

*Wambo Coal Mine
Annual Report*

*Environmental Noise Monitoring
1 January to 31 December 2016*

*Prepared for
Wambo Coal Pty Limited*



Noise and Vibration Analysis and Solutions

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Wambo Coal Mine – Annual Report

Environmental Noise Monitoring 1 January to 31 December 2016

Reference: 17017_R01

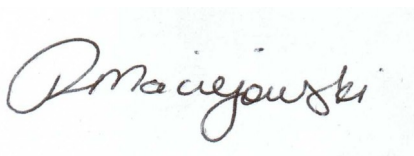
Report date: 23 February 2017

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EXECUTIVE SUMMARY

Global Acoustics was engaged by Wambo Coal Pty Ltd to provide a summary of the monthly environmental noise surveys conducted around Wambo Coal Mine (WCM), and the Wambo Coal Rail Spur (WCRS) from 1 January to 31 December 2016. The mine and spur operate under separate development consents and have been monitored separately. Reporting, however, has been combined in this document.

WCM was granted consent (DA 305-7-2003) in February 2004, which enables the extension of current open cut and underground mining operations. The latest modification to this consent was approved in October 2016.

The WCRS consists of two Development Applications (DA's):

- The Wambo Rail Loop (DA 177-8-2004); and
- The Wambo Rail Line (DA 235/97).

The relevant sections of these consents are reproduced in Appendix A.

The *Wambo Coal Environmental Management System, Noise Monitoring Plan* (EMP011, February 2014) was prepared in accordance with Schedule 4 of both consents. The Noise Monitoring Plan (NMP) indicates that monitoring will be conducted for WCM and WCRS activities, and the noise levels to be used for assessment.

Attended environmental noise monitoring described in this report was undertaken at four sites on a one night per month basis during 2016. The survey purpose was to quantify and describe the existing acoustic environment around WCM and WCRS and compare results with relevant development consent conditions.

Noise levels from WCM and WCRS complied with relevant criteria at all sites during the attended noise monitoring.

It is noted that wind speeds and/or temperature inversion conditions were at levels greater than which development consent conditions would apply for WCM and WCRS activities in some instances.

There have been no significant changes in noise level trends over the past three years.

Predicted noise levels from Year 9 were compared against actual noise levels during 2016. Results of the comparison indicate that meteorological conditions included in the EIS modelled predictions did not regularly occur during attended monitoring. When meteorological conditions were relevant, results show that WCM was generally well under the predicted levels.

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1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Wambo Coal Pty Ltd to provide a summary of the monthly environmental noise surveys conducted around Wambo Coal Mine (WCM), and the Wambo Coal Rail Spur (WCRS) from 1 January to 31 December 2016. The mine and spur operate under separate development consents and have been monitored separately. Reporting, however, has been combined in this document.

Wambo Coal 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, New South Wales (as shown in Figure 1) 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 Wambo Coal Mine to Mount Thorley; and
- rail transport of product coal to the market, an intermittent activity that can take place at any time; and
- a locomotive refuelling facility.

A noise survey around both the WCM and the WCRS is required monthly as detailed in the Noise Management Plan (NMP).

Attended environmental noise monitoring described in this report was undertaken at four sites on a one night per month basis during 2016. Figure 1 shows the monitoring locations.

The survey purpose was to quantify and describe the existing acoustic environment around WCM and WCRS and compare results with relevant limits.

1.2 Monitoring Locations & Frequency

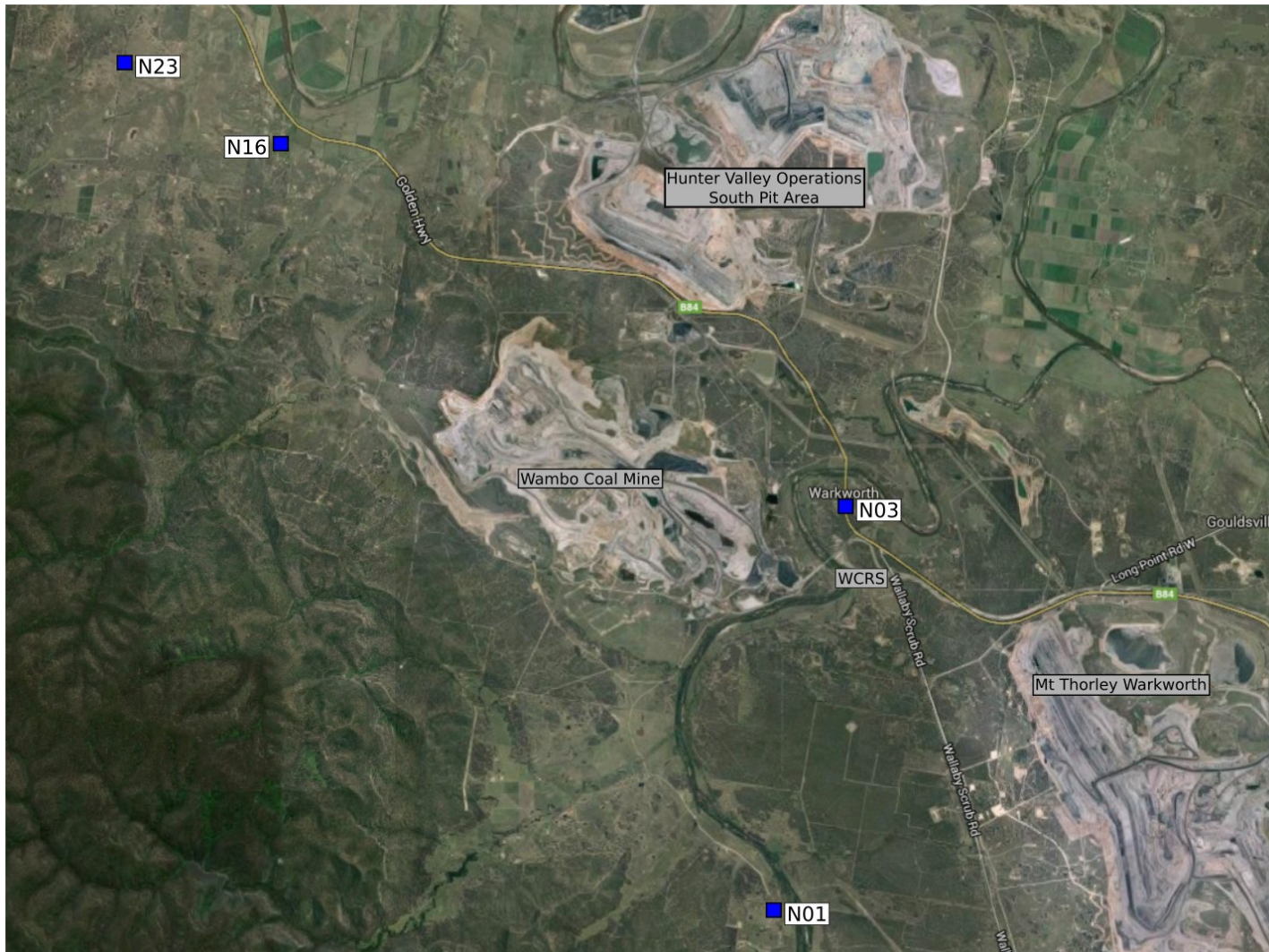
Attended noise monitoring was conducted at a total of four locations for WCM and the WCRS. There are also two real-time monitors (from a total of four) at other locations. Table 1.1 outlines the monitor type and frequency for the noise monitoring locations; attended monitoring locations are shown in Figure 1.

Table 1.1: WAMBO COAL MONITORING LOCATIONS & FREQUENCY^{1,2}

Site Reference	Site Location	Monitor Type	Consent Requirements	Frequency ¹
N01	<i>Lambkin Residence</i>	Attended	Mine Development Consents	Monthly
N03	<i>Kelly Residence</i>	Real-time & Attended	Mine and Rail Spur Development Consent	Continuous & Monthly
N16	<i>Muller Residence</i>	Real-time & Attended	Mine Development Consent	Continuous & Monthly
N20	Thelander Residence	Real-time	Mine Development Consent	Continuous
N21	Wambo South Residence	Real-time	Mine Development Consent	Continuous
N23	<i>Redmanvale Road</i>	Attended	Mine Development Consent	Monthly

Notes:

1. Sourced from the Draft Wambo Coal Noise Monitoring Plan -EMP011, February 2014; and
2. Attended locations are shown in italics.



Source: Google Maps

Figure 1: WCM Attended Noise Monitoring Sites

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 _{A10}	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels
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 _{Aeq}	The average noise energy during a measurement period
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
SC	Stability Class. Estimated from wind speed and sigma theta data
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 DEVELOPMENT CONSENT

2.1 Wambo Coal Mine Development Consent

WCM was granted consent (DA 305-7-2003) in February 2004, which enables the extension of current open cut and underground mining operations. The latest modification to this consent was approved in October 2016. The relevant sections of this modification are reproduced in Appendix A.

The *Wambo Coal Environmental Management System, Noise Monitoring Plan* (EMP011, February 2014) was prepared in accordance with Schedule 4. The NMP indicates that monitoring will be conducted for WCM activities, and the noise levels to be used for assessment. Monitoring for noise from mining activities is undertaken at the properties numbered N01, N03, N16 and N23.

It should be noted that properties N01 and N03 are subject to acquisition upon request, as detailed in Schedule 4, Condition 1 of DA 305-7-2003. As such, there are no operational noise goals that apply to these properties.

Table 2.1 summarises relevant noise assessment criteria for WCM.

Table 2.1: WAMBO COAL MINE NOISE CRITERIA

Location	Day L _{Aeq,15minute} dB	Evening / Night L _{Aeq,15minute} dB	Night L _{A1,1minute} dB
N01 ²	NA	NA	NA
N03 ²	NA	NA	NA
N16 ¹	35	40	50
N23 ¹	35	38	50

Notes:

1. Criteria from Development Consent DA 305-7-2003; and
2. N01 and N03 are acquisition upon request and criteria are NA 'not applicable'.

While the consent does not specify noise limits under which the above criteria apply, the NSW EPA environment protection licence (EPL No. 529) specifies that the limits apply under the following meteorological conditions:

- wind speeds of up to 3 m/s at 10 metres above ground level; or
- temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.

2.2 Wambo Coal Rail Spur Development Consent

The WCRS consists of two Development Applications (DA's):

- The Wambo Rail Loop (DA 177-8-2004), modified in February 2012 to include a rail refuelling facility; and
- The Wambo Rail Line (DA 235/97).

The *Wambo Coal Environmental Management System, Noise Management Plan* (EMP011, February 2014) was prepared in accordance with Schedule 4. The NMP indicates that monitoring will be conducted for WCRS activities, and the noise levels to be used for assessment. The relevant sections of the consents are reproduced in Appendix A.

Monitoring for noise from rail activities has previously been undertaken at properties numbered N01, N24 and N25 for rail pass-by noise. Locations N24 and N25 have been removed from the monitoring program following long-term demonstrated compliance. Monitoring is still undertaken at N01 as part of the mine consent, however, monitoring of the rail activities is no longer required. As detailed in the NMP, monitoring at these locations will recommence following any complaints or if there is a change in rolling stock.

It should be noted that properties at N01 are subject to acquisition upon request, as detailed in Schedule 4, Condition 1 of DA 305-7-2003. As such, there are no operational noise goals that apply directly to this property.

Quarterly monitoring of the rail loading facility is no longer undertaken at N03, due to a demonstrated history of compliance. Should anything change with the procedure for refuelling or a resident complaint be received, further monitoring will be undertaken to determine changes to received noise levels.

2.3 INP Modifying Factors

Noise monitoring and reporting is carried out generally in accordance with the Environment Protection Authority (EPA) 'Industrial Noise Policy' (INP). Chapter 4 of the INP deals specifically with modifying factors that may apply to industrial noise. The most common modifying factors are addressed in detail below.

As detailed in L4.3 of the EPL:

The modification factors in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise levels where applicable.

2.3.1 Tonality, Intermittent and Impulsive Noise

As defined in the Industrial Noise Policy:

Tonal noise contains a prominent frequency and is characterised by a definite pitch.

Impulsive noise has high peaks of short duration and a sequence of such peaks.

Intermittent noise is characterised by the level suddenly dropping to the background noise levels several times during a measurement, with a noticeable change in noise level of at least 5 dB. Intermittent noise applies to night-time only.

Years of monitoring have shown that noise levels from mining operations, particularly those levels measured at significant distances from the source are relatively continuous. Given this, noise levels from WCM at the monitoring locations are unlikely to be intermittent. In addition, there is no equipment on site that is likely to generate tonal or impulsive noise as defined in the INP.

2.3.2 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 using the method specified in the paper “A Simple Method for Low Frequency Noise Emission Assessment” (Broner JLFNV Vol29-1 pp1-14 2010). If the site only C-weighted noise level at a receptor exceeds the relevant modifying factor trigger, a 5 dB penalty (modifying factor) is added to predicted levels. This method is included to provide a comparison with the INP method.

Low Frequency Assessment Methods

Low frequency assessment methods are detailed in Table 2.2.

Table 2.2: LOW FREQUENCY ASSESSMENT METHODS AND MODIFYING FACTOR TRIGGERS

Method	Calculation Method	Night Period Modifying Factor Trigger	Day Period Modifying Factor Trigger
Broner, 2010	Site only L_{Ceq} to 250 Hz	>60	>65
INP, total	Site only Total L_{Ceq} minus Site only L_{Aeq}	≥ 15	≥ 15

The EPA is currently undertaking a review of the assessment of low frequency noise. While a Draft Industrial Noise Guideline (ING) was released in September 2015, low frequency noise results from WCM have been compared to the assessment methods and modifying factor triggers presented above. The applicability of these triggers has been considered when applying low frequency modifying factor corrections.

3 METHODOLOGY

3.1 Assessment Method

3.1.1 Overview

Noise monitoring was conducted at the nearest residences in accordance with the Environment Protection Authority (EPA) 'Industrial Noise Policy' (INP) guidelines and Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise'. The mine was operating for all monitoring periods.

A measurement of $L_{A1,1\text{minute}}$ corresponds to the highest noise level generated for 0.6 second during one minute. In practical terms this is the highest noise level emitted from the Wambo Coal noise source during the entire measurement period (i.e. the highest level of the worst minute during the 15-minute measurement).

As indicated in the consent conditions, the $L_{A1,1\text{minute}}$ measurement should be undertaken at 1 metre from the dwelling façade and the $L_{Aeq,15\text{minute}}$ measurement within 30 metres of the dwelling. However, the direct measurement of noise at 1 metre from the façade is not practical during monitoring for this project. In most cases, monitoring near the residence is impractical due to barking dogs or issues with obtaining access. In all cases, measurements for this survey were undertaken at a suitable and representative location.

Meteorological data was obtained from the Wambo Coal Mine meteorological station. This allowed correlation of atmospheric parameters and measured noise levels. Ground level atmospheric condition measurement was also undertaken during attended monitoring.

3.1.2 Attended Noise Monitoring

Attended noise monitoring was conducted at all sites generally during night hours. While night period monitoring is the required time to measure the source of interest, we consider atmospheric conditions during the later stages of the evening period to be the same as those during the night period and so it is valid to compare results from this measurement to night period criteria. The duration of all measurements was 15 minutes.

Attended monitoring is preferred to the use of loggers when determining compliance with prescribed limits; 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).

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. NM indicates that some site noise was audible, but indeterminate due to one of the following reasons:

- site noise levels were insignificant and unlikely, in many cases, to be even noticed; or
- site noise levels were masked by another relatively loud noise source, but were estimated to be less than L_{Aeq} 30 dB, which is insignificant in terms of any applicable criterion.

If site noise were NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods as per the Industrial Noise Policy (e.g. measure closer and back calculate) to determine a value for reporting. All sites noted NM in this report are due to insignificant absolute values.

3.2 Meteorological Data

Meteorological data was obtained from the Wambo meteorological station. Atmospheric parameters included wind speed, wind direction, rainfall and sigma theta. This data allowed correlation of atmospheric parameters and measured noise levels. Meteorological data was available in 5 minute intervals.

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 the measurement period and whether those conditions relate to noise criteria being applicable. In order to accurately compare 5-minute meteorological data to 15-minute noise level measurement periods, a rolling 15-minute meteorological interval was produced by converting each 5-minute meteorological interval into an average of the preceding three 5-minute intervals. The rolling 15-minute meteorological interval which most closely matched the 15-minute noise level measurement period was then adopted as the predominant meteorological conditions for that measurement period.

Where rolling averages could not be used (such as for VTG and stability class), the predominant condition, corresponding with the majority of 5-minute meteorological intervals, was adopted.

3.3 Weather Conditions

Weather conditions were recorded at each location during each noise level measurement. Although the consent is not specific as to where the meteorological data should be sourced, information from WCM has been used as it is measured with an elevated anemometer as is required by the consent. The anemometer at WCM is not overly distant from the monitoring locations and is considered to be representative of the general area. Wind speeds measured at 10 metres above ground are usually higher than those measured closer to ground level. In accordance with consent conditions, noise criteria only apply in wind speeds up to 3 metres per second.

4 RESULTS

There were a total of four monitoring locations during this survey as listed in Table 1.1 and shown on Figure 1.

4.1 Quarter 1, 2016

4.1.1 Total Noise Levels

Noise levels measured at each location during attended 15 minute surveys are provided in Table 4.1.

Table 4.1: MEASURED NOISE LEVELS – QUARTER 1, 2016¹

Location	Start Date and Time	L _{A1} dB	L _{A10} dB	L _{Aeq} dB	L _{A90} dB
N01	19/01/2016 00:00	52	51	50	48
N03	18/01/2016 23:30	49	47	46	44
N16	18/01/2016 23:02	57	52	51	48
N23	18/01/2016 22:37	46	44	43	42
N01	02/02/2016 23:51	46	44	42	40
N03	03/02/2016 00:46	43	41	40	38
N16	02/02/2016 23:47	47	46	44	42
N23	02/02/2016 23:10	55	45	45	40
N01	09/03/2016 23:50	48	45	43	42
N03	10/03/2016 01:46	50	48	47	45
N16	10/03/2016 01:01	47	46	44	41
N23	10/03/2016 00:17	44	41	40	38

Notes:

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

4.1.2 Wambo Coal Mine Noise

Noise levels generated by activity at Wambo mine are shown in Table 4.2 and Table 4.3, where comparison of measured $L_{Aeq,15}$ minute and $L_{A1,1}$ minute levels for WCM is made with relevant noise criteria.

Table 4.2: $L_{Aeq,15}$ minute GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 1, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion $L_{Aeq,15}$ min dB ¹	Criterion Applies? ³	WCM $L_{Aeq,15}$ min dB ^{4,5}	Exceedance ^{6,8}
N01 ²	19/01/2016 00:00	0.7	4.1	NA	NA	35	NA
N03 ²	18/01/2016 23:30	0.6	4.1	NA	NA	34	NA
N16	18/01/2016 23:02	0.7	4.1	40	No	IA	NA
N23	18/01/2016 22:37	0.9	4.1	38	No	IA	NA
N01 ²	02/02/2016 23:51	1.6	3.0	NA	NA	NM	NA
N03 ²	03/02/2016 00:46	0.0	4.1	NA	NA	39	NA
N16	02/02/2016 23:47	1.4	4.1	40	No	35	NA
N23	02/02/2016 23:10	1.6	4.1	38	No	<30	NA
N01 ²	09/03/2016 23:50	0.6	4.1	NA	NA	<30	NA
N03 ²	10/03/2016 01:46	0.7	4.1	NA	NA	47	NA
N16	10/03/2016 01:01	0.1	4.1	40	No	<30	NA
N23	10/03/2016 00:17	0.8	4.1	38	No	IA	NA

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable (NA);
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured $L_{Aeq,15}$ minute attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

Table 4.3: *L_{A1,1minute}* GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 1, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion L _{A1,1min} dB ¹	Criterion Applies? ³	WCM L _{A1,1min} dB ^{4,5}	Exceedance ^{6,8}
N01 ²	19/01/2016 00:00	0.7	4.1	NA	NA	37	NA
N03 ²	18/01/2016 23:30	0.6	4.1	NA	NA	38	NA
N16	18/01/2016 23:02	0.7	4.1	50	No	IA	NA
N23	18/01/2016 22:37	0.9	4.1	50	No	IA	NA
N01 ²	02/02/2016 23:51	1.6	3.0	NA	NA	NM	NA
N03 ²	03/02/2016 00:46	0.0	4.1	NA	NA	42	NA
N16	02/02/2016 23:47	1.4	4.1	50	No	38	NA
N23	02/02/2016 23:10	1.6	4.1	50	No	<30	NA
N01 ²	09/03/2016 23:50	0.6	4.1	NA	NA	32	NA
N03 ²	10/03/2016 01:46	0.7	4.1	NA	NA	55	NA
N16	10/03/2016 01:01	0.1	4.1	50	No	NM	NA
N23	10/03/2016 00:17	0.8	4.1	50	No	IA	NA

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable;
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured L_{A1,1minute} attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible “-” denotes no criterion;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable, or, there is no applicable criterion;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

4.1.3 Low Frequency Assessment

Table 4.4 provides statistics for attended noise monitoring undertaken around WCM during Quarter 1, 2016.

Table 4.4: ATTENDED MEASUREMENT STATISTICS FOR WCM – QUARTER 1, 2016

Conditions	Total for Quarter 1, 2016
Number of measurements	12
Number of measurements where WCM was measurable, was within 5 dB of the relevant criterion and the relevant criterion applied	0

None of the 12 measurements occurred during which WCM was measurable (not “inaudible” or “not measurable”), was within 5 dB of the relevant criterion and where meteorological conditions resulted in criteria applying (in accordance with the consent). No further assessment of low frequency noise was undertaken.

4.2 Quarter 2, 2016

4.2.1 Total Noise Levels

Noise levels measured at each location during attended 15 minute surveys are provided in Table 4.5.

Table 4.5: MEASURED NOISE LEVELS – QUARTER 2, 2016¹

Location	Start Date and Time	LA1 dB	LA10 dB	LAeq dB	LA90 dB
N01	28/04/2016 23:20	42	41	39	36
N03	29/04/2016 01:22	43	41	39	37
N16	29/04/2016 00:02	47	46	43	39
N16 ²	29/04/2016 01:15	48	47	44	41
N23	29/04/2016 00:47	36	33	32	29
N01	18/05/2016 22:01	38	37	35	27
N03	18/05/2016 22:31	52	42	42	38
N16	18/05/2016 22:57	59	47	46	27
N23	18/05/2016 23:20	35	26	25	19
N01	23/06/2016 00:08	51	46	42	31
N03	22/06/2016 23:15	42	40	39	37
N16	22/06/2016 22:24	53	37	39	28
N23	22/06/2016 22:00	46	42	39	30

Notes:

1. Levels in this table are not necessarily the result of activity at WCM; and
2. Remeasure.

4.2.2 Wambo Coal Mine Noise

Noise levels generated by activity at Wambo mine are shown in Table 4.6 and Table 4.7, where comparison of measured $L_{Aeq,15\text{minute}}$ and $L_{A1,1\text{minute}}$ levels for WCM is made with relevant noise criteria.

Table 4.6: $L_{Aeq,15\text{minute}}$ GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 2, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion $L_{Aeq,15\text{min}}$ dB ¹	Criterion Applies? ³	WCM $L_{Aeq,15\text{min}}$ dB ^{4,5}	Exceedance ^{6,8}
N01 ²	28/04/2016 23:20	0.1	4.1	NA	NA	IA	NA
N03 ²	29/04/2016 01:22	0.4	4.1	NA	NA	39	NA
N16	29/04/2016 00:02	0.4	4.1	40	No	43	NA
N16 ⁹	29/04/2016 01:15	0.3	4.1	40	No	44	NA
N23	29/04/2016 00:47	0.0	4.1	50	No	NM	NA
N01 ²	18/05/2016 22:01	2.9	0.5	NA	NA	25	NA
N03 ²	18/05/2016 22:31	2.8	-1.0	NA	NA	39	NA
N16	18/05/2016 22:57	3.0	-1.0	40	Yes	IA	Nil
N23	18/05/2016 23:20	3.4	-1.0	38	No	IA	NA
N01 ²	23/06/2016 0:08	3.0	-1.0	NA	NA	27	NA
N03 ²	22/06/2016 23:15	3.2	-1.0	NA	NA	NM	NA
N16	22/06/2016 22:24	2.6	-1.0	40	Yes	NM	Nil
N23	22/06/2016 22:00	2.9	-1.0	38	Yes	IA	Nil

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable (NA);
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured $L_{Aeq,15\text{minute}}$ attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures;
8. Bold and red text indicate an exceedance of relevant criterion; and
9. Remeasure.

Table 4.7: $L_{A1,1minute}$ GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 2, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion $L_{A1,1min}$ dB ¹	Criterion Applies? ³	WCM $L_{A1,1min}$ dB ^{4,5}	Exceedance ^{6,8}
N01 ²	28/04/2016 23:20	0.1	4.1	NA	NA	IA	NA
N03 ²	29/04/2016 01:22	0.4	4.1	NA	NA	45	NA
N16	29/04/2016 00:02	0.4	4.1	50	No	52	NA
N16 ⁹	29/04/2016 01:15	0.3	4.1	50	No	51	NA
N23	29/04/2016 00:47	0.0	4.1	50	No	NM	NA
N01 ²	18/05/2016 22:01	2.9	0.5	NA	NA	32	NA
N03 ²	18/05/2016 22:31	2.8	-1.0	NA	NA	43	NA
N16	18/05/2016 22:57	3.0	-1.0	50	Yes	IA	Nil
N23	18/05/2016 23:20	3.4	-1.0	50	No	IA	NA
N01 ²	23/06/2016 0:08	3.0	-1.0	NA	NA	35	NA
N03 ²	22/06/2016 23:15	3.2	-1.0	NA	NA	NM	NA
N16	22/06/2016 22:24	2.6	-1.0	50	Yes	NM	Nil
N23	22/06/2016 22:00	2.9	-1.0	50	Yes	IA	Nil

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable;
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured $L_{A1,1minute}$ attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible “-” denotes no criterion;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable, or, there is no applicable criterion;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures;
8. Bold and red text indicate an exceedance of relevant criterion; and
9. Remeasure.

4.2.3 Low Frequency Assessment

Table 4.8 provides statistics for attended noise monitoring undertaken around WCM during Quarter 2, 2016.

Table 4.8: ATTENDED MEASUREMENT STATISTICS FOR WCM – QUARTER 2, 2016

Conditions	Total for Quarter 2, 2016
Number of measurements	13
Number of measurements where WCM was measurable, was within 5 dB of the relevant criterion and the relevant criterion applied	0

None of the 13 measurements occurred during which WCM was measurable (not “inaudible” or “not measurable”), was within 5 dB of the relevant criterion and where meteorological conditions resulted in criteria applying (in accordance with the consent). No further assessment of low frequency noise was undertaken.

4.3 Quarter 3, 2016

4.3.1 Total Noise Levels

Noise levels measured at each location during attended 15 minute surveys are provided in Table 4.9.

Table 4.9: MEASURED NOISE LEVELS – QUARTER 3, 2016¹

Location	Start Date and Time	LA1 dB	LA10 dB	LAeq dB	LA90 dB
N01	07/07/2016 22:00	39	35	33	31
N03	07/07/2016 22:30	54	41	49	31
N16	07/07/2016 22:57	52	36	38	29
N23	07/07/2016 23:22	35	31	30	28
N01	01/08/2016 23:59	42	38	36	34
N03	01/08/2016 23:16	52	42	40	34
N16	01/08/2016 22:23	61	50	48	23
N23	01/08/2016 22:00	43	34	32	25
N01	20/09/2016 00:08	48	47	44	39
N03	19/09/2016 23:23	44	41	39	37
N16	19/09/2016 22:24	56	47	43	28
N23	19/09/2016 21:50	42	36	34	32

Notes:

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

4.3.2 Wambo Coal Mine Noise

Noise levels generated by activity at Wambo mine are shown in Table 4.10 and Table 4.11, where comparison of measured LAeq,15minute and LA1,1minute levels for WCM is made with relevant noise criteria.

Table 4.10: LAeq,15minute GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 3, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion LAeq,15min dB ¹	Criterion Applies? ³	WCM LAeq,15min dB ^{4,5}	Exceedance ^{6,8}
N01 ²	07/07/2016 22:00	1.7	0.5	NA	NA	IA	NA
N03 ²	07/07/2016 22:30	1.7	-1.0	NA	NA	NM	NA
N16	07/07/2016 22:57	1.8	-1.0	40	Yes	28	Nil
N23	07/07/2016 23:22	1.1	3.0	38	Yes	29	Nil
N01 ²	01/08/2016 23:59	0.5	4.1	NA	NA	<30	NA
N03 ²	01/08/2016 23:16	0.7	-1.0	NA	NA	NM	NA
N16	01/08/2016 22:23	0.3	4.1	40	No	IA	NA
N23	01/08/2016 22:00	0.1	4.1	38	No	IA	NA
N01 ²	20/09/2016 00:08	2.3	0.5	NA	NA	<25	NA
N03 ²	19/09/2016 23:23	2.1	3.0	NA	NA	39	NA
N16	19/09/2016 22:24	1.8	0.5	40	Yes	IA	Nil
N23	19/09/2016 21:50	2.6	-1.0	38	Yes	IA	Nil

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable (NA);
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured LAeq,15minute attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

Table 4.11: $L_{A1,1\text{minute}}$ GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 3, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion $L_{A1,1\text{min}}$ dB ¹	Criterion Applies? ³	WCM $L_{A1,1\text{min}}$ dB ^{4,5}	Exceedance ^{6,8}
N01 ²	07/07/2016 22:00	1.7	0.5	NA	NA	IA	NA
N03 ²	07/07/2016 22:30	1.7	-1.0	NA	NA	NM	NA
N16	07/07/2016 22:57	1.8	-1.0	50	Yes	28	Nil
N23	07/07/2016 23:22	1.1	3.0	50	Yes	30	Nil
N01 ²	01/08/2016 23:59	0.5	4.1	NA	NA	<30	NA
N03 ²	01/08/2016 23:16	0.7	-1.0	NA	NA	NM	NA
N16	01/08/2016 22:23	0.3	4.1	50	No	IA	NA
N23	01/08/2016 22:00	0.1	4.1	50	No	IA	NA
N01 ²	20/09/2016 00:08	2.3	0.5	NA	NA	25	NA
N03 ²	19/09/2016 23:23	2.1	3.0	NA	NA	52	NA
N16	19/09/2016 22:24	1.8	0.5	50	Yes	IA	Nil
N23	19/09/2016 21:50	2.6	-1.0	50	Yes	IA	Nil

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable;
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured $L_{A1,1\text{minute}}$ attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible "-" denotes no criterion;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable, or, there is no applicable criterion;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

4.3.3 Low Frequency Assessment

Table 4.12 provides statistics for attended noise monitoring undertaken around WCM during Quarter 3, 2016.

Table 4.12: ATTENDED MEASUREMENT STATISTICS FOR WCM – QUARTER 3, 2016

Conditions	Total for Quarter 3, 2016
Number of measurements	12
Number of measurements where WCM was measurable, was within 5 dB of the relevant criterion and the relevant criterion applied	0

None of the 12 measurements occurred during which WCM was measurable (not “inaudible” or “not measurable”), was within 5 dB of the relevant criterion and where meteorological conditions resulted in criteria applying (in accordance with the consent). No further assessment of low frequency noise was undertaken.

4.4 Quarter 4, 2016

4.4.1 Total Noise Levels

Noise levels measured at each location during attended 15 minute surveys are provided in Table 4.13.

Table 4.13: MEASURED NOISE LEVELS – QUARTER 4, 2016¹

Location	Start Date and Time	LA1 dB	LA10 dB	LAeq dB	LA90 dB
N01	06/10/2016 22:36	44	40	38	33
N03	06/10/2016 23:36	46	42	40	38
N16	06/10/2016 23:03	46	39	35	23
N23	06/10/2016 22:33	33	28	27	25
N01	09/11/2016 22:24	51	51	47	44
N03	09/11/2016 23:00	41	39	37	35
N16	09/11/2016 23:20	38	36	34	31
N23	09/11/2016 22:47	40	38	36	35
N01	01/12/2016 23:54	46	44	42	39
N03	01/12/2016 23:38	50	46	44	42
N16	01/12/2016 22:47	46	43	42	39
N23	01/12/2016 22:17	41	40	38	37

Notes:

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

4.4.2 Wambo Coal Mine Noise

Noise levels generated by activity at Wambo mine are shown in Table 4.14 and Table 4.15, where comparison of measured $L_{Aeq,15\text{minute}}$ and $L_{A1,1\text{minute}}$ levels for WCM is made with relevant noise criteria.

Table 4.14: $L_{Aeq,15\text{minute}}$ GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 4, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion $L_{Aeq,15\text{min}}$ dB ¹	Criterion Applies? ³	WCM $L_{Aeq,15\text{min}}$ dB ^{4,5}	Exceedance ^{6,8}
N01 ²	06/10/2016 22:36	1.3	3.0	NA	NA	<20	NA
N03 ²	06/10/2016 23:36	0.6	4.1	NA	NA	39	NA
N16	06/10/2016 23:03	1.1	0.5	40	Yes	<20	Nil
N23	06/10/2016 22:33	1.3	3.0	38	Yes	<20	Nil
N01 ²	09/11/2016 22:24	0.1	4.1	NA	NA	IA	NA
N03 ²	09/11/2016 23:00	0.0	4.1	NA	NA	36	NA
N16	09/11/2016 23:20	0.2	4.1	40	Yes	28	Nil
N23	09/11/2016 22:47	0.6	4.1	38	Yes	23	Nil
N01 ²	01/12/2016 23:54	0.1	4.1	NA	NA	<30	NA
N03 ²	01/12/2016 23:38	0.0	4.1	NA	NA	<30	NA
N16	01/12/2016 22:47	1.1	4.1	40	No	38	NA
N23	01/12/2016 22:17	0.8	4.1	38	No	IA	NA

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable (NA);
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level;
4. Estimated or measured $L_{Aeq,15\text{minute}}$ attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

Table 4.15: *L*_{A1,1minute} GENERATED BY WCM AGAINST NOISE CRITERIA – QUARTER 4, 2016

Location	Start Date and Time	Wind Speed m/s	VTG ⁷ °C/100m	Criterion <i>L</i> _{A1,1min} dB ¹	Criterion Applies? ³	WCM <i>L</i> _{A1,1min} dB ^{4,5}	Exceedance ^{6,8}
N01 ²	06/10/2016 22:36	1.3	3.0	NA	NA	25	NA
N03 ²	06/10/2016 23:36	0.6	4.1	NA	NA	48	NA
N16	06/10/2016 23:03	1.1	0.5	50	Yes	25	Nil
N23	06/10/2016 22:33	1.3	3.0	50	Yes	<20	Nil
N01 ²	09/11/2016 22:24	0.1	4.1	NA	NA	IA	NA
N03 ²	09/11/2016 23:00	0.0	4.1	NA	NA	41	NA
N16	09/11/2016 23:20	0.2	4.1	50	Yes	34	Nil
N23	09/11/2016 22:47	0.6	4.1	50	Yes	25	Nil
N01 ²	01/12/2016 23:54	0.1	4.1	NA	NA	<30	NA
N03 ²	01/12/2016 23:38	0.0	4.1	NA	NA	44	NA
N16	01/12/2016 22:47	1.1	4.1	50	No	45	NA
N23	01/12/2016 22:17	0.8	4.1	50	No	IA	NA

Notes:

1. Development consent criterion;
2. Monitoring location is within Zone of Affection, criterion not applicable;
3. The noise emission limits identified in the above table apply under meteorological conditions of:
 - Wind speeds of up to 3 m/s at 10 metres above ground level; or
 - Temperature inversion conditions of up to 3°C/100m, and wind speeds of up to 2 m/s at 10 metres above ground level.
4. Estimated or measured *L*_{A1,1minute} attributed to WCM;
5. NM denotes WCM audible but not measurable, IA denotes inaudible “-” denotes no criterion;
6. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable, or, there is no applicable criterion;
7. Vertical temperature gradient (VTG) calculated using sigma theta values according to INP procedures; and
8. Bold and red text indicate an exceedance of relevant criterion.

4.4.3 Low Frequency Assessment

Table 4.16 provides statistics for attended noise monitoring undertaken around WCM during Quarter 4, 2016.

Table 4.16: ATTENDED MEASUREMENT STATISTICS FOR WCM – QUARTER 4, 2016

Conditions	Total for Quarter 4, 2016
Number of measurements	12
Number of measurements where WCM was measurable, was within 5 dB of the relevant criterion and the relevant criterion applied	0

None of the 12 measurements occurred during which WCM was measurable (not “inaudible” or “not measurable”), was within 5 dB of the relevant criterion and where meteorological conditions resulted in criteria applying (in accordance with the consent). No further assessment of low frequency noise was undertaken.

4.5 Review of Site Noise Level Trends

Trends in measured site noise levels incorporating data from start of Quarter 1 2014 to the end of Quarter 4 2016 were reviewed to assess changes in measured $L_{Aeq,15\text{minute}}$ and $L_{A1,1\text{minute}}$ levels for WCM over the past three years of regular attended monitoring.

Figures 2 to 5 display measured $L_{Aeq,15\text{minute}}$ and $L_{A1,1\text{minute}}$ levels for the four monitoring locations with linear trend lines included to show any changes in data measurements over the past 3 years.

It should be noted that for the purpose of graphing data, all measurements that were either inaudible (IA), not measurable (NM), <30 dB or <20 dB, have been assigned a value of 0.

4.5.1 N01 - Lambkin

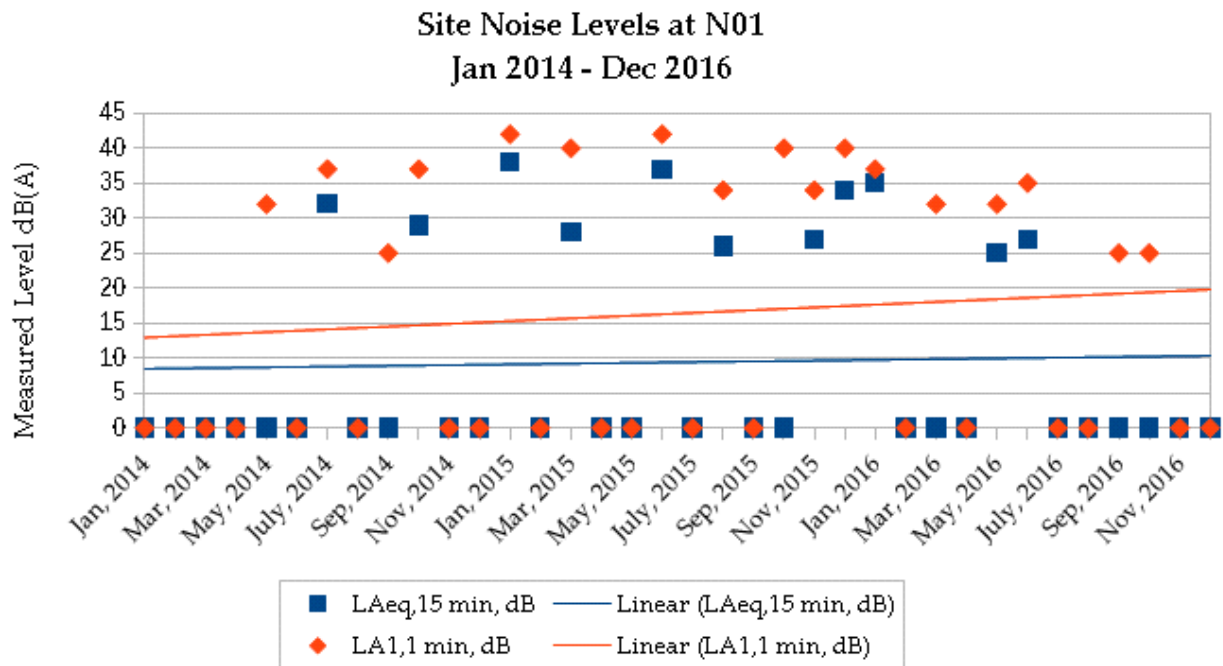


Figure 2: Summary of Measured Site Noise levels, N01 – Lambkin

There are no significant differences in measured site noise levels at monitoring location N01 over the 2014 to 2016 period.

Both LAeq,15minute and LA1,1minute levels were fairly consistent over the monitoring period, with a slightly increasing trend for LA1,1minute levels, most likely due to a larger number of non-recordable measurements towards the earlier stages of the three year period. In the last 6 months of 2016, LA1,1minute levels were again very low or non-recordable.

4.5.2 N03 - Kelly

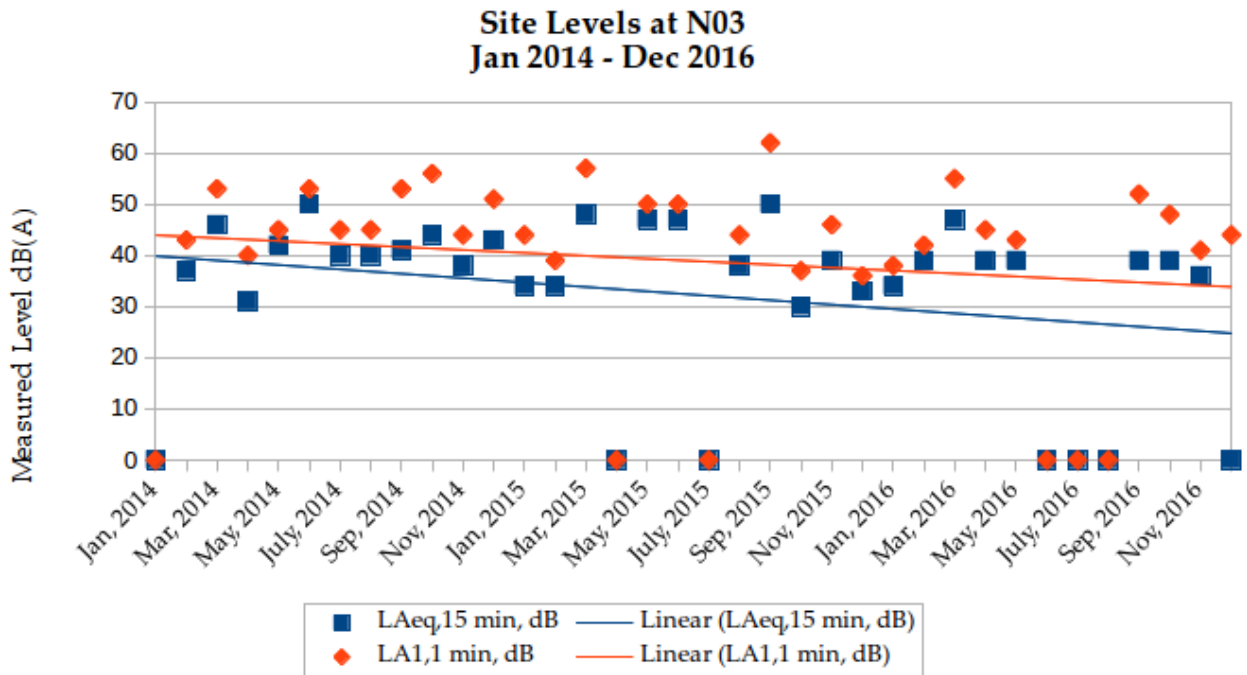


Figure 3: Summary of Measured Site Noise levels, N03 – Kelly

Due to N03 being the closest monitoring site to mine operations, this location had the least number of measurements that were noted as IA, NM or less than 30 dB, with only 7 monitoring events not having recordable values, with half of these occurring during 2016.

All measurement values were fairly consistent over the period, with a very slight downward trend.

4.5.3 N16 - Muller

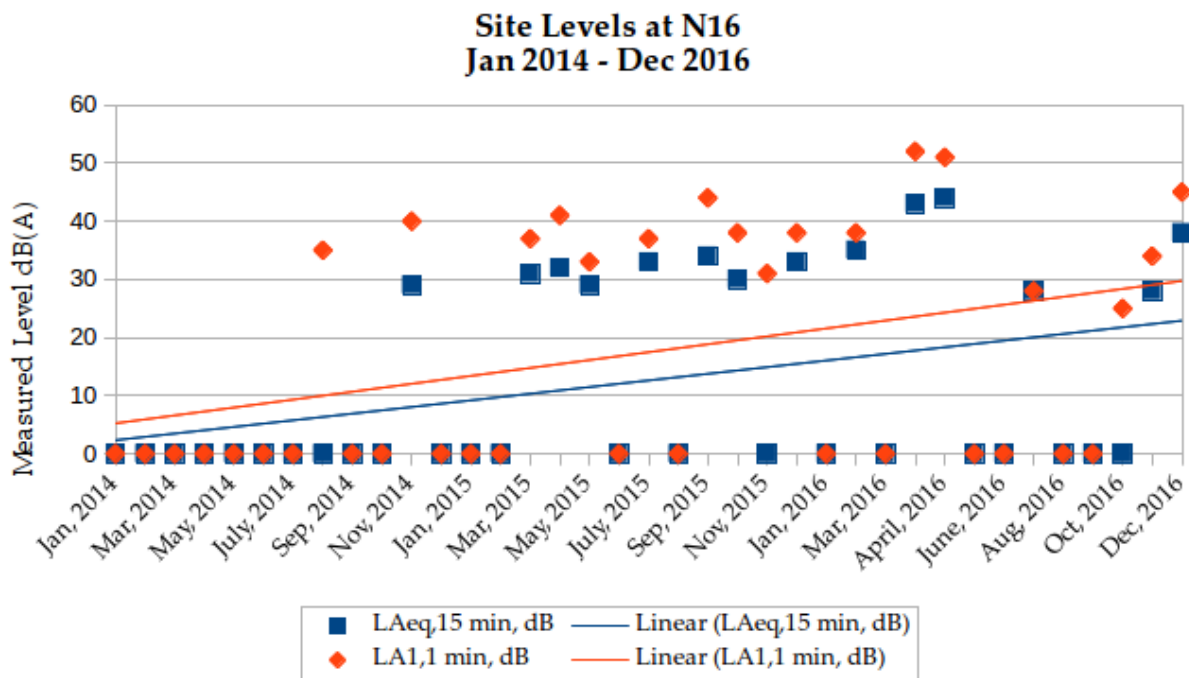


Figure 4: Summary of Measured Site Noise levels, N16 – Muller

Measured site noise levels at location N16 have shown a definite upward trend over the past three years. This is due to levels being either IA or NM for the majority of monitoring events during 2014. This can possibly be attributed to N16 being in the direction of pit progression.

Measured levels were fairly consistent over 2015, however during 2016 there was an increased number of non-recordable measurements again before an increasing trend in the late stages of 2016.

4.5.4 N23 - Carter

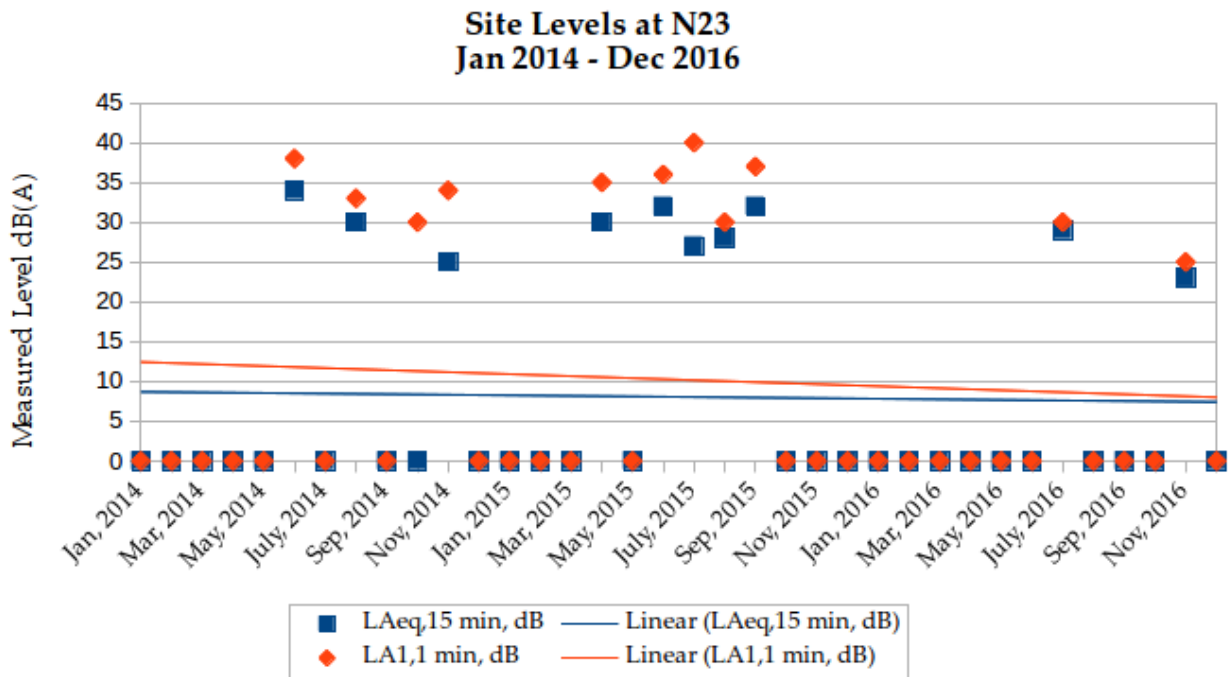


Figure 5: Summary of Measured Site Noise levels, N23 – Carter

Measured noise levels at monitoring location N23 have shown a very slight decreasing trend over the past 3 years. This is due to only 2 recordable measurements since late 2015, both in the second half of 2016. These measurements were also at relatively low levels compared to previous measured noise levels.

4.6 Comparison with EIS

Predicted Year 9 operational noise levels from Table 5.4.1 of the EIS (June 2003) are reproduced for the monitoring locations during the night period only as shown in Table 4.17.

Year 9 predictions have been used for comparison of measured levels. As detailed in the EIS, Year 9 operations are representative of the nearest open-cut operations to Bulga Village including Wambo and Arrowfield Seam underground, CHPP and train loading system operations (with train movement).

Table 4.17: WAMBO OPERATIONAL $L_{Aeq,15minute}$ dB EIS PREDICTIONS, YEAR 9

Location	Adverse SE Wind Summer, Autumn, Spring - Night	Adverse Inversion W Wind Winter - Night
N01, Lambkin	21	35
N03, Kelly	57 ³	56 ³
N16, Muller	37 ¹	25
N23, Redmanvale Road, Thelander	40 ²	18

Source: Wambo EIS (June 2003)

Notes from Table 5.4.1 of EIS:

1. Marginal Noise Management Zone 1 to 2 dBA above project specific criteria;
2. Moderate Noise Management Zone 3 to 5 dBA above project specific criteria; and
3. Noise Affection Zone >5 dBA above project specific criteria.

Table 3.2.3 of the EIS details applicable periods for predicted noise levels. This table has been reproduced below. It should be noted that data in Table 4.18 and Table 4.19 in this report detail the differences against predicted levels for the relevant seasons and periods. This comparison addresses wind speed, wind direction and temperature gradient. Air temperature and relative humidity have not been included in the comparison.

Table 3.2.3 Non-Adverse (Calm) and Adverse Noise Modelling Meteorological Parameters

Season	Period	Air Temp	Relative Humidity	Wind Velocity ¹	Temperature Gradient ¹
Non-Adverse Annual	Daytime	18°C	60%	0 m/s	0°C/100 m
Adverse Summer Autumn Spring	Evening and Night-time	12°C	75%	SE 3 m/s	0°C/100 m
Adverse Winter	Evening and Night-time	6°C	90%	W 2 m/s	3°C/100 m

Note 1: NSW INP (2000) default adverse wind speed 3 m/s and default inversion 3°C/100m plus 2 m/s wind.

Source: Wambo EIS (June 2003)

4.6.1 Year 9 Comparison

Measured operational levels have been compared to the predicted levels for Year 9 in the EIS for the relevant meteorological conditions. In the tables below, a positive difference is where the measured level is greater than the predicted level and a negative difference is where the measured levels are less than the predicted level. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-17 means the values are more than 17 dB less than the predicted level.

Table 4.18 provides the difference between measured and predicted levels with 3 m/s winds from the south east (SE) during the night period in summer, autumn and spring.

Table 4.18: 2016 WAMBO OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED SE WIND CONDITIONS DURING SUMMER, AUTUMN AND SPRING – NIGHT, YEAR 9^{1,2,4}

Location	Jan 16	Feb 16	Mar 16	Apr 16	May 16	Sep 16	Oct 16	Nov 16	Dec 16
N01, Lambkin ⁵	NR	NR	NR	NR	NR	NR	NR	NR	NR
N03, Kelly ⁶	NR	NR	NR	NR	NR	NR	NR	NR	NR
N16, Muller	NR	NR	NR	NR	NR	NR	NR	NR	NR
N23, Redmanvale Road, Thelander	NR	NR	NR	NR	NR	NR	NR	-17 ³	NR

Notes:

1. NR denotes met conditions not relevant, NA denotes not applicable, IA denotes conditions relevant but Wambo inaudible during monitoring, NM denotes conditions relevant but Wambo not measurable during monitoring;
2. SE wind conditions assumes winds at speeds between 0.1 and 3 m/s from a wind direction of 112.5 to 157.5 degrees during monitoring. Assumes no inversion conditions, i.e. the VTG is less than $-0.5^{\circ}\text{C}/100\text{m}$ (equivalent to stability categories A to D) during monitoring. All met data is taken from a height of 10 metres (meteorological station);
3. Wind conditions relevant, however, VTG is positive (greater than 0 degrees per 100 metres) during monitoring;
4. Measurements during Summer, Autumn and Spring only;
5. This property has been acquired by another mine, and, was previously acquisition (by Wambo) on request; no criteria applied there during 2016; and
6. Acquisition upon request.

Table 4.19 provides the difference between measured and predicted levels with up to 2 m/s winds from the west (W) and a 3 degree per 100 metre vertical temperature gradient (VTG) during the night period in winter only.

Table 4.19: 2016 WAMBO OPERATIONAL $L_{Aeq,15minute}$ dB DIFFERENCE AGAINST PREDICTED W WIND CONDITIONS DURING WINTER - NIGHT, YEAR 9^{1,2,4}

Location	June 16	July 16	August 16
N01, Lambkin ⁵	NR	NR	NR
N03, Kelly ⁶	NR	NR	NR
N16, Muller	NM ³	NR	NR
N23, Redmanvale Road, Thelander	IA ³	NR	NR

Notes:

1. NR denotes met conditions not relevant, NA denotes not applicable, IA denotes conditions relevant but Wambo inaudible during monitoring, NM denotes conditions relevant but Wambo not measurable during monitoring;
2. W wind conditions assumes winds at speeds between 0.1 and 2 m/s from a wind direction of 247.5 to 292.5 degrees during monitoring. Inversion conditions assumes a 3°C/100m VTG during monitoring. All met data is taken from a height of 10 metres (meteorological station);
3. Wind from W direction, however all other meteorological conditions not relevant;
4. Measurements during Winter only;
5. This property has been acquired by another mine, and, was previously acquisition (by Wambo) on request; no criteria applied there during 2016; and
6. Acquisition upon request.

As shown in the tables above, a comparison of predicted and measured levels from Wambo Year 9 operation shows very limited measurements that fall within meteorological conditions predicted. This comparison does not take into account operational activities at the time of monitoring compared to predicted scenarios.

5 CONCLUSION

5.1 Attended Noise Monitoring

Noise levels from WCM complied with the relevant criteria at all sites during 2016 attended monitoring.

There were no changes to train refuelling procedures so no monitoring for the WCRS was undertaken during 2016.

It is noted that wind speeds and/or temperature inversion conditions were at levels greater than which development consent conditions would apply for WCM activities in some instances.

5.2 Site Noise Level Trends

There have been no significant changes in noise level trends over the past three years.

5.3 Comparison with EIS

Predicted noise levels from Year 9 were compared against actual noise levels during 2016. Results of the comparison indicate that meteorological conditions included in the EIS modelled predictions did not regularly occur during attended monitoring. When meteorological conditions were relevant, results show that WCM was generally well under the predicted levels.

Global Acoustics Pty Ltd

APPENDIX

A *DEVELOPMENT CONSENT*

A.1 WAMBO COAL MINE DEVELOPMENT CONSENT

A.1.1 Relevant Wambo Coal Mine Development Consent Conditions

The relevant sections of the October 2016 modified conditions are reproduced below:

SCHEDULE 4 SPECIFIC ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant **must** acquire the land in accordance with the procedures in conditions 9-11 of schedule 5:

Table 1: Land subject to acquisition upon request

2 – Lambkin	23A & B - Kannar
13C - Skinner	31A,B,C & D - Fisher
19A & B – Kelly	51 – Hawkes
22 – Henderson	56 - Haynes

Note: For more information on the numbering and identification of properties used in this consent, see Attachment 1 of the EIS for the Wambo Development Project. Lands titled 23A & B – Kannar, 31A,B,C & D – Fisher, 51 – Hawkes and 56 – Haynes have been acquired and are now mine-owned.

¹NOISE

Noise Impact Assessment Criteria

6. The Applicant **must** ensure that the noise generated by the Wambo Mining Complex does not exceed the noise impact assessment criteria presented in Table 9.

Table 9: Noise impact assessment criteria dB(A)

Day <i>L_{Aeq}(15 minute)</i>	Evening/Night <i>L_{Aeq}(15 minute)</i>	Night <i>L_{A1}(1 minute)</i>	Land Number
35	41	50	94 – Curlewis
			3 – Birrell

¹ Incorporates EPA GTAs

Day L_{Aeq}(15 minute)	Evening/Night L_{Aeq}(15 minute)	Night L_{A1}(1 minute)	Land Number
35	40	50	4B – Circosta
			15B - McGowen/Caslick
			16 – Cooper
			23C – Kannar
			25 – Fenwick
			28A & B – Garland
			33 -Thelander/O'Neill
			39 – Northcote
			40 – Muller
			254A – Algie
35	39	50	5 – Strachan
			6 - Merrick
			7 - Maizey
			37 - Lawry
35	38	50	48 - Ponder
			1 - Brosi
			17 - Carter
			18 - Denney
			38 - Williams
			49 - Oliver
			63 - Abrocuff
35	37	50	75 - Barnes
			91 - Bailey
			27 - Birralee
			43 - Carmody
35	36	50	137 - Woodruff
			163 - Rodger/Williams
			246 - Bailey
			13B - Skinner
35	35	50	178 - Smith
			188 - Fuller
			262A, B & C - Moses
35	35	50	All other residential or sensitive receptors, excluding the receptors listed in condition 1 above

Notes:

- Noise generated by the Wambo Mining Complex is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy

Land Acquisition Criteria

7. If the noise generated by the **Wambo Mining Complex** exceeds the criteria in Table 10, the Applicant **must**, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 9-11 of schedule 5.

Table 10: Land acquisition criteria dB(A)

Day/Evening/Night <i>L_{Aeq}(15 minute)</i>	Property
43	94 - Curlewis 23C – Kannar 254A - Algie
40	All other residential or sensitive receptor, excluding the receptors listed in condition 1 above

Note: Noise generated by the Wambo Mining Complex is to be measured in accordance with the notes presented below Table 9 above. Property 23C – Kannar has been acquired and is now mine-owned.

Operating Conditions

8. The Applicant **must**:
- (a) implement best management practice to minimise the operational, low frequency and traffic noise of the Wambo Mining Complex;
 - (b) operate a comprehensive noise management system for the Wambo Mining Complex that uses a combination of predictive meteorological forecasting and real-time noise monitoring data to guide the day to day planning of mining operations and the implementation of both proactive and reactive noise mitigation measures to ensure compliance with the relevant conditions of this consent;
 - (c) maintain the effectiveness of noise suppression equipment (if fitted) on plant at all times and ensure defective plant is not used operationally until fully repaired;
 - (d) ensure that noise attenuated plant (if used) is deployed preferentially in locations relevant to sensitive receivers;
 - (e) minimise the noise impacts of the Wambo Mining Complex during meteorological conditions when the noise limits in this consent do not apply;
 - (f) co-ordinate the noise management for the Wambo Mining Complex with the noise management at nearby mines (including HVO South, HVO North and Mt Thorley Warkworth mines) to minimise the cumulative noise impacts of these mines and the Wambo Mining Complex, to the satisfaction of the [Secretary](#).

Noise Management Plan

9. The Applicant **must** prepare a Noise Management Plan for the Wambo Mining Complex to the satisfaction of the **Secretary**. This plan must:
- (a) be prepared in consultation with the EPA, and submitted to the **Secretary** for approval by the end of June 2013;
 - (b) describe the measures that would be implemented to ensure:
 - best management practice is being employed;
 - the noise impacts of the Wambo Mining Complex are minimised during meteorological conditions when the noise limits in this consent do not apply; and
 - compliance with the relevant conditions of this consent;
 - (c) describe the proposed noise management system in detail;
 - (d) include a monitoring program that:
 - uses a combination of real-time and supplementary attended monitoring measures to evaluate the performance of the Wambo Mining Complex;
 - adequately supports the proactive and reactive noise management system for the Wambo Mining Complex;
 - includes a protocol for determining exceedances of the relevant conditions in this consent;
 - evaluates and reports on the effectiveness of the noise management system for the Wambo Mining Complex;
 - provides for the annual validation of the noise model for the Wambo Mining Complex; and
 - (e) include a protocol that has been prepared in consultation with the owners of nearby mines (including HVO South, HVO North and Mount Thorley Warkworth mines) to minimise the cumulative noise impacts of these mines and the Wambo Mining Complex.

The Applicant must implement the approved management plan as approved from time to time by the Secretary.

A.2 WAMBO RAIL SPUR DEVELOPMENT CONSENT

The relevant sections of the February 2012 modified conditions for the rail spur are reproduced below:

SCHEDULE 4 GENERAL ENVIRONMENTAL CONDITIONS

ACQUISITION UPON REQUEST

- Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 1-3 of schedule 5.

Table 1: Land subject to acquisition upon request

19 - L Kelly	55 - E & C Burley
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Note: For more information on the numbering and identification of properties used in this consent, see Attachment 1A and Attachment 1B of the SEE for the Alterations to the Wambo Development Project – Rail and Train Loading Infrastructure.

- While the land listed in Table 1 is privately owned, the Applicant shall implement all practicable measures to ensure that the impacts of the development comply with the predictions in the SEE, and the relevant conditions in this consent, at any residence on this land, to the satisfaction of the Director-General.

NOISE

Noise Impact Assessment Criteria

- The Applicant shall ensure that noise generated by the development, combined with noise generated by any development in the Wambo Mining Complex, does not exceed the noise criteria provided in Table 2, unless higher noise criteria are specified in the consent for the Wambo Coal Mine (DA 305-7-2003).

Table 2: Noise impact assessment criteria dB(A)

Day	Evening/Night	Night	Land Number
$L_{Aeq}(15\text{ minute})$ 35	$L_{Aeq}(15\text{ minute})$ 35	$L_{A1}(1\text{ minute})$ 50	All private residential or sensitive receptors, excluding the receptors listed in Table 1

Notes:

- Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.
- For this condition to apply, the exceedance of the criteria must be systemic.

Construction Hours

- The Applicant shall ensure that all construction work is carried out from 7 am to 6 pm Monday to Saturday (inclusive) and 8 am to 6 pm Sundays and Public Holidays.

Operating Hours

- The Applicant shall:
 - take all practicable measures to minimise train movements at the development on Friday evening (6 pm-9 pm) and Sunday morning (9 am-12 am);
 - report on the implementation and effectiveness of these measures, to the satisfaction of the Director-General.

Rail Noise

6. The Applicant shall seek to ensure that its rail spur is only accessed by locomotives that are approved to operate on the NSW rail network in accordance with noise limits L6.1 to L6.4 in RailCorp's EPL (No. 12208) and ARTC's EPL (No. 3142) or a Pollution Control Approval issued under the former *Pollution Control Act 1970*.

Noise Monitoring

7. The Applicant shall monitor the noise generated by the development, and noise generated by the Wambo Mine, in general accordance with the Noise Management Plan for the Wambo Mining Complex and the *NSW Industrial Noise Policy*.
- 7A. By 31 May 2012, the Applicant shall review and update the Noise Management Plan for the Wambo Mining Complex, including a noise monitoring protocol for evaluating compliance with the criteria in condition 3 above.
- 7B. During the first 12 months of operation of the Rail Refuelling Facility, the Applicant must conduct attended noise monitoring at the nearest private receptor during refuelling events, no less often than every three months.

A.3 WAMBO RAIL LINE DEVELOPMENT CONSENT

The relevant sections of the 1998 conditions for the rail line are reproduced below:

Operational Noise

8. The Applicant shall ensure noise emissions from the operations of the railway line when measured at any residence along the railway line corridor shall not exceed the following EPA criteria:

- (a) planning level of $L_{Aeq, 24hr}$ 55dBA; and
- (b) maximum passby level of L_{Amax} 85dBA.

The noise criteria levels shall be measured under prevailing weather conditions in accordance with EPA requirements and to be consistent with EPA's requirements as applied to the New South Wales coal industry, or otherwise agreed to by the EPA.

9. Prior to the commencement of operations, the Applicant shall prepare in consultation with the EPA and Singleton Shire Council an Operational Noise Management Plan. The Operation Noise Management Plan shall demonstrate that all practical design and noise mitigation methods have been undertaken to achieve the noise levels specified in Condition 8.