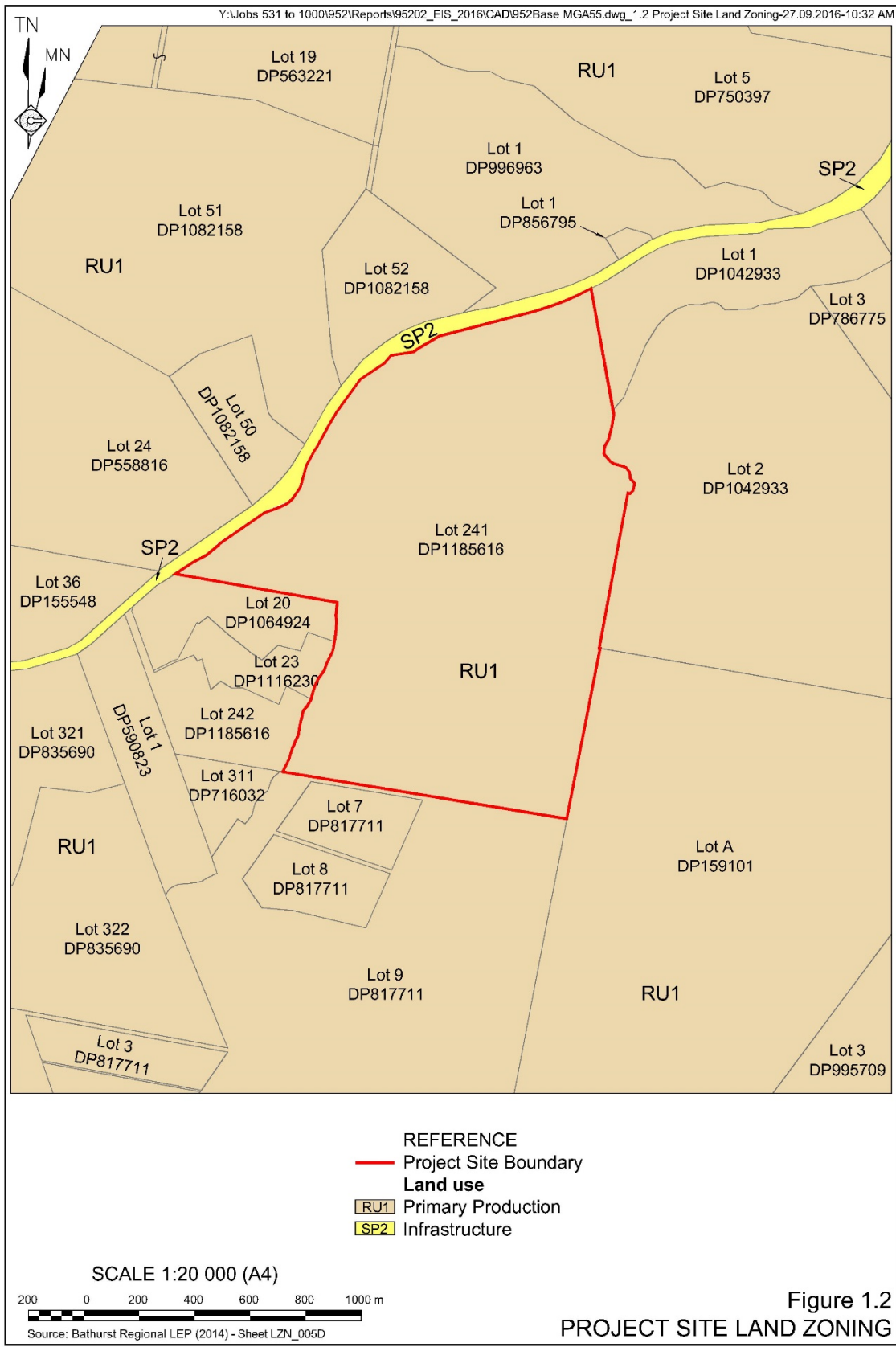


Figure 1.2
PROJECT SITE LAND ZONING

Figure Source : RWC Corkery & Co. Pty Limited.

1.2 Background

The Project will include the following activities:

- extraction of weathered granite from an enlarged Weathered Granite Extraction Area at an average rate of 35,000tpa, with a maximum extraction rate of 50,000tpa;
- processing of extracted weathered granite, including screening and washing;
- loading and transportation of extracted and stockpiled material from the Project Site via the Mid-Western Highway; and
- rehabilitation of the Project Site to achieve a final land use of nature conservation and/or agriculture.

Figure 2.1 (RWC, 2017) provides a Project Site layout identifying existing and proposed extraction areas.

1.3 Hours of Operation

Table 2 presents the proposed changes in operating hours for the Project. The proposed hours and combination of activities for the Project have formed the basis of the noise modelling scenarios for this assessment.

Table 2 Existing and Proposed Hours of Operation			
Operation	Monday to Friday ¹	Saturday ¹	Sunday
Extraction	7am to 5pm	8am to 12pm	N/A
Screening	7am to 5pm	8am to 12pm	N/A
Loading and Transportation	7am to 5pm	8am to 12pm	N/A
Rehabilitation	7am to 5pm	8am to 12pm	N/A

Note 1: Excludes public holidays which would operate as per the proposed hours of operation for Sunday

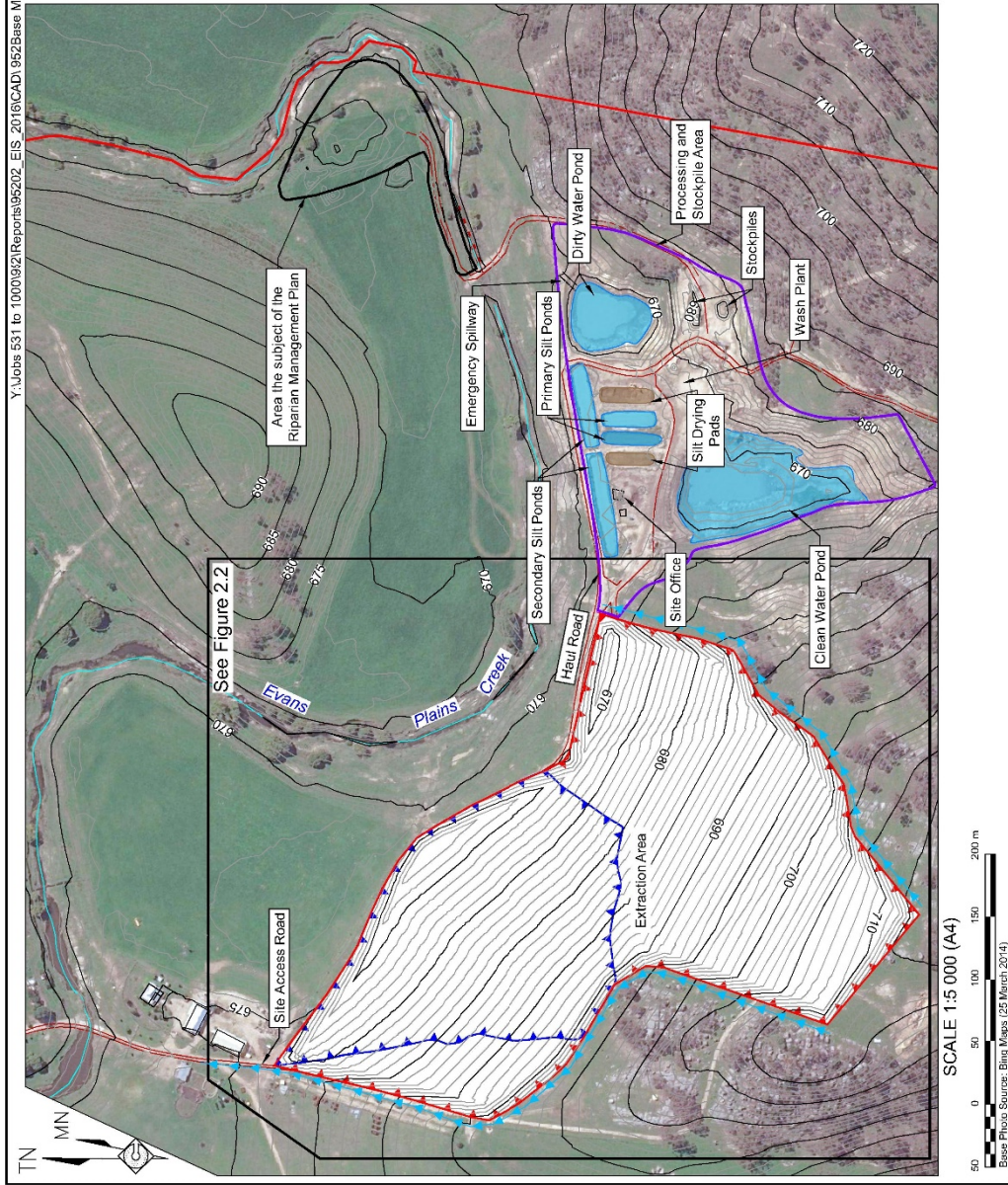


Figure 2.1
PROPOSED PROJECT
SITE LAYOUT

Figure Source : RWC Corkery & Co. Pty Limited.

2 Receiver Review

The Project is situated at Evans Plains, NSW. Receivers in the locality surrounding the Project Site are primarily rural residential. The receiver addresses and MGA(55) coordinates for the nearest affected receivers to the Project are summarised in **Table 3**.

Table 3 Residential Receiver Locations		
Receiver ID	Easting	Northing
R1	729719	6294774
R2	729612	6295092
R3	728997	6294345
R4	729210	6293658
R5	729176	6293499
R6	729110	6293355
R7	729176	6293035
R8	728952	6293042
R9	729585	6292908
R10	730665	6294954
R11	731318	6294902
R12	731456	6294500
R13	728491	6293348
R14	728680	6292585
R15	729124	6292000
R16	731813	6295398
R17	732164	6295019
R18	732281	6295387
R19	732192	6295821
R20	731913	6295913
R21	731469	6295889
R22	732556	6296385
R23	728141	6293658
R24	728060	6293265
R25	727582	6293024
R26	726963	6292676
R27	727119	6292490
R28	727670	6292134
R29	727664	6291519
R30	728858	6291348
R31	728894	6291488
R32	733316	6291622
R33	731620	6296996
R34	728279	6296711
R35	728257	6296952

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3 Noise Policy and Guidelines

The following section summarises relevant policy and guidelines pertinent to undertaking an industrial noise assessment. Key policies relevant to the Project include the INP and RNP. It is noted that since the commissioning of this project, the Noise Policy for Industry (NPI) (EPA, 2017) has been released which supersedes the INP. Notwithstanding, the EPA released notes titled 'Implementation and Transitional Arrangements for the Noise Policy for Industry' (EPA, 2017) which states the following (Point 2) with respect to transitioning between the INP and NPI:

'The Noise Policy for Industry (2017) will take effect immediately upon its release and should be referenced in relevant Secretary's Environmental Assessment Requirements (SEARs) for new industrial development issued after the policy release date. Where SEARs were issued before the release of the new policy, and have not been modified, the assessment requirements referenced in the SEARs will apply for a period of two (2) years from the date of issue of the SEARs consistent with the provisions in the Environmental Planning and Assessment Act 1979, Schedule 2, Part 2, 3 (7).'

Therefore, as this project has had SEARs issued prior to the release of the NPI, the INP has been adopted in full for this assessment.

3.1 Industrial Noise Policy

The EPA released the NSW INP in January 2000. The INP provides a process for establishing noise criteria for consents and licences enabling the EPA to regulate noise emissions from scheduled premises under the *Protection of the Environment Operations Act 1997*.

The specific policy objectives of the INP are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving Project specific noise levels;
- to promote uniform methods to predict, quantify and assess noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;

- to provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

3.1.1 Assessing Intrusiveness

The intrusiveness criterion essentially means that the equivalent continuous noise level (LA_{eq}) from the Project should not be more than 5dB above the existing rating background level (RBL) in any assessment period. Therefore, when assessing intrusiveness, the background noise needs to be measured. Where the RBL is less than 30dB(A), a value of 30dB(A) is used (as the RBL).

3.1.2 Assessing Amenity

The amenity assessment is based on noise criteria relevant to a specific land use or locality. The criteria relate only to limiting cumulative or combined levels of industrial noise in a locality. Where existing industrial noise approaches the criterion value, then noise levels from proposed industries need meet the amenity criteria so that cumulative noise or ‘industrial-creep’ is minimised. The amenity assessment methodology takes into consideration areas of high traffic noise when assessing ambient industrial noise.

Private residences and other sensitive receivers potentially affected by the Project are safeguarded by the EPA’s amenity categories as presented in Table 2.1 of the INP. Table 2.1 of the INP for residential receivers surrounding the Project is reproduced in **Table 4**.

Table 4 Receiver Locations – Assessing Amenity				
Type of Receiver	Indicative Noise Amenity Area	Period ¹	Recommended $LA_{eq(Period)}$	
			Noise Level, dB(A)	
			Acceptable	Recommended Max
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

Note 1: Monday – Saturday, Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

3.2 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in Section 5.

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4 Existing Environment

4.1 Background Noise Environment

4.1.1 Unattended Noise Monitoring

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at one representative location adjacent to the Project Site. The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, “Acoustics - Description and Measurement of Environmental Noise”.

The measurements were carried out using a Svantek Type 1, 977 noise analyser between Wednesday 11 October 2017 to Wednesday 18 October 2017. The monitoring location was situated to the northwest of the Project Site, approximately 150m from the Mid-Western Highway (MGA55 ref: 729959, 6294402).

Observations on site identified that the surrounding locality was typical of a rural environment, with wind, birds and traffic noise dominant. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed $\pm 0.5\text{dB(A)}$. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Chapter 4 of the INP. The results of long-term unattended noise monitoring are provided in **Table 5**. The noise monitoring charts for the background assessment are provided in **Appendix B**.

Table 5 Background Noise Monitoring Summary			
Logging Location	Period ¹	Measured Background	Measured LAeq,
		Noise Level (LA ₉₀), RBL, dB(A)	dB(A)
Unattended Logger	Day	43	56
	Evening	41	53
	Night	34	58

Note: Excludes periods of wind or rain affected data, meteorological data obtained from the Bureau of Meteorology Orange Airport AWS (33.3768°S 149.1263°E 945m AMSL).

Note 1: Monday – Saturday, Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

4.1.2 Attended Noise Monitoring

To gain a better understanding of the existing noise environment, MAC conducted attended noise monitoring at the unattended location during calm clear weather conditions. The purpose of the measurements was to ascertain dominant ambient noise sources and to quantify any existing industrial noise contribution.

The results of attended noise measurements and observations conducted on 11 October 2017 are summarised in **Table 6**.

Table 6 Operator-Attended Noise Survey Results, 11 October 2017					
Monitoring	Time	Primary Noise Descriptor (dB(A) re 20 µPa)			Description and SPL, dB(A)
Location	(hrs)	LA _{max}	LA _{eq}	LA ₉₀	
Ambient Noise Environment					
L1	10:37	78	52	42	Highway traffic 40 to 54
					Insects <38
					Birds <45
					No audible industrial noise sources were
					observed

5 Project Specific Noise Criteria

5.1 Operational Noise Criteria

The operational noise emission criteria for the Project have been set in accordance with Section 2 and Section 3 of the INP. The intrusiveness and amenity design criteria have been set, based on logging measurements conducted at a boundary location in close proximity and similar offset to the Mid-Western Highway to neighbouring receivers.

The Project Specific Noise Levels (PSNLs) (Project criteria) is the lower of the intrusive or amenity criteria. The background noise levels for setting the intrusiveness criteria have been determined in the absence of any noise from the Project Site. The existing LA_{eq} noise environment in the area surrounding the Project Site is dominated by traffic and rural noise sources. A review of transport noise in accordance with Section 2.2.3 of the INP identified that corrections to the amenity criteria to account for high traffic noise is not applicable, as levels are not more than 10dB above the recommended acceptable amenity levels.

The proposed operating hours of the Project are generally from 7am to 5pm (see **Table 1**). Therefore, this assessment has adopted a day criterion to quantify impacts from the Project. The PSNLs for the Project are presented in **Table 7**.

Table 7 Project Specific Noise Levels					
Receiver Location	Period	RBL	Intrusiveness Criteria LA _{eq(15minute)} , dB(A)	Amenity Criterion LA _{eq(period)} , dB(A)	PSNL, dB(A)
All Residential Receivers	Day	43	48	50	48

Note: Monday – Saturday, Daytime 7am to 6pm; Evening 6pm to 10pm; Night-time 10pm to 7am. On Sundays and Public Holidays, Daytime 8am to 6pm; Evening 6pm to 10pm; Night-time 10pm-8am.

5.2 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the NSW EPA's Road Noise Policy (RNP) (2011).

Therefore, in accordance with the RNP, this assessment has adopted the 'Freeway/arterial/sub-arterial road' category for the Mid-Western Highway. **Table 8** reproduces the road traffic noise assessment criteria reproduced from the RNP relevant for this road type.

Table 8 Road Traffic Noise Assessment Criteria for Residential Land Uses			
Road category	Type of Project/development	Assessment Criteria - dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial road	Existing residences affected by additional traffic on existing freeways/sub-arterial/roads generated by land use developments	60dB(A), LAeq(15hr)	55dB(A), LAeq(9hr)

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

5.2.1 Relative Increase Criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. Receivers experiencing increases in total traffic noise levels above those presented in **Table 9** due to the addition of quarry vehicles on the Mid-Western Highway should be considered for mitigation.

Table 9 Increase Criteria for Residential Land Uses			
Road Category	Type of Project/Development	Total Traffic Noise Level Increase, dB(A)	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic LAeq(15hr) +12dB (external)	Existing traffic LAeq(9hr) +12dB (external)

6 Noise Assessment Methodology

6.1 Operational Noise Modelling Methodology

A computer model was developed to determine the impact of Project noise emissions to neighbouring receivers for three worst case operational stages. Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts associated with the Project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process.

Additionally, the model uses relevant noise source data (measured on site at the quarry), ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic operating conditions for assessed scenarios.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'.

6.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the fixed plant and surrounding area, as derived from proposed Project Site plans and the surrounding land base topography, superimposed on each other. Where relevant, modifying factors in accordance with Section 4 of the INP have been applied to calculations.

6.2.1 Meteorological Analysis

Noise emissions from industry can be significantly affected by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source. As the strength of the wind increases, the noise produced by the wind will mask the audibility of most industrial sources.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for the potential for enhancements, the INP specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is considered to be a feature wind and predictions must incorporate these conditions.

The NSW INP Section 5.3 Wind Effects states:

‘Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season.’

To determine the prevailing conditions for the Project, weather data during the period January 2015 to June 2017 was obtained from the Bureau of Meteorology’s (BOM) Bathurst Airport weather station located approximately 17km north east of the Project Site. The data was analysed using the EPA’s Noise Enhancement Wind Analysis (NEWA) program in order to determine the frequency of occurrence of winds speeds up to 3m/s in each seasonal period.

Table 10 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season for each assessment period. The results of the detailed analysis of meteorological data is presented in **Appendix C**.

Table 10 Seasonal Frequency of Occurrence Wind Speed Intervals			
Season	Period ¹	Wind Direction ±(45°)	% Wind Speeds (m/s)
			0.5 to 3 m/s
Summer	Day	135	13
Autumn	Day	67.5	18
Winter	Day	67.5	19
Spring	Day	135	14

Based on the results of this analysis, wind speeds and direction are excluded from the assessment. The relevant meteorological conditions adopted in the noise modelling assessment are summarised in **Table 11**.

Table 11 Modelled Site Specific Meteorological Parameters

Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Daytime ¹ - Calm	20°C	n/a	60%	n/a

Note 1: Day 7am to 6pm.

6.2.2 Operational Noise Modelling Scenarios

Three modelling scenarios were adopted in this assessment to represent typical operational noise emissions from the Project. The scenarios are summarised below and graphically presented in

Appendix D:

- Scenario 1: Operational Scenario (existing) - The current granite extraction operations within the western region of the quarry. This scenario was completed as a calibration scenario for the Project;
- Scenario 2: Operational Scenario (future) - The proposed granite proposed extraction operations within the southwestern region of the quarry.

6.3 Sound Power Levels

Mobile plant noise emission data used in modelling for this assessment were obtained from measurements conducted at the Project Site or the MAC database. The noise emission levels used in modelling are summarised in **Table 12**. Modelled plant items for each scenario are shown in the noise modelling scenarios presented in **Appendix D**.

Table 12 Single Octave Equipment Sound Power Levels, $LA_{eq(15min)}$

Noise Source/Item	Octave Band Centre Frequency, Hz								Total, dB(A)
	63	125	250	500	1000	2000	4000	8000	
Dozer	86	106	100	104	106	108	102	93	113
Excavator	80	91	92	97	98	95	87	79	103
Front End Loader (x2)	88	87	84	92	95	94	88	77	100
Screening Plant	78	89	95	97	103	101	94	88	107
Water Cart	81	82	89	91	95	97	89	81	101
Road Truck	89	95	90	89	93	97	92	85	102
Haul Truck	93	101	101	111	113	110	102	91	117

6.4 Road Noise Assessment Methodology

Extracted material would be transported from the Project Site using truck and dog size trucks or smaller. Once loaded within the Processing and Stockpile Area, trucks would exit the Project Site via the Site Access Road and existing intersection with the Mid-Western Highway. All heavy vehicle traffic would continue to access the Project Site from the southwest towards Orange and Blayney, or northeast to Bathurst via the Mid-Western Highway.

The United States (US) Environment Protection Agency's road traffic calculation method was used to predict the LAeq noise levels from Project-related trucks travelling past existing receivers on Mid-Western Highway. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

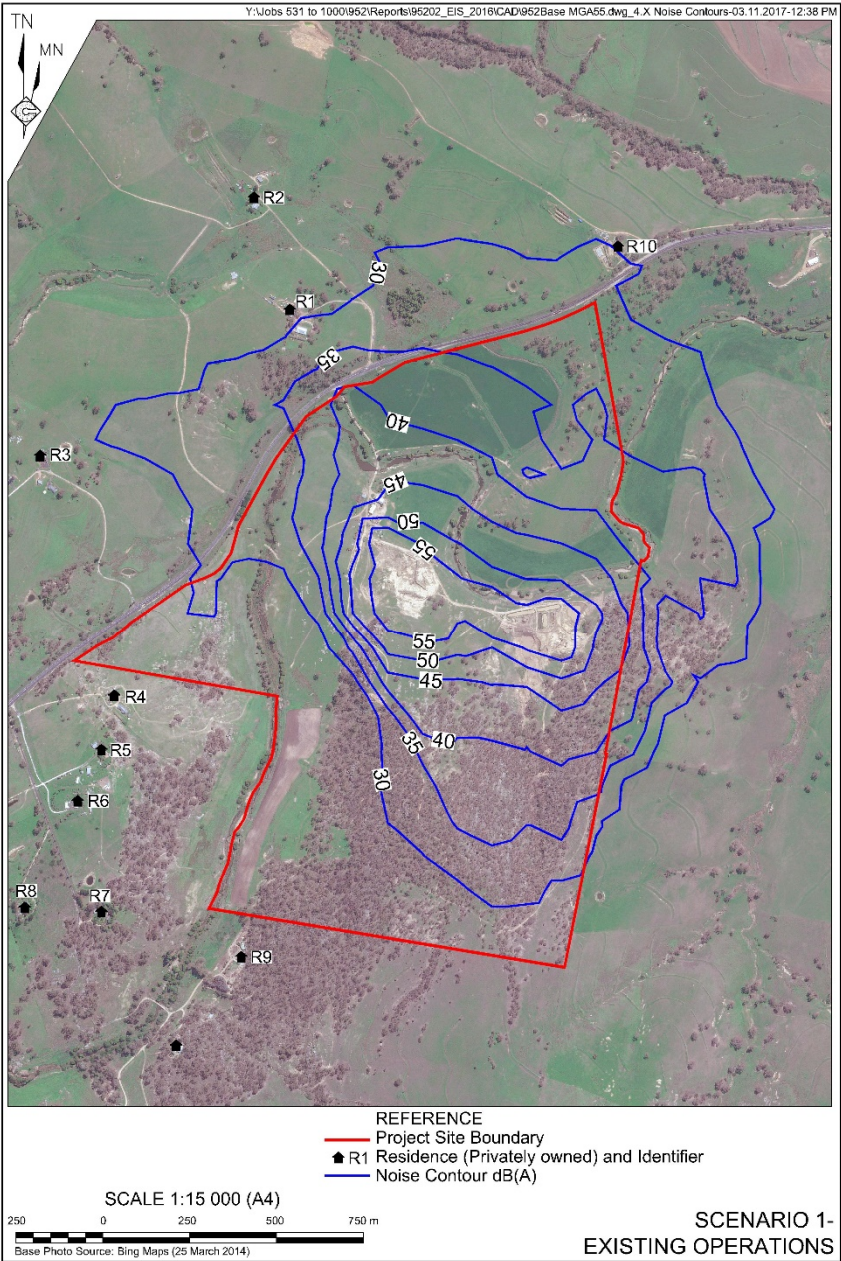
Project trucks would transport 28t of product per load, and the maximum number of vehicle movements for the Project would be approximately 40 per day.

The closest offset distance to receivers along Mid-Western Highway are situated approximately 15m from the centreline and have been adopted as the nearest offset distance to product truck movements along the public road network.

7 Noise Modelling Results and Discussion

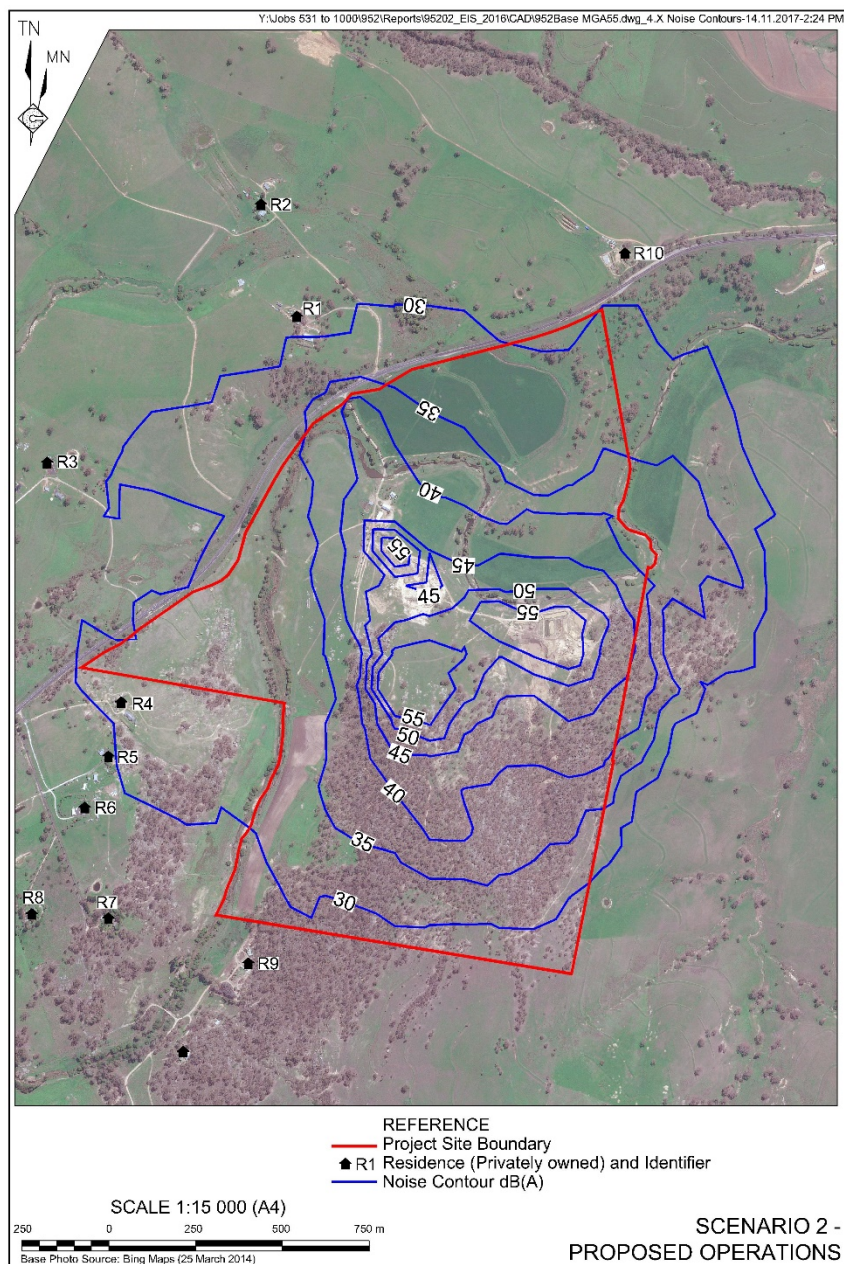
7.1 Scenario 1 - Operational Scenario (existing)

Predicted noise levels for Scenario 1 are provided in **Figure 7.1** and tabulated noise results are shown in **Appendix E**. The results of the model show that noise emissions from operations satisfy relevant criteria at all assessed receivers.



7.2 Scenario 2: Operational Scenario (future)

Predicted noise levels for Scenario 2 are provided in **Figure 7.2** and tabulated noise results are shown in **Appendix E**. The results of the model show that noise emissions from operations satisfy relevant criteria at all assessed receivers.



The results of the traffic noise calculations are presented in **Table 13** for receivers at the nearest offset distance of 15m which is the closest offset distance of residential dwellings situated adjacent to the Mid-Western Highway. Results demonstrate that existing traffic noise levels are below current road noise criteria, and that Project related noise levels assuming a maximum of 40 truck movements in any one day would remain below relevant criteria and not increase existing road traffic noise levels by more than 2dB(A).

Table 13 Operational Road Traffic Noise Levels					
Distance to Nearest Receiver (m)	Assessment Criteria	Existing Traffic	Future Project Traffic Noise	Existing + Future Project Combined	Total Change
Day ¹ LA _{eq(15hr)} , dB(A)					
15	60	62 ²	45.0	62.0	Nil

Note 1: Day 7am to 10pm.

Note 2: Based on measured data from L1 and corrected to take into account the additional offset distance to Mid-Western Highway.

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8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Noise Impact Assessment (NIA) of potential impacts from the continuation of operations at Swan Ponds Quarry, Evans Plains NSW. The assessment has quantified potential noise emissions including extraction and dispatch of product via road trucks associated with future operations from the Project Site.

The results of the NIA demonstrate that operational noise levels comply with the relevant INP criteria for all assessment periods at all privately owned non-project related receivers.

Additionally, the NIA demonstrates that the road noise criteria as specified in the RNP will be satisfied at receiver distances of greater than 15m and Project related vehicles will not increase existing road noise levels by more than 2dB.

Based on the NIA results, there are no noise related issues which would prevent the approval of the Project. The results of the assessment show compliance with the relevant operational and road noise criteria. Additionally, the results of the assessment demonstrate compliance with the relative EPA and DECCW policies, without ameliorative measures being required.

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Appendix A – Glossary of Terms

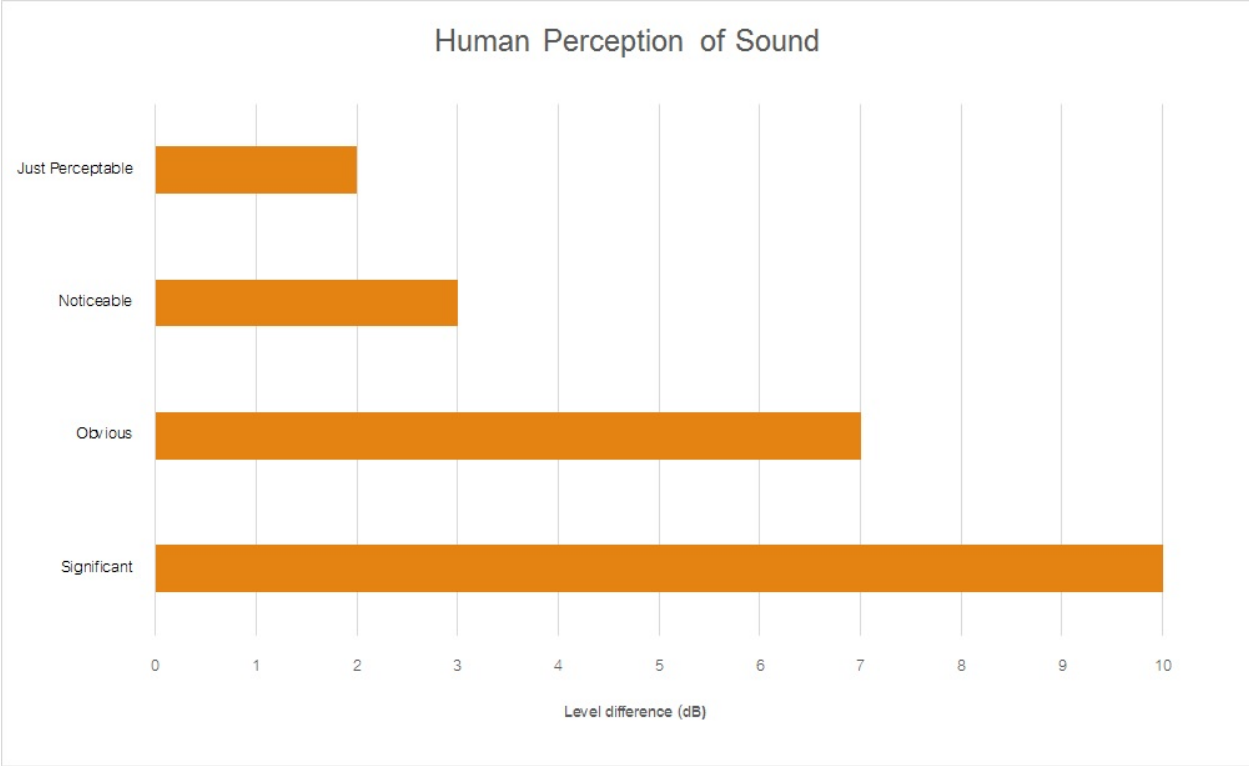
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. In some cases the overall change in noise level is described in dB rather than dB(A), or dB(Z) which relates to the weighted scale.
dB(Z)	Linear Z-weighted decibels.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA ₁₀	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA ₉₀	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LA _{eq}	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LA _{max}	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dB(A)	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

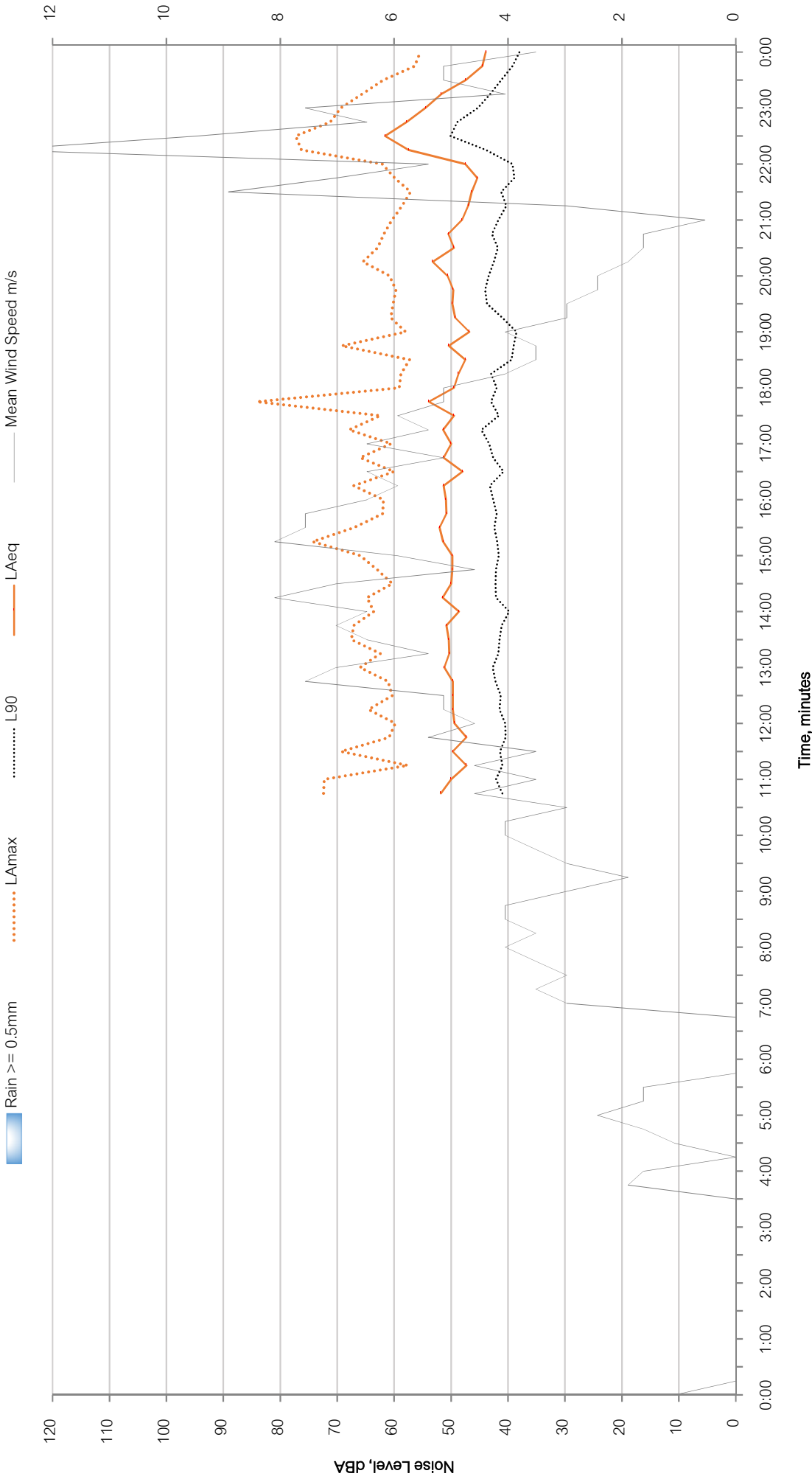
Figure A1 – Human Perception of Sound



Appendix B – Noise Monitoring Charts

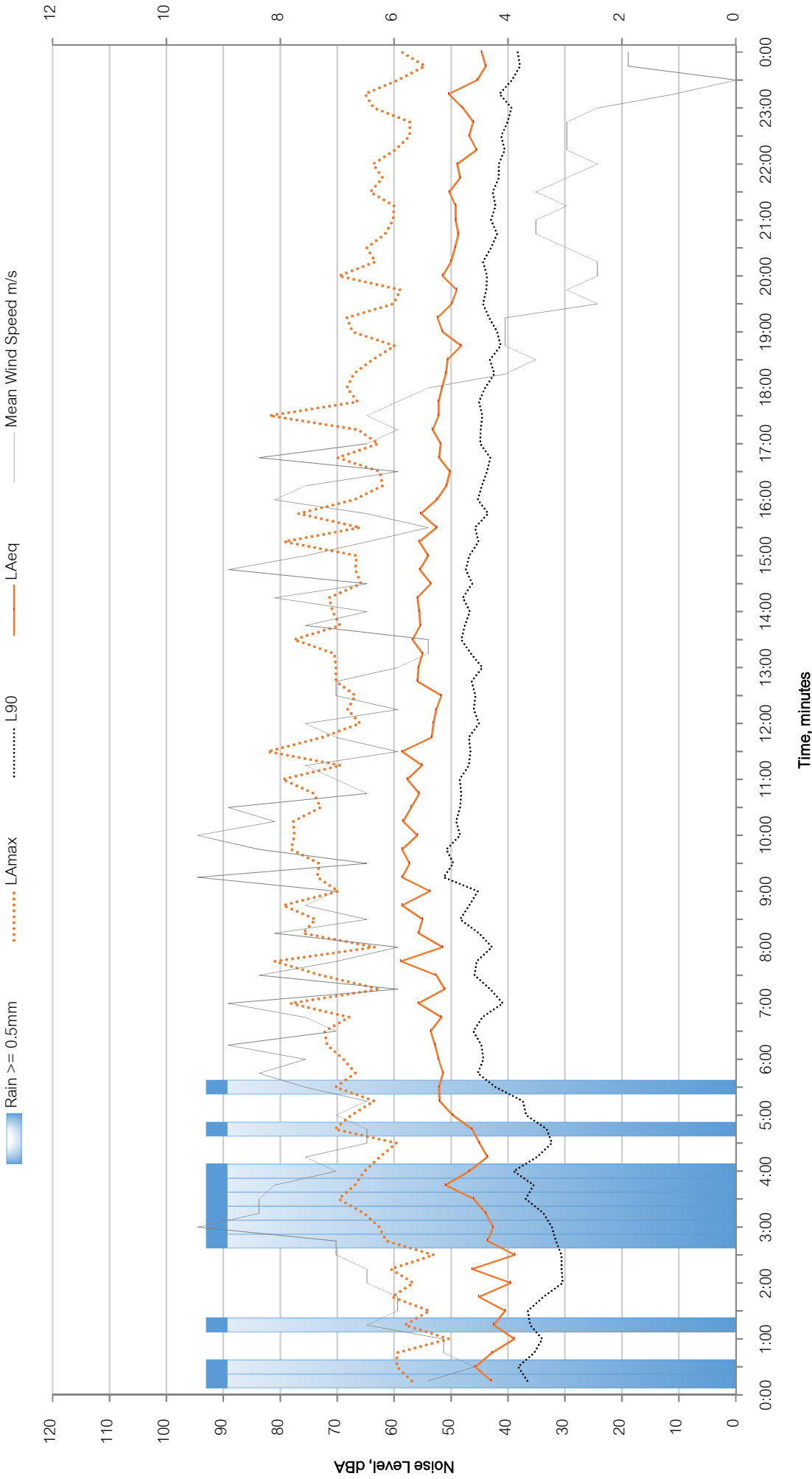
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Wednesday 11 October 2017



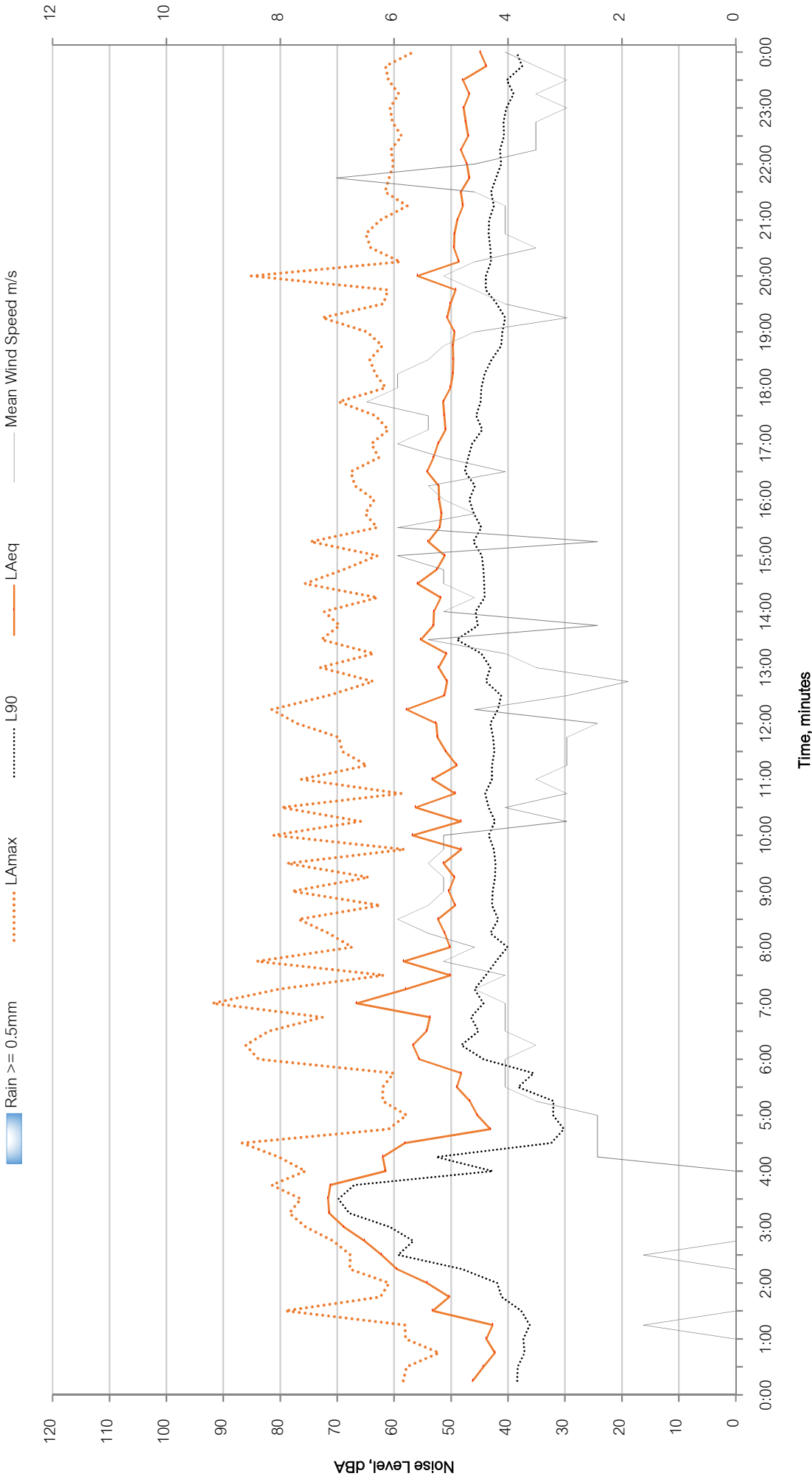
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Thursday 12 October 2017



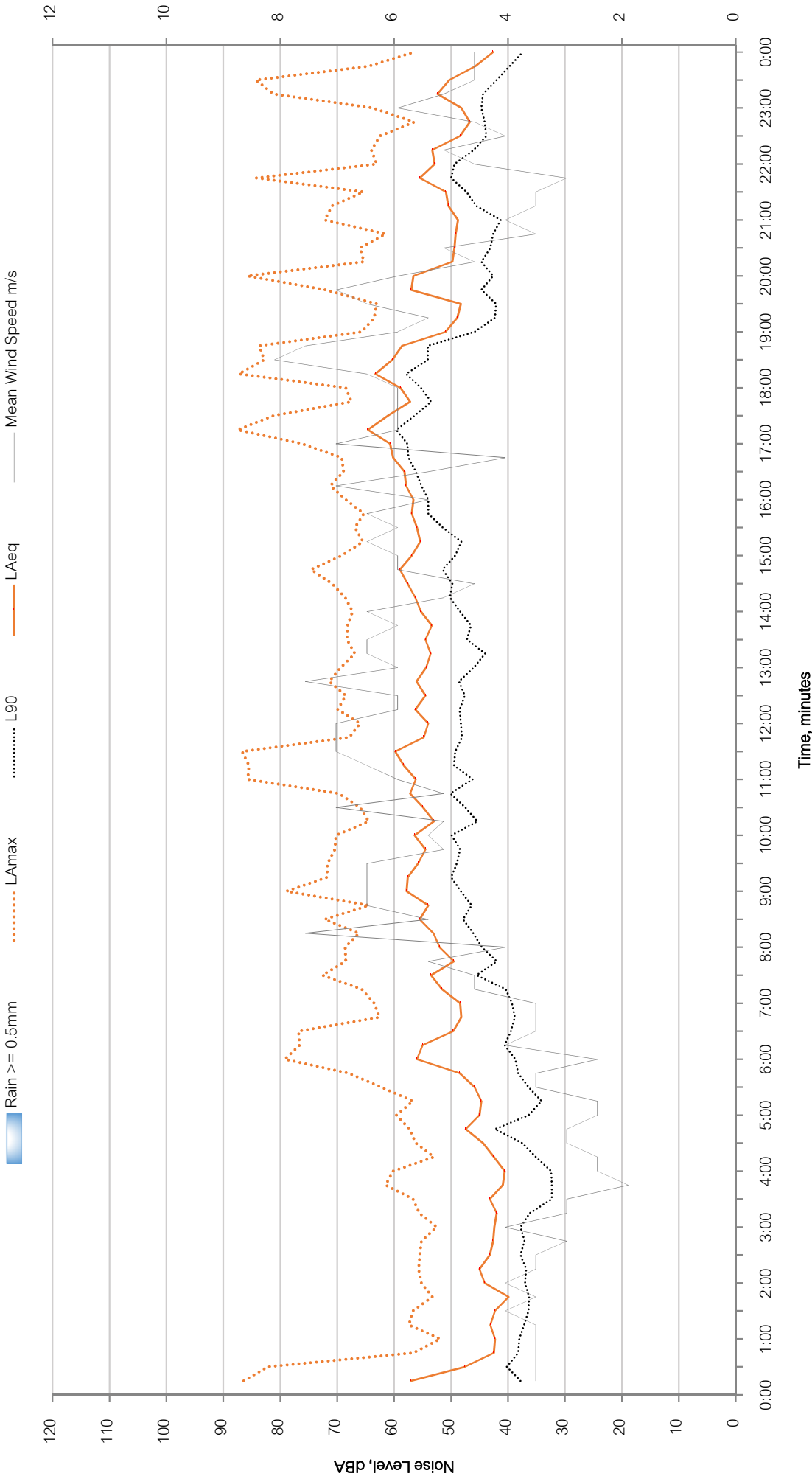
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Friday 13 October 2017



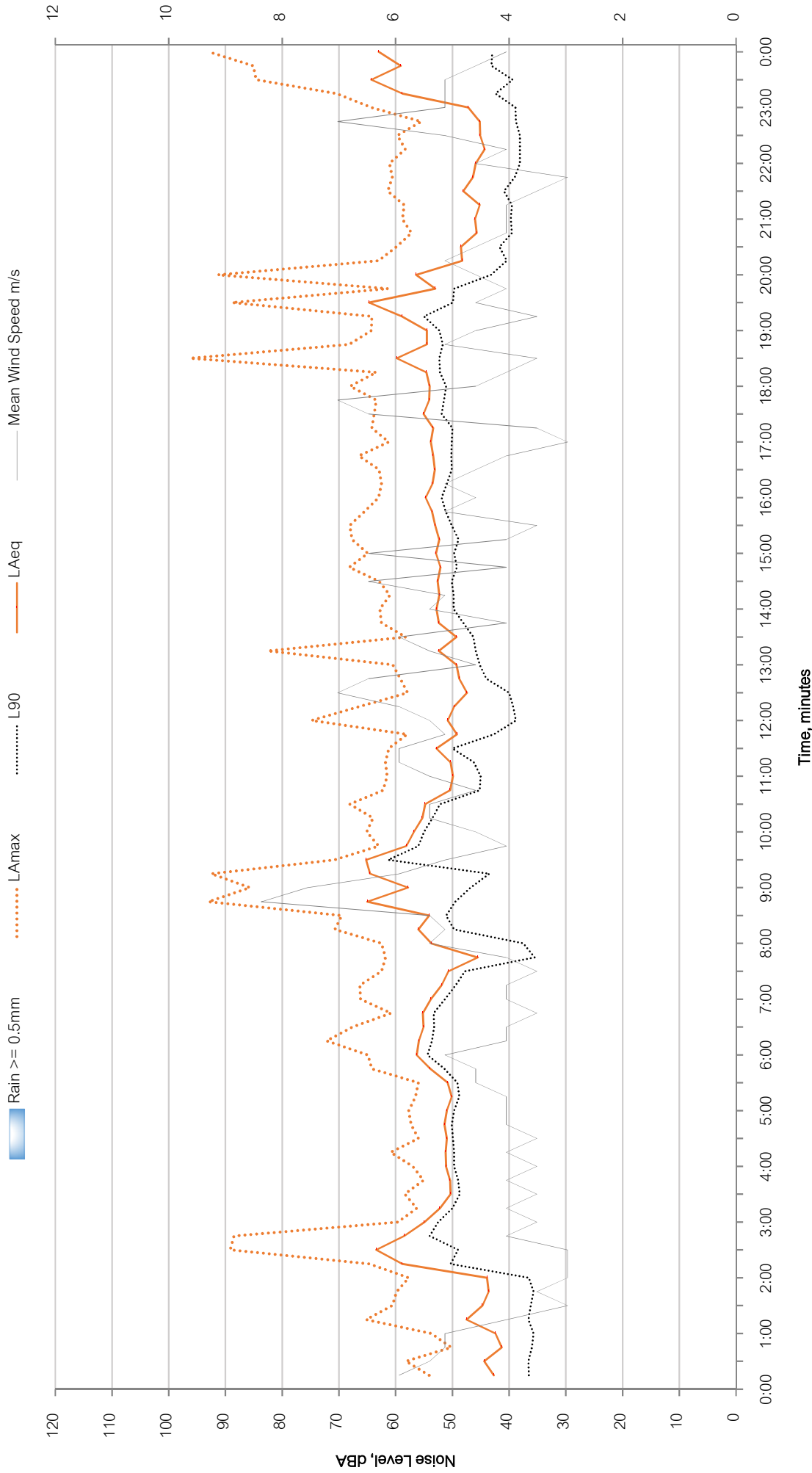
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Saturday 14 October 2017



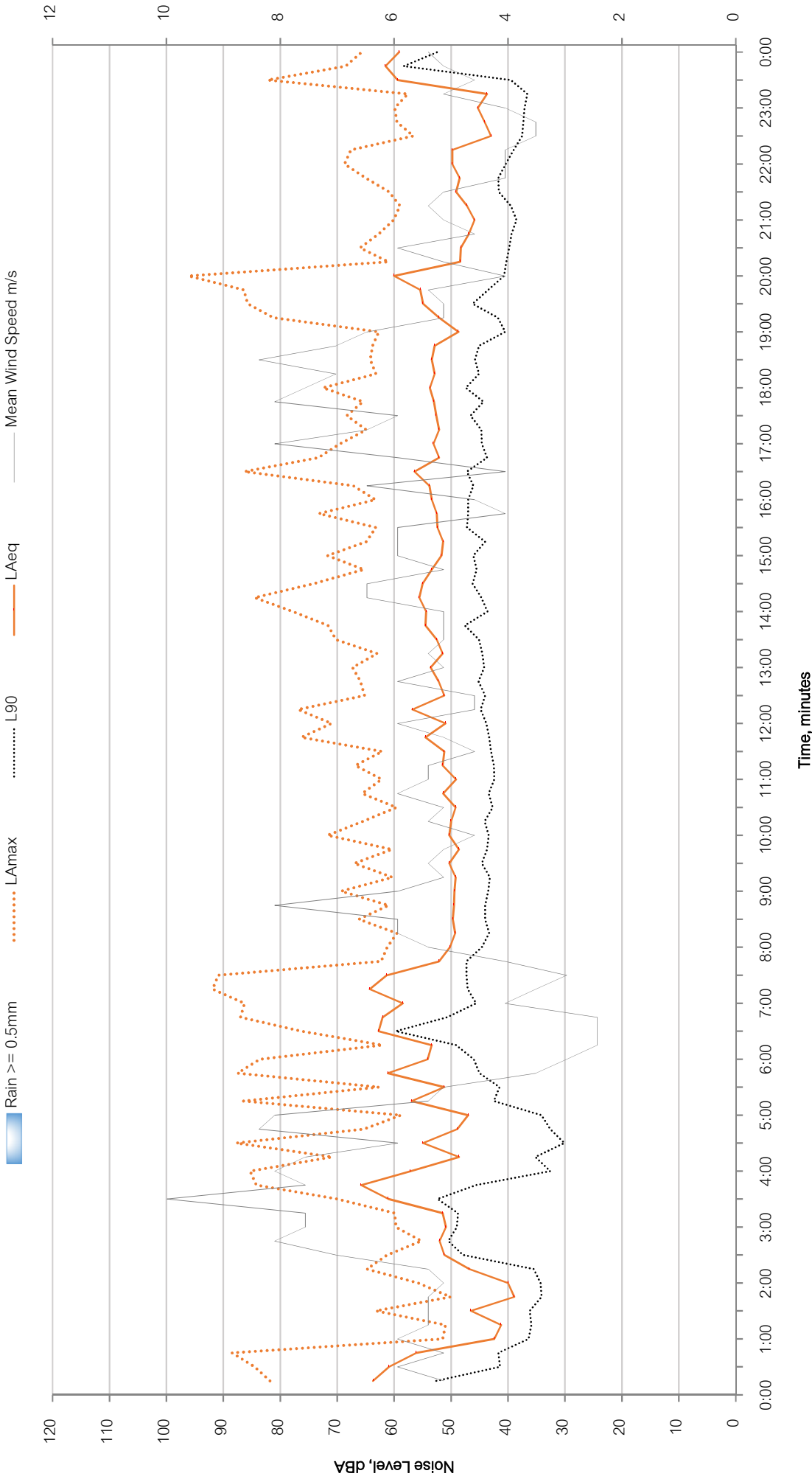
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Sunday 15 October 2017



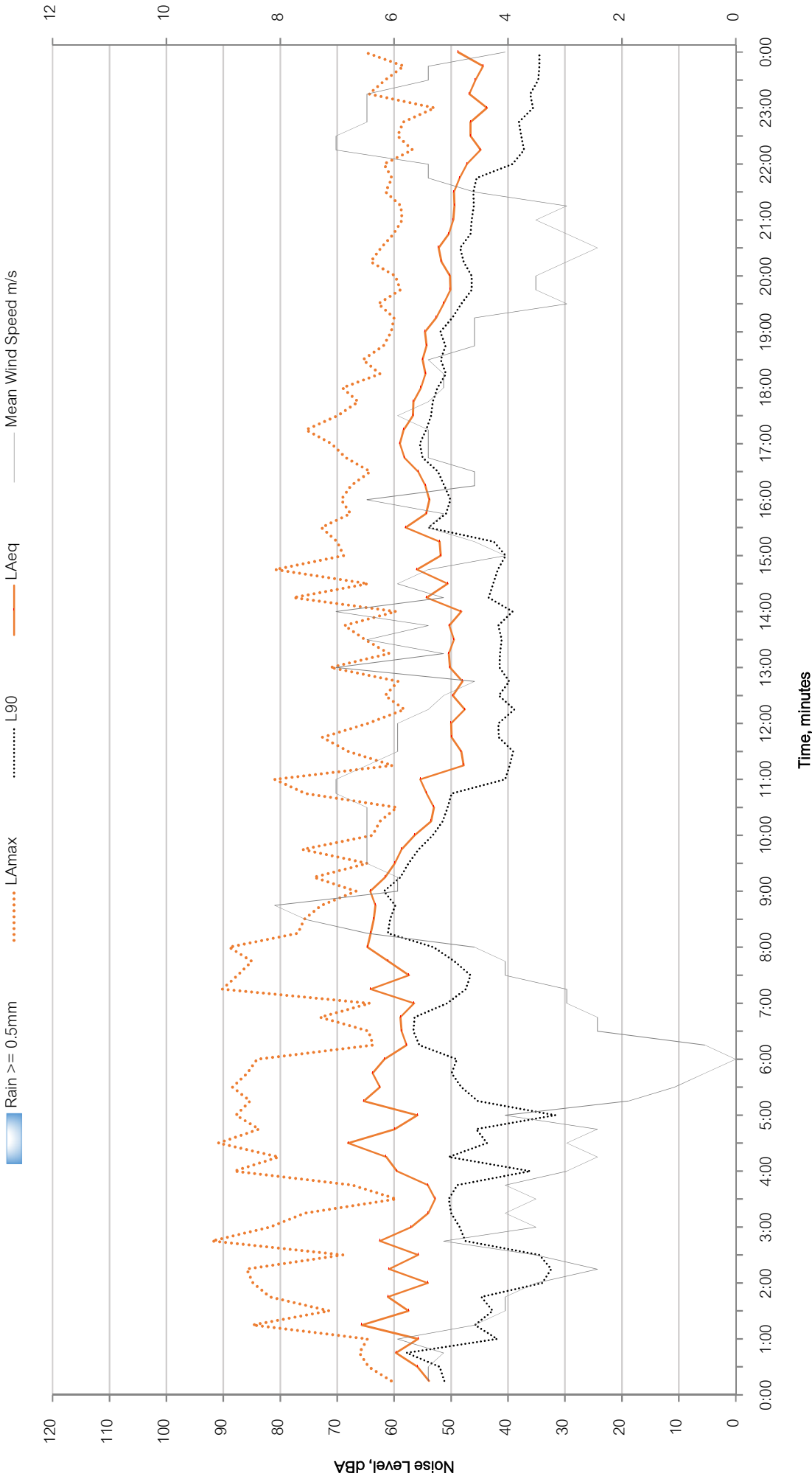
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Monday 16 October 2017



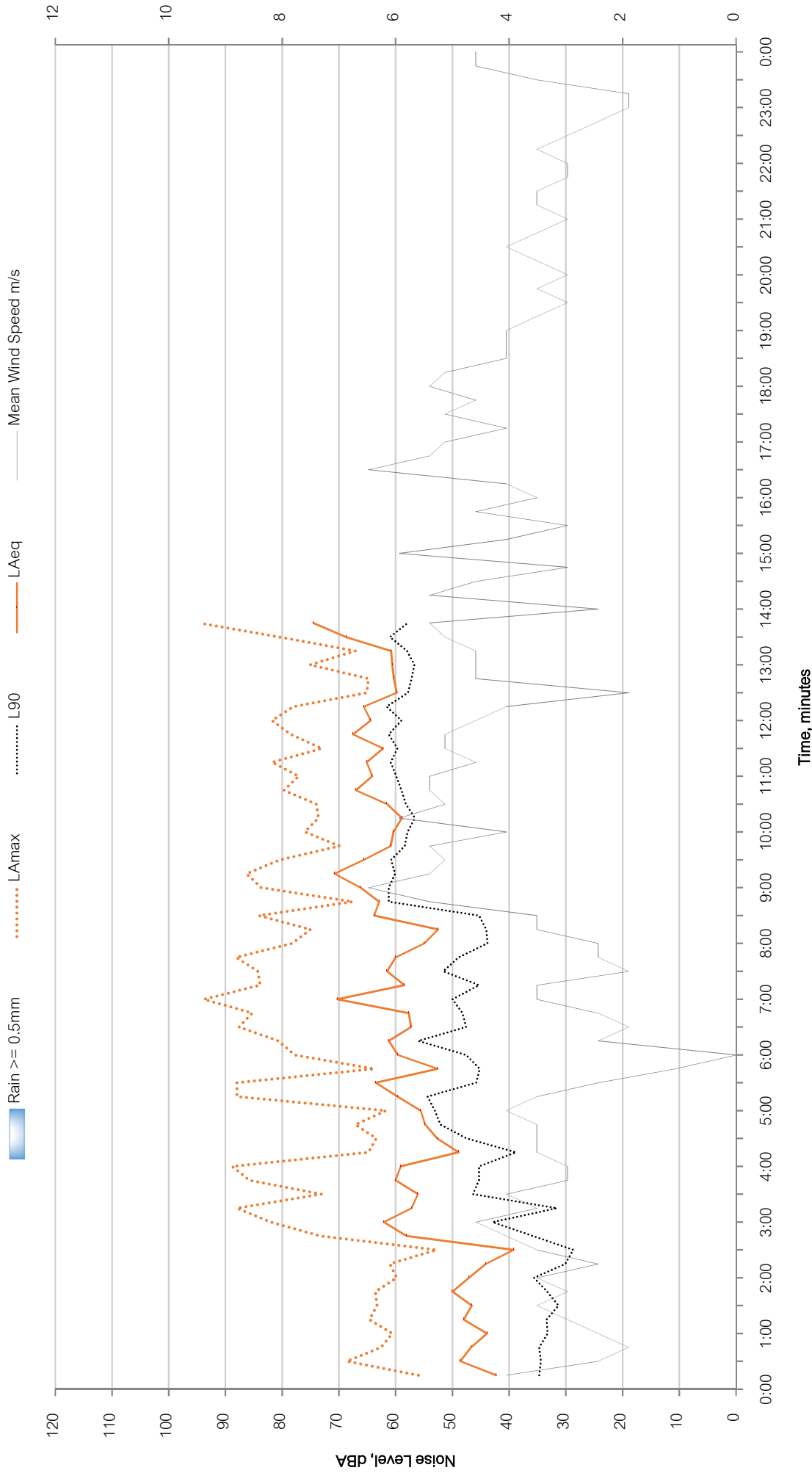
Background Noise Levels

Logger 1 - Swan Ponds Quarry - Tuesday 17 October 2017



Background Noise Levels

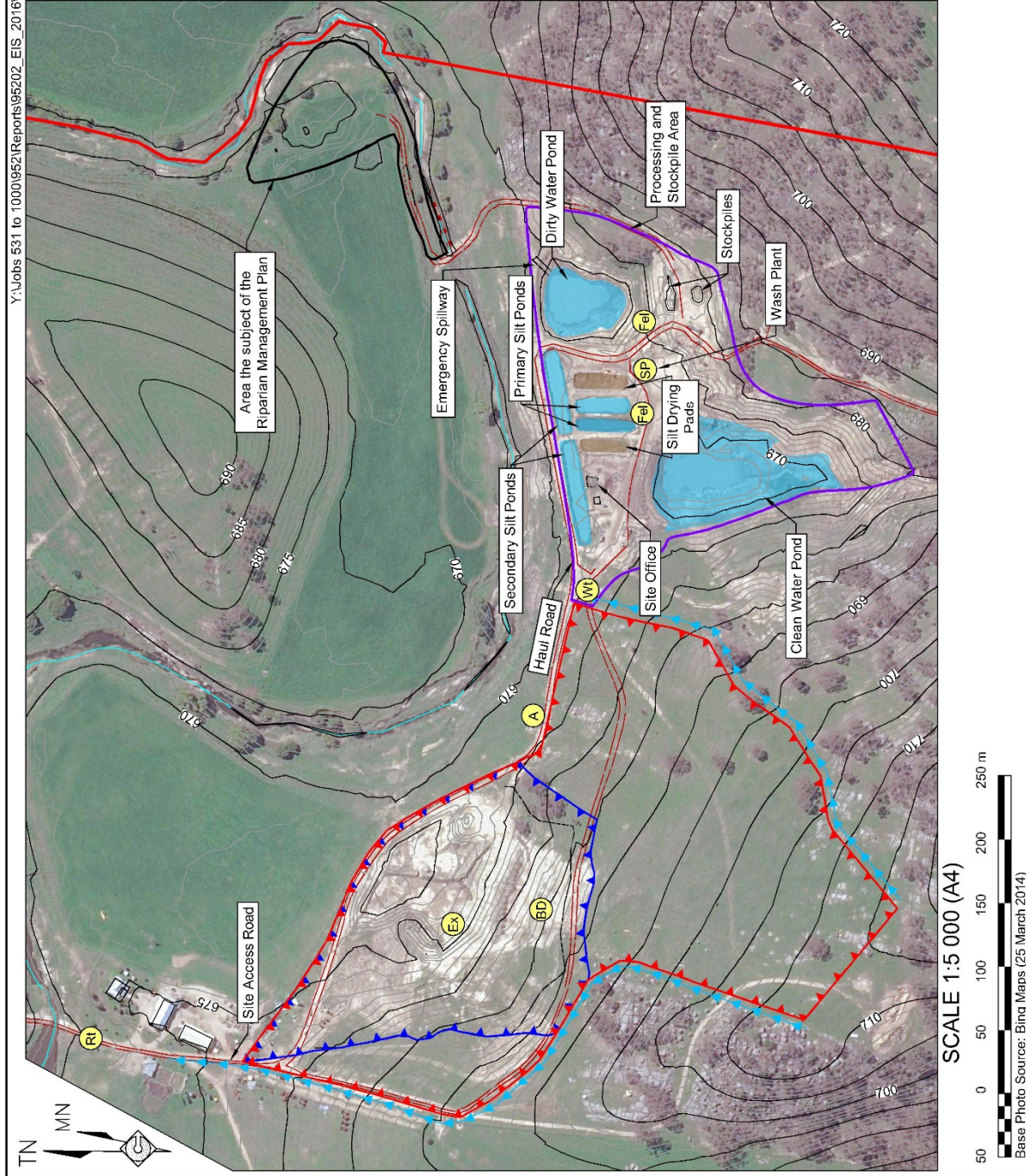
Logger 1 - Swan Ponds Quarry - Wednesday 18 October 2017

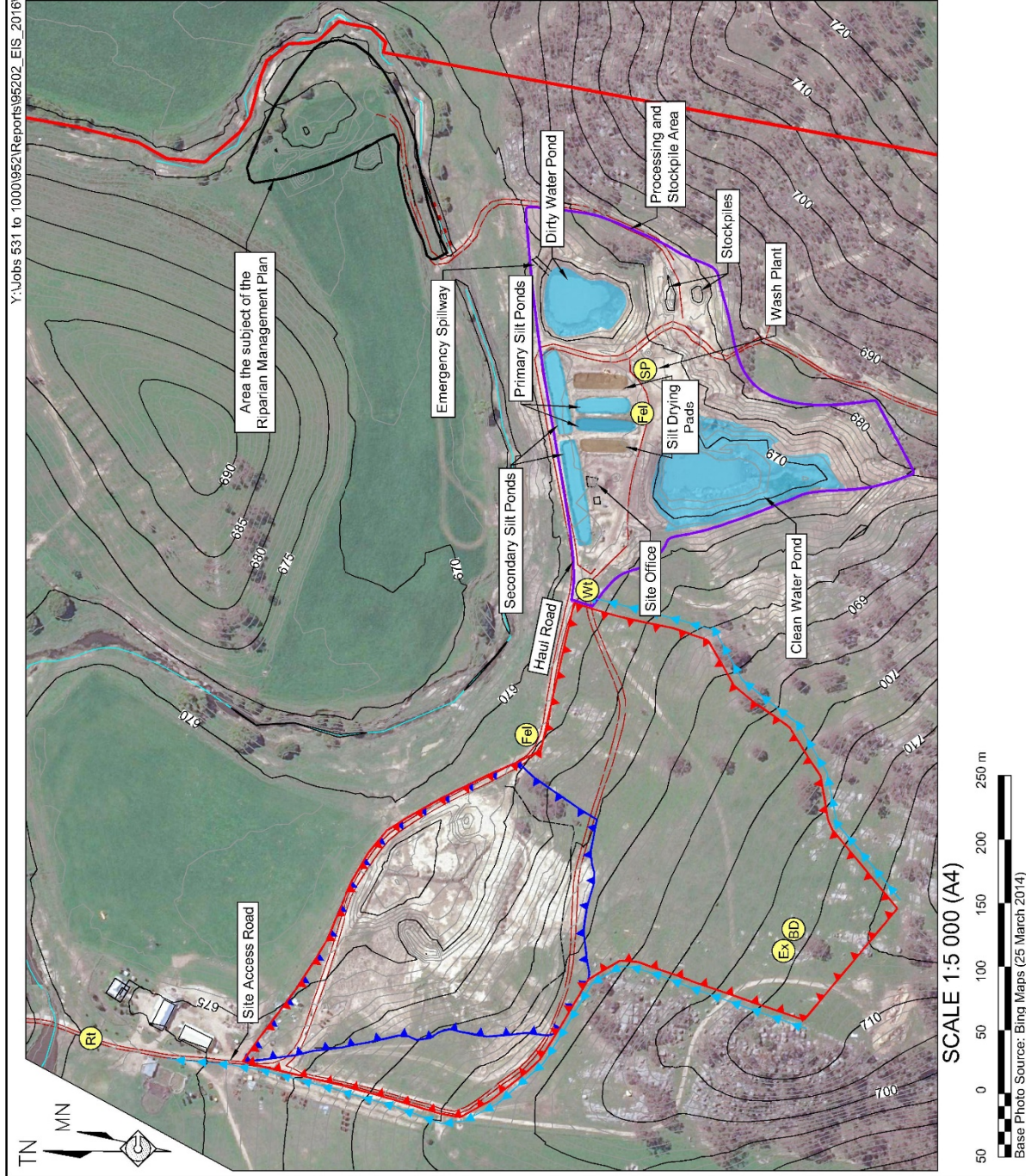


Appendix C – NEWA Analysed Meteorology

Table C1 NEWA Analysed Meteorological Conditions, Bathurst NSW									
Direction ± 45°	Season	Day	Evening	Night	Direction	Season	Day	Evening	Night
		Percentage Occurrence %					Percentage Occurrence %		
0	Summer	6	7	18	180	Summer	11	10	9
0	Autumn	9	14	26	180	Autumn	10	12	9
0	Winter	10	17	23	180	Winter	11	15	13
0	Spring	7	14	21	180	Spring	11	12	12
22.5	Summer	7	8	15	202.5	Summer	12	12	13
22.5	Autumn	12	13	24	202.5	Autumn	10	17	12
22.5	Winter	14	16	23	202.5	Winter	11	19	14
22.5	Spring	8	17	20	202.5	Spring	11	16	16
45	Summer	10	9	11	225	Summer	9	16	20
45	Autumn	17	13	17	225	Autumn	7	22	15
45	Winter	18	13	19	225	Winter	7	24	13
45	Spring	12	17	15	225	Spring	6	21	18
67.5	Summer	11	8	8	247.5	Summer	7	15	21
67.5	Autumn	18	11	12	247.5	Autumn	5	22	16
67.5	Winter	19	11	14	247.5	Winter	5	20	11
67.5	Spring	13	15	11	247.5	Spring	5	18	16
90	Summer	11	7	6	270	Summer	6	13	23
90	Autumn	18	9	8	270	Autumn	5	21	18
90	Winter	18	8	9	270	Winter	5	18	12
90	Spring	13	11	8	270	Spring	4	17	15
112.5	Summer	12	6	4	292.5	Summer	6	15	26
112.5	Autumn	16	7	6	292.5	Autumn	6	22	21
112.5	Winter	15	5	7	292.5	Winter	5	18	13
112.5	Spring	13	7	6	292.5	Spring	5	15	16
135	Summer	13	6	4	315	Summer	5	12	23
135	Autumn	14	6	5	315	Autumn	6	17	22
135	Winter	14	6	7	315	Winter	5	15	16
135	Spring	14	7	5	315	Spring	5	12	17
157.5	Summer	12	9	7	337.5	Summer	3	6	17
157.5	Autumn	12	9	7	337.5	Autumn	5	11	20
157.5	Winter	13	12	11	337.5	Winter	5	11	15
157.5	Spring	13	10	9	337.5	Spring	3	6	15

Appendix D – Modelled Equipment Locations





Appendix E – Tabulated Predicted Operational Noise Levels

E1 Predicted Operational Noise Levels, dB(A) LA _{eq(15min)}		
Receiver ID	Scenario 1	Scenario 2
R1	27	26
R2	24	<25
R3	27	28
R4	27	32
R5	26	30
R6	25	30
R7	<25	26
R8	<25	26
R9	<25	26
R10	30	28
R11	<25	25
R12	<25	<25
R13	<25	<25
R14	<25	<25
R15	<25	<25
R16	<25	<25
R17	<25	<25
R18	<25	<25
R19	<25	<25
R20	<25	<25
R21	<25	<25
R22	<25	<25
R23	<25	<25
R24	<25	<25
R25	<25	<25
R26	<25	<25
R27	<25	<25
R28	<25	<25
R29	<25	<25
R30	<25	<25
R31	<25	<25
R32	<25	<25
R33	<25	<25
R34	<25	<25
R35	<25	<25

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