Muswellbrook Coal Company

Environmental Noise Monitoring

May 2016

Prepared for

Muswellbrook Coal Company

Global Acoustics

Noise and Vibration Analysis and Solutions

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Muswellbrook Coal

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EXECUTIVE SUMMARY

Global Acoustics were engaged by Muswellbrook Coal Company (MCC) to conduct a noise survey around its operations, an open-cut mine north-east of Muswellbrook.

A noise survey around MCC is required biannually as a condition of their current Noise Management Plan (Dec 2015).

Environmental noise monitoring described in this report was undertaken during the day, evening and night periods of 25 May 2016.

Attended noise monitoring was conducted at a total of five locations for MCC (see Figure 1) during May 2016 monitoring.

The survey purpose is to quantify and describe the existing acoustic environment around MCC and compare results with relevant development consent conditions.

Attended monitoring was conducted in accordance with the EPA 'Industrial Noise Policy' (INP) guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'. The duration of each measurement was 15 minutes.

Noise levels from MCC complied with the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ development consent criteria at all monitoring locations during the May 2016 survey.

Global Acoustics Pty Ltd

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Muswellbrook Coal Company (MCC) to conduct a noise survey around its operations, an open cut coal mine north-east of Muswellbrook.

Attended environmental noise monitoring described in this report was undertaken during the day, evening and night periods of 25 May 2016.

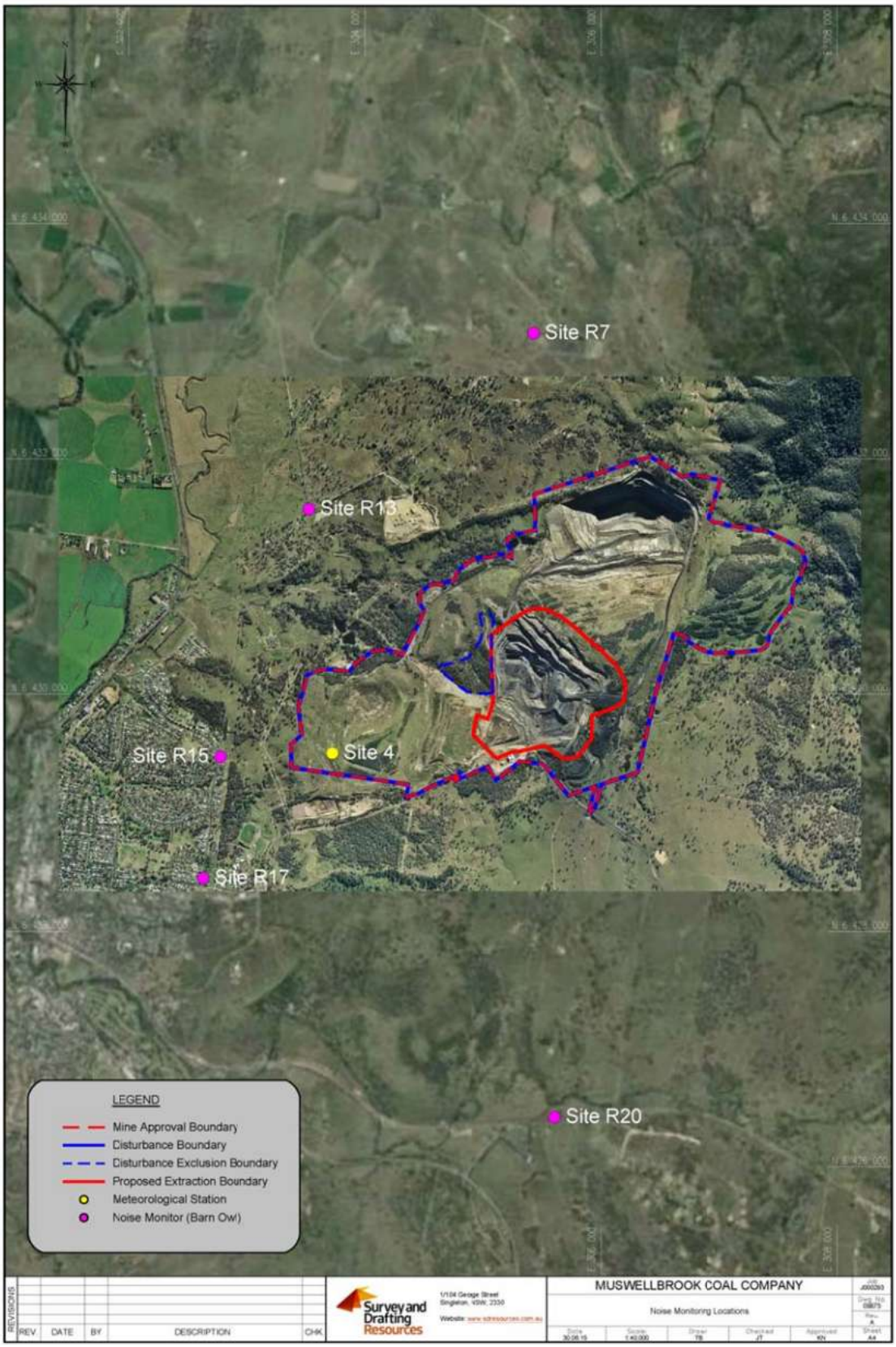
Figure 1 shows the monitoring locations. The locations of major plant items in operation during monitoring are shown in Figure 2 and Figure 3.

1.2 Attended Monitoring Locations

There were five monitoring locations during this survey as detailed in Table 1.1 and shown on Figure 1. It should be noted that this figure shows the actual monitoring position, not the location of residences.

Table 1.1: MCC ATTENDED MONITORING LOCATIONS

Report Descriptor	Monitoring Location
R7	Transgrid yard entrance, Sandy Creek Road
R13	Cnr Sandy Creek Road and St Heliers Road
R15	71 Queen Street
R17	42 Queen Street
R20	90 Muscle Creek Road



Source: MCC NMP, Dec 2015

Figure 1: MCC Attended Noise Monitoring Locations

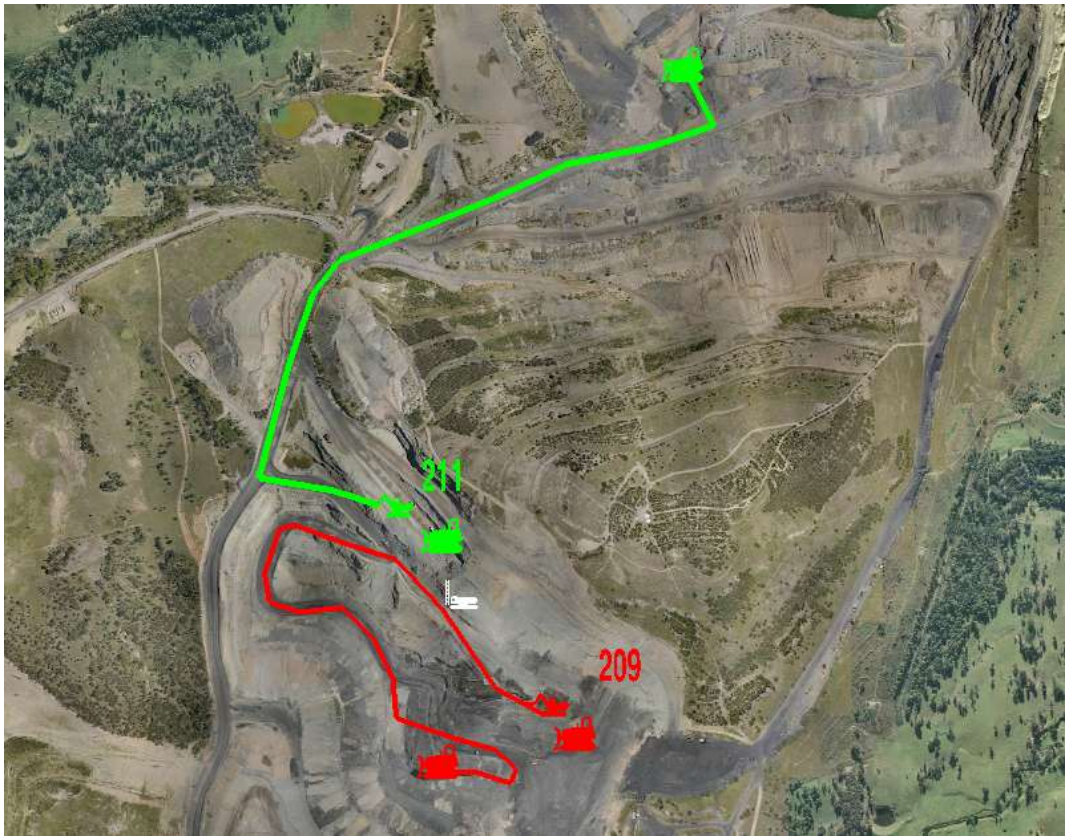


Figure 2 Equipment movements at MCC on 25 May – Day Shift

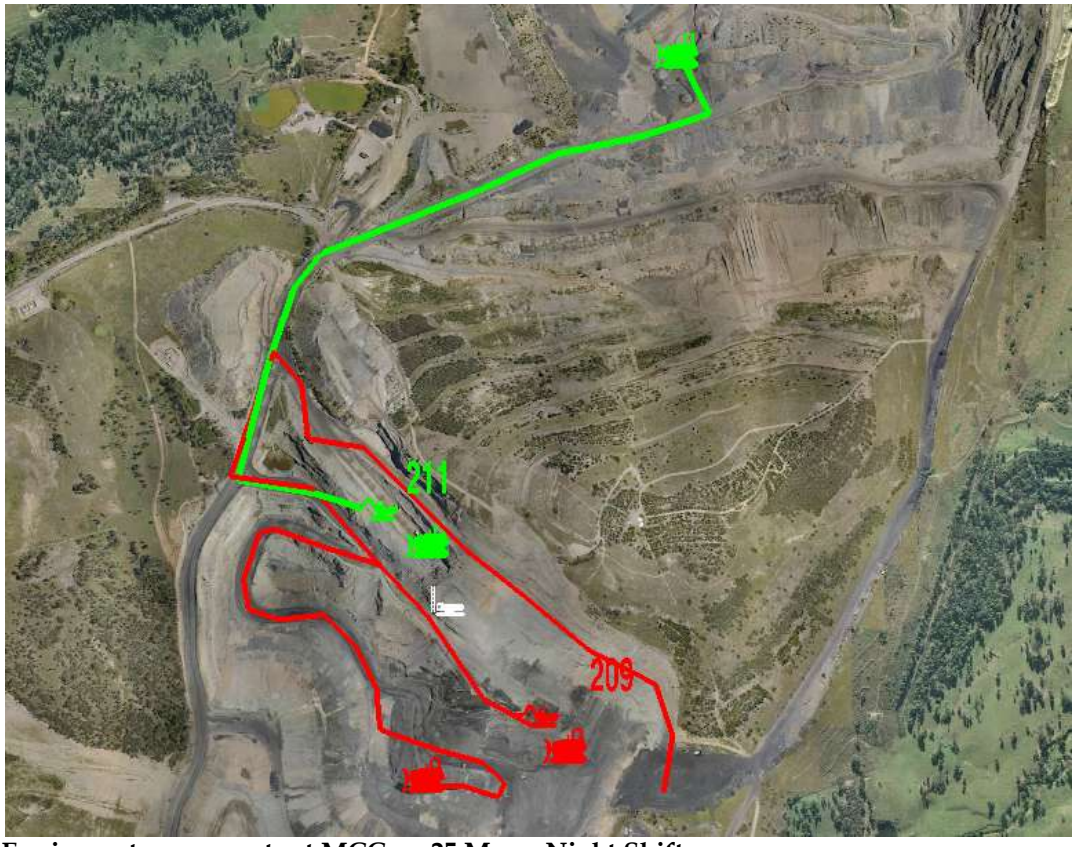


Figure 3 Equipment movements at MCC on 25 May – Night Shift

1.3 Terminology & Abbreviations

Some definitions of terms and abbreviations, which may be used in this report, are provided in Table 1.2.

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
L_{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
L_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Amin}	The minimum A-weighted noise level over a time period or for an event
L_{Aeq}	The average noise energy during a measurement period
L_{pk}	The unweighted peak noise level at any instant
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals
ABL	Assessment background level (ABL), the 10^{th} percentile background noise level for a single period (day, evening or night) of a 24 hour monitoring period
RBL	Rating background level (RBL), the background noise level for a period (day, evening or night) determined from ABL data
Hertz (Hz)	Cycles per second, the frequency of fluctuations in pressure, sound is usually a combination of many frequencies together
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude. Estimated from wind speed and sigma theta data
IA	Inaudible. When site only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

2 PROJECT SPECIFIC CONDITIONS AND CRITERIA

2.1 Project Approval

Noise criteria has been set as detailed in Development Consent DA205/2002 for MCC.

2.2 Project Specific Criteria

Impact assessment criteria are detailed in Table 2.1.

Table 2.1: MCC PROJECT SPECIFIC CRITERIA

Descriptor	Monitoring Location	Day	Evening	Night	
		$L_{Aeq,}$ 15 minute	$L_{Aeq,}$ 15 minute	$L_{Aeq,}$ 15 minute	$L_{A1,}$1minute
R7	Transgrid yard entrance, Sandy Creek Road	36	36	36	44
R13	Corner of Sandy Creek Road and St Heliers Street	40	40	40	51
R15	71 Queen Street	35	35	35	46
R17	42 Queen Street	35	35	35	46
R20	90 Muscle Creek Road	38	38	38	48

Wind speed and vertical temperature gradient data used for assessment of compliance is sourced from the MCC open cut weather station.

Noise Criteria applies under meteorological conditions of wind speed up to 3 metres per second at 10 metres above ground level and temperature inversion conditions of up to 3 degrees Celsius per 100 metres.

2.3 Low Frequency Noise

INP Method

As defined in the Industrial Noise Policy:

> *Low frequency noise contains major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.*

As detailed in Chapter 4 of the INP, low frequency noise should be assessed by measuring the site only C-weighted and site only A-weighted level over the same time period. The correction/penalty of 5 dB is applied *if the difference between the two levels is 15 dB or more*.

Broner Method

Low frequency noise can also be assessed against criteria specified in the paper *"A Simple Method for Low Frequency Noise Emission Assessment"* (Broner JLFNV Vol.29-1 pp.1-14, 2010). If the site only C-weighted noise level at a receptor exceeds the relevant criterion, a 5 dB penalty (modifying factor) is added to predicted levels. This method is included to provide a comparison with the INP method.

Draft Industrial Noise Guideline Method

Whilst the INP is the current document for assessment of industrial noise impact in NSW, the EPA has recently published the draft Industrial Noise Guideline (ING), which is currently under review after a period of public consultation. The draft ING contains an alternate method of assessing low frequency noise to the INP.

The draft ING method is:

Measure/assess C-weighted and A-weighted L_{eq},T levels over the same time period. The low frequency noise modifying factor correction is to be applied where the C-A level exceeds 15 dB and:

- where any of the 1/3 octave noise levels in Table C2 are exceeded by **up to** 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period;

- where any of the 1/3 octave noise levels in Table C2 are exceeded by **more than** 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured A weighted levels applies for the evening/night period and a 2 dBA positive adjustment applies for the daytime period.

Table C2 of the draft ING is reproduced below:

Table C2: One-third octave low frequency noise thresholds

Hz/dB(Z)	One-third octave $L_{Zeq,15minute}$ threshold level												
f,Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

Note: dB(z) = decibel (Z-weighted); f,Hz = frequency in Hertz; Hz/dB(Z) = hertz per decibel (Z-weighted). For the assessment of low frequency noise, care should be taken to select a wind screen that has wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to 5 metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler et.al. 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.

Low frequency noise shall be assessed under the meteorological conditions under which noise limits would apply.

Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or Environment Protection Licence and at locations nominated in the development consent or license.

2.4 Low Frequency Noise Criteria

As detailed in condition 6.4.3 (b) of the consent:

> *The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where practical.*

Low frequency criteria are detailed in Table 2.2.

Table 2.2: LOW FREQUENCY ASSESSMENT METHODS

Assessment Method	Calculation Method	Night Criterion	Day/Evening Criterion
Broner, 2010	L_{Ceq} for source of interest	60	65
INP	Site only L_{Ceq} minus site only L_{Aeq}	15	15
Draft ING	L_{Ceq} minus L_{Aeq}	15[1]	15[1]

Notes:

1. *Where this initial screening trigger is exceeded, further assessment is required through comparison of 1/3 octave spectra with threshold levels in Table C2 of the draft ING.*

Where appropriate, low frequency noise results from MCC have been compared to the range of assessment methods and criteria presented above.

3 METHODOLOGY

3.1 Overview

Noise monitoring was conducted at the nearest residences in accordance with the Environmental Protection Authority (EPA) 'Industrial Noise Policy' (INP) guidelines and Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise'. Atmospheric condition measurement was also undertaken.

The terms "Inaudible" (IA) and "Not Measurable" (NM), "Less than 20 dB" (<20dB) or "Less than 25 dB" (<25 dB) may be used in this report. When site noise is noted as IA then there was no site noise at the monitoring location.

However, if site noise is noted as NM, <20 dB or <25 dB, this means some noise was audible but could not be quantified. This means that noise from the site was either very low, or being masked by other noise that was relatively loud. In the former case (very low site levels) we consider it not necessary to attempt to accurately quantify site noise as it would be significantly less than any criterion and most unlikely to cause annoyance (and in many cases, to be even noticed).

If site noise were NM, <20 dB or <25 dB due to masking then we would employ methods as per the Industrial Noise Policy (eg measure close and back calculate) to determine a value for reporting if deemed necessary. All site NM in this report are due to low absolute values.

Meteorological data was obtained from the MCC open cut weather station, Site 04.

3.2 Monitoring Equipment

The equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix B.

Table 3.1: MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NA-28 sound level analyser	1070590	06/11/2017
Rion NA-28 sound level analyser	701424	22/05/2017
Pulsar 106 acoustic calibrator	57413	23/12/2017
Pulsar 106 acoustic calibrator	74813	08/07/2017

4 RESULTS

4.1 Attended Noise Monitoring

Noise levels measured at each location during attended surveys are provided in Table 4.1, discussion as to the noise sources responsible for these measured levels is provided in Chapter 5 of this report.

Table 4.1: MEASURED NOISE LEVELS – MAY 2016[1]

Location	Start Date and Time	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{A50} dB	L_{Aeq} dB	L_{A90} dB	L_{Amin} dB	L_{Ceq} dB
R7	25/05/2016 15:25	49	39	35	31	32	27	25	51
R7	25/05/2016 20:39	53	36	32	28	30	25	23	47
R7	25/05/2016 22:00	50	38	35	29	31	26	23	48
R13	25/05/2016 15:55	80	72	54	45	57	42	39	65
R13	25/05/2016 20:20	59	48	44	37	40	31	27	51
R13	25/05/2016 22:21	52	46	41	36	38	30	27	51
R15	25/05/2016 14:45	68	62	54	43	50	37	31	59
R15	25/05/2016 19:52	63	55	45	38	43	35	31	53
R15	25/05/2016 23:14	51	46	41	36	38	33	30	52
R17	25/05/2016 14:19	82	75	63	45	62	39	34	66
R17	25/05/2016 19:28	62	53	48	41	44	36	31	53
R17	25/05/2016 22:51	59	54	47	34	43	30	28	50
R20	25/05/2016 13:33	64	59	48	42	46	37	30	57
R20	25/05/2016 18:04	62	55	47	42	45	40	37	59
R20	25/05/2016 22:01	56	52	49	41	45	36	31	55

Notes:

1. *Levels in this table are not necessarily the result of activity at MCC.*

Table 4.2 compares measured $L_{Aeq,15minute}$ levels from MCC mine with impact assessment criteria. Table 4.3 compares measured $L_{A1,1minute}$ levels from MCC with impact assessment criteria.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY MCC MINE AGAINST IMPACT ASSESSMENT CRITERIA – MAY 2016

Location	Start Date and Time	Wind Speed m/s[5]	VTG °C/100m[5]	Criterion dB	Criterion Applies?[1]	MCC $L_{Aeq,15min}$ dB[2,4]	Exceedance[3]
R7	25/05/2016 15:25	0.7	-2.3	36	Yes	IA	Nil
R7	25/05/2016 20:39	0.0	3.5	36	No	<25	NA
R7	25/05/2016 22:00	0.0	1.3	36	Yes	<25	Nil
R13	25/05/2016 15:55	3.0	-1.8	40	Yes	IA	Nil
R13	25/05/2016 20:20	0.0	2.7	40	Yes	IA	Nil
R13	25/05/2016 22:21	0.0	2.7	40	Yes	<25	Nil
R15	25/05/2016 14:45	0.7	-3.2	35	Yes	IA	Nil
R15	25/05/2016 19:52	0.0	4.7	35	No	IA	NA
R15	25/05/2016 23:14	0.0	4.7	35	No	<25	NA
R17	25/05/2016 14:19	2.7	-2.7	35	Yes	IA	Nil
R17	25/05/2016 19:28	0.0	4.7	35	No	IA	NA
R17	25/05/2016 22:51	1.1	3.7	35	No	<30	NA
R20	25/05/2016 13:33	2.7	-3.6	38	Yes	IA	Nil
R20	25/05/2016 18:04	0.0	0.2	38	Yes	IA	Nil
R20	25/05/2016 22:01	0.0	1.3	38	Yes	NM	Nil

Notes:

1. *Noise emission limits do not apply during the following meteorological conditions: wind speeds greater than 3 metres per second (at a height of 10 metres); or temperature inversion conditions greater than 3°C/100m;*
2. *Estimated or measured $L_{Aeq,15minute}$ attributed to MCC;*
3. *NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;*
4. *Bolded results in red are possible exceedances of relevant criteria; and*
5. *Criterion may or may not apply due to rounding of meteorological data values.*

Table 4.3: $L_{A1,1minute}$ GENERATED BY MCC MINE AGAINST IMPACT ASSESSMENT CRITERIA – MAY 2016

Location	Start Date and Time	Wind Speed m/s[5]	VTG °C/100m[5]	Criterion dB	Criterion Applies?[1]	MCC $L_{A1,1min}$ dB[2,4]	Exceedance[3]
R7	25/05/2016 22:00	0.0	1.3	44	Yes	<25	Nil
R13	25/05/2016 22:21	0.0	2.7	51	Yes	<25	Nil
R15	25/05/2016 23:14	0.0	4.7	46	No	32	NA
R17	25/05/2016 22:51	1.1	3.7	46	No	<30	NA
R20	25/05/2016 22:01	0.0	1.3	48	Yes	NM	Nil

4.1.1 Low Frequency Assessment

Table 4.4 provides statistics for attended noise monitoring undertaken around MCC on 25 May 2016.

Table 4.4: ATTENDED MEASUREMENT STATISTICS FOR MCC – MAY 2016

Conditions	Total for May 2016
Number of measurements	15
Number of measurements where criterion applies	10
Number of measurements where MCC was the only low-frequency source, levels were within 5 dB of the criterion and criterion applied	0

None of the 15 measurements occurred during which MCC was the only low frequency source, was measurable (not "inaudible", "not measurable" or less than a maximum cut-off value of 30 dB), was within 5 dB of the relevant criterion, and where meteorological conditions resulted in criteria applying (in accordance with the project approval). No further low frequency assessment was carried out.

4.2 Atmospheric Conditions

Atmospheric condition measurement data, collected with each noise measurement, are shown in Table 4.5.

Table 4.5: MEASURED ATMOSPHERIC CONDITIONS – MAY 2016

Location	Start Date and Time	Temperature Degrees	Wind Speed m/s[1]	Wind Direction Degrees[1]	Cloud Cover Eighths
R7	25/05/2016 15:25	22	0.9	320	2
R7	25/05/2016 20:39	15	0.0	-	4
R7	25/05/2016 22:00	12	0.0	-	3
R13	25/05/2016 15:55	21	1.8	300	2
R13	25/05/2016 20:20	14	0.0	-	4
R13	25/05/2016 22:21	9	0.0	-	6
R15	25/05/2016 14:45	24	0.6	280	1
R15	25/05/2016 19:52	15	0.5	0	2
R15	25/05/2016 23:14	11	0.6	10	5
R17	25/05/2016 14:19	26	0.6	320	1
R17	25/05/2016 19:28	15	0.0	-	0
R17	25/05/2016 22:51	11	0.0	-	5
R20	25/05/2016 13:33	25	0.7	280	0
R20	25/05/2016 18:04	18	0.4	240	2
R20	25/05/2016 22:01	11	0.0	-	4

Notes:

1. *Wind speed and direction measured at 1.8 metres; and*
2. *"-" indicates calm conditions at the monitoring location during the measurement period.*

5 DISCUSSION

5.1 Noted Noise Sources

Table 4.1 presents data gathered during attended monitoring. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring. Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of MCC's contribution, if any, to measured levels. At each receptor location, the $L_{Aeq,15minute}$ and $L_{A1,1minute}$ for MCC (in the absence of any other noise) was, where possible, measured directly, or, determined by frequency analysis. Data is provided in Table 4.2 to Table 4.3. Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors.

From these observations summaries have been derived for each location. The following chapter sections provide these summaries. Statistical 1/3 octave band analysis of environmental noise was undertaken, Figure 5 to Figure 13 display frequency ranges for various noise sources at each location for L_{A10}, L_{Aeq} and L_{A90}. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 4 where it can be seen that frogs and insects are generating noise at frequencies above 1000 Hz; mining noise is at frequencies less than 1000 Hz (this is typical). Adding levels at frequencies that relate to mining only allows separate statistical results to be calculated. This analysis cannot always be performed if there are significant levels of other noise at the same frequencies as mining; this can be dogs, cows, or, most commonly, road traffic.

It should be noted that the method of summing statistical values up to a cut-off frequency can overstate the L_{A1} result by a small margin but is entirely accurate for L_{Aeq}.

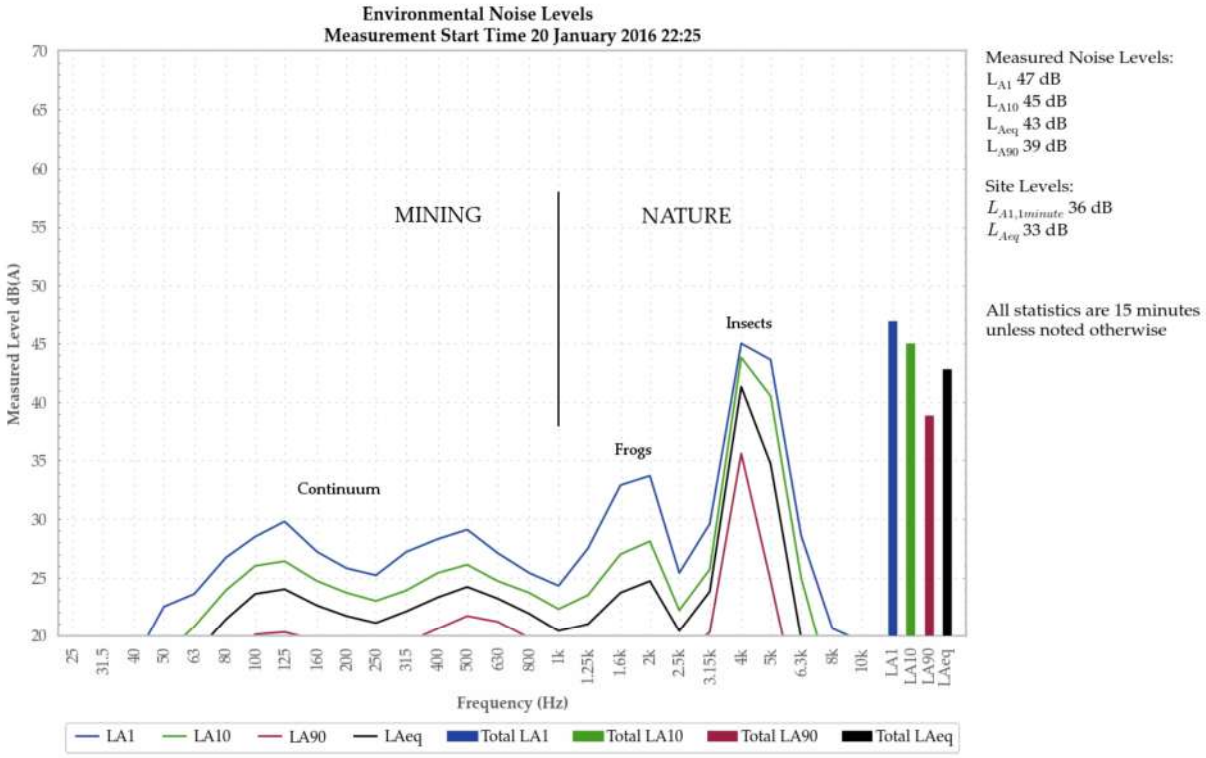


Figure 4: Sample Graph

5.1.1 R7 Sandy Creek Road - Day

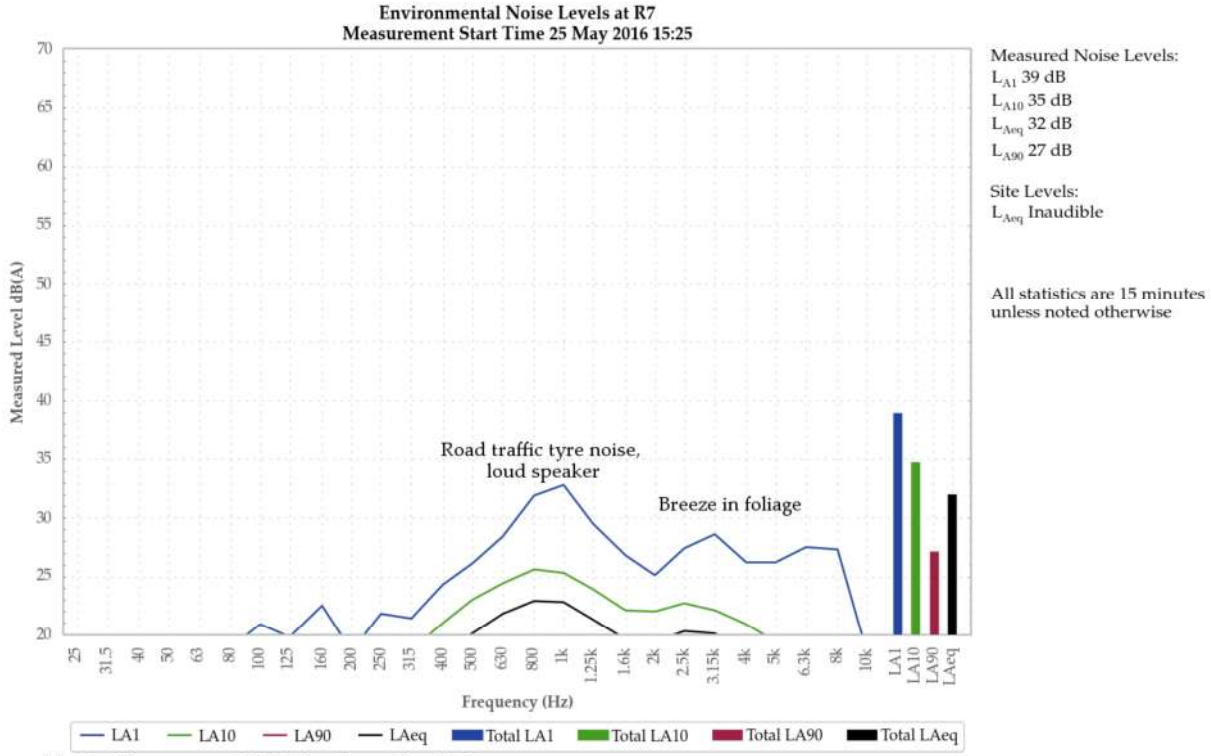


Figure 5: Environmental Noise Levels, R7

MCC was inaudible during the measurement.

Breeze in foliage and road traffic primarily generated measured levels. Noise from a loud speaker at a nearby event also contributed to the L_{A1}.

Birds and occasional impact and other noises from local residential properties were also noted.

5.1.2 R7 Sandy Creek Road - Evening

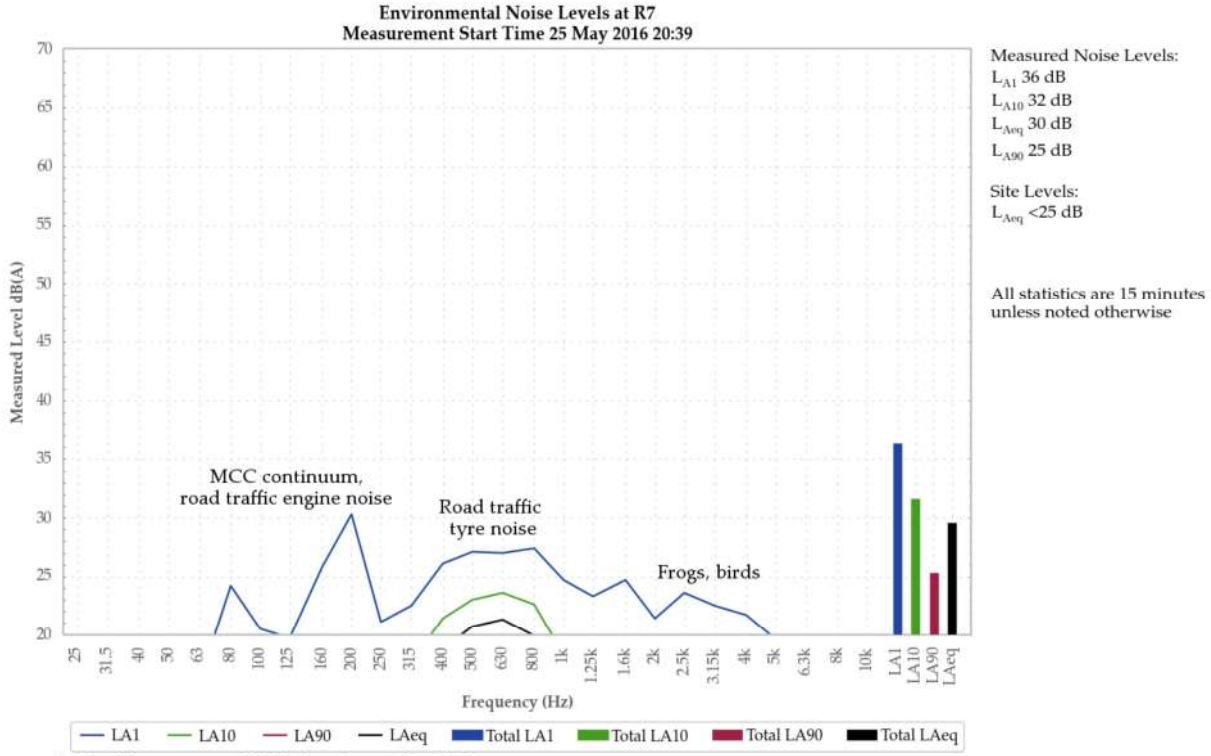


Figure 6: Environmental Noise Levels, R7

A general continuum from MCC was audible at very low levels during the measurement generating a site only L_{Aeq} of less than 25 dB.

Road traffic noise was primarily responsible for all measured levels. MCC contributed to the measured L_{A90}.

Frogs, birds and dogs were also noted.

5.1.3 R7 Sandy Creek Road - Night

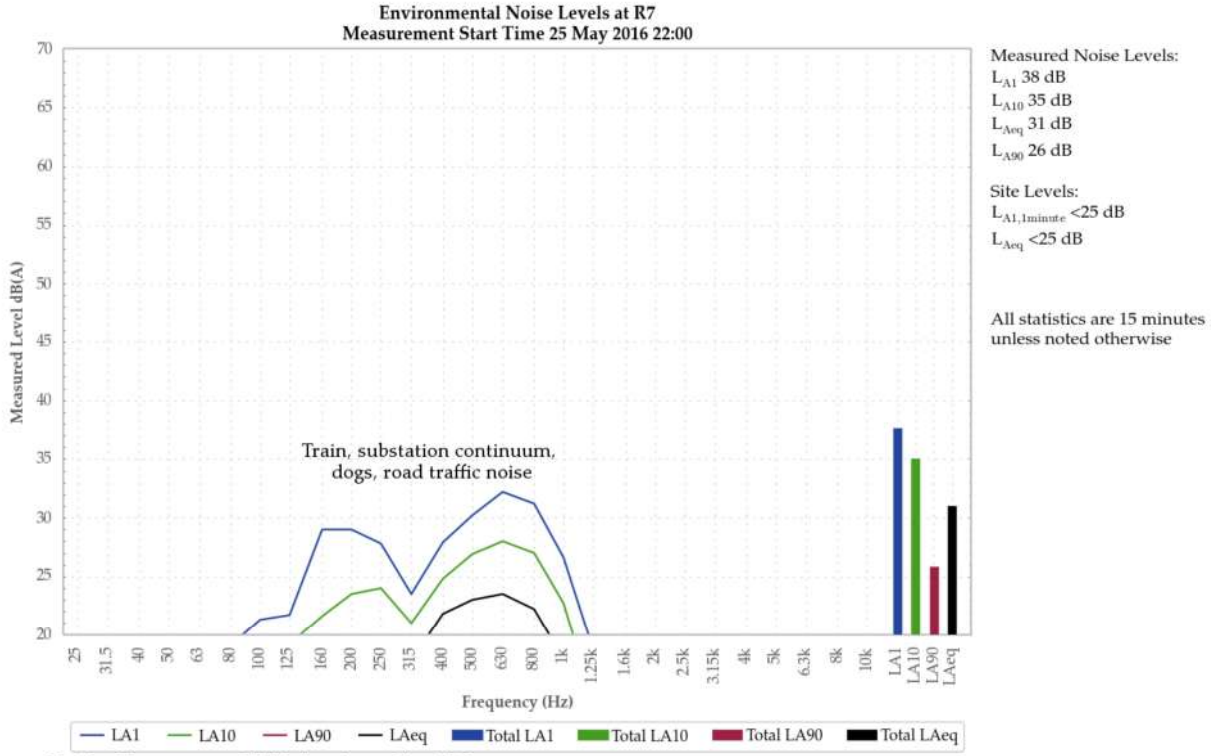


Figure 7: Environmental Noise Levels, R7

An engine continuum and rear dump truck exhaust noise from MCC were audible at very low levels during the measurement, generating a site only L_{Aeq} and $L_{A1,1min}$ of less than 25 dB.

A train, substation continuum and road traffic noise contributed to the measured L_{A1}, L_{A10} and L_{Aeq}. Dogs also contributed to the L_{A1}. Continuum from a substation generated the measured L_{A90}.

A train horn, birds and gunshots were also noted.

5.1.4 R13 Sandy Creek Road - Day

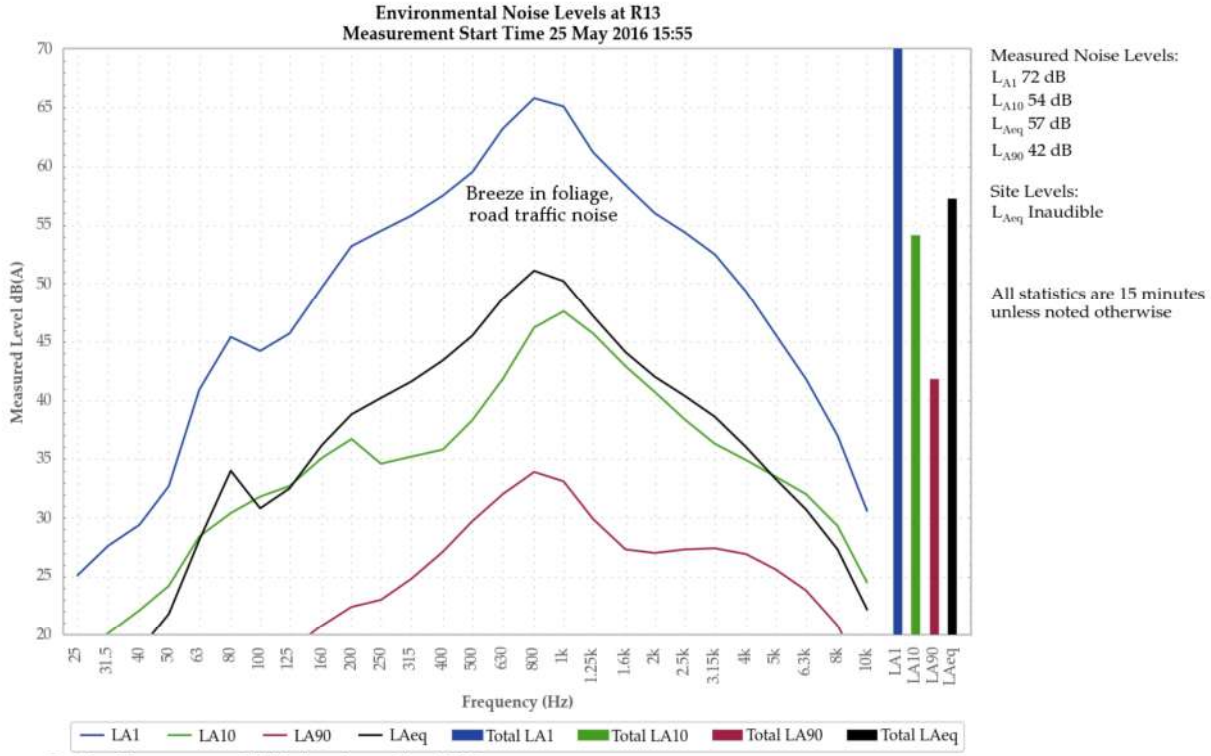


Figure 8: Environmental Noise Levels, R13

MCC was inaudible during the measurement.

Breeze in foliage generated the measured levels. Local road traffic also contributed to the L_{A1} and L_{A10}.

Road traffic noise, breeze on the microphone, birds and occasional impact noises and other noises from residential properties were also noted.

5.1.5 R13 Sandy Creek Road - Evening

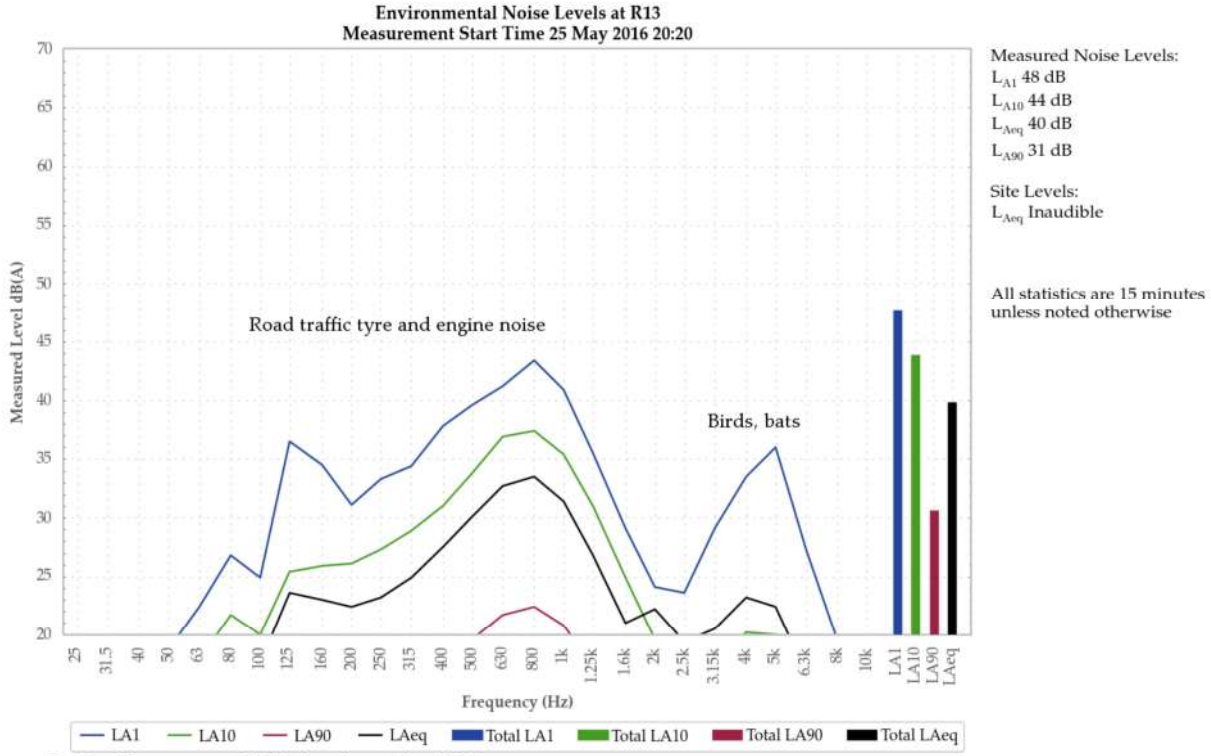


Figure 9: Environmental Noise Levels, R13

MCC was inaudible during the measurement.

Road traffic tyre noise primarily generated the measured levels.

Birds, bats and a low level continuum from a residential property were also noted.

5.1.6 R13 Sandy Creek Road - Night

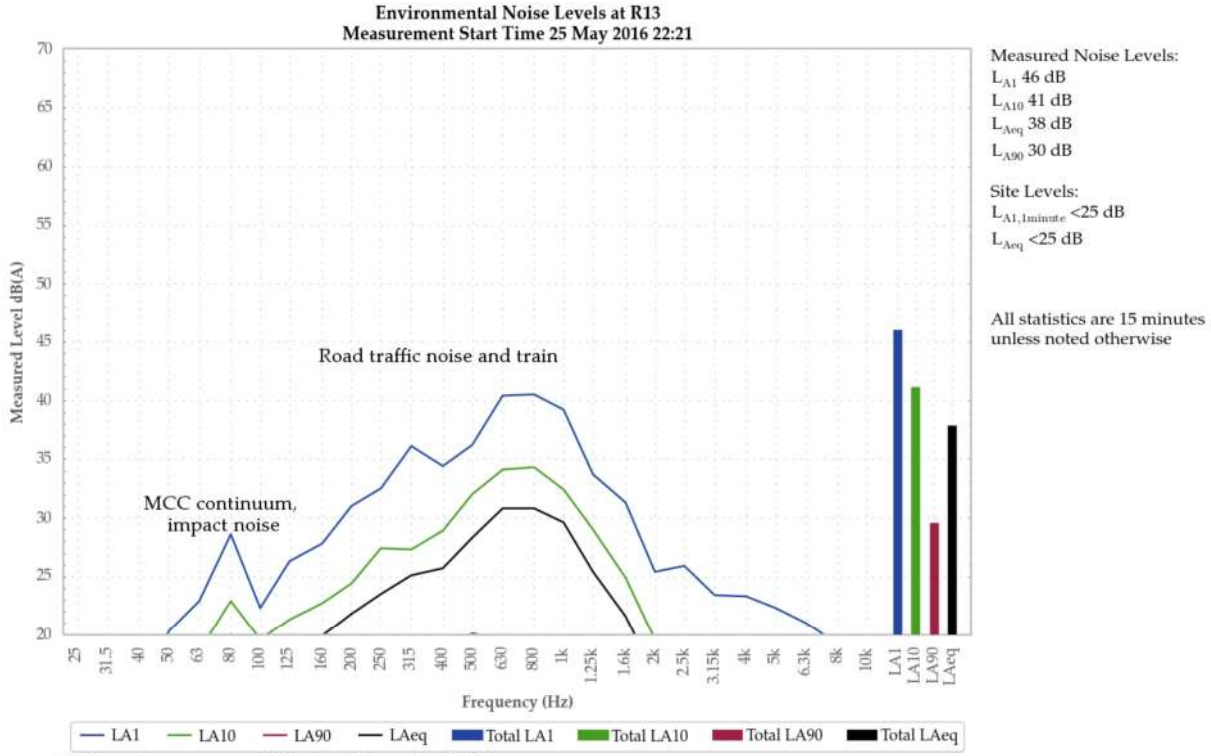


Figure 10: Environmental Noise Levels, R13

An engine continuum and rear dump truck exhaust noise from MCC were audible during some of the measurement. An impact noise was also noted from MCC. These sources generated the site only L_{Aeq} and $L_{A1,1min}$ of less than 25 dB.

Noise from road traffic primarily generated the measured L_{A1}, L_{A10} and L_{Aeq}. A train also contributed to the L_{A1} and L_{A10}. A continuum from a nearby residential property generated the measured L_{A90}.

5.1.7 R15 Queen Street - Day

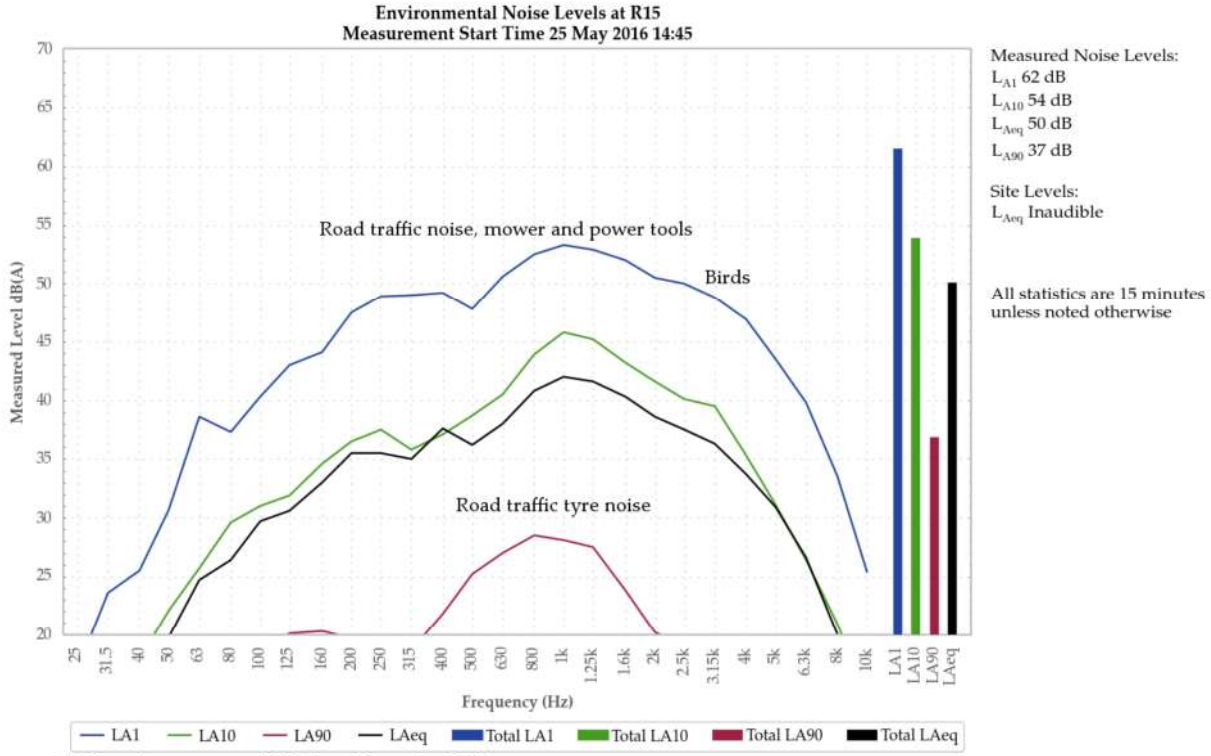


Figure 11: Environmental Noise Levels, R15

MCC was inaudible during the measurement.

Noise from power tools, a mower, birds and local traffic contributed to the L_{A1}, L_{A10} and L_{Aeq}. Road traffic tyre noise generated the measured L_{A90}.

Occasional impact noises from residential properties, dogs and resident's voices were also noted.

5.1.8 R15 Queen Street - Evening

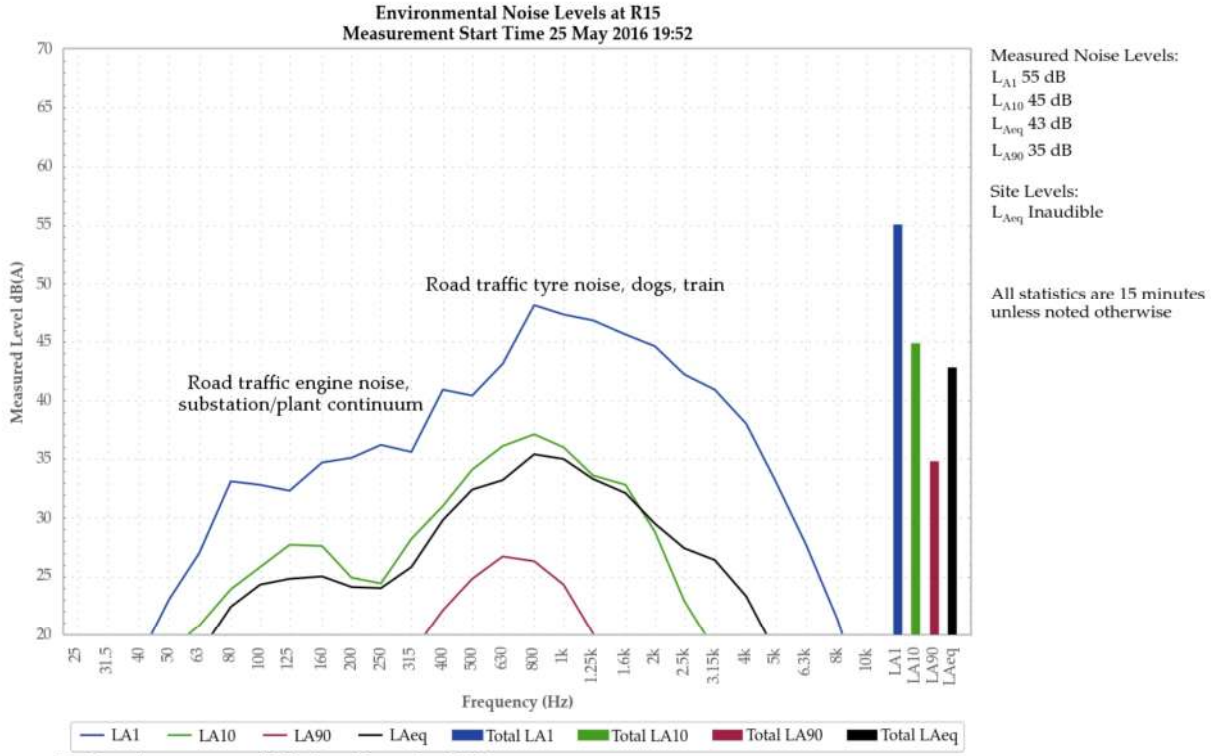


Figure 12: Environmental Noise Levels, R15

MCC was inaudible during the measurement.

Road traffic noise primarily generated all measured levels. Train noise contributed to the measured L_{A1} and L_{A10}, while dogs contributed to the measured L_{A1} and a substation continuum contributed to the measured L_{A90}.

A train horn, birds and insects were also noted.

5.1.9 R15 Queen Street - Night

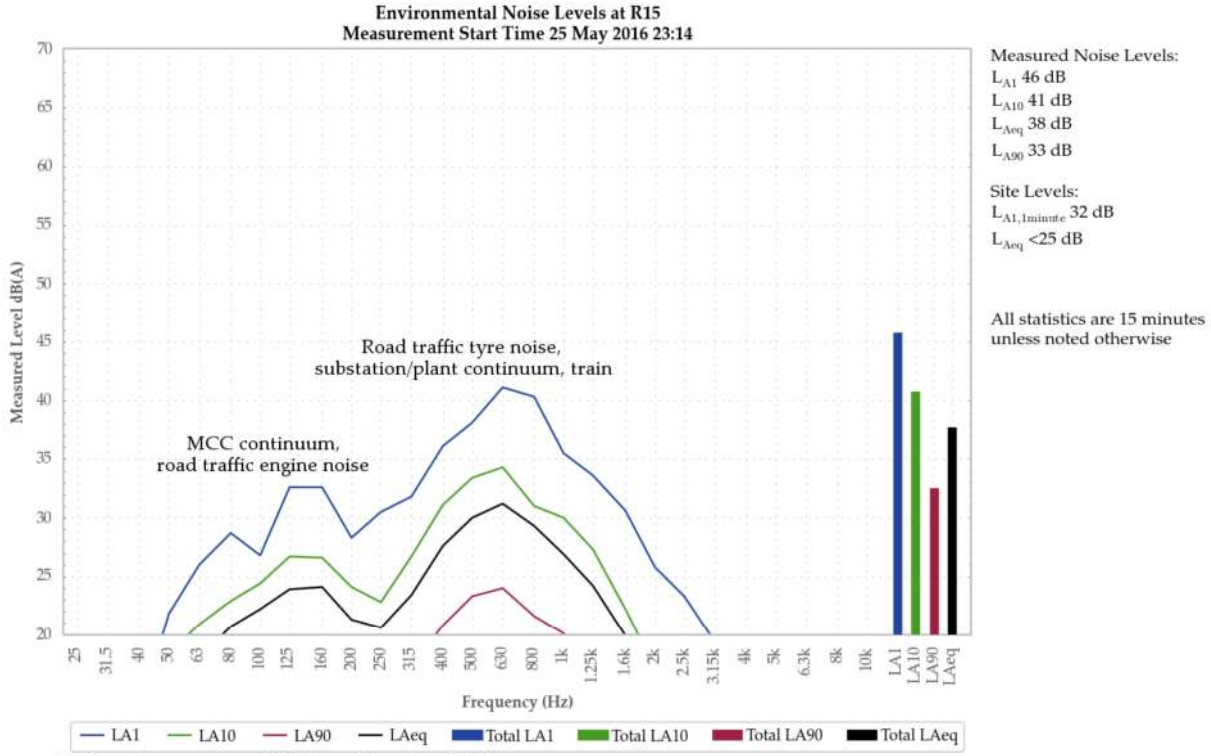


Figure 13: Environmental Noise Levels, R15

An engine continuum and exhaust noise from MCC generated the site only L_{Aeq} of less than 25 dB. A surge in engine noise generated the site only $L_{A1,1min}$ of 32 dB.

Road traffic noise primarily generated the measured levels. Noise from a train also contributed to the L_{A1}. A substation continuum contributed to the L_{A90} and L_{Aeq}.

Dogs, breeze in foliage and low-level continuum from another mine were also noted.

5.1.10 R17 Queen Street - Day

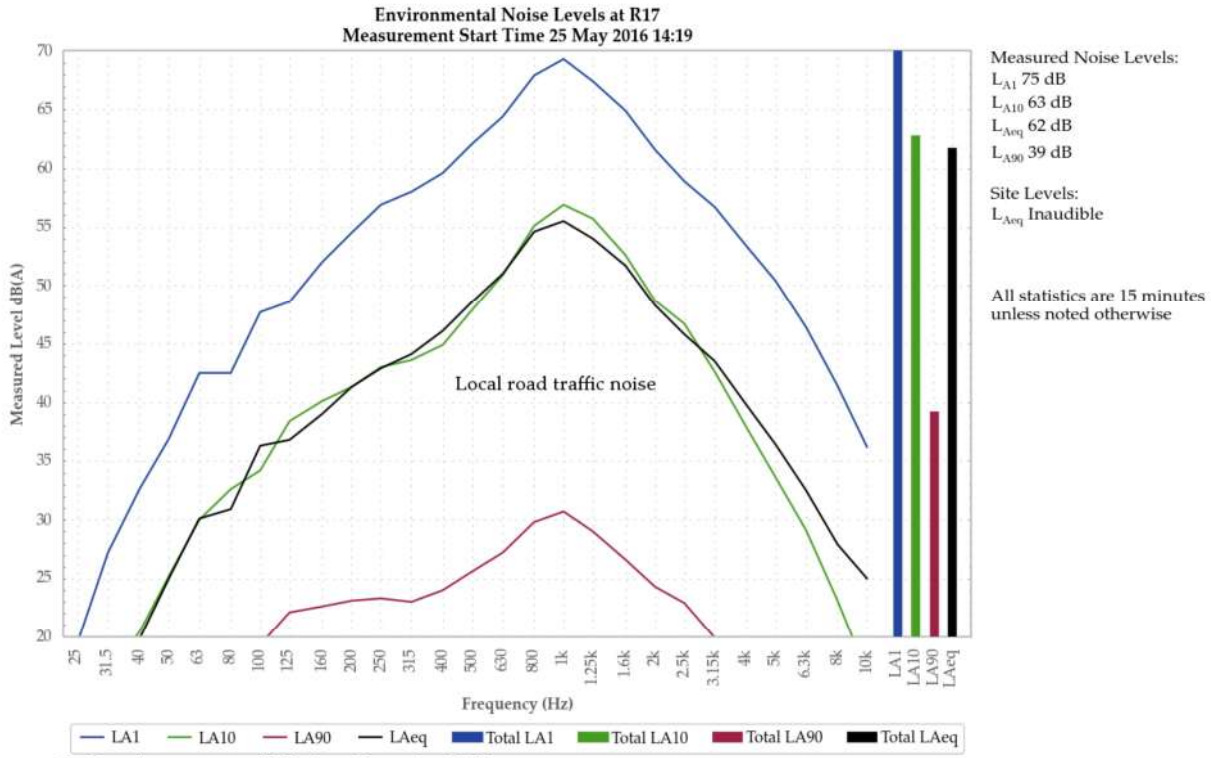


Figure 14: Environmental Noise Levels, R17

MCC was inaudible during the measurement.

Road traffic noise generated all measured levels.

Dogs, noise from a nearby industrial area, birds, breeze in foliage and an aircraft were also noted.

5.1.11 R17 Queen Street - Evening

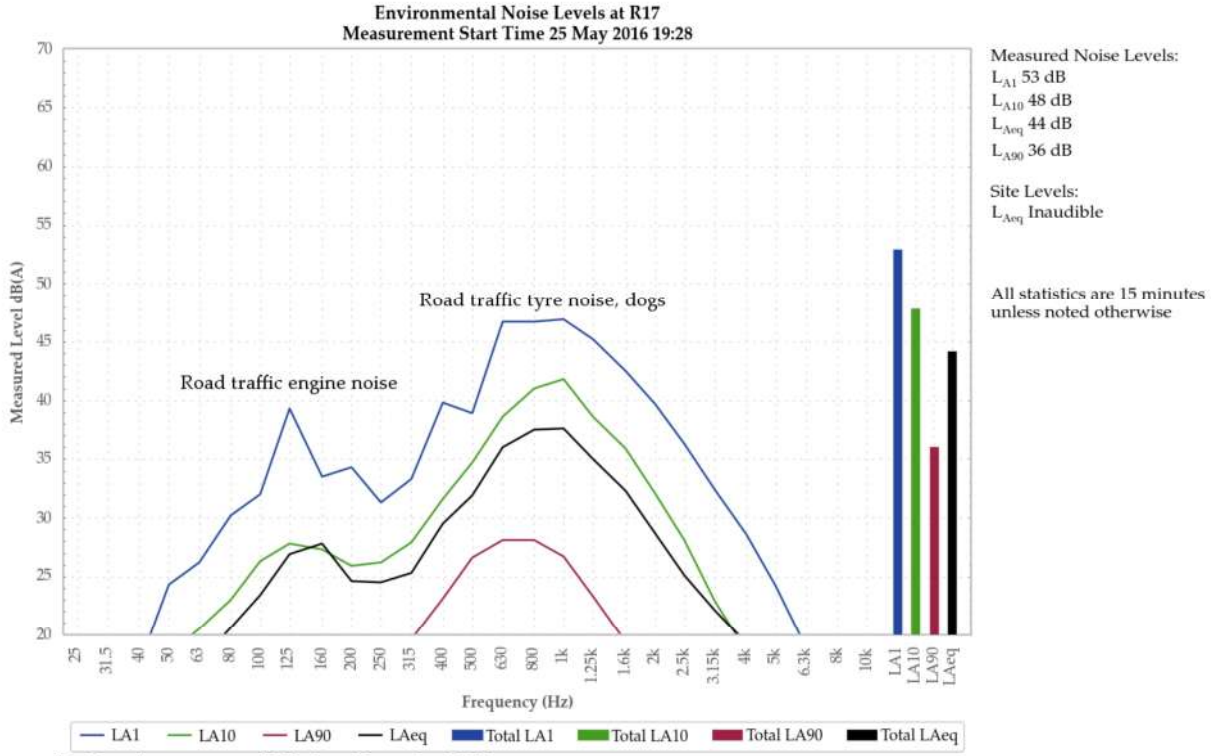


Figure 15: Environmental Noise Levels, R17

MCC was inaudible during the measurement.

Road traffic noise was primarily responsible for the measured levels. Dogs contributed to the L_{A1} and L_{Aeq}.

Breeze in foliage and power tools were also noted.

5.1.12 R17 Queen Street - Night

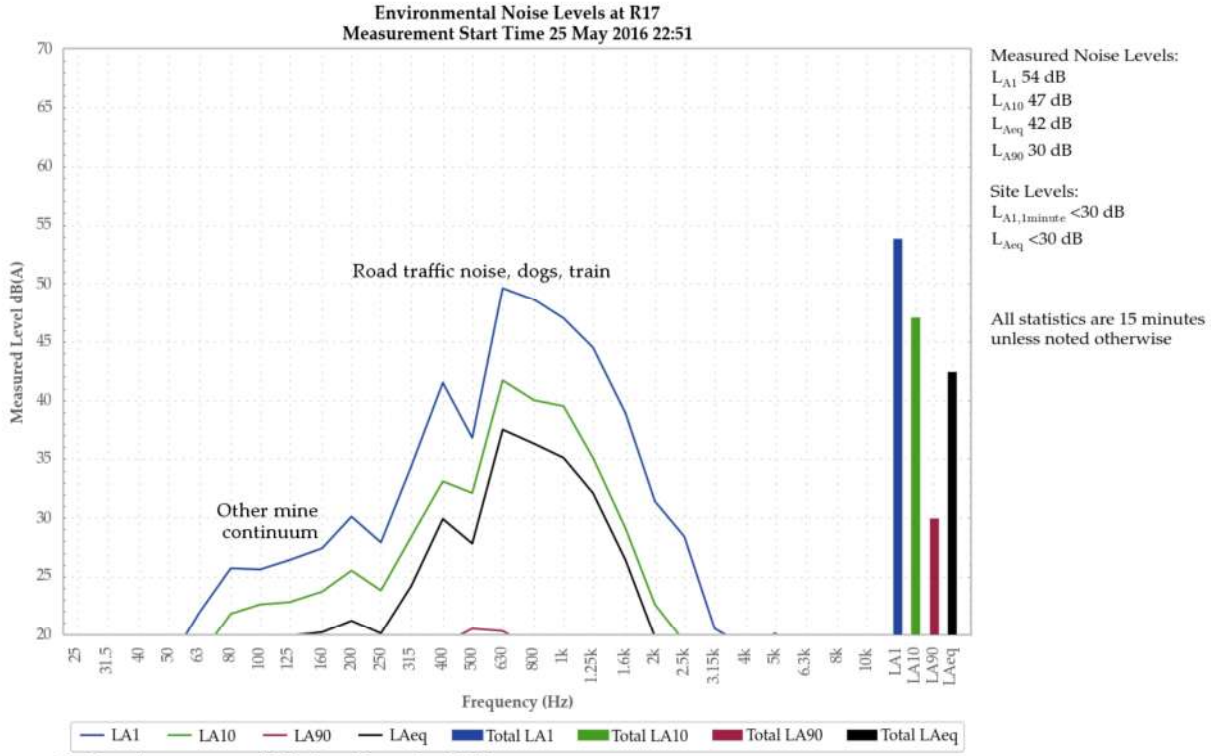


Figure 16: Environmental Noise Levels, R17

A low-level engine continuum from MCC was audible briefly during the measurement to generate a site only L_{Aeq} of less than 30 dB. Impact noise generated the site only $L_{A1,1min}$ of less than 30 dB.

Dogs were primarily responsible for generating the measured L_{A1}, L_{A10} and L_{Aeq}. Road traffic noise contributed to the measured L_{Aeq} and generated the measured L_{A90}. A train contributed to the measured L_{Aeq}.

Continuum and track noise from another mine and noise from a nearby industrial area were also noted.

5.1.13 R20 Queen Street - Day

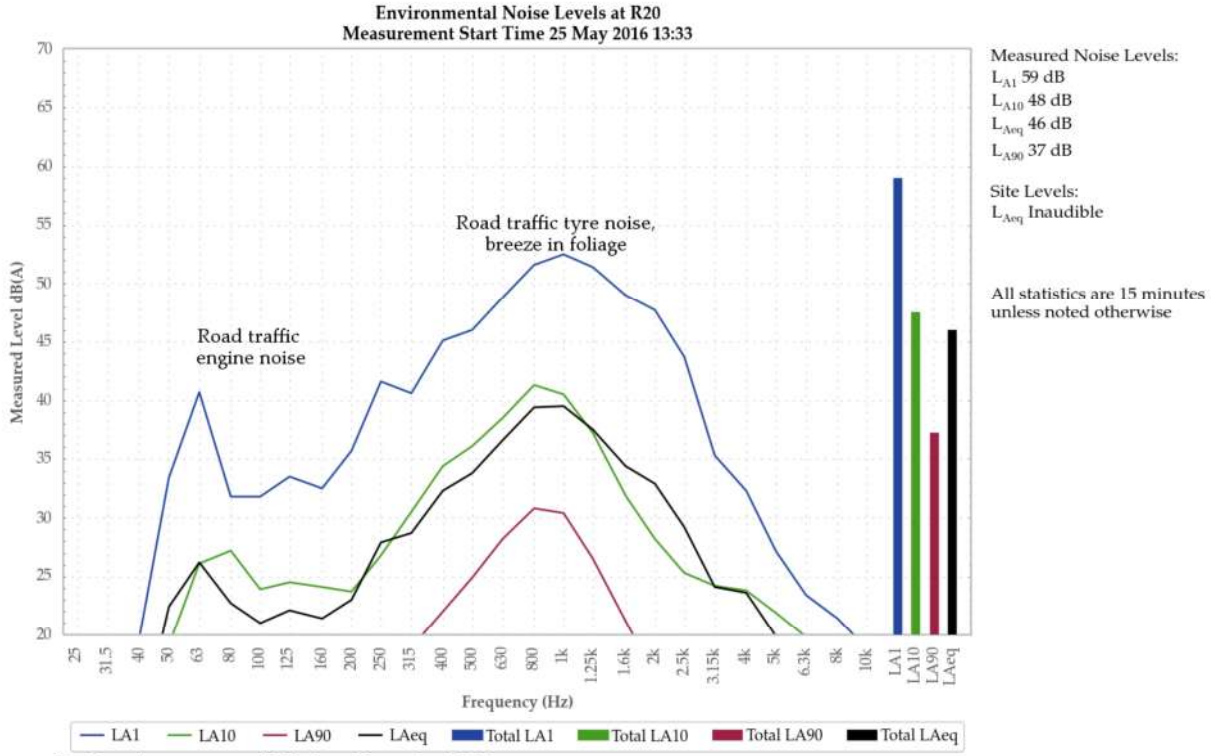


Figure 17: Environmental Noise Levels, R20

MCC was inaudible during the measurement.

Road traffic noise primarily generated all measured levels. Breeze in foliage also contributed to the measured L_{A10} and L_{Aeq}.

Insects and birds were also noted.

5.1.14 R20 Queen Street - Evening

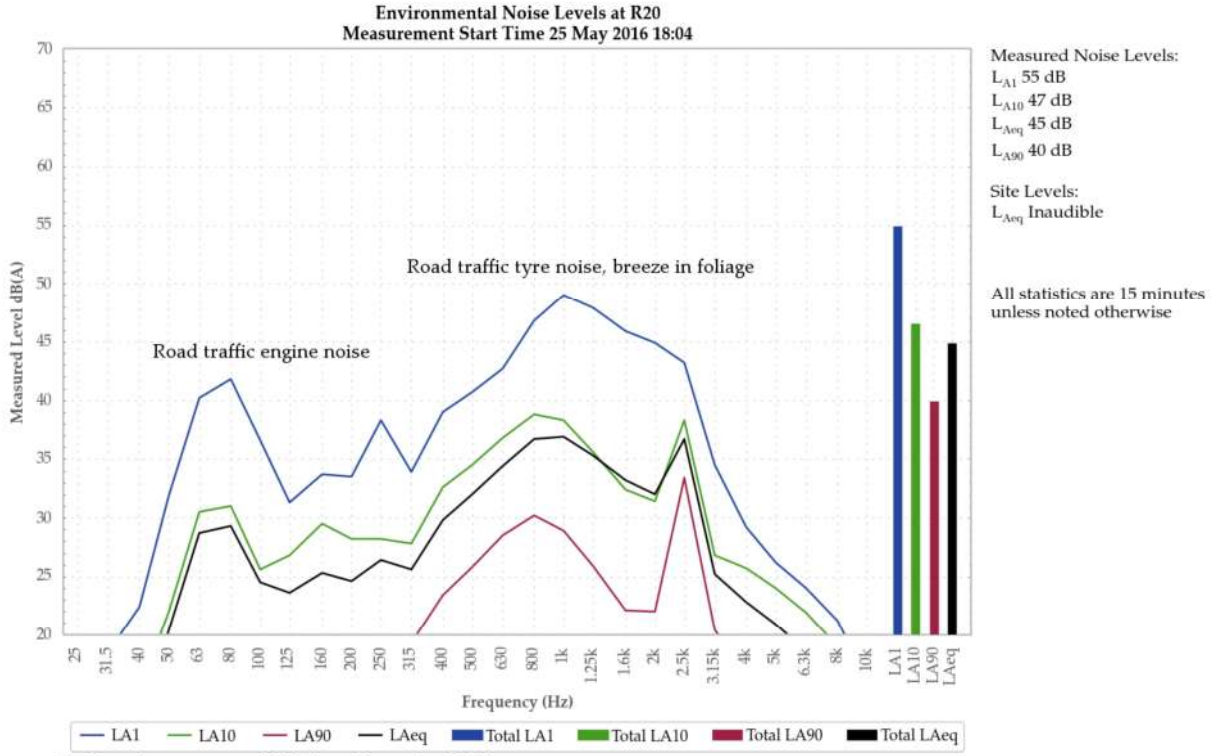


Figure 18: Environmental Noise Levels, R20

MCC was inaudible during the measurement.

Road traffic noise was primarily responsible for the measured levels. Insects contributed to the measured L_{A10}, L_{Aeq} and L_{A90}. Breeze in foliage also contributed to the measured L_{A1}, L_{A10} and L_{Aeq}.

A train was also noted.

5.1.15 R20 Queen Street - Night

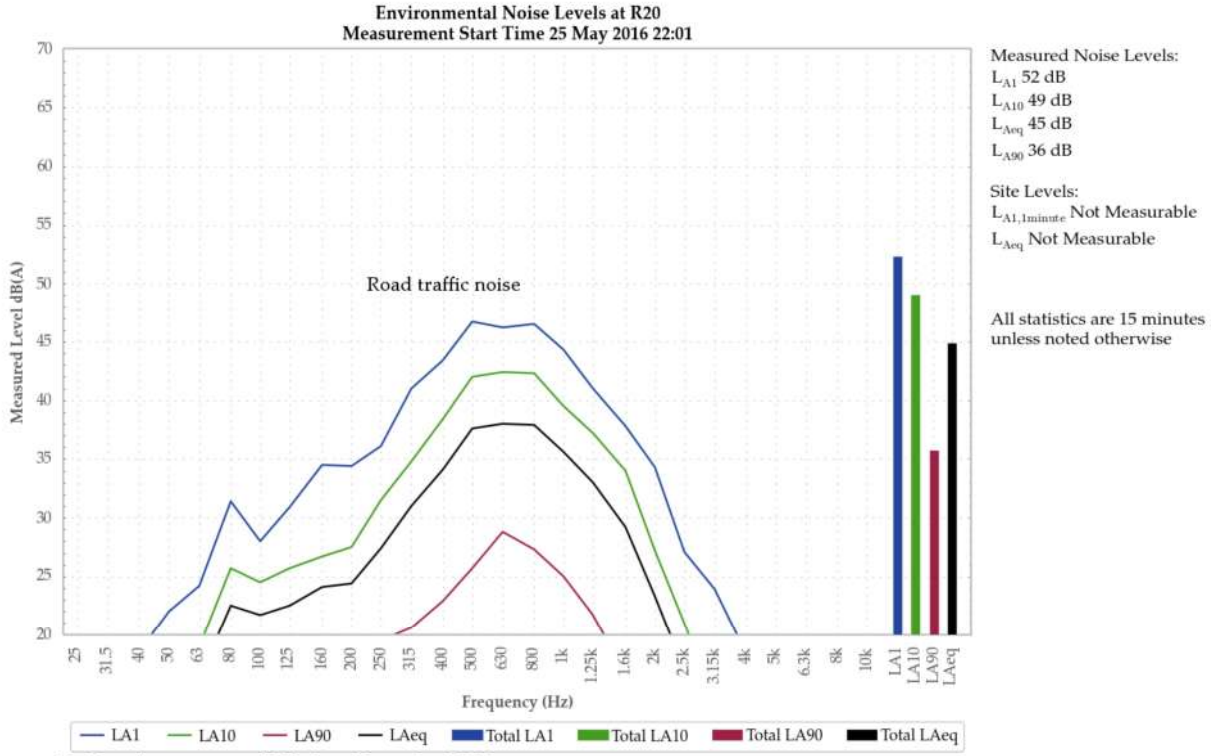


Figure 19: Environmental Noise Levels, R20

A low-level continuum was audible from MCC during the measurement, however levels were not measurable.

Noise from road traffic generated all measured levels.

Insects and frogs were also noted.

6 SUMMARY OF COMPLIANCE

The following summaries apply to attended noise monitoring conducted during the day, evening and night periods of 25 May 2016.

6.1 Operational Noise Assessment

Activities from MCC complied with the relevant development consent noise limits during monitoring on 25 May 2016 at all monitoring locations.

6.2 Low Frequency Assessment

No measurements occurred during which MCC mine was directly measurable and where meteorological conditions resulted in criteria applying (in accordance with the consent).

No further low frequency assessment was carried out.

Global Acoustics Pty Ltd

APPENDIX

A STATUTORY REQUIREMENTS

The relevant noise sections of the Development Approval DA 205_2002 are reproduced below.

6.4 Noise Control

6.4.1 Noise Criteria

EPA – GTA Noise generated at the premises must not exceed the noise limits presented in Table 6 below:

Table 6 *Noise Limits (dB(A))*

Location	Day	Evening	Night	
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{A1(1\ minute)}$
R7 RG & GA Watts	36	36	36	44
R 13 McMaster	40	40	40	51
R 15 Collins	35	35	35	46
R 16 Tuckey	35	35	35	46
R 17 Colvin	35	35	35	46
R 20 Gordon	38	38	38	48

Note: The EPA has advised that in order to prevent exceedences of the project specific noise levels during adverse meteorological conditions, especially at the R13 location, the saddle between the existing overburden dumps on the northern side of the No. 1 open-cut has to increase in height from RL205 to no greater than RL 224.

6.4.2 Noise Acquisition Criteria

The acquisition zone for noise is defined by predicted or demonstrated exceedence of the noise levels shown in Table 7 below

Table 7 *Acquisition Noise Limits (dB(A))*

Location	Day	Evening	Night
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$
R7 RG & GA Watts	41	41	41
R 13 McMaster	45	45	45
R 15 Collins	40	40	40
R 16 Tuckey	40	40	40
R 17 Colvin	40	40	40
R 20 Gordon	43	43	43

6.4.3 Interpretation of Noise Levels

(a) For the purposes of condition 6.4.1 and 6.4.2:

* Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
* Evening is defined as the period from 6pm to 10pm; and
* Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

(b) Noise from the project is to be measured within the residential boundary, or within 30m of the dwelling (rural stations) where the dwelling is more than 30m from the boundary to determine compliance with the LAeq(15 minutes) noise limit in Condition 6.4.1. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance. See chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where practical.

(c) Noise from the project is to be measured at 1m (unless otherwise agreed with the property owner) from the dwelling façade, to determine compliance with the LA1(1 minute) noise limits in Condition 6.4.1.

(d) The noise emission limits identified in Condition 6.4.1 apply under meteorological conditions of:

* Wind speed up to 3 m/s at 10 metres above ground level
* Temperature inversion conditions of up to 30C/100m.

(e) The loading of large rocks onto mine trucks is to be undertaken outside the night time period.

The relevant section of the EPL (Licence 656) is reproduced below.

L2 Noise limits

L2.1 Noise from the premises must not exceed the noise limits presented in the table below.

Location *	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LA1(1 minute)
R7 (RG & GA Watts)	36	36	36	44
R13 (McMaster)	40	40	40	51
R15 (Collins)	35	35	35	46
R16 (Tuckey)	35	35	35	46
R17 (Colvin)	35	35	35	46
R20 (Gordon)	38	38	38	48

Note: *The locations of the land identification numbers below are established in the document "*Muswellbrook Coal Company Ltd- No. 1 Open Cut Extension EIS 2003"* prepared by HLA Envirosciences Pty Ltd.

Where LAeq mean the equivalent continuous noise level - the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L2.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm; and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

L2.3 Noise from the premises is to be measured within the residential boundary, or within 30m of the dwelling (rural situations) where the dwelling is more than 30m from the boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1.

Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance.

L2.4 Noise from the premises is to be measured at 1 metre from the dwelling facade to determine comliance with the LA1(1 minute) noise limit in condition L2.1.

The relevant sections of the MCC Noise Management Plan (Dec 2015) are reproduced below.

4.0 NOISE MONITORING PROGRAM

4.1 ATTENDED NOISE MONITORING

The attended noise monitoring locations can be seen in **Figure 1** with a description provided in **Table 4**. All monitoring equipment will be maintained and calibrated as required.

Table 4: Noise Monitoring Locations

Location	Description
R7	Sandy Creek Road
R13	Sandy Creek Road
R15	Queen St
R17	Queen St
R20	Muscle Creek Road

Attended noise monitoring is undertaken approximately every six months. Noise levels during attended measurements will be taken in third-octave bands with an instrument that has Type 1 characteristics as defined in AS1259-1990 "Acoustics - Sound Level Meters". This instrument will have current calibration as per manufacturer's instructions and calibration will also be confirmed prior to and at the completion of measurements with a Sound Level Calibrator. The $LA_{eq\ (15\ minute)}$ noise emission levels, at each monitoring site, due to the normal operations of MCC will be determined.

Each attended noise survey will be conducted so that each of the Day, Evening and Night periods are monitored. If it is identified during the noise monitoring that the mining noise from the operation is 1dB(A) below the criteria or exceeding the criteria, MCC will be notified and the operations will be modified as required. Monitoring at the location(s) where the noise levels are elevated will be undertaken again with a minimum break of 75 minutes between monitoring.

Due to the distance of the mine from each residence, the monitoring of LA1 (1minute) at the facade is not necessary and will be conducted at the property boundary.

Field notes are to be taken at the time of the measurement, recording the time and duration of noise events, noise levels (dB), frequency (Hz), and source. Weather details and operational information will be recorded in the report.

APPENDIX

B CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
Level 7 Building 2 423 Pennant Hills Rd
Pennant Hills NSW AUSTRALIA 2120
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2006

Calibration Certificate

Calibration Number C15583

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	01070590
Microphone Serial Number :	00533
Pre-amplifier Serial Number :	70607

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	20.6°C	**Ambient Temperature :**	21.2°C
Relative Humidity :	56.3%	**Relative Humidity :**	62.4%
Barometric Pressure :	98.64kPa	**Barometric Pressure :**	98.56kPa

Calibration Technician :	Corey Stewart	**Secondary Check:**	Kate Alchin
Calibration Date :	06/11/2015	**Report Issue Date :**	10/11/2015

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10: Self-generated noise	*Pass*	14: Level linearity on the reference level range	*Pass*
11: Acoustical tests of a frequency weighting	*Pass*	15: Level linearity incl. the level range control	*Pass*
12: Electrical tests of frequency weightings	*Pass*	16: Toneburst response	*Pass*
13: Frequency and time weightings at 1 kHz	*Pass*	17: Peak C sound level	*Pass*
		18: Overload Indication	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.120dB*	*Temperature*	*±0.3°C*
12.5kHz	*±0.165dB*	*Relative Humidity*	*±4.1%*
16kHz	*±0.245dB*	*Barometric Pressure*	*±0.1kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.121dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA
WORLD RECOGNISED ACCREDITATION

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025.

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National standards.

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Acoustic Research Labs Pty Ltd
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www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3.2006
Calibration Certificate

Calibration Number C15226

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	00701424
Microphone Serial Number :	01916
Pre-amplifier Serial Number :	01463

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	20°C	**Ambient Temperature :**	21.6°C
Relative Humidity :	55.7%	**Relative Humidity :**	53%
Barometric Pressure :	99.62kPa	**Barometric Pressure :**	99.82kPa

Calibration Technician : Dennis Kim
Calibration Date : 22/05/2015
Secondary Check: Sandra Minto
Report Issue Date : 25/05/2015

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
10: Self-generated noise	*Pass*	14: Level linearity on the reference level range	*Pass*
11: Acoustical tests of a frequency weighting	*Pass*	15: Level linearity incl. the level range control	*Pass*
12: Electrical tests of frequency weightings	*Pass*	16: Toneburst response	*Pass*
13: Frequency and time weightings at 1 kHz	*Pass*	17: Peak C sound level	*Pass*
		18: Overload Indication	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.120dB*	*Temperature*	*±0.3°C*
12.5kHz	*±0.165dB*	*Relative Humidity*	*±4.1%*
16kHz	*±0.245dB*	*Barometric Pressure*	*±0.1kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.121dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

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www.acousticresearch.com.au

Sound Calibrator

IEC 60942-2004

Calibration Certificate

Calibration Number C15670

Client Details Global Acoustics
12/16 Huntingdale Drive
Thornton NSW 2322

Equipment Tested/ Model Number : Pulsar 106
Instrument Serial Number : 57413

Atmospheric Conditions
Ambient Temperature : 22°C
Relative Humidity : 54.8%
Barometric Pressure : 99.85kPa

Calibration Technician : Corey Stewart
Calibration Date : 23/12/2015
Secondary Check: Tim Williams
Report Issue Date : 23/12/2015
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
5.2.2: Generated Sound Pressure Level	*Pass*	5.3.2: Frequency Generated	*Pass*
5.2.3: Short Term Fluctuation	*Pass*	5.5: Total Distortion	*Pass*

Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
94.0	1000.0	94.2	1000.35

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Least Uncertainties of Measurement -

Specific Tests

Generated SPL	*±0.09dB*
Short Term Fluct.	*±0.02dB*
Frequency	*±0.01%*
Distortion	*±0.51%*

Environmental Conditions

Temperature	*±0.3°C*
Relative Humidity	*±4.1%*
Barometric Pressure	*±0.1kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA
WORLD RECOGNISED ACCREDITATION

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025

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Sound Calibrator
IEC 60942-2004

Calibration Certificate

Calibration Number C15325

Client Details Global Acoustics Pty Ltd
12/16 Huntingdale Drive
THORNTON NSW 2322

Equipment Tested/ Model Number : Pulsar Model 106
Instrument Serial Number : 74813

Atmospheric Conditions
Ambient Temperature : 21.9°C
Relative Humidity : 44%
Barometric Pressure : 100.6kPa

Calibration Technician : Dennis Kim
Calibration Date : 08/07/2015
Secondary Check: Sandra Minto
Report Issue Date : 13/07/2015

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
5.2.2: Generated Sound Pressre Level	*Pass*	5.3.2: Frequency Generated	*Pass*
5.2.3: Short Term Fluctuation	*Pass*	5.5: Total Distortion	*Pass*

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.09dB*	*Temperature*	*±0.3°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±4.1%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.1kPa*
Distortion	*±0.26%*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

NATA WORLD RECOGNISED ACCREDITATION

This calibration certificate is to be read in conjunction with the calibration test report.

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Accredited for compliance with ISO/IEC 17025.

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