Wambo Coal Mine and Rail Spur

Environmental Noise Monitoring

April 2020

Prepared for

Wambo Coal Pty Limited

Global Acoustics

Noise and Vibration Analysis and Solutions

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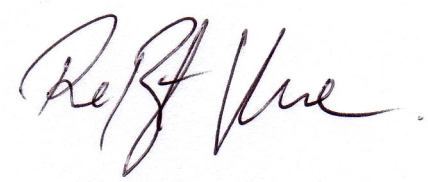

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Wambo Coal (WC) to conduct a monthly noise survey of operations at Wambo Coal Mine (WCM) and Wambo Coal Rail Spur (WCRS). WCM and WCRS operate under separate development consents and have been monitored separately, while reporting has been combined. The purpose of the survey is to quantify and describe the existing acoustic environment around WCM and WCRS, and compare results with relevant limits.

WC operates both open cut and underground mining operations from their mine at Warkworth, NSW. The open cut operations include use of heavy mobile equipment in open cut pits, on haul roads, and on waste rock emplacements. The underground operations have surface facilities. Both operations utilise a coal handling and preparation plant (CHPP) including conveyors, bins and other material-handling infrastructure.

The WCRS is located between Mt Thorley and Warkworth Village and includes the following components:

- a product coal stockpile and reclaim area, product coal conveyor, train load-out bin, rail loop and a rail spur from the WCM to Mount Thorley;
- rail transport of product coal to the market, an intermittent activity that can take place at any time; and
- a locomotive refuelling facility.

Attended environmental noise monitoring described in this report was undertaken during the night of 8/9 April 2020 at a total of six monitoring locations for WCM and WCRS.

1.2 Monitoring Locations & Frequency

Monitoring locations, type, and frequency are detailed in Table 1.1 and shown in Figure 1. It should be noted that Figure 1 shows the actual monitoring position, not the location of residences.

Table 1.1: WAMBO COAL MONITORING LOCATIONS AND FREQUENCY[1]

Site Reference	Residence	Monitor Type	Consent Requirements	Frequency
N01	Wambo Road Residence	Attended	Mine & Rail Spur	Monthly
N03	Kelly Residence	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly
N16	Jerrys Plains Road	Attended	Mine	Monthly
N20A	Redmanvale Road Central	Attended	Mine	Monthly
N20 [2]	*Redmanvale Road Central*	*Real-Time*	*Mine*	*Continuous*

Site Reference	Residence	Monitor Type	Consent Requirements	Frequency
N21	Wambo South	Real-Time & Attended	Mine & Rail Spur	Continuous & Monthly
N26	Redmanvale Road South	Attended	Mine	Monthly

Notes:

1. *Sourced from the NMP – WA-ENV-MNP-503, January 2018; and*
2. *N20 is not an attended noise monitoring location, but is the location of a real-time continuous noise monitor.*

Source: Google Maps

Figure 1: WCM Attended Noise Monitoring Locations

1.3 Terminology & Abbreviations

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
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise.
L_{Amax}	The maximum A-weighted noise level over a time period.
L_{A1}	The noise level which is exceeded for 1 per cent of the time.
$L_{A1,1minute}$	The noise level which is exceeded for 1 per cent of the specified time period of 1 minute.
L_{A10}	The noise level which is exceeded for 10 percent of the time.
L_{Aeq}	The average noise A-weighted energy during a measurement period.
L_{A50}	The noise level which is exceeded for 50 per cent of the time and the median noise level during a measurement period.
L_{A90}	The level exceeded for 90 percent of the time. 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.
L_{Ceq}	The average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
SC	Stability class (or category) is determined from measured wind speed and either sigma-theta or VTG.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible 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 REGULATOR REQUIREMENTS AND NOISE CRITERIA

2.1 WCM Development Consent

The most current development consent for WCM is DA 305-7-2003 (MOD 16, 29 August 2019). Schedule 4 of the WCM consent details specific conditions relating to noise generated by WCM. Relevant sections of the WCM consent are reproduced in Appendix A.

2.2 WCRS Development Consent

The most current development consent for Wambo Rail Loop is WCRS DA 177-8-2004 (MOD 3, 29 August 2019), last modified to include a rail refuelling facility. Schedule 4 of the WCRS consent details specific conditions relating to noise generated by WCRS. Relevant sections of the WCRS consent are reproduced in Appendix A.

2.3 Environment Protection Licence

WCM holds Environment Protection Licence (EPL) No. 529 issued by the Environment Protection Authority (EPA) most recently on 13 December 2019. Relevant sections of the EPL are reproduced in Appendix A.

2.4 Noise Management Plan

Noise monitoring requirements are detailed in the *Wambo Coal Noise Management Plan WA-ENV-MNP-503* (NMP, January 2018), prepared in accordance with the WCM and WCRS consents. The NMP states that monitoring will be conducted to assess noise levels from WCM and WCRS activities. Noise monitoring for rail activities is undertaken at properties numbered N01, N03 and N21 for rail pass-by noise. Relevant sections of the NMP are reproduced in Appendix A.

2.5 Noise Criteria

2.5.1 Development Consent

Noise criteria detailed in Table 2.1 have been adopted for each monitoring location based on the development consent (MOD 16).

Table 2.1: WCM OPERATIONAL NOISE CRITERIA, dB(A)

Location	Day $L_{Aeq,15minute}$	Evening/Night $L_{Aeq,15minute}$	Night $L_{A1,1minute}$
N01[1]	40	40	50
N03[2]	NA	NA	NA
N16	40	40	50
N20A	40	40	50
N21	40	40	50
N26	40	40	50

Notes:

1. *N01 was acquired and removed from MOD 16. Noise criteria for the nearest privately-owned property (R003 – Birrell) have been adopted; and*
2. *N03 was acquired. There are no other privately-owned properties in this area and noise criteria are NA 'not applicable'.*

2.5.2 Environment Protection Licence

Noise criteria detailed in Table 2.2 have been adopted for each monitoring location in accordance with Condition L4.1 of the EPL.

Table 2.2: WCM EPL NOISE LIMITS, dB(A)

Location	Day $L_{Aeq,15minute}$	Evening/Night $L_{Aeq,15minute}$	Night $L_{A1,1minute}$
N01[1]	35	40	50
N03[2]	NA	NA	NA
N16	35	40	50
N20A	35	40	50
N21	35	40	50
N26	35	40	50

Notes:

1. *N01 was acquired and removed from the EPL. Noise criteria for the nearest privately-owned property (3 – Birrell) have been adopted; and*
2. *N03 was acquired and removed from the EPL. There are no other privately-owned properties in this area and noise criteria are NA 'not applicable'.*

2.6 Meteorological Conditions

Meteorological conditions required for noise criteria to apply are not consistent between the consent and EPL.

2.6.1 Development Consent

Appendix 5 of MOD 16 details specific meteorological conditions required for noise criteria to be applicable:

APPENDIX 5 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in condition B12 are to apply under all meteorological conditions except the following:
   - (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
     - (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
     - (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or
     - (iii) temperature inversion conditions greater than 3°C/100m.
   - (b) where Pasquill Stability Classes have been assessed, then:
     - (i) wind speeds greater than 3m/s at 10m above ground level;
     - (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level;
     - (iii) stability category G temperature inversion conditions.

As lapse rates (VTG) were not measured directly, meteorological conditions have been assessed against Pasquill stability classes detailed in 1(b).

2.6.2 Environment Protection Licence

Condition L4.5 and L4.6 of the EPL detail meteorological conditions required for noise limits to apply:

L4.5 The noise emission limits identified in condition L4.1 apply under meteorological conditions of:

a) Wind speeds of up to 3m/s at 10 metres above the ground level; or
b) Temperature inversion conditions of up to 3ºC/100m and wind speeds of up to 2m/s at 10 metres above the ground.

L4.6 In regard to condition 4.5(b) of the Licence, temperature inversion conditions must be identified using the sigma-theta method in the EPA's Noise Policy for Industry, October 2017, from data obtained from the premises weather station at EPA monitoring point 17.

The 'sigma-theta method' outlined in the EPA's 'Noise Policy for Industry' (NPfI, 2017) allows Pasquill stability class to be determined from sigma-theta and wind speed data, but not temperature inversion gradient (VTG). VTG must be measured directly.

As VTG was not measured directly, there is no methodology available to assess against EPL condition L4.5. Subsequently, meteorological conditions have only been assessed against requirements detailed in Appendix 5 of the development consent.

2.7 Modifying Factors

The EPA NPfI was approved for use in NSW in October 2017, and supersedes the EPA's 'Industrial Noise Policy' (INP, 2000). Assessment and reporting of modifying factors is to be carried out in accordance with Fact Sheet C of the NPfI.

NPfI modifying factors, as they are applicable to mining noise, are described in more detail below.

2.7.1 Tonality and Intermittent Noise

As defined in the NPfI:

> *Tonal noise contains a prominent frequency and is characterised by a definite pitch.*
>
> *Intermittent noise is noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dB(A); for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.*

2.7.2 Low-Frequency Noise

As defined in the NPfI:

> *Low frequency noise is noise with an unbalanced spectrum and containing major components within the low-frequency range (10 – 160 Hz) of the frequency spectrum.*

The NPfI contains the current method of assessing low-frequency noise, which is a 2 step process as detailed below:

> *Measure/assess source contribution 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 is 15 dB or more and:*
>
> • *where any of the 1/3 octave noise levels in Table C2 are exceeded by **up to and including** 5 dB and cannot be mitigated, a 2 dBA positive adjustment to measured A weighted levels applies for the evening/night period; and*
>
> • *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 and associated notes from the NPfI is reproduced below:

Table C2: One-third octave low-frequency noise thresholds.

Hz/dB(Z)	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (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

Notes:

- dB(Z) = decibel (Z frequency weighted).
- For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from 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, 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 corrections only apply under the standard and/or noise-enhancing meteorological conditions.
- Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.
- 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 licence.

3 METHODOLOGY

3.1 Overview

Attended environmental noise monitoring was conducted in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise', relevant NSW EPA requirements, and the NMP. Meteorological data was obtained from the WCM automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured noise levels.

3.2 Attended Noise Monitoring

During this survey, monthly attended monitoring was undertaken during the night period at each location. The duration of each measurement was 15 minutes. Atmospheric condition measurement was also undertaken at each monitoring location.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows an accurate determination of the contribution, if any, to measured noise levels by the source of interest (in this case WCM and/or WCRS).

This survey presents noise levels gathered during attended monitoring that 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 WCM/WCRS's contribution, if any, to measured levels. At each receptor location, WCM/WCRS's $L_{Aeq,15minute}$ and $L_{A1,1minute}$ (in the absence of any other noise) was measured directly, where possible, or, determined by frequency analysis.

If the exact contribution of the source of interest cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise descriptors in accordance with Section 7.1 of the NPfI. This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods (e.g. measure closer and back calculate) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- Site noise levels were extremely low and unlikely, in many cases, to be even noticed;
- Site noise levels were masked by another relatively loud noise source that is characteristic of the environment (e.g. breeze in foliage or continuous road traffic noise) that cannot be eliminated by

moving closer; and/or

- It was not feasible, nor reasonable to employ methods such as move closer and back calculate. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

A measurement of $L_{A1,1minute}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level, or L_{Amax}, received from the site during the entire measurement period (i.e. the highest level of the worst minute during the 15 minute measurement).

Often extraneous noise events (for example, road traffic pass-bys and dogs) interfere with the measurement of site noise levels in the frequency range of interest. Where required, the analyser is paused during these occurrences to aid in quantification of the site only $L_{Aeq,15minute}$ level.

3.3 Meteorological Data

Meteorological data was obtained from the WCM meteorological station; this was logged at 10-minute intervals. Atmospheric parameters include wind speed, wind direction, rainfall and sigma theta. When meteorological data is provided in less than 15 minute intervals, an analysis must be conducted to determine the meteorological conditions present for the majority of each measurement period and whether those conditions result in noise criteria being applicable or not.

3.4 Modifying Factors

Years of monitoring have indicated that noise levels from mining operations, particularly those measured at significant distances from the source are relatively continuous and broad spectrum. Given this, noise levels from WCM at the monitoring locations are unlikely to be intermittent or tonal.

Assessment of low-frequency modifying factors is necessary when application of the maximum correction could potentially result in an exceedance of the relevant site-only L_{Aeq} criterion. Low-frequency analysis is therefore undertaken for measurements in this report where:

- meteorological conditions resulted in criteria being applicable;
- contributions from WCM were audible and directly measurable, such that the site-only L_{Aeq} was not "NM" or less than a maximum cut off value (e.g. "<20 dB" or "<30dB");
- contributions from WCM were within 5 dB of the relevant L_{Aeq} criterion, as 5 dB is the maximum penalty that can be applied by low-frequency modifying factors; and
- WCM was the only low-frequency noise source.

All measurements meeting these conditions were evaluated for possible low-frequency penalty applicability in accordance with the NPfI.

3.5 Attended Noise Monitoring Equipment

Equipment used to measure environmental noise levels are listed in Table 3.1. Calibration certificates are provided in Appendix B.

Table 3.1: ATTENDED NOISE MONITORING EQUIPMENT

Model	Serial Number	Calibration Due Date
Rion NA-28 sound level analyser	00370304	29/11/2020
Rion NA-28 sound level analyser	01070590	25/06/2020
Pulsar 106 acoustic calibrator	81334	12/02/2022
Pulsar 106 acoustic calibrator	79631	22/01/2021

4 RESULTS

4.1 Plant Locations

During monitoring undertaken on 8/9 April 2020 between 22:00 and 02:00, equipment in operation was as follows:

- EX211: Whybrow waste. All loads to the inpit dump. Walk to new dig at homestead after crib 11:45 till the end of shift;
- EX212: Topside loading ryder C waste exposing coal. Dozer to continue to push windrow on low wall side. All loads to the RL 100 dump;
- EX213: Conventional dig taking Wambo A waste. Dig back to limits to the South. All loads to the RL75 dump;
- EX214: Mining whynot coal then moving onto rib of coal to the north. All loads to the ROM stockpile Down 18:35-18:45 (10). Last load of coal at 2:30 walking (25);
- EX217: Down;
- EX218: Double benching wambo A waste. All loads to the rRL100 dump;
- EX219: Double benching wambo A waste. Dig limit pegs along the South. All loads to the RL75 dump. Down 18:05-;
- LD393: Loading BSUG. All loads to the ROM bin; and
- 3x watercarts operating and hotseated.

* Late staggered starts due to covid 19 and cleaning of equipment.

4.2 Total Measured Noise Levels

Overall noise levels measured at each location during attended measurements are provided in Table 4.1. Discussion as to the noise sources responsible for these measured levels is provided in Section 5 of this report.

Table 4.1: MEASURED NOISE LEVELS – APRIL 2020[1]

Location	Start Date and Time	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{Aeq} dB	L_{A50} dB	L_{A90} dB	L_{Amin} dB	L_{Ceq} dB
N01	08/04/2020 22:38	55	44	41	39	39	37	34	52
N03	08/04/2020 23:52	64	49	43	42	40	39	36	66
N16	08/04/2020 22:59	54	51	47	44	42	39	36	57
N20A	08/04/2020 22:29	51	42	38	36	35	34	32	54
N21	08/04/2020 22:13	57	55	54	52	52	50	45	56
N26	08/04/2020 22:00	59	38	36	35	34	32	30	55

Notes:

1. *Levels in this table are not necessarily the result of activity at WCM or WCRS.*

4.3 Modifying Factors

Measured site-only levels were assessed for the applicability of modifying factors in accordance with the NPfI.

There were no intermittent or tonal noise sources, as defined in the NPfI, audible from site during the survey.

None of the measurements satisfied the conditions outlined in Section 3.4 when assessing low-frequency noise. Therefore no further assessment of modifying factors was undertaken.

4.4 Attended Noise Monitoring

Table 4.2 to Table 4.3 detail noise levels from WCM in the absence of other noise sources. Noise criteria are applicable if weather conditions during the measurement were within parameters outlined in the WCM development consent.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL METEOROLOGICAL CONDITIONS – APRIL 2020

Location	Start Date and Time	Wind Speed m/s	Stability Category[1]	Criterion $L_{Aeq,15min}$ dB[2]	Criterion Applies?[3]	WCM $L_{Aeq,15min}$ dB [4,5]	Exceedance [5,6]
N01	08/04/2020 22:38	1.1	F	40	Yes	IA	Nil
N03	08/04/2020 23:52	0.8	F	NA	NA	40	NA
N16	08/04/2020 22:59	1.2	F	40	Yes	37	Nil
N20A	08/04/2020 22:29	1.1	F	40	Yes	35	Nil
N21	08/04/2020 22:13	1.0	F	40	Yes	IA	Nil
N26	08/04/2020 22:00	1.3	F	40	Yes	33	Nil

Notes:

1. *Stability Class calculated using sigma theta method provided by NPfI;*
2. *NA indicates that criterion is not applicable as this location has been acquired;*
3. *Noise emission limits identified in the above table apply under all meteorological conditions except wind speeds greater than 3 m/s at 10 metres above ground level; or stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level, or stability category G temperature inversion conditions;*
4. *Site-only $L_{Aeq,15minute}$ attributed to WCM, including modifying factors if applicable;*
5. *Bold results in red indicate an exceedance of relevant criterion; and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in development consent, therefore criterion was not applicable, or there is no applicable criterion.*

Table 4.3: $L_{A1,1minute}$ GENERATED BY WCM AGAINST PROJECT APPROVAL METEOROLOGICAL CONDITIONS – APRIL 2020

Location	Start Date and Time	Wind Speed m/s	Stability Category[1]	Criterion $L_{A1,1min}$ dB [2]	Criterion Applies?[3]	WCM $L_{Aeq,15min}$ dB [4,5]	Exceedance [5,6]
N01	08/04/2020 22:38	1.1	F	50	Yes	IA	Nil
N03	08/04/2020 23:52	0.8	F	NA	NA	42	NA
N16	08/04/2020 22:59	1.2	F	50	Yes	46	Nil
N20A	08/04/2020 22:29	1.1	F	50	Yes	44	Nil
N21	08/04/2020 22:13	1.0	F	50	Yes	IA	Nil
N26	08/04/2020 22:00	1.3	F	50	Yes	37	Nil

Notes:

1. *Stability Class calculated using sigma theta method provided by NPfI;*
2. *NA indicates that criterion is not applicable as this location has been acquired;*
3. *Noise emission limits identified in the above table apply under all meteorological conditions except wind speeds greater than 3 m/s at 10 metres above ground level; or stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level, or stability category G temperature inversion conditions;*
4. *Site-only $L_{A1,1minute}$ attributed to WCM;*
5. *Bold results in red indicate an exceedance of relevant criterion; and*
6. *NA in exceedance column means atmospheric conditions outside conditions specified in development consent, therefore criterion was not applicable, or there is no applicable criterion.*

4.5 Atmospheric Conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter is shown in Table 4.4. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.4: MEASURED ATMOSPHERIC CONDITIONS – APRIL 2020

Location	Start Date and Time	Temperature ° C	Wind Speed m/s	Wind Direction ° Magnetic North[1]	Cloud Cover 1/8s
N01	08/04/2020 22:38	17	0.7	170	8
N03	08/04/2020 23:52	18	0.3	140	8
N16	08/04/2020 22:59	17	0.8	140	8
N20A	08/04/2020 22:29	19	0.9	120	8
N21	08/04/2020 22:13	19	0.0	-	7
N26	08/04/2020 22:00	19	0.6	110	8

Notes:

1. *"-" indicates calm conditions at monitoring location.*

Meteorological data used for compliance assessment is sourced from the WCM AWS.

5 DISCUSSION

5.1 Noted Noise Sources

During attended monitoring, the time variations (temporal characteristics) of noise sources are taken into account in each measurement via statistical descriptors. From these observations, summaries have been derived for each location and provided in this chapter. Statistical 1/3 octave-band analysis of environmental noise was undertaken and the following figures display frequency ranges of various noise sources at each location for L_{A1}, L_{A10}, L_{Aeq}, L_{A50} and L_{A90} descriptors. These figures also provide, graphically, statistical information for these noise levels.

An example is provided as Figure 2 where it can be seen that frogs and insects are generating noise at frequencies above 1000 Hz while mining noise is at frequencies less than 1000 Hz, which 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, such as 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}.

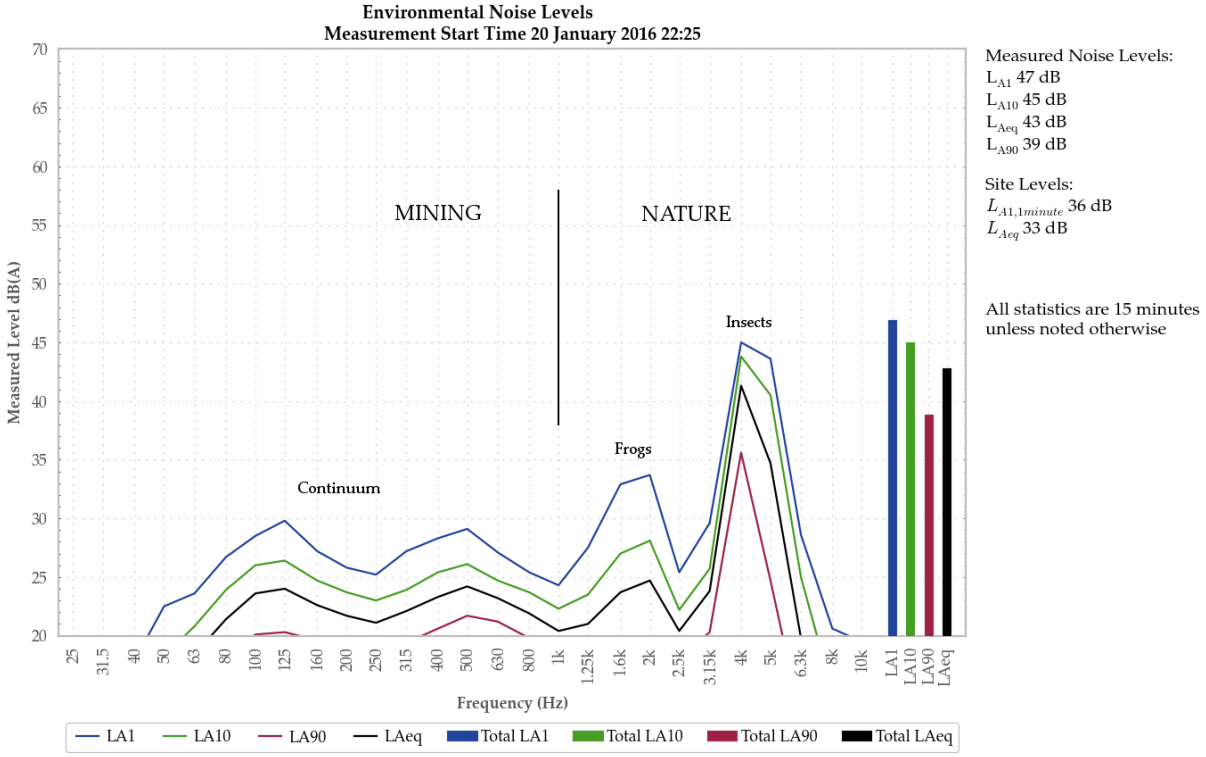

Figure 2: Example Graph (refer to section 5.1 for explanatory note)

5.1.1 N01

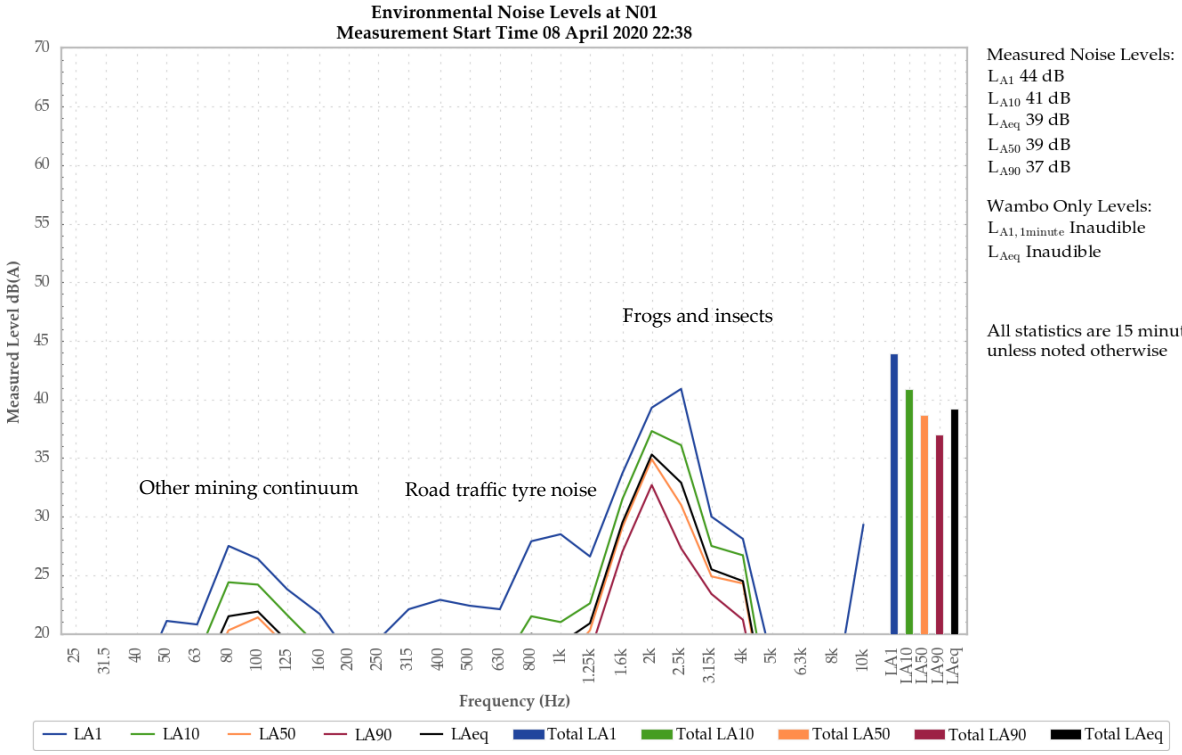

Figure 3: Environmental Noise Levels, N01 – Wambo Road

WCM was inaudible during the measurement.

Frogs and insects were responsible for all measured noise levels.

Road traffic tyre noise and continuum from another mining operation were also noted.

5.1.2 N03

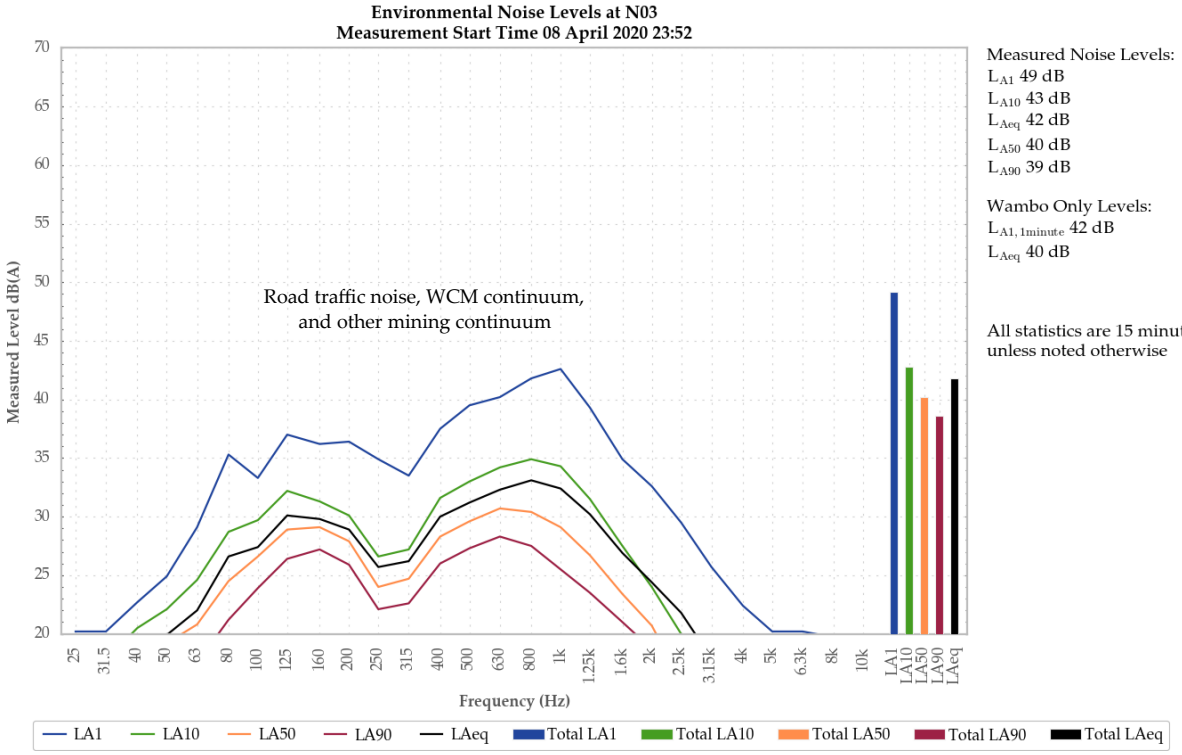

Figure 4: Environmental Noise Levels, N03 - Kelly

A mining and engine continuum from WCM was audible throughout the measurement, and generated the site-only L_{Aeq} of 40 dB. Surges in this continuum were responsible for the site-only $L_{A1,1minute}$ of 42 dB.

Road traffic noise was responsible for the measured L_{A1} and contributed to the measured L_{A10} and L_{Aeq}. WCM continuum also contributed to the measured L_{A10} and L_{Aeq}, and was primarily responsible for the measured L_{A50} and L_{A90}. Continuum from another mining operation was a minor contributor to the measured L_{A50} and L_{A90}.

Frogs and insects were also noted.

5.1.3 N16

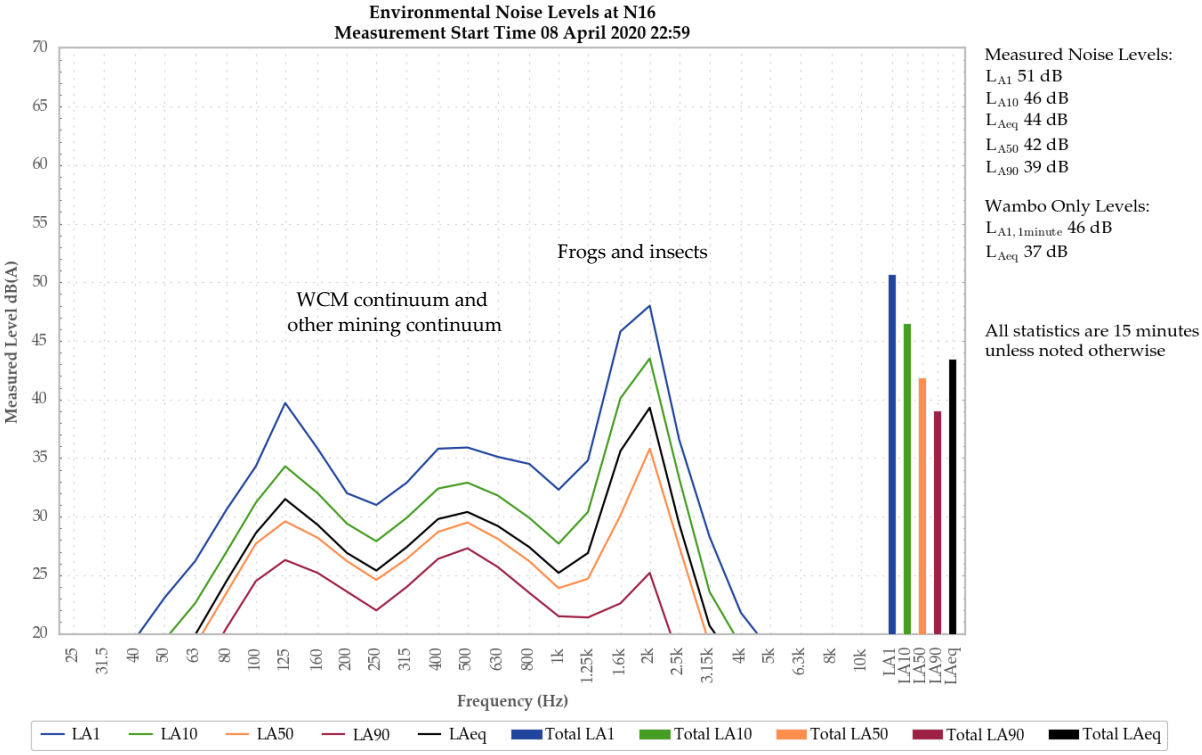

Figure 5: Environmental Noise Levels, N16 – Jerrys Plains Road

A mining continuum from WCM was audible throughout the measurement, and generated the site-only L_{Aeq} of 37 dB. Impact noise generated the site-only $L_{A1,1minute}$ of 46 dB. Engine and transmission noise were also noted.

Frogs and insects were primarily responsible for all measured noise levels. Continuum from WCM and another mining operation also contributed to the measured L_{A10}, L_{Aeq}, L_{A50}, and L_{A90}.

Breeze in the foliage was also noted.

5.1.4 N20A

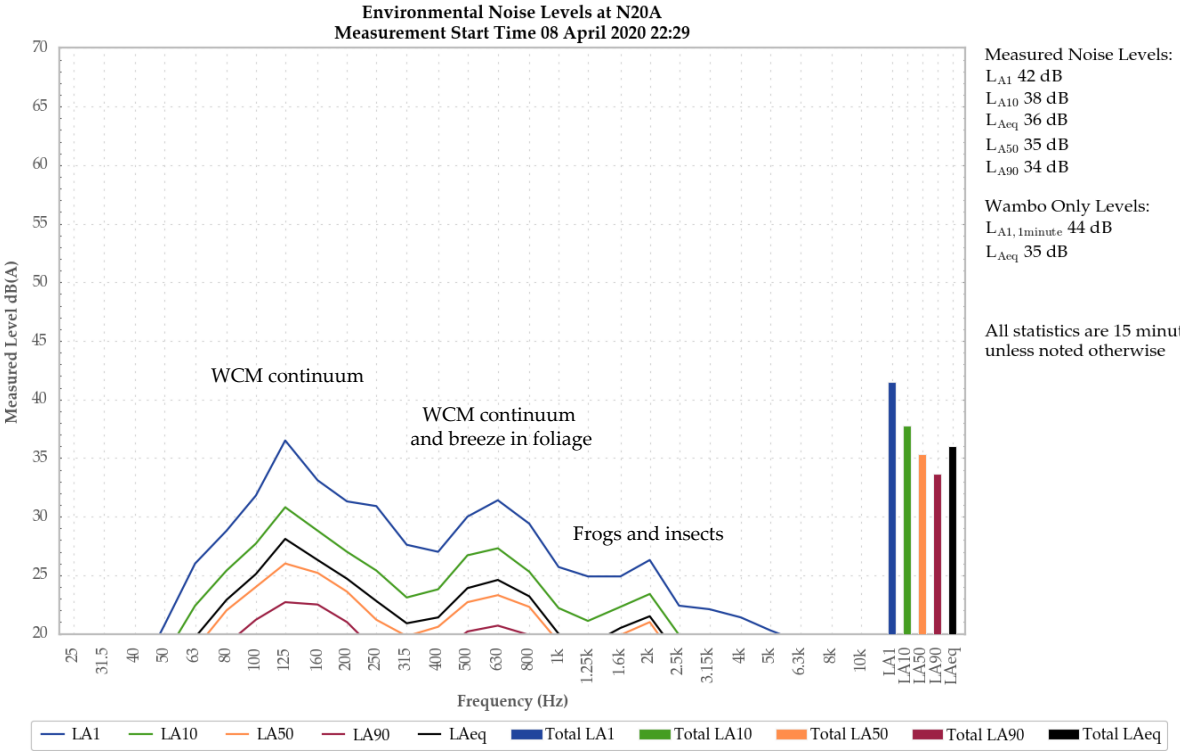

Figure 6: Environmental Noise Levels, N20A – Redmanvale Road Central

A mining continuum from WCM was audible throughout the measurement, and generated the site-only L_{Aeq} of 35 dB. Engine surges were responsible for the measured site-only $L_{A1,1minute}$ of 44 dB. Track and transmission noise were also noted.

Continuum from WCM primarily generated all measured noise levels. Breeze was a minor contributor to the measured L_{A10} and L_{Aeq}. Frogs and insects were a minor contributor to the measured L_{A50} and L_{A90}.

Bats and birds were also noted.

5.1.5 N21

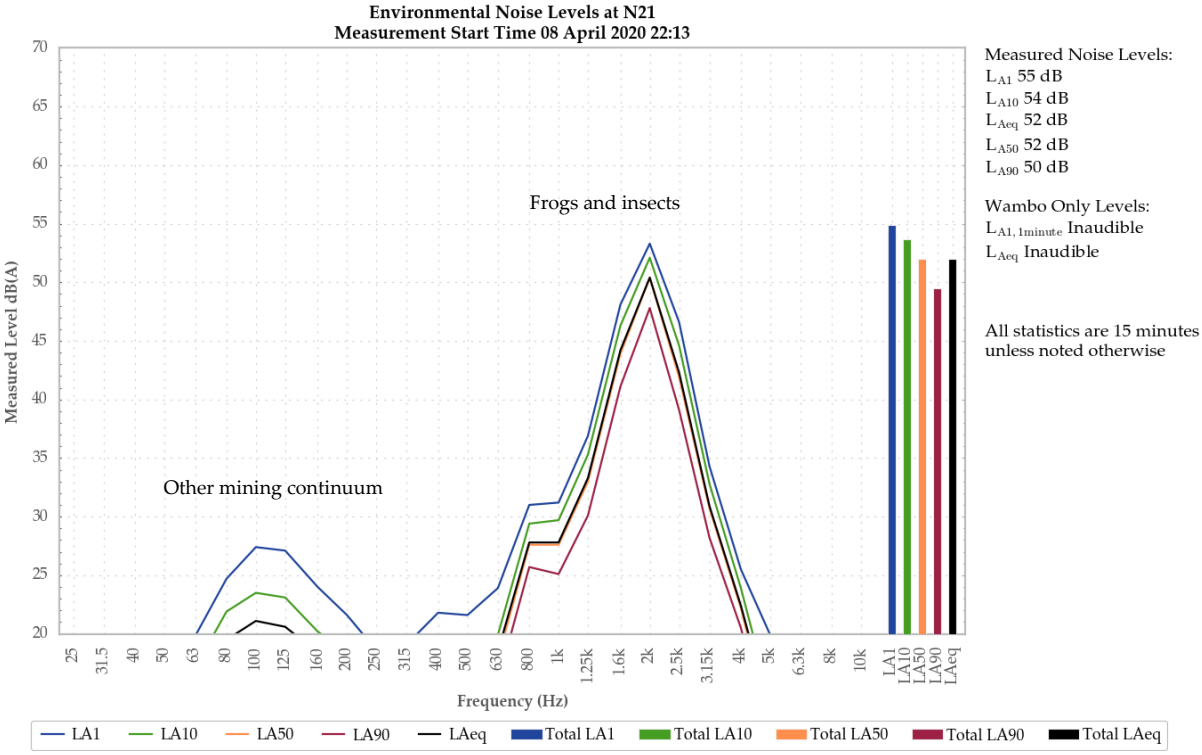

Figure 7: Environmental Noise Levels, N21 – Wambo South

WCM was inaudible during the measurement.

Frogs and insects generated the measured noise levels.

Continuum from another mining operation was also noted.

5.1.6 N26

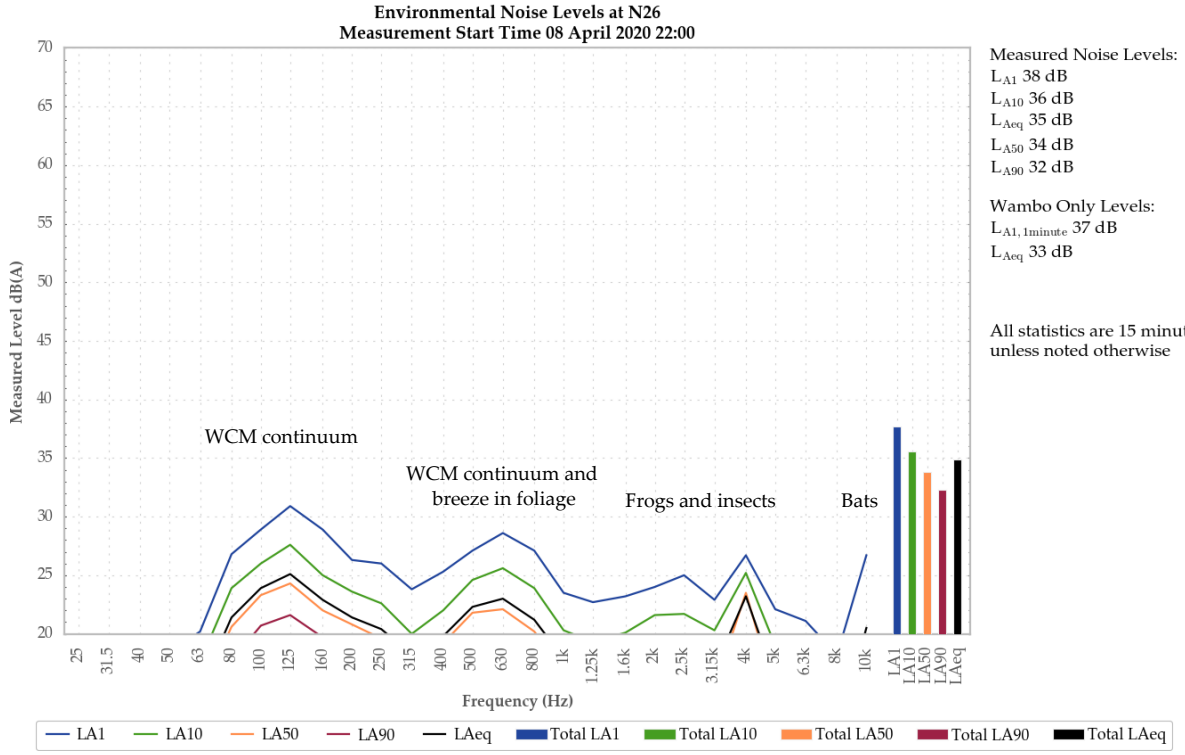

Figure 8: Environmental Noise Levels, N26 – Redmanvale Road South

A mining continuum from WCM was audible throughout the measurement, and generated the measured site-only L_{Aeq} of 33 dB. Engine surges were responsible for the site-only $L_{A1,1minute}$ of 37 dB. Track noise was also noted.

Continuum and other mining noise from WCM were primarily responsible for the measured noise levels. Bats contributed to the measured L_{A1}. Breeze in the foliage contributed to the measured L_{A10} and L_{Aeq}. Frogs and insects contributed to the measured L_{Aeq}, L_{A50}, and L_{A90}.

6 SUMMARY

Global Acoustics was engaged by WC to conduct a monthly noise survey of operations at WCM and WCRS. The purpose of the survey is to quantify and describe the existing acoustic environment and compare results with relevant limits.

Attended environmental noise monitoring described in this report was undertaken during the night of 8/9 April 2020 at six monitoring locations.

Noise levels from WCM and WCRS complied with relevant criteria at all monitoring locations during the April 2020 survey. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A REGULATOR DOCUMENTS

A.1 WAMBO COAL MINE DEVELOPMENT CONSENT

NOISE

Operational Noise Criteria

B12. During Phase 1, the Applicant must ensure that the noise generated by the Wambo Mining Complex does not exceed the criteria in Table 3 at any residence[a] on privately-owned land.

Table 3: *Operational noise criteria dB(A) for Phase 1*

Noise Assessment Location	Day $L_{Aeq\ (15\ min)}$	Evening/Night $L_{Aeq\ (15\ min)}$	Night $L_{A1\ (1\ min)}$
R019	59	59	N/A
R003	40	40	50
R016			
R025			
R029			
R033			
R039			
R042			
R320 (previously 15B)			
R345 (previously 15B)			
R006	39	39	50
R007			
R048			
R343 (previously 37)			
R017	38	38	50
R030 (previously 38)			
R035			
R049			
R075			
R346			
R348			
R379 (previously 91)			
R043	37	37	50
R163			
R344 (previously 137)			
R380 (previously 246)			
R381 (previously 178)	36	36	50
All other privately-owned residences	35	35	50

[a] *The Noise Assessment Locations referred to in Table 3 are shown in Appendix 4.*

Noise Management Plan

B17. The Applicant must prepare a Noise Management Plan for the Wambo Mining Complex to the satisfaction of the Planning Secretary. This plan must:

(a) be prepared by a suitably qualified and experienced person/s;

(b) be prepared in consultation with the EPA;

(c) describe the measures to be implemented to ensure:

(i) compliance with the noise criteria and operating conditions in this consent;

(ii) best practice management is being employed; and

(iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions under which the noise criteria in this consent do not apply (see Appendix 5);

(d) seek to minimise road traffic noise generated by employee commuter vehicles on public roads;

(e) describe the noise management system in detail; and

(f) include a monitoring program that:

(i) uses a combination of real-time and supplementary attended monitoring to evaluate the performance of the development;

(ii) includes a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results over time;

(iii) adequately supports the noise management system; and

(iv) includes a protocol for distinguishing noise emissions between the Wambo Mining Complex and United Wambo open cut coal mine; and

(v) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of any such event.

B18. The Applicant must not commence Phase 2 until the Noise Management Plan is approved by the Planning Secretary.

B19. The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

A.2 WAMBO RAIL SPUR DEVELOPMENT CONSENT

ACQUISITION UPON REQUEST

C1. Upon receiving a written request for acquisition from the owner of the privately-owned land[a] listed in Table 3, the Applicant must acquire the land in accordance with the procedures in conditions C3 to C10, inclusive.

Table 3: *Land subject to acquisition upon request*

R019

[a] *The location of the land referred to in Table 3 is shown on the figure in Appendix 3.*

NOISE

Noise Operating Conditions

B1. The Applicant must:

(a) take all reasonable steps to minimise all noise associated with the development, including during noise-enhancing meteorological conditions;

(b) operate a noise management system commensurate with the risk of impact to ensure compliance with the relevant conditions of this consent;

(c) only use locomotives and rolling stock that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL and use reasonable endeavours to ensure that rolling stock is selected to minimise noise;

(d) use all reasonable efforts to co-ordinate noise management on the site with the noise management at Wambo mine; and

(e) carry out regular attended noise monitoring to determine whether the development is complying with the relevant conditions of this consent.

A.3 ENVIRONMENT PROTECTION LICENCE 529

L4.1 Noise generated at the premises must not exceed the noise limits presented in the table below. The noise limits in the table below represent the noise contribution from the premises.

Noise Limits dB(A)

Receiver Land Number	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LA1(1 minute)
94 - Curlewis	35	41	41	50
3 - Birrell 4B - Circosta 15 - McGowen/ Caslick 16 - Cooper 25 - Fenwick 28 - Garland 33 - Thelander/ O'Neill 39 - Northcote 40 - Muller 254 - Algie	35	40	40	50
5 - Strachan 6 - Merrick 7 - Maizey 37 - Lawry 48 - Ponder	35	39	39	50
1 - Brosi 17 - Carter 18 - Denney 30 - Williams 49 - Oliver 63 - Abrocuff 75 - Barnes 91 - Bailey	35	38	38	50
27 - Birralee 43 - Carmody 137 - Woodruff 163 - Rodger/ Williams 246 - Bailey	35	37	37	50
13B - Skinner 178 - Smith 188 - Fuller 262 - Moses	35	36	36	50

All other residential or sensitive receptors excluding the receptors listed above and also excluding those listed in Table 1 of Schedule 4 of the Wambo Coal Mine Development Consent (DA 305-7-2003).	35	35	35	50

L4.2 For the purpose of Condition L4.1:
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
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays
d) The Receiver Land Owner locations are as detailed in the Environmental Impact Statement titled "*Wambo Development Project*", Volumes 1-5 dated July 2003 and prepared by Resource Strategies Pty Ltd.

L4.3 Noise from the premises is to be measured at the most affected point or within the residential boundary or at the most affected point 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 L4.1.

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

L4.4 Noise from the premises is to be measured at 1m from the dwelling façade to determine compliance with the LA1(1minute) noise limit in condition L4.1.

L4.5 The noise emission limits identified in condition L4.1 apply under meteorological conditions of:

a) Wind speeds of up to 3m/s at 10 metres above the ground level; or
b) Temperature inversion conditions of up to 3°C/100m and wind speeds of up to 2m/s at 10 metres above the ground.

L4.6 In regard to condition 4.5(b) of the Licence, temperature inversion conditions must be identified using the sigma-theta method in the EPA's Noise Policy for Industry, October 2017, from data obtained from the premises weather station at EPA monitoring point 17.

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 61672-3.2013
Calibration Certificate

Calibration Number C18618

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

Equipment Tested/ Model Number : Rion NA-28
Instrument Serial Number : 00370304
Microphone Serial Number : 10421
Pre-amplifier Serial Number : 60313

Pre-Test Atmospheric Conditions
Ambient Temperature : 23.6°C
Relative Humidity : 42.6%
Barometric Pressure : 98.42kPa

Post-Test Atmospheric Conditions
Ambient Temperature : 22.4°C
Relative Humidity : 42.4%
Barometric Pressure : 98.45kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 26 Nov 2018
Secondary Check: Lewis Boorman
Report Issue Date : 29 Nov 2018
Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*Pass*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, 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 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests
31.5 Hz to 8kHz ±0.12dB
12.5kHz ±0.18dB
16kHz ±0.51dB
Electrical Tests
31.5 Hz to 20 kHz ±0.12dB

Environmental Conditions
Temperature ±0.05°C
Relative Humidity ±0.46%
Barometric Pressure ±0.017kPa

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

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 - calibration.

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

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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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 61672-3.2013

Calibration Certificate

Calibration Number C18363

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 :	08184
Pre-amplifier Serial Number :	52329

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	21.3°C	**Ambient Temperature :**	22.7°C
Relative Humidity :	41.7%	**Relative Humidity :**	39.2%
Barometric Pressure :	100.95kPa	**Barometric Pressure :**	100.89kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 25 Jun 2018
Secondary Check: Lewis Boorman
Report Issue Date : 25 Jun 2018
Approved Signatory : Juan Aguero

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	Pass
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	Pass
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, 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 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.12dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.18dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.31dB*	*Barometric Pressure*	*±0.017kPa*
Electrical Tests			
31.5 Hz to 20 kHz	*±0.12dB*		

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

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 - calibration.

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Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
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www.acousticresearch.com.au

Sound Calibrator
IEC 60942-2017

Calibration Certificate

Calibration Number C20082

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

Equipment Tested/ Model Number : Pulsar Model 106
Instrument Serial Number : 81334

Atmospheric Conditions
Ambient Temperature : 24.6°C
Relative Humidity : 48.9%
Barometric Pressure : 99.8kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 12 Feb 2020
Secondary Check: Max Moore
Report Issue Date : 13 Feb 2020
Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.1	1000.35

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 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	*±0.14dB*	*Temperature*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.5%*	*Barometric Pressure*	*±0.015kPa*

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

* The tests <1000 kHz are not covered by Acoustic Research Labs Pty Ltd NATA 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 - calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Calibrator

IEC 60942-2017

Calibration Certificate

Calibration Number C19029

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

Equipment Tested/ Model Number : Pulsar Model 106
Instrument Serial Number : 79631

Atmospheric Conditions
Ambient Temperature : 23.1°C
Relative Humidity : 58.2%
Barometric Pressure : 99.49kPa

Calibration Technician : Charlie Neil
Calibration Date : 22 Jan 2019
Secondary Check: Lewis Boorman
Report Issue Date : 24 Jan 2019
Approved Signatory : Ken Williams

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.3	1000.38

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 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	*±0.11dB*	*Temperature*	*±0.2°C*
Frequency	*±0.01%*	*Relative Humidity*	*±2.4%*
Distortion	*±0.5%*	*Barometric Pressure*	*±0.013kPa*

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

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 - calibration.

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